Pixirad-1: Area Detector with CdTe Sensor
Detector Pool Guide
Quick Start: Mechanical Connections

Air flow, OD: 4mm Necessary to avoid condensation within the detector enclosure. Flow rate: 0.5 liters/minute ((≤3 liter/min for best performance).

NOTE: Please disconnect the air from the detector while adjusting the flow. Over pressuring will tear the Mylar film!

Cat 5 or 6: Connects to 2nd 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:
    • Ask Detector Pool for Login information. Ext 2-9490
  - Ensure that the chiller is connected and running
  - Ensure that the detector power supply is turned on (switch on back of 2nd 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

### Settings
- **Async Port**: PXI
- **EPICS Name**: 13PR1:cam1
- **Manufacturer**: Pixirad
- **Model**: Pixirad 1
- **Connection**: Connected
- **Debugging**: Off

### Shutter
- **Shutter Mode**: None
- **Status**: Det. Closed
- **Open/Close**: Open / Close
- **Delay**: Open 0.000 / Close 0.000
- **EPICS Shutter Setup**: Off

### High Voltage
- **HV Mode**: Auto
- **HV State**: Off
- **HV Setpoint**: 400.0 / 400.0 V
- **HV Value**: 0.0 V
- **HV Current**: 0.0 mA

### Environmental
- **Cooling**: On / Off
- **Setpoint**: 5.0 C
- **Cold Temp.**: 22.8 C
- **Hot Temp.**: 17.5 C
- **Box Temp.**: 24.8 C
- **Box Humidity**: 14.5 %
- **Dew Point**: -4.1 C
- **Peltier Power**: 0.0 %
- **Status**: OK

### Collect
- **Exposure Time**: 0.010 / 0.010
- **Acquire Period**: 0.000 / 0.000
- **# Images**: 1000 / 1000
- **Images Collected**: 0
- **Colors Collected**: 0
- **UDP Buffs Read**: 0
- **UDP Speed (MB/s)**: 0.0
- **UDP Buffs Free/Max**: 1500 / 1500
- **Frame Type**: 2 color DIT / 2 color DITF
- **Trigger Mode**: Internal / Internal
- **Done**: Off
- **Acquire**: Start / Stop
- **Image Counter**: 0
- **Image Rate**: 0.0
- **Array Callbacks**: Enable / Enable

### Status
- **Status**: Server returned OK
- **To Server**: DAQ!: INIT 5.0 0 400.0 0
- **From Server**: DETECTOR 1022 GOT: DAQ!: INIT 5.0 0 400.0 0
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... Not well tested!
      - 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.
- “Stop” image acquisition does not work properly, and will require detector reset (red button on lower left) before resuming detector operations.
- “Acquisition Period” is used to increase the time between images. There is a 8ms readout time per counter, and the detector will wait before starting the next acquisition. To maximize your framerate for a given exposure time, set “Acquisition Period = 0.0”
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.
## The PiXirad imaging sensors

**PIXIRAD-1**: a single unit system, 250K pixels, 500K counters
3×2.5 cm² active area

### Sensor specs:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASIC+CdTe base block</td>
<td>512 × 476 pixels</td>
</tr>
<tr>
<td>Number of blocks</td>
<td>1</td>
</tr>
<tr>
<td>Global active area</td>
<td>31 x 25 mm²</td>
</tr>
<tr>
<td>Total number of pixels</td>
<td>243712</td>
</tr>
<tr>
<td>Total number of counters</td>
<td>487424</td>
</tr>
<tr>
<td>Pixel size</td>
<td>60 µm hexagonal arrangement</td>
</tr>
<tr>
<td>Pixel density</td>
<td>323 pixels/mm², equivalent to 55 µm on square arrangement</td>
</tr>
<tr>
<td>Pixel rate capability</td>
<td>$10^6$ counts/pixel/s (after dead-time correction)</td>
</tr>
<tr>
<td>Global rate capability</td>
<td>$2.4 \times 10^{11}$ counts/s</td>
</tr>
<tr>
<td>Pixel deadtime</td>
<td>300 ns</td>
</tr>
<tr>
<td>Position resolution</td>
<td>11 line pairs/mm at MTF 50%</td>
</tr>
<tr>
<td>Reading while taking data</td>
<td>possible</td>
</tr>
<tr>
<td>Energy range</td>
<td>1-100 keV</td>
</tr>
<tr>
<td>Detection efficiency @10 keV, 25 keV, 50 keV</td>
<td>100%, 100%, 98%</td>
</tr>
<tr>
<td>Counters depth</td>
<td>15 bits</td>
</tr>
<tr>
<td>Read-out time @50 MHz clock</td>
<td>5 ms/counter</td>
</tr>
<tr>
<td>Frame rate</td>
<td>200 readouts/s</td>
</tr>
<tr>
<td>Minimum applicable global threshold</td>
<td>200 electrons</td>
</tr>
<tr>
<td>Sensor bias voltage</td>
<td>200 + 400 V</td>
</tr>
<tr>
<td>Leakage current density</td>
<td>5 nA/cm² at 400 V, -20 °C</td>
</tr>
<tr>
<td>Typical number of defective pixels</td>
<td>less than 1%</td>
</tr>
<tr>
<td>Number of independent thresholds (colors)</td>
<td>2 set of two (swappable in real time)</td>
</tr>
</tbody>
</table>

### Camera specs:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (W×L×H)</td>
<td>14×14×7 cm³</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt; 2Kg</td>
</tr>
<tr>
<td>Power consumption</td>
<td>60 Watts (typical)</td>
</tr>
<tr>
<td>Cooling</td>
<td>liquid or forced air</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>+40 –40 °C</td>
</tr>
</tbody>
</table>