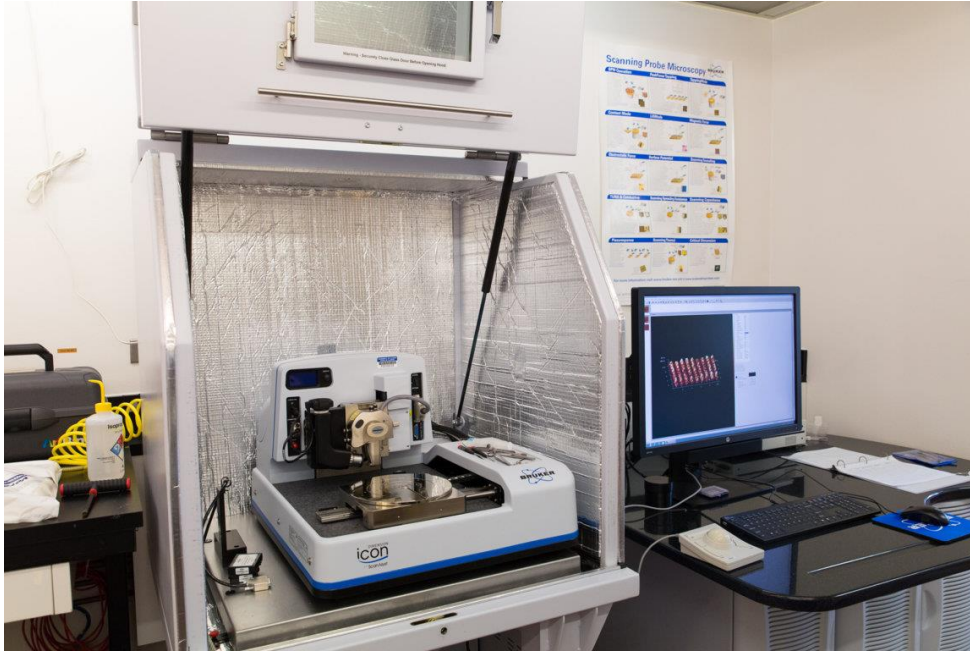# Bruker Dimension Icon Atomic Force Microscopy – Air Scan


Bruker's Dimension icon Atomic Force Microscope (AFM) System allows for multiple experimental scanning modes that utilize Bruker's new ScanAsyst algorithm. Users can perform scans in air and fluid, using Tapping Mode or Contact Mode. Available experimental setups include, Magnetic Force Microscopy, Peak Fore Quantitative NanoMechanics, Force Imaging, and Surface Potential Imaging. The maximum step height measurement is approximately 10 µm, with a scan range of 100µm x 100µm. ScanAsyst Air tips and installation are currently provided by NCF, however, special tips needed for user specific experiments can be purchased by the user from Bruker. NCF can also purchase tips on the user's behalf at a fee.

Experiment Setup

1. Open the **Nanscope** software on the desktop. As the software starts up, the laser is automatically turn on.
2. Once started, in the **Select Experiment** window, click on the type of experiment you would like to perform in the 1st section.
   a. Typically, **ScanAsyst**, but others experimental categories are available
   b. Click on **ScanAyst in Air** in the 2nd section.
   c. Click on the selected experiment in the 3rd section.
   d. Click on **Load Experiment**.

1. Choose "**ScanAsyst**"

2. **ScanAsyst in Air**

3. **ScanAsyst in Air**

4. Select **Load Experiment**
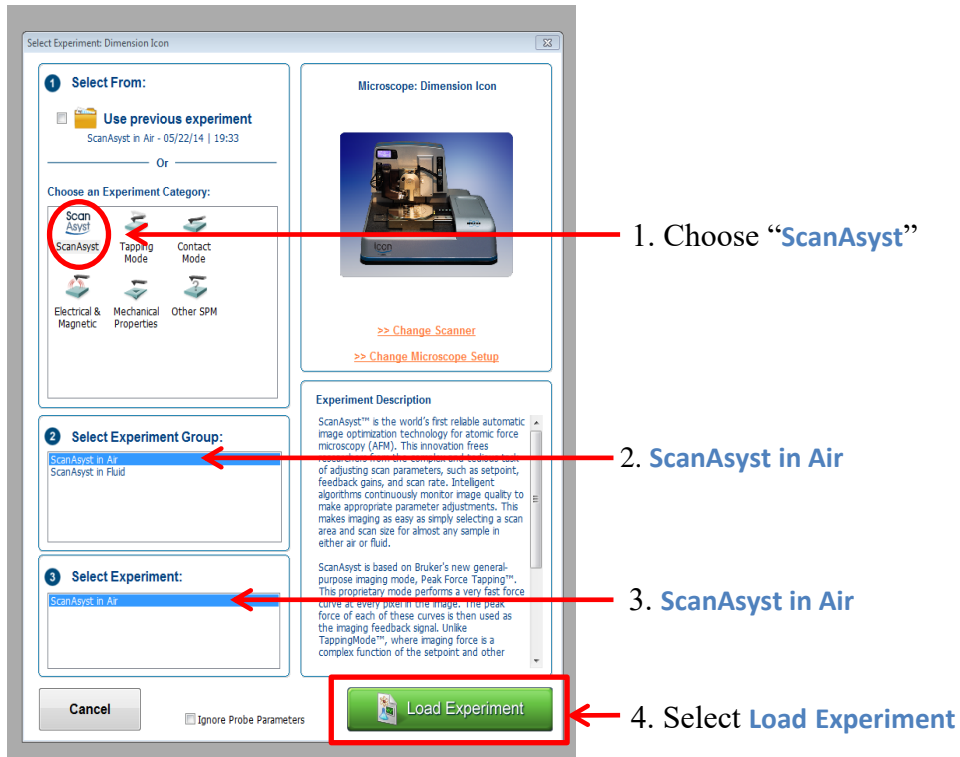
3. In the **Workflow Toolbar** window, click on **Setup**.

1. Click on **Setup**
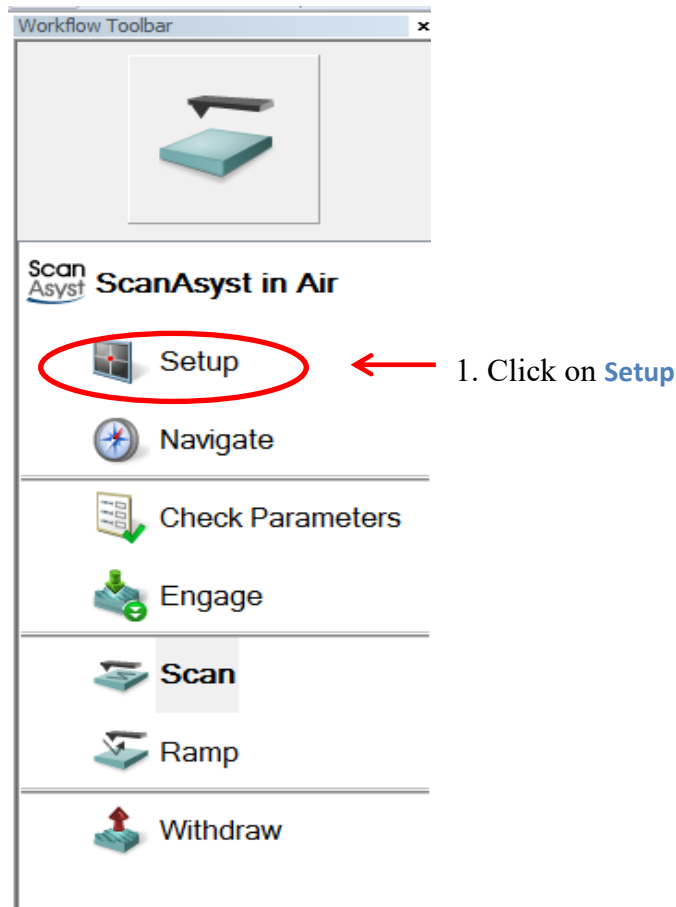
4. Click on button called **Move to the Alignment Station** in **section 2.1 of Align Laser on Probe**. The system will move the laser-detector assembly to the alignment station located on the stage.


5. Align the laser by centering it on the tip using the four knobs on the laser assembly **(turn the knobs very slowly)**. For reference, click on the videos in **sections 2.2 and 2.3 of Align Laser on Probe**.
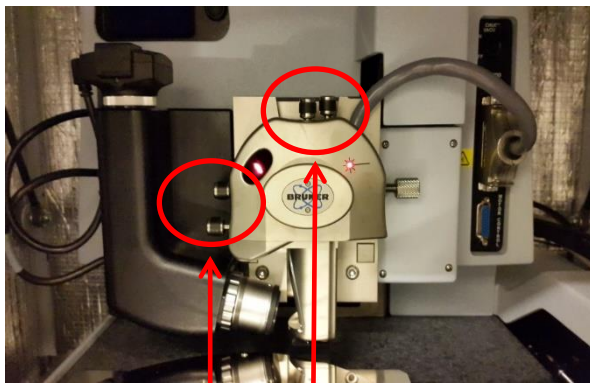
1. By rotating the two knobs, get the laser on top of cantilever with highest voltage, ideally ~ 4.2 -4.5 V
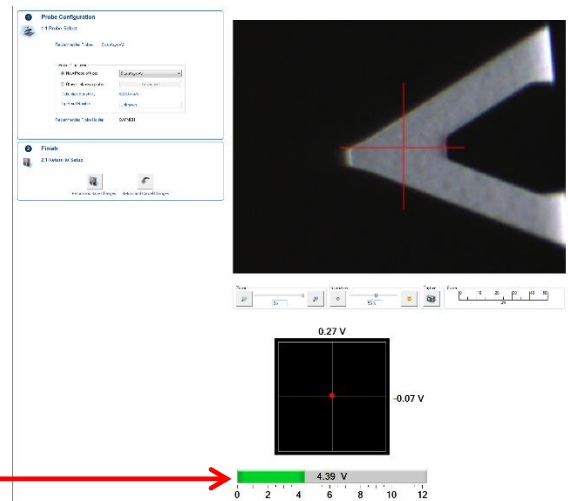
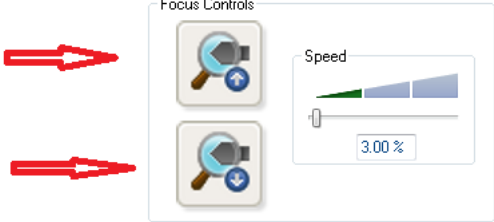2. By rotating the two knobs, get the horizontal and vertical detector voltages as close as possible to zero
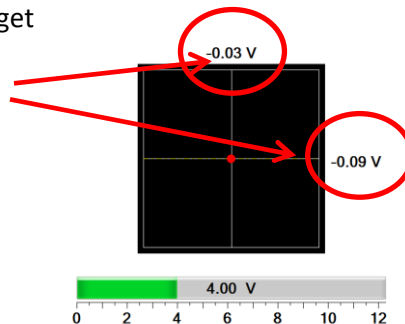
6. Click on the button called **Return from Alignment Station** in **section 3.1 of Focus Tip**. Wait for the laser-detector assembly to return from the alignment station.

7. In **section 3.2**, use the buttons called **Focus Controls** to focus the camera on the tip. You can change the speed at which this is done by using the speed control next to the Focus Controls.

8. Click on the tip position on the probe image to locate the cantilever. This centers the red cross-hairs on the cantilever. You can zoom in or out, and adjust the illumination using the controls at the bottom of the image.
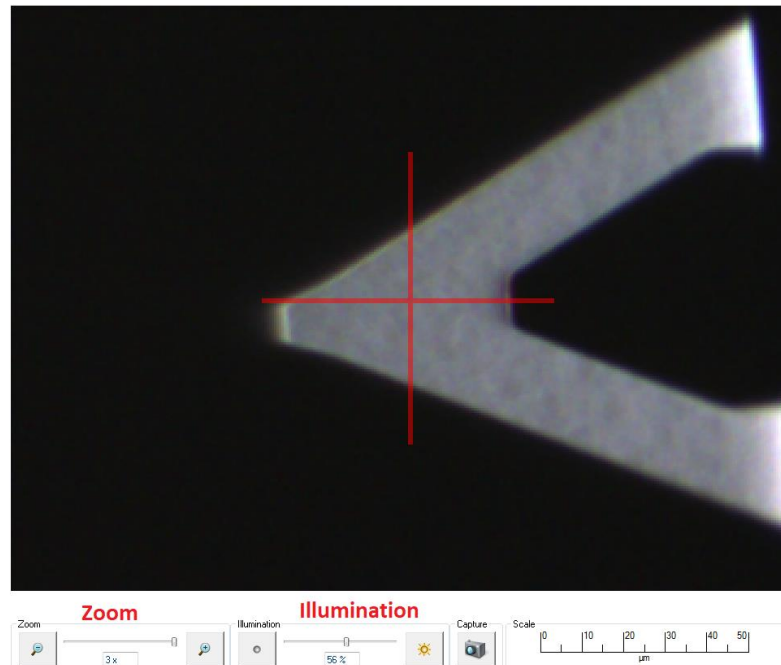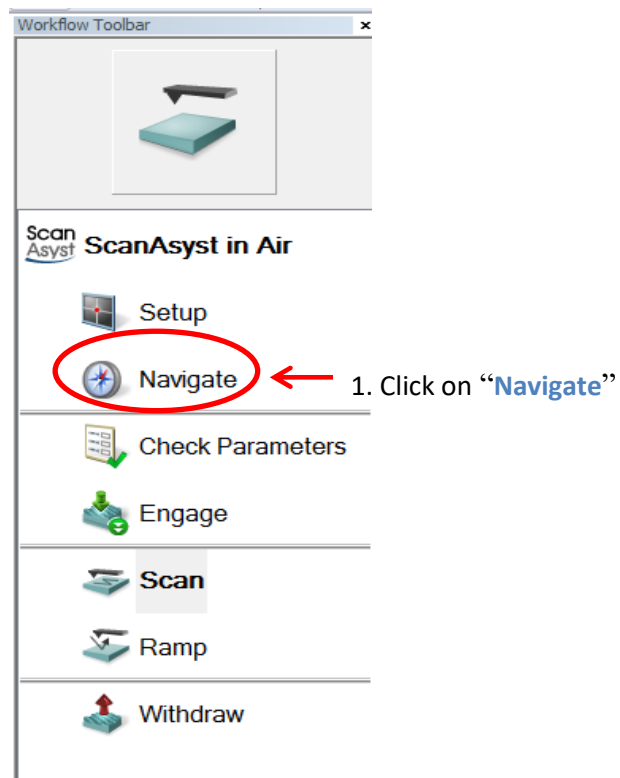

9. Using the track-pad, move the laser-detector assembly up to make sure that it is higher than the sample. **This ensures that the tip doesn't crash into the sample as you move in the sample.**

   a. Press and hold Lock

   b. Scroll the ball up once to make the assembly move up.

Sample Setup

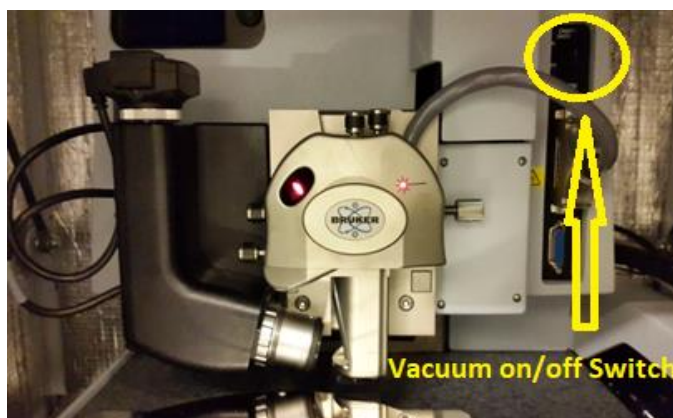10. In the **Workflow Toolbar**, click on the **Navigate**.

1. Click on "**Navigate**"

11. In **section 1.1 of Load Sample**, click on **Sample Load Position**.

12. Place your sample on the stage. Turn on the vacuum if necessary.

13. **To make sure that your sample doesn't crash into the tip, check that the laser-detector assembly is above the surface of your sample. If it is, go to step 14. If not, move the laser-detector assembly up by doing the following**

    a. Press and hold **Lock**. Then press and hold **Focus.**

    b. Scroll the ball up once to make the assembly move up.

14. Move the sample in by doing the following

    a. Press and hold **Lock**

    b. Scroll the ball once to move your sample underneath the tip.

15. In **section 2.1 of Focus on Sample**, click on **Sample (default)**

16. Reduce the illumination in the image. In section 2.2 of Focus on Sample, click on **Find Surface**. The scan-head (laser-detector-tip) assembly will approach the sample and stop once it has detected the surface.

Note: If your sample is not reflective or is transparent, the software will be unable to find the surface. You will have to find the surface manually. This is covered in the Appendix. If the software was unable to find the surface, skip to the Appendix and then return to step 20.

17. You can further lower the scan-head using the control on the side to get a clearer image of the sample surface. You can adjust the speed at which this is done. **ALWAYS USE A LOW SPEED WHEN LOWERING THE SCAN-HEAD.**

18. Move to the region of interest on your sample by using the **XY Controls in section 3.1 of Navigate to Scan Centerpoint**. Alternatively, you can use the track ball to move as well.
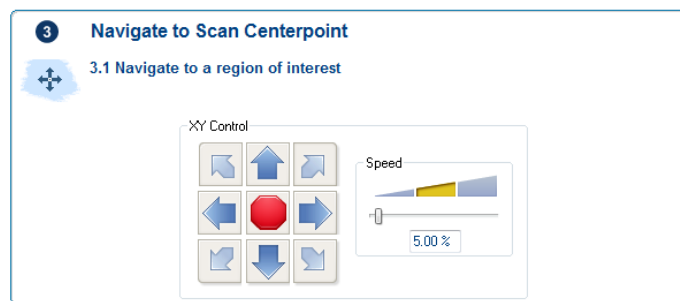
Scan Setup

19. In the **Workflow Toolbar**, click on **Check Parameters**.
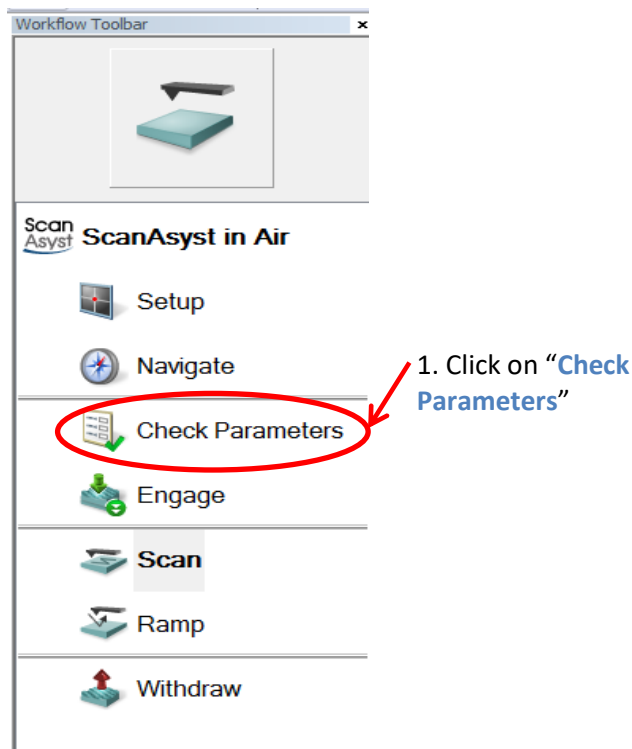
20. You may edit any of the following parameters. **Do not edit parameters in Feedback or Limits.**


a. **Scan size** – choose a small scan size in the beginning, once you see everything is working fine, then choose a higher scan size. Maximum scan size is 100 μm.

b. **Aspect Ratio** – x-y image size

c. **X Offset** – shifts the tip in the x-axis (max distance is 45 μm)

d. **Y Offset** – shifts the tip in the y-axis (max distance is 45 μm)

e. **Scan Rate** – rate at which the scan is performed. The software can change this at any time if it detects any irregularities in the peak-force feedback.

f. **Samples/Line** – resolution of the scanned image. Higher Resolution means better image quality but longer scan time.
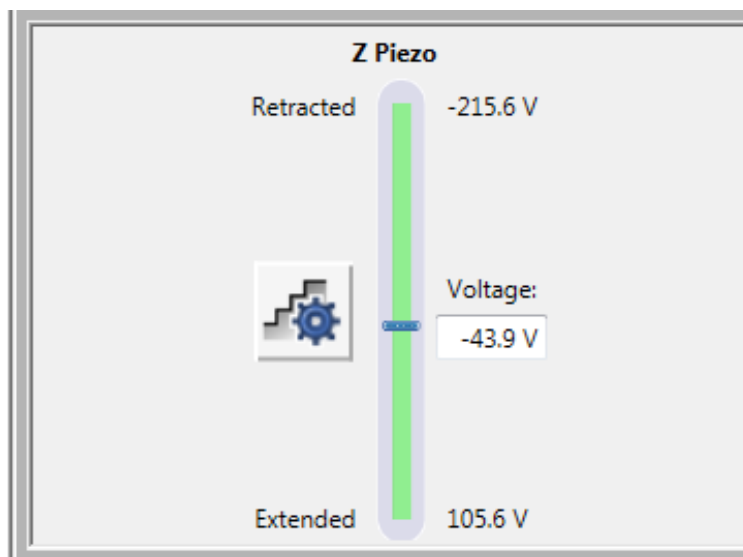
Scanning

21. Before scanning, double check your parameters, and the location of the sample and tip. If everything is okay, you may proceed to the next step. If not, revisit the steps 19 and 20 and perform them again.

22. In the **Workflow Toolbar**, click on Engage. A dialog box will pop-up as the process starts. **It is important to be vigilant here. If your notice anything strange, click on Abort in the dialog box on the screen.**

23. The screen will change to show the image below. will
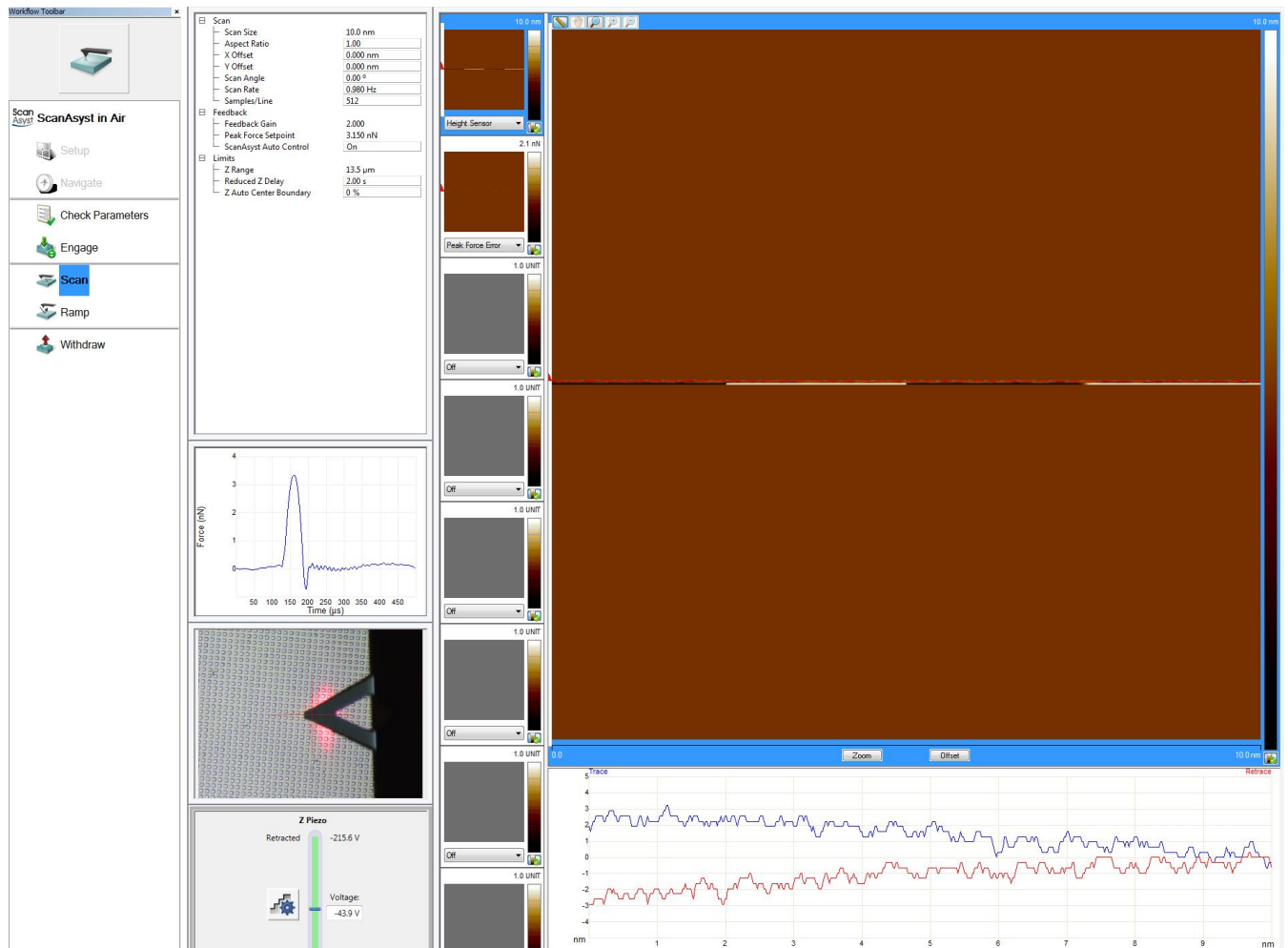
24. **Make sure the green bar at the bottom of the window remains green. If it turns yellow or red, immediately click Withdraw in the Workflow Toolbar, then repeat steps 21 – 25. Try reducing the scan size. If the green bar still changes to red or yellow after this, call the NCF office for assistance**.

25. The toolbar below shows so of the actions you can perform while scanning.

Scan directions

Resume Scan

Pause Scan

Scan Continuous

Window options
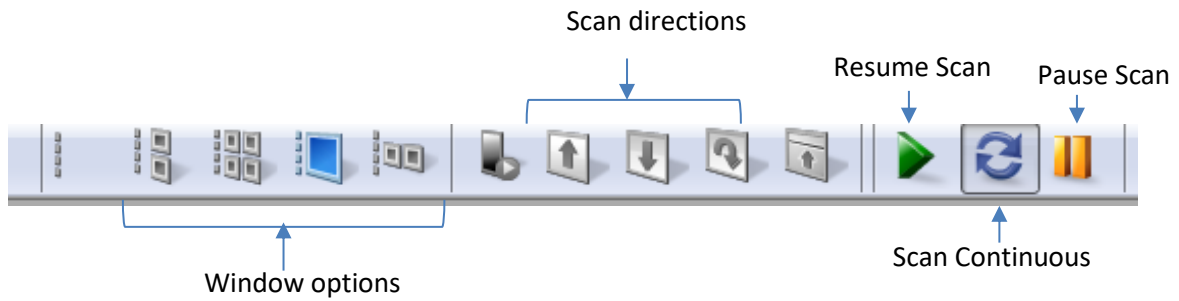
26. You can capture the image using any of the options in the capture toolbar and you choose to save the image in a directory you wish.


Image name

Select Directory

Image Capture options
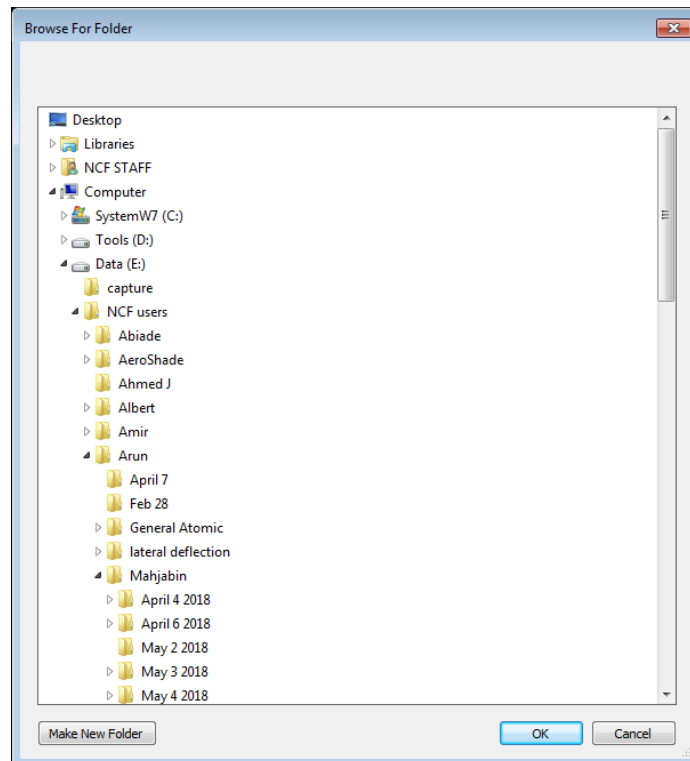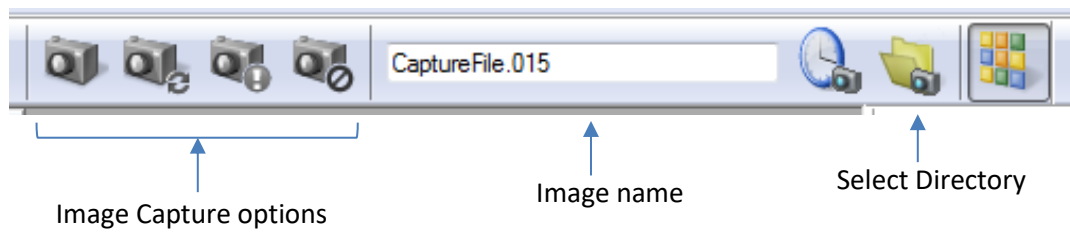
27. To view the images in your directory, click **Directory** view button and select your directory again.

Select Directory
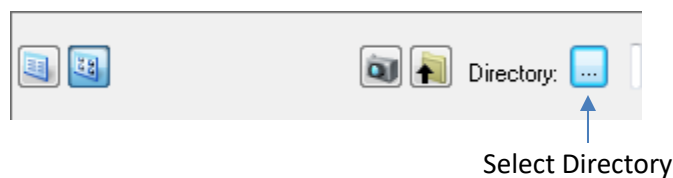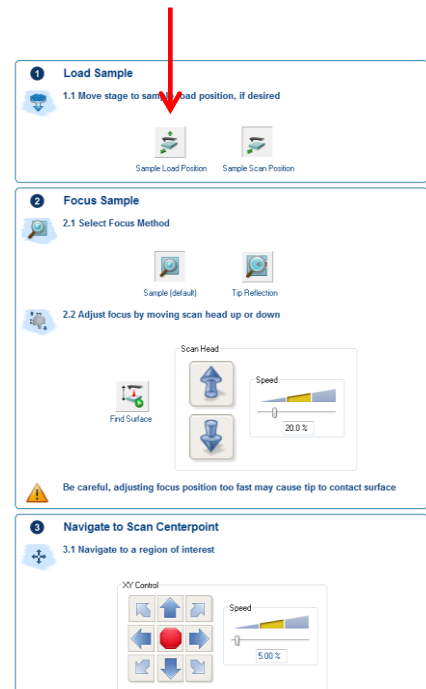
28. Once done scanning, click **Withdraw** on the **Workflow Toolbar** at least 3 times.

1. Click on "**Withdraw**"
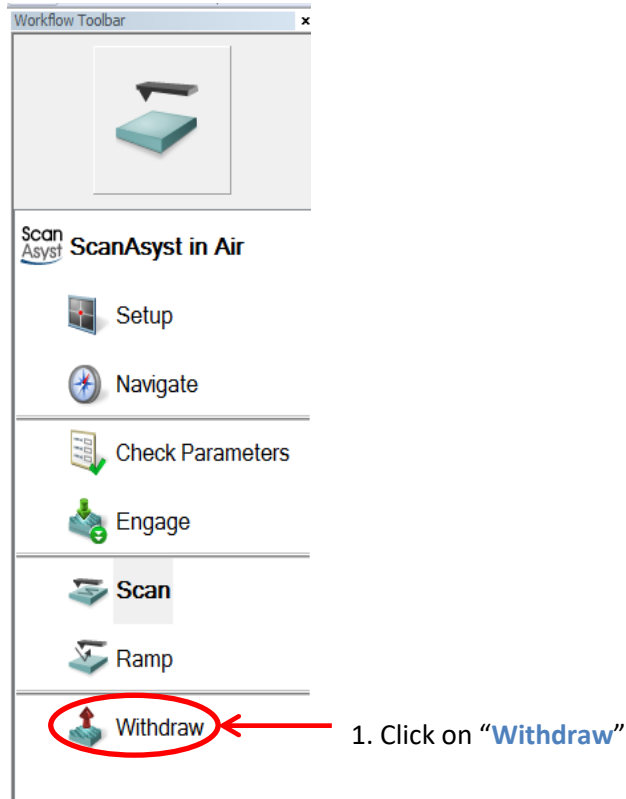
29. Click on **Navigate** in the **Workflow Toolbar**. Then click on **Sample Load Position** in **section 1.1 of Load Sample**. Unload your sample.

1. Click on "**Navigate**"
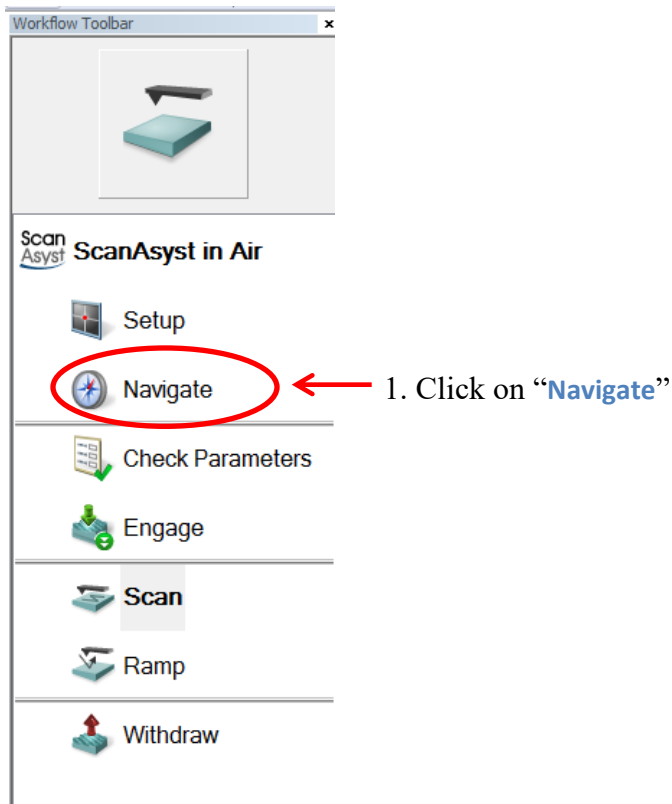
2. Click on: "**Sample Load Position**"

30. If you choose to scan another sample, you should check the deflection and sum voltages first since they may or may not have changed. Click on **Setup** in the **Workflow Toolbar**

    a. If the deflection voltages have drifted to be > 0.5 V or the sum voltage had dropped below 4 V, repeat steps 3 – 28.

    b. If not, click on **Navigate** in the **Workflow Toolbar** and repeat steps 10 – 28

31. If you are not scanning another sample, click the close button at the top of the software. This will shut off the laser and the rest of the system. Do not turn off the computer.

Appendix

Sample Focus When Find Surface Doesn't Work

Sometimes the Find Surface function can't find the surface of the sample to be scanned. This can happen if the sample if not reflective or is transparent. In cases like this, the objective will be to focus on the sample edge first.

Once you have completed steps 1 – 15,

1. Move to the edge of the sample by using the track-ball until you the edge of your sample is underneath the tip. If you look at your sample, you should be able to see a small light illuminating the edge of your sample.
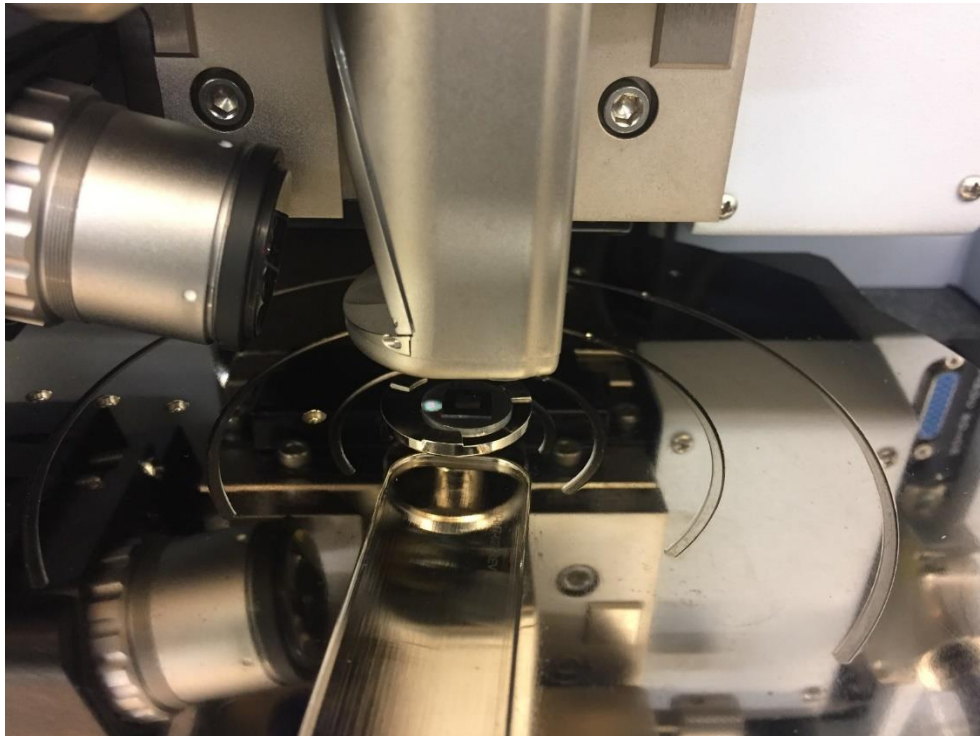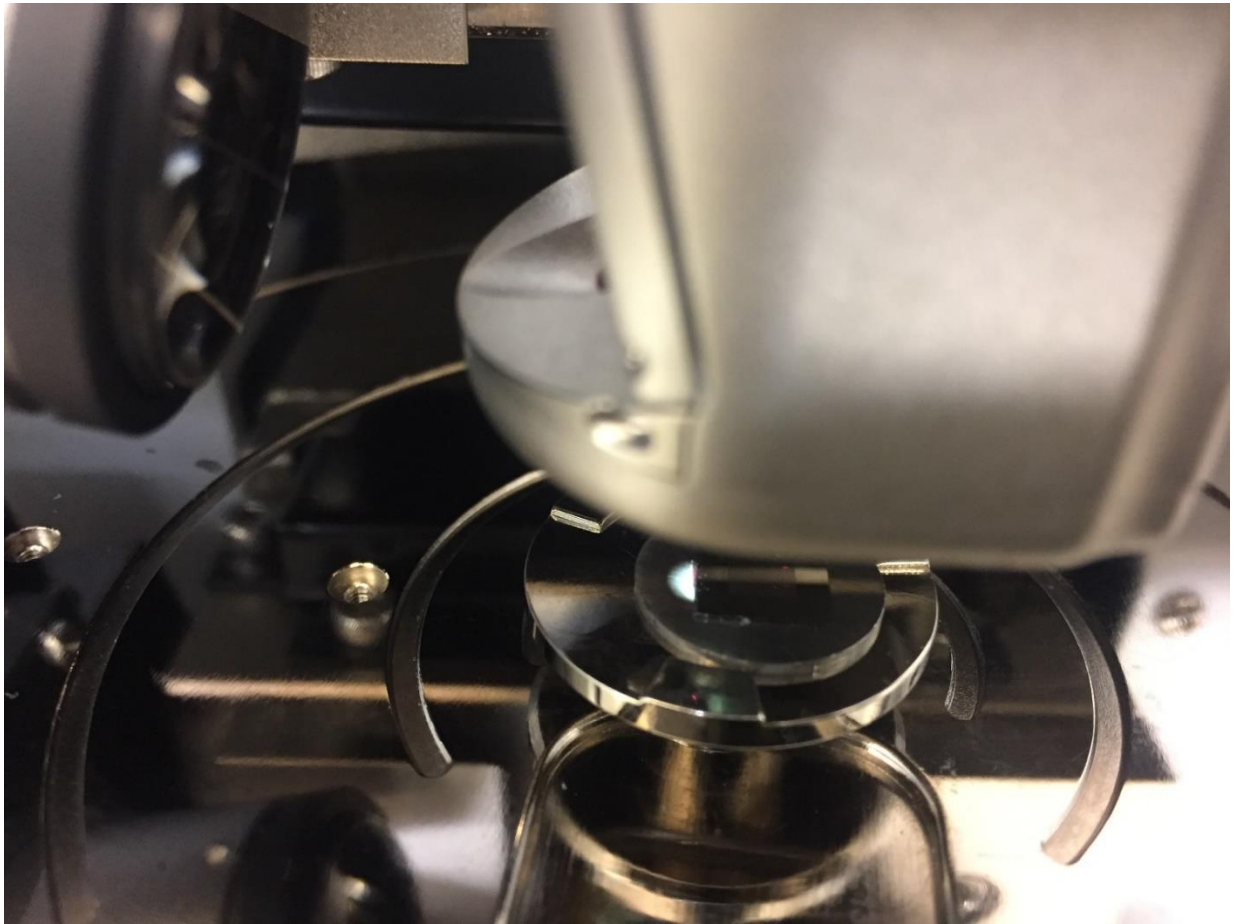
2. Now slowly lower the scan-head using the control on the side to get a clearer image of the sample edge. You can adjust the speed at which this is done. **ALWAYS USE A LOW SPEED WHEN LOWERING THE SCAN-HEAD.**
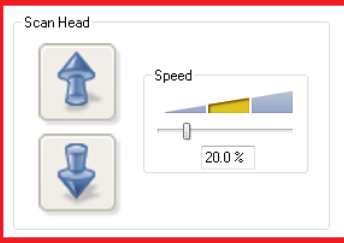
You can also lower the scan-head down by using the track-ball

   a. Press and hold Focus

   b. Scroll the ball until the sample edge is in focus.
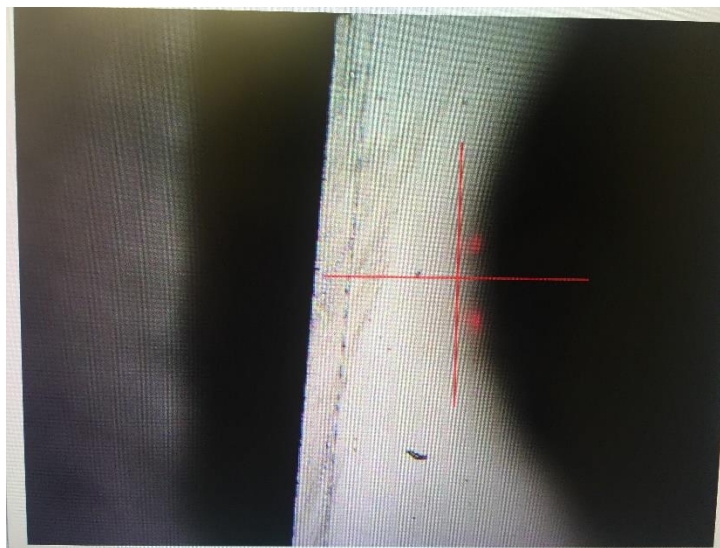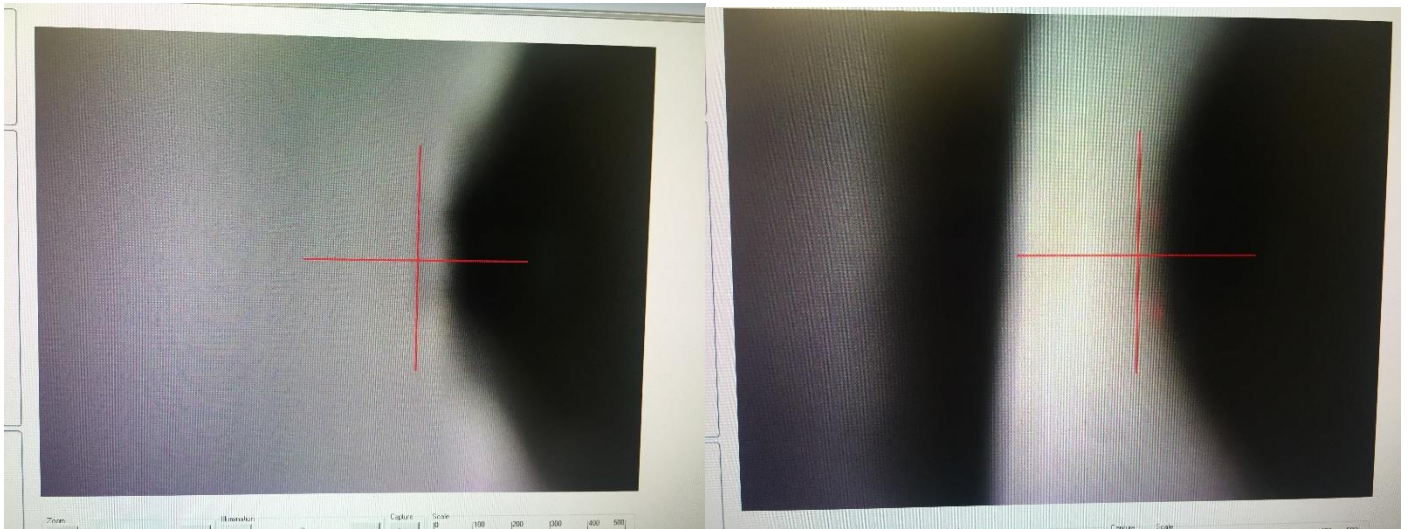
3. Once you the sample edge is in focus, move to the sample surface by using the track-ball or by clicking the arrows in the XY Controls in section 3.1 of Navigate to Scan Centerpoint.