

IIT Bombay Nanofabrication Facility



Tool Name: DektakXT Profilometer_1.1 Lab

Standard Operating System (SOP)

INDEX

Version 1.0

Updated on: 30 October 2024

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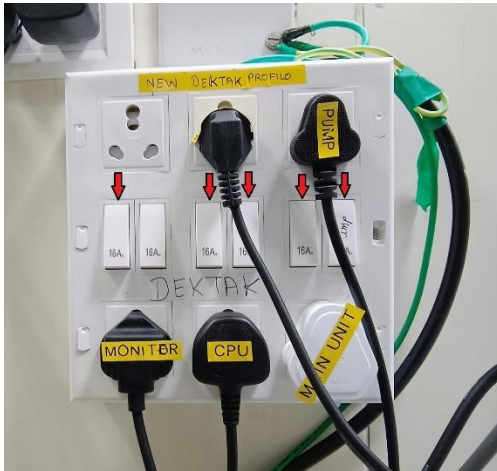
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Tool's Overview

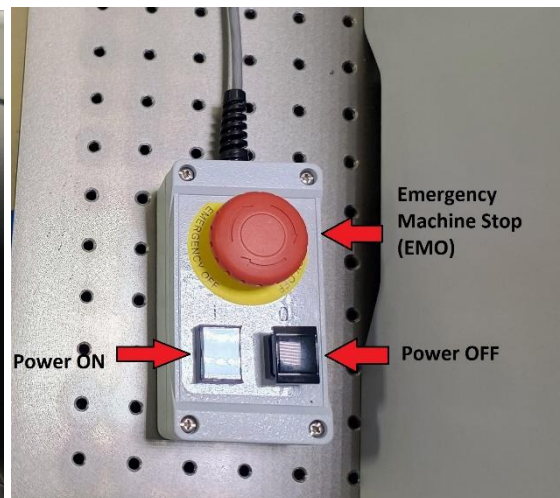


1. System startup and sample loading:

- a) Switch ON the following switches of Monitor, CPU, Main unit, Pump (for chuck vacuum, vibration table). This electrical board is located on the back side wall of the Dektak Profilometer system.



- b) Then switch on the Computer, after ensuring system is powered on. Switch on the hardware part using
1. Switch on the black power supply shown below : Press 1 to turn on
 2. Press the white power on button of White box controller as shown in the figure.

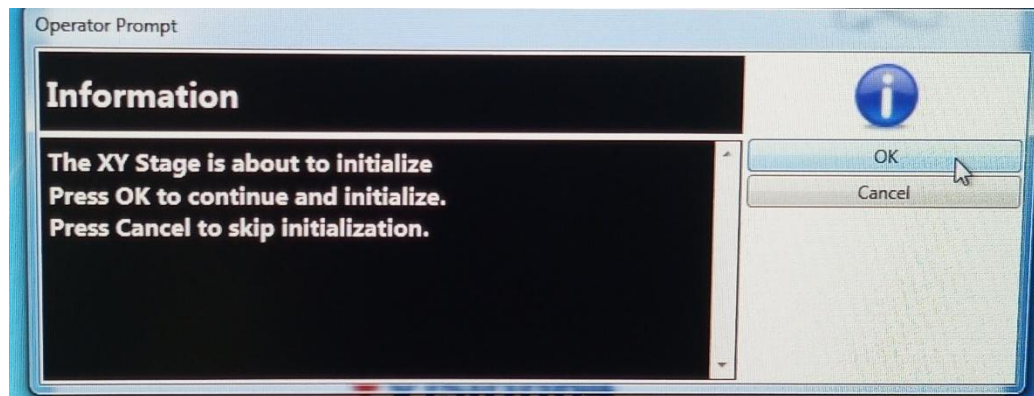


Give approx. 20 min time to warm up the system if it is shut down for more than 6 hours (check slotbooking module).

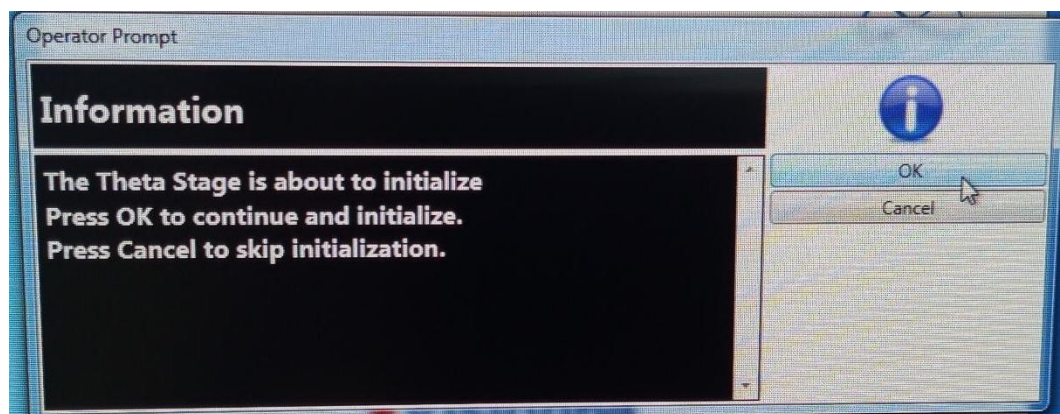


a) Start the Vision 64 software. using the shown desktop icon.

b) It will ask for XY stage to initialization as shown below, click on OK.



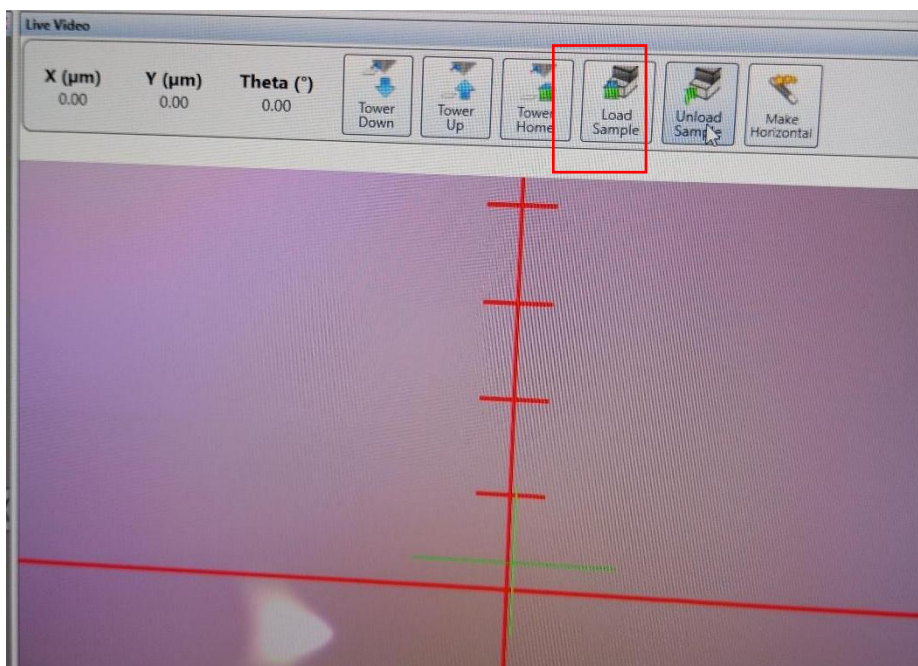
c) Now it will ask for Theta to initialization, again click on ok.



d) (F) Click Unload Sample icon shown in toolbar of the software screen as shown below.
On the toolbar above the Live Video Display to move the scan stage toward you. The stage will



move to the front.



e) Open the hood and load sample carefully onto scan stage and

f) Click on Load Sample.  The stage will move under the head.

g) Position the sample at the center of the stage and turn on the pump.

h) Now move the stage using X-Y controls shown below to ensure that the sample is under the stylus, Move the stylus down to the sample by clicking “Tower Down.”

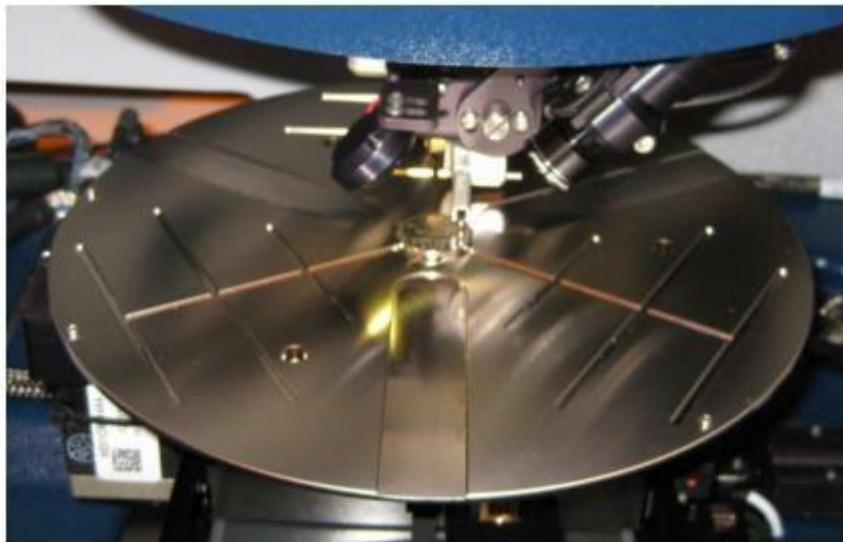
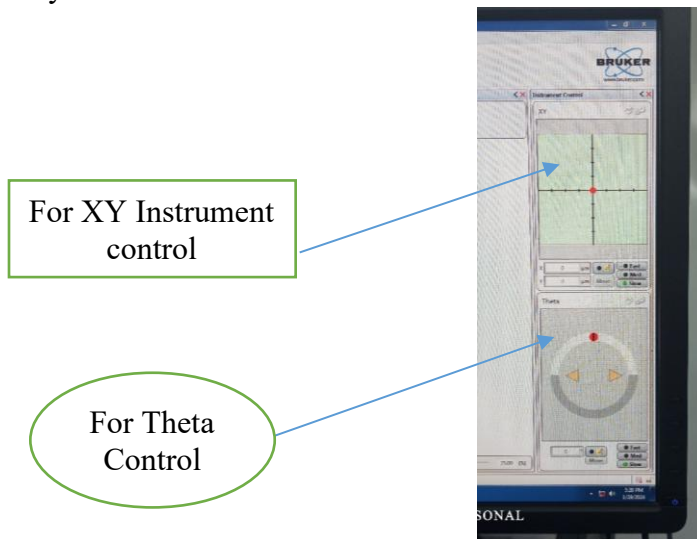


i) This brings the stylus down to make momentary contact with the sample then it will raise up slightly from the sample to be adjusted as needed.

j) Adjust the sample by using the Theta control in the bottom right of the program to set the proper angle desired.

k) Move the stage by using XY instrument control shown below to get your desired sample scan area

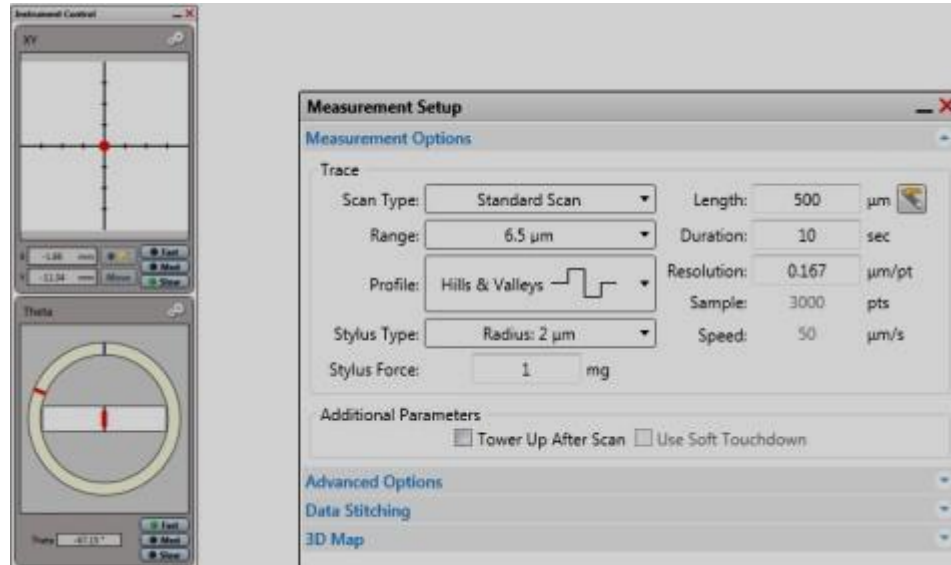
under the stylus.



Stylus will be lowered onto the substrate as shown in above figure.

2. Taking a scan:

The Measurement Setup window must be configured prior to collecting a manual or automated series of measurements. This window contains 4 sub-window sections: Measurement Options, Advanced Options, Data Stitching, and 3D Map. Most of the scan parameter can be adjusted from the Measurement Options sub-window.



Measurement Options sub-window

1. **Select Type:** For 2D profile, select the Standard Scan option.
2. **Select Scan Range:** Select the scan range the best matches sample topography. Available scan ranges: 6.5 µm, 65.5 µm, 524 µm, or 1 mm

Scan Profile Type	Typical Use Case
Valleys	90% of scan range is set below the zero line; Useful for trench measurements.
Hills	90% of scan range is set above the zero line; Useful for measuring step Height measurements.
Hills & Valleys	50% of the scan range is above and below the zero line. Useful for random height distributions or when the sample tilt has not been adjusted.

1. **Select Scan Profile.** Three scan profiles are available. Profile type affects how the scan range is apportioned.
2. **Select Stylus Type:** Select Radius 2 µm , 0.2 µm as per stylus size
3. **Select Stylus Force:** 3mg .

Set Scan Length: The Scan Length range, without stitching, is 50 µm -- 55 mm.
(When using stitching, the maximum scan length is 200m.

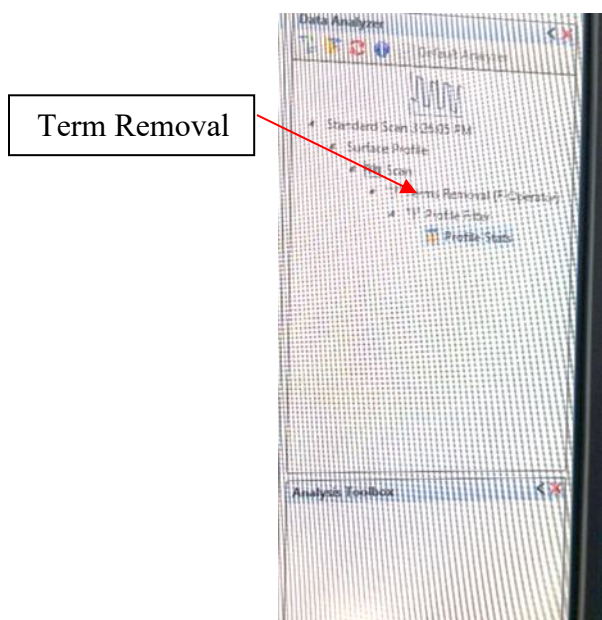
1. Run measurement
 - a) Close lid if haven't already.



2. Press Measurement or Single acquisition at the top of the software window to start the scan.

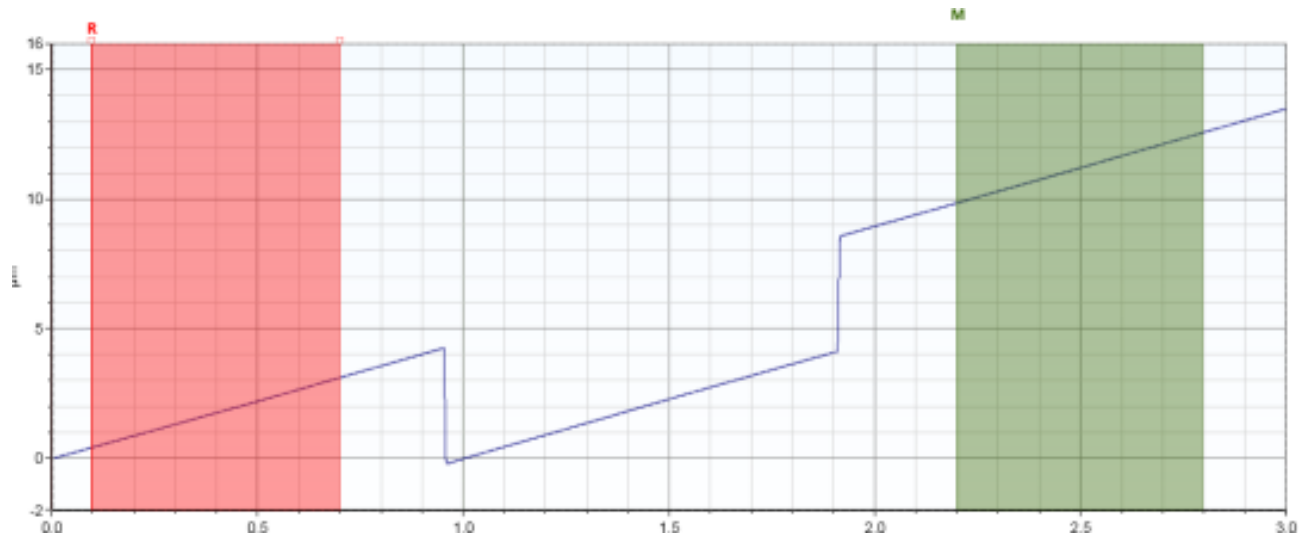
After the measurement the Data Analysis window is displayed

- a) For the automatic leveling, Analytical toolbox need to activate for that Right click on Term **Removal** (F-Operator) as shown in below figure.

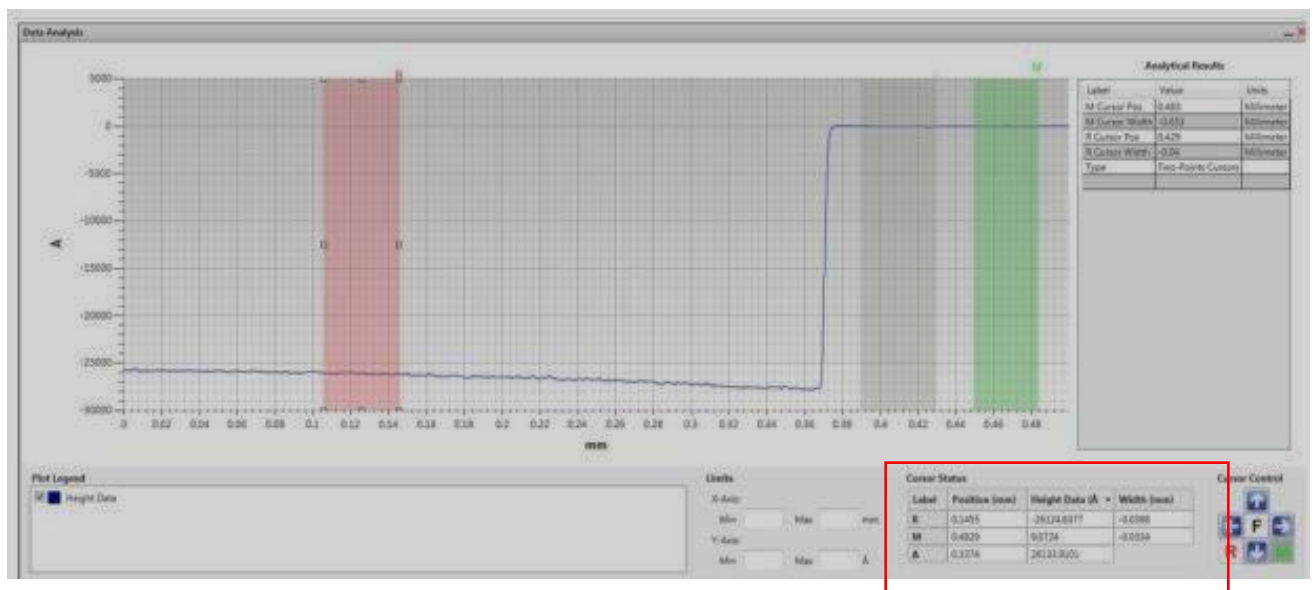


3. Data analysis:

- a) Move the reference (R) and measurement (M) cursors to two areas of the scan at the same height. Expand the cursors to cover a larger area



- b) Right-click on the plot and select Two-Point Linear Fit.
c) Move the R cursor to a baseline location and the M cursor to a step height to acquire the desired measurements in the marked panel.



- d) Right-click on the Analytical Pane and select Append. There are several analytical options to choose from.

4. Data saving and export:

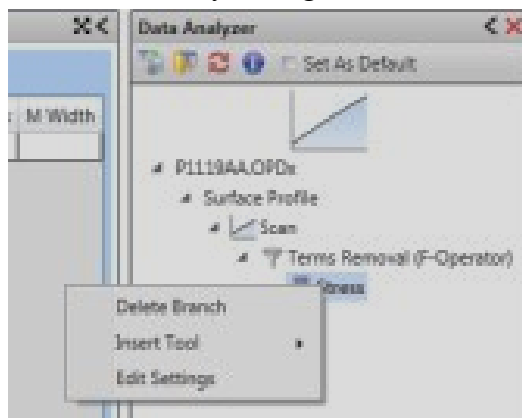


- a) The Save button allows one to save their file as a .opdx file.
- b) The data can be exported by right-clicking on the plot and selecting Export.
- c) Also, one can save the plots by saving the bitmap image.

5. Other features:

5.1 Stress Analysis:

- a) Load the pre-deposition sample as described in section 1.
- b) If 8" substrate is used then ensure that the steel balls are inserted in the proper slots on the stage. The wafer and wafer flat must be Aligned against the three pins on the stage.
- c) Set-up a scan recipe as described in section 2 to scan across >80 % of the sample. Save the recipe or write down the settings in a notebook.
- d) Run the scan and save the pre-deposition scan file. There is no need to level the scan.
- e) Deposit the film on the wafer.
- f) Load the post-deposition sample on the stage in exactly the same orientation as the pre-deposition sample.
- g) Use the same scan recipe as the pre-deposition sample and scan the wafer.
- h) Save the post-deposition scan file. There is no need to level the scan.
- i) In the data-analysis screen, open the post-deposition scan file.
- j) In Analysis Toolbox, select Stress to add the branch to the Data Analyzer.
- k) In the Data Analyzer, right-click on Stress and select Edit Settings.



- l) Select the correct substrate and input the correct thicknesses information. Input the R and M cursor positions in micrometers. Select the pre-deposition scan file.

Press OK.

Stress Parameters

Thin Film Substrate

Name: Si(100)
 Material: Si
 Orientation: 100
 Elasticity: 180500 Mpa

Editor...

Thickness

Substrate: 525 μm
 Film: 0.1 μm

Cursors

R Position: 10000 μm
 M Position: 70000 μm

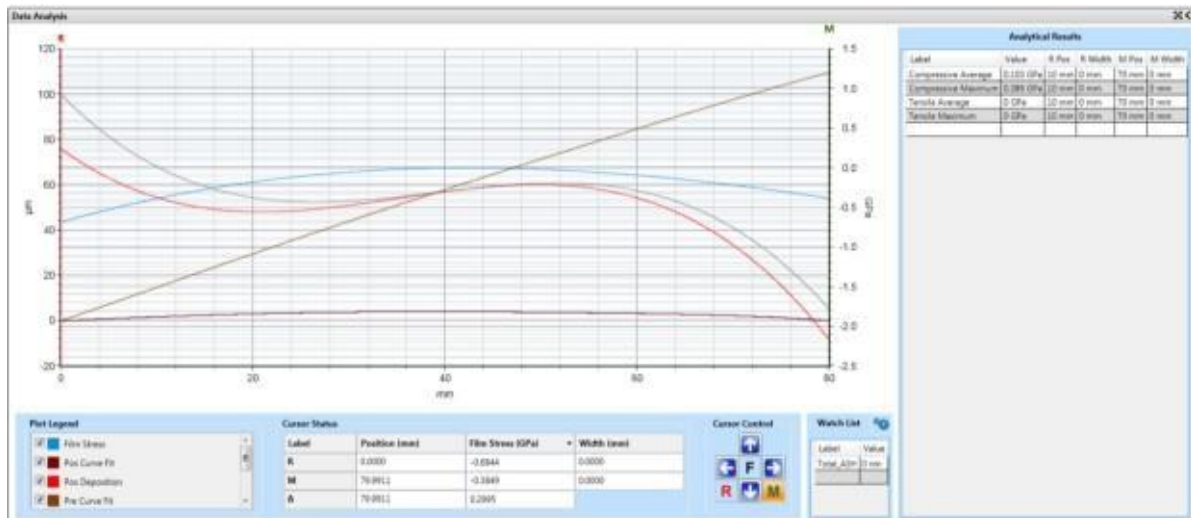
Use Current

Pre-Deposition Data File

C:\ProgramData\Bruker\Vision\Dat... ..

OK Cancel

m) The plot and data summary are displayed.



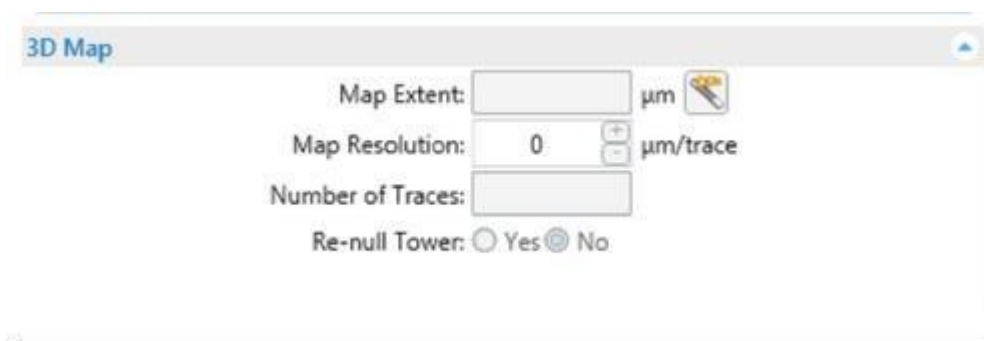
n) The data table can be exported by right-clicking on the table and selecting Export Analytical Results.

5.2. 3D Mapping option:

- a) Open the front door of the enclosure. Place the sample in the center of the stage with the scan start site under the stylus. Close the door to the enclosure
- b) Use the auto stage controls to fine-position the area of interest in the center of the Live Video Display.
- c) Slowly lower the tower assembly to bring the area of interest into focus. To do this, click the **Tower Down** button on the toolbar
- d) If necessary, adjust the illumination level of the video image. To do this, use the slider on the Illumination Bar at the bottom of the right pane of the Live Video Display.
- e) On the **Measurement Options** tab of the **Measurement Setup** dialog box, select **Map Scan** as the **Scan Type**.



- f) Select your other options on the **Measurement Options** tab of the **Measurement Setup** dialog box. For definitions of the parameters in the **Measurement Options** dialog box, see [Setting the Measurement Options](#).
- g) Make your settings on the **3D Map** tab of the Measurement Setup dialog box.
- h) Click the **Reset Dektak** button to initialize the stage.
- i) Enter your parameters on the **3D Map** tab of the **Measurement Setup** dialog box. If desired, click the **Teach** button and follow the on-screen instructions to drive the stage to the appropriate positions.



- a) If you want to log the statistics and analytical results to a database, open an existing database or set up a new one. Most of the time you will use the database that you have designated as the default in your Analyzer recipe. This default database automatically opens. However, you must select **Logging Enabled** on the Analyze tab to activate the logging process.
- b) Initiate the scan measurement by clicking the **Measurement** button on the Ribbon and then

selecting **Measurement** (which can include a loop count) or **Single Acquisition**. The events that now occur are described in What Happens During a Scan Measurement.

- c) At the end of the measurement, an end-measurement message appears. Click **OK** to open your selected graphical output plot—by default, the 2D contour plot



To shut down the DektakXT system:

- 1 Close the Vison64 software.
- 2 Press the black OFF button on the EMO Box. This shuts off power to all system devices but the computer, monitor, power supply adapter, and 24 VDC control circuit in the EMO Box.
- 3 Select Start > Shut Down from the Windows 7 Start menu, and then click Shut Down in the dialog box that appears.
- 4 Turn off the monitor.
- 5 Switch OFF the switches on the switch board.
- 6 Make entry in the log book.

Note :

Please keep in mind the following points while using the system:

- Do not open multiple windows at a time.
- If the system is not in use for 8-9 hrs. Giving 20 min. warm up time is mandatory.
- For smaller samples please check if the stylus is coming on the sample surface while lowering down.
- During manual levelling do not rotate the knob much. Take a scan, check and rotate little bit to get the proper alignment. Do it again if not aligned.

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