

Characterization of Diamond Samples -- CHESS Run Summer 2013

5/22-5/28/2013

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Useful information

- Phone numbers:
 - C1 hutch: 607-255-0256
 - Ken's office: 607-255-0914
 - See paper under the monitor for Ken's home and cell
- The expected theta value is 19.2
- pusher.sh is used to watch the directory at Cornell for new files and push it to a directory at UConn.
- scanfinder.pl is used to find fourc files in diffraction directories
- To edit an image in a terminal:
 - `display <filename>.tiff`
 - left click to open menu, click enhance -> normalize
 - click view -> resize -> change to 320x270
 - save -> `<filename>.png`
- To take a screenshot in Linux
 - Whatever window you want a screenshot of, make sure it is visible

- open a terminal and type `xwd > <filename>.xwd` (File type requested by Dr. Jones)
- The cursor should have changed to a plus sign. Click on the window you want a screenshot of.

Goals for this run

1. Adjust the zoom and focus of the camera to allow the 4x4mm diamonds to be fully viewed.
2. Take new rocking curves of the following samples in both x and y orientations:
 - **S300_30:1** - thin sample from Sinmat
 - **U500_500:6**
 - **U500_500:7**
 - **U500_500:8**
 - **U300_300:11**
 - **U300_300:12**
 - **U300_300:13**

Conditions of the experiment

- I0
 - Start of a fill: 19000
 - End of a fill: 18500
- Length between fills: 120 minutes
- Length of fills: 5 minutes
- Gain: Currently adjusted within the hutch. Next visit should be adjusted electronically through specuser.
- Beam current:
 - Start of fill: 193mA
 - End of fill: 172mA
- Inside the GUI:
 - Image binning: 1x1
 - Image size: 2560x2160
 - PreAmp gain: 16-bit (low noise & high well capacity)
 - Encoding: Mono16
 - Shutter mode: Rolling
 - Readout rate: 280MHz
 - Overlap: Yes
 - Noise filter: Yes

1. Adjusting the setup

May 22, 2013 AEB

I arrived at CHESS and checked in around 11:30am. I met with Ken and we discussed what changes to the setup need to be made. He brought up that the image file sizes previously were approximately 10MB but are now around 2MB in size. He suspects that pixel binning is occurring and would to know if that's acceptable for our purposes.

RTJ asks:

1. Can you inquire with Ken what changes were made to the camera to reduce the image resolution? It sounds like it might be digital zoom. We would prefer not to have digital zoom in play, and keep the image acquisition covering the full range of the ccd.
2. Can you set up a tcp tunnel for me from gluey to specuser (or whatever data acquisition machine you would like me to use for accessing the data as they are collected? To do that, you need to ssh from a local CHESS host to gluey using a command like the following: `ssh -R 2022:localhost:22 barnes@gluey.phys.uconn.edu`

Ken calibrated the beam energy to 15keV. The energy will remain constant but the intensity will vary over time. The intensity can be adjusted using the silver knob to the right of the digital readout above the monitor. The Nim-bin module has the tag "EL0122" on it.

To mount a diamond:

- Place the diamond in the center of the hoop. Use the screw holes as a guide.
- Orient the diamond such that it is in a "diamond" shape with the bottom point towards the screw hole that will be covered by the hoop mount.
- With this orientation, when mounted, the diamond will be correct when chi is set to 90.

We mounted **S300_30:1** to check if we are able to get a reflection. Once mounted we used fluorescent paper to locate the reflection. We were unable to find it and discovered that in the process the diamond had slipped within the mylar. The diamond was placed back in its container and the mylar hoop was cleaned with isopropanol and kim wipes.

The second time we mounted **S300_30:1** we again used fluorescent paper to find the reflection. This involves covering the detector with the paper and aiming a video camera at the paper. We drew a circle on the screen where the opening to the detector is and adjusted chi until the reflection appeared in the circle. Once the reflection is within the detector we were able to use the 'andor_lineup_on 1' command to finish centering the reflection on the detector. This command takes an image every second and displays it rather than saving it. Using this, th and chi can be adjusted until the image is centered.

The initial setup was zoomed in too far and would not fit an entire 4mm diamond. Since Ken left for the evening I asked for help from the operator. To adjust the zoom on the detector the front plate needs to be removed. Once open there is a shaft in the middle of the detector that shows the magnification. In this case it was at 3x. There are only markings for 1x, 3x, and 5x so we turned the dial to where 2x would be. We then attached the motor that controls the focus of the

camera. This required an extension cord. The cord had to be plugged into a specific location which the operator looked up. We were then able to adjust the focus by using the command 'tw focus 0.05'. For fine tuning we adjusted by 0.01 until the reflections of the diamond appeared crisp.

I took three images before the beam had to be refilled. They are called 'test2_011.tiff', 'test2_013.tiff' and test2_014.tiff'. These show the bottom corner, the middle, and the top corner, respectively. These are to check whether the zoom is appropriate and whether the resolution is satisfactory.

Comment from RTJ, 21:17 on 5/22

The zoom scale looks fine now, but the pixel resolution is degraded. Last time we ran, our images were 2560 x 2160. Now they are only 1280 x 1080, a factor of 2 less resolution and 4 times less information. However, even more important than the spatial resolution is the image contrast. These images are very dark and noisy. Even when you are at the diffraction peak, the images look black until you enhance them with the command Normalize. That is not how they looked back in November. Can you look up what the shutter time is right now, and play with increasing it until the images get brighter?

I took more pictures with varying shutter times. The original three images were taken at 10 second shutter times.

- test2_017.tiff is 15 seconds
- test2_018.tiff is 20 seconds
- test2_019.tiff is 25 seconds
- test2_020.tiff is 30 seconds

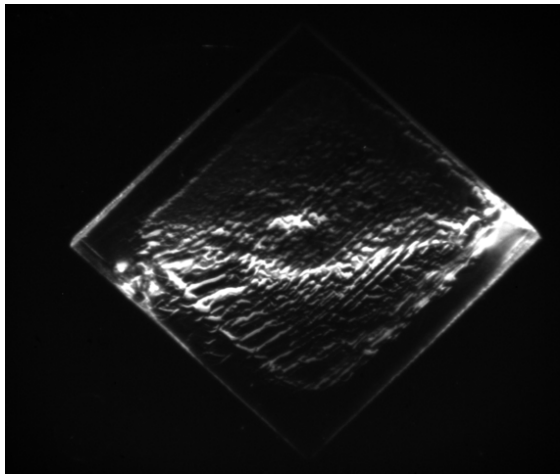
Response from RTJ, 22:09 on 5/22:

Here is a comparison of these image intensities with what we had last November.

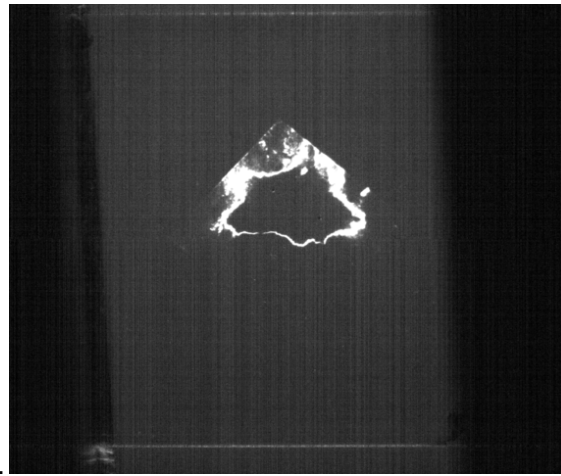
run period	scan image	exposure (s)	min pixel	max pixel	mean pixel
11/2012	Caseystudy01_scan005_109.tiff	5	92	2688	230
5/2013	test2_014.tiff	10	92	553	106
	test2_017.tiff	15	92	873	109
	test2_018.tiff	20	91	1196	112
	test2_019.tiff	25	92	1447	114

	test2_020.tiff	30	92	1498	118
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From this comparison, I conclude that to get exposures comparable to what we saw last November we would need to set the exposure time to 160 s, almost 3 minutes. That is too long to be reasonable. The first order of business is to understand the intensity problem. It might be that the camera aperture is reduced relative to last time, or that the gain of the camera has somehow been reduced. Two images are shown below for comparison. Notice the streaks in the background of the latest image, which seem to be associated with the noise level in the camera. The two diamonds are the same size, but the magnification has been reduced.



Caseystudy01_scan005_109.tiff



test2_014.tiff

May 23, 2013 AEB

In the morning Ken and I fixed the issue involving where the images are being stored. Any image taken should now be saved to /mnt/andor1/Data/Jones-5-2013. The binning for the images has been set to 1x1 and the image size is now 2560x2160, the same as previous runs.

Discussing with Dr. Jones over the phone we decided to investigate the f-stop of the camera to see if it can be adjusted. The lines in the background of the picture need to be understood. Ken set tth to 0 so that we could look at the crystal in the camera. Before changing tth our settings were: tth = 38.546, th = 19.15, chi = 80.60, phi = 90. While Ken finds the information about the f-stop I will switch from **S300_30:1** to **U500_500:6** so that we can set the zoom to fit perfectly.

Response from Ken F., 12:30 on 5/23:

The x-ray to visible light converter full size is 8mm x 8mm. It is mounted so the top/bottom edges are free and side edges are held in an aluminum mounting frame. We can see the top & bottom edges but the view from side to side is limited to approx. 7mm.

The active thickness (of doped layer) is 24um thick and depth of focus is 27um (no information on whether

this depends on magnification). At magnification 1X a standard 2/3" sensor (diagonal size ?) field of view is 8.8mm x 6.6mm. The Andor sensor is about 15.6mm x 13mm and the camera image can include more than the full vertical size of converter.

There is no f-stop adjustment and I'm told this is typical for microscope objective lenses. Numerical aperture varies from 0.04 to 0.1 over magnification range from 1-5X.

Naming convention for diamonds

The naming convention for the diamonds is as follows: <letter for origin, currently U or S><original thickness in microns>_<milled thickness in microns>:<serial number>

Resolving the image intensity problem

We mounted **U500_500:6** and had to orient the diamond in a "square" fashion in order to see a reflection. There appears to be fluctuations in the reflection which are partly caused by air currents. We are adding more plexi in front of the air conditioner to redirect the airflow while keeping the hutch cool. Ken also found styrofoam to place near the mount to help prevent air currents.

Watching a reflection over the course of 10 seconds can change the intensity of the reflection to change from bright to dark. Ken explained that this is due to the thickness of the diamond and its ratio with the Pendellosung length.

A setting was found in the ANDOR GUI that changes the gain of the image. It was originally set to 11-bit high well capacity and was changed to 16-bit low noise & high well. The lines seen in test2_014.tiff aren't visible now.

Area Detector Control - ANDOR1:cam1:

Setup

asyn port **ANDOR**
 EPICS name **ANDOR1:cam1:**
 Manufacturer **Andor**
 Model **DC-152Q-C00-FI**
 Serial Number **SCG-01690**
 Firmware Vers. **11.12.13.0**
 Software Vers. **3.5.30007.0**
 Ser ID **3**
 Debugging

Plugins

File ROI
 Statistics Other

Readout

	X	Y
Sensor size	2560	2160
Binning	1x1	1x1
	1	1
Region start	1	1
	2560	2160
Region size	2560	2160
AOI control	Yes	
Image size	2560	2160
Image size (bytes)	11093760	
Encoding	Mono16	
Shutter mode	Rolling	
	16-bit (low noise & high w	
PreAmp gain	16-bit (low noise & high w	
Readout rate	280 MHz	
Overlap	Yes	
Noise filter	Yes	
Readout Time	0.0101	

Attributes

File

Shutter

Shutter mode **None**
 Status: Det. **Closed** EPICS **Closed**
 Open/Close
 Delay: Open **0.000** Close **0.000**
 EPICS shutter setup

Collect

Exposure time **10.000** 10.000
 Acquire period **0.010** 10.000
 Frame rate **99** 0.100
 Max transfer rate **0.000**
 # Images **1** 1
 # Images complete **0**
 # Exp./image **1** 1
 Image mode **Fixed** **Fixed**
Internal
 Trigger mode **Internal**
 Software trigger

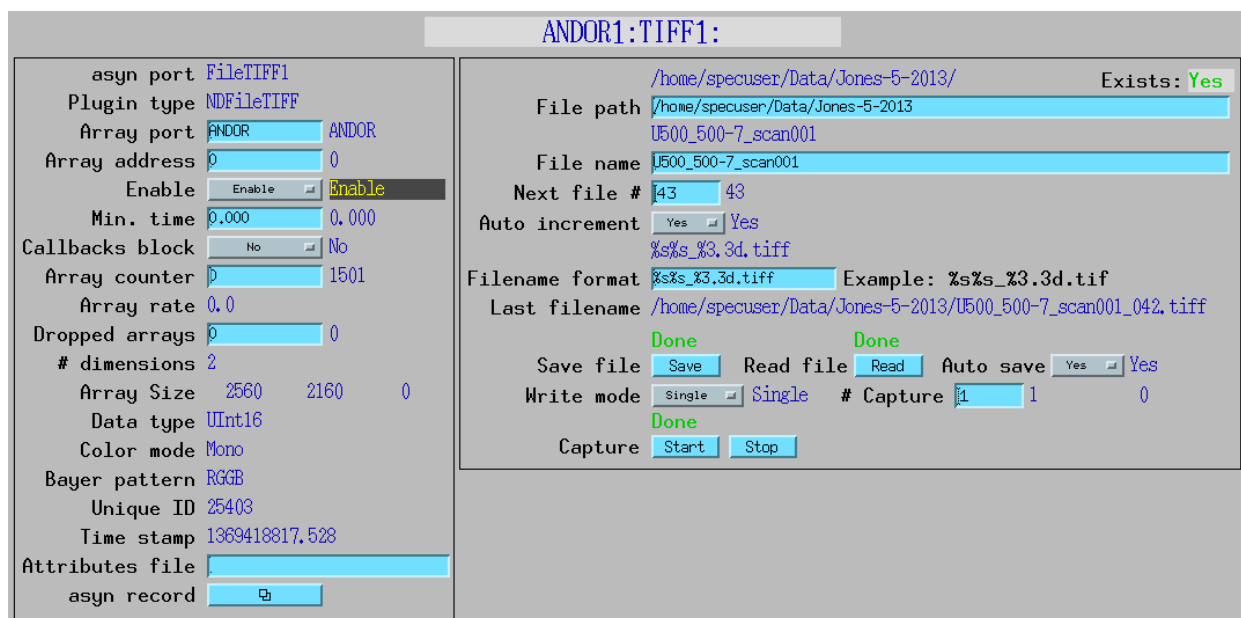
Collecting

Acquire
 Detector state **Acquire**
 Status **Acquire**
 Image counter **0** 25401
 Image rate **0.0**
 Array callbacks **Enable** **Enable**
 Buffers max/used **0** 1
 Buffers alloc/free **3** 2
 Memory max/used (MB) **0.0** 31.6
 Buffer & memory polling **1 second**

Cooler

Cooler **On** **On**
 Temperature **-30.00** **-30.00** **-30.970**
 Status **Stabilised**
 Fan **On** **On**

This is the ANDOR GUI. On this screen the binning, image size, encoding, shutter mode, preamp gain, readout rate, overlap, and noise filter can be adjusted on the left side. The right side displays current settings that have been entered in the terminal window.



To find this window, in the main screen click on the box next to File and select TIFF. This window is where the directory is set for stored images. In the upper right the current directory is /home/specuser/Data/Jones-5-2013. On the top right border there is a display showing that this directory exists and is a valid location for image storage.

2. Scans of U500_500:6

Ken left for the evening. I'm going to take images of **U500_500:6** to show the varying intensity. Files U500_500-6_039.tiff to U500_500-6_048.tiff are 1 second exposures of the diamond without changing any angles. The varying intensity can be seen by comparing U500_500-6_039.tiff and U500_500-6_045.tiff.

scan image	exposure (s)	min pixel	max pixel	mean pixel
U500_500-6_039.tiff	1	52	560	131
U500_500-6_040.tiff	1	55	524	130
U500_500-6_041.tiff	1	50	453	126
U500_500-6_042.tiff	1	51	498	130
U500_500-6_043.tiff	1	55	608	126
U500_500-6_044.tiff	1	63	589	130

U500_500-6_045.tiff	1	64	504	113
U500_500-6_046.tiff	1	64	426	111
U500_500-6_047.tiff	1	62	588	123
U500_500-6_048.tiff	1	62	454	127
U500_500-6_049.tiff	5	60	2194	252
U500_500-6_050.tiff	10	71	3779	384
U500_500-6_051.tiff	15	57	4752	568
U500_500-6_052.tiff	20	71	5920	699
U500_500-6_053.tiff	25	55	7351	811

I took a scan from th 18.405 to th 18.422 in 85 steps for 5 second exposures. The files are associated with **U500_500-6_scan002***. Scan001 didn't save the images and doesn't exist. I'm repeating the scan 3 times. Once the "2,2,0" scans are finished I will rotate the sample in chi by 90 degrees and scan "2,-2,0".

For scans 2-4 the position was: tth = 38.546, th = 18.405, chi = 38.8095, phi = 92. I took a scan from th 18.405 to th 18.422 in 85 steps for 5 second exposures.

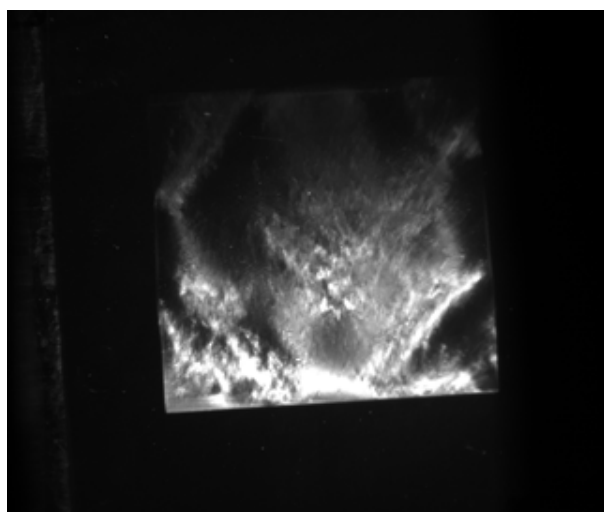
For scans 5-7 the position was: tth = 38.546, th = 18.118, chi = 128.8095, phi = 92. I took a scan from th 18.118 to th 18.138 in 100 steps for 5 second exposures.

For scan 8 I changed the exposure time to 10 seconds. This time will remain for all future scans.

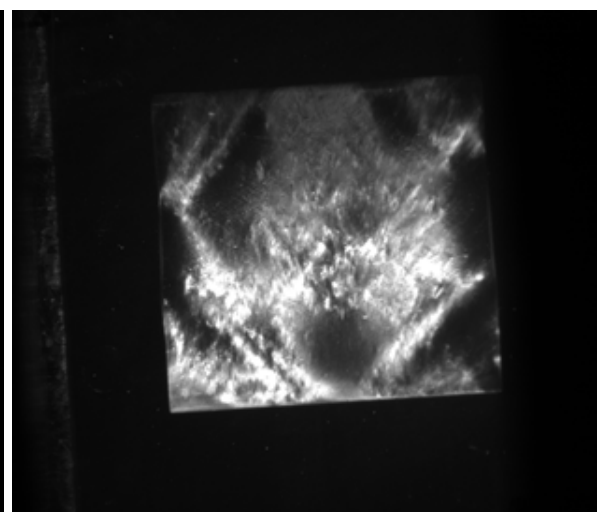
After scan 9 I rotated the hoop 180 degrees in phi. This should give us access to the other two orientations. I have been unable to find the transmission after rotating phi. I have rocked th from 17.7 to 20 while changing chi by 1 degree from 30.809 up to 48.809. I checked to make sure that the beam was hitting the sample. I attached a larger fluorescent paper to the detector in case the transmission was too far from the detector opening. I believe the transmission should be within the chi range I scanned but maybe theta is less than 17.7.

Note: The files are saved in a redundant fashion. There exists a master log of all the scan data with the original filename, e.g. U500_500-6. For each individual scan there is a separate file that contains only the information pertaining to that scan, e.g. U500_500-6.x. The master log contains the information of all the individual files.

Filename	Orientation	Step size (degrees)	Exposure (s)
U500_500-6_scan002	2,2,0	0.0002	5
U500_500-6_scan003	2,2,0	0.0002	5
U500_500-6_scan004	2,2,0	0.0002	5
U500_500-6_scan005	2,-2,0	0.0002	5
U500_500-6_scan006	2,-2,0	0.0002	5
U500_500-6_scan007	2,-2,0	0.0002	5
U500_500-6_scan008	2,-2,0	0.0002	10
U500_500-6_scan009	2,2,0	0.0002	10
U500_500-6_scan010	-2,-2,0	0.0002	10
U500_500-6_scan011	-2,-2,0	0.0002	10
U500_500-6_scan012	-2,-2,0	0.0002	10
U500_500-6_scan013	-2,2,0	0.0002	10
U500_500-6_scan014	-2,2,0	0.0002	10
U500_500-6_scan015	-2,2,0	0.0002	10



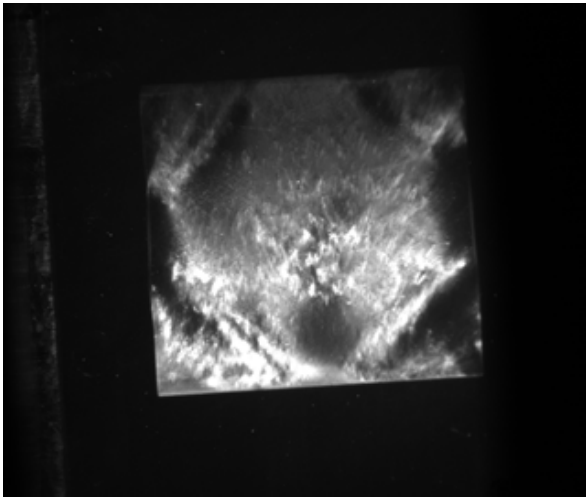
U500_500-6_scan002_032.png



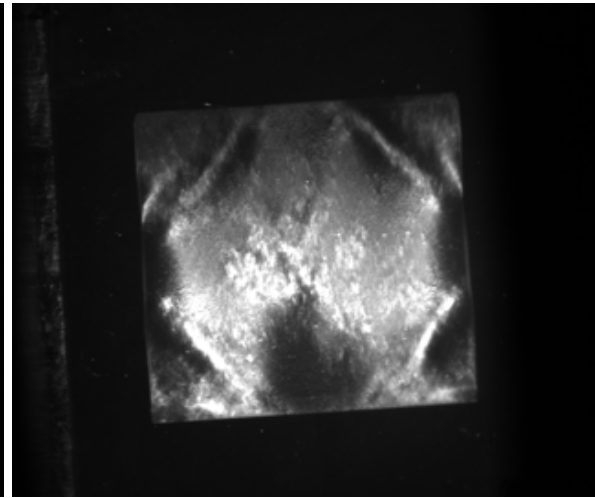
U500_500-6_scan003_035.png

Note: The tilt in these images is not physical. When aligning the diamond a laser level was used to help set the edge of the diamond parallel to the horizontal. The error is estimated by setting chi

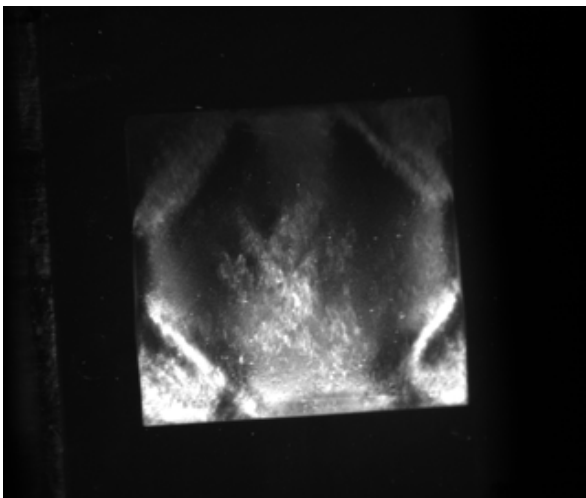
and rocking it up and down until the change is noticeable. I set chi to 49.5500 and tweaked it up and down by a degree at a time. By doing this I found a 2 degree range that I would consider to be horizontal. I would consider my error to be ± 1 degree.



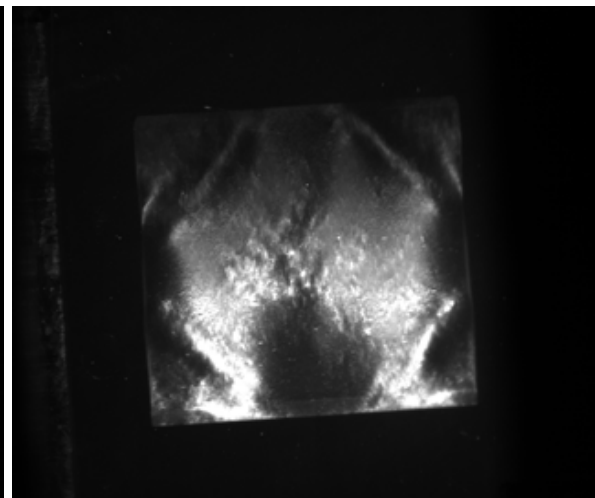
U500_500-6_scan004_035.png



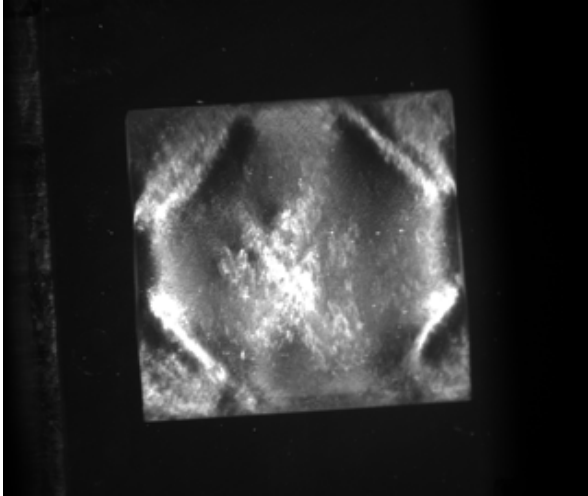
U500_500-6_scan005_052.png



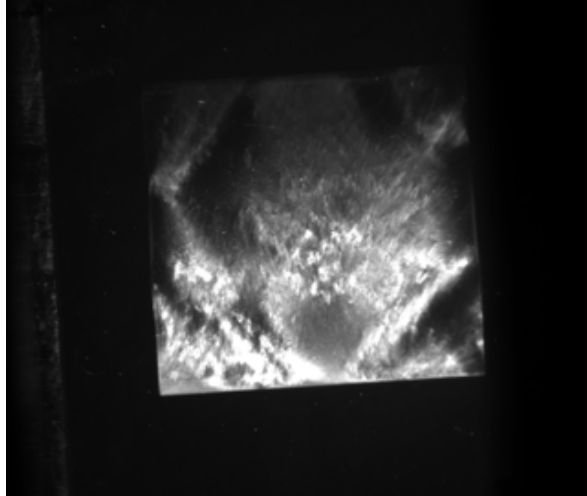
U500_500-6_scan006_057.png



U500_500-6_scan007_051.png



U500_500-6_scan008_059.png



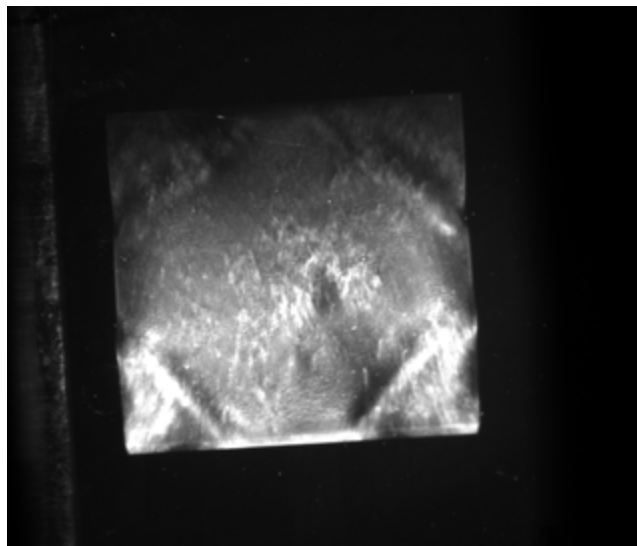
U500_500-6_scan009_047.png

May 24, 2013 AEB

I met Ken around 9:00 and we worked on finding the transmission. We adjusted chi with the hutch open so that we could see when the diamond edges were parallel with the floor. This involved using a laser level on a stand. The chi value is 51.509 and the th value is 20.006.

Scan 10 has the following settings: tth = 38.546, th = 19.996-20.016, chi = 51.5095, phi = 272. Exposure 10 seconds. Step size 0.0002.

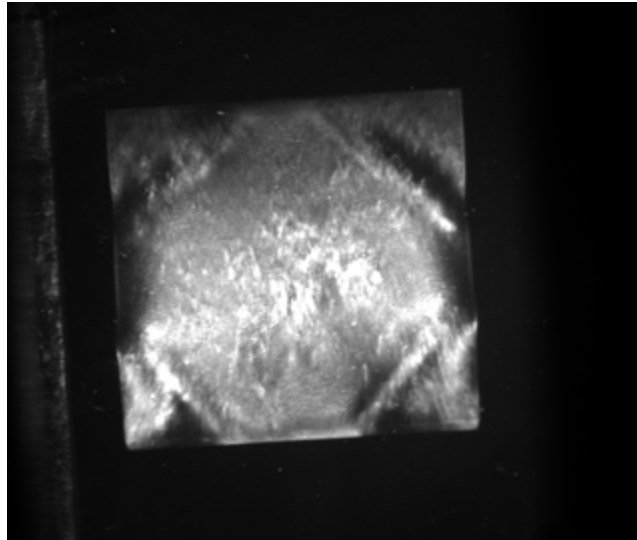
I want to study how I0 changes over the course of a scan. I0 at the beginning of the scan is 19100. I0 at the end of the scan 19100. Run started at 10:17am. Run ended at 10:34am. This scan was started immediately after a fill.



U500_500-6_scan010_060.png

Scan 11 has the following settings: $t_{th} = 38.546$, $th = 19.990-20.020$, $\chi = 51.5095$, $\phi = 272$. Exposure 10 seconds. Step size 0.0002. I expanded th to include more of the wings.

I0 at the beginning of the scan is 19000. I0 at the end of the scan 18800. Run started at 10:41am. Run ended at 11:08am.

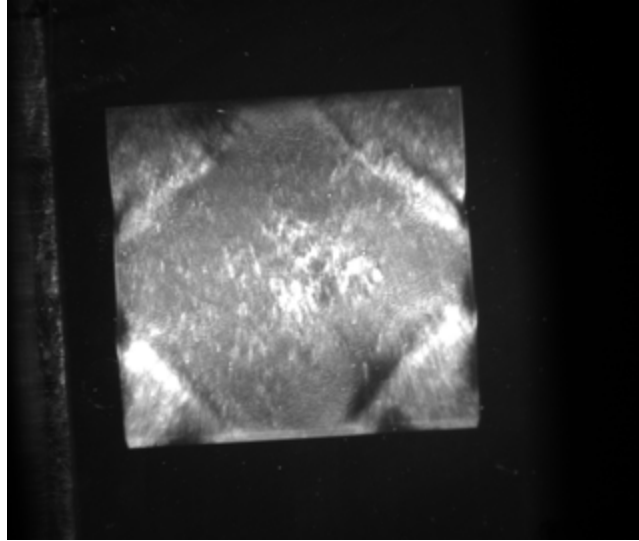


U500_500-6_scan011_088.png

Scan 12 has the following settings: $t_{th} = 38.546$, $th = 19.996-20.016$, $\chi = 51.5095$, $\phi = 272$. I don't believe it's necessary to have the extra wings for each run.

I0 at the beginning of the scan is 18700. I0 at the end of the scan 18400. Run started at 11:11am. Run ended at 11:28am.

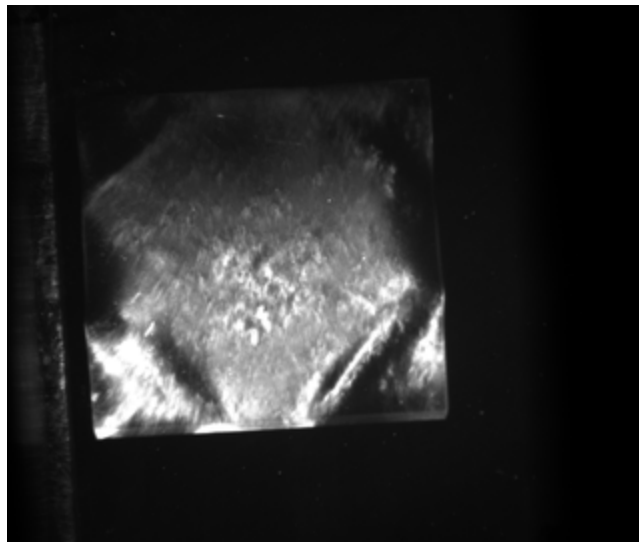
I rotated the sample in χ by 90 degrees. χ is now 141.5095. A reflection can be seen at 19.6760.



U500_500-6_scan012_059.png

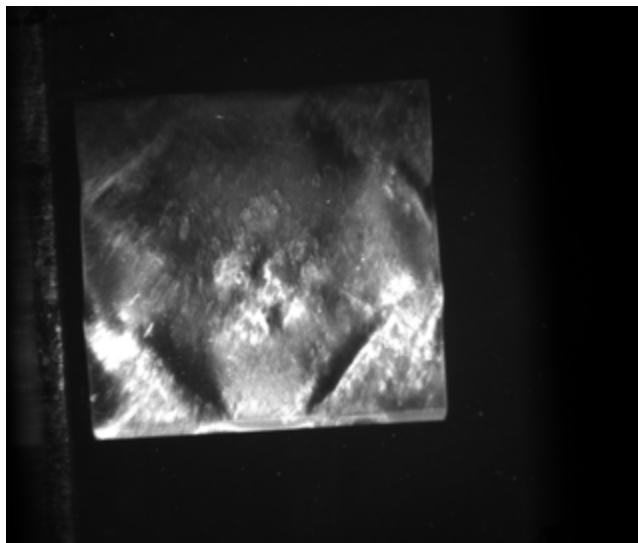
Scans 13-15 have the following settings: $tth = 38.546$, $th = 19.668-19.688$, $chi = 141.5095$, $\phi = 272$.

Scan 13: I_0 at the beginning of the scan is 18800. I_0 at the end of the scan 18700. Run started at 11:43am. Run ended at 12:02pm.



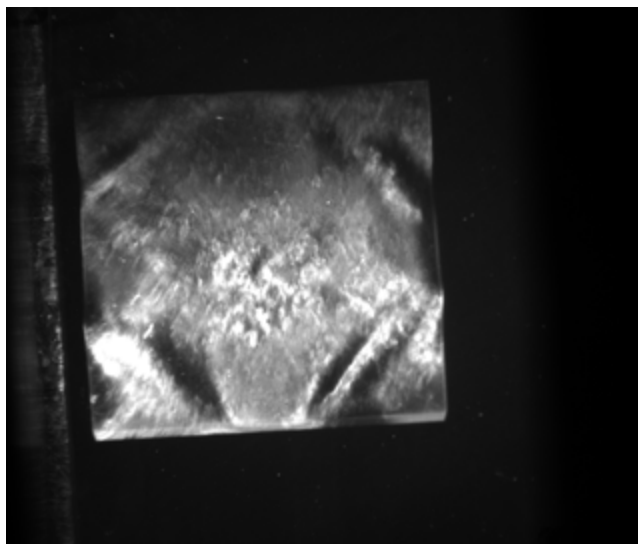
U500_500-6_scan013_039.png

Scan 14: I_0 at the beginning of the scan is 19100. I_0 at the end of the scan 1900. Run started at 12:30pm. Run ended at 12:50pm. This scan was started right after a fill.



U500_500-6_scan014_046.png

Scan 15: I0 at the beginning of the scan is 19000. I0 at the end of the scan . Run started at 12:51pm. Run ended at pm.



U500_500-6_scan015_041.png

Scan 15 is the last scan for **U500_500:6**. I will unmount it and mount the next diamond, **U500_500:7**.

Note: Ignore U500_500-6_scan016. I forgot to make a new file and cancelled the scan.

3. Scans of U500_500:7

Scan 1: I0 at the beginning of the scan is 18800. I0 at the end of the scan 18600. Run started at 1:59pm. Run ended at 2:18pm. Chi = 49.5500, th = 20.54..20.56.

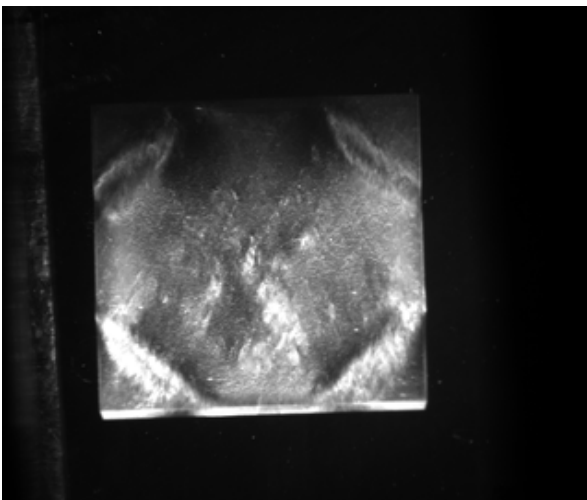
Scan 2: I0 at the beginning of the scan is? I0 at the end of the scan 18900. Run started at 3:02pm. Run ended at 3:20pm. Chi = 49.5500, th = 20.54..20.56.

Scan 3: I rotated chi by 90 degrees. I0 at the beginning of the scan is 18500. I0 at the end of the scan is ? Run started at 3:43pm. Run stopped at ? Chi = 139.15 , th = 17.868..17.888.

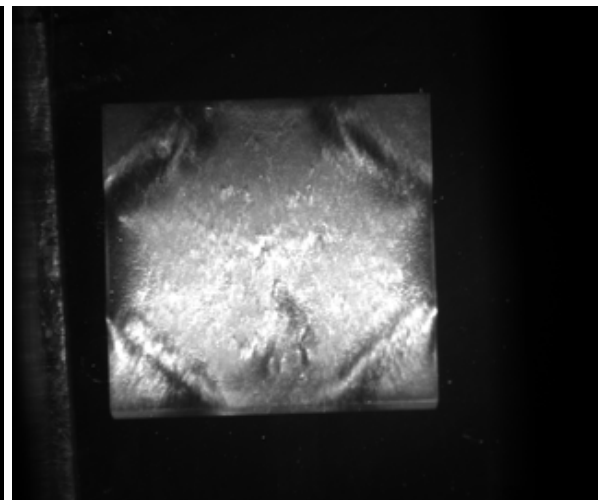
Scan 4: I rotated phi by 180 degrees and adjusted chi so that the diamond edge was level with the horizontal. Chi = 130.85, th = 17.478..17.498. I0 at the beginning of the scan is 19200. I0 at the end of the scan is 19200. Run started at 4:35pm. Run stopped at 4:53pm. This scan was started after a fill.

Scan 5: I rotated chi by 90 degrees. Chi =41.55, th =20.142..20.162. I0 at the beginning of the scan is 19100. I0 at the end of the scan is. Run started at 5:09pm. Run stopped at pm.

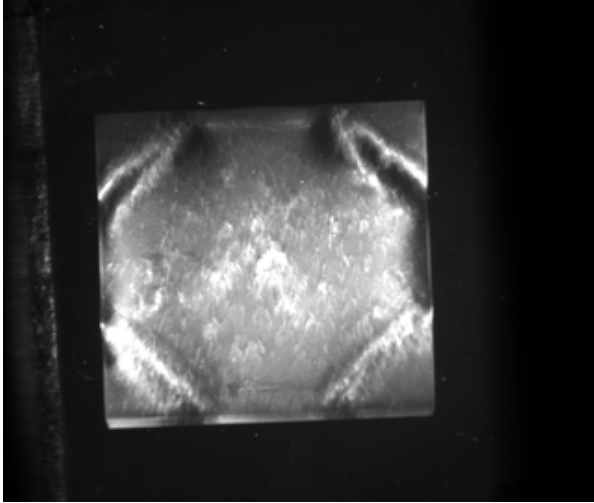
Filename	Orientation	Step size (degrees)	Exposure (s)
U500_500-7_scan001	2,2,0	0.0002	10
U500_500-7_scan002	2,2,0	0.0002	10
U500_500-7_scan003	2,-2,0	0.0002	10
U500_500-7_scan004	-2,2,0	0.0002	10
U500_500-7_scan005	-2,-2,0	0.0002	10



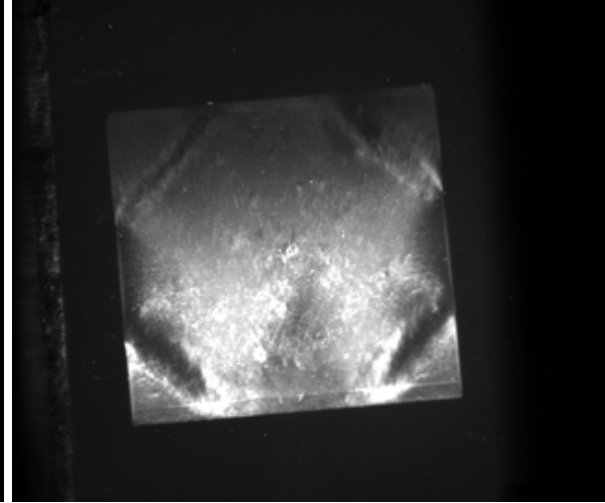
U500_500-7_scan001_049.png



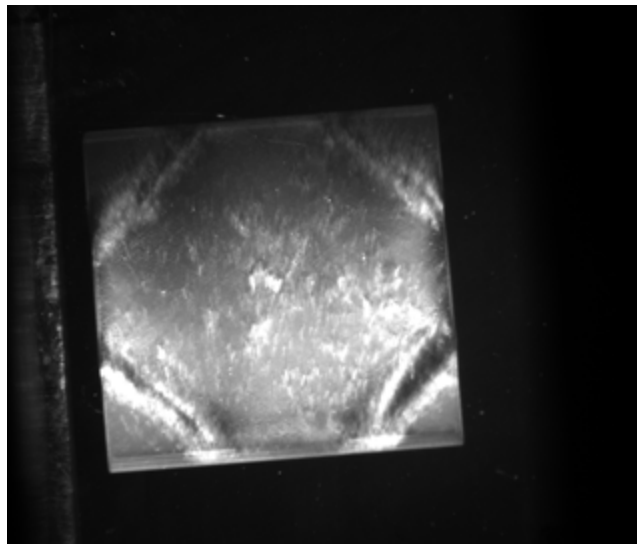
U500_500-7_scan002_055.png



U500_500-7_scan003_053.png



U500_500-7_scan004_053.png



U500_500-7_scan005_050.png

Note: Ignore U500_500-7_scan006. I forgot to make a new file and cancelled the scan.

4. Scans of U500_500:8

Scan 1: I0 at the beginning of the scan is 19200. I0 at the end of the scan 19100. Run started at 7:00pm. Run ended at 7:18pm. Chi = 44.000, th = 16.148..16.168.

The hoop shifted while rotating to the new chi. I recentered the diamond and adjusted chi to have the diamond edges horizontal.

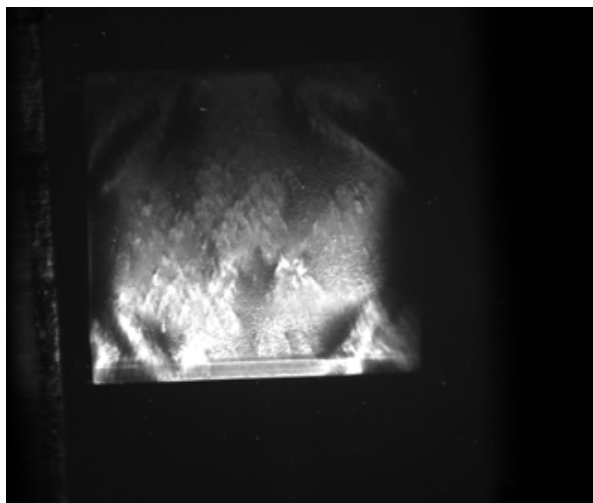
Scan 2: Chi has been rotated to 132.5 degrees. I0 at the beginning of the scan is 19100. I0 at the end of the scan 18900. Run started at 7:34pm. Run ended at 7:52pm. Chi = 132.500, th = 18.077..18.097.

Scan 3: Phi has been rotated 180 degrees to 272. I0 at the beginning of the scan is 18900. I0 at the end of the scan 18900. Run started at 8:07pm. Run ended at 8:25pm. Chi =137.5, th = 21.332..21.352.

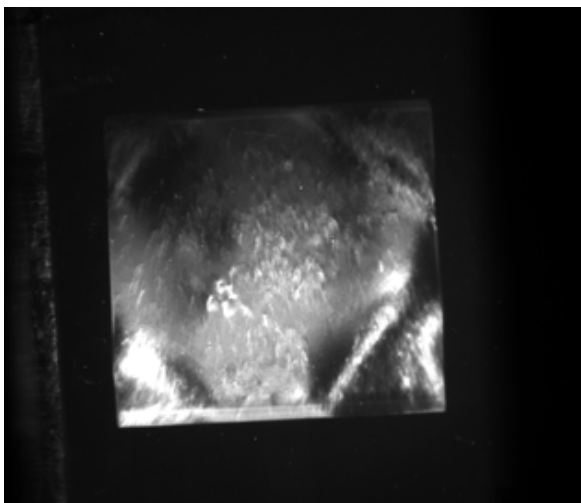
Scan 4: This scan was started in the wrong place. These should files should be ignored.

Scan 5: Chi has been rotated to 48.000. I0 at the beginning of the scan is 19200. I0 at the end of the scan 19200. Run started at 8:42pm. Run ended at 9:00pm. Chi =48.000, th = 19.989..20.009. This scan started after a fill.

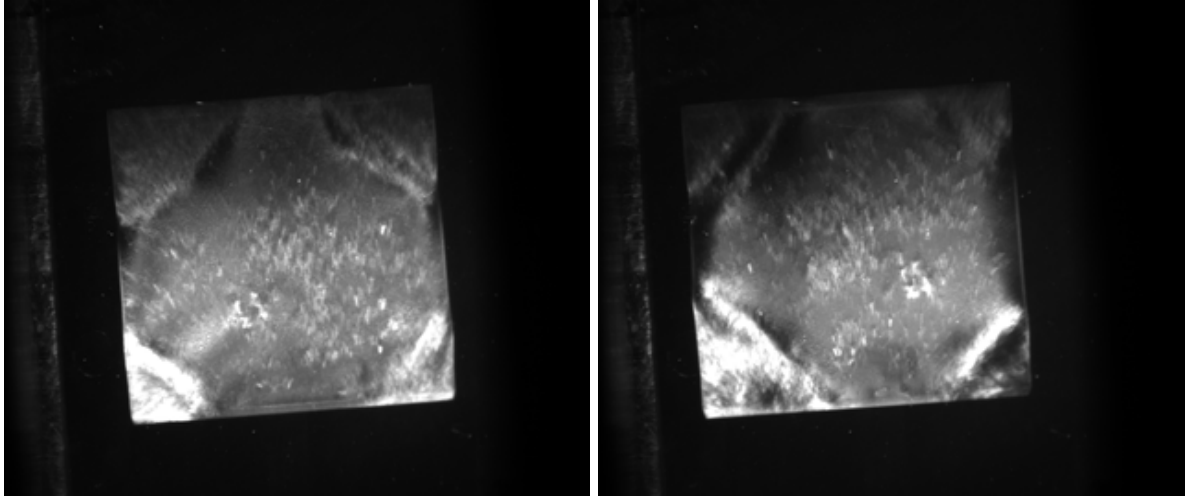
Filename	Orientation	Step size (degrees)	Exposure (s)
U500_500-8_scan001	2,2,0	0.0002	10
U500_500-8_scan002	2,-2,0	0.0002	10
U500_500-8_scan003	-2,2,0	0.0002	10
U500_500-8_scan005	-2,-2,0	0.0002	10



U500_500-8_scan001_050.png



U500_500-8_scan002_054.png



U500_500-8_scan003_046.png

U500_500-8_scan005_048.png

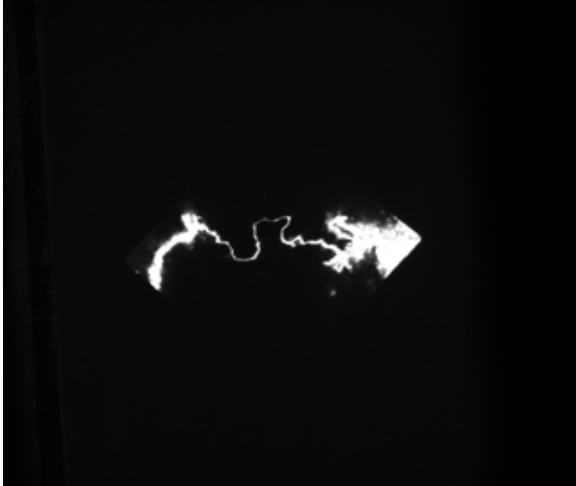
5. Scans of S300_30:1

I swapped out **U500_500:8** for **S300_30:1**. The orientation for this diamond should be in the “diamond” configuration. I used the laser level as a guide for lining up the opposite vertical corners.

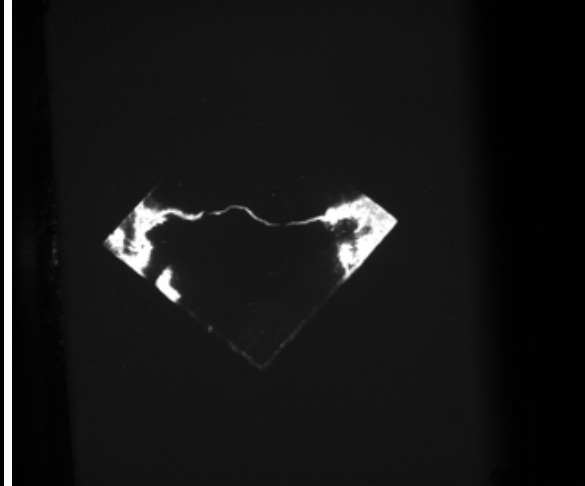
Scan 1: I0 at the beginning of the scan is 18900. I0 at the end of the scan 18000. Run started at 9:44pm. Run ended at 11:30pm. Chi =89.500, th = 22.372..22.492. This scan ran through a refill.

Scan 2: I0 at the beginning of the scan is 19100. I0 at the end of the scan . Run started at 11:45pm. Run ended at pm. Chi =179.5000, th = 18.992..19.112. This scan ran through a refill.

Filename	Orientation	Step size (degrees)	Exposure (s)
S300_30:1_scan001	2,2,0	0.0002	10
S300_30:1_scan002	2,-2,0	0.0002	10
S300_30:1_scan003	-2,2,0	0.0002	10
S300_30:1_scan004	-2,-2,0	0.0002	10



S300_30:1_scan001_311.png



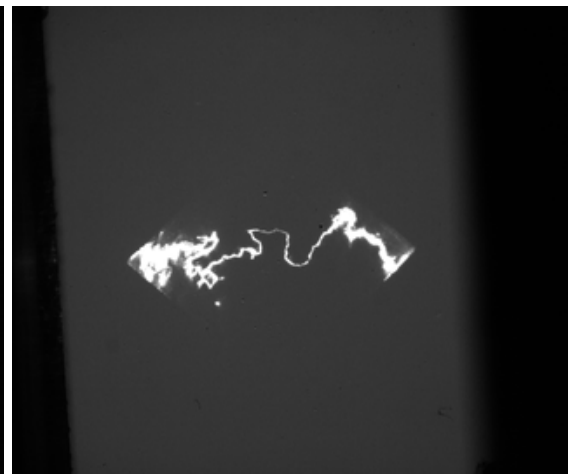
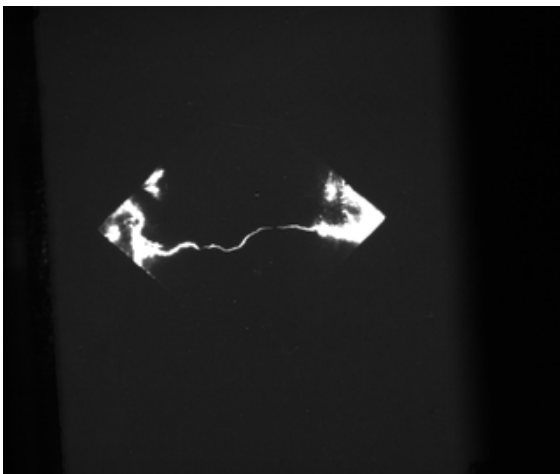
S300_30:1_scan002_380.png

May 25, 2013 AEB

I rotated phi 180 degrees to 272 and found the transmission on the fluorescent paper. When using *andor_lineup_on 1* to see the sample I needed to tweak chi to bring it into the middle of the image. Unfortunately this pushes me to the limit of the motor which is 180. Chi was at 179.5. To get around this I am shifting the hoop so that I can have play room with chi. I did not unmount the hoop but rather adjusted it. The orientation stayed the same.

Scan 3: I0 at the beginning of the scan is 19100. I0 at the end of the scan 19000. Run started at 9:59am. Run ended at 11:45am. Chi = 172.5000, th = 19.727..19.847. This scan ran through a refill.

Scan 4: I0 at the beginning of the scan is 19000. I0 at the end of the scan 18900. Run started at 12:09pm. Run ended at 3:55pm. Chi = 82.5000, th = 15.467..15.587. This scan ran through a refill.



6. Scans of U300_300:11

Because of the motor limit for chi that I discovered with the previous sample I decided to mount U300_300:11 in the "square" configuration. This allowed me to use the laser level to adjust chi when initially mounted at chi = 90. Once it was leveled I then tweaked it by 45 degrees and checked again that the diagonal was in line with the vertical laser level. All orientations should be accessible within the motor constraints.

Scan 1: I0 at the beginning of the scan is 19000. I0 at the end of the scan 19200. Run started at 2:37pm. Run ended at pm. Chi = 43.7000, th = 18.847..18.917. This scan ran during a fill. The transmission occurs from the bottom of the diamond and works it way up.

Scan 2: Chi has been tweaked by 90. I0 at the beginning of the scan is 19200. I0 at the end of the scan 17800. Run started at 3:55pm. Run ended at 5:05pm. Chi = 133.7000, th = 18.110..18.190. The transmission occurs from the bottom of the diamond and works it way up.

After scan 2 the beam will be down due to an 'access'. Scan 2 should be finished before this occurs. The beam downtime will be approximately one hour.

Scan 3: Ignore this run. Th started in the wrong place.

Scan 4: Phi has been tweaked by 180 degrees.. I0 at the beginning of the scan is 19200. I0 at the end of the scan. Run started at 6:50pm. Run ended at pm. Chi = 133.7000, th =19.170..19.260

Scan 4 had to be stopped because the beam was lost around step 282. I expect this is a hiccup from the beam access before this scan.

Scan 5: Same as scan 4. I0 at the beginning is 19100. I0 at the end is 11. Run started at 8:10pm. Run stopped at 9:00pm. Beam was lost again

Scan 6: Same as scan 4. I0 at the beginning is 19200. I0 at the end is 11. Run started at 9:32pm. Run stopped at 9:43pm. Beam was lost again.

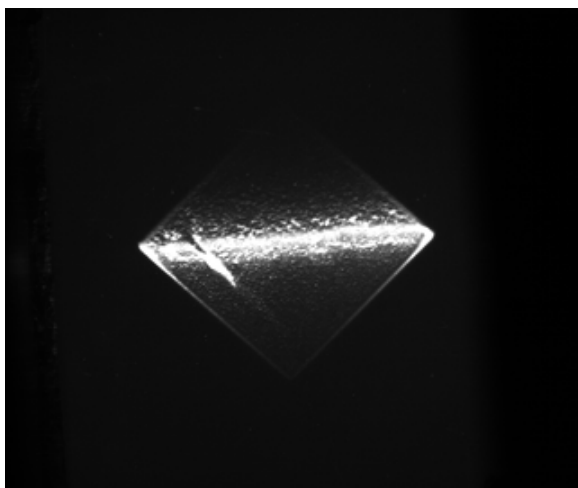
Scan 7: Same as scan 4. I0 at the beginning is 19200. I0 at the end is . Run started at 10:14pm. Run stopped at 11:33pm. The transmission occurs from the top of the diamond and works it way down.

Scan 8: I0 at the beginning is 18800. I0 at the end is . Run started at 11:43pm. Run stopped at 11:46pm. I forgot to turn off andor_lineup.

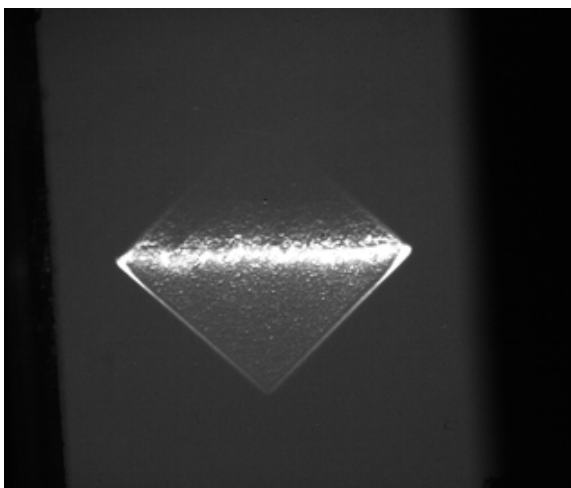
Scan 9: Same as scan 8. I0 at the beginning is 18800. I0 at the end is . Run started at 11:47pm. Run stopped at 12:57am. Chi = 46.800, th = 19.883..19.963. I left for the night after starting this scan. The transmission occurs from the top of the diamond and works it way down.

Based on the rocking curves this diamond is curved in both x and y directions causing the diamond to be concave.

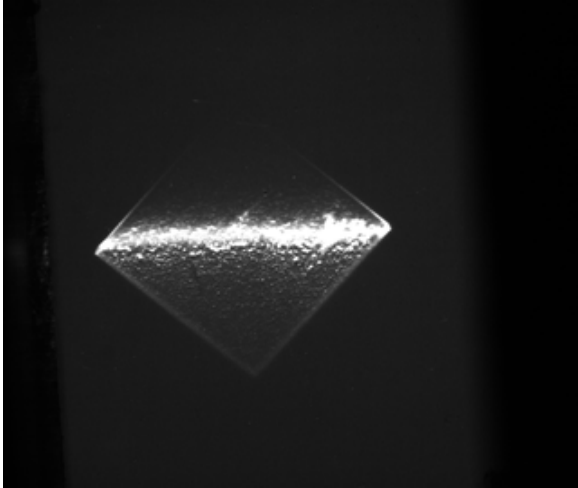
Filename	Orientation	Step size (degrees)	Exposure (s)
U300_300:11_scan001	2,2,0	0.0002	10
U300_300:11_scan002	2,-2,0	0.0002	10
U300_300:11_scan007	-2,2,0	0.0002	10
U300_300:11_scan009	-2,-2,0	0.0002	10



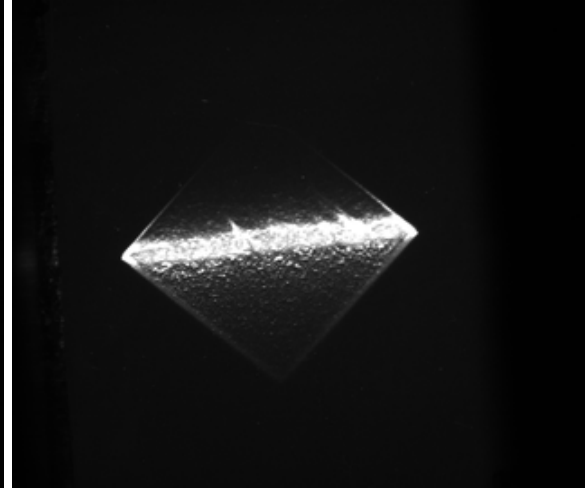
U300_300:11_scan001_197.png



U300_300:11_scan002_249.png



U300_300:11_scan007_201.png



U300_300:11_scan009_178.png

7. Scans of U300_300:12

May 26, 2013 AEB

I arrived around 11:00am because I had to check out of the cabin and check in to the campsite. I replaced U300_300:11 with U300_300:12 and began scanning.

Scan 1: Aborted. Mistyped the th spread.

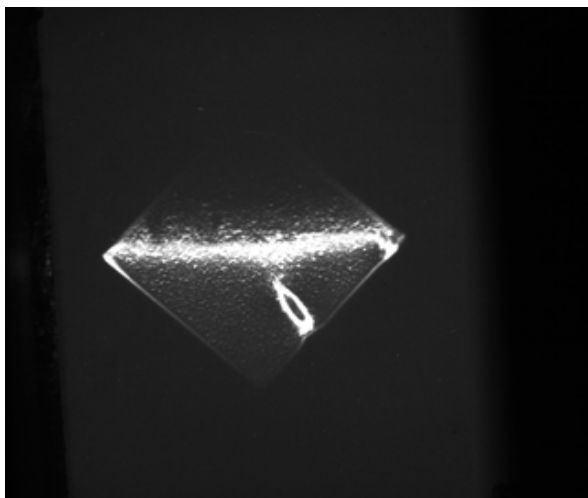
Scan 2: I0 at the beginning of the scan is 18700. I0 at the end of the scan 19000. Run started at 12:07pm. Run ended at 1:19pm. Chi = 38.0000, th = 18.431..18.511. This scan ran through a refill. The transmission occurs from the bottom of the diamond and works it way up.

Scan 3: I tweaked chi by 90. I0 at the beginning of the scan is 18800. I0 at the end of the scan 18500. Run started at 1:32pm. Run ended at 2:44pm. Chi = 127.600, th = 19.761..19.841. This scan ran through a refill. The transmission occurs from the bottom of the diamond and works it way up.

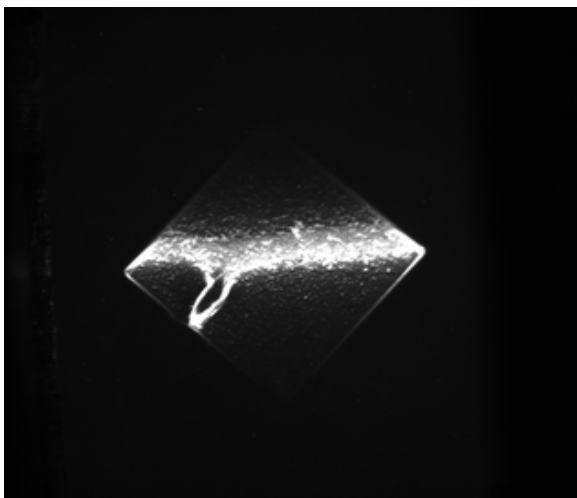
Scan 4: I tweaked phi by 180. I0 at the beginning of the scan is 19200. I0 at the end of the scan 18700. Run started at 2:59pm. Run ended at 4:01pm. Chi = 142.674, th = 19.581..19.651. The transmission occurs from the top of the diamond and works it way down.

Scan 5: I tweaked chi by 90. I0 at the beginning of the scan is 18800. I0 at the end of the scan . Run started at 4:19pm. Run ended at pm. Chi = 52.974, th = 18.201..18.281. The transmission occurs from the top of the diamond and works it way down.

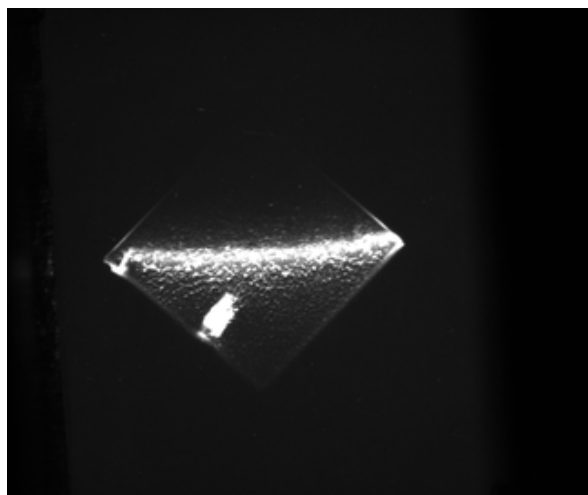
Filename	Orientation	Step size (degrees)	Exposure (s)
U300_300:12_scan002	2,2,0	0.0002	10
U300_300:12_scan003	2,-2,0	0.0002	10
U300_300:12_scan004	-2,2,0	0.0002	10
U300_300:12_scan005	-2,-2,0	0.0002	10



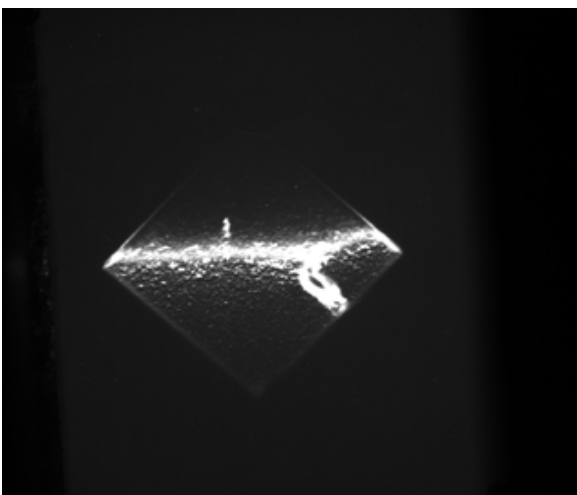
U300_300:12_scan002_294.png



U300_300:12_scan003_245.png



U300_300:12_scan004_137.png



U300_300:12_scan005_162.png

8. Scans of U300_300:13

Scan 1: I0 at the beginning of the scan is 18900. I0 at the end of the scan 19000. Run started at

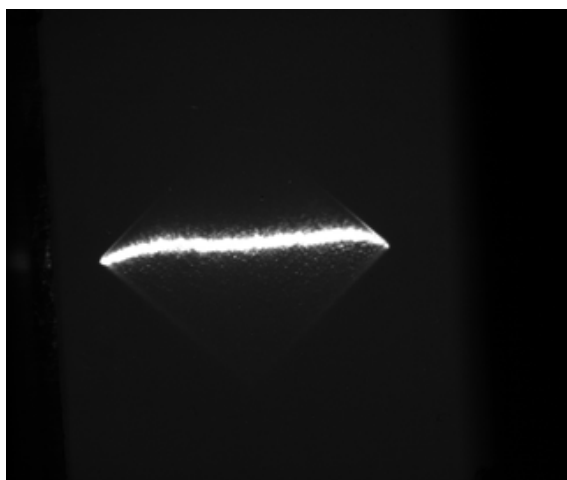
6:03pm. Run ended at 7:13pm. Chi = 46.0000, th = 17.691..17.781. The transmission occurs from the top of the diamond and works it way down. This scan spanned a refill.

Scan 2: I tweaked chi by 90. I0 at the beginning of the scan is 19000. I0 at the end of the scan 19100. Run started at 7:44pm. Run ended at 9:21pm. Chi = 136.300, th = 18.411..18.521. The transmission occurs from the top of the diamond and works it way down. This scan spanned a refill.

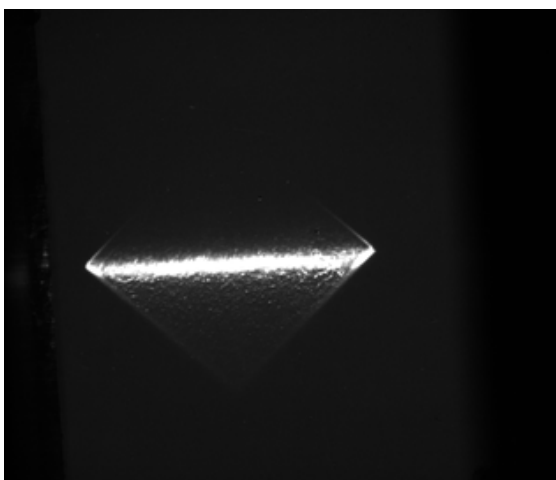
Scan 3: I rotated phi 180 degrees. I0 at the beginning of the scan is 19000. I0 at the end of the scan 19300. Run started at 9:33pm. Run ended at 11:11pm. Chi =134.3000, th =20.286..20.396. This scan spanned a refill. The transmission occurs from the bottom of the diamond and works it way up.

Scan 4: I rotated chi 90 degrees. I0 at the beginning of the scan is 19200. I0 at the end of the scan. Run started at 11:18pm. Run ended at am. Chi =44.600, th =19.555..19.665. The transmission occurs from the bottom of the diamond and works it way up.

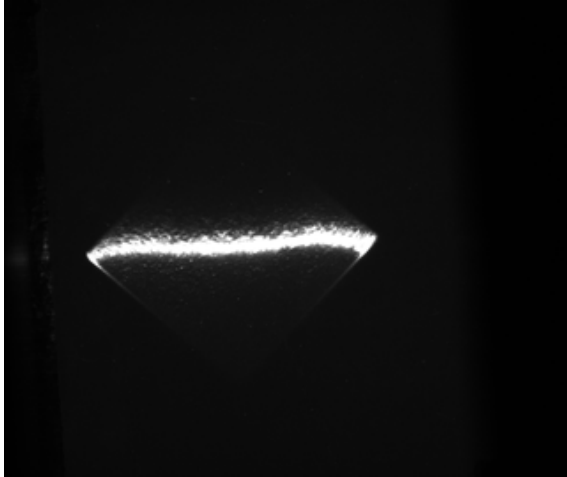
Filename	Orientation	Step size (degrees)	Exposure (s)
U300_300:13_scan001	2,2,0	0.0002	10
U300_300:13_scan002	2,-2,0	0.0002	10
U300_300:13_scan003	-2,2,0	0.0002	10
U300_300:13_scan004	-2,-2,0	0.0002	10



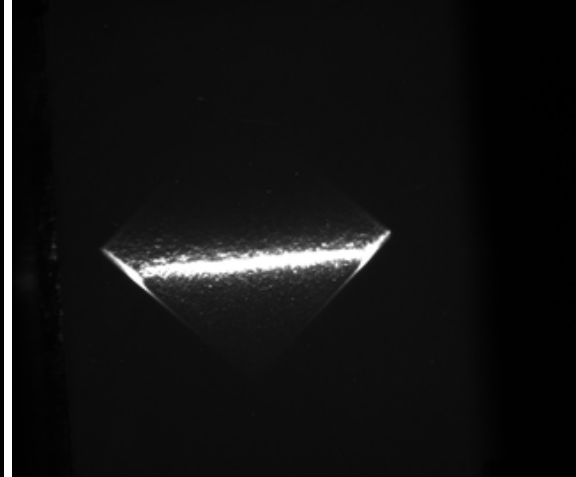
U30_300:13_scan001_193.png



U300_300:13_scan002_239.png



U300_300:13_scan003_352.png



U300_300:13_scan004_325.png

9. Scans of U500_500:9

May 27, 2013 AEB

I replaced **U300_300:13** with **U500_500:9**.

Scan 1: I0 at the beginning of the scan is 18800. I0 at the end of the scan 18600. Run started at 10:16am. Run ended at 10:52am. Chi =41.3000, th =18.550..18.590.

Scan 2: I tweaked chi by 90. I0 at the beginning of the scan is 18600. I0 at the end of the scan . Run started at 11:07am. Run ended at 11:15am. Chi =131.100, th =15.630..15.670. Beam went down.

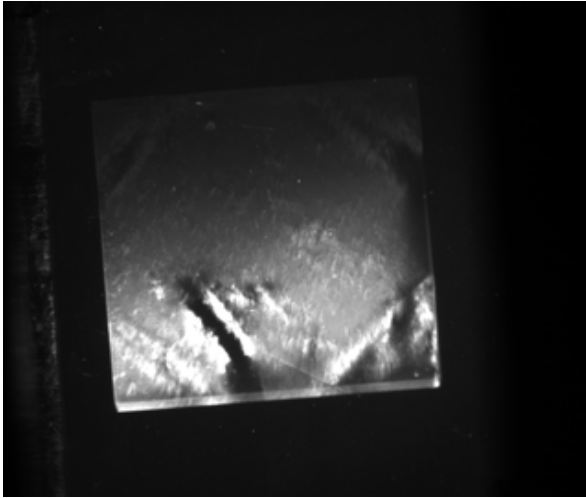
Scan 3: This is a repeat of scan 2. I0 at the beginning of the scan is 19200. I0 at the end of the scan 19000. Run started at 12:05pm. Run ended at 12:40pm. Chi =131.100, th =15.630..15.670.

Scan 4: I moved phi to 272. I0 at the beginning of the scan is 19000. I0 at the end of the scan 18700. Run started at 12:51pm. Run ended at 1:27pm. Chi =139.100, th =19.515..19.555.

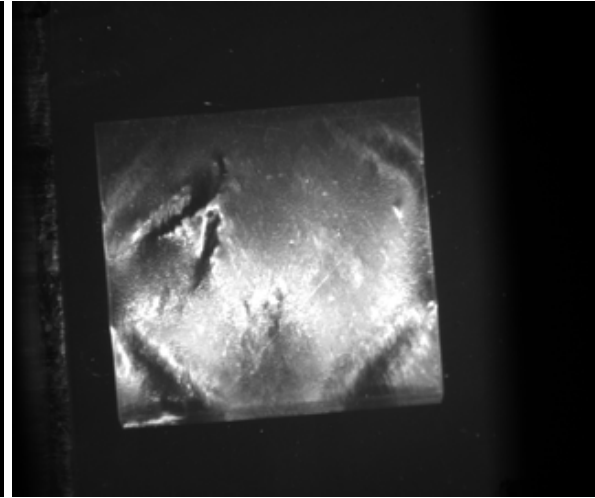
Scan 5: I tweaked chi by 90. I0 at the beginning of the scan is. I0 at the end of the scan 19200. Run started at 1:36pm. Run ended at 2:12pm. Chi =49.400, th =22.435..22.475. This scan ran through a refill.

Note: These rocking curves span a greater theta than necessary. The reason I spread the theta range is because one part of the diamond lights up throughout most of the range and I wanted to get the wings of the curve.

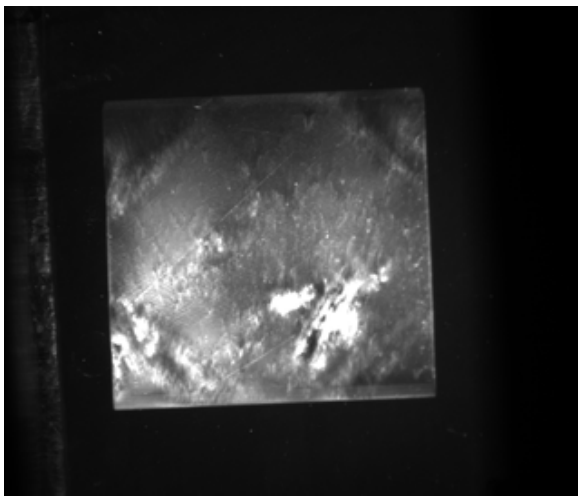
Filename	Orientation	Step size (degrees)	Exposure (s)
U500_500:9_scan001	2,2,0	0.0002	10
U500_500:9_scan003	2,-2,0	0.0002	10
U500_500:9_scan004	-2,2,0	0.0002	10
U500_500:9_scan005	-2,-2,0	0.0002	10



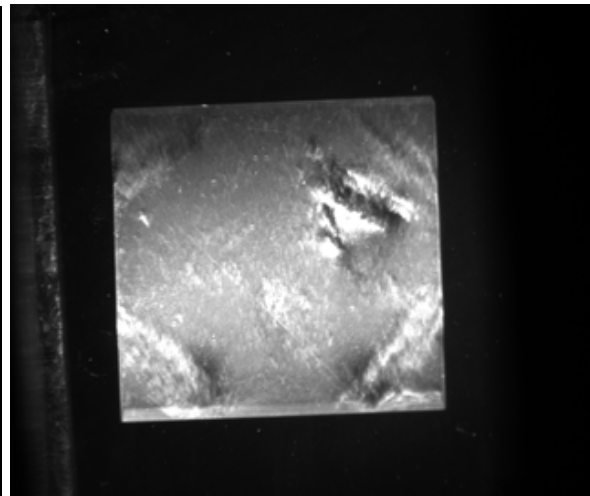
U500_500:9_scan001_116.png



U500_500:9_scan003_081.png



U500_500:9_scan004_147.png



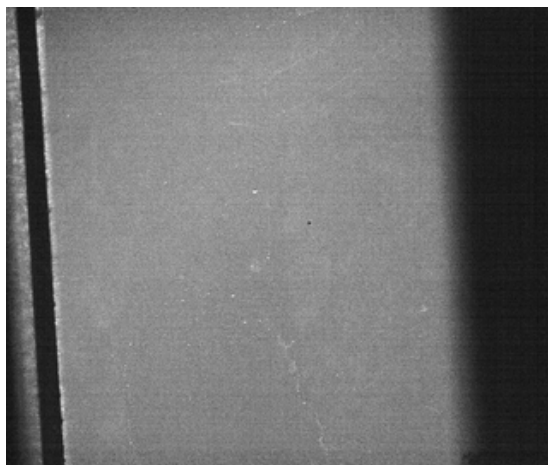
U500_500:9_scan005_099.png

10. Scans of the hoop with no diamond

As a reference for background I took one scan of the hoop without a diamond in it. This may not be necessary but it was a quick scan.

Scan 1: I mounted the hoop without a diamond and swept through a 0.01 degree range of theta in 50 steps. I0 at the beginning is 19200. I0 at the end is 19100. Run started at 2:23pm. Run ended at 2:32. Chi = 90, th = 22.435..22.445.

Filename	Orientation	Step size (degrees)	Exposure (s)
Empty_hoop_scan001	N/A	0.0002	10



Empty_hoop_scan001_025.png

11. Scans of U300_300:14

I mounted **U300_300:14** in the hoop and began scanning.

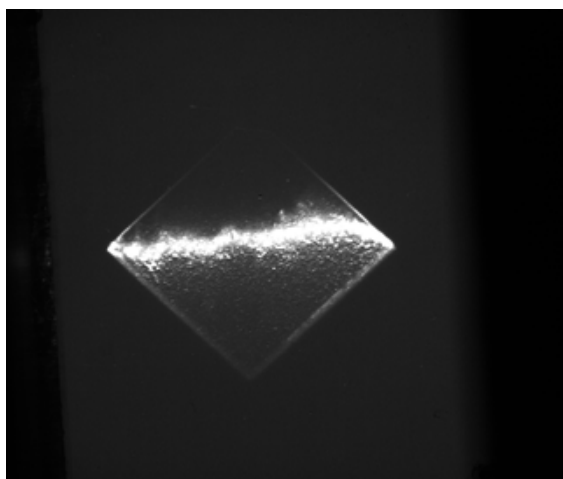
Scan 1: I0 at the beginning of the scan is 19000. I0 at the end of the scan 19200. Run started at 3:04pm. Run ended at 4:15pm. Chi =44.5000, th =17.225..17.305. The transmission occurs from the top of the diamond and works it way down.

Scan 2: I tweaked chi by 90. I0 at the beginning of the scan is 19200. I0 at the end of the scan 18900. Run started at 4:27pm. Run ended at 5:16pm. Chi =134.300, th = 18.310..18.365. The transmission occurs from the top of the diamond and works it way down.

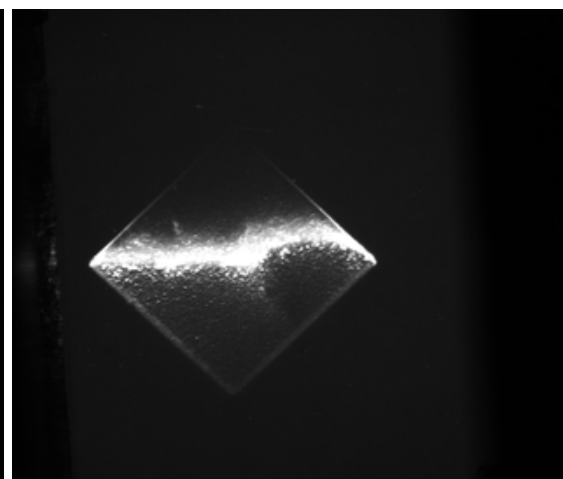
Scan 3: I moved phi to 272. I0 at the beginning of the scan is 18800. I0 at the end of the scan is 19100. Run started at 5:36pm. Run ended at 6:29pm. Chi = 136.100, th = 20.763..20.823. This transmission occurs from the bottom of the diamond and works its way up.

Scan 4: I tweaked chi by 90. I0 at the beginning of the scan is 19100. I0 at the end of the scan is . Run started at 6:41pm. Run ended at pm. Chi = 46.400, th = 19.664..19.724. This transmission occurs from the bottom of the diamond and works its way up.

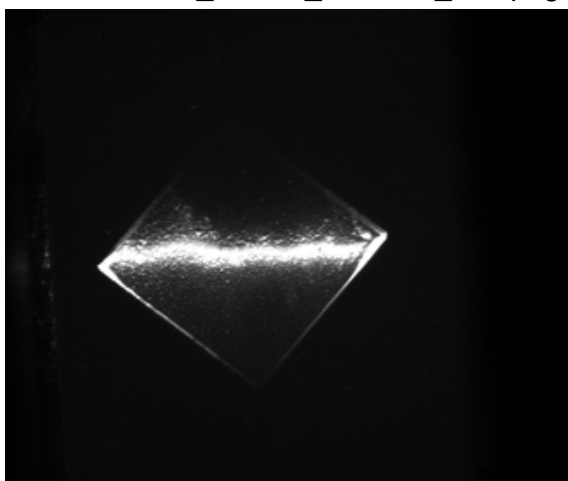
Filename	Orientation	Step size (degrees)	Exposure (s)
U300_300:14_scan001	2,2,0	0.0002	10
U300_300:14_scan002	2,-2,0	0.0002	10
U300_300:14_scan003	-2,2,0	0.0002	10
U300_300:14_scan004	-2,-2,0	0.0002	10



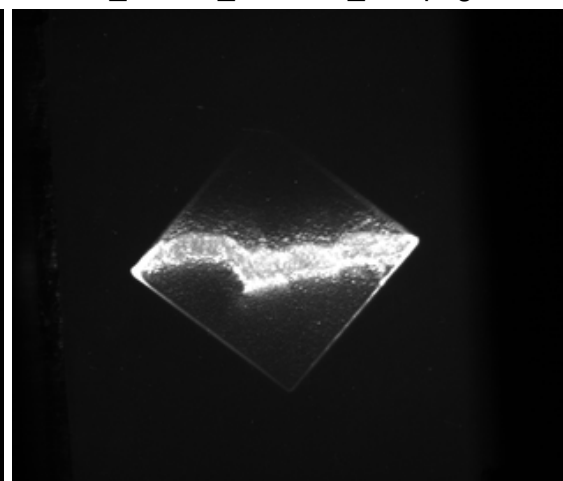
U300_300:14_scan001_148.png



U300_300:14_scan002_103.png



U300_300:14_scan003_185.png



U300_300:14_scan004_194.png

12. Scans of U500_500:10

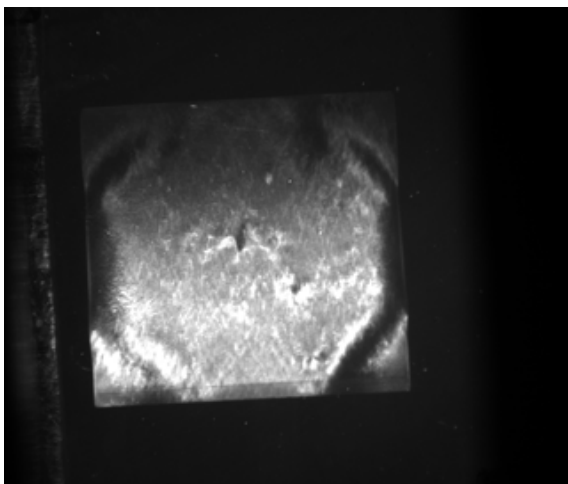
Scan 1: I0 at the beginning of the scan is 19100. I0 at the end of the scan 19000. Run started at 8:31pm. Run ended at 8:49pm. Chi =50.5000, th =17.336..17.356.

Scan 2: I tweaked chi by 90. I0 at the beginning of the scan is 18900. I0 at the end of the scan 18800. Run started at 9:05pm. Run ended at 9:22pm. Chi = 139.5, th =19.125..19.145. Tth was tweaked to center the image. tth = 38.246.

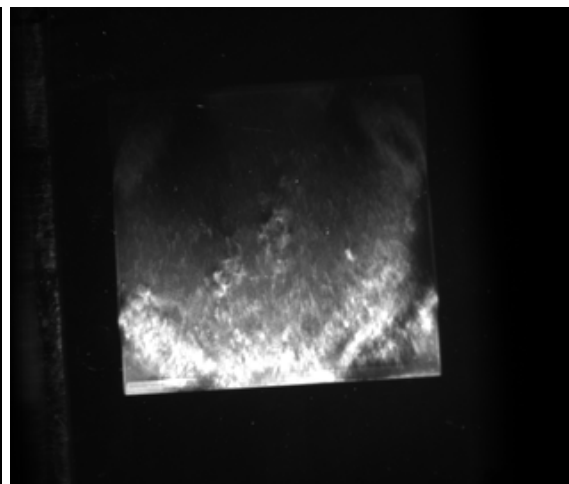
Scan 3: I moved phi to 272. I0 at the beginning of the scan is 18600. I0 at the end of the scan 19200. Run started at 10:12pm. Run ended at 10:30pm. Chi = 131.500, th =20.743..20.763. Tth was tweaked to center the image. tth = 38.446. This scan ran through a refill.

Scan 4: I tweaked chi by 90. I0 at the beginning of the scan is 19100. I0 at the end of the scan 18900. Run started at 10:41pm. Run ended at 10:59pm. Chi = 40.800, th =18.938..18.958. Tth = 38.146.

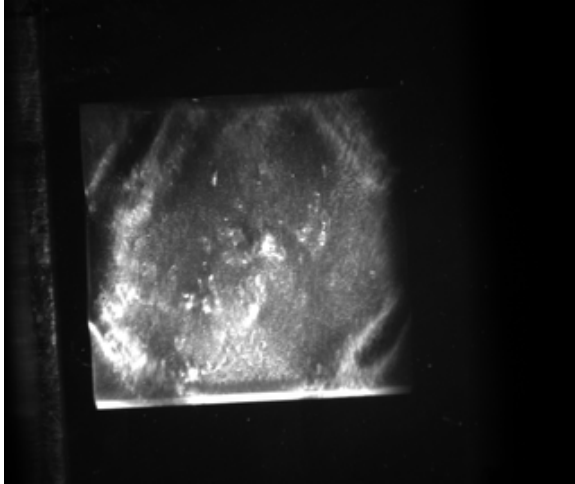
Filename	Orientation	Step size (degrees)	Exposure (s)
U500_500:10_scan001	2,2,0	0.0002	10
U500_500:10_scan002	2,-2,0	0.0002	10
U500_500:10_scan003	-2,2,0	0.0002	10
U500_500:10_scan004	-2,-2,0	0.0002	10



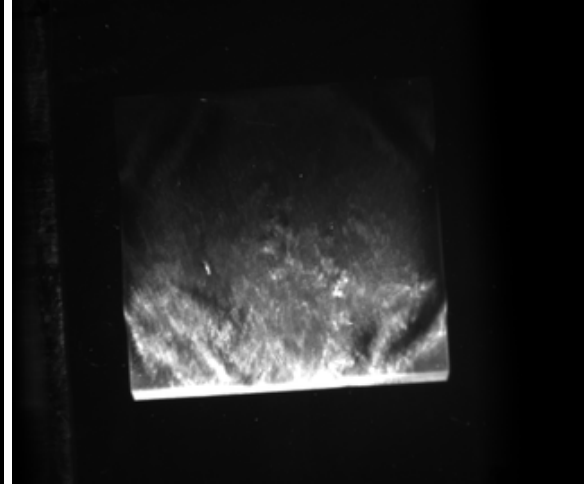
U500_500:10_scan001_041.png



U500_500:10_scan002_060.png



U500_500:10_scan003_032.png



U500_500:10_scan004_066.png

13. What to do before leaving CHESS

- Make sure all the diamonds and diamond accessories (tweezers, cleaners, etc) are put back in the safe box
- Place the hoop and mount in their storage box
- If Dr. Jones isn't there at check out be sure to call him before turning in badges.
- Make sure all image files and log files have been pushed to our servers.
- Leave the scan files on the computer so that in the future we can remember the naming convention.
- Remove the image files from the andor1 computer (computer in the hutch)