# Focusing with IDT mirror at sector 27

March 10, 2020

Using the Prosilica camera to measure focus

Start up procedure

1. The focusing optics have two parts: a yag crystal holder and a camera.
   a. Screw the crystal holder into the top of the displex
   b. Mount the camera with the large bolt hole on the upstream plate on top of the chi stage.
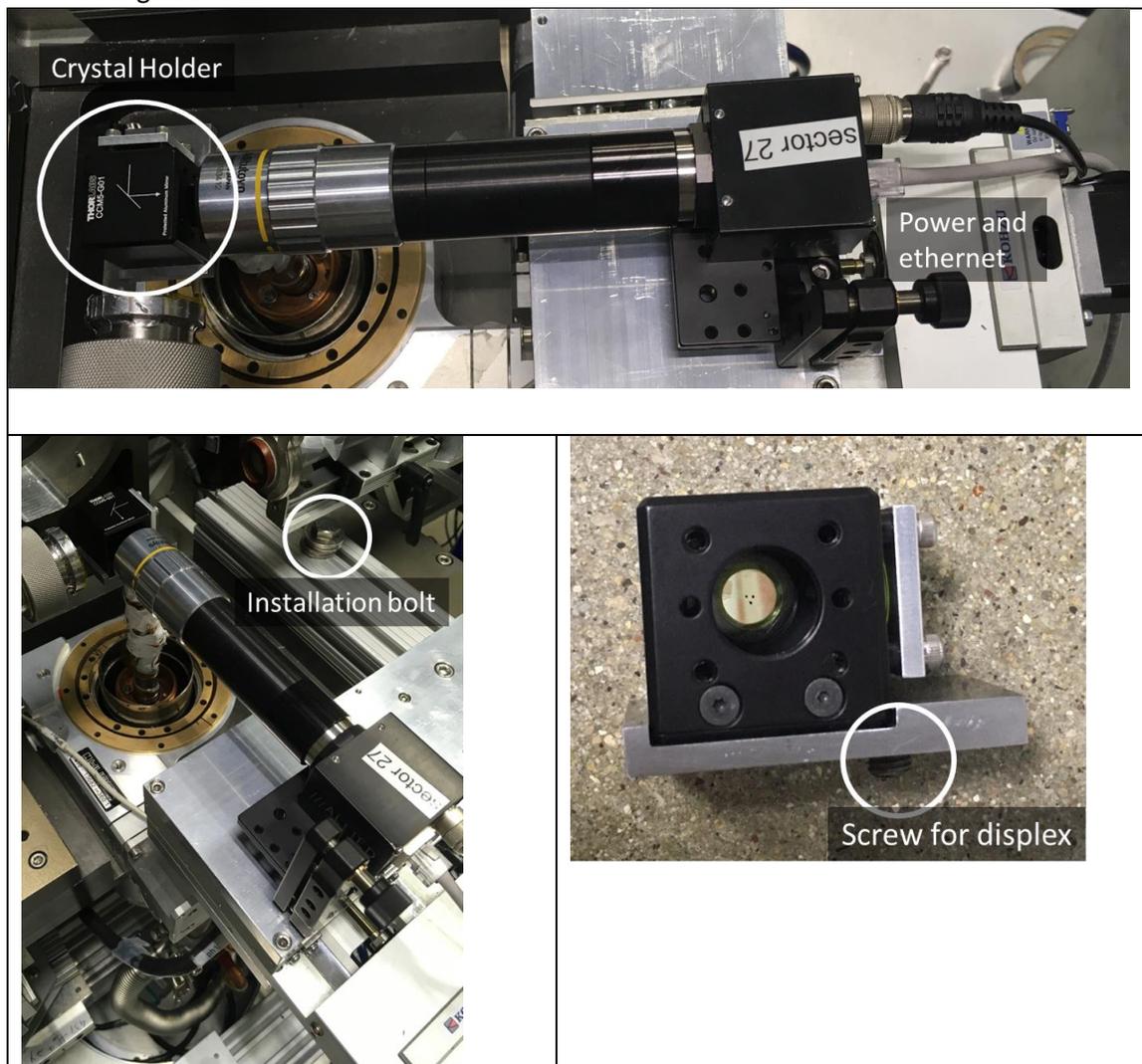

2. Connect the Prosilica camera power and network cables.
3. Type "start_ioc_prosilica" on grimlok

4. Type "start_caQtDM_prosilica" on grimlok. A caQtDM window will open
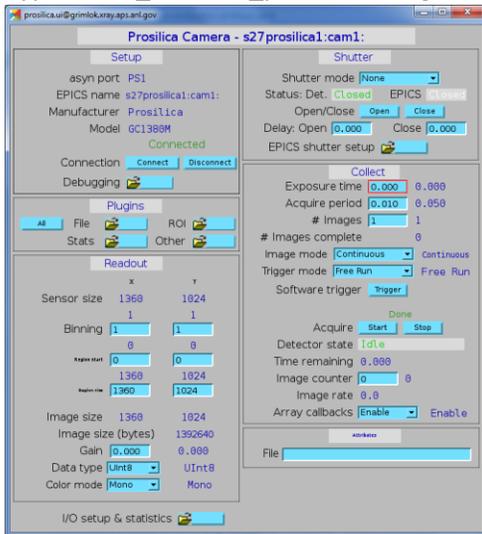
5. Type "ImageJ" on grimlok
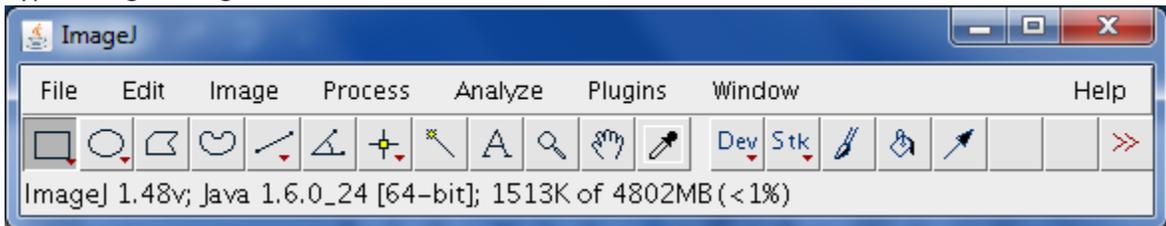
6. In the Plugins menu of ImageJ open EPICS_AD_viewer. This will open:
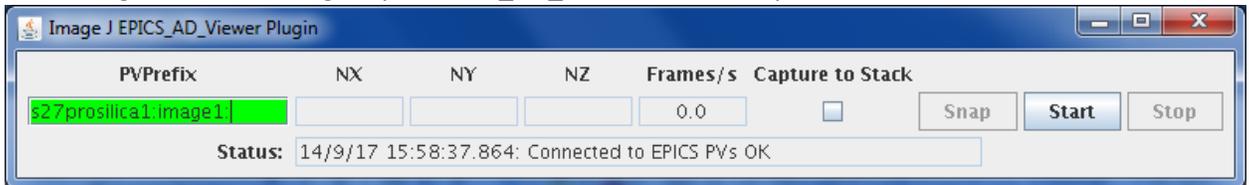
7. Click start in the EPICS_AD_viewer.
8. Click start in the catQDM window (opened in step 3).
9. The image of the YAG crystal should be visible in the ImageJ viewer. The mirror angle and distance may need to be adjusted so that the camera-YAG distance gives good focusing.
10. Align the YAG crystal to the center of rotation, using the micropositioning unit. Ideally, put one of the marks on the YAG crystal near the center of rotation.
11. Focus the camera on the surface of the YAG crystal.
12. Place a fluorescence screen in front of the YAG holder to find the beam and use table x and y (rtabx and rtaby) to bring the YAG crystal to the beam.
13. The beam profile can be fitted by using a Gaussian shape. Using ImageJ put a line across the image of the beam in the desired direction.
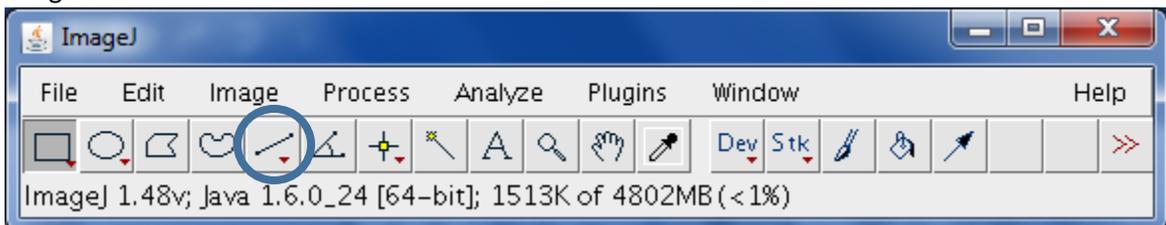
14. In ImageJ selection "Analyze", then "Plot Profile".
15. Click "List" (lower left hand corner) and copy the data onto the clipboard.
16. To fit the image, in ImageJ, select "Analyze", "Tools" then "Curve Fitting".
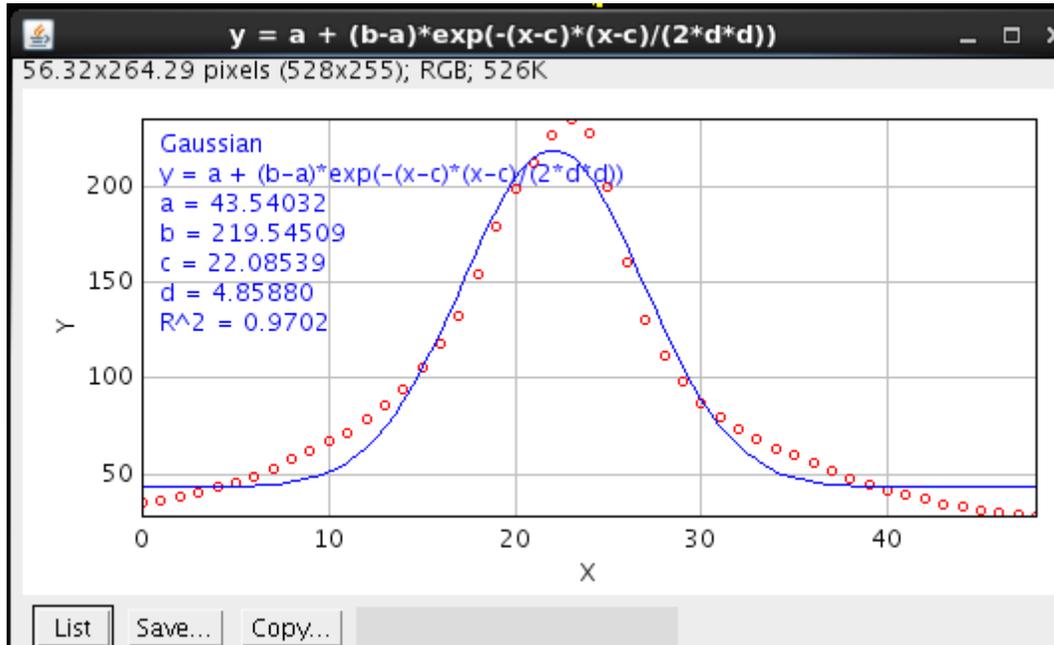
17. The FWHM of the beam is 2.352*0.85*d. The first factor converts gaussian width to FWHM. The second factor, 0.85, reflects the number of microns per camera pixel.

Troubleshooting

If plot profile lists only y values, not x

Go to Edit->Options->Profile Plot Options and uncheck "Do not save x-values".

No image on the ImageJ viewer

1. Check if the environment parameters are set correctly. Type
   echo $EPICS_CA_MAX_ARRAY_BYTES
   The environment variable EPICS_CA_MAX_ARRAY_BYTES should be set to 10000000 (10 million). This needs to be set in both the process running the IOC and in the process running ImageJ. Ideally, this will be put in login shell script.
   a. For the bash shell, the login shell script is ~/.bash_profile. Add the line: export EPICS_CA_MAX_ARRAY_BYTES=10000000
   b. For the csh or tcsh shell the login shell script is ~/.cshrc. Add the line: setenv EPICS_CA_MAX_ARRAY_BYTES=10000000
2. Make sure the Prosilica IOC is running on only one computer
3. "ArrayCallbacks" should be enabled in the main prosilica screen
4. Check that plugins are correctly enabled. Click on on "All" in the plugins window of the mail prosilica screen. This is correct:

commonPlugins.ui@oswin.xray.aps.anl.gov

s27prosilica1: Common Plugins

Plugin name	Plugin type	Port	Enable		Blocking	Dropped	Free	Rate	
Image1	NDPluginStdArrays	PS1	Enable	Enable	No	0	5	20.0	More
PROC1	NDPluginProcess	PS1	Disable	Disable	No	0	20	0.0	More
TRANS1	NDPluginTransform	PS1	Disable	Disable	No	0	20	0.0	More
CC1	NDPluginColorConvert	PS1	Disable	Disable	No	0	20	0.0	More
CC2	NDPluginColorConvert	PS1	Disable	Disable	No	0	20	0.0	More
OVER1	NDPluginOverlay	PS1	Enable	Enable	No	0	20	20.0	More
ROI1	NDPluginROI	PS1	Disable	Disable	No	0	20	0.0	More
ROI2	NDPluginROI	PS1	Disable	Disable	No	0	20	0.0	More
ROI3	NDPluginROI	PS1	Disable	Disable	No	0	20	0.0	More
ROI4	NDPluginROI	PS1	Disable	Disable	No	0	20	0.0	More
STATS1	NDPluginStats	ROI1	Enable	Enable	No	0	20	0.0	More
STATS2	NDPluginStats	ROI2	Disable	Disable	No	0	20	0.0	More
STATS3	NDPluginStats	ROI3	Disable	Disable	No	0	20	0.0	More
STATS4	NDPluginStats	ROI4	Disable	Disable	No	0	20	0.0	More
STATS5	NDPluginStats	PS1	Disable	Disable	No	0	20	0.0	More
FileNetCDF1	NDFileNetCDF	PS1	Disable	Disable	No	0	20	0.0	More
FileTIFF1	NDFileTIFF	PS1	Disable	Disable	No	0	20	0.0	More
FileJPEG1	NDFileJPEG	PS1	Disable	Disable	No	0	20	0.0	More
FileNexus1	NDPluginFile	PS1	Disable	Disable	No	0	20	0.0	More
FileMagick1	NDFileMagick	PS1	Disable	Disable	No	0	20	0.0	More
FileHDF1	NDFileHDF5 ver1.8.7	PS1	Disable	Disable	No	0	20	0.0	More

Aligning and focusing the mirror

Controlling mirror position and curvature

1. Open the horizontal and vertical mirror motion controls. The height and pitch are controlled from these windows

table.ui@oswin.xr...

HFM

Fixed point: Default
REFRESH MENU

	mm		degrees
	-4.6031		-0.1301
X	-4.6030	AX	-0.1301
	< 0.020 >		< 0.010 >
	Scan Go Kill		Scan Go Kill
	-8.0000		0.1280
Y	-8.0000	AY	0.1280
	< 0.000 >		< 0.001 >
	Scan Go Kill		Scan Go Kill
	0.2295		-0.0863
Z	0.2294	AZ	-0.0863
	< 0.000 >		< 0.000 >
	Scan Go Kill		Scan Go Kill

Use Set Zero   Done   Less
Sync Init   Stop   More

table.ui@oswin.xr...

VFM

Fixed point: Default
REFRESH MENU

	mm		degrees
	1.0850		0.2190
X	1.0850	AX	0.2190
	< 10.000 >		< 0.001 >
	Scan Go Kill		Scan Go Kill
			27idmot1:allstop.VAL
	-25.5619		0.0008
Y	-25.5620	AY	0.0008
	< 0.010 >		< 0.000 >
	Scan Go Kill		Scan Go Kill
	-0.3782		0.6174
Z	-0.3765	AZ	0.6174
	< 0.000 >		< 0.000 >
	Scan Go Kill		Scan Go Kill

Use Set Zero   Done   Less
Sync Init   Stop   More

Note that the horizontal mirror has a SiO2 and a Rh strip. At 11.215 keV the critical angle of SiO2 is ~0.16 degrees and that of Rh is ~0.35 degrees

2. The curvature of the horizontal mirror is controlled by piezos, which can be seen by going to 164.54.126.55. The user name and password are on a sticker on a red voltage supply in the cabinet to the right of the control computers.
3. The curvature of the vertical mirror is controlled by a separate set of electronics. Ignore the height and pitch controls (which are not connected) and tune the curvature and ellipticity

KBMirrorsVert.ui@oswin.xray.aps.anl.gov				
27ID KB Mirrors			More	
V Pitch	3.800	3.800	< 0.000 >	
V Height	-0.160	-0.160	< 0.000 >	
V Curvature	1.073	1.073	< 0.020 >	
V Ellipticity	-1.366	-1.366	< 0.020 >	