1.0 Purpose/Scope

1.1 This document covers the procedure that should be followed for normal operation of the Bruker Nano: Dektak XT (Stylus Profilometer). This procedure will instruct a user to perform a simple scan to examine variations in heights on the surface. This tool has many analytical functions for more advanced uses that can be learned from ASU Nanofab staff as needed. Deviation from this procedure can result in loss of access up to a submittal of a strike.

If an error condition occurs during your measurement immediately contact Nanofab Staff. The stylus is delicate and expensive to replace!

2.0 Reference Documents

2.1 Bruker XT Profilometer Operating Manual.

3.0 Equipment/Supplies/Material

3.1 Wafer Tweezers
3.2 Test Sample
3.3 Vacuum Chuck (maybe)

4.0 Safety

4.1 The Dektak XT is equipped with a Red Emergency Off (EMO) Button located on the auxiliary control panel to the left of the tool. Use this switch if the tool is in danger of being damaged. The EMO only interrupts power to the tool and the PC and display monitor are unaffected.

4.2 Be sure your sample does not exceed the limits of the tool performance specifications outlined in section 5.

5.0 Tool specifications/Limitations

5.1 This tool is setup to handle 4inch, 5in and 6inch wafers. There is a special chuck that can handle small and irregular size substrates. Ask Nanofab staff for access to this tooling and additional training to setup.

5.2 The maximum vertical range is 1mm and the scan length is 55mm.

5.3 There are manual controls to adjust X-axis, Y-axis, Rotation (Theta) and Tilt.

6.0 System Startup

6.1 Ensure that the white button on the auxiliary control panel (next to the EMO button) is illuminated. This is the sample illumination power and the software will not start properly if it is off.

6.2 Lt-Clk: Vision64 quick launch icon from the Windows Desktop. It is the 4th icon from the left on the quick launch menu. The system will perform an initialization and a Stage Homing sequence. At the completion of the initialization, the screen will display the MEASUREMENT SETUP window and the LIVE VIDEO window.

6.3 Lt-Clk: UNLOAD SAMPLE button. This will move the stage away from the stylus.
6.4 Taking care to stay away from the sensitive stylus assembly, place your sample on the center of the stage.

Note: The scan direction is towards the rear, that is, the motorized stage will move the sample forward, towards the user, during the measurement. Keep this in mind when positioning your sample.

6.5 Lt-Clk: LOAD SAMPLE button. This will move the stage to the measurement ready position.

6.6 Visually verify that your sample is directly beneath the stylus tip.

6.7 Lt-Clk: TOWER DOWN button. This will lower the stylus to the sample and then raise it slightly back up.

6.8 Adjust the sample position using the X-axis, Y-axis and Rotation (Theta). During the scan, the sample will move down in the LIVE VIDEO window.

Note: The sample should be viewable and the cross-hair target that is superimposed on the display denotes the starting location of the scan. During the scan the sample will appear to move downward.

6.9 For very large adjustments, use the X-Lead Screw Release and Y-Lead Screw Release. When re-engaging the lead screw, operate the X-axis or Y-axis controls to assure the mechanism has truly reseated onto the lead screw.

7.0 Measurement Setup

7.1 Set the following parameters in the MEASUREMENT SETUP window.

7.1.1 Scan Type: Standard Scan
7.1.2 Length: This is the length of your measurement and will be determined by the features that you want to measure. The maximum distance is 55000 µm.

7.1.3 Range: 6.5 µm, 65 µm, 524 µm, or 1 mm. This is the maximum height of the scan and will be determined by the features on the sample. Select the smallest range possible that will still measure the desired features.

7.1.4 Duration: 20 seconds. This is the default value, but can be lowered for faster measurements or increased for slower, more detailed measurements.

7.1.5 Profile: Hills, Valleys, or Hills and Valleys
   Hills: The measurement will start near the bottom of the measurement range, and should be used when the scan will step up.
   Valleys: The measurement will start near the top of the measurement range, and should be used when the scan will step down.
   Hills and Valleys: This should be used when the scan will measure both raised and lowered features. The scan will start in the middle of the measurement range.
   Example: If there are 5 µm hills and 5 µm valleys on the sample, the 65 µm range should be used since the 6.5 µm range will only be able to measure 3.25 µm up and 3.25 µm down.

7.1.6 Resolution, Sample and Speed: These are automatically calculated from the Length and Duration entries.

7.1.7 Stylus type: This is determined by the stylus that is loaded in the machine. It is not editable.

7.1.8 Stylus Force: 7 mg. This is the default value, and will work for most scans. It can be increased to as high as 15 mg if 7 mg does not give accurate measurements or if the stylus tip bounces during the measurement. It can also be decreased to as low as 0.1 mg for very soft or fragile samples. Do not adjust the force unless it is necessary.

7.1.9 The ADDITIONAL PARAMETERS should be left in their default states.

8.0 Perform a Scan

8.1 Lt-Clk: Single Acquisition button: This will start a measurement and the Data Acquisition window will begin to plot the result.

8.2 Use the shiny Tilt Adjust knob to adjust the stage level if the plot is significantly angled and will not finish the measurement before the reaching the top or bottom of the plot. Data at the top or bottom edge of the scan range will not be accurate.

8.3 If the plot goes out of range due to a step or other real feature on the sample, you will need to adjust the Measurement range and/or profile settings.

8.4 If needed, Lt-Clk on the MEASUREMENT SETUP icon to make any necessary changes to the scan parameters, and then repeat steps 8.1 to 8.4 until a good measurement is taken.

8.5 After the Scan is complete, the software will display the DATA ANALYSIS window.

9.0 Leveling/Data Analysis

9.1 In the DATA ANALYSIS Window, the measurement data may be difficult to evaluate due to the scan level. To level the data set:
9.1.1 Lt-Clk on Terms Removal (F-operator) in the DATA ANALYZER window.
9.1.2 Lt-Clk on the red R vertical line and drag it to a position that you want to define as zero height.
9.1.3 Lt-Clk on the green M vertical line and adjust it to the other desired zero position.
9.1.4 Rt-Clk on the plot area in the DATA ANALYSIS window.
9.1.5 Lt-Clk on the Level-Two Point Linear option in the pop up menu, as shown below.

Before Leveling:

![Data Analysis Window](image)

Note: Leveling does not permanently alter the data set, it just makes it easier to view and evaluate.
9.2 Using the data set to make measurements:

9.2.1 Adjust the R and M cursors to positions on the scan to be measured.

9.2.2 In the CURSOR STATUS table, the absolute positions of the R and M cursors are displayed. The Position Δ and Height Data Δ give the relative position of, or difference between, the R and M cursors.

9.3 If the data set is noisy or the sample is very rough, it is possible to average the height values over any range to get a more accurate representation of the height difference

9.3.1 Lt-Clk on the R or M cursor.

9.3.2 Use the Up arrow key on the keyboard to start and increase the size of the average. Use the Down arrow to decrease or remove the average. The width of the averaged data is shown in the Width Field on the CURSOR STATUS table.

9.3.3 Lt-Clk and drag the cursor to the desired position.

10.0 System shut down:

10.1 Lt-Clk on the MEASUREMENT SETUP icon.

10.2 Lt-Clk on the TOWER HOME icon. This will raise the stylus far from the sample.

10.3 Lt-Clk on the UNLOAD SAMPLE icon. This will move the stage towards the front of the machine, away from the stylus.

10.4 When the stage stops, unload your sample. Take care to avoid the sensitive stylus assembly.
10.5 Close the Vision64 software. The sample illumination should turn off.
10.6 Turn off the PC monitor.
10.7 Close the system cover.

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