Detector Pool's Pilatus User Guide

Logistics & basics....

1. **Computer & Power must live in the hutch.**
2. **Turn on Computer & log in using the local keyboard/monitor.**
3. **Turn on the Pilatus Power Supply, preferably after you have mounted the detector!!!!**
4. **Try to write data to networked disk space.**
5. **Shutdown: In the reverse order.**

How to log into Pilatus DAQ Computer, remotely?

- **Please open all the control windows from outside the hutch.**
- **Connect the Pilatus Computer via Unix or X-server software on PC (e.g., cygwin or EXCEED).**

ssh -Y det@164.54.107.190 (at Sector 7... IP might vary.. 164.54.107.19?)
Ask DP staff for the Password!!! (Should be the standard one)

Notes:

1. You might not need the -Y depending on your version of UNIX. It is sometimes needs to get X-Windows forwarding to work properly.
2. You can get the IP address by logging into the computer from the Console and open an xterm. The IP should be listed in the prompt. Or open up a web browser and go to: http://www.whatismyip.com/

Pilatus software:

From the home directory (/home/det/):

./start_camonly

This starts one window: camserver
Keep the camserver window around, since it will tell you if the system is having problems.

EPICS (talks to camserver)

1. From Pilatus control computer (e.g., det@164.54.107.199), type: **./start_epics**
   This will start the EPICS ioc and also the medm screens simultaneously. The EPICS IOC must run on the Pilatus control computer.
2. [Optional] You can start the Pilatus MEDM screens from your local beamline computer if it access to APSshare. Depending if you have Pilatus #1 or Pilatus #2, you would start one of these two scripts:
   /APSshare/DetectorPool/start_pilatus1_medm or
   /APSshare/DetectorPool/start_pilatus2_medm

Last Revised: 3/18/2011

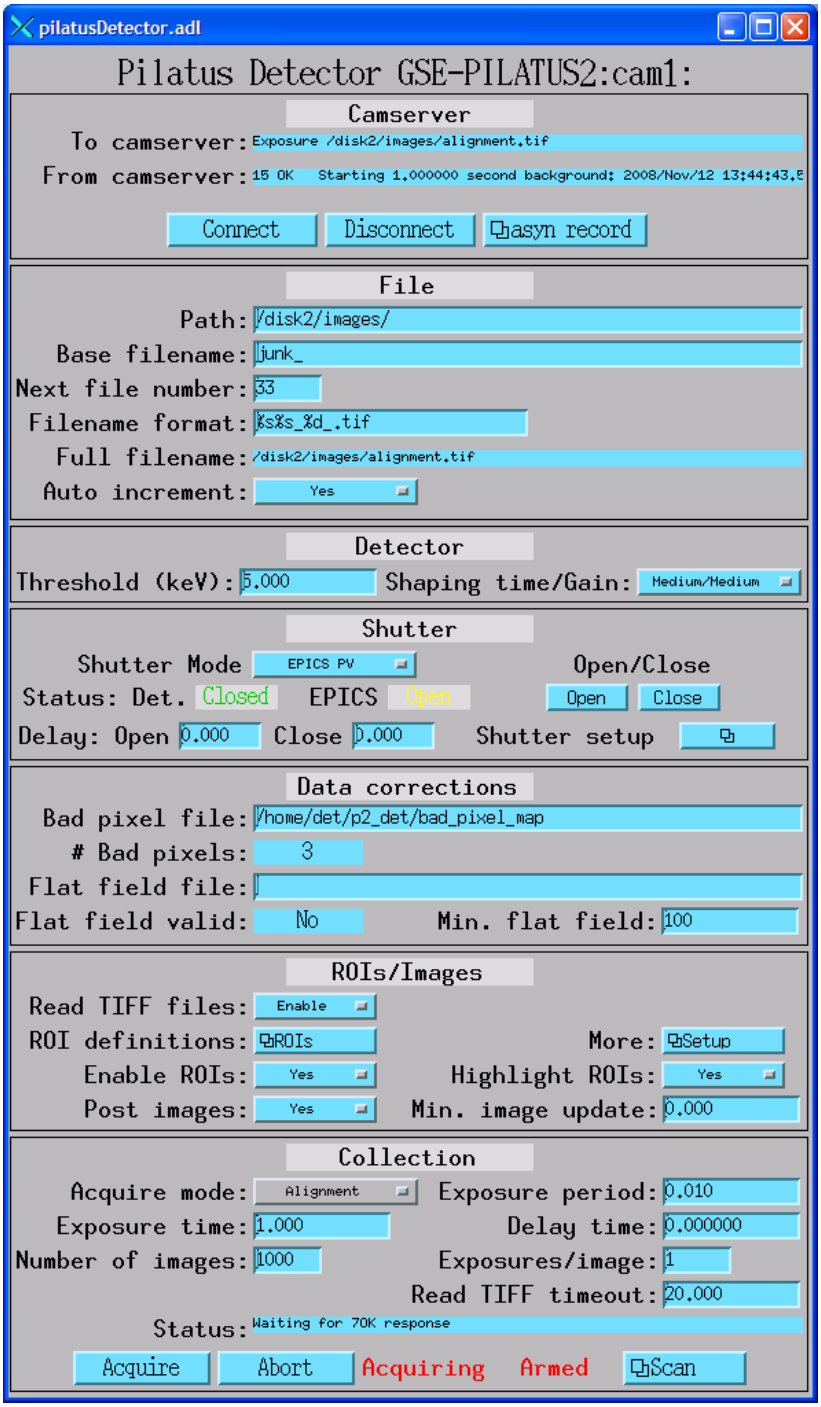
Storing Data:

While data can be written to the Pilatus computer, it is strongly recommended that you write your data to network mounted disk space. Locally mounted /disk2 is a large HDD that can be used for storing your images. However, DP computers see a lot of heavy use. While we do our best to maintain reliable disk space, we cannot guarantee that you will not have a disk failure. Network disk space is a more stable option. Network mounted /disk3 provides 100GB of disk space for data storage. Please copy (and delete) files before returning our equipment so that the disk space is available for the next user. Transfer of images over the network is fast enough to keep pace with the highest Pilatus frame rates.

Other disk resources may be available at your sector (consult beamline staff), and users are always welcome to mount their own media (large flash drives, USB-HDD, etc).

ImageJ Plugin Viewer

1. From the home directory (/home/det): **./start_viewer**
2. You can also start the ImageJ viewer from your local beamline computer if you have access to APSshare. Details are below. The script to run is:
   /APSshare/DetectorPool/start_ImageJ_viewer
3. For a guide on how to use this, look for instructions later in this document.



Pilatus MEDM screen

http://cars9.uchicago.edu/software/epics/pilatusDoc.html

Last Revised: 3/18/2011

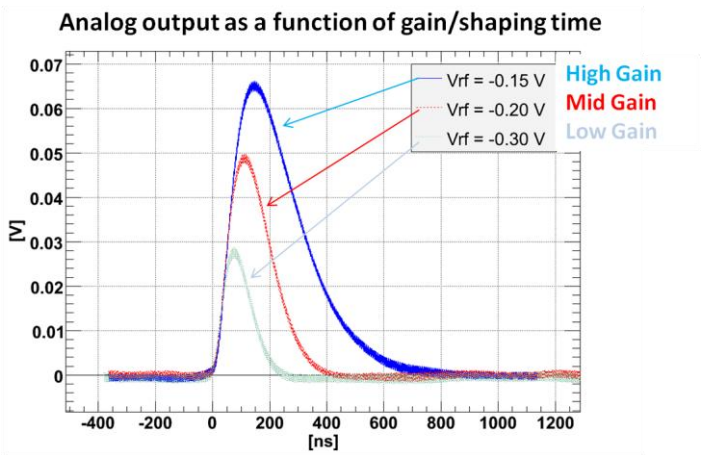
Thresholds & Shaping time/Gain:

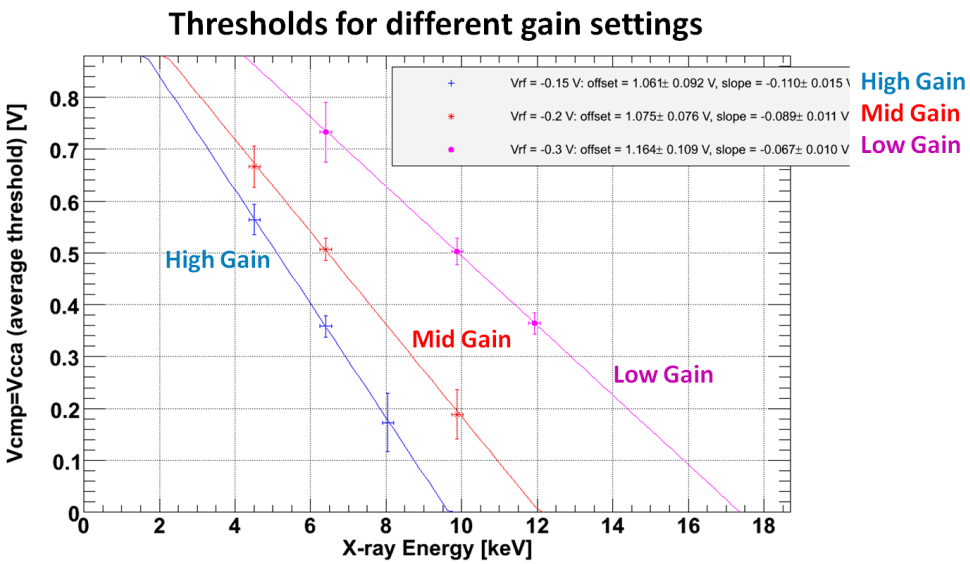
Lower level thresholds are currently set via EPICS. You can also adjust the shaping time/gain parameter. Shaping time and gain are linked. The threshold should ideally be set at 50% of the beam/scattering energy. If you set the closer to the beam energy, your efficiency will be reduced; in effect you are making the pixel size smaller. 50% minimize the number of missed photons from split between two pixels. In order to reach this 50% point you need to pick an appropriate gain. (Note: If you want to suppress fluorescence from a sample, Dectris recommends setting the threshold about 0.5keV above the fluorescence line.)

Here are some guidelines:

Beam Energy: 4.0 - 9.0 keV → High Gain/Slowest Shaping time
Beam Energy: 5.0 - 12.0 keV → Mid Gain/Medium Shaping time
Beam Energy: 7.0 - 18.0 keV → Low Gain/Fast Shaping time

For example, if your beam energy is 10keV, then use Mid Gain with threshold at 5 keV. (If you use Low Gain, you are close the hardware limit of the comparator level. These ranges are overlapping; picking the lower gain is usually better.

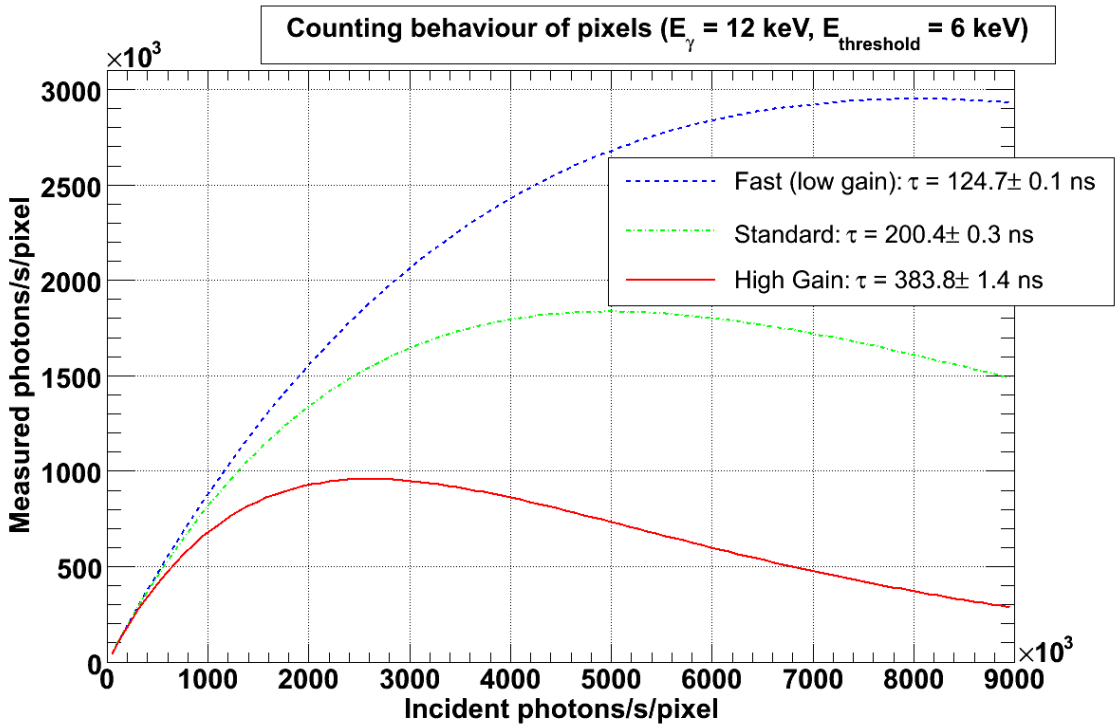




Last Revised: 3/18/2011

Deadtime corrections

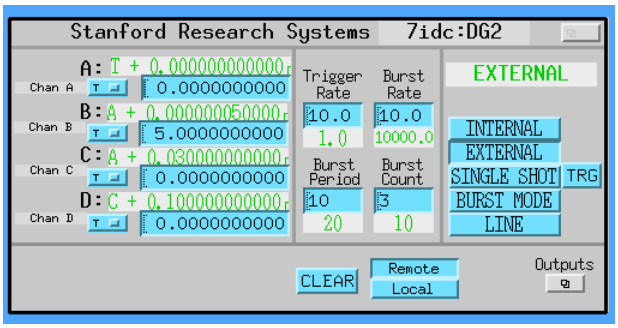
The low gain is the fastest shaping time, so for highest count rate throughput you would like use this, if you can afford given the energy threshold discussion in the previous section. If you assume that the x-rays are not pulsed, then the deadtime curves will follow a paralyzable model (see figure below). If you are using a synchrotron with a non-symmetric fill pattern (e.g. hybrid singlet), your deadtime curve will be different. Proper deadtime corrections in the 3 APS timing modes will be published soon. Refer to this paper for some help: Walko et al, *J. Synchrotron Rad.* (2008). **15**, 612-617 **(http://scripts.iucr.org/cgi-bin/paper?S0909049508022358)**



Last Revised: 3/18/2011

Acquisition Modes

1. **Internal – This is the software triggered mode. Just specify *Exposure Time* and hit acquire. You can also specify *Number of Images.* Ignore *Exposure Period* and *Exposures/image* parameters.**
2. **External Trigger – If you want to synchronize your exposure sequence with an external event (e.g., some sample reaction), use this mode. You specify *Number of Images*, *Exposure time*, and *Exposure Period*. The *Exposure Period* must be greater than *Exposure Time* plus 4 milliseconds to allow for readout. You arm the detector by hitting the acquire button. The Pilatus will wait until it sees a TTL rising edge on its external input LEMO. It is best to use a base filename which does not end in an underscore. It will produce individual files that are indexed properly. For example, use a base filename, like: image It is best to save data to the local disk in this mode. (Typical Application: time-resolved SAXS)**
3. **Multiple External Trigger In this mode, Pilatus uses the programmed ExposureTime, in addition to NImages and NExposures. Each external trigger pulse causes the Pilatus to collect one image at the programmed exposure time. This mode works well with a trigger source like the Newport motor controllers or the SIS380x multichannel scaler, that put out a short trigger pulse for each image. One only needs to take care that the time between external trigger pulses is at least 4msec longer than the programmed exposure time, to allow time for the detector to read out before the next trigger pulse arrives. (M. Rivers)**
4. **External Enable – This is for gating the detector (e.g., on a single-bunch for pump-probe studies such as at 7-id and 20-id). You specify Exposure/image (e.g., 65000) and it will gate for this many times (LEMO Input: Extern In). So, set the the exposure period to the period that the external triggering is coming in at. (This is only need to that the detector can calculate an internal timeout time.) This feature essentially does on-chip summing. Things to note: If using the SRS SDG 535, use TTL Normal High Z. T is usually P0 or laser signal. A = T+delay and B = A + 30ns.**



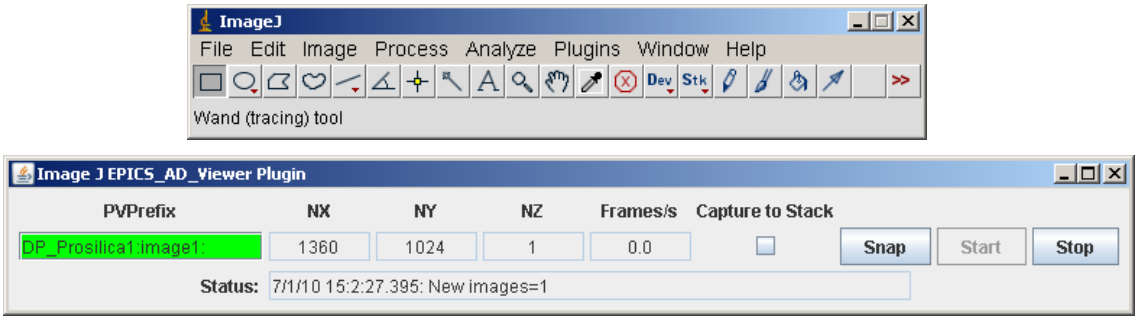
5. **Alignment – Takes images over and over again and saves to the same file. It overwrites to the same file. This is useful for alignment!**

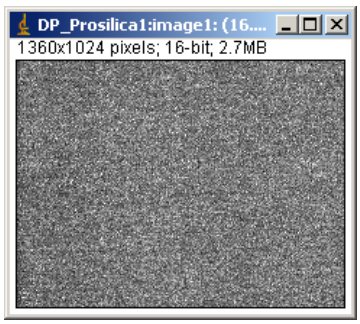
Last Revised: 3/18/2011

Image Viewer (ImageJ)

Installed on the Pilatus DAQ computer is an image display package called ImageJ. Simply type: imagej from an xterm on the Pilatus DAQ computer and it will load ImageJ. It is fairly easy to use... (File → Open → etc.) To change the gray scale contrast, type: Ctrl-Shift-c; To get a line profile, draw a line with the toolbar, then type Ctrl-k. To get statistics on the full image or a box, type: Ctrl-m. For more help go to http://rsbweb.nih.gov/ij/

ImageJ Viewer





- Remember to hit the "Start" Button
- EPICS PV: DP_Prosilica1:image1:
  - The is from the "Image Plugin"
  - Should be highlighted green
- If you have problems, close the plugin, take some images from the MEDM screen, and then restart the Viewer.
  - You can re-start from the main ImageJ widget
    - Plugins → EPICS_areaDetector → EPICS AD Viewer

Data Format

Images are saved as TIFF files. They are stored as 32-bit unsigned integers, little-endian. Each Pilatus pixel can count to 20-bits and will rollover if it goes beyond that.

Spec Interface to EPICS Area Detector

Xuesong Jiao (AES/BCDA) has written some nice macros designed to talk EPICS areaDetector. For a quick tutorial, go to:

http://wiki.aps.anl.gov/bts/index.php/Detector_Pool_Computing_Information

Last Revised: 3/18/2011