

Detector Pool's CoolSnapHQ CCD X-ray Microscopes User Manual

CoolsnapHQ Detector

Specs:

12-bits
1392 x 1040
6.45 micron pixels
-30C
60% Quantum efficiency (450-600 nm)
C-mount

Setup

There is only one on/off switch for the whole setup. Connect the data and power cables before turning on the power supply. Turn on the switch located on the power supply unit.

Software

The Detector Pool utilizes EPICS areaDetector as the user interface. EPICS areaDetector uses WinView to communicate with the camera. DP no longer provides Image Server on the Coolsnap PC. To start the software there are three icons:



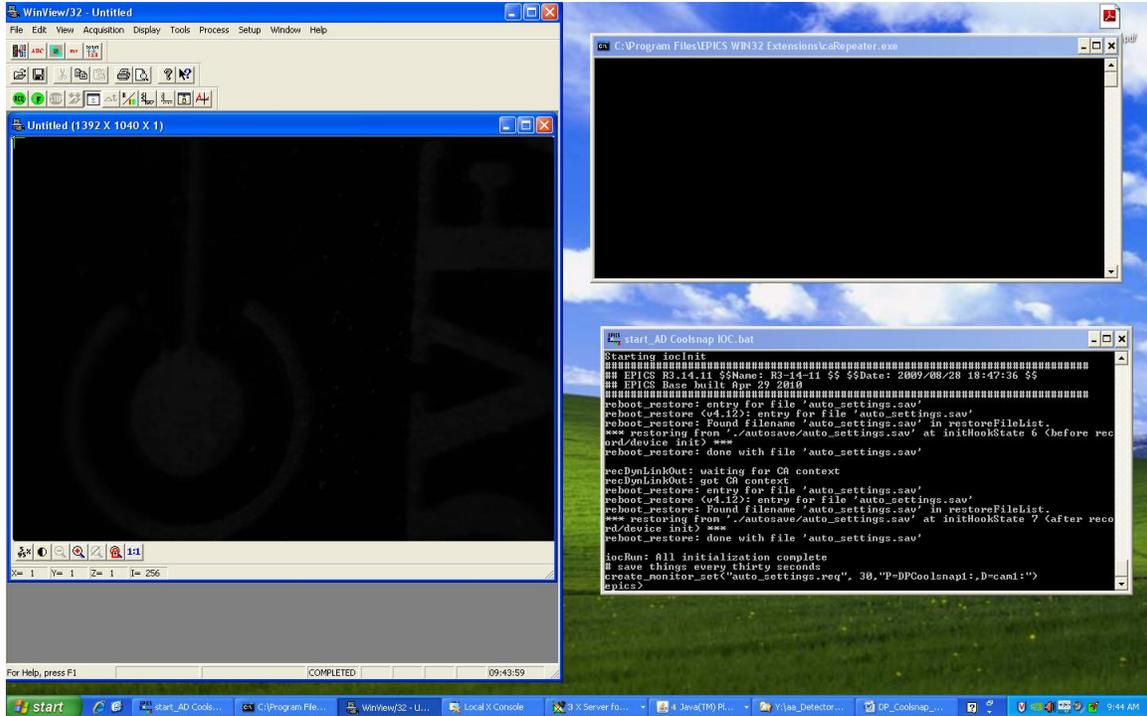
start_AD Coolsnap IOC.bat starts the areaDetector IOC.

start_AD Coolsnap medm.bat starts the areaDetector adl screens.

start_IJ Coosnap viewer.bat starts the ImageJ areaDetector viewer.

Starting the CoolsnapHQ areaDetector IOC

Double click *start_AD Coolsnap IOC*. WinView, caRepeater, and the IOC will start.



WinView and caRepeater windows are not used and they may simply be minimized.

When the IOC returns the prompt “epics>”, double click *start_AD Coolsnap medm*. Exceed and the Roper.adl screen will launch.

Area Detector Control - DPCoolsnap1:cam1:

Setup

asyn port ROPER1
 EPICS name DPCoolsnap1:cam1:
 Manufacturer Roper Scientific
 Model PVCAM
 Connected
 Connection
 Debugging

Shutter

Shutter Type
 Roper Shutter Mode
 Status: Det. Closed EPICS Closed
 Open/Close
 Delay: Open 0.000 Close 0.000
 EPICS shutter setup

Collect

Exposure Time 0.100 0.100
 Acquire Period 0.000 0.000
 # Exposures/Image 1 1
 # Exposures Complete 0
 # Images/Acquis. 1 1
 # Images Complete 0
 # Acquisitions 1 1
 # Acquisitions Complete 16
 Image Mode Continuous
 Trigger Mode Free run
 Done
 Acquire
 Detector State Idle
 Time Remaining 0.000
 Image Counter 1 19
 Image Rate 0.0
 Array Callbacks Enable

Readout

	X	Y
Sensor Size	1392	1040
Binning	1	1
Region Start	0	0
Region Size	1392	1040
Reverse	No	No
Image Size	1392	1040
Image Size (bytes)		2895360
Gain	1	1
Auto type	Yes	Yes
Data type		UInt16
Temperature	-26.950	-27.500

Plugins

File ROI
 Statistics Other

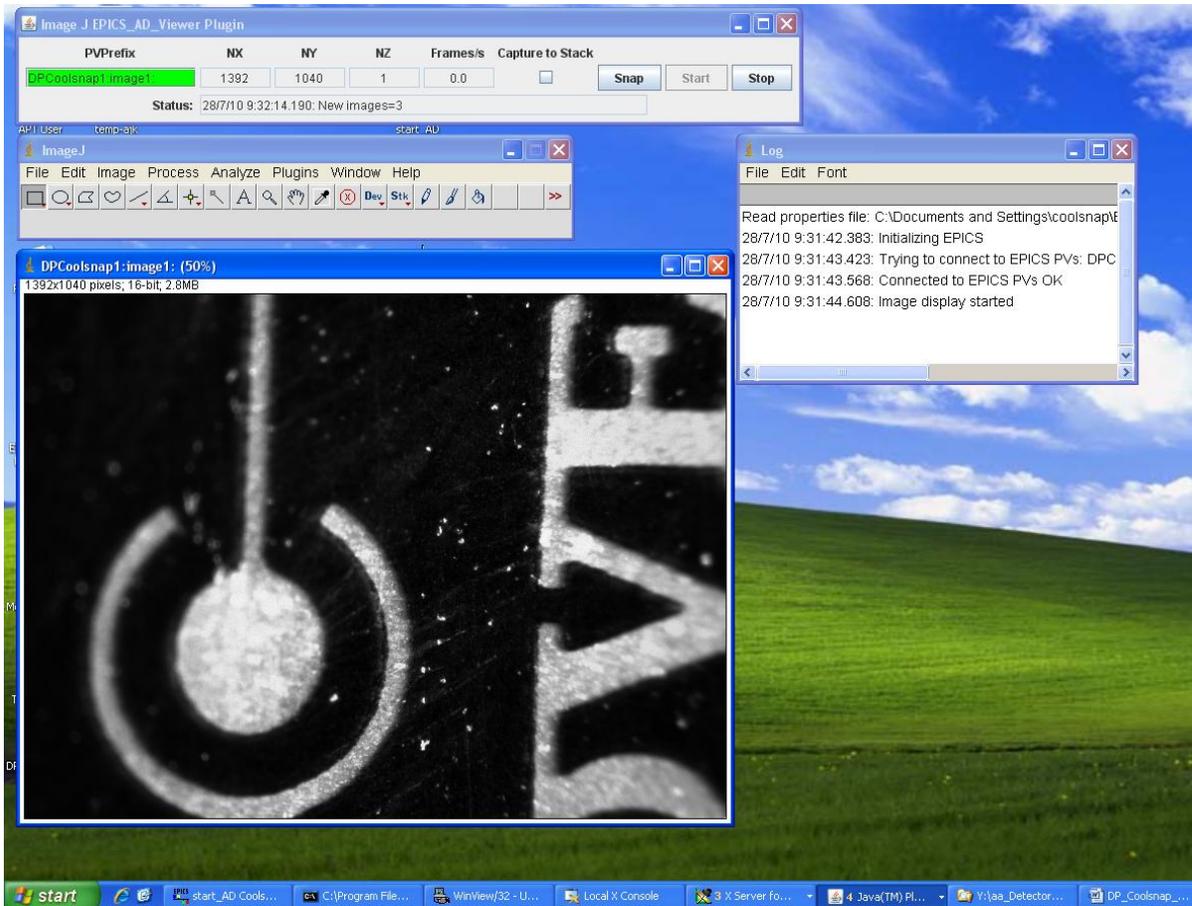
Attributes

File

File

Driver File I/O

Start the ImageJ viewer by clicking on the *start_IJ Coosnap viewer*. The following screens will launch:



The “PVPrefix” in the “Image J EPICS_AD_Viewer Plugin” window must match the prefix in the IOC. The IOC prefix is displayed at the top of the Roper.adl screen and next to “EPICS name”, which is “DPCoolsnap1” here. When the PV connects the field turns green. If an image was not collected before the viewer was started, the image window will not display. Collect an image and the window will automatically launch.

Saving CoolsnapHQ Images in areaDetector

The coolsnap uses 12-bit data and there are two options for saving images with areaDetector: the WinView driver or areaDetector plugins. The WinView driver only has TIFF and SPE formats available. AreaDetector has plugins available for TIFF, netCDF, Nexus, and JPEG formats.

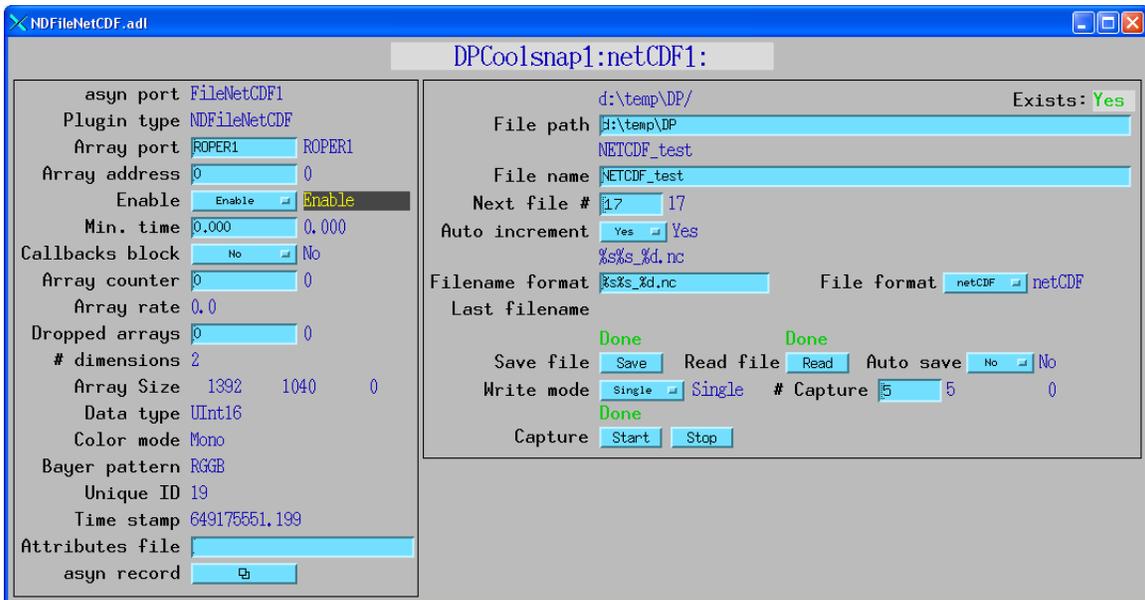
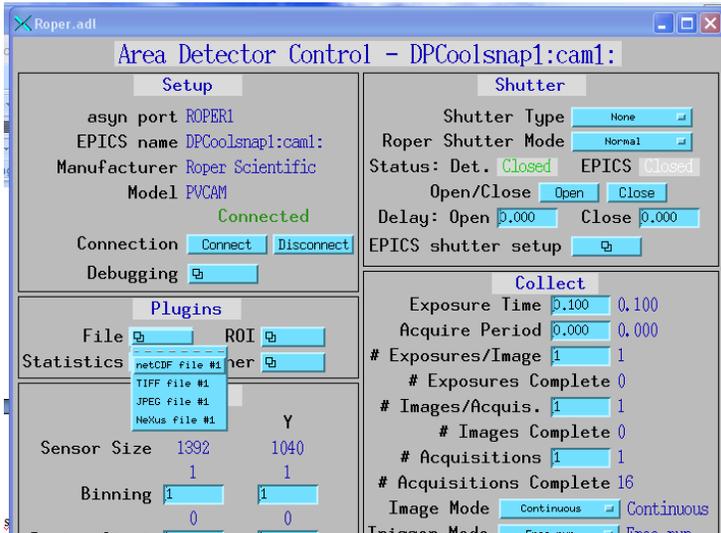
To save images from the WinView Driver, click on the “Driver File I/O” blue menu box. The following RoperFile.adl screen will launch:

The screenshot shows a dialog box titled "RoperFile.adl" with a subtitle "DPCoolsnap1:cam1:". The dialog contains the following fields and controls:

- File path:** d:/temp/DP/ (Exists: Yes)
- File name:** test_1
- Next file #:** 65
- Auto increment:** Yes (checked)
- Filename format:** %s%s_%d.tif
- File format:** TIFF (checked)
- Last filename:** d:/temp/DP/test_1_64.tif
- Comment 1-5:** Five empty text input fields.
- Save file:** Save (button)
- Read file:** Read (button)
- Auto save:** No (checked)

Comments entered in lines 1-5 will only be written to SPE format.

To save images using areaDetector plugins, click on the “File” blue menu box in the Plugins section of the Roper.adl screen. Select the desired plugin.



The desired plugin should be enabled using the “Enable” menu box. If more than one plugin is enabled, each will save it’s own copy of the image. If auto save is enabled and continuous mode is used, all files will be save during focusing (this may fill up the local disk). If you are saving images locally, only save images to D:\.

All of the above MEDM screens are available on the APS Share. See the linked page below:

[Detector Pool computing Information Page](#)

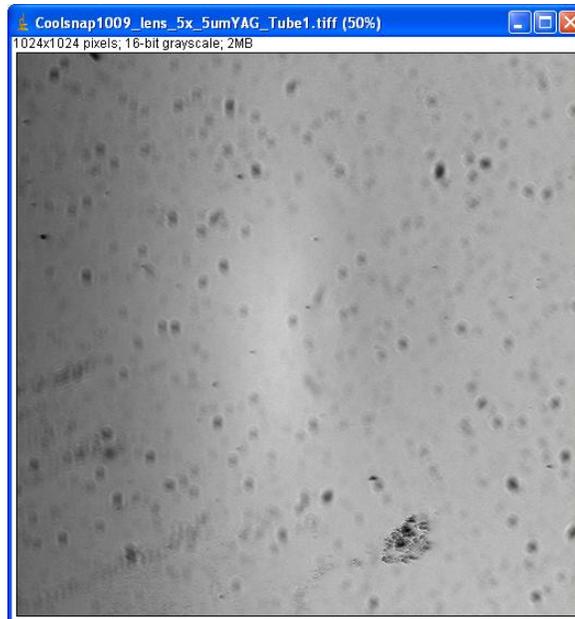
Initial Data Collection

Focusing

1. Enter the file path and base name in the desired plugin and turn off auto save.
2. In the Roper.adl select “Continuous” Image Mode and “Free run” Trigger Mode.
3. Click “Start”. The camera will begin acquiring data. It will appear in the image window of the ImageJ viewer. Each pixel is 6.45 um. When you place the cursor over the screen the value of the x and y position will be displayed as well as the count value for that pixel in the main ImageJ window. The range for the *Value* variable is from 0 (no counts) to 4095 (saturation).

Acquisition

1. Enter the file path and base name in the desired plugin and turn on auto save.
2. In the Roper.adl select the desired Image and Trigger mode. An external trigger cable for the I/O port on the back of the CoolsnapHQ is available from the Detector Pool by calling 2-9490.
3. For triggering the Detector with SPEC see: [Detector Pool computing Information Page](#)



In the above image it was determined that the blob in the lower right part was junk that was on the scintillator crystal. We were able to crudely focus on the junk by dialing the brass lens dials forward and back through the focal depth of the optics. The remaining dot pattern was determined to be dust particles that were within the lens tube and/or on the surface of the glass window on the coolsnap in front of the CCD chip. (Dust on the

CCD window will show up as artifacts much more than dust in the tube lens since light rays are converging close to the CCD window.

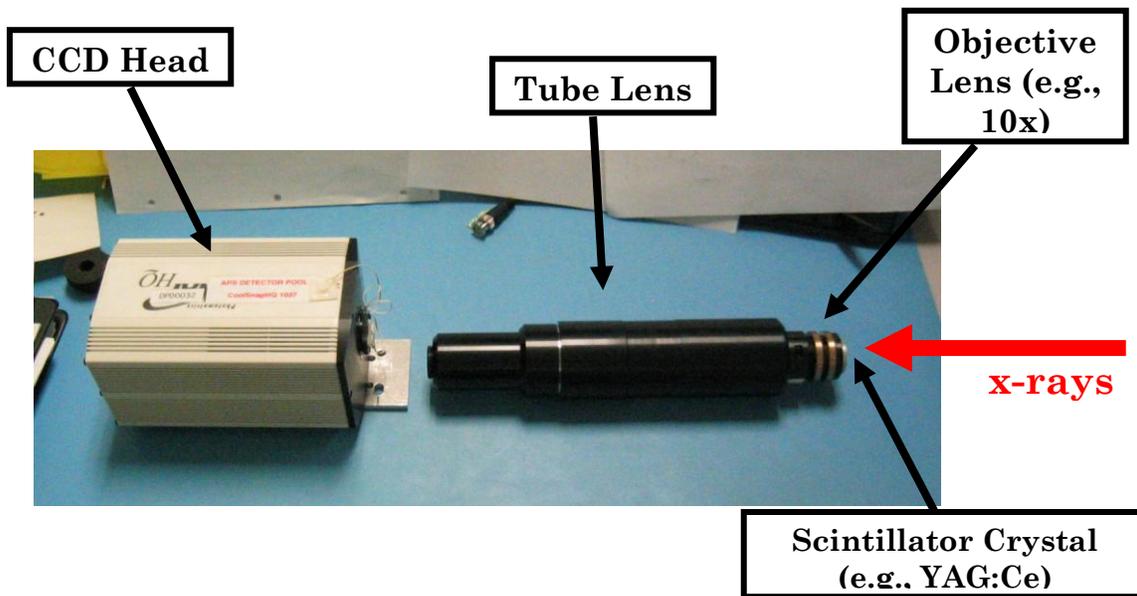
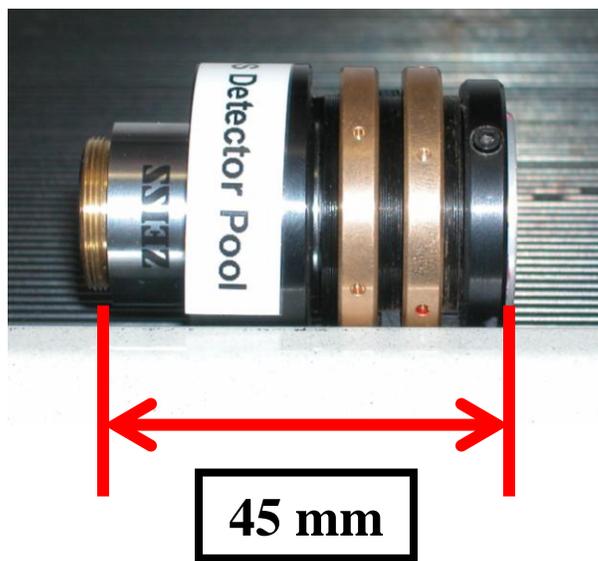
Paul Zschack managed to focus the CoolSnap by placing a TEM grid in front of the scintillator. Illuminating it with visible light allowed him to define an image on the scintillator surface. He confirmed the focus with x-rays.

Focus Image Mode

As of March 2011, we will not be supporting the “Focus” Image Mode on DP CoolSnap computers. The focus image mode did interact cleanly with WinView, and frequently hung the PC’s. We have removed this option from our medm screens. If you need the same functionality, please select “Continuous” Image Mode, “Free Run” Trigger Mode, and disable auto-saving of the resulting images.

CoolSnap Optics General Information

The microscopy optics used with the DP CoolSnap were handed down from designs from Sector 2. They use Zeiss Objective Lenses which are infinite-corrected. This means that a tube lens is needed to re-image onto the CCD focal plane. The tube lens was custom-made by an optics consultant (Uwe Langenbach at Desna Laboratories, Inc. in White Plains NY (914) 948-9502). The scintillating crystal is mounted on a black anodized holder with 2 brass rings for manual focusing (Emil Trakhtenberg). The optics are designed in such a way that the nominal focus of the optics is fixed. **Nominally, the crystal should be 45mm front the back edge of the objective lens (see picture).** Using calipers, one can get in the right ballpark. The next step is to use the imperfections that are attached to the crystal to focus. (See above images.) Using a bright light shining on the crystal, you will be able to see various things (“junk”) on the crystal. (You can tell what is on the crystal versus other artifacts from dust downstream in the tube lens and CCD by rotating the objective lens and see what moves.) The final step is to use x-rays. The crystals in the DP have thin active/doped layers (e.g., 1 and 5 microns). So, we want to focus on the thin doped layer. There are various ways that Beamline Scientists tend to do this (ask Francesco de Carlo or Christoph Rau). We need to learn this, but we also need beamtime or an x-ray tube.



Inventory

Currently, the Detector owns 2 CoolSnap CCD heads and 2 sets of optics.

1.)

DP Inventory #: DP00026
Database ID: CoolSnapHQ_1009_DP00026
Serial Number: A03G881009
Power Supply: DP00086
Data Cable: DP00088
Plate: DP00091

2.)

DP Inventory #: DP00032
Database ID: CoolSnapHQ_1037_DP00032
Serial Number: A03B881037
Power Supply: DP00084
Data Cable: DP00087
Plate: DP00089

Computers :

Computer: DP00210
Name: COOLSNAP1
PVPrefix DPCoolsnap1

Computer: DP00212
Name: COOLSNAP2
PVPrefix DPCoolsnap2

Note: Each computer has been configured to run with either detector.

Software: CCD Image Server (written by Brian Tieman, V4.0.2)
CCD Image Server Docs contains information supplied by Brian
on how the software operates
ImageJ (Image processing and analysis in Java tool from NIH)