Mar165 CCD
Detector Pool Guide

Contents

Quick Start

- Connect data cable from Detector to Computer PCI card
  - Mar165 A and B have orange fiber optic cable
  - Mar165 C has a black SCSI-like cable.

- Turn on the Detector power supply
  - Use the power strip next to the chiller

- Connect Ethernet to Computer!

- Turn on computer and Login
  - user name: dpuser
  - password: (ask DP Staff)
  - Alternatively, log in with any LDAP account

- Start Software using **EPICS Launcher**
  - select 'Mar165' and click Load
  - Open MARCCD by clicking on Start


Mar165 A, B   Mar165 C
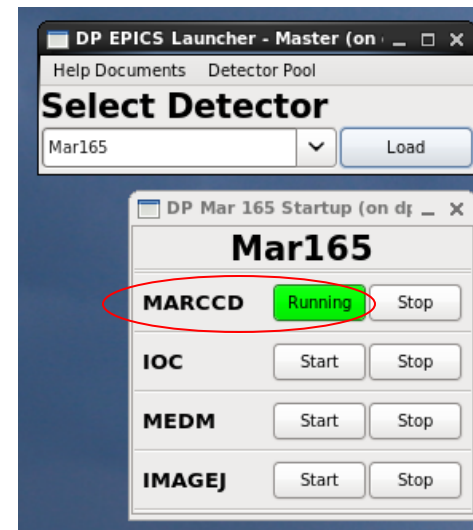
*GUI can be started with this desktop icon:

Quick Start - Reboot Detector

- Within marccd, you must Reboot the CCD controller & start cooling:
  - Locate the menu bar
  - Click on '**Configure**' → '**Detector**'
  - Select '**Reboot**'
    (should hear 2 beeps from the controller)

  - If Pressure < 1.0 Torr, then click '**Yes**' in cooling dialog box

  - Compressor should start about one minute after you say '**Yes**'

 - NOTE: cool down to -70C will require approximately 2hrs
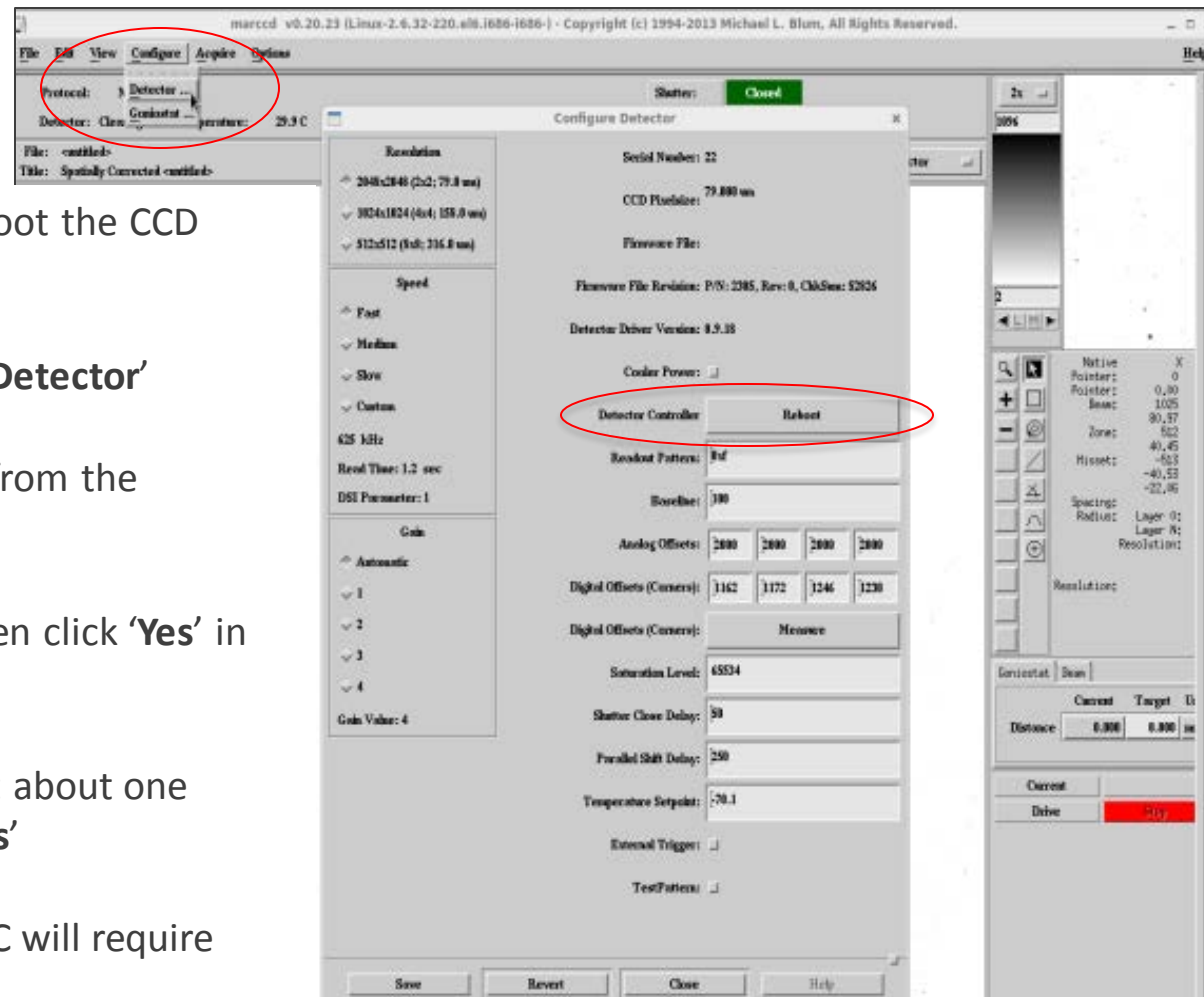
Quick Start - Enable Remote Mode

- Before the EPICS IOC can function, the detector software must be placed in Remote Mode
  - Locate the marccd menu bar
  - Click on Acquire → Remote Control
  - Click on "**Start**" in dialog box
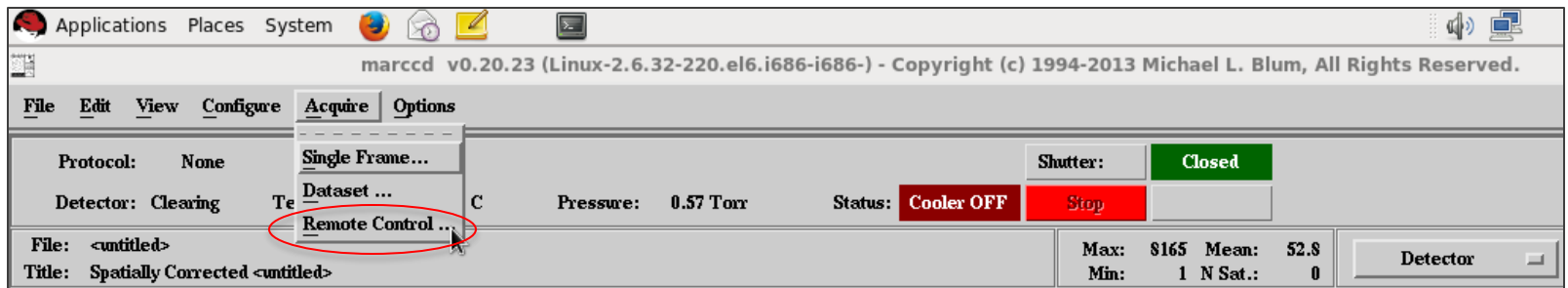
- <u>Now</u> you can start the EPICS software from the launcher:
  - start IOC
  - start MEDM
- To view images in real time:
  - start ImageJ
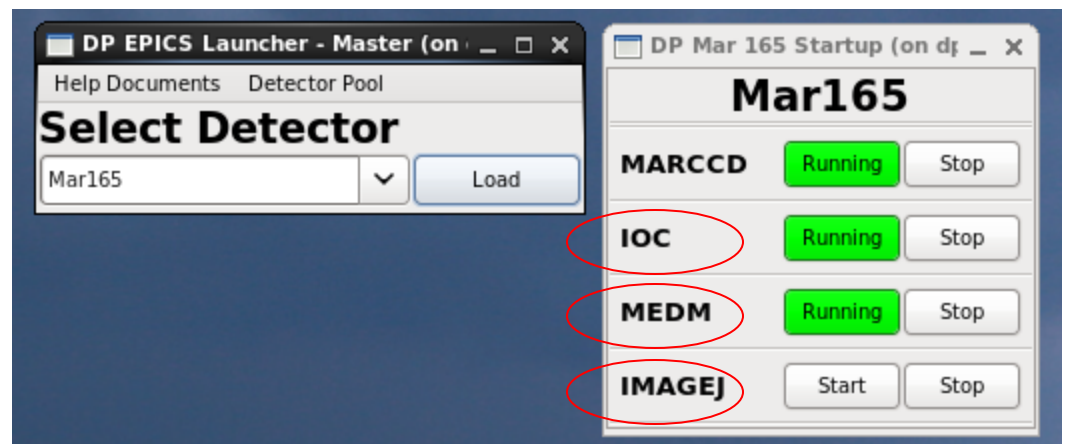
Important Notes

- **Take a Background image**, first and frequently!
  - If your file size is only 4096 bytes, then you probably did not take your first background, which marccd stores in the controller memory

- ImageJ
  - To change contrast, use the shortcut **Ctrl-Shift-c**
  - To generate a line profile, use the 'line' drawing tool from the toolbar, then type **Ctrl-k**
  - To get statistics on the full image or a box, type **Ctrl-m**
  - For additional information, see http://rsbweb.nih.gov/ij/

- Format
  - 2048 × 2048 array
  - Images are saved in the *.tif* format
  - Each pixel is binned 2x2 to a size of 80 × 80 μm^2
    (resolution is limited by the scintillator and fiber-optic taper so there is no 1x1 option)
  - Each pixel has a depth of 16-bits

Common Problems/Solutions:

Common Problems/Solutions:

- Plugins
  - Under 'All', make sure that 'Image1' is enabled
  - For tips on using other plugins, see the Detector Pool info page: https://wiki.aps.anl.gov/bts/index.php/Detector_Pool_Computing_Information

- Readout
  - Check that binning is 2x2

- Collect
  - Check that 'Array Callbacks' is enabled

- File
  - Check that the current 'File Path' exists
  - Check that the 'Filename format' is correct

- ImageJ
  - Click the '**Start**' button to activate the EPICS AD Viewer Plugin
  - Check that the PVprefix matches the MEDM screen
    - If you edit this text, you need to type 'Enter' to reconnect with the new PV
    - The box will appear green when connected (red if the PV is unreachable)
    - If the box is white, you need to click on it, and type 'Enter'
  - You can close the plugin and restart it from the 'Plugins' menu of ImageJ

Remote access to the MarCCD computer

- **You have 2 different options:**

  (1) ssh login
    - You will need the IP address of the computer
      - Open a terminal, run command: */sbin/ifconfig*
    - On the remote computer:
      - open a new terminal
      - Run the command: *ssh –Y det@[IP address]*
          (For example: *ssh –Y det@164.54.101.69*)
      - The password is the same you logged in with locally!
      - Run the command: `~/start_gui`
        - If that fails, try: `/local/DPbin/wxDPStartup/start_gui`

  (2) run MEDM and ImageJ remotely
    - You will need the correct EPICS PV prefix (eg. dp_mar165_xrd78)
    - You will need access to the APSshare network disk from the remote computer:
      - You can mount it from your sectors local dserver
          (eg. At sector 2, look for *s2dserv.xray.aps.anl.gov:/export/APSshare*)
      - Within */APSshare/DetectorPool* you will find the appropriate startup scripts
      - e.g., `/APSshare/DetectorPool/start_medm_mar165   dp_mar165_xrd78`
    - NOTE: marccd and the IOC cannot be remotely started or stopped using this method.

Storing Data:

- 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. We cannot guarantee that you will not have a disk failure.

- Network disk space is a more stable option. The transfer of images over the network is fast enough to keep pace with the fastest detector 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).

NOTE: If you do choose to save data locally, please copy (and delete) files before returning our equipment so that disk space is available for the next user.

Tech Specs

Technical Specifications	CCD165
Type	Single CCD; single fiber-optic taper
X-ray Sensitive Surface	Round, 165mm diameter (21,380mm^2)
DQE (Detective Quantum Efficiency)	Up to 0.8 for 8keV to 12keV radiation
PSF (Point Spread Function)	FWHM = 100μm; FW 1%M = 300μm
Gain	6e$^-$/12keV photon
Read Noise	9 e$^-$/pixel @ 3.5 sec. readout; 13 e$^-$/pixel @ 2.5 sec. readout
Dark Current	<0.01 e$^-$/pixel/sec. @ 2048 × 2048 pixels
Full Well Capacity	400,000 e$^-$/pixel = 65,000 12keV photons/pixel @ 2048 × 2048 pixels
Dynamic Range	16 bits
Fiber-optic Taper	2.7:1 demagnification ratio
CCD Chip	61mm × 61mm; 4096 × 4096 15μm pixels
CCD Operating Temperature	−70° C
Cooling	Closed-cycle refrigeration
Readout Electronics	4-channel readout; 16-bit ADCs

Readout Options (Software Selectable):

On-chip Binning	Pixel Size	Readout Time	Number of Pixels in Image
2 × 2	80μm	2.5 sec.	2048 × 2048
4 × 4	160μm	1.0 sec.	1024 × 1024
8 × 8	320μm	0.5 sec.	512 × 512

Computer Interface	Proprietary PCI full-frame DMA; single fiber-optic cable

Physical Dimensions:

Detector Head	21.5cm diameter × 34cm; weight: approx. 20kg
Electronics/Cooling Assembly	72cm × 43cm × 64cm; weight: approx. 60kg

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