

## Scanning Probe Microscope – Bruker Dimension ICON ScanAsyst-Air Type of Analysis

### Opening Enclosure

1. Use the 5/16 T-Handle Hex Key and turn it counterclockwise to open the acoustic enclosure of ICON.
2. Lift the front part of the enclosure for a cantilever (probe) and sample mounting.
3. Take out a cantilever stand (black cylinder box) for cantilever mounting and a flat box with cantilever holders.

### Inserting Cantilever

4. Select the correct cantilever holder from the flat box – holders with a silver probe clamp are designated for normal modes, holder with a gold probe clamp is for torsional modes (sideways excitation).
5. Put the selected cantilever holder on the stand carefully to avoid damage of pins. To insert cantilever, use the tool with two empty pins and without a black supporting leg.
6. According to the type of desired analysis, select the correct cantilevers from a marked white plastic box on the table. To begin with, use the ScanAsyst-Air type of cantilevers.
7. Select a cantilever from the correct box – its position in the box provides the information about its condition:  
↑ - new, ↗ - used but OK, → - dead.
8. Use tweezers from the blue plastic envelope on the table to insert the cantilever into the selected holder.
9. Hold the cantilever holder with two fingers in its front part when fixing the cantilever with a probe clamp.
10. Release the big silver screw on the right side of the scan head.
11. Release the scan head using the handle with the Bruker logo.
12. Turn the released scan head carefully and insert the cantilever holder to its bottom end.
13. Insert the head back to its original position using the handle.
14. Gently fasten the silver screw until it clicks to fix the head.

### Starting the ICON System

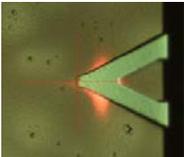
15. Open the left cabinet below the table, turn ON controller (Furman box) and PC.
16. Write the password (operator's phone number).
17. Check the pneumatic suspension of ICON system by pressing the silver plate below the system (when it is OK, it should return automatically to its original position).
18. Start **NanoScope SW** with a double click on the desktop icon.

### Selecting Experiment

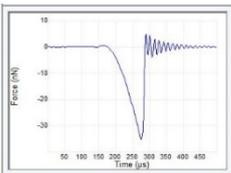
19. In the **Select Experiment** window, choose what mode will be used:
  - a. In the **Select From, Choose and Experiment Category**, click on icon **ScanAsyst**
  - b. In the **Select Experiment Group**, choose **ScanAsyst in Air**
  - c. In the **Select Experiment**, choose **ScanAsyst in Air**
  - d. Confirm your selection by pressing the **Load Experiment** button
20. When the experiment is loading, the **Status Log** shows the progress of a startup procedure.
21. If the ICON system was powered down when starting the analysis, **Error Log** and **Stage Initialization** appears. Confirm **Stage Initialization** by clicking on the **Yes** button and close **Error Log** with **x**.
22. When the stage initialization procedure is finished, confirm return of the stage to its original position by clicking on the **Yes** button (optional).

### Aligning ICON System

23. The **Setup** page with ICON system alignments automatically opens – it is important to follow the procedure step by step:
  - a. In **Probe Setup**, press the button **LoadProbe**:
    - i. In the **Probe Select** window choose from a roll-up menu **ScanAsyst-Air** item (it is the very first item on the list).
    - ii. Confirm the selection by pressing the **Return and Save Changes** button.

- b. In **Align Laser on Probe**:
  - i. Press the **Move to the Alignment Station** button. A warning dialog appears. If the standard cantilever holder is used, confirm the dialog by pressing the **Yes** button – the scan head will be moved above the Optical Standard. Never use the Optical Standard in the case of an installed fluid cantilever holder!
  - ii. Using the 2 screws placed on the top of the scan head, align the red laser spot so it touches the tip of the cantilever (see the instructional video and the image). In the case that the laser spot is not visible on the optical image - make "virtual" circles or squares to get the red spot into the field of view, or try to find a middle position between the end positions of each screw. 
  - iii. Using the 2 screws placed on the left side of the scan head, align the red laser point to the center of a quad detector (see the instructional video). Voltages in both directions has to be as close to 0 V as possible, and the sum signal should be between 4 and 5 V.
- c. In **Focus Tip**:
  - i. Press the **Return from the Alignment Station** button. When the message dialog appears, confirm it by pressing the **Yes** button.
  - ii. By clicking on the **Focus Controls** icons, focus the cantilever tip in the optical image. Try **Focus Control**  $\uparrow$  first, in the case of no visible change, increase the speed to 20 %, or try to add more **Illumination**.
  - iii. When the tip is focused, click with the mouse on the optical image to mark its position.

### Inserting Sample

24. Put the desired sample in the middle of the stage and turn the vacuum ON (on ICON system: **Chuck Vacuum** -> flip vacuum switch to **ON** position).
25. Switch to **Navigate** page for the orientation on the sample surface and its focus:
  - a. Move the X-Y stage to align the desired location on the sample under the crosshairs:
    - i. Using **XY Control** arrows in **Navigate to Scan Centerpoint / Navigate to a region of interest**.
    - ii. Using a trackball: To move long distances – hold the upper left/upper right trackball button (Lock button) down and simultaneously roll the trackball with a high speed. Release the button to stop the motors. To move short distances – roll the trackball without holding down any buttons.
  - b. Focus carefully on the sample surface in **Focus Sample / Adjust focus by moving Scan Head up or down** by clicking on buttons **Scan Head** with blue arrows.
26. Close the acoustic enclosure of the ICON system and lock it with the Hex Key.
27. Click on **Engage** to touch the sample surface with the cantilever and start the measurement.
28. In the **Force Monitor** window, check the proper shape of a measured curve – compare it with a **Monitor Heart Beat** section in **ScanAsyst Principles of Operation** in the ICON user manual). 

### Turning the ICON System OFF

29. Press **Withdraw** to release the cantilever from the sample surface.
30. In **Navigate page / Load Sample**, click on **Sample Load Position** icon to move the stage from below the scan head.
31. Open the enclosure of ICON. Flip vacuum switch to the **OFF** position and remove the sample.
32. Turn OFF **NanoScope SW** with the red **x** in the right upper corner of the main window. Turn OFF PC and **controller**.
33. Release the scan head. Remove the cantilever holder and fix the head back.
34. Put the holder on the tool stand. Use the tool with the black supporting leg to easily release the cantilever.
35. Hold the cantilever holder in the front part when releasing a probe clamp.
36. Use tweezers to remove cantilever from the holder. Insert it into the correct box – follow the condition convention:  $\nearrow$  - used but OK,  $\rightarrow$  - dead. Write down the number of the used cantilever into the notebook on the table.
37. Insert empty cantilever holder into the flat box for holders. Close the cantilever stand and put both boxes on their place inside the ICON enclosure.
38. Close the ICON acoustic enclosure and lock it with the Hex Key.
39. Clean the workplace (box with cantilevers, samples, etc.)