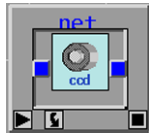
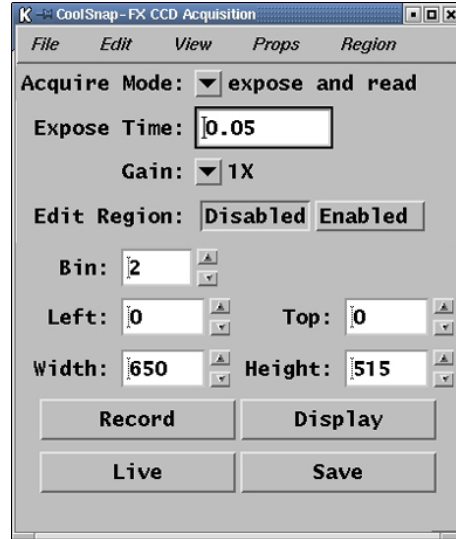




CCD Acquisition Function



Double Click on Icon →



File

- Open Flatfield Corr.
- Open Background Corr.
- Close

Edit

- Optics
- Reset Camera
- Autoexpose

View

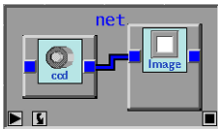
- Image Stats
- Image Profile

Props

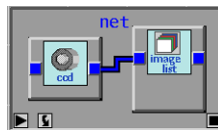
- Setup
- Temperature
- Autofocus
- Correction
- Output
- Dual Shutter

Region

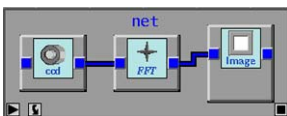
From the CCD function, the user can acquire a single image, a stacks of images, or create a complete image acquisition and processing routine.



- acquire a single image



- acquire a stack of images



- acquire an image and apply a 2D deconvolution algorithm.

CCD Acquisition Function



1 Acquire Mode

a. "expose and read"

1. The default setting
2. This option clears the charge on the CCD. Then opens the CCD shutter and accumulates for the time set in the "Expose Time" function. Then it closes the CCD shutter. Finally it reads and digitizes the charge and places the results in memory.

b. "Read dark current"

1. This option clears the charge on the CCD. Then accumulates for the time set in the "Expose Time" function. Then it reads and digitizes the charge and places the results in the memory.

c. "Expose only"

1. This option is available only on Series 300 cameras
2. This option clears the charge on the CCD. Then opens the CCD shutter and accumulates for the time set in the "Expose Time" function. Then it closes the CCD shutter.
3. This option is used in conjunction with the "Read only" and "Shift" option detailed next.

d. "Read only"

1. This option is available only on Series 300 cameras
2. This option reads and digitizes the charge and places the results in memory.

e. "Shift"

1. This option is available only on Series 300 cameras
2. This option translates the charge on the CCD by the number of pixels set in the "Rows to Shift" property in the "Shift" window. If the "Expose Time" is not set to zero, a 1 second exposure will be performed.

f. "External Shutter"

1. This option opens a second excitation shutter and if connected to the system, the shutter on the emission filter wheel.

g. "Read bias"

1. Clears the charge on the CCD. Reads and digitizes the charge and places the results in memory.

h. "Trigger"

1. Waits for an external hardware trigger pulse before performing an expose and read sequence.
2. This option is turned on by a system dependent environment variable.

CCD Acquisition Function



2 Expose Time

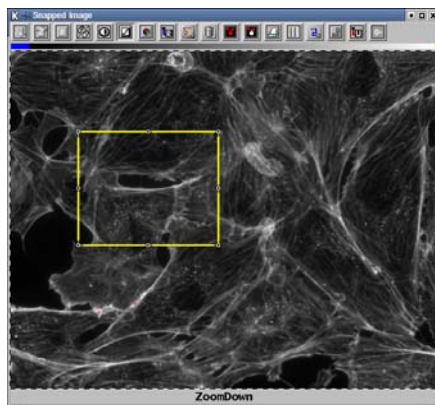
a. Allows the user to determine how long the CCD will accumulate charge and how long the shutter will remain open in order to collect an image.

3 Gain

- a. "High Signal/Noise"
- b. "High Dynamic Range"
- c. "High Sensitivity"

4 Edit Region: Disable Enable

- a. Allows the user to select the subarray (rectangular area) on the CCD chip that is to be used in acquiring images.
- b. When the user selects "Disabled", the "Snapped Image" window opens and includes a yellow editing box that can be moved and resized by placing the cursor arrow over the yellow line and depressing the left mouse button.
 - 1. As you move the box, the new coordinates and/or new dimensions are automatically updated in the "Region" property.
 - 2. The area this box includes will become the region acquired the next time "Record" is pressed or the Pnode is fired.



- c. The "Disable" button must be depressed before acquiring a new image for the new region to take effect.

CCD Acquisition Function



5 Binning:

- a. The binning factor represents the number of adjacent pixels whose charge will be summed and digitized as a single pixel. For example, on a 512 by 512 chip, if you chose Bin of 2, the resulting image would be 256 x 256. Binning increases the charge and gray level of the resulting pixel at the expense of spatial resolution.
- b. The amount of binning available varies from camera to camera

6 Left:

- a. Is the left most column of pixels on the CCD chip to be included in the acquire image.

7 Top:

- a. Is the top row of pixels on the CCD chip to be included in the acquired image.

8 Width:

- a. Is the total number of columns in the resulting image. "Width" cannot exceed the serial dimension of the CCD chip. It is automatically decremented when you increase the "Bin" factor.

9 Height:

- a. Is the total number of rows in the resulting image. "Height" cannot exceed the parallel dimension of the CCD chip. It is automatically decremented when you increase the " Bin" factor.

CCD Acquisition Function



10 Record

- a. Acquires an image from the CCD camera

11 Live

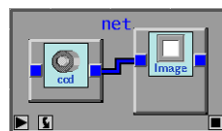
- a. Images are continuously acquired and displayed.
- b. When the focus mode is active, the user can adjust the parameters in the CCD properties window, or adjust the focus and position of the camera.

12 Display

- a. Opens a window for displaying images

13 Save

- a. Sends the most recently acquired CCD image to either an Image Pnode or a List Pnode depending upon which is attached to the CCD Pnode output link pad.



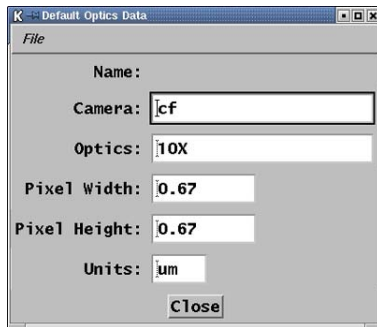
CCD Acquisition Function

File Menu

1. **Open Flatfield Correction** Function
 - a. Loads a flatfield correction image
2. **Open Background Correction** Function
 - a. Loads a background correction image
3. **Close** Function
 - a. Closes the CCD Acquisition Screen

Edit Menu

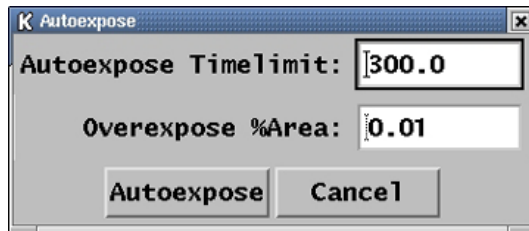
1. **Optics** Function
 - a. Display the Optics Setup Window
 - b. User can input, open and save calibration data for each microscope objective and camera used on the system.



File Menu

- Open** - opens an existing calibration file
- Save** - saves current calibration file using existing file name.
- Save As** - saves current calibration file using new file name
- Close** - closes Default Optics Data Screen

2. **Reset Camera** Function
 - a. Resets the camera values to their default state.
3. **Autoexpose** Function
 - a. Automatically determines the exposure time

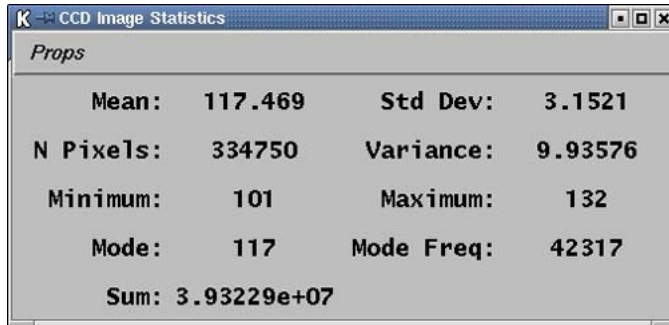


CCD Acquisition Function

View Menu

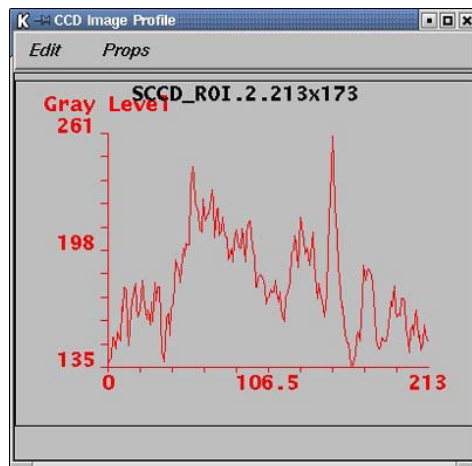
1. Image Stats Function

- a. Displays the pixel value information for the most recently acquired image



2. Image Profile Function

- a. Displays an intensity profile for the most recently acquired image

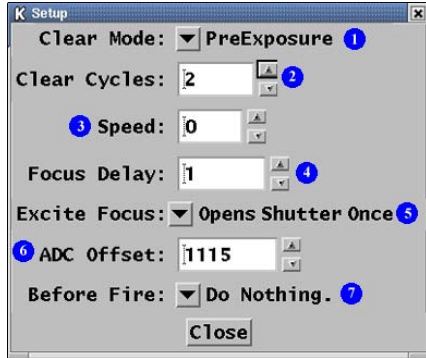


CCD Acquisition Function

Props Menu

1. Setup Function

- a. Allows the user to control the internal camera functions



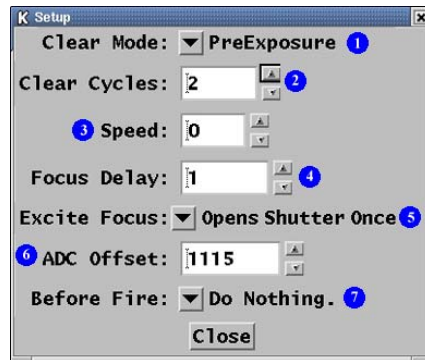
① Clear Mode:

- a. "Never" - does not clear the CCD at any time.
- b. "PreExpose" - clears the CCD before each exposure.
- c. "PreSequence" - clears the CCD before a sequence of exposures begin.
- d. "PostSequence" - sets the CCD to clear continuously after a sequence.
- e. "PrePostSequence" - clears the CCD before a sequence starts; it then sets the CCD to clear continuously after the sequence.
- f. "PreExposure-PostSequence" - clears the CCD before each exposure in a sequence; it then sets the CCD to clear continuously after the sequence.
- g. "Continuously"- sets the CCD to clear continuously any time it is in an idle state.

② Clear Cycle:

- a. Sets the number of times it will read the CCD in order to remove the charge
- b. Default is 2

CCD Acquisition Function



Props Menu

1. Setup Function (continued)

- ③ **Speed:**
 - a. Is an index to a range of readout rates that the camera is capable of
 - b. The actual rate differs between camera heads and controller configurations.
 - c. The higher the number is, the higher the speed.

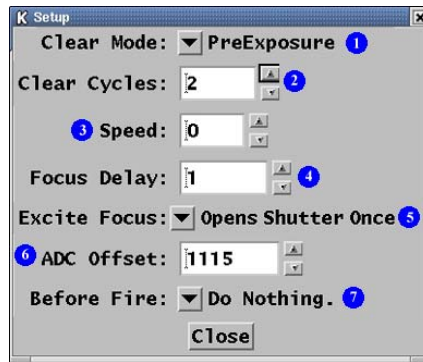
- ④ **Focus Delay:**
 - a. Is the interval, in milliseconds, inserted between each acquisition in a focus loop.
 - b. If the delay is set to "0", acquisitions will be queued in the window server without delay.

- ⑤ **Excite Focus:**
 - a. **Open Shutter Once** Function
 - 1. Opens the excitation shutter once
 - b. **Cycle Shutter** Function
 - 1. Cycles the shutter

- ⑥ **ADC:**
 - a.

- ⑦ **Before Fire:**
 - a. Allows the system to automatically set the autoexpose function or the autofocus function prior to acquiring an image.
 - b. Typically used in conjunction with long time lapse sequences.
 - c. Choices include:
 - 1. Do Nothing
 - 2. Autoexpose
 - 3. Fine Focus
 - 4. Medium Focus
 - 5. Course Focus

CCD Acquisition Function



Props Menu

1. **Setup** Function (continued)

- b. Additional setup functions available for frame transfer cameras and cameras with shutters.

Frame Transfer: Frame Transfer Enabled

- a. Displayed only when a frame transfer CCD is attached to the system.
- b. Frame transfer CCD cameras have a physical mask over the storage area.
- c. "On"
 1. Default
 2. The image array is transferred to storage area and then read.
- d. "Off"
 1. Both the storage array and image array are read.

Shutter: Open PreExposure

- a. "Open PreExposure"
 1. Opens the camera shutter each time an image is acquired when the "Acquire Mode" is set to "expose and read" or "external shutter".
 2. When the camera shutter is open, the camera controller is wait for the time, in milliseconds, specified in the "Open Delay" property.
 3. After the exposure is complete, the shutter is closed and after the time specified in the "Close Delay" parameter has expired, the CCD is readout.
- b. "Open PreSequence"
 1. Opens the camera shutter at the beginning of a sequence.
 2. This option should only be used with the CCD Sequence Pnode.
- c. "Open Always"
 1. Opens the camera shutter immediately and leaves it open.
 2. This option has only be used with frame transfer cameras

Open Delay:

- a. Is the length of time, in milliseconds, that should elapse between opening the camera shutter and starting the exposure of the image

Close Delay:

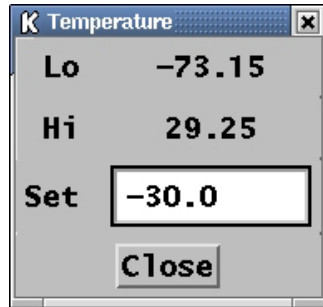
- a. Is the length of time, in milliseconds, that should elapse between closing the camera shutter and reading out the charge on the CCD.

CCD Acquisition Function

Props Menu

2. **Temperature** Function

- a. Displays the camera's current temperature setting
- b. Allows the user to set the camera's temperature

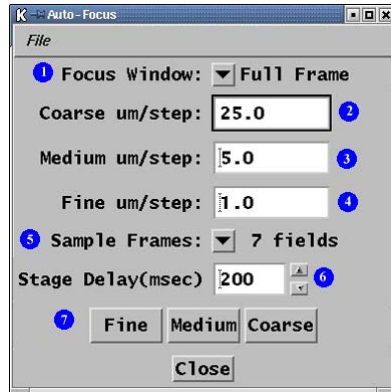


CCD Acquisition Function

Props Menu

3. Autofocus Function

- a. Active only when a Z focus attachment is connected to the microscope
- b. Allows the software to determine the optimal focus.



- 1 Focus Window:**
 - a. Sets the size of the focus window
 - Full Frame
 - Half Frame
 - Quarter Frame
- 2 Course um/step:**
 - a. Sets the z focus course step increments
- 3 Medium um/step:**
 - a. Sets the z focus medium step increments
- 4 Fine um/step:**
 - a. Sets the z focus fine step increments
- 5 Sample Frames:**
 - a. Sets the number of frames that will be acquired to determine the best in-focus image.
- 6 Stage Delay:**
- 7 Fine Medium Coarse**
 - a. **Fine** - activates the fine focus mode using the fine focus parameter input into the setup screen
 - b. **Medium** - activates the medium focus mode using the medium focus parameter input into the setup screen
 - c. **Coarse** - activates the coarse focus mode using the coarse focus parameters input into the setup screen.

CCD Acquisition Function

Props Menu

4. Average Frames Function

- a. Allows the user to set the number of frames to be averaged.



5. Correction Function

- a. Allows the user to acquire background and flatfield image to use for automatically correcting the acquired image.



Autocorrect

- a. When , the acquired images are automatically corrected for background and flatfield before they are displayed.

Snap Background

- a. Acquires the image that will be used as the background during the correction process.
- b. Stores the acquired image in the file named ccd.background in the currently selected image directory.

Show Background

- a. Opens a window and displays the current ccd.background image

Snap Flatfield

- a. Acquires the image that will be used as the flatfield during the image correction process.
- b. Stores the image in the file name ccd.flatfield in the currently selected image directory.

Show Flatfield

- a. Opens a window and displays the current ccd.flatfield image

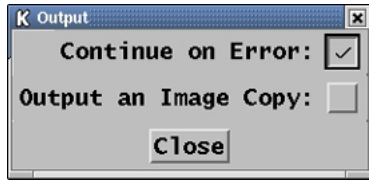
Correct Image

- a. Corrects the most recently acquired image.

CCD Acquisition Function

Props Menu

6. Output Function



Continue on Error:

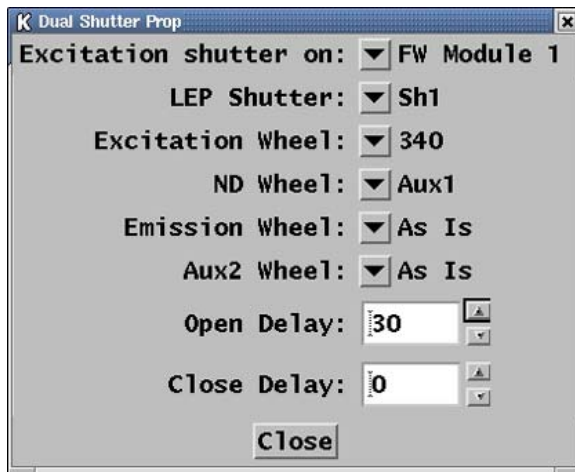
- a. When checked (✓), the default,

Output an Image Copy:

- a.

7. Dual Shutter Function

- a. Allows the user to setup and control excitation and emission filter wheels and transmitted light shutters



CCD Acquisition Function

Region Menu

1. Allows the user to quickly select sub-regions for acquisition