



Neurotechnology Research Systems

User Guide

Version 3.0 February 2010

CinePlex[®]

Video Capture, Tracking, Behavioral, and Editing System



CAUTION

Camera Damage

Never connect or disconnect the camera while the power is on. The camera can be permanently damaged.



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NOTE TO CINEPLEX V1 AND V2 USERS

The V3 version of CinePlex is not compatible with hardware, software, or licensing for prior versions. **DO NOT ATTEMPT TO INSTALL V3 ON SYSTEMS RUNNING PRIOR VERSIONS.** It will not operate correctly, or, possibly, not at all.



Caution Electrostatic Discharge

Some devices can be damaged by improper handling. Use appropriate electrostatic discharge (ESD) procedures when handling these devices. See <http://www.esda.org/> for additional information on ESD procedures.



CAUTION Camera Damage

Never connect or disconnect the camera while the power is on. The camera can be permanently damaged.



Caution USB Security Key Damage

Before installing Sentinel System security key drivers remove *all* Sentinel USB keys from the PC. If a system driver is installed with a USB key in the port, the key may become unusable.

CinePlex

Video, Capture, Tracking, Behavioral, and Editing System
User Guide

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1.1 About the CinePlex System

The term CinePlex System is used in this manual to refer to the Plexon CinePlex Video Capture, Tracking, Behavioral, and Editing System. The CinePlex System is a digital video recording, tracking, behavioral, and editing tool. With the CinePlex System, the user may record (capture) video in Windows-standard audio-video interleaved (AVI) format. The user may also synchronize the video capture with simultaneously recorded neural data files. With the CinePlex System, the user may play the synchronized video and neural data recordings and add behavioral event markers and time-interval variables. The user may then export the marked-up data from the CinePlex System for further analyses with other programs.

The CinePlex System consists of two elements: CinePlex Studio and CinePlex Editor. CinePlex Studio consists of hardware and software to enable the user to simultaneously capture, track, analyze, and record video data synchronized with neural data from a Plexon Neural Data Acquisition System (hereafter Plexon NDAQ). CinePlex Studio also allows re-tracking and re-analysis of previously recorded video files. CinePlex Editor is a software tool that enables the user to view and edit the resulting video and neural data files together.

1.1.1 CinePlex Studio Features

CinePlex Studio includes the following features:

- General
 - CinePlex Studio is a normal Windows application
 - CinePlex Studio runs on a Plexon NDAQ computer with or without a network
 - CinePlex Studio can run on a regular computer in offline mode (i.e. analyzing files produced by the PC to which cameras are connected)
- Video
 - A video capture capability, which can be synchronized with neural recordings from a Plexon NDAQ
 - Names video files to correspond to names given to synchronized neural data files
 - Produces standard video AVI files in MPEG format
 - Allows user-specified prefixes for filenames when recording non-synchronized files
 - Essentially unlimited AVI file size (Microsoft extension to NTFS format eliminates the 4 GB file size limit)
 - Selectable image quality settings by changing nominal bit rate
 - Recording directly to internal hard drive

-
- All-digital imaging with one or two Stingray™ camera (640 x 480 resolution, up to 80 frames per second)
 - Near IR (infrared) tracking (optionally available)
 - Online and Offline Tracking and Analysis
 - Features **Smart Tracking** that uses robust algorithms for LED tracking, object contour tracking, and reflective color tracking
 - Uses strobed word format to deliver tracking coordinates directly to the MMF
 - Records position and time data in text files
 - Analyzes contour motion across adjacent video frames to detect freezing behavior in fear-conditioning experiments
 - Behavioral Analysis and Digital Events
 - Monitors animal speeds to create digital events when over/under threshold
 - Monitors vectors between objects to create digital events when within/outside of an angle and tolerance
 - Allows user to define static and dynamic zones of interest and zone sequences
 - Monitors objects traversing zones and sequences to generate logical and digital events
 - Allows user to define combinations of events from one or two cameras to generate digital events
 - Offline extraction of selected static and dynamic data from CinePlex video files
 - Reads any MPEG file created by CinePlex Version 3 or later
 - Allows selection of a time range or all of the file to be extracted
 - Allows selection of tab or comma delimited output files with or without header row
 - Allows selection of desired static data columns
 - Allows selection of dynamic data columns
 - Writes text file with selections implemented

1.1.2 CinePlex Editor Features

CinePlex Editor includes the following features:

- Viewing

- Integrated viewing of neural data files (Plexon PLX, NEX) and AVI files
- Display of tracking position data overlaid on video
- Seek and search based on event markers
- Full digital video playback capabilities
- Editing
 - Video-aided insertion of event markers and intervals
 - Removal of temporal segments of neural data during artifact-generating behaviors (chewing, grooming, etc.)
 - Ability to enter and edit position coordinate data created by CinePlex Studio
 - Ability to play a sound (standard or user-selected) when event markers or neural spikes occur during playback
 - Supports Microsoft's extension to NTFS file format to be able to utilize AVI files larger than 4GB
 - Save neural data to Plexon (PLX) and NeuroExplorer (NEX) files, or export to Excel, MATLAB, or text files

1.1.3 CinePlex System Installation

For system requirements and installation instructions, see "[Appendix A - Installation](#)".

1.1.4 About CinePlex Studio

CinePlex Studio is the data acquisition portion of the CinePlex System. It can also be used to process existing data in File Mode. As shown in Figure 1-1, "CinePlex General Arrangement for a Plexon NDAQ", CinePlex Studio consists of

- at least one Firewire camera and lens
- a MAP computer, which runs the CinePlex Studio software and associated MAP software
- a monitor that displays the CinePlex Studio user interface
- a keyboard to allow user input such as file names
- a mouse, to control the CinePlex Studio software
- associated cables

CinePlex Studio provides three main capabilities:

- 1 **Digital Video Recording (DVR):** CinePlex Studio provides the ability to capture video to an AVI file for later viewing and analysis. Frames are time-

stamped with corresponding MAP times. For more information on this capability, see [“Digital Video Recording” on page 55](#).

- 2 **Position Tracking: If the Tracking option is licensed**, CinePlex Studio provides the ability to track the position of subject(s) in the video images, in real time, and deliver the tracked position coordinates to a Plexon NDAQ. Tracking can also be used with existing pre-recorded files. When the Tracking option is enabled, there are three different modes of operation:
 - a **Object Contour Mode:** In this mode, CinePlex Studio uses a setup procedure to color contrast and threshold the image until the subject being tracked is all white and the background is all black. For each frame, CinePlex Studio computes the centroid of the white pixels to obtain the tracking coordinates. This mode of tracking operation is described in [“Object Contour Mode Tracking” on page 75](#).
 - b **LED Tracking Mode:** In this mode, CinePlex Studio tracks up to five light emitting diodes (LED) on the subject or subjects being tracked. To improve tracking, LED Tracking Mode applies filters that remove the halo surrounding bright LEDs. This mode of tracking operation is described in [“LED Mode Tracking” on page 82](#).
 - c **Reflective Colors Tracking Mode:** In this mode, CinePlex Studio tracks up to three colors (tape or paint, for example) on the subject or subjects being tracked. This mode of operation is described in [“Reflective Colors Mode Tracking” on page 85](#).

Guidelines for choosing which tracking mode to use for a particular experiment are discussed in [“CinePlex Studio Tracking Pane \(if available\)” on page 72](#).

Note: The user may configure CinePlex Studio to capture video only, or to track positions only, or to both capture video and track positions simultaneously.

For either function, the user must mount the CinePlex Studio video camera(s) a short distance away from an appropriately designed experimental arena. Adjust the camera(s) to have the appropriate field of view (see [Lens Selection on page C-3](#)) so that the entire experimental arena is visible on the video images.

Arena functions are enabled when Tracking is available. Using the tools provided, an outline of the experimental arena can be drawn over the video image(s). Once drawn, Studio ignores objects outside of the arena when processing the images. This results in lower CPU usage and reduces false object detections due to reflections and shadows. It also allows the experimenter to exclude areas of the image that have no relevance to the experiment. Arena tools allow drawing circles, ellipses, rectangles, and freehand objects. Arena logical operations (AND, OR, NOT, XOR) allow combining multiple arena shapes to produce a single complex arena shape.

- 3 **Behavior Monitoring: If the Behavior option is available**, tracked objects representing experimental subjects can cause logical and digital events by tra-

versing zones within the arena, sequences of zones, matching angle targets for head vectors, and meeting speed targets. In addition users with two cameras can define combinations of events that, in turn, can cause other digital events.

- a **Zones:** A zone is a defined portion of the arena that has significance in an experiment. Zones that do not move with respect to the image or the arena are referred to as static zones. For example, a static zone could be an area the animal should avoid to receive a reward or it could be an area the animal must traverse to receive the reward. It could even be one of the zones in a sequence of zones the animal should traverse. CinePlex Studio provides tools to allow the user to draw zone outlines on top of the video image. These tools operate in the same way as the arena tools, allowing complex shapes and logical operations. CinePlex Studio also allows the definition of dynamic zones that are circular areas around the center of gravity of a tracked animal or color. Dynamic zones are treated the same logically as static zones. Many zones can be defined simultaneously.
- b **Sequences:** An ordered list of zones in an arena (called a sequence) can be defined. Many different sequences can be defined.
- c **Events:** Logical events can be defined so that, when an animal enters or leaves a zone, or completes a sequence, the event becomes true. Many events can be specified. Their current states are dynamically displayed in the Event Statistics pane.
- d **Combination Events:** A combination event is an event that becomes true when two or more other events are true. The events used in a combination event can be generated from one or both cameras. This allows events to be generated by simultaneous occurrences in two different images, if desired.
- e **Digital Outputs:** The experimenter can specify that a digital output be generated when any event occurs. Up to 24 different digital outputs can be specified, any of which can be pulsed, high or low when active.

CinePlex Studio can be started from an icon or the Programs Menu. For a full description of the user interface elements, [“Main Window” on page 120](#).

1.1.5 About CinePlex Editor

CinePlex Editor is a software tool that enables the user to view and edit video and neural data files. With **CinePlex Editor**, the user may view time-correlated video, neural, and positional data. The user may also use **CinePlex Editor** to add and edit annotations and perform other operations on the data, such as artifact removal. **CinePlex Editor** records user actions to its own separate CinePlex project file, so the user may continue annotation and editing work over several sessions. When the the markup process is completed, the user may save the results and export the data for further analysis. For a complete list of **CinePlex**

Editor features, see [“Offline extraction of selected static and dynamic data from CinePlex video files”](#) on page 3.



CAUTION

Upgrade Notice

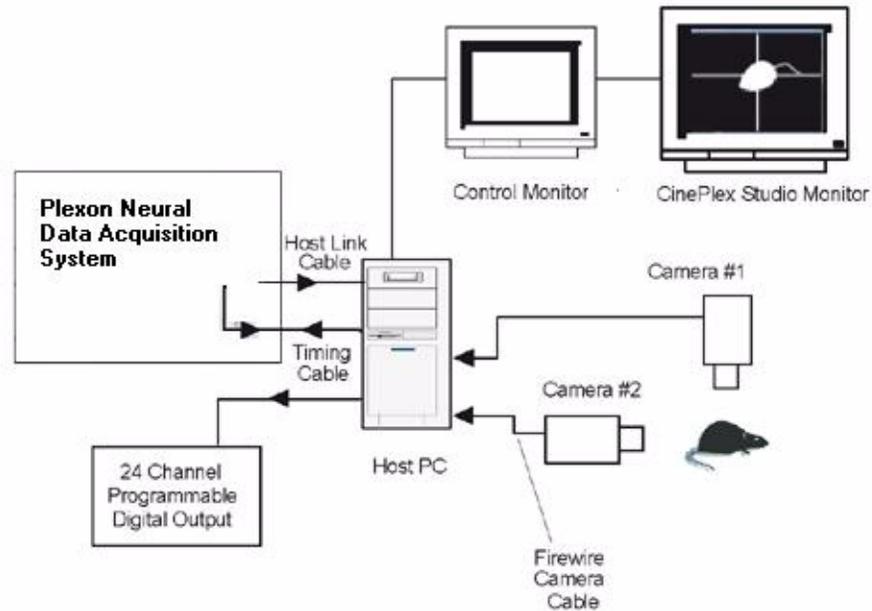
If the system has been upgraded to **CinePlex 3.0**, **CinePlex Editor** should also be updated. The upgraded **CinePlex Editor** is backwards compatible and will also read AVI files created by **CinePlex Capture 1.0, 1.1, 1.2, 1.4, and 2.0**.

1.2 Using the CinePlex System with a Plexon NDAQ

The following illustration shows the general arrangement of the CinePlex System as used in conjunction with a Plexon NDAQ.

Figure 1-1

CinePlex General Arrangement for a Plexon NDAQ



The CinePlex Studio computer receives and processes the raw video from the FireWire camera. The user may view the raw video on the Control Monitor or the optional CinePlex Studio monitor. CinePlex Studio compresses and stores the captured video on the internal hard drive, as an AVI file. Through the Timing cable, the MAP system signals the CinePlex Studio computer to start, stop, pause, and resume recording video to the AVI file. The MAP system also provides a 1 MHz clock signal that enables CinePlex Studio to time stamp each video frame.

Note: Starting with CinePlex version 2.0, the host and CinePlex Studio functions can be combined in a single computer. This also results in a single monitor for the host and CinePlex Studio.

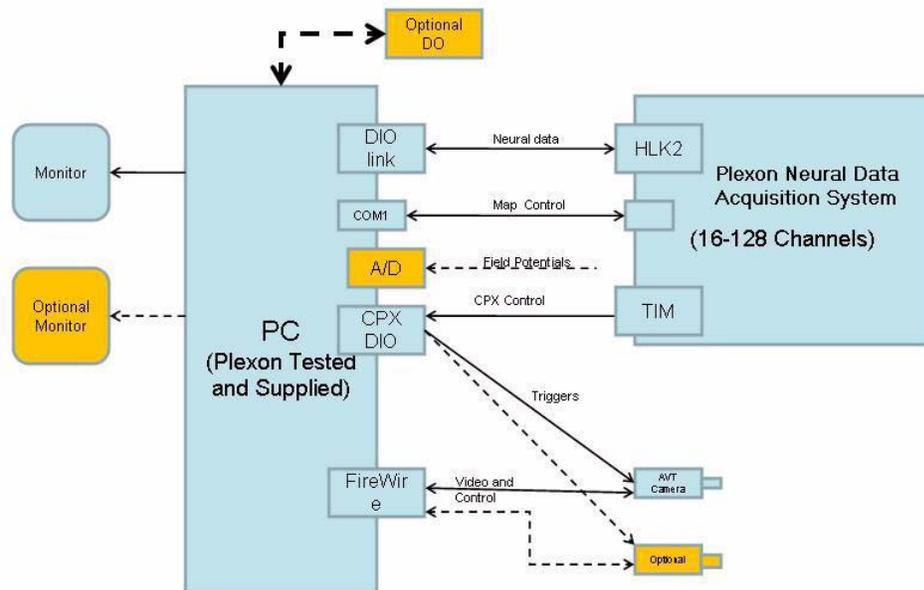
1.3 CinePlex System Hardware and Software Components

In addition, if the CinePlex System includes the Tracking option (see [“CinePlex Studio Tracking Pane \(if available\)” on page 72](#)), CinePlex Studio simultaneously analyzes each frame of video data to determine the positions of the objects being tracked. The computer encodes this position information into digital words and sends the information back to the Plexon NDAQ into the neural data buffer, appropriately time-stamped.

After a recording session, the user may transfer the AVI files and the Digital VideoTracker (DVT) files to a different computer where the neural data files are stored. For more information on DVT files, see [“Digital VideoTracker \(DVT\) Files” on page 156](#). With all files accessible from the same computer, the user may then use CinePlex Editor on that computer for simultaneously viewing, annotating, and processing the video, neural data, and position data. CinePlex Studio can be run on the same computer in File mode, as well.

1.3.1 CinePlex Hardware Components

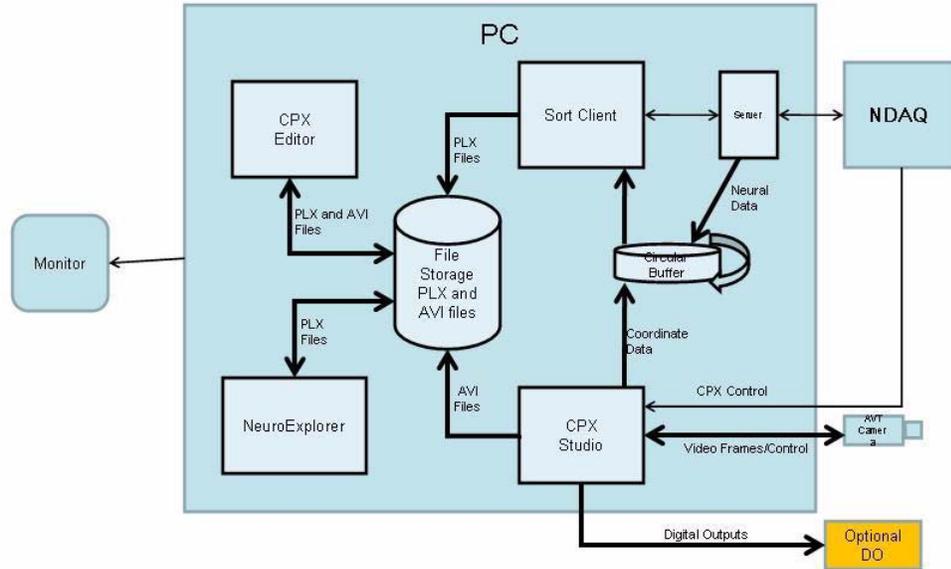
The following illustration shows the major hardware components for a single MAP/CPX system.



The CinePlex System computer allows up to two cameras to be connected via a FireWire card. Control for the CinePlex System is received at the CPX DIO board from the MAP system TIM board. Additional control between the MAP and CPX computer is via a serial connection. Neural data is transmitted between the MAP and CPX via the DIO link in the CPX computer and the HLK2 in the MAP. The CPX computer supports up to two monitors. The CPX computer also allows digital outputs via an optional DO board and field potential inputs via an optional A/D card.

1.3.2 CinePlex Software Components

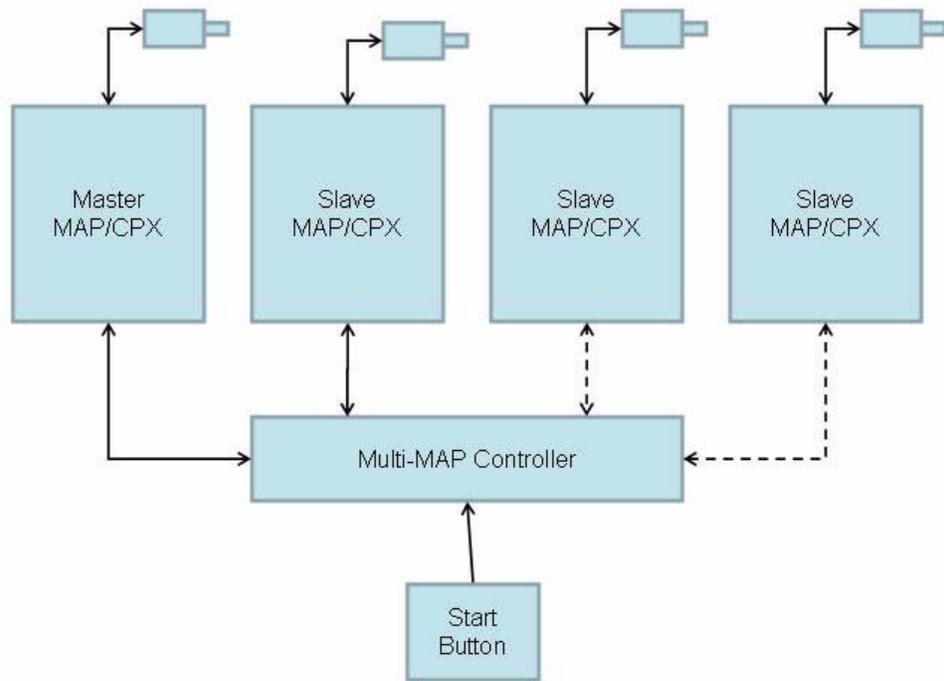
The following illustration shows the major software components for a single MAP/CPX system.



The MAP provides control for CPX Studio. CPX Studio controls the camera(s) and receives video from the camera(s). CPX writes AVI file to file storage and also sends coordinate data to the circular buffer which, in turn, sends the data to Sort Client. The circular buffer also receives neural data from Server. Sort Client writes PLX files to file storage. CPX Editor reads/writes PLX and AVI files from/to file storage. NeuroExplorer reads/writes PLX files from/to file storage.

1.3.3 Multi-MAP Architecture

The following illustration shows the multi-MAP architecture.

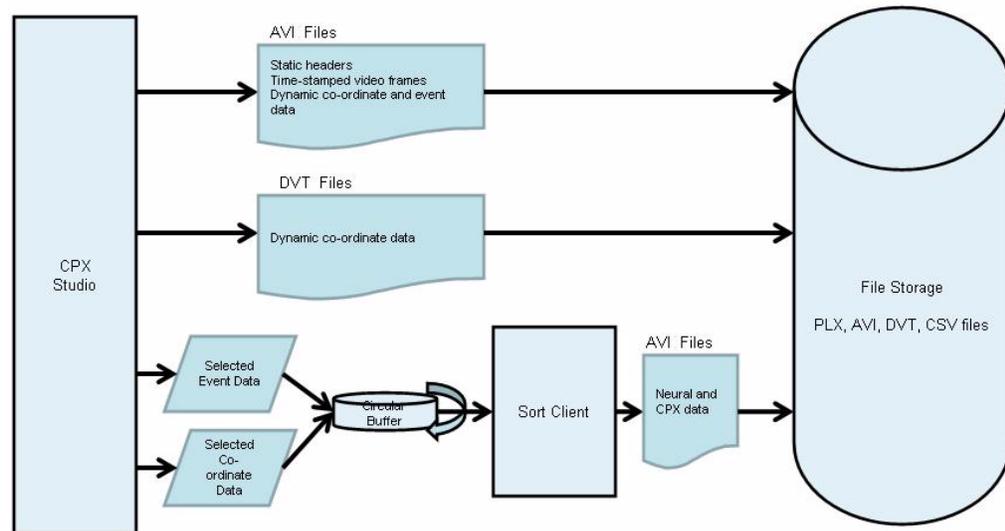


The Quad MAP Controller (QMC) can control up to four MAP/CPX systems from a single start button as shown in the previous illustration. One MAP/CPX system acts as a master system, and the others are slaves.

1.3.4 System Data Flow

The following illustration shows a logical view of the data flow in a complete video and neural data acquisition system using a Plexon NDAQ and other Plexon products:

Figure 1-2
CinePlex Data Schematic for a Plexon NDAQ



In the preceding illustration, CPX Studio writes AVI files directly to file storage. These AVI files have static headers, time-stamped video frames, and dynamic coordinate and event data. CPX Studio also writes DVT files containing dynamic coordinate data. CPX Studio also sends selected event data and coordinated data to the circular buffer which, in turn, sends the data to Sort Client which writes AVI files containing neural and CPX data to file storage. The CinePlex System also includes a utility program called VTViewer (see [“Using VTViewer” on page 93](#)), which works only with the MAP system to read position data. The user may use VTViewer to display, in real time, the position tracking data generated by CinePlex Studio.

1.4 Data Analysis

After recording, the user may process the PLX file with other software, available from Plexon; for example, the user may spike sort the data with Offline Sorter (OFS), or analyze it with NeuroExplorer (NEX). The user may save the results of this processing to another PLX file or to a NEX file. For more information on OFS and NEX, go to www.plexon.com.

If the user transfers the recorded AVI file from the internal CinePlex Studio hard drive to an offline analysis computer, the file can be opened in CinePlex Editor along with either the original PLX file or the files from OFS or NEX. CinePlex Editor presents the time-correlated video, neural, and positional data, and enables the user to add and edit annotations and perform other operations on the data, such as artifact removal. CinePlex Editor records the actions the user performs on the data to a CinePlex project file (CPJ), so that the user may do the annotation and editing work over several sessions. When the user completes the markup process, the results can be saved back into PLX or NEX files, or exported into text files, MATLAB files, or Excel spreadsheets for further analysis.

1.5 Effects on Monitor Functionality

When Studio is running, the screen saver and power saver functions for the monitor are disabled. This is because DirectX rendering is damaged and causes video to go black. This is a result of using DirectX and cannot be coded around. Screen saver and power saver settings are restored if Studio exits normally.

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2.1 Getting Started

This section provides an overall procedure for using **CinePlex Studio**. Each step in the procedure is covered in detail in the subsequent sections.

When embarking on a project, the user should have a detailed plan in place. The more detailed the plan, the more successful its execution will be. When using **CinePlex Studio** in an experiment, perform the following steps:

- **Designing the experiment** - this step is concerned with animal selection, stimuli and rewards, physical design, environmental conditions, execution plan, and/or anything else pertinent to the overall design of the desired experiment. Detailed discussion of this step is beyond the scope of this manual.
- **Setting up the equipment** - this step is concerned with setting up all of the equipment to be used in the experiment (**CinePlex Studio** workstation, Plexon NDAQ, computers, monitors, and any other peripheral equipment and their interconnection).
- **Performing an operational test** - this step is concerned with checking out each piece of equipment, all connections, and all cables for proper operation.
- **Setting up CinePlex Studio** - this step is concerned with positioning the camera so that the desired physical experiment area is within the field of view of the camera, deciding on the tracking mode to be used, and arranging the windows, setting the necessary properties of the selected tracking mode, determining file locations, synchronizing with other equipment, and any other considerations that may be pertinent.
- **Executing the experiment plan** - this step is concerned with implementing the execution plan created in the **Designing the experiment** step. Detailed discussion of implementing the execution plan is beyond the scope of this manual.

2.2 Designing the Experiment

The prime consideration from the **CinePlex Studio** point of view is whether **CinePlex Studio** will work properly with the experimental design. Some possible examples where **CinePlex Studio** may not work include:

- The design of the experiment requires tracking of the entire body of a dark-colored animal in the dark. Contact Plexon for near infrared tracking options.
- The ratio of the size of the trackable arena to the size of the animal is such that the animal's image is too small or too large to be tracked.

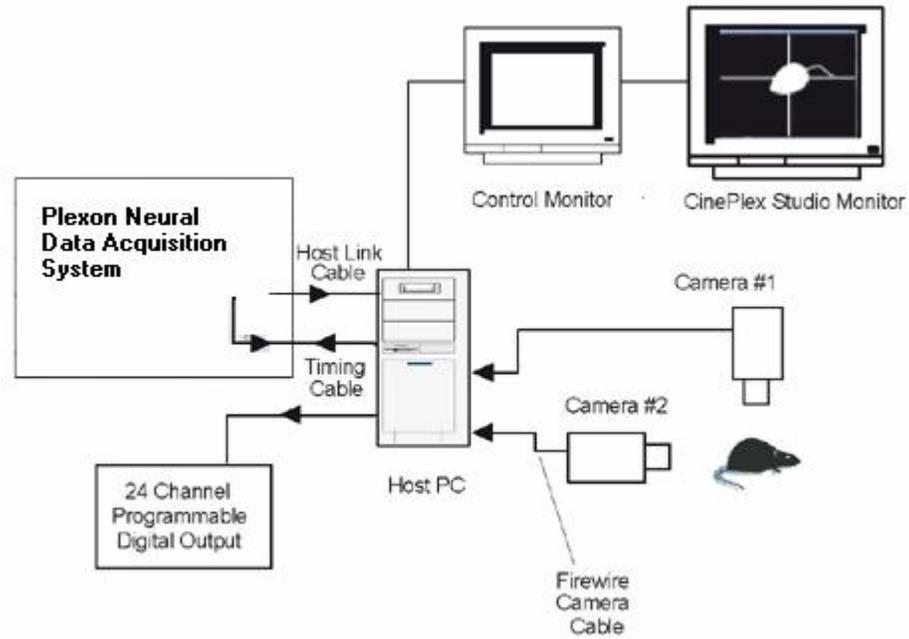
If assistance is needed in determining whether **CinePlex Studio** is applicable to the experimental design, please contact Plexon at 214-369-4957.

2.3 Setting up the Equipment

The following sections cover the different configurations of the CinePlex System with various equipment.

2.3.1 Setting up the CinePlex System with a Plexon NDAQ

The illustrations below shows how CinePlex Studio may be connected to a Plexon NDAQ.



If using the post 2.0 CinePlex Studio computer, see [Installation - Hardware on page A-2](#).

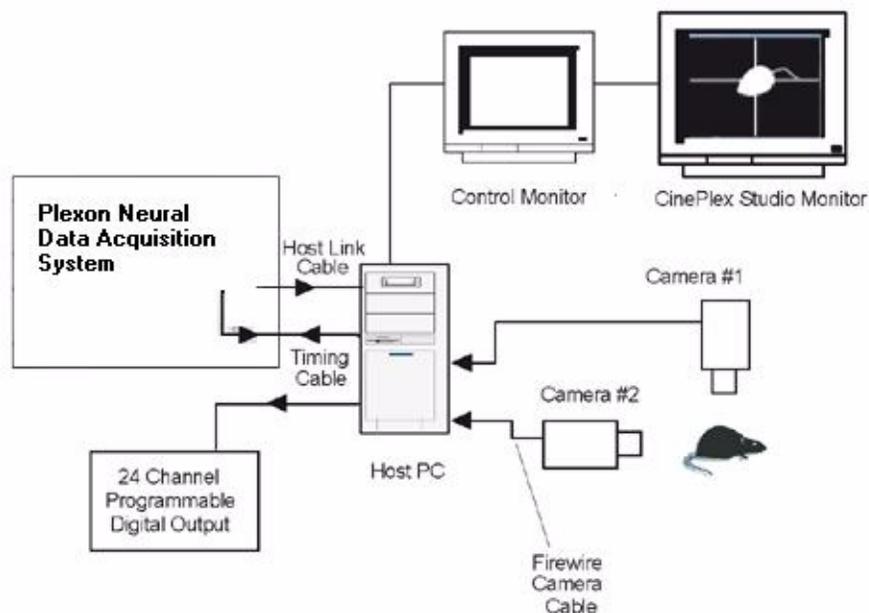
2.4 Performing an Operational Test

Before beginning the experiment, it is best to check out the equipment for proper operation. The sections below give pointers on what to check for different equipment configurations.

2.4.1 CinePlex Studio and a Plexon NDAQ

Set up the CinePlex Studio System as shown by the illustration below.

In this configuration the primary points to check are the camera, both monitors, all of the connections, and all of the cables.



The primary points to check in this configuration are the camera, the monitor, all of the connections, and all of the cables.

2.4.2 Start-Up Sequence (MAP)

The starting sequence for a MAP/CinePlex combination system is important for correct operation of CinePlex. If not followed, video may not be visible or CinePlex control by the MAP may not be possible.

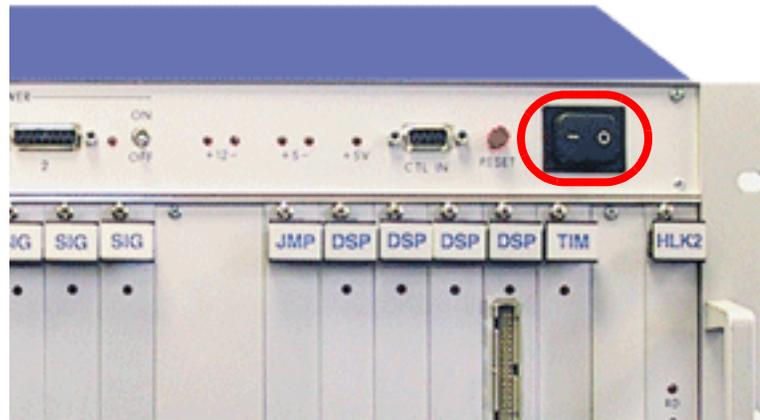


Startup

The startup sequence is extremely important. RASPUTIN must be started before Studio is started so that the client registration process works properly. Otherwise, when a recording is eventually started by RASPUTIN neither the file name string nor the recording time 0 messages are received.

If RASPUTIN exits or is closed for any reason, it should be brought back up, then Studio should be closed and restarted, as well.

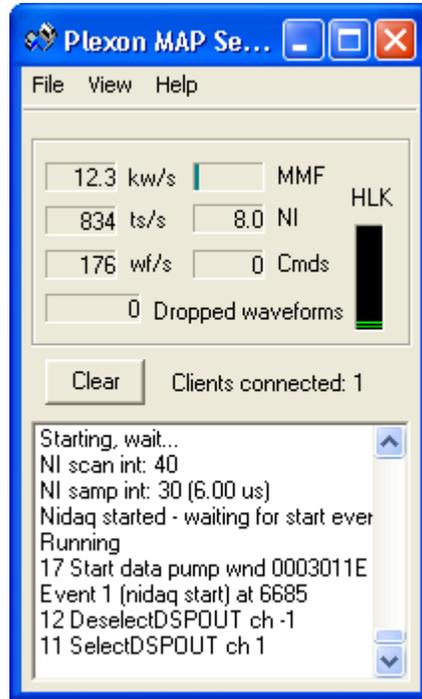
- 1 Power up the computer and log in.
- 2 Turn on power to the MAP box.



- 3 Start **Server** program and verify no errors. The easiest way is to double-click the **Server** desktop icon.



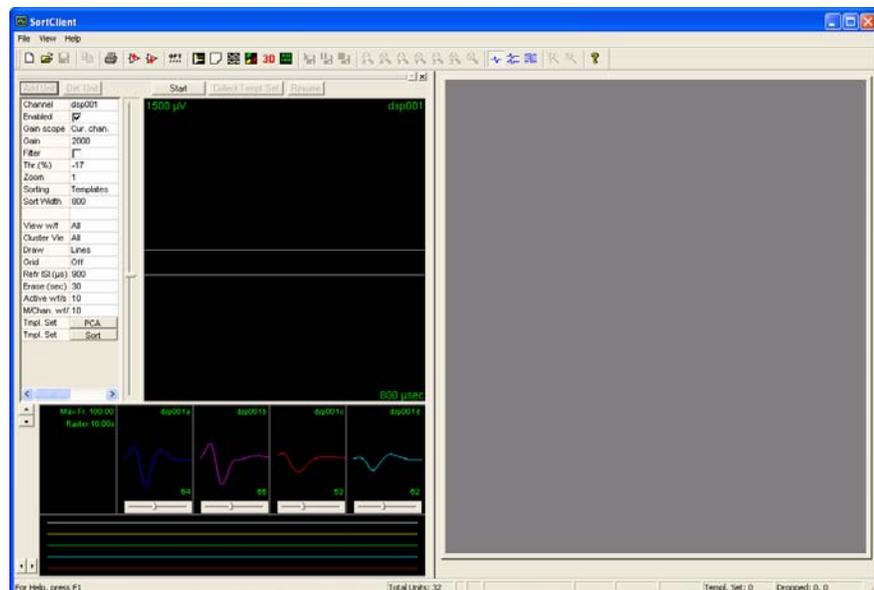
If there are no problems, the **Server** main window appears.



- 4 Start **Sort Client** program and verify no errors. The easiest way is to double-click the **Sort Client** desktop icon.



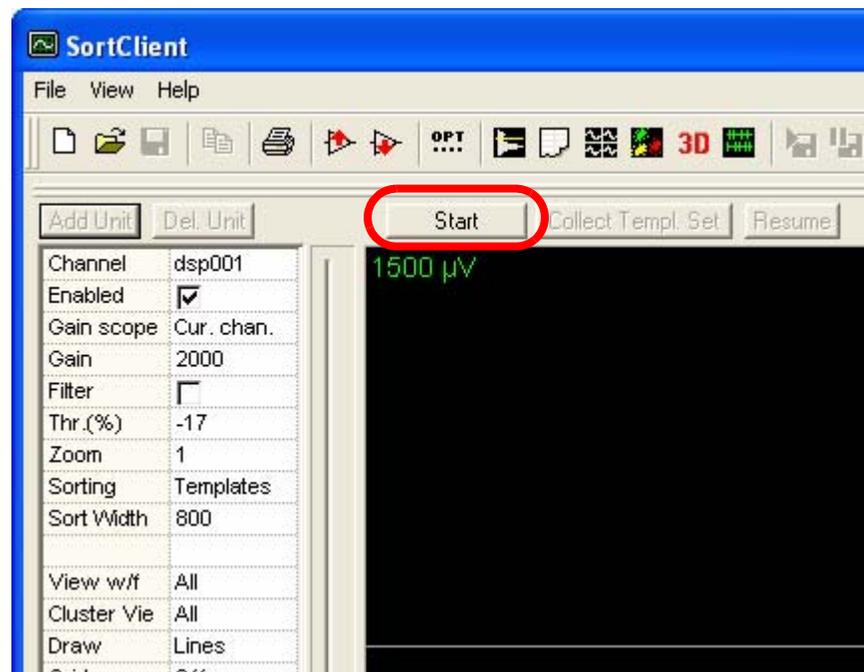
The **Sort Client** window displays.



- 5 Read a stored parameters file into **Sort Client**, if desired. Just click the **Open Sorting Parameters File...** item in the **File** menu.



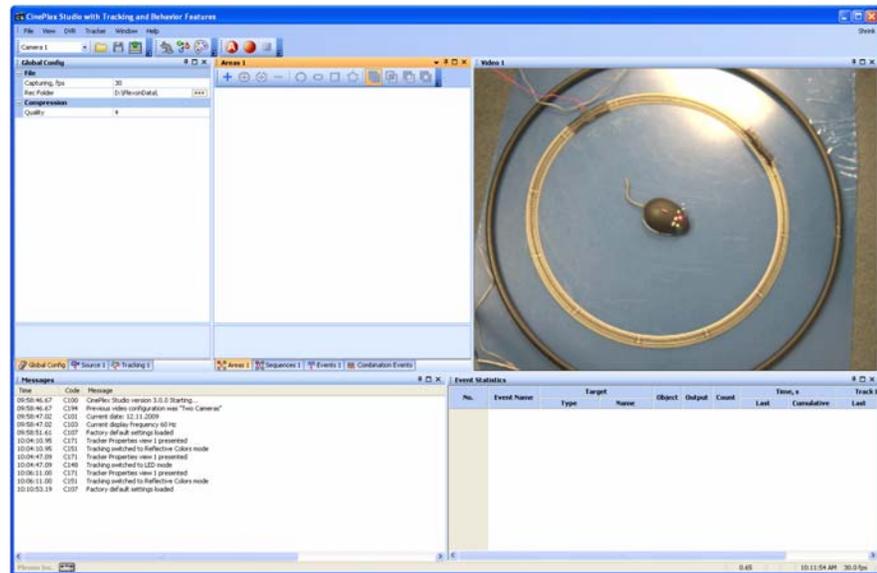
- 6 Press **Start** button on **Sort Client**.



- 7 Start **CinePlex Studio** program. The easiest way is to double-click the **CinePlex Studio** desktop icon.



The **CinePlex Studio** main window displays.



- 8 Select **Camera 1** mode (from the dropdown shown below), if not already selected. Video should now be displayed on the **Video 1** window.



- 9 If proper video is observed at the monitor, it is reasonable to assume the camera, computer, and monitor are working correctly.

If there is no video, check the cabling, connections, AC power, on/off switches, lighting, and the iris, zoom, and focus of the camera. The cables may not be connected properly, one or more cables may be broken internally, a pin or pins on a cable could be bent or broken, the iris on the camera could be shut, the zoom on the camera could be set improperly, or the focus could be set so that everything is a blur.

2.4.3 Start-Up Sequence (OmniPlex)

(Reserved for future expansion)

2.5 Setting up CinePlex Studio

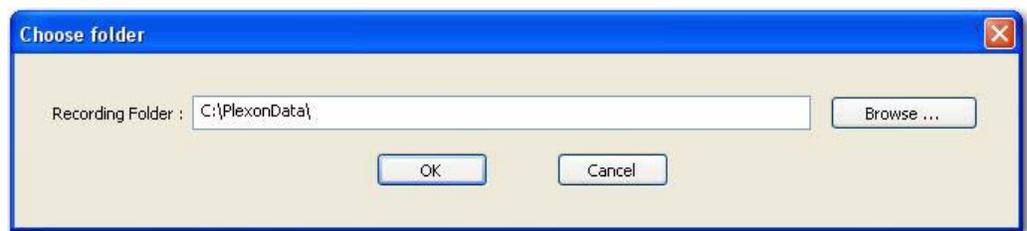
2.5.1 Arranging CinePlex Studio Windows

The default window layout will be sufficient for most instances. However, to change the window layout, see [Appendix D Plexon User Interface 1](#). To load or save a layout configuration, see [Window Menu on page D-11](#).

2.5.2 Selecting File Locations

Decide on the locations to store the recording files.

- 1 To set their locations, select **Change Data Folders** from the **File** menu. The **Choose Folders** dialog box appears.



- 2 Click the **Browse** button at the right of the **Recording Folder** text box to change the **Recording Folder**. The **Browse for Folders** dialog box appears.
- 3 Navigate to the desired folder and click **Open**. A new folder may be created by using the “Make New Folder” button.
- 4 When finished choosing a storage folder, click **OK**.

2.5.3 Positioning Camera 1

- 1 In general, it is better to position the camera as far from the experiment as possible, then zoom as much as possible in order to fill the field of view with the area of interest without distortion. To compute the distance from the camera to the arena so that the whole arena is visible, see [Appendix C](#) for more details.
- 2 When tracking is desired, ensure that the ratio of the object size to the arena size is such that the system will be able to track the object. If the ratio is too small (the image size of the object would be less than a few pixels) the system

will not be able to distinguish the object from noise. If the ratio is too large (more than 1/4 of the video image) the system will not track the object.

- 3 If there are two cameras, Camera 1 will be the one with the lowest Serial Number. If there is only one camera, it is Camera 1. Calibration only works accurately when Camera 1 is orthogonal to the arena.
- 4 Obtain an initial video image using the default **CinePlex Studio** settings and changing only the lens parameters (iris, focus, zoom).
- 5 If the previous step does not result in a good image, manually change **Camera Settings** in **CinePlex Studio**. Adjust the settings in this order: **Contrast, Brightness, Sharpness, and Saturation**.
- 6 When tracking, create an **Arena** that includes all areas of interest in the video.

2.5.4 Tracking Mode Considerations (if tracking option is available)

2.5.4.1 Tracking Mode Choices

The table below shows which tracking mode to use under various circumstances.

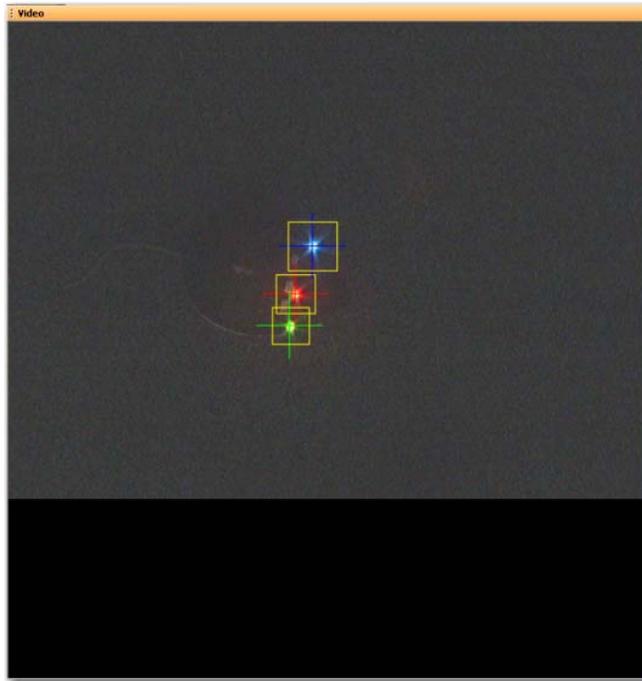
Table 1:

Using	LEDs are the Brightest Spots in Arena	Tracking Mode to Use
LEDs	Yes	LED or Reflective Colors
LEDs	No	Reflective Colors
Colored Markers	NA	Reflective Colors
No LEDs, no Colored Markers	NA	Object Contour

2.5.4.2 LED and Reflective Colors Tracking

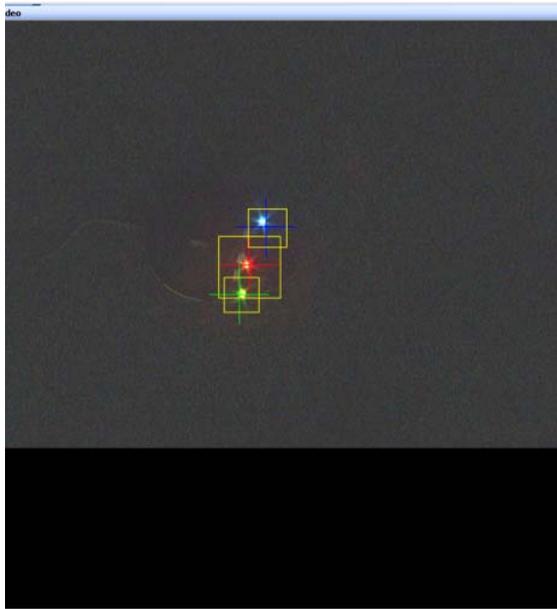
If using LED or Reflective Colors tracking, consider the lighting conditions. The illustrations below show examples of the video window with LED or Reflective Colors tracking modes under different lighting conditions.

2.5.4.2.1 LEDs in Darkness with LED Tracking Mode.



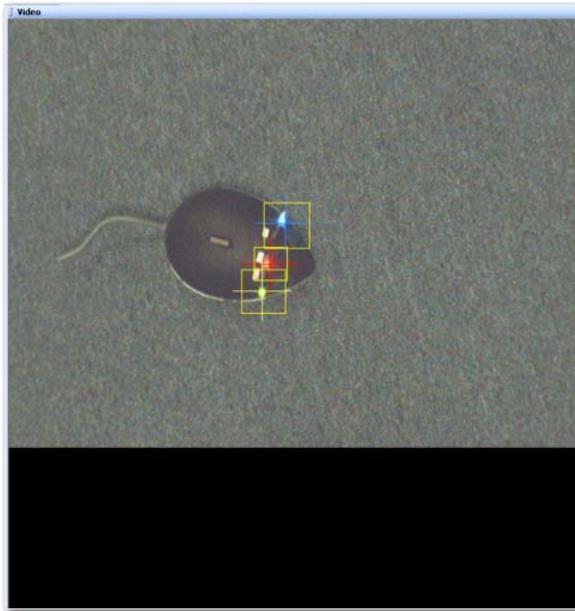
In darkness the LEDs are the brightest spots in the window, and the LED Tracking mode is excellent for this condition.

2.5.4.2.2 LEDs in Darkness with Reflective Colors Tracking Mode.



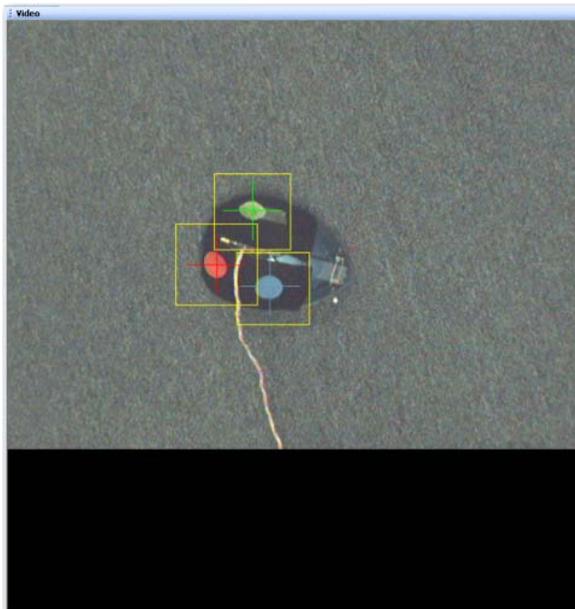
In darkness the user may also use Reflective Colors tracking mode with the LEDs being the reflective colors.

2.5.4.2.3 LEDs in Light with Reflective Colors Tracking Mode.



In lighted conditions the user may use Reflective Colors Tracking mode with the LEDs being the reflective colors.

2.5.4.2.4 Reflective Colors Tracking Mode in Light.

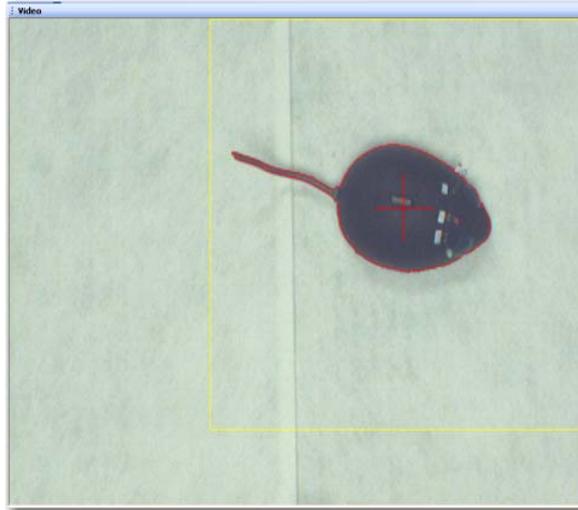


In lighted conditions without LEDs the user may use the Reflective Colors Tracking mode with the reflective colors shown in the illustration.

2.5.4.3 Object Contour Tracking

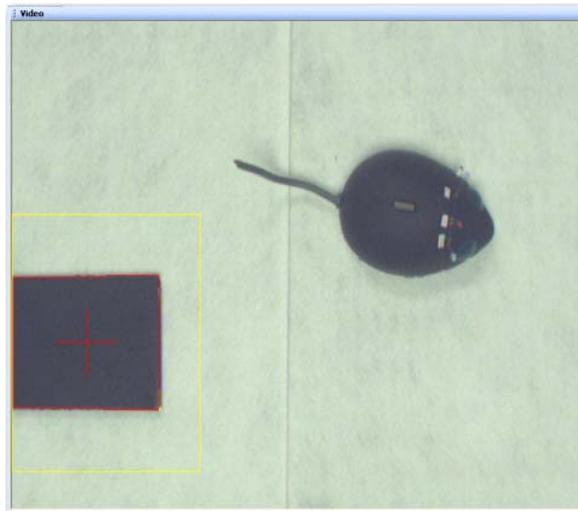
When using Object Contour tracking, consider the background color and any background objects. The illustrations below show different background and color conditions in conjunction with Object Contour tracking. For example, suppose the user wishes to track a dark animal as shown in the illustration below.

2.5.4.3.1 Animal with No Background.



This illustration shows the animal to be tracked without any background object in the window. The background color is uniform and provides a good contrast to the animal's color.

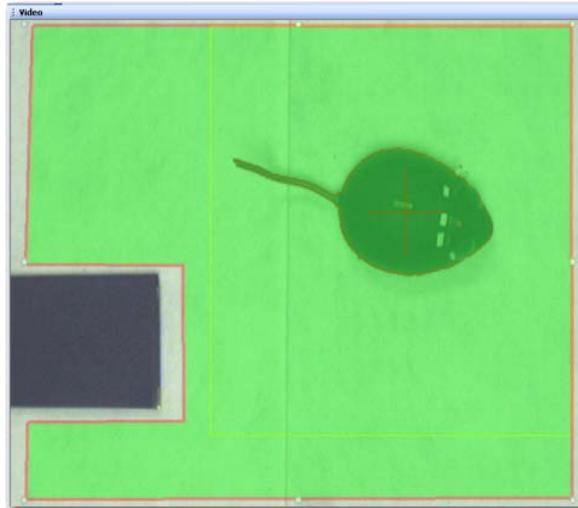
2.5.4.3.2 System Tracking Background Object.



This illustration shows an animal to be tracked along with a background object of approximately the same color. The background object is larger than the animal and the system is tracking the background object (the red cross hair is centered on

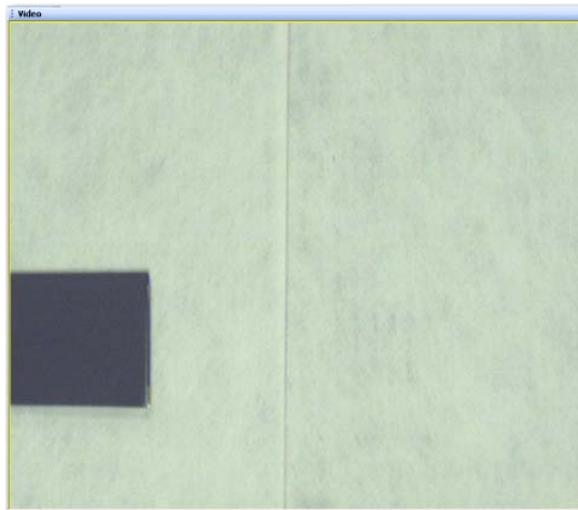
the object and the yellow rectangle is surrounding the object). To avoid this situation, define an arena in which to track or use background subtraction.

2.5.4.3.3 Arena Defined.



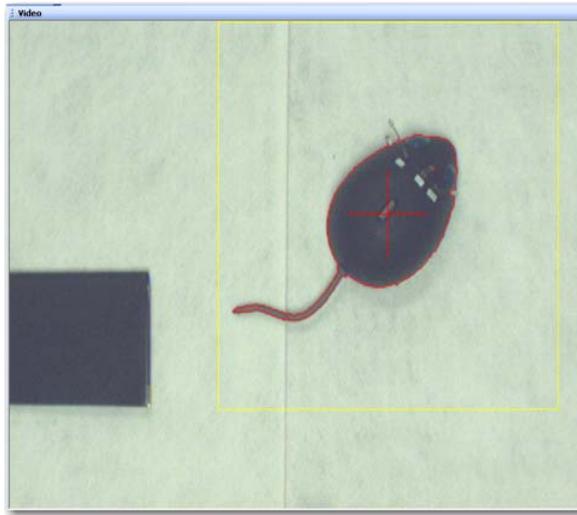
This illustration shows a defined arena (in green) that the system will use to track the animal. The arena excludes the background object so that the system will never lock onto the object by mistake.

2.5.4.3.4 Background Object.



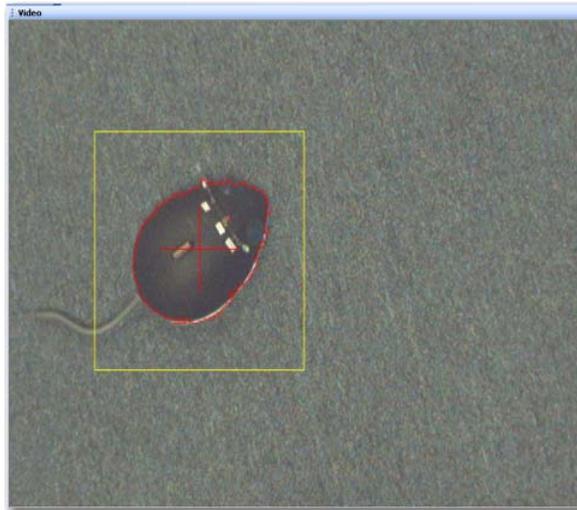
This illustration shows the background object with nothing else in the window. The user may capture the image of this window to use for background subtraction. Background subtraction allows the system to disregard the background object or objects.

2.5.4.3.5 Background Subtraction.



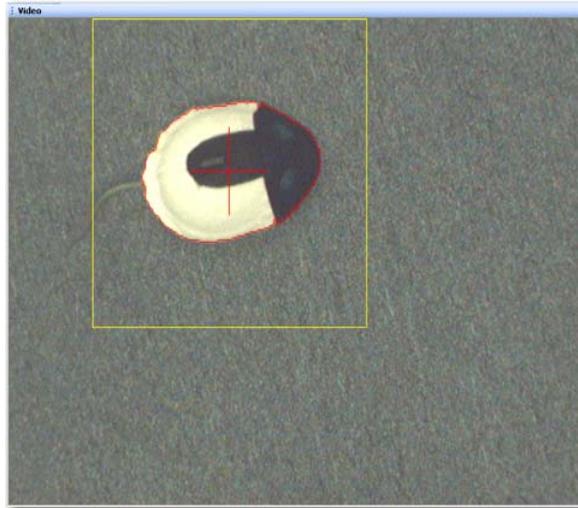
This illustration shows the background object and the animal together using background subtraction. Note that the system is tracking the animal.

2.5.4.3.6 Low Color Contrast.



Background subtraction will allow the user to do body tracking even at a low color contrast between the animal and background.

2.5.4.3.7 Multicolored Animal.

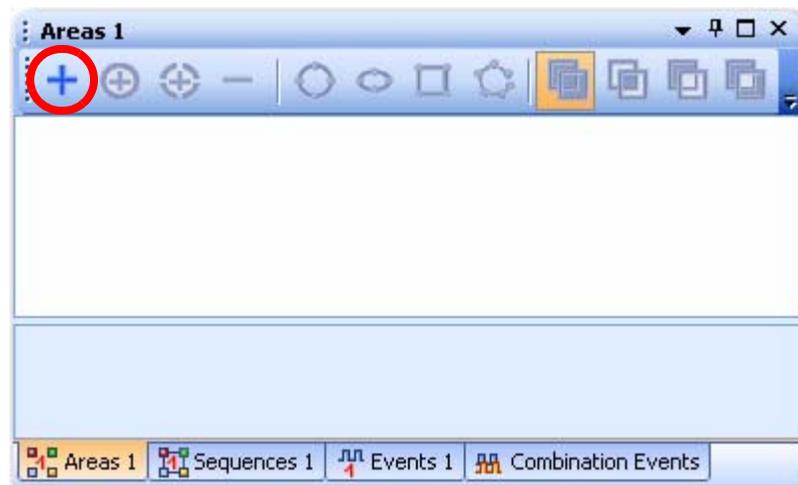


The user will be able to track multicolored animals using Plexon's special algorithm of background subtraction. In this case be sure that all colors contrast with the background color. The user may use different background colors to try to improve the quality. For example, a brick red background works well for Long-Evans rats.

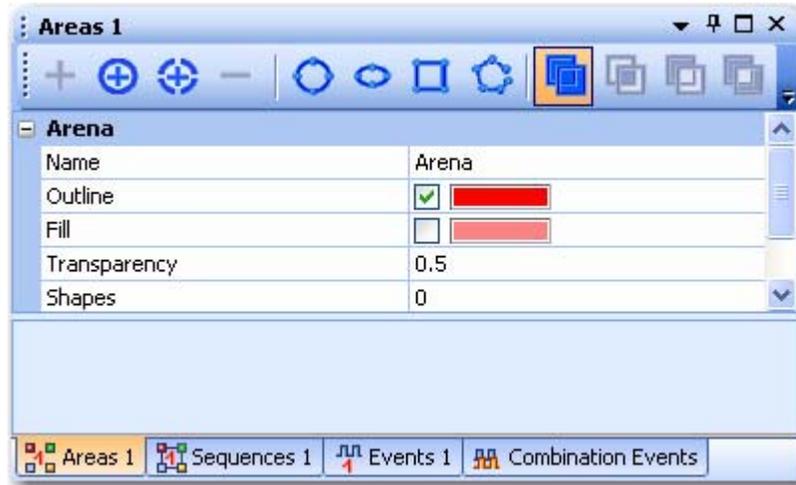
2.5.5 Tracking Mode Settings (if the tracking mode is available)

Adding Arenas

- 1 Click the **Add arena** button.



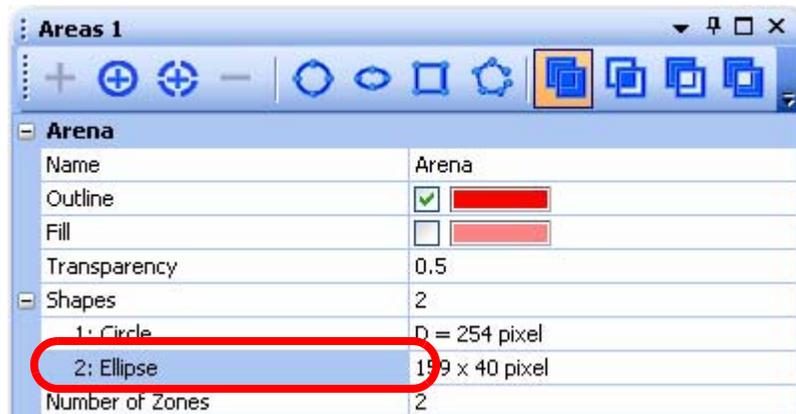
- 2 An **Arena Settings** pane is added.



- 3 Zones may be added to the arena, if desired. See [“Adding Zones” on page 47](#).
- 4 Shapes may be added to the arena, if desired. To draw a shape, click the desired shape on the toolbar (Circle, Ellipse, Rectangle, or Polygon) and then click the left mouse button in the video window and drag the shape to its desired size.



- 5 To delete a shape, select the desired shape in the **Arena** pane (or in the Video pane) and press the **Delete** key on the computer keyboard. In the images below note that the ellipse is selected for deletion.





Selecting the Tracking Mode

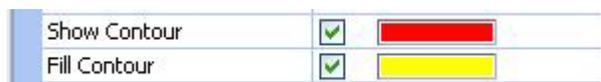
- 1 Select the desired tracking mode by clicking the appropriate icon on the **Tracker** toolbar.



- 2 The **Tracking** pane for the selected tracking mode displays in the **Static Configuration** pane.
- 3 Perform adjustments as described in section below that corresponds to the the selected tracking mode.

2.5.5.1 LED Tracking

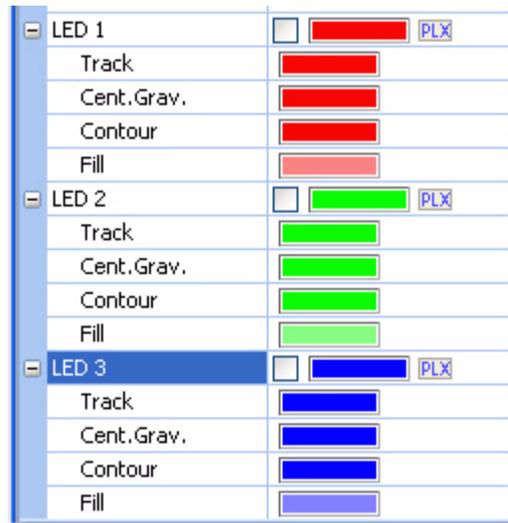
- 1 In the **Visualization** group check **Show Contour** and **Fill Contour** so that the objects found by the system are visible.



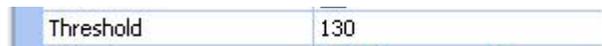
- 2 Check the **Pure Colors** checkbox in the **LED Tracker** area.



- 3 Check each color to track in the **LED** properties area.



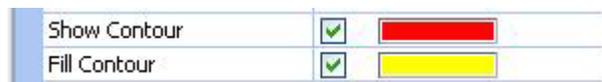
- 4 Change the **Threshold** (common to all LEDs) so that the correct objects are filled and outlined on the **Video** window. Their color crosses (representing the centers of gravity) should be centered on the correct objects.



- 5 If pure colors do not give good results, use the pick-up tool to select the color from the video (see ["Using the Color Pick-up Tool" on page 84](#)). Adjust the **Threshold** as needed.

2.5.5.2 Reflective Colors Tracking

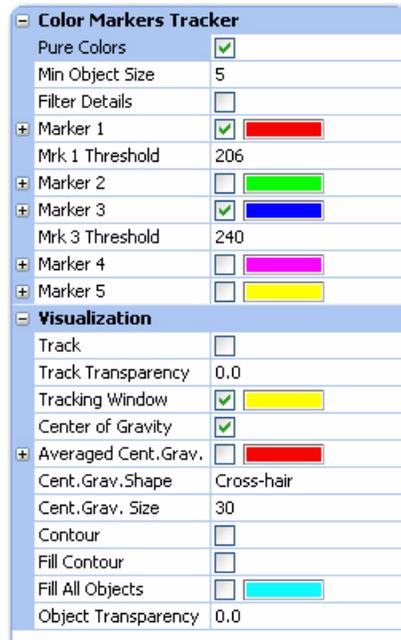
- 1 In the **Visualization** group check **Show Contour** and **Fill Contour** so that the objects found by the system are visible.



- 2 Check the **Pure Colors** checkbox in the **Reflective Colors Tracker** area.



- 3 Check the color to track (by clicking the corresponding checkbox).



- 4 Click on the '+' of any markers whose settings need to be changed.



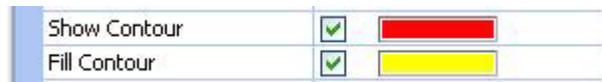
- 5 Adjust the **Threshold** of the selected color (see diagram above) so that the correct object is filled and outlined on the **Video** window and its color cross is properly centered.

Note: If working with pure RGB colors, the **Threshold** should be moved to lower values to provide stable tracking.

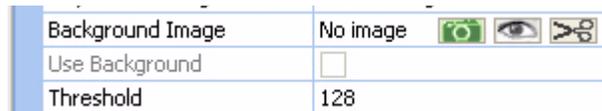
- 6 If pure colors do not give good results, select the color from the video (using the pick-up tool - see “Using the Color Pick-up Tool” on page 84). Adjust the **Threshold** higher to find and track the object.
- 7 Repeat steps 2-4 for each color selected.

2.5.5.3 Object Contour Tracking

- 1 In the **Visualization** group check **Show Contour** and **Fill Contour** so that the objects found by the system are visible.



- 2 If the animal has a good contrast relative arena image, and the background is uniform, i.e., there are no other objects with similar contrast - work without subtraction of the background image. Adjust the threshold to fill the whole animal.
- 3 With a non-uniform background, use background subtraction to track better.
- 4 Remove animal from the tracking area.
- 5 Capture background image by clicking the **Camera** icon. The **Use Background** control will activate so that it may be clicked.



- 6 Check the **Use Background** checkbox (see diagram above).
- 7 Replace the animal in the tracking area.
- 8 Adjust the **Threshold** (see diagram above) to fill the whole animal.

Use **Detail Filter** to remove non-required features of the detected objects (tail, etc.) or to remove parasite objects in the whole image. Note that object features, such as the tail, slightly shifts the center of gravity of the body, and filtering helps to correct it.

Pressing the eye icon brings up a window containing the latest background image.

For systems with a second camera, repeat Steps 2.5.3, 2.5.4, 2.5.5, and 2.5.6.

2.5.5.4 Calibration

Once the tracking method has been selected and other parameters adjusted as desired, the experimenter may desire to calibrate the Camera 1 video image so

that sizes, positions and velocities are reported in the desired units of measure instead of pixels.

Note: Calibration applies only to Source 1. Dimensions of arenas, zones, and track lengths are in pixels for Source 2. Speed events are not allowed for Source 2 because it is never calibrated.

CinePlex Studio provides two methods of calibration - single axis and dual axis. Use single bar unless Camera 1 is not orthogonal to the experimental surface - then use the dual bar method.

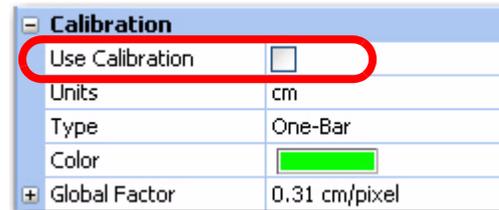
Calibration is the final section of the **Source 1** pane.

Calibrating CinePlex Studio

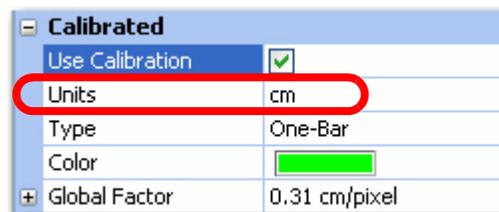
- 1 Open up the **Calibration** (if it is not already open) section by clicking on the “+” sign.



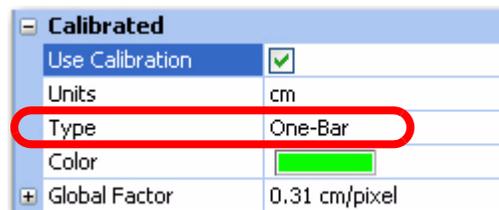
- 2 Check the box labeled **Use Calibration**. Note that the title of the section changes from **Calibration** to **Calibrated**. This is because the current calibration **Global Factor** is being applied.



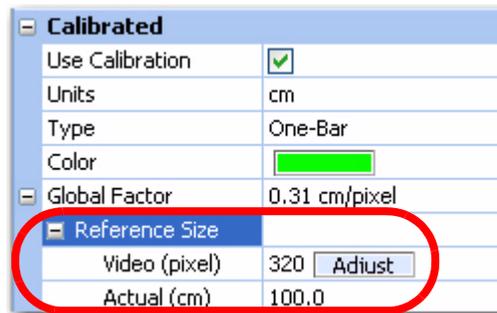
- 3 Select the unit of measure - either cm for centimeters or in. for inches.



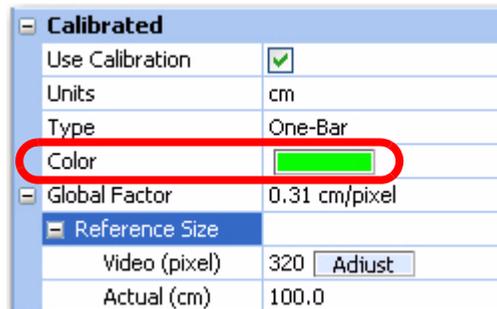
- 4 Select the method of calibration - either **One-Bar** or **Two-Bar**.



- 5 When one-bar has been selected:
- Click the “+” sign next to **Global Factor** and then the “+” next to **Reference Size** to expand their subsections, if needed. If they are already shown as “-” signs, this is not needed.



- If the current color in the box next to the **Color** item will not provide good contrast with the video image, click in the box and select a suitable color. The color selected is the color of the measurement bar used for calibration.



- Choose a feature in the experimental area whose video image extends over much of the field of view. As an illustration, the inside diameter of the clock frame in the image below will be used as the desired dimension.



- d Measure its longest dimension in the units desired, and record it for reference. The inside diameter of the clock frame measured 30.5 cm.
- e Click the **Adjust** button. The cursor will go to the video image and a line will appear in the color selected. Select one end of the colored line and move it to one end of the feature just measured. Select the other end of the line and move it to the other end of the feature. Right-click to record the length of the bar in pixels.

Calibrated	
Use Calibration	<input checked="" type="checkbox"/>
Units	cm
Type	One-Bar
Color	
Global Factor	0.31 cm/pixel
Reference Size	
Video (pixel)	320 <input type="button" value="Adjust"/>
Actual (cm)	100.0



In the image above note the green line through the middle of the clock with the box on each end. This is the sizing bar.

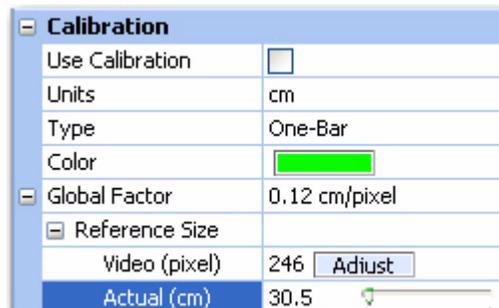


In the above image note that the left end of the sizing bar has been moved to the inside edge of the clock's frame. Select the other end of the sizing bar and move it to the opposite inside edge of the clock frame and ensure the sizing bar crosses the intersection of the clock hands.



In the above image note that the sizing bar now measures the inside diameter of the clock's frame.

- f Go to the slider next to the **Actual** item and move it so that it reads the dimension recorded above. Studio is now calibrated to the measured distance.



In the image above note that the Actual setting has been changed to the measured inner diameter of the clock's frame (30.5 cm).

- g Click all three "-" signs once the adjustment is satisfactory to hide the adjustments.
- 6 When two-bar has been selected:
 - a Click the "+" sign next to **Horizontal Factor** and then the "+" next to **Reference Size** to expand their subsections, if needed. If they are already shown as "-" signs, this is not needed.

Calibrated	
Use Calibration	<input checked="" type="checkbox"/>
Units	cm
Type	Two-Bar
Color	<input type="color" value="#00FF00"/>
Horizontal Factor	0.31 cm/pixel
Vertical Factor	0.42 cm/pixel

Calibrated	
Use Calibration	<input checked="" type="checkbox"/>
Units	cm
Type	Two-Bar
Color	<input type="color" value="#00FF00"/>
Horizontal Factor	0.31 cm/pixel
Reference Size	
Vertical Factor	0.42 cm/pixel

Calibrated	
Use Calibration	<input checked="" type="checkbox"/>
Units	cm
Type	Two-Bar
Color	<input type="color" value="#00FF00"/>
Horizontal Factor	0.31 cm/pixel
Reference Size	
Video (pixel)	320 <input type="button" value="Adjust"/>
Actual (cm)	100.0
Vertical Factor	0.42 cm/pixel

- b If the current color in the box next to the **Color** item will not provide good contrast with the video image, click in the box and select a suitable color.

Calibrated	
Use Calibration	<input checked="" type="checkbox"/>
Units	cm
Type	Two-Bar
Color	<input type="color" value="#00FF00"/>
Horizontal Factor	0.31 cm/pixel
Reference Size	
Video (pixel)	320 <input type="button" value="Adjust"/>
Actual (cm)	100.0
Vertical Factor	0.42 cm/pixel

- c Choose a horizontal feature (horizontal relative to the video image) in the experimental area whose video image extends over much of the field of view. Once again the inner diameter of the clock's frame will be used.



- d Measure the feature's horizontal dimension in the units desired, and record it for reference. The inner diameter is 30.5 cm.
- e Click the **Adjust** button in the **Horizontal** section. The cursor will go to the video image and a line will appear in the color selected.



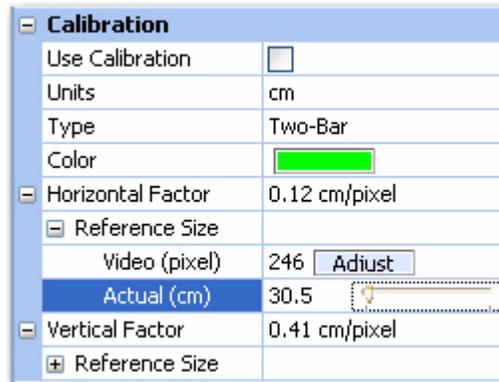
In the image above note the green line through the middle of the clock with the box on each end. This is the sizing bar.

- f Move the sizing bar vertically so that it rests on the intersection of the clock hands. Select one end of the sizing bar and move it to the inside edge of the clock frame. Select the other end of the sizing bar and move it to the inside edge of the clock frame. Right-click to record the length of the bar in pixels.



In the above image note that the sizing bar now measures the inside diameter of the clock's frame.

- g Go to the slider next to the **Horizontal Actual** item and move it so that it reads the dimension recorded above.



- h Click the "+" sign next to the **Vertical Factor** and then the "+" next to **Reference Size** to expand their subsections, if needed. If they are already shown as "-" signs, this is not needed.

Calibrated	
Use Calibration	<input checked="" type="checkbox"/>
Units	cm
Type	Two-Bar
Color	<input type="color" value="#00FF00"/>
Horizontal Factor	0.31 cm/pixel
Reference Size	
Video (pixel)	320 <input type="button" value="Adjust"/>
Actual (cm)	100.0
Vertical Factor	0.42 cm/pixel
Reference Size	

Calibrated	
Use Calibration	<input checked="" type="checkbox"/>
Units	cm
Type	Two-Bar
Color	<input type="color" value="#00FF00"/>
Horizontal Factor	0.31 cm/pixel
Reference Size	
Video (pixel)	320 <input type="button" value="Adjust"/>
Actual (cm)	100.0
Vertical Factor	0.42 cm/pixel
Reference Size	
Video (pixel)	240 <input type="button" value="Adjust"/>
Actual (cm)	100.0

- i If the current color in the box next to the **Color** item will not provide good contrast with the video image, click in the box and select a suitable color.

Calibrated	
Use Calibration	<input checked="" type="checkbox"/>
Units	cm
Type	Two-Bar
Color	<input type="color" value="#00FF00"/>
Horizontal Factor	0.31 cm/pixel
Reference Size	
Video (pixel)	320 <input type="button" value="Adjust"/>
Actual (cm)	100.0
Vertical Factor	0.42 cm/pixel
Reference Size	
Video (pixel)	240 <input type="button" value="Adjust"/>
Actual (cm)	100.0

- j Choose a vertical feature (vertical relative to the video image) in the experimental area whose video image extends over much of the field of view. Once again the inner diameter of the clock's frame will be measured.

- k Measure the feature's vertical dimension in the units desired, and record it for reference. The inner diameter of the clock's frame is 30.5 cm.
- l Click the **Adjust** button in the **Vertical** section. The cursor will go to the video image and a line will appear in the color selected.



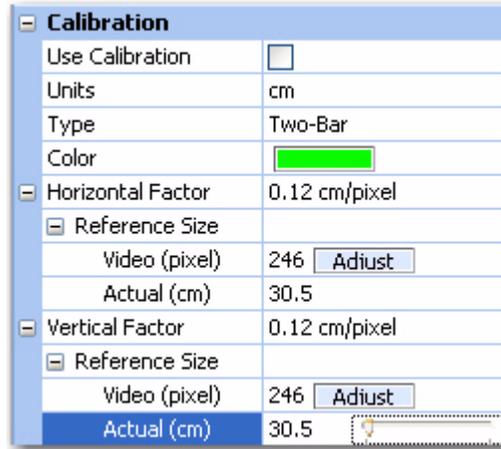
In the image above note the vertical green line with a box at each end. This line is the sizing bar.

- m Select the sizing bar and move it horizontally until the sizing bar rests on the intersection of the clock hands. Select one end of the sizing bar and move it so that one end of the sizing bar touches the inside edge of the clock frame. Select the other end of the sizing bar and move it to the opposite inside edge of the clock frame. Right-click to record the length of the bar in pixels.



In the image above the bottom of the sizing bar has been set within the clock frame.

- n Go to the slider next to the **Vertical Actual** item and move it so that it reads the dimension recorded above (30.5 cm).



Now Studio has been calibrated in both horizontal and vertical directions.

- o Click all five “-” signs once the adjustments are satisfactory to hide the adjustments.

2.5.6 Behavior Mode Settings (If the Behavior Option is available)

The behavior option adds zones, sequences of zones, combination events, and digital outputs to CinePlex Studio.

Adding Zones

- 1 On the **Areas** tab click the **Add static zone to current arena** or **Add dynamic zone to current arena** icon.



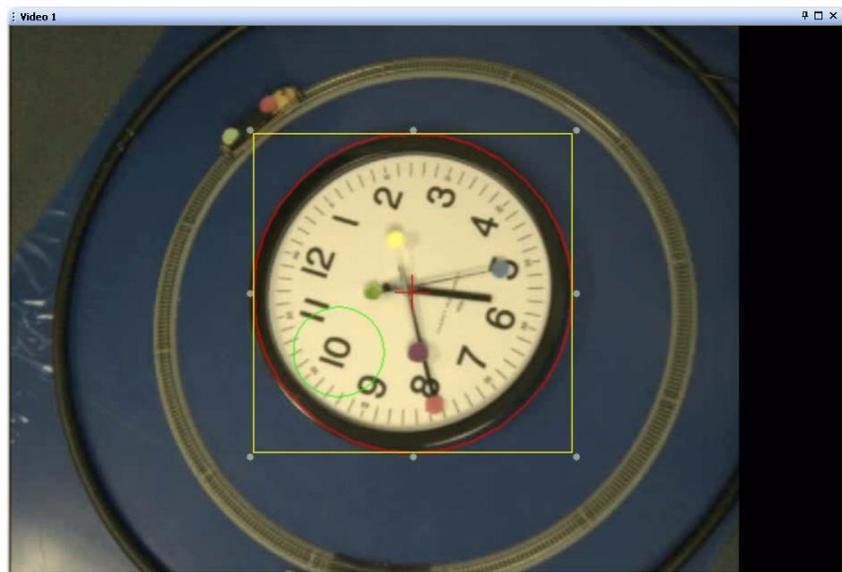
- 2 Select the drawing tool that makes the most sense for the zone that needs to be created.



- 3 Draw the zone outline over the image corresponding to the first physical zone of interest. For the image below a red circle was added.



- 4 Adjust size and shape so that the complete zone, and nothing else, is enclosed by the outline. For the image below, the circle was adjusted to fit around the clock by moving and adjusting the circle by the handles on the yellow square.



- 5 Select a different drawing tool if needed.
Note: Remember that complex zones can be created by AND, XOR, NOT, and NOR operations on additional shapes as they are added to the zone.
Note: Dynamic zones are created by clicking the **Dynamic Zone** icon and selecting the color around which to draw it.

- 6 Repeat these steps for each additional zone to be defined.

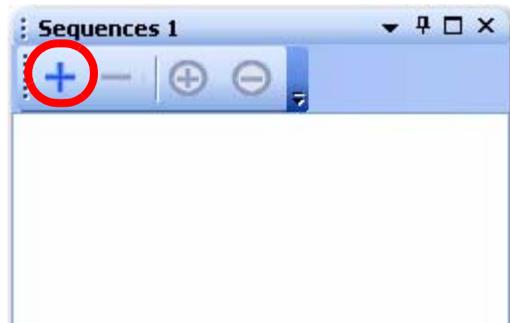
Defining Sequences of Zones

Note: Before defining sequences of zones, two or more zones must be defined.

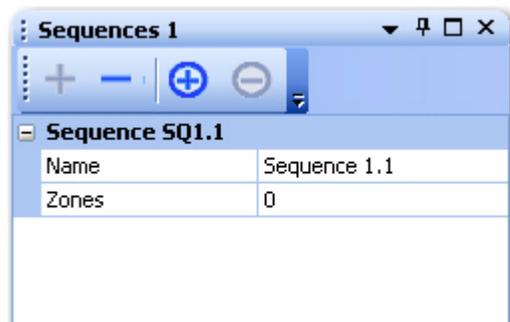
- 1 After two or more zones have been added, use the **Sequences** tab.



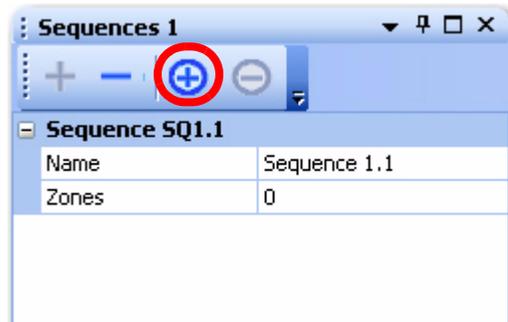
- 2 Click the **Add new sequence** icon to add a sequence.



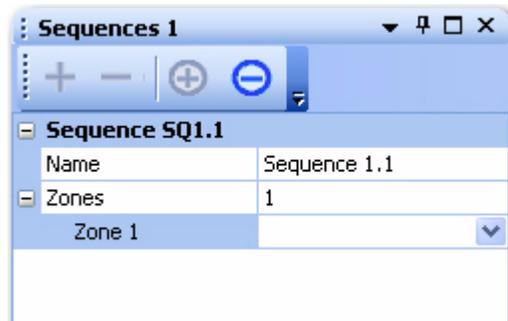
A new sequence is added to the pane.



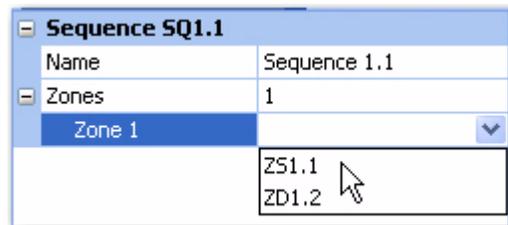
- 3 Click the **Add zone to selected sequence** icon to add a zone to the sequence.



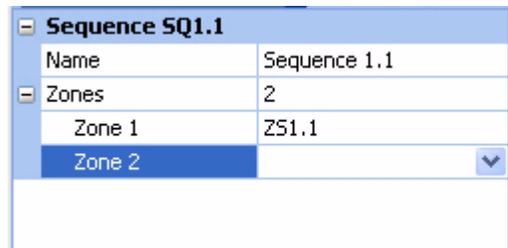
A zone is added to the sequence.



- 4 Select available zones from the drop down list for the new sequence.



The selected zone is displayed in the **Zone 1** setting.



- 5 Repeat these steps for each additional sequence to be defined.

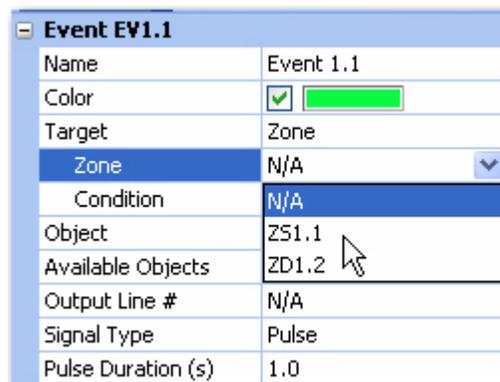
Defining Logical Events

Logical events can be defined so that, when an animal enters or leaves a zone, or completes a sequence, the event becomes TRUE.

- 1 Use the **Events** tab.



- 2 Select a zone or sequence of zones.



- 3 Select a tracked object to traverse the zone or sequence.

Event EV1.1	
Name	Event 1.1
Color	<input checked="" type="checkbox"/>
Target	Zone
Zone	N/A
Condition	Entering Zone
Object	Position of Object
Available Objects	Marker 3 ▼
Output Line #	N/A
Signal Type	Marker 1
Pulse Duration (s)	Marker 3

- 4 Define the conditions.

Event EV1.1	
Name	Event 1.1
Color	<input checked="" type="checkbox"/>
Target	Zone
Zone	N/A
Condition	Entering Zone ▼
Object	Entering Zone
Available Objects	Exiting Zone
Output Line #	N/A
Signal Type	Pulse
Pulse Duration (s)	1.0

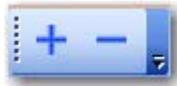
The event will become TRUE when the conditions are satisfied. At that point, the event count will be incremented and times and track lengths will be extended.

Defining Combination Events

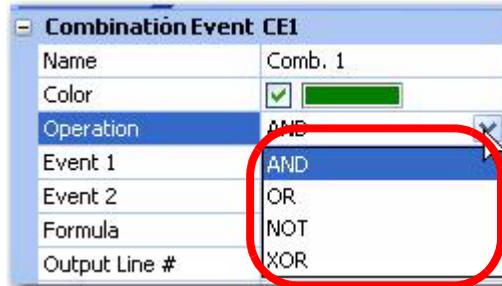
- 1 Use the **Combination Events** tab.

Combination Event CE1	
Name	Comb. 1
Color	<input checked="" type="checkbox"/>
Operation	AND
Event 1	EV1.1
Event 2	N/A
Formula	N/A
Output Line #	N/A
Signal Type	Pulse
Pulse Duration (s)	1.0

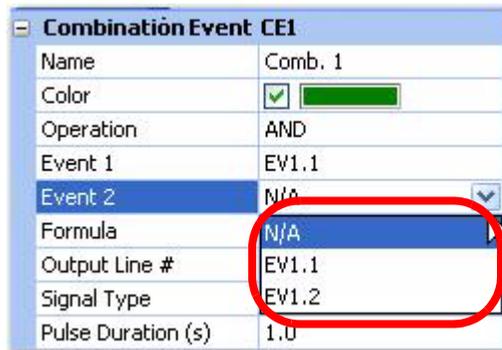
- 1 Click the **Add new combination of tracking events** icon.



- 2 Select the logical operation to use.



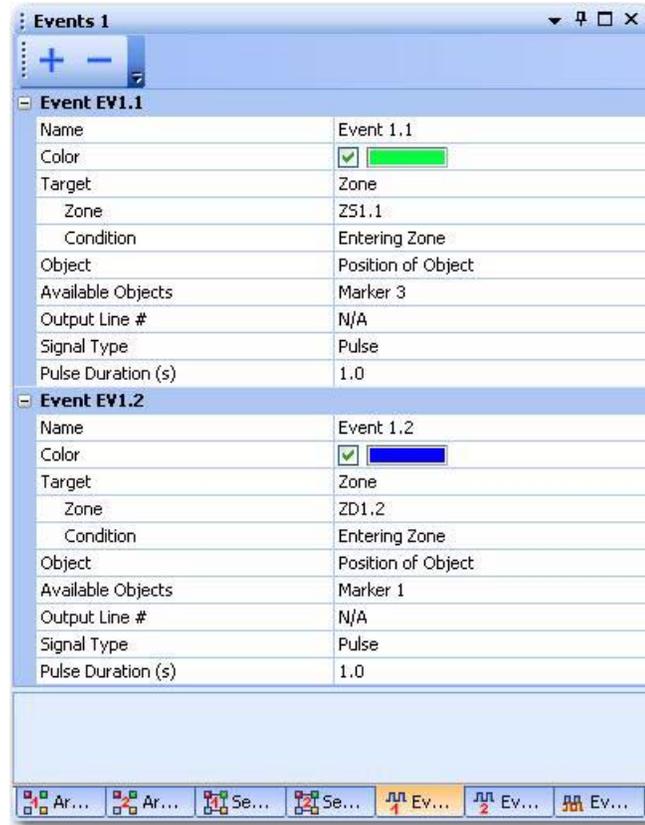
- 3 Select each event in the sequence from the drop down list of available events.



Specifying Digital Outputs

Digital outputs are an option when creating a logical event.

- 1 Use the **Events** tab.



- 2 To specify that a digital output occurs when an event is TRUE, select the desired output line from the drop down list associated with the event.



Up to 24 different digital outputs can be specified, any of which can be pulsed, high, or low when TRUE.

2.6 Executing the Experiment Plan

The steps performed in this part of the process depend on the experiment plan. Since implementing the experiment plan depends on the contents of the plan and there are an unlimited number of experiment plans, detailed discussion of this section is beyond the scope of this manual.

2.6.1 Digital Video Recording

The Digital Video Recording (DVR) feature of CinePlex Studio stores the video recording from one or more cameras on an internal hard drive. In most experiments, the user simultaneously collects a neural data file in an AVI file. With CinePlex Studio, the user may start, stop, and time stamp these AVI files in a way that enables the user to subsequently correlate them offline with the simultaneously-captured neural data. For information on starting, pausing, and stopping recording of files, see [“DVR Menu” on page 153](#). For more information, see [“Understanding CinePlex Editor Files” on page 162](#).

To enable offline analysis, bring the pairs of AVI and neural data files together on the same computer—the “analysis computer”—with CinePlex Studio and Editor. The user may use a variety of means to transfer the AVI files from the CinePlex Studio internal hard drive to the analysis computer, if needed. Likewise, if the neural data files are stored elsewhere, the user may transfer the neural data files to the analysis computer, perhaps by using a network connection or some other means. If the analysis computer is the Plexon Neural Data Acquisition/CinePlex computer, it typically stores the neural data files on a local disk.

Recording and transferring video files

- 1 Use CinePlex Studio to record one or more AVI or DVT files on the internal hard drive. If the Recording Folder has not been set, a notification message will display.
- 2 Transfer the AVI files or DVT files, or both, onto the analysis computer, if different. When finished copying the files to the analysis computer, rename the files, if desired.
- 3 Use CinePlex Editor (or some other method) to match up the AVI file with its partner neural data file, or DVT file, or both, and analyze the data.

Note: For a detailed version of this procedure, see [“Recording Synchronized Video and Neural Data” on page 62](#) or [“Managing Video Files” on page 64](#).



CAUTION **Camera Damage**

Never connect or disconnect the camera while the power is on. The camera can be permanently damaged.

2.6.2 Dropped Frames

With CinePlex Version 3 dropped frames occur much less frequently than for earlier versions. However, in the event that dropped frames ever cause problems, please contact Plexon Support.

2.6.3 Frame Rate

The instantaneous frame rate observed by Studio is displayed at the bottom of the Studio window. It should steadily display the user-selected frame rate while recording. If it does not, the computer is experiencing partial congestion. Partial congestion is normally caused by non-Plexon applications. Partial congestion does not result in dropped frames, but tracking and other processing may be slightly delayed.

2.6.4 Digital Video Recorder AVI Format Files

CinePlex Studio typically records video into motion-JPEG AVI files at a resolution of 640x480 pixels at up to 80 frames per second, which implies a raw data rate of over 300 GB/hour. However; to reduce disk usage, CinePlex Studio compresses the video before it writes it to the AVI file. Studio offers a choice of MJPEG and MPEG formats. With each format the user may vary the file compression to find a suitable balance between AVI file size and image quality.

2.6.4.1 Motion JPEG Recordings (MJPEG)

The quality settings for MJPEG range from 20 to 90. At an image quality setting of 65, an AVI file grows at a rate of approximately 2.1 GB/hour. This growth rate depends on the complexity of the video image, which affects the compressibility.

2.6.4.2 MPEG Recordings

MPEG is the default recording format because it produces files that are routinely 75 to 90% smaller than the equivalent MJPEG formatted files.

The quality settings for MPEG range from 1 to 10. The values represent the nominal bit rate divided by 500,000.

While it records, CinePlex Studio continually calculates and displays the amount of recording time left until the target hard drive fills up. As the hard drive capacity is neared, CinePlex Studio stops recording.

Note: Experiment to find the minimum quality setting that yields an acceptable image. For example, if the user increases the MJPEG quality setting from 65 to 90, the size of the AVI file doubles using the same recording time—but it does not dramatically increase the quality of the image. Conversely, if the user reduces the quality setting from 65 to 20, the size of the AVI file halves using the same recording time—however, the quality of the image degrades significantly.

The AVI files created by CinePlex Studio are industry-standard AVI-format files that the user may play with many standard tools, including Microsoft Windows Media Player, which is pre-installed on most Windows computers. The user may

also use a variety of commercial software applications to edit and perform other operations on AVI files.

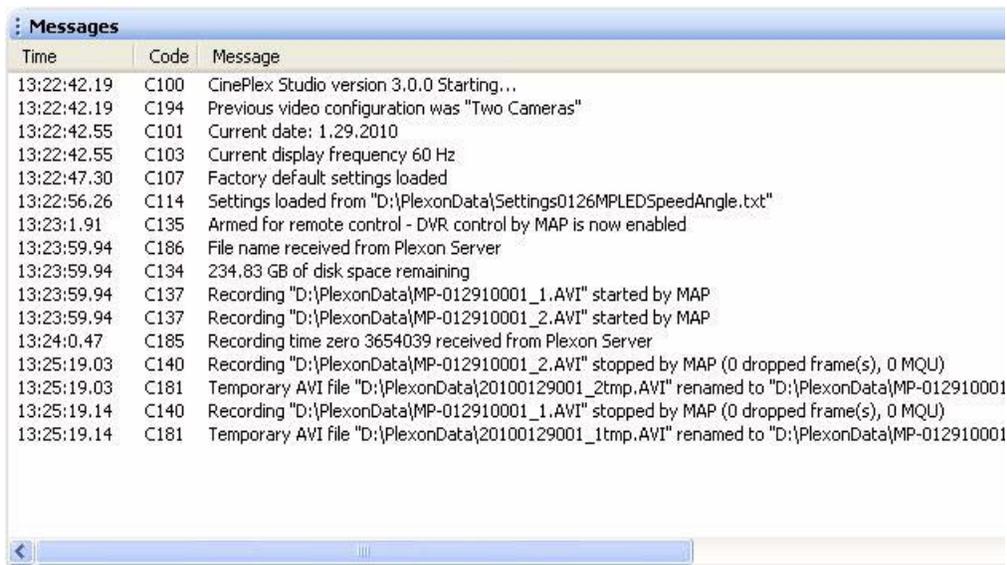
Note: Windows Media Player and other video players render files slower than real time if the files were recorded at 40 frames per second or greater. This can be confusing because the slider moves faster than the video plays such that the slider reaches the end of its travel before the video finishes playing.

The AVI format allows the embedding of additional data segments within AVI files. Each embedded data segment has an identification tag. Typically, an AVI file reader that does not recognize a tag for an embedded data segment skips that data segment. CinePlex Studio always produces AVI files with a Plexon-specific additional tagged data segment that contains dynamic data for each video frame. CinePlex Editor can read this additional data segment in the AVI files generated by CinePlex Studio and thus recover the timestamp of each frame. Other AVI file readers like Windows Media Player ignore this data. This Plexon-specific nondestructive embedded data is not visible on the video frame. However, CinePlex Studio contains an optional feature that can overlay this time stamp in visible numerals on the video image itself; see [“DVR Group” on page 125](#).

2.6.5 File Naming

2.6.5.1 CinePlex Studio File Handling

This section discusses the sequence of events when starting CinePlex Studio remotely (i.e. clicking the **Arm** toolbar button on CinePlex Studio and then clicking the **Start** button on Sort Client). The events in the Message pane will illustrate the sequence of events.



Time	Code	Message
13:22:42.19	C100	CinePlex Studio version 3.0.0 Starting...
13:22:42.19	C194	Previous video configuration was "Two Cameras"
13:22:42.55	C101	Current date: 1.29.2010
13:22:42.55	C103	Current display frequency 60 Hz
13:22:47.30	C107	Factory default settings loaded
13:22:56.26	C114	Settings loaded from "D:\PlexonData\Settings0126MPLED5speedAngle.txt"
13:23:1.91	C135	Armed for remote control - DVR control by MAP is now enabled
13:23:59.94	C186	File name received from Plexon Server
13:23:59.94	C134	234.83 GB of disk space remaining
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_1.AVI" started by MAP
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_2.AVI" started by MAP
13:24:0.47	C185	Recording time zero 3654039 received from Plexon Server
13:25:19.03	C140	Recording "D:\PlexonData\MP-012910001_2.AVI" stopped by MAP (0 dropped frame(s), 0 MQU)
13:25:19.03	C181	Temporary AVI file "D:\PlexonData\20100129001_2tmp.AVI" renamed to "D:\PlexonData\MP-012910001_2.AVI"
13:25:19.14	C140	Recording "D:\PlexonData\MP-012910001_1.AVI" stopped by MAP (0 dropped frame(s), 0 MQU)
13:25:19.14	C181	Temporary AVI file "D:\PlexonData\20100129001_1tmp.AVI" renamed to "D:\PlexonData\MP-012910001_1.AVI"

Sequence of Events

- 1 The **Arm** toolbar button on CinePlex Studio is clicked.

Messages		
Time	Code	Message
13:22:42.19	C100	CinePlex Studio version 3.0.0 Starting...
13:22:42.19	C194	Previous video configuration was "Two Cameras"
13:22:42.55	C101	Current date: 1.29.2010
13:22:42.55	C103	Current display frequency 60 Hz
13:22:47.30	C107	Factory default settings loaded
13:22:56.26	C114	Settings loaded from "D:\PlexonData\Settings0126MPLEDSpeedAnc
13:23:1.91	C135	Armed for remote control - DVR control by MAP is now enabled
13:23:59.94	C186	File name received from Plexon Server
13:23:59.94	C134	234.83 GB of disk space remaining
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_1.AVI" started by MAP
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_2.AVI" started by MAP
13:24:0.47	C185	Recording time zero 3654039 received from Plexon Server
13:25:19.03	C140	Recording "D:\PlexonData\MP-012910001_2.AVI" stopped by MAP
13:25:19.03	C181	Temporary AVI file "D:\PlexonData\20100129001_2tmp.AVI" renam
13:25:19.14	C140	Recording "D:\PlexonData\MP-012910001_1.AVI" stopped by MAP
13:25:19.14	C181	Temporary AVI file "D:\PlexonData\20100129001_1tmp.AVI" renam

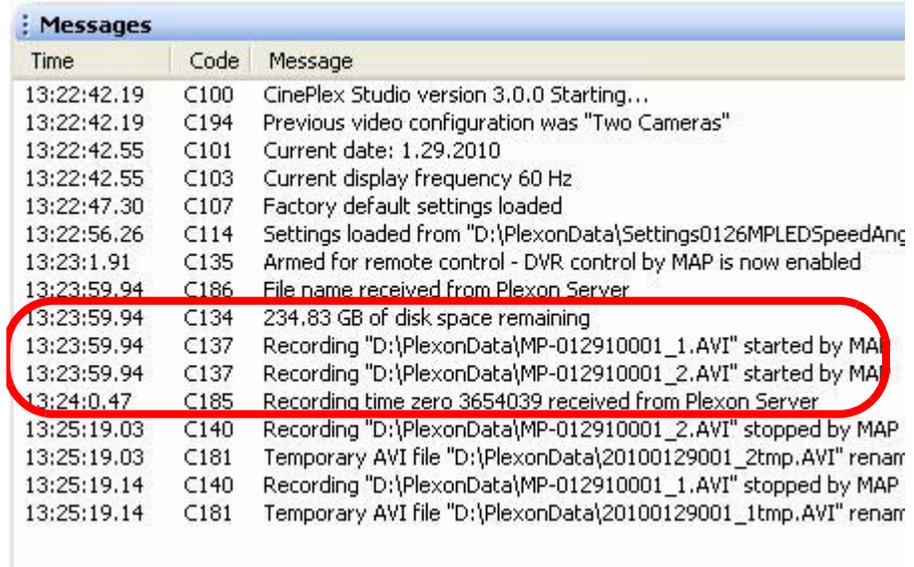
When the **Arm** button is clicked, Studio opens one or two (one if one camera is used, two if two cameras are used) temporary AVI files. The reason that the files are temporary is that no time is lost opening the files when the Start button is clicked and that Sort Client sends the filename to Studio and since Studio does not know the filename in advance, the newly opened files must be temporary. The file format is **yyyymmdd001tmp.avi** if one camera is used. If two cameras are used, then two temporary files are created with the format **yyyymmdd001tmp_1.avi** for camera 1 and **yyyymmdd001tmp_2.avi** for camera 2 where **yyyy** is the year, **mm** is the month, and **dd** is the date. The 001 is the current file number. This number increments with each recording during the day.

- 2 The **Start** button on Sort Client is clicked.

Messages		
Time	Code	Message
13:22:42.19	C100	CinePlex Studio version 3.0.0 Starting...
13:22:42.19	C194	Previous video configuration was "Two Cameras"
13:22:42.55	C101	Current date: 1.29.2010
13:22:42.55	C103	Current display frequency 60 Hz
13:22:47.30	C107	Factory default settings loaded
13:22:56.26	C114	Settings loaded from "D:\PlexonData\Settings0126MPLEDSpeedAnc
13:23:1.91	C135	Armed for remote control - DVR control by MAP is now enabled
13:23:59.94	C186	File name received from Plexon Server
13:23:59.94	C134	234.83 GB of disk space remaining
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_1.AVI" started by MAP
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_2.AVI" started by MAP
13:24:0.47	C185	Recording time zero 3654039 received from Plexon Server
13:25:19.03	C140	Recording "D:\PlexonData\MP-012910001_2.AVI" stopped by MAP
13:25:19.03	C181	Temporary AVI file "D:\PlexonData\20100129001_2tmp.AVI" renam
13:25:19.14	C140	Recording "D:\PlexonData\MP-012910001_1.AVI" stopped by MAP
13:25:19.14	C181	Temporary AVI file "D:\PlexonData\20100129001_1tmp.AVI" renam

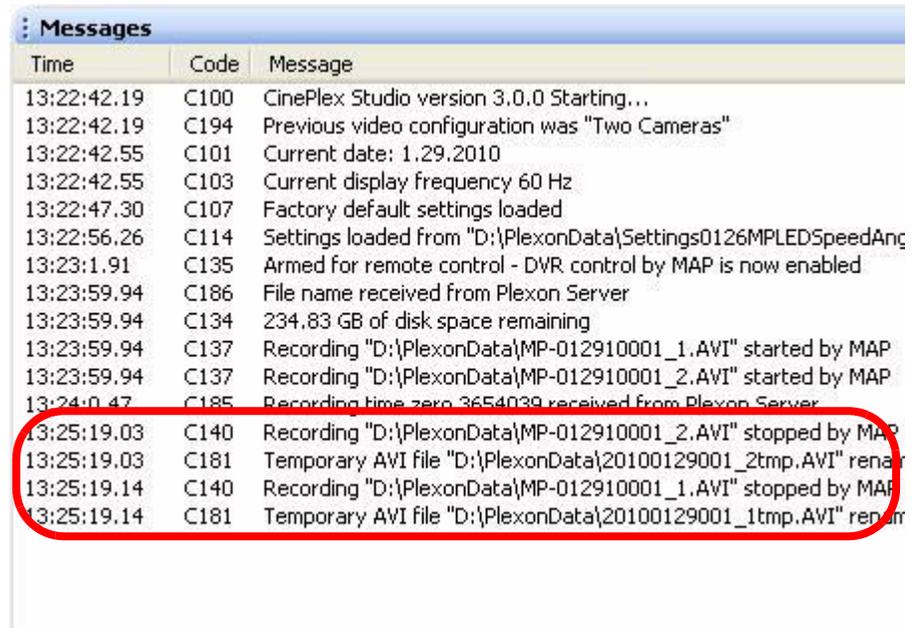
When the **Start** button is clicked, Sort Client sends Studio the filename. However, Studio cannot rename the files because they are open. Thus, Studio will have to wait until recording is stopped before renaming the files

- 3 Studio reports how much disk space is remaining, that the files are being recorded, and the beginning recording time.



Time	Code	Message
13:22:42.19	C100	CinePlex Studio version 3.0.0 Starting...
13:22:42.19	C194	Previous video configuration was "Two Cameras"
13:22:42.55	C101	Current date: 1.29.2010
13:22:42.55	C103	Current display frequency 60 Hz
13:22:47.30	C107	Factory default settings loaded
13:22:56.26	C114	Settings loaded from "D:\PlexonData\Settings0126MPLEDSpeedAnc
13:23:1.91	C135	Armed for remote control - DVR control by MAP is now enabled
13:23:59.94	C186	File name received from Plexon Server
13:23:59.94	C134	234.83 GB of disk space remaining
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_1.AVI" started by MAP
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_2.AVI" started by MAP
13:24:0.47	C185	Recording time zero 3654039 received from Plexon Server
13:25:19.03	C140	Recording "D:\PlexonData\MP-012910001_2.AVI" stopped by MAP
13:25:19.03	C181	Temporary AVI file "D:\PlexonData\20100129001_2tmp.AVI" renam
13:25:19.14	C140	Recording "D:\PlexonData\MP-012910001_1.AVI" stopped by MAP
13:25:19.14	C181	Temporary AVI file "D:\PlexonData\20100129001_1tmp.AVI" renam

- 4 At some later time recording is stopped.



Time	Code	Message
13:22:42.19	C100	CinePlex Studio version 3.0.0 Starting...
13:22:42.19	C194	Previous video configuration was "Two Cameras"
13:22:42.55	C101	Current date: 1.29.2010
13:22:42.55	C103	Current display frequency 60 Hz
13:22:47.30	C107	Factory default settings loaded
13:22:56.26	C114	Settings loaded from "D:\PlexonData\Settings0126MPLEDSpeedAnc
13:23:1.91	C135	Armed for remote control - DVR control by MAP is now enabled
13:23:59.94	C186	File name received from Plexon Server
13:23:59.94	C134	234.83 GB of disk space remaining
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_1.AVI" started by MAP
13:23:59.94	C137	Recording "D:\PlexonData\MP-012910001_2.AVI" started by MAP
13:24:0.47	C185	Recording time zero 3654039 received from Plexon Server
13:25:19.03	C140	Recording "D:\PlexonData\MP-012910001_2.AVI" stopped by MAP
13:25:19.03	C181	Temporary AVI file "D:\PlexonData\20100129001_2tmp.AVI" renam
13:25:19.14	C140	Recording "D:\PlexonData\MP-012910001_1.AVI" stopped by MAP
13:25:19.14	C181	Temporary AVI file "D:\PlexonData\20100129001_1tmp.AVI" renam

Studio's Message pane reports that recording is stopped for both cameras and also that the temporary files were renamed. Studio also opens new temporary files in anticipation of the next recording.

Note: If the recording is stopped abnormally (i.e. system crash, etc.), the temporary files are not renamed.

2.6.5.2 CinePlex Studio File Formats

CinePlex Studio automatically generates filenames for AVI or DVT files. There are a number of formats for the filename. The format may contain an optional 3-character prefix, an optional date format, and a 3-digit file number. The table below shows the various possibilities.

Table 2:

Prefix	Date	File #	Filename Format
None	None	nnn	nnnAVI
PPP	None	nnn	PPPnnnAVI
None	mmddy	nnn	mmddyynnnAVI
None	ddmmy	nnn	ddmmyynnnAVI
None	mmddy	nnn	mmddyynnnAVI
None	ddmmy	nnn	ddmmyynnnAVI
None	mmdy	nnn	mmdyynnnAVI
None	ddmy	nnn	ddmyynnnAVI
PPP	mmdy	nnn	PPPmmdyynnnAVI
PPP	ddmy	nnn	PPPddmmyynnnAVI
PPP	mmdy	nnn	PPPmmdyynnnAVI
PPP	ddmy	nnn	PPPddmmyynnnAVI

Note: The table shows the format for AVI filenames. The formats for the DVT filenames are identical except that the extension is DVT.

The user may choose to have a prefix and/or a date as part of the filename. The prefix (*PPP* in the table) can be defined as any text string that is legal for Windows file names. There are four date formats (*mmddy*, *ddmmy*, *mmdy*, *ddmy*) where *mm* indicates the month, *dd* indicates the day, and *yy* or *yyyy* indicates the year. The file number contains any three digits. Unless the user specifies a different starting number, the file number begins at 001 or at the next available file number if 001 is already used. CinePlex Studio determines the number *nnn* from the AVI files already recorded and stored on the internal hard drive. The latest file name is always one greater than the largest-numbered AVI file already on the selected hard drive. If using one of the date formats and midnight occurs, the first file recorded after midnight restarts at 001. The last possible file number is 999. When recording that file number, the **Next Available File** property displays **N/A** (Not Available).

Note: If Studio is armed on one day, but the start signal is not received until the next day, the filename remains the one for the previous day.



CAUTION

Lighting Conditions

If lighting conditions change enough during recording that ‘objects too large’ or some other condition occurs, the position data may be meaningless.

2.6.6 Synchronizing Files from Two Video Cameras

In some cases of synchronizing files from two video cameras, one file can be several frames larger than another due to minor software delays handling the Stop signal. The critical functionality is that the cameras start together and that triggers for corresponding frames occur at exactly the same time.

2.6.7 Synchronizing Video Files with Neural Data Files

To synchronize the video files to the neural data files, a system must:

- derive all time stamps from the same clock
- start the recording of both files at the same time
- stop recordings at approximately the same time

Use of the same clock to generate the time stamps in each file avoids longer-term “drifting” of the time-base of one file relative to the other. For example, say the clock controlling the time stamp generation for video frames has a frequency difference of 1% from the clock controlling the time stamp generation of neural firing events in the neural data files; after 100 seconds, the occurrences that should appear as simultaneous in the neural data and AVI files appear instead as one second apart. Since CinePlex Studio is integrated in a Plexon NDAQ, synchronization occurs because CinePlex Studio is controlled with a clock signal derived from the main Plexon Neural Data Acquisition clock. Thus, the PLX and AVI files are guaranteed to have the same time-base.

Note: The CinePlex Studio clock is 1 MHz. This means that the resolution of time stamps generated by CinePlex Studio is 1 μ sec.

Simultaneous starting, stopping, pausing, and resuming of the neural data and video files is also essential to synchronization, because non-coincident start times make it difficult for the user to synchronize the behaviors captured in the video with their time-coincident neural activity.

Although the user may manually start, stop, pause, and resume recording an AVI file at any time in CinePlex Studio by simply clicking the appropriate toolbar buttons, Plexon does not recommend this mode of operation for recording synchronized files, because it produces video files that do not have the same start time as the corresponding neural data files. Instead, configure CinePlex Studio to use Start, Stop, and Pause on the Plexon NDAQ.

When using CinePlex Studio with a Plexon NDAQ, the NDAQ generates control signals and routes the signals through the control cable to the appropriate inputs for CinePlex Studio. To use this mode of operation, *arm* CinePlex Studio to respond to the electrical control signals. When armed, CinePlex Studio starts recording the video file one frametime after the start of the neural data file.

Note: CinePlex Studio resets the time stamp to zero when recording is started in Arm mode by Sort Client or when clicking the Record button to manually start recording a video file. Otherwise the time stamps continue to increment until CinePlex Studio is shut down.

2.6.8 Recording Synchronized Video and Neural Data

The system is connected as described in [Appendix A](#) so that the clock and control signals are sent from the Plexon Neural Data Acquisition to the CinePlex Studio components.

Note: For more information on setting up and running the MAP Sort Client, refer to the *RASPUTIN User's Guide*.

Procedure for recording time-synchronized video and neural data files

- 1 At the Plexon NDAQ, turn the power on and configure the Plexon NDAQ so that neural data appears in Sort Client; see [“Operating CinePlex Studio with RASPUTIN Sort Client” on page 91](#). Do not start recording data to a PLX file.
- 2 Click the CinePlex Studio icon. Wait for the CinePlex Studio application main window to appear on the monitor.
- 3 CinePlex Studio provides a time code that tracks the time elapsed since the last time recording began. To view and configure the CinePlex Studio time display, in the Properties window in the **Timecode** area, click **Visible**. Choose a **Location** and a **Format** setting to configure the display. For example, the following illustration shows the time code in the **Upper Left** location in **HH:MM:SS.SSS** format.



- 4 In the Properties window in the **Camera** area, set the **Contrast**, **Brightness**, and **Sharpness** controls to get a acceptable image on the screen.
- 5 In the **DVR** area, set the **Image Quality** to the default setting of 4.

Note: The user may also use other image quality settings. To evaluate image quality settings, manually collect a set of AVI files at different

settings and use the file mode to determine a minimum acceptable image quality setting for the use.



HINT

Reducing blurs and color streaks in the video

If the experimental subject moves quickly, blurs and color streaks can appear in the video. Reduce or eliminate these problems by increasing the shutter speed. For more information, see “Shutter” under “[Source Tab\(s\)](#)” on page 122.

- 6 From the CinePlex Studio **DVR** tool bar, click the **Arm** button. A yellow flashing cassette icon appears on the status bar.
- 7 At Sort Client, click **Data File**, then click **Options**. On the **Start and Stop** tab, click the **CinePlex Sync** check box, then click the **Use User Commands** radio button. Select and set **Start and File Name Options** as desired in the **Options for User Command Start** section.
- 8 From the Sort Client toolbar, click the icon to start recording. If a file name has not been selected, enter it.

Sort Client starts recording and displays status information about the neural data file on the Sort Client status bar; for information on the Sort Client status, see the RASPUTIN User’s Guide.

CinePlex Studio starts recording and displays information about the video file in the CinePlex Studio status bar.

Note: The Studio status bar will display the amount of free space remaining on the drive selected. The file can grow to fill the space available.

Note: For more information about recording files using Sort Client, refer to the Plexon *RASPUTIN User’s Guide*; see “Using Sort Client, Section C, Record.”

- 9 To pause recording, from the Sort Client **Datafile** menu, click the **Pause Recording** icon.

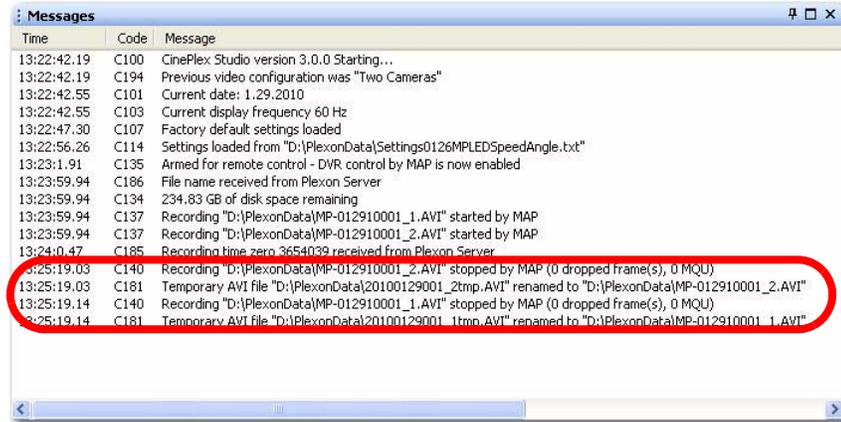
Sort Client pauses recording and displays status information about the neural data file on the Sort Client status bar; for information on the Sort Client status, see the RASPUTIN User’s Guide.

CinePlex Studio pauses recording and displays information about the video file in the CinePlex Studio status bar. The status bar flashes green and gray to indicate that the recording is paused.

To resume recording, click **Pause Recording** again.

- 10 To stop recording, from the Sort Client **Datafile** menu, click **Stop Recording** or the Stop icon.

Sort Client stops recording to the neural data file, clears the recording information from the status bar, and saves the file to the location specified in [Step 8](#).



Note: When recording remotely Studio writes to temporary files. For efficiency, the files are opened before recording begins. When recording is stopped, the temporary files are renamed, and new temporary files are opened in anticipation of a new recording session (see the indicated section in the image above).

CinePlex Studio stops recording to the video file and saves the file to the location shown in the status bar at [Step 6](#). CinePlex Studio clears the recording information from the status bar and re-arms itself for the next recording session.

- 11 To disarm CinePlex Studio, from the **DVR** toolbar, click **Arm** to clear it. The status bar returns to the disarmed state.
- 12 To view the captured video file, follow the procedure at ["Managing Video Files" on page 64](#).
- 13 To transfer the files to the analysis computer (if different), follow one of the procedures at ["Transferring Recorded Files" on page 65](#).
- 14 To view the files together, start CinePlex Editor by following the procedures described in [Chapter 4](#).

Note: The user may also view just the video files by using Windows Media Player on the analysis computer.

2.6.9 Managing Video Files

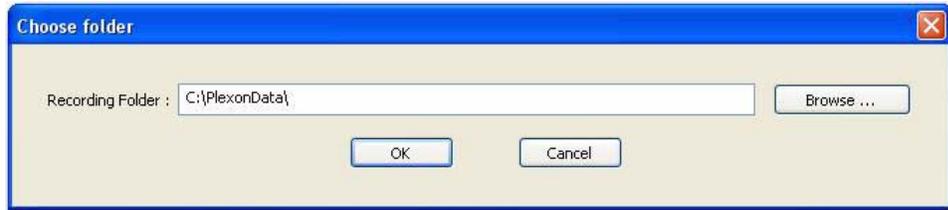
To manage video files, first set the location of the Recording files.

Setting the Recording folder

- 1 At CinePlex Studio, from the **Tools** menu, click **Change Data Folder**.

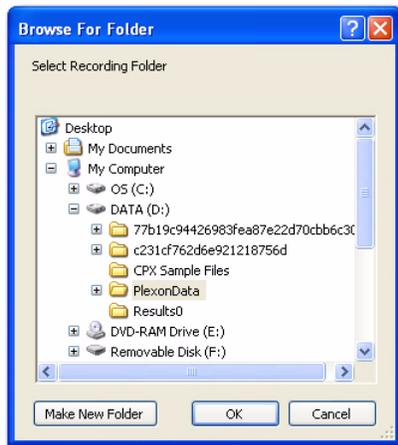
*The **Choose Folders** dialog box opens.*

When Capture starts for the first time, it creates the Recording folder "C:\PlexonData\" if it does not already exist. Thus, the default location of the Recording folder is the internal hard drive. Since the MAP/CPX computer is supplied with two hard drives (C: and D:), Plexon recommends putting neural data on one (C: usually) and the video data on the other (D: usually).



- 2 To set or change the folder location, click on the **Browse** button.

*The **Browse for Folder** dialog box opens.*



Note: It is possible to delete a folder from this dialog box by selecting the folder and hitting the Delete key. However, the user can not delete the Recording folder in this manner.

- 3 Create a new folder or navigate to a desired existing folder and click OK when finished.

The location of the Recording folder is automatically saved in the Capture configuration file and loaded at the next launch of the application.

Note: If the Recording drive is not NTFS, a warning message displays.

2.6.10 Transferring Recorded Files

Note: This section applies to implementations with separate capture and analysis computers.

To transfer the files to the analysis computer, Plexon recommends a USB drive or network connection. Files can be moved from the Studio computer to another device using standard Windows tools.

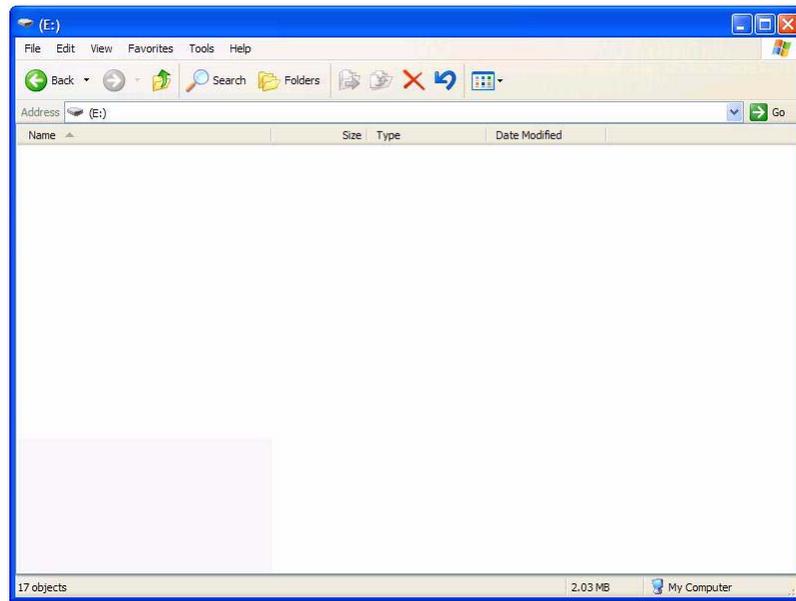
Using an external USB drive or memory stick to transfer files

- 1 Insert the USB drive into a USB slot on the computer where the desired files reside.

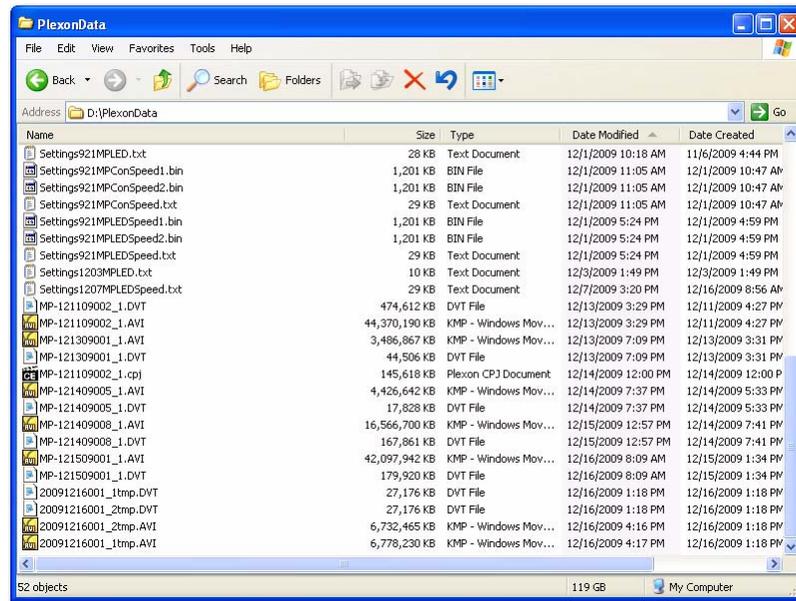
Note: If the Plug and Play framework is enabled, just follow the instructions on the popup window to navigate to the files to move or copy. Then, move or copy the files as needed.

Note: If the Plug and Play framework is disabled, just move or copy the desired files by using standard move or copy methods.

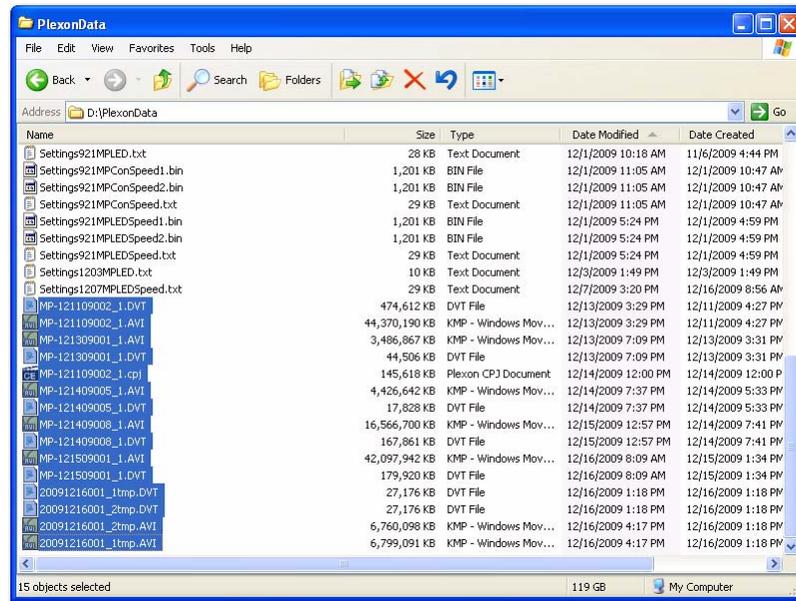
- 2 Open Windows Explorer and navigate to the USB drive.



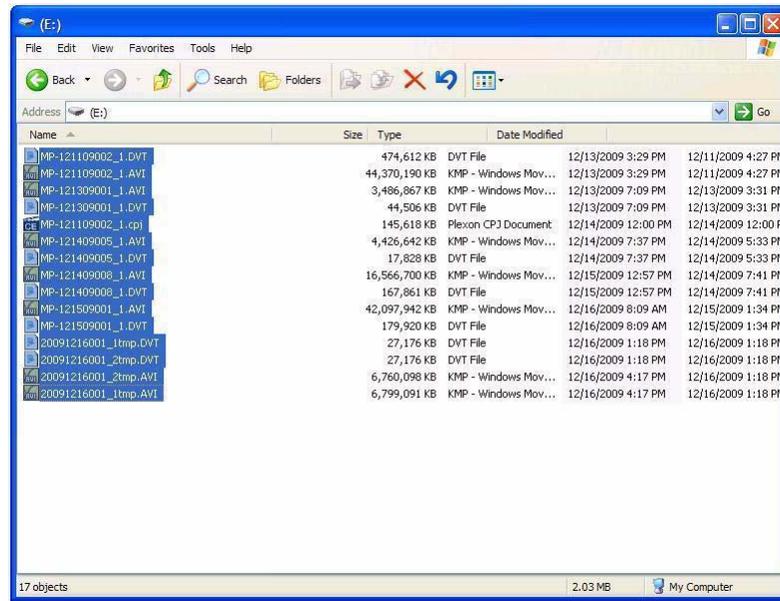
- 3 Open a second Windows Explorer and navigate to the directory containing the files to be copied



- 4 Select the desired files. Hold down the CTRL key while clicking the left mouse button on each desired file.



- Click the left mouse button on one of the highlighted files and hold the mouse button down while dragging the mouse to the destination folder in the other Windows Explorer. All of the selected files will be copied to the USB drive.



Note: After selecting the files, it is also possible to copy the files by right-clicking the mouse on one of the highlighted files, selecting **Copy** from the right-click menu, then right-clicking the mouse in the destination folder, and selecting **Paste** from the right-click menu.

- Unplug the USB drive from the MAP/CPX computer.
- Plug the USB drive into the analysis computer, and copy the files to the desired location.

Note: With the flexibility of the PlexUI interface, the experimenter may elect to dock any of the CinePlex Studio window panes in a different area than the default, float them completely free from the Studio window, or close them entirely. For simplicity of this discussion, all panes are assumed to be in their default positions. The user can return any Plexon application to its default layout by clicking the "Window" item in the top level toolbar, clicking "Layout", then clicking "Reset to Default Layout".

2.7 Global Configuration Pane

The Global Configuration default position is as a tab in the upper left pane of the CinePlex Studio window. This pane is the first an experimenter will normally use when setting up CinePlex Studio, but perhaps not very often after that. It contains settings that pertain to frame rate to use when recording, quality of recordings to make, and whether the experiment involves one animal or many. There are two slightly different versions of this pane depending on whether the video being processed comes from cameras or files.

2.7.1 Processing Camera Video

2.7.1.1 Frame Rate

The frame rates available for selection depend on the camera(s) attached to the system. The lowest frame rate available is normally 1 frame per second. The highest is the maximum frame rate attainable by the system as a whole after accounting for camera, FireWire, disk and CPU limitations. In general, if there are two cameras installed, the achievable frame rate per camera may be less than if there were only one camera installed.

2.7.1.2 Compression

Any new files that CinePlex Studio creates will always be encoded in MPEG format as defined in the applicable MPEG specification document. MPEG file sizes and quality vary with the nominal compression bit rate. The higher the bit rate, the higher the resulting video quality, but the resulting AVI files are larger as well. In CinePlex Studio the MPEG Quality is adjustable from 1 to 10. The larger the value selected, the larger the resulting AVI file will be, but it will have better resolution. Adjust this number to obtain acceptable results for the experiments. The value defaults to 4, a value Plexon has found to be a good compromise in most situations. For reference, the selectable values correspond to the MPEG nominal bit rate divided by 500,000.

2.7.1.3 Local File Name

This section allows the user to specify a file naming plan for recordings that are not controlled by Sort Client. If the ARM mode is entered, these file names are ignored and CinePlex Studio waits for file naming information from Sort Client. If Local Record is started, the file name will be constructed using the parameters selected here. These parameters include File Name Prefix if desired, Date insertion, if desired, and numbering selection. The next file name for local recording is shown for reference.

2.7.1.4 Experiment

The only currently available experiment adjustment is a selection as to whether the experiments involve one animal or more than one. Make the selection “Single” or “Multiple” appropriately. The effect on CinePlex Studio is to change the way it searches for multiple colors or LEDs when tracking is lost momentarily.

2.7.2 Processing File Video

These are the available options when the video being processed comes from one or more files.

2.7.2.1 Frame Rate

This is a display-only field showing the frame rate at which the video file(s) were recorded.

2.7.2.2 Speed

This adjustment determines the speed at which CinePlex Studio will attempt to create the new video file(s). It does not change the frame rate of the video. This speed will ultimately be limited by the capabilities of the computer on which it is installed.

2.7.2.3 Position

This is the frame number from which recording of new files will start. It can be changed by adjusting the slider which can be placed anywhere within the file, once a file has been selected on the Source pane.

2.7.2.4 Compression

Any new files that CinePlex Studio creates will always be encoded in MPEG format as defined in the applicable MPEG specification document. MPEG file sizes and quality vary with the nominal compression bit rate. The higher the bit rate, the higher the resulting video quality, but the resulting AVI files are larger as well. In CinePlex Studio the MPEG Quality is adjustable from 1 to 10. The larger the value selected, the larger the resulting AVI file will be, but it will have better resolution. Adjust this number to obtain acceptable results for the experiments. The value defaults to 4, a value Plexon has found to be a good compromise in most situations. For reference, the selectable values correspond to the MPEG nominal bit rate divided by 500,000.

2.7.2.5 Experiment

The only currently available experiment adjustment is a selection as to whether the experiments involve one animal or more than one. Make the selection “Single” or “Multiple” appropriately. The effect on CinePlex Studio is to change the way it searches for multiple colors or LEDs when tracking is lost momentarily.

2.8 Source Pane

The Source Pane default position is as a tab in the upper left pane of the CinePlex Studio window. This pane is the second an experimenter will normally use when setting up CinePlex Studio. There can be multiple Source panes if there are multiple cameras on the system or if the user wishes to process multiple video files together. The source pane for a camera is different from the Source pane for a file. It contains settings that pertain to frame rate to use when recording, quality of recordings to make, and whether the experiment involves one animal or many.

2.8.1 Frame Rate

The frame rates available for selection depend on the camera(s) attached to the system. The lowest frame rate available is normally 1 frame per second. The highest is the maximum frame rate attainable by the system as a whole after accounting for camera, FireWire, disk and CPU limitations. In general, if there are two cameras installed, the achievable frame rate per camera may be less than if there were only one camera installed.

2.8.2 Compression

Any new files that CinePlex Studio creates will always be encoded in MPEG format as defined in the applicable MPEG specification document. MPEG file sizes and quality vary with the nominal compression bit rate. The higher the bit rate, the higher the resulting video quality, but the resulting AVI files are larger as well. In CinePlex Studio the MPEG Quality is adjustable from 1 to 10. The larger the value selected, the larger the resulting AVI file will be, but it will have better resolution. Adjust this number to obtain acceptable results for the experiments. The value defaults to 4, a value Plexon has found to be a good compromise in most situations. For reference, the selectable values correspond to the MPEG nominal bit rate divided by 500,000.

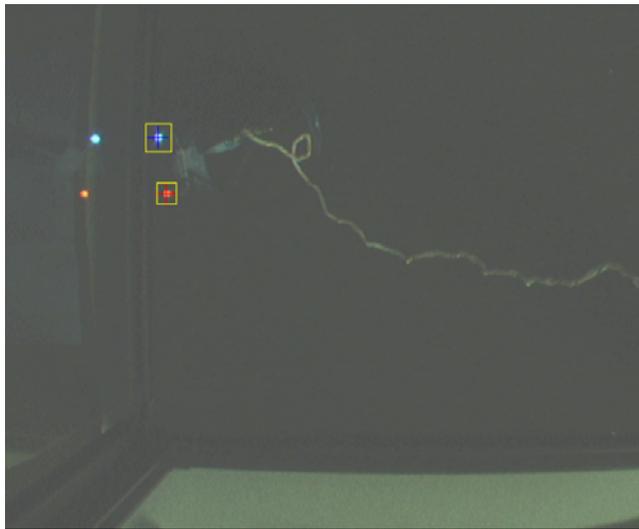
2.9 CinePlex Studio Tracking Pane (if available)

As described in [Chapter 1](#), the CinePlex Studio Tracking option can generate tracking coordinates in one of three modes: Object Contour, LED, or Reflective Colors. The Tracking tab is blank until a tracking mode has been selected.

CinePlex Studio uses Tracking Windows and Arena Definition to track objects and reduce unwanted parasite objects. These elements are explained below.

2.9.1 Tracking Window

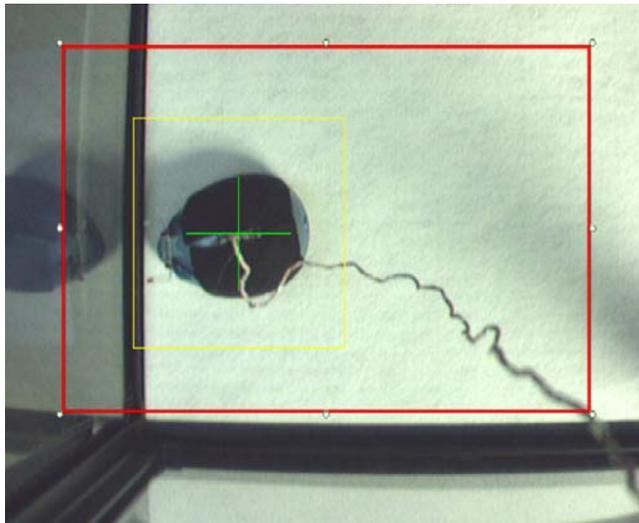
Tracking windows are used to reduce problems with unwanted parasite objects (e.g. reflections) and to reduce the processor load by restricting analysis to a small portion of the video image.



The size of the tracking window is set automatically to cover the whole object. Each object (whole animal, LED, or marker) has its own tracking window. The tracking window is repositioned automatically. A history of an object's movement is used to predict its next position. If the object disappears because of occlusion by a cable or other means, its tracking window is moved according to the speed and movement direction in its most recently detected frames. If the system is tracking multiple LEDs or markers in single animal mode, the system will also use the positions of the found LEDs or markers to predict the position of the one that disappeared. If the object is not found after a certain number of frames, the size of the tracking window will be increased. If the object is not found within two seconds, the system switches to search in the whole frame (possibly restricted by an arena - see below).

2.9.2 Arena Definition in the Areas Tab

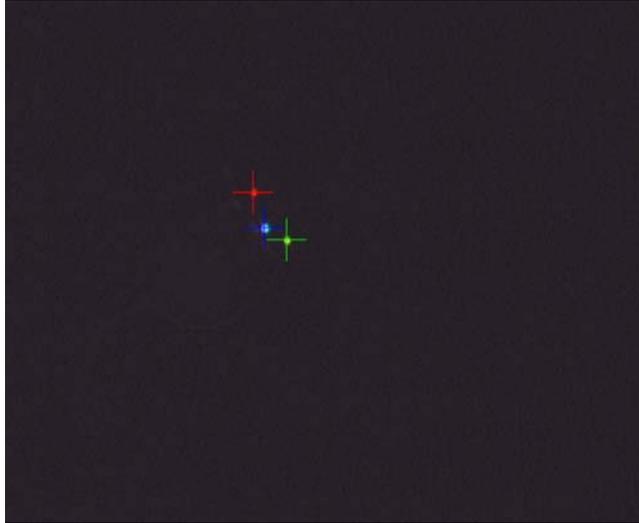
The Arena Definition is also used to reduce problems with unwanted parasite objects outside of the working area. If a reflection of other unwanted object appears outside the arena, it will not be detected by CinePlex Studio.



The Arena Definition is also used to reduce the processor load because only the portion of the video image restricted by the arena is analyzed.

Special drawing tools are available in CinePlex Studio to design the arena. The user may draw many shapes: circles, ovals, rectangles, and freehand polygons. To perform operations on the arena, click the one of the Arena nodes (**Arena Outline** or **Arena Transparency**).

Select the shape to draw. For a rectangle or circle, left-click and hold the mouse on a desired point on the image and move the mouse to size the arena. For a freehand polygon, click the left mouse button over desired points that will be the nodes of the polygon. The user may move and resize the arena and also drag the nodes of a freehand polygon.

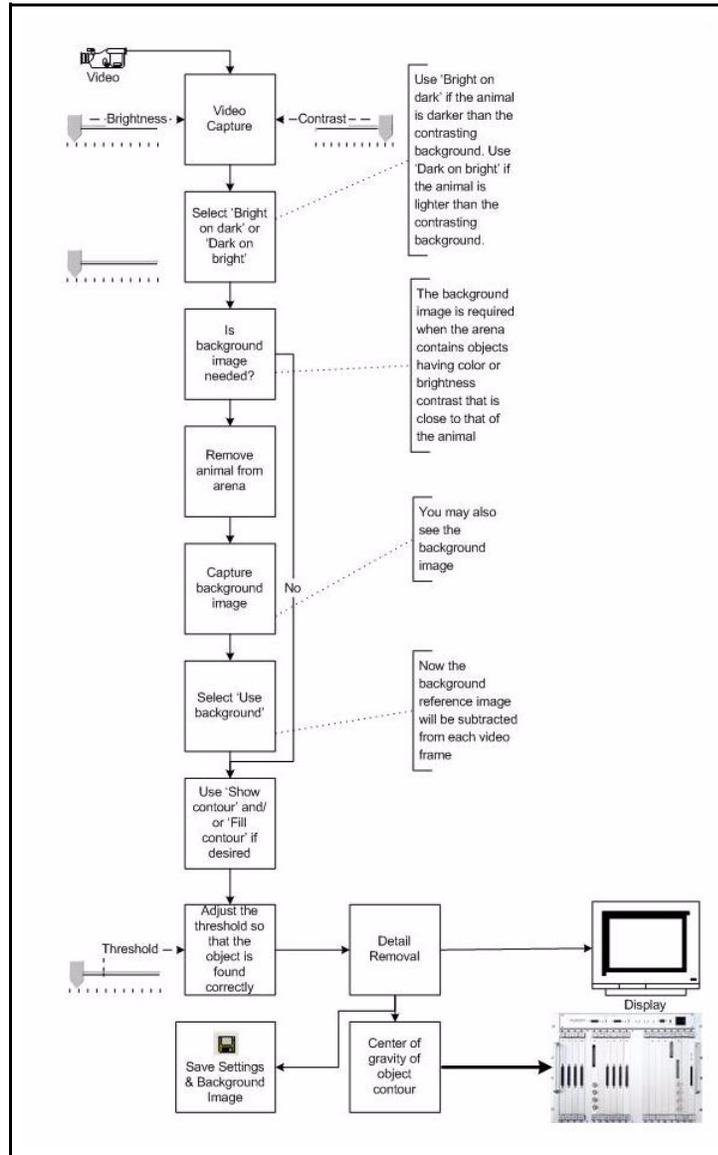


- In Reflective Colors mode, pixels having the specified colors are analyzed as belonging to the corresponding object. Use this mode, if desired, for tracking LEDs or color markers when the arena is lit.
- In general, to obtain optimal tracking results put more effort into setting up Object Contour mode than either LED or Reflective Colors modes. Object Contour mode is also more sensitive to changes in background or lighting conditions.

2.9.4 Object Contour Mode Tracking

Object Contour mode tracking contrasts and thresholds a monochrome image and computes its centroid to track the target. Object Contour tracking includes options that provide detail filtering, background subtracting, contour closing, and motion measuring. For more information on using the CinePlex Studio optional capabilities for Object Contour mode, see [“Options For Object Contour Mode” on page 78](#). The flowchart in [Figure 2-2](#) illustrates the steps involved in configuring both the basic setup and the setup options for Object Contour mode. Detailed procedures follow the flowchart. If desired, use the Tracking Wizard (see [“Object Contour Mode Tracking” on page 75](#)) to provide an on-screen step-by-step guide to the following procedure.

Figure 2-2
CinePlex Studio Object Contour Mode Tracking Flowchart

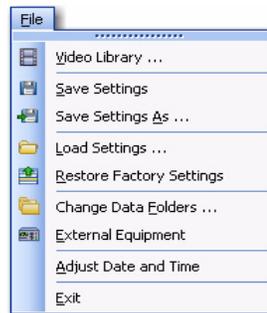


HINT **Use Default Settings**

Use the **Restore defaults to factory settings** toolbar button to return all CinePlex Studio and camera settings to their default values. Set the default values prior to configuring a tracking mode.

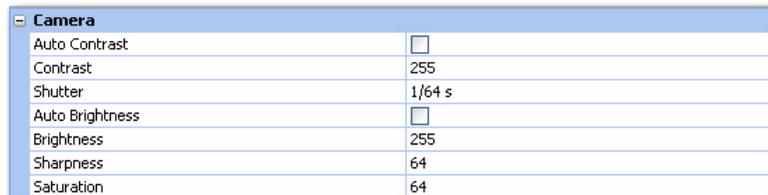
Configuring CinePlex Studio to track in Object Contour mode

- 1 Turn on the CinePlex Studio computer. On the **File** menu, click **Restore Factory Settings**.



Note: To complete this procedure, install the CinePlex Studio system. If the system installation has not been completed, see [Appendix A](#).

- 2 On the **Tracker** menu, click **Object Contour**.
- 3 While observing the display on the monitor, position the camera to capture the entire arena in the field of view. Minimize the capture of areas outside the arena.
- 4 In the **Camera** area, click to clear the **Auto Contrast** and **Auto Brightness** checkboxes.
- 5 In the **Camera** area, adjust the **Brightness** slider to get a video image that provides the maximum difference in intensity between the target animal and the arena. Then, adjust the **Contrast** slider to maximize the contrast between the target and the arena.

A screenshot of the 'Camera' settings panel in CinePlex Studio. The panel is titled 'Camera' and contains several settings with checkboxes and numerical values.

Setting	Value
Auto Contrast	<input type="checkbox"/>
Contrast	255
Shutter	1/64 s
Auto Brightness	<input type="checkbox"/>
Brightness	255
Sharpness	64
Saturation	64

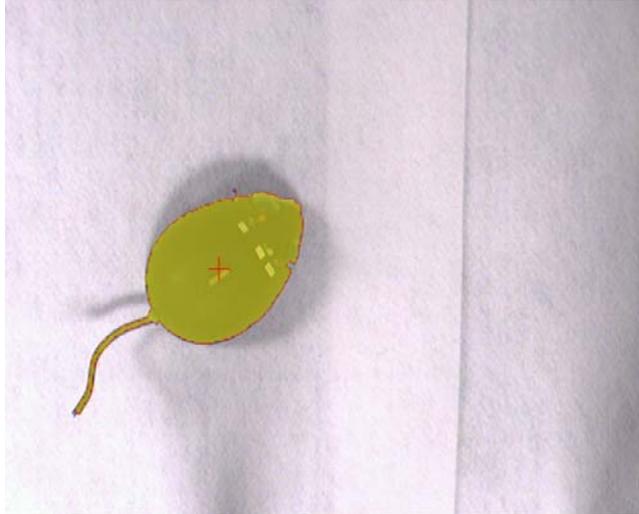


HINT

Reducing blurs and color streaks in the video

If the experimental subject moves quickly, blurs and color streaks can appear in the video. Reduce or eliminate these problems by increasing the shutter speed. For more information, see “Shutter” under [“Source Tab\(s\)” on page 122](#).

- 6 In the **Object Contour Tracker** area, click **Show Contour/Fill Contour** to view the contour(s) of the object(s) that the system is tracking.
- 7 Adjust the **Threshold** setting so that the object is found. For more information about setting the threshold, see [“Setting the Threshold” on page 87](#).



Threshold 128

- 8 On the **File** menu, click **Save Settings**.



or

Click the **Save Settings** button () on the toolbar.

2.9.4.1 Options For Object Contour Mode

CinePlex Studio Object Contour mode includes optional capabilities to handle special circumstances in the experimental environment:

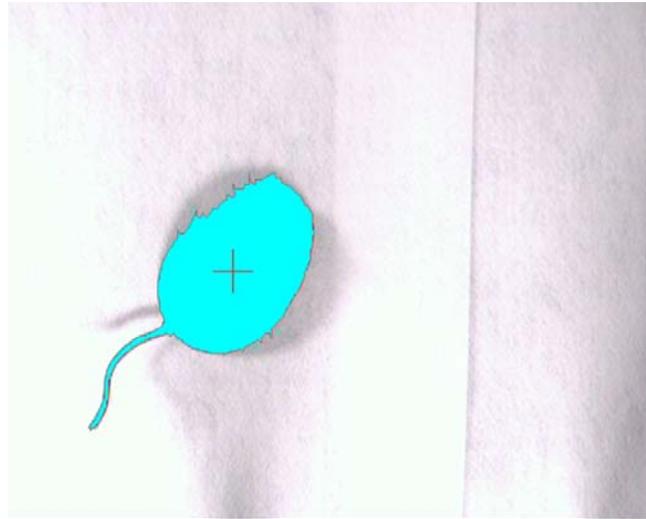
- Detail filtering
- Background subtraction
- Close contour
- Motion measurement

2.9.4.1.1 Detail Filtering Adjustment. Use Detail Filtering to remove small features of the image that distort the tracking results. For example, a long tail on a target animal can skew the centroid calculation; cables attached to the target can also skew the results. The Detail Filtering adjustment has 10 settings that can

remove progressively larger features. Use the lowest setting that provides adequate results for the experiment.

To apply Detail Filtering

- 1 In the Properties window **Object Contour Tracker** area, click **Show Contour** or **Fill Contour**. Click **Detail Filter** and set the slider to **2**.
- 2 Observe the effect on the image. Set the **Detail Filter** slider to lowest setting that removes the undesirable features from the target image.



Close Contour	0
Detail Filter	0



- 3 On the **File** menu, click **Save Settings**.

2.9.4.1.2 Background Option. Use the Object Contour mode Masking option to configure CinePlex Studio to ignore areas in the image that are at the same intensity as the target. Use this option to remove background clutter that cannot be

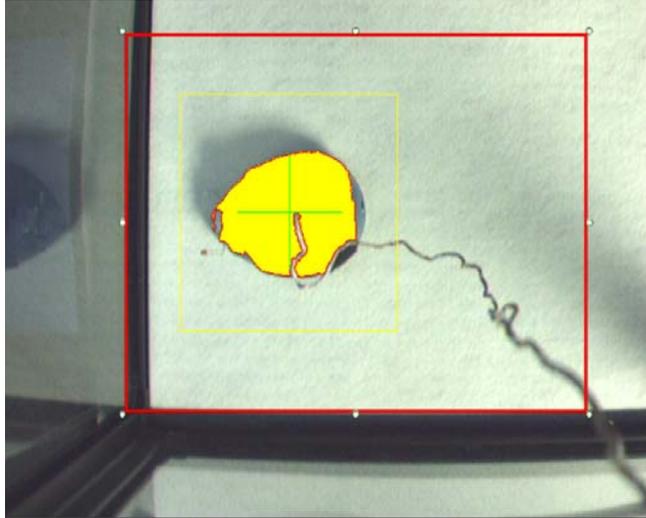
physically eliminated from the field of view, or image clutter that cannot be eliminated by using CinePlex Studio's brightness, contrast, and threshold settings.

To apply the Background option

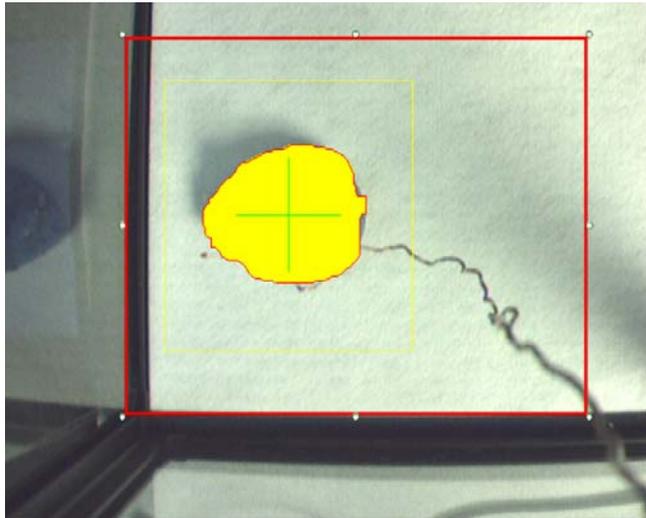
- 1 Set up CinePlex Studio to track the target in Object Contour mode. In the Properties window **Object Contour Tracker** area, click to clear the **Use background** checkbox.
 - 2 In the **Object Contour Tracker** area, click **Show Contour/Fill Contour**.
 - 3 In the **Camera** area, click to clear the **Auto Contrast** and **Auto Brightness** checkboxes.
 - 4 In the **Camera** area, adjust the **Brightness** slider to get a video image that provides adequate discrimination of the target with the least number of white pixels outside the target area. Do not distort the integrity of the target shape. Likewise, adjust the **Contrast** slider to minimize the white pixels outside the target area.
- Note:** The user may also use CinePlex Studio to adjust automatically both brightness and contrast. To do so, in the **Camera** area, click **Auto Contrast** and **Auto Brightness**.
- 5 Remove the target animal from the arena.
 - 6 On the **Tracker | Background** menu, click **Capture**, or click  on the toolbar. The user may also see the captured background or clear the captured background image by using the two buttons next to this button.
 - 7 In the **Object Contour Tracker** area, click **Use Background**.
 - 8 Return the target animal to the arena and adjust the threshold so that the desired object is found.

2.9.4.1.3 Close Contour Option. The Close Contour capability causes the tracker to merge multiple objects in near proximity to each other into a single object. This can occur when a cable passes between the animal and the camera. Adjust the setting so that a single object is displayed. The illustration below is taken before the Close Contour setting is applied.

Threshold	128
Close Contour	0



The illustration below is taken after the Close Contour setting is applied.



2.9.4.1.4 Motion Measure Option. CinePlex Studio Motion Measure is an additional Object Contour mode option that can be used to detect animal “freezing” in fear-conditioning experiments. The Motion Measure option is separate and distinct from the target-tracking capability. If the Motion Measure option is selected, CinePlex Studio optionally writes both the motion-measurement data and the target position data for each video frame to the Plexon Neural Data Acquisition, or to a DVT file.

CinePlex Studio analyzes the images of the target animal in consecutive frames. The pixels that lie on the animal in the current video frame but *not* on the animal in the previous video frame (and vice versa) are counted. This number is divided by the total number of animal pixels in the current frame. The maximum result is nominally 2.0, and the range 0.0 to 2.0 is scaled to the range 0 to 1023 and written to the Plexon NDAQ. A value of 1023 indicates that the animal moved so quickly

that no pixels were in common with the previous frame. A value of 0 results when:

- the frame is the first frame of the file,
- the previous frame and the current frame are identical,
- the tracking window switched from small in the previous frame to large in the current frame,
- the tracking window switched from large in the previous frame to small in the current frame, or
- the object in the previous frame and the object in the current frame are of 0 size.

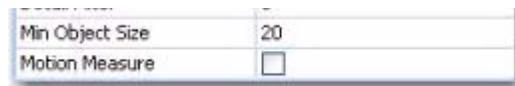
CinePlex Studio writes the motion measure value to a digital VideoTracker (DVT) format file; for more information, see [“Digital VideoTracker \(DVT\) Files” on page 156](#).

The Motion Measure frame-to-frame pixel overlap technique provides information on the movement of the animal’s body over time. For example, a rotating animal’s centroid might not change, but the Motion Measure feature would indicate that the animal is not actually “frozen” because consecutive video frames are not identical.

Note: The VTViewer motion measure chart does not move until the center of gravity is sent to the PLX file.

To apply the Motion Measure option

- On the **Object Contour Tracker** menu, click the **Motion Measure** checkbox.



HINT **Use Default Settings**

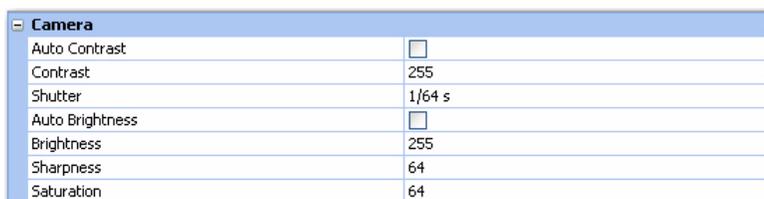
Use the default settings toolbar button to return all CinePlex Studio and camera settings to their default values. Set the default values prior to configuring a tracking mode.

2.9.5 LED Mode Tracking

This section includes the configuration procedure for configuring CinePlex Studio to track colored LEDs. The user may track up to three different colored LEDs. Each tracking mode operates separately. The user cannot combine Object Contour mode and LED mode. Use the Tracking Wizard (see [“Object Contour Mode Tracking” on page 75](#)) to provide an on-screen guide to the following procedure.

Configuring CinePlex Studio to track in LED mode

- 1 From the **File** menu, select **Set Defaults**.
- 2 From the **Tracker** menu, select **LED**.
- 3 Place powered LEDs in the camera field of view. At the camera lens, adjust the zoom, focus, and iris settings for the best picture quality.
- 4 In the Properties window **Camera** area, click to clear the **Auto Contrast** and **Auto Brightness** checkboxes.
- 5 In the **Camera** area, adjust the **Brightness** and **Contrast** sliders to provide the best quality picture.

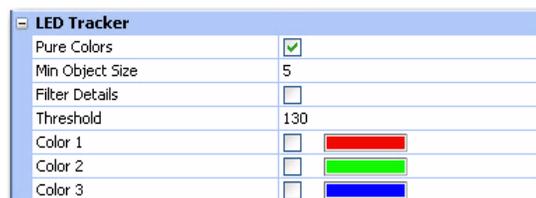


HINT

Reducing blurs and color streaks in the video

If the experimental subject moves quickly, blurs and color streaks can appear in the video. Reduce or eliminate these problems by increasing the shutter speed. For more information, see “Shutter” under “[Source Tab\(s\)](#)” on page 122.

- 6 To select the first LED to track, in the **LED Tracker** area, click **Color 1**.



- 7 To have CinePlex Studio recognize the standard red, green, and blue colors, ensure the Pure Colors checkbox is checked.



If Pure Colors is not selected, the color desired can be selected by clicking in the color display and positioning the cursor over a pixel of the desired color.

CinePlex Studio changes the mouse cursor to cross hairs and a magnified view of the screen pixels appears in a window on the image.

Position the cross hair over a colored pixel that best represents the color of the LED to track. Click the left mouse button to set the color. Repeat this step for each color to track. Also see [“Setting the Threshold” on page 87](#).

2.9.5.1 Using the Color Pick-up Tool

To adjust Color 1, Color 2, or Color 3 in the LED Tracker or Reflective Colors Tracker modes, follow the procedure below.

- 1 To use the color pick-up tool, click on the Color Selection box whose color to adjust. The image below shows a sample video window before clicking the Color Selection box.



-
- - 2 In the **Video** window a square area surrounding the mouse cursor displays as a magnified window. Move the magnified window over the area to be shown in the **Color Selection** box. The image below shows the magnified cursor window in the lower left of the diagram - note the digitization of the area.



-
-
- 3 Position the crosshair over a representatively colored pixel. The **Color Selection** box displays the color of the pixel directly under the crosshair. The image below shows a red pixel under the magnified area.



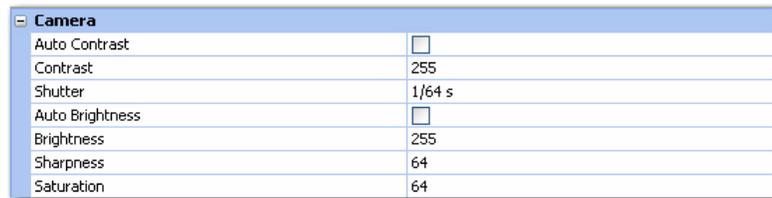
-
-
-
- 4 Click the pixel.
- 5 The color of the corresponding color box in the properties window will be changed to that of the clicked pixel.

2.9.6 Reflective Colors Mode Tracking

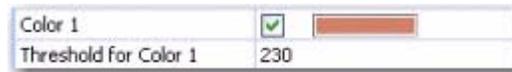
This section includes the procedure for configuring CinePlex Studio to track in Reflective Colors mode. The user may track up to three different reflective colors, like painted markers or colored garbs. Each tracking mode operates separately. It is not possible to combine Object Contour, LED, and Reflective Colors modes. The user may use the Tracking Wizard (see [“Object Contour Mode Tracking” on page 75](#)) to provide an on-screen guide to the following procedure.

Configuring CinePlex Studio to track in Reflective Colors mode

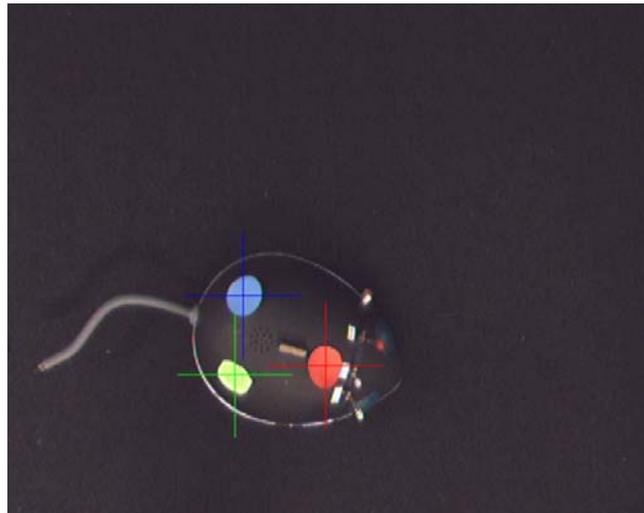
- 1 From the **File** menu, select **Restore Defaults**.
- 2 From the **Tracker** menu, select **Reflective Colors**.
- 3 Place color targets in the camera field of view. At the camera lens, adjust the zoom, focus, and iris settings for the best picture quality
- 4 In the Properties window **Camera** area, click to clear the **Auto Contrast** and **Auto Brightness** checkboxes.
- 5 In the **Camera** area, adjust the **Brightness** and **Contrast** sliders to provide the best quality picture.



- 6 To select the first color to track, in the **Reflective Colors Tracker** area, click **Color 1**.



- 7 To have CinePlex Studio recognize the standard red, green, and blue colors, ensure the Pure Colors checkbox is checked and also check the color channels to be tracked.



If Pure Colors is not selected, the color desired can be selected by clicking in the color display and positioning the cursor over a pixel of the desired color.

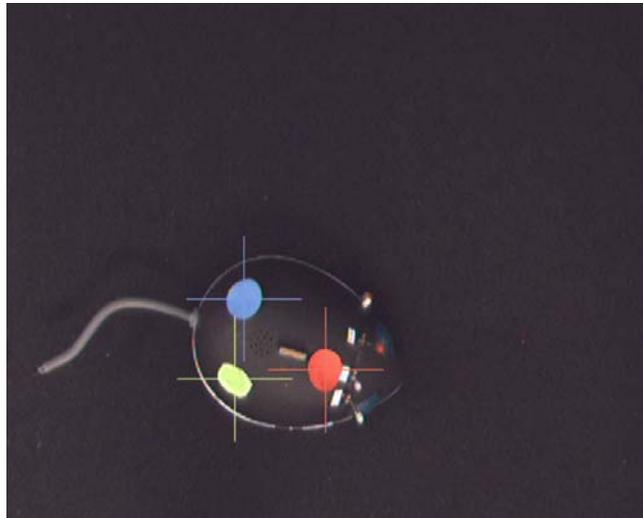
CinePlex Studio changes the mouse cursor to cross hairs and a magnified view of the screen pixels appears in a window on the image.

Position the cross hairs over a colored pixel that best represents the color of the object to track. Click the left mouse button to set the color.

- 8 If the cursor does not track the object accurately, in the **Reflective Colors Tracker** area, adjust the **Threshold for Color 1** slider until the cursor tracks accurately.

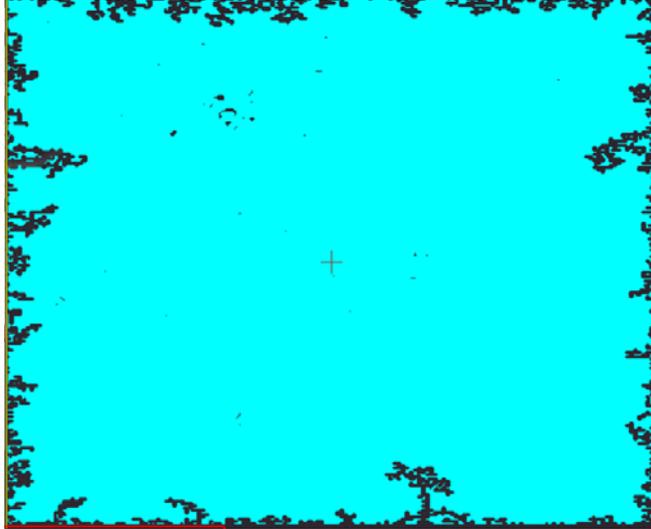
Note: If the cursor does not track accurately with the sensitivity at maximum, change the color or adjust the sharpness and saturation.

- 9 To track additional colors, repeat [Step 5](#) through [Step 8](#) substituting the **Color 2** or **Color 3** controls for the **Color 1** control and the **Threshold for Color 2** or **Threshold for Color 3** controls for the **Threshold for Color 1** control. Also see [“Setting the Threshold” on page 87](#).
- 10 After completing the previous steps, verify that the configured CinePlex Studio system looks like the following illustration, which is set up to track three colors.



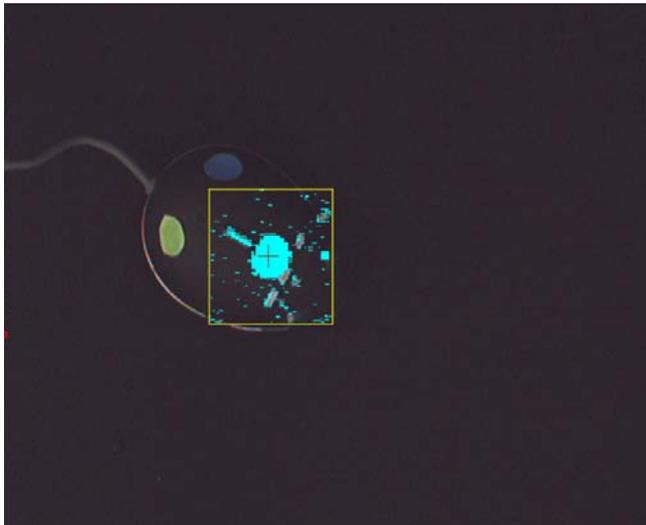
2.9.6.1 Setting the Threshold

CinePlex Studio can locate an object of a specified color by the color contrast between the desired color and the threshold setting. If the threshold setting is too low, the image could be similar to the one shown below. It will probably be necessary to experiment with the setting to obtain the optimal value.

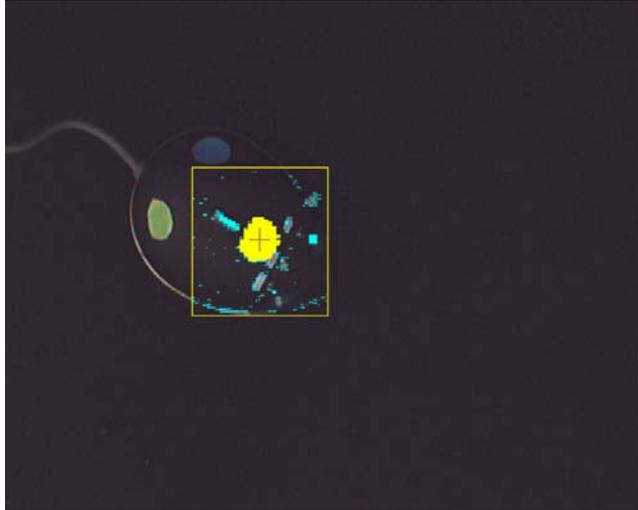


If the size of the found target object is larger than 1/4 of the frame area, there will be a red blinking message on the bottom of the screen notifying that the threshold is probably too low and both the Arm and Record buttons will be disabled.

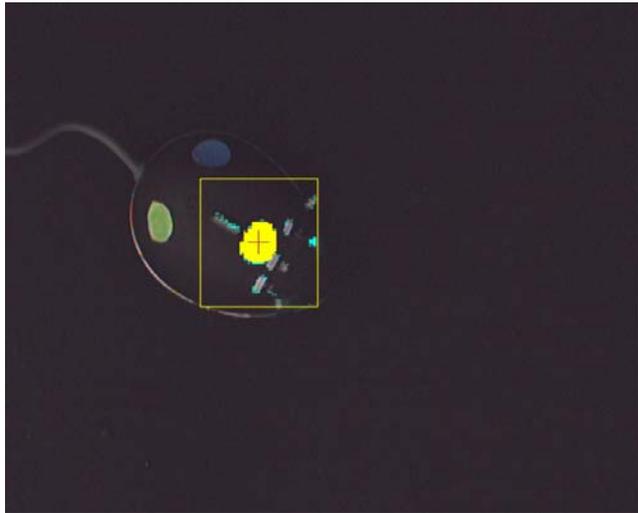
Try to set the threshold so that the number of parasite objects is as few as possible. To see all objects, check the “Show All Objects” checkbox.



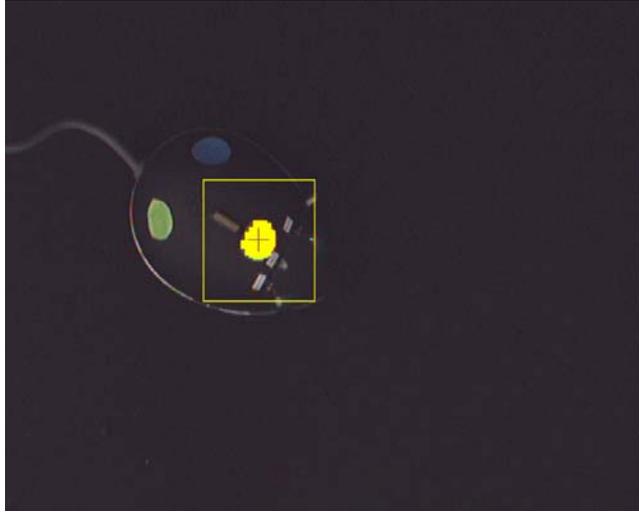
To see the object recognized as the target object, check the “Show Contour” and “Fill Contour” checkboxes.



Increase the threshold to reduce the number of parasite objects.



Increasing the threshold does not work in all cases. If the threshold is too large, the target object will be smaller. In such cases, detail filtering is helpful.



2.10 Operating CinePlex Studio with RASPUTIN Sort Client

Setting up CinePlex Studio to Transmit Tracking Data to a MAP

When tracking is operational, the (X,Y) location values for up to three tracked objects from Camera 1 (or File 1) can be time stamped and sent to the MAP circular buffer in real time. The values are tagged as strobed data, since they are strobed by the video frame trigger. Once in the buffer, they are available to client software, whether written by Plexon or its customers. If enabled, the Plexon Sort Client program displays hash marks representing the receipt of each packet of location values. All location data values are saved into PLX files, together with the associated neural data.

Note: Once an initial offset message has been received after a boot, mode change, or settings reload, data is sent to the circular buffer at all times except when in armed state.

- 1 Set up CinePlex Studio so that contours, LEDs, or colors are being tracked successfully, at least on Source 1. (This is described in detail in earlier sections of this chapter).
- 2 On the Tracking 1 window, press the PLX button next to the object or color to send to the MAP. In the case of LED or Color Markers mode, up to three colors may be selected.
- 3 Press the start icon on Sort Client, and then press the stop icon a few seconds later. This causes Sort Client to send a synchronizing time message to CinePlex Studio so that the time stamps of neural data and video data are synchronized.
- 4 Verify that strobed data is being received by Sort Client (see below).
- 5 If desired, delete the short PLX file created by Sort Client in Step 3.

Note: Note that if CinePlex Studio is restarted, a different settings file is loaded, or tracking mode is changed, steps 1 through 5 must be repeated to ensure that position data is being sent and received as desired.

All CinePlex Studio tracking data is recorded directly to the PLX files generated by RASPUTIN Sort Client. After setting up CinePlex Studio to track animal motion, set up Sort Client to record the tracking data. The following procedure explains how to set up Sort Client to record tracking data.



Startup

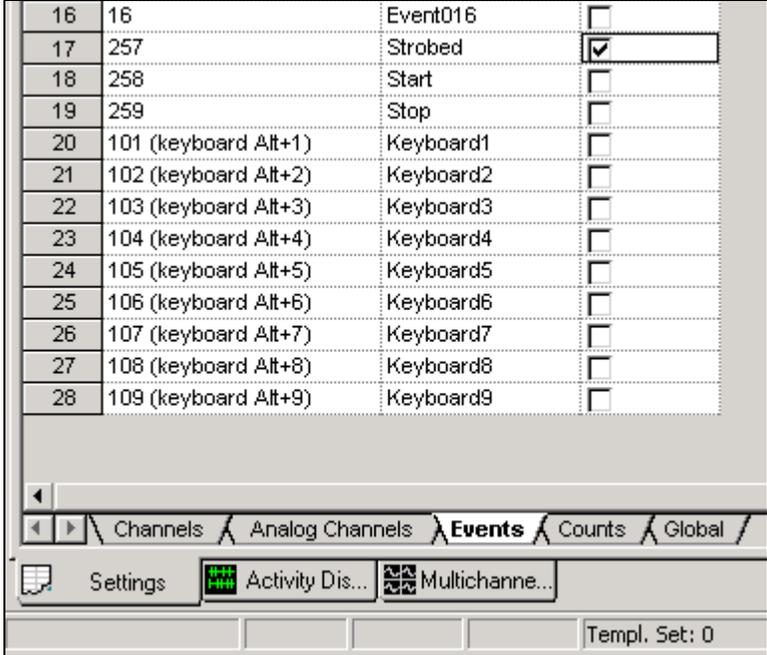
The startup sequence is extremely important. RASPUTIN must be started before Studio is started so that the client registration process works properly. Otherwise, when a recording is eventually started by RASPUTIN neither the file name string nor the recording time 0 messages are received.

If RASPUTIN exits or is closed for any reason, it should be brought back up, then Studio should be closed and restarted, as well.

Note: For additional information on setting up and running Sort Client, refer to the *RASPUTIN User's Guide*.

Setting up Sort Client to record CinePlex Studio data

- 1 Turn the Plexon MAP on. Turn the computer on.
- 2 At the computer, start Server.
- 3 Start Sort Client.
- 4 On the Sort Client **View** menu, click **Settings Window**.
- 5 In the **Settings** window, click the **Events** tab.
- 6 In the **Name** column, locate the channel named **Strobed**. In the **Show** column, click to select the check box for the **Strobed** channel.
- 7 Click the **Start** button on **Sort Client**.



16	16	Event016	<input type="checkbox"/>
17	257	Strobed	<input checked="" type="checkbox"/>
18	258	Start	<input type="checkbox"/>
19	259	Stop	<input type="checkbox"/>
20	101 (keyboard Alt+1)	Keyboard1	<input type="checkbox"/>
21	102 (keyboard Alt+2)	Keyboard2	<input type="checkbox"/>
22	103 (keyboard Alt+3)	Keyboard3	<input type="checkbox"/>
23	104 (keyboard Alt+4)	Keyboard4	<input type="checkbox"/>
24	105 (keyboard Alt+5)	Keyboard5	<input type="checkbox"/>
25	106 (keyboard Alt+6)	Keyboard6	<input type="checkbox"/>
26	107 (keyboard Alt+7)	Keyboard7	<input type="checkbox"/>
27	108 (keyboard Alt+8)	Keyboard8	<input type="checkbox"/>
28	109 (keyboard Alt+9)	Keyboard9	<input type="checkbox"/>

Channels / Analog Channels / **Events** / Counts / Global

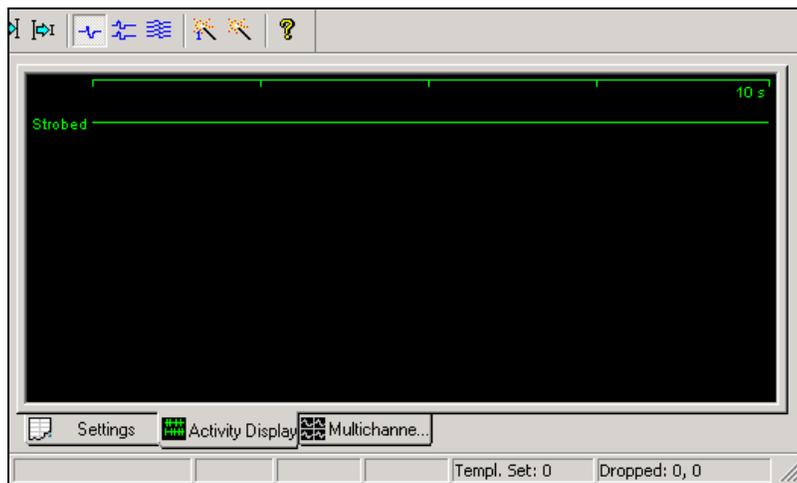
Settings Activity Dis... Multichanne...

Templ. Set: 0

To verify CinePlex Studio data acquisition

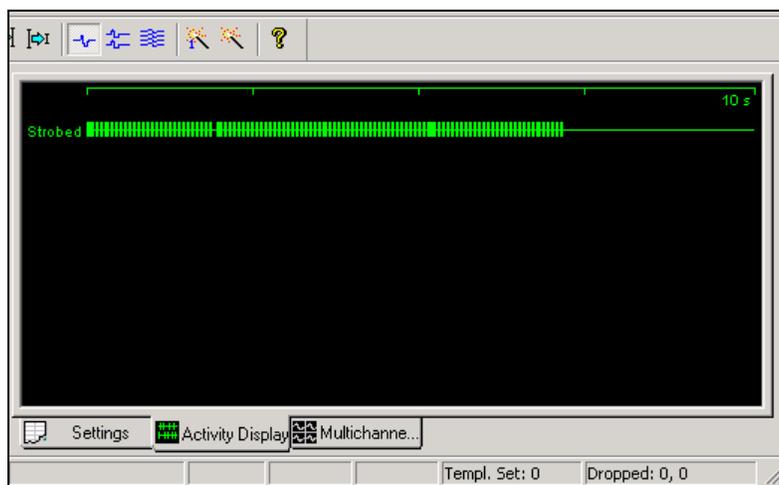
- 1 Configure CinePlex Studio so that it is generating position data. For more information, see [“CinePlex Studio Tracking Pane \(if available\)”](#) on page 72.
- 2 In Sort Client, on the **View** menu, click **Activity Display**.

*As shown in the following illustration, the **Activity Display** shows no activity on the strobed channel.*



- 3 Click **Start**, or, from the **Server** menu, select **Start Data Transfer**.

*The red LED on the DSP-board input port turns on. As shown in the following illustration, when the red LED is on the **Activity Display** shows the strobed events from the CinePlex Studio tracking data.*



Note: If the **Activity Display** does not show the strobed events, or the red LED on the DSP-board input port is not on, refer to [Appendix B](#).

2.10.1 Using VTViewer

CinePlex includes a utility program called VTViewer. After setting up and starting Sort Client, use VTViewer to see a graphical image of the animal position on

a 1024 by 768 grid. VTViewer provides a grid view for all tracking modes, as well as a selectable Motion Measure display in the Object Contour mode.

Note: VTViewer only shows tracking position data. It cannot show captured video frames.

Before beginning

Before using VTViewer, set up data transfer in Sort Client. To so, make sure to complete all the steps up to *and* including those in [“To verify CinePlex Studio data acquisition”](#) on page 93.

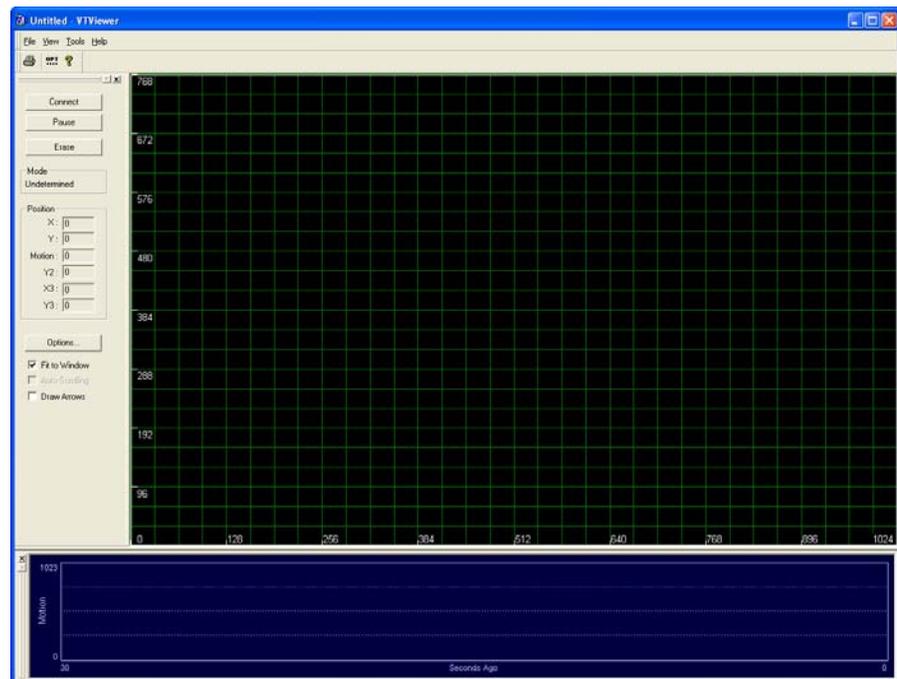
Note: It is extremely important to follow precisely the startup sequence given or else the position data may not be visible.

Starting VTViewer

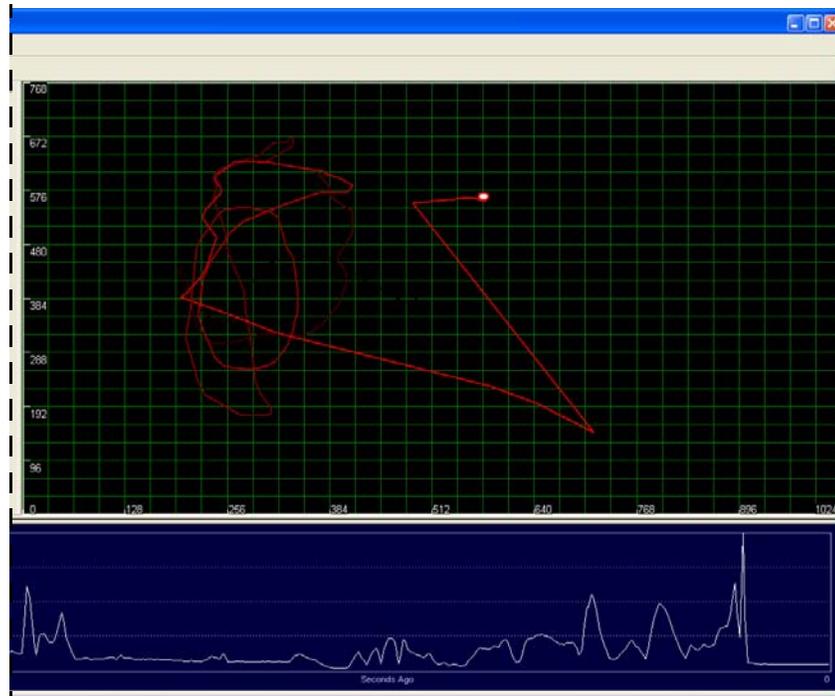
- 1 Click the VTViewer icon on the desktop to start VTViewer.



- 2 As the following illustration shows, the default VTViewer window includes the following three areas, in addition to the location grid:
 - Control View (panel on the left side)
 - Toolbar
 - Motion Level View (across the bottom)



- 3 In the Control View, click **Connect**. VTViewer plots the real-time location of the target animal on the grid as shown in the following illustration. The illustration shows a Object Contour-mode plot that includes motion measure data.

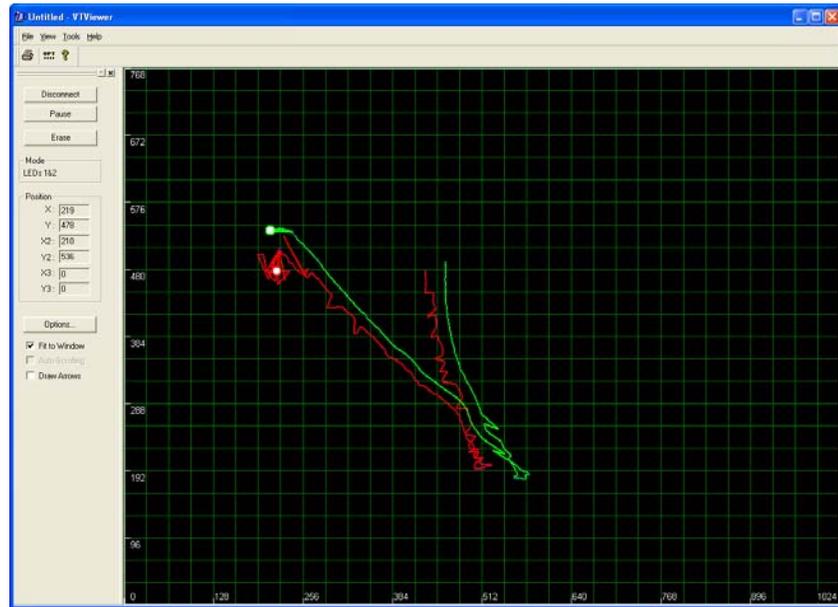


Note: The motion measure chart does not move until the center of gravity is sent to the PLX file.

- 4 If CinePlex Studio is set for LED tracking mode or Reflective Colors tracking mode, and at least one color is defined, VTViewer plots the real-time location of each colored LED that has been set up to track.

Note: If CinePlex Studio is tracking in LED or Reflective Colors mode, define at least one color to have data appear in VTViewer. If no colors have been defined, data does not appear at the Plexon MAP.

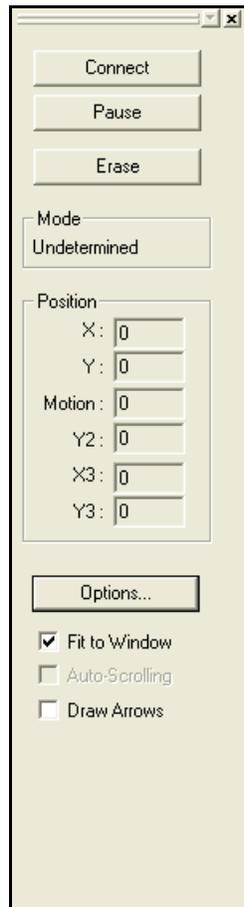
The following illustration shows a plot of a two-LED headset with one red and one green LED.



Note: VTViewer provides the motion measure plot for Object Contour mode tracking only. If CinePlex Studio is set to LED mode or Reflective Colors mode, and **Motion Level View** from the **View** menu is selected, VTViewer briefly displays the motion level plot below the grid. Because there is no motion measure data to plot, VTViewer removes the motion measure display after a few seconds.

2.10.1.1 Control View

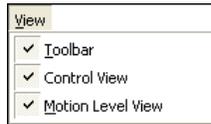
VTVIEWER displays the Control View by default.



Control View provides the following controls:

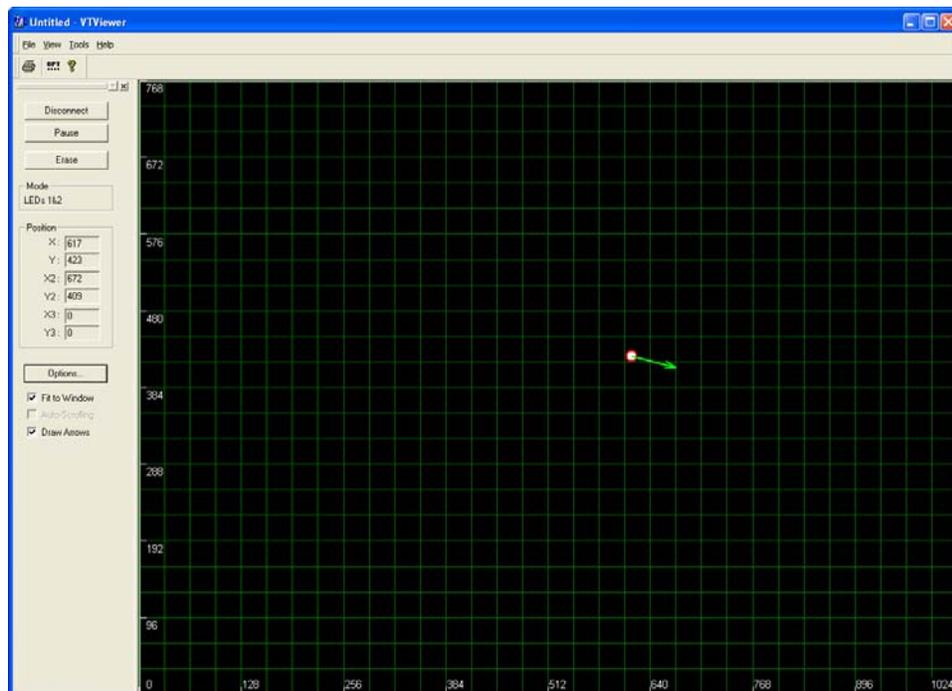
- **Connect**, **Pause**, and **Erase** buttons
- The **Mode** area, which shows the CinePlex Studio tracking mode.
- The **Position** area, which displays X, Y data points in real-time.
- The **Options** button, which opens the VTVIEWER **Options** dialog box.
- The **Fit Window** checkbox, which expands the 1024 X 768 plot to fit the size of the current window.
- The **Auto-Scrolling** checkbox, which enables scrolling of Object Contour mode displays when the window containing the display is smaller than 1024 X 768.
- The **Draw Arrows** checkbox, which enables the display of arrows in LED mode. For more information, see [“Arrows In the LED Mode” on page 98](#).

To expand the display area, close the Control View by clicking the close button, or, from the **View** menu, click to clear the **Control View** checkbox.



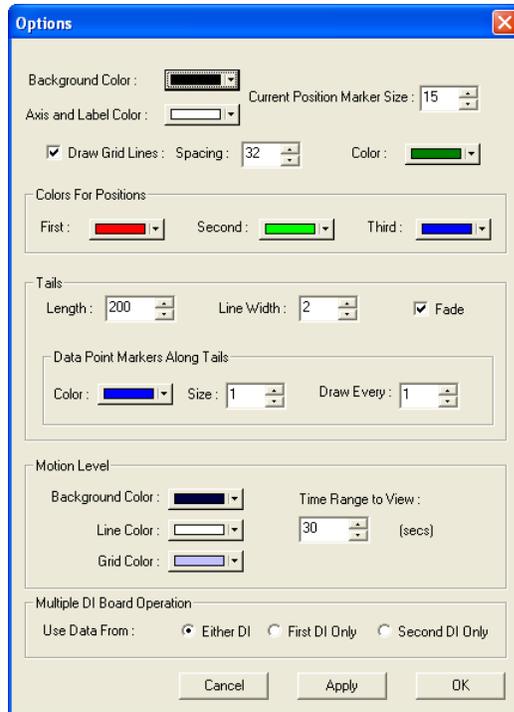
2.10.1.2 Arrows In the LED Mode

The user may set VTViewer to display arrows that point from LED to LED in the order of their selection. For example, to have an arrow to point to the nose of the target animal, select the LED nearest the tail first. Then select the LED nearest the nose. The resulting arrow in the VTViewer plot points toward the nose of the animal. The following illustration shows the plot of an animal with a red LED nearest the tail and a green LED nearest the nose.



2.10.1.3 VTViewer Options

The **Options** button opens the VTViewer **Options** dialog box. This dialog box includes controls for display colors, grids, and data input selections. The following illustration shows the **Options** dialog box default settings.



The VTViewer **Options** dialog box provides the following controls:

- The **Background Color** and **Axis and Label Color** controls set the display colors. The **Current Position Marker Size** control sets the size (in pixels) of the on-screen marker that indicates the animal's position. The **Draw Grid Lines** control applies grid lines to the plot. The **Spacing** control sets the spacing (in pixels) between the grid lines. The grid-line **Color** control sets the color of the grid lines.
- In the **Colors For Positions** area, the color controls set the display color for each LED being tracked. These position colors apply to the VTViewer display only and they do not apply to the CinePlex Studio image. The user may set these colors to match the LED colors set up to track in CinePlex Studio. The user may also set them to the desired choice of colors.
- In the **Tails** area, the controls set the characteristics of the plot line (tail) that tracks the current position marker. The **Length** control sets the length of the tail in data points. The **Line Width** control sets the width of the line in pixels. The **Fade** setting makes the tail slowly fade away as the target animal moves about the arena. In the **Data Point Markers Along Tails** sub-area, the **Color** control sets the color of the data points on the tails. The **Size** control sets the

size of the data-point markers in pixels. The **Draw Every** control sets the frequency that VTViewer plots data-point markers along the tails.

- In the **Motion Level** area, the controls set the characteristics of the Motion Level display. The **Background Color**, **Line Color**, and **Grid Color** controls set the appearance of the Motion Level display. The **Time Range to View** control sets the number of seconds on the horizontal axis of the display.
- For Plexon NDAQs with two digital input (DI) boards, in the **Multiple DI Board Operation** area, the controls select which input board to use. The **Use Data From** control buttons can be set to
 - **Either DI** (default setting) to use data from either the top or the bottom board, whichever one has a digital input

Note: VTViewer cannot accept data from more than one board. Do not connect a digital input to both boards.

 - **First DI Only** to use data from the top DI board only
 - **Second DI Only** to use data from the lower DI board only

2.10.2 Recording Remotely from MAP Sort Client

Most users will want to synchronize completely their video data with their neural data. The best way to do this is to allow the MAP Sort Client to start video recording at the exact time that neural data recording starts. Follow the procedure below to make this happen.

Procedure for Recording Remotely from MAP Sort Client

- 1 Adjust all the CinePlex Studio recording, tracking, and behavior settings as needed. Save the settings to a uniquely named TXT file, if not already done so.
- 2 Press the Arm button (circle with an "A" inside) on CinePlex Studio. This places CinePlex Studio into armed mode and no settings can be changed.
- 3 Adjust all parameters in the MAP Sort Client as needed. Save the parameters to a uniquely named file, if not already done so.
- 4 Press the Record button on Sort Client.
- 5 Observe that the new file name is present, green and indicating recording in the status bar at the bottom of the Sort Client main window and the CinePlex Studio main window.
- 6 When the experiment has been completed, press the Stop button on Sort Client.
- 7 Observe that the status bars are no longer green, and that Sort Client is ready to record again.
- 8 If finished recording, press the Arm button on CinePlex Studio again to take it out of armed mode. If any setting changes are needed, they can be done now.
- 9 If not finished recording, just leave CinePlex Studio in armed mode and repeat from Step 3.

2.11 CinePlex Studio Offline Mode

2.11.1 Entering Offline Mode

CinePlex Studio will come up in offline mode automatically if no cameras are detected. This will be the case, for example, when CinePlex Studio is installed on a non-MAP computer for the purposes of offline analysis of existing video files. Depending on the last offline activity performed on this computer, the mode will be automatically selected as “File 1”, “File 2”, or “Two Files”. The user can change from the selected offline mode to another by dropping down and selecting the desired mode - “File 1”, “File 2”, or “Two Files”.

The user can also change CinePlex Studio to operate in offline mode by selecting “File 1”, “File 2”, or “Two Files” from the drop down in the File toolbar. This can be done on the normal MAP computer where the camera(s) are installed, as well as on another computer. Depending on the last offline activity performed on this computer, the mode will be automatically selected as “File 1”, “File 2”, or “Two Files”. The user can change from the selected offline mode to another by dropping down and selecting the desired mode - “File 1”, “File 2”, or “Two Files”.

2.11.2 Offline Settings

Offline mode allows existing CinePlex video file(s) to be re-recorded with different or changed settings from the original recording. This means the user can:

- Re-record CinePlex files previously saved in MJPEG format to the much more compact MPEG format, thus saving storage space
- Re-record CinePlex files already in MPEG format with a reduced quality setting to reduce further their size and save storage space
- Change brightness or contrast so that existing files are more usable
- Change tracking parameters (if option is available) and re-track the file
- Add behavior parameters (if option is available) to existing files that may have been recorded without them and apply them in the re-recording
- Modify existing tracking or behavior parameters (if option is available) and re-record
- Modify existing tracking or behavior parameters (if option is available) and allow digital outputs to occur for testing of experimental setups - note that the digital output capability must be installed on the computer for actual electrical signals to be sent

CinePlex Studio operating settings can be taken from:

- Existing settings files saved in online mode
- Existing settings files saved in offline mode
- Settings data contained within the AVI files themselves

- New settings made by the user while analyzing the video file(s)
- Modifications made to settings from any of the sources above

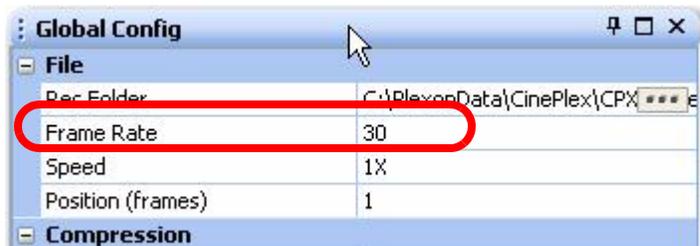
2.11.3 Offline Functionality

Most offline functionality is only marginally different from its online equivalent. The major exception is that the optional tracking and behavior functionality against a recorded file will be slightly different than that against live video. This is because the compression techniques used to create AVI files of manageable size inherently discard some of the data that was present in the original, i.e. they are “lossy” compression techniques. In particular, some color, details, and brightness information is compromised. Normally the differences are not visible to the naked eye, but they will cause slight differences in the sensitive algorithms used for tracking and behavior analysis.

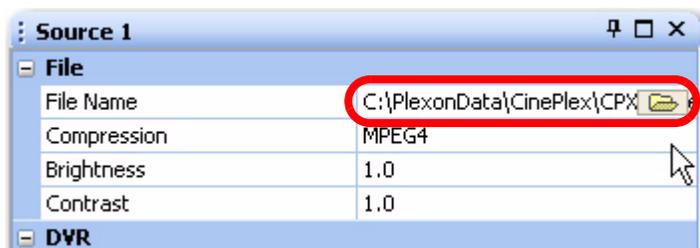
Sending tracking data to the MAP Sort Client is not enabled and does not occur in offline mode because there are no camera triggers and no neural data to synchronize with. In addition, Sort Client may not even be installed on the computer where the offline analysis is being done.

Differences in the user interface are described below:

- **Global Config Pane** - The frame rate shown is that of the source files selected. Other sections are unchanged.



- **Source Pane(s)** - Most Camera adjustments are replaced with a file selection browsing tool. In their places are simple adjustments for brightness and contrast. Other sections are unchanged.



- **Messages Pane** - No differences.
- **Tracking Panes** (if tracking option is available) - No differences.
- **Areas Pane(s)** (if tracking option is available) - No differences.

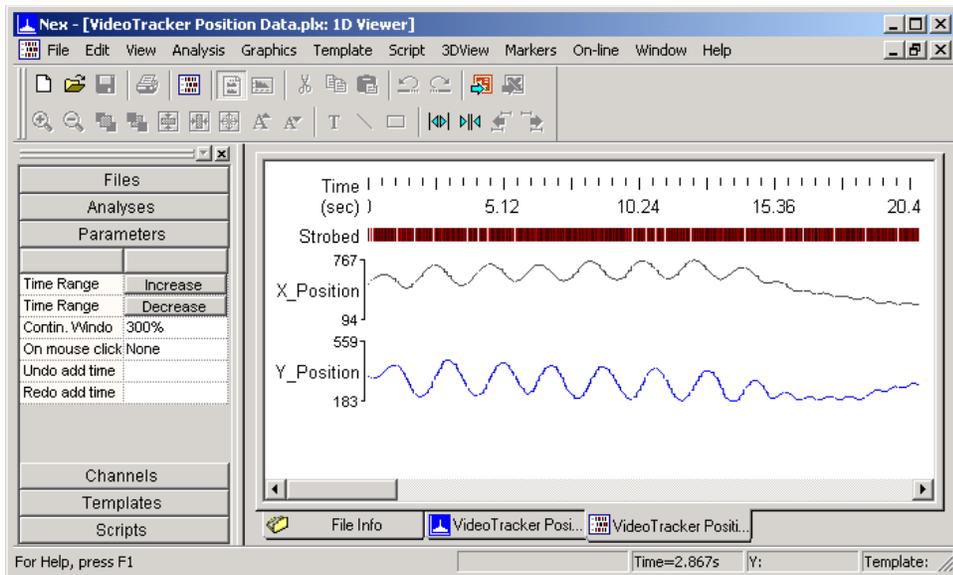
-
- **Sequences Pane(s)** (if behavior option is available) - No differences.
 - **Events Pane(s)** (if behavior option is available) - No differences.
 - **Combination Event Pane(s)** (if behavior option is available) - No differences.
 - **Event Statistics Pane** (if behavior option is available) - No differences.

2.12 Importing and Analyzing Position Data with NeuroExplorer

NeuroExplorer is a neurophysiological data analysis package that can be used to analyze data files offline, or it can be used in real-time with a Plexon NDAQ. For more information on NeuroExplorer, see <http://www.plexoninc.com/NEX.htm>.

The user may import and analyze the X, Y position data in PLX files with NeuroExplorer (NEX), Version 3.088 or later. NEX converts the strobed digital position data into continuous X and Y position variables, which can be used in NEX Place Cell Analysis, etc. For more information on position variables, refer to the *NeuroExplorer Version 3.0 User Manual and Reference*, or a later version.

The following illustration shows the strobed position data and the continuous X, Y position variables in the Nex 1-D Viewer.

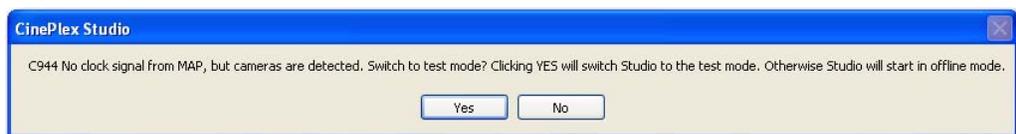


2.13 CinePlex Studio Test Mode

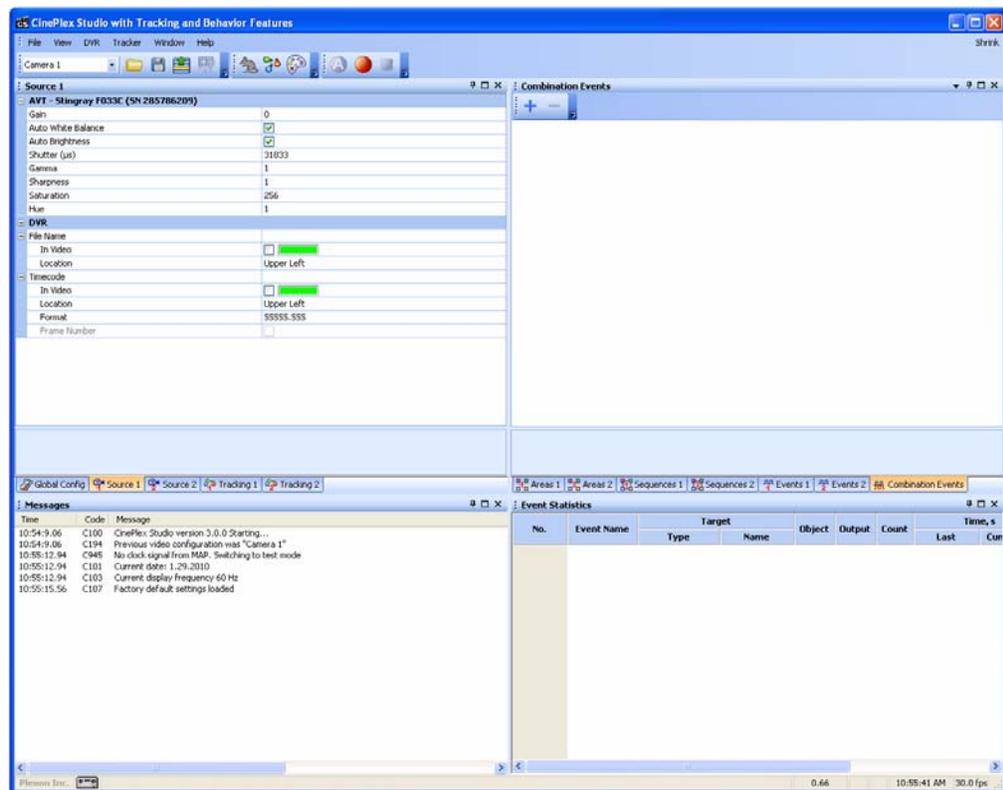
Test mode is provided to enable the experimenter to verify operation of the video portion of their experimental setup without having to activate and connect the MAP, prepare animals for recording, connect preamplifiers, etc. The license keys normally required must be present on the computer.

When CinePlex Studio starts, it checks for the presence of the Access IO board. If the AccessIO board is present, Studio checks for the clock signal from the MAP.

If the AccessIO board is not present or if there is no clock signal from the MAP, the following message displays if one or more cameras are detected. Otherwise Studio opens in File mode without showing the message.



Click **Yes** to enter **Test** mode or **No** to enter **File** mode. The Test mode main window is shown below.



Test mode has several restrictions compared to the normal mode:

- CPX switches cameras to free-running mode (using their internal trigger), since there is no external trigger available.
- “Arm” button is disabled, since it’s impossible to sync with MAP without the clock.
- Recording can be done as local ones only.
- Duration of each recording is restricted by 1 min.

2.14 Operation with the Quad MAP Controller

The Quad MAP Controller (QMC) will synchronize the operation of two, three, or four MAP systems together with their associated CinePlex systems.



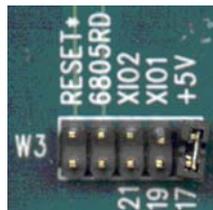
Startup

The startup sequence is extremely important. RASPUTIN must be started before Studio is started so that the client registration process works properly. Otherwise, when a recording is eventually started by RASPUTIN neither the file name string nor the recording time 0 messages are received.

If RASPUTIN exits or is closed for any reason, it should be brought back up, then Studio should be closed and restarted, as well.

Procedure for Quad MAP Controller Operation

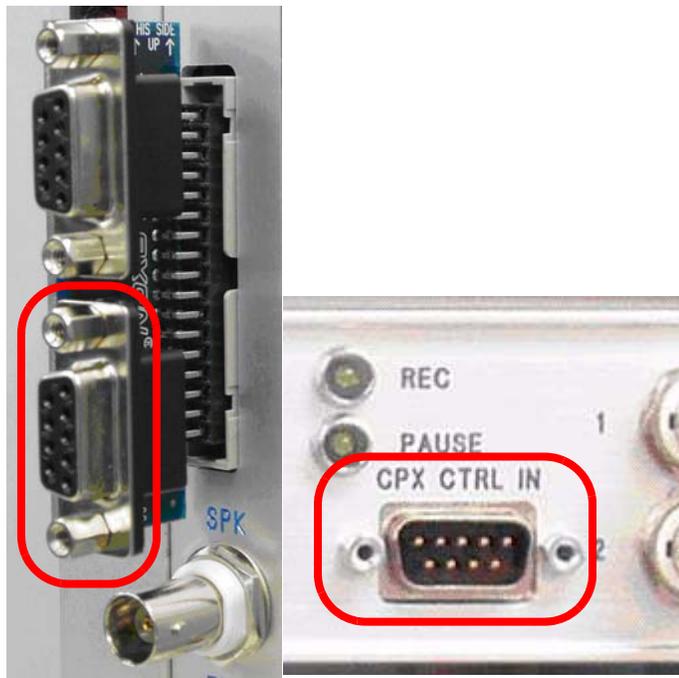
- 1 Each of the MAP/CinePlex combination systems should be tested and validated to be operational in stand-alone mode before attempting to connect them for synchronized use with the QMC. If this has not been done for each of the systems, please do so now. Then power all components of all systems down.
- 2 Select one MAP system to be the “Master” MAP system. Signals from the master MAP system will control all of the connected CPX systems and will provide power to the Quad MAP Controller.
- 3 Configure the TIM board of the master MAP system to supply power to the Quad MAP Controller. Apply a jumper at the position marked “17” and “+5V” on jumper block W3 as shown.



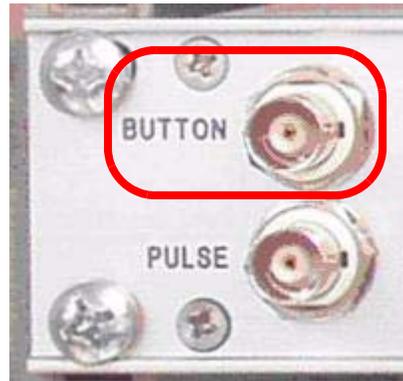
- 4 Connect a TIM cable adaptor (01-01-A-06) to the 34-pin connector on the master MAP TIM board as shown.



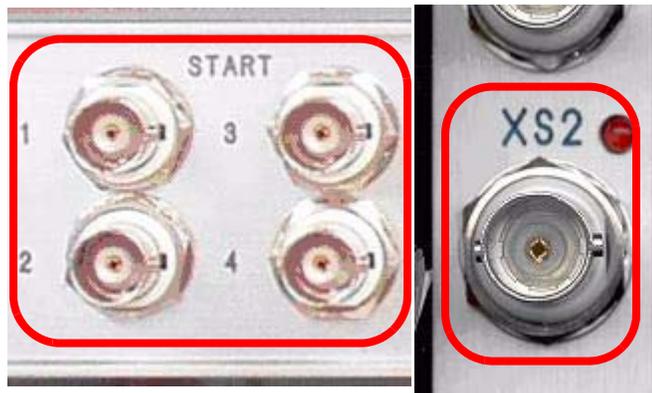
- 5 Connect the lower connector (marked "TO CPX") on the TIM cable adaptor to the connector marked CPX CTRL IN on the QMC using a universal TIM cable (06-19-A-01).



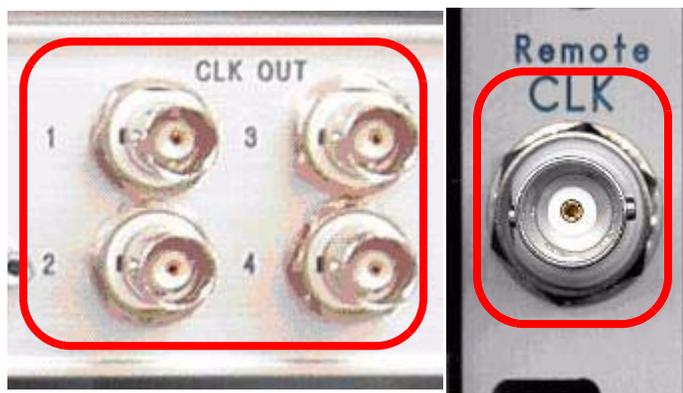
- 6 Connect a push button switch (09-40-A-01) to the BUTTON input of the Quad MAP Controller using a standard BNC cable.



- 7 Connect the START BNCs on the QMC to the XS2 BNC on the TIM board of each MAP system using equal length BNCs.

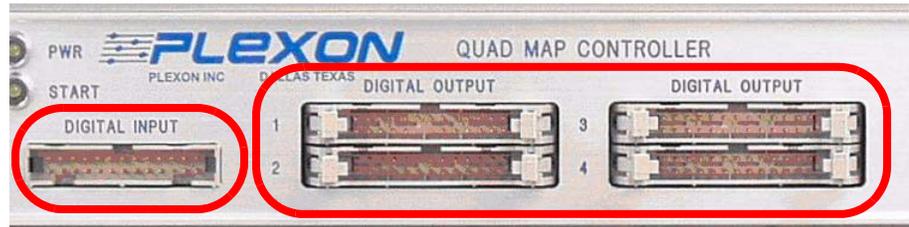


- 8 Connect the CLK OUT BNCs on the QMC to the CLK BNC on the TIM board of each MAP system using equal length BNC cables.



- 9 (Optional) Connect the DIGITAL INPUT on the QMC to a behavioral control system. Use the same cable that would normally connect the behavioral control system directly to a MAP system. Connect the DIGITAL OUTPUT

connectors on the QMC to each MAP system using a 26-pin ribbon cable (06-17-A-03).



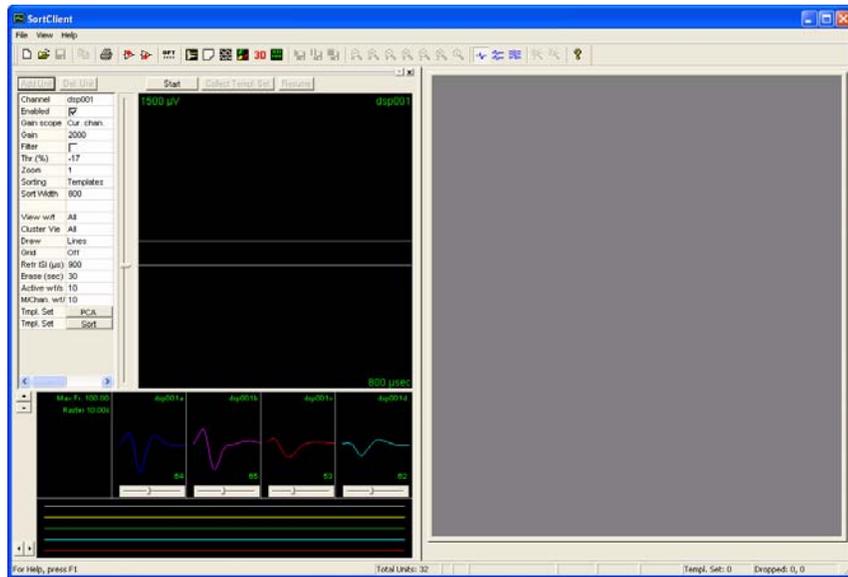
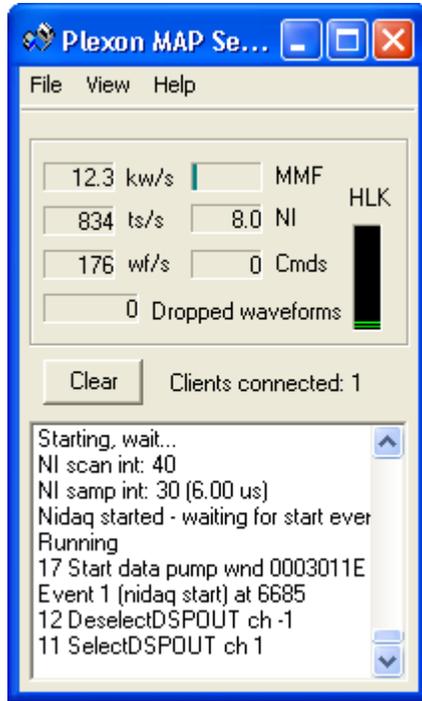
- 10 (Optional) Connect the CPX CONTROL OUT connectors on the QMC to the TIMING connector on the Access IO adaptor (07-02-A-03) on each CPX unit using a universal TIM cable (06-19-A-01).



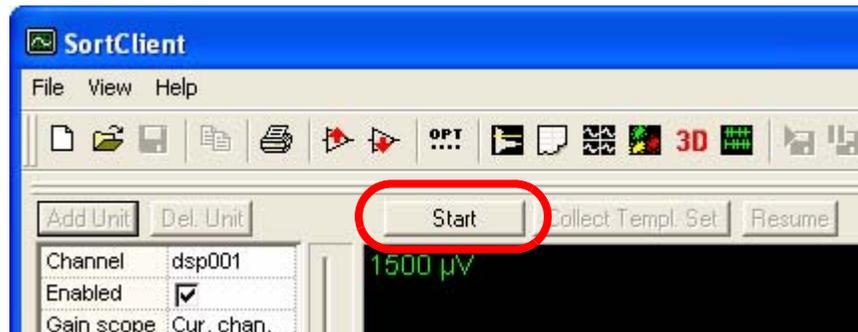
- 11 Turn on each computer, CPX, and MAP system.
Note: If the system has a cCPI expansion chassis, this must be turned on before the computer is turned on.
- 12 On each computer, launch the Server and Sort Client applications. Double-click the Server and Sort Client desktop icons.



The Server and Sort Client windows open.

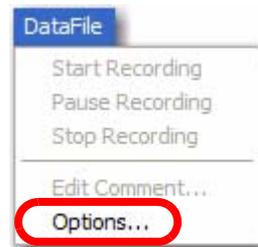


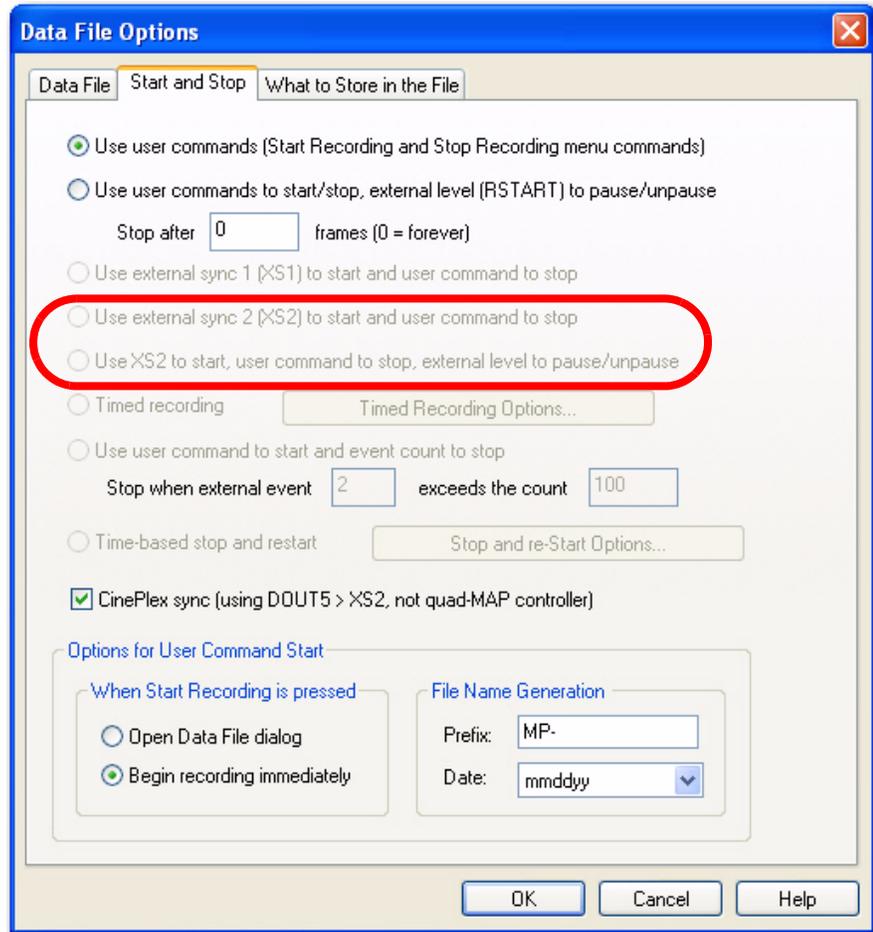
- 13 In each Sort Client, click the “Start” button in the upper left hand corner of the screen.



Note: When recording using a QMC, pressing stop on the Master MAP Sort Client actually stops recording neural data on the Master MAP and video recording on all four copies of CinePlex Studio. Stop must be pressed on Sort Client on the other three MAPs individually to stop their neural data recordings.

- 14 In each Sort Client, go to DataFile, Options, Start and Stop. If using a behavioral control system to pause and unpause recording to disk, select the option “Use XS2 to start, user command to stop, external level to pause/unpause”. If not using a behavioral control system to pause and unpause recording to disk, select the option “Use external sync 2 (XS2) to start and user command to stop”.

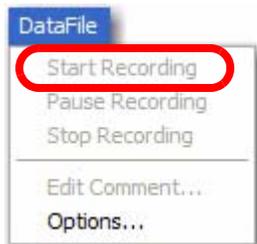




- 15 On each CPX, launch and arm CPX.



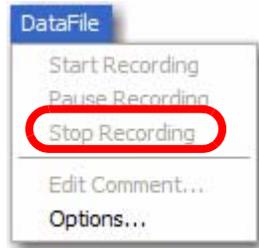
- 16 In each Sort Client, select DataFile, Start Recording. The systems will go into a paused state. The status indicator at the bottom of the Sort Client screen will turn green but say "paused".



- 17 Press the push button switch. If using a behavioral control system to pause and unpause recording to disk, the systems will stay in a paused state. There will be no change in the status of each system until an "unpause" event is

received from the behavioral control system. If not using a behavioral control system each MAP system will start recording to disk. The status indicator will no longer say "paused".

- 18 To stop recording to disk, in each Sort Client, select DataFile, Stop Recording.



2.15 Using the Extractor

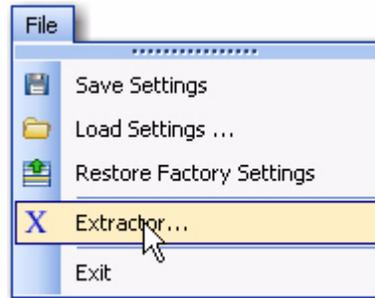
This chapter contains information necessary for setting up and operating the CinePlex Extractor program. CinePlex Extractor is an offline tool that extracts desired static and dynamic data from a Plexon AVI file, placing it into Plexon Settings file format and/or formats suitable for use by database programs such as Microsoft SQL Server[®] or data processing tools such as Microsoft Excel[®].

Static data in AVI files includes system information and settings data. Dynamic data includes positions, speeds, angles, and other computed information.

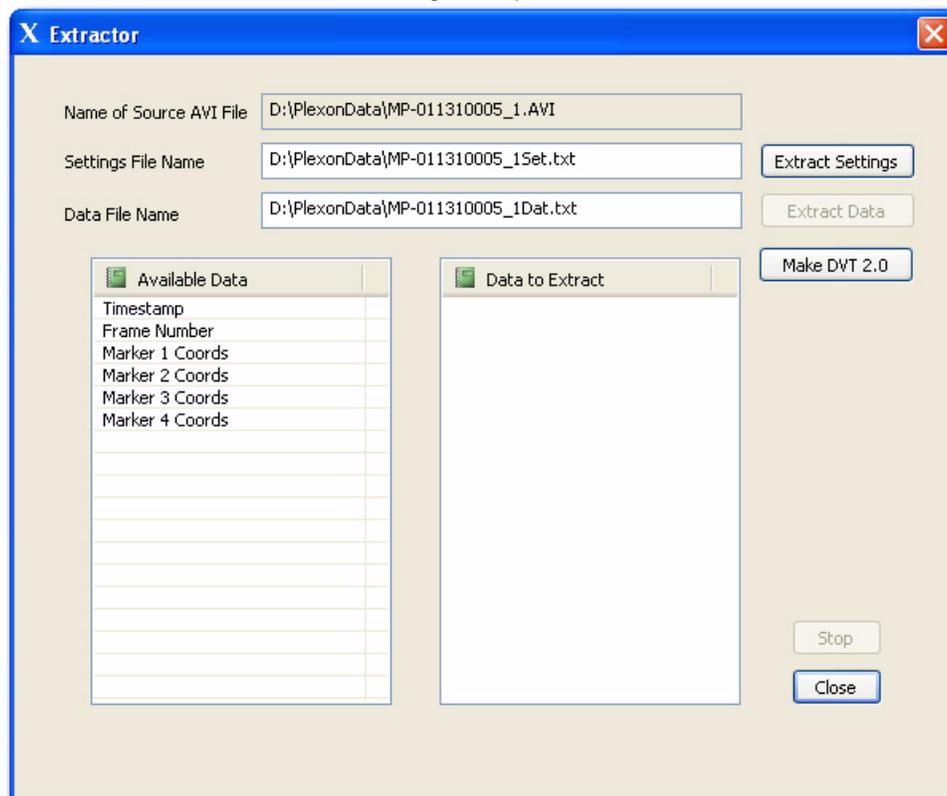
Before attempting to use the extractor, an AVI file must be loaded from which to extract the data.

Using Extractor to extract data from AVI file

- 1 From the **File** menu select **Extractor...** or click the **Extractor** icon on the toolbar.

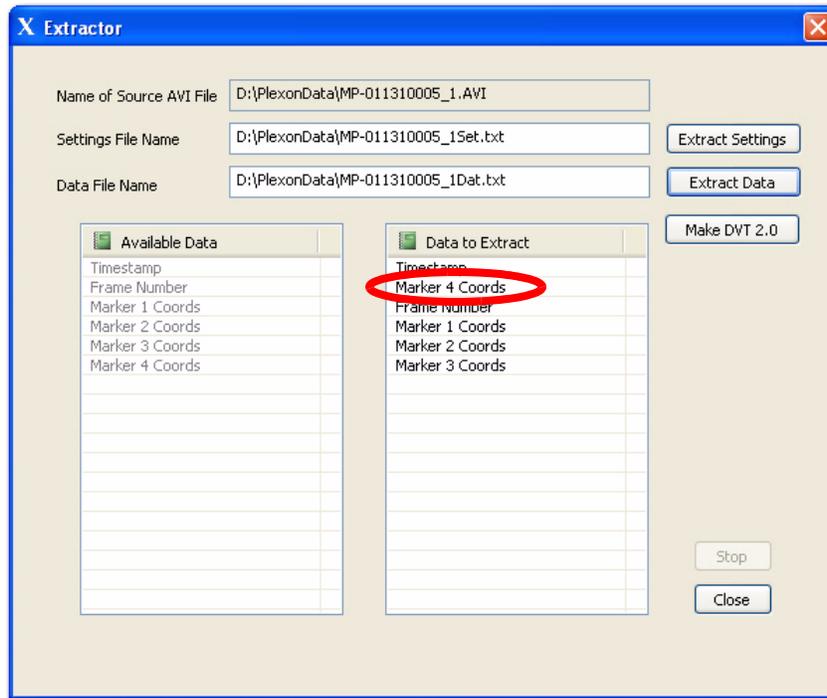


- 2 The **Extractor** dialog box opens.

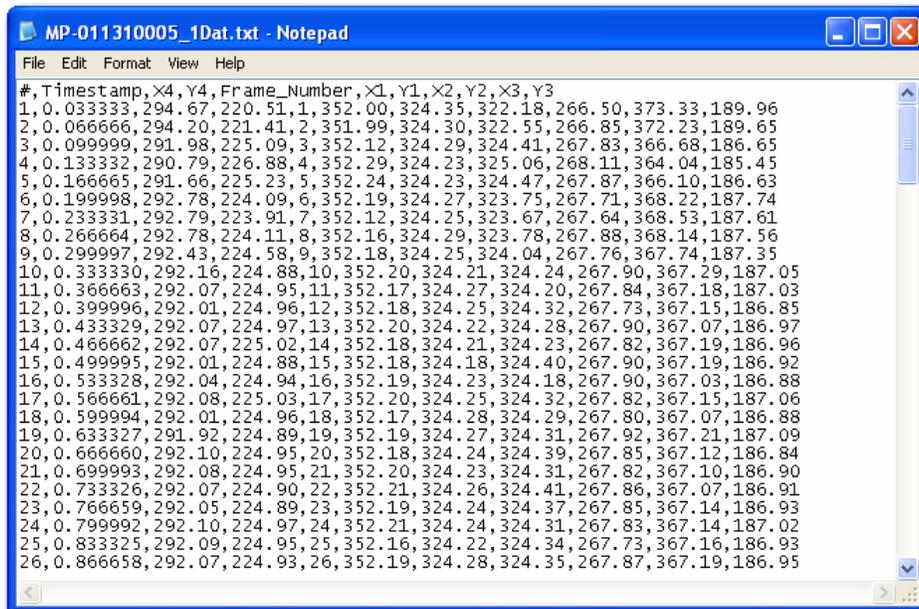


- 3 The settings from the file may be extracted by clicking the **Extract Settings** button or a DVT file may be created by clicking the **Make DVT 2.0** button.
- 4 To extract data drag and drop entries in the **Available Data** section to the **Data to Extract** section. The order of the entries in the **Data to Extract** section may be rearranged by dragging and dropping as the image below

illustrates. Note that the **Marker 4 Coords** entry has been moved to position 2 in the **Data to Extract** section.



- 5 When ready to extract the data, click the **Extract Data** button.
- 6 If it is desired to stop the data extraction before the end of the file is reached, click the **Stop** button.
- 7 The data is extracted to a comma-delimited file (headings located in the first row in the order shown in the Data to Extract section of the dialog) as shown by the image below.



Chapter 3

CinePlex Studio Reference

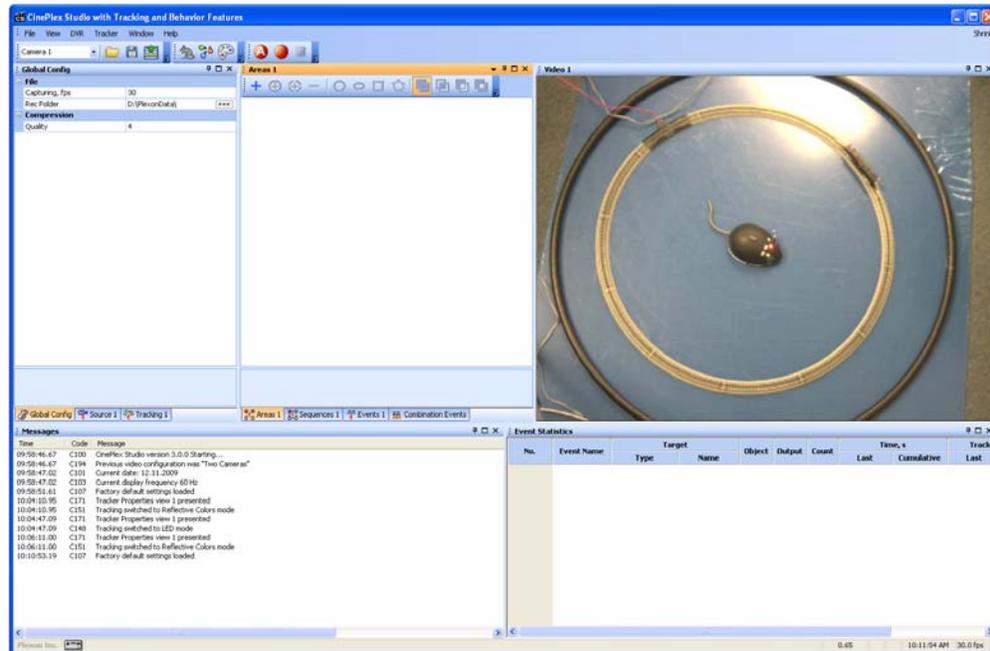
- 3.1 Overview.....120
- 3.2 Main Window120
- 3.3 Menus.....151
- 3.4 Toolbars.....155
- 3.5 Digital VideoTracker (DVT) Files156
- 3.6 Using Studio in File Mode158

3.1 Overview

This chapter contains detailed reference information about **CinePlex Studio**. Use this chapter to identify and locate information for menu items, toolbar buttons, dialog boxes, or windows. The information in this section generally flows by pane and by menu item from left to right across the main window.

3.2 Main Window

The default layout of the **CinePlex Studio** main window is shown below.



The **CinePlex Studio** main window is a configurable window. In default layout, it contains a status bar, the main menu, toolbars, and several other panes depending on options that are licensed:

- **Static Configuration** pane containing up to five tabs for global configuration, video source configuration, and tracking configuration
- **Dynamic Configuration** pane containing up to seven tabs for setting up areas, zones, events, event sequences, and combination events.
- **Video** pane(s) - one per camera or source
- **Messages** pane
- **Event Statistics** pane for visualization of current state of defined events.

This section describes the status bar and the windows. Later sections describe the menus and toolbars.

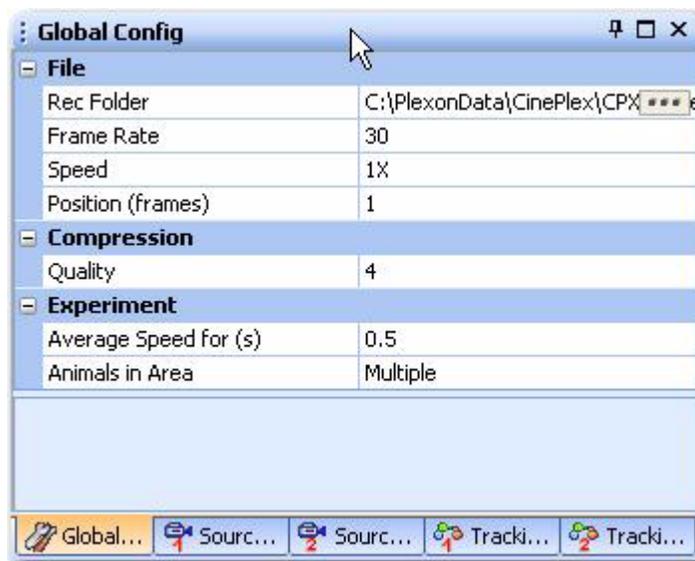
3.2.1 Static Configuration Pane

The **Static Configuration** pane contains the following:

- **Global Configuration Tab** - containing general settings for Studio
- **Source Tab(s)** - one or two tabs containing video source (camera or file) settings
- **Tracking Tab(s)** - one or two tabs containing tracking mode settings

3.2.1.1 Global Configuration Tab

The **Global Configuration** tab contains general settings for CinePlex Studio. The image below shows sample **Global Configuration** settings.



The Global Configuration tab contains a **File** group, a **Compression** group, and an **Experiment** group of settings.

3.2.1.1.1 File Group. The **File** group contains the following settings:

- **Rec Folder** - this setting is the recording folder path
- **Frame Rate** - this setting is the recording rate in frames per second
- **Speed** - this setting is the playback speed
- **Position (frames)** - this setting indicates the current frame position in the file

3.2.1.1.2 Compression Group. The **Compression** group contains the following setting:

- **Quality** – This setting controls the quality of recorded video. The user may adjust this value from 1 (low image quality) to 10 (high image quality). Video recordings with lower image quality settings take up less disk space. The

default setting is 75. For more information on video quality setting versus file size, see “[Digital Video Recorder AVI Format Files](#)” on page 56.



HINT

Viewing Image Quality

The Video window does not show the effect of the **Image Quality** setting. View the Video in CinePlex Editor or use the Video Library Preview function to see the effect.

3.2.1.1.3 Experiment Group. The **Experiment** group has the following settings:

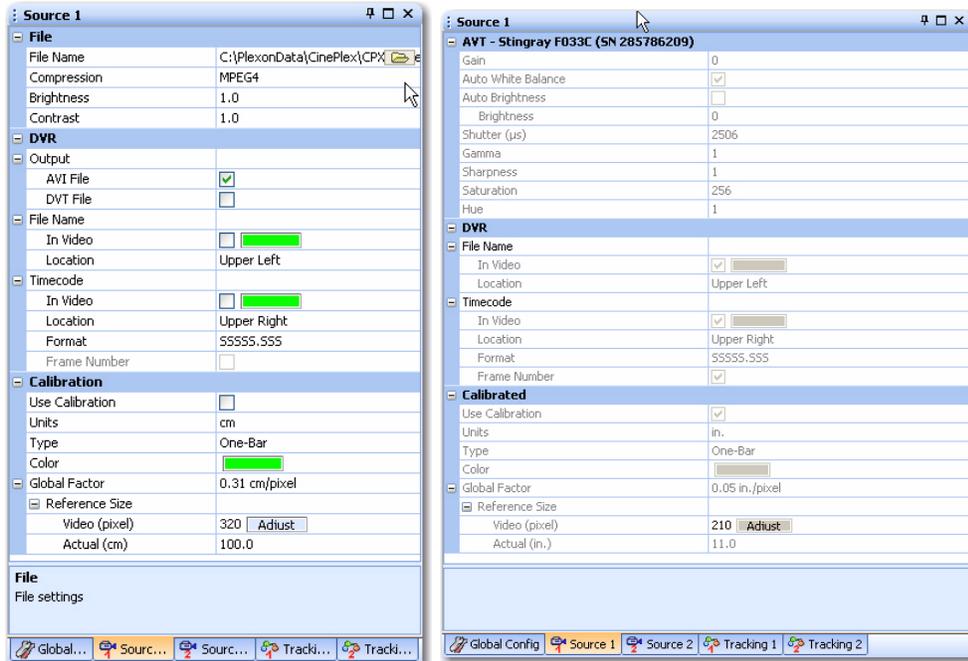
- **Average Speed for (s)** - this setting specifies the time period or window (in seconds) over which the average speed is calculated. This setting is used to minimize jitter in the calculation of average speed. If the setting is left at 0, the average speed calculations will vary widely (jitter). Thus, the setting needs to be greater than 0 and less than the amount of time the tracked object spends in the arena over which the average speed is calculated. Frame rate also affects the jitter, so if the frame rate is changed, the Average Speed for (s) would probably need to be changed as well.

Note: The average speed calculated for different LEDs attached to the same tracked animal may not be exactly the same value even though this setting is optimized. A small amount of jitter may still be present that affects the calculations.

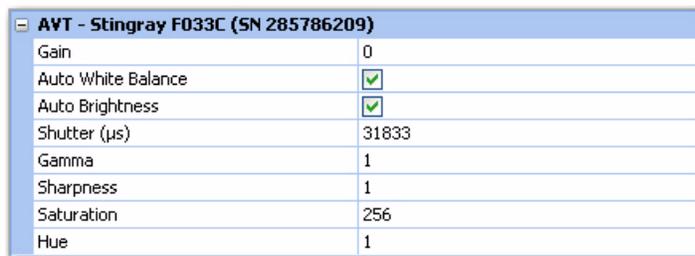
- **Animals in Area** - this setting specifies whether a single or multiple animals are being tracked and has dropdown selectable values of Single and Multiple. This setting does not appear in **Object Contour** mode since there is only one animal being tracked.

3.2.1.2 Source Tab(s)

There are one or two **Source** tabs, each of which contains settings its video source (either camera or file). If the video source is a camera, the Source tab contains a **Camera** group, a **DVR** group, and a **Calibration** group of settings. If the video source is a file, the Source tab contains a **File** group, a **DVR** group, and a **Calibration** group of settings. The image illustrates the **Source** tabs in **File** mode and **Camera** mode.



3.2.1.2.1 Camera Group. The **Camera** group displays when Studio is in **Camera** mode and is common to all tracking modes. It does not display in **File** mode.



It contains the following settings:

- **Auto Contrast** – If the **Auto Contrast** checkbox is checked, the camera automatically controls the contrast and shutter speed. If the **Auto Contrast** checkbox is unchecked, the **Contrast** and **Shutter** settings will appear.
- **Contrast** – This control send commands to the camera to control the contrast in the video image. If the user clicks **Auto Contrast**, the camera automatically controls the contrast and shutter speed and the **Contrast** and **Shutter** settings disappear. Otherwise, use the **Contrast** slider to manually set the contrast to a value between 0 and 255, resulting in a pleasing image.
- **Shutter** – This control sends commands to the camera to adjust the shutter speed. The shutter speed controls the length of time that a light-induced charge builds up at the camera CCD (Charge Coupled Device) sensor before the video cycle repeats for the next frame. The user may adjust the shutter speed from a slow speed of 2^{-5} (1/32nd of a second) to a high speed of 2^{-11} (1/

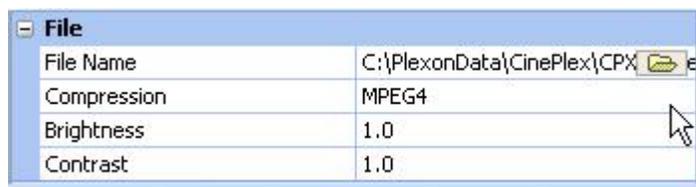
2048th of a second). Rapidly moving experimental subjects can appear blurred in the video. To reduce blurring increase the shutter speed. However, faster shutter speeds usually result in a darker image and are not as reliable in the LED mode. Compensate somewhat for the darker image by adjusting **Brightness** and **Contrast**. If the image is still too dark adjust the manual iris on the camera lens; see [Step 3 on page B-10](#).

Note: When recording under fluorescent lights, use a normal 2^{-6} (1/64th of a second) shutter speed. Faster shutter speeds typically result in a flickering effect in the video as the CCD sensor exposure interval interacts with the normal flicker of fluorescent lights.

- **Auto Brightness** – If the user checks the **Auto Brightness** checkbox, the camera automatically controls the brightness. If the **Auto Brightness** checkbox is unchecked, the **Brightness** setting will appear.
- **Brightness** – This control send commands to the camera to control the brightness of the video image. If the user clicks **Auto Brightness**, the camera automatically controls the brightness and the **Brightness** setting disappears. Otherwise, use the **Brightness** slider to manually set the video image brightness to a value between 0 and 255.
- **Sharpness** – This control sends commands to the camera to control the sharpness of the image. The range of the **Sharpness** control is from 0 to 255. Adjust this control to achieve a pleasing image.
- **Saturation** – This control sends commands to the camera to control the color saturation. The color saturation determines the amount of color added to the image. The range of the **Saturation** control is from 0 to 255. Adjust the control so that colors are pleasing, but not excessive.

Note: Because Object Contour mode is monochrome, **Saturation** does not appear under **Camera** when **Object Contour Tracker** is enabled.

3.2.1.2.2 File Group.



The **File** group is present in **File** mode but not in **Camera** mode. The **File** group contains the following settings:

- **File Name** - this setting contains the complete path and file name of the source file. The source file is selected from the **Browse Folder** button at the right side of the setting.
- **Compression** - this setting specifies the type of compression used for the file.

- **Brightness** - this setting specifies the brightness of the Video pane. Values range from 0.1 to 5.0.
- **Contrast** - this setting specifies the contrast of the Video pane. Values range from 0.1 to 5.0.

3.2.1.2.3 DVR Group.

DVR	
Output	
AVI File	<input checked="" type="checkbox"/>
DVT File	<input type="checkbox"/>
File Name	
In Video	<input type="checkbox"/>
Location	Upper Left
Timecode	
In Video	<input type="checkbox"/>
Location	Upper Left
Format	SSSSS.SSS
Frame Number	<input type="checkbox"/>

The **DVR** group contains three main sections - **Output** section, **File Name** section, and **Timecode** section.

Output Section

- **AVI File** – Click this control to generate a video file in AVI format.
- **DVT File** – Click this control to generate a position data file in DVT format. DVT-format files are useful in standalone scenarios. For information on the DVT file format, see [“Digital VideoTracker \(DVT\) Files” on page 156](#).

File Name Section

- **In Video** - this checkbox allows the user to specify if the filename appears in the video window. The **Color Selection** box allows the user to select the color of the text of the filename.
- **Location** - this dropdown allows the user to specify where the filename appears.

Timecode Section

- **In Video** – Checking this checkbox will make the timecode visible in the video. The color selection box allows the user to define the font color of the timecode display.

- **Location** – This setting allows the user to determine where the timecode will display on the screen. Choices are upper left, lower left or upper right, lower right.
- **Format** – This setting allows the user to determine the format of the displayed timecode. Choices are HH:MM:SS.NNNN and SSSSS.NNNN.

3.2.1.2.4 Calibration Group.

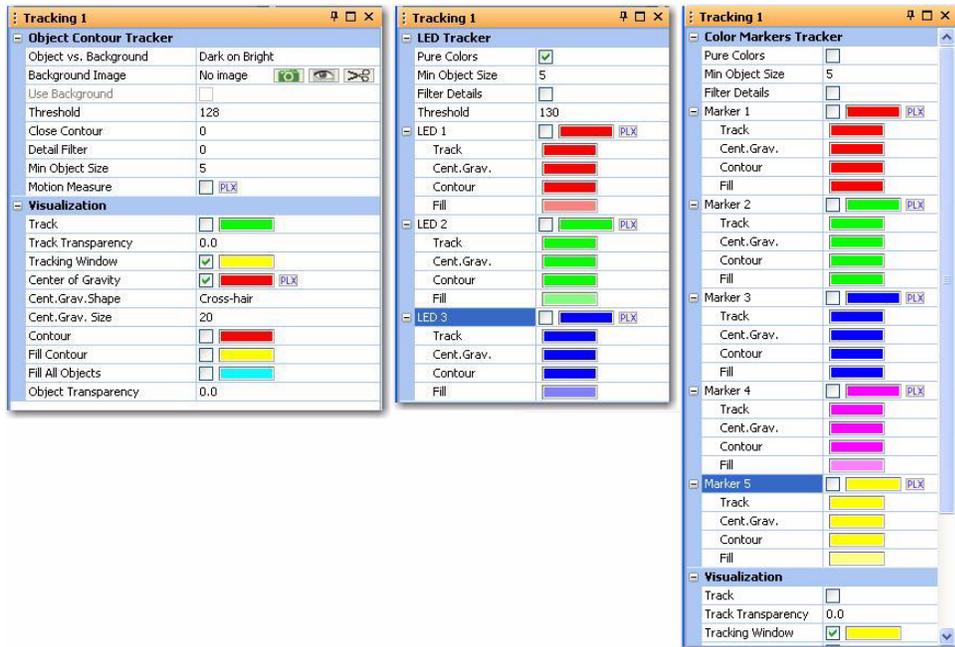
Calibration	
Use Calibration	<input type="checkbox"/>
Units	cm
Type	One-Bar
Color	
Global Factor	0.31 cm/pixel
Reference Size	
Video (pixel)	320 <input type="button" value="Adjust"/>
Actual (cm)	100.0

The **Calibration** group contains the following settings:

- **Use Calibration** - checking this checkbox causes Studio to use calibration
- **Units** - this setting (cm or in) specifies the calibration units
- **Type** - this setting indicates the number of calibration bars (**One-Bar** or **Two-Bar**).
- **Color** - this setting indicates the color of the reference bar(s).
- **Global Factor** - this setting specifies the factor of global calibration. This setting is present only if the **Type** setting is **One-Bar**.
- **Reference Size** - this setting is present once if the **Type** setting is **One-Bar** and twice if the **Type** setting is **Two-Bar** (one associated with the Horizontal Factor and one associated with the Vertical Factor). It contains two sub-settings:
 - **Video (pixels)** - this setting is the size of the reference bar in pixels.
 - **Actual (cm)** or **Actual (in)** - this setting adjusts the actual size of the reference bar in centimeters or inches depending on the **Units** setting.
- **Horizontal Factor** - this setting contains the horizontal calibration value. There is a **Reference Size** section under **Horizontal Factor**.
- **Vertical Factor** - this setting contains the vertical calibration value. There is a **Reference Size** section under **Vertical Factor**.

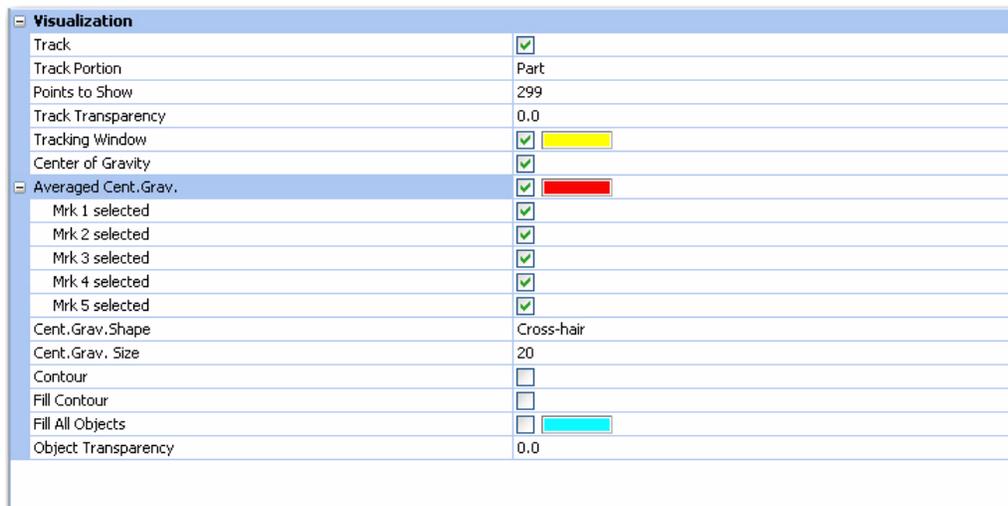
3.2.1.3 Tracking Tabs

One of three panes is displayed which corresponds to the tracking mode being used. The panes are the **Object Contour Tracker** tab, the **LED Tracker** pane, and the **Color Markers Tracker** pane. The three panes are shown in the diagram below.



Each pane consists of an upper group that has adjustments and settings particular to that tracking mode; together with a bottom group with visualization settings tailored for the mode.

3.2.1.3.1 Visualization Group. The **Visualization** group is common to all tracker modes. It is visible only after one of the tracking modes is selected.

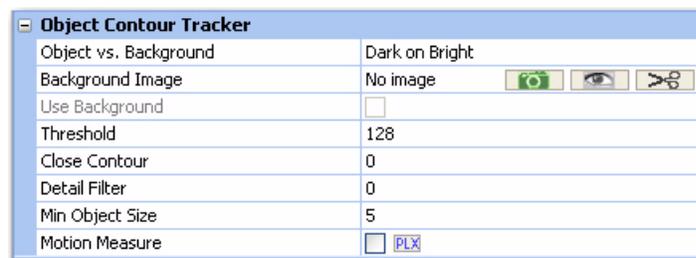


It contains the following settings:

- **Track** – Checking this item shows the animal’s trajectory and color selection.
- **Track Portion** – This allows the user to show the whole trajectory or the last “Point Count” points.
- **Points to Show** – This setting (from 30 to 300) indicates how many points to show in the trajectory when **Track Portion** is selected.
- **Track Transparency** – This setting determines the transparency of the trajectory layer. The range of the **Track Transparency** control is 0.0 (opaque) to 1.0 (transparent).
- **Tracking Window** – Checking this item shows the tracking window.
- **Center of Gravity** – Checking this item shows the center of gravity.
- **Averaged Cen. Grav** – Up to five markers may be selected under this setting, and Studio displays a marker to indicated the averaged center of gravity for the selected markers.
- **Cent. Grav. Shape** – This setting determines the shape that designates the center of gravity of the object.
- **Cent. Grav. Size** – This setting determines the size of the shape showing the center of gravity. The range of the control is from 10 to 100.
- **Contour** – Checking this item shows the contour of the found object-boundaries.
- **Fill Contour** – Checking this item fills the contour of the found object.
- **Fill All Objects** – Checking this item shows all objects (including parasite spots) in the current tracking window.
- **Object Transparency** – This setting determines the transparency of the contour of the found object. The range of the Contour Transparency is from 0.0 (opaque) to 1.0 (transparent).

3.2.1.4 Object Contour Tracker Pane

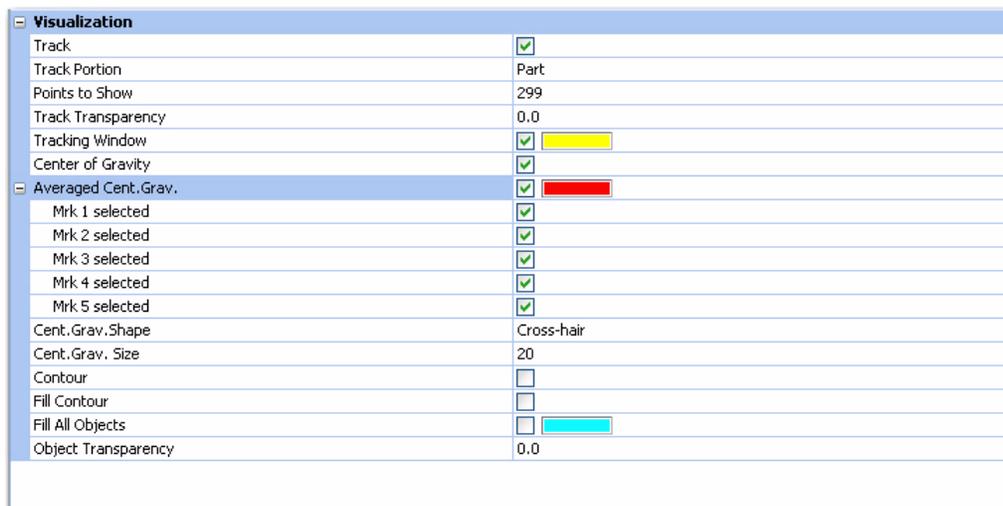
The following illustration shows the **Object Contour Tracker** group on the **Object Contour Tracker** pane for Object Contour mode:



3.2.1.4.1 Object Contour Tracker Group. From the **Tracker** menu, if the user selects **Object Contour**, the **Object Contour Tracker** group appears in this area. The controls are as follows:

- **Object vs. Background** – This setting allows the user to select **Dark on Bright** or **Bright on Dark**. **Dark on Bright** means a dark object on a brighter background. **Bright on Dark** means a bright object on a darker background.
 - **Background Image** – This setting allows the user to set a background image. A background image is a reference image containing no animal. To set a background image, click the **Camera** icon. When a background image has been captured and **Use Background** is checked, each video frame is compared with the background image. The pixels that are different between the two images will be considered as the object. This option is recommended when the arena contains objects which are similar in contrast (color) to that of the animal to be tracked. Clicking the **Eye** icon after capturing an image will display the image in a modal window. Clicking the **Scissors** icon will clear the background image.
 - **Use Background** – Check this option to use a captured background image. If **Use Background** is checked, **Object vs. Background** is disabled.
 - **Threshold** – This setting selects all pixels that are darker (or brighter) than the threshold as target objects. This setting depends on the **Object vs. Background** setting.
 - **Close Contour** – This setting is used to eliminate the artifact created by the cable crossing the animal's body and splitting the image into two parts. It can also be helpful when tracking multiple-colored animals (e.g., hooded rats). Close Contour adds and then removes an n-pixel-width layer from the image, resulting in an object without the occluding cable. The range for the Close Contour control is 0 to 10.
 - **Detail Filter** – This setting helps remove parasite objects and unwanted details from the animal body (for example, the tail). The setting erodes a layer of pixels from the object. The range for the Detail Filter control is 0 to 10.
- Note:** The other modes have a checkbox called **Filter Details** which will erode a layer of pixels (1 pixel thickness) from the object. The **Detail Filter** control allows the user to specify an erosion layer thickness of more than 1 pixel.
- **Min Object Size** – This setting determines the minimum area (in pixels) required for a blob to be identified as an object. The range for the Min Object Size control is 1 to 10,000.
 - **Motion Measure** – Checking this item provides a measure of the object's movement.

3.2.1.4.2 Visualization Group. The **Visualization** group is common to all tracker modes. It is visible only after one of the tracking modes is selected.



It contains the following settings:

- **Track** – Checking this item shows the animal’s trajectory and color selection.
- **Track Portion** – This allows the user to show the whole trajectory or the last “Point Count” points.
- **Points to Show** – This setting (from 30 to 300) indicates how many points to show in the trajectory when **Track Portion** is selected.
- **Track Transparency** – This setting determines the transparency of the trajectory layer. The range of the **Track Transparency** control is 0.0 (opaque) to 1.0 (transparent).
- **Tracking Window** – Checking this item shows the tracking window.
- **Center of Gravity** – Checking this item shows the center of gravity.
- **Averaged Cen. Grav** – Up to five markers may be selected under this setting, and Studio displays a marker to indicated the averaged center of gravity for the selected markers.
- **Cent. Grav. Shape** – This setting determines the shape that designates the center of gravity of the object.
- **Cent. Grav. Size** – This setting determines the size of the shape showing the center of gravity. The range of the control is from 10 to 100.
- **Contour** – Checking this item shows the contour of the found object-boundaries.
- **Fill Contour** – Checking this item fills the contour of the found object.
- **Fill All Objects** – Checking this item shows all objects (including parasite spots) in the current tracking window.

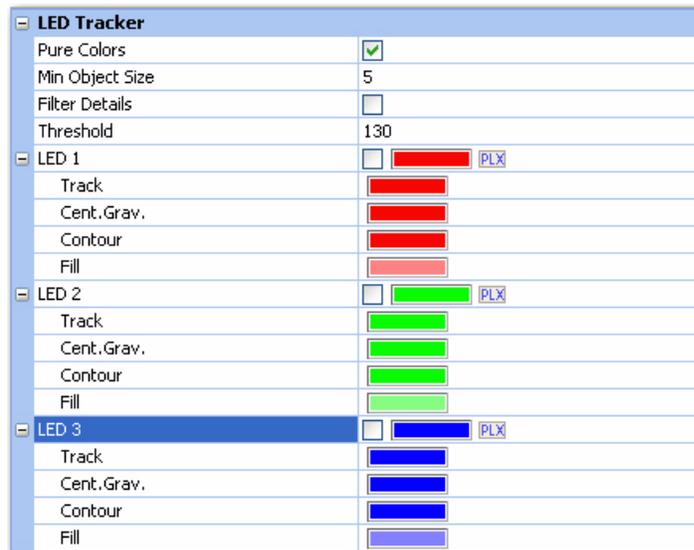
- **Object Transparency** – This setting determines the transparency of the contour of the found object. The range of the Contour Transparency is from 0.0 (opaque) to 1.0 (transparent).

3.2.1.4.3 Information Box. The **Information** box displays information about the selected area in the pane, similar to Windows Tool Tips. The following illustration shows a typical item that can appear in the **Information** box when the user moves the mouse pointer over items in a tracking pane:



3.2.1.5 LED Tracker Pane

The following illustration shows the LED Tracker group for the LED Tracker pane:



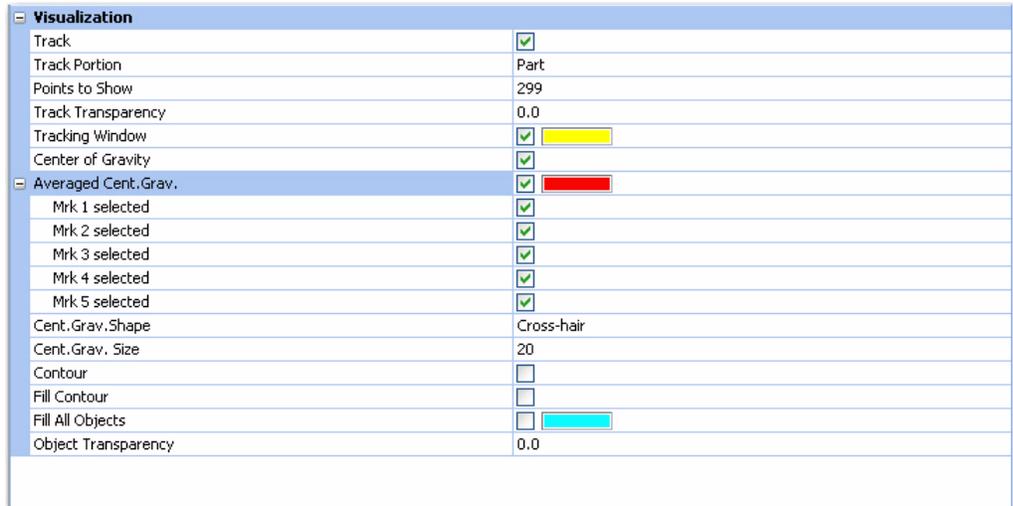
3.2.1.5.1 LED Tracker Group. From the **Tracker** menu, selecting **LED** displays this area. The LED area contains the following controls:

- **Pure Colors** – Checking this item forces tracking of pure R, G, and B colors. When checked colors 1-3 will be set to R, G, and B respectively and cannot be changed.
- **Min Object Size** – This setting determines the minimum area (in pixels) required for a blob to be identified as an object.
- **Filter Details** – Checking this item erodes a 1 pixel layer from the objects. This helps avoid parasite objects.

Note: **Object Contour** mode has a checkbox called **Detail Filter** which will erode a layer of pixels (with a thickness of more than 1) from the object.

- **Threshold** – This setting selects pixels that are darker (brighter) than the threshold as target objects. The range for the Threshold control is 0 to 255.
- **LED1, LED2, LED3** – These controls enable color tracking via the check boxes and set the color for up to three tracking channels. If Pure Color is not checked, clicking in a color bar allows dragging the cursor to the defined color. Left-click to select the color; right-click to exit color selection mode.

3.2.1.5.2 Visualization Group. The **Visualization** group is common to all tracker modes. It is visible only after one of the tracking modes is selected.



It contains the following settings:

- **Track** – Checking this item shows the animal’s trajectory and color selection.
- **Track Portion** – This allows the user to show the whole trajectory or the last “Point Count” points.
- **Points to Show** – This setting (from 30 to 300) indicates how many points to show in the trajectory when **Track Portion** is selected.
- **Track Transparency** – This setting determines the transparency of the trajectory layer. The range of the **Track Transparency** control is 0.0 (opaque) to 1.0 (transparent).
- **Tracking Window** – Checking this item shows the tracking window.
- **Center of Gravity** – Checking this item shows the center of gravity.
- **Averaged Cen. Grav** – Up to five markers may be selected under this setting, and Studio displays a marker to indicated the averaged center of gravity for the selected markers.
- **Cent. Grav. Shape** – This setting determines the shape that designates the center of gravity of the object.

-
- **Cent. Grav. Size** – This setting determines the size of the shape showing the center of gravity. The range of the control is from 10 to 100.
 - **Contour** – Checking this item shows the contour of the found object-boundaries.
 - **Fill Contour** – Checking this item fills the contour of the found object.
 - **Fill All Objects** – Checking this item shows all objects (including parasite spots) in the current tracking window.
 - **Object Transparency** – This setting determines the transparency of the contour of the found object. The range of the Contour Transparency is from 0.0 (opaque) to 1.0 (transparent).

3.2.1.5.3 Information Box. The **Information** box displays information about the selected area in the pane, similar to Windows Tool Tips. The following illustration shows a typical item that can appear in the **Information** box when the user moves the mouse pointer over items in a tracking pane:



3.2.1.6 Color Markers Tracker Pane

The following illustration shows the Settings window for Reflective Colors mode:



3.2.1.6.1 Reflective Colors Tracker Group. From the **Tracker** menu, selecting **Reflective Colors** displays this area. It contains the following controls:

- **Pure Colors** – Checking this item forces tracking of pure R, G, and B colors. When checked colors 1-3 will be set to R, G, and B respectively and cannot be changed.
- **Min Object Size** – This setting determines the minimum area (in pixels) for a blob to be identified it as an object. The range for the Min Object Size control is 1 to 10,000.
- **Filter Details** – Checking this item erodes a 1 pixel layer from the objects. This helps avoid parasite objects.

Note: **Object Contour** mode has a checkbox called **Detail Filter** which will erode a layer of pixels (with a thickness of more than 1) from the object.

- **Marker1, Marker2, Marker3, Marker4, Marker5** – These controls enable color tracking and color selection for up to five colors. If Pure Color is not checked, clicking in a color bar allows dragging the cursor to the desired pixel color in the image. Left-click selects the color; right-click exits color selection mode.

- **Mrk1Threshold, Mrk2Threshold, Mrk3Threshold, Mrk4Threshold, Mrk5Threshold** – These controls allow the user to set the threshold level for their respective colors. These controls are normally hidden until their respective Marker checkboxes are checked. The range for the Threshold Color controls is 0 to 255.

Each Marker control can be expanded by clicking on the “+” (plus) sign to the left. This allows selecting different visualization colors for the marked track, center of gravity symbol, contour boundary, and fill color.

Each marker control has a PLX button to the right. Pushing this button causes the coordinates to be sent to the MAP for inclusion in the PLX file. Only three of the PLX buttons can be active simultaneously.

3.2.1.6.2 Visualization Group. The **Visualization** group is common to all tracker modes. It is visible only after one of the tracking modes is selected.

Visualization	
Track	<input checked="" type="checkbox"/>
Track Portion	Part
Points to Show	299
Track Transparency	0.0
Tracking Window	<input checked="" type="checkbox"/> 
Center of Gravity	<input checked="" type="checkbox"/>
Averaged Cent.Grav.	<input checked="" type="checkbox"/> 
Mrk 1 selected	<input checked="" type="checkbox"/>
Mrk 2 selected	<input checked="" type="checkbox"/>
Mrk 3 selected	<input checked="" type="checkbox"/>
Mrk 4 selected	<input checked="" type="checkbox"/>
Mrk 5 selected	<input checked="" type="checkbox"/>
Cent.Grav.Shape	Cross-hair
Cent.Grav. Size	20
Contour	<input type="checkbox"/>
Fill Contour	<input type="checkbox"/>
Fill All Objects	<input type="checkbox"/> 
Object Transparency	0.0

It contains the following settings:

- **Track** – Checking this item shows the animal’s trajectory and color selection.
- **Track Portion** – This allows the user to show the whole trajectory or the last “Point Count” points.
- **Points to Show** – This setting (from 30 to 300) indicates how many points to show in the trajectory when **Track Portion** is selected.
- **Track Transparency** – This setting determines the transparency of the trajectory layer. The range of the **Track Transparency** control is 0.0 (opaque) to 1.0 (transparent).
- **Tracking Window** – Checking this item shows the tracking window.
- **Center of Gravity** – Checking this item shows the center of gravity.

- **Averaged Cen. Grav** – Up to five markers may be selected under this setting, and Studio displays a marker to indicated the averaged center of gravity for the selected markers.
- **Cent. Grav. Shape** – This setting determines the shape that designates the center of gravity of the object.
- **Cent. Grav. Size** – This setting determines the size of the shape showing the center of gravity. The range of the control is from 10 to 100.
- **Contour** – Checking this item shows the contour of the found object-boundaries.
- **Fill Contour** – Checking this item fills the contour of the found object.
- **Fill All Objects** – Checking this item shows all objects (including parasite spots) in the current tracking window.
- **Object Transparency** – This setting determines the transparency of the contour of the found object. The range of the Contour Transparency is from 0.0 (opaque) to 1.0 (transparent).

3.2.1.6.3 Information Box. The **Information** box displays information about the selected area in the pane, similar to Windows Tool Tips. The following illustration shows a typical item that can appear in the **Information** box when the user moves the mouse pointer over items in a tracking pane:

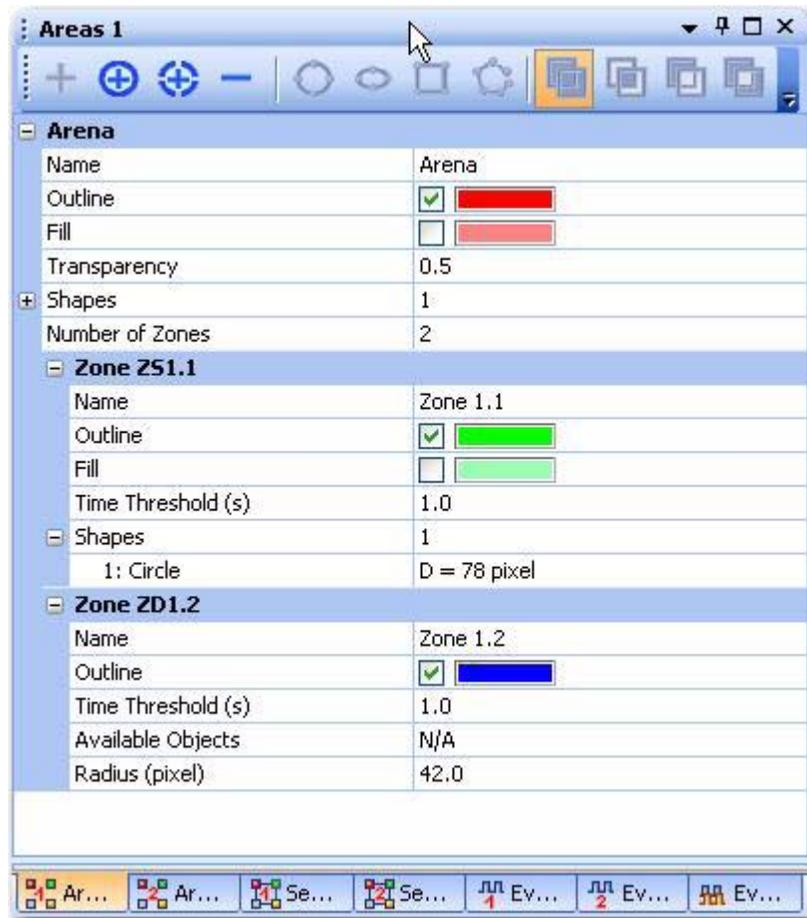


3.2.2 Dynamic Configuration Pane

This pane consists of tabs for setting up a logical area (arenas and zones), sequences, events, and combination events.

3.2.2.1 Areas Tab(s)

The **Areas** tab allows the user to define an arena in which any tracking is to be performed and zones of interest within the arena.



The **Areas** tab contains a toolbar and may contain one or more settings groups. When an arena is added and when zones are added, settings groups are added to the display.

3.2.2.1.1 Toolbar. The toolbar has buttons for adding arenas, static zones, and dynamic zones, for deleting arenas and/or zones, for adding shapes (circle, ellipse, rectangle, and polygon), and for performing logical operations on shapes.



The toolbar buttons are as follows:

- **Add arena** -  - this button adds an arena to the **Areas** tab.
- **Add static zone to current arena** -  - this button adds a static zone to the current arena.
- **Add dynamic zone to current arena** -  - this button adds a dynamic zone to the current arena
- **Delete arena or zone** -  - this button deletes the currently selected zone or arena
- **Draw circle** -  - this button draws a circle.
- **Draw ellipse** -  - this button draws an ellipse.
- **Draw rectangle** -  - this button draws a rectangle.
- **Draw polygon** -  - this button draws a polygon.
- **Union shapes** -  - this button performs a UNION operation on shapes. The result contains every point that is in either shape. Mathematically, this may be represented by $A \cup B$.
- **Intersect shapes** -  - this button performs an INTERSECTION operation on shapes. The result contains every point that is found in both shapes. Mathematically, this may be represented by $A \cap B$



- **Subtract shapes** - this button performs a SYMMETRIC DIFFERENCE operation on the shapes. The result contains that is found in the first shape but not in the second shape. Mathematically, this may be represented by $A \nabla B$.



- **XOR shapes** - this button performs an EXCLUSIVE-OR operation on the shapes. The result contains every point that is in one shape or the other but not both. Mathematically, this may be represented by $A \oplus B$.

3.2.2.1.2 Arena Group. The Arena group of settings is added when the user clicks the **Add arena** button.

Arena	
Name	Arena
Outline	<input checked="" type="checkbox"/> 
Fill	<input type="checkbox"/> 
Transparency	0.5
Shapes	1
Number of Zones	2

- **Name** – this setting contains the name of the arena.
- **Outline** – If this checkbox is checked the outline of the area will be displayed using the color of the color selection box.
- **Color Selection Box** – Selecting a color in this control sets the color of the outline of the area.

Note: Checking the Area Outline checkbox requires that an area be drawn before tracking will work.

- **Fill** – to visualize the current active area within the area by filling it.
- **Transparency** – This setting controls the transparency of the arena. The range for the control is 0.0 to 1.0.
- **Shapes** – This setting indicates how many shapes have been added to the arena. If one or more shapes have been added, the setting is expandable to display the shapes.
- **Number of Zones** – This setting indicates the number of zones that have been added to the arena. If one or more zones have been added, each zone's settings group displays below the **Arena** group.

An area can contain multiple shapes. To start drawing an arena, activate the arena toolbar by clicking one of the arena nodes - **Area Outline** or **Area Transparency**.

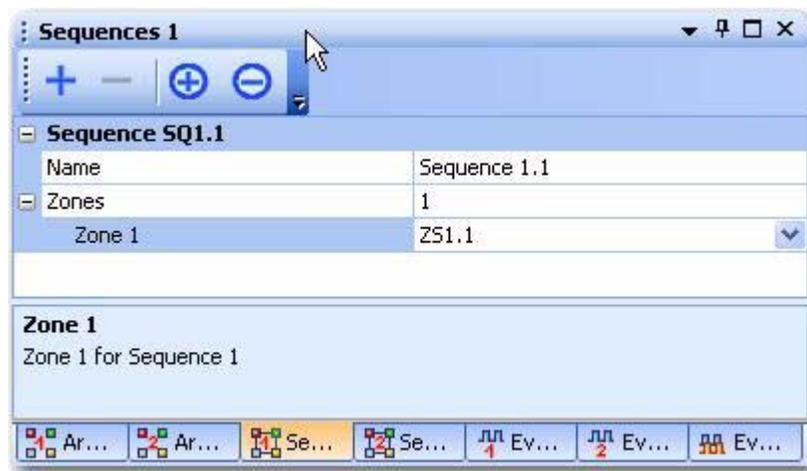
Part of an area can be moved by highlighting the shape description, placing the cursor inside of the arena and dragging it to the desired location.

An area can be deleted by highlighting the shape description, placing the cursor inside of the arena, selecting it, and pressing **Delete**. Alternatively, a right-click will bring up a small menu from which **Delete Area** can be selected.

The first shape is always OR'd into the video. Successive shapes can be added logically to the existing composite shape by selecting the operation desired first (Union, Intersect, Subtract, XOR) then selecting the next shape and drawing it inside the video.

3.2.2.2 Sequences Tab(s)

A Sequences tab contains a toolbar and one or more Sequence settings groups. The image below show the **Sequences** tab.



3.2.2.2.1 Toolbar. The toolbar has buttons for adding and deleting sequences and adding and deleting zones.



The toolbar buttons are as follows:

- **Add new sequence** -  - this button adds a new sequence group to the pane.
- **Delete sequence** -  - this button deletes the selected sequence from the pane.

-
- **Add zone to selected sequence** -  - this button adds a zone to the selected sequence group.
 - **Delete zone from selected sequence** -  - this button deletes the selected zone from the selected sequence.

3.2.2.2.2 Sequence Group. Each Sequence group has the following settings:

- **Name** - the name of the sequence
- **Zones** - the number of zones contained in the sequence. When a zone is added to the sequence, a sub-setting appears under **Zones**.
 - **Zone X** - this setting contains the name of the zone selectable from a dropdown list. The X refers to the number of the zone.

3.2.2.3 Events Tab(s)

The image below shows the one of the **Events** tabs. The Events tab contains a toolbar and one or more groups of Event settings.



3.2.2.3.1 Toolbar. The toolbar has buttons for adding and deleting events.



The toolbar buttons are as follows:

- **Add new tracking event** -  - this button adds a new Event group to the pane.



- **Delete selected tracking event** -  - this button deletes the selected event from the pane.

3.2.2.3.2 Event Group. There are two events in the image shown, and each event has several settings:

- **Name** - the name of the event
- **Color** - the color of the event
- **Target** - the type of target (Zone, Sequence, Speed, Head Direction). Target will have sub-settings based on the target type selected in the dropdown:

— **Zone Sub-settings**

- **Zone** - dropdown selectable values of zone names
- **Condition** - dropdown selectable values of **Entering Zone** and **Leaving Zone**.

Note: There is a small delay (dwell time) between the occurrence of the zone event and its condition going to the TRUE state. However, when the zone event is finished, the event condition will go FALSE immediately (in the first video frame following the end of the event).

— **Sequence Sub-settings**

- **Sequence** - dropdown selectable values of sequence names

— **Speed Sub-settings**

- **Value Threshold (pixel(s))** - this setting determines the speed threshold. If the instantaneous speed of the object is lower or higher (determined by the **Condition** setting) than this setting during a period of time set by the **Time Threshold** setting, the event is considered to have occurred. The range of values is from 0 to 1000.

Note: There is a small delay (dwell time) between the occurrence of the speed event and its condition going to the TRUE state. However, when the speed event is finished, the event condition will go FALSE immediately (in the first video frame following the end of the event).

- **Time Threshold(s)** - this setting (in seconds) works with the **Value Threshold** setting and the **Condition** setting to determine if the event occurs. The range of values is from 0.0 to 10.0.
- **Condition** - dropdown selectable values of **Higher than value threshold** and **Less than value threshold**.

— **Head Direction Sub-settings**

- **Value Threshold (grad.)** - the event is considered to have occurred if the head direction angle is higher or lower (determined by the

Condition setting) than the **Value Threshold** setting during the period of time set by the **Time Threshold** setting.

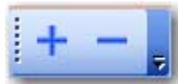
- **Point 1** - this setting indicates point 1 of the head direction vector. This setting is dropdown selectable.
 - **Point 2** - this setting indicates point 2 of the head direction vector. This setting is dropdown selectable.
 - **Time Threshold** - this setting is the time in seconds that determine occurrence of the event in conjunction with the **Value Threshold** setting and the **Condition** setting.
 - **Condition** - dropdown selectable values of **Higher than value threshold** and **Less than value threshold**
- **Object** - (only present in LED and Reflective Colors tracking modes) contains how tracking is done. Selections include **Averaged Cent. Grav.** (averaged center of gravity) and **Position of Object**.
 - **Available Objects** (only present in LED and Reflective Colors tracking modes) contains an object selectable from dropdown list
 - **Output Line #** - dropdown selectable values for output line, if any
 - **Signal Type** - dropdown selectable values of Pulse, Low, or High
 - **Pulse Duration(s)** - (only present if Signal Type is Pulse) dropdown selectable values of 0.1, 0.2, 0.5, 1.0, 2.0, and 5.0.

3.2.2.4 Combination Events Tab

The image below shows the **Combination Events** tab. The Combination Events tab contains a toolbar and one or more groups of Combination Event settings.



3.2.2.4.1 Toolbar. The toolbar contains buttons for adding and deleting combination events.



The toolbar buttons are as follows:

- **Add new combination of tracking events** -  - this button adds a new **Combination Event** group to the pane.
- **Delete combination of tracking events** -  - this button deletes the selected **Combination Event** group from the pane.

3.2.2.4.2 Combination Event Group. The **Combination Event** group has the following settings:

- **Name** - the name of the combination event
- **Color** - the color of the combination event
- **Operation** - dropdown selectable values of AND, OR, NOT, and XOR
- **Event1** - dropdown selectable name of event 1.
- **Event2** - dropdown selectable name of event 2
- **Formula** - formula associated with the combination event

-
- **Output Line #** - dropdown selectable output line number, if any
 - **Signal Type** - dropdown selectable values of Pulse, Low, or High
 - **Pulse Duration(s)** - (only present if Signal Type is Pulse) dropdown selectable values of 0.1, 0.2, 0.5, 1.0, 2.0, and 5.0.

3.2.2.5 Detection Latency

The time elapsed from the actual occurrence of an event occurs and when the event is detected in the video is called *detection latency*. Detection latency is determined by the user settings of frame rate, shutter open time, and detection threshold.

3.2.2.6 Processing Latency

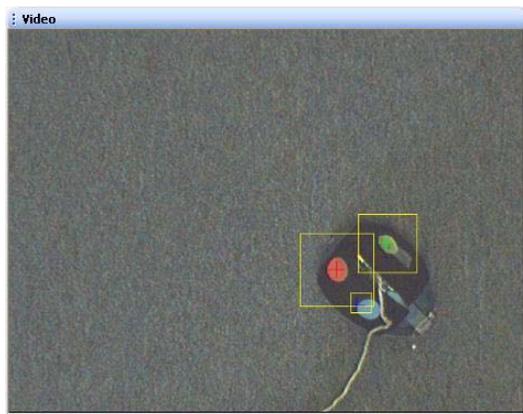
Processing latency is the time between the time the shutter closes on a frame in which the event can be detected and the time the dependent output line is toggled. Processing latency in current configuration of CinePlex systems is 13 to 14 milliseconds. The worst case is when an event occurs during a shutter open time, but is not detectable by CinePlex until the next frame due to high detection thresholds. For these reasons, when digital outputs are needed for an experiment, shutter time and frame rate should be set to the maximum usable while detection thresholds should be set as low as possible.

3.2.2.7 Total Event Latency

Total event latency is the time between when an event occurs and when its dependent digital output is generated. Thus, total event latency consists of detection latency and processing latency.

3.2.3 Video Pane(s)

There may be up to two Video panes visible. The default setting is to have the Video 1 pane visible. The **Video** pane(s) displays the video image(s) from the camera(s). The user may optionally stretch the image to fill the size of the **Video** pane(s).



Note: The effects of the **Image Quality** setting cannot be seen in the Video window; the user must view the AVI file to see that effect.

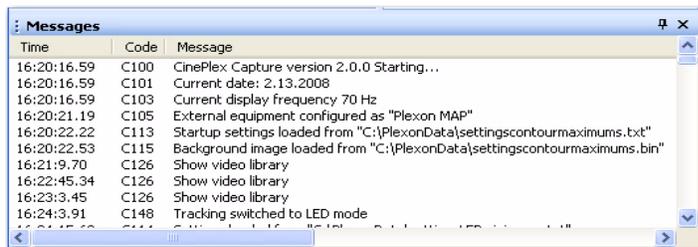
Right-clicking the mouse in the **Video** window displays the **Video Right-click menu** if there is an active arena for the video even though it may not be visible.



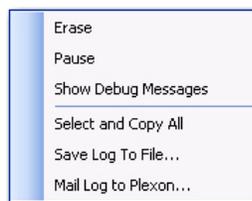
- **Delete Arena** - Clicking this item deletes the arena. This item is grayed out unless an arena is active. Delete the arena by selecting it and pressing the Delete key.
- **Clear Trajectory** - Clicking this item clears the trajectory.

3.2.4 Messages Pane

The **Messages** window displays CinePlex Studio system messages.



The **Messages** window displays the timestamp, message code, and description of each message. Right-clicking the mouse in the **Messages** window displays the **Messages Right-click menu**.



- **Erase** - Clicking this item erases all of the messages in the **Messages** window.
- **Pause** - Clicking this item pauses the display of messages. Clicking again resumes the display.
- **Show Debug Messages** - Clicking this item toggles the display of debug messages. If checked, debug messages will be shown. If not checked, debug messages will not be shown.

- **Select and Copy All** - Clicking this item selects all of the messages and copies them to the clipboard.
- **Save Log to File** - Clicking this item opens a standard windows File Save dialog box so that the messages may be saved to a user-named file.
- **Mail Log to Plexon** - Clicking this item attaches the message log to an E-mail message that can be sent to Plexon for troubleshooting.

Note: This feature will work only if an E-mail client is installed on the computer.

3.2.5 Event Statistics Pane

This pane contains statistics on events and combination events.

No.	Event Name	Target		Object	Output	Count	Time, s		Track Length, pixel	
		Type	Name				Last	Cumulative	Last	Cumulative
EV1.1	Event 1.1	Zone Z51.1	Zone 1.1	Mrk 3	N/A	0	0.0	0.0	0.0	0.0
EV1.2	Event 1.2	Zone ZD1.2	Zone 1.2	Mrk 1	N/A	0	0.0	0.0	0.0	0.0
EC1	Comb. 1	AND	N/A	N/A	N/A	0	0.0	0.0	N/A	N/A

The statistics displayed are as follows:

- **No.** - this value is the number of the event or combination. event
- **Event Name** - this value is the name of the event or combination event.
- **Target** - this statistic has two sub-statistics:
 - **Type** - this value depends on what the given line represents - an event or an combination event. **Type** will use the **Target** setting from an event or the **Operation** setting from an combination event.
 - **Event (Target = Zone)** - if the **Zone** sub-setting in the **Event** pane is N/A, then **Type** will be **Zone**. If the **Zone** sub-setting is a zone, then **Type** will be **Zone xyz** where **xyz** is the zone number.
 - **Event (Target = Sequence)** - if the **Sequence** sub-setting in the **Event** pane is N/A, then **Type** will be **Sequence**. If the **Sequence** sub-setting is a sequence, then **Type** will be **Sequence xyz** where **xyz** is the sequence number.
 - **Event (Target = Speed)** - this value will be the **Value Threshold (pixel(s))** setting from the **Event** pane.
 - **Event (Target = Head Position)** - this value will be the **Value Threshold (grad.)** setting from the **Event** pane.
 - **Combination Event** - this value will be the **Operation** setting from the **Combination Events** pane.

- **Name** - this value depends on what the given line represents - an event or an combination event. For an event, the **Name** setting will either be N/A, the zone name if the **Target** setting is **Zone**, the sequence name if the **Target** setting is **Sequence**, or 0.0 for **Target** settings of **Speed** and **Head Direction**. For an combination event, the **Name** setting will be N/A.
- **Object** - this value will be the **Available Objects** setting from the **Event** pane.
- **Output** - this value indicates output line number, if any output lines are used
- **Count** - this value represents how many time the event has occurred.
- **Time, s** - this statistic has two values; **Last** and **Cumulative**. The **Last** value is the duration in seconds the last time the event occurred. The **Cumulative** value is the total duration in seconds of every occurrence of the event.
- **Track Length, pixel** - this statistic has two values; **Last** and **Cumulative**. The **Last** value is the length of the track in pixels the last time the event occurred. The **Cumulative** value is the total length in pixels of all the tracks of the event.

3.2.6 Status Bar

The status bar at the bottom of the screen shows the capture file information, remote line status, the camera frame rate, and camera noise figures. Descriptions of the status bar items follows.

3.2.6.1 Capture Information

The information that appears in the status bar depends on state of the video recorder. If CinePlex Studio is armed, the status bar flashes yellow and displays the name of the video AVI file to create for the video that will be captured.



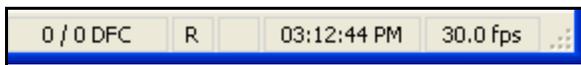
When CinePlex Studio records, the status bar turns green and displays the name of the video AVI file, the time recorded thus far, and the time remaining.



If recording is paused, the status bar flashes green.

3.2.6.2 Status Information

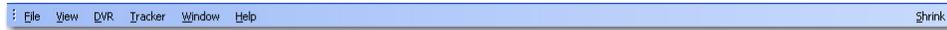
The right end of the status bar contains the following status information:



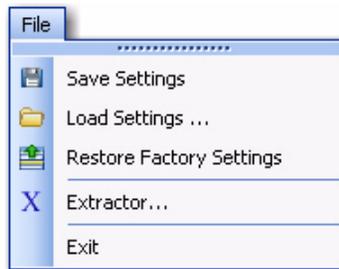
-
- **Ratio** - Appears only during a recording (Noise Figure below displays here when not recording). A fraction showing the count of frames delayed 10% or more as the numerator and the count of missing frames as the denominator. Delayed frame counts should be in the range of one to two per hour of recording. There should be no dropped frames. This box will turn red if any frames are dropped. Excessive counts in the first position and count > 0 in the second position indicate there is too much other activity on the Capture computer. Exit any non-essential processes or programs. If the problem persists, contact Plexon Support.
 - **Camera Frame Rate** - The camera frame rate panel displays the average frame rate of the camera. The nominal value should be within 0.1 of the rate selected.
- Note:** If the camera frame rate area flashes red, CinePlex Studio is either not receiving a clock signal or the clock signal is the wrong frequency.
- **Noise Figure** - The camera noise figure (RMS value) displays when not recording. It is found in the area that also displays the **Ratio**. When recording starts the area displays the **Ratio** instead of the **Noise Figure**.

3.3 Menus

The CinePlex Studio File menu is shown below. Each menu is described in more detail.

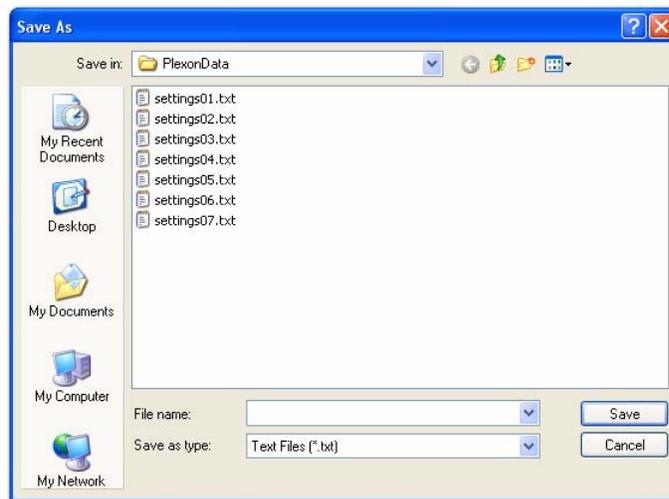


3.3.1 File Menu



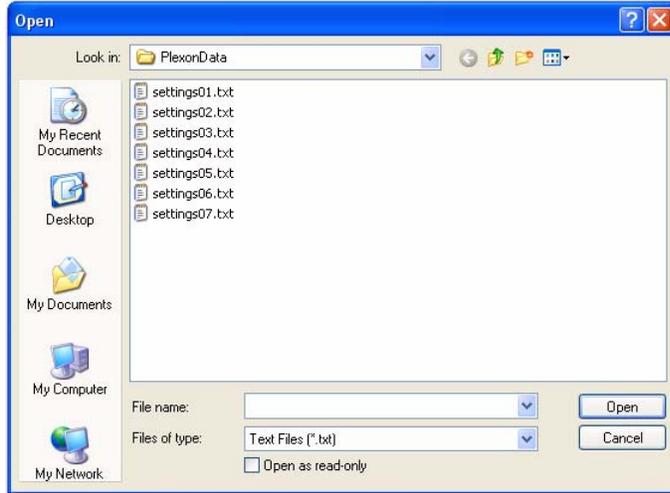
3.3.1.1 Save Settings

This item allows the user to save the configuration settings [and name the file if a keyboard is connected]. Clicking this item will open the standard **File Save** dialog box.



3.3.1.2 Load Settings

This item loads previously saved configuration settings. Clicking this item will open the standard **File Open** dialog box.



3.3.1.3 Restore Factory Settings

This item sets all software and camera settings to their factory default values.

3.3.1.4 Extractor (File Mode only)

This item brings up the **Extractor** dialog box which allows the user to extract desired static and dynamic data from a Plexon AVI file, placing it into Plexon Settings file format and/or formats suitable for use by database programs. For additional details, see [“Using the Extractor” on page 115](#).

3.3.1.5 Exit

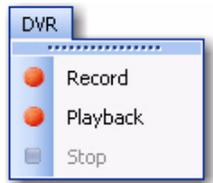
This item closes the application.

3.3.2 View Menu

Panes or tabs can be opened by selecting them in this menu. Clicking the Close button (x) in the upper right corner closes them. If windows and/or panes are messed up, go to **Window Menu/Layout/Reset to Default Layout** to return to a good state.



3.3.3 DVR Menu



3.3.3.1 Arm

Clicking this item arms CinePlex Studio to accept a remote record command from the MAP system or other external hardware.

3.3.3.2 Record

Clicking this item starts manual recording.

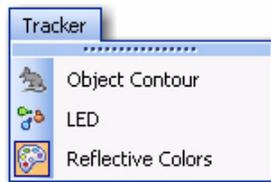
3.3.3.3 Pause

Clicking this item pauses and resumes manual recording. This function only appears once manual recording has started.

3.3.3.4 Stop

Clicking this item stops manual recording and closes the recorded file.

3.3.4 Tracker Menu



3.3.4.1 Object Contour

Clicking this item sets the tracker mode to Object Contour.

3.3.4.2 LED

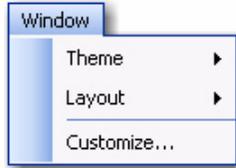
Clicking this item sets the tracker mode to LED.

3.3.4.3 Reflective Colors

Clicking this item sets the tracker mode to Reflective Colors.

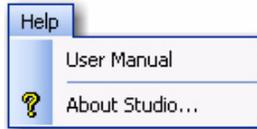
3.3.5 Window Menu

The **Window** menu is a standard menu of the **Plexon User Interface**. For more details, see [“Window Menu” on page 11](#).



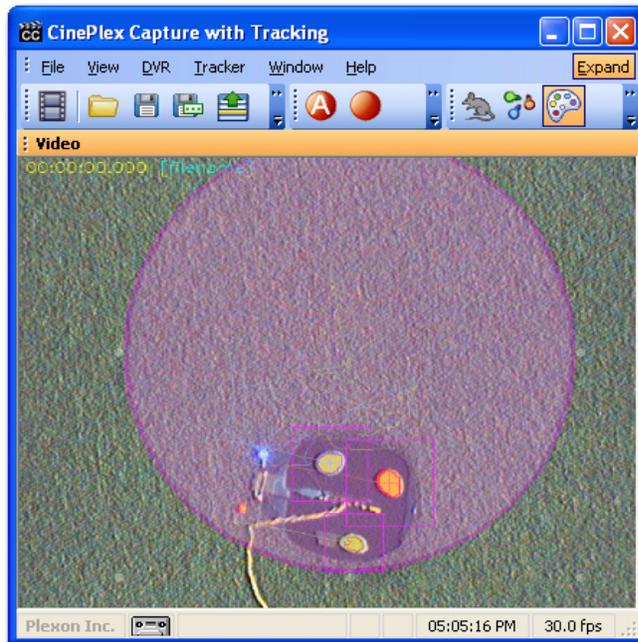
3.3.6 Help Menu

The **Help** menu is a standard menu of the Plexon User Interface. For more details, see [“Help Menu” on page 13](#).



3.3.7 Shrink

Clicking the **Shrink** menu item saves the current layout to a file and reduces the user interface to a single small window showing the video as shown in the diagram below. To restore the previous layout, click **Expand** and the layout previously saved by clicking the **Shrink** menu item is loaded and displayed. If there are some wrong settings preventing the **Arm** and **Rec** buttons to be enabled, the Shrink button is disabled as well. The **Shrink** mode can be useful when more visibility is desired for other applications, e.g. Sort Client for the Plexon MAP.



3.4 Toolbars

The **File**, **DVR** and **Tracker** menus may all be displayed as toolbars as desired (see [“Menus” on page 3](#) for more details). The buttons from left to right on each tool equate to the menu commands from top to bottom on the corresponding menu.

3.4.1 File Toolbar



The **File** toolbar contains buttons that are equivalent to the **File** menu commands. For more details, see [“File Menu” on page 151](#).

3.4.2 DVR Toolbar



The **DVR** toolbar contains buttons that are equivalent to the **DVR** menu commands. For more details, see [“DVR Menu” on page 153](#).

3.4.3 Tracker Toolbar



The **Tracker** toolbar contains buttons that are equivalent to the **Tracker** menu commands. For more details, see [“Tracker Menu” on page 153](#).

3.5 Digital VideoTracker (DVT) Files

A Digital VideoTracker (DVT) file contains timestamp and tracking information for an audio video interleave (AVI) format recording. The DVT file is a text file where each line contains position data for a video frame. An example of a DVT file for LED mode follows:

```
1,0.033000,910,35,110,366,19,247
2,0.066000,915,37,112,366,19,247
3,0.099000,927,38,112,366,19,247
...
```

The format of each line depends on the selected tracker mode. The first column in the DVT file is the row number, not the frame number. These can become unsynched when recording is paused.

3.5.1 Object Contour Mode

For Object Contour mode, the format of each line is:

```
row,time,x,y,m
```

where:

- *row* is the row number
- *time* is the time of the frame in seconds
- *x* and *y* is the track position of the target centroid
- *m* indicates the motion measure value; see [“Motion Measure Option” on page 81](#)

3.5.2 LED Mode

For LED mode, the format of each line is:

```
row,time,x1,y1,x2,y2,x3,y3
```

where:

- *row* is the row number
- *time* is the time of the frame in seconds
- *x1* and *y1* is the track position of color #1
- *x2* and *y2* is the track position of color #2
- *x3* and *y3* is the track position of color #3

3.5.3 Reflective Colors Mode

For Reflective Colors mode, the format of each line is:

row,time,x1,y1,x2,y2,x3,y3,x4,y4,x5,y5

where:

- *row* is the row number
- *time* is the time of the frame in seconds
- *x1* and *y1* is the track position of color #1
- *x2* and *y2* is the track position of color #2
- *x3* and *y3* is the track position of color #3
- *x4* and *y4* is the track position of color #4
- *x5* and *y5* is the track position of color #5

3.5.4 Conversion of DVT Coordinates to Pixels

To convert DVT coordinates to pixels, multiply each coordinate by 639/1023.:

$$x_{pixels} = \frac{x_{coordinate} \times 639}{1023}$$

:

$$y_{pixels} = \frac{y_{coordinate} \times 639}{1023}$$

3.6 Using Studio in File Mode

3.6.1 Default Mode

When CinePlex Studio starts it will default to camera mode, file mode, or it will give the user a choice depending on the conditions that Studio detects. The table below lists the various conditions and the default mode for Studio.

Table 1: CinePlex Studio Default Mode

Camera(s) Detected	RASPUTIN Key Detected	Clock Detected	Default Mode
No	No	No	File
No	No	Yes	File
No	Yes	No	File
No	Yes	Yes	File
Yes	No	No	File
Yes	No	Yes	File
Yes	Yes	No	User Choice (see note)
Yes	Yes	Yes	Camera

Note: When the clock is not detected, camera(s) is (are) detected, and a RASPUTIN key is detected, Studio will display a dialog box to allow the user to decide on the mode.

If Studio defaults to Camera mode, the user still has the option of switching to File mode manually if desired.

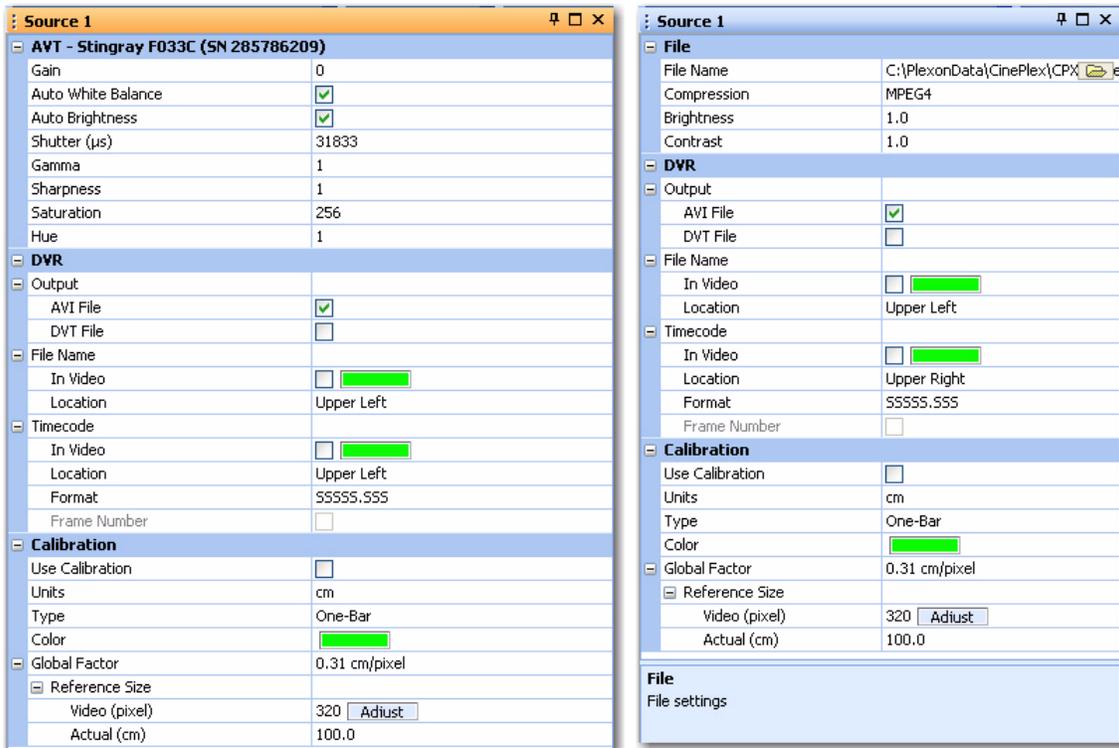
3.6.2 Manual Selection of File Mode

From the **Video Source** dropdown on the toolbar, select **One File** or **Two Files** to enter offline mode.



3.6.3 Source Settings

The **Source** settings are different depending on whether Studio is in offline mode or not.



Note: The image on the left (Camera mode) has a **Camera** section (AVT Stingray) and the image on the right (File mode) has a **File** section.

3.6.4 Dynamic and Static Data

Dynamic and static data may be extracted from an AVI file and used. To do this a file must be loaded using the **Browse Folder** icon in the **File Name** setting of the **File** section of a **Source** tab. Then use the **Extractor** to extract the desired data. See [“Using the Extractor” on page 115](#) for more details.

3.6.5 Arenas, Zones, Sequences, Combination Events, and Re-recording

After a CinePlex version 3 file has been loaded, the arenas, zones, sequences, and combination events in the file may be edited using the procedures given in Chapter 2, and then the file may be re-recorded.



WARNING

The color of an object is changed when it moves into the area covered by the background of an inserted file name and/or time stamp. This will result in tracking problems in that area when doing file mode tracking.

Chapter 4

Using CinePlex Editor

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4.1 Understanding CinePlex Editor Files

Although it can be used to work with single files, **CinePlex Editor** is typically used with a pair of data files recorded in the lab—a video file and a neural data file. To use **CinePlex Editor** successfully, it is important to understand how **CinePlex Editor** works with files. This section describes what happens to the various files when creating a CinePlex project, importing data, editing information, saving a project, re-opening a project file, and exporting data.

Note: When using an AVI file and a DVT file, the system uses the timestamps from the DVT file.

Note: When using an AVI file and a PLX file, the system uses the timestamps from the AVI file.

When starting **CinePlex Editor** for the first time, it prompts for a separate file to store project information. This CinePlex project (CPJ) file can include the following items:

- File references: locations and names of the neural data file and the video file
- Marker definitions, which includes the marker type, name, and any zone or level definitions as appropriate

Note: Markers are a type of indicator or identifier. Marker occurrences are placements of particular markers in a file. For more information on markers, see [“Digital VideoTracker \(DVT\) Files” on page 156](#).

- Information for each marker occurrence

4.1.1 Creating a Project File

Normally the first step is to create a CinePlex Project file. To create a project file the user must specify the neural data file, which is usually either a PLX or a NEX file (although it can be a DVT file), and the associated AVI video file. The **New Project Wizard** can step through this process; see [“Setting Up a New Project” on page 165](#). After these files are specified, their file names are stored in the CPJ file, and the initial import of data into the project begins.

Note: A CinePlex Project file can accommodate only one pair of data files—usually a neural data file and a video file.

4.1.2 Importing Data Files

During the initial import of the neural and video data into a project, **CinePlex Editor** creates markers and marker occurrences based on the contents of the neural data and video files. From the neural data file, **CinePlex Editor** translates any events (for example, Type 4 data from PLX files) or appropriate NEX variables (event, marker, or interval) into markers and marker occurrences. From the video file, **CinePlex Editor** creates a Frame marker and creates occurrences for the timestamps of each video frame. However, **CinePlex Editor** does not store neural data, continuous data, or the video frame images in the CPJ file.

4.1.3 Changing and Saving Project Files

After importing the marker information from the data files into **CinePlex Editor** and it is in the form of marker occurrences, the user may edit, extend, or even delete the information; then the user may save the changes to a CPJ file. When saving the CPJ file, **CinePlex Editor** also saves any new marker information that it creates into the CPJ file. Thus, when re-loading a CPJ file, **CinePlex Editor** completely restores the markers and marker occurrences that were present when the CPJ file was saved.

4.1.4 Reopening Project Files

When subsequently re-opening a CPJ file, **CinePlex Editor** gets the marker data exclusively from the CPJ file; **CinePlex Editor** does not re-import the markers from the neural data or video files. However, **CinePlex Editor** does open the original neural data and video files and reads them to get the neural spike data, continuous data, and video images.

Note: If the user moves the original neural data or video files to another location on the hard drive, CinePlex Editor prompts to locate the files when re-opening the project file.

4.1.5 Exporting Files

Although CPJ files cannot currently be used by any software other than **CinePlex Editor**, the user may export all of the data stored in CPJ files into other formats, such as PLX or NEX data files, text files, MATLAB files, or Excel spreadsheets.

4.2 Getting Started

This section describes a quick-start example to provide familiarization with **CinePlex Editor**. The screens, views, and operations mentioned in the quick-start procedure appear in much greater detail in the reference chapter; see [Chapter 5, CinePlex Editor Reference](#).

4.2.1 Using the Quick Start Files

This quick-start example uses two sample data files that *do not install* with **CinePlex Editor**: `CM_Quickstart.plx` and `CM_Quickstart.avi`. Because these two files are very large, they are located in the Quickstart folder on the CinePlex installation CD. As an alternative, instead of using `CM_Quickstart.plx` and `CM_Quickstart.avi`, the user may use any video data file (**AVI**) collected with **CinePlex Studio** together with a neural data file (**PLX**, **NEX**, **DVT**) collected by a tool such as **Recorder** or **MAP**. Before using the quick-start sample files, Plexon recommends copying them to the local disk on the computer to improve performance.

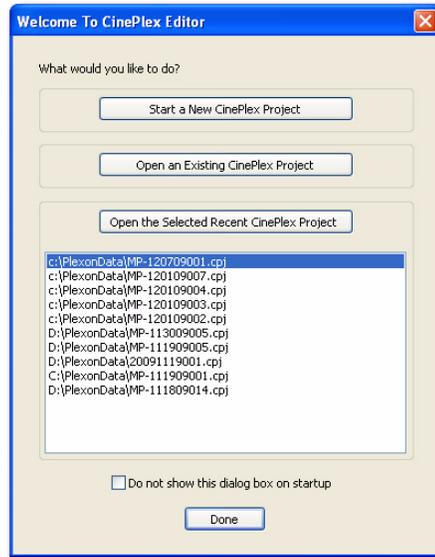
The quick-start example consists of the following series of procedures:

- [4.2.2 Setting Up a New Project](#)
- [4.2.3 Understanding the CinePlex Editor Main View](#)
- [4.2.4 Defining a New Marker](#)
- [4.2.5 Creating Marker Occurrences](#)
- [4.2.6 Saving and Exporting the Data](#)
- [4.2.7 Re-opening a Project File](#)

4.2.2 Setting Up a New Project

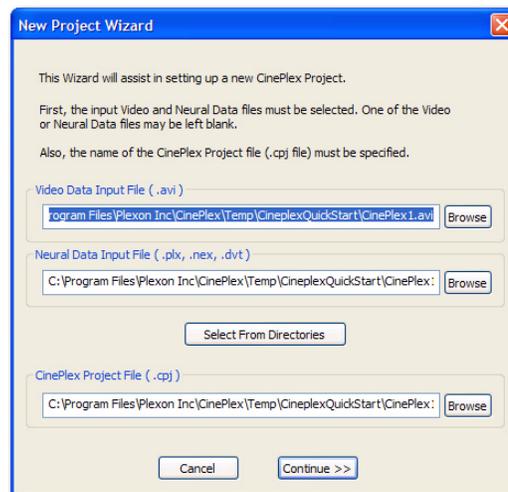
This procedure covers the steps required to set up a new project.

- 1 Click the CinePlex Editor desktop icon or click **CinePlex Editor** on the Windows **Start** menu. *The **Welcome To CinePlex Editor** dialog box opens.*



Note: The **Welcome to CinePlex Editor** dialog box provides a quick way to start a new project, load an existing project file, or load a recently-used project file. The first time **CinePlex Editor** runs, CPJ files do not appear in the list box and **Open the Selected Recent CinePlex Project** is unavailable.

- 2 Click **Start a New CinePlex Project**, which starts the **New Project Wizard**, which is a series of dialog boxes that guide the user through the process of setting up a new project. *The **New Project Wizard** opens.*



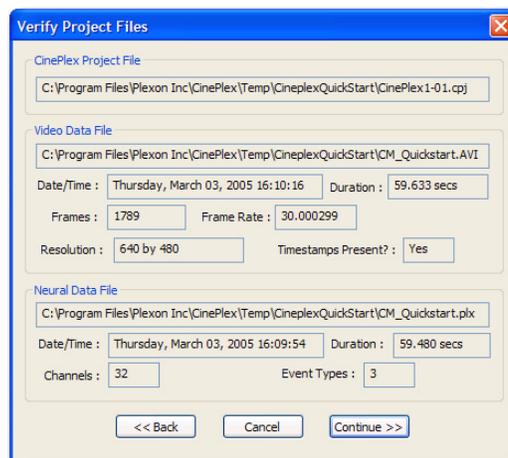
- 3 In the **Video Data Input File (AVI)** area, click **Browse**, go to the directory where the quick-start files are stored and locate **CM_Quickstart.avi**. Open the file. *The **New Project Wizard** changes all the file names to match.*



Note: When the user enters a name in the **Video Data Input File (AVI)** box, the **Neural Data Input File (PLX, NEX, DVT)** and **CinePlex Project File (CPJ)** boxes change to reflect the name entered. This is a typical example of the helpful behavior of **CinePlex Editor**, which suggests file names.

Note: For use with CinePlex, AVI files must be saved in Motion JPEG (MJPEG) video compression format. If the user attempts to open an AVI file that is not in MJPG format, a notification dialog box appears:

- 4 For this quick-start procedure, accept the suggested names and click **Continue**. *The **Verify Project Files** dialog box opens, which contains some basic information to allow verification of the selected files.*



- 5 If the file information is correct, click **Continue**.

*The initial import operations begin; **CinePlex Editor** creates the CPJ file and opens the **CinePlex Editor** main view.*

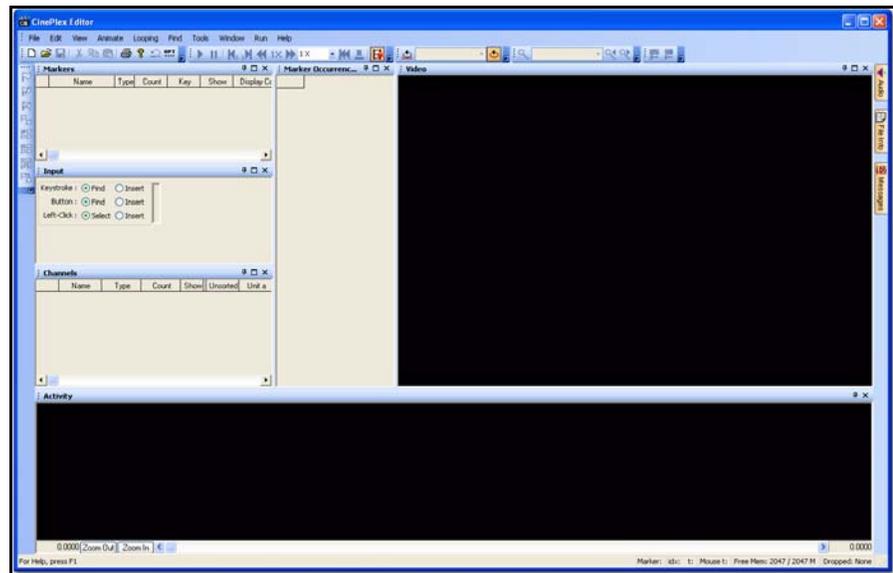
4.2.3 Understanding the CinePlex Editor Main View

This procedure covers the steps required to set up and control the **CinePlex Editor** main view.

- 1 When the CinePlex Editor main view appears, click the maximize button in the Windows title bar to maximize the CinePlex Editor window.

Note: **CinePlex Editor** is easier to set up and use when its screen area is maximized.

- 2 Rearrange the windows within the **CinePlex Editor** main window to look something like the following illustration:



The first frame of the video file appears in the **Video** window at the upper-right. Because the CM_QuickStart neural and video data files were recorded using **CinePlex Studio** with the Tracking option enabled, **CinePlex Editor** imports the tracking coordinates from the neural data file, and they appear as crosshairs superimposed over the video.

The neural data appears in the **Activity** window at the bottom, which shows the neural activity at the beginning of the file. Each row in the **Activity** window represents either a marker or a channel of data. The marker occurrence times and neural firing times for each channel appear as tick marks in the view. The user may color code the ticks as appropriate for the marker type and unit designation; for more information, see “[Markers Window](#)” on page 220 and “[Colors Tab](#)” on page 270.

- 3 On the toolbar, click the **Play** button



*The video plays, and the neural data scrolls from right to left in the **Activity** window. This keeps the current video frame at the position marked by the current-time indicator in the **Activity** window. The current-time indicator is the*

downward-pointing triangle near the center of the view, which is surrounded by the current frame time and frame number.

- 4 Click the **Pause** button to pause the display.



Note: The user may also pause the display by pressing the SPACEBAR key. To restart the display click the **Pause** button or press the spacebar key.

- 5 Click the **Previous Frame** and **Next Frame** buttons to move backwards or forwards to sequentially view each frame in the display.



Note: The user may also step through the display by pressing the LEFT ARROW key or the RIGHT ARROW key.

- 6 Click **Play**. Click the rate buttons to decrease or increase the speed of the display. Continued decreasing the speed will eventually cause a reversal to occur, and continued increasing the speed will eventually reach a maximum speed.



Note: The user may also change the speed by using the UP ARROW key and the DOWN ARROW key on the computer keyboard. The user may also select a speed from the drop list on the toolbar.



- 7 Click the **Reverse Animation** button to switch the direction of play. The speed of the new direction will be the same as in the old direction.



- 8 Click the **Normal Speed** button to reset the playback speed to normal, which is one times the recorded speed of the video in the forward direction.

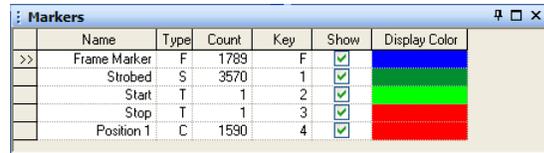


- 9 Click the **Rewind** button to return to the beginning of the file.



4.2.4 Defining a New Marker

This procedure covers the steps required to define a new marker. The **Markers** window in the upper left corner of the main view shows the set of markers imported from the data files.



	Name	Type	Count	Key	Show	Display Color
>>	Frame Marker	F	1789	F	<input checked="" type="checkbox"/>	Blue
	Strobed	S	3570	1	<input checked="" type="checkbox"/>	Green
	Start	T	1	2	<input checked="" type="checkbox"/>	Yellow
	Stop	T	1	3	<input checked="" type="checkbox"/>	Red
	Position 1	C	1590	4	<input checked="" type="checkbox"/>	Red

The >> indicator denotes the current marker. The **Markers** window shows the following basic information about each marker:

- **Name** shows the name assigned to the marker. Marker names must be unique.
- **Type** indicates the abbreviation that denotes the type of the marker; for a complete list of marker types, see “[Table 5-1](#)” on page 278.
- **Count** shows the number of occurrences of each marker type.
- **Key** indicates the keystroke that is associated with this marker, which can be used to find and insert markers.
- **Show** indicates if the occurrences of this marker display in the **Activity** window.
- **Display Color** shows the color of the occurrences of this marker in the display views.

For the purpose of this quick-start example, suppose the user wants to use **CinePlex Editor** to invalidate intervals in the neural data that were corrupted by artifacts, in this case from the animal chewing. This is done by defining a marker to bracket the chewing interval as in the procedure below.

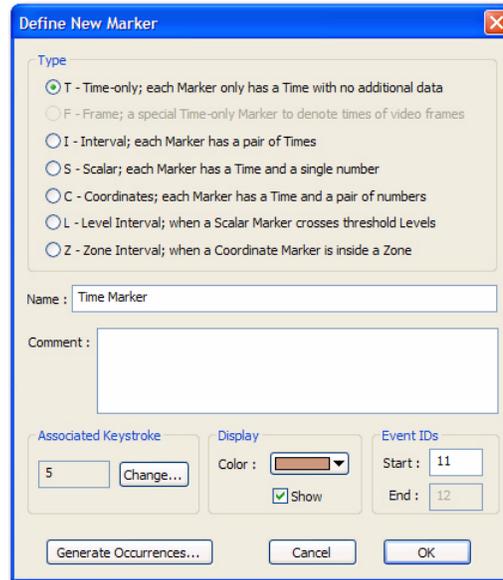
- 1 Click **Pause**.

Note: Although pausing is not required, the video can be distracting when performing other operations in **CinePlex Editor**.

- 2 Define a new marker to denote the time intervals that are dominated by artifacts. This can be done in three ways:

- Click the **New Marker** button,
- or, from the **Edit** menu, click **Define New Marker**,
- or, from the right-click menu in the **Markers** window, select **Define New Marker**.

The **Define New Marker** dialog box appears.



- 3 In the **Type** area, click **I** to define an interval marker.
- 4 In the **Name** box, in the place of the default name **Interval** type **Chewing Artifact**. Retain the default settings for the other items.

Note: For explanations for the other items in the **Define New Marker** window, see [“Define New Marker” on page 245](#).

- 5 Click **OK**.

*The **Chewing Artifact** entry appears in the **Markers** window, and the **>>** symbol appears in the left-most column to indicate that this marker is currently selected. However, there are no occurrences of this marker, so the value in the **Count** column is **0**.*

4.2.5 Creating Marker Occurrences

This procedure covers the steps required to create new marker occurrences. It is possible to have more than one occurrence for any given marker. The user may manually enter marker occurrences in three different ways:

- keystroke
- button click in the **Input** window
- mouse click in an appropriate view

Each method has advantages and disadvantages; we suggest trying each method to find the appropriate one. For more information on each one of these methods, see [“Inserting Marker Occurrences” on page 176](#).

This quick-start example covers only the keystroke method. In the previous procedure the user defined the **Chewing Artifact** marker, which appears in the

Markers window in the **Name** column and its associated key appears in the **Key** column as **5**. If the **5** key is pressed, **CinePlex Editor** expects an operation with the **Chewing Artifact** marker.

The available marker operations appear in the **Input** window, which normally opens directly beneath the **Markers** window. The **Keystroke** radio buttons define the operations associated with pressing keys. The default selection is **Find**. If the **5** key is pressed, **CinePlex Editor** finds the next occurrence of the **Chewing Artifact** marker. However, because no occurrences of the **Chewing Artifact** marker have been created, the **5** key currently has no effect. To create marker occurrences follow the procedure below.

- 1 In the **Markers** window, select the **Chewing Artifact** marker.
- 2 To arm **CinePlex Editor** to insert new marker occurrences when pressing the **5** key, in the **Input** window at **Keystroke**, click **Insert**.
- 3 Click **Play**, or press the **SPACEBAR** key.
- 4 Although interval markers are easier to insert while **CinePlex Editor** is playing, the default **1X** playback speed can be too fast to insert markers precisely. Adjust the playback speed by selecting a slower setting from the speed droplist on the toolbar, for example, **1/8X**.
- 5 To insert an occurrence of the **Chewing Artifact** marker, press the **5** key once to define the beginning of the interval and press the **5** key again to define the end of the interval.

Note: The user may use other **CinePlex Editor** capabilities to change marker occurrence intervals, so a convenient work method is to quickly insert placeholder marker occurrences, which can later be edited to set precise start and end times. This is discussed under [“Operating with Marker Occurrences” on page 190](#).

- 6 Insert several more occurrences using the **5** key. As occurrences are entered, they appear in the **‘Chewing Artifact’ Marker Occurrences** window. Each marker occurrence appears with the start and end times for each interval.

Note: The **Marker Occurrences** default window is tall and narrow and it can obscure the complete window title. Move the mouse cursor over the title bar to see the complete title. Also, the title of this window changes to include the currently selected marker in single quotation marks. The information that appears in the window also changes for each marker type. For example, a **Coordinate** marker shows **Time, X,** and **Y** coordinates instead of **Start Time** and **End Time**.

- 7 Click **Pause**. In the **Edit Markers** window next to **Keystroke**, click **Find**.
- 8 Press the **5** key to advance to an occurrence of the **Chewing Artifact** marker. Press the **5** key several times to cycle through the intervals entered.

4.2.6 Saving and Exporting the Data

This procedure covers the steps required to save the marked up files from the quick-start example and to export the data to other applications. When saving a

project, **CinePlex Editor** saves all the marker information in the CPJ file. The user may also export the marker data to:

- a PLX file: The markers become Type 4 Events in the PLX file, along with the spike and continuous data from the original neural data file.
- a NEX file: The markers become Nex variables, along with the spike times and continuous data from the original neural data file.
- a text file: Each marker occurrence becomes a line in the text file.
- a MATLAB file: Each marker occurrence becomes a row in a 2D matrix.
- an Excel spreadsheet: Each marker occurrence becomes a row in the spreadsheet.

Note: Matlab or Excel must be installed on the computer to export these file types. Otherwise, all Matlab or Excel functions, or both, appear dimmed.

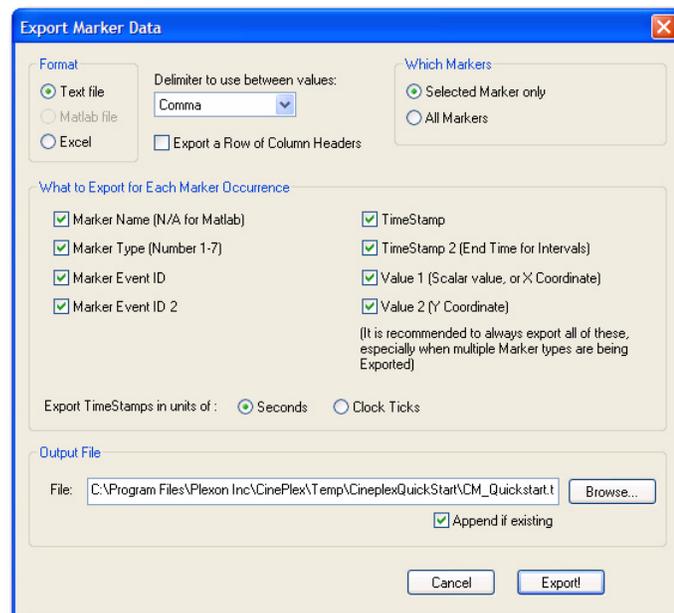
To save the project and export the data, follow the procedure below.

- 1 To save the quick-start example work, click **Save**. *The **Save As** dialog box opens with the file name CM_Quickstart-01.* Click **Save** to save CM_Quickstart-01.

Note: If the user reloads the same CPJ file just saved, it puts **CinePlex Editor** back into the same state it was in prior to the save operation. **CinePlex Editor** reloads with the same markers, marker occurrences, current marker selection, etc.

- 2 For this quick-start example, export the data as a text file. From the **File** menu, select **Export Markers**.

*The **Export Marker Data** dialog box opens.*



- 3 In the **Format** area, accept the default value **Text file**. The **Export Marker Data** dialog box includes various options for how, where, and what data to export. However, for this quick-start example, accept the defaults values and click **Export!**

*The **Export Complete** dialog box appears.*

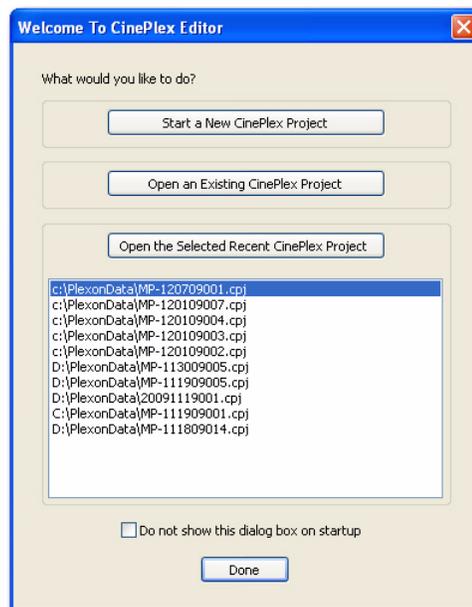
- 4 Locate CM_Quickstart.txt. Open the file with Windows Notepad or another text reader to see how the data is exported.

4.2.7 Re-opening a Project File

This procedure covers the steps required to re-open a project file.

- 1 Exit and re-start **CinePlex Editor**.

*The **Welcome To CinePlex** dialog box opens.*



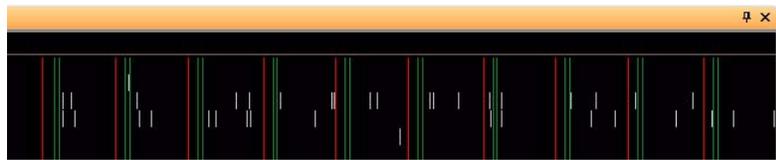
Note: The **Welcome To CinePlex** dialog box now contains an entry for the CM_Quickstart.cpj file in the recent projects list box.

- 2 Double-click **CM_Quickstart.cpj** to open the quick-start example project.
CinePlex Editor opens in the same state that it was in when the project file was saved.
- 3 This completes the last procedure in the Quick-Start Example.

4.3 Using the Activity Window

In the **Activity** window, **CinePlex Editor** provides two frequently-used items to display neural data—the time pointer and the time range. The time pointer represents the concept of a current instant. The frame in the **Video** window is the frame whose occurrence time is no later than the current time pointer and is the nearest frame on the left side of the current time pointer. The range of neural data in the **Activity** window is based on the time pointer.

The inverted white triangle symbol in the Activity window depicts the current time:



The **Activity** window displays the current time in seconds (**t**), and the current frame number (**F**). The **Activity** window default setting positions the current time symbol at the center of the window, so that an equal span of time before and after the current time appears in the window. However, the user may reposition the current time symbol by clicking and dragging it with the left mouse button. In this way, the user may configure the **Activity** window to show an asymmetric span of time about the current time; for example, from 1 second before to 5 seconds after the current time.

In general, the time pointer may or may not point to the time of a video frame. The video frame that appears for a given current time is the frame at the *latest* time, which can be less than or equal to the current time. However, the user may configure **CinePlex Editor** to lock the current time to the times of Frame Markers; see **Lock to Video Frames** on [page 251](#).

The user may expand or contract the range of time that appears in the **Activity** window by clicking **Zoom In** or **Zoom Out**. The user may also shift the current time by dragging the scroll bar at the bottom of the window.

The user may also override the current time in a more persistent way by using the **Find** functions to change the current time to be that of a marker. For example, by clicking the **Find Occurrences** button, or from the **Find** menu, select **Find Marker Occurrences...**, which opens the **Find Marker Occurrences** dialog box; see [“Find Marker Occurrences”](#) on [page 253](#).

4.3.1 Understanding Looping

By default, **CinePlex Editor** starts in looping mode, where animation and searches that run past the end of the file restart from the beginning. To turn off looping mode, from the **Looping** menu, click **Toggle Looping**; for more information, see [“Looping Menu”](#) on [page 251](#).

4.4 Customizing the User Interface

Although the default user interface setup in **CinePlex Editor** may be adequate for the needs, the user may also customize the user interface. For details on customizing the user interface, see [D Plexon User Interface](#).

Some general principles and conventions repeat throughout the **CinePlex Editor** user interface as well as the Plexon User Interface.

- **Right-click Menus** – See [“Right-click Menus” on page 18](#).
- **Current Selections** – See [“Current Selections” on page 18](#). The currently selected marker and channel also appear in their selected color (bright violet by default) in the Activity window.
- **Keystroke Shortcuts** – See [“Keyboard Customization” on page 20](#).
- **Views** – The user may quickly close and re-open windows by using the **View** options or the corresponding toolbar buttons.
- **Undo** – See [“. Undo” on page 18](#).
- **Quick Reference** – See [“Help Menu” on page 13](#).

4.5 Using Markers and Marker Occurrences

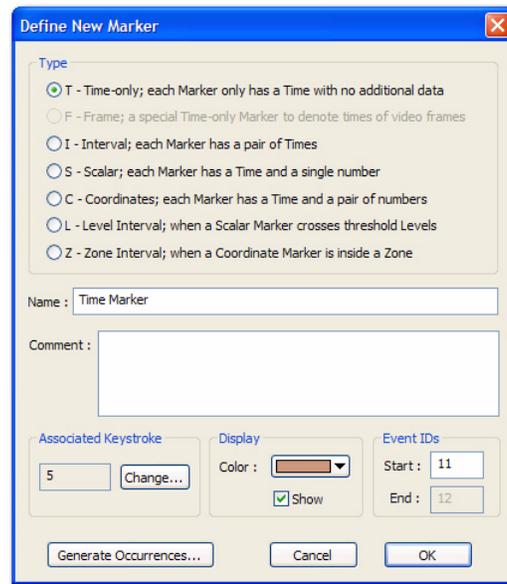
This section explains how to use markers and marker occurrences. Markers are designators that are used to identify or describe timepoints in a file. There can be several types of markers. Each marker type contains specifically-defined information. **CinePlex Editor** uses seven different marker types; for detailed descriptions of the content of each marker type, see [Table 5-1, “Marker Types,” on page 278](#). A marker occurrence is a specific circumstance, or instance, where a marker appears. A marker can have multiple occurrences. Each marker occurrence contains unique information, which consists of a minimum of a timestamp and the other values defined by its marker type. For a more extensive discussion of markers and their occurrences, see [“Digital VideoTracker \(DVT\) Files” on page 156](#).

4.5.1 Defining Markers

To define a CinePlex Marker, designate it as one of the seven available CinePlex types defined in [“Table 5-1” on page 278](#) and name it uniquely. The user may add optional information to the definition such as comments, associated keystroke, display color, and associated event IDs. Follow the procedure below to define markers.

- 1 On the **Edit** menu, click **Define New Marker**.

The **Define New Marker** dialog box appears.



- 2 In the **Type** area, click a marker type.
- 3 In the **Name** box, type a unique name for the marker.
- 4 Add any additional items. For more information, see [“Define New Marker” on page 245](#).
- 5 Click **OK**.

The new marker appears as the selected marker in the list in the **Markers** window.

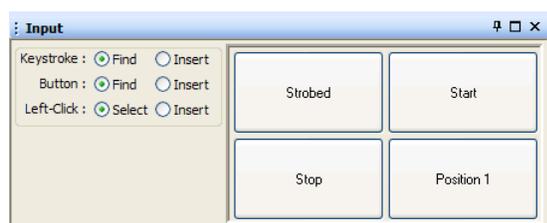
Markers						
	Name	Type	Count	Key	Show	Display Color
	Frame Marker	F	1789	F	<input checked="" type="checkbox"/>	Blue
	Strobed	S	3570	1	<input checked="" type="checkbox"/>	Green
	Start	T	1	2	<input checked="" type="checkbox"/>	Red
	Stop	T	1	3	<input checked="" type="checkbox"/>	Yellow
	Position 1	C	1590	4	<input checked="" type="checkbox"/>	Red
>>	Time Marker	T	0	8	<input checked="" type="checkbox"/>	Brown

4.5.2 Inserting Marker Occurrences

There are three primary methods to insert new marker occurrences:

- Keystroke
- Button
- Left-Click (of the mouse button)

In the **Input** window, select an input method. For more information on the Input window, see [“Input Window” on page 223](#).



Note: The user may also use items from the **Edit** menu to choose one these input methods to insert new marker occurrences. For more information, see [“Edit Menu” on page 245](#).

Keystroke

To use the keystroke method to insert marker occurrences, associate a key with each marker for which occurrences are created. When defining a marker, the user typically associate a keystroke with it. The associated keystroke appears in the **Key** column of the **Markers** window.

Note: If there is no associated key with the marker or to change the key association, from the right-click menu in the **Markers** window, click **Edit Selected Marker** to open the **Edit Marker** dialog box. For more information, see [“Edit Selected Marker” on page 246](#).

To insert marker occurrences using the keystroke method, follow the procedure below.

- 1 In the **Input** window, next to **Keystroke** click **Insert**.

Note: This arms **CinePlex Editor** to insert an occurrence of a marker at the current time when pressing the key associated with that marker.

- 2 Use keystroke insertion when **CinePlex Editor** is paused or playing. Enter marker occurrences with keystrokes for each marker type as follows:
 - For Time Only (T) markers – Press the associated key once to insert a single marker occurrence at the current time.
 - For Interval (I) markers – Press the associated key once to start the interval. Press the key a second time to end the interval.
 - For Scalar (S) markers – The keystroke behavior for Scalar markers changes with the animation status as follows:

- If paused – Open a **Scalar** window for the marker. Press the associated key and drag the mouse pointer in the **Scalar** window to set the value for the new occurrence.
- If playing – Open a **Scalar** window for the marker. Press the associated key to pause the animation. Drag the mouse pointer in the **Scalar** window to set the value for the new occurrence.
- For Coordinate (C) markers - Press the associated key and move the mouse pointer in the **Video** window and click to enter the coordinate values. If it was playing before pressing the key, after clicking, **CinePlex Editor** enters the new marker occurrence, and resumes animation.

Note: Although the user typically insert Level Interval (L) and Zone Interval (Z) markers automatically by using the **Levels Editor** and **Zones Editor** dialog boxes, the user may also enter them with a keystroke.

Note: For Scalar and Coordinate markers, to use the keystroke or button method the user must have the value of the Scalar or Coordinate marker occurrence set by clicking the mouse in either the **Scalar** window or the **Video** window. For this reason, the left-click input method is better for entering Scalar or Coordinate marker occurrences. Also, it does not make sense to use the keystroke or button input methods unless the **Scalar** or **Video** windows are open.

Button Insertion

The **Input** window includes an associated button for each marker. Each button displays the marker name. **CinePlex Editor** automatically creates a button for each new marker defined. As the user defines new markers or repositions the **Input** window, the button palette rearranges itself. Follow the procedure below

- 1 In the **Input** window, next to **Button** click **Insert**.
- 2 To insert a marker occurrence, in the **Input** window click the appropriate marker button.

***CinePlex Editor** inserts the occurrence at the current time.*

Note: With button insertion, each marker type behaves exactly the same as described in the preceding section for keystrokes.

Left-Click Insertion

The Left-Click insertion method is fundamentally different from the other insertion methods. Use the Left-Click method only to insert occurrences for the currently selected marker.

Understanding Click-To-Add Mode

Click-To-Add mode is a semi-automatic subset of the Left-Click insertion method. In Click-To-Add mode, each time a marker is chosen and the left mouse button is clicked, **CinePlex Editor** inserts an occurrence of the marker and auto-

matically advances the video by a preset number of frames. Two examples follow:

- Example 1: The user watches each frame in the **Video** window and assign a Scalar value to some on-screen behavior, say a number between 1 and 10 for a rat's activity level. To assign a range to the **Scalar** window, see “[Scalar Right-click Menu](#)” on page 232. With each frame, left-click in the **Scalar** window to enter a Scalar marker occurrence with a value that corresponds to the location clicked in the **Scalar** window, at the time of the current video frame. After each left-click, **CinePlex Editor** automatically advances to the next frame or to the number of frames set. To set the number of frames, see [Number of Frames to Advance During Click-To-Add](#) on page 266.
- Example 2: The user watches each frame in the **Video** window and mark some position of interest, for example, the end of the rat's tail. With each frame, left-click in the **Video** window to enter a Coordinate marker occurrence with a value that corresponds to the location clicked in the **Video** window, at the time of the current video frame. After each left-click, **CinePlex Editor** automatically advances to the next frame or to the number of frames set.

To insert marker occurrences with a mouse click, follow the procedure below.

- 1 In the **Input** window, next to **Left-Click** click **Insert**.

Note: This arms **CinePlex Editor** to insert an occurrence of a marker at the current time when clicking (left-click) the mouse.

- 2 In the **Markers** window, click the marker for which to insert occurrences.

A >> appears in the left most column to designate the marker as the currently selected marker.

- 3 Use mouse click insertion when **CinePlex Editor** is paused or playing. Enter marker occurrences for each marker type as follows:

- For Time Only (T) markers – Click in the **Activity** window only, as follows, otherwise **CinePlex Editor** ignores the click.
 - If paused – Click anywhere in the window and the occurrence appears at the time corresponding to the pointer location.
 - If playing – Because the display typically moves too fast for precise insertion, click anywhere in the window and the occurrence appears at the current time. Keep the pointer over the **Activity** window while watching the video and click to insert each occurrence.
- For Interval (I) markers – Click in the **Activity** window only, as follows, otherwise **CinePlex Editor** ignores the click.
 - If paused – Click once to mark the start of the interval. Click a second time to mark the end of the interval. The user may enter the ends of the interval in either order, but **CinePlex Editor** always

makes the earlier time the start time for the Interval marker occurrence.

- If playing – Click once to mark the start of the interval. *The start time appears at the current time and the interval expands.* Click a second time to mark the end of the interval. The end also appears at the current time. The user may keep the pointer over the **Activity** window while watching the video, then click to mark the start time and click again to mark the end time of each occurrence.
- For Scalar (S) markers – Click in the **Scalar** window only, as follows, otherwise **CinePlex Editor** ignores the click.
 - If paused – *Click-To-Add* mode activates; see [“Understanding Click-To-Add Mode” on page 178](#). Click to insert a Scalar marker occurrence with a value (see Note that follows) that corresponds to the location clicked in the **Scalar** window, at the time of the current video frame. With this feature, the user may enter a new Scalar occurrence on every nth frame and then use the **Interpolate Missing Occurrences** feature to fill in the skipped values; see [“Interpolate Missing Occurrences” on page 262](#).

Note: The user must have the **Scalar** window configured correctly for the desired range of the Scalar value; see [“Scalar Right-click Menu” on page 232](#).
 - If playing – Click to insert an occurrence at the current time with a value that corresponds to the location clicked in the **Scalar** window. The animation does not pause.
- For Coordinate (C) markers – Click in the **Video** window only, as follows, otherwise **CinePlex Editor** ignores the click.
 - If paused – *Click-To-Add* mode activates; see [“Understanding Click-To-Add Mode” on page 178](#). Click in the **Video** window to enter a Coordinate marker occurrence with a value that corresponds to the location clicked in the **Video** window, at the time of the current video frame. With this feature, the user may enter a new Coordinate occurrence on every nth frame and then use the interpolate missing occurrences feature to fill in the skipped values; see [“Interpolate Missing Occurrences” on page 262](#).
 - If playing – Click to insert an occurrence at the current time with a value that corresponds to the location clicked in the **Video** window. The animation does not pause.

Note: The left-click method works for Level Interval and Zone Interval markers. However, in general the user should automatically generate these marker types by using the **Levels Editor** and **Zones Editor** dialog boxes. See [“Using the Levels Editor” on page 185](#) and [“Using the Zones Editor” on page 188](#).

4.5.3 Editing Markers and Marker Occurrences

This section includes a series of short procedures dealing with markers and marker occurrences. Each procedure uses the most-efficient primary method, but additional methods that can be used to accomplish the same task appear in parentheses after the primary one. Follow the procedure below to delete a selected marker.

- 1 In the **Markers** window, select the marker to delete.
- 2 From the **Markers** window right-click menu, choose **Delete Selected Marker** (or from the **Edit** menu, choose **Delete Selected Marker**, or click the **Delete Selected Marker** button):

CinePlex Editor immediately deletes the selected marker and its marker occurrences.

Note: **CinePlex Editor** provides no confirmation before it deletes the marker. However, to undo the deletion, from the **Edit** menu, click **Undo**.

Deleting all occurrences of a selected marker

- 1 In the **Markers** window, select the marker with the marker occurrences to delete.
- 2 From the **Markers** window right-click menu, choose **Delete all Occurrences of Selected Marker** (or from the **Edit** menu, choose **Delete all Occurrences of Selected Marker**, or click the **Delete all Occurrences of Selected Marker** button):

CinePlex Editor immediately deletes all marker occurrences for the selected marker.

Note: **CinePlex Editor** does not delete the marker itself, but it removes all occurrences of the marker. **CinePlex Editor** provides no confirmation before it deletes the marker occurrences. However, to undo the deletion, from the **Edit** menu, click **Undo**.

Copying a selected marker

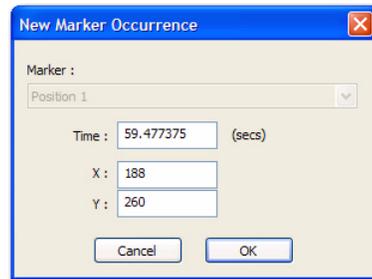
- 1 In the **Markers** window, select the marker to copy.
- 2 From the **Markers** window right-click menu, choose **Make Copy of Selected Marker** (or from the **Edit** menu, choose **Make Copy of Selected Marker**). *An exact copy of the selected marker named **Copy of <OldMarker>** appears in the **Markers** window.*

Note: The new marker has the same marker occurrences. However, the new marker gets new values for the associated key and for the Event ID(s), since those values need to be unique among the markers.

Adding new marker occurrences

- 1 In the **Marker Occurrences** window, select the marker for the new occurrence.
- 2 From the **Marker Occurrences** window right-click menu, choose **Add New Marker Occurrence** (or from the **Edit** menu, choose **Add New Marker**

Occurrence, or click the **Add New Marker Occurrence** button). *The New Marker Occurrence dialog box for the selected marker opens.*



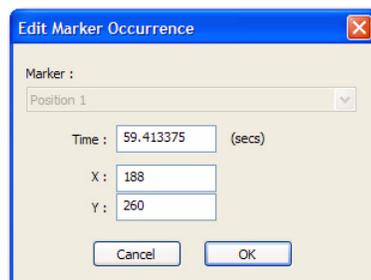
Note: For more information on the **New Marker Occurrence** dialog box, see [“Add New Marker Occurrence” on page 248.](#)

- 3 In the **Time** box, type a time in seconds for the marker occurrence. If the marker is a Coordinate marker, type the **X** and **Y** coordinates. Click **OK**.

Editing marker occurrences

- 1 In the **Marker Occurrences** window, select the marker occurrence to edit.
- 2 From the **Marker Occurrences** window right-click menu, choose **Edit Selected Marker Occurrence** (or from the **Edit** menu, choose **Edit Selected Marker Occurrence**, or click the **Edit Marker Occurrence** button):

*The **Edit Marker Occurrence** dialog box opens.*



Note: For more information on the **Edit Marker Occurrence** dialog box, see [“Edit Selected Marker Occurrence” on page 248.](#)

- 3 In the **Time** and **End Time** boxes, type new times in seconds. If the marker type includes coordinates, change these as needed. Click **OK**.

Deleting selected marker occurrences

- 1 In the **Marker Occurrences** window, select a marker occurrence to delete.

Note: To delete more than one occurrence, see Step 3.

- 2 From the **Marker Occurrences** window right-click menu, choose **Delete Selected Marker Occurrence** (or from the **Edit** menu, choose **Delete**

Selected Marker Occurrence, or click the **Delete Marker Occurrence** button):

CinePlex Editor deletes the currently selected marker occurrence.

- 3 The user may also select multiple occurrences to delete. To delete a currently selected marker occurrence *plus* all of the marker occurrences that are highlighted with a black background in the **Marker Occurrences** window, from the right-click menu choose **Delete Highlighted Marker Occurrences**.

CinePlex Editor immediately deletes all of the marker occurrences that are highlighted in the **Marker Occurrences** window.

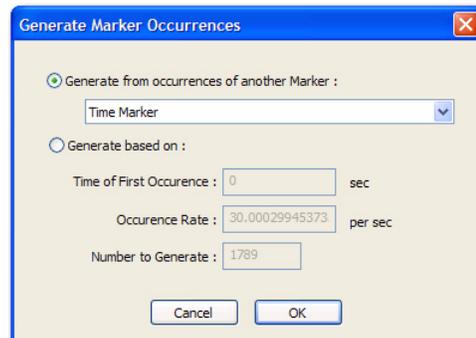
Note: **CinePlex Editor** includes other right-click menu entries for selecting and copying text with marker occurrence information onto the Windows clipboard, which can be pasted into other applications.

4.5.4 Automatically Generating Marker Occurrences

CinePlex Editor can automatically generate marker occurrences. When the user defines a new marker using the **Define New Marker** dialog box (see “[Define New Marker](#)” on page 245), the user may choose to have **CinePlex Editor** populate the new marker with algorithmically-generated marker occurrences. The available algorithms for generating marker occurrences depend on the marker type, which the following sections describe.

Automatically generating Time-Only or Frame Marker occurrences

- 1 To automatically generate Time-Only or Frame Marker occurrences, in the **Define New Marker** dialog box, click **T** then click **Generate Occurrences** to open the **Generate Marker Occurrences** dialog box.



- 2 To generate occurrences for this marker from the occurrences of another marker, click **Generate from occurrences of another Marker**. Otherwise, go to [Step 4](#).
- 3 Select a marker from the drop-down list. Click **OK**.

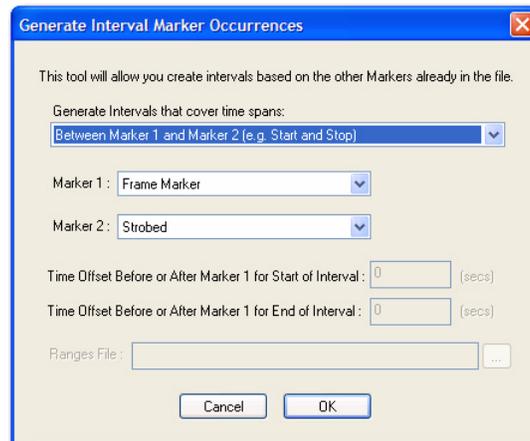
CinePlex Editor generates marker occurrences at the times of the occurrences of the marker selected in the drop list.

- 4 To generate occurrences for this marker based on other criteria, click **Generate based on**.
- 5 To generate regularly-spaced marker occurrences, in the **Time of First Occurrence** box type an offset from the beginning of the file.
- 6 To space the occurrences at intervals such that they occur at a specified rate, in the **Occurrence Rate** box, type the rate in occurrences per second.
- 7 To specify the total number of marker occurrences to generate, in the **Number to Generate** box, type the total.

Note: Under some conditions, the New Project Wizard also displays the **Generate Marker Occurrences** dialog box so that the required frame marker occurrences can generate. The suggested values that appear in the **Occurrence Rate** and **Number to Generate** edit boxes when the dialog box first appears correspond to the frame rate and number of frames detected in the currently-loaded video data file. In most cases, simply click **OK** to generate appropriate frame marker occurrences.

Automatically generating Interval marker occurrences

- 1 To automatically generate Interval marker occurrences, in the **Define New Marker** dialog box, click **I**, then click **Generate Occurrences** to open the **Generate Interval Marker Occurrences** dialog box.



- 2 From the **Generate Intervals that cover time spans** drop-down list box, select one of the following algorithms to generate the intervals:
 - **Between Marker 1 and Marker 2** – If this algorithm is selected, go to [Step 3](#).
 - **Around Marker 1** – If this algorithm is selected, go to [Step 4](#).
 - **Between a time offset from Marker 1 and a time offset from Marker** – If this algorithm is selected, go to [Step 5](#).
 - **Defined by time ranges read in from a file** – If this algorithm is selected, go to [Step 6](#).

-
- 3 Select entries in the **Marker 1** and **Marker 2** lists. Click **OK**.

*Intervals generate with a start time that corresponds to the occurrence times of the **Marker 1** selection. The end time correspond to the first subsequent occurrence time of the **Marker 2** selection. **CinePlex Editor** ignores additional occurrences of Marker 1 that occur before an ending Marker 2.*

- 4 Select entries in the **Marker 1** list. In the two **Time Offset...** boxes, enter time offsets TS and TE in seconds. Click **OK**.

Note: For every occurrence of Marker 1 at time t , an interval generates from time $t + TS$ to time $t + TE$, where TS and TE are the time offsets entered in the first and second marker boxes respectively. TS and TE can be positive or negative.

- 5 Select entries in the **Marker 1** and **Marker 2** lists, and enter time offsets in the **Time Offset...** boxes. Offsets can be positive or negative. Click **OK**.

Note: This is a generalization of the first algorithm where the interval is offset in a fashion similar to the second algorithm from the exact times of the start and end marker occurrences.

- 6 In the **Ranges File** box, type or select a text file that contains the ranges. Click **OK**.

Note: The format of the text file is one range per line of text, with each line containing the start time and end time in seconds. The delimiter between the times can be a comma, a space, or a tab.

Automatically generating Scalar and Coordinate marker occurrences

- In the **Define New Marker** dialog box, if the user selects **S** (Scalar) or **C** (Coordinate) and clicks **Generate Occurrences**, **CinePlex Editor** just generates some fake, random data for testing and demonstration purposes. It has no usefulness in general.

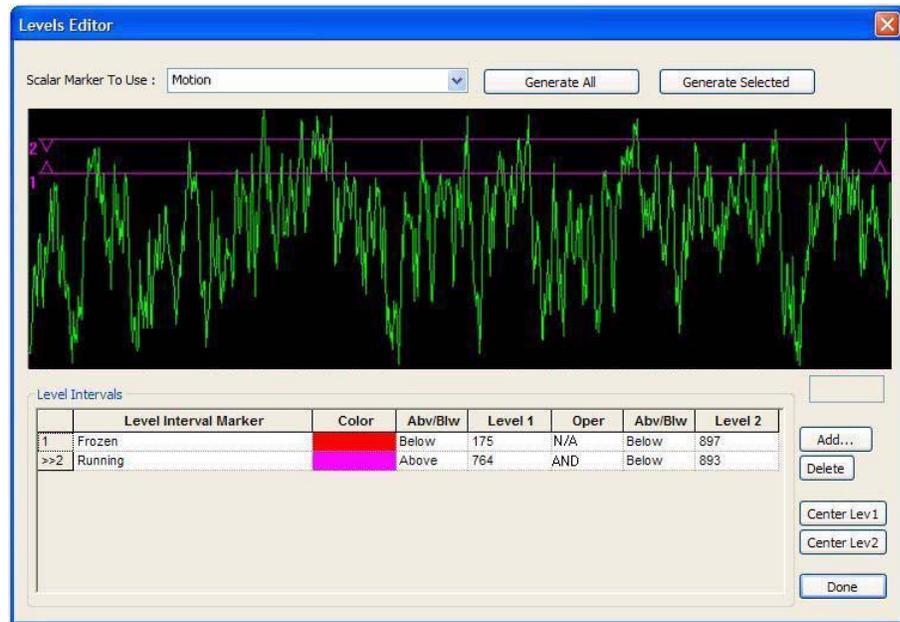
Automatically generating Level Interval and Zone Interval marker occurrences

- In the **Define New Marker** dialog box, if the user selects **L** (Level Interval) or **R** (Zone Interval) and clicks **Generate Occurrences**, **CinePlex Editor** defines the new marker and then opens either the **Levels Editor** or **Zones Editor** dialog boxes. Use the editors to generate occurrences based on level crossings for Scalar markers, or Zone containment for Coordinate markers. For basic information, see [“Using the Levels Editor” on page 185](#) and [“Using the Zones Editor” on page 188](#). For detailed information on each editor, see [“Levels Editor” on page 254](#) and [“Zones Editor” on page 256](#).

4.5.5 Using the Levels Editor

The user may use the **Levels Editor** to define Level Interval markers and insert marker occurrences for them. To open the **Levels Editor** dialog box, from the

Tools menu, click **Levels Editor** (or click the **Levels Editor** button on the toolbar).



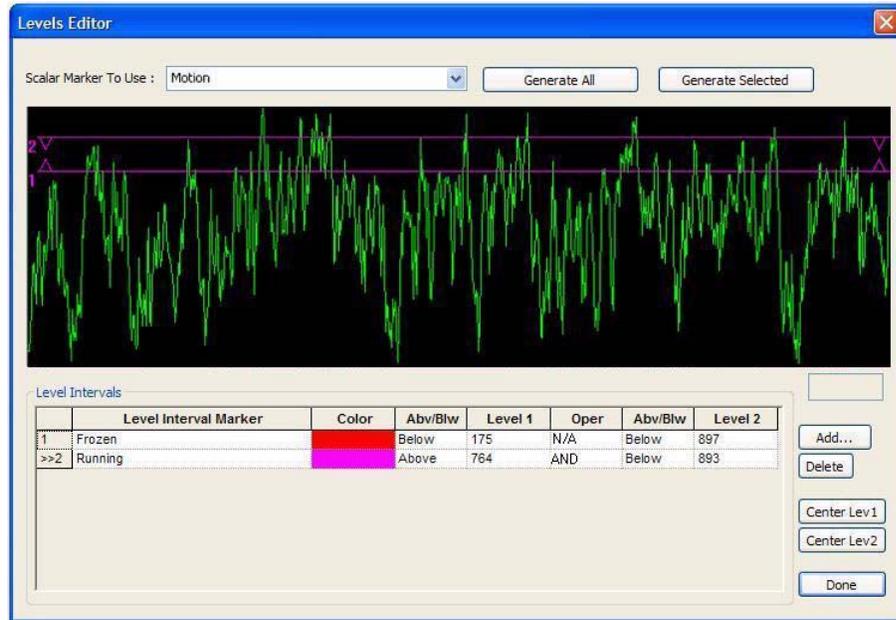
Level Interval Markers

Level Interval marker occurrences indicate the time intervals during which the values of another Scalar marker satisfied some condition. The user may use the Levels Editor to set up the conditions, apply the conditions to a specific Scalar marker, and generate occurrences of the selected Level Interval marker or markers.

Level Interval markers are like Interval markers, but they are extended to store additional information that defines a condition. This additional information appears with the Level Interval marker definition in the CPJ file. The occurrence of a Level Interval marker is always tied to the values of the occurrence of a Scalar marker.

The condition for a Level Interval marker can be either one or two level settings, which can include an above or below flag for each level, and when two levels are used, a logical operator between them (AND or OR). For example, the user may define a simple thresholding operation that generates the time intervals for which the value of the **Motion** Scalar marker went below the value of **175**. This definition might be useful as a freezing behavior detector. For more information on freezing behavior, see [“Motion Measure Option” on page 81](#). The generated Level Interval then represents the episodes during which the animal froze. The preceding illustration shows the Levels Editor when such a **Frozen** Level Interval

is defined and selected. A more sophisticated condition involving two levels appears in the following illustration:



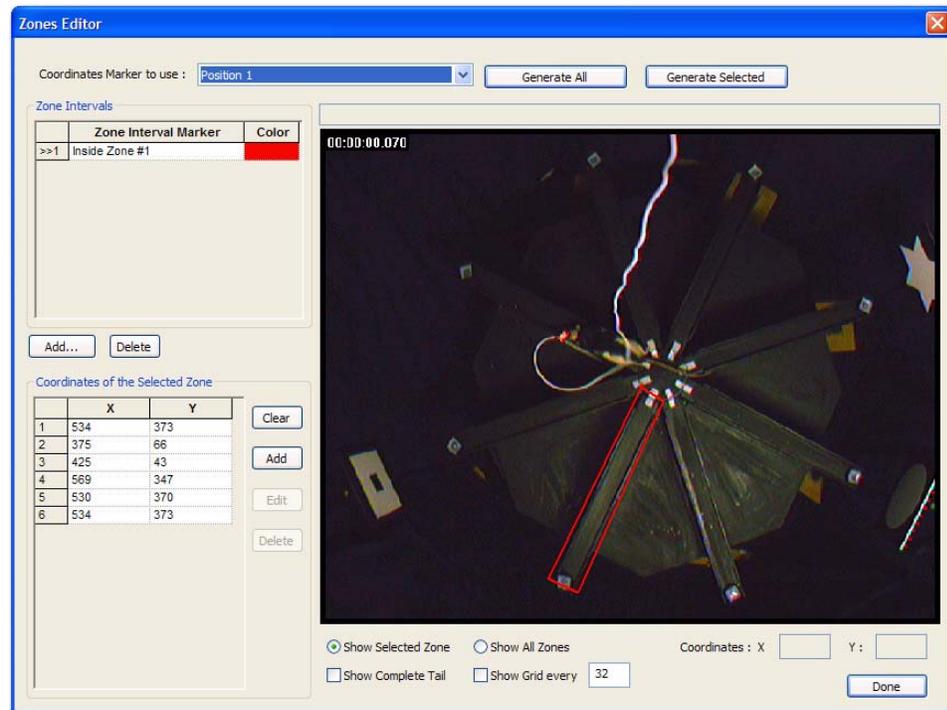
In the preceding illustration, **Running** marker is populated with occurrences that represent the time intervals for which the **Motion** Scalar marker is **Above** the value of **764** and is also **Below** the value of **893**. The user can add, edit, and delete these Level Interval markers using the buttons in the bottom portion of the **Levels Editor** window.

To use the Levels Editor

- 1 On the **Tools** menu, click **Levels Editor**.
*The **Levels Editor** window opens.*
- 2 To define a new Level Interval marker, click **Add**.
*The **Define New Marker** dialog box (see [“Define New Marker” on page 245](#)) opens to enable the user to customize the general properties of the new Level Interval marker.*
- 3 Define the new marker and click **OK** to close the **Define New Marker** dialog box.
*A new row appears in the **Level Intervals** box.*

4.5.6 Using the Zones Editor

The user may use the **Zones Editor** to define Zone Interval markers and generate marker occurrences for them. To open the **Zones Editor** dialog box, on the **Tools** menu, click **Zones Editor** (or click the **Zones Editor** button on the toolbar):



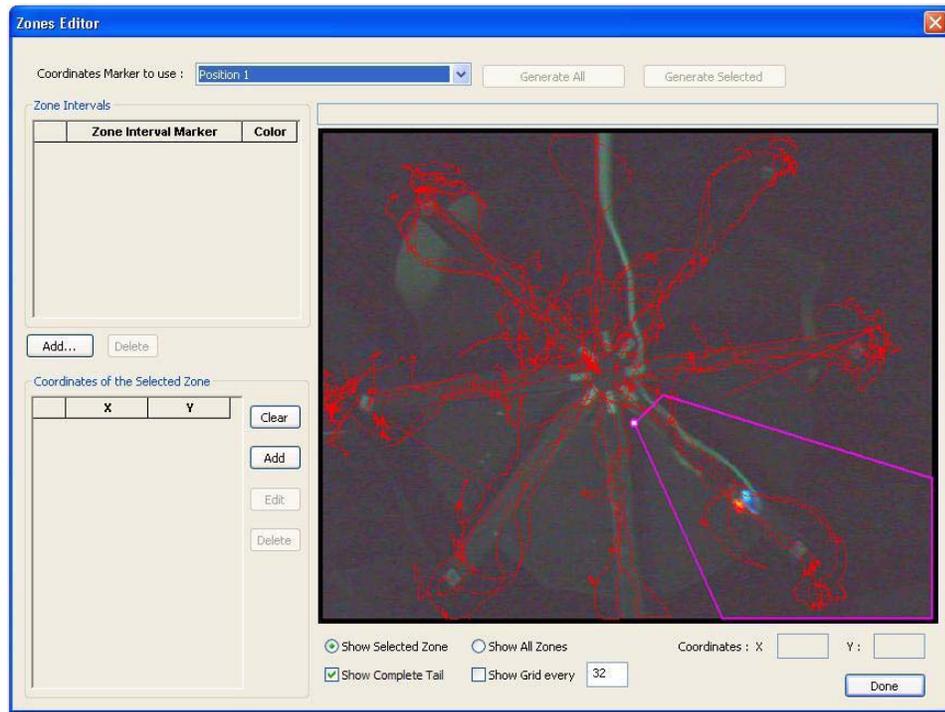
Zone Interval Markers

Zone Interval marker occurrences indicate the time intervals during which a Coordinate marker occurrence remains inside a Zone that is defined. The user may use the **Zones Editor** dialog box to define the Zones, to search for the times when the specified Coordinate marker entered and left the defined Zones, and generate Zone Interval marker occurrences.

Zone Interval markers are Interval markers, but they are extended to store additional information that defines a Zone. This additional information appears with the Zone Interval marker definition in the CPJ file. A Zone is an ordered list of coordinates that are connected with line segments, to form a closed Zone. Zone Interval marker occurrences are always tied to the values of the occurrence of a Coordinates marker.

The coordinate system for all Coordinate markers, and therefore also for all Zone definitions, range from (0,0) to (1023,767), with (0,0) representing the lower left

corner of the image. If the video resolution is other than 1024x768, which is usually the case, the coordinates are linearly mapped onto the video.



To use the Zones Editor

- 1 On the **Tools** menu, click **Zones Editor**.
*The **Zones Editor** window opens.*
- 2 To define a new Zone Interval marker, under the **Zone Intervals** area click **Add**.
*The **Define New Marker** dialog box (see “[Define New Marker](#)” on [page 245](#)) opens to enable the user to customize the general properties of the new Zone Interval marker.*
- 3 Define the new marker and click **OK** to close the **Define New Marker** dialog box.
*A new row appears in the **Zone Intervals** box.*

Note: Immediately after the user creates a new Zone Interval marker, **Zones Editor** enables the user to click in the video window to set the **X and Y Coordinates of the Selected Zone**. The box directly above the video then contains this text:

Left-Click on the view to add a new coordinate; Right-Click to end

- 4 Move the mouse pointer into the **Zones Editor** video area.
*The mouse pointer changes to crosshairs and the current pointer location coordinates appear under X and Y in the **Coordinates of the Selected Zone** area.*
- 5 Move the pointer to the desired location for the first coordinates of the selected Zone. Click to add the first coordinates.
*The first set of coordinates appear as line 1 in the **Coordinates of the Selected Zone** box and line 2 indicates the current pointer position.*
Note: As the user moves the mouse pointer, a line follows it from the first coordinates to its current location. The current location always appears as a small circle with a white interior.
- 6 Move the pointer to the desired location and click again to add the second set of coordinates, and so on. Stop entering coordinates when the next set would be the starting point.
- 7 Click the right mouse button.
*The **Zones Editor** automatically closes the Zone by making the last coordinate the same as the first coordinate.*

The user may select a point at a vertex of a selected Zone Interval by clicking on a line in the **Coordinates of the Selected Zone** box. The point the user selects appears with a >> in the leftmost column box and as a small circle with a white interior in the video area.

After the user has defined the Zones, the user may generate Marker occurrences just for the selected Zone Interval marker, or for all Zone Interval markers by clicking **Generate Selected** or **Generate All**.

4.5.7 Operating with Marker Occurrences

With **CinePlex Editor**, the user may perform certain simple operations on marker occurrences. The user can find, move, and delete occurrences. The user may also shift, align and interpolate marker occurrences, and invalidate waveforms that occur either inside or outside of Interval marker occurrences.

Finding Marker Occurrences

CinePlex Editor includes the following three ways to find marker occurrences:

- Keystroke
- Button
- Using the Find menu items or toolbar buttons

Finding marker occurrences with a keystroke

- In the **Input** window next to **Keystroke**, click **Find**. Press the key associated with the marker, which appears in the **Key** column of the **Markers** window.

*CinePlex Editor advances the file in the **Activity** window to align the first occurrence of the marker with the current time triangle.*

Finding marker occurrences with a button click

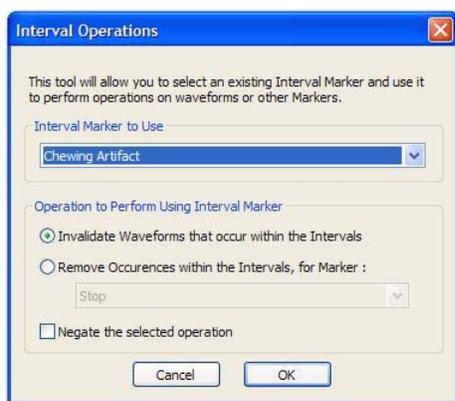
- In the **Input** window next to **Button**, click **Find**. In the **Input** window, click the button associated with the marker.

*CinePlex Editor advances the file in the **Activity** window to align the first occurrence of the marker with the current time triangle.*

Interval Operations

For Interval, Level Interval, or Zone Interval markers, the user may invalidate spike waveforms inside or outside of the Intervals, or remove the occurrences of other markers that fall inside or outside of the intervals.

To use an Interval marker (see [“Defining a New Marker” on page 169](#)) for operations, from the **Tools** menu, click **Interval Operations** to open the **Interval Operations** dialog box:



From the **Interval Marker to Use** list, choose one of the currently-defined Interval, Level Interval, or Zone Interval markers.

To mark as invalid each waveform (spike time) in every channel that falls inside the start and end times of all occurrences of the Interval marker, click **Invalidate Waveforms that occur within the Intervals**. This operation can be inverted; before doing so, see the cautionary note in this section.

If a marker occurrence falls inside a defined interval, the user may remove that marker occurrence. To do so, click **Remove Occurrences within the Intervals, for Marker**, and choose a non-Interval marker from the second list. This operation may be inverted; before doing so, see the following cautionary note.

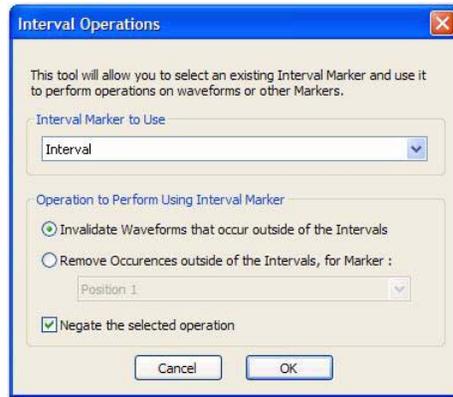


CAUTION

Negate inverts the selection for the entire file

If the user clicks **Negate the selected operation**, the selection is logically inverted. This means the user invalidates or removes all the items he/she did *not* select, which is the entire portion of the file outside the limits of the Interval occurrences.

If the user clicks **Negate the selected operation**, in the **Interval Operations** dialog box, the text in the **Operation to Perform Using Interval Marker** area changes as follows:



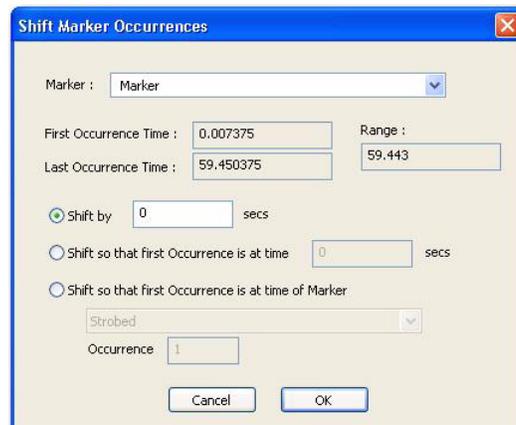
If the user chooses an operation and clicks **Negate the selected operation**, the user either invalidates all waveforms that *do not* fall between the start and end times of any Interval occurrences or removes all occurrences of the selected marker that *do not* occur inside the time span any Interval marker occurrence. For more information on the **Interval Operations** dialog box, see [“Interval Operations” on page 258](#).

Shifting Marker Occurrences

The user may add a constant offset, which can be negative, to all the timestamps of a marker. The user may use this capability to align neural data files and video files.

Shifting marker occurrences

- 1 From the **Tools** menu, click **Shift Marker Occurrences** to open the **Shift Marker Occurrences** dialog box:



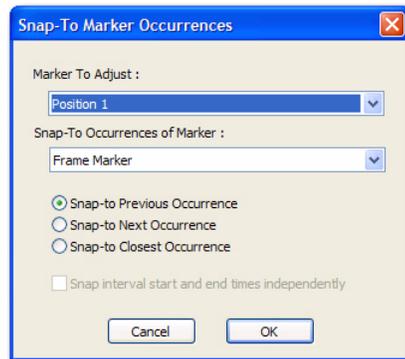
- 2 Choose a marker from the **Marker** list.
Note: The first, last, and range of times covered by the occurrences of the chosen marker appear below the **Marker** list.
- 3 Choose one of the following methods for specifying the time shift:
 - To shift marker occurrences by a fixed amount, in the **Shift by** box, enter the amount of the shift in seconds.
 - To shift marker occurrences so that the first occurrence is at a specified time, enter the specified time in seconds in the **Shift so that first Occurrence is at time** box. **CinePlex Editor** applies this shift amount to all occurrences.
 - To shift marker occurrences so that the first occurrence of a marker to shift is at the time of another marker occurrence, select the marker representing the time to shift *to* from the **Shift so that first Occurrence is at time of Marker** list, and enter the occurrence of the marker to use by typing its 1-based index in the **Occurrence** box.
- 4 Click **OK** to shift the marker occurrences and close the dialog box.

Snap-To Marker Occurrences

The **Snap-To Marker Occurrences** tool shifts all the occurrences of a marker to match up in time with the occurrences of another marker.

Repositioning marker occurrences to align with others

- 1 From the **Tools** menu, choose **Snap-To Marker Occurrences**
*The **Snap-To Marker Occurrences** dialog box opens.*



- 2 From the **Marker To Adjust** list, choose the marker to match up in time. From the **Snap-To Occurrences of Marker** list, choose the marker representing the occurrences to match in time.
Note: Typically, the entry in **Marker To Adjust** is the one to align with the times of the video frames and the entry in **Snap-To Occurrences of Marker** is a Frame marker. **CinePlex Editor** uses the following algorithm: For every occurrence of the entry in **Marker To Adjust**, **CinePlex Editor** finds the *best match* occurrence of the entry in **Snap-To**

Occurrences of Marker, and makes the occurrence time of the entry in **Marker To Adjust** equal to the time of the *best match* occurrence.

- 3 To determine the *best match* occurrence of the entry in **Snap-To Occurrences Marker**, click one of the following items:
 - **Snap-to Previous Occurrence**: Click this item to use the occurrences that are positioned immediately before the times of the entry in **Marker To Adjust**. This adjustment always reduces the time of the occurrences being adjusted.
 - **Snap-to Next Occurrence**: Click this item to use the occurrences that are positioned immediately after the times of the entry in **Marker To Adjust**. This adjustment always increases the time of the occurrences being adjusted.
 - **Snap-to Closest Occurrence**: Click this item to use the occurrences that are closest in time the entry in **Marker To Adjust**. This adjustment can shift the occurrence being adjusted either direction in time.
- 4 If the entry in **Marker to Adjust** is an Interval-type marker, it consists of two times—a start time and an end time. To adjust the span, which can change the duration of the interval by making both the start and the end times snap to their respective *best match* occurrences, click **Snap interval start and end times independently**. To retain the span, which retains the duration of the interval by only making the start times snap to their *best match* occurrences and shifting the end times to match, click to clear the checkbox.
- 5 Click **OK** to adjust the occurrences and close the dialog box. A confirmation dialog box appears to display how many marker occurrences were moved. The result may be two or more markers with the same timestamp.

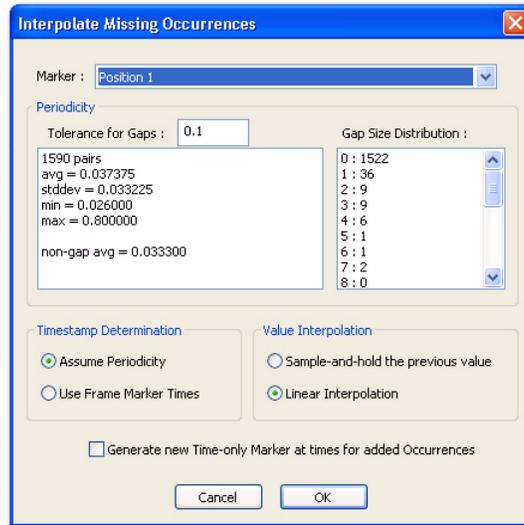
Interpolating Missing Marker Occurrences

This tool is useful for adding entries in any gaps in marker occurrences. For example, when tracking some feature on the video by hand, the user may enter tracking coordinates only for every *n*th frame, and then interpolate them to complete the remaining frames; this is a form of *key-frame animation*. Also, **CinePlex Studio** is occasionally unable to provide valid coordinates for some video frames, for example, when the headset cable for a rat occludes the LED being tracked. The user may use this tool to complete tracking coordinates for every frame.

Interpolating missing occurrences

- 1 From the **Tools** menu, choose **Interpolate Missing Occurrences**.

*The **Interpolate Missing Occurrences** dialog box opens.*



Note: For detailed information on how the interpolation algorithm runs, see [“How the Interpolation Algorithm Works” on page 263](#).

- 2 In the **Timestamp Determination** area, choose one of the following items:
 - **Assume Periodicity:** If the results in the **Periodicity** area indicate that the data is truly periodic enough so that filling in gaps by assuming a periodicity is valid, click this item.
 - **Use Frame Marker Times:** If there should be marker occurrences for the selected marker for every frame, click this item; this lets the frame markers—not the periodicity analysis—determine where missing marker occurrences appear.
- 3 In the **Value Interpolation** area, if the marker being interpolated is a Scalar marker or a Coordinates marker, choose one of the following methods to calculate reasonable values to give the added marker occurrences:
 - **Sample-and-hold the previous value** – Click this item to assign the value or coordinates of the last pre-gap marker occurrence to the new marker occurrences that fill the gap.
 - **Linear Interpolation** – Click this item to assign values to the new marker occurrences that fall on a line connecting the last pre-gap value or coordinates with the first post-gap value or coordinates.
- 4 To have **CinePlex Editor** define and populate a new marker to identify the marker occurrences that it generates through interpolation, click **Generate**

new Time-only Marker at times for added Occurrences. Otherwise, click to clear the checkbox.

Note: If the user chooses this item, **CinePlex Editor** defines a new marker name “Interpolated X”, where X represents the name of the interpolated marker; this *tags* the occurrences that are not part of the original data.

- 5 Click **OK** to close the dialog box.

CinePlex Editor adds the new occurrences to the file and, if the user chose the item in [Step 4](#), adds a new row entitled “Interpolated ___” to the list in the **Activity** window.

4.5.8 Selecting and Editing Marker Occurrences

To select a marker, in the **Activity** window, double-click on any marker time-line, or on the label for a marker. The label of the marker selected appears in the high-light color, which is violet by default.

In the **Input** window (see “[Input Window](#)” on page 223), if the user chooses **Select** for the **Left-Click** input, a left click in the **Activity** window selects the nearest on-screen marker occurrence for the selected marker. The selected marker occurrence appears with a white box around it:



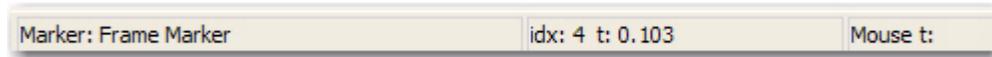
If the user selects the end time interval, the white box appears around the end time tick mark and the interval line:



In the **Marker Occurrences** window, the newly selected marker occurrence appears with a > next it, and the window can scroll to position the newly selected marker occurrence near the top of the view. If the **Activity** window is in the mode where it is selecting the nearest marker occurrence, the mouse pointer becomes white crosshairs.

In the **Activity** window, the status bar shows useful information about the selected marker and marker occurrence. The name of the selected marker appears and the 1-based index of the selected marker occurrence; for example, in the fol-

lowing illustration **idx** indicates the 4th occurrence of this marker and **t** indicates its time in seconds:



In the **Activity** window, the user may also drag selected marker occurrences to different times; this enables the user to make minor adjustments to the positioning of marker occurrences. To drag a marker occurrence to a new time, hold down the **SHIFT** key, click the marker occurrence, and drag it to a new time. For Interval-type markers, the user may independently adjust the start and end times; for selection techniques, see the preceding paragraphs.

4.5.9 Entering or Editing Coordinate Markers

In the **Input** window (see [“Input Window” on page 223](#)), if the user chooses **Insert** for the **Left-Click** input and the selected marker is a Coordinate marker, the user may enter or change coordinates by clicking in the **Video** window. If the **Video** window is in the mode where a left-click can change or add new Coordinate marker occurrences, the mouse pointer in the Video window changes to crosshairs and a line of text at the bottom of the window shows the current coordinates.

Because **CinePlex Editor** can enable only one marker occurrence for any given time, if the user enters a new coordinate at the time of an existing marker occurrence, the user effectively replace the existing coordinates. Thus, if the Coordinate marker occurrences occur at the same time as the Frame marker occurrences, the user may *touch up* existing coordinates with a simple click on the new location.

By default, the Click-To-Add feature (see [“Left-Click Insertion” on page 178](#)) automatically advances a number of frames, so if the user continually clicks in the **Video** window he/she can quickly enter a sequence of coordinates on subsequent video frames.

Importing Markers

CinePlex Editor can import additional markers and marker occurrences from additional neural data files into an existing project. The user may add neural data files to the project and process them as during the initial import of neural data when the project was first created (see [“Setting Up a New Project” on page 165](#)). The user may turn their events (from PLX files) or variables (from NEX files) into the appropriate markers and marker occurrences.

To import markers, from the **File** menu, click **Import Markers** to open a Windows file selection dialog box for the neural data file. After selecting the file, click **OK** to import the data from that file as new markers. **CinePlex Editor** must have unique marker names, so if a marker name from the imported neural data files conflicts with an existing marker, **CinePlex Editor** renames the file by add-

ing “_n” to the name, and increasing the number n until it establishes a unique name.

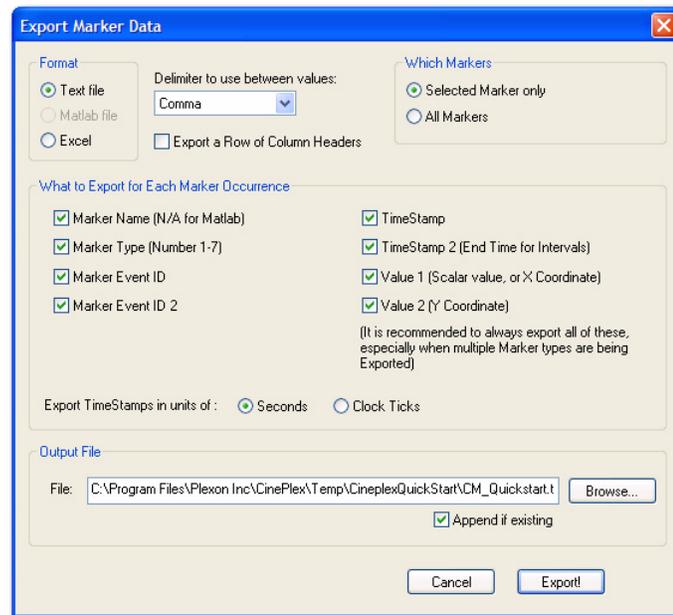
Exporting Markers to text files, Matlab, or Excel

CinePlex Editor can export marker occurrences data in a tabular format to either a text file, a Matlab file, or an Excel spreadsheet.

Exporting makers as text, Matlab, or Excel files

- 1 From the **File** menu, click **Export Markers** to open the **Export Marker Data** dialog box.

*The **Export Marker Data** dialog box opens.*



- 2 In the **Format** area, select the type of file to export.

Note: To use the corresponding Matlab or Excel export functionality, those programs must be installed on the same computer with **CinePlex Editor**. Otherwise, the corresponding radio buttons appear dimmed.
- 3 For all formats, **CinePlex Editor** exports one marker occurrence per row—or per line for text files, and all rows have the same number of columns. From the **Delimiter to use between values** list, select one of the following delimiters: **Comma**; **Comma, Space**; **Space**; **Semicolon**; or **Tab**.
- 4 If want the file to have a header row, click **Export a Row of Column Headers**.
- 5 In the **Which Markers** area, click **Selected Marker** to export only the occurrences for the selected marker. To export the occurrences for all markers, click **All Markers**.

Note: If the user selects **All Markers**, the selection generally results in a confusing output file.

-
- 6 The user may set the columns for each row in the **What to Export for Each Marker Occurrence** area. For more information on exporting marker data, see [“Export Markers” on page 239](#).
 - 7 In the **Output File** area, in the **File** box, type or select the output file name.
Note: Under **Format**, if the user selects **Text file** or **Excel**, click the **Append if existing** checkbox to append the marker data onto the end of a file that already exists on disk. Otherwise, **CinePlex Editor** overwrites the existing file.
 - 8 Click **Export!** to create the file and close the dialog box. The **Export Complete** dialog box appears.

Exporting as a PLX File

CinePlex Editor can export marker occurrences data along with spike and continuous data read in from the original neural data file to a new PLX file.

Mapping Markers to Event IDs

When exporting to a PLX file, the marker occurrences in the project are represented as external events (type 4 data) in the output PLX file. There are two kinds of external events in the PLX file format:

- 1 Individual External Events – These events appear only by their Event ID, and each occurrence includes a timestamp only. There can be many different Individual External Events (with different Event IDs) present in a PLX file.
- 2 Strobed Events – These events appear only by a special Event ID, so only one strobed event can be in a PLX file. Each occurrence of a strobed event stores a timestamp plus a single 16-bit value, called the strobe code.

The user must define a mapping between markers and Event IDs before **CinePlex Editor** can represent marker occurrences as external events.

Each marker for which the marker occurrences are to be exported to a PLX file must have its own unique Event ID. The user may define or edit the Event IDs in the **Define New Marker** or **New Marker Occurrence** dialog boxes (see [“Define New Marker” on page 245](#) and [“Add New Marker Occurrence” on page 248](#)), or the user may change them in the **Export To PLX** dialog box (see [“Export to PLX” on page 242](#)).

The fact that individual external events do not have any data values associated with them means that only Time-Only, Frame, and Interval-type (Interval, Level Interval, or Zone Interval) markers can be represented by using individual external events. For Interval-type markers, specify two Event IDs, one to represent the start time of the interval and one to represent the end time.

Furthermore, the fact that a PLX file can only contain one kind of strobed events means that only a limited number of Scalar or Coordinates markers can simultaneously appear in a single PLX file. For example, if the strobed events in a PLX file are to represent all the occurrences of a certain Scalar marker, then there is no

way to represent another scalar marker or any coordinates markers in the same PLX file.

Because of the existence of the **VideoTracker** protocol, coordinates markers can be represented in a PLX file. Up to three coordinates markers can be represented using the **VideoTracker** protocol in a single PLX file, along with an additional scalar marker.

Exporting as a NEX file

CinePlex Editor can export marker occurrences data along with spike and continuous data read in from the original neural data file to a new NEX file. For information on mapping from markers to Nex variables, see [“Export to NEX” on page 244](#).

4.6 CinePlex Editor How-Tos

This section contains suggested procedures for several common operations in **CinePlex Editor**. These procedures are by no means meant to be an exhaustive list of what can be done with **CinePlex Editor**, nor are they intended to be a presentation of the only possible way to achieve any desired end result.

Note: The following procedures assume a project has already been created and that it is currently open. For details on how to create CinePlex projects, see [“Setting Up a New Project”](#) on page 165.

4.6.1 Printing

Several windows in **CinePlex Editor** support rudimentary printing. To print a specific window, click in the window so the title bar is highlighted. If the window supports printing, the **Print** and **Print Preview** items on the **File** menu are available. The **Input** and **Scalar** windows do not support printing.

4.6.2 Denoting Interesting Behavior In the Video

A basic use for **CinePlex Editor** is to introduce a new marker occurrence into the data each time an animal or other subject in the video performs an action that is of interest in an experiment. For example, perhaps a neuron is suspected to be associated with a rat deciding to get a drink of water. The user might test this hypothesis by introducing a time marker into the data whenever the rat drinks his first sip of water, as shown by the video. Then it would be desirable to perform a peri-event analysis against this new event in Neuroexplorer (NEX) to see if any neurons are associated with the first sip.

The procedural approach here is to define a new Time-only marker in **CinePlex Editor**, then enter marker occurrences whenever the rat starts to sip water. Initially, we *rough in* all the marker occurrences during one continuous pass through the video, then we go back and adjust each marker occurrence to be as accurate as possible. Then this information is saved to a NEX file, from which we can easily load it into NEX for analysis.

Denoting interesting behavior in the video

- 1 Define a new Time-only marker as described in [“Defining a New Marker”](#) on page 169. Label it “First Sip.” Assign a keystroke to it that is easy to press quickly.
- 2 Click **Play**. Adjust the **Faster** and **Slower** settings to a comfortable speed to view the video, which balances the desire to get through the video quickly against the risk of missing the behavior should it occur too quickly to spot.
- 3 Use the **Zoom In** and **Zoom Out** buttons at the bottom of the **Activity** window to adjust the time range such that, should the sip behavior be spotted in the video view, a key on the keyboard can be hit before the time of the first sip scrolls out of the **Activity** window.
- 4 In the **Input** window, at **Keystroke**, click **Insert** (The user could just as easily use the **Left-click** or **Button** input methods here.). **CinePlex Editor** is now

armed to enter new occurrences of the new marker when pressing that marker's associated key.

- 5 Click **Rewind**. Click **Play**. Position a finger over the associated keystroke for the "First Sip" event.
- 6 When the sip behavior is observed, quickly press the key associated with the "First Sip" marker. Accuracy is not important at this point; fine-tuning will come later. Go through the entire video.
- 7 Now, lets go back through and adjust the time of the "First Sip" marker occurrences to be more accurate. We will use the **Find** function to quickly locate our marker occurrences. In the **Input** window, after **Keystroke**, click **Find**.
- 8 Rewind the video file, then press the assigned key for the "First Sip" marker. This causes the system to jump to the first marker occurrence. Use the left and right arrow keys on the keyboard to look at each frame of the video to decide where the sip actually occurs.
- 9 In the **Activity** window, drag the marker occurrences to the correct time. To do so, press and hold the **SHIFT** key, then click near the tick mark for the marker occurrence. Drag the tick mark to the desired time and release the mouse button.
- 10 To save the data, on the **File** menu, click **Export to NEX**, and if desired, select the appropriate **What to Export** checkboxes. Click **Export!** to write the file.

4.6.3 Invalidating Artifact Waveforms

Artifact waveforms can occur, for example, because a rat rapidly shakes its head. This behavior can easily be spotted in the video view, and it generally produces a cluster of spikes and large voltage deviations in a continuous data channel. It is desirable to invalidate all spike waveforms that occur during each head-shaking episode, and save the data to a new PLX file that does not contain those invalidated waveforms. This file can then be loaded into **Offline Sorter** and sorted.

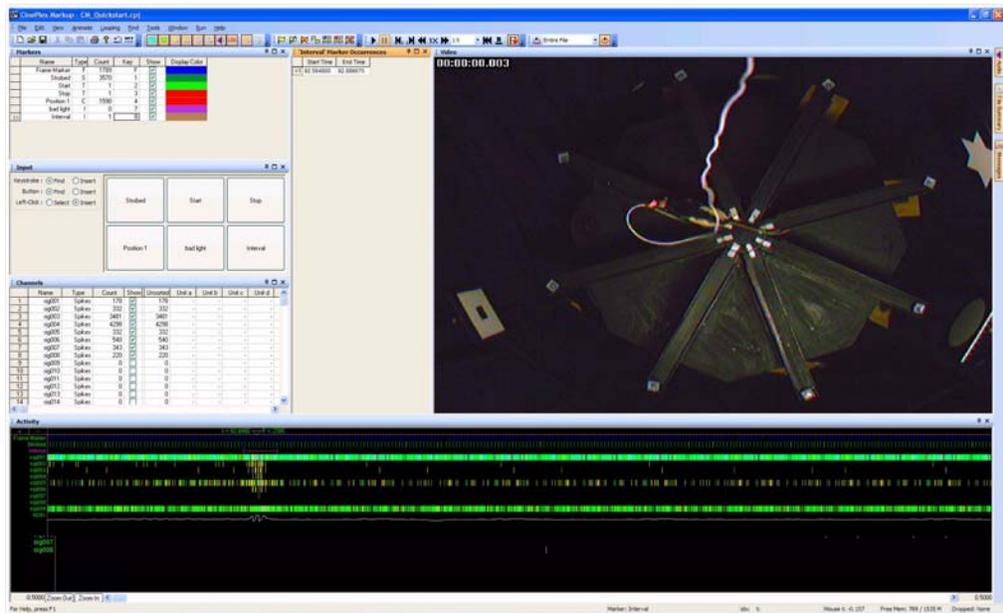
The procedural approach here is to define a new Interval marker, whose occurrences start and end when the head-shaking episodes start and end. We then use this Interval marker to invalidate the spike waveforms that occur within the head-shaking episodes. We then save the data to a new PLX file minus the invalidated spike waveforms.

Invalidating artifact waveforms

- 1 Define a new Interval marker (see ["Defining a New Marker" on page 169](#)). Label it "Head Shake". Make sure that the new marker is the currently-selected marker.
- 2 In the **Channels** window (see ["Channels Window" on page 224](#)), click **Show** for the spike and continuous channels that are the best indicators of when this artifact occurs, which makes them appear in the **Activity** window.
- 3 Use the **Zoom Out** button at the bottom of the **Activity** window to expand the time range as much as possible, which helps to examine the file quickly.

However, do not expand the range so far that the artifact cannot be spotted should it occur.

- 4 In the **Input** window, at **Left-Click**, click **Insert** (Or use the **Left-click** or **Button** input methods here.). **CinePlex Editor** is now *armed* to enter new occurrences of the new marker when pressing that marker's associated key.
- 5 Starting at the beginning of the file, click **Play**. If it doesn't make the behavior too difficult to spot as it scrolls by, increase the speed of the playback so that the file can be reviewed quickly.
- 6 When the head shake behavior is observed, quickly press SPACEBAR to pause the playback. Use the left and right arrows to single-step the frames to verify the head shake and decide when the head shake behavior begins and ends.
- 7 In the **Activity** window, left-click at the starting and ending times of the head shake episode. This inserts new marker occurrences of the "Head Shake" marker.



- 8 Press SPACEBAR to resume playing. Repeat Steps 6, 7, and 8 for each head shaking episode until the end of the file is reached.
- 9 From the the **Tools** menu, click **Interval Operations**. Select the "Head Shake" marker from the **Interval Marker to Use** list. Click **Invalidate Waveforms that occur within the Intervals**. Click **OK**.
- 10 Now all of the spikes that occur within the head shake episodes have been invalidated. To hide invalidated spikes in the **Activity** window, open the right-click menu and click **Hide Invalidated Spikes**.
- 11 To save the data, from the **File** menu, click **Export to PLX**. Verify that the **Export invalidated spikes** checkbox is clear (the default). If desired, check

or clear the **Write?** checkboxes for any markers that should be exported or not exported into the new PLX file. Click **Export!** to write the file.

4.6.4 Freeze Detection

CinePlex Studio can detect freeze behavior using recorded data with the Motion Measure option. The user may define a new interval that occurs whenever a rat freezes. The user may set a *threshold* level for the motion measure and define a freeze to be whenever the motion measure falls below that level. The user may then export the freezing episodes to a text file.

The procedural approach here is to use the Levels Editor to define the freezing threshold and apply it to the Motion Measure data generated by **CinePlex Studio**, and then import it into **CinePlex Editor** as the “Centroid Motion” Scalar marker. This generates occurrences of a newly labelled “Rat Froze” marker. The user may then export this marker to a text file.

Detecting freezing behavior

- 1 Define a new Interval marker (see [“Defining a New Marker” on page 169](#)). Label it “Rat Froze”. From the **Define New Marker** dialog box, click **Generate Occurrences**. This opens the **Levels Editor** dialog box, which is described in detail in [“Using the Levels Editor” on page 185](#).
- 2 In the **Levels Editor** dialog box, make sure to select the “Centroid Motion” variable in the **Scalar Marker To Use** list. The display window opens showing the Centroid Motion values over the duration of the file.
- 3 Click **Center Lev 1** to get the line to the middle of the display window. Adjust it to a reasonable freeze threshold.
- 4 Since we want to generate intervals when the “Centroid Motion” value falls below the threshold, click **Below** from the list in the first **Abv/Blw** column for the “Rat Froze” line in the grid.
- 5 Click **Generated Selected** because we only have one Level Interval marker and it is selected. Click **Done**.

*The **Marker Occurrences** window and the **Activity** window now show the new “Rat Froze” intervals.*

- 6 To write the intervals to a text file, from the **File** menu, select **Export Markers**. In the **Export Marker Data** dialog box, accept the default settings, which produce a reasonable output file. The user may change the **Delimiter to use between values**, select **Export a Row of Column Headers**, and clear some of the checkboxes under **What to Export for Each Marker Occurrences**. For a more information, see [“Export Markers” on page 239](#). Type a file

name and click **Export!** The **Export Complete!** dialog box confirms the action.

- 7 Use a text editor such as Windows Notepad to inspect the text file. Most other analyses programs can import the text format.

4.6.5 Entering Tracker Coordinates

Suppose that it is desirable to track the movement of some subtle feature on the video image. Something that **CinePlex Studio** cannot track automatically, like the position of the tip of a rat's tail.

The procedural approach here is to define a new Coordinates marker, and use the Video window to enter—by mouse click—the coordinates that populate the new marker. Then, we can use the **Interpolate Missing Occurrences** tool to fill in the in-between frames.

Entering tracking coordinates

- 1 Define a new Coordinates marker (see [“Defining a New Marker” on page 169](#)). Label it “Tail Position”.
- 2 In the **Input** window, after **Left-Click**, click **Insert**. **CinePlex Editor** is now “armed” to create a new occurrence of the “Tail Position” marker whenever clicking in the **Video** window.
- 3 Decide how often coordinates need to be entered. The default case is to enter a Coordinates maker occurrence for each and every video frame. However, this means that the video must be advanced frame-by-frame, which can take a long time to do the tracking for an entire experimental run. If less accuracy is acceptable, it is possible to configure **CinePlex Editor** automatically to advance N video frames each time a coordinated is entered by clicking. This means that a “Tail Position” coordinate is entered only every N th frame, but transversing the file occurs N times faster. From the **Tools** menu, select **Options**, and click the **General** tab in the **Options** dialog box. Type the value of N into the **Number of Frames to Advance During Click-To-Add** edit box. The default is $N = 1$, which enters a coordinate for every video frame.
- 4 Click **Play**, then **Pause**, then **Rewind** to return to the beginning of the file. This ensures that **CinePlex Editor** is ready to take new coordinates.
- 5 In the **Video** window, click at the position of the tip of the rat's tail. **CinePlex Editor** enters a new marker occurrence, and advances N video frames.
- 6 Repeat Step 5 until all the data needed has been gathered.
- 7 When finished, in the **Input** window, at **Left-Click**, click **Select** to “disarm” **CinePlex Editor**.
- 8 It is possible to generate automatically new “Tail Position” marker occurrences for the skipped frames by interpolating the coordinates between the ones entered. This is similar to “key-frame” animation techniques. **CinePlex Editor** interpolates the coordinates mathematically with no regard for the video images—the interpolated positions may or may not match the actual positions of the rat's tail on the skipped video frames. To perform this operation, from the **Tools** menu, select **Interpolate Missing Occurrences**; for more information, see [“Interpolate Missing Occurrences” on](#)

[page 262](#). From the **Marker** list, select **Tail Position**. Because we want coordinates for every frame, in the **Timestamp Determination** area, click **Use Frame Marker Times**. Click **OK** to close the dialog box and enter the tracking coordinates.

4.6.6 Repairing Tracking Coordinates

Suppose that **CinePlex Studio** is used to track an LED mounted to the headstage on a rat. Occasionally, the cable from the headstage can get between the LED and the camera, so the position data for the LED is missing in some frames. Or, suppose something caused the tracker to produce bad coordinates for a few frames, possibly caused by some light leaking into the experimental setup that confused the tracking algorithms.

In either case, the procedural approach is to put **CinePlex Editor** into a state where the video is advanced frame-by-frame and enter new or replacement tracker coordinates by clicking in the Video window at the desired location.

Repairing tracking coordinates

- 1 In the **Markers** window, select the Coordinates marker to repair. Click **Show**. To minimize confusion during the procedure, clear **Show** for other Coordinate markers (if present).
- 2 For the following procedure to work, the Coordinates markers must be aligned to the Frame marker times by using the **Snap-to Marker Occurrences** dialog box, for more information, see [“Snap-To Marker Occurrences” on page 193](#). Follow the procedure outlined in that section to align the Coordinate markers to the Frame markers.
- 3 Locate a section of time that has bad or missing values for the selected Coordinate marker that needs to be repaired. Pause the playback at the first frame with bad or missing coordinates.
- 4 From the **Tools** menu, click **Options**, and in the **Options** dialog box click the **General** tab. Make sure that the the selection in the **Number of Frames to Advance During Click-To-Add** box is **1** (the default). Also, from the **Animate** menu, select **Lock To Video Frames**.
- 5 In the **Input** window, at **Left-Click**, click **Insert**. This “arms” **CinePlex Editor** to enter new (or replace existing) marker occurrences when clicking the left mouse button in the **Video** window.
- 6 Position the mouse cursor where the new (or replacement) coordinate needs to be and click.

The position is entered (or updated) and the video automatically advances by one frame.

-
- 7 Repeat Step 6 until all the coordinates are entered or repaired. Move the file forward to the next episode of bad tracking coordinates and repeat.
 - 8 When finished, from the **File** menu, click **Save**. The user may save and export the new or updated positions like any other marker data.

4.6.7 Simple Place Cell Analysis

Suppose it is suspected that a certain neuron seems to fire only when the rat is in his nest. As a procedural approach to test this hypothesis, a new Zone Interval marker could be defined that defines the boundaries of the rat's nest. The generated occurrences of this marker represent the intervals during which the rat was in its nest. NeuroExplorer could then be used to search for correlations between neural firing rates and this interval.

- 1 Advance the video until a frame shows where the outline of the desired Zone (the nest) is clearly visible.
- 2 Define a new Zone Interval marker (see [“Defining Markers” on page 175](#)). Label it “Rat In Nest”. In the **Define New Marker** dialog box, click **Generate Occurrences** to open the **Zones Editor** dialog box (see [“Zones Editor” on page 256](#)).
- 3 In the **Coordinates of the Selected Zone** area, click **Add** and then click the left mouse button repeatedly in the video window in order to define the outline of the nest. Before completely closing the contour, click the right mouse button, which closes the contour.
- 4 In the **Coordinates Marker to use** list, select the appropriate Coordinates marker, and click **Generate Selected**. This generates occurrences of the new “Rat In Nest” marker. Click **Done** to close the **Zones Editor** dialog box.
- 5 To inspect the “Rat In Nest” intervals, use the **Find Marker Occurrences** dialog box (see [“Find Marker Occurrences” on page 253](#)) to quickly advance through all the occurrences of the “Rat In Nest” marker. It is also possible to use the **Marker Occurrences** window (see [“Marker Occurrences Window” on page 229](#)) to remove any undesirable “Rat In Nest” occurrences.
- 6 From the **File** menu, click **Export to NEX** (see [“Export to NEX” on page 244](#)) to write the data to a NEX file for subsequent analysis. The “Rat In Nest” marker shows up as an interval variable in NeuroExplorer.

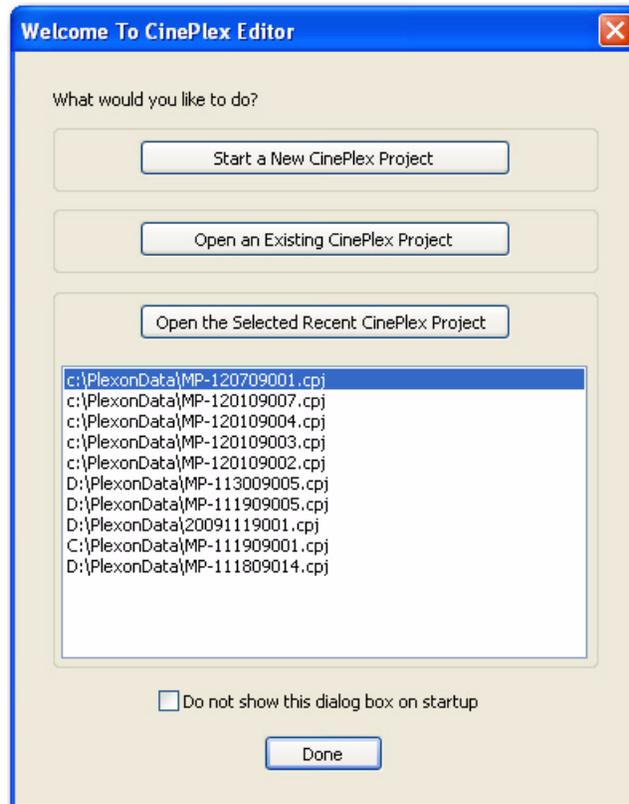
Chapter 5

CinePlex Editor Reference

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5.1 Overview

This chapter contains detailed reference information about menus, toolbars, dialog boxes, and windows for **CinePlex Editor**. By default, the **Welcome To CinePlex Editor** dialog box appears when **CinePlex Editor** starts. This dialog box provides streamlined access to operations that are also available under the **File** menu.

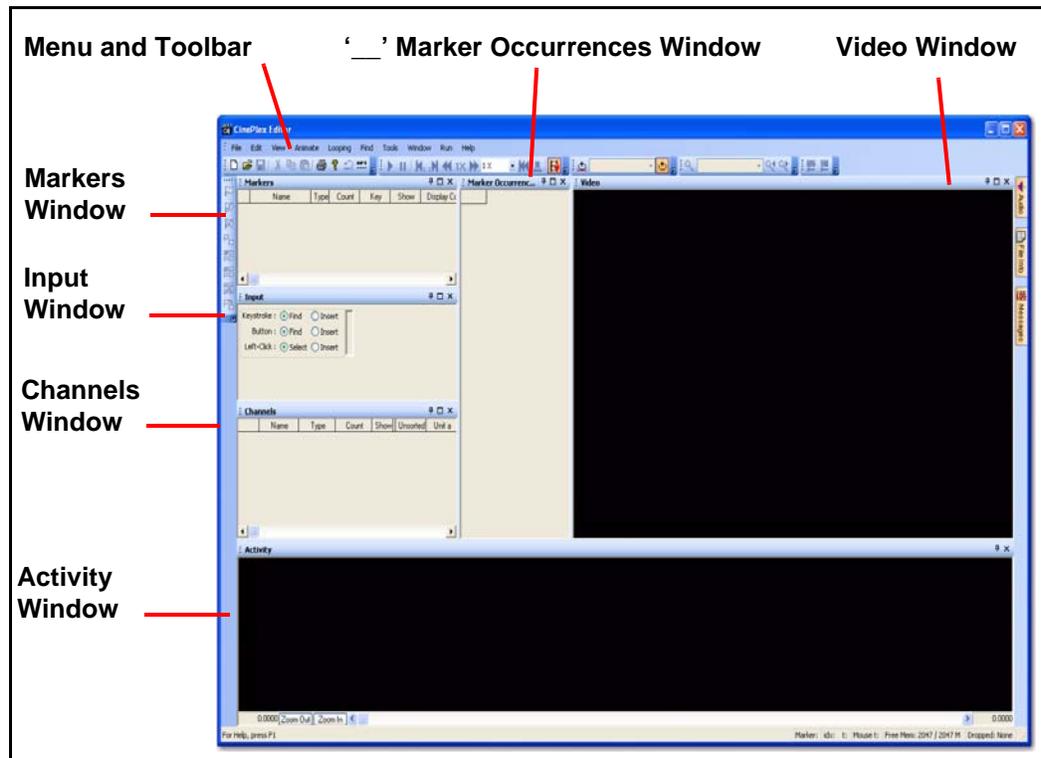


- **Start a New CinePlex Project** - This button starts the **New Project Wizard**, which assists in setting up a new CinePlex project. See “[New Project](#)” on page 235.
- **Open an Existing CinePlex Project** - This button opens a file browser that allows selection of an existing CPJ file.
- **Open the Selected Recent CinePlex Project** - This button operates on the list box of the most recently used CPJ files. Select one and click **Open the Selected Recent CinePlex Project** to load that project. Alternately, double-click the project CPJ file in the list box to open it.

The user can choose whether or not the welcomes dialog box appears after **CinePlex Editor** is started; to prevent the dialog box from appearing, click **Do not show this dialog box on startup**. To have the dialog box reappear, from the **Tools** menu, click **Options**, click the **Display** tab, and select **Initially show 'Welcome To CinePlex' Dialog Box**.

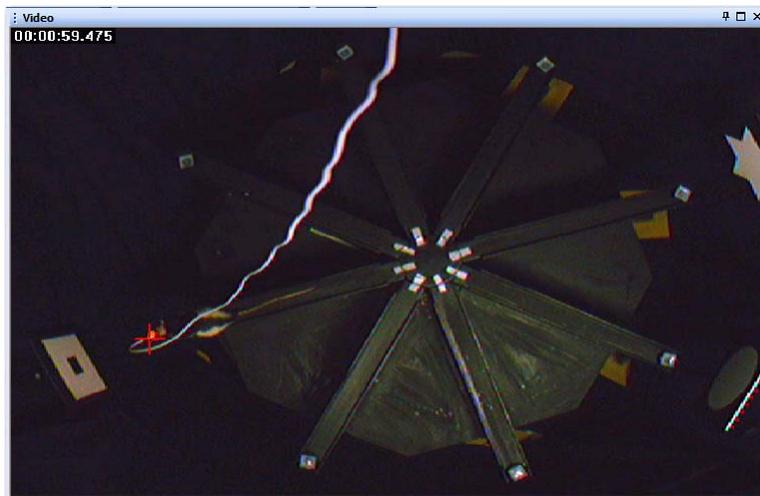
5.2 Main Window

This section describes the **CinePlex Editor Main** window as shown below.



5.2.1 Video Window

The **Video** window by default is in the upper-right corner of the main window.



5.2.1.1 Function

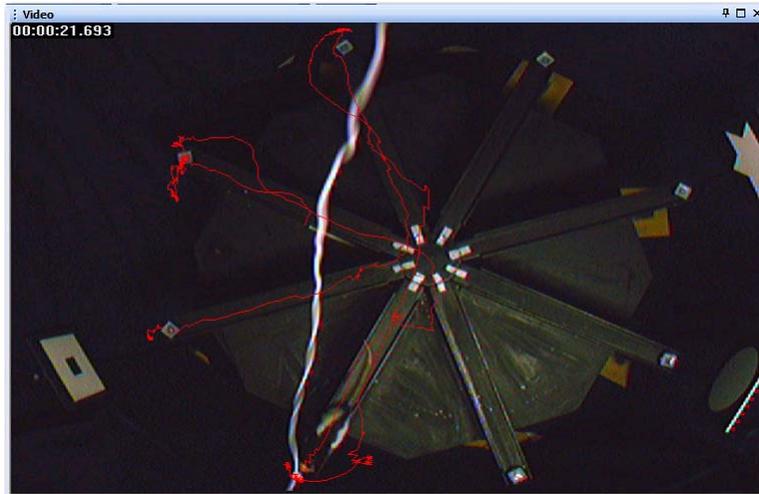
The **Video** window displays the current frame of the video file. If the timecode and/or filename were inserted into the video, they are also displayed.

5.2.1.2 Features

Features of the **Video** window include:

- **Customizable Window** - The user may customize the user interface. **CinePlex Editor** features a docking window architecture (see “[Windows](#)” on [page 6](#)) that enables the user to
 - float individual windows to any location
 - dock windows to various positions
 - close windows as needed
 - resize windows by clicking and dragging the splitter bars that divide them.
- **Resizable Video** - By default, the **Video** window stretches or shrinks the native video resolution (typically 640 X 480) to match the size of the **Video** window. The user may also configure it to always show the video at its native resolution regardless of the size of the **Video** window by unchecking the **Resize Video to Fit Window** item on the right-click menu.
- **Coordinate Marker Crosshairs** - If coordinate markers are present with their **Show** checkboxes selected, the coordinates in effect for the current video frame appear as crosshairs superimposed over the video image. The crosshairs appear in the display color set for the coordinate marker. The range for coordinates is always (0,0) to (1023,767) with (0,0) being in the lower-left corner, regardless of the video resolution. Before plotting the crosshairs, **CinePlex Editor** scales the marker coordinates to the video resolution. Also, the coordinates that appear in the **Video** window are always those that are relevant for the frame in the display—not necessarily the selected marker occurrences. That is, if different coordinate marker occurrences are selected in the **Marker Occurrences** window, in general it does not change the coordinate crosshairs shown in the **Video** window. Note that if coordinates have not been computed or supplied for a frame, the values for the prior frame are used.
- **Grid Lines** - The user has the option of showing grid lines overlaid on the video and also determining the spacing and color of the grid lines.
- **Tails** - While the video plays, it is possible to show the crosshairs with a *tail* line that shows the coordinate positions of previous frames. The length and width of this tail may be configured. By default, the tail changes color according to the age of the points. The tail color results from a blending of the marker color with another specified color; the blending amount increases for older points. If a **Fade-to Color** similar to the background color of the video is chosen, a *fading* effect is created that makes the tail appear to fade away. If the current time frame is rapidly advanced by using either the find functions or the Activity window scroll bar, **CinePlex Editor** can produce a confusing display for the rendered tails. In this case, from the right-click menu, select **Clear Tails** to erase the tail. Also, the user may draw a complete version of the tail by selecting **Show Complete Tail** from the right-click menu. The

Show Complete Tail feature is useful, for example, for determining the locations visited by the tracked animal. If the mouse pointer is moved outside of the **Video** window, the complete tail is erased. This menu item shows a line connecting the coordinates for all marker occurrences for the Coordinates marker, as shown in the following illustration:

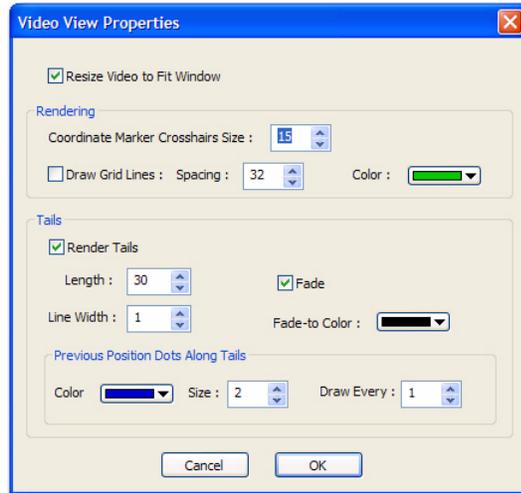


5.2.1.3 Video Right-click Menu

The right-click menu allows changing of the behavior of the window, which includes controlling the tail rendering and stretching the video. Click the right mouse button to open the right-click menu for the **Video** window:



- **Resize Video To Fit Window** - When checked, this item resizes the video to fit the **Video** window. When unchecked, the video appears at its native resolution regardless of the size of the **Video** window.
- **Clear Tails** - Clicking this item clears the tails from the video window if the **Render Tails** checkbox has been set on the **Video View Properties** dialog box.
- **Show Complete Tail** - Clicking this item shows the complete tail from the whole video file if the **Render Tails** checkbox has been set on the **Video View Properties** dialog box.
- **Properties** - Clicking this item opens the **Video View Properties** dialog box. The properties are discussed below.



- **Resize Video to Fit Window** - This item stretches or shrinks the video to fit the size of the **Video** window. If not checked, the video is shown at its native resolution of 640x480 pixels.
- **Rendering** - This area contains items that controls how the video is presented in the Video window:
 - **Coordinate Marker Crosshairs Size** – This item controls the size of the crosshairs drawn at the current Coordinates marker position.
 - **Draw Grid Lines** – This item draws a grid of lines over the Video window.
 - **Spacing** – This item controls the spacing of the grid lines, which appear in Coordinates marker units of (0,0) to (1023,767).
 - **Color** – This item controls the color of the grid lines. Select a color from the drop-down list.
- **Tails** - This area contains items that control the appearance of the tracking tell tails:
 - **Render Tails** – This item toggles on or off the rendering of the tails that show previous Coordinates marker positions.
 - **Length** – This item controls the length of the tails, which is measured by the number of previous positions that appear in the window.
 - **Line Width** – This item controls the width of the line used to draw tails, which is measured in marker occurrences.
 - **Fade** – This item controls whether or not the tail fades away.
 - **Fade-to Color** – This item controls the color to which the tails fade. Fading occurs as follows:

The color drawn at point p in the tail, where $p = 0$ for the current position and $p = L$ (**Length**) for the oldest position is:

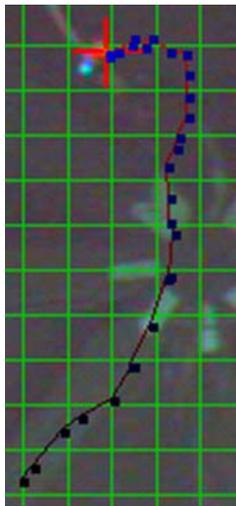
the rendered color at $p = (p/L) \times FC + (1 - (p/L)) \times DC$

where

DC = display color for the current Coordinates marker

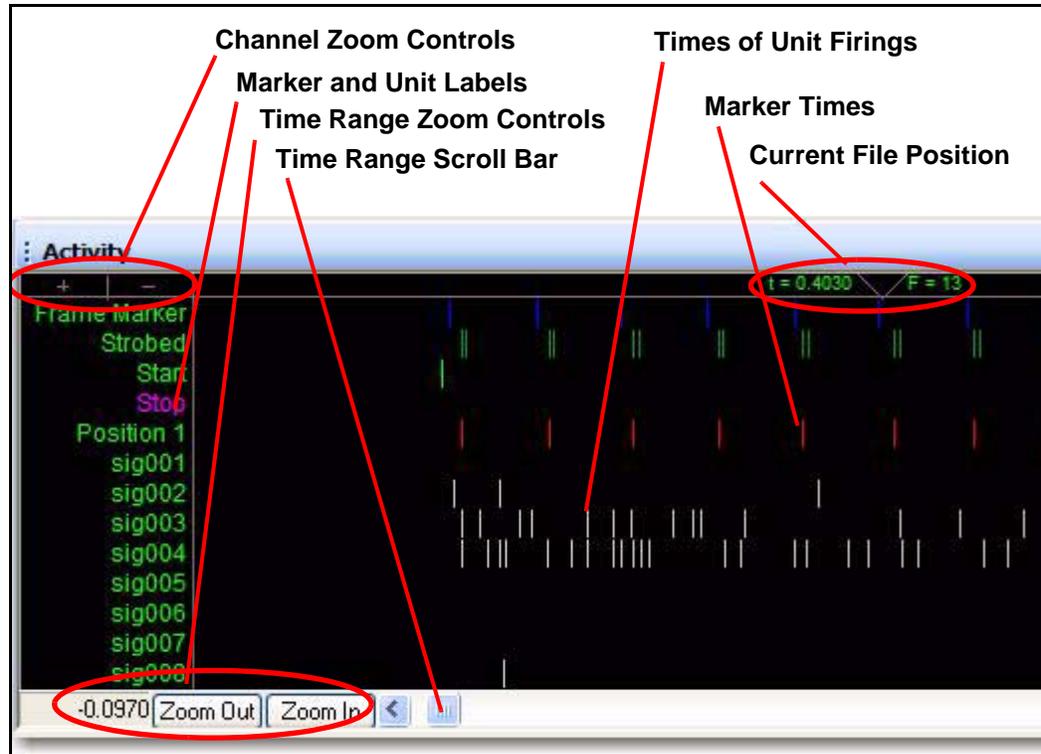
FC = **Fade-to Color**

- **Previous Position Dots Along Tails** – This area contains the items that control the rendering of the small dots that indicate the previous positions:
 - **Color** – This item controls the color of the small dots at the coordinates of previous marker occurrences.
 - **Size** – This item controls the size in marker occurrences of the small dots at the coordinates of previous Coordinates marker occurrences.
 - **Draw Every** – This item controls a factor that only draws a dot at every N th previous position.
 - The illustration below shows a segment of the **Video** window with larger previous-position dots and **Draw Grid Lines** enabled.



5.2.2 Activity Window

In many ways, the Activity window is the heart of **CinePlex Editor**. The default docking position is at the bottom of the main window. This truncated view shows each important item or area in the **Activity** window.



5.2.2.1 Function

The **Activity** window displays markers and marker occurrences against their associated timelines.

5.2.2.2 Features

This section describes the various elements in the **Activity** window as shown in the illustration above.

- **Channel Zoom Controls** - The vertical zoom buttons appear at the left side under the top banner of the **Activity** window, as the illustration below shows. Click + to vertically *zoom in* on the display so that fewer time-lines appear, but each time-line is taller. This is the equivalent of selecting **Zoom In to Show Fewer Time-lines** from the right-click menu. Click – to *zoom out*, which is the equivalent of selecting **Zoom Out to show More Time-lines** from the right-click menu. The user may also vertically scroll the time-lines in any of the following ways:
 - If the mouse has a wheel, by rotating it. This works when the mouse pointer is positioned anywhere inside the **Activity** window.

- By pressing the PAGE UP or PAGE DOWN keys
- By dragging in the vertical direction in the label area



- **Marker and Unit Labels** - A label for each time-line appears on the left side of the **Activity** window. The user may resize the label area by dragging the dividing line between it and the rest of the window. By default, CinePlex Editor selects the **Automatically Adjust Label Area Width** item in the right-click menu, which means that the dividing line continually adjusts so that the labels fit into the label area. To keep the size of the label area constant, click to clear the **Automatically Adjust Label Area Width** item in the right-click menu; this means the beginning of larger marker names can get truncated. If the divider line is dragged, CinePlex Editor automatically clears the **Automatically Adjust Label Area Width** item.
- **Time Range Zoom Controls** - The bottom of the **Activity** window contains the **Zoom Out** button, the **Zoom In** button, and the scrollbar for expanding, contracting, and moving the time range displayed by the Activity window. Each end contains boxes showing the current minimum and maximum extents of the displayed time range in seconds.
- **Time Range Scroll Bar** - Use the scroll bar at the bottom of the display to move the time span of the display. When the scroll bar is moved, the video frame that appears in the **Video** window is always updated to remain synchronized with the **Activity** window.
- **Times of Unit Firings, Marker Times** - The central area of the **Activity** window shows the times of marker occurrences and unit firings as colored tick marks that are arranged along horizontal **time-lines**. By default, **CinePlex Editor** provides a horizontal time-line on the display for each marker or spike channel whose **Show** column is checked in the **Markers** window or the **Channels** window. The color of the marker ticks results from the display-color setting in the Markers window. The colors of the tick marks on the time-lines for spike channels correspond to the unit classification of each spike. The user may set the colors to associate with each unit; to do so, from the **Tools** menu, select **Options** and click the **Colors** tab. Also, if their respective **Show** column in **Channels** window is checked, **CinePlex Editor** provides line traces on the display for continuous data channels. To improve clarity, the **Activity** window devotes twice as much vertical space to the continuous data channels than it does to the marker or spike channels. The user may drag the dividing line that separates the central area from the top banner. The user may also drag a selected marker occurrence to a different time. To drag a marker occurrence to a new time, hold down the **SHIFT** key, click the marker occur-

rence, and drag it to a new time. For Interval-type markers, the start and end times may be independently adjusted. For more information on the **Activity** window, see “[Selecting and Editing Marker Occurrences](#)” on page 196. When **CinePlex Editor** is appropriately configured, click the mouse in the **Activity** window to perform the following actions:

- Select the marker occurrence for the currently selected marker nearest in time (default). Double click to select a new current marker.
 - Add a new marker occurrence
 - Change the timestamp of an existing marker occurrence
- **Current File Position** - The top banner contains the *now* triangle, which denotes and displays the current time (or current file position). The current time indicator (*now* triangle) is the white triangle in the following illustration. The current time (**t**) in seconds appears to the left of the triangle, and the current video frame (**F**) number appears to the right of it. By default, CinePlex Editor positions the triangle in the center of the Activity window, but it can be dragged to a new location in the top banner. This causes the Activity window to display an asymmetric range for the activity surrounding the triangle. For example, from 1 second before to 3 seconds after the triangle position. The user may control the time range shown. The range surrounds the current time, which is denoted by the small triangle at the top of the display. The text next to the triangle shows the current time (in seconds) and the current frame number. The user may click and drag the current time triangle to a different position within the window of time shown.

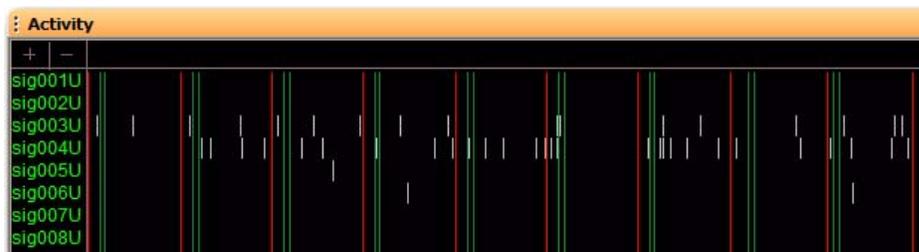


5.2.2.3 Activity Right-click Menu

The **Activity** window has many options that can be controlled by using the right-click menu.



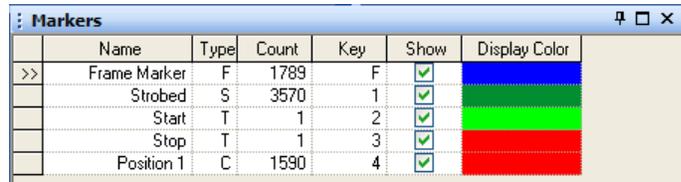
- **Automatically Adjust Label Area Width** - This item causes the dividing line between the labels on the left and the central portion of the view to automatically adjust to accommodate the longest marker name.
- **Show Unsorted Spikes** - Selected by default, this item shows tick marks for unsorted spikes in the color chosen to represent unsorted spikes, or else the spikes do not appear.
- **Hide Invalidated Spikes** - Selected by default, this item hides tick marks for invalidated spikes; clearing this item causes tick marks to appear in a dark grey color.
- **Show All Units for a Channel on One Time-line** - Selected by default, this item plots each spike channel with a single time-line, and plots spikes with different units from that channel on the same time-line, but with different colors according to their unit classification. Clearing this item causes each unit to appear on a separate time-line. The channel name plus a letter of the alphabet denoting the unit appear as a label for the per-unit timelines. That is, if the channel *sig001* has two defined units and some unsorted spikes and if **Show Unsorted Spikes** is checked, there are 3 time-lines for that channel, which appear as *sig001U* (unsorted), *sig001a*, and *sig001b*.
- **Show Markers Across All Time-lines** - Normally, each marker appears as its own time-line in the display. Select this item to make each marker appear as a vertical line drawn across all of the other channels. This arrangement makes it somewhat easier to tell when marker occurrences happened with respect to spikes. The following illustration shows the **Activity** window with the **Show All Units for a Channel on One Time-line** item cleared and the **Show Markers Across All Time-lines** item selected:

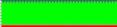


- **Show Markers On Top Time-lines** - Selected by default, this item shows the time-lines for the markers at the top of the view, before the spike or continuous channel time-lines. Clearing this item causes the marker channels to appear at the bottom. This item is only relevant if the **Show Markers Across All Time-lines** item is cleared.
- **Show Line for Each Time-line** - This item draws a horizontal line in the middle of each time-line.
- **Zoom Out ..., Zoom In to Show Fewer Time-lines** - As previously discussed, this item shows more or fewer time-lines.

5.2.3 Markers Window

The **Markers** window is the central location for information about markers. The illustration below shows the **Markers** window.



	Name	Type	Count	Key	Show	Display Color
>>	Frame Marker	F	1789	F	<input checked="" type="checkbox"/>	
	Strobed	S	3570	1	<input checked="" type="checkbox"/>	
	Start	T	1	2	<input checked="" type="checkbox"/>	
	Stop	T	1	3	<input checked="" type="checkbox"/>	
	Position 1	C	1590	4	<input checked="" type="checkbox"/>	

5.2.3.1 Function

The **Markers** window shows a quick overview of the important properties of the markers defined in the current project, and it provides easy access to all marker-related operations.

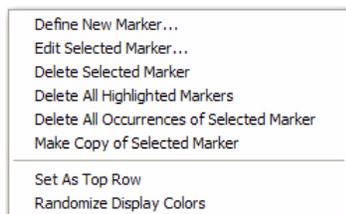
5.2.3.2 Features

A >> in the leftmost column indicates the currently selected marker. The columns in the **Markers** window show the following information about each marker:

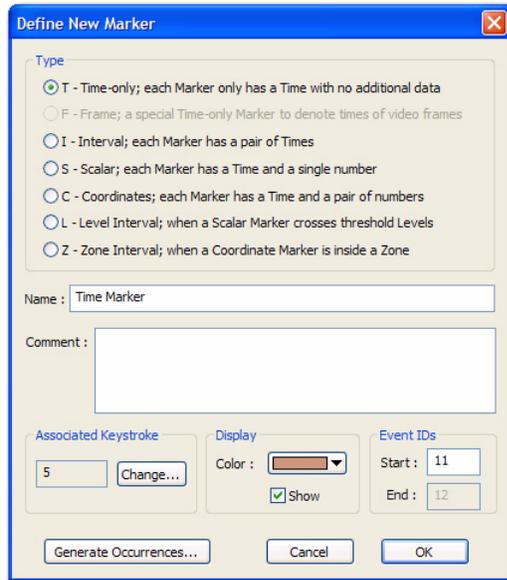
- **Name** – Shows the name given to each marker.
- **Type** – Indicates the marker type, as listed in “Table 5-1” on page 5-278.
- **Count** – Shows the number of occurrences of this marker.
- **Key** – Indicates the keyboard key associated with the marker.
- **Show** – When selected, this item displays the occurrences of this marker in the **Activity** window, and also in the **Video** or **Scalar** windows as appropriate for the marker type.
- **Display Color** – Shows the color used to display occurrences of this marker in the **Activity**, **Video**, or **Scalar** windows. Click a marker in the **Display Color** column to open a color selection dialog box, which allows changing the display color for a marker.

5.2.3.3 Markers Right-click Menu

Right-clicking the mouse in the **Markers** window opens a right-click menu.



- **Define New Marker** - This item opens the **Define New Marker** dialog box.



- **Type** - In the **Type** area, select a marker type for the new marker. For a description of all marker types, see “[Table 5-1](#)” on page 5-278. Under most circumstances, a new Frame marker cannot be created.
- **Name** - Enter a unique name for the new marker. Marker names must be unique.
- **Comment** - This is an optional box in which a free-form comment that describes the new marker may be typed.
- **Associated Keystroke** - This area identifies the keystroke that is associated with this marker, which can be used for finding or inserting new marker occurrences. **CinePlex Editor** suggests an unused key; click **Change** to open the **Assign Key** dialog box and select a different key. When the dialog box appears, press the key to associate and click **OK**.

Note: Only single-keystrokes (not CTRL- or ALT- key combinations) can be associated with Markers.

- **Display** - This area identifies the display color and the show setting for the marker.
 - **Color** – This box shows the display color for this marker in various windows. The user may also set the color directly in the Marker window.
 - **Show** – This item toggles the appearance of the Marker in various windows. The user may also set this item directly in the Marker window.
- **Event IDs** - This area shows the **Event IDs** associated with the marker. Use these IDs only when this marker is exported to a PLX file. These event IDs are the Plexon external event IDs that represent this marker

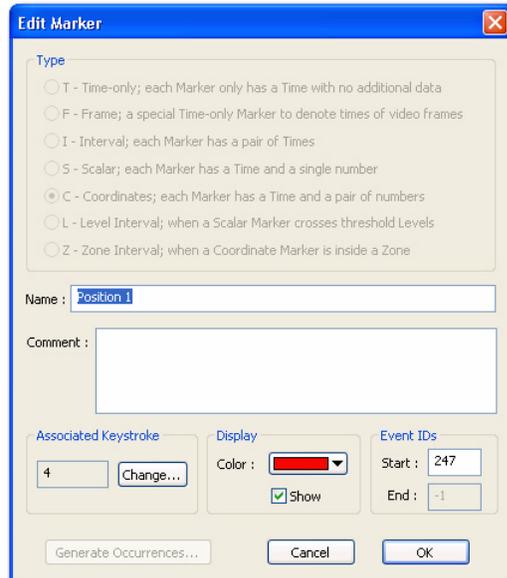
in the PLX file. For interval-type markers, a second event ID must be specified to represent the end time for the interval.

Note: These IDs must be unique across all markers. **CinePlex Editor** suggests an unused and unique value for these IDs, so they do not usually require immediate attention when the marker is first created. If the data is exported to a PLX file, there will be an opportunity to change these event IDs.

Note: The user may also click **Generate Occurrences** to have **CinePlex Editor** create the marker and also automatically populate the new marker with algorithmically-generated marker occurrences. The available methods for automatically populating the marker with marker occurrences varies by marker type; for a description, see [“Automatically Generating Marker Occurrences” on page 183](#).

— **OK** - Click **OK** to close the dialog box and create the new marker.

- **Edit Selected Marker** - This item opens the **Edit Marker** dialog box.



Note: The user may also open the **Edit Marker** dialog box from the right-click menus in the **Markers** and **_Marker Occurrences** windows.

The marker type cannot be changed for an existing marker. However, it is possible to change the following marker items:

- **Name** - Enter a unique marker name. Marker names *must* be unique. Duplicates are not accepted during the **Add Marker** process.
- **Comment** - Add, add to, or edit a free-form comment that describes the marker.
- **Associated Keystroke** - This area identifies the keystroke that is associated with this marker; click **Change** to open the **Assign Key** dialog

box and select a different key. When the **Assign Key** dialog box appears, press the key to associate and click **OK**.

Note: Only single-keystrokes can be associated with markers. CTRL- or ALT- key combinations are not valid.

- **Display** - This area identifies the display color and the show setting for the marker.
 - **Color** – This box shows the display color of this marker in various windows. Select a new color from the drop-down list.
 - **Show** – This item toggles the appearance of the marker in various windows. Change as needed.
- **Event IDs** - This area shows the **Event IDs** associated with the marker. These event IDs are used when this marker is exported to a PLX file; for more information, see **Event IDs** on [page 5-246](#). Change the event IDs as needed.
- **Delete Selected Marker** - This item deletes the selected marker and all of its occurrences.
- **Delete All Highlighted Markers** - This item deletes all selected markers and all of their occurrences.
- **Delete All Occurrences of Selected Marker** - This item deletes all of the occurrences of the selected marker, but does not delete the selected marker.
- **Make Copy of Selected Marker** - This item copies the selected marker to the clipboard.
- **Set As Top Row** - Sets the highlighted items in the **Show** or **Display Color** columns to the same value or color as the topmost value.
- **Randomize Display Colors** - Sets random colors for all of the **Display Color** items.

5.2.4 Input Window



5.2.4.1 Function

The **Input** window consists of an area of option buttons (left side of window) and an array of marker buttons (right side of window). The option buttons control the operation occurring with keystrokes, the marker buttons, or the left mouse button.

5.2.4.2 Features

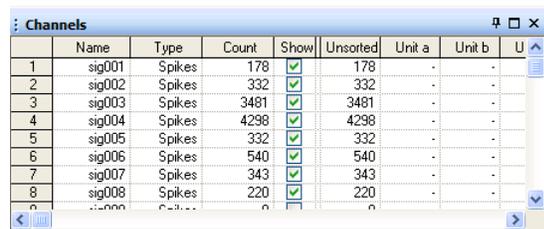
The **Input** window includes selections for the following three actions:

- **Keystroke** – The user may bind a keystroke to the current marker, which can be used to **Find** the next occurrence of the marker or **Insert** a new occurrence of the marker.

Note: If **CinePlex Editor** is in looping mode (see “[Understanding Looping](#)” on page 174), the search for the next marker occurrence wraps around the end of the file and continues the search at the beginning.

- **Button** – Specific marker buttons appear in the array on the right side of the **Input** window. Click a marker button to **Find** the next occurrence of the marker or **Insert** a new occurrence of the marker.
- **Left-Click** – This item refers to a click of the left mouse button in the **Activity** window. **Select** finds the nearest occurrence of the selected marker. **Insert** inserts a new occurrence of the selected marker at the time corresponding to the mouse pointer position when the left mouse button is clicked.

5.2.5 Channels Window



	Name	Type	Count	Show	Unsorted	Unit a	Unit b	U
1	sig001	Spikes	178	<input checked="" type="checkbox"/>	178	-	-	-
2	sig002	Spikes	332	<input checked="" type="checkbox"/>	332	-	-	-
3	sig003	Spikes	3481	<input checked="" type="checkbox"/>	3481	-	-	-
4	sig004	Spikes	4298	<input checked="" type="checkbox"/>	4298	-	-	-
5	sig005	Spikes	332	<input checked="" type="checkbox"/>	332	-	-	-
6	sig006	Spikes	540	<input checked="" type="checkbox"/>	540	-	-	-
7	sig007	Spikes	343	<input checked="" type="checkbox"/>	343	-	-	-
8	sig008	Spikes	220	<input checked="" type="checkbox"/>	220	-	-	-
9	<input type="checkbox"/>	...	-	-	-

5.2.5.1 Function

The **Channels** window displays all of the channels in the neural data file and their associated properties.

5.2.5.2 Features

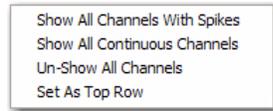
The columns in the **Channels** window list the following information for each channel:

- **Name** – Shows the name of the channel
- **Type** – Indicates the type of channel, either spike or continuous
- **Count** – Shows the number of spikes for spike channels, or the number of samples for continuous channels
- **Show** – When selected, shows the spikes or continuous data from that channel in the **Activity** window
- **Unsorted, Unit a, b, c, ...** – Indicates the number of spikes in the channels that are unsorted, or that belong to Unit a, Unit b, etc.

Note: By default, if the **Show** checkbox is clear, any continuous data channels in the neural data file do not appear in the **Activity** window.

5.2.5.3 Channels Right-click Menu

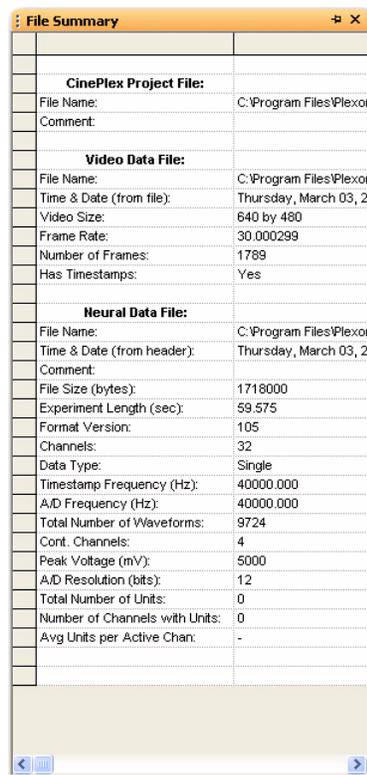
Clicking the right mouse button will open a right-click menu with the following items:



- **Show All Channels With Spikes** - Clicking this item resets the window to show all channels with spikes.
- **Un-Show All Channels** - Clicking this item resets the window to hide all channels.
- **Show Only Selected Channel** - Clicking this item resets the window to only show the selected channel.
- **Set As Top Row** - Clicking this item sets selected columns to the same value as the same columns in the top row.

5.2.6 File Info Window

The **File Info** window does not appear by default. To open the **File Info** window, from the **View** menu, select **File Info View**.



5.2.6.1 Function

The **File Info** window shows various items of information about the neural data files and video files that are currently loaded into **CinePlex Editor**.

5.2.6.2 Features

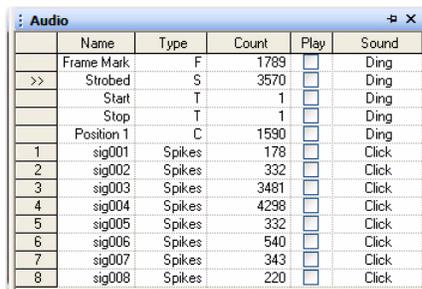
The File Info window contains the following items:

- **CinePlex Project File** - This area contains information about the currently opened CinePlex project file.
 - **File Name:** - This item contains the name of the project file.
 - **Comment:** - This editable item contains comments about the project file.
- **Video Data File** - This area contains information about the currently opened video data file.
 - **File Name:** - This item contains the name of the video data file.
 - **Time & Date (from file):** - This item contains the time and date that the video data file was last modified.
 - **Video Size:** - This item contains the resolution of the video data file. Default is 640 X 480.
 - **Frame Rate:** - This item contains the frame rate of the video data file. Default is 30 frames per second.
 - **Number of Frames:** - This item contains the total number of frames in the video data file.
 - **Has Timestamps:** - This item indicates if the frames are timestamped or not.
- **Neural Data File** - This area contains information about the currently opened neural data file.
 - **File Name:** - This item contains the name of the neural data file.
 - **Time & Date (from header):** - This item contains the time and date that the neural data file was last modified.
 - **Comment:** - This item contains comments about the neural data file. This field is not editable in the **File Info** window.
 - **File Size (bytes):** - This item contains the size of the neural data file in bytes.
 - **Experiment Length (sec):** - This item contains the duration of the experiment in seconds.
 - **Format Version:** - this item contains the format version of the file.
 - **Channels:** - This item contains the total number of channels.

- **Data Type:** - This item contains the data type. Values are **Single** or **Trodal**.
- **Timestamp Frequency (Hz):** - This item contains the frequency at which the timestamps are created. Default is 40,000 Hz.
- **A/D Frequency (Hz):** - This item contains the analog-to-digital frequency. Default is 40,000 Hz.
- **Total Number of Waveforms:** - This item contains the total number of waveforms in the neural data file.
- **Cont. Channels:** - This item contains the number of continuous channels.
- **Peak Voltage (mV):** - This item contains the peak voltage of the signals in millivolts.
- **A/D Resolution (bits):** - This item contains the analog-to-digital resolution in bits. Default is 12.
- **Total Number of Units:** - This item contains the total number of occurrences for all channels.
- **Number of Channels with Units:** - This item contains the number of channels that have units.
- **Avg Units per Active Chan:** - This item contains the ratio of **Total Number of Units** to **Number of Channels with Units**.

5.2.7 Audio Output Window

The Audio Output window is hidden by default. To open the **Audio Output** window, hover the mouse over the **Audio** tab of the sidebar tabs at the right side of the screen, select **Audio Output** from the **View** menu, or click the **Audio Output View** button on the toolbar. The illustration below shows the **Audio Output** window.



: Audio					
	Name	Type	Count	Play	Sound
	Frame Mark	F	1789	<input type="checkbox"/>	Ding
>>	Strobed	S	3570	<input type="checkbox"/>	Ding
	Start	T	1	<input type="checkbox"/>	Ding
	Stop	T	1	<input type="checkbox"/>	Ding
	Position 1	C	1590	<input type="checkbox"/>	Ding
1	sig001	Spikes	178	<input type="checkbox"/>	Click
2	sig002	Spikes	332	<input type="checkbox"/>	Click
3	sig003	Spikes	3481	<input type="checkbox"/>	Click
4	sig004	Spikes	4298	<input type="checkbox"/>	Click
5	sig005	Spikes	332	<input type="checkbox"/>	Click
6	sig006	Spikes	540	<input type="checkbox"/>	Click
7	sig007	Spikes	343	<input type="checkbox"/>	Click
8	sig008	Spikes	220	<input type="checkbox"/>	Click

5.2.7.1 Function

The **Audio Output** window controls **CinePlex Editor**'s ability to play a sound through the computer's audio system when Markers or neural spikes occur during data playback.

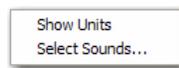
5.2.7.2 Features

The columns of the **Audio Output** window include:

- **Name** - This column contains the name of each marker.
- **Type** - This column contains the type of each marker.
- **Count** - This column contains the number of occurrences of each marker.
- **Play** - This column contains a checkbox that controls whether any sound will be played when the Markers or neural spikes of that type pass by the ‘current time’ marker during animated playback.
- **Sound** - This column contains a droplist that lists all the available sounds that **CinePlex Editor** can play. If the Play checkbox is checked, the sound selected in the Droplist will play when an occurrence of the corresponding Marker or neural spike is encountered during playback. The contents of this list can be controlled from the **Audio** tab of the **Tools | Options...** dialog, see [“Options” on page 264](#).

5.2.7.3 Audio Output Right-click Menu

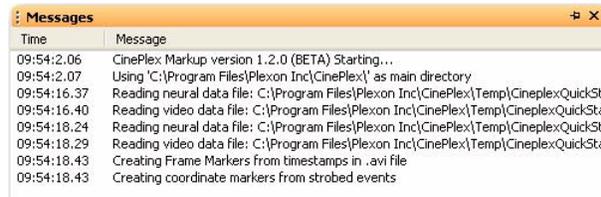
The **Audio Output Window** has a right-click context menu that contains the following menu entries:



- **Show Units** - The Audio Output view can show just one line per neural spike channel (the default). In this mode, CinePlex Editor will play the same selected sound when any spike occurs on that channel, regardless of the unit designation of that spike. When Show Units is checked, each unit on each channel gets a separate line, as shown in the above screenshot. In this mode, every unit can have a different sound mapped to it and can be independently enabled or disabled for playing. This selection is equivalent to checking or unchecking the ‘Show Units in the Audio Output Window’ checkbox on the **Tools | Options | Audio** tab.
- **Select Sounds** - Clicking this item will show the Audio tab on the **Tools | Options** dialog box, which allows loading new sounds from WAV files so that they are available for mapping to Markers or Units.

5.2.8 Messages Window

To open the **Messages** window (hidden by default), hover the mouse over the **Messages** tab of the sidebar tabs at the right side of the screen, select **Messages** from the **View** menu, or click the **Messages View** button on the toolbar.



5.2.8.1 Function

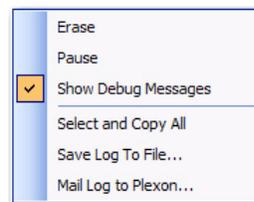
The **Messages** window displays timestamps and application events and is used for troubleshooting purposes by Plexon Support.

5.2.8.2 Features

- **Time** - This column contains timestamps of the events.
- **Message** - This column contains descriptions of the events.

5.2.8.3 Messages Right-click Menu

Right-clicking the mouse in the **Messages** window displays the right-click menu.



- **Erase** - Clicking this item erases all messages from the Messages window.
- **Pause** - If this item is checked, message logging is paused.
- **Show Debug Messages** - If this item is checked, then debug messages will appear in the Messages window. This can be useful for troubleshooting.
- **Select and Copy All** - Clicking this item selects all the messages and copies them to the clipboard.
- **Save Log to File** - Clicking this item displays a standard file save dialog box and allows the message log to be saved to a file.
- **Mail Log to Plexon** - Clicking this item will sent the messages log to Plexon for troubleshooting. Note that a mail client and associated account information must be present on the computer for E-mail to work.

5.2.9 Marker Occurrences Window

The **Marker Occurrences** window includes an entry for each occurrence of the currently-selected marker. The currently-selected marker occurrence appears with a > in the first column. Click any marker to make it the currently-selected marker. More than one **Marker Occurrences** window may be opened. The win-

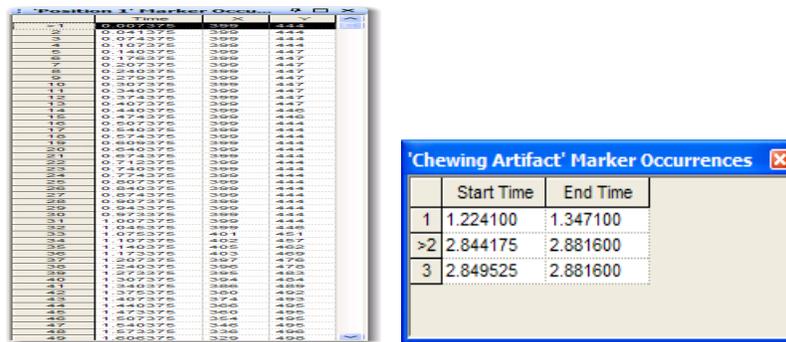
dow also changes title and columns depending on the marker type of the currently-selected marker.

5.2.9.1 Function

The function of the **Marker Occurrences** window is to display information about all occurrences of the currently selected marker.

5.2.9.2 Features

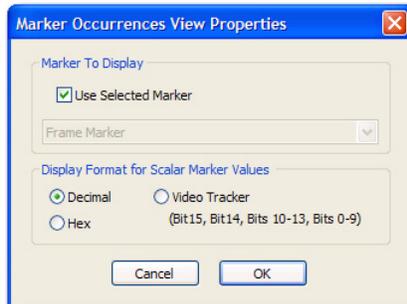
The features of the **Marker Occurrences** window will vary according to the type of selected marker. A coordinate marker will have the timestamp, an x-coordinate, and a y-coordinate while an interval marker will have the beginning timestamp and the ending timestamp as shown in the illustrations below.



-
- **Add, Edit, and Delete Marker Occurrence Menu Items** - The items in the section below ‘Go to Selected Marker Occurrence Time’ except for “Delete Highlighted Marker Occurrences” are the same as the items on the **Edit** menu. For complete information, see [“Edit Menu” on page 245](#).

There are three different ways to display marker occurrence data:

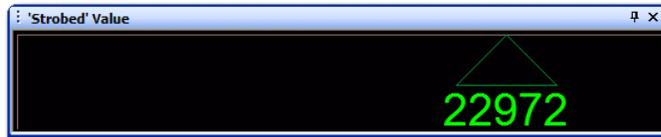
- **Show Values in Decimal** - Clicking this item displays the marker occurrence data in normal decimal format.
- **Show Values in Hex** - Clicking this item displays the marker occurrence data in hexadecimal format.
- **Show Values as VT Bit Fields** - Clicking this item displays the marker occurrence data as VideoTracker (VT) bit fields. For more information on VT bit fields, see [“Digital VideoTracker \(DVT\) Files” on page 156](#).
- **Copy and Select All** - These items function as standard Windows copy and select functions.
- **Properties** - Clicking this item displays the **Marker Occurrences View Properties** dialog box. Clicking this item enables the configuration of marker occurrence windows to show the marker occurrences of a specific marker instead of the currently selected marker. This capability may be used to display marker occurrences simultaneously for different markers on screen.



- **Marker To Display** - This area contains a drop-down list of markers. The currently selected marker appears in the dimmed list box.
- **Display Format for Scalar Marker Values** - This area contains items that control the display format for Scalar markers:
 - **Decimal** – This item displays the Scalar markers in decimal format.
 - **Hex** – This item displays the Scalar markers in hexadecimal format.
 - **VideoTracker** – This item displays the Scalar markers in Plexon VideoTracker format.

5.2.10 Scalar Window

Scalar windows do not appear by default in **CinePlex Editor**. To open a **Scalar** window, from the **View** menu, select **New Scalar View**.



5.2.10.1 Function

The **Scalar** window provides an at-a-glance graphical representation of a scalar value as a pointer arrow on a scale.

5.2.10.2 Features

The **Scalar** window re-oriens itself depending on the size of the view. If the **Scalar** window is tall and narrow, the pointer points horizontally. If the **Scalar** window is short and wide, the pointer points vertically. Like the coordinate crosshairs in the **Video** window, the position of the pointer always reflects the value for the selected marker occurrence. The numerical value also appears next to the pointer. Like the **Marker Occurrences** window, there can be multiple **Scalar** windows on the screen at once, with each one showing a different scalar marker.

5.2.10.3 Scalar Right-click Menu

Right-clicking in the **Scalar** window displays the following menu:

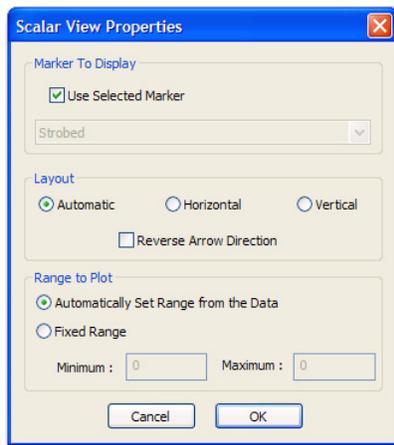


- **Reverse Arrow Direction** - By default, the **Scalar** window re-oriens itself depending on its size. If the **Scalar** window is tall and narrow, the arrow is horizontal. If the **Scalar** window is short and wide, the arrow is vertical. By default, the arrow points either left or up, but the direction may be reversed by selecting **Reverse Arrow Direction** from the right-click menu. The position of the arrow always reflects the value for the selected marker occurrence. As shown in the following illustration, the numerical value of the selected scalar marker occurrence also appears at the base of the arrow.



Like the **Marker Occurrences** window, there can be multiple **Scalar** windows on screen at once, with each one showing a different **Scalar** marker.

- **Reset Automatic Range Adjustment** - By default, CinePlex Editor automatically adjusts the range of scalar values to accommodate the range of scalar values that appear in the data as new Scalar values become current. The user may reset the range by selecting **Reset Automatic Range Adjustment** from the right-click menu, which sets the range to dynamically expand based on the subsequent values that appear. Alternately, a fixed range may be set in the **Scalar View Properties** dialog box.
- **Properties** - Clicking the **Properties** item displays the **Scalar View Properties** dialog box.

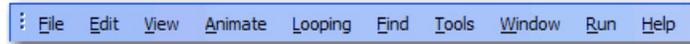


- **Marker To Display** - This area contains the items that control which marker appears in the Scalar window:
 - **Use Selected Marker** – This item displays the current value for a new marker in the Scalar window, if the marker is a Scalar type.
 - **List box** – Clearing **Use Selected Marker** causes the Scalar window to display the values of the Scalar marker that appears in the drop-down list, regardless of which marker is selected.
- **Layout** - The area contains the items that control the appearance of the Scalar window:
 - **Automatic** – This item sets the Scalar window to automatically switch its layout from horizontal to vertical based on the current size of the Scalar window. For example, if the window is taller than it is wide, a vertical layout appears, otherwise a horizontal layout appears.
 - **Horizontal** – This item sets the Scalar window to a horizontal layout, regardless of the dimensions of the Scalar window.
 - **Vertical** – This item sets the Scalar window to a vertical layout, regardless of the dimensions of the Scalar window.

- **Reverse Arrow Direction** – This item toggles the direction that the indicator arrow points between up/down for horizontal layouts and left/right for vertical layouts.
- **Range to Plot** - This area contains the minimum and maximum values to show on the scale:
 - **Automatically Set Range from the Data** – This item automatically and dynamically adjusts the range as new values are encountered in the Scalar marker occurrences. The current range being plotted always appear dimmed in the **Minimum** and **Maximum** boxes.
 - **Fixed Range** – This item allows entering specific values for the range in the **Minimum** and **Maximum** boxes.

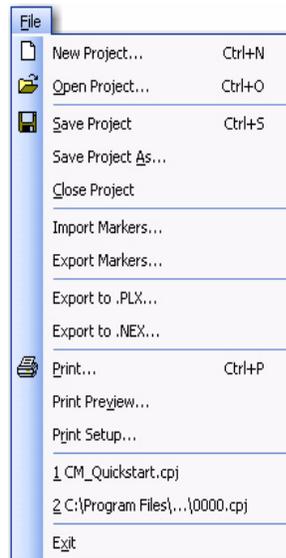
5.3 Menus

Menus provide access to **CinePlex Editor** features, commands, controls, and settings. The following sections describe each **CinePlex Editor** menu in detail. The user may also use the toolbar buttons to execute many of the commands that appear on the **CinePlex Editor** menus.



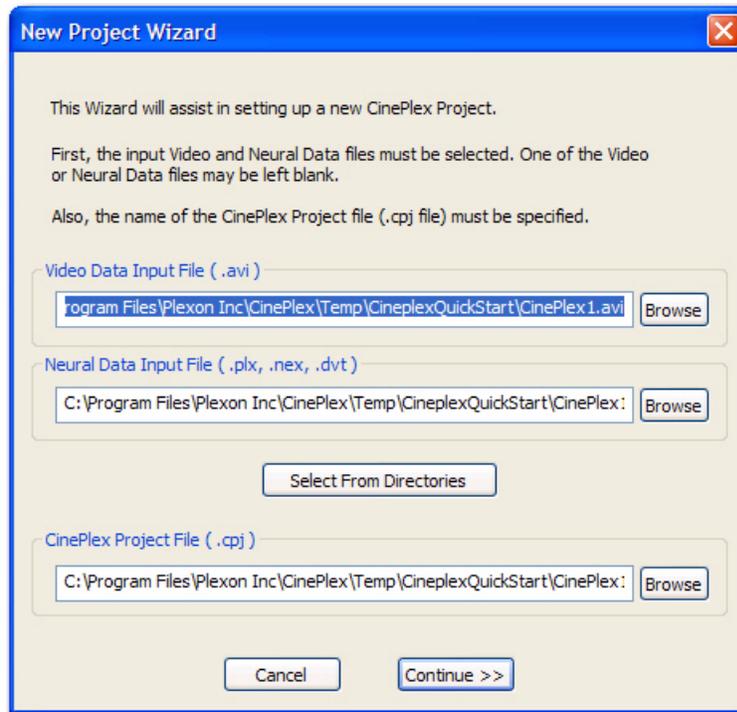
5.3.1 File Menu

The following illustration shows the **File** menu.



5.3.1.1 New Project

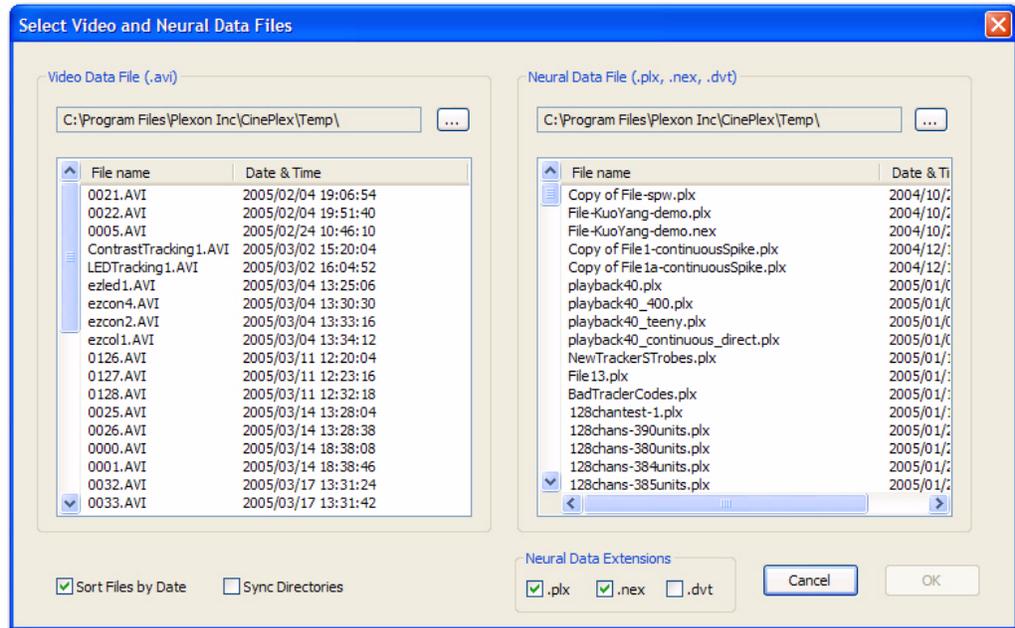
This item opens the **New Project Wizard** dialog box which proceeds through the necessary steps to set up a new project. In the **Welcome To CinePlex** dialog box, click **Start a New CinePlex Project** to open the **New Project Wizard** dialog box. Otherwise, from the **File** menu, click **New Project**.



The first box in the **New Project Wizard** dialog box helps to select filenames.

Note: Specify a video file or a neural data file, or both.

- **Video Data Input File (AVI)** - This box allows the user to specify a file-name for the video file. The video file must be an Audio Video Interleave (AVI) file.
- **Neural Data Input File (PLX, NEX, DVT)** - This box allows the user to specify a file name for the neural data file. The neural data file can be a Plexon data (PLX) file, a NeuroExplorer (NEX) file, or a digital video tracker (DVT) file.
- **CinePlex Project File (CPJ)** - This box requires the user to specify a file-name for the CinePlex Project (CPJ) file.
- **Browse** - This button allows the user to open a file selection dialog box. When one filename is selected, **CinePlex Editor** suggests names for the remaining unspecified filenames, which are based on the selected filename.
- **Select From Directories** - This button opens the **Select Video and Neural Data Files** dialog box, which provides a convenient alternative to **Browse**, where it is possible to display and match pairs of files from two directories. The **Select Video and Neural Data Files** dialog box provides list boxes for two different directories. The user may use the various features of this dialog box to create project files.

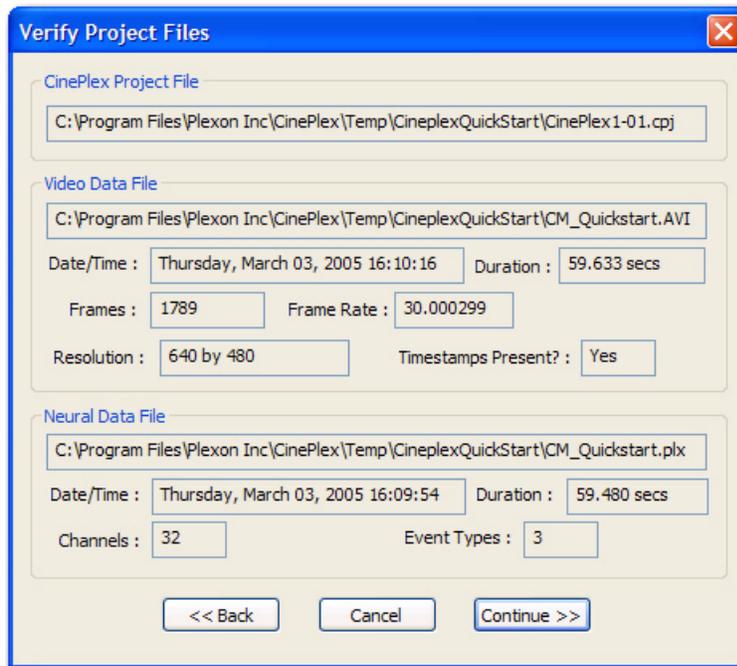


- **Video Data Input File (AVI)** - This area displays **AVI** files, file system dates, and times. Click the **...** button to select a different directory for the video data files.
- **Neural Data Input File (PLX, NEX, DVT)** - This area displays **PLX**, **NEX**, and **DVT** files, file system dates, and times. Click the **...** button to select a different directory for the neural data files.
- **Sort Files by Date** - This checkbox is checked by default and causes the files to be sorted by date. Click to clear this checkbox to sort by file name.
- **Sync Directories** - If this checkbox is checked, it forces the two directories to be identical, which can save the effort of having to reselect the same directory again if the video and neural data files happen to reside in the same directory.
- **Neural Data Extensions** - These checkboxes allow the user to select the extensions for the neural data files to appear in the list box.

Whenever a file is selected from one of the list boxes, the dialog box attempts to select the file from the other list box that best matches the file selected. This feature is very convenient for matching up the files collected using **CinePlex Studio** with their corresponding **PLX** files, because the file dates and times should be nearly the same.

When the correct files have been highlighted in the two directory listings, click **OK** to enter the selected files into the appropriate text boxes in the **New Project Wizard** dialog box. After entering the correct filenames, click **Continue >>** to open the **Verify Project Files** dialog box.

The **Verify Project Files** dialog box provides complete information on the files being entered into the project. It lists relevant information for each file type.



- **CinePlex Project File** - This box lists the project file location and name.
- **Video Data File** - This box lists the video file location and name.
- **Date/Time** - This box shows the date and time (hh:mm:ss) when the video file was saved.
- **Duration** - This box indicates the duration of the video file in seconds.
- **Frames** - This box lists the total number of frames in the video file.
- **Frame Rate** - This box indicates the frame rate at which the video was recorded.
- **Resolution** - This box shows the resolution of the video in pixels.
- **Timestamps Present?** - This box indicates **Yes** if timestamps are contained in the video file and **No** if otherwise.
- **Neural Data File** - This box lists the neural file location and name.
- **Date/Time** - This box shows the date and time (hh:mm:ss) when the neural file was saved.
- **Duration** - This box indicates the duration of the neural file in seconds.
- **Channels** - This box lists the number of data channels in the neural file.
- **Event Types** - This box lists the number of different event types contained in the neural file.

After verifying that the correct files have been selected, click **Continue >>** to exit the Wizard. **CinePlex Editor** creates the initial project file.

Note: To have the directories containing the files selected appear as the defaults the next time **CinePlex Editor** starts, from the **Tools** menu, choose **Options**, click the **General** tab, and select **Use the last directory of the previous session as Initial Directory**.



CAUTION

File Relocation

The project file stores the full paths to the video and neural data files. If the neural or video data files are moved to another location, **CinePlex Editor** cannot locate the files when reopening the project file. In this case, select the neural or video files, or both, from their new locations. Make sure to select the same files that were used in the original creation of the project file. Otherwise, the results can be very confusing.

5.3.1.2 Open Project

This item opens a standard Windows **Open** dialog box to allow choosing an existing project file (CPJ) to open.

5.3.1.3 Save Project, Save Project As, and Close Project

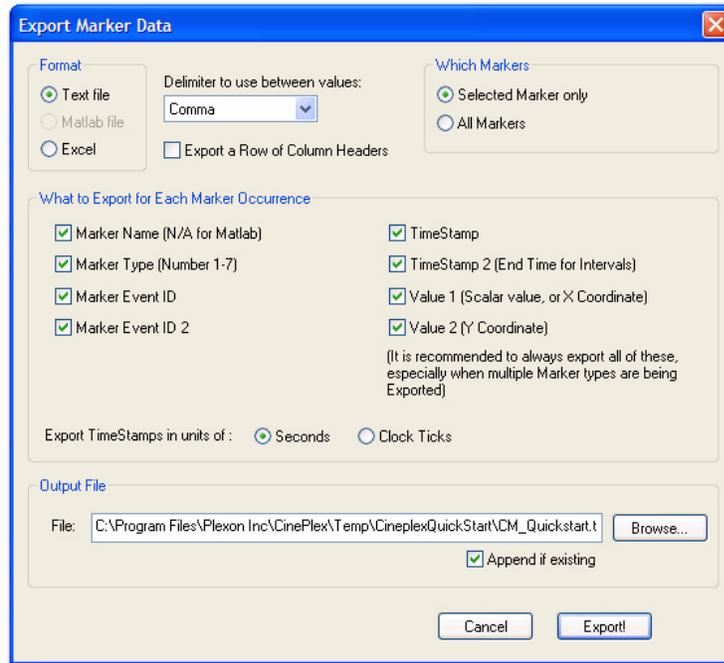
These items apply to a CPJ file and its related video file and neural data file. These commands use standard Windows dialog boxes.

5.3.1.4 Import Markers

This item opens a standard Windows **Open** file-selection dialog box. When a file is selected, CinePlex Editor imports the file to create new markers in the project; for more information, see [“Importing Markers” on page 197](#).

5.3.1.5 Export Markers

This item opens the **Export Marker Data** dialog box. The **Export Marker Data** dialog box includes all the items to set prior to exporting the file. The following illustration shows the default view of the dialog box.



- **Format** - This area provides a choice of three file types: text, Matlab, or Microsoft Excel.

Note: Matlab or Excel must be installed on the computer where **CinePlex Editor** is running to allow these to be used. If the **Matlab file** selection or the **Excel** selection, or both, appear dimmed, these format options are unavailable; install Matlab or Excel, or both, to enable them.

- **Delimiter to use between values** - This dropdown allows the user to select one of the following delimiters to use between the columns of text (if **Text File** is selected for the format):
 - Comma
 - Comma, space
 - Space
 - Semicolon
 - Tab
- **Export a Row of Column Headers** - If the user selected **Text File** or **Excel** for the format, this checkbox allows exporting the first row as a row of textual labels for each column, which can be helpful when a human is reading the exported data file.

Note: **CinePlex Editor** exports marker occurrences for all formats as one occurrence per row, or one occurrence per line for text files, and all rows have the same number of columns. The columns in each row depend on the selections made in the **What to Export for Each Marker Occurrence** area.

- **Which Markers** - The default value is **Selected Marker only**. Selecting **All Markers** causes the occurrences for all markers to be exported, which usually results in a confusing output file; in general, Plexon does not recommend this option.
- **What to Export for Each Marker Occurrence** - The selections in this area determine which columns appear for each marker occurrence (row). The available columns always appear in a fixed order; clearing a checkbox removes the column. The available items for export are:
 - **Marker Name (N/A for Matlab)** – This item includes the textual name of the marker in the exported file. The marker name is generally useful only when selecting **All Markers** to export, otherwise the marker name is the same for all marker occurrences when selecting **Selected Marker only** to export. Because the data is output to MATLAB as a two-dimensional array of doubles, this option is unavailable for the MATLAB format.
 - **Marker Type (Number 1-7)** – This item exports a number that indicates the type of the marker, as indicated in the following table:

1	Time-only
2	Frame
3	Interval
4	Scalar
5	Coordinates
6	Level Interval
7	Zone Interval

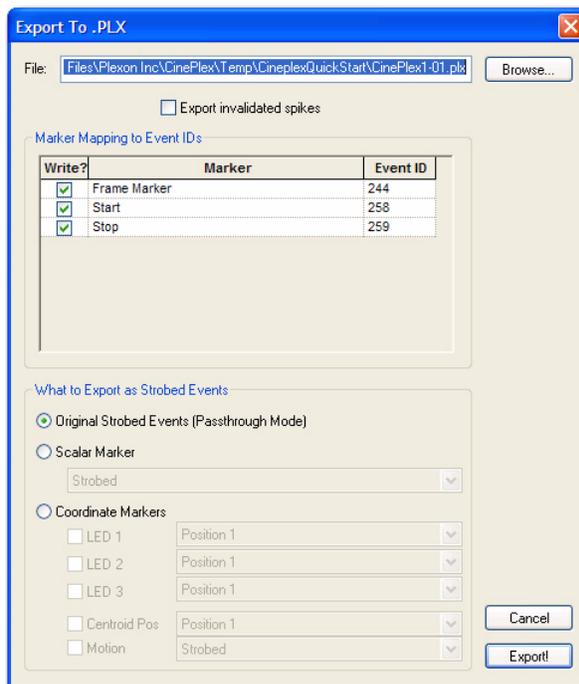
Note: For a complete explanation of the marker types, see “[Table 5-1](#)” on [page 5-278](#).

- **Marker Event ID** – This item exports the Event ID associated with this marker; for more information, see **Event IDs** on [page 5-246](#).
 - **Marker Event ID 2** - This item exports the second Event ID associated with this marker. This item applies only if the marker is an Interval, Level Interval, or Zone Interval type.
 - **TimeStamp** - This item exports the time of the marker occurrence. For Interval-type events, this is the start time.
- Note:** The user may export timestamps in units of seconds or in raw clock ticks; see “**Export TimeStamps in units of**”, which follows in this list.

- **TimeStamp2 (End Time for Intervals)** - This item is only relevant for Interval-type marker occurrences and it exports the end time.
- **Value 1 (Scalar value, or X Coordinate)** - This item exports different things, which depend on the marker type. For Scalar markers, it exports the scalar value. For Coordinate markers, it exports the X coordinate value. For all other markers, it exports -1.
- **Value 2 (Y Coordinate)** - This item exports different things, which depend on the marker type. For Coordinate markers, it exports the Y coordinate value. For all other markers, it exports -1.
- **Export TimeStamps in units of** – The user may export time stamps in one of the following units:
 - **Seconds** – This item exports the values for **TimeStamp** and **TimeStamp 2** in seconds.
 - **Clock Ticks** – This item exports the values for **TimeStamp** and **TimeStamp 2** in raw ticks of the system clock.
- **Output File** - Type or select the output file name in the **File** box. Under **Format**, if **Text file** or **Excel** is selected, click the **Append if existing** checkbox to append the marker data onto the end of a file that already exists on disk. Otherwise, the existing file is overwritten.

5.3.1.6 Export to PLX

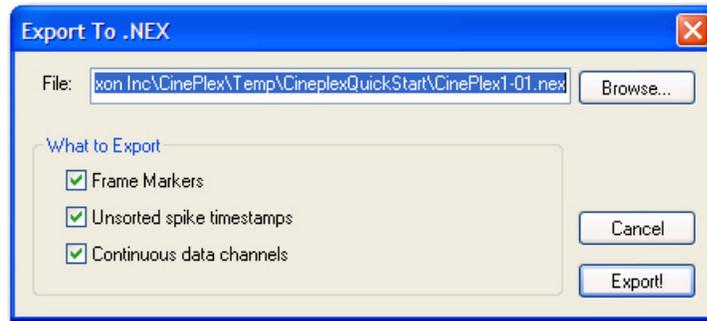
This item opens the **Export To PLX** dialog box.



-
- **File** - Type an export file name and path, or click **Browse** and select an existing file.
 - **Export invalidated spikes** - Click this checkbox to export invalidated spikes to the PLX file. Invalidated spikes appear with a unit number of 0 (unsorted).
 - **Marker Mapping to Event IDs** - This list box controls which markers appear in the output file and which event IDs represent them. Only Time-only, Frame, and Interval-type markers appear in this list box; Scalar and Coordinates markers must be represented by strobed events. To remove individual markers from the output PLX file, click to clear the **Write?** checkbox. The user may also change the event IDs by typing a new value in the **Event ID** column. There are two entries in the list box for each Interval-type marker, one for the start time and another for the end time.
 - **What to Export as Strobed Events** - Select one of these items to export:
 - **Original Strobed Events (Passthrough Mode)** – Select this item to pass unchanged the strobed event data blocks from the original neural data file through to the output PLX file. Use this mode when if not interested in representing any changes to any Scalar or Coordinates marker occurrences in the output file, or if there are not any Scalar or Coordinates data to output.
 - **Scalar Marker** – Select this item to represent the values from a single Scalar marker in the strobed events. Select the Scalar marker from the list.
 - **Coordinate Markers** – Select one of the following combinations:
 - Click **LED 1**, **LED 2**, or **LED 3** or any combination of these LEDs. For each LED, select a corresponding Coordinates marker from the drop-down list.
 - To export coordinates for the centroid position, click **Centroid Pos** and select a corresponding Coordinates marker from the drop-down list.
 - To include Motion Measure data, click **Centroid Pos** and click a corresponding Coordinates marker from the drop-down list; then click **Motion** and select a corresponding Scalar marker from the drop-down list. For more information on the Motion Measure option, see [“Motion Measure Option” on page 81](#).
 - **Export!** - Click **Export!** to close the dialog box and write the new PLX file.

5.3.1.7 Export to NEX

This item opens the **Export To NEX** dialog box.



- **File** - Type an export file name and path, or click **Browse** and select an existing file.
- **What to Export** - This area includes the following items:
 - **Frame Markers** – **CinePlex Editor** exports frame markers to the NEX file as just another marker variable. To inhibit this, click to clear the **Frame Markers** checkbox.
 - **Unsorted spike timestamps** – **CinePlex Editor** exports both sorted and unsorted spike timestamps to the NEX file by default. To export only the sorted spike timestamps, click to clear the **Unsorted spike timestamps** checkbox.
 - **Continuous data channels** – By default, **CinePlex Editor** exports any continuous channels present in the original neural data file as continuous variables to the NEX file. To prevent continuous data being written to the NEX file, click to clear the **Continuous data channels** checkbox.
- **Export!** - Click **Export!** to close the dialog box and create a new NEX file.

5.3.1.8 Print, Print Preview, and Print Setup

These items are standard Windows print commands. The **Print** command will output the CPJ file to an installed printing device.

5.3.1.9 File list

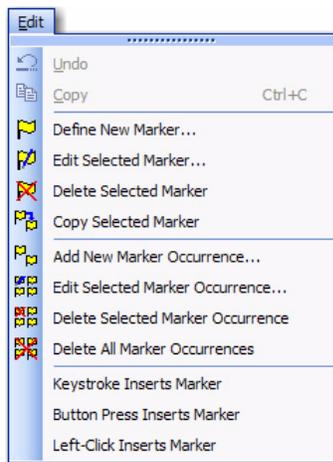
This section includes up to 10 of the most recently opened files.

5.3.1.10 Exit

This item closes all windows and exits **CinePlex Editor**.

5.3.2 Edit Menu

The following illustration shows the **Edit** menu.



5.3.2.1 Undo

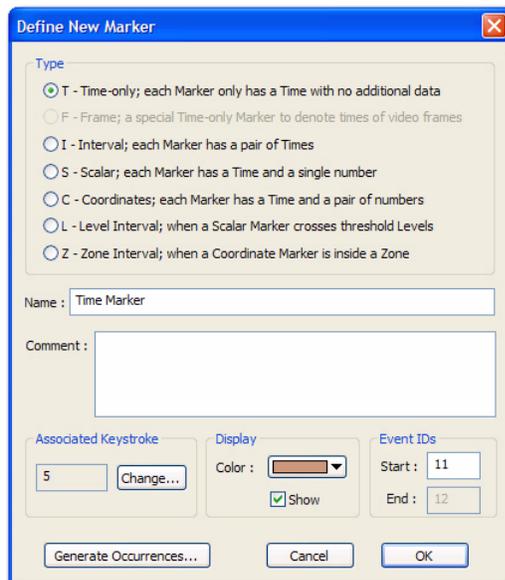
This item provides multiple undo levels. Operations that change the contents of the project file may be undone, but operations that change the user interface options or colors cannot be undone.

5.3.2.2 Copy

This item is the standard Windows copy command.

5.3.2.3 Define New Marker

This item opens the **Define New Marker** dialog box.



- **Type** - In the **Type** area, select a marker type for the new marker. For a description of all marker types, see “[Table 5-1](#)” on [page 5-278](#). Under most circumstances, a new Frame marker cannot be created.
- **Name** - Enter a unique name for the new marker. Marker names must be unique.
- **Comment** - This is an optional box in which to insert a free-form comment that describes the new marker.
- **Associated Keystroke** - This area identifies the keystroke that is associated with this marker, which can be used for finding or inserting new marker occurrences. **CinePlex Editor** automatically suggests an unused key; click **Change** to open the **Assign Key** dialog box and select a different key. When the dialog box appears, press the key to associate and click **OK**.

Note: Only single-keystrokes (not CTRL- or ALT- key combinations) can be associated with Markers.

- **Display** - This area identifies the display color and the show setting for the marker.
 - **Color** – This box shows the display color this marker in various windows. The color can also be set directly in the Marker window.
 - **Show** – This item toggles the appearance of the Marker in various windows. This item can also be set directly in the Marker window.
- **Event IDs** - This area shows the **Event IDs** associated with the marker. Use these IDs only when exporting this marker to a PLX file. These event IDs are the Plexon external event IDs that represent this marker in the PLX file. For interval-type markers, a second event ID must be specified to represent the end time for the interval.

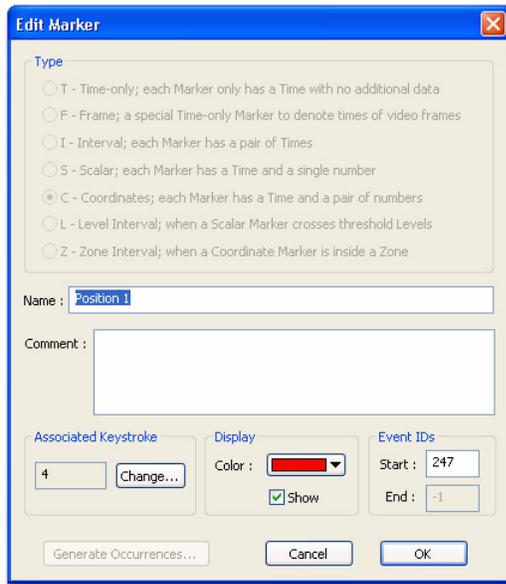
Note: These IDs must be unique across all markers. **CinePlex Editor** suggests an unused and unique value for these IDs, so they do not usually require immediate attention when first creating the marker. If exporting the data to a PLX file, there will be an opportunity to change these event IDs.

Clicking **Generate Occurrences** causes **CinePlex Editor** to create the marker and also automatically populate the new marker with algorithmically-generated marker occurrences. The available methods for automatically populating the marker with marker occurrences varies by marker type; for a description, see “[Automatically Generating Marker Occurrences](#)” on [page 183](#).

- **OK** - Click **OK** to close the dialog box and create the new marker.

5.3.2.4 Edit Selected Marker

This item opens the **Edit Marker** dialog box. An illustration of the dialog box follows:



Note: The **Edit Marker** dialog box may also be opened from the right-click menus in the **Markers** and **_Marker Occurrences** windows.

The marker type for an existing marker cannot be changed. However, it is possible to change the following marker items:

- **Name** - Enter a unique marker name. Marker names *must* be unique. Duplicates are not accepted during the **Add Marker** process.
- **Comment** - Add, add to, or edit a free-form comment that describes the marker.
- **Associated Keystroke** - This area identifies the keystroke that is associated with this marker; click **Change** to open the **Assign Key** dialog box and select a different key. When the **Assign Key** dialog box appears, press the key to associate and click **OK**.

Note: Only single-keystrokes can be associated with markers. CTRL- or ALT- key combinations are not valid.

- **Display** - This area identifies the display color and the show setting for the marker.
 - **Color** – This box shows the display color of this marker in various windows. Select a new color from the drop-down list.
 - **Show** – This item toggles the appearance of the marker in various windows. Change as needed.
- **Event IDs** - This area shows the **Event IDs** associated with the marker. These event IDs are used when exporting this marker to a PLX file; for more information, see **Event IDs** on [page 5-246](#). Change the event IDs as needed.

5.3.2.5 Delete Selected Marker

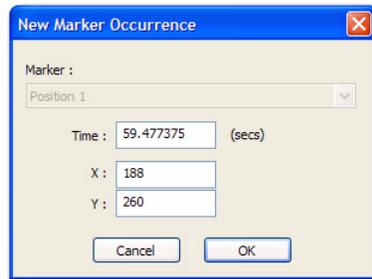
This item deletes the selected marker and all occurrences of that marker.

5.3.2.6 Copy Selected Marker

This item copies the selected marker to the clipboard.

5.3.2.7 Add New Marker Occurrence

This item opens the **New Marker Occurrence** window.

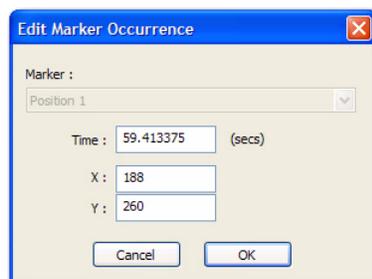


Note: **CinePlex Editor** identifies marker occurrences by their time, thus no two marker occurrences can have the same time. Adding a new marker occurrence with the same timestamp as an existing marker occurrence replaces the existing marker occurrence with the new one; that is, it is overwritten and the old data values are erased. Editing an existing marker occurrence by changing its timestamp to be the same as another existing marker occurrence replaces the existing marker occurrence.

- **Marker** - This box shows the marker for which a new occurrence is being added.
- **Time** - This is time of the new marker occurrence and its related data values. The data values depend on the marker type. For example, for Coordinates markers, the **X** and **Y** data values appear as shown in the illustration, but for Interval markers, start and end times appear.

5.3.2.8 Edit Selected Marker Occurrence

This item opens the **Edit Marker Occurrence** dialog box.



-
- **Marker** - This box shows the marker whose occurrence is being edited.
 - **Time** - This is time of the marker occurrence and its related data values. The data values depend on the marker type. For example, for Interval markers, the start **Time** and **End Time** appear as shown in the illustration, but for Coordinates markers, X and Y data values appear.

5.3.2.9 Delete Selected Marker Occurrence

This item deletes only the selected occurrence for the marker.

5.3.2.10 Delete All Marker Occurrences

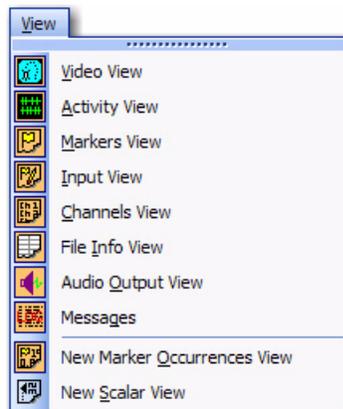
This item deletes all occurrences for the selected marker, but leaves the marker itself intact.

5.3.2.11 Keystroke ..., Button Press ..., and Left-Click Inserts Marker

These items determine which user action inserts markers. For information on marker insertion, see [“Understanding Markers and Marker Occurrences” on page 278](#).

5.3.3 View Menu

The following illustration shows the **View** menu.



All the items in this menu open or close a window in **CinePlex Editor**.

5.3.4 Animate Menu

The following illustration shows the **Animate** menu.



5.3.4.1 Play

This button automatically advances time at a rate determined by the time multiplier. Selecting **Play** when already playing causes a **Pause** condition.

5.3.4.2 Pause

This button halts the automatic advance of time. **Play** and **Pause** are mutually exclusive. Press `SPACEBAR` to toggle between **Play** and **Pause**. Selecting **Pause** when already paused resumes play.

5.3.4.3 Slower

If pressed while playing at any speed, this button slows down the rate of time progression by half until the speed is 1/256 of normal. Continued pressing reverses the direction and increases the speed.

5.3.4.4 Faster

This button speeds up the rate of time progression by a factor of 2. The `UP ARROW` key and the `DOWN ARROW` key are equivalent to the **Slower** and **Faster** buttons. Continued clicking will eventually cause the speed to reach a maximum of 256 times normal.

5.3.4.5 Reset to 1X Speed

This button sets the rate of time progression to 1X normal speed.

5.3.4.6 Step Backwards

This button advances time to the previous video frame. The `LEFT ARROW` key is equivalent to this button.

5.3.4.7 Step Forward

This button advances time to the next video frame. The `RIGHT-ARROW` key is equivalent to this button.

5.3.4.8 Rewind

This button sets the current time to the time of the first video frame.

5.3.4.9 Reverse

This button reverses the flow of time at the current time rate. If already in reverse, it goes forward.

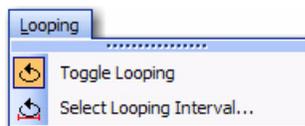
5.3.4.10 Lock to Video Frames

This button advances time by increments of whole frames only. CinePlex Editor does not change the current time at all until enough time has elapsed to make a new video frame the current frame. Then it sets the current time to be the exact time of the frame marker corresponding to that frame. This is the default mode.

Note: A potentially confusing effect occurs when **CinePlex Editor** is in **Frame Locking** mode. If the video capture was paused during acquisition so that there is a gap of time that contains no frame marker occurrences, animation appears to freeze at the point where the gap starts until enough time passes such that the next video frame is current, which can be much later. Conversely, when **CinePlex Editor** is not in **Frame Locking** mode, the animation continues smoothly through the gap and time advances without regard to video frame boundaries. The video frame remains unchanged until the next one is encountered.

5.3.5 Looping Menu

The following illustration shows the **Looping** menu.

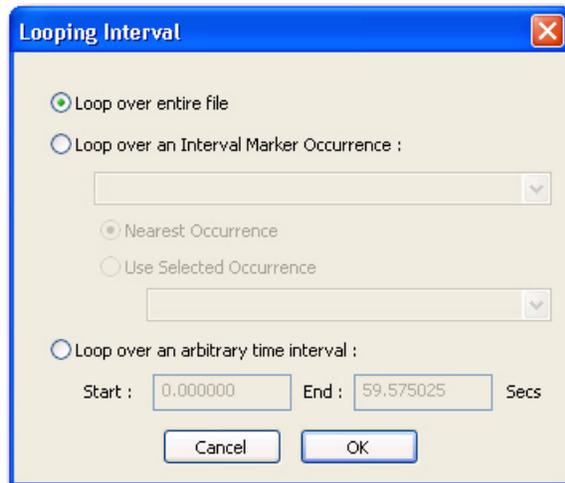


5.3.5.1 Toggle Looping

This item turns looping on or off for the interval selected in the list. Select this option to turn looping on during play back when a specific interval appears that should be reviewed. Playback loops from the beginning to the end of the interval. Click again to resume normal playback.

5.3.5.2 Select Looping Interval

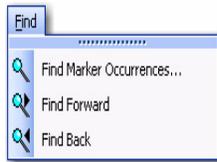
This item opens the **Looping Interval** dialog box to allow a looping interval to be defined. An illustration of the dialog box follows:



- **Loop over entire file** - This is the default selection. **CinePlex Editor** plays the file to the end and restarts from the beginning.
- **Loop over an Interval Marker Occurrence** - This selection makes **CinePlex Editor** loop over the time span defined by a specified occurrence of an interval marker. When selecting this option, choose the interval marker from the drop-down list and then choose the specific occurrence of the interval marker to loop over.
 - **Nearest Occurrence** – uses the occurrence nearest to the current time
 - **Use Selected Occurrence** – uses the specific occurrence selected from the drop-down list
- **Loop over an arbitrary time interval** - This selection makes **CinePlex Editor** loop over an arbitrary interval of time specified in the **Start** and **End** boxes. Use the Looping toolbar controls to control looping parameters; see [“Looping Toolbar” on page 274](#).

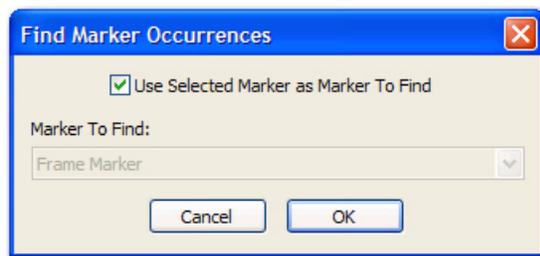
5.3.6 Find Menu

The following illustration shows the **Find** menu.



5.3.6.1 Find Marker Occurrences

This item opens the **Find Marker Occurrences** dialog box to choose which marker to find. Either find the selected marker or choose from a dropdown list. An illustration of the dialog box follows:



- **Use Selected Marker as Marker To Find** - By default, **CinePlex Editor** loads the current marker into the **Marker To Find** list box. To select another marker from the drop list, click to clear the checkbox and select another marker in the **Marker To Find** box.
- **Marker To Find** - Click to clear the **Use Selected Marker as Marker To Find** checkbox and select a marker from the drop-down list.

5.3.6.2 Find Forward

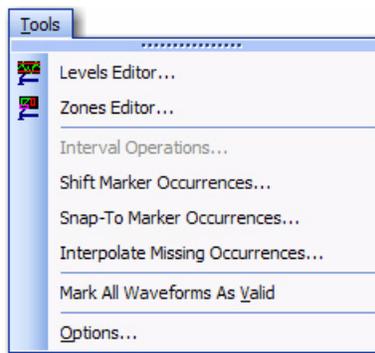
This item searches forward for the next selected marker.

5.3.6.3 Find Back

This item searches backward for the next selected marker.

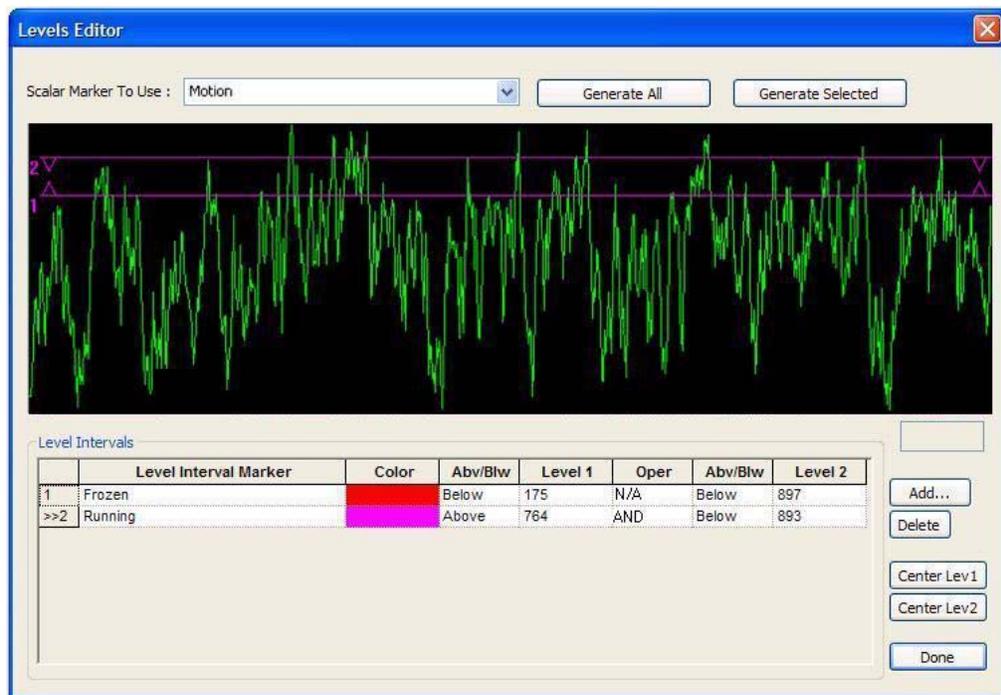
5.3.7 Tools Menu

The following illustration shows the **Tools** menu.



5.3.7.1 Levels Editor

This item opens the **Levels Editor** window. Use the **Levels Editor** dialog box to define level interval markers and generate marker occurrences for them. An illustration of the dialog box follows:



- **Scalar Marker To Use** - This box contains the scalar marker to use for generating levels.
- **Generate All** - This button generates marker occurrences for all the Level Interval markers that appear in the **Level Intervals** box.

-
- **Generate Selected** - This button generates marker occurrences for the selected level interval, which appears with a >> in the left-most column in the **Level Intervals** box.

Note: Clicking either **Generate All** or **Generate Selected** deletes all existing marker occurrences for the affected Level Interval markers, and generates a new set of occurrences according to the current Scalar marker and conditions.

The graph in the middle of the **Levels Editor** window shows the values of the selected Scalar marker as a function of time. The horizontal range of time that appears is always the entire file. The vertical scaling of the plot always adjusts to show the full range of the scalar data values. The levels appear as horizontal lines on the display, with the above or below setting for each level shown as either upward- or downward-pointing arrows on the lines. The number on the left indicates whether the line represents **Level 1** or **Level 2**.

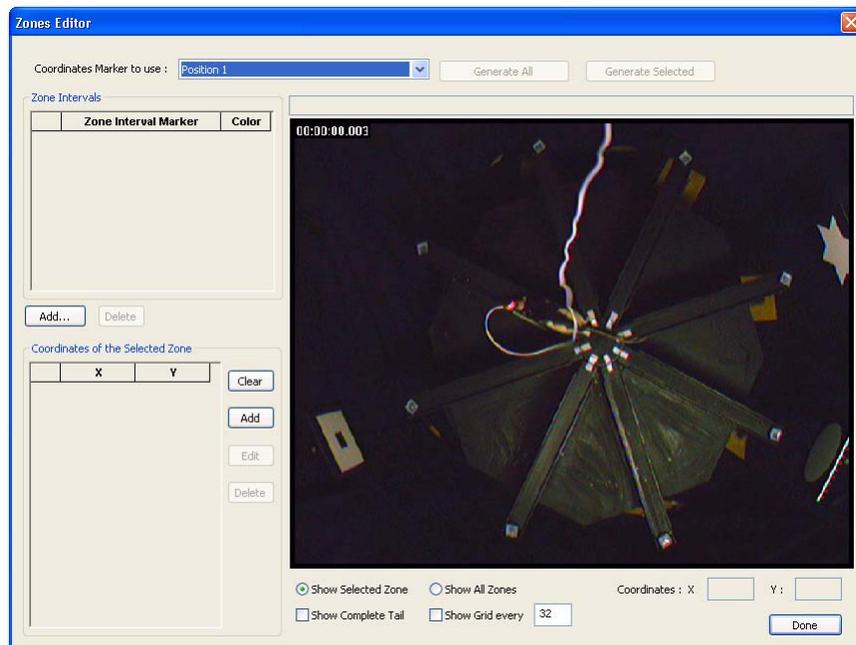
Note: Positioning the mouse pointer inside this portion of the editor causes the scalar value corresponding to the pointer position to appear in the edit box at the bottom right of the display.

- **Level Intervals** - This area contains a grid that has a line for each defined level interval. Select level intervals by clicking in the grid. Set the condition by editing the grid fields. When defining multiple Level Interval markers, only the one selected in the **Level Intervals** box displays. Click any level interval to select it. The selected level interval appears with a >> in the left-most column of the grid. The columns shown in the grid are:
 - **Level Interval Marker** – This column contains the name of the Level Interval marker. The name can be changed by changing the text in this field.
 - **Color** – This column contains the color associated with the Level Interval marker. To change the color, click in this field to bring up a color selection dialog box.
 - The next five columns together define the condition for the Level Interval marker. The column arrangement forms a condition statement, for example “Above 175 AND Below 200.”
 - **Abv/Blw** – This column contains the above or below indicator for the first level. To change the condition, click in this field to open a drop-down list and select **Above** or **Below**.
 - **Level 1** – This column contains the numerical value for the first level. Type a numerical value in this field or click and drag horizontal line **1** on the graph.
 - **Oper** – This column contains the logical operator between the two halves of the condition. The available selections in the drop-down list are **AND**, **OR**, or **N/A**. Selecting **N/A** means that there is only one level in the condition; CinePlex Editor ignores the last two columns and a second line on the graph does not appear.

- **Abv/Blw** – This column contains the **Above** or **Below** indicator for the second level, which only applies if **N/A** is not selected.
 - **Level 2** – This column contains the numerical value for the second level, which only applies if **N/A** is not selected. Type a numerical value in this field or click and drag horizontal line **2** on the graph.
- **Add** - This button opens the **Define New Marker** dialog box to add a new Level Interval marker.
 - **Delete** - This button deletes the selected interval level.
 - **Center Lev1 and Center Lev2** - By default, CinePlex Editor sets the level intervals to the middle of the display range shown in the graph, which it determines from the range of scalar values encountered for the selected Scalar marker. Click these buttons to re-position the corresponding level line to the center of the view again.
 - **Done** - Click **Done** to close the editor. CinePlex Editor stores the conditions with the Level Interval marker and displays them when the **Levels Editor** re-opens.

5.3.7.2 Zones Editor

This item opens the Zones **Editor** window. An illustration of the dialog box follows:



- **Coordinates Marker To Use** - This box lists the Coordinates marker used to define the zone.

- **Generate All** - This button generates marker occurrences for all the level intervals that appear in the **Zone Intervals** box.
- **Generate Selected** - This button generates marker occurrences for the selected Level Interval marker, which is indicated by the >> in the left-most column in the **Level Intervals** box.

Note: Clicking either **Generate All** or **Generate Selected** deletes all existing marker occurrences for the affected Zone Interval markers, and generates a new set of occurrences according to the current Coordinates marker and conditions.

- **Zone Intervals** - This area lists all the defined Zone Interval markers.
 - The leftmost column lists the interval number; the selected Zone Interval marker appears with a >> in the leftmost column.
 - **Zone Interval Marker** – This column lists the names of the Zone Interval markers. Add or change names by typing in this field.
 - **Color** – This column shows the colors of the zone boundaries. To change a color, click the color to open a color selection dialog box.
 - **Add** – This button adds a coordinate to the selected zone.
 - **Delete** – This button deletes the selected Zone Interval marker.
- **Coordinates of the Selected Zone** - This area lists the coordinates of the currently selected Zone Interval marker. The zone of a Zone Interval marker consists of a list of 2D coordinates (**X** and **Y**) that define the closed contour. Define these contours by clicking on the screen image (see **Add** that follows), or by individually adding and typing in the coordinate values in the columns.
 - The leftmost column lists the coordinate number; the selected coordinate appears with a >> in the leftmost column.
 - **X** – This column contains the X coordinate distance from the lower left corner (zero distance).
 - **Y** – This column contains the Y coordinate distance from the lower left corner (zero distance).
 - **Clear** - This button completely clears all points from the current zone. Click **Add** to re-enter the zone.
 - **Add** - This button puts the **Zones Editor** into the click-to-add mode. The first left-click in the main window defines the first point in the contour, subsequent left-clicks continue to define the contour. A right-click ends the drawing and closes the contour.
 - **Edit** - This button enables the currently selected point to be re-positioned. After clicking **Edit**, move the mouse pointer to the desired location on the main window. The contour continually re-adjusts as the mouse pointer moves. Left-click to select the new position, or right-click to cancel the operation and revert to the previous position.

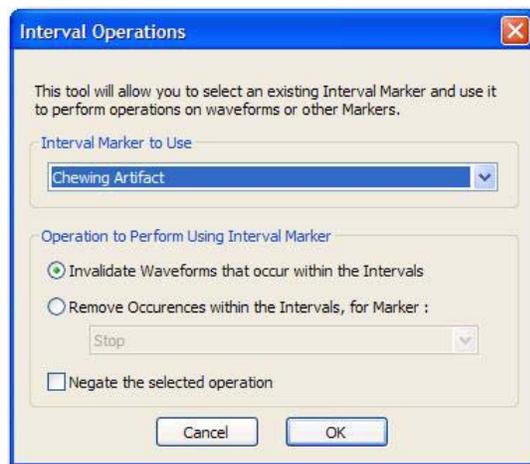
- **Delete** - This button deletes the currently selected point from the zone contour. The contour re-adjusts automatically for the remaining points.

When the **Zones Editor** dialog box is opened, the main view shows the same video frame that CinePlex Editor displays. By default, the zone for the currently selected Zone Interval marker appears superimposed on the video frame.

- **Show Selected Zone** - This is the default setting. It shows the zone for the currently selected Zone Interval marker superimposed on the video frame
- **Show All Zones** - Click this button to see all defined Zone Interval marker zones simultaneously.
- **Show Complete Tail** - Click this button to display a line connecting all the positions visited by the selected Coordinates marker. This can help to show what effect various placements of the zone boundaries can have when a zone is defined.
- **Show Grid every** - Click this button to superimpose a grid over the video image. Enter the grid spacing in the box.
- **Coordinates: X Y** - When the mouse pointer moves over the main window, the corresponding coordinates of the mouse pointer appear in the **X** and **Y** edit boxes.
- **Done** - Click **Done** when finished defining zone intervals.

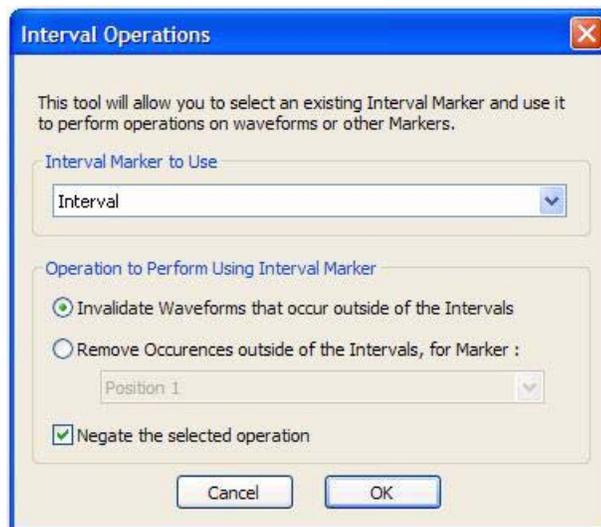
5.3.7.3 Interval Operations

This item opens the **Interval Operations** dialog box.



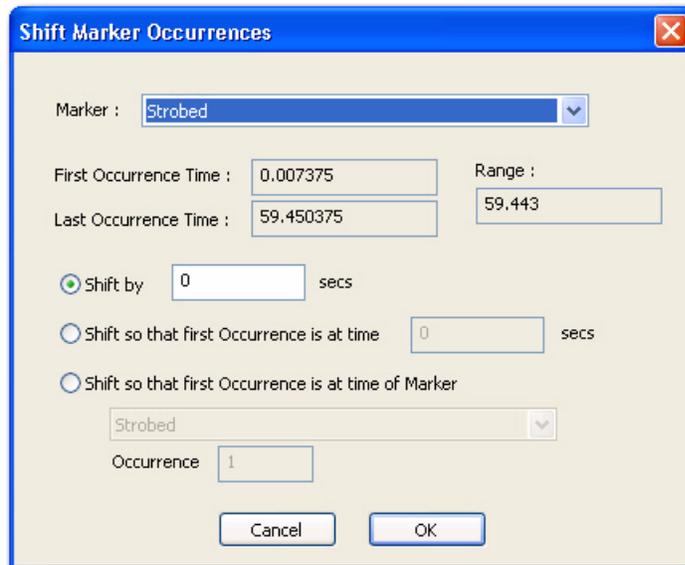
- **Interval Marker to Use** - From the drop-down list, select a marker of the following type:
 - Interval
 - Level Interval

- Zone Interval
 - **Operation to Perform Using Interval Marker** - In this area, choose one of the following operations:
 - **Invalidate Waveforms that occur within the Intervals** – This selection invalidates all waveforms that occur within (inclusive) the interval marker. CinePlex Editor compares each waveform (spike time) in every channel against all occurrences of the interval marker to see if it falls within the start and end times. If it does, CinePlex Editor marks the waveform as invalid.
 - **Remove Occurrences within the Intervals, for Marker** – This selection removes the occurrences of the marker selected from the drop-list, from within the intervals. CinePlex Editor compares the times of the occurrences of this marker to the selected interval occurrences, and removes any occurrences that fall within (inclusive) of any interval.
- Note:** In both cases, CinePlex Editor considers exact matches of the spike timestamp to the interval occurrence start or end times to be within the interval. For example, if spike time *Tspike* is inside the interval defined by *Tstart* and *Tend*, it means that the condition ($Tspike \geq Tstart$) and ($Tspike \leq Tend$) is true.
- **Negate the selected operation** – This selection changes either of the previous selections to an exclusive function. Selecting **Invalidate Waveforms that occur within the Intervals** invalidates all waveforms that do not fall between the start and end times (exclusive) of any interval marker occurrences. Selecting **Remove Occurrences within the Intervals, for Marker** removes all occurrences of the selected marker that do not occur within the times spanned (exclusive) by any interval marker occurrence. The text in the **Interval Operations** dialog changes as follows:



5.3.7.4 Shift Marker Occurrences

This item opens the **Shift Marker Occurrences** dialog box. An illustration of the dialog box follows:

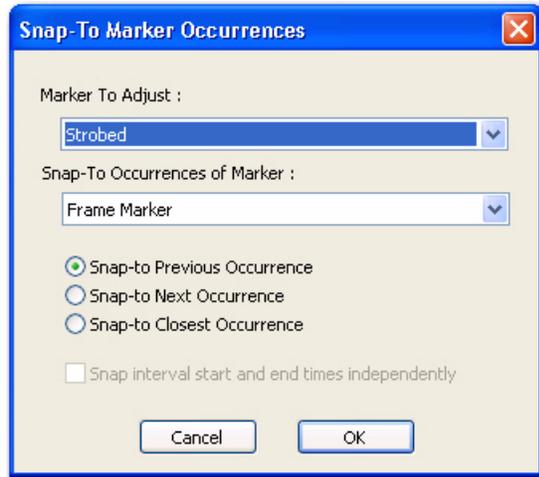


Use this dialog box to add a constant offset, which can be negative, to all timestamps of a marker. It is useful for aligning neural data with the video data.

- **Marker** - Select a marker to shift from the drop-down list.
- **First Occurrence Time** - This is the time that the first occurrence of the marker appears.
- **Last Occurrence Time** - This is the time that the last occurrence of the marker appears.
- **Range** - This is the time span between the first and last occurrences.
- **Shift by _ secs** - This selection shifts the occurrences by a constant amount. Enter the amount of shift directly in the edit box.
- **Shift so that first Occurrence is at time _ secs** - This selection calculates the shift amount by determining how much the first occurrence of the selected marker must be shifted to make it equal to the specified time. CinePlex then applies this shift amount to all occurrences.
- **Shift so that the first Occurrence is at time of Marker** - This selection shifts the time to that of another marker occurrence. Select the shift-determining marker from the drop list.
- **Occurrence** - Enter which occurrence of the shift-determining marker to use by typing its 1-based index into the edit box.

5.3.7.5 Snap-To Marker Occurrences

This item opens the **Snap-To Marker Occurrences** dialog box. An illustration of the dialog box follows:



The purpose of the “Snap-To” functionality is to shift the occurrences of one marker to match up in time with the occurrences of another marker. However, unlike the Shift Marker Occurrences functionality described on [page 5-260](#), the “Snap-To” functionality can shift each occurrence by a different amount.

- **Marker To Adjust** - From the drop-down list, select the marker occurrences to match up in time.
- **Snap-To Occurrences of Marker** - From the drop-down list, select the marker occurrence to match up to in time.

Note: Typically, the **Snap-To Occurrences of Marker** are Frame marker types, which means the **Marker To Adjust** aligns with the times of the video frames.

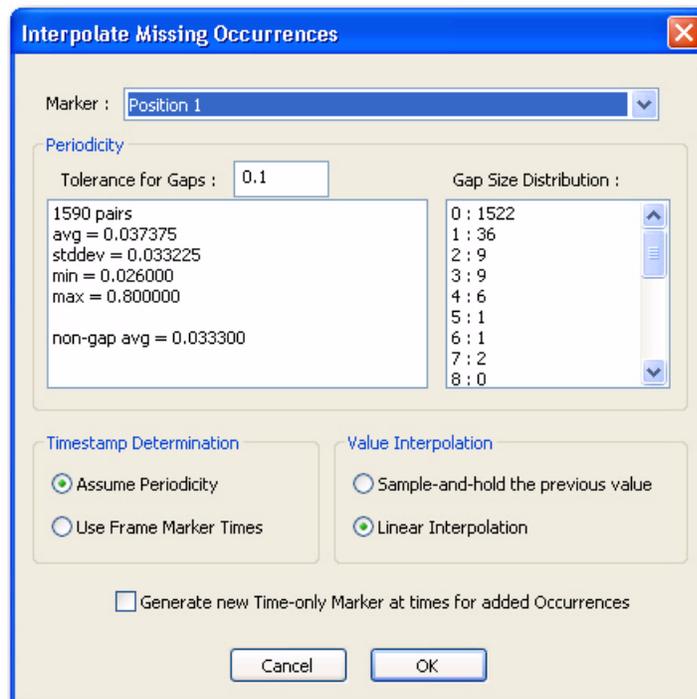
The CinePlex Editor algorithm find the *best match* occurrence of the **Snap-To Occurrences of Marker** entry for every occurrence of the **Marker To Adjust** entry, and makes the **Marker To Adjust** occurrence time equal to the time of the *best match* occurrence. There are two ways that CinePlex Editor determines the *best match* occurrence of the “Snap-To” marker:

- **Snap-to Previous Occurrence** – This selection uses the occurrence that is just before the time of the occurrence being adjusted. The adjustment always reduces the time of the occurrence being adjusted.
- **Snap-to Closest Occurrence** – This selection uses the occurrence that is closest in time to the occurrence being adjusted. The adjustment can shift the occurrence being adjusted ahead or behind in time.
- **Snap interval start and end times independently** - Because interval-type markers consist of two times (a start time and an end time), they are treated differently and they are controlled by this checkbox. When this box is

checked, CinePlex Editor snaps both the start and the end times to their respective *best match* occurrences. This can change the length of the interval. When the checkbox is cleared, CinePlex Editor uses the *best match* to the start time to shift the entire interval. In this case, the end time shifts by the same amount as is the start time, so the length of the interval remains constant.

5.3.7.6 Interpolate Missing Occurrences

This item opens the **Interpolate Missing Occurrences** dialog box. An illustration of the dialog box follows:



- **Marker** - From the drop-down list, select the marker to interpolate.
- **Periodicity** - This box displays the periodicity results for the selected marker as follows:
 - **Tolerances for Gaps** – For the gap analysis, the average separation between markers is determined. If the time gap between any two adjacent marker occurrences is not within the Tolerance for Gaps value (i.e. between $(1 - \text{TFG})$ and $(1 + \text{TFG})$ times the average separation, it is marked as a gap.
 - **pairs** – the number of pairs of adjacent times
 - **avg** – the average time difference between pairs in seconds
 - **stddev** – the standard deviation around the average time difference
 - **min** – the smallest time difference encountered in seconds

-
- **max** – the largest time difference encountered in seconds
 - **non-gap avg** – the average time difference in seconds when the discovered *gaps* are excluded from the calculation
 - **Gap Sizes** - This box lists of the distribution of skipped occurrences (gaps); for example, **0 : nnn** indicates the number of number of pairs without a missing timestamp between them, **1 : nnn** indicates the number with one timestamp missing, **2 : nnn** indicates the number with two missing timestamps, and so on.
 - **Timestamp Determination** - The area contains the following two selections:
 - **Assume Periodicity** – This selection assumes that the data is periodic and adds marker occurrences accordingly.
 - **Use Frame Marker Times** – This selection adds missing marker occurrences at the frame markers.
 - **Value Interpolation** - The area contains the following two selections:
 - **Sample-and-hold the previous value** – This selection assigns a value (or coordinates) to the new marker occurrences added to fill a gap, which is the same as the value (or coordinates) of the last pre-gap marker occurrence.
 - **Linear Interpolation** – This selection assigns values to the new marker occurrences added to fill a gap that are calculated to fall on a line connecting the last pre-gap value (or coordinates) with the first post-gap value (or coordinates).

If the marker being interpolated is a scalar marker or a coordinates marker, the tool can calculate reasonable values to apply to the added marker occurrences by using one of two methods:

Generate new Time-only Marker at times for added Occurrences

- **Generate new Time-only Marker at times for added Occurrences** - This selection enables the tool to define and populate a new marker named *Interpolated X*, where *X* is the name of the marker being interpolated, and which has occurrences at the times where interpolated marker occurrences are added. In effect, this differentiates the occurrences of the selected marker that are generated via interpolation from those that are part of the original data.

How the Interpolation Algorithm Works

The interpolation tool is capable of calculating both the times at which new marker occurrences need to be added (that is, where the gaps appear), and for Scalar markers and Coordinates markers, what values need to be given to the added marker occurrences. Obviously, when finding the times where there are gaps, there is an implicit assumption of periodicity in the marker occurrences. This may or may not be the case with the marker occurrences for the selected

marker, but the tool displays information that helps to determine the extent to which the periodicity assumption is valid.

When a marker is selected, the algorithm analyses the times of the occurrences for that marker, and displays the results in the two list boxes. The algorithm can use or ignore the results of this analysis, depending on the following **Timestamp Determination** selections. The analysis proceeds as follows:

- 1 Consider each pair of adjacent times for the marker occurrences, and calculate the time difference between each pair. The number of pairs appears in the left list box.
- 2 Find the min, max, average, and standard deviation on the set of calculated time differences. Display this information in the **Periodicity** list box as **avg =** for the average time difference, **stddev =** for the standard deviation around the average time difference, **min =** and **max =** for the smallest and largest time differences encountered.
- 3 Assume that any difference between adjacent occurrences that is larger than 1.1 times the average time difference constitutes a *gap*, or a skipped occurrence. Using this definition of a *gap*, compute and display a histogram of the sizes of the gaps in the **Gap Sizes** list box. The **0:** line in this list box is to be interpreted as the number of timestamp pairs for which there were no *gaps* or missing timestamps between them. The next **1:** line is the number of timestamp pairs for which there was a gap of 1 missing timestamp between the pair, and so on.
- 4 By ignoring the gaps, compute a new average time difference between adjacent, gap = 0 timestamp pairs. Display this as **non-gap avg =** in the **Periodicity** list box. Whereas the **avg =** value has factored in the gaps and thus produced a larger average time difference, the **non-gap avg =** has taken out the gaps, and so produces a smaller and in many cases more accurate estimate of the true periodicity. In effect, this is the periodicity that would be seen if it weren't for missing samples (gaps) in the occurrences.

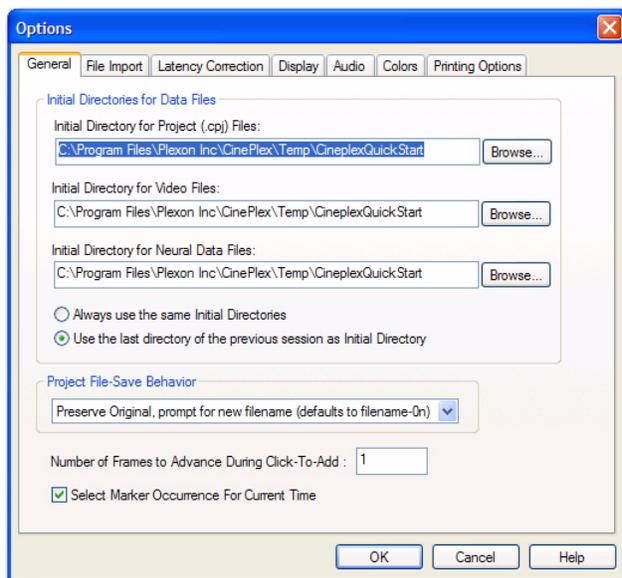
5.3.7.7 Mark All Waveforms As Valid

This item re-validates any waveforms that were invalidated with the Interval Operations tool; see [“Interval Operations” on page 258](#).

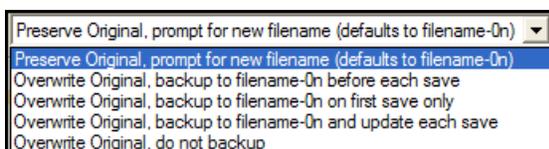
5.3.7.8 Options

This item opens the **Options** dialog box with several tabs as described in the following sections.

5.3.7.8.1 General Tab.



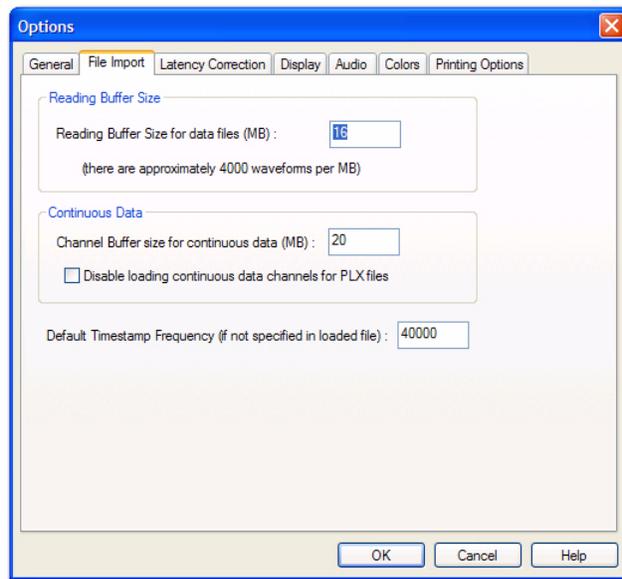
- **Initial Directories for Data Files** - This area contains list boxes and controls for the initial project directories as follows:
 - **Initial Directory for Project (CPJ) Files** – Type a directory location and name or click **Browse** and select an existing directory.
 - **Initial Directory for Video Files** – Type a directory location and name or click **Browse** and select an existing directory.
 - **Initial Directory for Neural Data Files** – Type a directory location and name or click **Browse** and select an existing directory.
 - **Always use the same Initial Directories** – This selection sets the default initial directories to the directories entered.
 - **Use the last directory of the previous session as Initial Directory** – This item sets the default initial directories to the directories used for the last project.
- **Project File-Save Behavior** - When a project file is saved, from the dropdown menu one may set one of the following default file-save behaviors:



Note: On this menu, *filename-0n* means CinePlex Editor defaults to the first unused filename and adds a numeric increment 0 (zero) n (digit). For example, *Test-01*, *Test-02*, *Test-03*, etc.

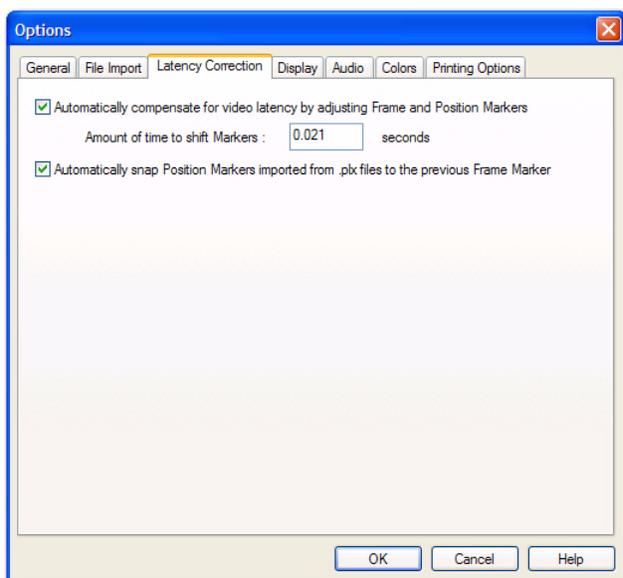
- **Number of Frames to Advance During Click-To-Add** - Type the number of frames to advance when adding or editing coordinates in the Video or Scalar windows. For more information on Click-To-Add, see [“Understanding Click-To-Add Mode”](#) on page 178.
- **Select Marker Occurrence For Current Time** - Select this item to have CinePlex Editor automatically select, in the Marker Occurrences window, the most appropriate marker occurrence for the current time.

5.3.7.8.2 File Import Tab.



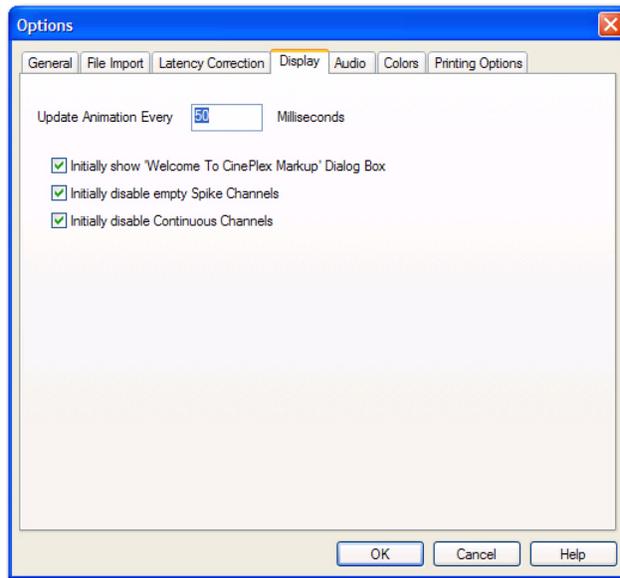
- **Reading Buffer Size** - This area contains an input box for the reading buffer size setting and an advisory estimate of the amount of space waveforms take.
 - **Reading Buffer Size for data files (MB)** – Type a size value for the reading buffer in megabytes (MB).
- **Continuous Data** - This area contains an input box for the size of the continuous-data channel buffer and a checkbox that disables the loading of continuous-data channels to PLX files.
 - **Channel Buffer size for continuous data (MB)** – Type a size value for the channel buffer in megabytes (MB).
 - **Disable loading continuous data channels for PLX files** – This selection inhibits the loading of continuous data channels to PLX files.
 - **Default Timestamp Frequency (if not specified in loaded file)** – If the initial neural data file does not specify a timestamp frequency (for example, a DVT file), enter a default timestamp frequency in Hz.

5.3.7.8.3 Latency Correction Tab. For more details on latency correction, see [“Correcting for Video Latency” on page 282.](#)



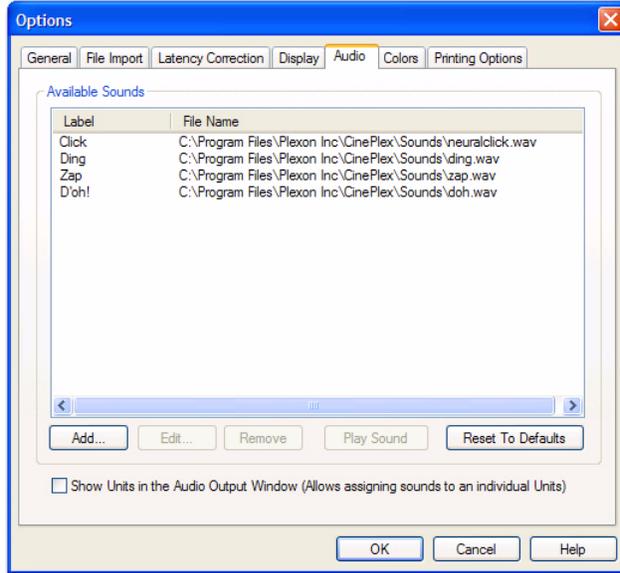
- **Automatically compensate for video latency by adjusting Frame and Position Markers** - this setting is checked by default. This setting compensates for the amount of time elapsed between the camera’s capture of the image to the computer’s timestamp of the video frame (the video latency). If there is data that was analyzed with previous versions of CinePlex Editor, there may be timestamp shifts and this setting could be unchecked for that data.
 - **Amount of time to shift Markers** - Type the amount of time to shift the markers in seconds. The number should always be positive because the number is subtracted from the timestamps.
 - **Automatically snap Position Markers imported from PLX files to the previous Frame Marker** - this setting is checked by default. This setting is applied automatically only when data is initially imported from a PLX file.
- Note:** When CinePlex is being used with Plexon’s MAP system, leaving the MAP on overnight could result in excessive latency - much greater than 30 milliseconds. If the MAP has been left on overnight, it is better to reset the MAP system.

5.3.7.8.4 Display Tab.

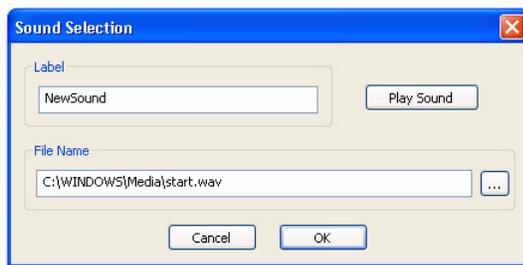


- **Update Animation Every __ Milliseconds** - Type an animation update frequency in milliseconds. This is the screen update rate while the video and data files play are playing.
- **Initially show 'Welcome To CinePlex' dialog box** - This selection makes the **Welcome to CinePlex** dialog box appear at startup.
- **Initially disable empty Spike Channels** - This selection suppresses empty spike channels in the **Activity** window at startup.
- **Initially disable Continuous Channels** - This selection suppresses continuous channels in the **Activity** window at startup.

5.3.7.8.5 Audio Tab.



- **Available Sounds** - CinePlex Editor ships with a selection of four WAV files, and these sounds are available for playback in CinePlex Editor by default. However, any WAV file can be used, provided that CinePlex Editor knows where to find it on the hard drive. Before WAV file sounds can be mapped to Marker or spike occurrences in the **Audio Output Window**, they must be loaded into CinePlex Editor. The **Available Sounds** section lists the Sounds that are currently available for playback. Each sound has a Label that shows up in the droplist in the Sounds column of the **Audio Output Window**, and the full path to the WAV file that contains the sound.
- **Add** - Pressing Add... will show a file selection dialog followed by the Sound Selection dialog box which allows entering a Label used to represent that sound. Pressing the **Play Sound** button will play the sound, which is useful for previewing.



- **Edit** - Highlighting an existing sound in the list and pressing Edit... will show the Sound Selection dialog box and allow re-selecting the WAV file or changing the Label for a sound.

- **Remove** - Highlighting an existing sound in the list and pressing Remove will remove the sound.
- **Play Sound** - Highlighting an existing sound in the list and pressing Play Sound will immediately play the sound, allowing it to be previewed.
- **Reset to Defaults** - Pressing the Reset to Defaults button will reset the list to contain the four sound files that are shipped with CinePlex Editor.



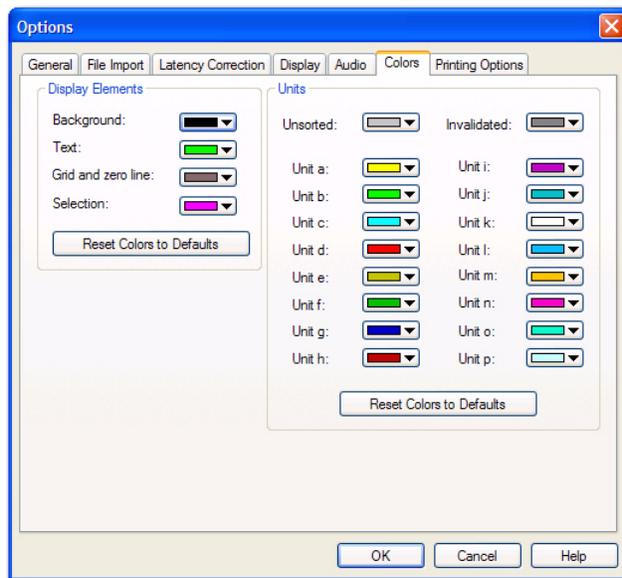
HINT

Minimizing number of sounds to play

Computer audio hardware can only mix a certain number of sound streams together, so CinePlex Editor can only play about 10 sounds simultaneously. Sounds that overlap in time because they are played quickly one after the other count as simultaneous sounds. Therefore, it is quite easy for CinePlex Editor to overwhelm the audio subsystem by attempting to play too many sounds, as Markers or neural firings may occur at rates too fast for the audio system's capabilities. When this happens, CinePlex Editor will play as many sounds as it can, but there may be gaps in the audio playback. To minimize this issue:

- do not select many units or markers to be played at once. Even a single neural channel with a high firing rate can saturate the audio.
- use WAV files that are as short as possible. In this regard the 'neuralclick.wav' file is ideal, as it can be played very quickly.

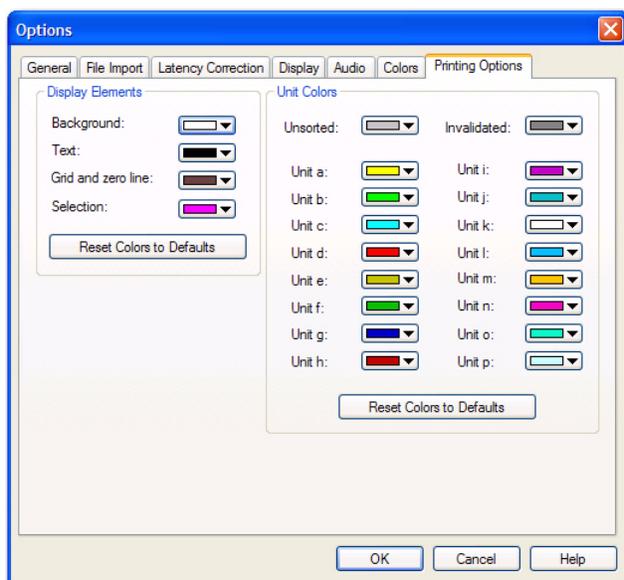
5.3.7.8.6 Colors Tab.



- **Display Elements** - This area contains the following color choices for the main display:

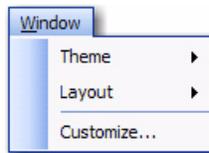
- **Background** – This is the background color of the **Activity** window.
- **Text** – This is the text color in the **Activity** and **Video** windows.
- **Grid and zero line** – This is the color of the grid and zero line in the **Activity** windows.
- **Selection** – This is the color of selected items in the **Video** and **Activity** windows.
- **Restore Colors to Defaults** – Click to restore the display elements to their default colors.
- **Units** - This area contains the color choices for each unit and unsorted waveforms.
 - **Unsorted** – This is the color for unsorted waveforms.
 - **Invalidated** - This is the color for invalidated waveforms.
 - **Unit a: ... Unit p** – These are the color selections for up to 16 units.
 - **Restore Colors to Defaults** – Click to restore the unit colors to their default colors.

5.3.7.8.7 Printing Options Tab.



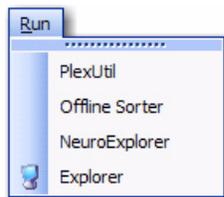
The selections on the **Printing Options** tab are the same as those on the **Colors** tab. See [“Colors Tab” on page 270](#)

5.3.8 Window Menu



For more details on the **Window** menu, see [“Window Menu” on page 11](#).

5.3.9 Run Menu



5.3.9.1 PlexUtil

This item launches the PlexUtil application.

5.3.9.2 Offline Sorter

This item launches the Offline Sorter application.

5.3.9.3 NeuroExplorer

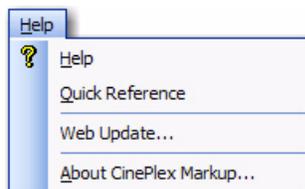
This item launches the NeuroExplorer application.

5.3.9.4 Explorer

This item opens Windows Explorer.

See also [“Run Menu” on page 13](#) and [“Run Menu Customization” on page 22](#).

5.3.10 Help Menu



For more details on the **Help** menu, see [“Help Menu” on page 13](#).

5.4 Toolbars

CinePlex Editor includes toolbars that provide access to features, commands, controls, and settings. Most features and commands are available on the toolbars. It is also possible to create toolbars from most of the dropdown menus on the menu bar. Briefly rest the mouse pointer over a button to see the button name. Descriptions of the toolbars follow:



5.4.1 Standard Toolbar

This toolbar includes typical Windows controls for file **New**, **Open**, **Save**, **Cut**, **Copy**, **Paste**, **Print**, **Help**, **Undo**, and **Options**. Except for **Options**, these are typical Windows controls. For information on **Options**, see [“Options” on page 264](#).



5.4.2 Edit Toolbar

The **Edit** toolbar includes a series of buttons that manage markers and marker occurrences within **CinePlex Editor**. This toolbar has eight buttons that correspond to the marker and marker occurrences commands on the **Edit** menu; see [“Edit Menu” on page 245](#).



5.4.3 Views Toolbar

The **Views** toolbar includes a series of buttons that open the various windows within **CinePlex Editor**. Each window opens at its default size. This toolbar’s buttons are equivalent to the commands on the View menu; see [“View Menu” on page 249](#).



HINT

Missing Buttons on the ViewsToolbar

If there are missing buttons on the toolbar, select **Window | Customize | Toolbars**, and select the line labeled **View** in the list box in the **Toolbars** tab. Do not uncheck the checkbox -- just select the line. Then press the **Reset** button.

5.4.4 Animate Toolbar

The most convenient way to control the flow of time in **CinePlex Editor** is to use the time-control toolbar buttons. The associated **Animate** menu entries or key-

board shortcuts may also be used; see [“Animate Menu” on page 250](#). The **Animation Speed** list box is the only **Animate** toolbar control that has no equivalent command on the **Animate menu**.



- **Animation Speed** - This list box provides a choice of time progression rates, where 1X is the normal speed. It has no equivalent on the **Animate menu**.

5.4.5 Looping Toolbar

The **Looping** toolbar includes a list of looping intervals over which the video file may be played, and two looping control buttons. The equivalent **Looping** menu entries or keyboard shortcuts may also be used; see [“Looping Menu” on page 251](#).



5.4.6 Find Toolbar

The **Find** toolbar provides a drop down list that includes all markers. The equivalent **Find** menu entries or keyboard shortcuts may also be used; see [“Find Menu” on page 253](#).



By default, the currently selected marker appears in the list box. However, another marker may be selected from the drop down list.

5.4.7 Tools Toolbar

The **Tools** toolbar includes two time-interval editors. One editor for a defined zone of the video window and one editor for level interval markers. The equivalent commands on the **Tools** menu may also be used; see [“Tools Menu” on page 254](#).



5.5 How CinePlex Editor Creates Initial Project Files

When a new CinePlex project is created, CinePlex Editor reads both the neural data file and the video data file, and it generates markers and marker occurrences based on the contents of the files. After the initial file reading, CinePlex Editor stores the generated markers and marker occurrences in the project (CPJ) file. When the project file is re-opened, CinePlex Editor reads the markers and marker occurrences from the project file, not from the original neural data or video files. In this way, one may add, edit, shift, or delete markers without regard for what is actually in the original neural or video data files. However, when an existing project file is re-opened, CinePlex Editor still reads the neural data file in order to obtain the spike timestamps and continuous data, and it still reads the video file to obtain video frame images.

5.5.1 Reading Video (AVI) Files

When CinePlex Editor reads the video (AVI) file, it looks for timestamps embedded in the data stored with each frame. CinePlex Studio imbeds these timestamps. If the embedded timestamps are present, CinePlex Editor creates a special Frame marker, and it generates a marker occurrence for each video frame. See “[Non-Typical Initial File Creation](#)” on page 276 if there are no embedded timestamps.



CAUTION

Upgrade Notice

If the system has been upgraded to **CinePlex Studio 2.0**, **CinePlex Editor** should also be update. The upgraded **CinePlex Editor** will read AVI files created by **CinePlex Studio 1.0**, 1.1, 1.2, and 1.4. However, earlier versions will not be able to read AVI files produced in version 2.0

5.5.2 Reading Plexon (PLX) Files

When CinePlex Editor reads a Plexon (PLX) file during the initial project creation, depending on the contents of the PLX file, it can create and populate a number of different markers as follows:

- Non-strobed external events (type 4 data blocks) become Time-Only markers
- Strobed events become a single Scalar marker, with the scalar values set to the strobe values
- If strobed events are present, and CinePlex Editor identifies them to be in conformance with the Plexon VideoTracker protocol, then CinePlex Editor generates additional markers by interpreting the strobe codes as data produced by Plexon VideoTracker. Depending on the VideoTracker mode detected, CinePlex Editor creates the following markers:
 - One, two, or three Coordinates markers with names like *Position n* to denote the tracker positions, when VideoTracker is in LED or Reflective Color tracking modes.

- A Coordinates marker named *Centroid Position*, when VideoTracker is in Object Contour tracking mode.
- A Scalar marker named *Centroid Motion*, when the VideoTracker Motion Measure option is enabled.

Note: In Plexon VideoTracker protocol, if VideoTracker cannot locate the object being tracked it reports the positions for those frames as (0,0); for example, if a head-stage cable occluded the LED for a frame VideoTracker reports that frame as “0,0”. When CinePlex Editor translates strobed events into Coordinates marker occurrences, it automatically ignores any (0,0) coordinates, which leaves gaps where there is no position data. The Interpolate Missing Occurrences tool can fill these gaps, see [“Interpolate Missing Occurrences” on page 262](#).

Note: Important: Spike waveforms and timestamps and continuous data from a PLX file are not converted into markers.

5.5.3 Reading NeuroExplorer (NEX) Files

When CinePlex Editor reads a NEX file during the initial project file creation, it ignores the spike timestamps and continuous data. CinePlex Editor converts other NEX variables into CinePlex markers as follows:

- Event variables become Time-Only markers, unless the event variable has the exact name *Frame Marker*, in which case it becomes a Frame marker.
- NEX interval variables become interval markers.
- NEX marker variables that have one associated value become Scalar markers.
- NEX marker variables that have two associated values become Coordinates markers.
- CinePlex Editor ignores NEX marker variables with more than two associated values, and NEX population vector variables.

5.5.4 Reading Digital VideoTracker (DVT) Files

When CinePlex Editor reads a DVT file produced by CinePlex Studio during the initial project file creation, it always creates Frame marker occurrences. CinePlex Editor also produces Coordinates and Scalar markers for the coordinate and centroid motion data streams in the file, in a manner analogous to how it translates the strobed values into markers in a PLX file.

After creating the initial project, one may import additional markers from additional data files into the project; see **Import Markers** on [page 5-239](#). The import operation also follows the preceding rules.

5.5.5 Non-Typical Initial File Creation

The normal operating mode for CinePlex Editor is to use an AVI file captured with CinePlex Studio so that frame timestamps are embedded in the AVI file;

then load a neural data file that contains neural firing timestamps. However, other modes of operation may be used:

- When using the New Project Wizard, leave either the video-file filename or the neural-data filename blank, but not both. In effect, this allows CinePlex Editor to be used to annotate video data without the presence of neural data, and vice versa.
- If the video data file is blank, the CinePlex Editor Activity window may still be used. If the neural data file contains VideoTracker coordinates that are based the Plexon VideoTracker protocol, CinePlex Editor still interprets them as Coordinates marker occurrences and displays them against a blank background in the video window. However, it requires an extra step in this case to generate Frame markers artificially. The New Project Wizard detects when this needs to be done, and it automatically prompts.
- If the neural data filename is blank, CinePlex Editor still functions; the video can be viewed in the normal way: advance frame by frame, animate, etc.

Note: In both of the previous cases, new markers can still be entered and defined. It is still possible to export the markers to any of the supported output-file formats.

- CinePlex Editor supports the use of AVI files recorded without the CinePlex Studio system, which therefore does not contain embedded timestamps. To use these files, Frame markers must be generated before using CinePlex Editor.
- CinePlex Editor can also read certain other AVI files, but those AVI files must use the Motion JPEG method for encoding and storing the video frames.

5.6 Understanding Markers and Marker Occurrences

To use CinePlex Editor effectively, it is important to understand the difference between a marker and a marker occurrence. A marker is defined by its type and name. A marker occurrence is a specific insertion of a marker at a designated time. Each marker can have many marker occurrences associated with it. Before any marker occurrences for a given marker can be created, that marker must exist. To use concepts from object-oriented software methodologies, a marker corresponds to a class, and marker occurrences correspond to instances of that class.

Every marker has a *marker type* definition. Each marker occurrence stores at least one timestamp, along with other supplemental data, depending on the marker type. The following table describes each marker type and the information it stores for each occurrence:

Table 5-1 Marker Types

Marker Type	Abbr	Information Stored	Description
Time Only	T	Timestamp	Single happenings, where the only required information is the time of the happening. E.g. “Shock Applied”
Frame	F	Timestamp	Single happenings, where the only required information is the time of the happening. E.g. “Shock Applied”
Interval	I	Start Timestamp, End Timestamp	Denotes a time interval over which something occurred. E.g. “Stimulus Applied” or “Valid Trial”
Scalar	S	Timestamp, Value	Denotes a value (stored in a 16-bit number) at a given time. E.g. the Motion Measure produced by the CinePlex Studio Tracking Option.
Coordinates	C	Timestamp, X, Y	Denotes a pair of values (stored in 16-bit numbers) at a given time. E.g. Animal coordinates produced by the CinePlex Studio Tracking Option.
Level Interval	L	Start Timestamp, End Timestamp	A special version of an interval marker where the intervals are automatically produced by applying a thresholding operation to the values of a Scalar marker (using the Level Editor). E.g. “Rat Froze”

Marker Type	Abbr	Information Stored	Description
Zone Interval	R	Start Timestamp, End Timestamp	A special version of an interval marker where the intervals are automatically produced when the values of a 2D vector are inside a certain spatial zone (using the Zones Editor). E.g. "Rat In Maze Arm 3"

It is possible to open a quick reminder of the marker types and their abbreviations; see **Quick Reference** in ["Help Menu" on page 13](#). Throughout this manual, the marker types Interval, Level Interval, and Zone Interval are collectively referred to as *interval-type markers* or *interval markers*, as they share many common characteristics.

CinePlex Editor uses the concepts of both a selected marker and a selected marker occurrence; that is, one may open a dialog box to edit the characteristics of a selected marker, and one may delete or edit the selected marker occurrence. CinePlex Editor also uses the concept of *current time* and a closely related *current video frame*.

By default, whenever the current time is changed in CinePlex Editor, it automatically selects the most appropriate marker occurrence of the selected marker for the current time. However, to turn this behavior off, from the **Tools** menu select **Options** and on the **General** tab, click to clear the **Select Marker Occurrence For Current Time** checkbox.

5.6.1 Marker Occurrences and the Marker Occurrences Window

This section includes descriptions of the CinePlex Editor facilities for displaying, generating, and editing marker occurrences.

The Activity window graphically shows where marker occurrences occur in time. The Video window and the Scalar window each show the data values associated with Coordinates and Scalar markers. But the Marker Occurrences window (see ["Marker Occurrences Window" on page 229](#)) contains a concentration of functionality for dealing with marker occurrences. The following Marker Occurrences window shows the numerical values of the marker occurrences for **Position 1**.

	Time	X	Y
1	0.007375	399	444
2	0.041375	399	444
3	0.074375	399	444
4	0.107375	399	444
5	0.140375	399	447
6	0.176375	399	447
7	0.207375	399	447
>8	0.240375	399	447
9	0.279375	399	447
10	0.307375	399	447
11	0.340375	399	447
12	0.374375	399	447
13	0.407375	399	447
14	0.440375	399	446
15	0.473375	399	446

This illustration shows the currently selected marker occurrence with a > in the leftmost column. The shortcut menu (see [“Marker Occurrences Window” on page 229](#)) provides several operations that can be performed on marker occurrences. One may use other shortcut menu entries to select and copy text with marker occurrence information onto the Windows clipboard, and paste into other applications. In the Marker Occurrences window, the columns change according to the selected marker type as follows:

Table 5-2 Column Displays for Various Marker Types

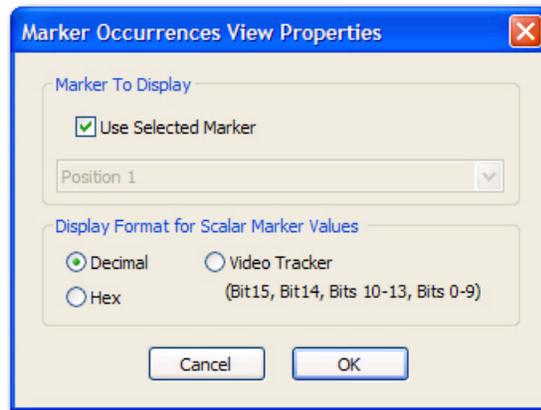
Marker Type	Columns
Time Only, Frame	Time
Interval, Level Interval, Zone Interval	Start time, end time
Scalar	Time and value
Coordinates	Time, X, and Y

Note: Marker Occurrences are *identified* by time, so no two marker occurrences can have the same time. Attempting to add a new marker occurrence with the same timestamp as an existing marker occurrence causes CinePlex Editor to replace the existing marker occurrence with the new one, which deletes the old data values by overwriting them. Likewise, if an existing marker occurrence is edited by changing its timestamp to be the same as another existing marker occurrence, CinePlex Editor replaces the existing marker occurrence.

Also, when Scalar markers appear in the Marker Occurrences window, one can control the display format of the data values associated with each marker occurrence. One can use the shortcut menu items to display data values in decimal (the default), hexadecimal, or as Plexon VideoTracker bit fields, where the information appears as comma separated items as follows:

Bit15, Bit14, Bits 10 through 13, Bits 0 through 9

From the Marker Occurrences window shortcut menu, one can select **Properties** to open the **Marker Occurrences View Properties** dialog box:



By default, the dialog box displays the marker occurrences for the currently selected marker. However, one can click to clear the **Use Selected Marker** checkbox and select a different marker from the list to display the marker occurrences for that marker. When **OK** is clicked, the current **Marker Occurrences** window will switch to the one selected in the dropdown list. If there are more than one **Marker Occurrences** window open, this capability can be used to display marker occurrences for different markers simultaneously.

In the **Display Format for Scalar Marker Values** area, one can set the display format for Scalar marker values, which are described in [“Table 5-2” on page 5-280](#). In the Marker Occurrences window, the items in the **Value** column change the display format chosen.

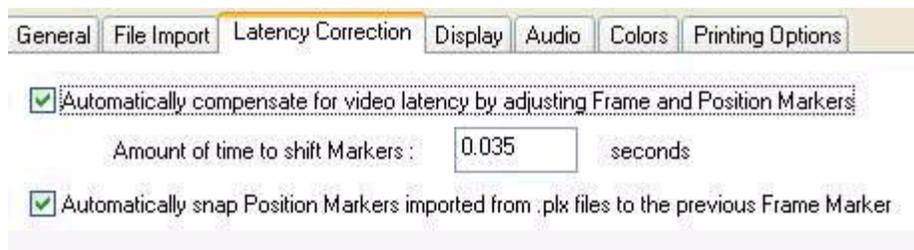
By default, whenever the current time is changed in CinePlex Editor, it automatically selects the most appropriate marker occurrence of the selected marker for the current time. However, this behavior can be turned off; from the **Tools** menu, click **Options** and then click the **General** tab; click to clear the **Select Marker Occurrence For Current Time** checkbox.

5.7 Correcting for Video Latency

If CinePlex Editor is being used to display data obtained using CinePlex Studio, be aware that there is a latency between the times of the video frames / position data sent from CinePlex Studio and the Neural Data. In CinePlex Studio, the camera takes some time to acquire and transmit each video frame to the Capture computer over the firewire cable. The CinePlex Studio computer will timestamp the frame as soon as it receives notification from the camera that the frame has been delivered, but our tests indicate that the camera takes approximately 21 milliseconds after the ‘shutter’ closes to deliver the frame. Therefore, the timestamps of the video frames and of the position data from CinePlex Studio are about 21 milliseconds after the actual frame. One way to think about this is that if something suddenly happens in the experimental arena, say an LED suddenly turns on, the video frame that first shows the LED illuminated will have a timestamp that is about 21 milliseconds later. Note also that there can be substantial jitter in this number, depending on when the LED turned on in relation to when the ‘shutter’ opened in the camera.

Also, there is a systematic offset that can add a constant amount to the latency of each frame, having to do with the exact time that is taken to be zero in the AVI file versus the PLX file recorded on a Plexon NDAQ or the Plexon Recorder system. Because of this effect, the video latency for Recorder is measured to be closer to 33 milliseconds.

CinePlex Editor contains a feature that will automatically subtract some amount of time from each video frame timestamp and each position timestamp when a project is first created. To activate this feature, select the **Latency Correction** tab of the **Tools – Options** dialog box and check the ‘Automatically compensate for video latency by adjusting Frame and Position Markers’, and enter a amount of time to subtract from each timestamp:



The amount of time specified is always subtracted from the timestamps, so the entered number should always be positive. Note that this subtraction will only occur when the project is first created, when the Frame and Position Markers are initially created from the video and neural data files (see [“How CinePlex Editor Creates Initial Project Files” on page 275](#)), or when a DVT file is imported. It is not performed when a CPJ file is read, or when data from a NEX file is imported. Note that the timestamp shift that is performed automatically is equivalent to the shift that can be performed manually using the **Tools | Shift Marker Occurrences**.

Note that applying this correction can shift Markers to have a negative timestamp near the beginning of files. When this happens, the timestamps will be assigned the value of 0.

In addition to the correcting for the camera latency, an independent correction for the tracking latency can be applied, as discussed in the next section.

Note: As of CinePlex Editor version 1.2.0, these latency corrections are now enabled by default, with a default correction of 21 milliseconds. If data have been analyzed using previous versions of CinePlex Editor, the timestamp shifts after upgrading to version 1.2.0. To return to pre-version-1.2.0 behavior, one can disable the corrections by unchecking the checkboxes.

Note: When CinePlex is being used with Plexon's Recorder system, there was an issue with Recorder versions prior to 2.3.2 that could artificially increase this latency by up to 80 milliseconds. If using CinePlex with Recorder, please upgrade the version of Recorder to version 2.3.2 or later. Also, use a video latency correction of 33 milliseconds as discussed above.

Note: When CinePlex is being used with Plexon's MAP system, leaving the MAP on overnight could result in excessive latency - much greater than 30 milliseconds. If the MAP has been left on overnight, it is better to reset the MAP system.

5.8 Aligning Tracker Coordinates to Frames

If neural and video data files are collected using a Plexon NDAQ and CinePlex Studio with tracking enabled, then the temporal relationship between Frame markers, the arrival of strobe codes to the MAP digital input card, and video tracker coordinates are depicted in the following illustration of the Activity window:



Note: Note: the above screenshot depicts the timing assuming that the automatic corrections for (see previous section) are not enabled.

When the video frame is available, CinePlex Studio immediately timestamps the file and stores the time in the AVI file along with the video frame image. When CinePlex Editor initially reads the AVI file, the time for each frame becomes a **Frame Marker** time, which appears as the blue tick marks in the previous illustration.

After CinePlex Studio acquires the video frame, it feeds the video image to the tracking algorithm. Some time later, the tracking algorithm determines the tracking positions and CinePlex Studio encodes the tracking positions using the VideoTracker protocol and outputs a burst of strobed data words. The time between the frame timestamp and the sending of the strobe codes depends on how quickly the tracking algorithms finish, but the first strobed data word always occurs before the start of the next video frame. The words within a burst are clocked out at a constant rate every two milliseconds.

When strobed data words arrive at the MAP, the MAP timestamps them as it reads them in, and then stores them as events in the PLX file. When CinePlex Editor in turn reads these strobed events from the PLX file, they become occurrences of a Scalar marker named **Strobed**; in the preceding illustration, these occurrences appear as brown tick marks. Also, if CinePlex Editor recognizes that the strobed codes are in VideoTracker protocol, it decodes them into occurrences of one or more Coordinates markers (see “[Table 5-1](#)” on page 5-278). CinePlex Editor then assigns times to the Coordinate marker occurrences. The assigned times are derived from the time of the first strobed event in each burst of strobed events. As a result, CinePlex Editor assigns times to the tracked positions that are later than the timestamps of the corresponding video frames; in the preceding illustration, the tracked positions (**Position 1**) are the red tick marks and the video frames are the blue tick marks.

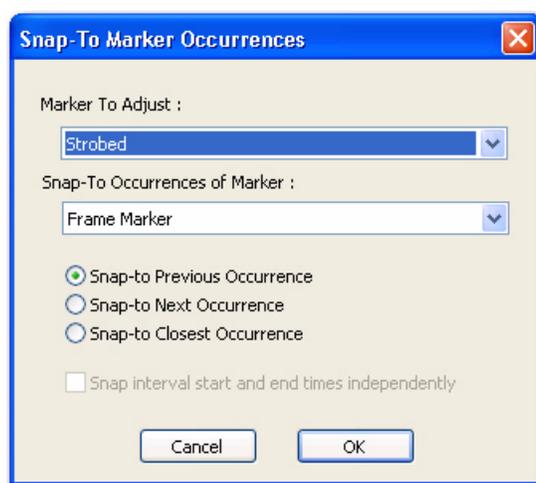
This time offset between the frame time and the tracking coordinates, although realistic, is not desirable in some cases. For example, one can simplify subsequent analysis when the coordinates corresponding to a video frame are equal to the time of the video frame. One can do this with CinePlex Editor, by using the

Snap-To Marker Occurrences tool described in “[Snap-To Marker Occurrences](#)” on page 261.

To align frame times and tracking coordinates

- 1 To align the tracking coordinate *Position n* marker occurrences to video frames, on the **Tools** menu, click **Snap-To Marker Occurrences**.

The **Snap-To Marker Occurrences** dialog box opens.



- 2 Select the *Position n* marker in the **Marker To Adjust** box. Leave the **Snap-To Occurrences of Marker** set to the default value **Frame Marker**.
- 3 Click **Snap-to Previous Occurrence**.
- 4 Click **OK**. A confirmation box will appear that specifies how many marker occurrences were moved.

After the *Snap-to* operation completes, the previous illustration becomes:



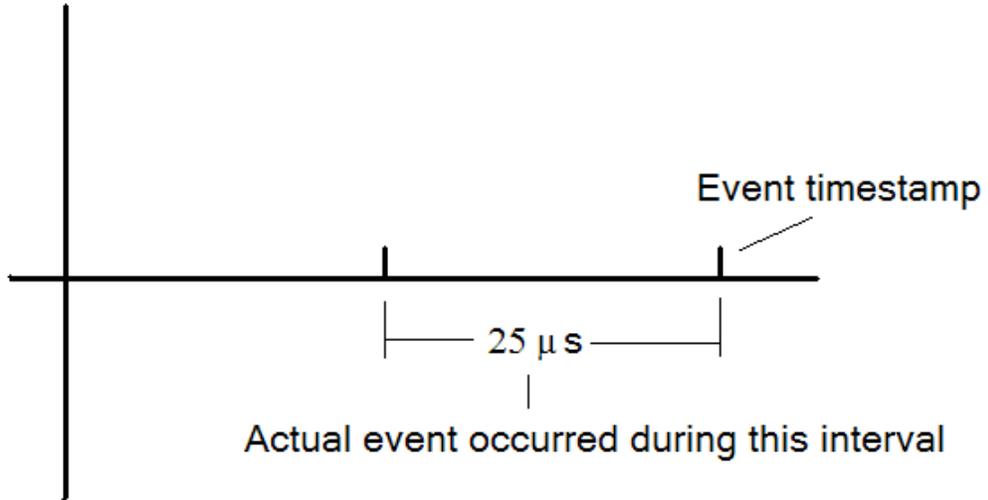
The red tick marks are now aligned with the blue tick marks. Thus, the tracker coordinate **Position 1** occurrences are now aligned with the **Frame Marker** occurrences.

Note that position data imported from a DVT file is already timestamped with the time of the corresponding frame, so this correction is not required.

One can configure CinePlex Editor to automatically perform this snap-to previous operation for newly-created projects by checking the ‘Automatically snap Position Markers imported from PLX files to the previous Frame Marker’ checkbox in the **Latency Correction** tab of the **Options** dialog box. This correction is only automatically applied when the data is initially imported from a PLX file.

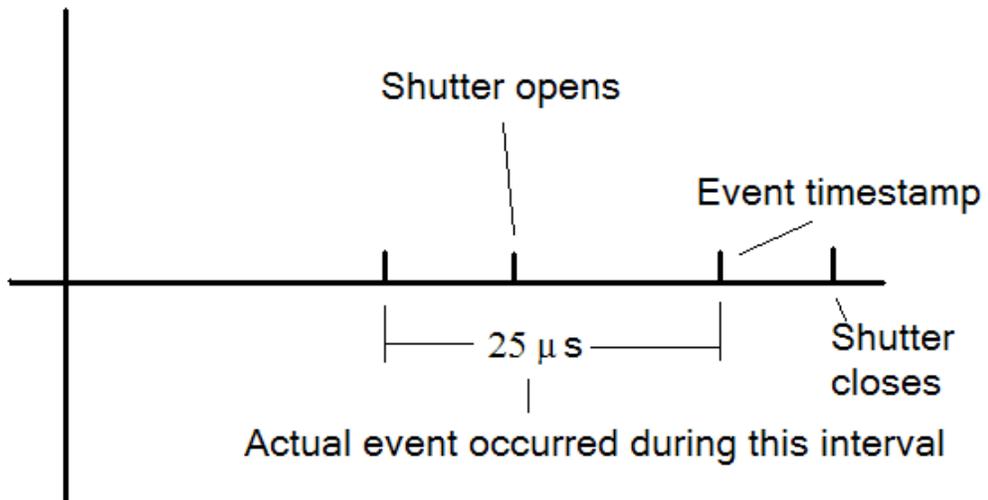
5.9 Interpreting Frame and Event Timestamps

An event timestamp indicates that the MAP detected the event within the prior 25 microseconds. This is illustrated by the diagram below.



A frame timestamp shows when the shutter was opened. The shutter will remain open until the exposure time elapses.

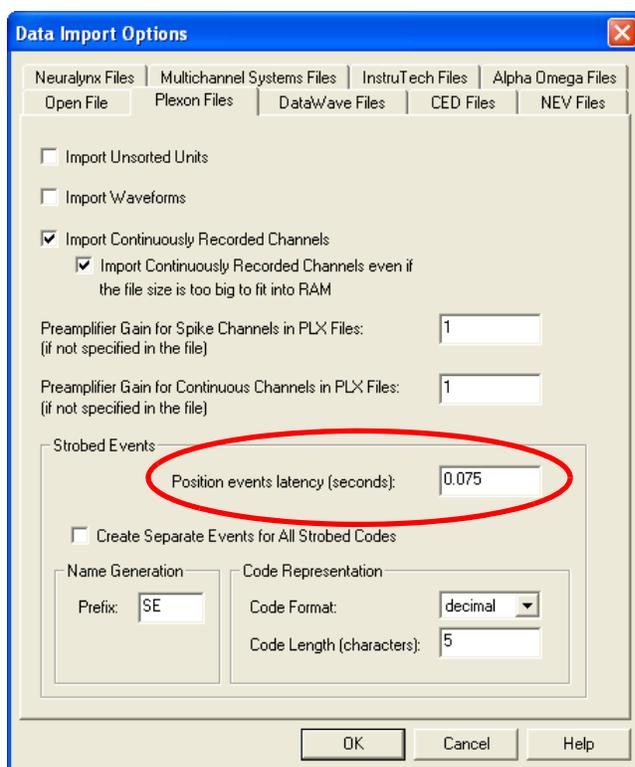
Note: If the shutter is opened within the 25 microseconds prior to an event timestamp, it is possible that the visual evidence of the event will not be captured as illustrated by the diagram below. Referring to the diagram, if the event occurred prior to the shutter opening, the visual evidence will not be recorded.



5.10 Analyzing CinePlex Studio data with NeuroExplorer

As discussed in “[Export to NEX](#)” on page 244, data can be exported from CinePlex Editor as a NEX file and read into NeuroExplorer. In this case, CinePlex Editor can perform latency corrections as described in the previous sections, and the data read into NeuroExplorer will be already corrected for latency.

However, a PLX file containing coordinates from CinePlex Studio can also be read directly into NeuroExplorer. NeuroExplorer can decipher the Video Tracker protocol strobe codes (See Appendix D) and turn them into continuous variables. In this case, the timestamps for the coordinates should be corrected for latency within NeuroExplorer. Note that since NeuroExplorer does not have access to the frame times (stored in AVI and DVT files), it needs to compensate both for the video latency (see “[Correcting for Video Latency](#)” on page 282) and for the tracking latency (see “[Aligning Tracker Coordinates to Frames](#)” on page 284) by subtracting a larger number from the position timestamps. To configure the latency correction, from the **View** menu select **Data Import Options**. In the **Data Import Options** dialog box, click the **Plexon Files** tab. In the **Strobed Events** area, enter a latency value in the **Position events latency (seconds)** field.



The default value for this latency correction in the screenshot is 75 milliseconds (appropriate for the Plexon Video Tracker product, but too high for CinePlex Studio). A more appropriate number is 31 milliseconds (21 milliseconds video latency plus about 10 milliseconds of tracking latency).

Appendix A Installation

A.1 Installation - Hardware A-2
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A.3 Licensing..... A-32
A.4 Plexon Technical Support A-34



CAUTION

Never plug or unplug a camera FireWire cable with the PC Power ON.
Permanent damage to the camera may result.

A.1 Installation - Hardware

This section is intended to assist customers and Plexon personnel with questions and advice regarding installation of CinePlex Version 3 hardware that enables recording from one or two video cameras on their MAP/CPX Personal Computers.

Note: None of this special hardware is required for systems that will operate in offline mode; i.e. editing, playing, re-recording, and/or re-tracking existing video files. All that is needed for offline operation is CinePlex Version3 software and a license key that enables the desired capability.

Before beginning the installation, it is important to determine that the MAP/CPX computer on which the installation will be done meets the minimum system requirements. In general, this means a computer has a dual core Intel processor operating at better than 3 GHz with three GB of memory, and a GeForce 9600 GT or better video card. Requirements that are more current are available from Plexon support (support@plexon.com).

The first procedure covers MAP/CPX computer hardware changes required for CinePlex Version 3. CinePlex Version 3 software can then be installed to allow recording video from one or two cameras.

The second procedure covers the MAP hardware changes required for CinePlex Version 3.

The result should be that CinePlex Version 3 software with recording capabilities may be installed on a target system.

Plexon hopes that this procedure solves these issues for most hardware installations. Plexon welcomes feedback as to how to improve the experience. Please contact Plexon support (support@plexon.com, +1 214 369 4957) with comments.

Procedure for MAP/CPX Computer Hardware Changes Required for CPX V3

This installation procedure will result in a platform that will be able to record video files from one or two video cameras on the target computer.

- 1 Ensure the slots in the MAP/CPX computer are configured (numbering slots from top down) as listed below.
 - 1) Data Acquisition card -- National Instruments PCI-6071E (MAP system option - if present)
 - 2) Dual-bus PCI Express FireWire adapter - Allied Vision Technologies FA-PCIE-BB
 - 3) Blank slot
 - 4) GeForce 8600 GT PCI video card - EVGA
 - 5) PCI-DIO-32HS connects HLK2 card in MAP (MAP system component already present)
 - 6) AccesIO Assembly
 - a) 24-channel Parallel Digital Input/Output PCI Card - AccesIO PCI-DIO-24D S02 S10 with IRQT jumper removed
 - b) Access IO Adaptor - Plexon 07-02-A-03-B



CAUTION

Changing card order, video cards, monitor count or video resolution may result in occasional dropped neural or video data. Currently shipping PC and monitor configurations are tested to handle two cameras at 80 fps and 128 channels of neural data. However, configuration changes may compromise this ability.

Procedure for MAP Hardware Changes Required for CPX V3

- 1** Make sure the TIM board has its Timing jumper set to 1 MHz instead of the 1 kHz that is normal for non-CPX V3 uses.
- 2** Install TIM Cable Adaptor on the TIM board with THIS SIDE UP positioned upwards.

See [Appendix E: Cabling Guide](#) for detailed interconnection instructions.

A.2 Installation - Software

This section is intended to assist customers and Plexon personnel with questions and advice regarding installation of CinePlex Version 3 software on their Personal Computers, whether online running both MAP and CinePlex or offline running components of CinePlex.

Before beginning the installation, it is important to determine that the computer on which the installation will be done meets the minimum system requirements. In general, for a MAP/CPX system, this means a computer with Windows XP SP3 running on an Intel Core 2 Duo processor operating at 3 GHz or better, three GB of memory, and a 9600 GT or better video card. If a camera will be used, FireWire capability must be installed. If two cameras will be used, a dual bus card is needed. Any computer supplied by Plexon for the purpose of running a MAP/CPX system will meet the minimum requirements.

The requirements for offline systems are not as stringent, but certain operations may proceed more slowly than is desired.

More detailed current requirements are available from Plexon support support@plexon.com

The first procedure explains a typical installation that will result in the ability to record, play and edit files on the target computer. This installation is the type of installation required on a computer that controls both a MAP and CinePlex recording together.

The second procedure describes how to install the CinePlex components required to process CinePlex AVI files on a computer where no cameras are installed.

The third procedure describes the installation of the codecs needed to play CinePlex AVI files in Windows Media Player.

The last procedure is a high level overview of the installation of other possible component combinations.

The result should be that the desired capabilities of CinePlex Version 3 may be installed on the target system.

Plexon hopes that these procedures solve installation issues for most of our customers. Plexon welcomes feedback as to how to improve the experience. Please contact Plexon support support@plexon.com (+1 214 369 4957) with comments.



CAUTION

English must be the primary language on the target PC for CinePlex. The installation batch files will not run successfully if a double byte language like Chinese is installed as the primary language. If a double byte language is installed, it must be secondary.

Procedure for Typical MAP/CPX Computer Installation

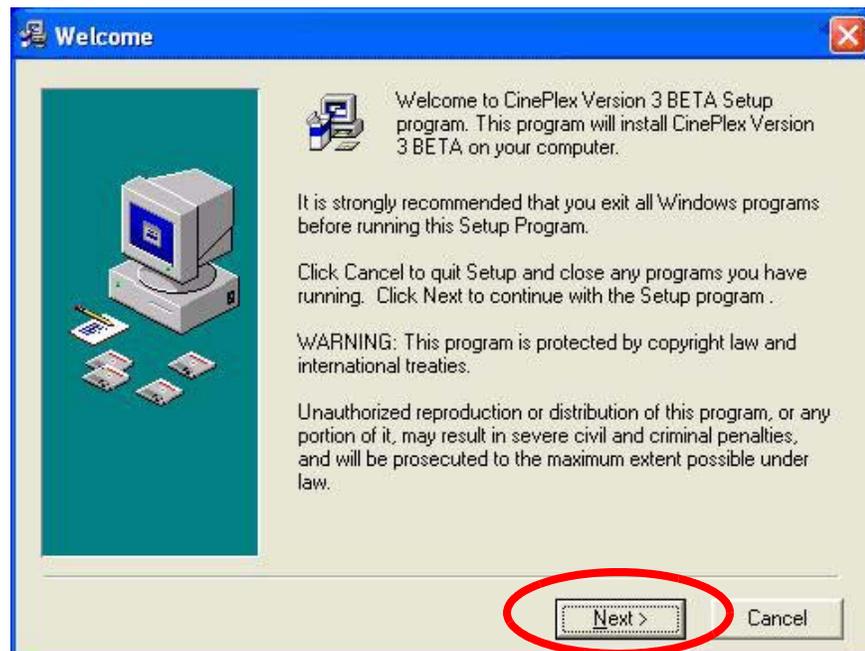
This installation procedure will result in the ability to record, play and edit CinePlex files on the target MAP/CPX computer. Installation of the RASPUTIN software is covered elsewhere and assumed to have been accomplished already.

Note that the installer will not execute correctly unless it runs on the target computer under an account with Administrative privileges. The name of the current installer package is CPXv3SetupBETA.exe. It is available on the Plexon Software USB drive that is distributed to Plexon customers. Plexon recommends placing the package on the desktop so it can easily be deleted after it has been run.

- 1 Double-click the **CPXv3Setup** icon:



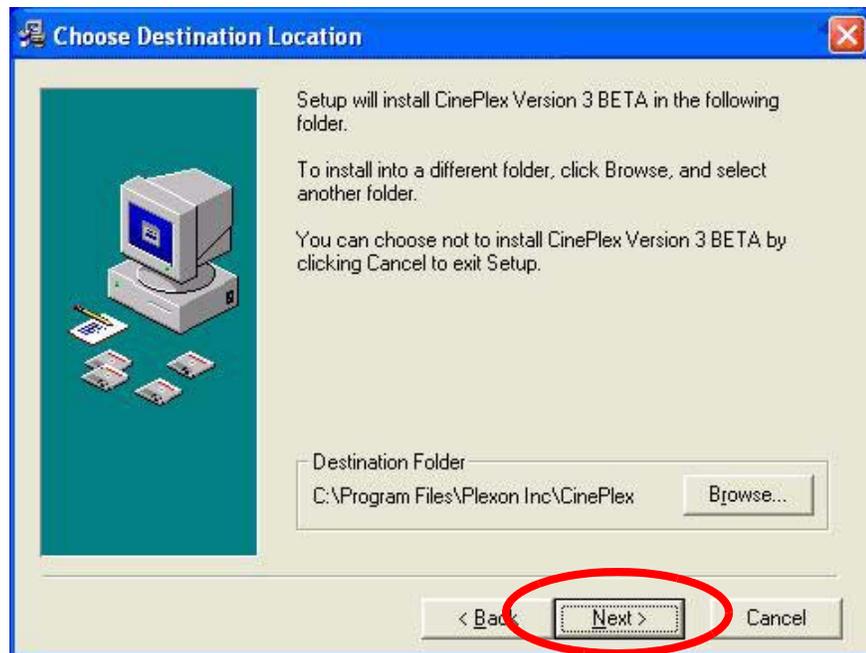
- 2 The **Welcome** window appears. Press **Next**.



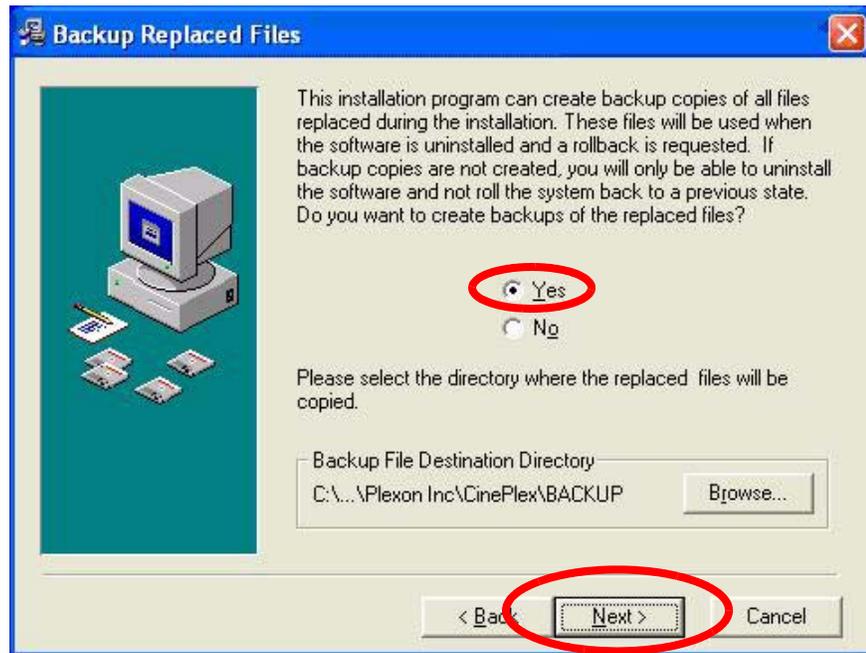
- 3 The **End User License Agreement** window appears. Click **Agree** to agree to the terms:



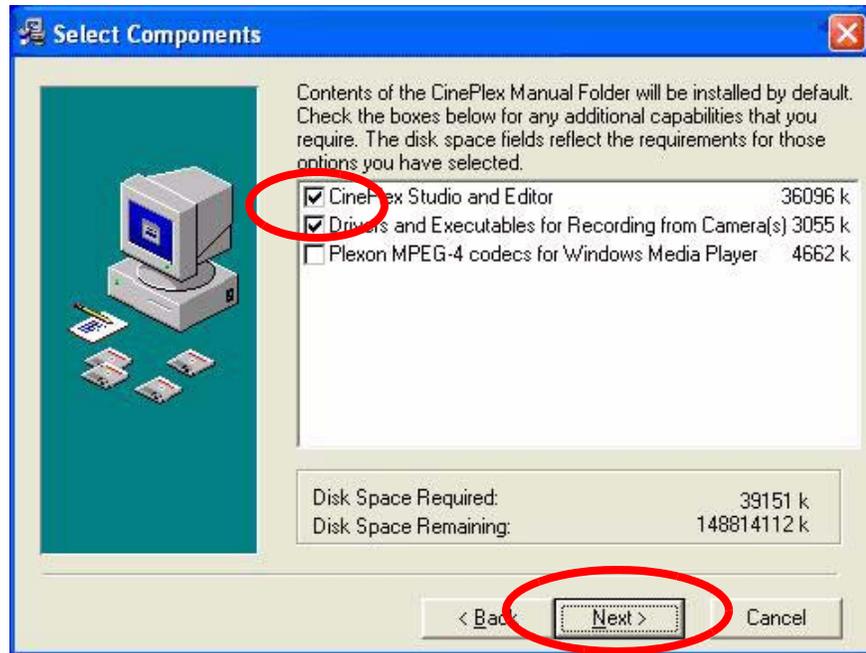
- 4 The **Choose Destination Location** window appears. Click **Next** unless a different location is desired.



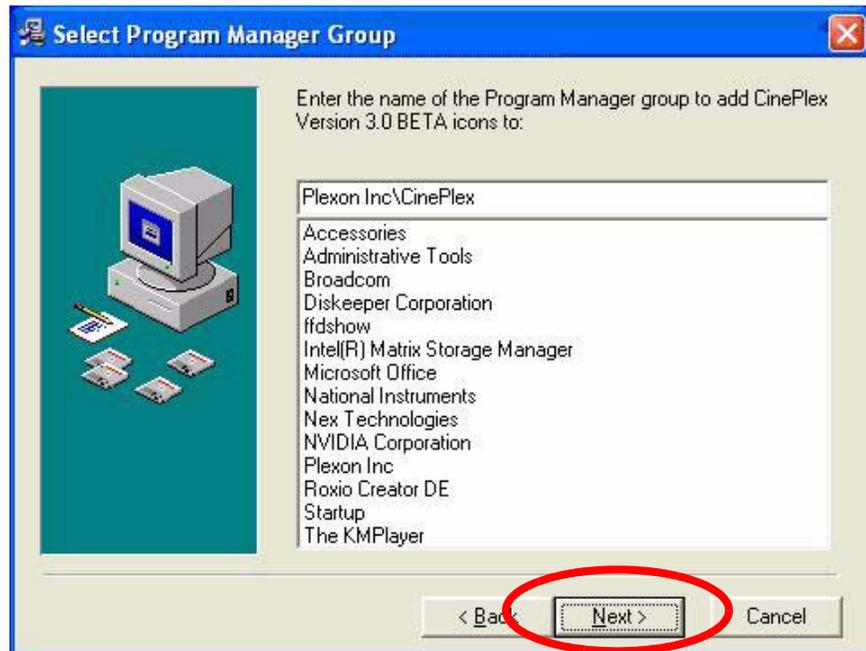
- 5 The **Backup Replaced Files** window appears. Plexon recommend leaving **Yes** selected and clicking **Next**.



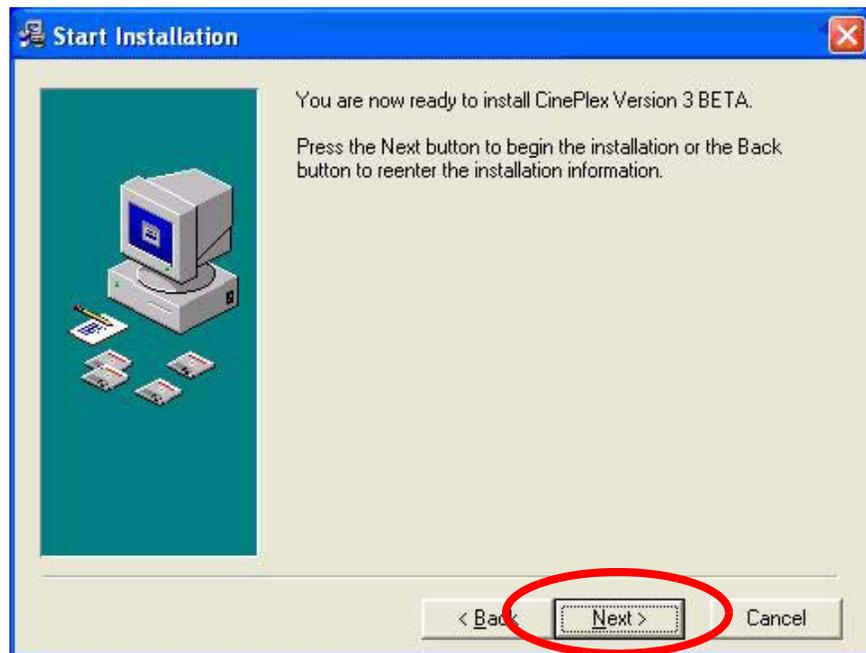
- 6 The **Select Components** window appears. For the MAP/CPX installation leave the first two boxes checked and click **Next**.



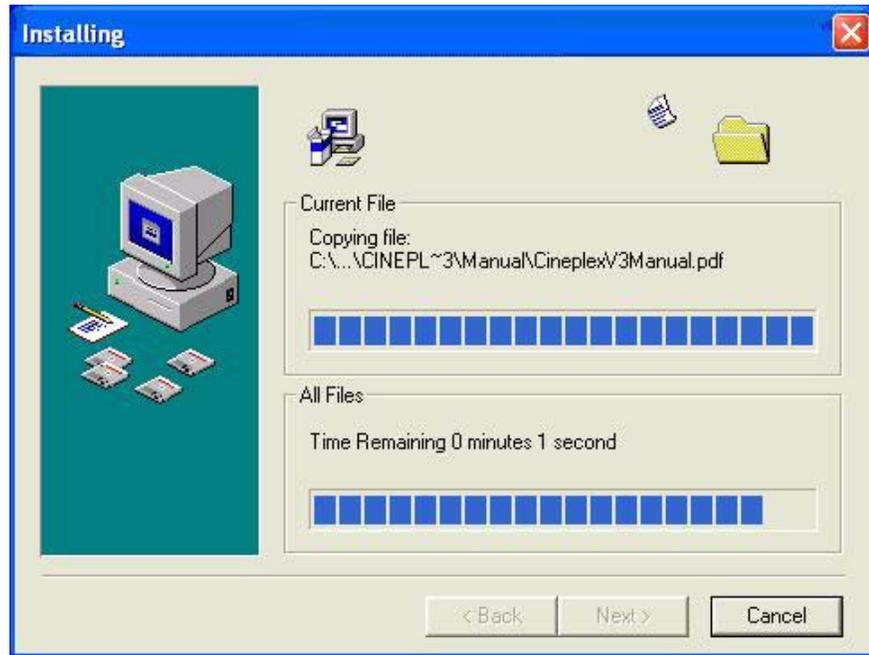
- 7 The **Select Program Manager Group** window appears. Click **Next** unless a different group is desired.



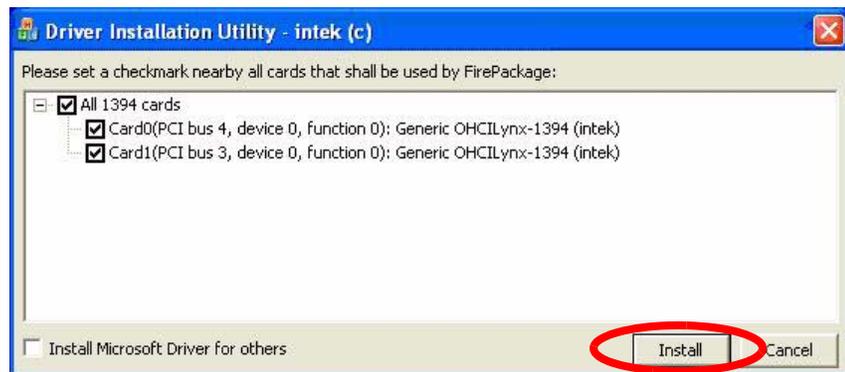
- 8 The **Start Installation** window appears. Select **Next**.



- 9 The following window displays while the installation is in progress.



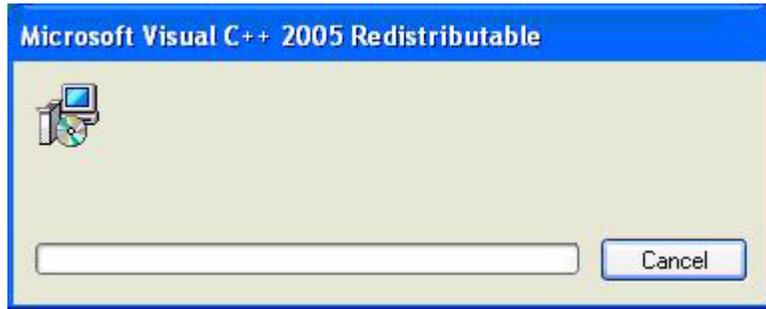
- 10 The **Driver Installation Utility** window appears. Click **Install** to install the selected FireWire buses.



- 11 The following window appears twice -- click **Continue Anyway** both times:



- 12 Then the Visual C++ redistributable is automatically installed and the following window is shown:



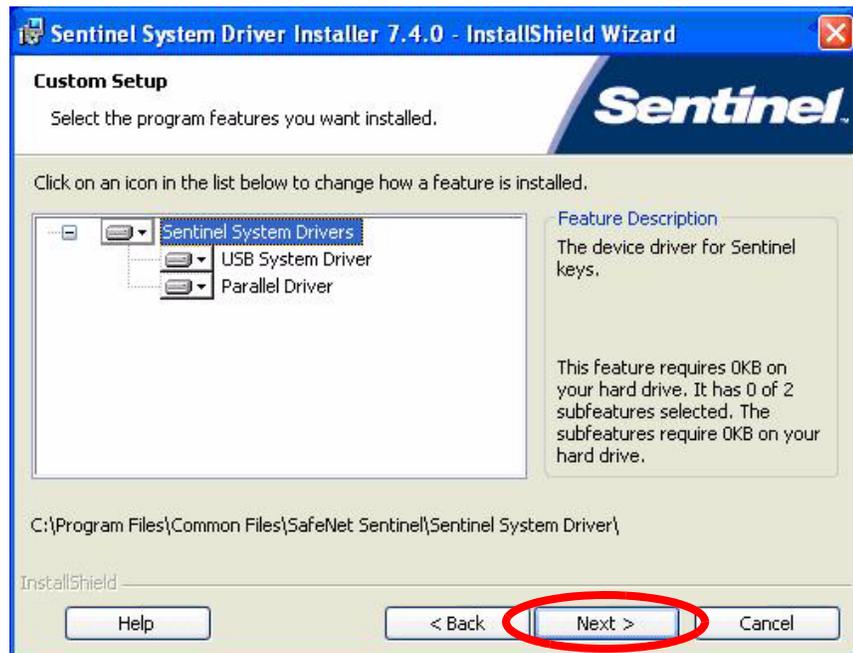
- 13 Next, the **Sentinel Key Drivers** are installed. Click **Next** on the window below.



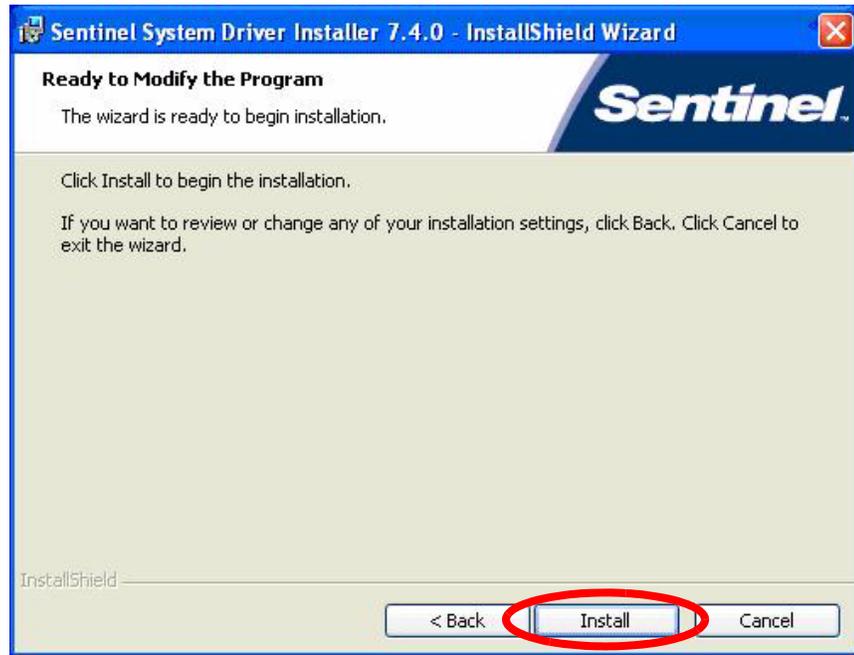
- 14 Click **Next** on the window below.



- 15 Click **Next** on the window below.



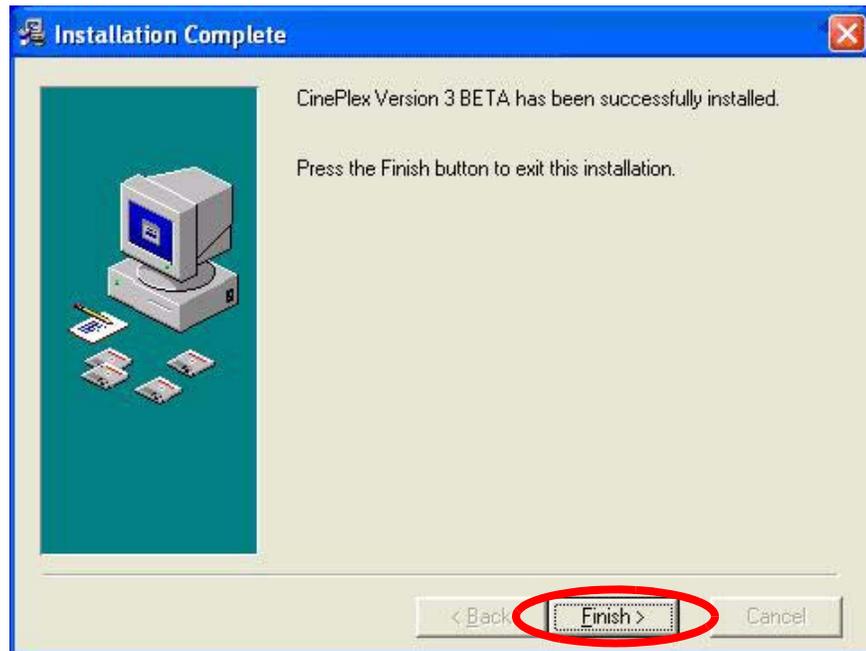
- 16 Click **Install** on the window below.



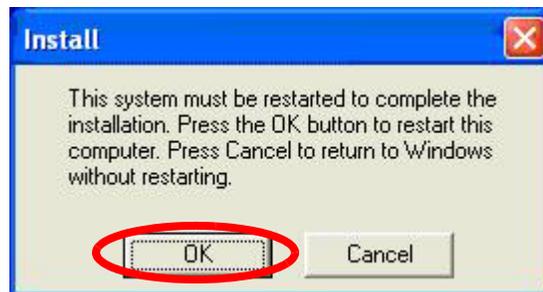
- 17 Click **Finish** on the window below.



- 18 The CinePlex installation has now completed and the window below should appear. Click **Finish**.



- 19 Then click **OK** on the install window to force a restart and complete the installation.



- 20 These shortcuts should appear on the desktop after the installation.



Procedure for Installation of Offline Computer without Camera(s)

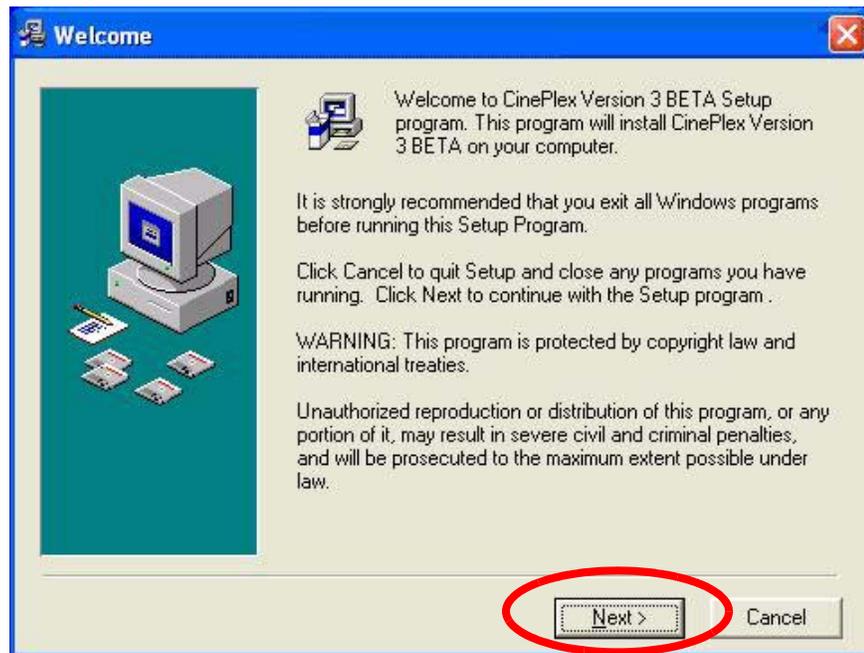
This installation procedure will result in the ability to play and edit CinePlex files on the target MAP/CPX computer. Installation of the RASPUTIN software is covered elsewhere and assumed to have been accomplished already.

Note that the installer will not execute correctly unless it runs on the target computer under an account with Administrative privileges. The name of the current installer package is CPXv3SetupBETA.exe. It is available on the Plexon Software USB drive that is distributed to Plexon customers. Plexon recommends placing the package on the desktop so it can easily be deleted after it has been run.

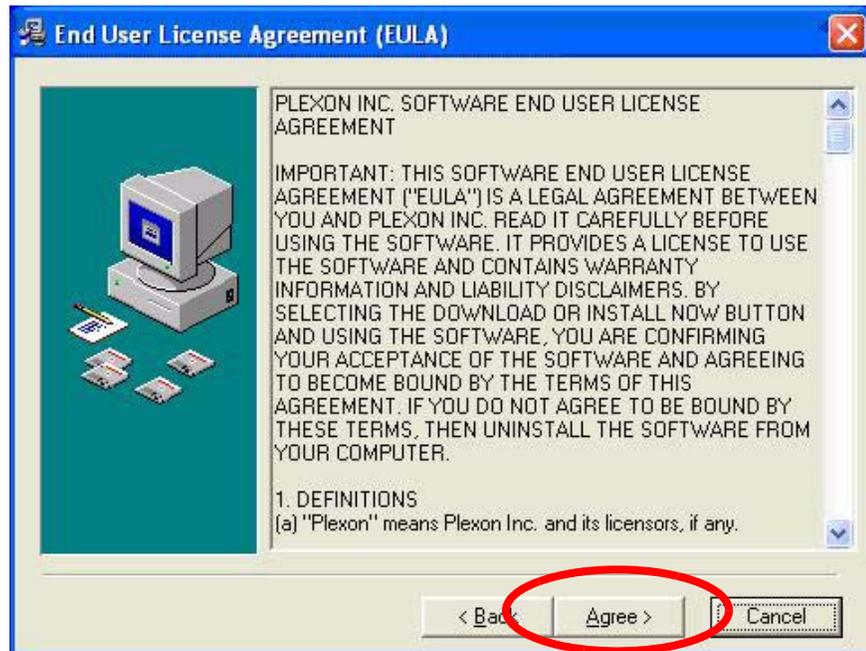
- 1 Double-click the **CPXv3Setup** icon:



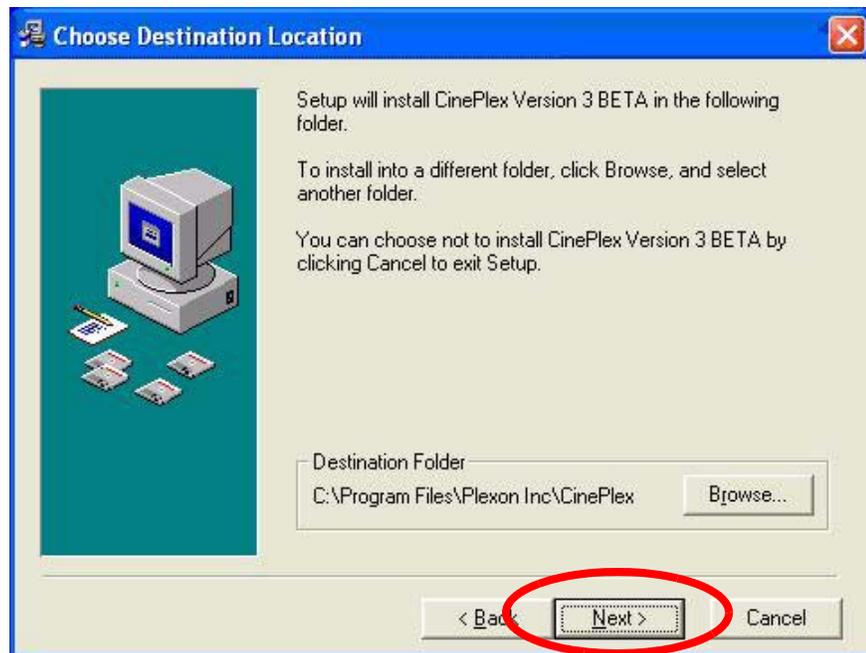
- 2 The **Welcome** window appears. Press **Next**.



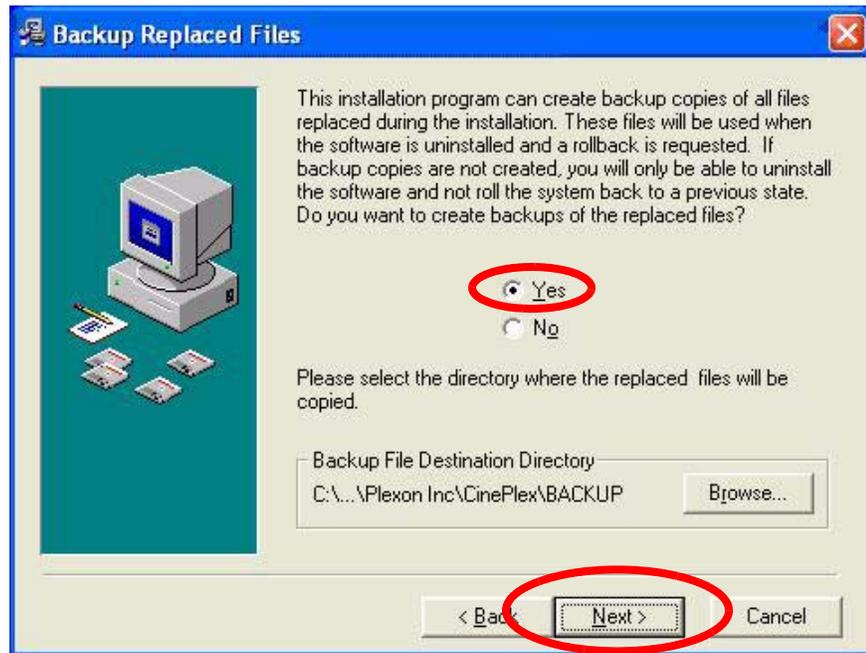
- 3 The **End User License Agreement** window appears. Click **Agree** to agree to the terms:



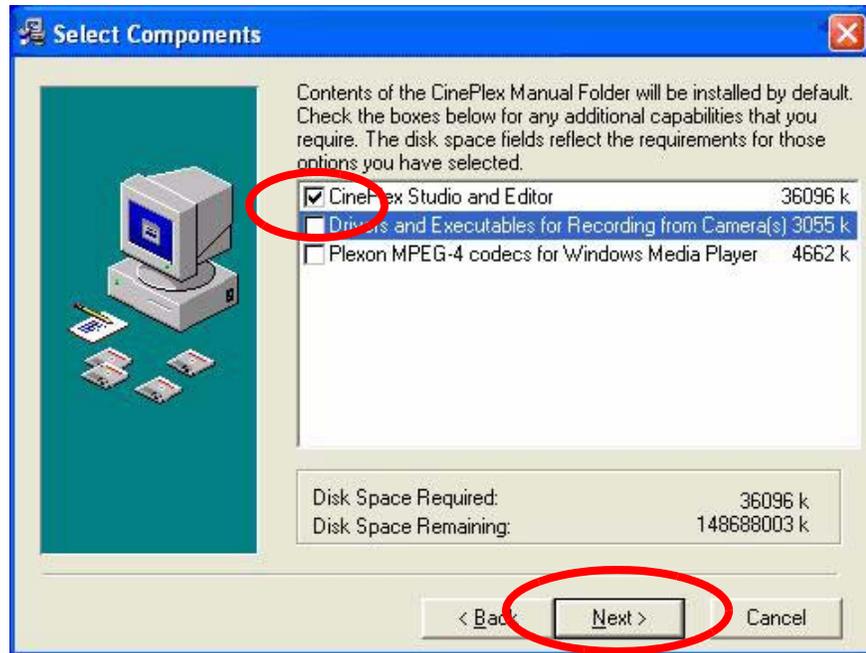
- 4 The **Choose Destination Location** window appears. Click **Next** unless a different location is desired.



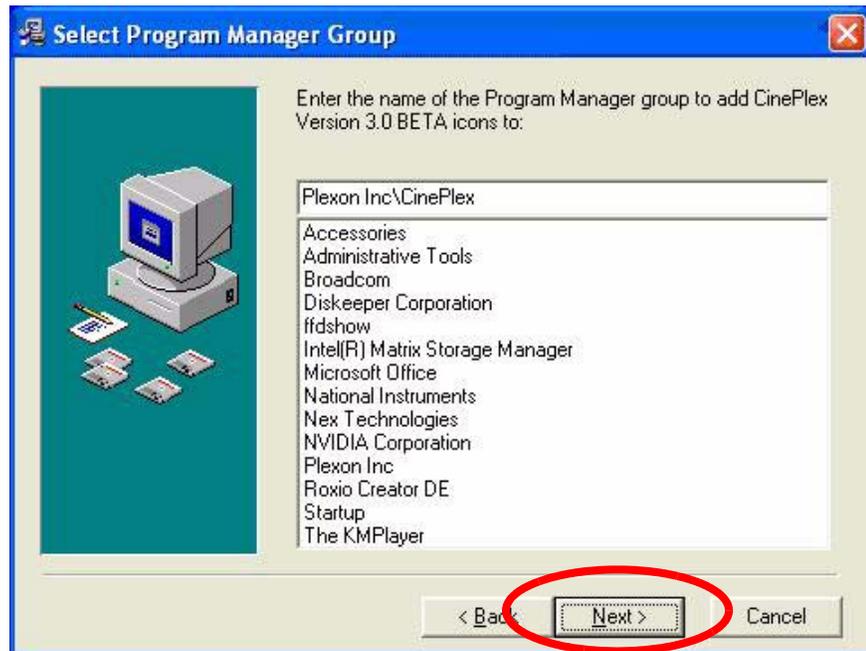
- 5 The **Backup Replaced Files** window appears. Plexon recommend leaving **Yes** selected and clicking **Next**.



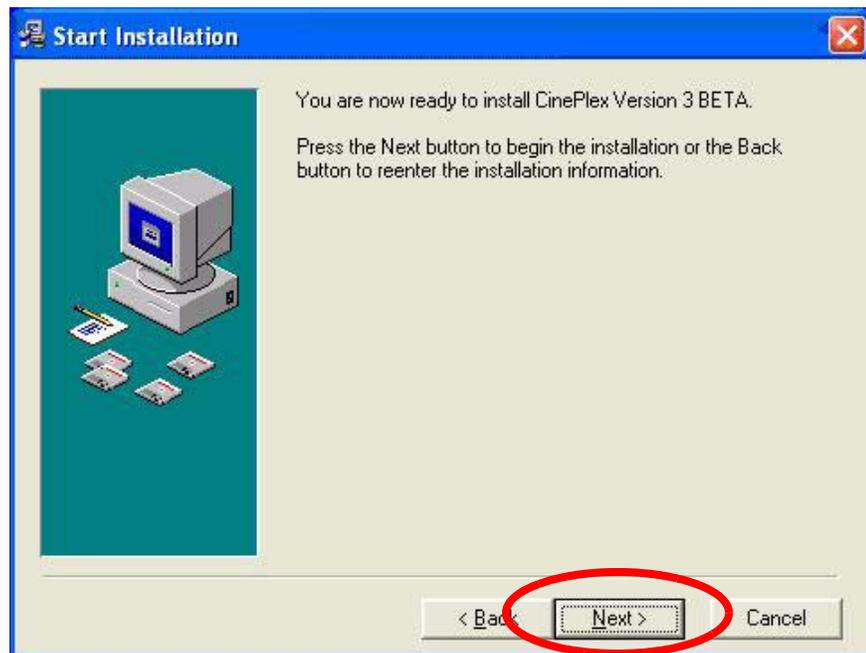
- 6 The **Select Components** window appears. For the offline computer installation check only the first box and click **Next**.



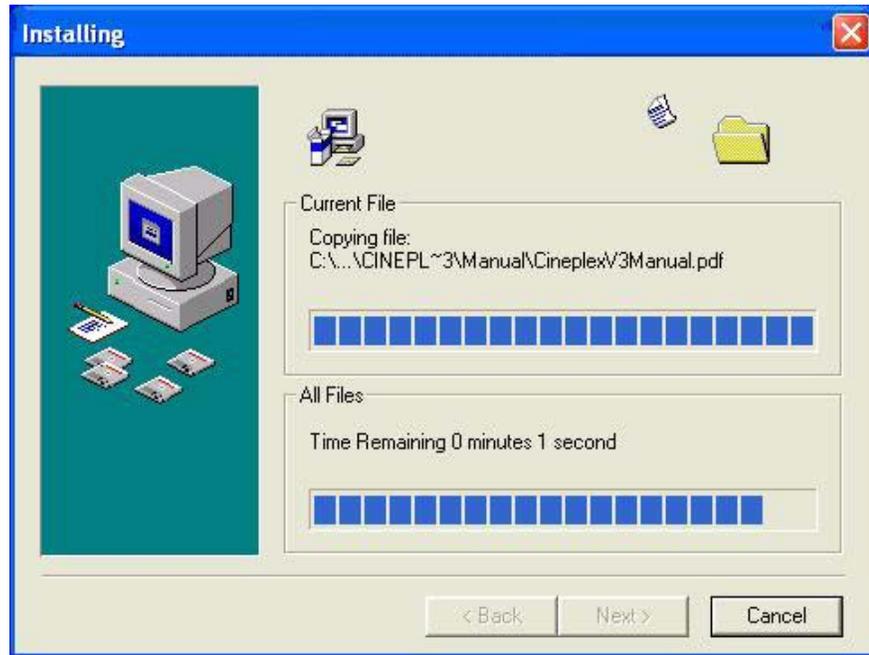
- 7 The **Select Program Manager Group** window appears. Click **Next** unless a different group is desired.



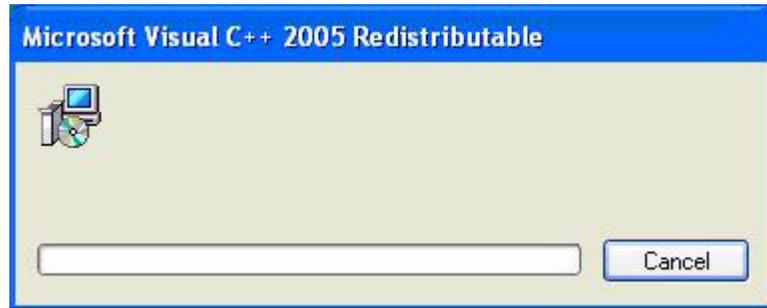
- 8 The **Start Installation** window appears. Select **Next**.



- 9 The following window displays while the installation is in progress.



- 10 Then the Visual C++ redistributable is automatically installed and the following window is shown:



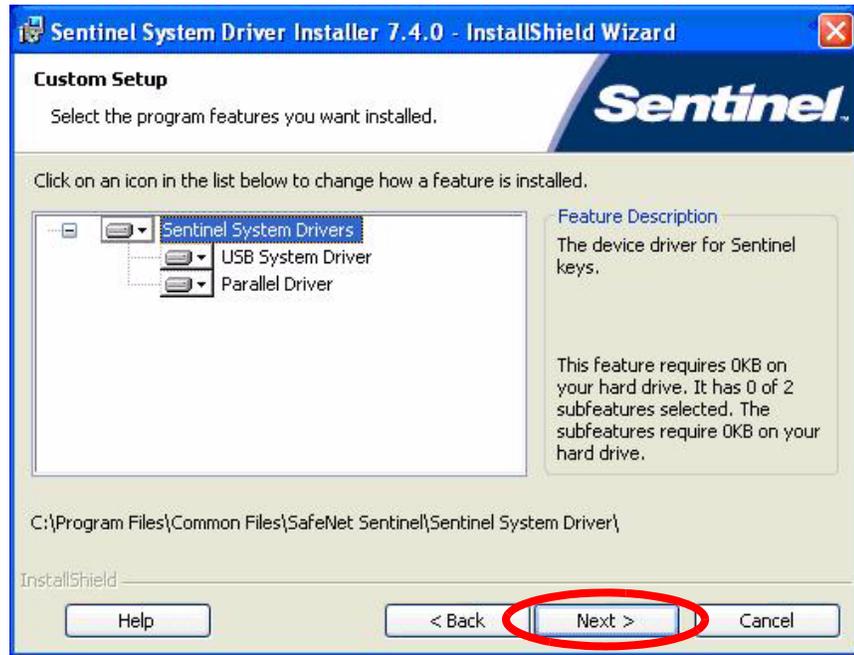
- 11 Next, the **Sentinel Key Drivers** are installed. Click **Next** on the window below.



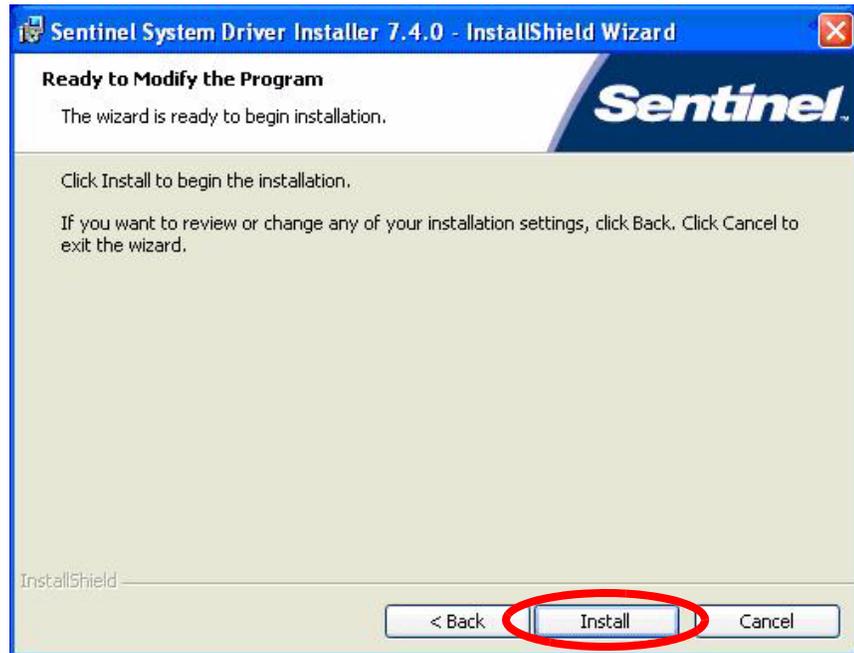
- 12 Click **Next** on the window below.



- 13 Click **Next** on the window below.



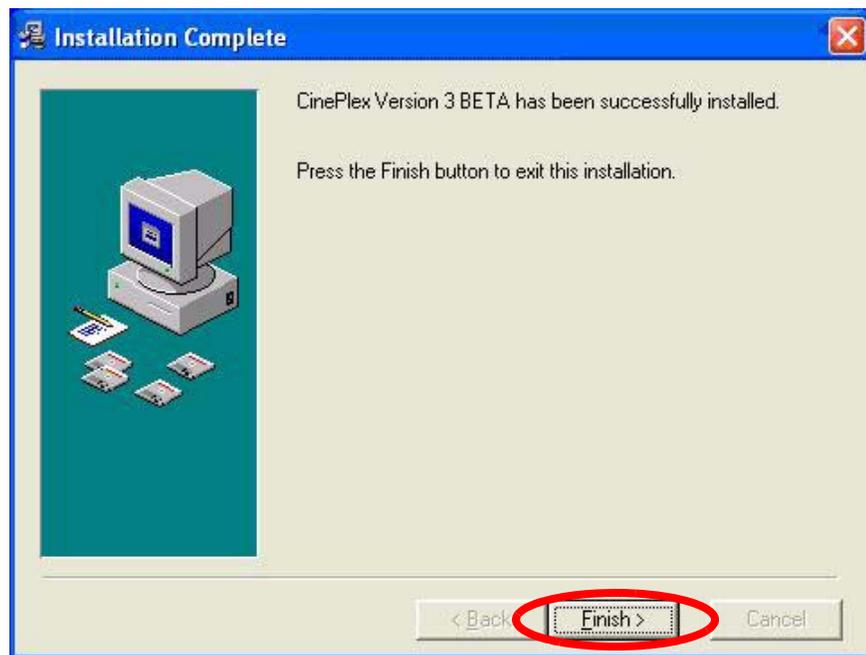
- 14 Click **Install** on the window below.



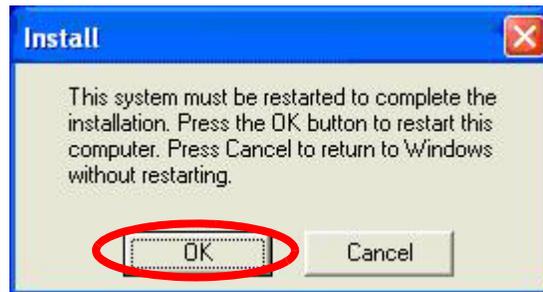
- 15 Click **Finish** on the window below.



- 16 The CinePlex installation has now completed and the window below should appear. Click **Finish**.



- 17 Then click **OK** on the install window to force a restart and complete the installation.



- 18 These shortcuts should appear on the desktop after the installation.



Procedure for Installation of Codecs for Media Players

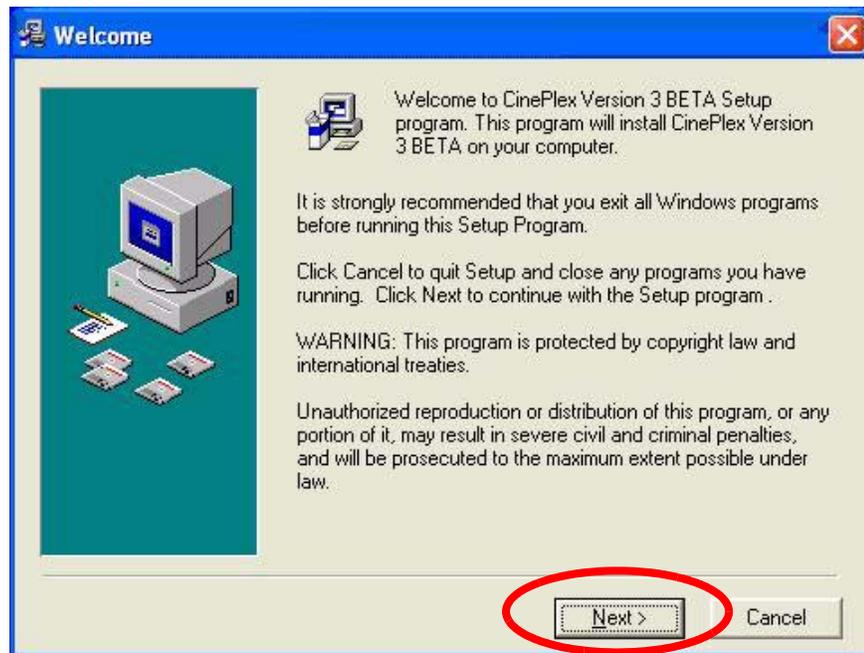
This installation procedure will result in the ability to play CinePlex AVI files on the target computer with Windows Media Player.

Note that the installer will not execute correctly unless it runs on the target computer under an account with Administrative privileges. The name of the current installer package is CPXv3SetupBETA.exe. It is available on the Plexon Software USB drive that is distributed to Plexon customers. Plexon recommends placing the package on the desktop so it can easily be deleted after it has been run.

- 1 Double-click the **CPXv3Setup** icon:



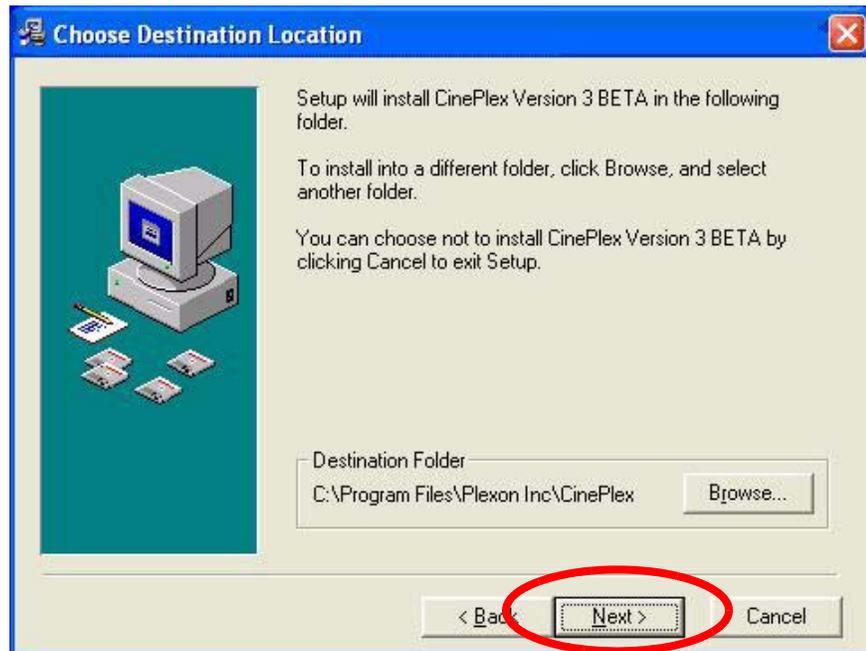
- 2 The **Welcome** window appears. Press **Next**.



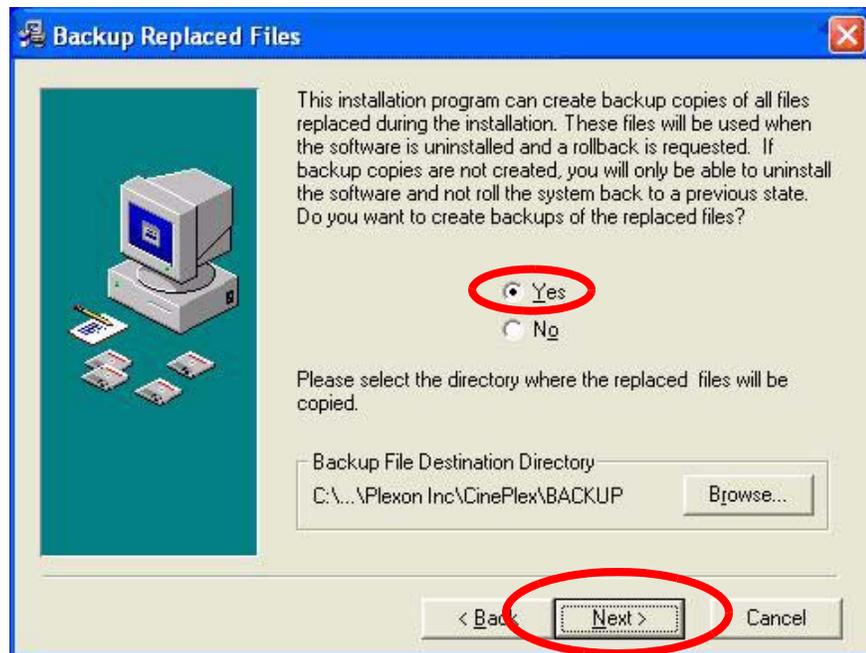
- 3 The **End User License Agreement** window appears. Click **Agree** to agree to the terms:



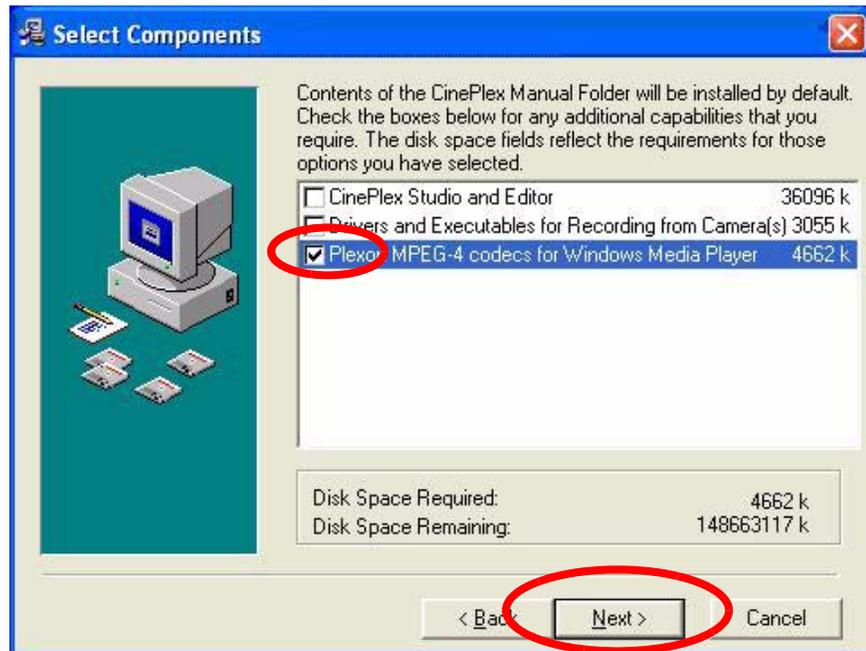
- 4 The **Choose Destination Location** window appears. Click **Next** unless a different location is desired.



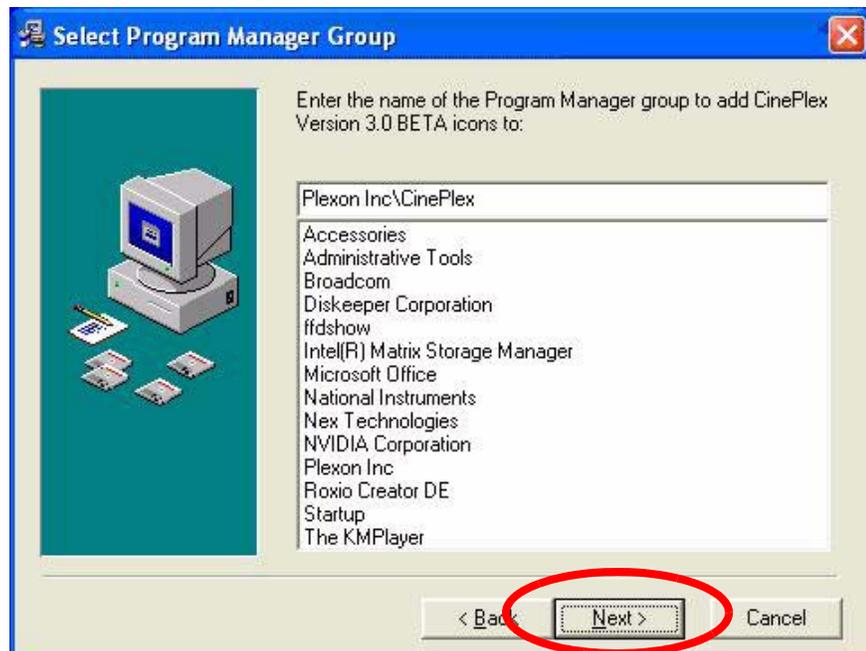
- 5 The **Backup Replaced Files** window appears. Plexon recommend leaving **Yes** selected and clicking **Next**.



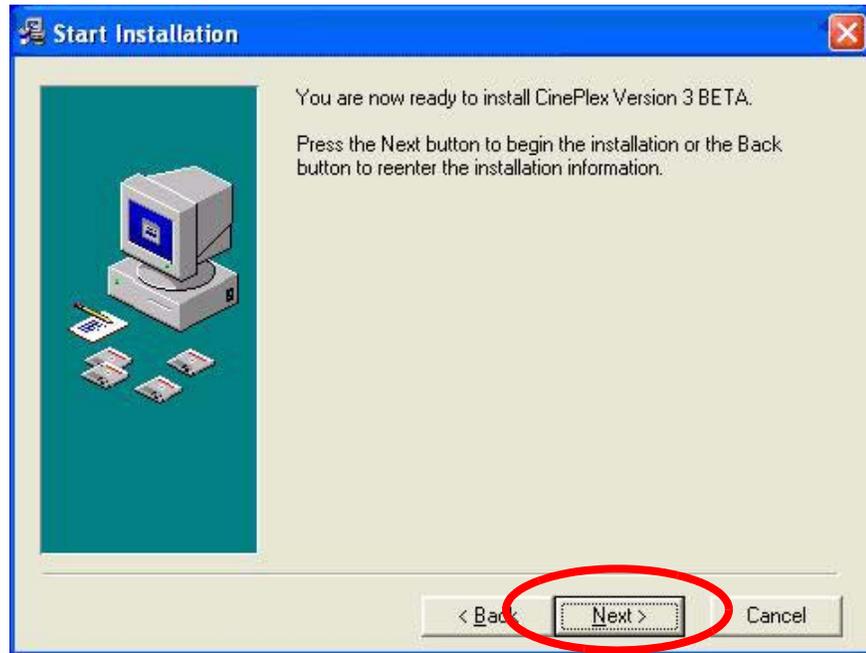
- 6 The **Select Components** window appears. For the codecs installation check only the third box and click **Next**.



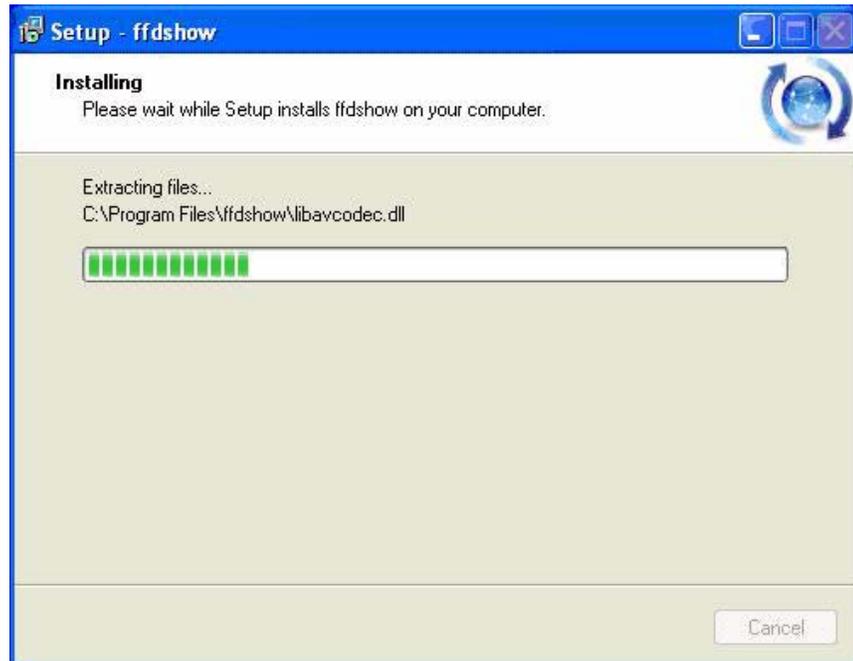
- 7 The **Select Program Manager Group** window appears. Click **Next** unless a different group is desired.



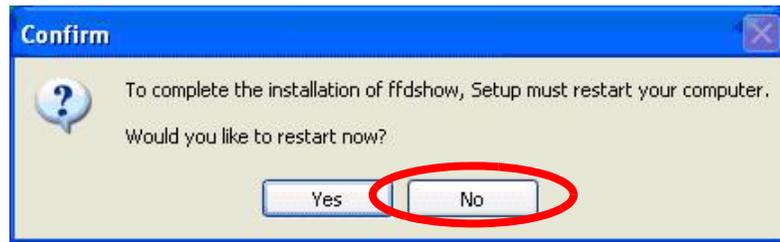
- 8 The **Start Installation** window appears. Select **Next**.



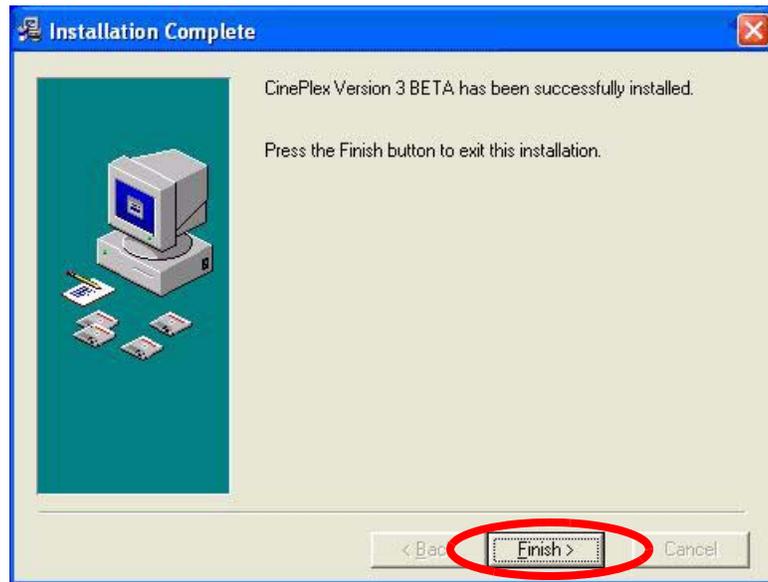
- 9 The following window displays while the installation is in progress.



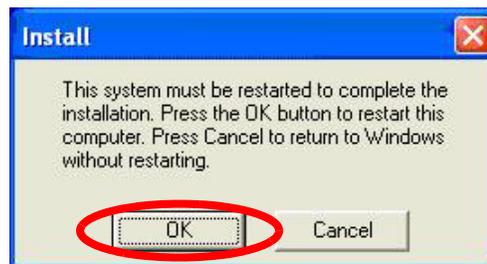
- 10 Nothing else will be installed, but the installation package must be completed before restarting, so click **No** on the window below.



- 11 The CinePlex installation has now completed and the window below should appear. Click **Finish**.



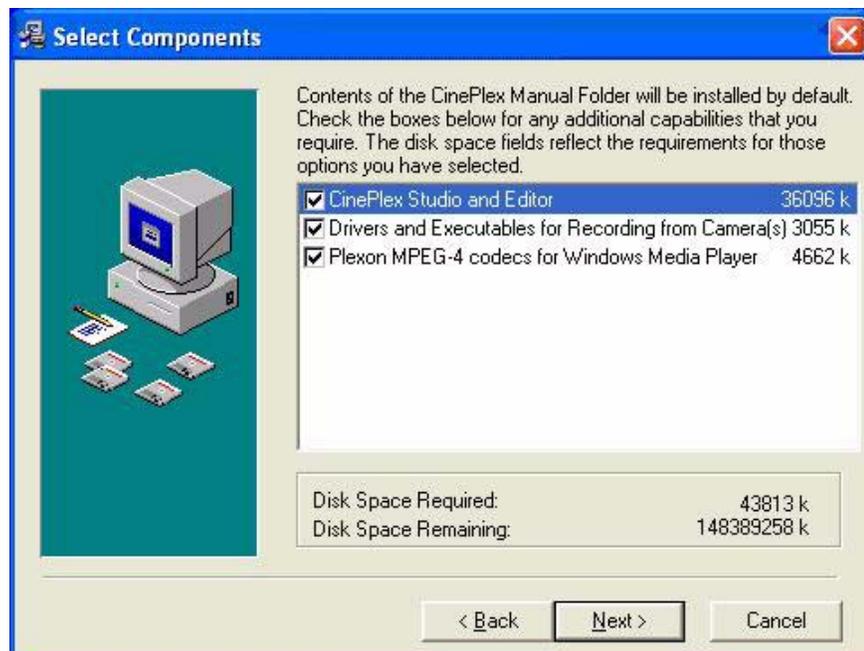
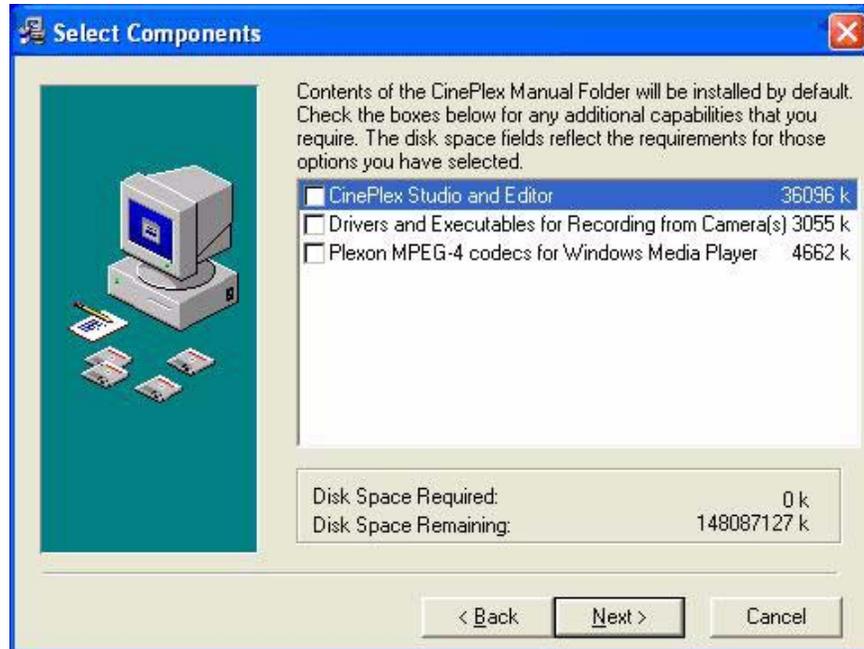
- 12 Then click **OK** on the install window to force a restart and complete the installation.

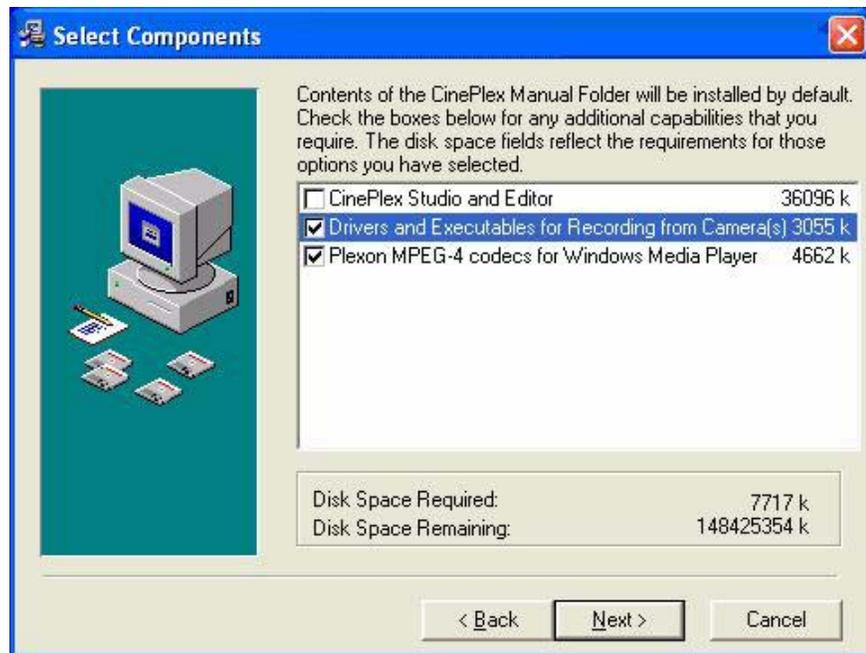
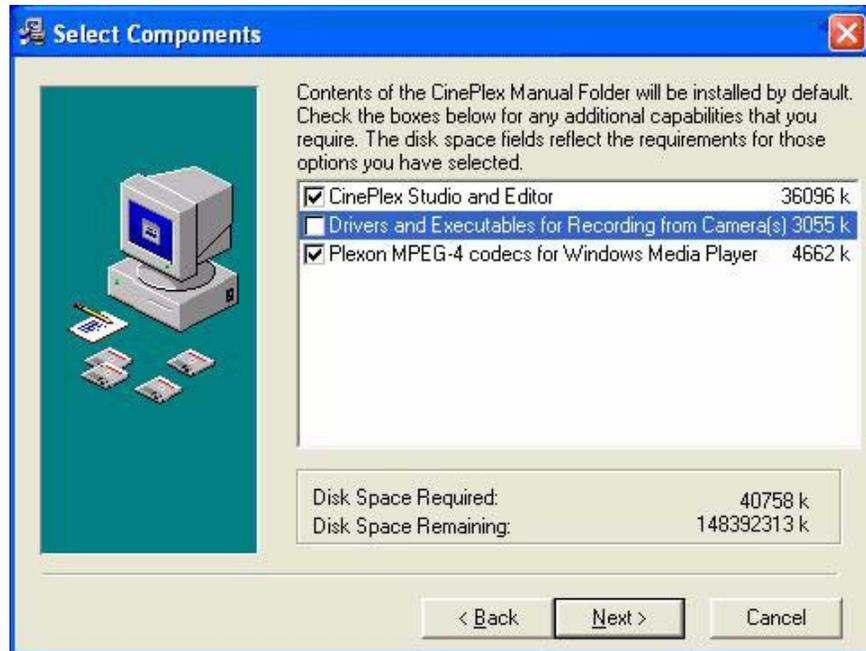


- 13 No new shortcuts should appear on the desktop after the installation.

Procedure for Installation of Other Component Combinations

- 1 Use the **Procedure for Installation of Codecs for Media Players**.
- 2 At step 6, arrange the checkboxes to correspond to one of the diagrams below:





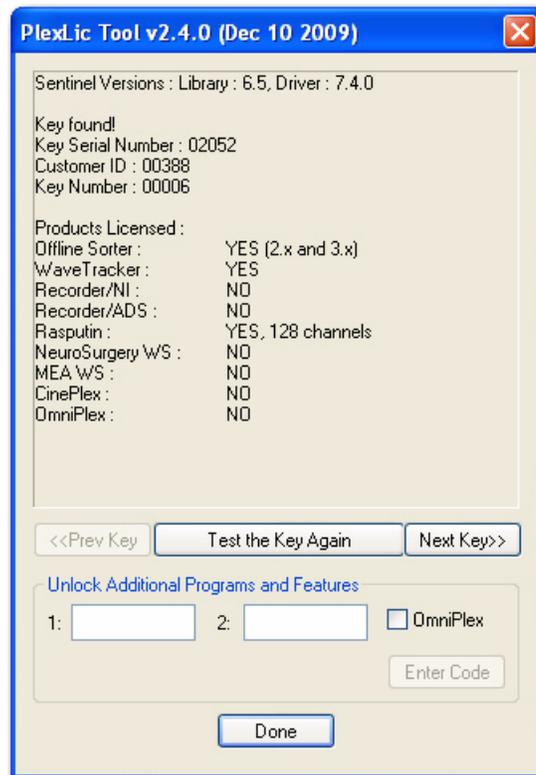
- 3 After step 6 continue the procedure as shown in **Procedure for Installation of Codecs for Media Players**.

A.3 Licensing

After the user has installed the Sentinel hardware key, it requires no additional attention. However, **CinePlex Editor** contains facilities for examining the licensing status of the CinePlex System and other Plexon products, and for performing remote upgrades to unlock additional features, or product licenses. Use the following procedure to check Plexon licenses.

Opening the License Management Window

- 1 From the **Help** menu, click **About CinePlex Editor**, and select **Licensing** to bring up the **Plexon License Management** window.



Note: In the main text area, the window contains a summary of the licensing status of the hardware key or keys. If CinePlex Editor cannot read a hardware key, an explanation appears in the window. If CinePlex Editor can read a hardware key, it interrogates it and displays the information from it. The *Key Serial Number*, *Customer ID*, and *Key Number* identify a particular key. This information must be provided to Plexon to unlock additional Plexon products. The *Products Licensed* section tells which Plexon products are currently unlocked by the hardware key.

- 2 Click **Test the Key Again** to re-interrogate the key and re-display the information. The **Unlock Additional Program and Features** section applies

to remote upgrades. If a remote upgrade applies, Plexon provides instructions on how to use this feature.

Note: Multiple Plexon hardware keys can be installed on the computer. CinePlex Editor can find and use a license on any of the keys attached to the computer. If Plexon software detects multiple Plexon keys on the computer, additional **Next Key>>** and **<<Previous Key** buttons appear in the license window. Use these buttons to step through the keys to individually examine each key.

A.4 Plexon Technical Support

A.4.1 Technical Support

Assistance is available with the CinePlex System via e-mail at support@plexon.com.

A.4.2 Demo Mode

If there is not a valid Plexon hardware key connected to the computer, CinePlex Editor runs in **Demo Mode**. CinePlex Editor opens a startup message box to indicate that it is running in Demo mode. Plexon provides all CinePlex Editor features in Demo mode, except the file saving functionality.

Appendix B Problem Resolution

B.1 Physical Installation Issues	B-2
B.2 Other Issues.....	B-4
B.3 CinePlex Studio Messages	B-11



CAUTION

Never plug or unplug a camera FireWire cable with the PC Power ON.
Permanent damage to the camera may result.

CinePlex Version 3 is a powerful, complex product that gives its users extensive control over the video portions of their neural data collection process. This complexity gives rise to possible interactions and issues that were not present in earlier versions. For that reason Plexon has compiled this list of common problems reported from the field, together with their normal solutions. If the steps here do not solve the problem, or if the problem is not listed, please contact Plexon Support at support@plexon.com or 214-369-4957.

B.1 Physical Installation Issues

In general, all of the following should be checked when unexplained problems are occurring. For more detailed installation instructions of CinePlex V3 hardware, please refer to the relevant documents.

Missing/Improper Wire and Cable Connections - Single Systems

Be sure that all required cable connections are in place and tight. Unpredictable results may occur if they are not. See [“Appendix A-Installation”](#) for complete detailed instructions for installing CinePlex. The most likely items to check are:

- 1 Short purple wire from TIM card nose board to the XS2 BNC connector on the TIM card.
- 2 Trigger cable(s) from the AccesIO tail board to the camera(s).
- 3 FireWire cable(s) from the FireWire card in the computer to the camera(s). If there are two cameras, there must be an empty FireWire socket between the two connections to the FireWire board or maximum frame rates will not be achievable.
- 4 Control cable from the TIM card nose board to the AccesIO tail board. If this cable is not in place, video frames may not be clocked and/or Studio may not start recording correctly.

Missing/Improper Wire and Cable Connections - Synchronized Systems

Cabling is slightly different when CinePlex and MAPs are deployed as multiple synchronized systems using a Quad MAP Controller (QMC). Again, be sure that all required cable connections are in place and tight. This includes:

- 1 BNC cable and start button to the “BUTTON” input on the QMC OR BNC cable from the “PULSE” input on the QMC to an external experiment control system.
- 2 Control cable from the Master MAP TIM nose board to the QMC “CPX CTRL IN” socket.
- 3 Control cables from the QMC “CPX CONTROL OUT” for each system to their respective AccesIO tail boards. If this cable is not in place, video frames may not be clocked and/or Studio may not start recording correctly.
- 4 BNC Start cable from the QMC “START” socket to the “XS2” BNC connector on the TIM card on each synchronized MAP system.
- 5 BNC clock cable from the Quad MAP controller “CLK OUT” connector to the “Remote CLK” on each of the respective TIM boards. Also make sure that the

toggle switch above these connectors is in the down position to select the remote clock.

- 6 Optionally, digital input signals from an external system can be input to the "DIGITAL INPUT" socket on the QMC where they are made available on the "DIGITAL OUTPUT" sockets to all MAP boxes.
- 7 Trigger cable(s) from the AccesIO tail board to the camera(s).
- 8 FireWire cable(s) from the FireWire card in the computer to the camera(s). If there are two cameras, there must be an empty FireWire socket between the two connections to the FireWire board or maximum frame rates will not be achievable.

Cables Too Short between Camera(s) and MAP/CinePlex Computer

Plexon supplies several lengths of these cables from 7 feet (2 meters) to 26 feet (8 meters). Please contact Plexon if one of these standard lengths will work in the installation. Note that cable lengths over 26 feet result in intermittent video signals at higher frame rates and are NOT RECOMMENDED.

Unstable Camera Mounting

Camera mounts must be stable or the resulting video data will shake and not be repeatable. This can be the case, for example, when a tripod is used to mount a camera, instead of the preferred wall or ceiling mount. Please refer to ["Appendix C- Lens Selection, Experiment Design, and Camera Installation"](#).

B.2 Other Issues

General Problem Solution - No Video from Camera and Other Problems

The correct starting sequence must be applied to the MAP box, Sort Client, and CinePlex Studio. Not following the sequence completely is the cause of many types of errors, including no video being shown from the cameras. The startup sequence is as follows:

- 1 Power up the MAP.
- 2 Power up the computer, log in as Administrator, bring up the Server program, and then bring up the Sort Client program. Select the desired Parameters file.
- 3 In Sort Client, press "START" button and then the start recording triangular icon. Then press the stop recording rectangular icon.
- 4 Bring up CinePlex Studio. Verify that video is showing and select a tracking mode. Adjust parameters so that objects are being tracked successfully.
- 5 Contact Plexon support if problem is not resolved.

Error Messages While Running the Software Installation Package

The installation package adds programs and DLLs to the system. Therefore, the installation software:

- 1 Must be run from a computer account with administrator privileges.
- 2 Cannot be installed on a Vista computer.
- 3 Cannot be installed on a 64 bit computer.
- 4 Must be downloaded to and run from a local hard drive. Removable drives, including USB flash drives and USB hard drives, are not acceptable. Neither are networked drives.
- 5 Contact Plexon support if problem is not resolved.

Antivirus Software

Some MAP/CPX systems come from Plexon with antivirus software pre-installed. The system has been tested with this antivirus software in place and should operate without problem as long as software and update settings are not changed. If problems occur that can be traced to the pre-installed antivirus software, please contact Plexon Support. It could be that a new set of virus signature files has caused some CinePlex components to be flagged as untrustworthy.

Please do not install any other antivirus software on the MAP/CPX computer without consulting Plexon Support first. There are two reasons for this:

- 1 First, some antivirus tools have been known to quarantine or remove key components of the CinePlex system, rendering it unusable. A reinstallation of

the CinePlex software will be required after the antivirus tool is removed from the computer.

- 2 Second, periodic downloads of updates or periodic scans for infections can disrupt video streams and processing, causing lost frames and delayed events.
- 3 Contact Plexon support if problem is not resolved.

Studio Will Not Start At All

There can be many causes for Studio failing to start when its icon is clicked or displaying an error and failing to start when OK is clicked. The most common causes and their solutions are shown below.

- 1 Missing CinePlex license key. Obtain or find the correct license key and restart CinePlex.
- 2 If CinePlex still will not start and reports a missing license key, install the Sentinel drivers (this is done by the CinePlex installation software or by running the file C:\Program Files\Plexon Inc\CinePlex\Common Files\Sentinel System Driver Installer 7.4.0.exe).
- 3 If CinePlex reports missing DLLs, reinstall CinePlex. All the required DLLs are in the installation package.
- 4 Contact Plexon support if problem is not resolved.

Studio Will Not Start In or Switch to Camera Mode

There can be many causes for Studio failing to go into camera mode. The most common causes and their solutions are shown below.

- 1 Missing MAP and/or CinePlex license key. Obtain or find the correct license key, install the Sentinel drivers (this is done by the CinePlex installation software), and restart CinePlex.
- 2 Missing or inoperative IO card or drivers.
- 3 Camera cables are loose or unplugged. Power all components of the system down, then check and reseat both ends of the two cables to the camera. Power the system back up, and follow the normal startup steps.
- 4 Contact Plexon support if problem is not resolved.

Studio Cannot Find AccesIO Drivers

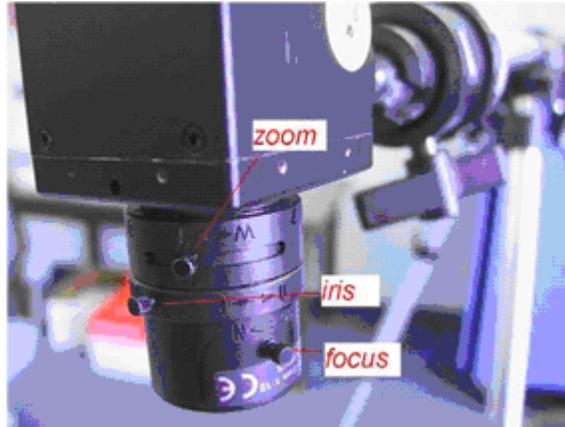
- 1 Check for and disable any antivirus software. If the AccesIO drivers are in quarantine, restore them.
- 2 Try running Studio again. If the system still cannot find the AccesIO drivers go to the next step.
- 3 Reinstall CinePlex.
- 4 Contact Plexon support if problem is not resolved.

No Video in Studio

- 1 Sort Client must have a valid configuration file and the button labeled "START" must have been pushed. Until this has been done, no CinePlex

clock (or MAP clock from which it is derived) is being generated, so there is not video frame trigger.

- 2 After powering the system down, check the camera cables, especially the CPX control cables.
- 3 Power the system back up and follow the normal startup steps.
- 4 If there is still a problem ensure that the manual iris control on the lens is fully open.



- 5 If the problem is still not resolved, there is a standalone un-triggered tool that will display video from the camera(s) if it is connected correctly and operational. Open the file below:
`C:\Program Files\Plexon Inc\CinePlex\Common Files\AVT_SmartView_1_8.exe`
- 6 If there is video for a particular camera using this tool, the camera and its FireWire cables are OK, and something is wrong with MAP cabling or operation. If no video, contact Plexon Support.

Cannot Focus the Video Image

The video is present, but blurry and cannot be focused at any zoom or focus setting. Note that the nearest focus for Plexon supplied lenses is from 0.2 to 1.6 meters depending on the lens.

- 1 Check for the presence of an annular spacer between the lens and the camera. The spacer should be present if the lens is a C-mount lens like Plexon's H6Z0812. The spacer should be absent for CS-mount lenses like the H32Z4512.
- 2 Adjust the zoom and focus rings on the lens until a clear picture is obtained. See figure above.
- 3 Contact Plexon support if problem is not resolved.

Slow Video in Studio

The video is present, but is updating very, very slowly - perhaps once every several minutes.

-
- 1 Remove the TIM card and check that the DIVCLK jumper is on the 1 MHz position instead of the 1 kHz setting. If not, move it to the 1 MHz setting.
 - 2 Contact Plexon support if problem not resolved.

Filtering Video

Video is present, but the image is flickering.

- 1 Turn off any fluorescent lights illuminating the arena and use incandescent lights instead. If the flickering goes away, there may be problems with the fluorescent bulbs themselves, the starters, or the ballast. If fluorescent fixtures must be used, these problems must be fixed. Otherwise, look for alternative lighting sources
- 2 Contact Plexon support if problem is not resolved.

Arena is Too Small or Too Large within the Video Image

Once video has been obtained, the camera and lens must be adjusted so that the maximum dimension of the arena nearly fills the long dimension of the video image while ensuring that all other parts of the arena are within the video image as well.

- 1 If the arena image is too small, move the camera closer to the arena (outside of the near limit) or adjust the zoom ring towards the T (telephoto). Then adjust the lens focus ring until the video image is clear, if possible.
- 2 If the arena image is too large, move the camera away from the arena (within the physical limits of the environment) or adjust zoom ring towards the W (Wide Angle). Then adjust the lens focus ring until the image is clear, if possible.
- 3 Contact Plexon support if the arena cannot be adjusted to fill the video window.

Studio Will Not Start Recording When the Sort Client Start Icon is Pushed

- 1 Check that the Rasputin Datafile Options are set up for CPX operation. If Sort Client does not have these options available, contact Plexon Support to obtain the latest version.
- 2 Check that Studio is in the armed mode, waiting for Sort Client to start recording.
- 3 Check cables, especially the control cables - see the Physical Installation section of this document.
- 4 Check that the disk selected for recording video files is not full.
- 5 Contact Plexon support if problem is not resolved.

No Strobed Data Showing in Sort Client after Initial Startup

Usually, this occurs because the correct starting sequence has not been applied to the MAP box, Sort Client, and CinePlex Studio. The startup sequence is detailed in the section above General Problem Solution - Startup Sequence Not Followed.

- 1 Follow the start sequence. Go to LED or Markers mode. Press the PLX button next to up to three colors.
- 2 In Sort Client, ensure that the Strobed Data box is checked on the Settings/ Events tab. Press the Activity tab icon so that tab appears.
- 3 Scroll down to the bottom of the Activity tab window and verify that strobed data hash marks are being displayed.
- 4 Earlier version of Sort Client may not always display strobed data even though it is being received and written to the PLX data file successfully. Use the section below to verify strobed data in earlier versions of Sort Client.
- 5 Contact Plexon support if problem is not resolved.

No Strobed Data Showing in Earlier Versions of Sort Client - Use VTViewer

Sometimes, strobed data may not appear on the Activity tab after recording has been started. This is due to a display fault in earlier versions of Sort Client. The simple VTViewer client may be used to verify the generation of strobed data in this case.

- 1 Use the VTViewer icon or open the file below (on the MAP/CPX computer) to bring up the VTViewer program
`C:\Program Files\Plexon Inc\CinePlex\Common Files\VTViewer.exe`
- 2 Drop down the File menu and select the Connect option.
- 3 If the connection to Sort Client has been successful, colored spots representing current reported positions of the tracked objects will appear on the VTViewer grid.
- 4 If no colored spots are shown, please contact Plexon support.

Live Video Being Corrupted or Neural Data Being Dropped

Sometimes the live data will be corrupted or neural data will be dropped.

- 1 Try reducing monitor count, monitor resolution, or both.
- 2 If cards have recently been added to the PC bus, remove them to see if the problem is solved.
- 3 Contact Plexon Support for help in rearranging the order that existing cards are plugged into the PC bus.

Dropped Frame Count Non-zero While Recording

When the MAP/CPX computer is heavily loaded causing available video buffering to fill, video frames may be dropped. The count of dropped frames is incremented each time this happens. This is not a normal condition and probably indicates that the computer is being asked to perform more than MAP/CPX processing.

-
- 1 Stop running all unnecessary applications on the computer while recording. This includes CinePlex Editor, which can initiate intensive hard drive activity. Use the Task Manager to display and end unneeded tasks.
 - 2 Disable scheduled tasks such as backup and Windows Update. These can cause dropped frames when they run. Use the Task Scheduler to view all tasks. Contact the system administrator to disable unwanted tasks.
 - 3 Internet activity, especially that involving heavy downloads such as from YouTube or similar sites should be prohibited on the MAP/CPX computer. To avoid this possibility Plexon recommends placing the computer on a subnet isolated from intensive internet traffic.
 - 4 If dropped frames still persist after these steps, please contact Plexon Support.

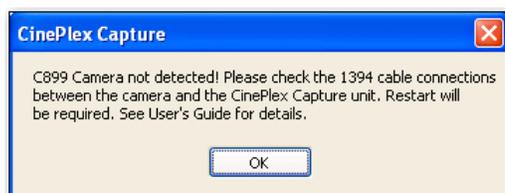
B.3.16 Other Typical Problems and Solutions

This section includes a list of some of the other typical problems with remedies for each one.

Note: The following problem refers to **CinePlex Capture** (earlier version of **CinePlex Studio**).

The following dialog appears when trying to run CinePlex Capture:

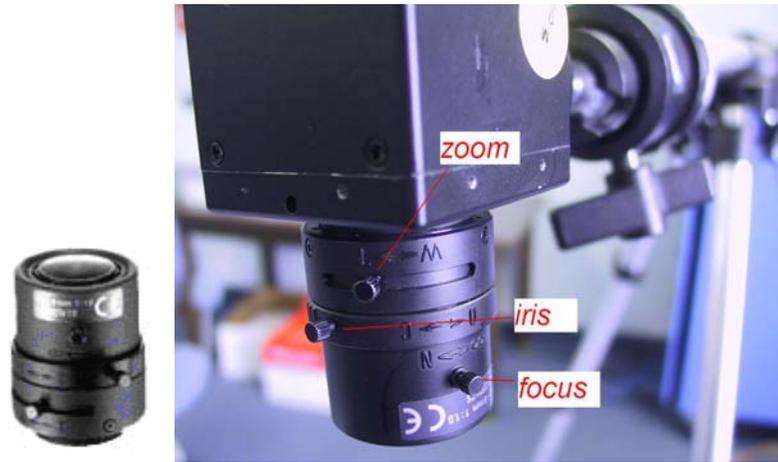
- 1 If the following **CinePlex Capture** dialog box appears after starting CinePlex Capture, read the instructions in the box. Verify the camera connections as detailed in the steps that follow.



- 2 Check the 1394 cable between the camera and the CinePlex Capture computer. Make sure the cable is undamaged. Make sure to connect the cable to the "In" port on the camera. Do not connect the cable to the "DaisyChain" port on the camera.
- 3 Make sure the camera is the same camera that Plexon shipped with the CinePlex Capture computer. CinePlex cameras and computers are uniquely calibrated to each another and they are *not* interchangeable.

The video preview display is black

- 1 Set the manual iris control on the camera by twisting middle ring (iris) on the camera lens from closed to open.



- 2 From the **File** menu, click **Set Defaults**.

The video preview display is out of focus

- 1 Set the zoom and the focus controls on the camera by twisting the outer and inner rings on the camera lens until a clear picture displays in the Video window.
- 2 On CS mount cameras, ensure that the C to CS adaptor ring is not installed between the lens and the camera.

Dropped Frame Counts

- 1 Stop running all unnecessary applications on the computer while recording. This includes CinePlex Editor, which has file intensive activity. Use the Task Manager to display and end unneeded tasks.
- 2 Disable tasks such as backup and Windows Update. These can cause DFC increments when they run. Use the Task Scheduler to vie all scheduled tasks.
- 3 Place the CinePlex System computer on a subnet isolated from intensive internet traffic.
- 4 If the problem persists, please contact Plexon Support.

For details on DFC counts, see [“Status Information on Page 149”](#) and/or [“Dropped Frames on Page 56”](#).

B.3 CinePlex Studio Messages

The table below lists the CinePlex Studio system simple messages. In the table below %s, %d, and \%s\ are variable text strings that differ between messages.

Table 1: CinePlex Studio Simple Messages

Error #	Message
C100	CinePlex Studio version %s Starting...
C101	Current date:
C102	Date change. Current date:
C103	Current display frequency
C104	Display frequency successfully changed to %d Hz
C107	Factory default settings loaded
C108	Loading startup settings from \%s\ failed because this version of settings file is not supported by Current version of CinePlex Studio
C109	Current CinePlex Studio does not support this version of settings file. Try to read another file.
C110	Loading last saved settings file \%s\ failed because the file is missing. Factory default settings have been applied
C111	Settings loading failed because file \%s\ is missing. Factory default settings have been applied
C112	No settings file to load. Factory default settings have been applied
C113	Startup settings loaded from \%s\
C114	Settings loaded from \%s\
C115	Background image loaded from \%s\
C116	Settings stored in the file \%s\
C117	Background image stored in the file \%s\
C118	Play file started
C119	Combination Events view presented
C120	Video view presented
C121	Recorder Properties view presented
C122	Area Properties view presented
C123	Messages view presented
C124	Previous video configuration is not applicable due to hardware changes or absence of Rasputin key
C125	Video configuration has been automatically reset to One File

Table 1: CinePlex Studio Simple Messages

Error #	Message
C126	The layout loaded contains panels incompatible with the current license. These panels are removed.
C127	Remote start received and discarded
C128	Remote stop received and discarded
C129	Remote pause received and discarded
C130	Video configuration has been automatically set to two cameras
C131	Video configuration has been automatically set to Camera 1
C132	Video configuration has been automatically set to One File
C133	Video configuration has been automatically reset to Camera 1
C135	Armed for remote control - DVR control by MAP is now enabled
C136	Remote control disabled -
C137	Recording \%s\ started by MAP
C138	Recording \%s\ paused by MAP
C139	Recording \%s\ resumed by MAP
C140	Recording \%s\ stopped by MAP (%d dropped frame(s), %d MQU)
C141	Recording \%s\ started locally
C142	Recording \%s\ stopped locally (%d dropped frame(s), %d MQU)
C143	Recording \%s\ paused locally
C144	Recording \%s\ resumed locally
C145	Tracking switched to Object Contour mode
C146	Object Contour tracking stopped
C147	No LEDs are active. The objects for dynamic zones will be switched to N/A.
C148	Tracking switched to LED mode
C149	LED tracking stopped
C150	Can not switch to LED mode, since tracking license is not detected
C151	Tracking switched to Reflective Colors mode
C152	Reflective Colors tracking stopped
C153	Can not switch to Reflective Colors mode, since tracking license is not detected
C154	Recording \%s\ stopped due to missing license key
C155	Tracking stopped due to missing license

Table 1: CinePlex Studio Simple Messages

Error #	Message
C156	No markers are active. The objects used in dynamic zones will be switched to N/A.
C158	Recording %s\ stopped since file size on FAT32 drive cannot exceed 4GB (%d dropped frame(s), %d MQU)
C159	Recording %s\ stopped due to low disk space (%d dropped frame(s), %d MQU)
C160	Can not start recording since disk information can not be retrieved
C162	Can not start recording due to low disk space.
C163	Wizard opened
C164	Wizard finished
C165	CPX Studio window size reduced by Shrink button
C166	CPX Studio window size restored by Expand button
C167	Date has changed since the last file was recorded. The file number reset to 001
C168	Can not add sequence due to missing license key
C169	Tracking settings ignored since missing license
C171	Tracker Properties view presented
C172	New shape added to Arena
C173	New shape added to Zone
C174	Shape #%d deleted from Arena
C175	Shape #%d deleted from Zone
C176	Tracking Events view presented
C177	Event Statistics view presented
C178	Output lines for the loaded tracking events ignored since no digital output device found
C179	All shapes deleted from Arena
C180	All shapes deleted from Zone
C181	Temporary AVI file %s\ renamed to %s\
C182	Renaming temporary AVI file %s\ failed
C183	Temporary DVT file %s\ renamed to %s\
C184	Renaming temporary DVT file %s\ failed
C190	Zone Sequences view presented
C193	Video Properties view presented
C194	Previous video configuration was %s\

The table below lists the CinePlex Studio critical messages.

Table 2: CinePlex Studio Critical Messages

Error #	Message
C898	MAP and CinePlex Studio out of synch.
C900	Clock signal not detected
C901	Clock signal detected
C902	Recording %s\ stopped due to loss of clock
C904	Current CinePlex Studio does not support this version of settings file. Try to read another file.
C905	Can not be armed for remote recording before arena definition is finished
C906	Apparently Adobe Acrobat Reader is not installed on this system This is required to display the help file. Please go to http://www.adobe.com , download the latest version, and install it.
C907	Cannot find the manual at: %s
C908	Error code %d has occurred while trying to open %s.
C999	Polygon can not have less than 3 points.
C910	Can not create self-intersecting polygons.
C911	Recording folder doesn't exist. Please choose another one.
C912	Saved layout does not exist
C913	Unable to load the requested layout! The default layout applied
C914	Can not be armed for remote recording until Wizard is exited.
C915	Can not start recording until Wizard is exited.
C916	Can not add new zone: number of zones of interest can not exceed 100.
C917	Can not add new zone: the boundary of the last existing zone is not defined.
C918	The number of shapes in arena can not exceed 100.
C919	The number of shapes in zone can not exceed 100.
C920	Overlapped zones are not allowed in sequence
C921	Can't delete selected zone since it is used for generation of tracking event(s). Modify the event(s) first.
C922	Can't delete selected zone since it is used in sequence(s). Modify sequence(s) first.
C923	The number of events can not exceed 100.
C924	Can't delete the last remaining shape from the selected zone since it is used for generation of tracking event(s). Modify the event(s) first.
C925	Can not be armed for remote recording due to missing license key

Table 2: CinePlex Studio Critical Messages

Error #	Message
C926	Can not add event since LED or Marker tracking mode is not selected.
C927	Can not add event since no LEDs selected.
C928	Can not add event since no markers selected.
C929	Can't delete selected sequence since it is used for generation of tracking event(s). Modify the event(s) first
C930	Unable to save current layout
C931	Can not add combination event since tracking mode is not selected.
C932	Can not add combination combination since no single events are defined.
C933	Can not add new combination event since not all events for the last combination are defined.
C934	Can not add new combination event since not all events for the last combination are defined.
C935	Can't uncheck selected LED since it is used for generation of tracking event(s). Modify the event(s) first.
C936	Can't uncheck selected marker since it is used for generation of tracking event(s). Modify the event(s) first.
C937	Can not add event since tracking mode is not selected.
C938	Can not add event since no LEDs selected
C939	Can not add event since no markers selected.
C940	No Rasputin key found. Switching to offline mode
C941	Access I/O board is not found, but cameras are detected. Switch to test mode? Clicking YES will switch Studio to the test mode. Otherwise Studio will start in offline mode.
C942	Access I/O board is not found. Switching to test mode
C943	Access I/O board is not found. Switching to offline mode
C944	No clock signal from MAP, but cameras are detected. Switch to test mode? Clicking YES will switch Studio to the test mode. Otherwise Studio will start in offline mode.
C945	No clock signal from MAP. Switching to test mode
C946	No clock signal from MAP. Switching to offline mode
C947	Recording is stopped, since recordings longer than 1 min. are not allowed in test mode
C948	Can not add new sequence since the previously added sequence contains no zones.
C949	Can not add new sequence since the last zone in the previously added sequence is undefined.

Table 2: CinePlex Studio Critical Messages

Error #	Message
C950	The number of sequences can not exceed 100.
C951	Can't delete selected sequence since it is used for generation of tracking event(s). Modify the event(s) first.
C952	Can not add new zone to the current sequence since the last zone in the sequence is undefined.
C953	Sequence can not contain more than 100 zones.
C954	Can not add new zone to the current sequence since no zones is defined.

Appendix C

Lens Selection, Experiment Design, and Camera Installation

C.1 Introduction C-2

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C.3 Experiment Design C-5

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CAUTION

Never plug or unplug a camera FireWire cable with the PC Power ON.
Permanent damage to the camera may result.

C.1 Introduction

This appendix is intended to assist current and prospective customers with questions and advice regarding physical implementation of a CinePlex Version 3 system in their laboratories.

In any experiment where video recording would enhance experimental results or is required in a particular experiment, there is a particular area of interest in which it would be meaningful to record video. This area of interest can be a simple enclosure, a maze, a geometrical track, or any other area needed for the experiment. For video recording of behaving animals, this area of interest is known as the arena. The arena shape and size are critical in determining the lens used and the distance from the camera to the arena. Colors used and target visibility are also extremely important.

The second section explains how to select the best lens for the video camera within the limits of the experiment's environment. The third section discusses general experiment design issues that relate to video recording, including arena layout. The fourth section describes requirements and procedures for video camera installation.

The result should be that an experimenter achieves the capability to set up for and install CinePlex Version 3 to conduct successful experiments collecting neural and video data.

Plexon hopes that this procedure solves these issues for most installations. Plexon welcomes feedback as to how to improve the experience. Please contact Plexon support at support@plexoninc.com (+1 214 369 4957) with comments.

C.2 Lens Selection

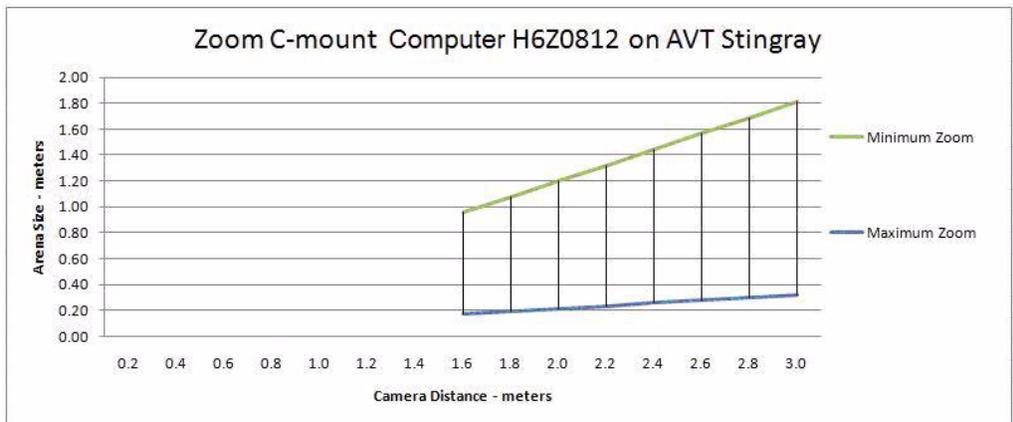
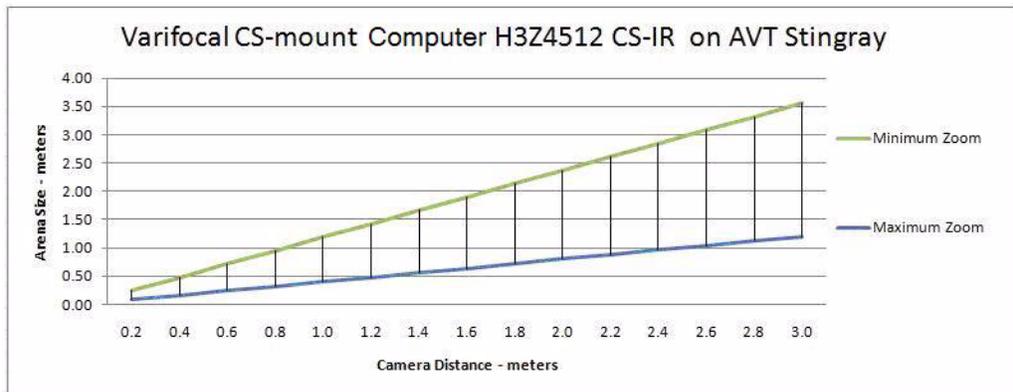
For CinePlex Version 3, Plexon currently offers the AVT Stingray camera (Type 1/2 CCD) and several lenses - both varifocal and zoom. Experimental setups may have to be changed to accommodate camera and lens limitations. The limiting factors are that the lens must be able to focus the arena image and that the arena image should fill the screen. If the camera's distance to the arena is fixed, the arena size must be kept within certain limits for best results. Alternatively, if the arena size is fixed, the distance between the camera and arena must be kept within limits for best results.

Most investigators will find that they need to compromise arena size and/or camera distance to accommodate the physical limitations of the camera/lens combinations.

Procedure for Lens Selection

1 Determine Optimal Arena Setups

Use the charts below to determine if a particular lens can be used with the current experimental setup. The area between the green and blue lines in the charts represents arena size and camera distance combinations that are acceptable for best results.



2 Determine the distance from the camera to the arena in meters

This distance should be as far as possible from the arena, while still close enough to allow the zoom function to fill the sensor with the arena image. Be sure to allow space for camera mounting. Find that distance on the X-axis (Camera Distance) of the Standard Varifocal chart.

3 Determine the size of the arena in meters

Imagine a circle, square or 4:3 rectangle drawn around the arena, completely enclosing it. The Arena Size in the charts above is the diameter of the circle, the side of the square, or the longer side of the 4:3 rectangle. Find that size on the Y-axis (Arena Size) of the Standard Varifocal chart.

4 Determine if the arena size and camera distance are optimal

If the (X,Y) position specified by the Camera Distance and Arena Size is in the area between the Green and Blue lines, the setup should yield optimal results when the camera is zoomed appropriately. It is not necessary to proceed. The Standard Varifocal lens will work. If the (X,Y) position specified by the Arena Size and Camera Distance is NOT in the area between the Green and Blue lines, the setup is sub-optimal. The image will be smaller than desirable, larger than desirable, or out of focus.

5 If the position is not optimal, try the steps above on the chart for the Zoom lens

If this lens yields an optimal result, contact Plexon to obtain the lens. If not, try adjusting Arena Size and Camera Distance to find an optimal combination with one of the lenses.

6 If an optimal result cannot be obtained using this procedure, contact Plexon for other lens possibilities

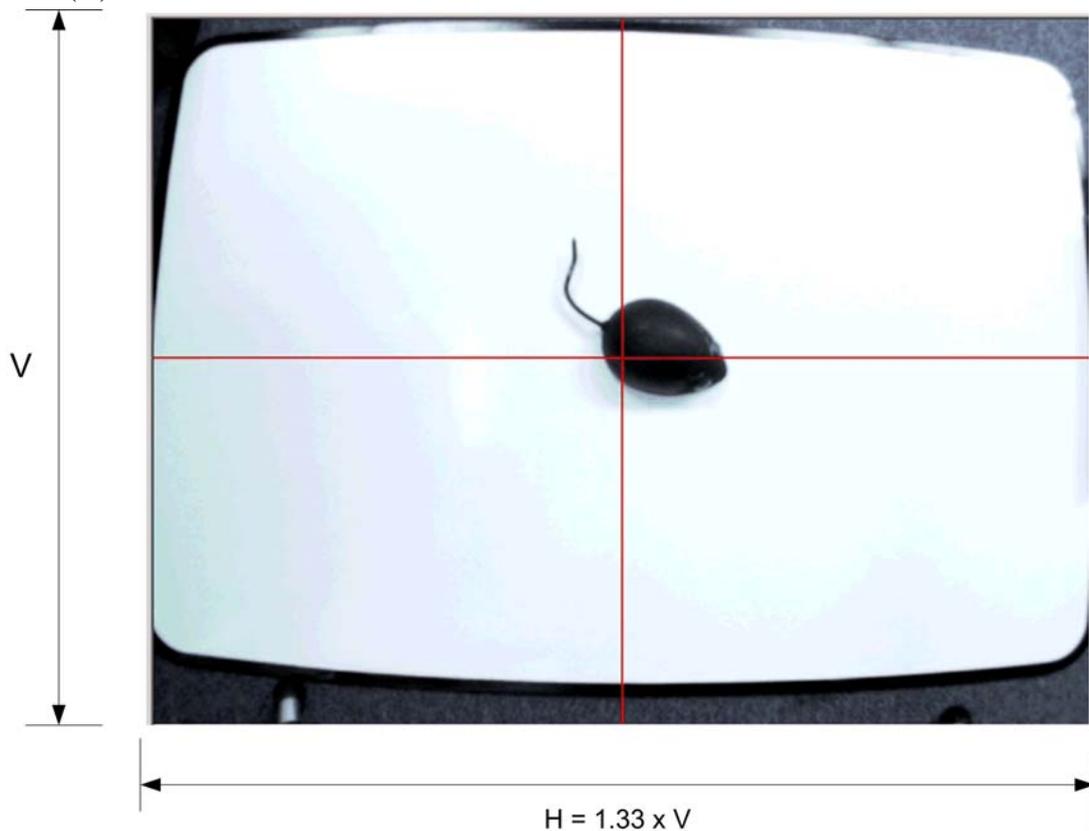
Note: The charts are derived from calculated numbers. Small variations in lens and camera manufacturing can result in as much as 10% variation.

C.3 Experiment Design

C.3.1 Field of View

The field of view (what the sensor of the camera sees) depends on the distance between the camera and the surface and the angles of view of the lens that is used with the camera. The cameras supplied by Plexon generate screen images that are 4 units wide by 3 units high as shown by the diagram below. This aspect ratio corresponds to the sensor image size of 640 by 480 pixels.

Orient the camera to the experimental area to take maximum advantage of the rectangular field of view. As shown in the following illustration, the 4:3 ratio corresponds to a horizontal dimension (H) that is 1.33 times the vertical dimension (V).



When the camera is placed so that it is directed towards the experimental area, it has a horizontal angle of view and a different vertical angle of view because of the aspect ratio described above. The image producing sensor in the camera is also rectangular in the same proportion. So the ideal experimental layout will have a rectangular 4:3 arena with the camera aligned so that its longer (horizontal) sensor dimension is parallel to the arena's long side. Actual arenas may not be

4:3 rectangles, but in all cases, best results will be obtained when the longest dimension of the arena is parallel to the longer sensor dimension of the camera.

When the camera and lens are viewed as shown in the image below, the long axis of the sensor is in the horizontal plane. This axis should be parallel to the longest dimension of the experimental area.

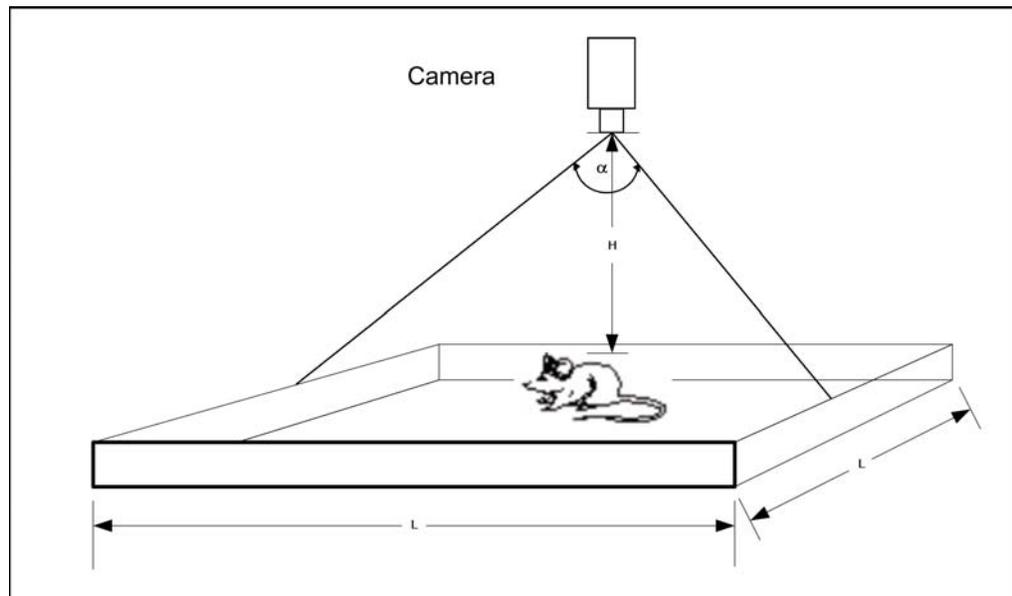
The table below shows the horizontal and vertical angles of view that correspond with maximum and minimum zoom of the camera, using the standard lens as an example. Other lenses will differ.

Table C-1 Angles of View

	α (normal lens)	
	Maximum zoom (minimum angle and area covered)	Minimum zoom (maximum angle and area covered)
Horizontal	30 degrees	83 degrees
Vertical	22 degrees	61 degrees

The best way to avoid optical distortions is to set the lens at Maximum Zoom and move the camera far enough away from the experiment that the maze, cage, track or other setup is completely imaged. This is the optimum height. See figure below.

**Figure C-1
Field of View Estimation (Maze Size)**



The formula to calculate the optimum height (**H**) of a camera over a square maze of side **L** (or a circular maze of diameter **L**) is:

$$H = \frac{L}{2 \tan\left(\frac{\alpha}{2}\right)}$$

If the maze is round or square, use the Vertical Maximum zoom angle (or 22 degrees for the normal lens). If the maze is rectangular, use the Horizontal Maximum Zoom angle (30 degrees for the normal lens).

C.3.2 Colors

In contour tracking, to achieve the best tracking accuracy, choose colors with maximum contrast. For example, if the target animal is white, choose black or another dark color for the arena floor. Likewise, if the target is dark-colored, choose a bright white or other light color for the floor. For multi-colored animals like Long-Evans rats, red has been shown to have good contrast to the animal's fur colors. It may be necessary to experiment to determine the best background color in individual situations.

In all tracking modes, use materials with solid colors as floors, if at all possible. Avoid floor materials with patterns or textures.

C.3.3 Visibility

Unless otherwise required, the design of the arena should ensure that the target is completely visible to the camera in all areas. If the target is partially obscured by overhangs or other obstacles during its travel around the arena, the centroid calculations that determine target position and orientation can be affected.

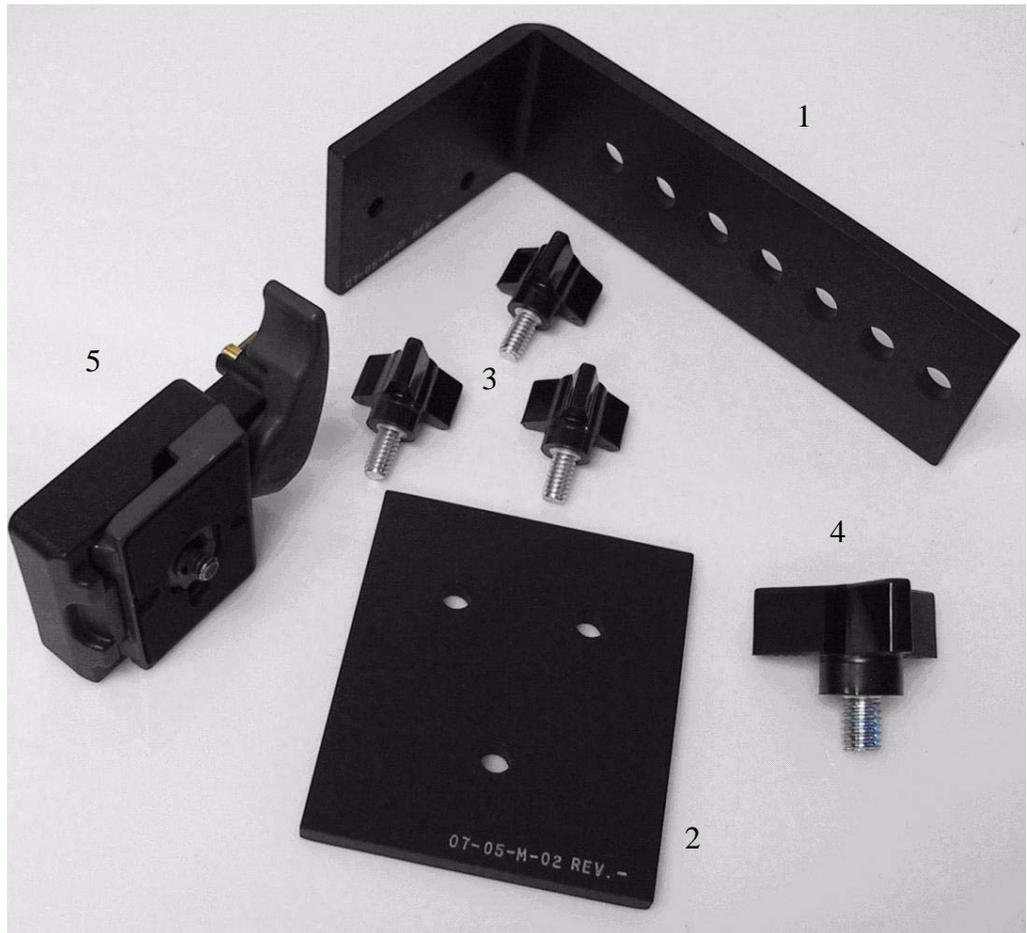
C.4 Camera Installation

C.4.1 The Plexon Camera Mounting Kit and Accessories

For repeatable, reliable video recording, the video camera(s) must be mounted stably and securely with respect to the experimental area. Cameras that vibrate or move can result in not just partial recordings or blurred images, but also in inaccurate position metrics, event triggers at undesired times, and, worst of all, non-repeatable experimental trials.

C.4.1.1 Plexon Mounting Kit

The Plexon mounting kit consists of both purchased and Plexon manufactured parts. It is included with CinePlex Version 3 and later cameras. The parts have been selected to apply in most of the situations encountered while doing CinePlex installations. Note that because of the general nature of the kit, not all parts will be used in all cases. In addition, there will be some cases where a particular installation will require that the customer purchase some additional parts locally.



- 1 Mounting Bracket (Plexon 07-05-M-01)
- 2 Sandwich Plate (Plexon 07-05-M-02)

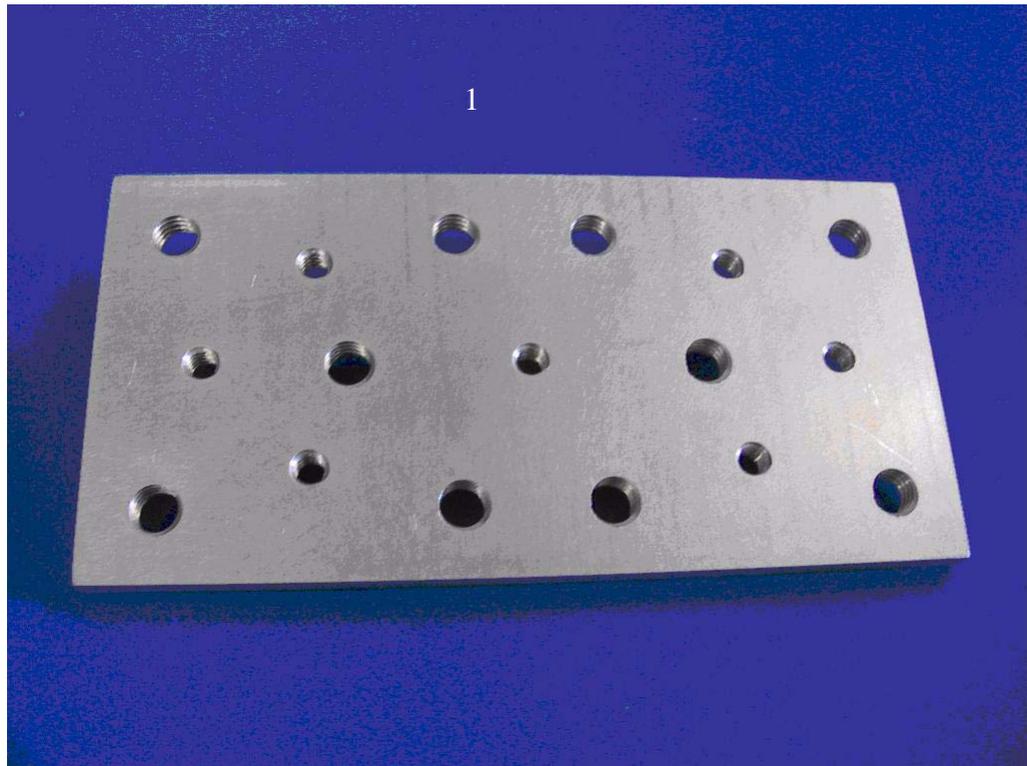
-
- 3 Three Arm Phenolic Knob (small) - 1/4"-20 (3 ea.)(McMaster Carr 57715K16)
 - 4 Three Arm Phenolic Knob (large) - 3/8"-16 (McMaster Carr 57715K83)
 - 5 Quick Change Mounting Assembly (Bogen-Manfrotto)
 - a Rectangular Plate Adaptor (323)
 - b Rectangular Plate (200PL)

C.4.1.2 Customer Supplied Parts as needed

The mounting kit does not include the small parts required for securing the mounting bracket to the desired surface. In those cases the customer will need to acquire the needed parts locally. Depending on the nature of the surface; screws, bolts, wall anchors, adhesive, or other items may be needed for a particular experimental setup. The customer should acquire these as needed.

C.4.1.3 Optional Mounting Accessories

Some experimental setups may require hard-to-find parts over and above those supplied in the Plexon Mounting Kit. Plexon has some optional parts available that can help provide secure mounting in many non-typical situations. See pages X and Y for some examples using these optional accessories.



1 Camera Mounting Plate 3x6" (Plexon 07-03-M-01)



- 2 Stud 036-014 (1/4"-20 m x 1/4" 20 f)(Bogen Manfrotto 036-014)*
- 3 Stud 036-038 (3/8" m x 3/8" f)(Bogen Manfrotto 036-038)*
- 4 Stud 037 (1/4"-20 m x 3/8" m)(Bogen Manfrotto 037)*
- 5 Stud 066 (1/4"-20 f x 2/8" f)(Bogen Manfrotto 066)*



- 6 Ball Head - Micro (Bogen Manfrotto 482)*
- 7 Ball Head - Mini w/ RC2 (Bogen Manfrotto 484RC2)*
- 8 Ball Head - Compact w/ RC2 (Bogen Manfrotto 486RC2)*

* Starred optional items are available from:

- Plexon - please contact the Plexon salesperson
- Online - search for "Manfrotto" and the item number from many sources such as:
 - <http://www.amazon.com/>
 - <http://www.ritzcamera.com/>
 - <http://www.bhphotovideo.com/>

-
- A local professional camera or video store



CAUTION ABOUT TRIPODS

Note specifically that tripod mounting of the camera is **NOT RECOMMENDED**. This is because tripod adjustments, particularly leg locking mechanisms, can loosen and become unstable. Tripods can also be jostled or moved easily since they are generally not secured to a surface.

C.4.2 Bracket Mounting Choices to Make

First, choose where the camera should be mounted. Common choices are shown below:

C.4.2.1 Above the Experiment

- 1 Ceiling mount
- 2 Top of enclosure
 - a Inside of enclosure with room for cables
 - b Above the enclosure through an opening
 - c Inside of cage with room for cables

C.4.2.2 From the side of the Experiment

- 1 Wall mount
- 2 Side of enclosure
 - a Inside of enclosure with room for cables
 - b Outside of enclosure through an opening
 - c Inside of cage with room for cables

C.4.2.3 Below the Experiment

- 1 Up through a glass or cage floor to view the undersides of animals or for birds in perches
- 2 Floor mount aimed up at animals in the air or above the floor
- 3 Below enclosure
 - a Inside of enclosure with room for cables
 - b Below the enclosure through an opening
 - c Inside of cage with room for cables

C.4.2.4 Bracket Attachment Methods

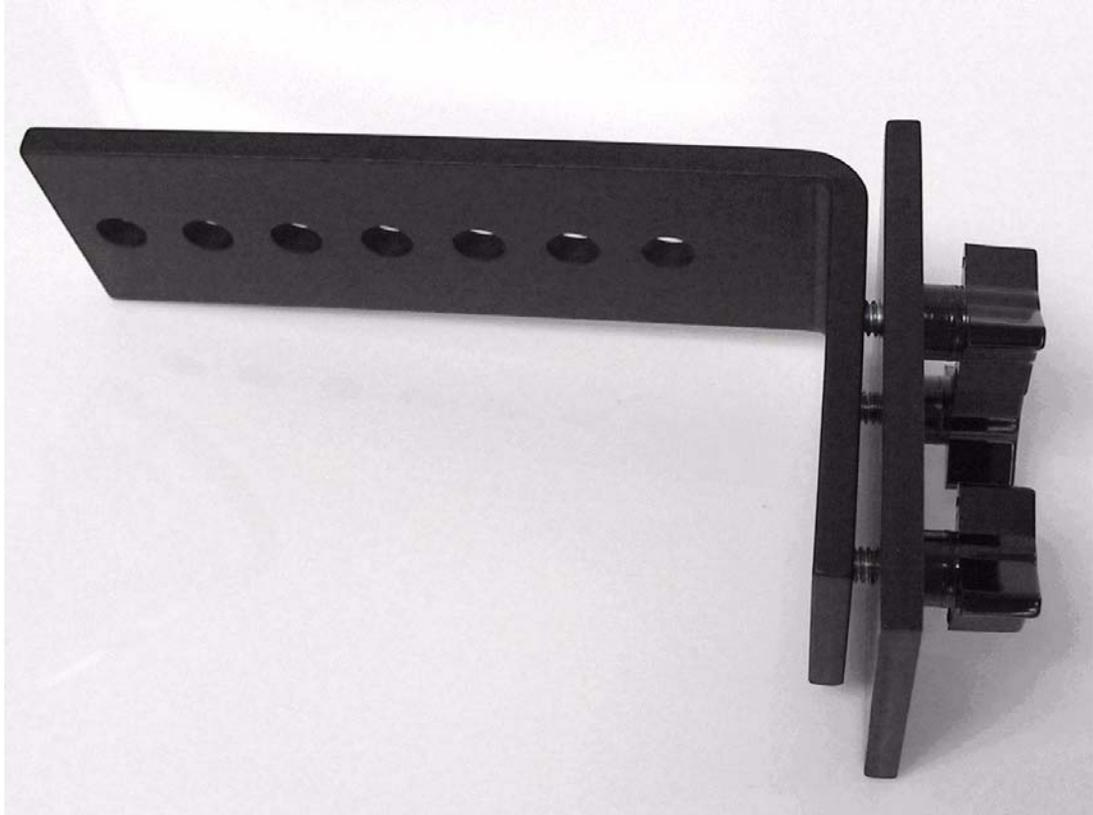
Then, choose the most appropriate method of attaching the camera mounting bracket to the desired location.

- 1 On a surface of a wall or ceiling over 0.4 in (1 cm) thick, use one of the following methods or devise a custom method.



- a Customer provided screws through the three threaded holes in the bracket into the wall. Wall anchors should be used as necessary.
 - b Customer provided bolts through the three threaded holes in the bracket into a wooden surface. Pilot holes can be drilled, if needed, using the sandwich plate as a template.
 - c Customer provided adhesive or epoxy to glue the surface of the mounting bracket containing the three threaded holes to the surface.
- 2 On a cage:

-
- a** Place the sandwich plate on the outside of the cage, then
 - b** Insert the three small knobs through the sandwich plate holes and through openings in the cage, then
 - c** Thread the three small knobs into the threaded holes in the mounting plate.



- 3** On a wall or surface under 0.4 inches (1 cm) thick:
 - a** Drill three $9/32$ " (7 mm) holes using the sandwich plate as a template, then
 - b** Insert the three small knobs through the wall into the threaded holes in the mounting plate.

C.4.3 Installing the Camera

Procedure for Camera Installation

- 1 Power down all system components - computer, MAP, etc.
- 2 Select the bracket attachment method suitable for the experiment and install the mounting bracket. Make sure that the mounting bracket is firmly attached and stable.
- 3 Install the rectangular plate adaptor on the mounting bracket using the large phenolic knob. For most applications, the point of large lever should be pointing away from the experiment when secured. Tighten finger-tight.



- 4 Make sure that the large lever on the plate adaptor is in the open position and ready to accept the plate. If the large lever cannot be moved easily, move the small brass level to the unlock position, and try again.



- 5 Remove any cables from the camera, if present.
- 6 Attach lens to camera by screwing it on finger-tight.

-
- 7 The tripod adaptor should already be attached to the camera - if not, do so at this time.



- 8 Attach the rectangular plate to the camera tripod adaptor. For most applications, the lens should be oriented in the position labeled "2 LENS". use the attached wire loop to finger-tighten the camera and then fold the loop down.

- a Position "1 LENS" shown below



- b Position "2 LENS" shown below



-
- 9 Snap the camera/plate combination into the plate adaptor that is already attached to the mounting bracket. Note that there is only one possible orientation. The large lever will snap closed. Move the small brass lever to the lock position. Make sure that the large lever cannot be unlocked.



- 10 Attach the FireWire cable(s) to the camera(s). Use the FireWire socket labeled "1" in the photo.

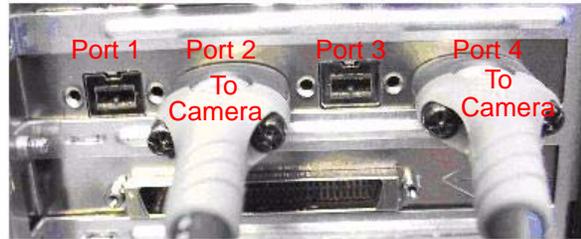
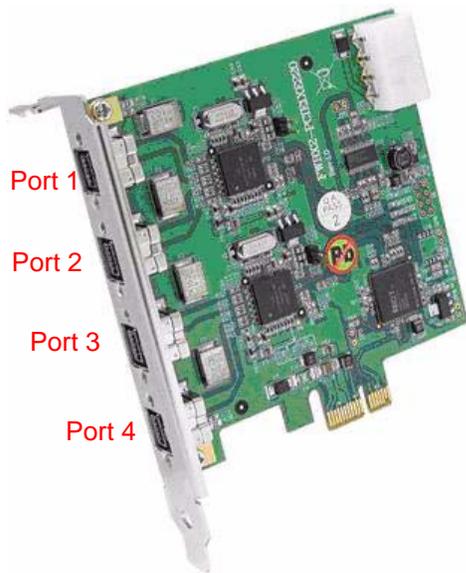


- 11 Connect the other end(s) of the camera FireWire cable(s) to the FireWire board in the computer. The cable for Camera 1 should be connected to Port1 or Port2 on the FireWire board. If there is a second camera, it should be connected to Port3 or Port4. Tighten the screws so that each plug is secure in its socket.



CAUTION

Never plug or unplug a camera FireWire cable with the PC Power ON. Permanent damage to the camera may result.



- 12 Now connect the trigger cable(s) to the BNC connector on the AccesIO adaptor on the computer. If there are two cameras, a BNC T-adaptor will also be required.
- 13 Make sure all other system cables are attached as required. Apply power to all components, bring up the MAP Server and Sort Client and press the Start button on Sort Client. Bring up CinePlex and ensure that video is present. If not, go to the Troubleshooting section of the CinePlex manual and work through those procedures until a picture is present. If unable to get a picture, please contact Plexon support.
- 14 Loosen the large phenolic knob holding the camera/plate assembly to the mounting bracket and adjust the camera orientation until the experimental area is centered. Then tighten the large phenolic knob. It may also be necessary to repeat Step 8 with the camera in the “1 Lens” position of more adjustment latitude is needed.
- 15 Adjust the camera zoom until the experimental area fills the viewable image. If this is not possible the camera may need to be moved closer to or further away from the experiment. This can be done by selecting a different hole in the mounting bracket for the adaptor plate attachment. If there is space available, the mounting bracket may even be moved to the other side of its mounting surface. If a satisfactory view is still not possible, contact Plexon support for additional lens options.
- 16 Adjust focus, and iris as needed for a good image.

C.4.3.1 Mounting Options for Multi-camera Systems

Place each camera as needed to record its area of interest. Make the choices required for each position. Install each camera using the procedure.

C.4.4 Examples Using Optional Accessories

Some difficult mounting situations require the use of some of the optional mounting accessories mounted shown earlier. Here are some examples.

- 1 Using the optional Mini Ball Head between the camera and the mounting plate.



- 2 Using multiple ball heads to achieve difficult angles.



-
- 3 Using the Plexon camera mounting plate together with a ball head and stud 037 to achieve an offset camera mount at a difficult angle.



C.4.5 Camera Removal

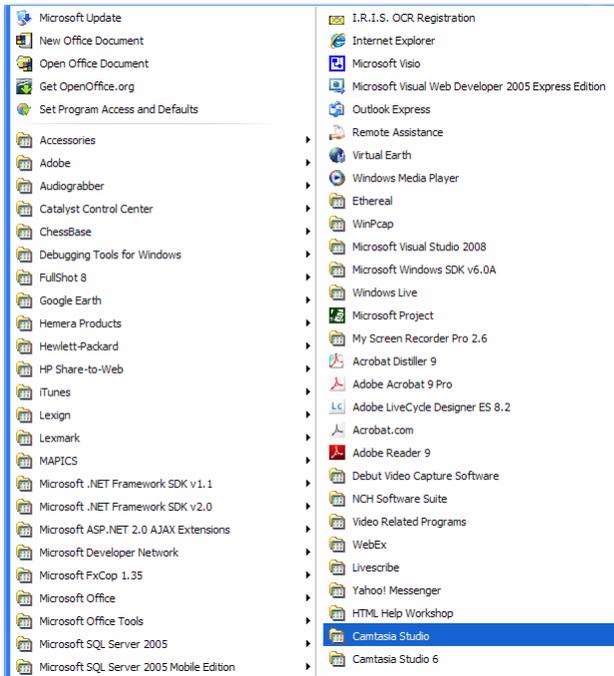
Procedure for Camera Removal

- 1 Power down all systems.
- 2 Remove all cables from the camera.
- 3 Move the small brass level to the unlock position if not already there.
- 4 Place a hand on the camera to catch it as it releases.
- 5 Move the large lever to the unlock position.
- 6 Catch the camera and place it in a safe location.

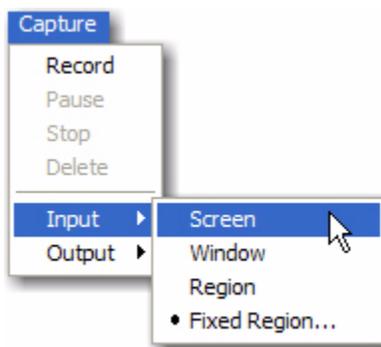
C.5 CinePlex Screen Capture

It is possible to record the operation of CinePlex as well as other applications by the use of a screen capture program, such as Camtasia Studio[®]. The procedure below describes how to use a screen capture program to record the activities on the computer screen. For illustrative purposes, the procedure describes the use of Camtasia Studio. The procedure for using other screen capture applications would be similar.

- 1 From the **Start->All Programs** menu, locate the screen capture program and open it.



- 2 From the **Camtasia Recorder Capture->Input** menu select what to record.



- 3 Ensure **Camtasia Recorder** is minimized and hit the **F9** key when ready to record.
- 4 When finished recording, hit the **F10** key. A dialog box will appear to allow naming of the recorded file and also to decide where to store the file.
- 5 The recorded file will be saved as an AVI file in the directory specified and the file will be presented for viewing immediately after saving.

Appendix D

Plexon User Interface

D.1 Plexon User Interface	D-2
D.2 Screen Elements	D-3
D.3 Standard Menu Items and Dialogs.....	D-11
D.4 Customization	D-19

D.1 Plexon User Interface

The **Plexon User Interface** embodies a standard look-and-feel for Plexon software products. To illustrate the underlying concepts behind the look-and-feel, this appendix uses screenshots from Plexon's **CinePlex Editor** and CinePlex Studio applications. Although there will be differences in menus and toolbars between different applications, how to use, handle, and operate the user interface components will be fundamentally the same across future generations of Plexon's software products including:

- CinePlex Studio
- CinePlex Editor
- Offline Sorter

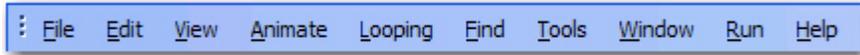
This appendix covers common functionality of the look-and-feel between different Plexon software applications. The discussion includes the following sections:

- **Screen Elements**
- **Standard Menu Items and Dialogs**
- **Customization**

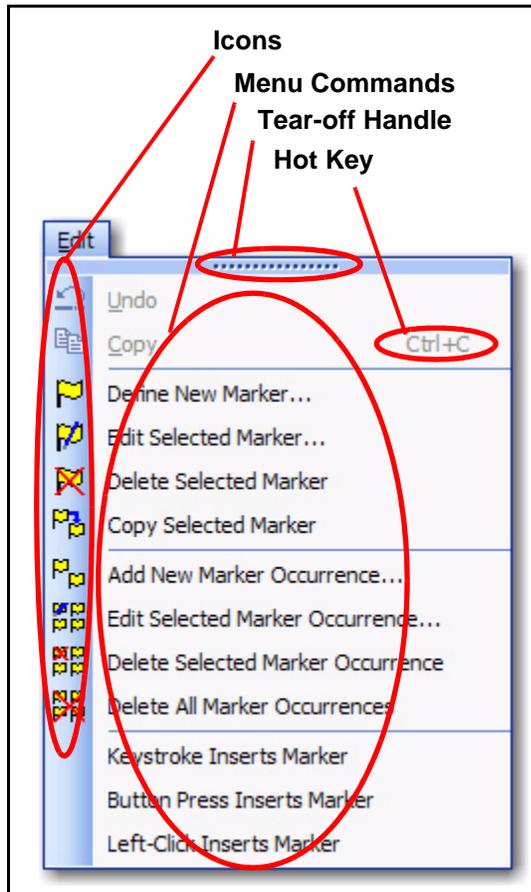
D.2 Screen Elements

D.2.1 Menus

The menu bar of the application contains the names of all of the menus for the application. Each menu name has a letter underlined which indicates the hot-key combination for that menu. To activate a particular menu the user may click the left mouse button on the name or press and hold the **ALT** key while pressing the underlined letter. The illustration below is the main menu of **CinePlex Editor**.



Each menu of the **Plexon User Interface** contain menu commands and may also contain Icons, Hot Keys and a Tear-off Menu Handle as shown by the illustration below of the Edit menu of **CinePlex Editor**.



While all Plexon applications are shipped with their available menu commands organized into a set of menus, the contents of the menus can be customized and new menus can be created.

- **Icons** - **Icons** may be located immediately to the left of the menu commands. These icons will be displayed on the toolbar associated with the menu. In the

example menu, there are icons associated with all but the last three of the menu commands. The presence of an icon next to a menu command means that the icon is also a label on a toolbar button and will execute the same command when clicked as the menu command on the menu.

- **Hot Keys** - **Hot Keys** are key combinations that will cause a menu command to execute without having to click the command on the menu. Typically, hot keys will contain two keys that must be pressed simultaneously for the combination to execute. The area at the far right of the menu commands may display the hot key combinations for the menu commands. In the example menu, there is a hot key combination (CTRL + C) for the Copy command. Hot keys may be added or customized via the **Tools-Customize** dialog.
- **Tear-off Menu Handle** - The **Tear-off Menu Handle** is an area (the one containing the dots) at the top of the menu, present on many menus. The tear-off feature allows the quick creation of a toolbar that contains all of the commands in the menu that have command icons. The user may hover the mouse over the tool to highlight it, drag the mouse to the toolbar area and place the menu as a toolbar there. The illustrations below show highlighting the **Tear-off Menu Handle** to begin dragging the toolbar, dragging the toolbar across the screen, and finally docking the toolbar in place.

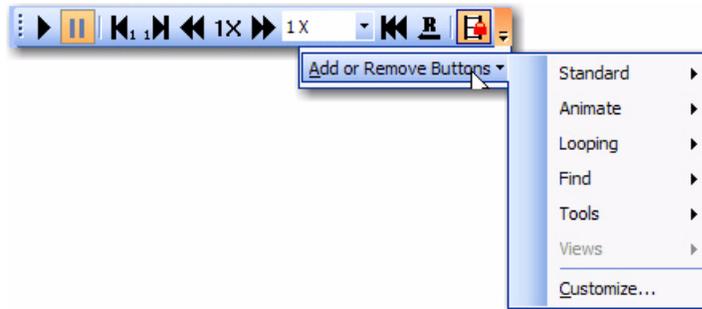


D.2.2 Toolbars

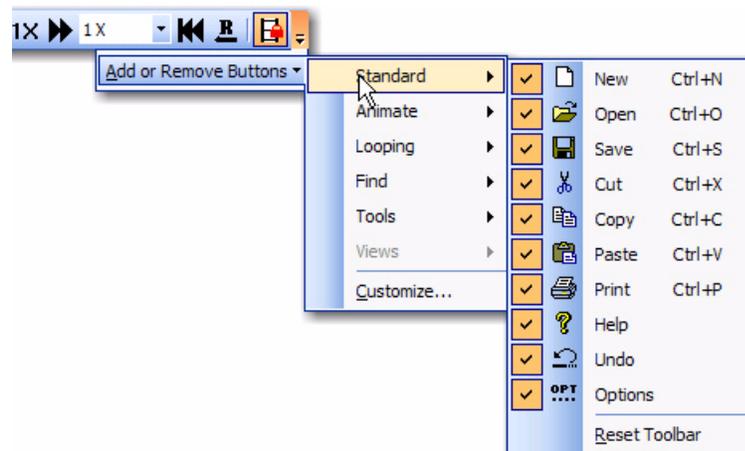
Each toolbar has a dropdown button at the right that will allow the user to add or remove buttons from toolbars and will also allow the user to access the **Customize** dialog box. When the user clicks the dropdown button the **Add or Remove Buttons** dropdown menu will appear as shown below.



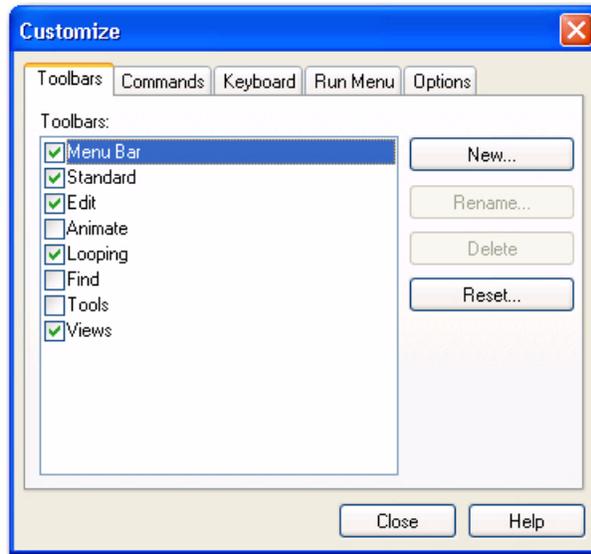
The dropdown menu also has a dropdown button. Clicking that button displays a menu list of the available toolbars and a menu command to allow access to the **Customize** dialog box.



Expanding one of the toolbar menus will display all of the available toolbar buttons for that particular toolbar and a checkbox beside each one that will indicate whether or not the button is visible on the toolbar. There is also an option to reset the toolbar back to its factory default setting.



Clicking the **Customize** menu command will open the **Customize** dialog box. This dialog box is common to Plexon software applications but may have different content on the tabs according to the software application.



For details on using the **Customize** dialog box, see [“Customization” on page D-19](#)

D.2.3 Windows

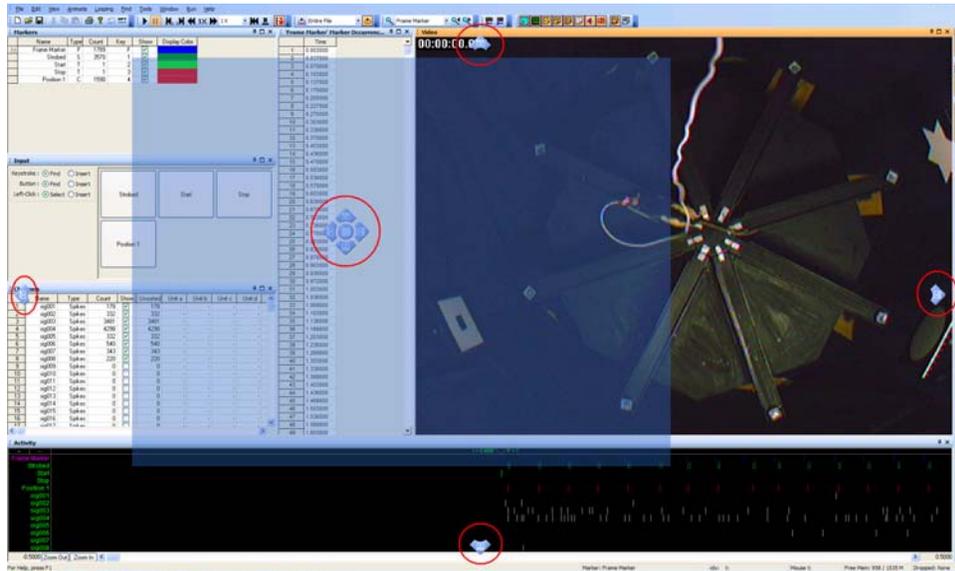
The illustration below shows a typical window title bar. It contains (from left to right) a **Title**, a **Auto Hide** button, a **Maximize** button, and a **Close** button.



- 📌
Auto Hide Button - The **Auto Hide** button “pins” a window to the screen to keep it visible or “rolls up” a visible window into a tab. When the window is pinned, the **Auto Hide** button points in a vertical direction. If the window is rolled up, the **Auto Hide** button points in a horizontal direction.
- ☐
Maximize Button - The **Maximize** button may not appear on all windows. It is the standard Windows maximize button. Clicking the **Maximize** button on a window will maximize the original window and hide other windows occupying the same horizontal or vertical space. Clicking the **Maximize** button again will restore the previous layout. When clicked the image on the button toggles between one window and overlapping windows.

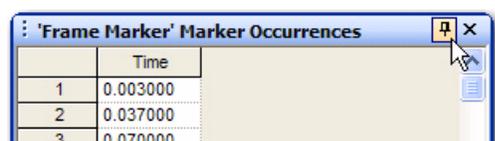
- **Close Button**  - The **Close** button closes the window.

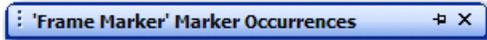
Plexon software applications often display several windows simultaneously. These windows may be resized by using standard resizing methods and may also be repositioned by dragging and dropping and by using **Docking Stickers**. The illustration below shows the repositioning of a window (denoted by the blue transparent rectangle) and various **Docking Stickers** (with red circles around them). These **Docking Stickers** allow the user to dock the window being moved in one of several ways described below.



The user may position a window by floating it, docking it at the desired docking sticker at a window edge or in a tab.

- **Floating a Window** - The user may drag a window by the **Caption Bar** near the center of the screen and release it causing the window to float. Holding down the CTRL key while dragging will always float the window. Double-clicking on the **Caption Bar** will also float a window. Note that the size and position of the floating window is remembered.
 - **Rolled-up Windows** - Floating windows may be enabled for roll up up by pressing the **Auto Hide** button. The window will roll up when the focus is changed to a different window. The first illustration below shows a floating window before rolling it up. The second illustration below shows the rolled-up window after the focus has changed.





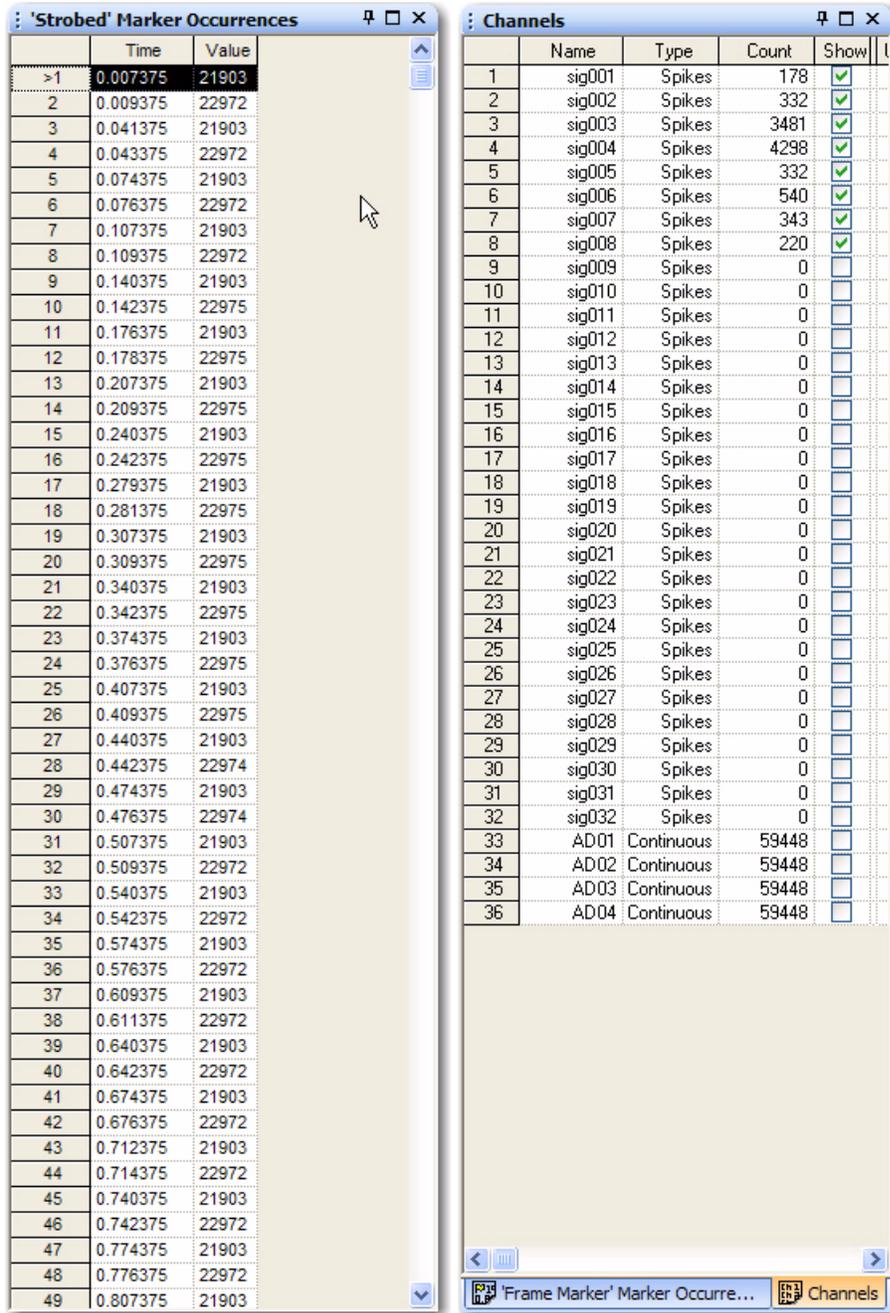
- **Docking a Window at the Application Frame** - When the user begins to drag a window, a transparent blue rectangle appears to indicate the position of the window and the four **Docking Stickers** appear individually at each edge of the application frame to allow the user to dock the window to the respective edge. To dock just move the mouse to the desired **Docking Sticker** and release the mouse button. The docked window will extend along the entire length of the edge to which it is docked. The illustration below shows all four screen **Docking Stickers**.



- **Docking a Window at a Window Edge** - When the user moves the window inside another window, the window **Docking Stickers** appear inside the window grouped together near the center of the window. Releasing the mouse button while it is over one of these stickers (except the center one) will dock the moving window to the respective edge of the window associated with the window **Docking Stickers**. The illustration below shows the window **Docking Stickers**. Note that the shading of these **Docking Stickers** is different than the shading of the **Docking Stickers** in the previous illustration.

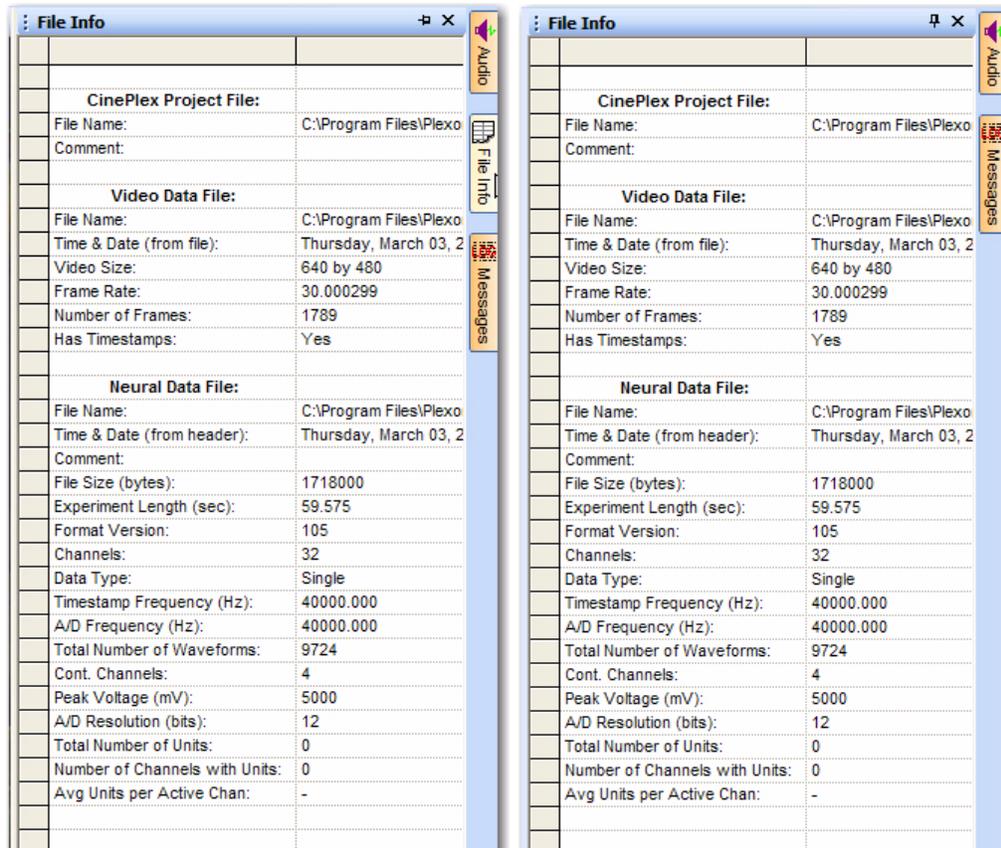


- **Placing Windows into Tabs** - Releasing the mouse button over the center **Docking Sticker** will allow the moving window to occupy the same space as the window beneath and will create tabs along the bottom for switching the view between the two windows. The illustration below shows the **Marker Occurrences** window without sidebar tabs on the left. On the right, a **Channels** window has been placed into the same space by using the center docking sticker. Note that there are two sidebar tabs at the bottom of the window.



- **Hidden Windows** - Docked windows whose access is not needed often can be hidden or “rolled up” by pressing the **Auto Hide** button. When hidden, the window is represented by a sidebar tab. Sidebar tabs may be located at the left, right, or bottom of the screen and indicate hidden windows. To show one of these windows, just hover the mouse over one of the tabs and the window will appear. The **File Info** window of **CinePlex Editor** opened by the sidebar tab is shown below on the left. If the user clicks the **Auto Hide** control, the window will be pinned and

remain open after the user moves the mouse away from the sidebar tab as shown on the right. The **Auto Hide** button will also have changed direction and be pointed downward. Note also that the **File Info** sidebar tab is gone on the right illustration.

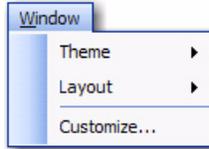


D.3 Standard Menu Items and Dialogs

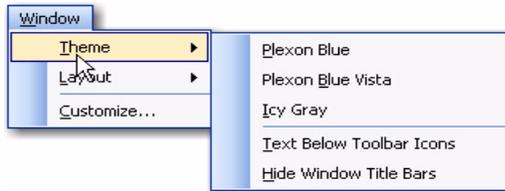
In Plexon software applications, some menu items may have the same functionality across several applications. These items are standard menu items and consist of the **Window** menu, the **Run** menu, and the **Help** menu.

D.3.1 Window Menu

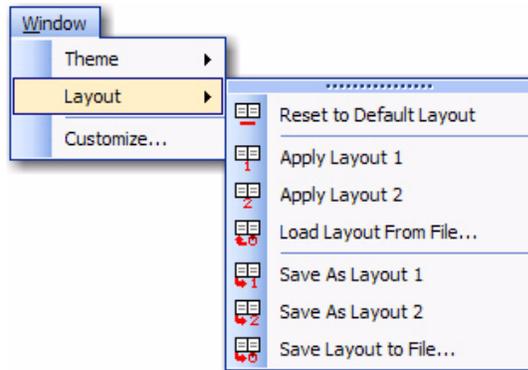
The **Window** menu contains three items: **Theme**, **Layout**, and **Customize**.



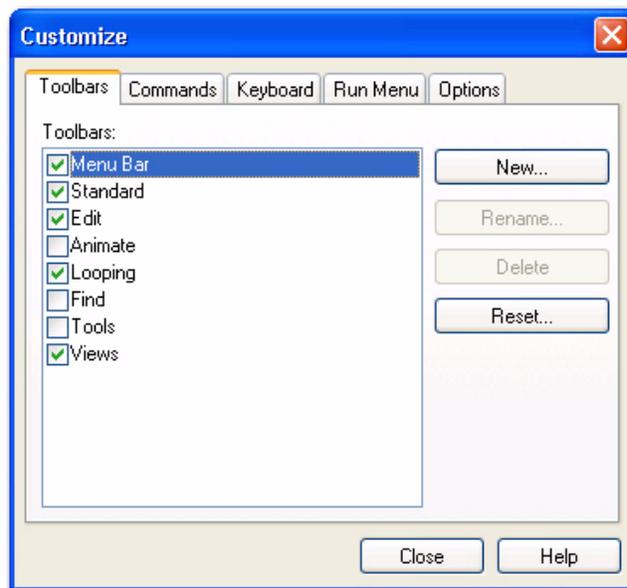
- **Theme** - Clicking on **Theme** displays a menu as shown below. A theme is a color scheme that is part of the look-and-feel of the user interface.



- **Theme Group** - The top group of items are theme toggle items that may be selected to apply to the user interface look-and-feel. Only one of the themes may be selected at a time.
 - **Text Below Toolbar Icons** - This item is a toggle item to show or not show text below the toolbar icons.
 - **Hide Window Title Bars** - This item is a toggle item to hide or show window title bars.
- **Layout** - Clicking on **Layout** displays a menu as shown below. A layout is the size and placement of the windows on the screen. It also remembers the number and placement of toolbars.



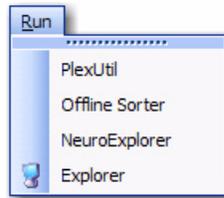
- **Reset to Default Layout** - Clicking on this item resets the layout to the factory default.
- **Load Layout Group** - Clicking on **Apply Layout 1** or **Apply Layout 2** applies one of the standard layouts to the user interface. Clicking on **Load Layout From File** will allow the user to select a layout file to apply to the user interface.
- **Save Layout Group** - Clicking on **Save As Layout 1** or **Save As Layout 2** saves the current screen layout as one of the two standard layouts. The user may also click **Save Layout to File** to save the current screen layout to a file that can be loaded by the **Load Layout From File** item.
- **Customize** - Clicking **Customize** displays the **Customize** dialog box as shown below



For details on using the **Customize** dialog box, see [“Customization” on page D-19](#).

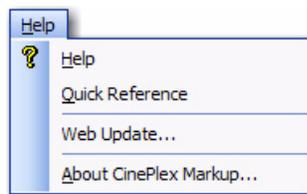
D.3.2 Run Menu

The purpose of the **Run** menu is to launch other applications quickly. The **Run** menu will be populated by default with some common Plexon applications. To launch other applications from within the current application, the user may add new entries to the **Run** menu. A sample **Run** menu is shown below. For additional information about customizing the **Run** menu, see [“Run Menu Customization” on page D-22](#).

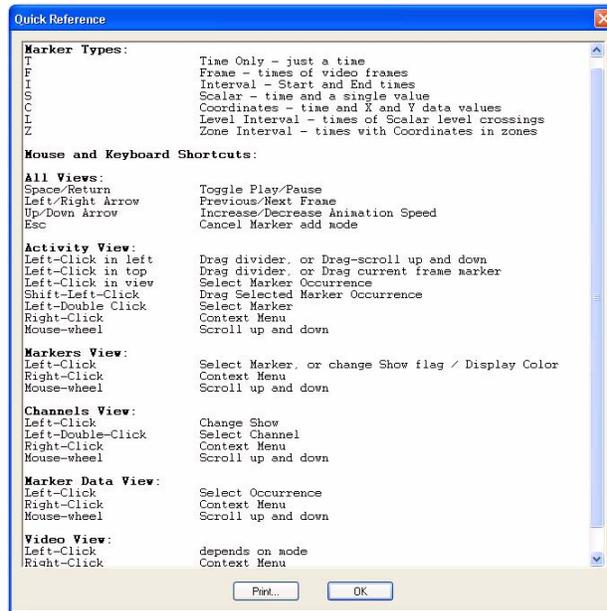


D.3.3 Help Menu

The **Help** menu contains four items: **Help**, **Quick Reference**, **Web Update**, and **About XXXXX** where **XXXXX** is the name of the application.



- **Help** - Clicking **Help** displays the User's Guide for the application.
- **Quick Reference** - Quick Reference may be missing in some applications. When present, clicking **Quick Reference** displays a dialog box similar to the one shown below. The purpose of the **Quick Reference** dialog box is to show keys and mouse buttons that control some of the commonly used functions in various views. The user may print it by clicking **Print** or close it by clicking **OK**.



— **Print** – Click **Print** to print a copy of the Quick Reference.

- **Web Update** - This item allows the user to update software via the internet. Clicking **Web Update** will first check to see if an update is available. If an update is available, it will be downloaded and installed.
- **About** - Clicking the **About** item displays the **About** dialog box. The text of the **About** item varies according to the application. The **About** dialog contains the version number and build data of the application, links to the Plexon website and support e-mail, and buttons for **Licensing**, **System Report**, and **Manage File Extensions**.

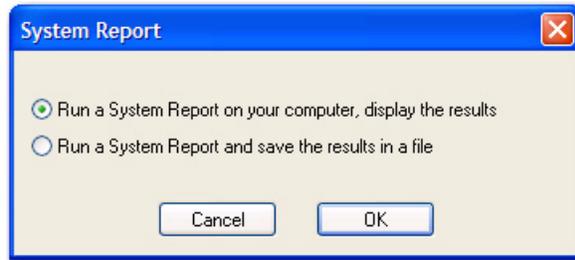


- **Licensing** - Clicking the **Licensing** button displays the **Plexon License Management** dialog box. The **Plexon License Management** window includes the complete licensing information for Plexon products. The window includes the following three areas: information, key testing, and code entry.

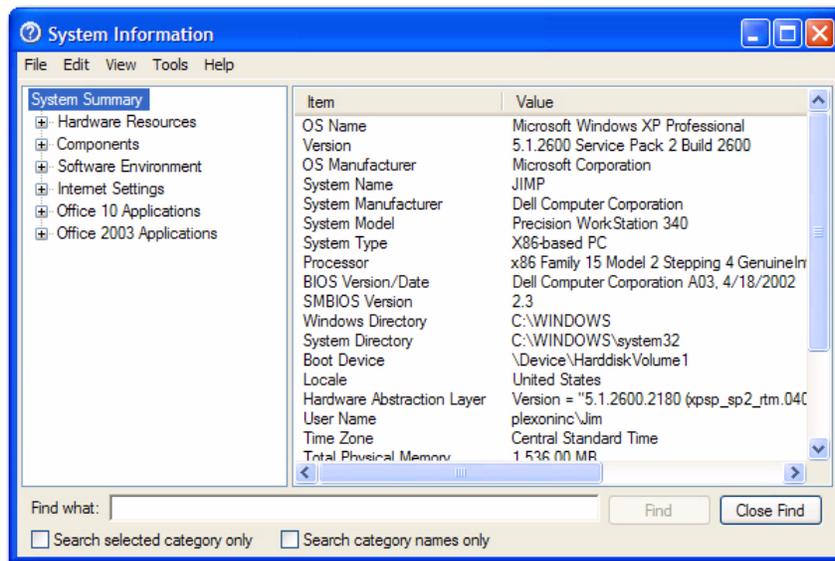


- The information area includes information on license keys and a list of all the Plexon products and their licensed status on this computer.
 - If the user has moved or added a key, the **Test the Key Again** button provides a convenient tool to test license keys to ensure they function correctly.
 - If the user has more than one key installed, the **Next Key>>** and **<<Prev Key** buttons appear. The user may use these buttons to cycle through and test all keys.
 - The code entry area is used to enter the unlock codes for optional programs and features. If the user has licensed optional items, instructions for entering codes and testing keys are included with Plexon installation programs.
- **System Report** - The purpose of the **System Report** button is to help Plexon Support diagnose problems by listing system information. Clicking the **System Report** button will first display a dialog box to

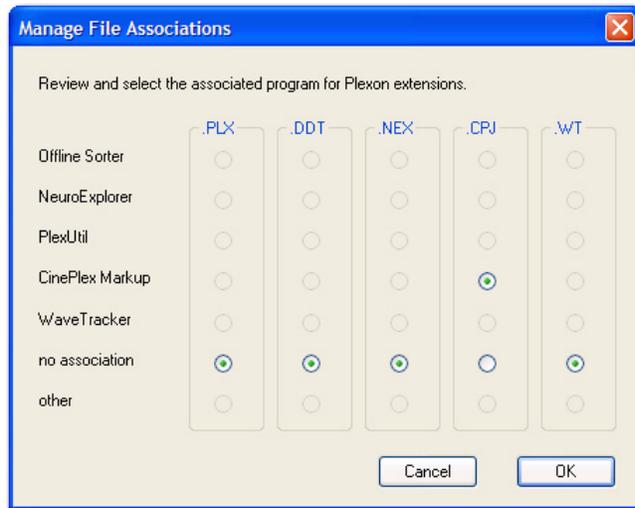
allow the user to display the system report on the monitor or save the report to a file that can be sent via E-mail to Plexon Support.



- After selecting a choice, clicking **OK** will launch the standard Microsoft System Information tool. The illustration below shows the System Information report displayed on the monitor.



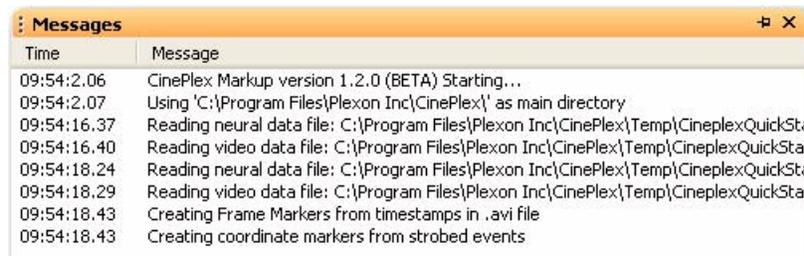
- **Manage File Extensions** - Clicking the **Manage File Extensions** button opens the **Manage File Associations** dialog box. The **Manage File Associations** dialog box allows the user to review and select which file types are associated with Plexon software applications. For example, when the PLX file type is associated with **Offline Sorter**, double-clicking on a PLX file will open **Offline Sorter** and load that PLX file. If the user has not installed some of the applications, their file extension radio buttons will be disabled.



D.3.4 Messages Window

The **Messages** window displays a log of timestamps and associated application events that Plexon Support can use for troubleshooting purposes.

Note: The **Messages** window is not available for all applications.



Right-clicking the mouse in the **Messages** window will display a right-click menu with the following items:

- **Erase** - This item clears the window of all messages
- **Pause** - This item stops the logging of messages
- **Show Debug Messages** - This item is a toggle to show or hide debug messages
- **Select and Copy All** - This item allows the user to copy all of the messages to another application - such as a word processor
- **Save Log to File** - This item allows the user to save the messages to a log file.
- **Mail Log to Plexon** - This item allows the user to send the message log to Plexon for troubleshooting purposes

D.3.5 Right-click Menus

Most windows have right-click menus that control their behavior and options. To open a right-click menu, place the cursor inside a window and click and release the right mouse button. The right-click menu appears where the mouse is clicked. To select a menu item, move the cursor over it and click the left mouse button.

D.3.6 Current Selections

In grid-based windows, the currently selected item always appears with a >> or > in the left column of the appropriate grid-based window.

D.3.7 . Undo

Plexon applications provide multiple *undo* levels. To undo an operation, on the **Edit** menu, click **Undo** or click the **Undo** button on the toolbar. The user may undo operations that change the contents of the project file but may not undo operations that change the user interface options or colors.

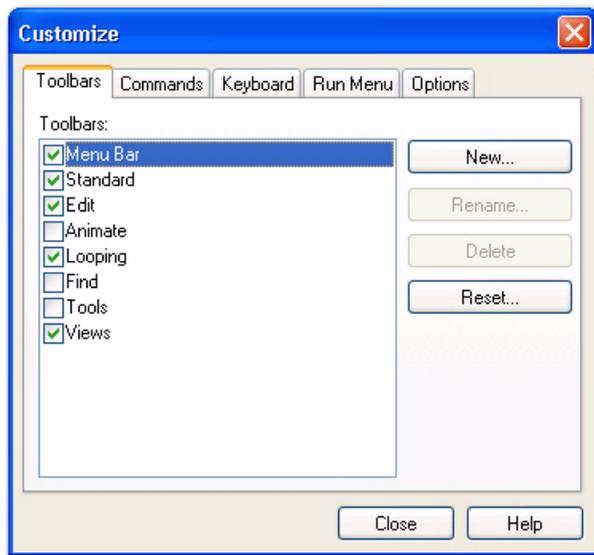
D.4 Customization

Although the menus and toolbars offer a rich set of commands and functions that should meet the needs of most Plexon customers, the **Customize** dialog box also allows the user to customize several areas of the interface should the need ever arise. This section describes the uses of the **Customize** dialog box.

To open the **Customize** dialog box, from the **Tools** menu, select **Customize**. The **Customize** dialog box contains several tabs. The illustrations below show the **Customize** dialog box from **CinePlex Editor** and displays five tabs - **Toolbars**, **Commands**, **Keyboard**, **Run Menu**, and **Options**. Although the content of the tabs will vary according to the application, the functional operation of each tab is respectively the same across all Plexon software applications.

D.4.1 Toolbars Customization

An illustration of the **Toolbars** tab follows:

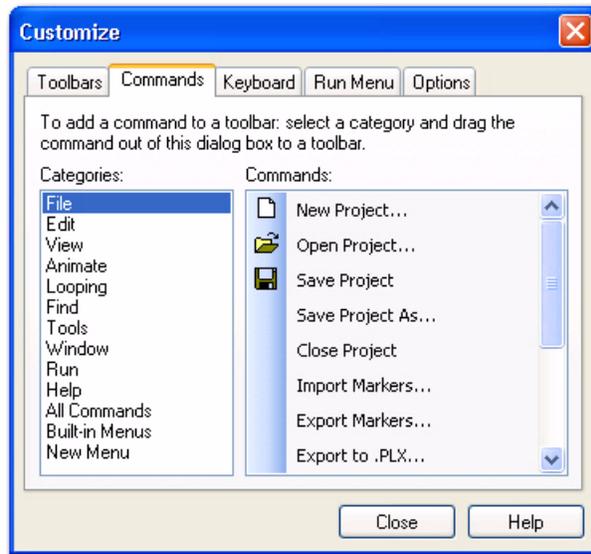


- **Toolbars** - This box contains a list of the toolbars for the application. Click a toolbar checkbox to have it appear in the main application window.
- **New** - This button opens the **New Toolbar** dialog box. The user may use this feature to create a custom toolbar for commands frequently used. Enter a toolbar name in the **Toolbar name** box.
- **Rename** - If the user has selected a toolbar that was previously defined, click **Rename** to change the name of the toolbar. The **Rename Toolbar** dialog box displays.
- **Delete** - If the user has defined a new toolbar and selected it, click **Delete** to remove that toolbar. There are no default values for newly defined toolbars. Standard toolbars may not be deleted. A confirmation dialog box displays.

- **Reset** - If the user has selected a standard toolbar, click **Reset** to restore the toolbar to its default contents. If new buttons have been dragged to a toolbar, click **Reset** to restore the default version of the toolbar. A confirmation dialog box displays.

D.4.2 Commands Customization

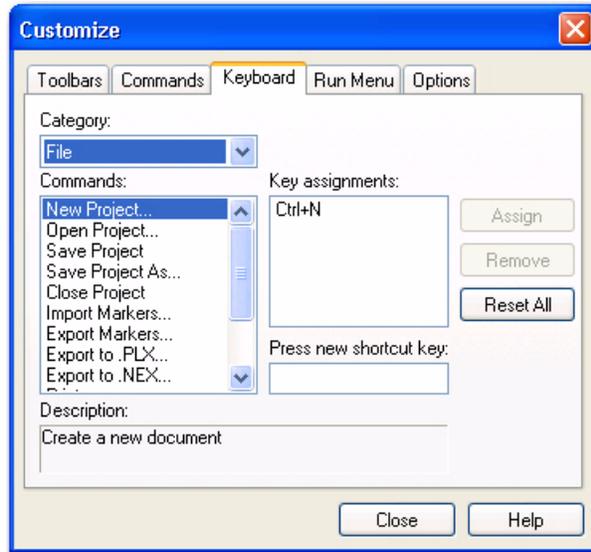
The **Commands** tab is used to customize which commands are available in toolbars. An illustration of the **Commands** tab follows:



- **Categories** - This is a list of all the toolbar categories. Select a toolbar category to see the buttons in the **Commands** area.
- **Commands** - This area shows all the buttons and the associated menu commands that belong to the selected category. The user may select the desired command and drag it to the toolbar.

D.4.3 Keyboard Customization

The **Keyboard** tab allows the user to bind keystrokes to commands. An illustration of the **Keyboard** tab follows:



- **Category** - This is a list of all the main menu headings. Select a menu heading to category to see the associated commands in the **Commands** area.
- **Commands** - This is a list of all the commands associated with the selected main menu heading in the **Category** area.
- **Key assignments** - This displays the current key assignment for the command selected in the **Commands** area.
- **Press new shortcut key** - This allows the user to enter a shortcut key combination for the command selected in the **Commands** area.
- **Description** - This area displays a description of the currently selected command in the **Commands** area.
- **Assign** - This button assigns the shortcut in the **Press New Shortcut Key** area to the selected command in the **Commands** area. If the shortcut key is already assigned to another command, a confirmation dialog box displays to allow or cancel the reassignment.
- **Remove** - This button removes the selected shortcut key in the **Key Assignments** area from the selected command in the **Commands** area.
- **Reset All** - This button removes all custom key assignments. A confirmation dialog box displays to allow or cancel the operation.

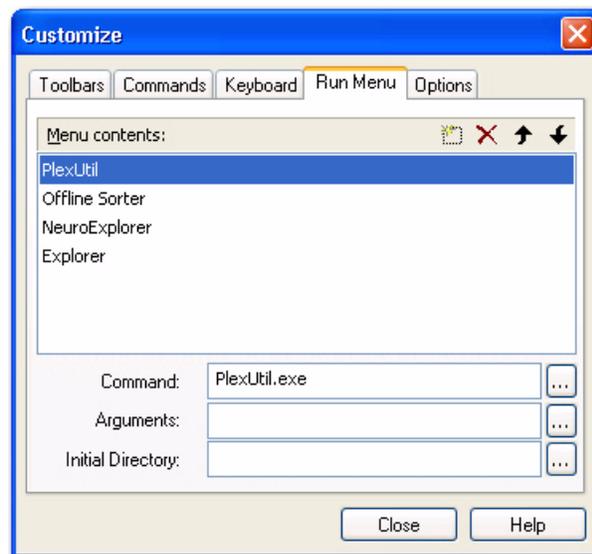
Procedure for Customizing Keystroke Shortcuts

- 1 From the **Window** menu, select **Customize**, and then click the **Keyboard** tab of the **Customize** dialog box.
- 2 Choose a category from the **Category** dropdown and from the **Commands** list, select the desired command to bind to a keystroke shortcut.
- 3 If there is already a key assignment listed in the **Key assignments** area, remove it by clicking the **Remove** button if so desired. The user may also just reassign a new key combination to the selected command. (See Step 5)
- 4 Click the mouse in the **Press new shortcut key** area.
- 5 Click the **CTRL** or **ALT** key and hold it down while clicking another key. The dual key combination will be displayed in the **Press new shortcut key** area. This combination will be the key assignment for the selected command.
- 6 Click the **Assign** button to assign the key combination to the selected command. If there already is a key assignment for the command, a confirmation box will display to confirm or cancel the reassignment.

Note: In CinePlex Editor do not bind menu operations to keystrokes that are associated with markers. Use only CTRL- or ALT- key combinations to bind to menu items, as these key combinations cannot be associated with markers.

D.4.4 Run Menu Customization

The **Run Menu** tab allows the user to manage menu items on the **Run Menu**. An illustration of the **Run Menu** tab follows:



- **Menu contents** - This is a list of all the menu items in the **Run Menu**. Select an item to see its characteristics in the **Command**, **Arguments**, and **Initial Directory** areas.

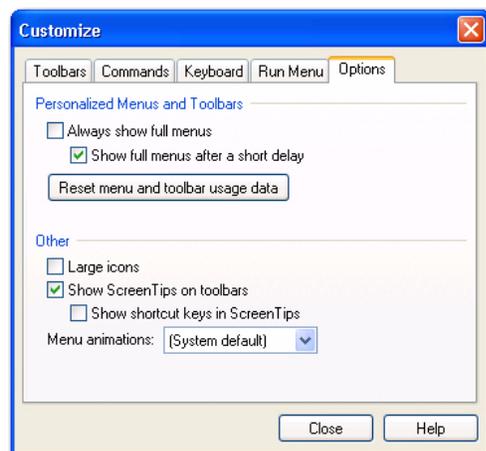
- **Buttons** - The toolbar buttons allow the user to add a new menu item, delete a selected menu item, move the selected menu item upward in the list, and move the selected menu item downward in the list.
- **Command** - This area contains the name of the file that runs when the menu item is selected from the **Run Menu**. The browse button opens the standard **Open** dialog box filtered for executable files.
- **Arguments** - This is a list of all the arguments to be passed to the file in the **Command** area, if any. The browse button opens the standard **Open** dialog box filtered for all files. When applicable, the symbol “%1” can be used to denote the current document.
- **Initial Directory** - This contains the path of the file in the **Command** area. The path allows the system to find the file and execute it. The Browse button opens the standard **Browse For Folder** dialog box.

Procedure for Customizing the Run Menu

- 1 From the **Window** menu, select **Customize**, and click the **Run Menu** tab.
- 2 To add a menu item, click the **New** icon, enter the command in the **Command** text box, enter any arguments in the **Arguments** text box, and set the applications directory in the **Initial Directory** text box. In each case use the appropriate **Browse** button at the right of the text box. The **Browse** button for the command opens the standard **File Open** dialog box filtered for executable files. The **Browse** button for the arguments opens the standard **File Open** dialog box filtered for all files. Then **Browse** button for the initial directory opens the **Browse for Folder** dialog box.
- 3 To delete a menu item, select it and click the **Delete** button.
- 4 To reorder the menu items, select a menu item and use the **Up** and/or **Down** arrow buttons to reorder.

D.4.5 Options Customization

An illustration of the **Options** tab follows:



- **Personalized Menus and Toolbars** - This area contains two check boxes and a button. The application will hide infrequently used menu items, but the user may customize the display of menu items using these two checkboxes. If the user check the **Always show full menus** checkbox, the application will always show full menus and the **Show full menus after a short delay** checkbox will be disabled. If the user does not check the **Always show full menus** checkbox, there will be the option of checking or clearing the **Show full menus after a short delay** checkbox. The **Reset menu and toolbar usage data** button will allow the user to delete the record of commands used in the application and restore the default set of visible commands to the menus and toolbars. A confirmation dialog displays.
- **Other** - This area contains three checkboxes and a dropdown list. If the user check the **Large icons** checkbox, the application will use large icons on the toolbar. If the user checks the **Show Screentips on toolbars** checkbox there will be the option of checking the **Show shortcut keys in Screen Tips** checkbox. The **Menu animations** dropdown list allows the user to select the type of animation to be used on menus that have animation.

Appendix E

Cabling Guide

E.1 Overview E-2

E.2 Typical MAP/CPX Cabling Diagram E-3

E.3 Typical MAP/CPX System Cabling E-5

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E.5 Close-up Images of MAP/CPX Cables Installed E-10



CAUTION

Never plug or unplug a camera FireWire cable with the PC Power ON.
Permanent damage to the camera may result.

E.1 Overview

This appendix is intended to assist customers and Plexon personnel with questions and advice regarding cabling their Plexon NDAQ/CinePlex Version 3 (NDAQ/CPX) combination systems.

Before beginning the installation, it is important to determine that the Personal Computer on which the installation will be done meets the minimum system requirements. In general, for a MAP/CPX system, this means at least Windows XP Service Pack 3 computer running on an Intel Core 2 Duo processor operating at 3 GHz with three GB of memory, and a 9600 GT video card. FireWire (IEEE 1394) capability must be installed. If two cameras will be used, a dual bus FireWire card is needed. Any computer supplied by Plexon for a MAP/CPX system will meet minimum requirements.

Contact Plexon support (support@plexon.com) to obtain more detailed current requirements.

The first section is a high-level diagram of the cabling needed.

The second section contains more detailed photographic and pictorial representations of the cable connections needed for several standard MAP/CPX system configurations.

The third section contains photographs of the cables to facilitate identification.

The fourth section contains close-up images of cables plugged into their sockets.

Plexon's goal is to enable the interconnection of the various CinePlex Version 3 components on the MAP/CPX system.

Plexon hopes that this procedure solves cabling issues for most installations. Plexon welcomes feedback as to how to improve the experience. Please contact Plexon support (support@plexon.com, +1 214 369 4957) with comments.

E.2 Typical MAP/CPX Cabling Diagram

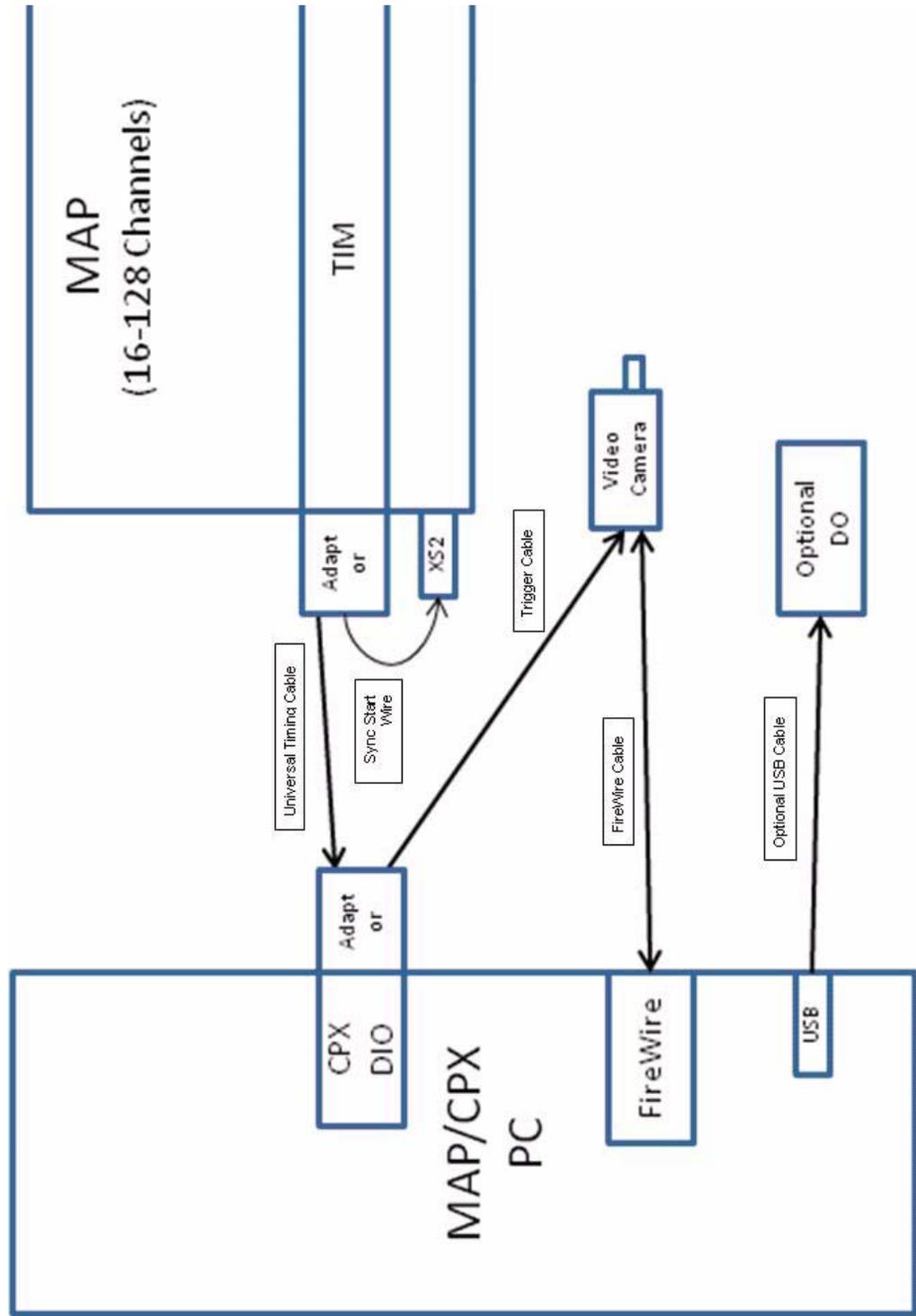
There are five cables and wires over and above those needed for normal MAP operation:

- Universal timing cable between the TIM Cable Adaptor and the Access IO Adaptor.
- Sync start wire from the TIM Cable Adaptor to the XS2 BNC connector.
- Trigger cable(s) from the CinePlex Access IO Adaptor to the video camera(s).
- FireWire cable(s) from the FireWire card in the computer to the video camera(s).

Note: Plexon supplies the Trigger and FireWire cables bundled together with plastic tiewraps. This combination is referred to as a Combination Cable on the following pages.

- Optional (for customers purchasing the Behavior option) cable from a USB port on the computer to the Digital Output unit.

Below is a high-level block diagram of the cables and wiring required for correct operation of a MAP with its associated CinePlex Version 3 installation. The cables and wires are shown in black.



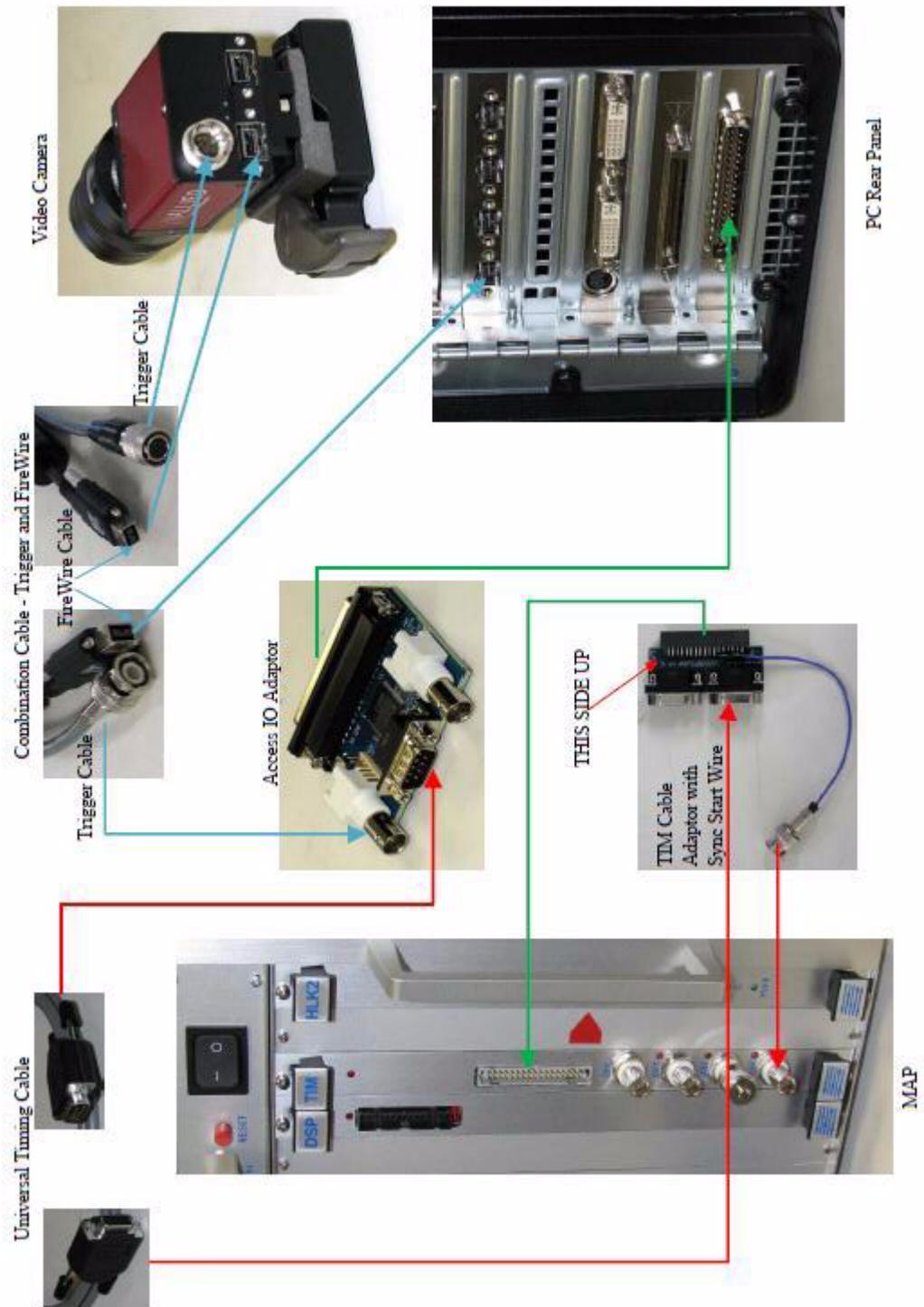
E.3 Typical MAP/CPX System Cabling

This section contains pictorial representations of the cabling for several typical MAP/CPX setups:

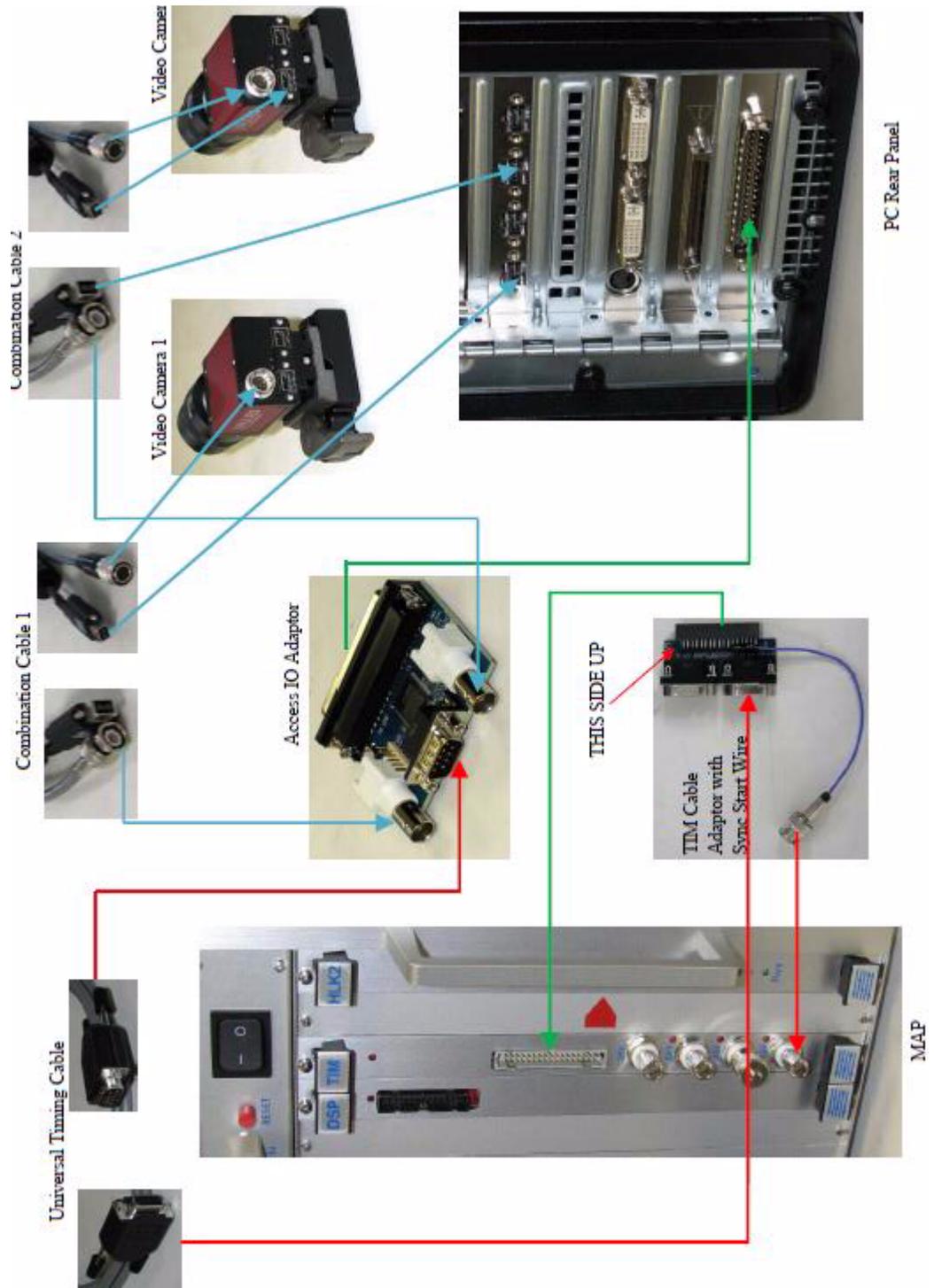
- MAP/CPX system with one video camera and no CHUB
- MAP/CPX system with two video cameras and no CHUB
- MAP/CPX system with one video camera and CHUB

Please contact Plexon with questions about the setup or if it differs substantially from those represented.

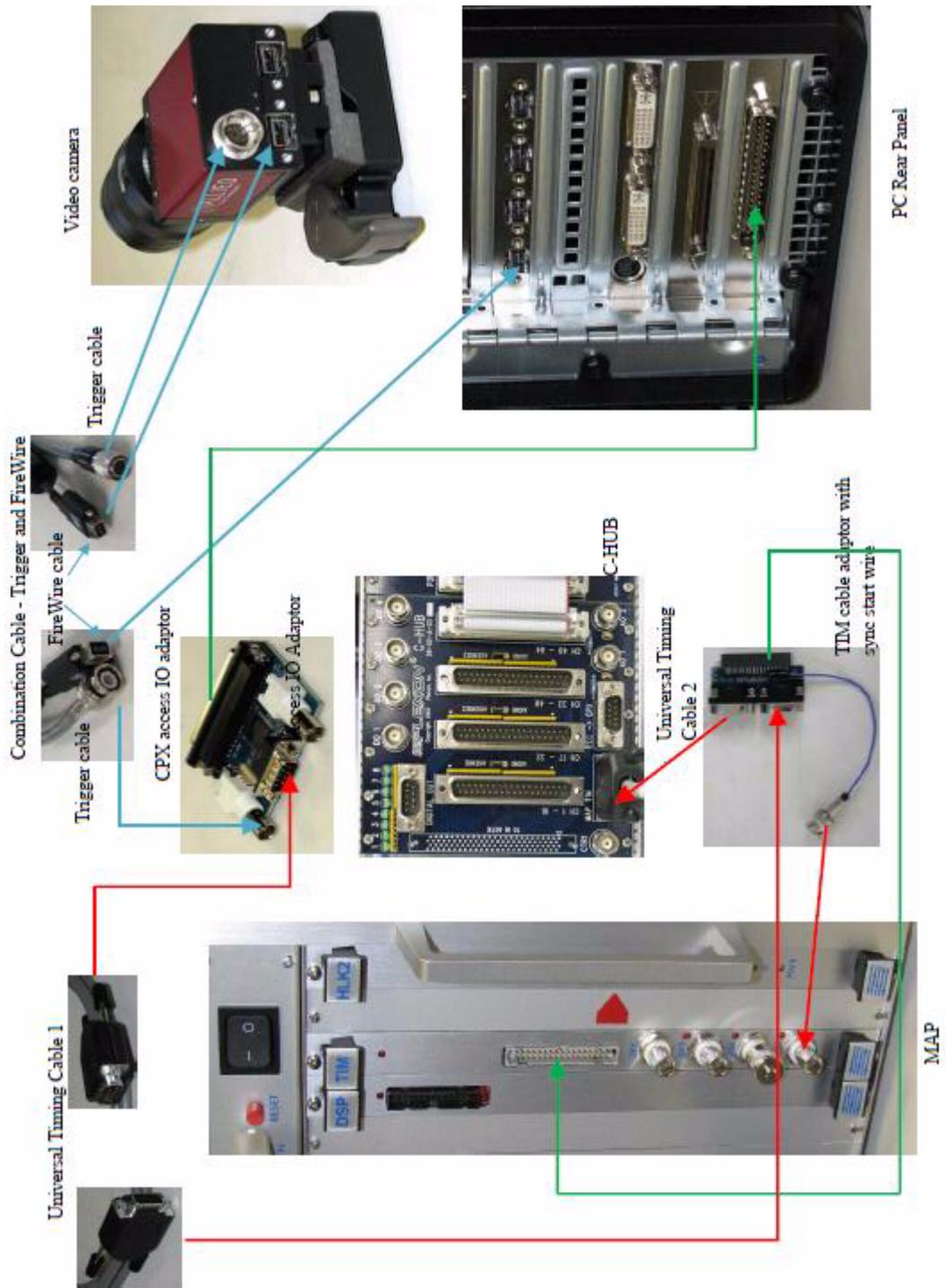
E.3.1 MAP/CPX System with One Video Camera, No CHUB



E.3.2 MAP/CPX System with Two Video Cameras, No CHUB



E.3.3 MAP/CPX System with One Video Camera, CHUB

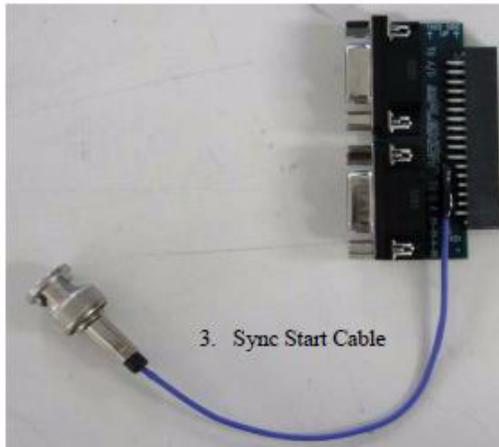


E.4 MAP/CPX Cable Images

1. Universal Timing Cable



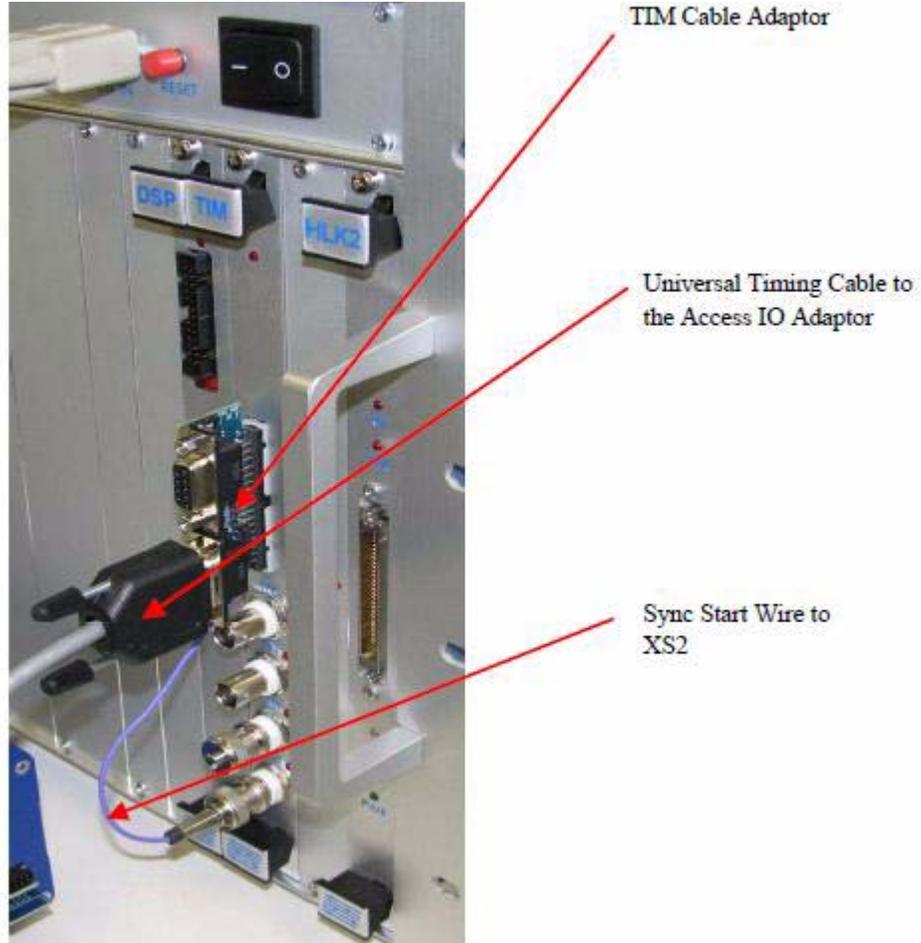
2. Combination Cable – Trigger and FireWire



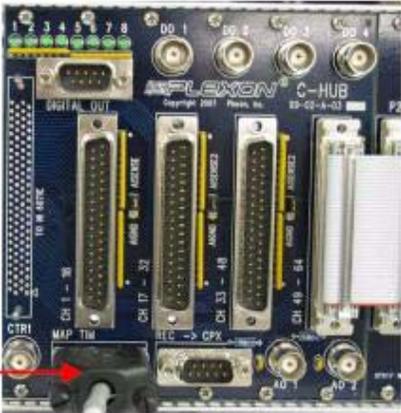
E.5 Close-up Images of MAP/CPX Cables Installed

E.5.1 Connections to MAP Box

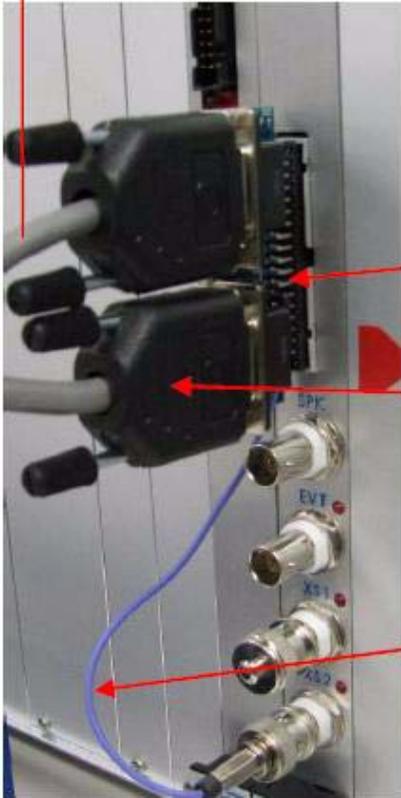
E.5.1.1 No CHUB



E.5.2.2 With CHUB



Universal Timing Cable 2 - from TIM Cable Adaptor to CHUB



TIM Cable Adaptor

Universal Timing Cable 1 - to the Access IO Adaptor

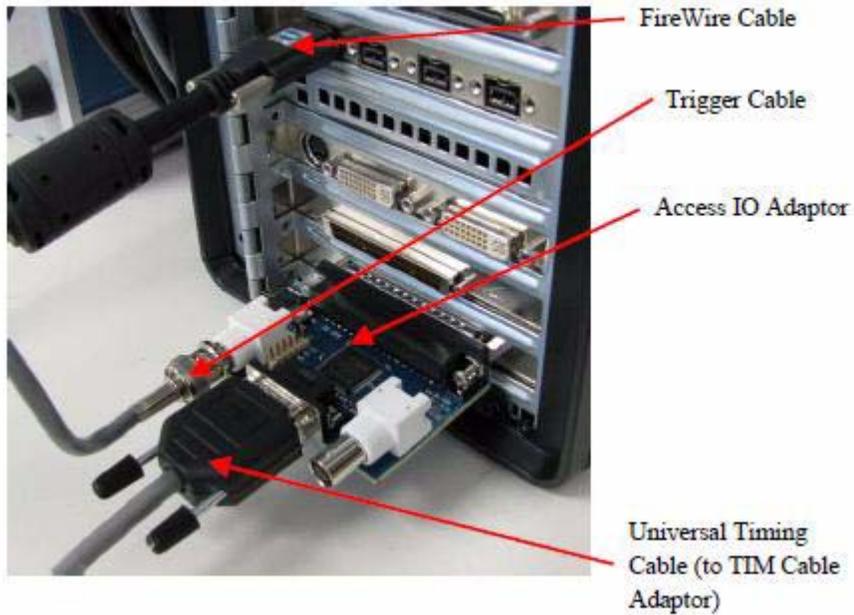
Sync Start Wire to XS2

E.5.2 Connections to Video Camera

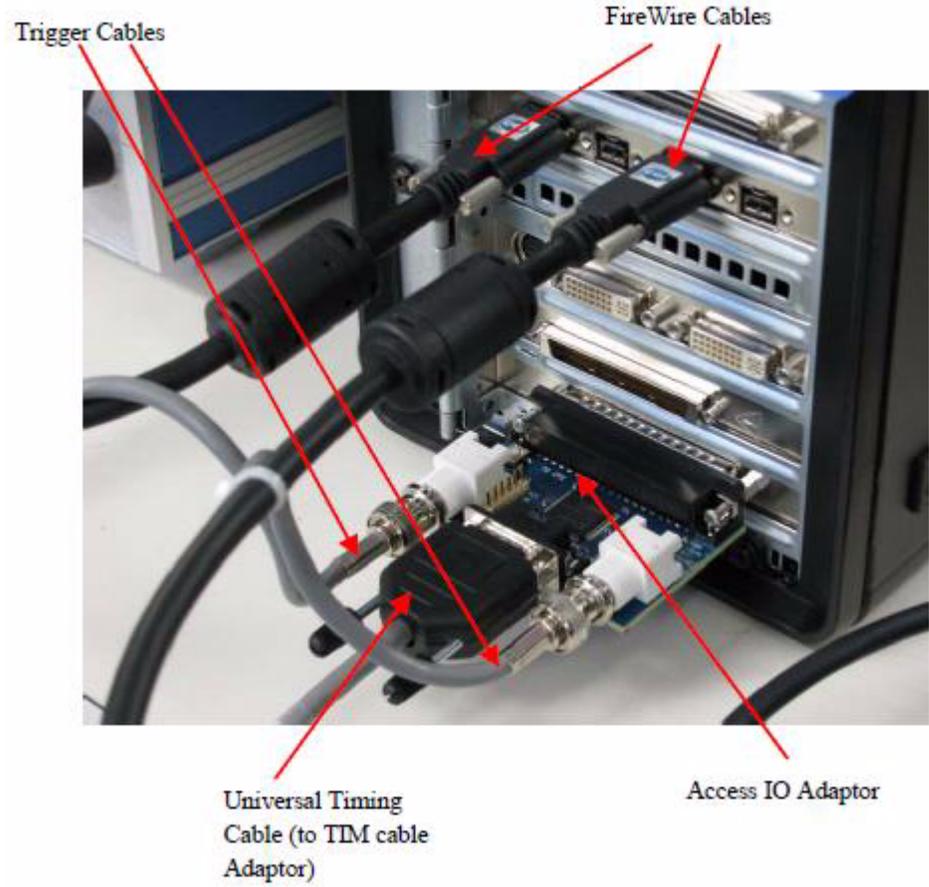


E.5.3 Connections to Computer

E.5.3.1 One Video Camera



E.5.3.2 Two Video Cameras



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CinePlex

Video Capture, Tracking, Behavioral, and Editing System User Guide

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