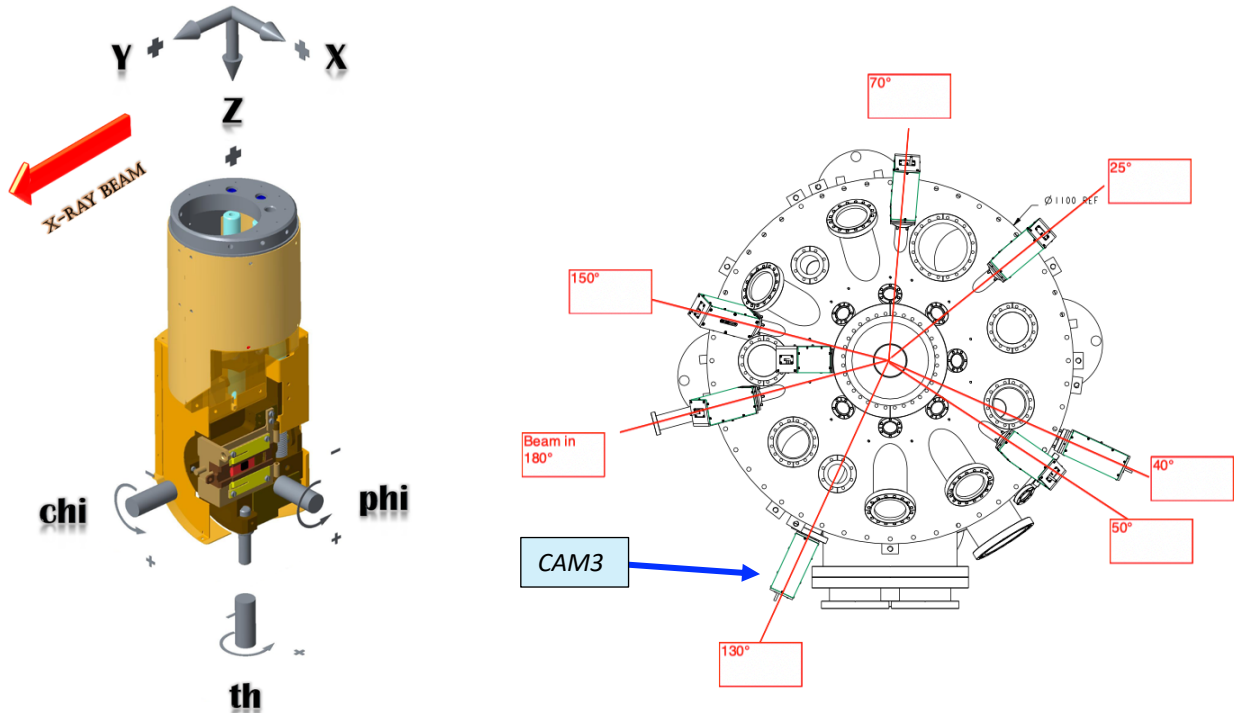


# Sample Alignment Steps

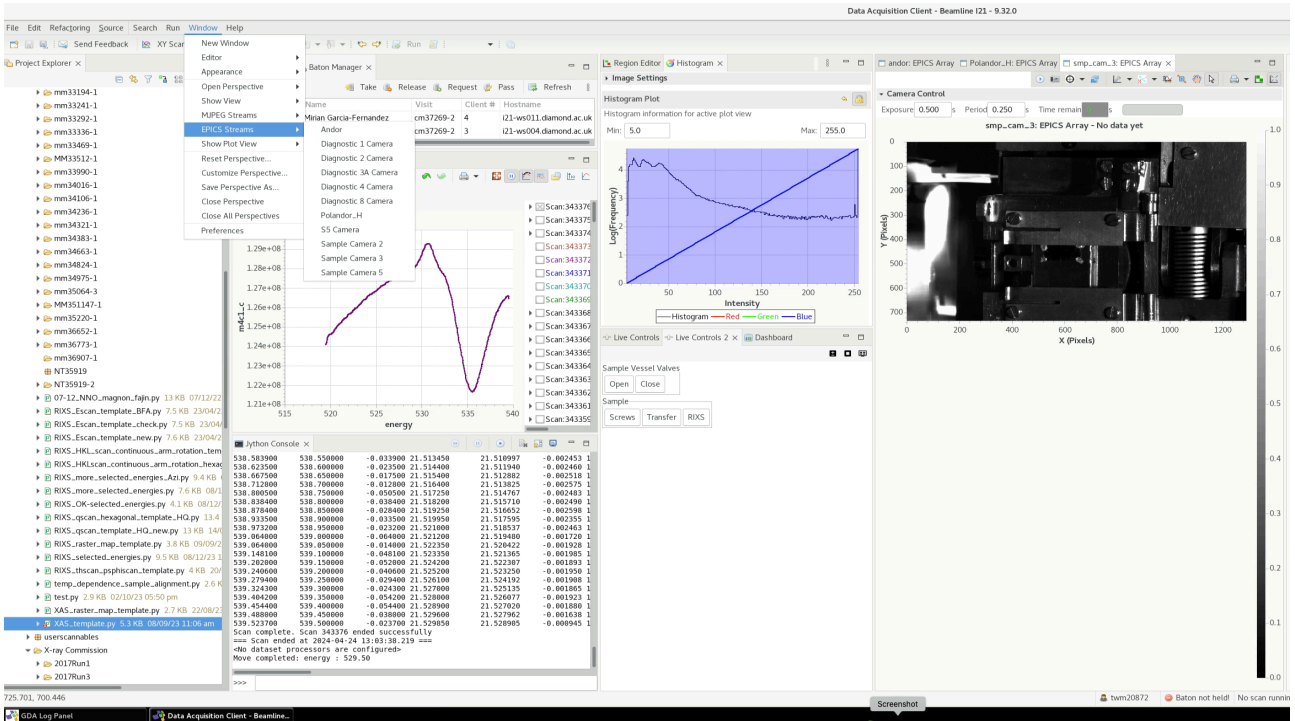
## Table of Contents

<b>Manipulator geometry</b> .....	<b>2</b>
<b>Align sample and carbon tape y and z positions using CAM3</b> .....	<b>2</b>
<b>Find a good region in the sample using XAS.</b> ....	<b>4</b>
On the fly XAS .....	4
Step scanning XAS .....	4
Surface mapping of the sample using XAS .....	5
<b>Half cutting of the sample</b> .....	<b>5</b>
<b>RIXS measurement on sample</b> .....	<b>6</b>
<b>Finding specular on sample using RIXS</b> .....	<b>7</b>

## Manipulator geometry



## Align sample and carbon tape y and z positions using CAM3



To go to Cam3, we need to move theta to 140

```
>> pos th 140
```

To open the Cam3 view in GDA:

```
window > EPICSSstreams > Sample Camera 3
```

Then a window for Cam3 will open at the same place as the Andor window is opened. In the Cam3 window you can switch the camera on by pressing the **on** button.

To turn the lights on:

```
>> lightOn
```

Align the sample position to the **cross** that marks the beam position moving y and z:



```
>> pos y
```

```
>> pos z
```

You should now switch **off** Cam3 on the Cam3 window in the **stop** button.

To turn the lights off:

```
>> lightOff
```

Once you have found the optimal positions you can store them using GDA. To capture a sample position from current motor positions, please use function

```
>> save_sample_positions("given_name")
```

For carbon tape use function

```
>> save_carbon_tape_positions("given_name")
```

### Find a good region in the sample using XAS.

First we move the sample to  $\theta = 90$  degrees so that the surface of the sample is perpendicular to the incident beam.

```
>> pos th 90
```

We could collect both fluorescence yield and total electron yield. Ideally one would like to collect FY at the same angle as we will measure RIXS. To increase the signal flux by using the collection mirror we will need to move the rotating photodiode to 1.5 degrees above of the position of the collection mirror that will be equal to the position of the spectrometer arm. For instance if we would like to measure RIXS and XAS at 150 degrees, then we have to move **m5tth** to 150 deg and the **rotating photodiode (diffth)** to the optimal position with respect to the mirror:

```
>> pos m5tth 150
```

```
>> pos diffth 151.5
```

If we don't have any special request about the resolution for the XAS measurements, we can open the exit slits to 50 microns to win intensity:

```
>> pos eslit 50
```

### On the fly XAS

Then we can collect XAS using the of the fly XAS scanning.

```
>> repeat_xas(start_energy, end_energy, number_of_scans)
```

```
>> repeat_xas(910, 960, 5)
```

This will launch a total of 5 continuous energy scans from 910 eV to 960 eV. This command will automatically set the fast shutter mode to `fsxas()`

To change Femto Gain if the diode signal or drain current is too small or is saturating, the value must be one of (1e3, 1e4, 1e5, 1e6, 1e7, 1e8, 1e9) for "Low Noise" mode. To do that, chose the adequate value and select it by typing into GDA:

```
>> draincurrent_i.setGain(1e8)
```

```
>> diff1_i.setGain(1e9)
```

```
>> fy2_i.setGain(1e9)
```

### Step scanning XAS

To measure a step scanning XAS we need to launch the following command.

```
>> scan energy 910 960 0.25 diff1 draincurrent fy2 m4c1 checkbeam
```

## Surface mapping of the sample using XAS

Still at  $\theta=90$ , we can collect z and y scans on and off the resonance to locate the best sample area.

```
>> pos energy [on resonance]
>> rscan z -0.5 0.5 0.05 draincurrent diff1 fy2 m4c1
>> pos energy [off resonance]
>> rscan z -0.5 0.5 0.05 draincurrent diff1 fy2 m4c1
>> pos z [best position]
```

```
>> pos energy [on resonance]
>> rscan y -0.5 0.5 0.05 draincurrent diff1 fy2 m4c1
>> pos energy [off resonance]
>> rscan y -0.5 0.5 0.05 draincurrent diff1 fy2 m4c1
>> pos y [best position]
```

## Half cutting of the sample

We need to do half cutting of the sample to make sure that we place the surface of the sample at the centre of rotation. The half cutting is a combination of x and theta scans. We need to move the sample to  $\theta = 0$  degrees and the rotating photodiode diffth also to 0 degrees.

```
>> pos th 0
>> pos diffth 0
```

Then we measure an x scan to find out where the sample cuts the incident beam. For measuring the direct beam we need to set the gain from diff1 to  $1e5$ .

```
>> diff1_i.setGain(1e5)
>> rscan x -1 1 0.1 diff1
```

To find the half cutting position the best is to use the differential plotting feature from GDA

xy plotting tools > Maths and Fitting > Derivative view

Move to halfcutting of the beam and do a finer x scan

```
>> rscan x -0.1 0.1 0.005 diff1
```

Once x is at half cutting, do a theta scan.

```
>> rscan th -2 2 0.2 diff1
```

Move **th** to the centre of the scan and repeat the iteration of **x** scans and **theta** scans until the theta scan looks like a symmetric triangle and the intensity of the maximum of the theta scan is half of the intensity of the direct beam.

Once you have optimized the half cutting for the sample you will have the preliminary **x** value and **theta** offset.

The next step is to find the x position for the **carbon tape** in an analogous way. There is no need to measure theta scan for the carbon tape.

#### RIXS measurement on sample

Once we have found the optimal positions for x, y and z, we test the quality of the RIXS image. First we change the mode of the fast shutter to camera mode.

```
>> primary()
```

We move the theta of the sample to any desired position:

```
>> pos th 70
```

We make sure that the collecting mirror M5 is at the same angle as the spectrometer arm and that the rotating photodiode is at theta=0 degrees.

```
>> pos m5tth 150
```

```
>> pos diffth 0
```

We move the energy to the resonance value.

```
>> pos energy [resonance energy]
```

For the initial test we can open the slits to have more flux

```
>> pos eslit 50
```

We acquire an image:

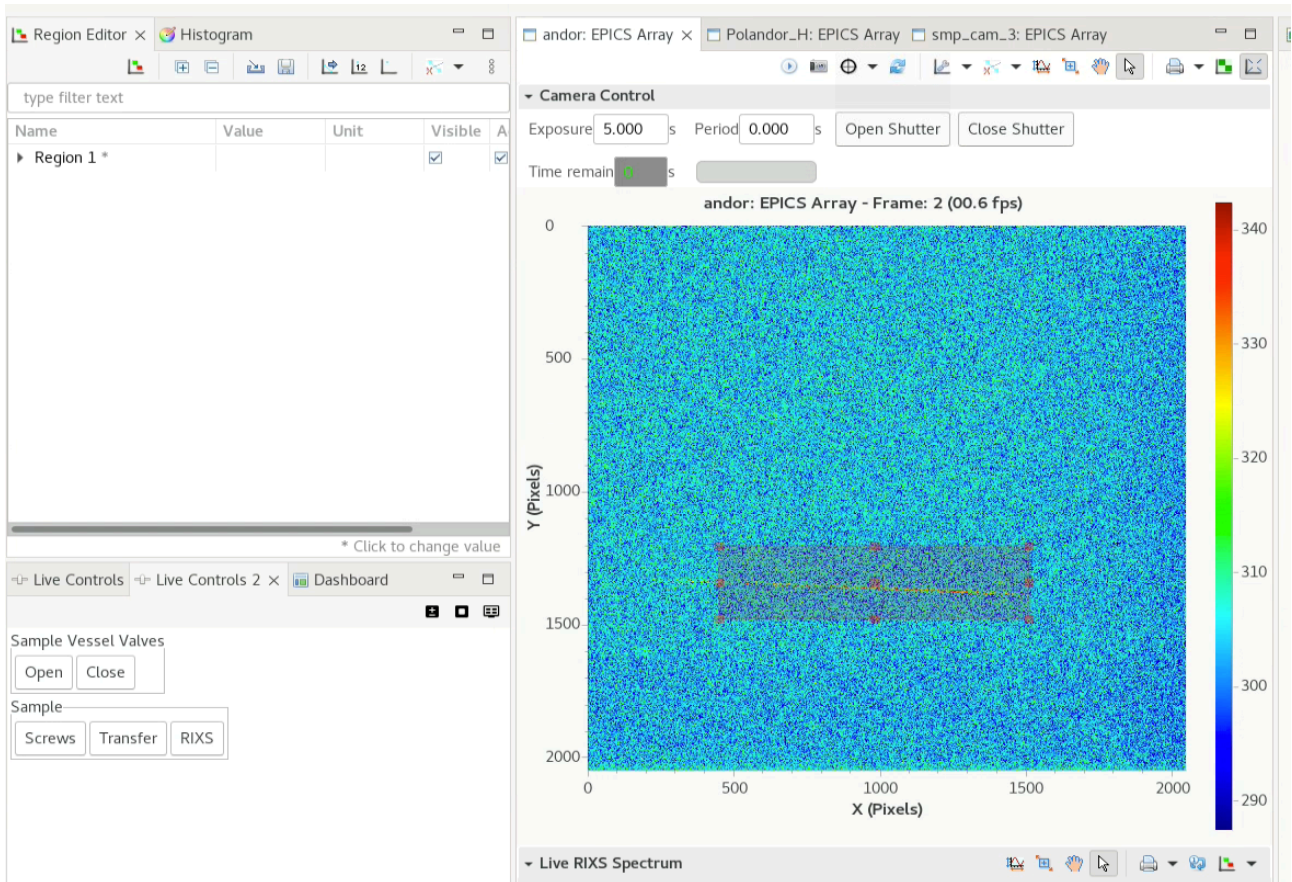
```
>> acquireRIXS 1 andor 20
```

Or

```
>> get_rixs(1, 20)
```

Next step is to optimize the **x** value so that the signal is on the centre of the detector. We can adjust the vertical position of the signal in the detector by moving **spech**.

With the region editor in GDA, we can create a region of interest that includes the signal of the elastic signal in the detector.



Then we can move theta to the value that we expect to have the specular, for a flat sample with the spectrometer arm at 150 degrees, as hq mirror will be at 154 degrees we would expect to find the specular at  $\theta=77$ . Then:

```
>> pos th 77
```

```
>> rscan th -2 2 0.2 andor 20
```

Once we find the maximum value in theta, we should scan chi. We have created a pseudo motion of chi that will correct for any misalignment of x and z while moving chi.

```
>> rscan ps_chi -2 2 0.2 andor 20
```