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The MityCAM-C8000 MityViewer Quick Start Guide will guide you through the software installation process and the steps to acquire your first image with the MityViewer application.

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# 1 Revision History

| Revision | Date | Notes |
|---|---|---|
| Draft | 8/14/2014 | Draft Release |
| 1.0 | 8/22/2014 | Initial 1.0 Release |
| 1.1 | 2/10/2015 | Added additional feature descriptions |
| 1.2 | 3/12/2015 | Added section on noise statistics and peak detect |
| 1.3 | 4/06/2015 | Added section on Playback/Record |

# 2 Interface Options

## 2.1 Setup USB/RNDIS PC Adapter

All MityCAM-C8000 models feature the option to send image data over the USB 2.0 interface of the camera. This communication occurs over a USB 2.0 Remote Network Driver Interface Specification (RNDIS) to a PC. The camera is already configured to have an IP address of 10.1.47.2 for this interface and the PC should configure its corresponding RNDIS USB Gadget address to be 10.1.47.1.

This device should have been configured using the Hardware Setup Guide that was included with the MityCAM. If this has not been performed yet, then please follow the steps outlined in that guide.

In addition to image capture with the MityViewer application the USB interface allows SSH access to the camera for configuration and debug activities.


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## 2.2 Gigabit Ethernet Enabled MityCAM Setup

For MityCAM-C8000 cameras that feature the Gigabit Ethernet interface type configuration of the USB/RNDIS interface is not recommended for image capture as the Ethernet interface offers superior frame rate capabilities.

Each MityCAM is pre-configured to obtain an IP address from a DHCP server running on a network. If directly connecting to a PC a DHCP server would need to be run on the PC or the camera must be configured to use a static IP address instead. Please contact your Critical Link account representative for further details about how to make such modifications.

Once the camera and the PC are connected to the same DHCP enabled network no other configuration is necessary to communicate using the MityViewer application, once installed on the PC, Section 3.


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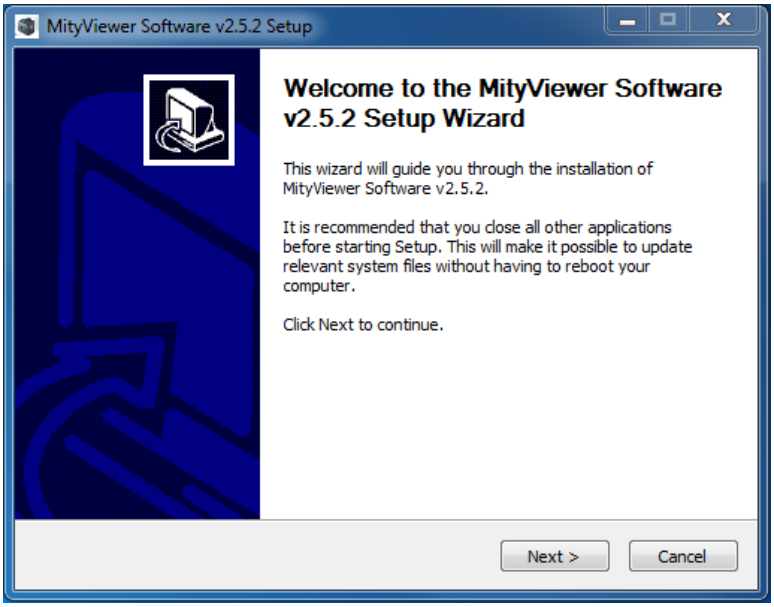
# 3 Install MityViewer Software

The MityViewer is a Windows PC application which lets you setup and configure the CMV8000 sensor/camera as well as acquire and display image data. Follow the steps below to install the MityViewer application on your PC.

Installing the application on your computer will create shortcuts to start it under the standard menus (Start→Programs→Critical Link→MityCCD on a Windows based computer). During the installation, you will be able to select which plugin elements you wish to install. Some of the plugins are designed for factory and/or development use and will require keys to install. The default set should be adequate for the majority of users.

1. Select the application (MityViewer_setup_2_X_X.exe) from the CD / DVD and then follow the prompts



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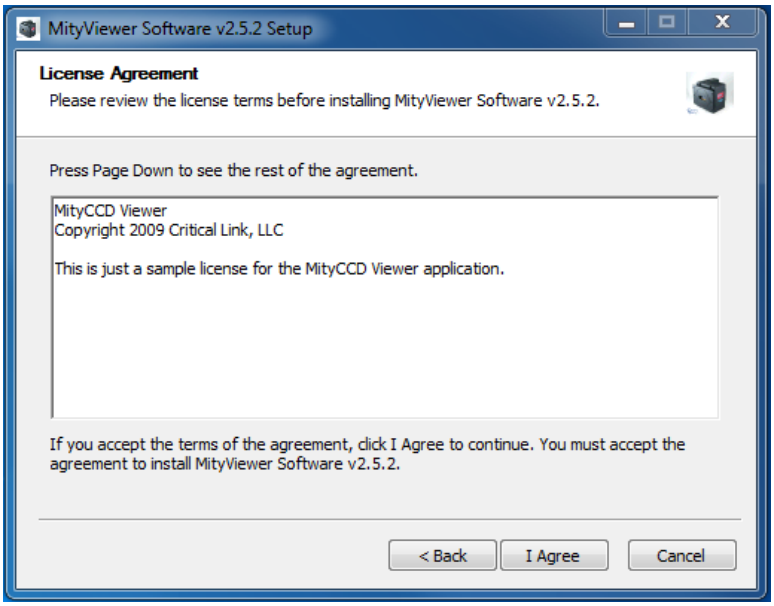


Figure 1: Software License Information

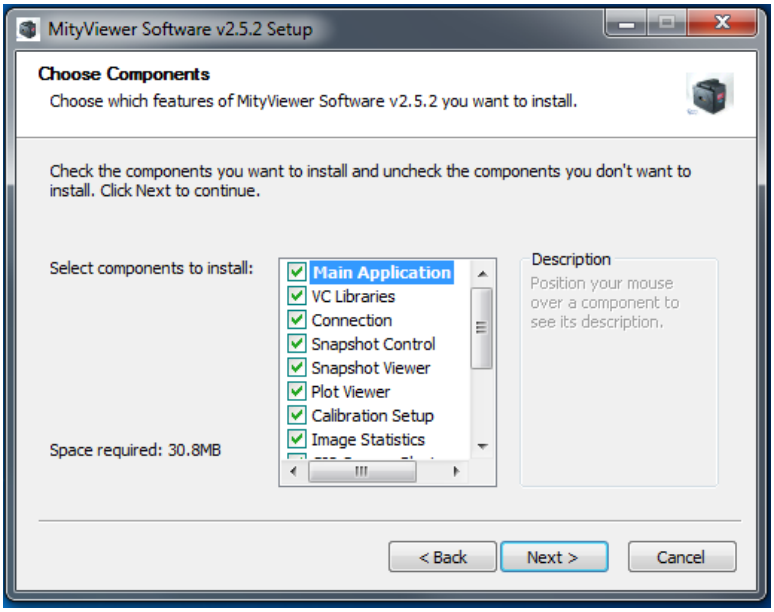


Figure 2: All components are selected by default



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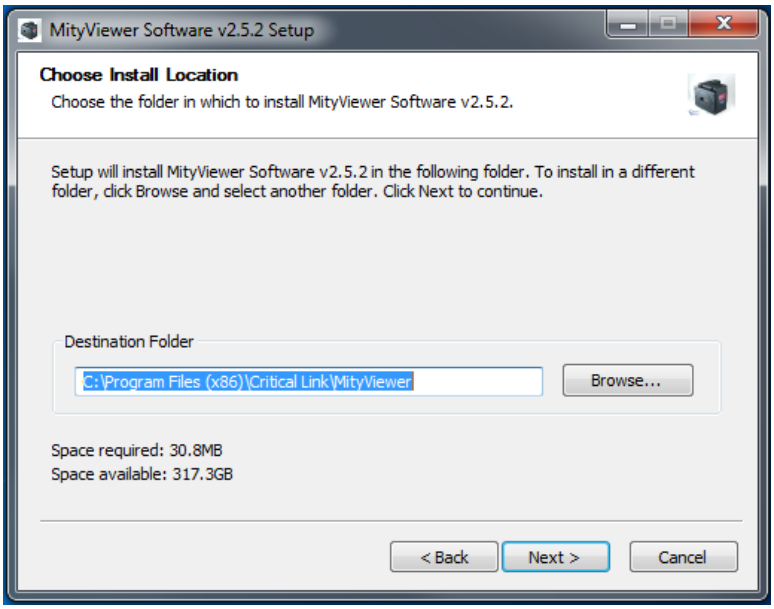
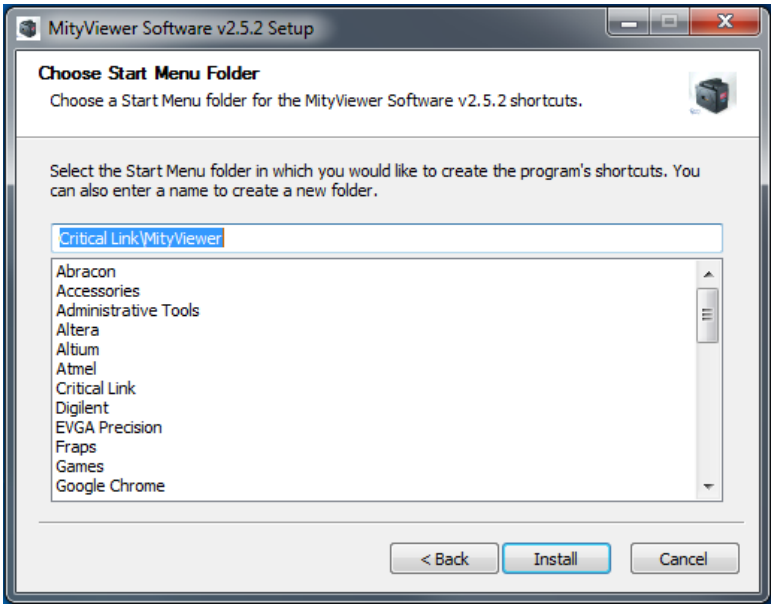



Figure 3: Default installation location



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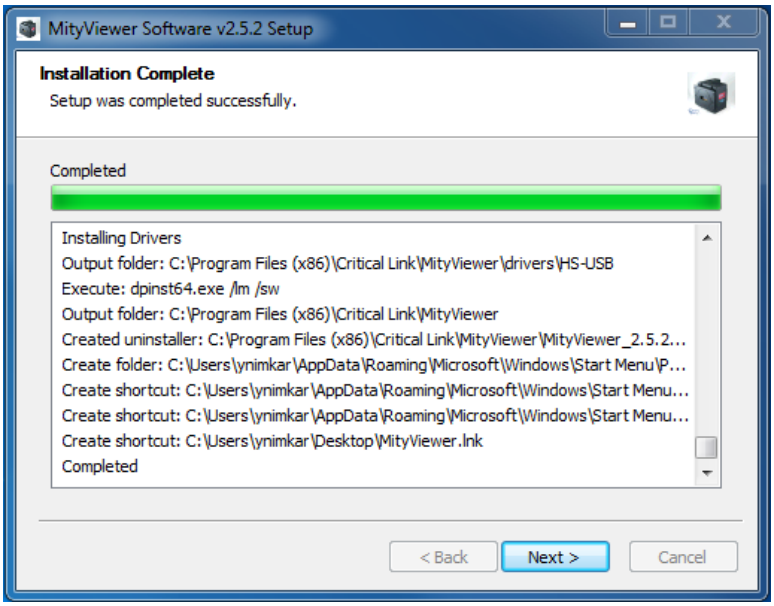


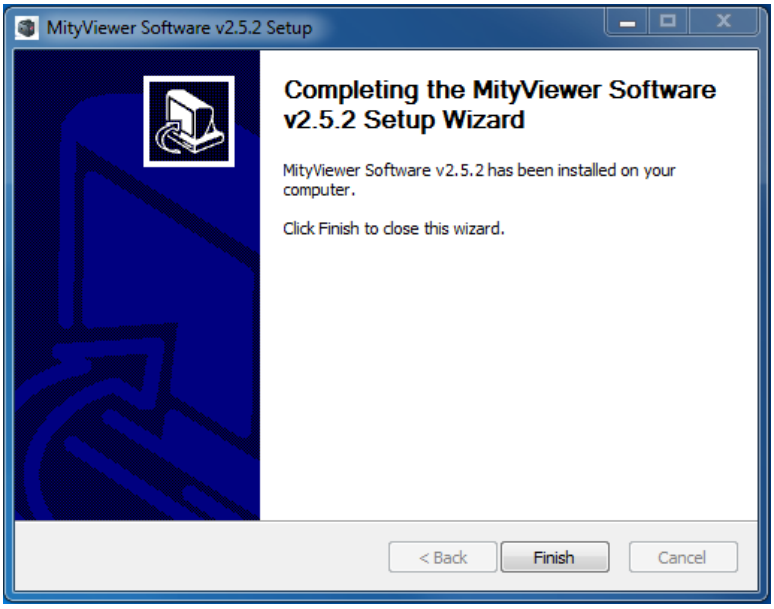




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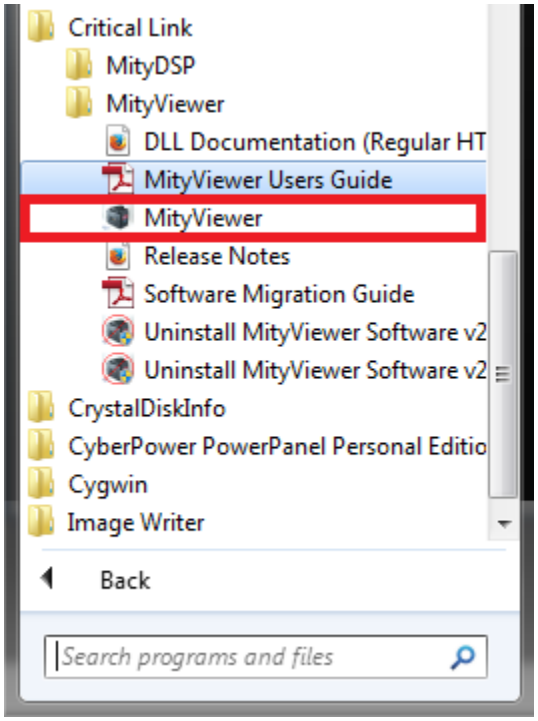
# 4 Acquire First Image

This section discusses the steps needed to connect to the camera, launch the MityViewer software and acquire the first image.

## 4.1 Launch MityViewer

Launch the MityViewer software by going to the Windows Start menu and typing MityViewer. The program will start and the desktop will appear (Windows 7). Alternatively you can also find the application in your start menu under Start→Programs→Critical Link→MityViewer.



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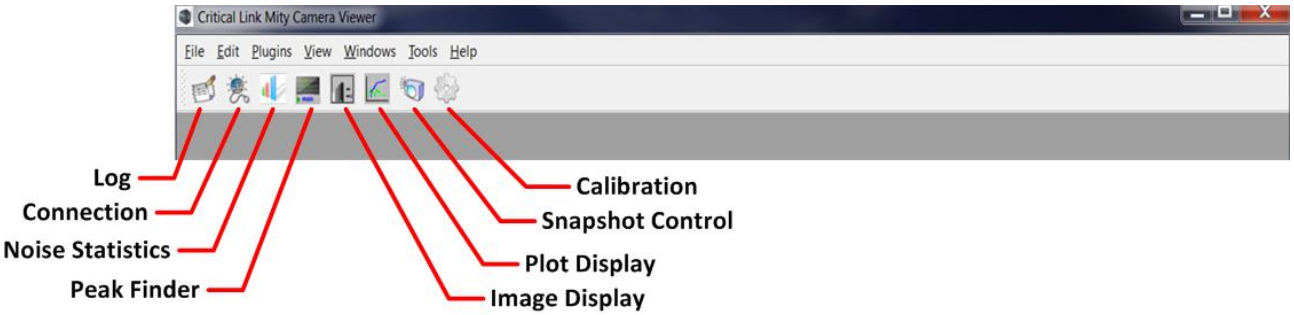
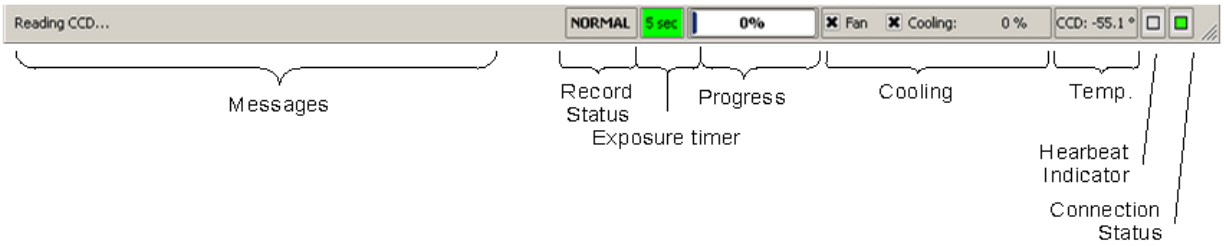
## 4.2 MityViewer

All key features of the Viewer are easily accessible via icons below the menu bar.

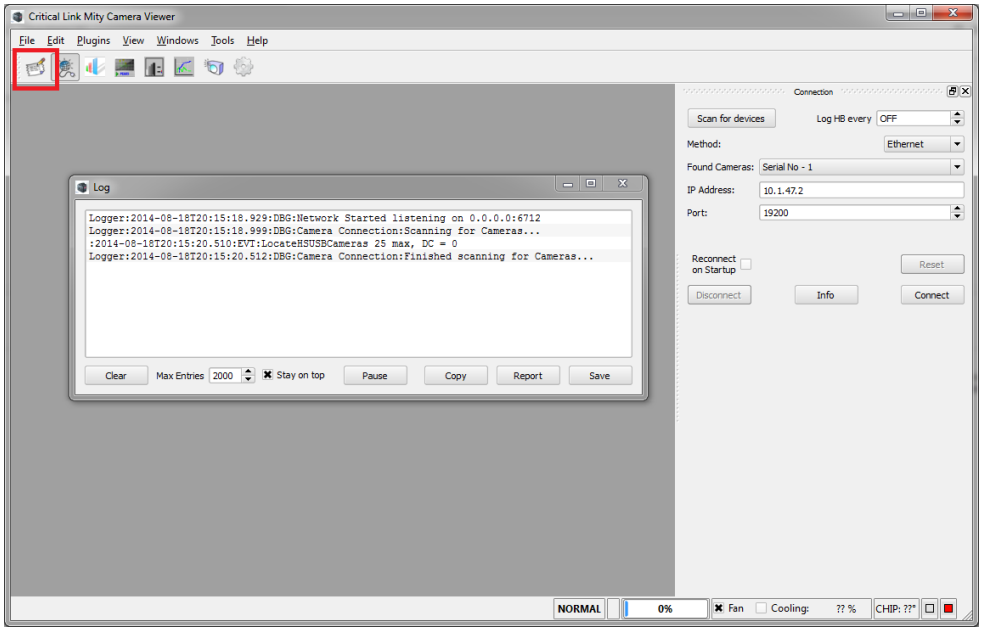



The status bar – displayed at the bottom of the window – shows a summary of camera / image acquisition status.




## 4.3 Launch Log Viewer

This dialog shows all the communication between the camera and PC and can assist in understanding overall operation. Click on the Log Viewer icon to launch the Log window.



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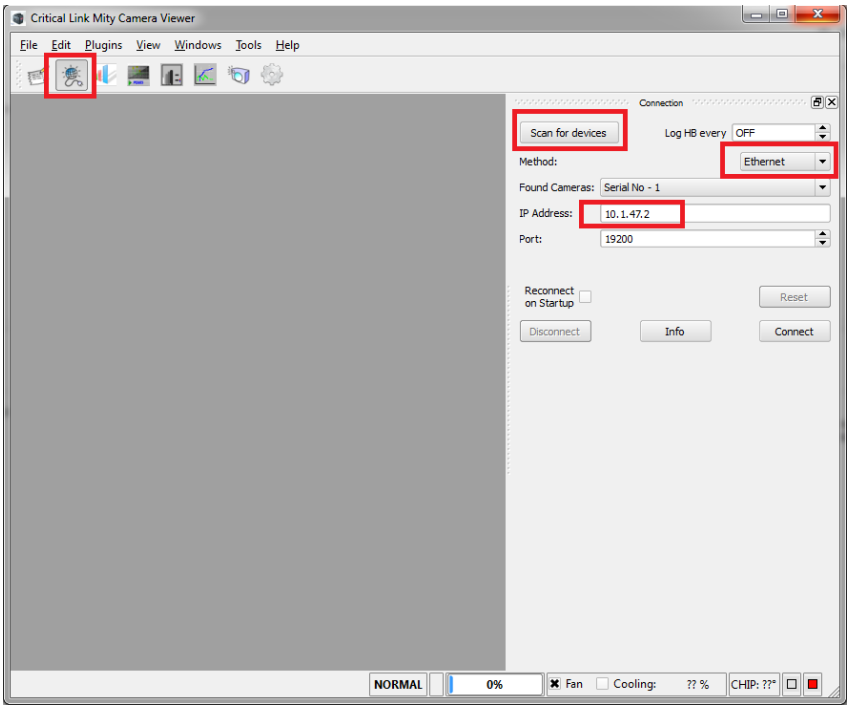
## 4.4 Connecting to Camera

1. Attach USB Cable (for RNDIS USB Gadget) from the PC to the camera if not already done
2. Turn power on to the camera and you should immediately hear the fan turn on. Note, it takes the camera approximately 20 seconds to boot-up from a power-on cycle so you may need to wait 20 ~ 45 seconds to connect successfully. You should see a green status LED through the fan grill on the rear of the camera if it is running and "ready".

3. If the connection dialog is not open, then select the connection icon form menu bar
4. Select **Ethernet** as the communication method
5. Select **Scan for devices** button




6. Wait for a few seconds and the camera S/N should appear on the **Found Cameras** drop down list. If the **Found Cameras** drop down list is empty, then select **Scan for devices** again. If you have multiple cameras on your network, then all **Found Cameras** should appear in this drop down list.
7. Select the camera based on S/N. A printed label with S/N may be found on the back of the camera.



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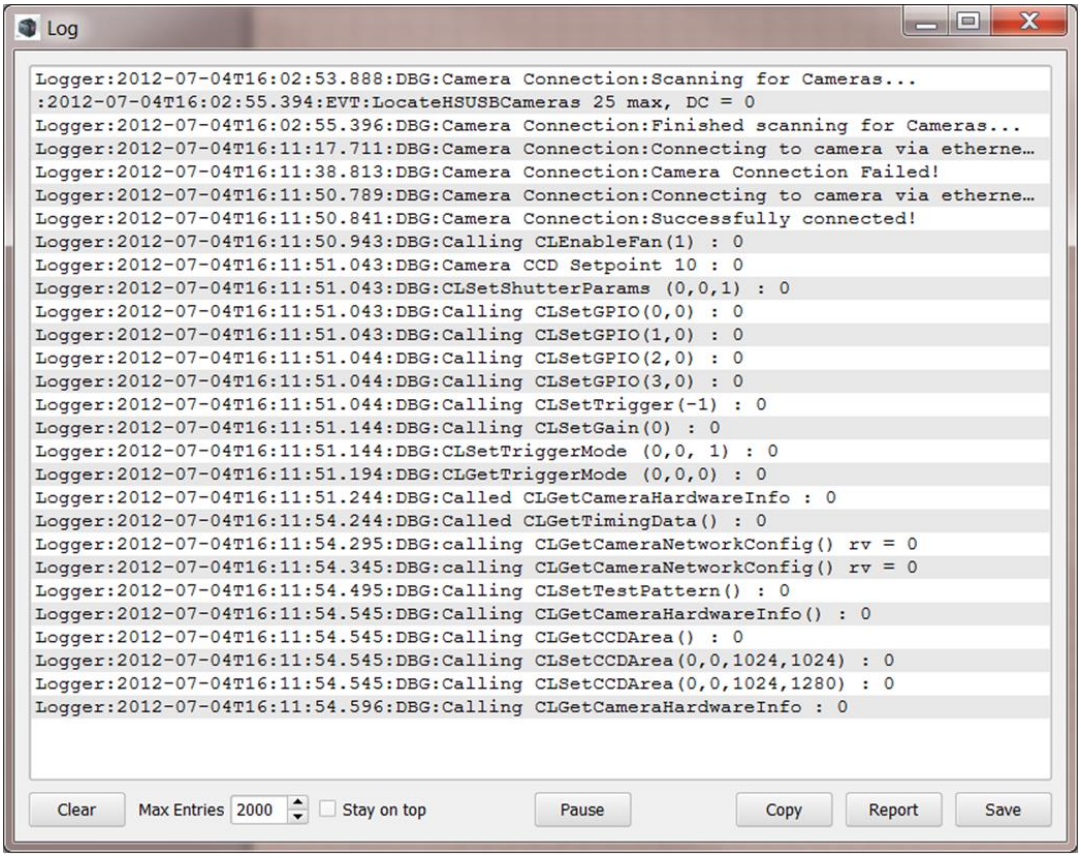
8. Select **Connect** button and observe display on Log Viewer. If the connect fails initially, then select the **Connect** button a second time.




9. Once the camera has successfully connected, then two green indicators will appear on the bottom right of the status bar. The right-most green indicator indicates connection to the camera. The indicator next to the left most indicator flashes green and indicates receipt of a periodic heartbeat message from the camera. A message indicating that the **Camera Connection Established** also appears on the bottom left.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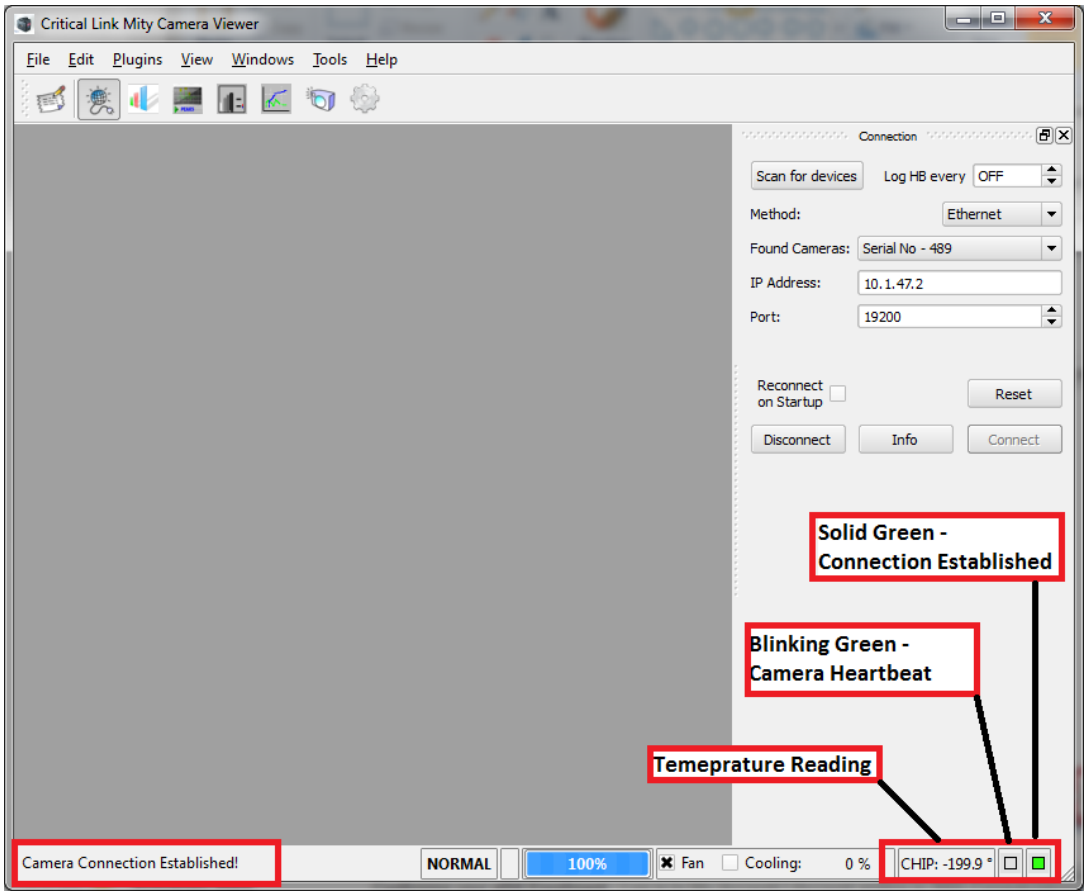
10. The periodic heartbeat message contains status information and some of the information may be shown by selecting the **Info** button.
11. Currently the temperature sensory is not implemented for the MityCAM-C8000 and will report -199.9C in the MityViewer application.



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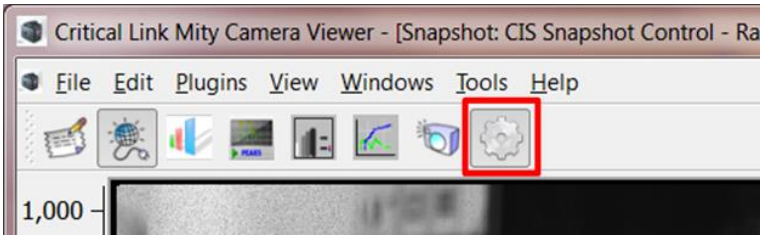
## 4.5 Sensor Configuration and Calibration

1. Select the **CMV Calibration** icon to display the **Calibration** Control Panel.




### 4.5.1 Mirroring

1. If desired you can mirror the image over both the horizontal and vertical axes.

### 4.5.2 Gain/Offset

All settings in the Gain/Offset section directly manipulate the sensors registers.

1. The programmable gain amplifier, **PGA**, can be set to one of 5 values; 1.0, **1.33 (default)**, 2, 3 and 4.
2. **ADC Gain** can be set to a value between 0 and 64 with **32 being the default**.
3. **Offset** is a digital bias on the data and can be set to a value between 0 and 2047 with **444 being the default**.

### 4.5.3 Registers

1. If necessary it is possible to read and write registers within the MityCAM-C8000 camera itself through the Peek and Poke buttons. Note that it is possible to damage or cause the MityCAM-C8000 to become inoperable using this feature. An address or data must be provided in hex format.

### 4.5.4 GPIO

1. The GPIO section of the CMV calibration tool allows the configuration of the 4 GPIOs accessible on the rear side of the camera. Please contact your Critical Link representative if a GPIO interface cable is needed as one is not included.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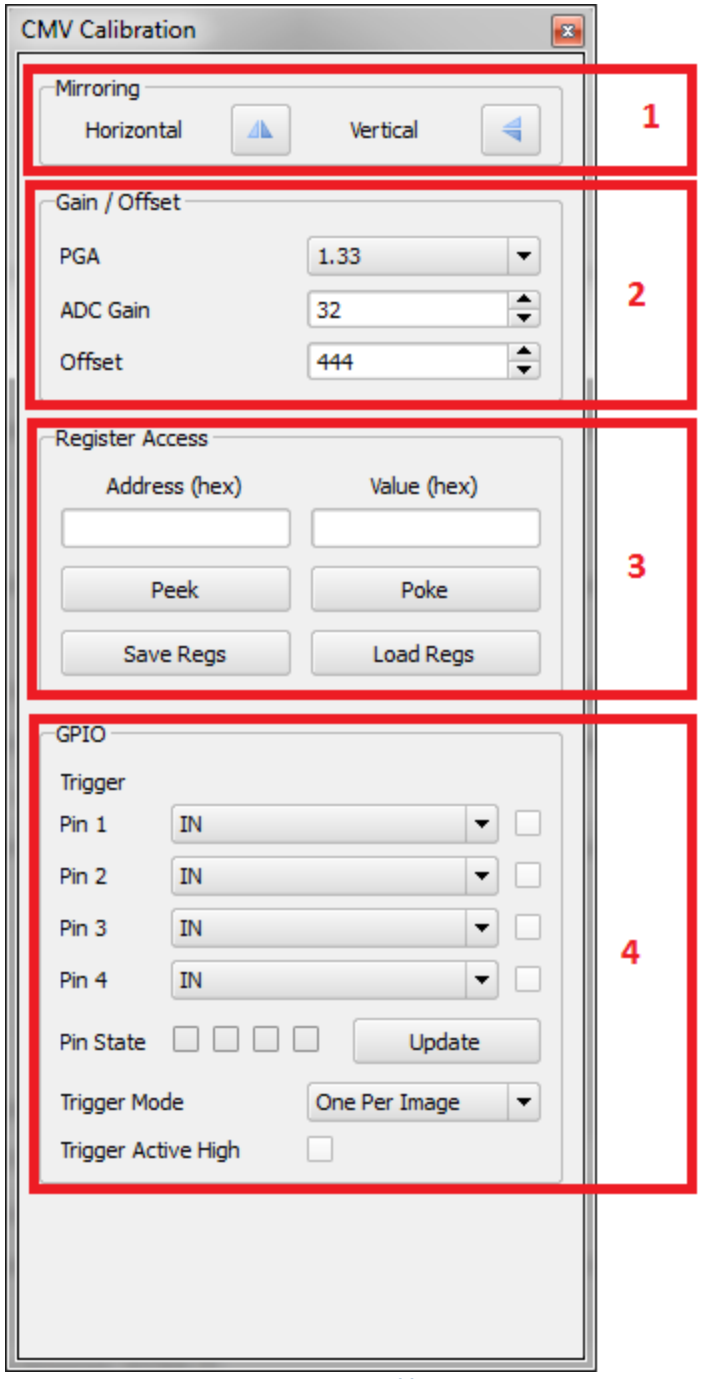


Figure 4: CMV Calibration



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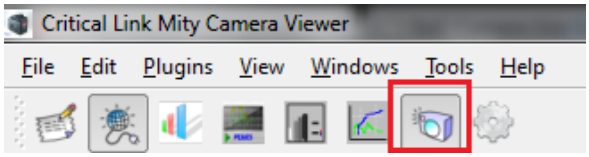
## 4.6 CMV Snapshot Control

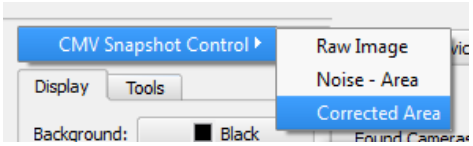
Select the **CMV Snapshot Control** icon to display the **Snapshot Control** Panel.




### 4.6.1 Background Subtraction

1. **Number of Frames** sets the number of frames that will be averaged together
2. **Measure** captures the specified number of background frames

To view the corrected image using the background subtraction select the Source -> Corrected Area option in the Snapshot Display.




### 4.6.2 Test Pattern

1. The **Test Pattern** feature is not yet implemented for the MityCAM-C8000 camera.

### 4.6.3 Number of Frames

1. The **Number of Frames** option sets either the total number of frames captured upon press of the **Start Capture** button if the **Continuous** check box is unchecked.
2. If the **Continuous** check box is selected then the number of frames cannot be set as the camera will capture frames and transmit them to MityViewer as quickly as possible.

### 4.6.4 Timing

1. When **HDR Interleaved Mode** each row of camera data will be captured at alternating exposure times based on **Exposure Time 1** and **Exposure Time 2**.
2. **Exposure Time 1** is used for all rows of data when **HDR Interleaved Mode** is not enabled.
3. **Exposure Time 2** is only available in HDR interleaved mode.
4. The **Frame Interval Time [ms]** is the amount of time between two subsequent frame captures.

### 4.6.5 ROI

1. Please reference **Section 0** for details about using the ROI options.

### 4.6.6 Stop Capture, Image Info and Start Capture

1. **Stop Capture** causes the camera to stop sending image data to MityViewer. This should be used prior to changing any settings in the **Snapshot Control** panel.
2. **Start Capture** causes the camera to begin sending camera data using the settings specified in the **Snapshot Control** panel.
3. **Image Info** displays the settings used for the last image captured.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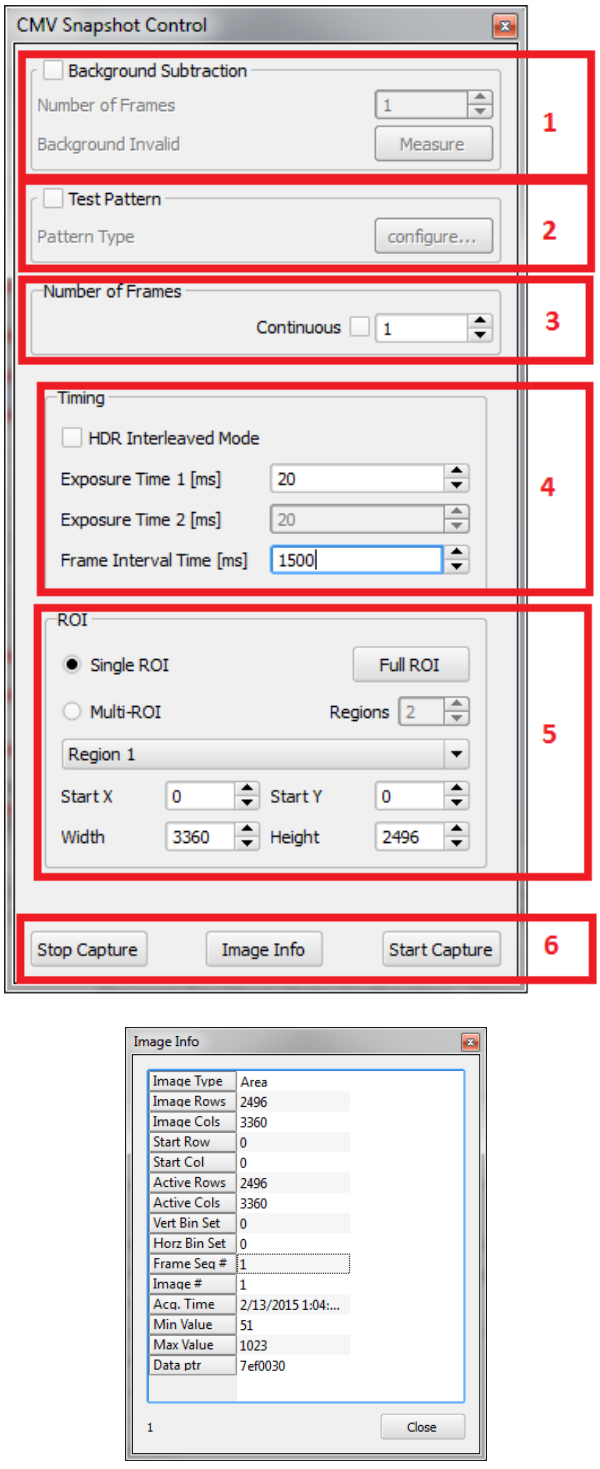





Figure 5: Image Info



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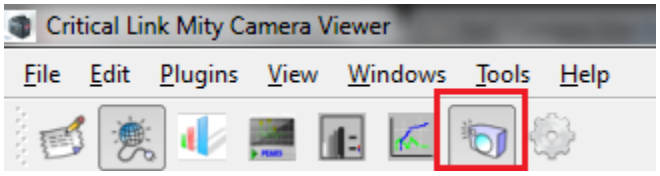
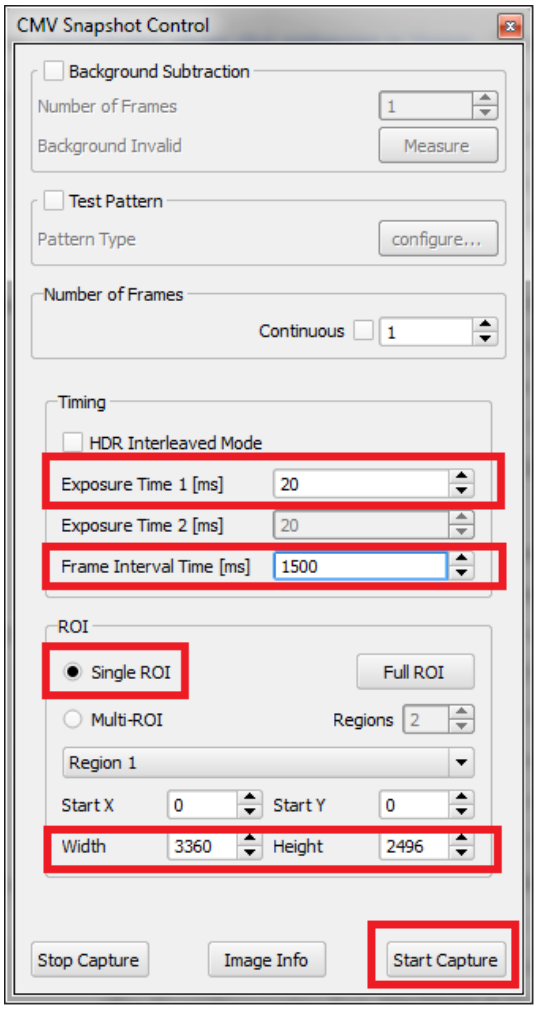
## 4.7 Acquire Image

1. Select the snapshot icon to display the **Snapshot** Control Panel.




2. Set **Number of Frames** to 1 and keep the **Continuous** check box unchecked.
3. Set **Exposure Time** to 20 ms.
4. Set **Frame Interval Time** to 1500 ms.
5. Set **Single ROI**. The width should be 3360 and the height should be 2496.
6. Select **Start Capture.**



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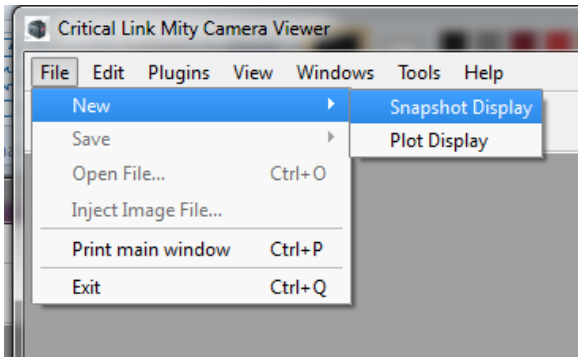
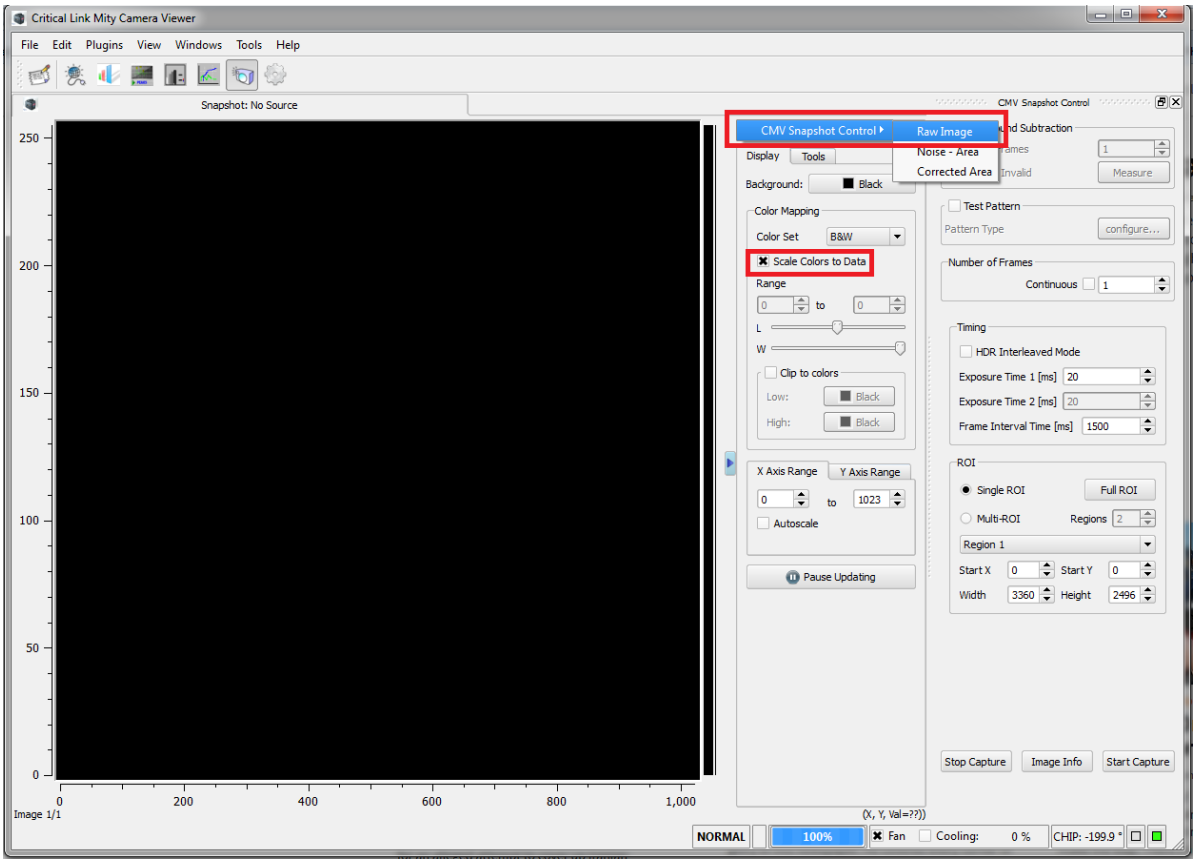
## 4.8 Display Image

1. To view the Image Data, load a Snapshot Display. Click on the File→New→Snapshot Display menu.
2. Select the **Raw Image** as the **Source Snapshot Display.**
3. Select **Scale Color to Data** checkbox.
4. An image should appear on the **Snapshot Display** control panel.
5. Adjust the lens iris and focus and select **Start Capture** on the **Snapshot** Control panel.
6. You may also select **Continuous** on the **Snapshot** Control panel followed by **Start Capture** to continuously acquire images. Select **Stop Capture** to stop acquisition. Note, don't make any changes to the **Exposure Time** or **Frame Interval Time** during continuous acquisition.



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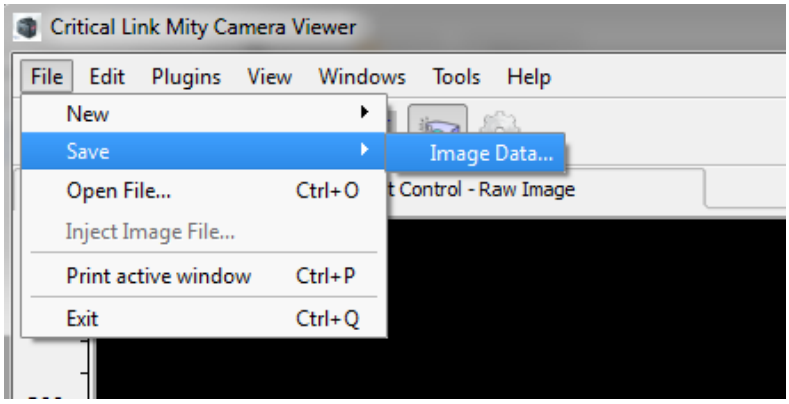
# 5 Saving Image Data to File

1. You may save an image data as a CSV, TIFF or binary CDI format.
2. Select File → Save and a dialog will prompt you for the file type.
3. The file may be analyzed at a later time using MS Excel or another application.



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# 6 Select / Change ROI

The ability to set the ROI for the MityCAM-C8000 can be found in the **Snapshot Control** settings dialog, **Section 4.6**.

By default, the Region of Interest (ROI) is set to the maximum size of the sensor and only a single region.

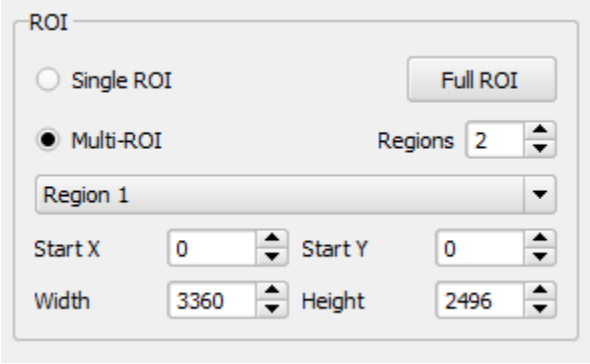
- CMV8000: 0,0 – 2496, 3360

You may also select multiple Regions of Interest. Up to a total of 8 different ROI regions may be set in the MityViewer application. Each region has a specified Start X, Start Y, Width and Height.

1. Use the **Regions** box to set the number of regions from 2 to 8
2. For each **Region** that is enabled a set of settings will be available which can be set by changing the **Region N** drop down menu.
3. For each **Region** a Start X, Start Y, Width and Height may be specified.

You may change the ROI by modifying the **Start Row / Column** and **End Row / Column** in the CIS **Snapshot** Control dialog. Note the following rules for changing the ROI:

- Total Bytes = Width x Height x 2
- Total Bytes = N x BL
- N must be an integer number
- BL must be evenly divisible by 8
- 32K <= BL < 64K
- The simplest way is to use regions that are multiples of 16K pixels (e.g. 16x1024) or are less than 32K pixels in size



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# 7 Stream Image Data to PC / Laptop

1. To view the Image Data, load a Snapshot Display. Click on the File→New→Snapshot Display menu.
2. Select the **Raw Image** as the **Source Snapshot Display.**
3. Select **Scale Color to Data** checkbox
4. Setup **Exposure Time** in the **Snapshot** Control panel
5. Setup **Frame Interval Time** in the **Snapshot** Control panel. Ensure that the **Frame Interval Time** is at least 1500 ms for CMV8000 sensor (full ROI)
6. Select **Continuous** on the **Snapshot** Control panel
7. Select **Start Capture** to continuously acquire images.
8. Select **Stop Capture** to stop acquisition. Note, don't make any changes to the **Exposure Time** or **Frame Interval Time** during acquisition


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# 8 Stream Image Data to Internal Memory

1. To view the Image Data, load a Snapshot Display. Click on the File→New→Snapshot Display menu.
2. Select the **Raw Image** as the **Source Snapshot Display.**
3. Select **Scale Color to Data** checkbox
4. Setup **Exposure Time** in the **Snapshot** Control panel
5. Setup **Frame Interval Time** in the **Snapshot** Control panel. The **Frame Interval Time** can be set to any value greater than 1000 ms for CMV8000 sensor (full ROI)
6. Unselect **Continuous** on the **Snapshot** Control panel
7. Select Number of Frames to be greater than 1 (maximum is 20)
8. Select **Start Capture** to continuously acquire images.
9. Acquisition will stop after the number of frames has been acquired. The image data is captured at 20 frames/sec rate (Frame Interval = 1000 ms) and sent to the PC at a slower rate


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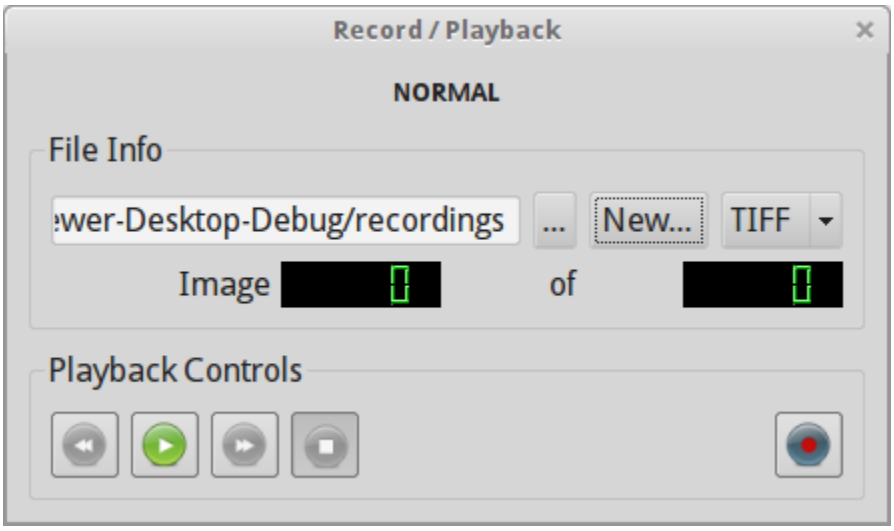
# 9 Record / Playback Images to / from disk

1. The MityViewer can be configured to stream received images to disk by using the **Playback / Record** dialog accessible via the main window **View** menu.




2. The **Playback / Record** dialog supports recording TIFF files as well as a custom format named CDI (continuous data inject). Select the desired format using the menu option next to the **file select button**, .
3. Select the **file select button** to choose a record file name that will contain meta-data information needed for playback. The location of this file also will include the image files stored to disk during a record session. If an existing recording is selected (for playback, or to overwrite), the number of images in the record session will be shown.
4. To start recording, press the **record button**, . The dialog will prompt you if you will be overwriting an existing record set. Each image acquired is saved to disk before being passed to the rest of the application for processing.
5. To stop recording, press the **stop button,** .
6. To playback a record set, press the **play button**, . Images played back are injected as if they came from the camera DLL (before any application processing). During playback, the **play button** will change to a **pause button**, .
7. To stop playback, click the **stop button**.



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# 10 Image Statistics

## 10.1 Image Statistics Dialog

The Image Noise Statistics dialog is shown using its icon on the toolbar. When the **Enable** box is checked, this dialog will compute image statistics on every acquired image. When acquiring images at high frame rates, you may need to disable this dialog to achieve the desired throughput (depending on your PC's CPU). The dialog computes the image mean pixel value, the noise (std deviation) value, and shows how many pixels fall outside of 1,2,3, and 4 sigma from the noise value as a percentage. The nominal values for these percentages (based on a Gaussian distribution) are shown to the right of the values). You can reduce the size of the considered area by adjusting the **X Margin** and **Y Margin** controls. These values are applied to both edges of the X or Y limits. The noise computation is a multi-pass operation. First it does a sliding window average (using the **Window** setting for the size of the window) across a row. Any pixel who's value is more than **Peak Cutoff** counts above the average is discarded for the computation and the average of its one-away neighbors is used for the computation (the actual pixel data is untouched). Once this peak shearing operation is done, the line mean is computed and used to derive the noise figure. The running average noise and mean values are displayed next to the image mean and noise fields. Pressing the **Reset Averages** button clears the running average.

## 10.2 Plot Statistics

The Image Noise Statistics dialog can compute image statistics suitable for plotting using the plot display window. Clicking the **Generate** button will compute the following data sets:



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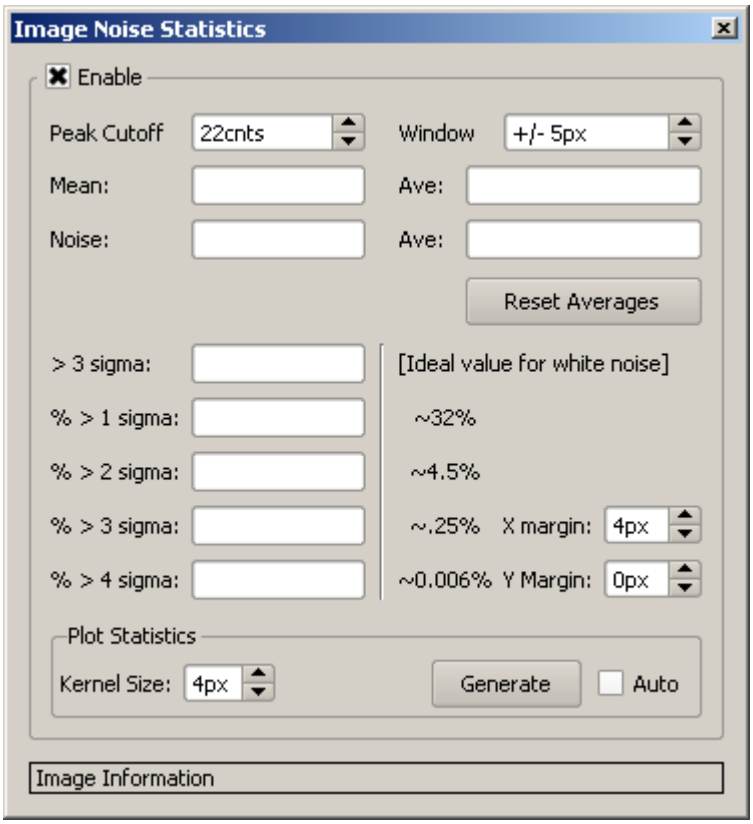


- StdDev by Row — StdDev for each pixel in a row
- StdDev by Column — StdDev for each pixel in a column
- Mean by Row — Mean value across a row
- Mean by Column — Mean value along a column
- Data by Row — Image data in a given row
- Data by Column — Image data in a given column
- FFT by Row — FFT [1024 bin] of the data in a row
- Histogram — Image histogram.

Checking the **Auto** box will cause the dialog to compute image plot statistics for every image acquired. You may find this is too much for your CPU to handle.



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## 10.3 Important notes related to the Noise Statistic Plug-in

This plug-in was primarily developed to support internal testing of a number CCDs and CMOS arrays. The plug-n is available for customer use, but please note the following limitations, caveats, and definitions.

All of the statistics a developed using a local Area Mean matrix developed from the input image, X, and the specified kernel size of the noise statistics dialog. The equation for the Area Mean matrix is given by:

$$AreaMean_{row,col} = \frac{\sum_{i=row-kernelsize}^{row+kernelsize} \sum_{j=col-kernelsize}^{col+kernelsize} X_{i,j}}{(2xkernelsize+1)^2}$$

For the edge cases of pixels within the kernel size at the top, bottom, left or right edge of the image, the Area Mean is computed using the kernel that fits within the image bounds. This means that the Area Mean matrix edge pixels are duplicated up to an offset of the kernel size.

### Mean by Rows

The mean by rows option accepts a row number as a parameter. When this option is selected, a plot of ranging from col = 0 to the number of columns – 1 is generated from the Area Mean matrix using the requested row.

### Mean by Cols

The mean by cols option accepts a column number as a parameter. When this option is selected, a plot of ranging from row = 0 to the number of rows – 1 is generated using the requested column.

### Standard Deviation by Column

The "StdDev by Column" option accepts a column number as a parameter, but this parameter is not used. You should get the same plot for any column selected. When this option is selected, a plot of ranging from row = 0 to the number of rows – 1 is generated from the following:

$$StdCols_{row} = \sqrt{\frac{\sum_{col=10}^{COLS-10}\left(X_{row,col} - AreaMean_{row,col}\right)^2}{COLS-20}}$$

### Standard Deviation by Row

The "StdDev by Row" option accepts a row number as a parameter, but this parameter is not used. You should get the same plot for any row selected. When this option is selected, a plot of ranging from col = 0 to the number of columns – 1 is generated from the following equation:



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$$StdRows_{col} = \sqrt{\frac{\sum_{row=0}^{ROWS-1}\left(X_{row,col} - AreaMean_{row,col}\right)^2}{ROWS}}$$

**FFT**

The FFT option accepts a row number as a parameter. A 1024 FFT is computed using the left most pixels along the row selected. If the number of columns available is less than 1024, then the FFT is zero padded. The data is displayed in dB (20*log10(magnitude)) scale. This was originally intended to detect periodic noise components in the data. It has not been modified to accommodate larger FPAs that have more than 1024 columns.

## Comments

Some of the statistics operations exclude the outer left/right of the FPA. This was due to several legacy CCD sensors generating "special" columns that needed to be excluded for statistical analysis (e.g., several sensors generate optical and/or electrical dark columns that corrupt the statistics of optically active pixels). There were also some CCDs that included a bias on the first pixel due to how double correlated sampling was performing in the analog circuitry.

The results of our Noise Statistics plug in is used for several automated test procedures, so modification of the algorithms is possible but will require parameterization in order to maintain current functionality for legacy sensors.



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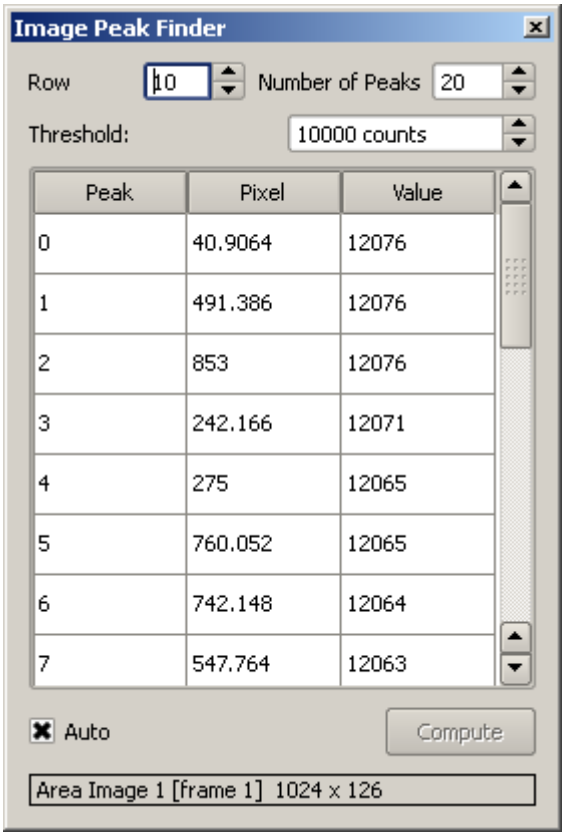
## 10.4 Peak Finder Dialog

The Peak Finder dialog can be used to examine a row in an image to find the peak values. Click the icon in the toolbar to open this dialog.



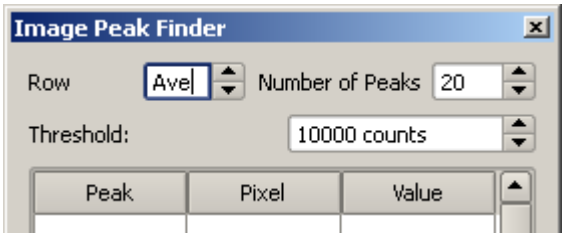




Figure 6 Peak Finder Dialog

Use the **Row** control to select which row to find peaks on (or select "Ave" to average all the rows in the image [its one down from "0"]). The Number of Peaks control limits the number of peaks extracted. Only pixels whose value exceeds the threshold are considered in the peak processing. The Pixel value shown is interpolated using a centroid algorithm and thus is a floating point pixel equivalent. The Value shown is the pixel value of the peak from the image (not interpolated).
If the **Auto** button is checked the peaks are located for every image acquired, otherwise click the **Compute** button to populate the table.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