This instruction covers the set-up and safe use of the KLA-Tencor P10 Stylus Profiler. This machine is a stylus contact profiler capable of 150mm scan lengths with ~10Å resolution and ~20Å noise floor. It is capable of measuring step height, roughness, and waviness on samples with a firm surface.

1.   SAFETY REQUIREMENTS

1.1.   Eye protection must be worn whenever in the Soft Materials Lab, except when using a microscope or when wearing protective goggles.

1.2.   Information regarding the hazardous materials used in this lab may be found through SDS documentation located on the Wiki.

1.3.   Operate the P10 Stylus Profiler with all protective shields and doors in place.

1.4.   Do not reach into the tool except to place your sample on the chuck. Do not put your hands under the scan head, or you may damage the stylus.

2.   EQUIPMENT

2.1.   KLA-Tencor P10 Stylus Profiler

    2.1.1.   Manufacturer: KLA-Tencor, Model: P-10, S/N: 0701114362

    2.1.2.   Computer, keyboard and monitor

    2.1.3.   Isolation table

    2.1.4.   VLSI Standards;

        2.1.4.1.   VLSI Step Height Standard, 8.00 μm

        2.1.4.2.   VLSI Step Height Standard, 9400Å (85nm)
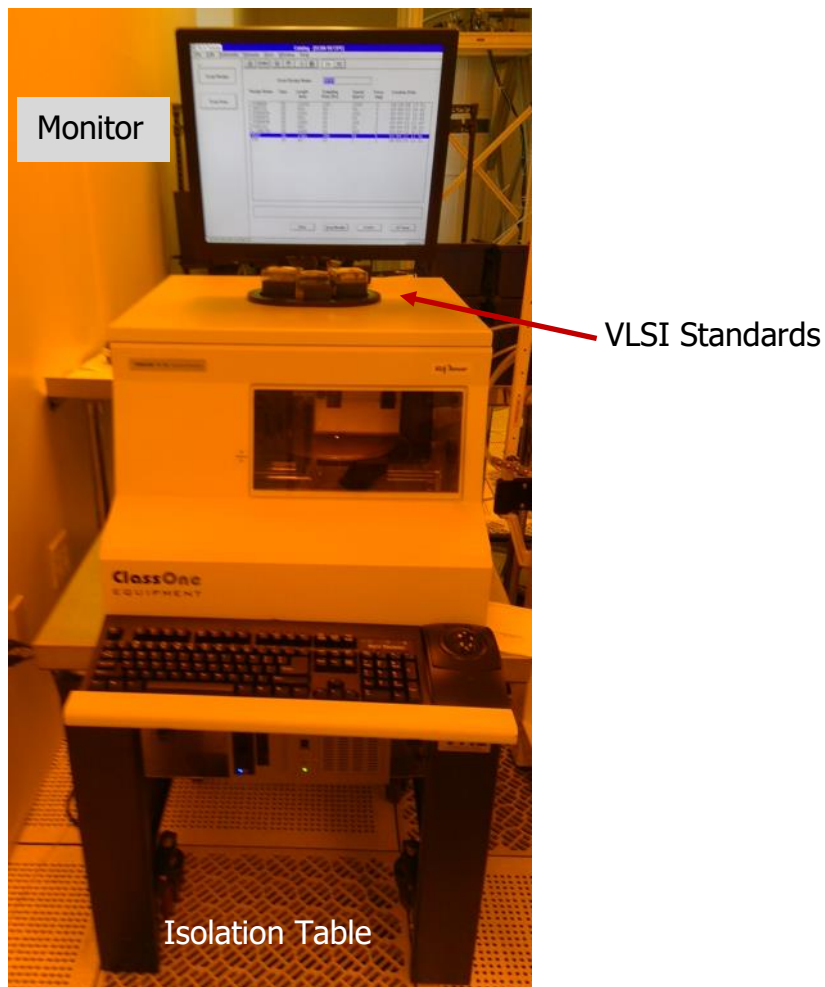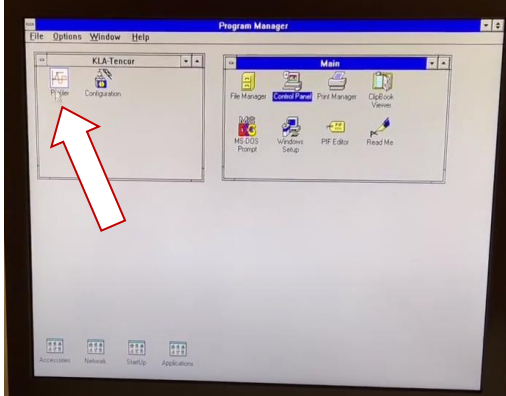
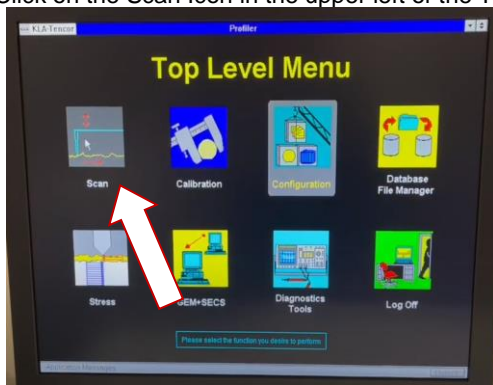## 3.   TOOL CONFIGURATION

Figure 1

4. CYCLE OF OPERATION

    4.1.   Enable the tool in iLab

   4.2.   Double click the Profiler icon if not already open

    4.3.   Click on the Scan Icon in the upper left of the Top Level Menu page

    4.4.   Choose an existing recipe by placing the cursor over the recipe and double left click (_STEPHTH; 327µm or less, _STEPHTM; 65µm or less, _STEPHTL; 13µm or less). The recipe selection will depend on the size of the sample step to be measured.
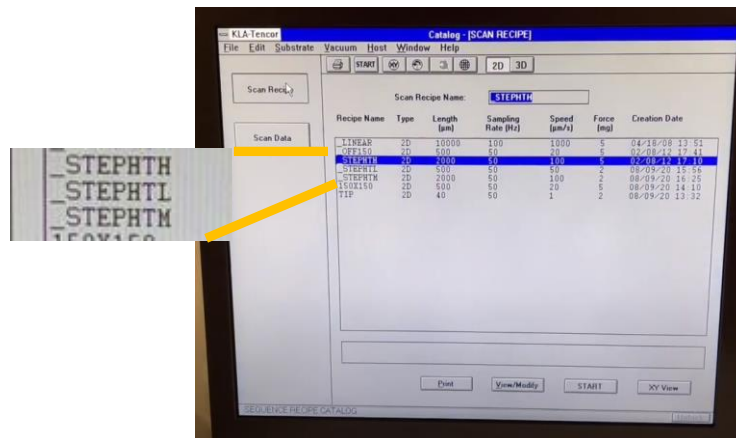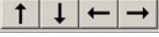
    4.5.   Press **XY** button to switch to camera mode

    4.6.   Press the **MAN LOAD** button which will cause the stage to move toward the front of the tool.

    4.7.   After the stage movement stops, open the door
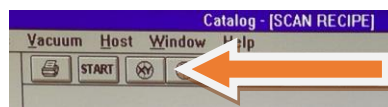
FOR BASELINE MEASUREMENT

    4.8.   Load the VLSI standard sample with extreme care placing it in the **exact center** of the chuck covering all 5 vacuum ports. *Note: Keep your hand away from the stylus head to avoid damage to the instrument.*

4.9.   Turn on the vacuum switch on the left side of door opening to prevent the sample from moving
   Note: Small samples that do not cover all 5 vacuum ports require the exposed vacuum ports be covered with small pieces of silicon or glass OR the sample can be mounted to a larger carrier

4.10.   Close the door

4.11.   Press the **MAN LOAD** again to move the chuck into the measurement position

4.12.   Verify the sample is in the center of the stage and under the stylus

4.13.   Press the FOCUS , this will move the stylus head down to the surface of the sample
   NOTE: Pressing the spacebar will stop the movement of the measurement assembly

4.14.   Use the arrows or click on the image to position the sample for measurement

4.15.   Click and drag (from left to right) to define the stylus scan path. The path will be indicated by a blue line with an arrow indicating the scan direction.

4.16.   Press OK when complete

4.17.   Refer to Section 5 of this document if the scan parameters need be adjusted

4.18.   Press the START button at the top of the menu bar

LEVELING

4.19.   Once the scan is finished, press the LEVEL button at the top menu bar (shown below)

4.20.   Drag, pull and manipulate the left and right Level bar cursors on the same plane to define a flat and even plane

4.21.   Press the LEVEL button a second time to planarize the scan results

STEP MEASUREMENT

4.22.   Position the left and right Measurement cursors to define the differential step. The width of the cursor bars can be adjusted.

4.23.   Record the difference in height between the two cursors displayed next to St Height

4.24.   If another measurement location is to be measured, press the XY button to move the sample and redefine the scan path.

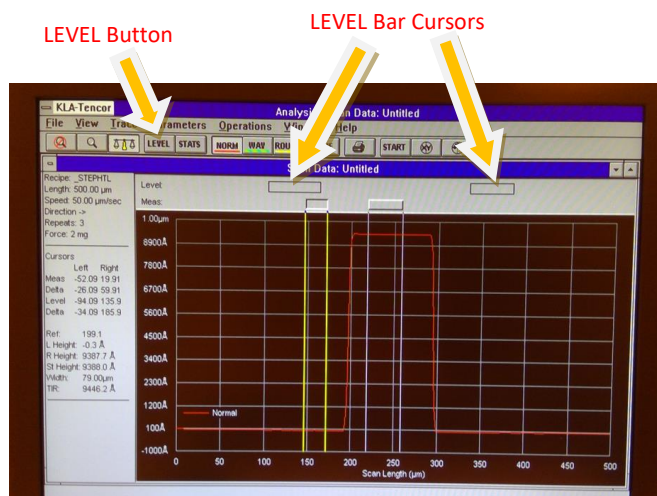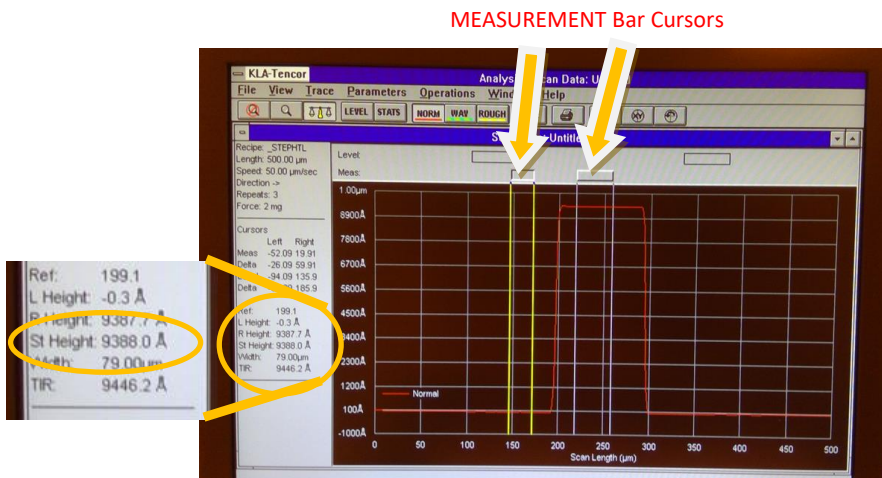4.25.   When finished, press the **XY** button

4.26.   Press the **MAN LOAD** button which will cause the stage to move toward the front of the tool

4.27.   After the stage movement stops, open the door

4.28.   Turn off the vacuum switch
4.29.   Carefully remove your sample from the stage
4.30.   Close the door
4.31.   Press the **MAN LOAD** button which will cause the stage to move toward the home position
4.32.   Exit the software and log out of iLab

5.   SUPPLEMENTAL DATA (Edit Recipes and Performance Specifications)

<u>EDITING RECIPES</u>
5.1.   Review and configure the scan parameters
    5.1.1.   Scan Length = represented by the *blue arrow length*
    5.1.2.   Scan Speed *($\mu m/s$)*
    5.1.3.   Sampling Rate *(amount of data collected)*
    5.1.4.   Scan Direction *(Always scan left to right)*
    5.1.5.   Applied Force *(Use 1 mg force for soft metals or polymers & use 2 mg force for metals and semiconductors*
    5.1.6.   Range/Resolution *(Ensure the step height maximum of the feature on interest is within this range)*
5.2.   For short scans, 2mm and smaller, the general rule of thumb is to keep the scan time between 5 and 10 seconds
5.3.   The General Parameters tab, and the Roughness Waviness tab may be used to determine slope, area, roughness, and other parameters from your scan analysis.
5.4.   The MicroHead V SR (standard range) has a vertical range of 300 μm, and is capable of scanning at forces between 0.5 and 5 mg
5.5.   The BNC unit has a 2 μm radius tip with a 60° angle installed and ask that all users limit the maximum force to 2mg
5.6.   The motorized theta stage is controlled with the rotating arrow buttons on the XY screen.

<u>PERFORMANCE SPECIFICATIONS</u>
5.7.   The P10 Stylus profiler at Purdue is equipped with the standard head configuration capable of 150mm scan lengths
5.8.   Resolution is approximately 10 angstroms and a 20 angstroms noise floor
5.9.   The software controlled motorized stage rides on a 12-inch optical flat
5.10.   Vertical range 0 μm to 300μm
5.11.   Substrate size from 3mmX3mm up to 200mm diameter
5.12.   2 μm radius diamond stylus with 60° cone angle tip
5.13.   Sample Surface Limitations
    5.13.1.   No uncured SU8
    5.13.2.   No uncured PDMS
    5.13.3.   No uncured photoresists
    5.13.4.   No other soft materials that might stick to the stylus

6.   STARTUP and SHUTDOWN

<u>STARTUP</u>
6.1.   Verify the tool is enabled in iLab
6.2.   Verify the computer is powered on
6.3.   Open the KLA-Tencor software if it is not running (shown in line 4.2)
6.4.   Double click on the Profiler icon

<u>SHUTDOWN</u>
6.5.   Verify the sample has been removed from the stage and the stage is in the home position
6.6.   Exit out of the software
6.7.   Disable the tool in iLab

REVISION RECORD

Reason for Revision	Date of Revision	Person Responsible
Initial Release	Apr 2022	Rich Harlan / Bill Rowe