DELTAVISION®

Imaging System Operating Instructions
(Revision A)

applied precision®

Legal Notices

Revision A of the *DeltaVision* System Safety Notice. Part number 04-720153-000 Rev A.

Information in this document is subject to change without notice.

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All other registered names and trademarks referred to in this manual are the property of their respective companies.

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Contents

1 Introduction

Purpose of the Operating Instructions

The Operating Instructions provide the information necessary to use the DeltaVision imaging system in a safe way.

Prerequisites

This document assumes that you are familiar with the basics of microscopy. Correct operation of the microscope is fundamental to obtaining quality images with DeltaVision. In addition, an understanding of image processing basics will help you use the system to its full potential. To manage the computer systems, some familiarity with Linux workstations and Windows-based personal computers is helpful.

In this chapter

This chapter provides an introduction to DeltaVision, lists the supported imaging modes, and summarizes the data acquisition options.

- *Important User Information* discusses the intended use for a DeltaVision system, safety notices, including Notes and Tips and how to interpret them, and typographical conventions used in these Operating Instructions.

- *Regulatory Information* provides regulatory compliance information for manufacturing, CE conformity, international standards, CE marking, and connected equipment.
- *Instrument* provides a brief description of DeltaVision and lists the systems components.
- *Control Software* presents a brief description of softWoRx, the control software for DeltaVision imaging systems.

Important User Information

Read This Before Using DeltaVision

All users must read the Safety Instructions in Chapter 2 of these Operating Instructions before installing, using, or maintaining the system.

Intended Use

The DeltaVision Restoration Microscopy System can be used to collect and analyze three-dimensional microscope images, acquired over long periods of time and on multiple samples.

Safety Notices

These Operating Instructions contain Warnings, Cautions, and Notices concerning the use of this product, with meanings as defined below.

Important Indicates important or critical information about the previous paragraph or step in a procedure.

WARNING: Indicates important information regarding potential injury.

WARNING: Indicates risk of explosion.

WARNING: Indicates risk of shock.

CAUTION: Indicates important information regarding potential damage to equipment or software.

Notes and Tips

These Operating Instructions contain Notes and Tips concerning the use of this product, with meanings as defined below.

Note Indicates important information about the previous paragraph or step in a procedure.

Tip Indicates helpful advice for improving or optimizing your procedures.

Typographical conventions

Boldface indicates the names of buttons, menus, window options, and fields.

Initial Capitals indicate the names of windows and tabs.

ALL CAPITALS SAN SERIF indicates the name of a key on your keyboard or keypad, such as ENTER, DELETE, or STEP INCREASE.

`Uniform width font` indicates text to enter on a command line or in the GUI.

Regulatory information

This section lists the directives and standards that are fulfilled by a DeltaVision system.

Manufacturing information

Requirement	Content
Name and address of manufacturer	Applied Precision, Inc 1040 12th Avenue Northwest Issaquah, Washington 98027-8929 USA
Place and date of declaration	1040 12th Avenue Northwest Issaquah, Washington 98027-8929 USA 05/19/11
Identity of person authorized to sign Declaration of Conformity	Steven Reese

CE Conformity

Directive	Title
2004/108/EEC	Electromagnetic Compatibility (EMC) Directive
2006/95/EC	Low Voltage Directive with Amendment

International Standards

Standard	Description	Notes
EN 61010-1:2007 &EN 60825-1:2007	Safety	
EN 61326-1:2006	EMC	

CE marking

The CE marking and corresponding Declaration of Conformity is valid for the instrument when it is:

- Used as a stand-alone unit
- Connected to other CE-marked instruments
- Connected to other products recommended or described in the user documentation
- Used in the same state as it was delivered from Applied Precision, except for alterations described in the user documentation of explicitly authorized by Applied Precision.

Regulatory compliance of connected equipment

Any equipment connected to a DeltaVision system should meet the safety requirements of EN 61010-1/IEC61010-1 or relevant harmonized standards. Within the European Union, connected equipment must be CE-marked.

Instrument

DeltaVision imaging systems use research grade microscopes to collect optical images in fluorescence, brightfield, phase contrast, or differential interference contrast imaging modes.

The instrument consists of the following components:

- Microscope
- Workstation
- Keypad
- Hi-res monitor
- IC/MIC (control electronics)
- Multispectral illumination (xenon arc lamp or solid-state illumination module)
- Excitation filters
- Emission filters
- Objective turret

- Laser Module
- Stage
- Camera

Control software

With the sophisticated *softWoRx* image analysis and model-building software, the DeltaVision system is a comprehensive package for biological image data collection, interpretation, and display.

The *softWoRx* workstation provides a sleek interface that allows you to control the optical sectioning through a specimen. Behind the scenes, macro language provides automated computer control of sample position, optical filters, and shutters. After image data acquisition, a series of image processing algorithms improve image resolution. Three-dimensional information can be reconstructed and then visualized in a variety of ways that allow quantitative measurement and analysis.

2

Safety Instructions

Introduction

This chapter describes safety compliance, safety labels, general safety precautions, emergency procedures, power failure, recycling, and damage prevention issues to be aware of when using a DeltaVision imaging system. The precautions detailed in this chapter must be carefully observed to prevent possible personal danger:

> **Note** All laser-related safety issues, including proper labeling, are discussed in *Lasers and Safety Issues* on Page *18*.

In this chapter

- *General Precautions* provides basic safety information to be noted when using a DeltaVision system, including warning labels, UV exposure, bright light exposure, laser hazards, and the risks of burn or electrical shock.
- *Xenon Lamp Safety* provides safety information regarding the xenon arc lamp component, including explosion risks, high voltage, radiation dangers, thermal hazards, and disposal of a used xenon bulb.
- *Damage Prevention* describes actions that can damage the system and how to avoid them.

- *Lasers and Safety Issues* explains the precautions that should be observed when working with a DeltaVision system containing lasers.
- *DeltaVision X4 Laser Module Safety* describes the hazards and precautions to take when using the DeltaVision *X4* Laser Module.
- *X4 Laser Module Safety Labeling* shows the labels required when using the DeltaVision X4 Laser Module.
- *X4 Safety Label Locations* shows the locations for each of the required X4-specific laser safety labels.
- *API FI Laser Safety Labels* describes the hazards and precautions to take when using the *API FI* Module.
- *API FI Laser Safety Label Locations* shows the locations for each of the required API FI-specific laser safety labels.
- *Emergency Procedures* describes how to do an emergency shutdown of a DeltaVision imaging system and what to do in the event of a power failure.

General Precautions

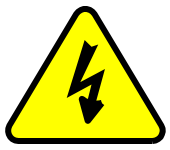
This section describes basic safety issues to be noted when using a DeltaVision imaging system.

Warning Labels

Warning labels have been applied to the components of the system that pose a potential hazard to the user. The labels have been duplicated here and carefully explained. Please read this section carefully.

> 🕮 **Note** For a description of DeltaVision components, see Chapter 7, *Facility Requirements and Components* in the *DeltaVision Restoration Microscopy System User's Manual*.

***DeltaVision* Warning Labels**

	**Hazardous Voltage Warning Label** This label indicates the danger of electric shock. This label is found on the xenon arc lamp housing.
	**Caution or Warning Label** This label indicates a danger of personal injury or possible damage to equipment. It is accompanied by an explanation of the specific danger. This label may be found on the microscope, the lamp, the High Res camera, the Fast Camera, or the workstation.

Please see the section, *Lasers and Safety Issues* for laser-specific safety warning labels.

UV Exposure

Since the xenon arc lamp emits ultraviolet (UV) light, there is a danger of exposing your eyes and skin. Loss of eyesight could occur if unfiltered light from the xenon arc lamp reaches your eyes.

To prevent UV exposure:

- Open the shutter only when an excitation filter is engaged.
- Do not open the xenon arc lamp housing during operation.

Bright Light Exposure

While the transmitted light source installed in the microscope does not present possible UV exposure, it could cause discomfort under certain conditions.

- You must be aware of the eyepiece filter wheel when viewing a specimen through the microscope oculars. Make sure that the proper filters are in place so that your eyes are not suddenly exposed to a bright flash of light when the transmitted light shutter is opened.
- Do not look through the eyepiece while switching filters. Your eyes can be exposed to unfiltered light during the filter transition.

Laser Hazards

The DeltaVision fluorescence illuminator contains up to three 50mW lasers and one 100mW laser, and is considered a Class 3R device. This means that laser radiation from the installed lasers can exit the device at the same time. The power level is high enough to cause damage to the human eye instantaneously and possible damage to the skin.

The optional *UltimateFocus*™ Module complies with CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007 IEC 60825-1, 2007-03.

OSHA regulations require (via ANSI Z136.1) and IEC 60825-1 recommends that a Laser Safety Officer be identified who will be responsible for the safe use of Class 3B lasers. This includes training users, installing all necessary warnings and controls in the laser area, and other duties.

WARNING:
Given the inherent exposure possible with an inverted frame microscope stand, users of the system *must be trained in laser safety before using this instrument*. Contact your lab administrator for information about Laser Safety training at your institution. Training information is also available online at:
www.kenteklaserstore.com/
The International Electrotechnical Commission (IEC) and the FDA recommend that Class 3R and Class 4 lasers be used only in restricted areas.

Please see the section in this notice, *Lasers and Safety Issues* on Page 18, for detailed laser safety information.

Burn

The xenon arc lamp reaches a very high temperature when lit. Never touch the housing during operation. Never remove the housing during operation or before allowing it to cool completely. Carefully follow the directions found in *Replacing the Xenon Bulb* on Page 65 for changing the lamp.

Shock

Hazardous voltages are present even when the system is disconnected from the AC main power outlet.

To replace the transmitted light source LED, follow the instructions in the manuals that are included with your microscope. To replace the xenon arc lamp, follow the instructions found in "*Replacing the Xenon Lamp*" on Page 65. Refer also to the following section in this notice, *Xenon Lamp Safety*, for additional related safety issues. No other system components contain user-serviceable parts and do not warrant disassembly.

If the High Res Camera coolant fluid is leaking, shut down the system and contact Applied Precision Customer Service.

Xenon Lamp Safety

Xenon lamps are under high pressure and emit high levels of radiation. Proper handling procedures and safety precautions should be observed to assure the safety of the users of this product. Only operate this lamp within the recommended operating specifications as detailed in this manual. Refer to "*Replacing the Xenon Lamp*" on Page 65 for details on the proper procedures for lamp replacement.

Explosion

These xenon lamps are under high pressure. Use of face shields or safety glasses during handling is recommended. Avoid applying excessive shock or stress to the lamp during handling.

High Voltage

The ignition voltage of the xenon lamp presents a very high voltage hazard. Do not touch the lamp during operation. To avoid the risk of electrical shock, the input power should be disconnected prior to servicing the lamp.

UV, Visible, and IR Radiation

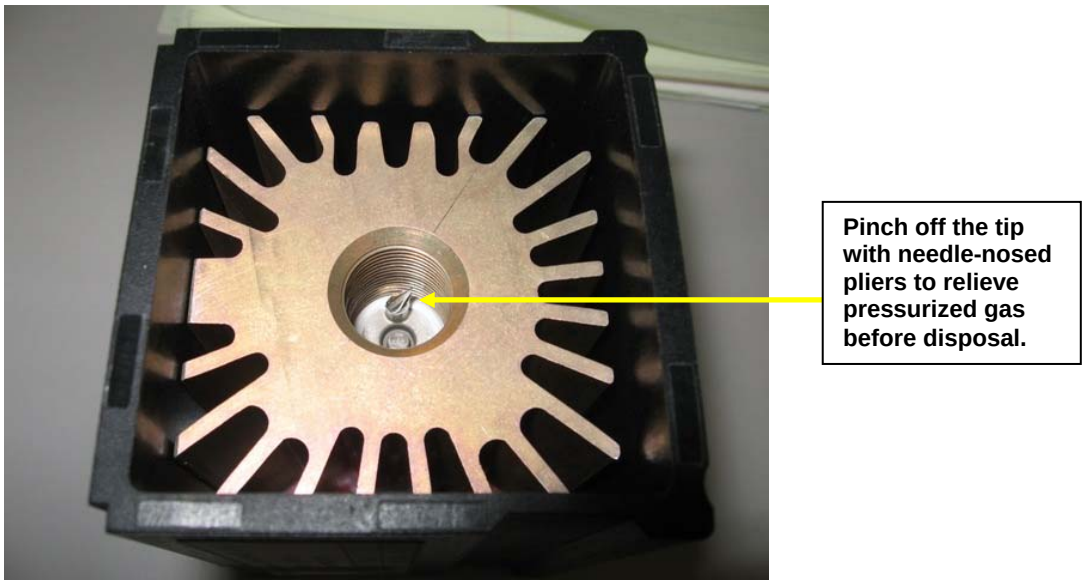
Xenon lamps emit high levels of radiation that can cause severe skin burns and permanent eye damage. Avoid direct exposure to the emitted or reflected beams.

Thermal Hazards

Xenon lamps can get very hot during and after operation (up to several hundred degrees C). To avoid potential for serious burns, do not touch the lamp during operation. Do not touch the lamp after operation until the lamp has adequately cooled.

Disposal/Recycling

It is recommended that the xenon lamp's internal pressure be relieved prior to disposal. This is accomplished by squeezing off the tip (see illustration below) with needle-nosed pliers until the pressurized gas escapes.



Relieve the xenon lamp's internal pressure before disposal!

Pressurized xenon lamps should not be incinerated, but disposed of in a landfill.

Damage Prevention

The following actions could damage the system:

- Moving the stage to the home position with the objective up could break or scratch the objective. The stage could be driven into the objective and may potentially scratch the top lens or compress the lens housing, causing a leak, crack, or lens misalignment.
- Disconnecting cables before the system is completely shut down will damage one or more of the electronic circuit boards.
- Disconnecting cables to the camera when the power is on can damage the camera.
- Touching optical filters or the polychroic beam splitter contaminates them with oil and can lead to premature failure or poor image quality. For cleaning information, see *Cleaning* on Page 72
- Bending the fiber optic cable into a coil with a diameter less than 24" will damage the cable.
- Using improperly rated replacement fuses can create a fire hazard and may result in damage to components. Use only the fuse types listed on the component or in the manual.
- Leaving a camera out of the tray when it is not in use presents an opportunity for the camera to fall to the floor and break. Always place the camera in the camera tray when it is not in use.

Lasers and Safety Issues

This section describes the necessary precautions to take when working with a DeltaVision system containing lasers, including required safety labeling and label locations.

Please read the sections carefully to determine the proper safety measures to take for your particular laser configuration.

DeltaVision X4 Laser Module Safety

This section describes the hazards and precautions to take when using the *DeltaVision X4* Laser Module. These hazards and precautions must be fully reviewed and understood, and proper safety protocols followed during any use of the *DeltaVision X4* Laser Module. Personnel servicing the *DeltaVision X4* Laser Module should have completed a Field Service Engineer Training course provided by Applied Precision, Inc. prior to performing diagnosis, repair, or service to a *DeltaVision X4* Laser Module.

The *DeltaVision X4* Laser Module is a Class 3B laser system.

Important Safety Recommendations

The *X4* Laser Module contains up to three 50mW lasers, one 100mW laser, and is considered a Class 3B device. This means that radiation from all installed lasers can exit the device at the same time. The power level is high enough to cause damage to the human eye instantaneously.

OSHA regulations require (via ANSI Z136.1) and IEC 60825-1 recommends that a Laser Safety Officer be identified who will be responsible for the safe use of Class 3B lasers. This includes training users, installing all necessary warnings and controls in the laser area, and other duties.

⚠ **WARNING:**
Given the inherent exposure possible with an inverted frame microscope stand, users of the system *must be trained in laser safety before using this instrument*. Contact your lab administrator for information about Laser Safety training at your institution. Training is also available online at:

`www.kentek-laser.com/edu/lasercrs.htm`

The International Electrotechnical Commission (IEC) and the FDA recommend that Class 3B and Class 4 lasers be used only in restricted areas.

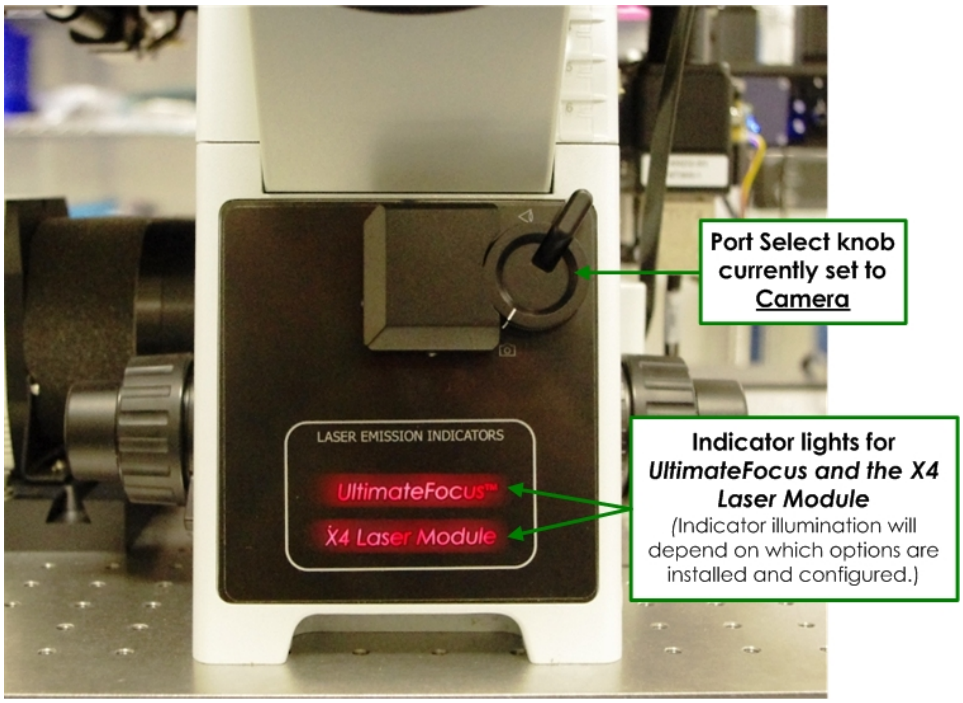
Safety Features

The Laser Module provides several features that control access to the device and improve its safety.

- The Key Lock switch on the front panel of the Laser Source Chassis must be in the LASER ON position to enable use of the lasers. The key can be removed only when this switch is in the LASER STAND-BY position.

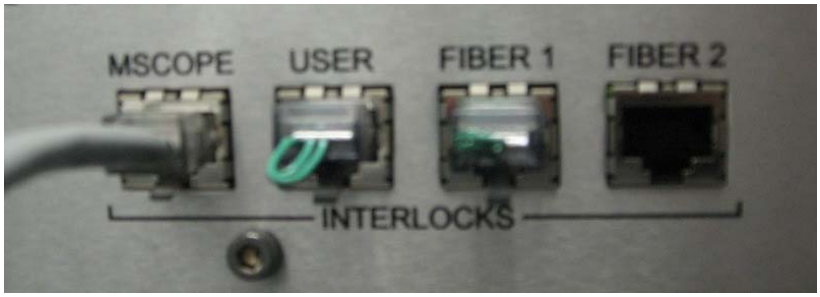
Laser Source Key Switch

- A Port Selector Interlock prevents laser output unless the Port Selector knob on the microscope stand is set to the Camera (left side port) position. This device prevents exposure to the beam while looking through the eyepieces.



Port Selector Knob for X4 Laser Module

- Indicator lights on the system illuminate when the lasers are powered on and the interlocks are closed. The lasers can be fired at any time when the system is in this state, so the lights warn users to take any necessary precautions. A pair of indicator lights is visible on the front of the Laser Source Chassis. Another pair of indicator lights is visible on either the Port Selector switch (non-*API FI* systems) or near the Port Selector switch (*API FI* systems…see previous photo). All lights should be OFF or ON at the same time in proper operation.
- A User Interlock Connector on the back panel of the Laser Source Chassis allows you to install a door interlock to prevent laser output when the door is open. When the door interlock is active, the lasers turn ON but cannot emit light past the shutter.
- If you are not using a remote interlock, you must insert Interlock Jumpers into the User Interlock Port and the Fiber1 Interlock Port. These jumpers must be in place for the lasers to emit light.



Interlock Jumpers

For the lasers to operate, all of the following safety devices must be set as follows:

- The Key Lock switch must be ON.
- The Port Select knob must be set to the **Camera** position.
- The User Interlock Connector must be closed.
- At least one of the fiber interlocks must be closed.

If any of these devices are not set as described above, the shutters between the laser heads and the fibers are prevented from opening.

Avoiding Specific Hazards

The hazard of being exposed to the laser beam through the objective turret when no objective is in place can be mitigated by turning off the key lock switch on the front of the Laser Source Chassis prior to any system reconfiguration or maintenance.

Specific hazards during alignment or system maintenance include:

- Exposure to the beam when disassembling the Fiber Optic Module from the microscope.
- Exposure to the beam when disassembling the Laser Optics Module from the Fiber Optic Module.
- Exposure to the beam when disassembling the optical fiber from the Laser Optics Module or the Laser Source Chassis.
- Exposure to the beam while the polychroic beam splitter turret is removed from the stand.

Radiation can be emitted as follows:

- **Through the objective.** The beam that comes through the objective is emitted during imaging experiments. It can be as powerful as 26mW and includes all wavelengths of lasers available in the Laser Source Chassis. The beam is highly divergent and depends on the objective used; using various API-approved objectives, the divergence angle can be as low as 45 degrees or as

high as 140 degrees. With the maximum power on all lasers, using the lowest-NA objective, the Nominal Optical Hazard Distance (NOHD) is less than 10cm (4 inches).

- **From the objective turret when no objective is in place.** This beam is only visible during maintenance (for example, when aligning the Laser Optics Module) or when the lasers are triggered accidentally without an objective being in place. This beam is collimated and small (a few mm across). The beam power may be as high as 30mW.
- **From the fluorescence illuminator when no dichroic is in place.** This beam is only visible during maintenance, when adding or removing dichroic cubes from the dichroic cube turret. This beam is collimated and small (a few mm across). The beam power may be as high as 45mW.

Whenever you use the *X4* Laser Module, it is critical to keep your own safety and the safety of those around you a top priority. This is particularly important when maintaining the system, such as aligning the Optics Module or focusing the beam. ***Some maintenance tasks involve potential exposure to dangerous levels of laser radiation.*** According to ANSI Z135.1 (which is the standard the United States government uses for the safe use of lasers), the operator of a laser is responsible for the safety of everyone in the area, so you must be aware of the risks and keep others in the area safe. Some basic precautions will dramatically reduce the potential for injuries and damage.

WARNING: CAUTION - USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

WARNING! EVEN IF ALL OF THESE PRECAUTIONS ARE TAKEN, A RISK OF INJURY CAN STILL EXIST.

DURING USE:

• **Make sure the system is ready for use before enabling the lasers.** An objective should be in place and the dichroic cube turret should be installed. The indicator lights on the system (two small lights on or near the Port Selector Interlock, depending on whether or not the system includes the *API FI* Module) and two more on the Laser Source Chassis) should be either all ON or all OFF.

• **Do not lean close to the objective** to view the sample or make adjustments to parts of the system, etc. while the laser is on.

BEFORE BEGINNING MAINTENANCE:

• **Whenever possible, work with the lasers disabled,** for example, by turning the key to the "LASER STAND-BY" position.

• **When lasers must be used, begin work by reducing the beam power** as much as possible. Only increase the beam power if the work cannot be performed with lower laser power settings.
• **Do not turn the laser on until the entire beam path is safe.** Determine where the beam is going to go before turning on the laser and make sure the beam is blocked as soon as possible. Clear all reflective surfaces from the beam path—a reflected beam can be dangerous for several meters in many cases.
• **Be extremely vigilant about putting items in the beam path.** Tools, watches, rings and microscope samples can all make excellent reflective surfaces, and when inserted into the beam path, they can steer the beam in dangerous and unpredictable ways.
• **If other people are in the room, brief them on the procedures to be performed and what hazards will be present.** Reiterate that the area may be dangerous and that they must comply with any instructions you give regarding safety.

WARNING: CAUTION - USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

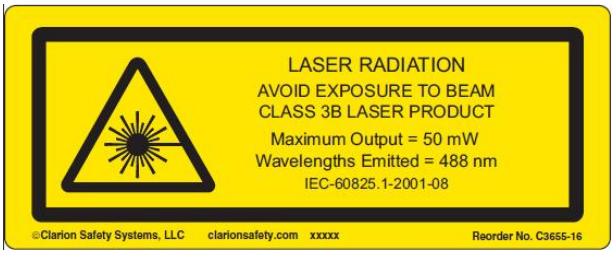
TIRF-specific Laser Safety Considerations

Due to the TIRF illumination optics provided by the TIRF/PK Module and its laser component, the light being emitted from the *DeltaVision* objective is collimated and has high power density. The TIRF system also has the ability to direct this light to sharp, off-axis angles relative to the objective axis. When servicing the TIRF system, use extreme caution that the emitted light is not directed into the user's eyes. Appropriate laser safety goggles selected for the specific wavelength being tested are mandatory.

X4 Laser Module Safety Labeling

Standard Configuration

Avoid Exposure Caution Label



CAUTION

CLASS 3B VISIBLE AND INVISIBLE LASER RADIATION WHEN OPEN.

AVOID EXPOSURE TO BEAM.

Avoid Exposure Label

AVOID EXPOSURE.

VISIBLE AND INVISIBLE LASER RADIATION IS EMITTED FROM THIS APERTURE.

Avoid Exposure Label

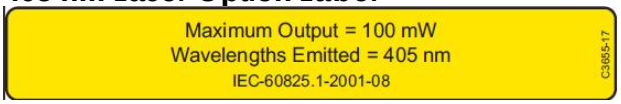
CAUTION

CLASS 3B VISIBLE AND INVISIBLE LASER RADIATION WHEN OPEN.

AVOID EXPOSURE TO BEAM.

Optional Configurations

405 nm Laser Option Label



405 nm Laser Option

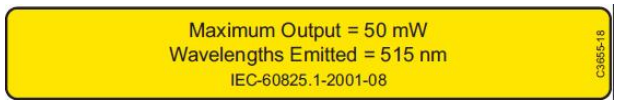
λ	max. power
405 nm	100 mW

445nm Laser Option Label

445nm Laser Option

λ	max. power
445nm	40mW

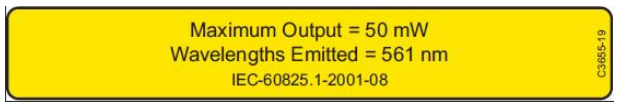
515 nm Laser Option Label



515 nm Laser Option

λ	max. power
515 nm	50 mW

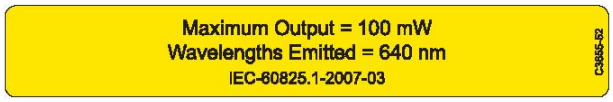
561 nm Laser Option Label



561nm Laser Option

λ	max. power
561 nm	50 mW

640nm Laser Option Label



640nm Laser Option

λ	max. power
640nm	100mW

X4 Safety Label Locations

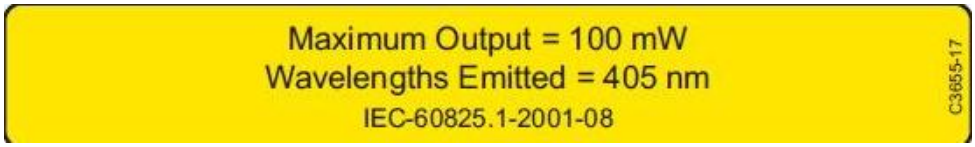
Laser Safety labels and notifications should be installed on the *X4* Laser Module product as illustrated below. In the event that a label is not installed or installed improperly, please notify Applied Precision by contacting `hotline@api.com` or calling 800.862.5166.

X4 Laser Source Chassis

The following labels are placed on the front of the Laser Source Chassis.

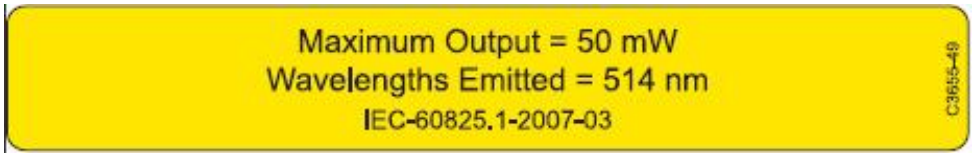
📖 **Note:** Only safety labels that correspond to the laser(s) installed in the Laser Source Chassis will be present.

Primary Laser (488nm) Safety Label

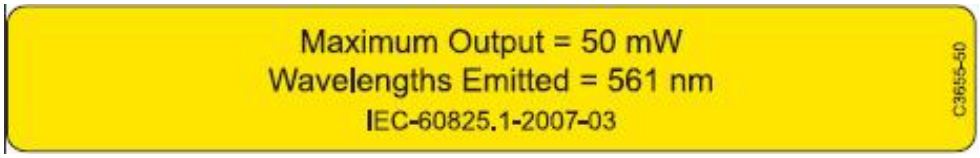


405nm Laser Safety Label

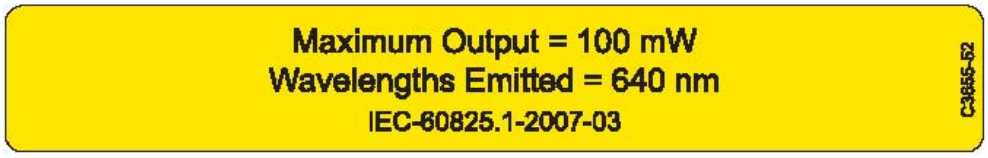
445nm Laser Safety Label



514nm Laser Safety Label

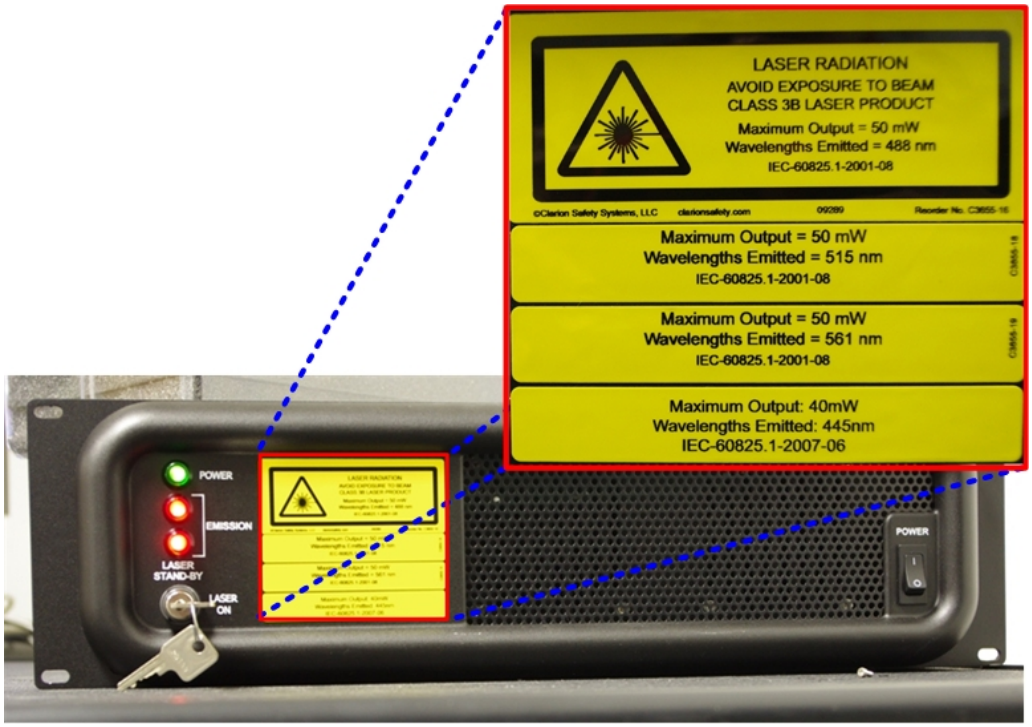


561nm Laser Safety Label



640nm Laser Safety Label

The following photo shows the locations for the safety labels above to be placed on the front of the Laser Source chassis.



Laser Source Chassis Laser Safety Label Locations

X4 Laser Optics Module

The *X4* Laser Optic Module connects to the *DeltaVision* Fiber Optic Module on non-*API FI* systems and to the TIRF/PK Module on *API FI* systems. The Laser Optics Module has the following laser safety label attached in two places on the module as shown.

Optics Module Laser Safety Label

One safety label is attached to the beam cover of the Optics Module as shown.

Optics Module Safety Label (Location 1)

The second safety label is attached to the upper portion (opposite side) of the Optics Module as shown.

Optics Module Safety Label (Location 2)

DeltaVision Stage

The following safety label is placed on the edge of the *DeltaVision* stage as shown.

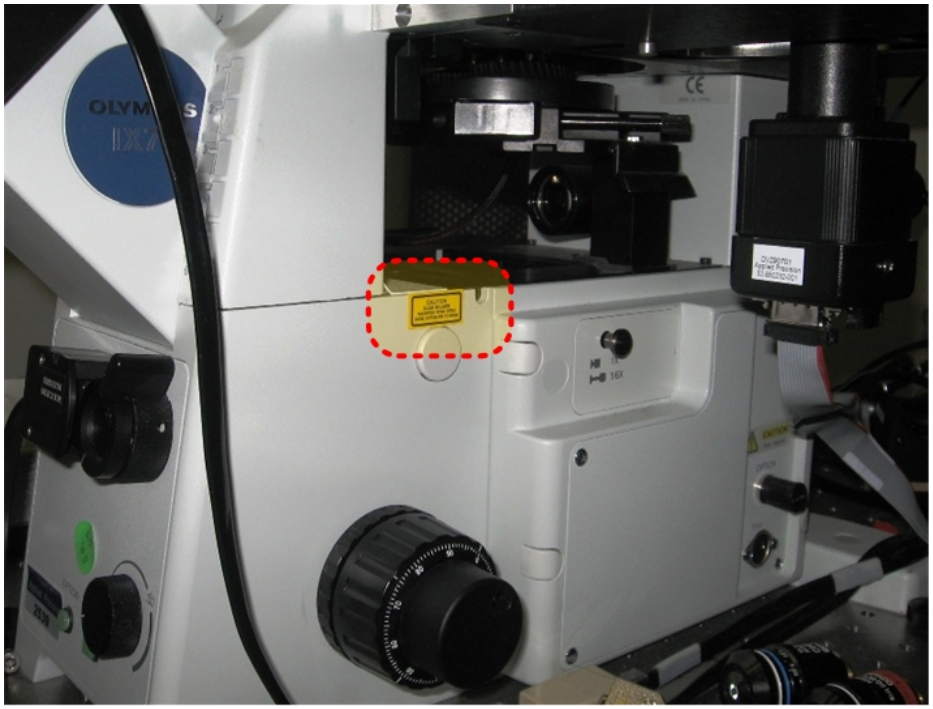
Laser Safety Label Location - *DeltaVision* Stage

Polychroic Beam Splitter Removal Screw

The following label is placed on the side of the *DeltaVision*, next to the screw for removing the Polychroic Beam Splitter.

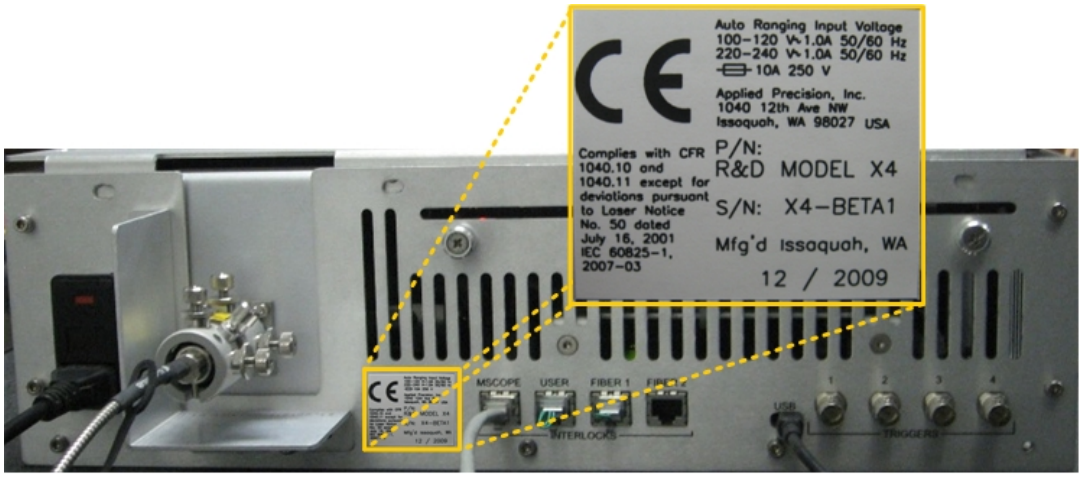
Polychroic Beam Splitter Removal Warning

This label warns users that, with the turret removed, laser radiation will come out through the fluorescence illuminator and be accessible. The label is attached to the *DeltaVision* as shown.



CE Label

The CE Label for the *X4* Laser Module is attached to the back of the Laser Source Chassis as shown.



API FI Laser Safety Labels

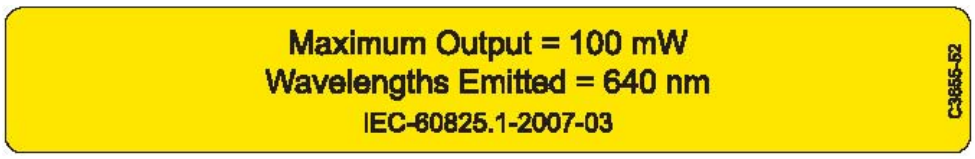
Laser Safety labels and notifications should be installed on the API Fluorescence Illumination Module product as illustrated below. In the event that a label is not installed or installed improperly, please notify Applied Precision by contacting hotline@api.com or calling 800.862.5166.

Laser Source Chassis

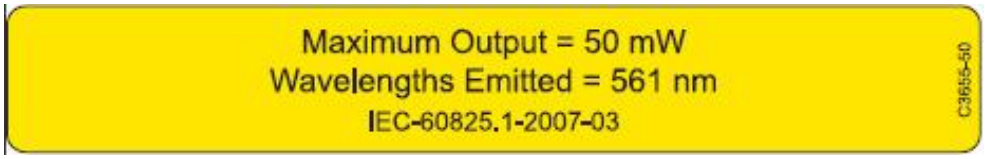
The following labels are placed on the front of the Laser Source Chassis.

Note: Only safety labels that correspond to the laser(s) installed in the Laser Source Chassis will be present.

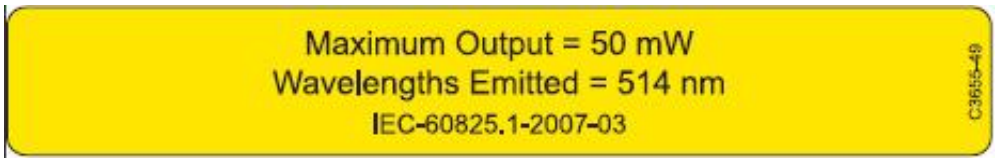
Primary Laser (488nm) Safety Label



640nm Laser Safety Label

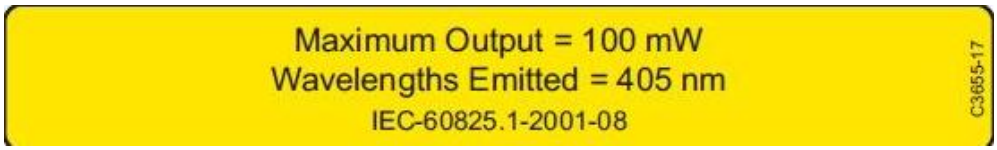


561nm Laser Safety Label



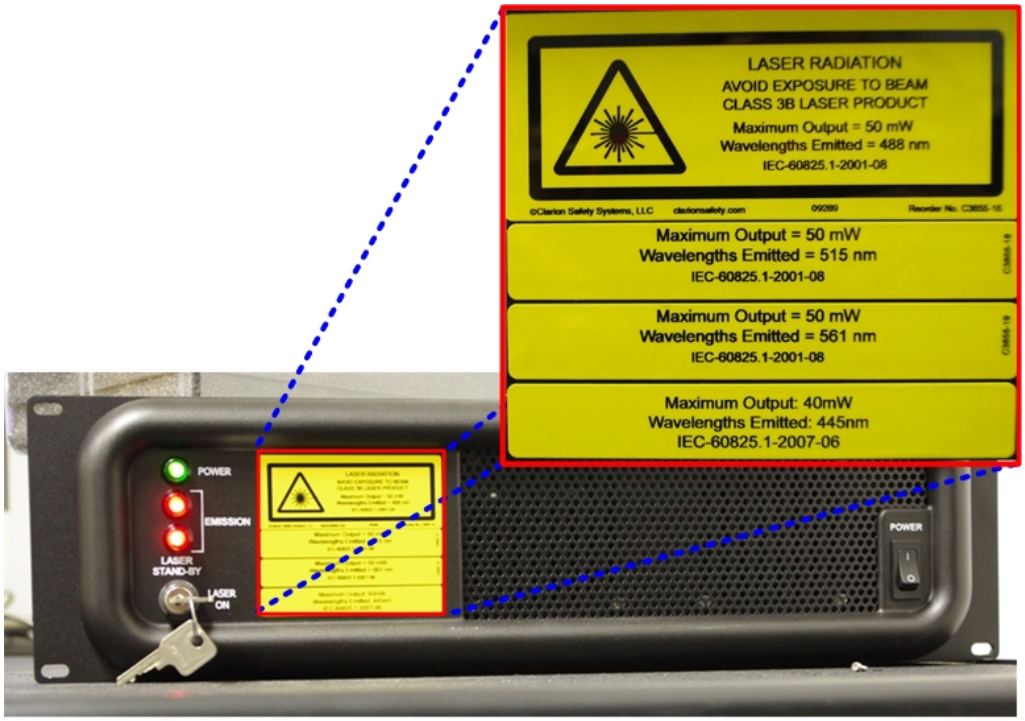
514nm Laser Safety Label

445nm Laser Safety Label



405nm Laser Safety Label

The following photo shows the locations for the safety labels above to be placed on the front of the Laser Source chassis.



Laser Source Chassis Laser Safety Label Locations

🕮 **Note:** Safety labels on the Laser Source Chassis will vary depending on which lasers are installed in your system.

API FI Laser Safety Label Locations

The API Fluorescence Illumination Module is a fairly complex device, adding several different visible and invisible laser wavelengths to the standard *DeltaVision* system. Since the different options available with this module are so many and varied, you should consult the following table to determine the location and type of Laser Safety Labels that should be attached to a particular system.

The following table shows the location and type of Laser Safety Labels, depending on the various options installed, that should be attached to a system equipped with the *API FI* Module. Use this table in conjunction with the illustrations immediately following, in which the label positions are called out by number.

WARNING! When using low NA air objectives (anything below 0.45 NA), the *UltimateFocus*™ laser beam does not diverge as much as it does with higher NA objectives. The beam, a Class 3R Invisible Laser light up to 2.2mW, is nearly collimated and is emitting straight up through the objective. Whenever the Laser Emission Indicators show that *UltimateFocus*™ is on, users must not look down the objective turret.

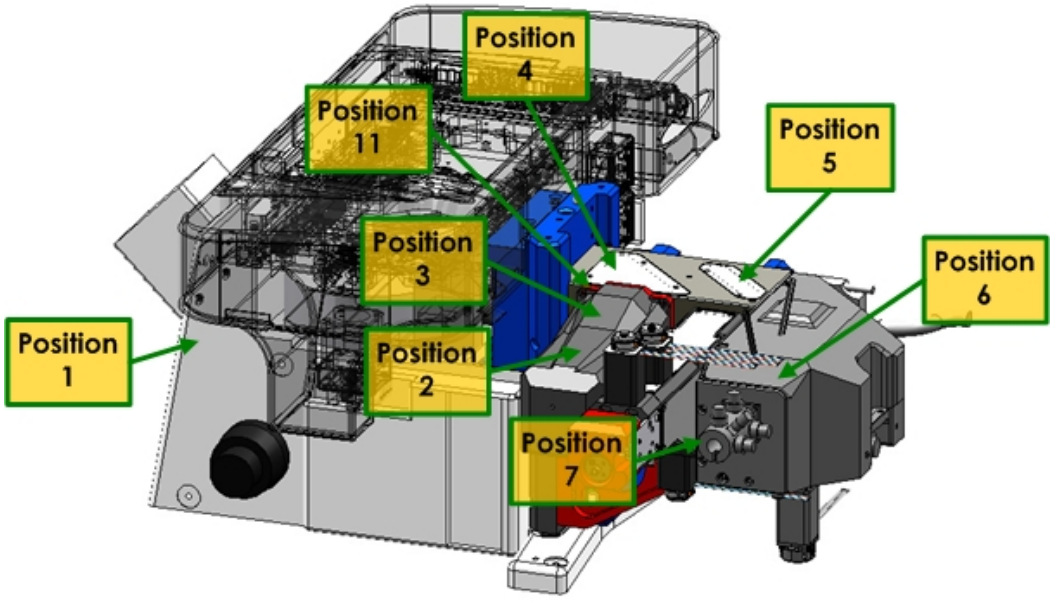
APIFI Module Laser Safety Label Types and Locations on the *DeltaVision* system

Options and Label Locations → / **Labels** ↓	***X4***	***Ultimate Focus™***	***X4* and *Ultimate Focus™***
Visible Laser Warning 	**9**		
Invisible Laser Warning 		**9**	
Visible and Invisible Laser Warning 			**9**
Class 3R Invisible when Open Laser Warning 		**1, 4, 8, 10**	**1, 4, 8, 10**

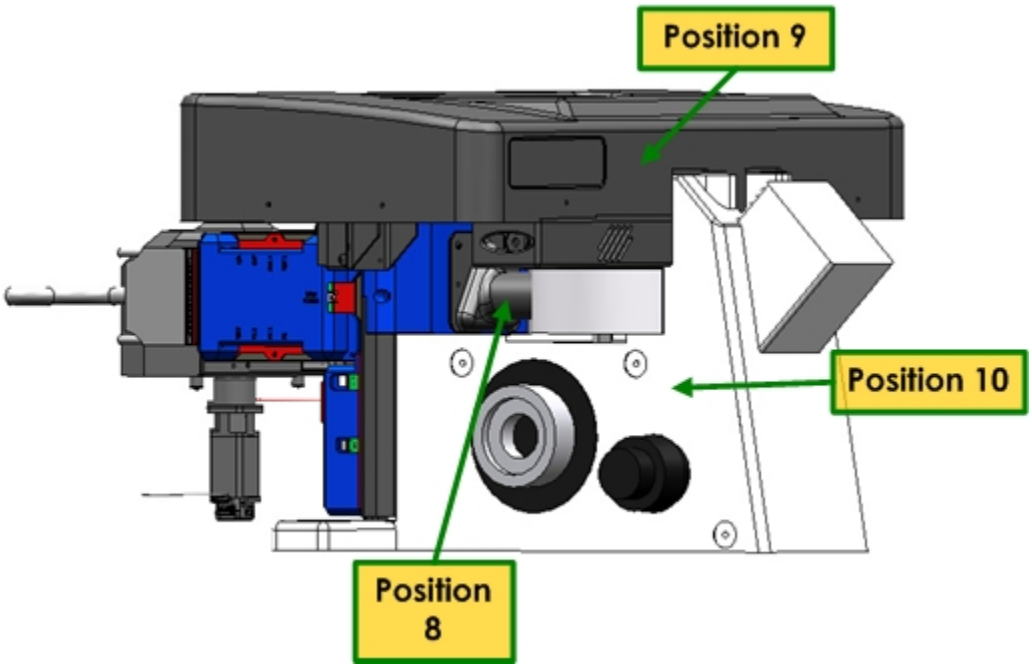
Class 3B Visible when Open Laser Warning 	**1, 4, 5[A], 6, 7, 10, 11[A]**		**1, 4, 5, 6, 7, 10**
Invisible Laser Radiation, Class 3R 		**2**	**2**
Class 3B Visible and Invisible when Open 		**3**	**3**

[A]Label is also present underneath this panel

[B]Label is present only when the Ultimate Focus Module is not installed..



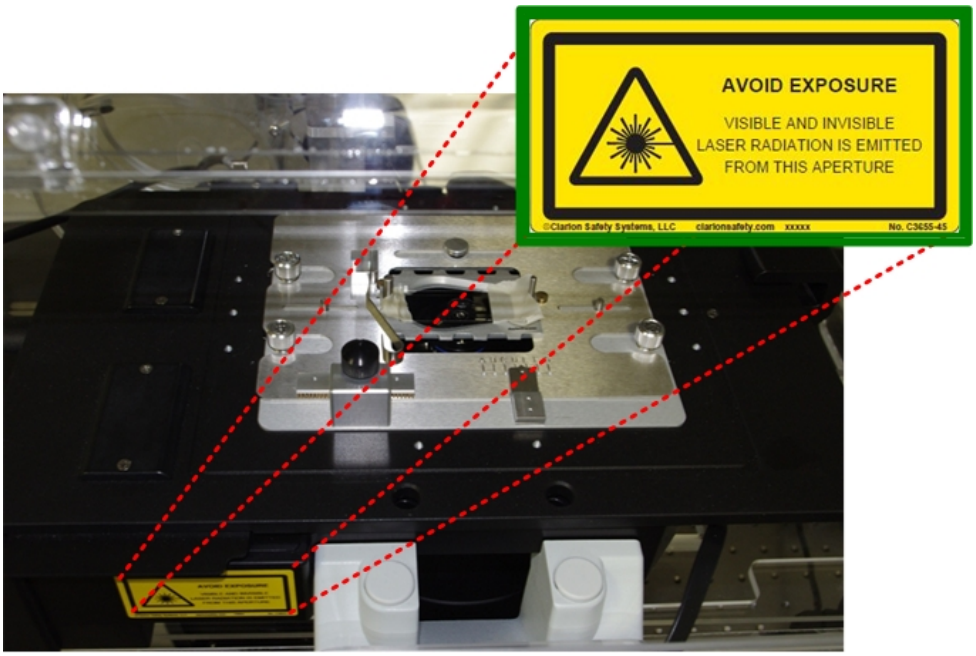
Laser Safety Label Locations (as viewed from the right rear of the system)



Laser Safety Label Locations (as viewed from the left front)

DeltaVision Stage

The following label is placed on the edge of the *DeltaVision* stage as shown.



Laser Safety Label Location - *DeltaVision* Stage

CO_2 Cell Box / TIRF Cover

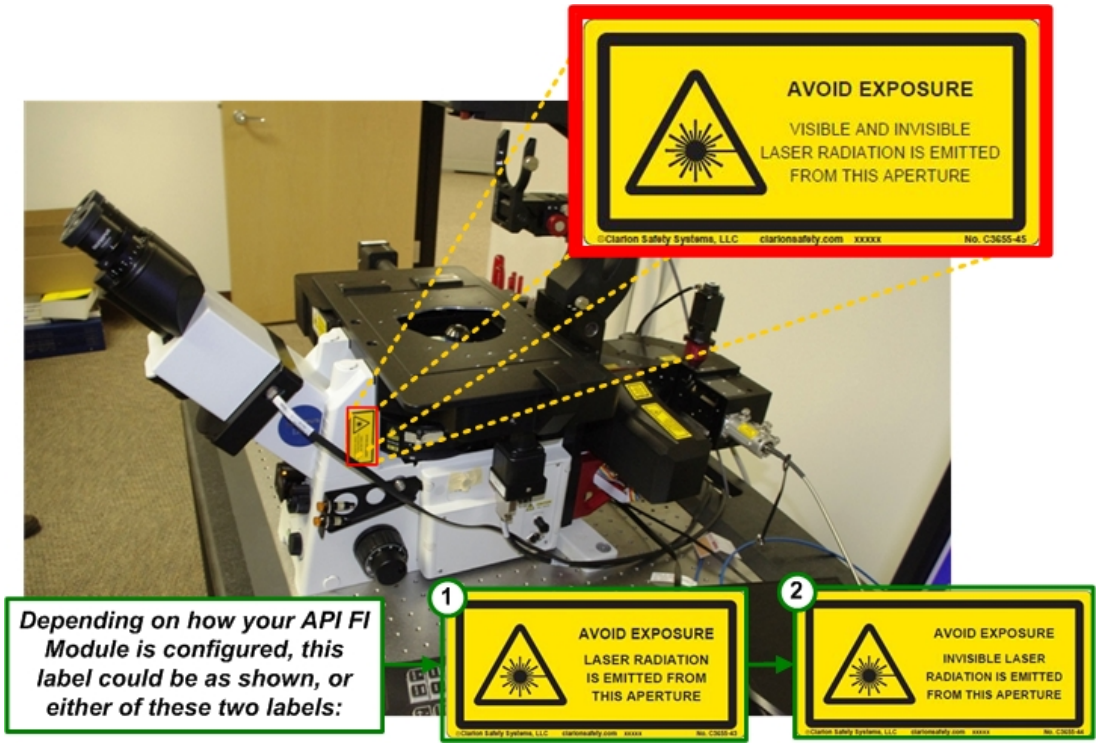
The following label is placed on the CO_2 Cell Box / TIRF Cover as shown.

Laser Safety Label Location - CO_2 Cell Box / TIRF Cover

Polychroic Turret Removal

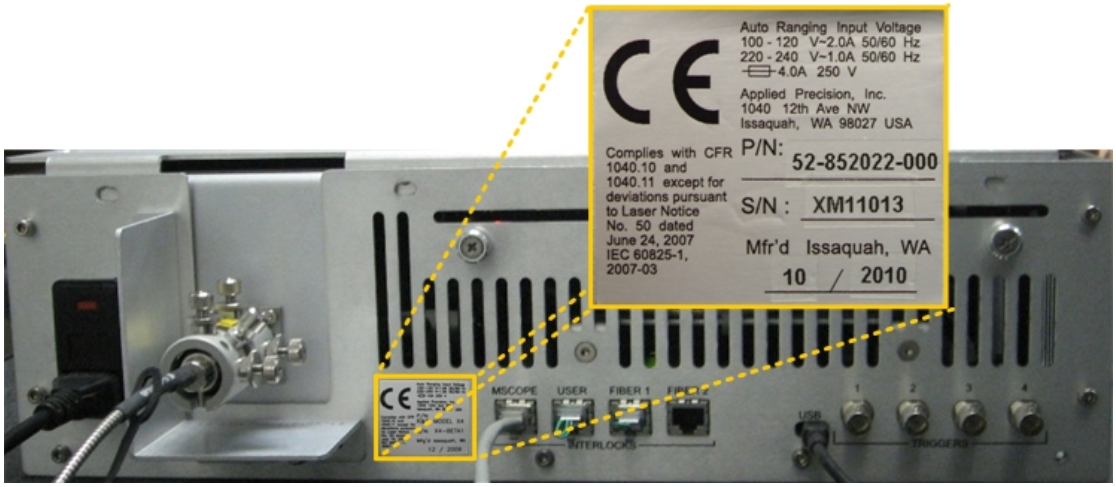
The following label is placed on the right side of the *DeltaVision*, next to the screw for removing the Polychroic Turret.

This label warns users that, with the turret removed, laser radiation can be accessible coming out through the fluorescence illuminator. The label is attached to the *DeltaVision* as shown.



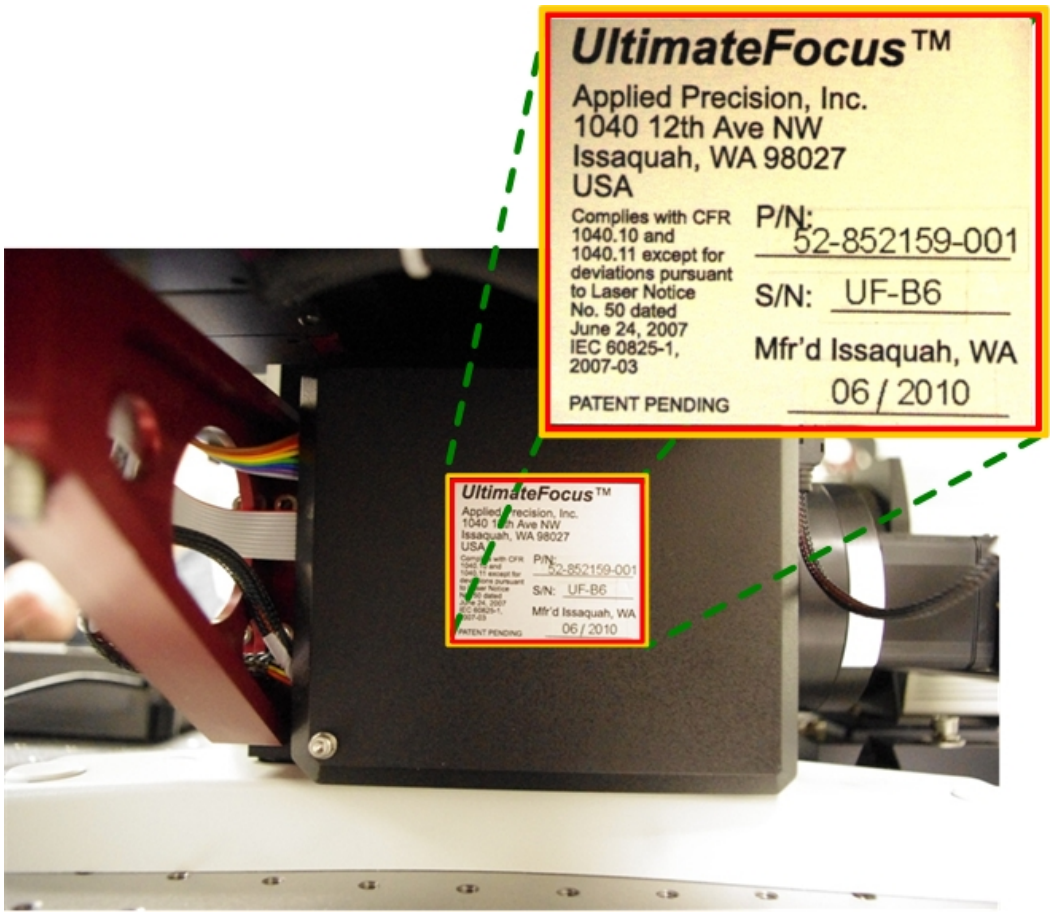
Compliance Labels

The CE Label for the *X4* Laser Module is attached to the back of the Laser Source Chassis as shown.



***X4* Laser Module - CE Label**

The Compliance Label for the *UltimateFocus*™ Module is attached to the back of the *DeltaVision* Microscope as shown.



***UltimateFocus™* Compliance Label**

WARNING! When using low NA air objectives (anything below 0.45 NA), the *UltimateFocus*™ laser beam does not diverge as much as it does with higher NA objectives. The beam, a Class 3R Invisible Laser light up to 2.2mW, is nearly collimated and is emitting straight up through the objective. Whenever the Laser Emission Indicators show that *UltimateFocus*™ is on, users must not look down the objective turret.

Emergency Procedures

This section describes how to do an emergency shutdown of a DeltaVision imaging system and what to do in the event of a power failure.

Emergency Shutdown Procedure

In an emergency situation, perform the following steps to shut down the system:

To shut down the *DeltaVision* system:

1. If you have the X4 Laser Module attached, turn off the key switch for the interlock that disables the laser safety shutter.
2. Turn off any lasers that have been turned on.

3. Disconnect all system power cables from the power receptacles.

Power Failure

In the event of a power failure, complete the following steps:

1. If you have the X4 Laser Module attached, turn off the key switch for the interlock that disables the laser safety shutter.
2. Turn off any lasers that have been turned on.

Recycling Procedures

The equipment shall be decontaminated before decommissioning and all local regulation should be followed with regard to scrapping of the equipment.

Disposal, General Instructions

When taking a DeltaVision system out of service, the different materials must be separated and recycled according to national and local regulations.

Recycling Hazardous Substances

DeltaVision sometimes uses hazardous substances. Detailed information is available from your local Applied Precision representative.

Disposal of Waste Materials

All materials used in the instrument must be disposed of in the manner prescribed by national and local regulations.

WARNING: Hazardous waste must be handled and disposed of properly.

Disposal of Electrical Components

Electrical and electronic equipment must not be disposed of as unsorted municipal waste and must be collected separately. Please contact an authorized Applied Precision representative for information concerning the decommissioning of equipment.

WARNING: DeltaVision and its components containing electrical and electronic equipment must NOT be disposed of as unsorted municipal waste and must be collected separately. Please contact Applied Precision for information concerning the decommissioning of equipment.

3

Installation

In this chapter

- *Site Requirements* provides information on power, space, temperature, and humidity requirements for the DeltaVision imaging system.
- *Transport* explains what to do when you need to move the system.
- *Unpacking* provides information on unpacking the system.
- *Communication Recommendations* discusses the information needed to connect the system to a network.
- *Air Movement* presents some possible causes for unwanted air circulation near the system.
- *Vibration Isolation* points out locations and equipment that can cause motion artifacts in your image results if the location is not carefully determined.
- *Ambient Illumination* provides tips for avoiding unwanted light when collecting images.
- *Spare Parts and Accessories* provides a source for finding additional parts and equipment for a DeltaVision system.

Site Requirements

The following table provides the DeltaVision system requirements for power, location, temperature, and humidity.

Parameter	Requirement
Electrical power	**Operating Frequency:** 50/60 Hz **Operating Power:** Up to three separate 100-120 VAC 15A circuits. (One for the Instrument Controller, a second one for the Environmental Chamber (if included), and a third one for the rest of the *DeltaVision* system. Up to three separate 200-240 VAC 6A circuits. (One for the Instrument Controller, a second one for the Environmental Chamber (if included), and a third one for the rest of the *DeltaVision* system. **Transients:** Transient over-voltages in accordance with Installation Category II in IEC 664 **Maximum Power:** 1200 VA
Placement	*DeltaVision* - 3 ft x 6 ft (90 cm x 180 cm). Include 18 in (45 cm) space behind instrument rack. *personalDV* - 22in x 54 to 62in (depending on whether or not the keyboard is kept in a slide-out tray). Include 18 in (45 cm) space behind instrument rack. Maximum System Weight: 940 lbs (425 kg).
Ambient temperature	65 - 77 °F (18 - 25 °C), daily variation of no more than 3 °F (1.8 °C). The actual room temperature should be stable to within 1 degree (Fahrenheit or Celsius) per hour. Fluctuations in temperature will affect microscope optics, which can cause the specimen to drift approximately 1 µm per 0.1 degree Celsius.
Humidity	Stable humidity levels under 50%, with daily variations of less than 10%. High humidity can result in condensation on the CCD camera window that obscures image formation. Excessive humidity may also reduce filter life and may result in chromatic aberrations in the images.

Transport

If you need to move your *DeltaVision* system, call Applied Precision for instructions.

Unpacking

The unpacking process must be performed by those who will be doing the installation. Be sure to carefully examine all of the packages for possible damage prior to opening them.

CAUTION: An authorized Applied Precision representative must unpack and install the DeltaVision system. DO NOT attempt to unpack the system on your own. Unpacking of the system by any person not authorized by Applied Precision may void the warranty.

When you receive the shipment, perform the following inspection:

1. Check the packaging for any apparent damage.
2. Inspect TiltWatch® and Shockwatch® indicators located on the crates. Note if any of the sensors have been tripped, but do not reject the system at this time.
3. Document any damage carefully and contact Applied Precision Customer Service.

The Applied Precision service technician will require the customer's assistance in moving and setting up the heavier system components. This assistance will be required for initial installation, future moves, and service calls requiring replacement of heavier parts. Installation and subsequent service calls may be delayed or rescheduled if the customer's assistance is not available.

Communication Recommendations

Connect the workstation to a local area network for data storage. To connect to a network, you will need an IP address, domain name server address, and network mask. A connection to the Internet will provide access to Applied Precision's web site.

CAUTION: Applied Precision, Inc. is not responsible for damage or harm to the workstation or scanner due to network security breaches.

Having a telephone in the same room as the system will facilitate communication with Technical Support.

Air Movement

Air movement around the microscope can cause specimen drift on the scale of several microns. Two common sources of air movement are window air conditioners and open windows. Central air conditioning is recommended. However, the system should not be placed in the direct path of the incoming air.

Vibration Isolation

The vibration absorbing design of the system minimizes motion artifacts from internal vibration due to shutters, filter wheels, and stage movement. The system is also designed to damp out external vibration as well. Avoiding locations near refrigerators, elevators, ventilation equipment, and other sources of vibration will improve image resolution.

Ambient Illumination

For best results, minimize ambient illumination during data collection. A light-tight room is recommended. Ensure that there are no light sources pointed downward into the lens.

A small desk lamp located near the workstation is recommended for preparing and monitoring experiments. The workstation keyboard is backlit for working in low light situations.

You can press the BLANK SCREEN key on the keypad to darken the monitor for improved image quality. Pressing any key on the keyboard restores monitor function.

Dust

It is important to minimize dust on the microscope components because dust on components can cause spots on microscope images. Minimize contamination by maintaining a clean room and covering the microscope when it is not in use. Store all extra filter sets, cameras, objectives, plates, etc. away from dust.

Spare Parts and Accessories

For current information on spare parts and accessories for DeltaVision systems, see www.api.com.

4 Basic Operation

In this chapter

- *Before You Start* provides tips on what you should have ready before you begin imaging with a DeltaVision system.
- *Getting Familiar with DeltaVision* includes information regarding the basic features of a DeltaVision system.
- *Acquiring Image Data* steps through the basic process for setting up an experiment and acquiring an image.
- *Saving Image Data* describes the basic process for saving acquired image data.

Before You Start

Before you start, make sure that you:

- Select the proper oil for your objective and specimen. The immersion oil kit includes 18 oils with refractive indexes that range from 1.500 to 1.534, in increments of 0.002. (For personalDV, the kit includes 6 oils that range from 1.512 to 1.522.) If you are working at standard temperature and pressure, the oil with a 1.516 refractive index is generally a good place to start. For work at 37 degrees C, use the oil with a 1.520 refractive index.
- Know your login ID and password for the workstation.

- Prepare your sample using standard practices. If you are not currently trained in sample preparation, consider attending a course on the subject.

Getting Familiar with *DeltaVision*

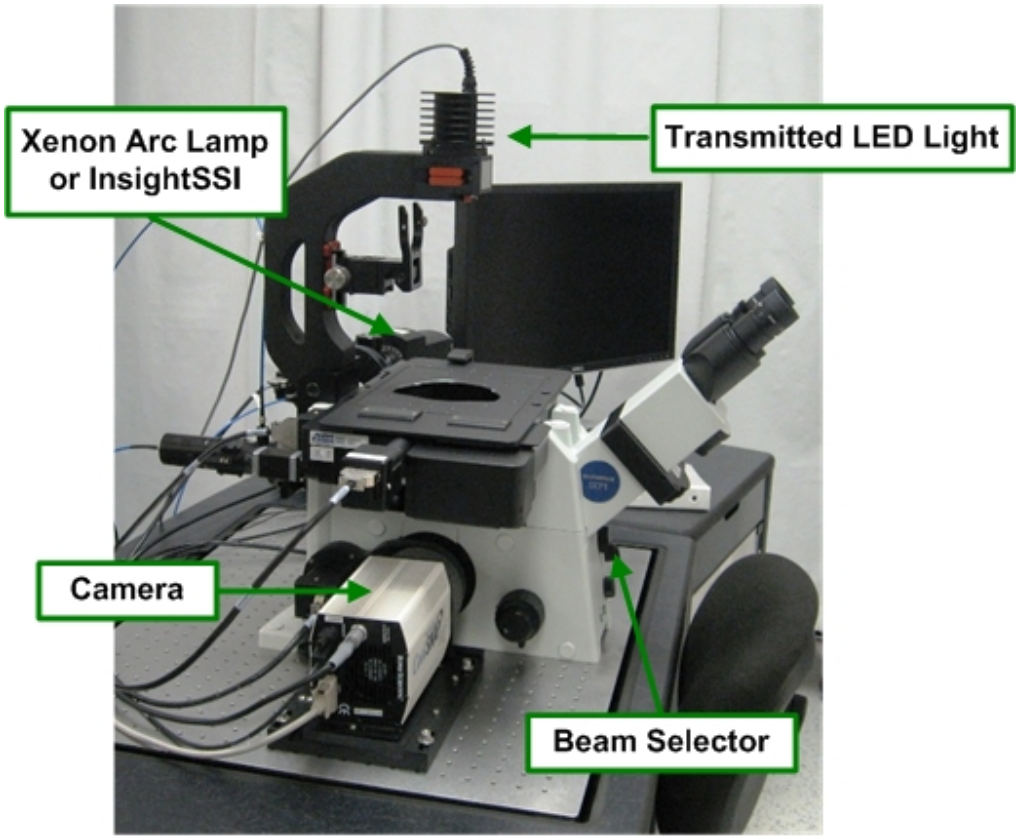
Before you acquire an image, become familiar with the key *DeltaVision* controls for:

- Controlling the Light Path
- Focusing
- Choosing Filters
- Using the Keypad and Joystick

Most of the manual controls for controlling the light path, focusing, and choosing filters are similar to those that you will find on any microscope. Additional controls for moving the stage and acquiring images are provided by the keypad and joystick.

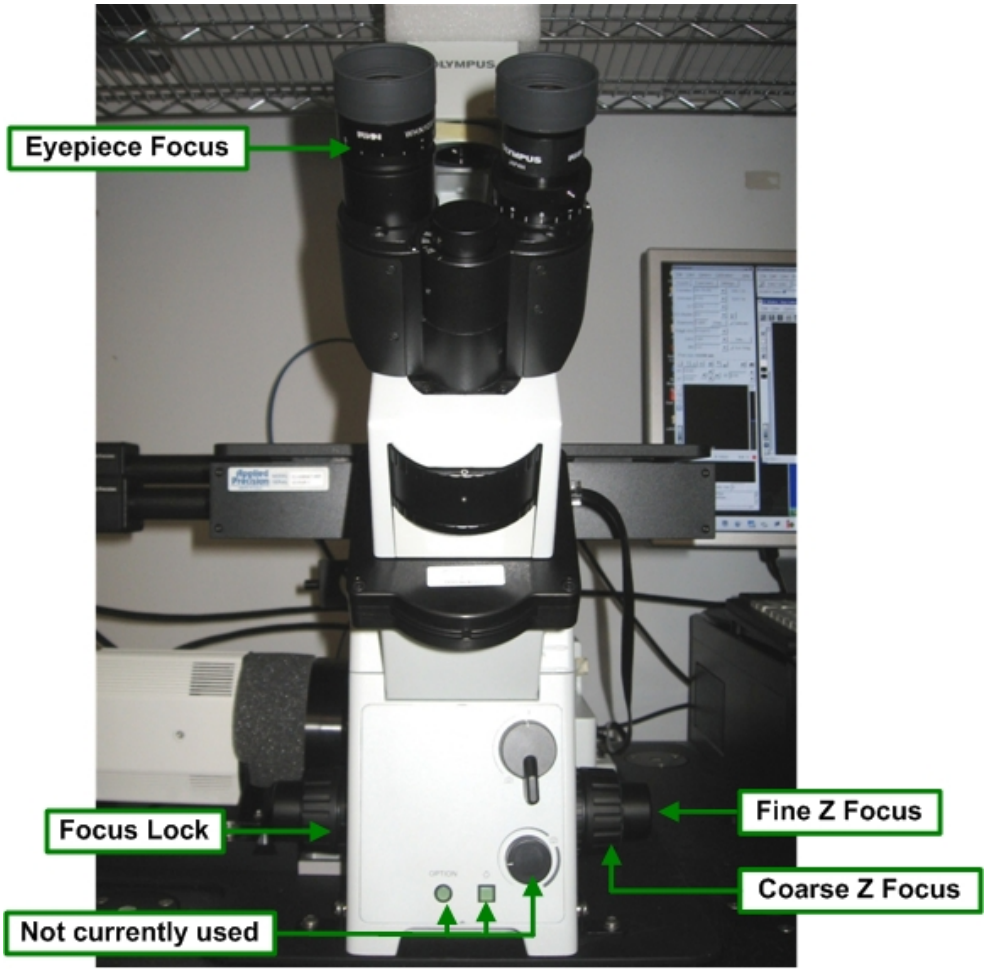
Controlling the Light path

DeltaVision provides a transmitted LED light and either a xenon arc lamp or a solid state illumination source. The transmitted light works the same as the light source for a traditional microscope, with the light path directed on the specimen from above. Both the xenon arc lamp and the InsightSSI (solid state illumination source) provide excitation light directed through the back of the microscope and focused on the specimen from below. You can use the Port Selector to direct the light path either from the specimen to the **Eyepiece** or from the specimen to the **Camera**.



Focusing

There are three manual focus controls and a Focus Lock on the *DeltaVision* microscope. These controls are similar to those on other microscope systems.



Eyepiece Focus Use the Eyepiece Focus (on the left ocular) to focus the eyepiece.

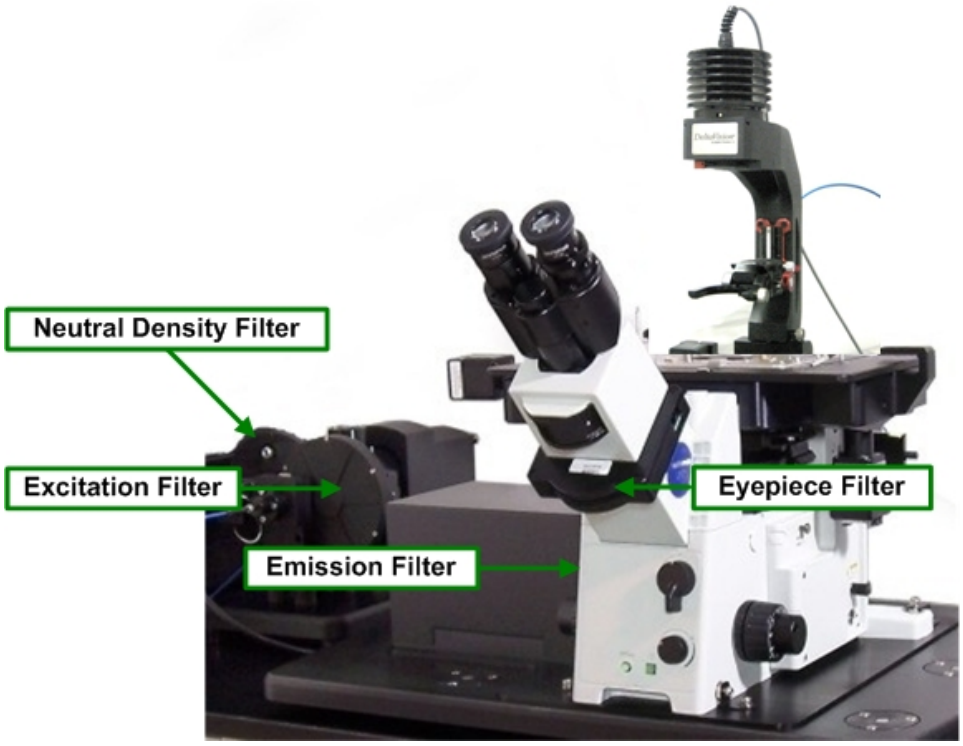
Focus Lock Use the Focus Lock to set a maximum height for Z focus. This can keep users from hitting the sample with the objective. There is also a tension adjustment on the focus knob to help keep the knob from moving inadvertently.

Fine Z Focus Use the Fine Z Focus knob to move the objective in very small increments. It is used to focus on the focal plane.

Coarse Z Focus Use the Coarse Z Focus knob to move the objective in large increments. It is typically used to lower the objective when the system is initialized or to move the objective up to the slide until the oil is touching the slide.

Choosing Filters

Choosing and controlling filters is a key for any fluorescent probe experiment. When a fluorescent probe is excited by a specific wavelength, it emits light at another wavelength. Choosing the correct filters for the dyes in your sample allows you to obtain a complete set of data specifically from your probe without interference from other wavelengths.



DeltaVision provides five different types of filters for controlling the fluorescent light path:

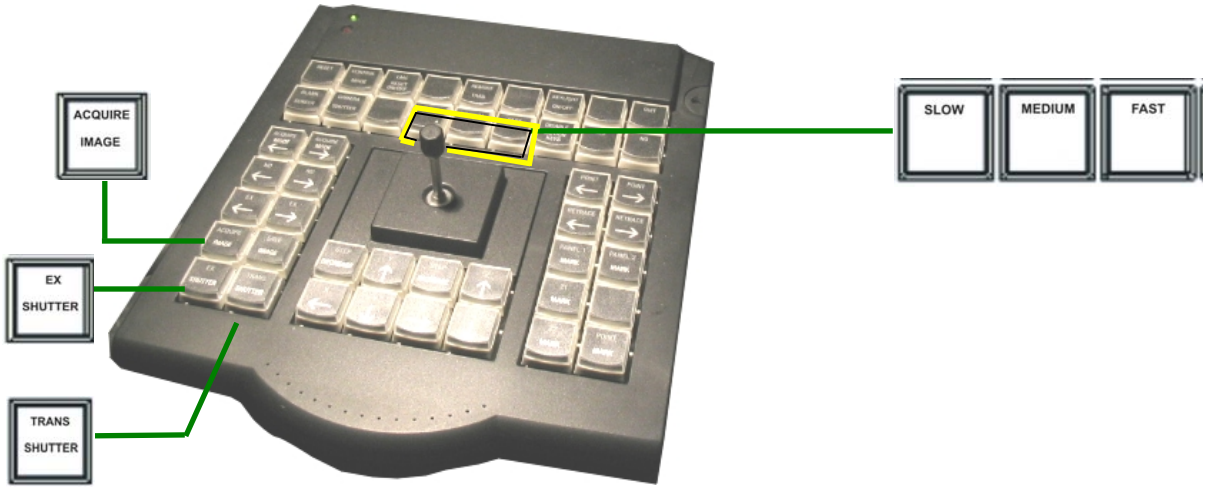
- **Neutral Density** filters (often denoted as "%T") reduce the amount of light that illuminates your sample when you are using fluorescence. *DeltaVision* provides six neutral density filters that block from 0 to 99.9% of all light.
- **Excitation** filters block all but a single band of wavelengths, providing a specified range of light to excite the fluorescent probes in the sample.
- **Polychromatic Beam Splitter** reflects the excitation wavelengths to the sample and transmits the emission wavelengths from the sample. *DeltaVision* ships with a standard polychromatic beam splitter for DAPI, FITC, TRITC, and Cy5. Other beam splitters ship with optional live-cell sets.
- **Emission** filters allow only a single band of light from the excited probe to reach the camera.
- **Eyepiece** filters are emission filters that allow only a single band of light from the excited probe to reach the eyepiece and your eyes.

These filters are arranged in sets that are associated with specific dyes. (For example, a dye such as DAPI is typically used with a DAPI Excitation filter, a DAPI Emission Filter, a DAPI Eyepiece Filter, and a 100% Neutral Density filter.)

You can choose filter sets manually by rotating the eyepiece filter wheel. The filter sets are synchronized so that when you change an eyepiece filter, the neutral density filter, excitation filter, and emission filter automatically change.

Using the Keypad and Joystick

The keypad and joystick are used to move the stage, open shutters, acquire images, and control other acquisition options. Key controls are shown below.



Key controls on the Keypad

Acquire Image

With the microscope set to Camera Mode, this button acquires an image and displays it on the monitor. Use this key when you are scanning through your sample and want to get a quick look at the specimen on the monitor. (Note that Resolve3D must be running at the time.)

Ex Shutter

Opens or closes the Excitation (i.e., Fluorescence) shutter. You will use this control frequently to open and close the shutter. Because the shutter is designed to protect your eyes from exposure to ultraviolet light, it automatically closes each time that a filter wheel is moved. It must be reopened with the EX SHUTTER button.

Trans LED Source

Toggles the transmitted light LED between off and on. (Subsequent to changing the transmitted light source from halogen to LED, an actual shutter is no longer necessary.)

Slow, Medium, and Fast

Control the speed that the stage is moved by the joystick or keypad arrows. It's usually best to start with medium.

The Joystick

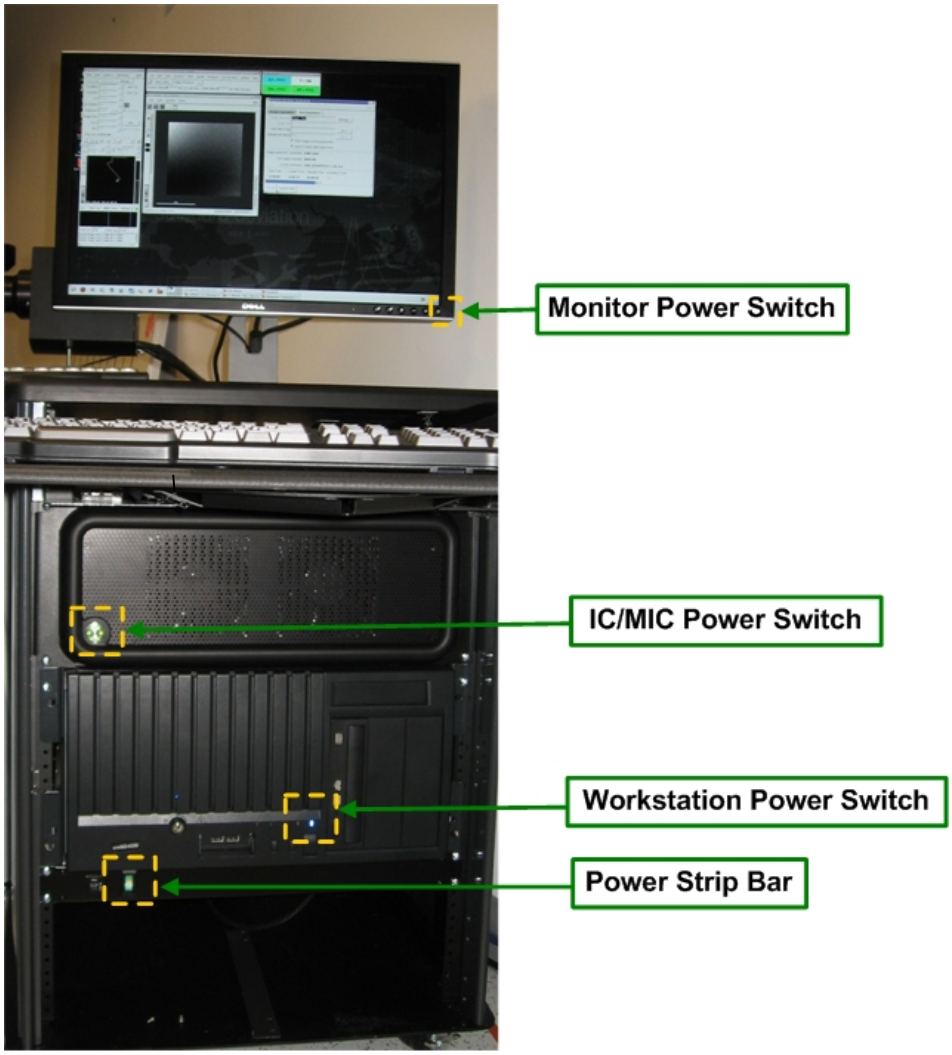
Controls stage movement. Use the joystick to move the stage in the direction that you point with the joystick (for example, moving the joystick up moves the stage away from you, moving joystick left moves the stage to the left, and so on).

Turning *DeltaVision* On

Use the following instructions to turn the system on for day-to-day use.

To turn on *DeltaVision*:

1. Turn on the power strip bar.
2. Turn on any additional equipment such as cameras or the heater for the Environmental Chamber.
3. Turn on the IC/MIC.



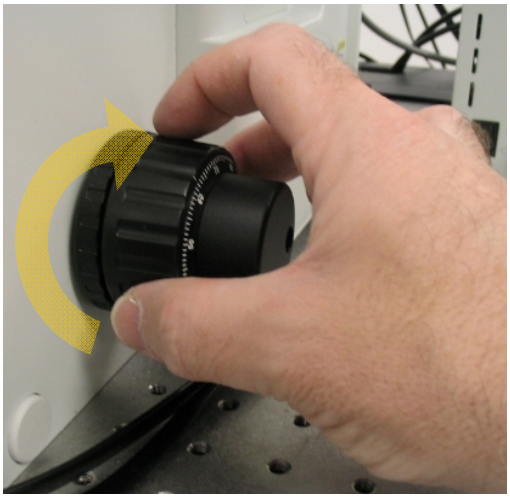
Main Power Switches (*DeltaVision* Cabinet)

4. If the monitor is off, turn it on.
5. If the Workstation is off, turn it on and wait for it to boot up.
6. Log on to the Workstation.
7. Remove any slides from the stage.

8. On the desktop, double-click the **Start *softWoRx***  icon to open the *softWoRx* control software.
9. On the *softWoRx* menu, choose **File | Acquire (Resolve3D)** and follow the prompts, allowing the system to initialize.
10. Release the Focus Lock by turning it clockwise (when facing the lock) until it is loose.

Releasing the Focus Lock

11. Lower the objective by turning the Coarse Z Focus knob away from you (clockwise) when facing the knob.

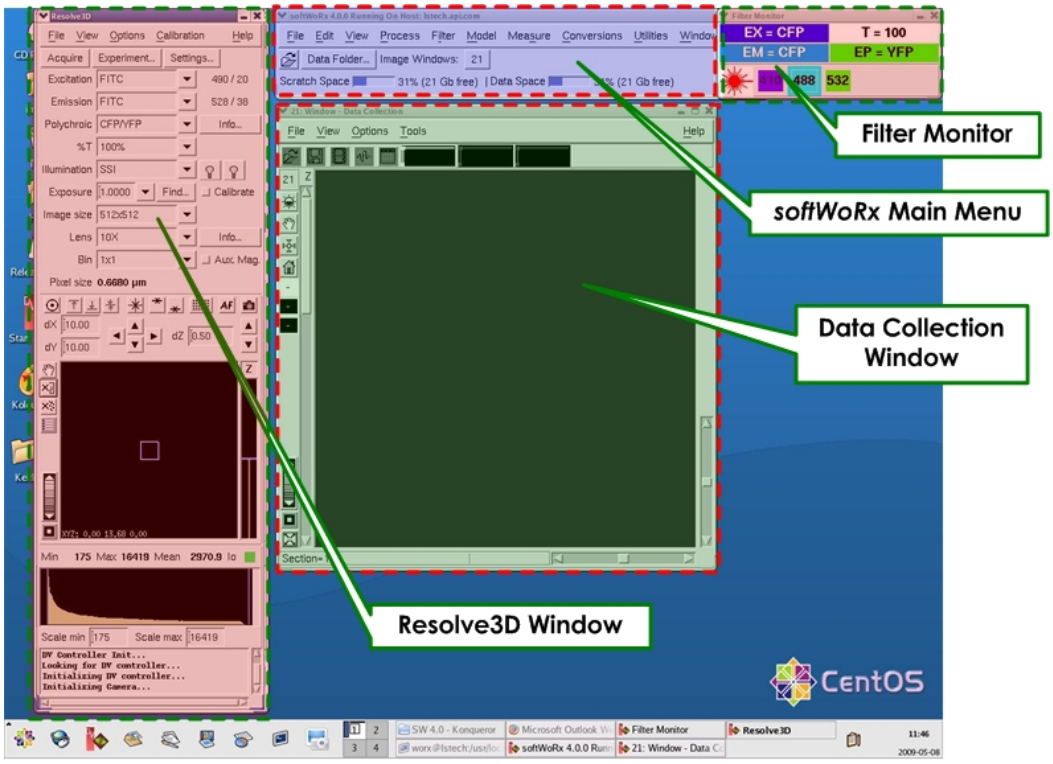


Turning the Coarse Z Focus Knob

CAUTION: Always lower the objective before you initialize the system to prevent damage to the objective lens.

12. A prompt is displayed reminding you to lower the objective before continuing. After you lower the objective, select **Initialize** to initialize the system.

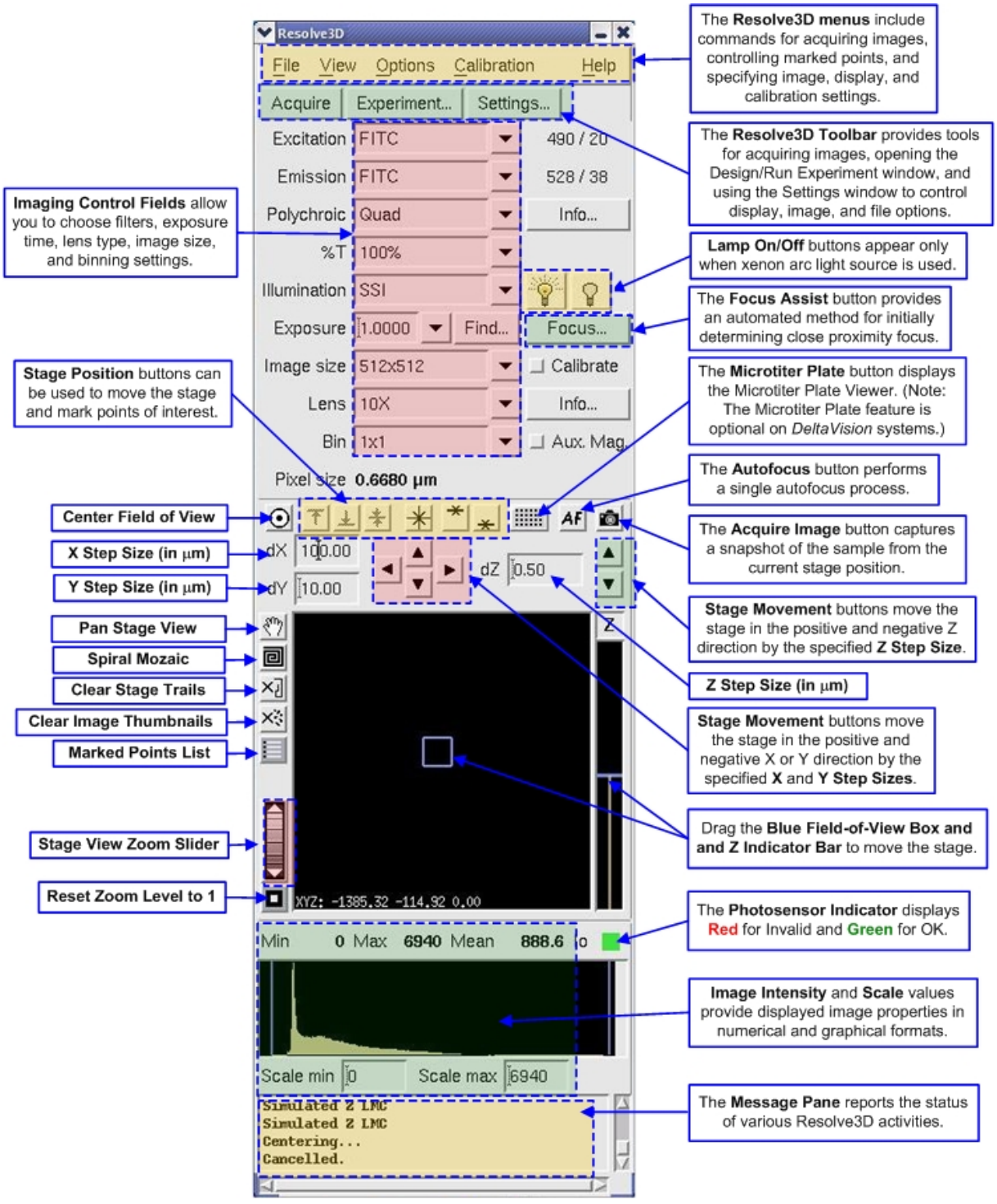
    The Resolve3D window, the Data Collection Window, and the Filter Monitor window open on the desktop.



softWoRx Desktop Display

The Resolve3D window includes acquisition parameters and controls for moving the stage, the Data Collection window displays images as they are acquired, and the Filter Monitor displays the filters currently selected.

The Resolve3D window contains the majority of tools you'll use for setting up experiments and acquiring images. The following figure points out the various functions accessible from the Resolve3D window.



Resolve3D Main Menu

Acquiring Image Data

Overview

To acquire an image of your sample:

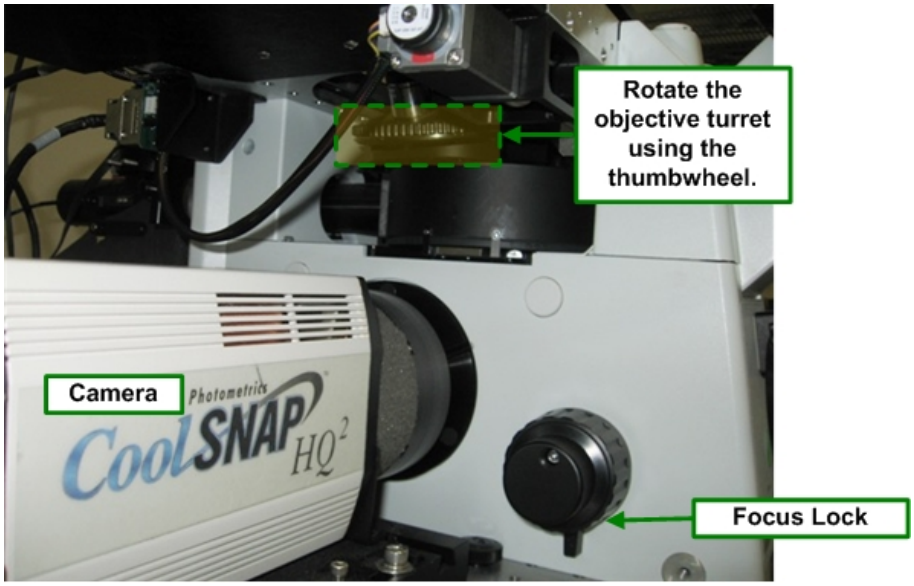
- Set up *DeltaVision* by placing the sample slide and selecting the appropriate filters.
- Find the sample so that it is visible in the eyepieces.
- Set the *DeltaVision* microscope to **Camera** mode.
- Acquire an image with the camera.

Setting Up the Sample for Image Acquisition

Setting up *DeltaVision* for imaging includes placing the sample on the stage and selecting the appropriate filter set for the fluorescent probe used to label your sample.

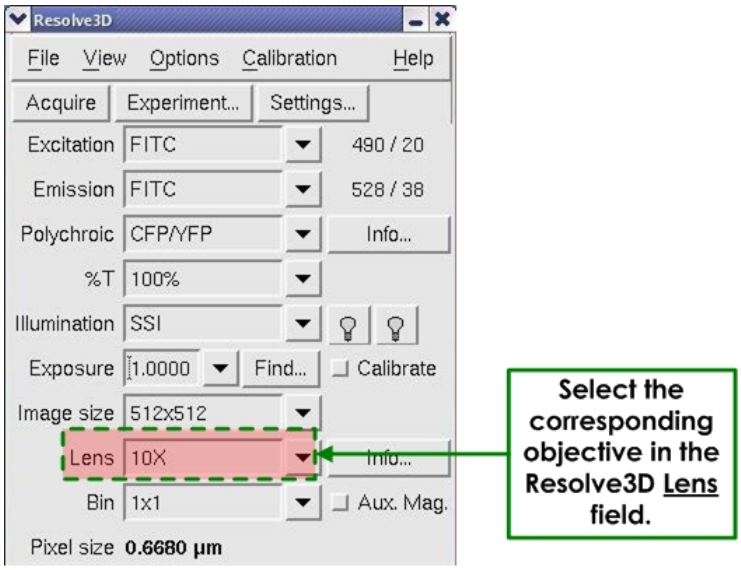
To prepare for image acquisition:

1. Rotate the Coarse Focus knob so that the top of the knob rotates away from you (while you are sitting in front of the microscope) to move the objective all the way down.
2. Rotate the objective turret (using the thumbwheel located at the left-underside of the stage) to select an objective.



Adjust the objective turret beneath the left side of the stage to select an objective.

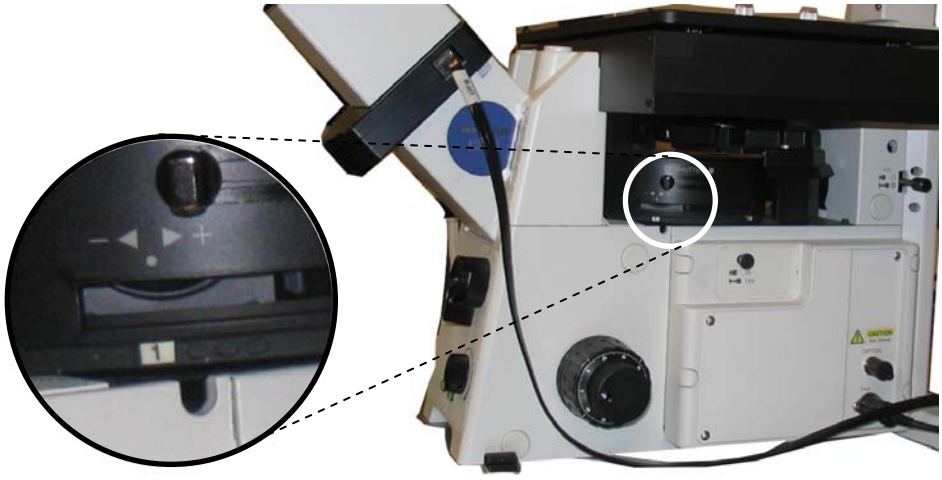
3. In the Resolve3D Lens list, select the same objective.



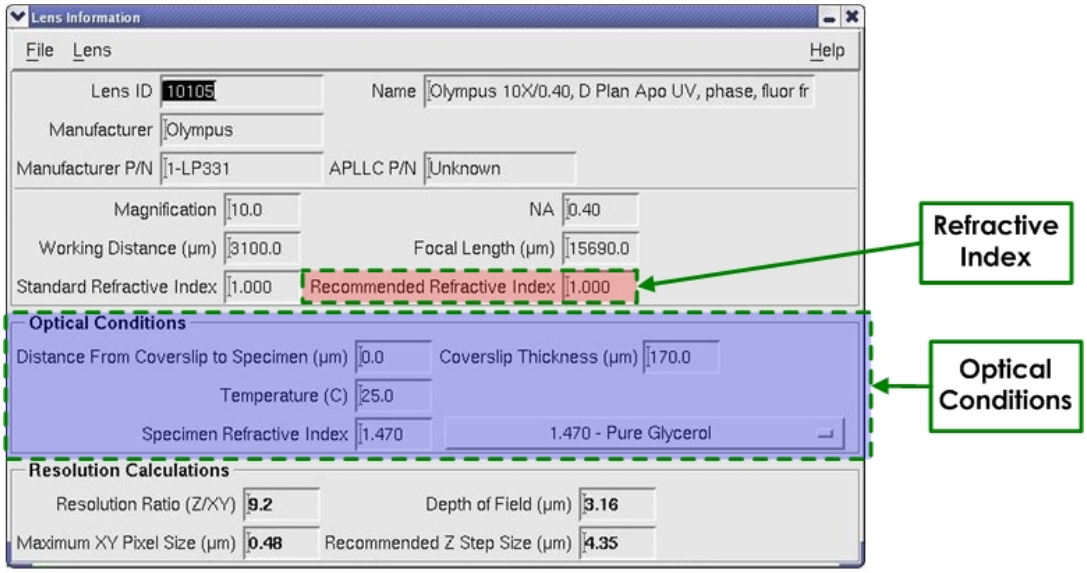
CAUTION: Make sure that the objective is selected in the Resolve3D Lens list.

4. Rotate the dichroic filter wheel (located on the right-underside of the stage) to select the appropriate dichroic mirror.

Note If your *DeltaVision* system is equipped with a motorized dichroic turret, you will control the turret's position using the *softWoRx* software.



5. In the Resolve3D Window, click the **Info** button next to the **Lens** field to open the Lens Information window.



Lens Information Window

6. In the **Optical Conditions** fields, enter the conditions for the sample.
7. Note the displayed value in the **Recommended Refractive Index** field and use an oil with that refractive index.
8. Place a drop of oil (water) on the objective. Be sure to use the proper oil (water). See Page 45 for details.

CAUTION: Do not touch the glass dropper to the objective.

9. Mount the slide on the stage with the coverslip down.
10. If installed, use the Adjustment knob on the Repeatable Slide Holder and the joystick on the Keypad to center the coverslip over the objective.
11. Rotate the Coarse Focus knob toward you to move the objective up until the coverslip is just in contact with the oil. From this point on, use only the fine focus knob to raise and lower the objective.
12. Rotate the eyepiece filter wheel (below the oculars on the scope) to select the filter for the probe that you used to stain your sample. If your sample has more than one probe, select the one with the brightest fluorescence (typically DAPI). The selected filter is displayed on the Filter Monitor window.

Filter Monitor Window

The filter names are displayed in the Filter Monitor window on the right side of the workstation screen. As you rotate the eyepiece filter wheel, the filter name next to **EP** (eyepiece) changes and the **EM** and **EX** (emission and excitation) filters change automatically to match.

The displayed colors match the wavelengths of the installed filters. If an X4 Laser Module is installed, the Filter Monitor also displays the wavelengths of the lasers that are available on your system.

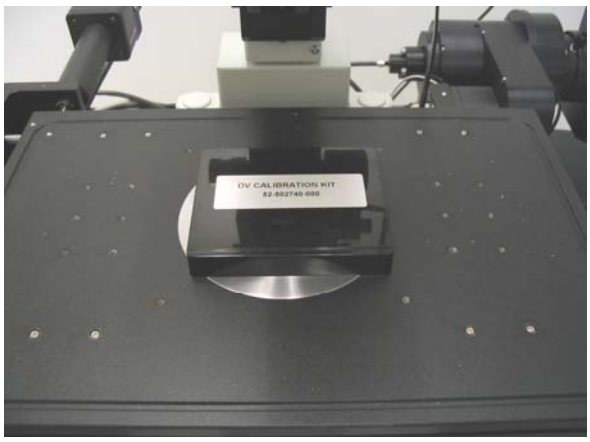
🕮 **Note** You must move the eyepiece filter wheel to initialize the Filter Monitor window.

Finding the Sample

To set the focal plane for imaging, you will need to find the sample in the eyepieces and then focus on the sample.

To find the sample:

1. With the sample on the stage and the filters selected (shown in the previous procedure), set the Port Selector to **Eyepiece**.
2. Turn off the lights in the lab. If you cannot turn off the lights, place a box over the sample to reduce the amount of ambient light.



3. Open the Excitation shutter by pressing the EX SHUTTER button in the lower left corner of the keypad.

   You should see light through the objective. The light on the stage should be the same color as the Excitation filter that you selected. (For example, if you selected DAPI, the light should be very deep violet. It may be hard to see.) Be sure the eyepiece filter position matches the desired excitation filter position.

🕮 **Note** The Excitation shutter is designed to protect your eyes. Each time the eyepiece filter wheel position is changed, the shutter automatically closes and must be reopened with the EX SHUTTER button.

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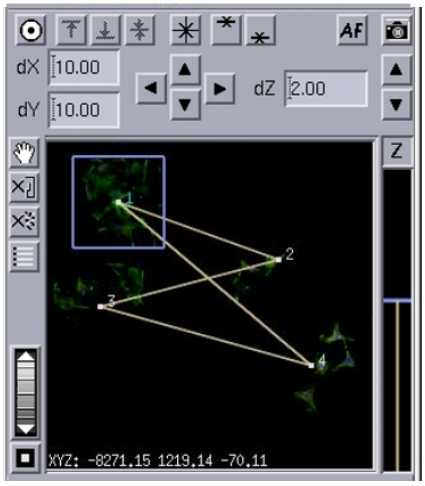
4. Focus to find the focal plane. Turn the Fine Focus knob toward you to slowly raise the objective until you see a cloud of emission color in the eyepiece. Continue to slowly raise the objective until the sample image is sharp and clear.
5. Use the joystick to move the stage around. Change the speed of the movement with the SLOW, MEDIUM, and FAST keys on the Keypad. When you find a region of interest, place it in the middle of the field of view.

   On the Stage View, note the stage trails that show where you have moved the stage in XY.



Stage Trails in the Stage View Window

Acquiring an Image

To acquire a *DeltaVision* image, you'll need to direct light to the camera and work with the images that are displayed in the Data Collection window until you are satisfied. You can then save the image as a *DeltaVision* file or create and run experiments.

To acquire an image:

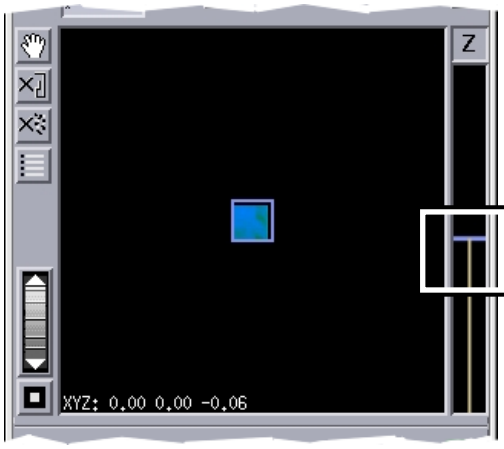
1. On the keypad, press **EX Shutter** to close the shutter.
2. Switch the Port Selector to **Camera**.
3. In the Resolve3D window **Exposure** field, enter an exposure time (in seconds). A good starting exposure time is 0.1 second for fixed cell and 0.01 seconds for live cell applications.

> **Tip** You can also click the **Find** button on the Resolve3D window to find a good exposure time. Use **Find** carefully. Overuse of this option can photo-bleach the specimen. You need to be particularly careful when determining exposure times for live cells. When using **Find** for live cells, start with lower exposure times by changing the Target Intensity Value to around 200 counts.

4. Click  to acquire an image.

> **Tip** You can also acquire an image by clicking the ACQUIRE IMAGE button, right-clicking on the stage view and selecting **Acquire**, or choosing **File | Acquire Image** on the Resolve3D menu.

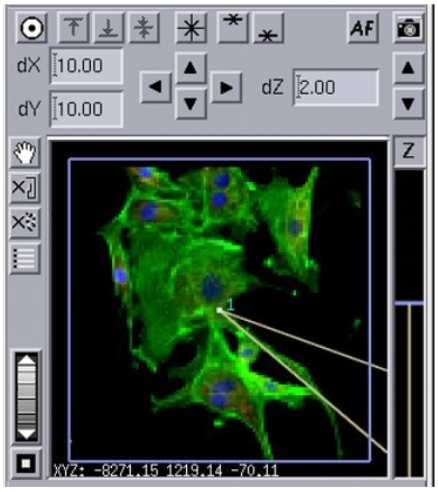
5. To focus, use the mouse to slide the Stage Z Control bar up or down.



> **Tip** You can also use contrast-based Auto Focus to focus the sample as follows: On the Resolve3D window, click **AF** to auto focus the sample. If your image is far out of focus, you may need to click **AF** more than once.

6. To center the image, click  (above the Stage View window) and then click on the object that you want to center in the Image window.

7. To enlarge the thumbnail image displayed in the stage view, drag the mouse down over the zoom wheel.



> **Note** Thumbnails appear only when the Show Stage Thumbnails option is selected on the Misc tab in the Resolve3D Settings window.

8. To clear the thumbnail image, click **Clear Thumbnails**  button next to the Stage View window.

5 Maintenance

In this chapter

This chapter provides the following instructions for the basic maintenance of the system:

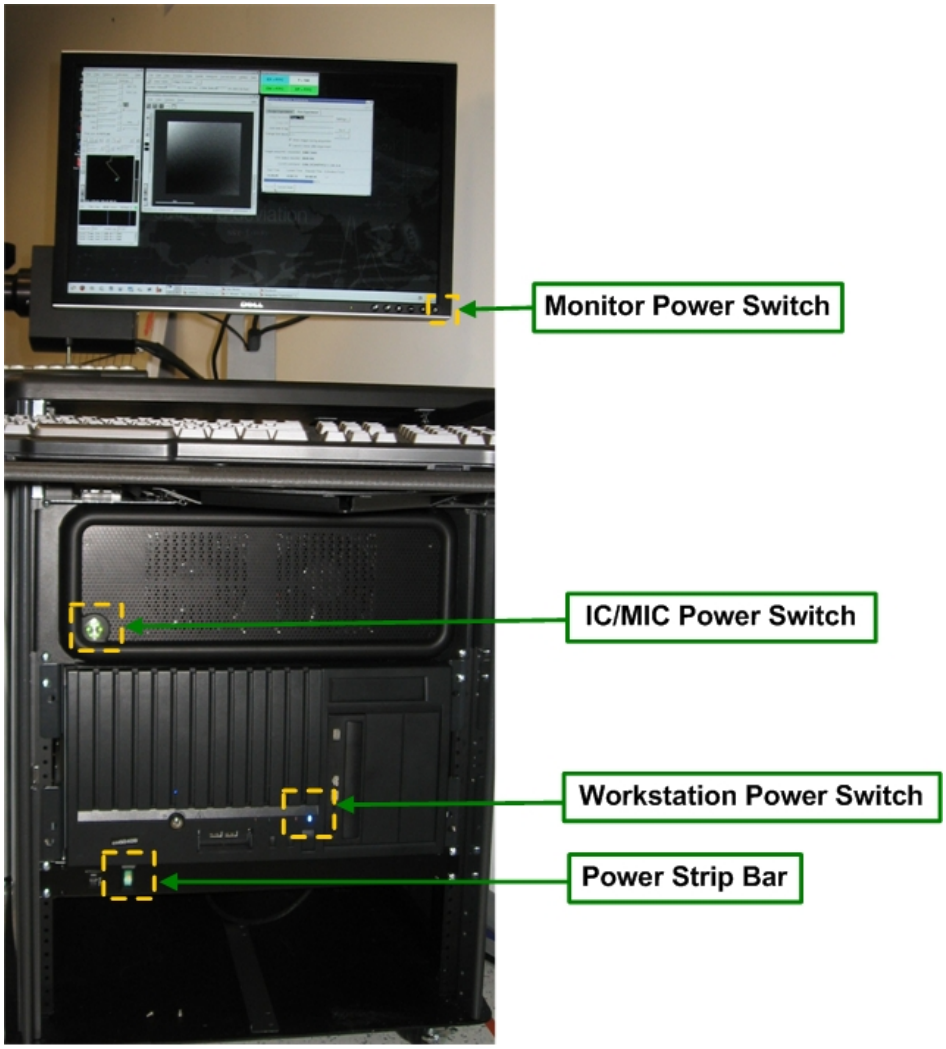
- *Shutting Down and Starting the System* provides procedures for performing a system shutdown and a system startup.
- *Replacing the Xenon Bulb* provides instructions for removing and replacing a xenon bulb in a DeltaVision system.
- *Replacing the IC/MIC Fuses* explains how to remove and replace fuses in the Instrument Controller and Microscope Interface Chassis (IC/MIC).
- *Cleaning* provides general information on cleaning a DeltaVision system.

Shutting Down and Starting the System

Use the following instructions for shutting the system down during a power outage or other occasions that require total shutdowns.

DeltaVision Power Switches

The main *DeltaVision* power switches are shown below.



Guidelines for Using Switches

Power Strip Bar

Use this switch to turn power on and off for the *DeltaVision* Workstation, Instrument Controller and Microscope Interface Chassis (IC/MIC), the Fast Camera Power Supply, and the *DeltaVision* Microscope.

Workstation, IC/MIC, and Monitor

Leave these switches on except on rare occasions (such as power outages) when you need to shut down the entire system.

Shutting Down the System

In some situations, such as power outages, you will need to shut down the entire *DeltaVision* system.

To shut down the *DeltaVision* system:

1. Save all data on the workstation.
2. Turn off the main light source (for xenon arc lamp only) using the bulb  icon on the Resolve3D window. Clicking the icon will switch it to the off  state.
3. On the *softWoRx* menu bar, choose **File** | **Exit**. Then exit all other workstation applications.
4. From the main menu button, choose **Logout** and then **Shut Down**. Wait until the monitor displays `Power Down`.
5. Press the power button on the IC/MIC once to shutdown.
6. Turn off the monitor.
7. Turn off the power strip bar switch.
8. Clean the objective.
9. Lower the objective.

Starting the System

Use the following instructions to start the system after a total shut down.

To start the *DeltaVision* System:

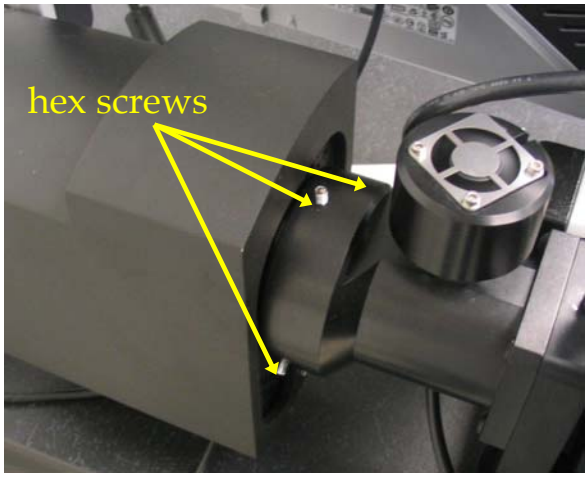
1. Turn on the power strip bar.
2. Turn on the IC/MIC.
3. Turn on the workstation.
4. Turn on the monitor.
5. Follow the complete instructions for turning on *DeltaVision* on Page 51.

Replacing the Xenon Bulb

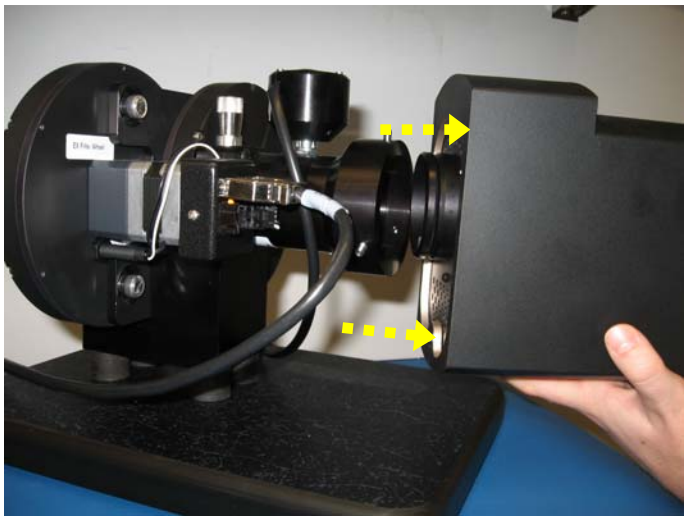
> ⚠ **WARNING:** Ensure the xenon lamp is off and has had plenty of time to cool before starting this procedure. Refer to the "Xenon Lamp Safety" section in Chapter 2 of this manual for details on safety issues and proper disposal of the lamp.

Follow these steps to replace the xenon bulb on *DeltaVision*:

1. If the system is on, exit Resolve3D and ensure that the IC/MIC is off prior to proceeding. The fan on the lamp housing must be off before you begin this procedure.
2. Loosen the three hex screws in the flange of the xenon lamp housing.

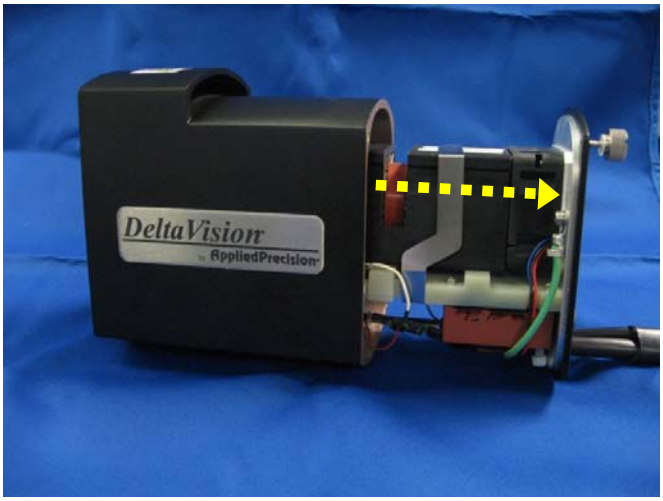


3. Gently slide the lamp housing away from the flange to remove it from the *DeltaVision* excitation module.

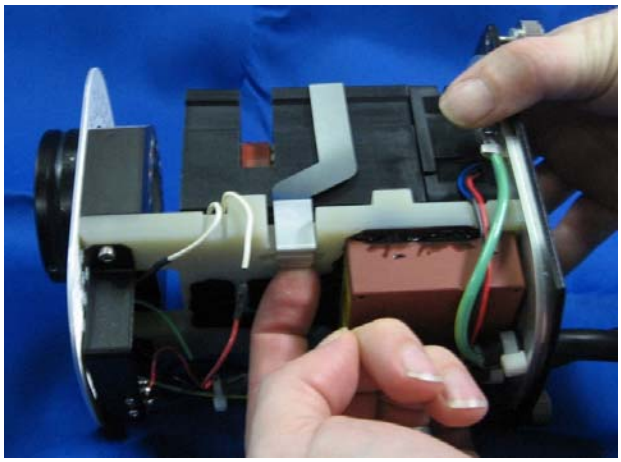


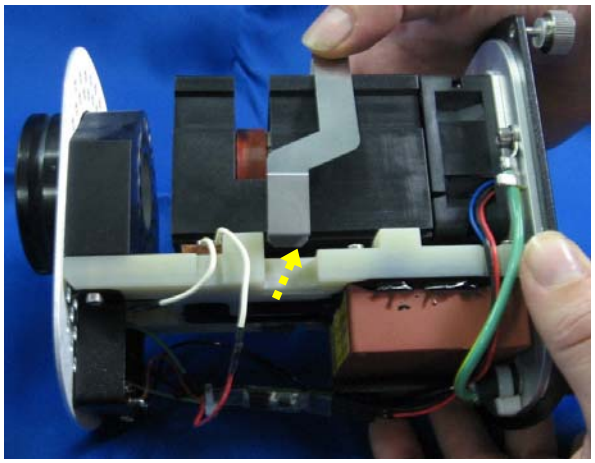
4. Loosen the two thumb screws on the opposite end of the xenon lamp housing.

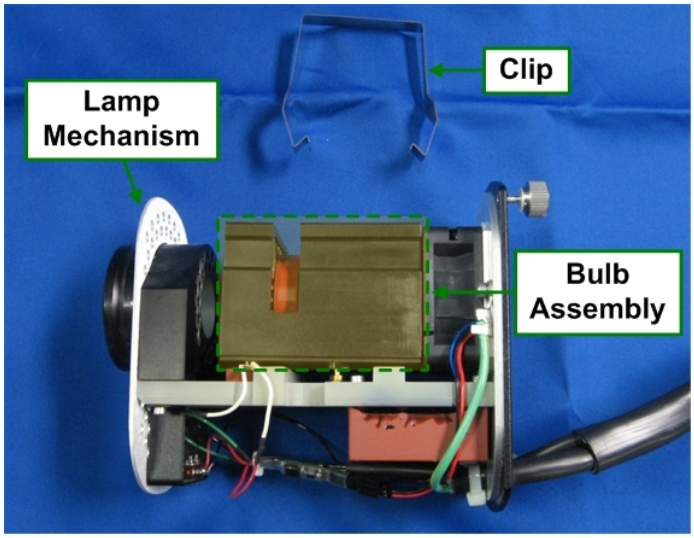
5. Gently slide the internal lamp mechanism from the lamp housing.



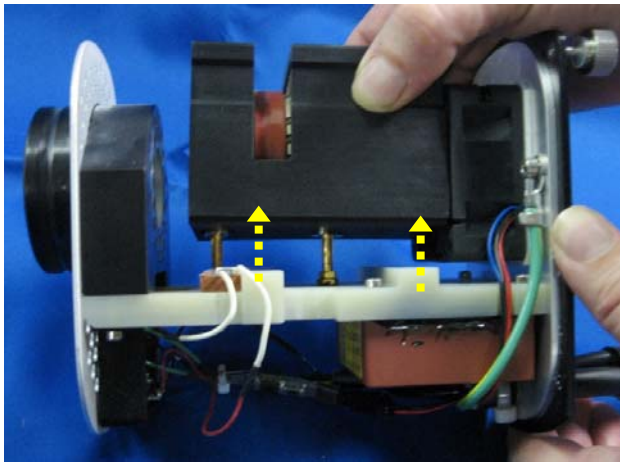
6. Remove the center clip from the internal lamp mechanism as shown.

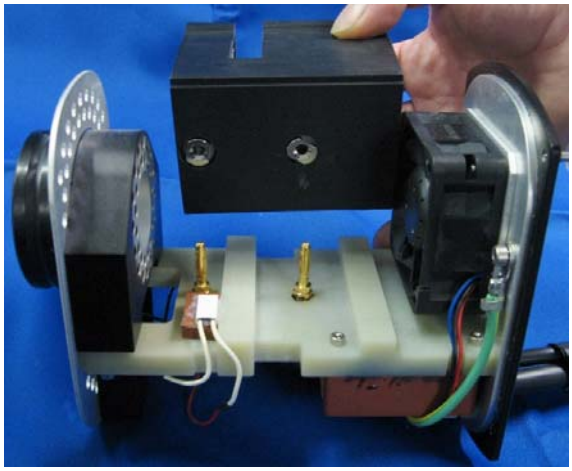




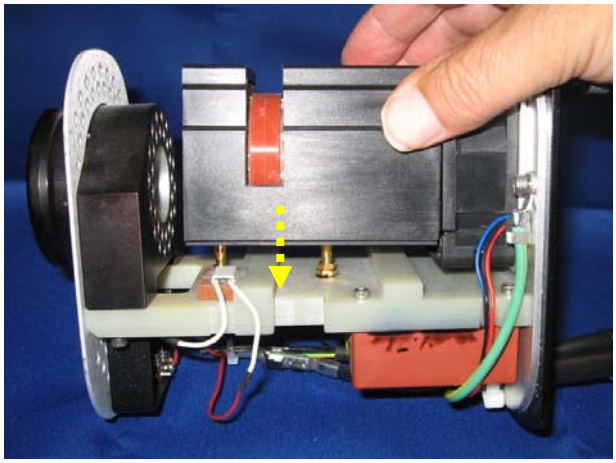


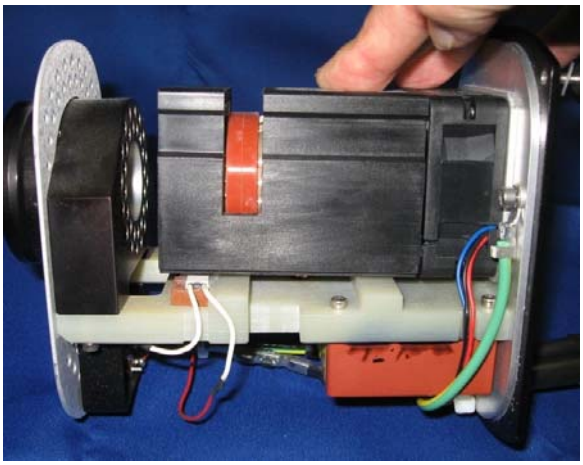
7. Lift the bulb assembly (small black box) from the two supporting pins in the lamp mechanism.



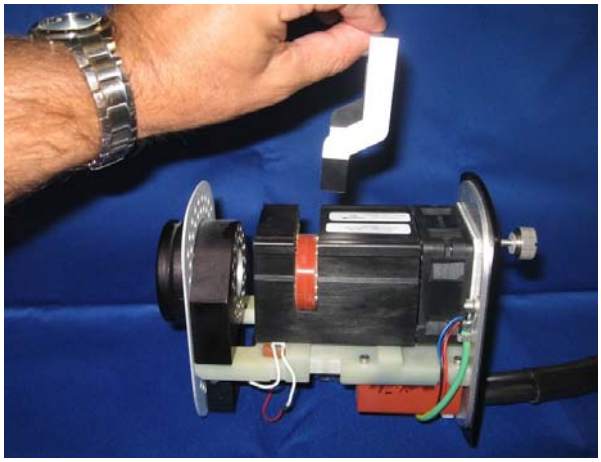


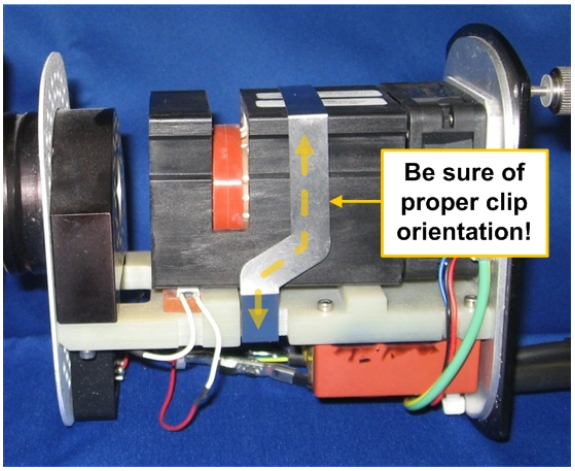
8. Replace the xenon bulb assembly with a new one (Part #34-100390-002). Insert the new bulb assembly onto the two supporting pins and press down firmly.



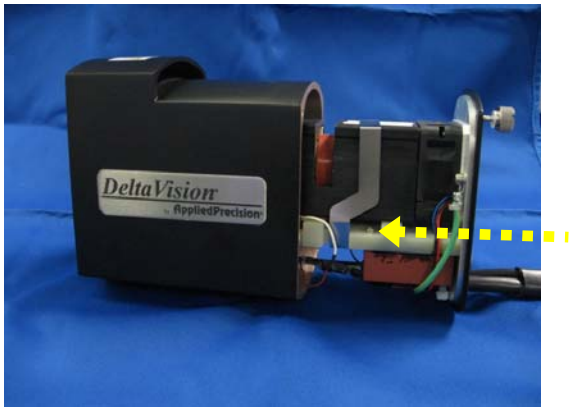


9. Replace the clip around the internal lamp assembly, making sure the clip is properly oriented.





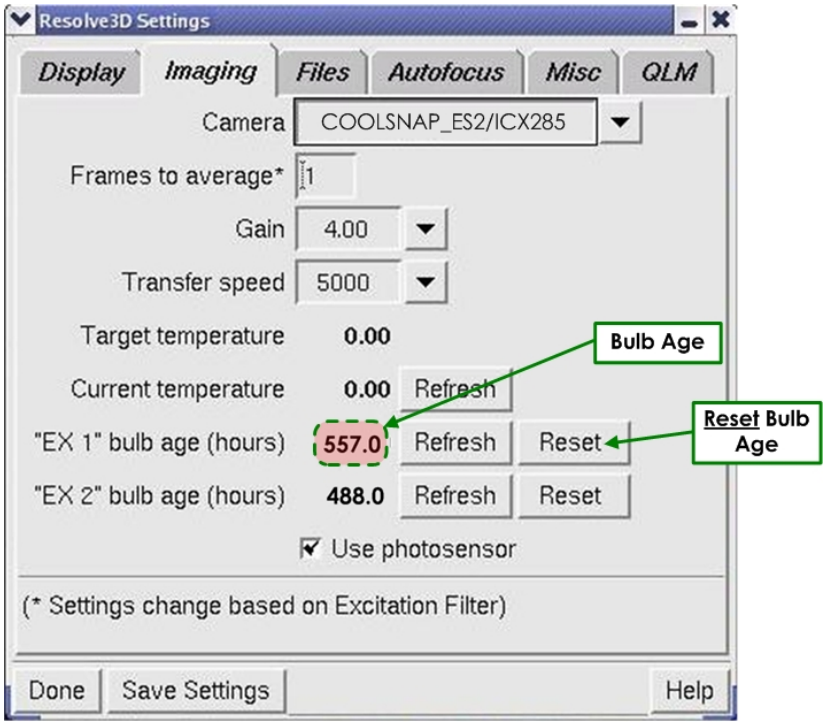
10. Gently slide the internal lamp mechanism into place within the lamp housing.



11. Tighten the two thumb screws on the end of the lamp housing.

12. Place the open end of the lamp housing over the flange on the *DeltaVision* and tighten the three hex screws as shown.

13. Turn the *DeltaVision* on as usual and start Resolve3D.
14. Before resetting the bulb age, write down the age of the bulb you just replaced. This will help you to keep track of when you may need to replace the next one.
15. Open the **Imaging** tab in the Resolve3D Settings window and click the **Reset** button to reset the bulb age.



Note For *DeltaVision* systems with the Multiplexed Wavelength option installed, the procedure for changing the xenon bulb in the secondary lamp housing is identical to the procedure described above.

Replacing IC/MIC Fuses

Follow these instructions to replace a fuse in the Microscope Interface Chassis. To replace fuses for other components, follow the instructions in the manuals that are provided for those components.

CAUTION: Installation of improperly rated fuses can cause damage to the system.

To replace a fuse:

1. Shut down the system.
2. Unplug the power cord on the back of the IC/MIC.
3. Remove the fuse holder.
4. Test the fuses with a continuity meter.
5. Replace any bad fuses with 5X20mm 6.3A 250V UL high break capacity fuses (API P/N 19-170045-000).
6. Install the fuse holder.
7. Plug in the power cord.

Cleaning

Most system surfaces are best cleaned with a lint-free cloth or lint-free swabs and spectroscopy-grade isopropyl alcohol or chloroform. Avoid contaminating the cleaning solution by never reusing the cleaning cloth or swabs. Operators should be trained in the handling of flammable liquids such as alcohol. Material Safety Data Sheets (MSDS) should be maintained for the cleaning solutions, as with any hazardous material.

The exceptions to this cleaning practice are the polychroic mirror and the optical filters. These components should be cleaned with low-pressure air. For example, use a bulb designed for cleaning camera lenses, which blows air across the surface. Do not use high pressure. Do not use canned air, as this often leaves a fluorescent residue.

To clean the microscope, follow the instructions in the manufacturers' manuals that are provided for these components.

CAUTION: Improper cleaning of the polychroic mirror and the optical filters will result in damage.