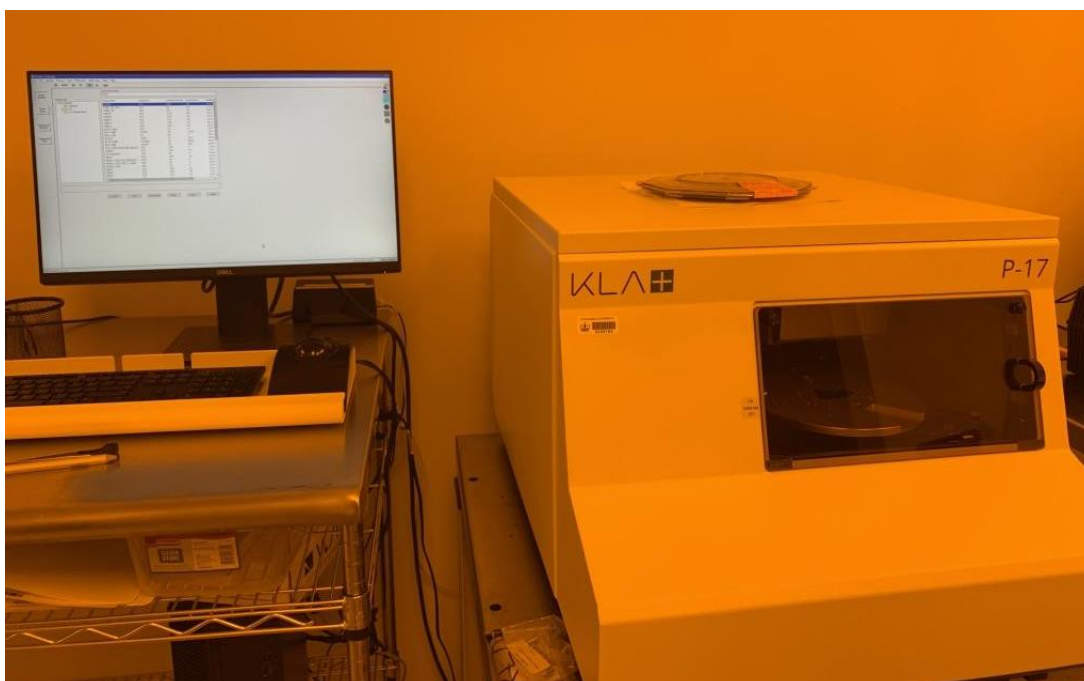




KLA Tencor P-17 Standard Operating Procedure



These instructions were developed as a reference for properly using the stylus profilometer and does not replace formal training.

Written by Dr. Philippe Chow





SYSTEM INFORMATION:

The P-17 stylus profilometer offers step height measurement capability for steps from a few nanometers to one millimeter, for production and R&D environments. The system supports 2D and 3D measurements of step heights, roughness, bow and stress for scans up to 200mm without stitching.

Note on SOP scope:

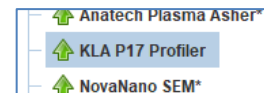
This procedure gives the user instructions for performing a basic step height measurement. Please note that users are encouraged to explore the many additional features the tool offers such as:

- 3D-mapping
- Roughness characterization
- Film-stress determination
- Scan sequencing/automation

The software includes helpful resources to understand and perform these advanced features (simply press the 'F1' key, or locate 'Search for help' under the 'Help' dropdown menu). Please contact staff for assistance and instruction.

1. Badger:

Enable the tool in Badger.

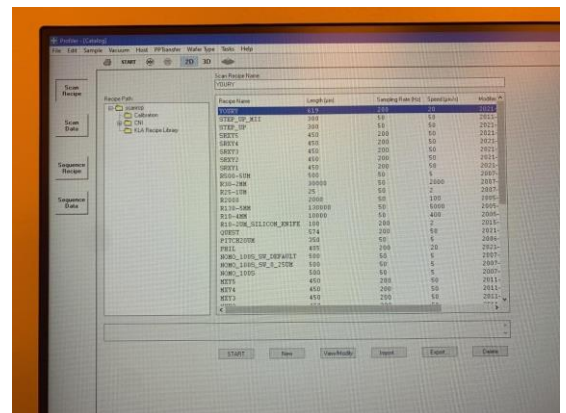


2. Software "Catalog" screen:

Upon enabling the P17, the Profiler software should be open and the "Catalog" screen visible.

This screen shows the saved scan recipes/data as well as for scan sequences.

If this screen is not visible, you must close/exit other windows to access it





	<p>(such as the stage navigation or recipe editor windows).</p>	
<p>3.</p>	<p>Verify stage and tower position: The stage should be left in the loading position, in which the stage is as close as possible to the door/window. Additionally, the stylus tower should be in the upper position, as shown in the photo here. If these are not in the correct position when beginning to use the tool, please alert the staff.</p>	
<p>4.</p>	<p>Place sample *IMPORTANT*: Open the door to the chamber and place the sample on the stage. It is critical that the sample covers the central hole in the stage to prevent the tower from crashing. The photos here illustrate proper placement of large and small wafer pieces. Apply vacuum to the sample by toggling the switch on the left-hand side of the door frame. Close the door when mounting is complete.</p>	





5. Position sample:

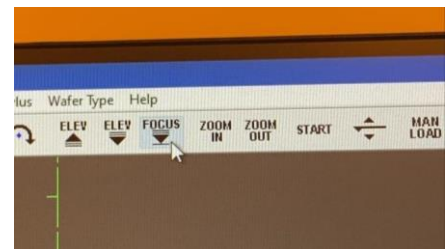
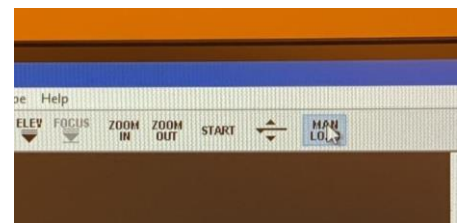
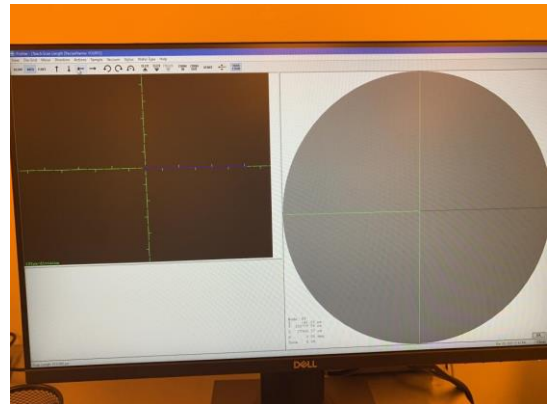
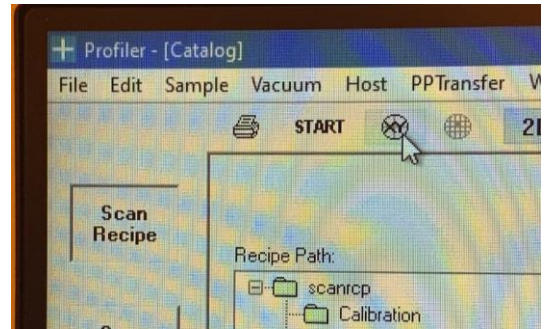
Click the **XY icon** from the Catalog screen to enter the stage navigation window.

The stage navigation window includes a microscope camera on the left-hand pane and a top-down coordinate map on the right-hand side.

Click on the **“MAN LOAD”** icon on the top toolbar. This command brings the stage to the central position under the stylus tower.

Click the **“FOCUS”** icon. This command initiates the process in which the stylus makes contact to the sample surface. This is an automated process so manual tower movement is not necessary.

One should note that at the beginning of the process, the stage moves to the right by several centimeters. This is because a proximity sensor, which is offset from the stylus, is used to automatically detect the sample surface. Once the surface is detected, the stage moves back to the center position and slowly





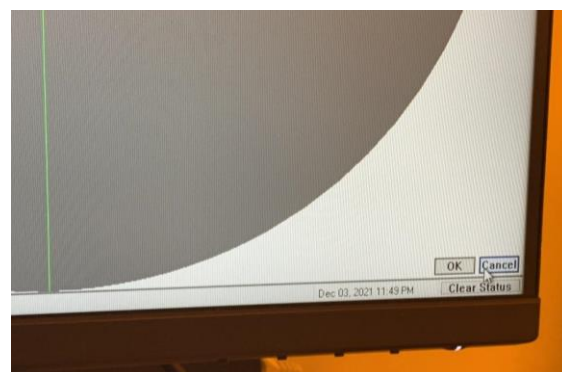
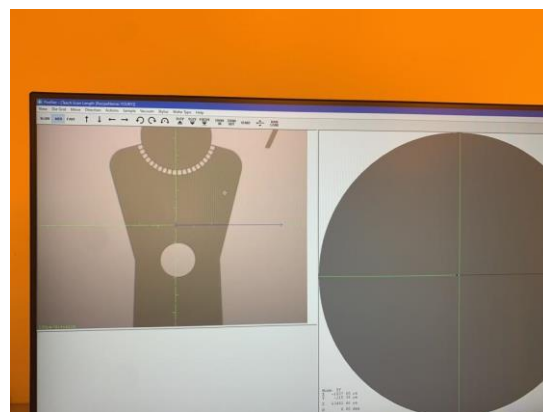
approaches the surface with the stylus.

Therefore, it is critical to make sure your sample covers the central hole in the stage to avoid crashing the stylus.

As the stylus approaches, the 45-degree angle camera will show the view of the stylus tip contacting the surface. After successfully approaching the sample, the stylus retracts and the camera switches to the top-down microscope view.

Move to the desired scan location using the keyboard arrows, the navigation arrows above the microscope camera, or by left-clicking a desired area in the microscope camera viewer.

Press OK in the bottom right corner to exit the stage navigation screen and return to the Catalog screen.



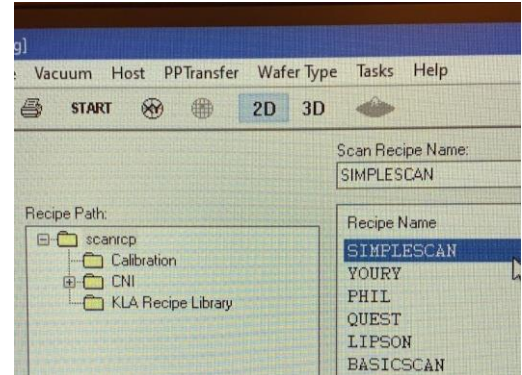


6. Set scan recipe:

Select a scan recipe from the list visible from the Catalog screen.

To modify a recipe, double-click it.

The recipe shown here “SIMPLESCAN” shows some standard scanning parameters.





2D Scan

X Scan Size (μm): 705.000

Find Define...

Scan Speed ($\mu\text{m/s}$): 20

Sampling Rate (Hz): 200

Multi-Scan Average : 1

Scan Direction: → Teach...

Scan Time:

Individual Trace (s): 35.3 Total Data Points:

Approx. Total (hr:min:s): 0 : 0 : 44.2 Point Interval (μm):

Stylus:

Applied Force (mg): 2.00 Recommended Maximum (mg):

Stylus Radius (μm): 2.00

Vertical Ranging:

Range/Resolution: 327um/0.1953A

Profile Type : □

- **Scan speed:** 20 $\mu\text{m/s}$
- **Sample Rate:** 200 Hz
- **Multi-scan average:** 1 (takes multiple scans over the same length and averages the results).
- **Scan direction:** left-to-right
- **Teach:**
Allows the user to define the scan path from the microscope camera. Upon clicking, the software will take you to the stage navigation screen, where the scan path can be defined in the left-hand microscope display. Use the left mouse button and drag the blue arrow using the trackball. Press OK to return to the recipe editor.
- **Stylus force:** 2 mg (adjustable, sample-dependent)

(continued...)





- **Vertical Ranging:**

Range/Resolution:

Defines the measurement range and resolution. The following are the *maximum* feature heights that can be measured with a given Profile Type (i.e. steps+trenches, step only or trench-only):

Range/resolution	Step + trench (μm)	Step-only (μm)	Trench-only (μm)
327 μm	163.5	327	327
65 μm	32.5	n/a	n/a
13 μm	6.5	n/a	n/a

If the ranging setting is not set properly the scan will saturate and abort. For example, attempting to measure an 8 um step using the 13-micron setting will cause saturation. Simply clear the error status and restart the scan with a lower step range.

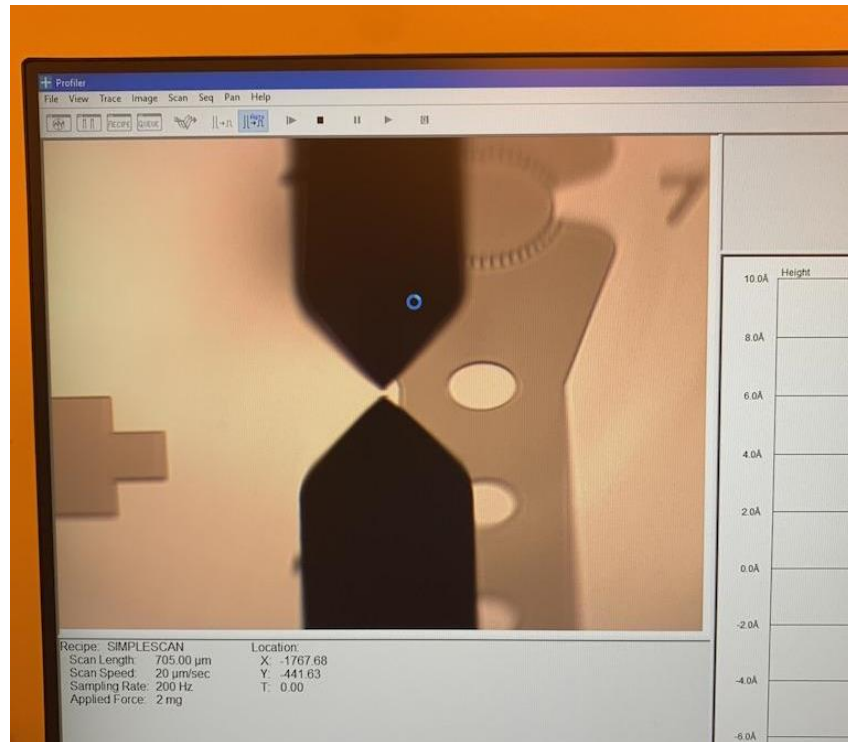
7. Start the scan

Once the settings are complete, click the “START” icon on the top toolbar of the Recipe Editor, Catalog Screen or Stage Navigation Window.

The camera will switch to the 45-degree angle view. The stylus will protract.

The stage will move beyond (before) the entered start point to make contact with the sample surface.





The scan will also begin prior to the entered start point, but the data will begin collecting when the stage reaches the starting point.

Once the scan completes, the stage will return to the initial start point and switch to the data viewer window.



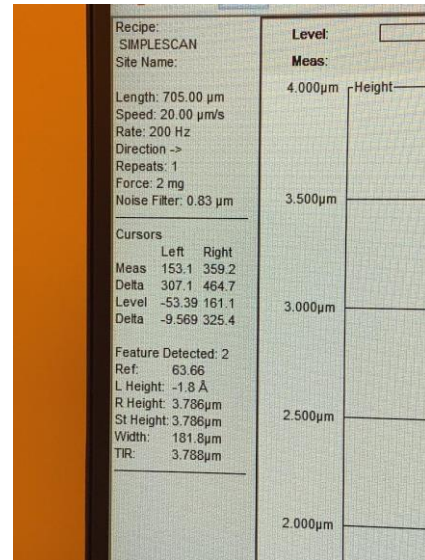
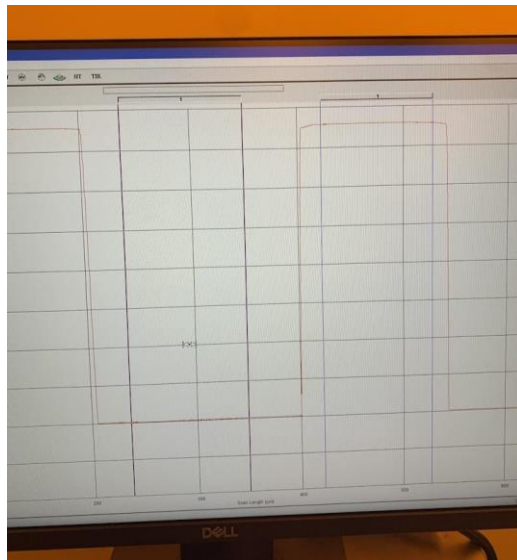


8. View/manipulate data:

The data viewer will automatically open after the scan finishes.

Refer to the software documentation for specifics on data manipulation and analysis.

To export data to ASCII format, you must save the data before closing the data viewer window. Return to the “Catalog” screen and locate the scan in the Scan Data navigation. Select the appropriate file and it can be exported.





Unloading your sample:

Open the stage navigation window (**XY icon**).

Click "**MAN LOAD**".

The stylus will retract and the tower will move into the "up" position and return to the load position automatically.

Switch off the vacuum and remove the sample from the stage.

Close the door panel.

Return the software to the "Catalog" screen.

THIS IS HOW THE TOOL MUST BE LEFT AFTER USING

Log out of Badger.

