

## Scanning Probe Microscope – Bruker Dimension ICON Tapping Mode Type of Analysis

### Inserting Cantilever

1. Select the correct cantilever holder (with a silver probe clamp for normal modes).
2. Put the selected cantilever holder on the stand carefully to avoid damaging the pins.
3. Select the proper cantilevers from a marked white plastic box on the table. To work in Tapping Mode, use the RTESP type of cantilevers.
4. Select a cantilever from the box – its position in the box provides the information about its condition:  
↑ - new, ↗ - used but OK, → - dead.
5. Insert the cantilever into the selected holder. Hold the cantilever holder with two fingers in its front part when fixing the cantilever with a probe clamp.
6. Insert the holder into the scan head using the handle with the Bruker logo.

### Starting the ICON System

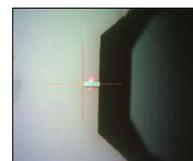
7. Open the left cabinet below the table, turn ON the controller (Furman box) and PC.
8. Write the password (operator's phone number).
9. Start **NanoScope SW** with a double click on the desktop icon.

### Selecting Experiment

10. In the **Select Experiment** window, choose what mode will be used:
  - a. In the **Select From, Choose and Experiment Category**, click on the icon **Tapping Mode**
  - b. In the **Select Experiment Group**, choose **Tapping Mode in Air**
  - c. In the **Select Experiment**, choose **Tapping Mode in Air – Standard**
  - d. Confirm your selection by pressing the **Load Experiment** button
11. When the experiment is loading, the **Status Log** shows the progress of a startup procedure.
12. If the ICON system was powered down when starting the analysis, **Stage Initialization** appears. Start it by clicking on the **Yes** button.
13. When the procedure is finished, confirm the return of the stage to its original position by clicking on the **Yes** button (optional).

### Aligning ICON System

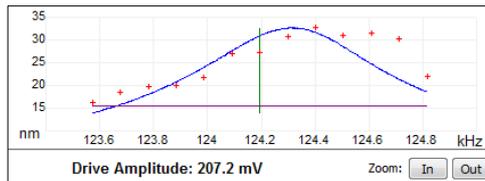
14. The **Setup** page with ICON system alignments opens automatically – it is important to follow the procedure step by step:
  - a. In **Probe Setup**, press the button **LoadProbe**:
    - i. In the **Probe Select** window choose from a roll-up menu **RTESP** item (the precise probe type is specified on the bottom part of the probe box).
    - 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.
    - 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 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. Voltages in both directions have to be as close to 0 V as possible, and the sum signal should be between 4 and 5 V.



- c. In **Focus Tip**:
- Press the **Return from the Alignment Station** button. When the message dialog appears, confirm it by pressing the **Yes** button.
  - 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**. If the tip is barely visible even if the illumination is increased to maximum, put white cleanroom wipe on the stage to get more contrast, or readjust cantilever in the holder (mind the laser beam is ON) and repeat aligning the system (step 14).
  - When the tip is focused, click with the mouse on the optical image to mark its position.

d. In **Tune Cantilever**:

- Click the **Auto Tune** button to find cantilever resonance peak – a plot of cantilever response appears.



- If the procedure is not successful, repeat **Auto Tune** step, or click on **Manual Tune** button for manual cantilever tuning.

### Inserting Sample

- 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).
- Switch to **Navigate** page for the orientation on the sample surface and its focus:
  - Move the X-Y stage to align the desired location using **XY Control** arrows in **Navigate to Scan Centerpoint / Navigate to a region of interest**.
  - 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.
- Check visually that the tip-to-sample distance is approximately 1 mm. If not, please check tip focus including return from alignment station (step 14c) and repeat sample focusing (step 16). If the issue still persists, please contact system operator.
- Click on **Engage** to touch the sample surface with the cantilever and start the measurement.

### Turning the ICON System OFF

- Press **Withdraw** to release the cantilever from the sample surface.
- In **Navigate page / Load Sample**, click on **Sample Load Position** icon to move the stage from below the scan head.
- Open the enclosure of ICON. Flip vacuum switch to the **OFF** position and remove the sample.
- Turn OFF **NanoScope SW** with the red **x** in the right upper corner of the main window. Turn OFF PC and **controller**.
- Release the scan head. Remove the cantilever holder and fix the head back.
- Put the holder on the tool stand. Use the tool with the black supporting leg to easily release the cantilever.
- Hold the cantilever holder in the front part when releasing a probe clamp.
- 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.
- Insert empty cantilever holder into the flat box for holders. Close the cantilever stand and put both boxes in their place inside the ICON enclosure.
- Clean the workplace (box with cantilevers, samples, etc.)