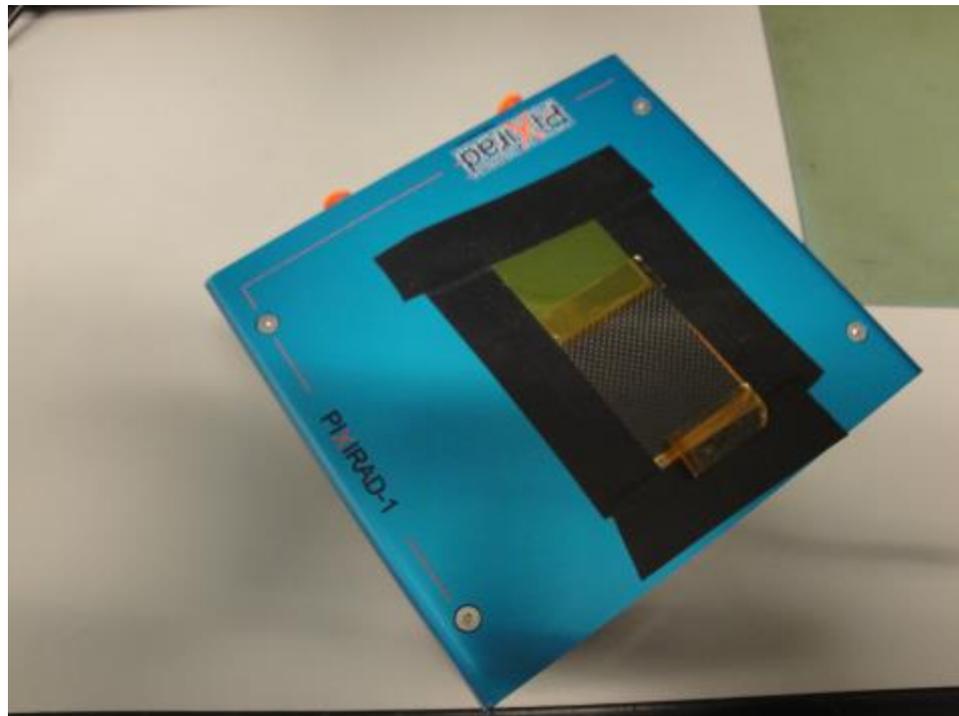
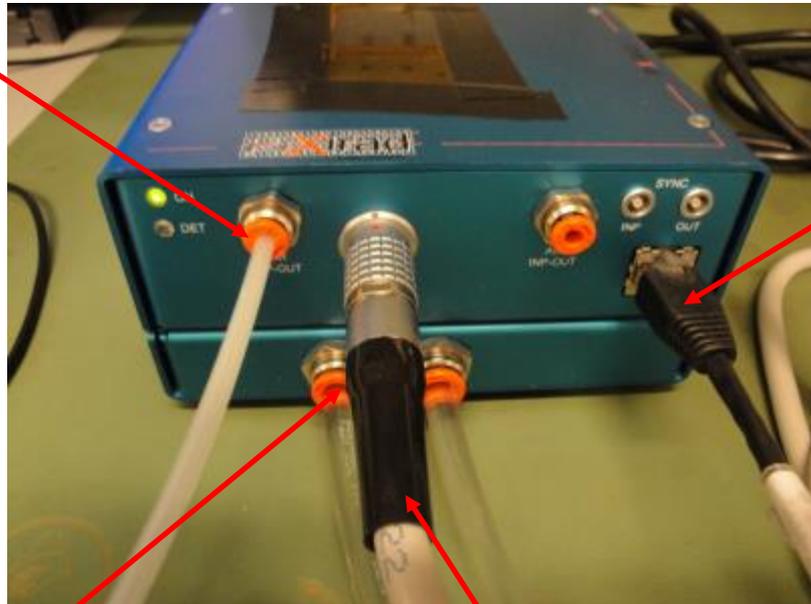


# Pixirad-1: Area Detector with CdTe Sensor Detector Pool Guide



# Quick Start: Mechanical Connections

Please flow nitrogen or some other dry gas to avoid condensation within the detector enclosure. Flow rate: 0.5 liters/minute ( $\leq 3$  liter/min for best performance). IN/OUT tube Outer Diameter: 4mm



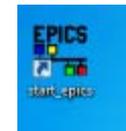
Cat 5 or 6: Connects to 2<sup>nd</sup> ethernet card on PC (in expansion bus)

Chiller lines

From power supply

# Quick start

- Mounting detector to your experimental setup:
  - Please mount with M3 screws – several mounting holes are available on the sides or bottom (remove rubber feet) of the detector head.
  - Mounting plate is available from the DP staff.
- IOC Startup:
  - Login information:
    - Username: Pixirad
    - Password: !apsDP9490!
  - Ensure that the chiller is connected and running
  - Ensure that the detector power supply is turned on (switch on back of 2<sup>nd</sup> box).
  - IOC startup icon is on the desktop:
    - Clicking will launch both the ioc and medm screen
- After dry gas has flowed for a few minutes, turn cooling on. Recommended to run at -30°, but ensure that setting is not below dew point or sensor will ice up.
- HV settings: Run at 400V once chilled. Leave “HV Mode” in “auto” and “HV State” in “off”. HV is turned on automatically once you start an acquisition.
- Run “Auto Calibrate” before taking data.



# Medm Screen

The screenshot displays the 'Pixirad Detector Control - 13PR1:cam1' window. It is divided into several functional panels:

- Setup:** Shows configuration for 'asyn port' (PIXI), 'EPICS name' (13PR1:cam1), 'Manufacturer' (Pixirad), and 'Model' (Pixirad 1). It indicates the device is 'Connected' and provides 'Connect' and 'Disconnect' buttons.
- Shutter:** Controls the detector's shutter mode (set to 'None'), status (Det. Closed, EPICS Closed), and provides 'Open' and 'Close' buttons. It also shows delay times for opening and closing (0.000) and an 'EPICS shutter setup' button.
- High Voltage:** Manages the high voltage system, including 'HV mode' (Auto), 'HV state' (Off), 'HV setpoint' (400.0 V), 'HV value' (0.0 V), and 'HV current' (0.0 nA).
- Collect:** Manages data acquisition parameters such as 'Exposure time' (0.010), 'Acquire period' (0.000), '# Images' (1000), and 'Images collected' (0). It also shows 'UDP speed' (0.0 MB/s) and 'UDP buffers free/max' (1500/1500).
- Environmental:** Monitors environmental conditions like 'Cooling' (On), 'Setpoint' (5.0 C), and various temperatures (Cold: 22.8 C, Hot: 17.5 C, Box: 24.8 C). It also shows 'Box humidity' (14.5%), 'Dew point' (-4.1 C), and 'Peltier power' (0.0%).
- Detector:** Configures detector parameters including 'Detector Size' (476 x 512), four energy thresholds (all at 30.0 keV), 'Sync in/out polarity' (both Pos.), 'Sync out function' (Read done), 'Auto calibrate' (AutoCal), and a 'System reset' button.
- Status:** Provides real-time feedback, showing 'Status: Server returned OK' and communication logs to and from the server.

# A few notes about detector operation

- Detector has 2 counters per pixel, and two discriminators per counter
  - Thresholds determine discriminator settings
  - Frame type field configures discriminators and counters:
    - 1 color low – acquires single image using lower discriminator
    - 1 color high – acquires single image using upper discriminator (threshold 2)
    - 2 color – implements both discriminators in single counter. Actually records 2 images to output file.
    - DTF modes – Reads out single counter while other counter is being used to acquire data. Permits fastest data acquisition.
      - 2 color DTF uses threshold 1 and 3
- Images are saved through Area Detector plug-ins. 2 or 4 color modes can only be saved through NetCDF or HDF formats.
- First image of multi-image acquisitions is always blank.
- “Stopping” image acquisition does not work properly, and will require detector reset (red button on lower left) before resuming detector operations.

# Viewers

- An ImageJ shortcut is available on the desktop
- If ImageJ fails to display your images:
  - Double check that you have the detector properly named in the ImageJ plugin.
  - On the medm screen, ensure that “array callbacks” and the Image1 plug-in are both enabled.



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**The Chromatic Photon Counting**

# The PiXirad imaging sensors

**PIXIRAD-1: a single unit system, 250K pixels, 500K counters**  
**3x2.5 cm<sup>2</sup> active area**

Sensor specs:	
CdTe, 650 μm, 30.9 × 25.0 mm <sup>2</sup> Schottky type diode Electron collection at pixel	
ASIC+CdTe base block	512 × 476 pixels
Number of blocks	1
Global active area	31 x 25 mm <sup>2</sup>
Total number of pixels	243712
Total number of counters	487424
Pixel size	60 μm hexagonal arrangement
Pixel density	323 pixels/mm <sup>2</sup> , equivalent to 55 μm on square arrangement
Pixel rate capability	10 <sup>6</sup> counts/pixel/s (after dead-time correction)
Global rate capability	2.4x10 <sup>11</sup> counts/s
Pixel dead-time	300 ns
Position resolution	11 line pairs/mm at MTF 50%
Reading while taking data	possible
Energy range	1-100 keV
Detection efficiency @10 keV, 25 keV, 50 keV	100%, 100%, 98%
Counters depth	15 bits
Read-out time @50 MHz clock	5 ms/counter
Frame rate	200 readouts/s
Minimum applicable global threshold	200 electrons
Sensor bias voltage	200 + 400 V
Leakage current density	5 nA /cm <sup>2</sup> at 400 V, -20 °C
Typical number of defective pixels	less than 1%
Number of independent thresholds (colors)	2 set of two (swappable in real time)
Camera specs:	
Size (W×L×H)	14×14×7 cm <sup>3</sup>
Weight	< 2Kg
Power consumption	60 Watts (typical)
Cooling	liquid or forced air
Operating temperature	+40 -40 °C