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The technical content of this CMOSIS / AWAIBA document is still valid.

#### **Contact information:**

#### Headquarters: ams AG Tobelbaderstrasse 30 8141 Premstaetten, Austria Tel: +43 (0) 3136 500 0 e-Mail: ams\_sales@ams.com

Please visit our website at www.ams.com



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

RevisionDateNotes		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.





#### 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.





# 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  $(\text{Start} \rightarrow \text{Programs} \rightarrow \text{Critical Link} \rightarrow \text{MityCCD} \text{ on a Windows based computer})$ . 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





4



MityViewer Software v2.5.2 Setup		
License Agreement Please review the license terms before installing MityViewer Software v2.5.2.		
Press Page Down to see the rest of the agreement.		
MityCCD Viewer Copyright 2009 Critical Link, LLC		
This is just a sample license for the MityCCD Viewer application.		
If you accept the terms of the agreement, click I Agree to continue. You must accept the agreement to install MityViewer Software v2.5.2.		
< Back I Agree Cancel		

Figure 1: Software License Information

MityViewer Software v2.5.2 Setup				
Choose Components Choose which features of MityViewer Software v2.5.2 you want to install.				
Check the components you want to install and uncheck the components you don't want to install. Click Next to continue.				
Select components to install:	Main Application     VC Libraries     Connection     Snapshot Control     Snapshot Viewer     Plot Viewer	Description Position your mouse over a component to see its description.		
Space required: 30.8MB	Calibration Setup			
< Back Next > Cancel				

Figure 2: All components are selected by default



5



MityViewer Software v2.5.2 Setup
Choose Install Location Choose the folder in which to install MityViewer Software v2.5.2.
Setup will install MityViewer Software v2.5.2 in the following folder. To install in a different folder, click Browse and select another folder. Click Next to continue.
Destination Folder C: Program Files (x86)\Critical Link\MityViewer Browse
Space required: 30.8MB Space available: 317.3GB
< Back Next > Cancel

Figure 3: Default installation location

MityViewer Software v2.5.2 Setup	<u> </u>
Choose Start Menu Folder Choose a Start Menu folder for the MityViewer Software v2.5.2 shortcuts.	<b>(</b>
Select the Start Menu folder in which you would like to create the program's sh can also enter a name to create a new folder.	ortcuts. You
Abracon Accessories Administrative Tools Altera Altum Atmel Critical Link Diglient EVGA Precision Fraps Games Google Chrome	•
< Back Install	Cancel





nstallation Complete Setup was completed successfully.	
Completed	
Execute: dpinst64.exe /lm /sw Output folder: C: \Program Files (x86 Created uninstaller: C: \Program File Create folder: C: \Users \ynimkar \App Create shortcut: C: \Users \ynimkar \	s (x86)\Critical Link\MityViewer\MityViewer_2.5.2 pData\Roaming\Microsoft\Windows\Start Menu\P AppData\Roaming\Microsoft\Windows\Start Menu AppData\Roaming\Microsoft\Windows\Start Menu
Completed	







#### 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.







#### 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.

Critical Link Mity Camera Viewer	
<u>File Edit Plugins View Windows Iools Help</u>	
📧 💐 💵 🔜 🐨 🕸	
	Scan for devices Log HB every OFF
	Method:
	Found Cameras: Serial No - 1
	IP Address: 10.1.47.2
Logger:2014-08-18720:15:18.929:DBG:Network Started listening on 0.0.0.0:6712 Logger:2014-08-18720:15:18.999:DBG:Camera Connection:Scanning for Cameras 12014-08-18720:15:20.510:EVT:LocateRUSTGAmerras Z5 max, D = 0	Port: 19200
Logger:2014-08-18T20:15:20.512:DBG:Camera Connection:Finished scanning for Cameras	Reconnect Reset
	Disconnect Info Connect
Clear Max Entries 2000 🖨 🕱 Stay on top Pause Copy Report Save	
NORMAL	6 🛛 🗶 Fan 📄 Cooling: ?? % CHIP: ??* 🗖 📕





#### 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

Critical Link Mity Camera Viewer				
<u>File Edit P</u> lugins <u>V</u> iew <u>W</u> indows Tools <u>H</u> elp				
🥑 🎉 🖳 📰 🖪 🖉 😳				
		Scan for devices     Log HB every     OF       Method:     E       Found Cameras:     Serial No - 1       IP Address:     10.1.47.2       Port:     19200   Reconnect Disconnect Info		
	NORMAL 0%	Fan Cooling: ?? % CHI	IP: ??"	

- 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.





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

Logger:2012-07-	04T16:02:53.888:DBG:Cam	era Connection:Scanning for Cameras
:2012-07-04T16:	02:55.394:EVT:LocateHSU	SBCameras 25 max, DC = 0
Logger:2012-07-	04T16:02:55.396:DBG:Cam	era Connection: Finished scanning for Cameras
Logger:2012-07-	04T16:11:17.711:DBG:Cam	era Connection:Connecting to camera via etherne.
Logger:2012-07-	04T16:11:38.813:DBG:Cam	era Connection:Camera Connection Failed!
Logger:2012-07-	04T16:11:50.789:DBG:Cam	era Connection:Connecting to camera via etherne.
Logger:2012-07-	04T16:11:50.841:DBG:Cam	era Connection:Successfully connected!
Logger:2012-07-	04T16:11:50.943:DBG:Cal	ling CLEnableFan(1) : 0
Logger:2012-07-	04T16:11:51.043:DBG:Came	era CCD Setpoint 10 : 0
Logger:2012-07-	04T16:11:51.043:DBG:CLS	etShutterParams (0,0,1) : 0
	04T16:11:51.043:DBG:Cal	
Logger:2012-07-	04T16:11:51.043:DBG:Cal	ling CLSetGPIO(1,0) : 0
Logger:2012-07-	04T16:11:51.044:DBG:Call	ling CLSetGPIO(2,0) : 0
Logger:2012-07-	04T16:11:51.044:DBG:Call	ling CLSetGPIO(3,0) : 0
Logger:2012-07-	04T16:11:51.044:DBG:Cal	ling CLSetTrigger(-1) : 0
Logger:2012-07-	04T16:11:51.144:DBG:Call	ling CLSetGain(0) : 0
Logger:2012-07-	04T16:11:51.144:DBG:CLS	etTriggerMode (0,0, 1) : 0
Logger:2012-07-	04T16:11:51.194:DBG:CLG	etTriggerMode (0,0,0) : 0
Logger:2012-07-	04T16:11:51.244:DBG:Cal	led CLGetCameraHardwareInfo : 0
Logger:2012-07-	04T16:11:54.244:DBG:Cal	led CLGetTimingData() : 0
Logger:2012-07-	04T16:11:54.295:DBG:cal	ling CLGetCameraNetworkConfig() rv = 0
Logger:2012-07-	04T16:11:54.345:DBG:cal	ling CLGetCameraNetworkConfig() rv = 0
Logger:2012-07-	04T16:11:54.495:DBG:Cal	ling CLSetTestPattern() : 0
Logger:2012-07-	04T16:11:54.545:DBG:Cal	ling CLGetCameraHardwareInfo() : 0
Logger:2012-07-	04T16:11:54.545:DBG:Call	ling CLGetCCDArea() : 0
Logger:2012-07-	04T16:11:54.545:DBG:Cal	ling CLSetCCDArea(0,0,1024,1024) : 0
Logger:2012-07-	04T16:11:54.545:DBG:Cal	ling CLSetCCDArea(0,0,1024,1280) : 0
Logger:2012-07-	04T16:11:54.596:DBG:Cal	ling CLGetCameraHardwareInfo : 0

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.





- 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.

Critical Link Mity Camera Viewer						
<u>File Edit Plugins View Window</u>	vs <u>T</u> ools <u>H</u> elp					
📗 🛃 💽 🚺 🖉	i 🗑 🎡					
		Scan for devices Log HB every OFF				
		Method:				
		Found Cameras: Serial No - 489 👻				
		IP Address: 10.1.47.2				
		Port: 19200				
		Reconnect Reset				
		Disconnect Info Connect				
		Solid Green - Connection Established				
		connection established				
		Blinking Green - Camera Heartbeat				
	Temepr	ature Reading				
Camera Connection Established!	NORMAL 100% 🗙 Fan	Cooling: 0 % CHIP: -199.9 °				





# 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.







Mirroring Horizontal A Vertical	1
Gain / Offset	
PGA 1.33 💌	
ADC Gain 32	2
Offset 444	
Register Access	
Address (hex) Value (hex)	
	3
Peek Poke	3
Save Regs Load Regs	
GPIO	
Trianan	
Trigger Pin 1 IN	
Pin 1 IN 🔻	
Pin 1         IN         Image:	4
Pin 1       IN       ▼         Pin 2       IN       ▼         Pin 3       IN       ▼	4
Pin 1       IN       IN         Pin 2       IN       IN         Pin 3       IN       IN         Pin 4       IN       IN	4
Pin 1       IN       IN         Pin 2       IN       IN         Pin 3       IN       IN         Pin 4       IN       IN         Pin 5tate       IN       Update	4
Pin 1  IN    Pin 2  IN    Pin 3  IN    Pin 4  IN    Pin State  Update    Trigger Mode  One Per Image	4
Pin 1  IN    Pin 2  IN    Pin 3  IN    Pin 4  IN    Pin State  Update    Trigger Mode  One Per Image	4

#### Figure 4: CMV Calibration





#### 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.





Background Subtraction       Number of Frames       Background Invalid   Measure	1
Pattern Type Configure	2
Continuous 1	3
Timing HDR Interleaved Mode Exposure Time 1 [ms] 20 Exposure Time 2 [ms] 20 Frame Interval Time [ms] 1500	4
ROI Single ROI Multi-ROI Region 1 Start X 0 Start Y 0	5
Start X   0   Start Y   0     Width   3360   Height   2496	
	6

Figure 5: Image Info





#### 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.

CMV Snapshot Control
Background Subtraction
Number of Frames
Background Invalid Measure
Test Pattern
Pattern Type configure
Number of Frames
Continuous 🗌 1
Timing
HDR Interleaved Mode
Exposure Time 1 [ms] 20
Exposure Time 2 [ms] 20
Frame Interval Time [ms] 1500
ROI
Single ROI     Full ROI
Multi-ROI Regions 2
Region 1
Start X 0 🜩 Start Y 0 🜩
Width 3360 🔶 Height 2496 🚔
Stop Capture Image Info Start Capture





#### 4.8 Display Image

- 1. To view the Image Data, load a Snapshot Display. Click on the File  $\rightarrow$  New  $\rightarrow$  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.







Critical Link, LLC 6712 Brooklawn Pkwy Syracuse, NY 13211



# 5 Saving Image Data to File

- 1. You may save an image data as a CSV, TIFF or binary CDI format.
- 2. Select File  $\rightarrow$  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.







# 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 =  $N \times BL$
- N must be an integer number
- BL must be evenly divisible by 8
- $32K \le BL \le 64K$
- The simplest way is to use regions that are multiples of 16K pixels (e.g. 16x1024) or are less than 32K pixels in size

OI		Full ROI
DI		Regions 2
		-
0	🗘 Start Y	0
3360	🖨 Height	2496 븆
		DI 0 🔷 Start Y





# 7 Stream Image Data to PC / Laptop

- 1. To view the Image Data, load a Snapshot Display. Click on the File $\rightarrow$ New $\rightarrow$ 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





# 8 Stream Image Data to Internal Memory

- 1. To view the Image Data, load a Snapshot Display. Click on the File  $\rightarrow$  New  $\rightarrow$  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





# 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.

Record / Playback	×
NORMAL	
File Info	
wer-Desktop-Debug/recordings New TIFF -	
Image of	
Playback Controls	
	]

- 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**, **Solution**. 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**, **Solution**. 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**.





# **10 Image Statistics**

#### **10.1 Image Statistics Dialog**

The Image Noise Statistics dialog is shown using its icon finance. 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:





Image Noise Statistics	×
Enable	
Peak Cutoff 22cnts 🚔	Window +/- 5px 🚔
Mean:	Ave:
Noise:	Ave:
	Reset Averages
> 3 sigma:	[Ideal value for white noise]
% > 1 sigma:	~32%
% > 2 sigma:	~4.5%
% > 3 sigma:	~.25% X margin: 4px 🚔
% > 4 sigma:	~0.006% Y Margin: Opx 🚔
Plot Statistics	
Kernel Size: 4px 🚔	Generate Auto
Image Information	

• StdDev by Row StdI

•

•

•

- 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.





# 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:

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

# 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:





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

#### 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 real icon in the toolbar to open this dialog.

mage Peak Fi	nder		×	Image Peak Find	er		
Row 10	Number	of Peaks 20	•	Row Ave	😫 Number	of Peaks 20	
Threshold:	100	100 counts	-	Threshold:	1000	0 counts	
Peak	Pixel	Value		Peak	Pixel	Value	•
0	40.9064	12076					
1	491.386	12076	***				
2	853	12076					
3	242.166	12071					
4	275	12065					
5	760.052	12065					
6	742.148	12064					
7	547.764	12063	-				
🗶 Auto		Comput	:e				
Area Image 1	[frame 1] 1024	x 126					

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.

