

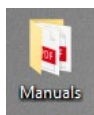
XPS2 Operating Procedure

Thermo Scientific Nexsa G2

Help Resources



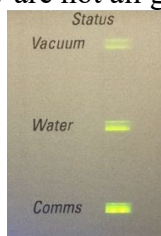
XPS knowledge viewer: Has information and videos on setting up experiments, performing data processing, and using other techniques on the Nexsa (UPS, ISS, Rheels)



Nexsa G2 User Manual provided by Thermo Scientific is located in the Manuals folder on the desktop

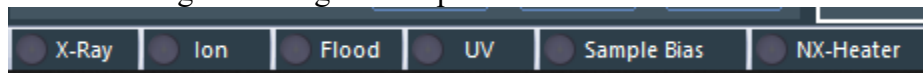
Pre-Check

1. Ensure you have an XPS2 reservation in CoreResearch, and Start your reservation
2. Inspect the instrument before using it
 1. Verify the three status lights for Vacuum, Water, and Comms are all green. If they are not all green, please contact SMIF

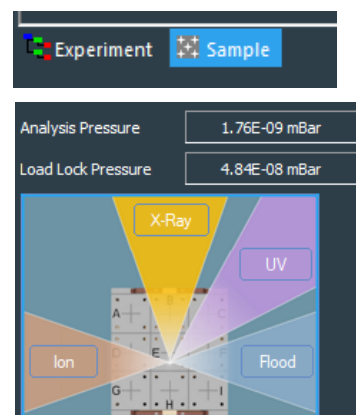


Nexsa Status Lights

2. Check the status of all sources on the lower left-hand-corner of the control software panel and make sure all guns are all off before you start anything. If any guns are on, you need to manually shut them off from the control panel before loading/unloading the samples.



3. Check the vacuum levels by clicking on the sample tab (if needed).
 - Analysis Pressure should be less than 1E-8 mBar
 - Load Lock Pressure should be less than 1E-6 mBar



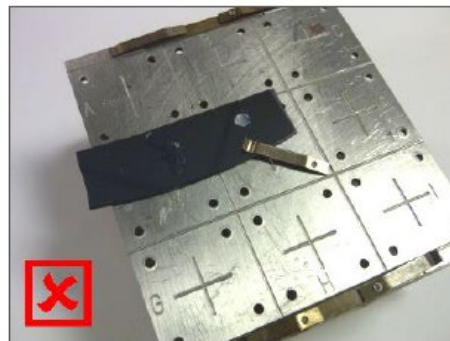
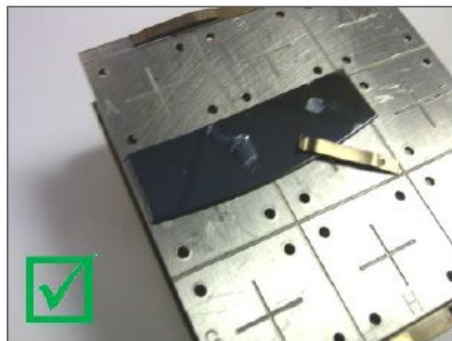
Sample Loading

ALWAYS WEAR GLOVES whenever you are touching the sample stage and loading/unloading the samples

3. Click on the venting load lock button
4. Unload the sample stage from the load lock

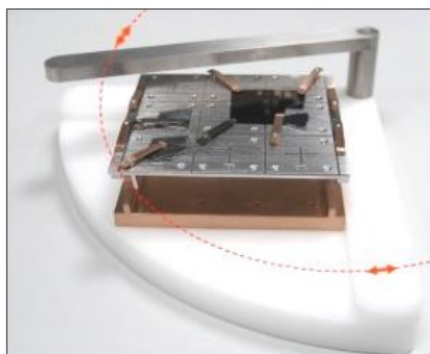


5. Mount your samples on the stage using sample spring clips or double-sided adhesive carbon tape
 1. It is suggested to place the clips on the bottom edge of the sample to avoid shadowing the X-Ray beam
 2. Ensure that the clips and samples **DO NOT** extend beyond the top plate of the sample holder. Run your finger along the edges of the plate to verify nothing is hanging over the edge. This is to prevent internal damage to the transfer mechanism.
 3. **NEVER** use the 4 clips on both edges of the stage to mount your samples. These 4 clips are designed to hold the sample plate.

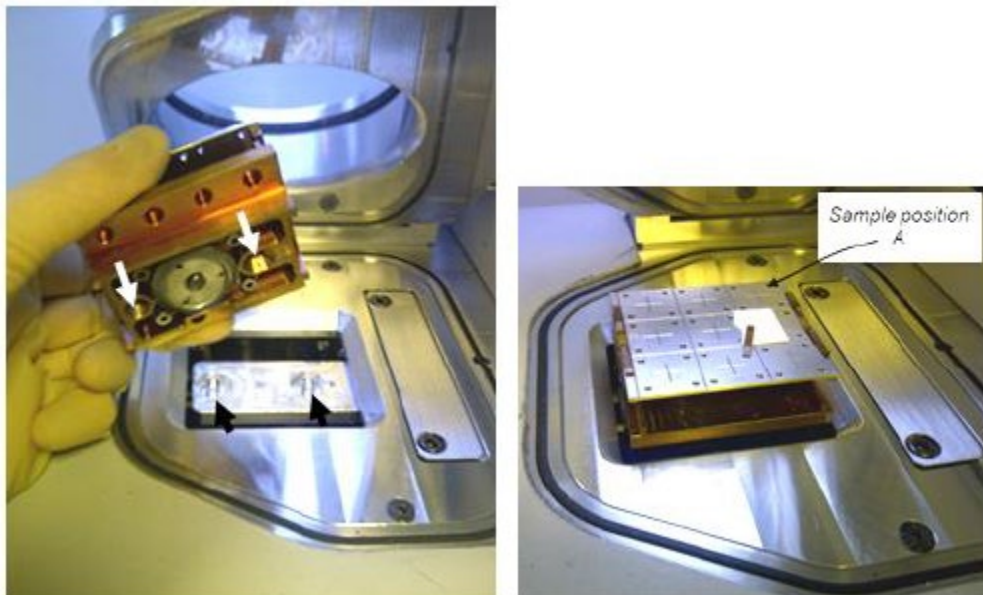


Good Sample Mounting (Left) and Bad Sample Mounting (Right)

6. Check that the maximum height of the samples is suitable using the loading gauge arm. It should move across the sample holder without touching the top of the samples.




7. Load the sample stage with the letter “A” facing the analysis chamber (towards the right side of the system) as shown below. Ensure that the two holes on the bottom of the holder (white arrows in diagram below) engage correctly with the pins on the carrier plate (black arrows)



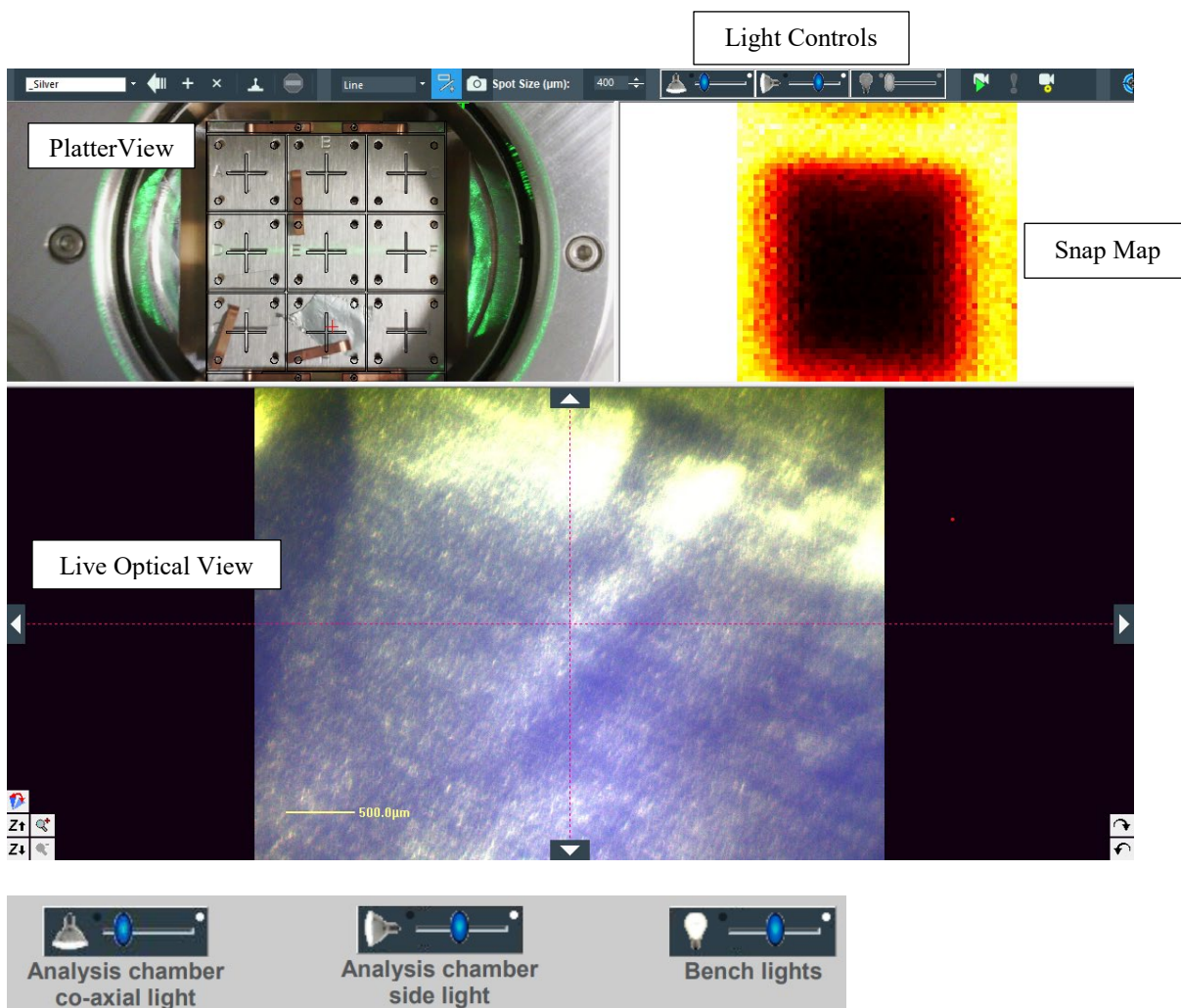
8. Click on the pump button and let the stage pump in the load lock until the pressure reaches $<7E-7$ mBar
9. Once the load lock pressure is below $7E-7$ mBar, click on the transferring button, which will move the stage into the analysis chamber



10. Wait until the stage transfer completely finishes (“command complete”) and the analysis chamber pressure reaches **$8E-8$ mBar** or lower.

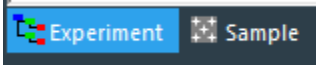
11. Open the optical view by clicking the optical view icon 
12. Navigate to the desired measurement point on your sample by double clicking on one of the optical images or by using the 4 direction arrow keys to move the stage. Fine positioning is best done by navigating using the Live Optical View (Large Window)

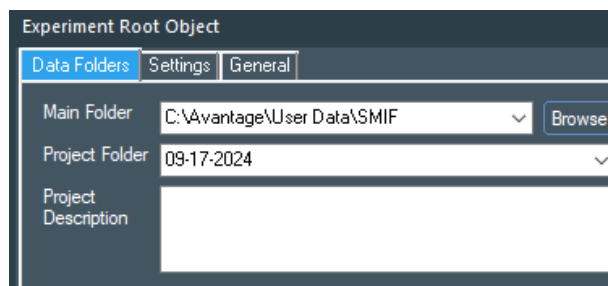
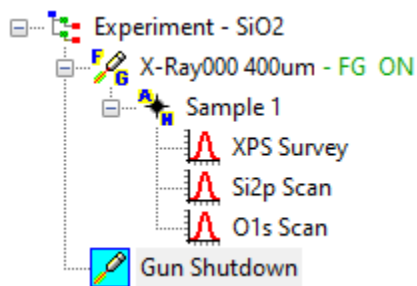
1. Adjust light controls as needed to get best view of your sample



13. Use the Z+ and Z- buttons to bring your sample surface into focus. This is just to get the sample in close focus. The software will optimize the sample height as part of the XPS experiment.

Setting Up Experiment

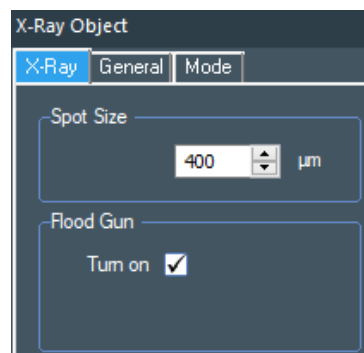
14. Go to the Experiment Section on the software control panel 
15. Under the file menu select “New Experiment” to build a new experiment from scratch, or select “Open Experiment” to open a previous experiment for editing
16. An example experiment is shown below. Other examples are shown in the Appendix. Click on any step to modify the settings from the default values



17. Experiment: Click on this step to select where to store the data
 1. If needed, create your Main folder in windows in the User Data Folder (shortcut on desktop)
 2. Browse to select your folder as the Main folder
 3. Enter a desired folder name for the Project Folder (e.g., today’s date)
 4. The data is stored in a file structure based on the Experiment Tree structure, with each object being a folder, and the spectrum data files being stored in a folder based on the name of the object they are attached to. Typically this would be the Main Folder Path Name\Experiment Name\Source\Point. In the above example, the data is stored in C:\Avantage\User Data\SMIF\09-17-2004\Experiment – SiO2\X-Ray000 400um – FG ON\Sample 1
 5. Click Apply

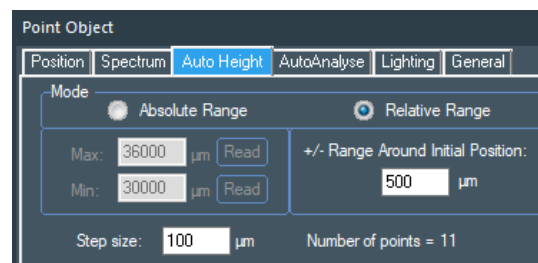
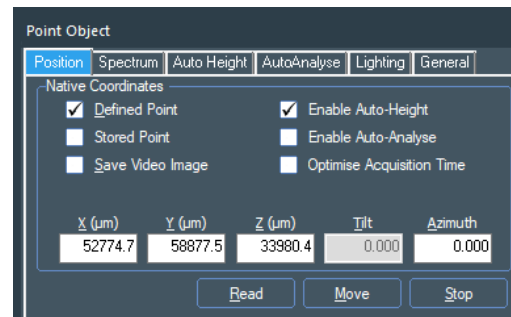
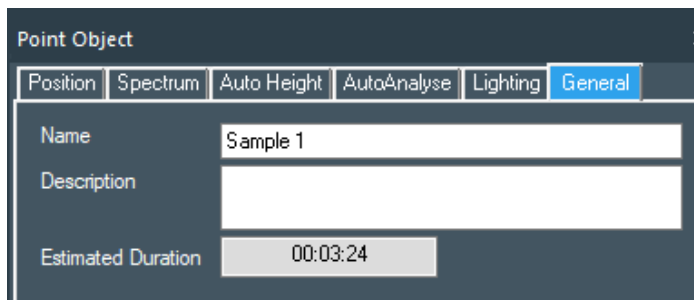


18. Source
 1. Choose X-Ray Gun (typical)
 2. Set desired spot size (30 to 400um)
 3. Turn on Flood gun unless sample is conducting

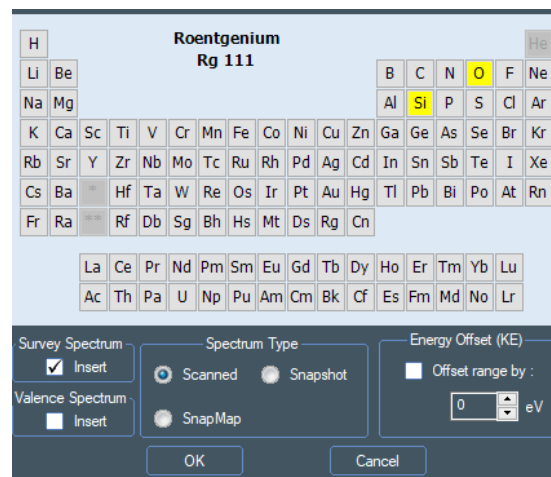


19. Point 

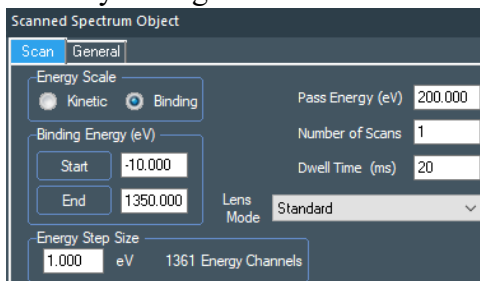
1. Select Point (typical)
2. Check Enable Auto-Height
 1. Under Auto Height Tab use relative range +/- 500um with step at 100um
3. Go to General tab and change the name to your sample name

20. Spectra 

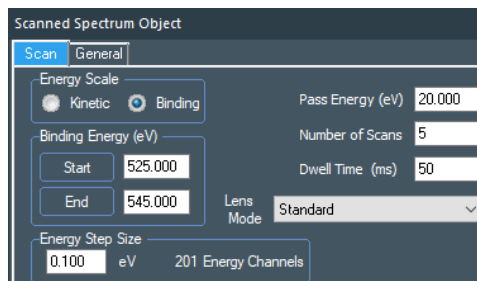
1. Select Multi Spectra
2. Check the Survey Spectrum box for survey scan
3. Click on the elements that you would like to do high resolution region scans
4. If desired, modify scan parameters from defaults by clicking on the particular scan in the experiment tree



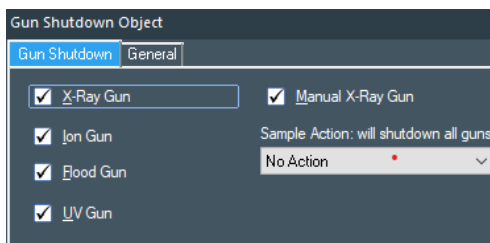
Default Survey settings



Default High Resolution Region Scan settings



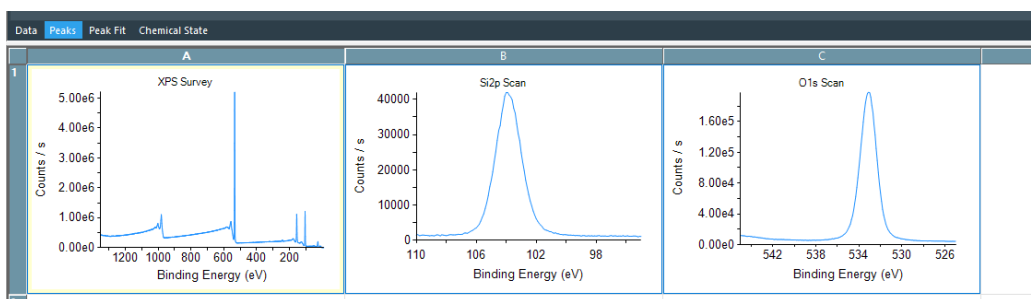
21. **Always** end your experiment with a Gun Shutdown Step, and make sure all guns are checked



22. Start experiment by clicking on the green arrow



23. View and process the data by dragging the point position in the experiment tree to the large window on the right



Processing Data

Note: You can download your own copy of Avantage for offline data processing. See separate instructions for doing this.



The XPS knowledge viewer has guides and videos for processing data in the Avantage software. Commonly used functions are:

Survey Scan Processing



Auto-ID of elements in the survey spectrum and performs quantification



Manual peak identification of peaks in the survey spectrum

Region Scan Processing



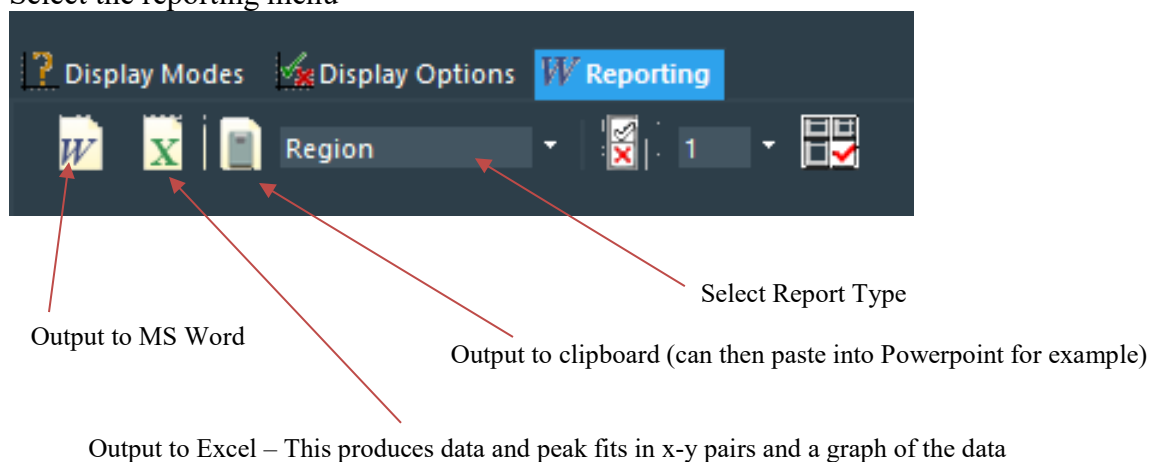
Peak Fitting



Peak Shift for charge compensation (if needed)

Exporting Data (Reports)

Select the reporting menu



1. After clicking on the Excel or Word icon, select “Report Options”
2. Select “Browse” to select the file path for saving the document
3. Once in the desired folder, enter a filename for your document and click “Open”
4. Click “OK” in the Report Settings Window
5. Click the Excel or Word icon again, and select “Report to C:\...\your file name”
6. An Excel file will be created and automatically saved to the file and folder you designated

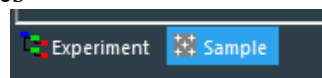
Sample Unloading and Shut Down

ALWAYS WEAR GLOVES whenever you are touching the sample stage and loading/unloading the samples

24. Make sure all guns are off before unloading your samples

25. Go to the Sample Section on the software control panel

26. Click on the unloading button to transfer your sample stage from the analysis chamber to load lock and vent the load lock



27. Unload the sample stage from the load lock

28. Unload your samples from the sample stage.

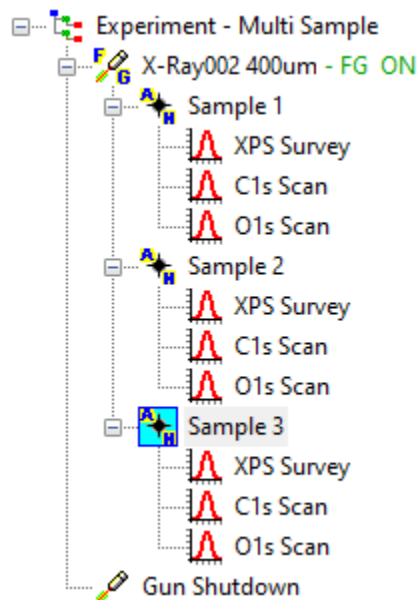
29. Completely remove any carbon tape from the stage and wipe the surface with a clean tissue wipe
30. Make sure no clips are hanging over the edge of the sample stage
31. Load the sample stage with the letter “A” facing the analysis chamber (towards the right side of the system) as shown in Step 9. Ensure that the two holes on the bottom of the holder engage correctly with the pins on the carrier plate (black arrows).
32. Press the button to pump the load lock again. **You always need to leave the load lock in high vacuum when you are done with your measurement.**



33. **Leave the Avantage software open. Do not close the Avantage software.**
34. Stop your XPS2 reservation in CoreResearch

Appendix: Sample Experiments

Multi Sample Experiment

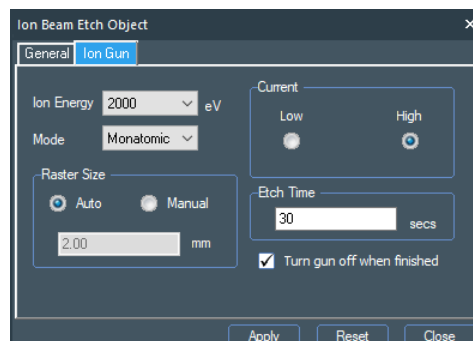
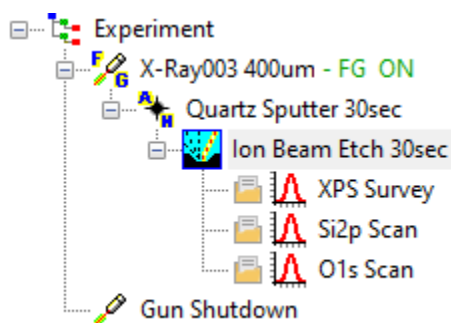


Sputter Etch – Surface Cleaning



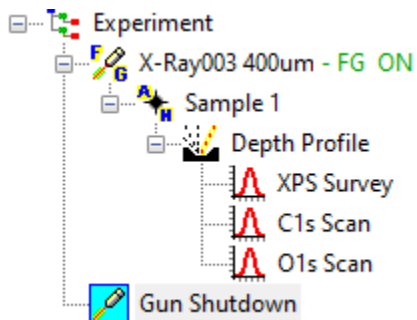
Monatomic Mode: Used for hard materials (e.g. metals and semiconductors) – more aggressive

Cluster Mode: Used for soft materials (e.g. polymers) – very gentle, minimizes bond disruption

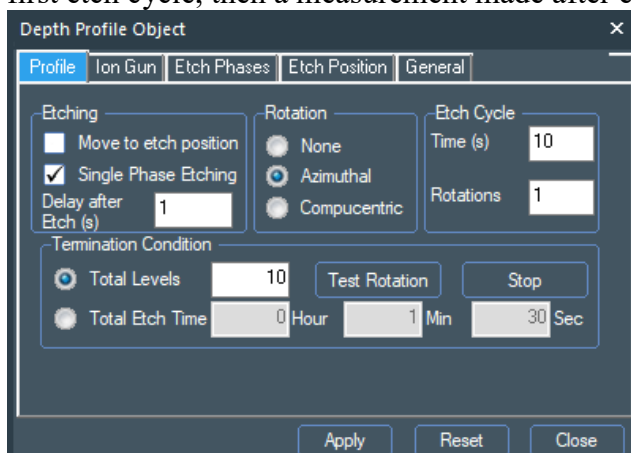


In the Ion Gun tab, select Monatomic or Cluster mode and the desired ion energy. Selecting Auto for raster size will set the etch area to be 5x the X-Ray spot size.

Sputter Etch – Depth Profile



In the profile tab, select the number of total levels and the etch cycle time. Note: The number of levels is the number of measurements made, including a measurement prior to sputter etching. For example, 10 total levels would result in a measurement prior to the first etch cycle, then a measurement made after each of 9 etch cycles.



In the Ion Gun tab, select Monatomic mode and the desired ion energy. Selecting Auto for raster size will set the etch area to be 5x the X-Ray spot size. Note that an estimated etch rate for Ta₂O₅ is shown.

