COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK
COLUMBIA NANO INITIATIVE / CENTER FOR INTEGRATED SCIENCE AND ENGINEERING

KLA Tencor D-600 Profilometer Standard Operating Procedure

These instructions are intended for reference only and do not replace proper training and certification. In addition, recipe optimization is always needed per process and sample needs.

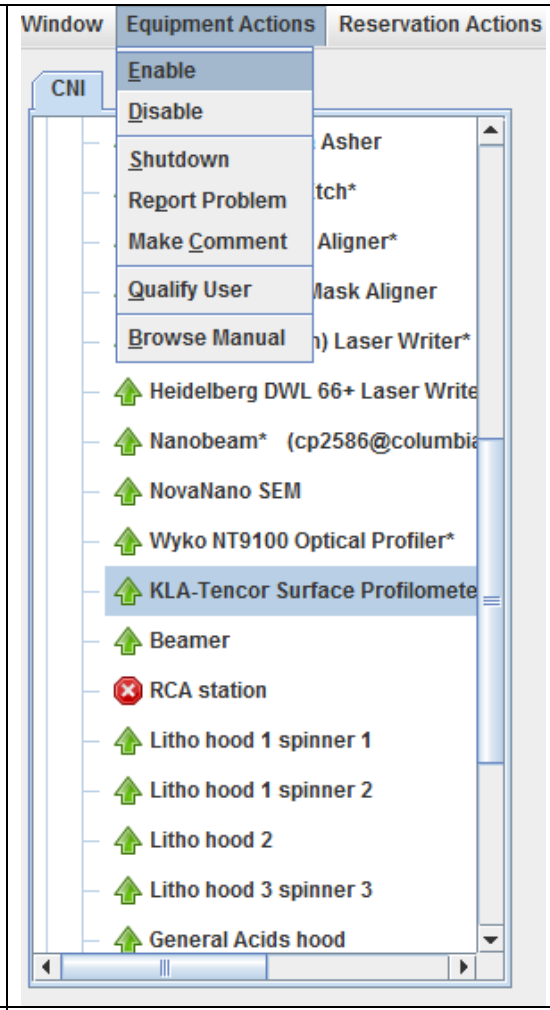
Written by Caroline Yu and Dr. Jaeeun Yu

1. NOTES

- **Always raise the stylus while moving the stage**
- No uncured materials (photoresist, PDMS)
- Stylus tip radius: 2 µm with 60° cone angle
- Measuring large features **(> 400 µm)** must be discussed with the super user or cleanroom staff

2. BADGER:

Enable the tool in badger.



3. VERIFY SYSTEM STATUS:

Check that the stylus is raised up and that the stage is in the loading position.

Open **AlphaStep Development Series** software.

4. LOAD SAMPLE:

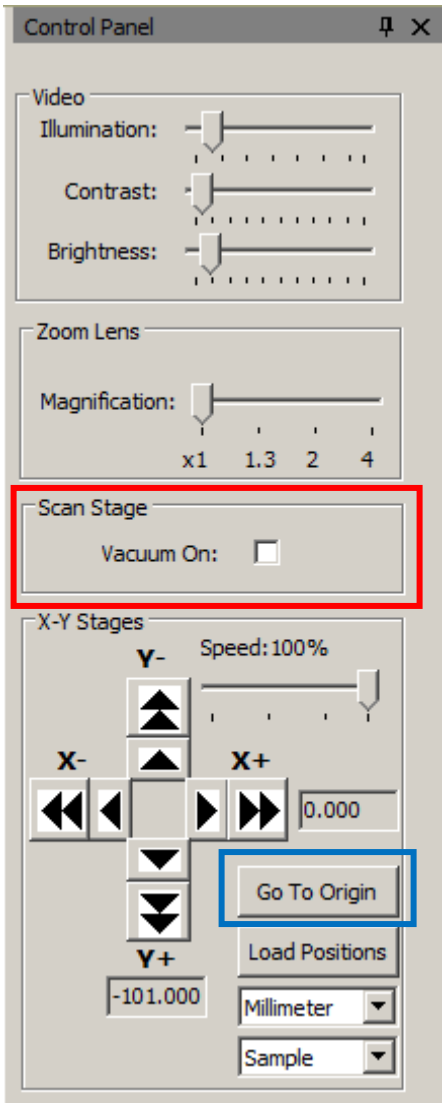
Open the stage cover. Place sample at the center of the stage. Turn the vacuum on.

Click 'Go To Origin' to move the stage to the measuring position (0, 0). **Make sure your sample height is lower than the stylus before you click it.**

Use X and Y controls to move your sample to the desired location. Close the stage cover.

Video Parameters:

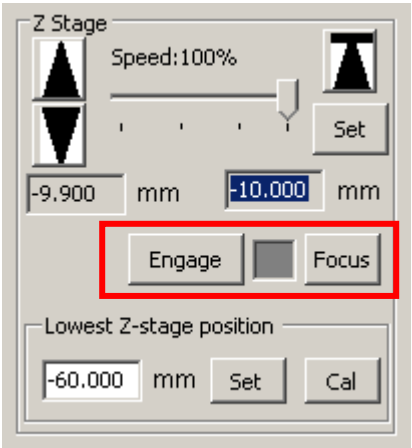
a) Illumination: LED light brightness
b) Contrast: video camera and card contrast
c) Brightness: video camera and card brightness
d) Zoom Lens: change the magnification of the live images



5. ENGAGE THE STYLUS:

Bring the stylus down close to the surface, then click 'Engage'. The stylus will approach slowly to the sample surface. Wait until the grey box shows a green color.

If you need to relocate the scan position, must click an up-arrow icon to bring the stylus off the surface.

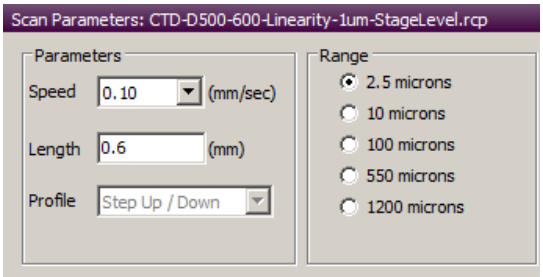


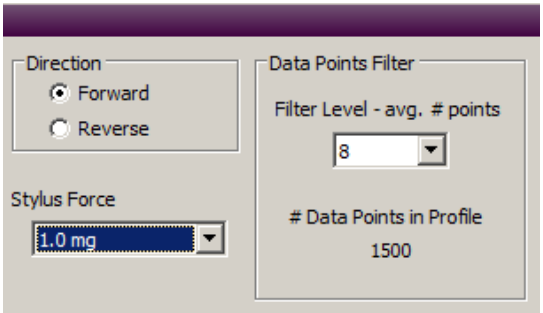
6. SCAN:

Choose the parameters for the sample.

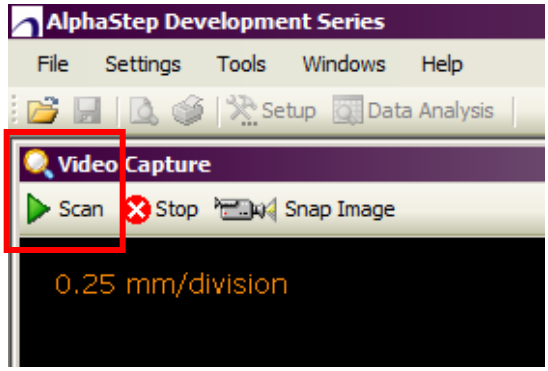
a) Length: total scan length in mm
b) Speed: scan speed in mm/s (0.01 – 0.4 mm/s range)
c) Profile: "Step Up/Down" is recommended
d) Vertical range: full height (2.5 – 1200 microns range)
e) Scan direction: forward = -Y direction; reverse = +Y direction
f) Stylus force: applicable in step up/down profile type (0.03 – 15 mg) for short vertical ranges
g) Filter level: smoothing filter, sampling rate = 2000 points/s
h) Data points: number of data points after filtering

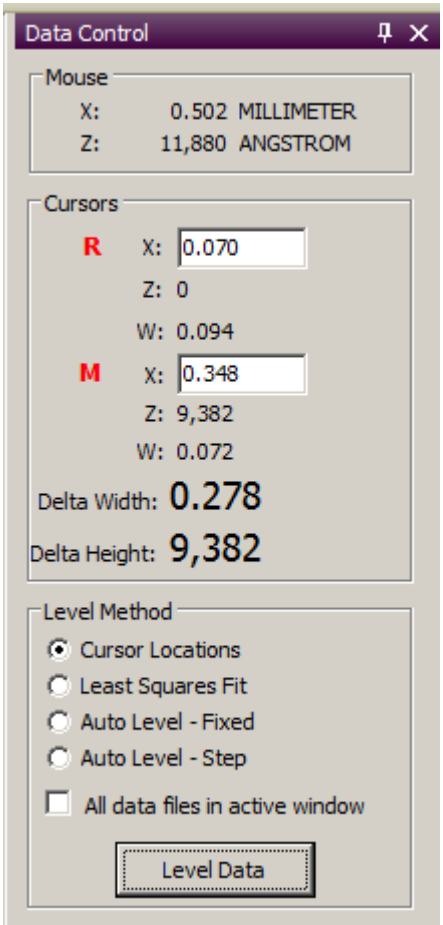
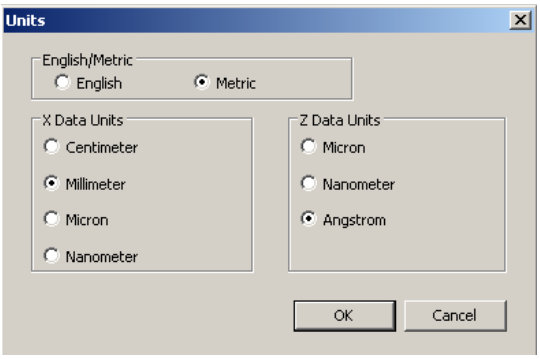
*For large ranges (550 & 1200 µm), only 15 mg in force is available.
* For range 2.5 µm, only 'step up/down' is available.

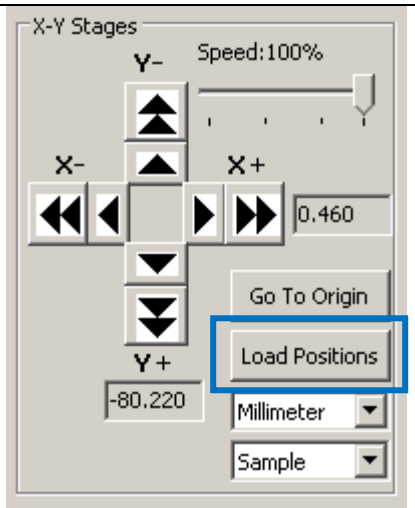
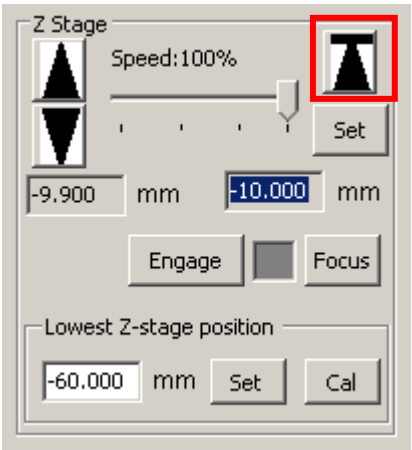
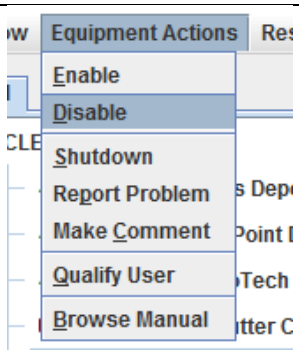




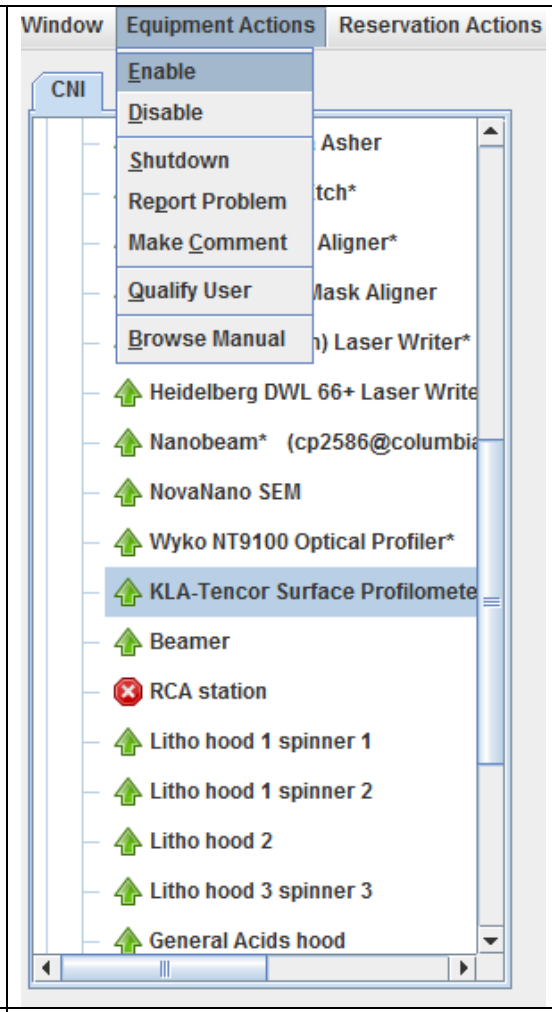
Press 'Scan' button on the video capture window.



7.	**DATA:** 'Level Data' using two cursor locations. The delta Height value is showing in Angstroms. The unit can be changed in 'Units' from 'Settings' drop-down list. Save 2D profile by clicking "File" in the data window ➔ "Save Data File As"	 
8.	**UNLOAD SAMPLE:** Click 'Load Positions' and use the stored Load/Unload positions to bring the stage to the loading position. ➔ If you have multiple samples, you can load your second sample and	

	click 'Go To Origin'. **Again, make sure your sample height is lower than the stylus before you click it.** ➔ If you're done with all your samples, click the arrow icon (shown on the right image) to bring the stylus all the way up. ***Do not change the default setting "-10.000 mm".*** Turn vacuum off. Open the stage cover and remove the sample. Close the stage cover. **Close the AlphaStep software.**	  
9.	**BADGER LOGOUT:** Don't forget to disable the tool in badger after you're done.	

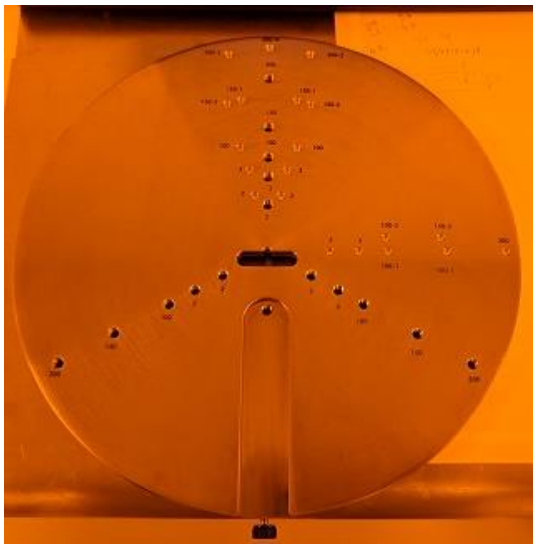
THIN FILM STRESS MEASUREMENT

10.	**BADGER:** Enable the tool in badger.	
11.	**VERIFY SYSTEM STATUS:** Check that the stylus is raised up and that the stage is in the loading position. Open **AlphaStep Development Series** software.	

12. WAFER STRESS CHUCK:

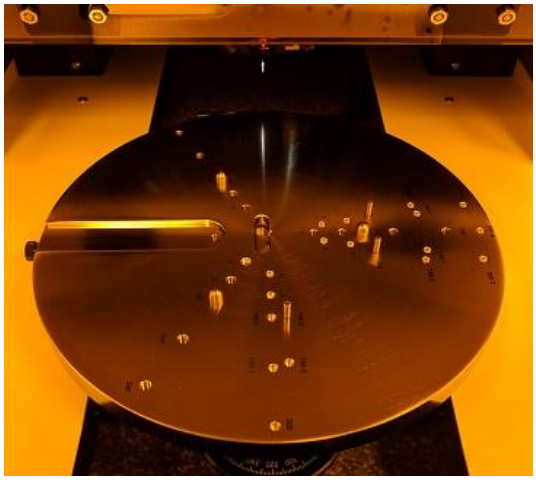
The wafer stress chuck and pin locators can be found under the table.

The wafer stress chuck can accommodate: 2” with primary flat, 3” with primary flat, 100 mm with primary and secondary flat, 150 mm with primary and secondary flat, and 200 mm with primary flat and notched.



Screw the three spherical pins at the appropriate positions. Then, place the three clocking pins. The example for 4” wafer with secondary flat is shown on the right.

Add the wafer stress chuck on top of the standard chuck. **Rotate the chuck** so that the clocking pins do not hit the stylus.

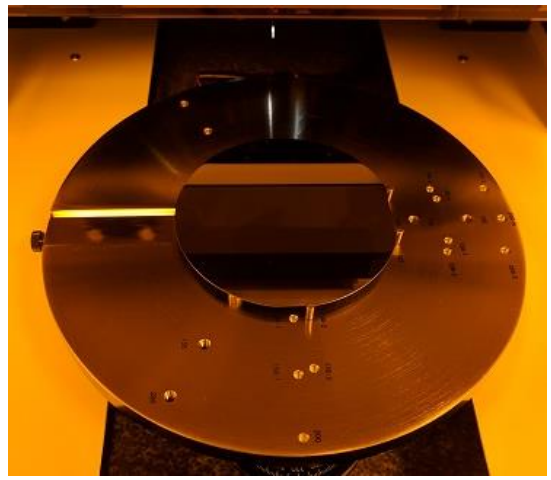


13. LOAD SAMPLE:

Mount the wafer on the three spherical pins.

Click "Go To Origin" to the move stage to the measuring position (0, 0). **Make sure the stylus is all the way up.**

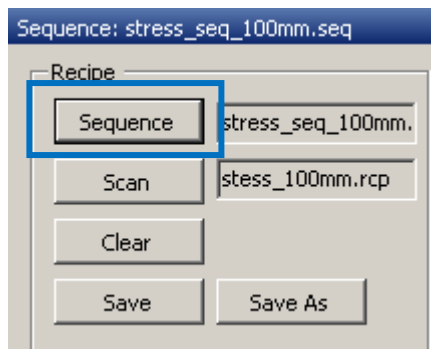
Bring the stylus down close to the surface. Do not engage.



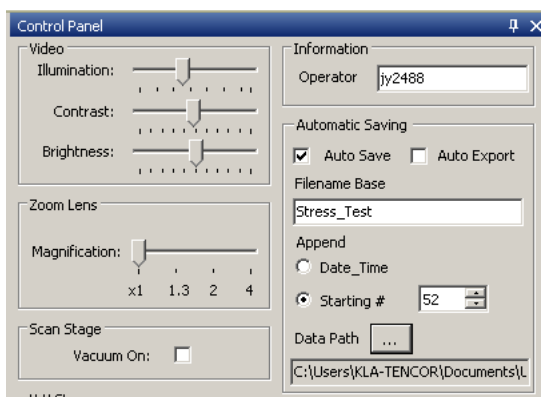
14. MEASUREMENT:

A sequence recipe for 100 mm wafers is available. Click 'Sequence' on the Sequence tab. Load the file "stress_seq_100mm.seq".

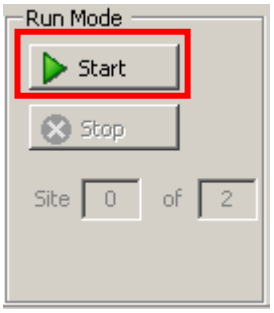
If you need to create the recipe, go to **step 15**.



On the Control Panel, enable the 'Auto Save' and give the Filename. You can change the 'Data Path' to your own folder.



Click 'Start' on the Sequence tab.



15. SCAN AND SEQUENCE RECIPE PREPARATION (OPTIONAL):

For the stress measurement, the scan should cover 80% of the length of the sample. The maximum length of a single scan is 55 mm. Use the auto-stitching function if you need to make measurement longer than 55 mm (*e.g.,* two 40 mm measurements are required for 100 mm wafer)

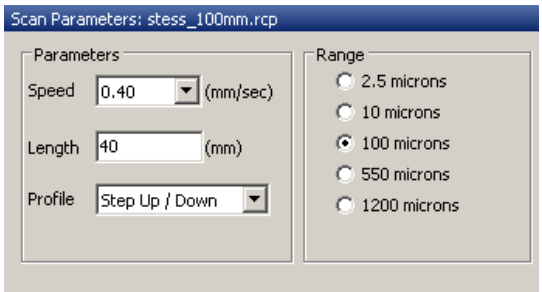
First, create the scan recipe. Choose the appropriate scan parameters for the sample.

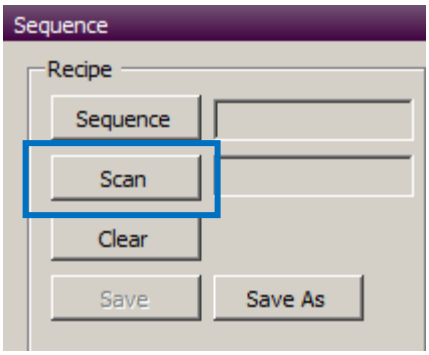
Then, click 'Scan' on the Sequence tab and load the saved recipe.

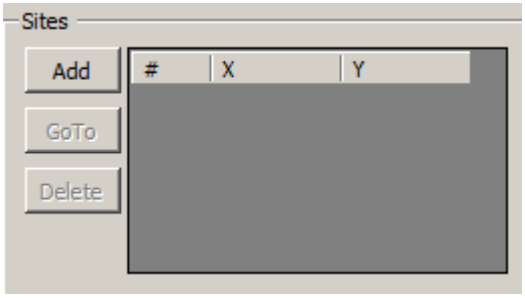
At the origin (0,0), add the coordinates as the first measurement site. Add the other measurement site based on the scan length.

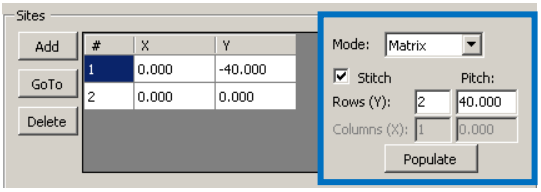
Select 'Matrix' mode and enable the 'Stitch' checkbox. Set the Rows and Pitch accordingly.

Save As to save the current sequence recipe.









16. THIN FILM STRESS:

After the sequence is complete, the stitched profile will be displayed.

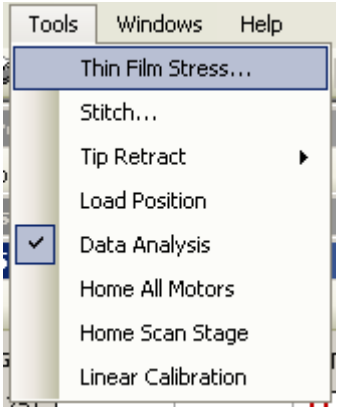
Go to 'Thin Film Stress' under the 'Tools' menu.

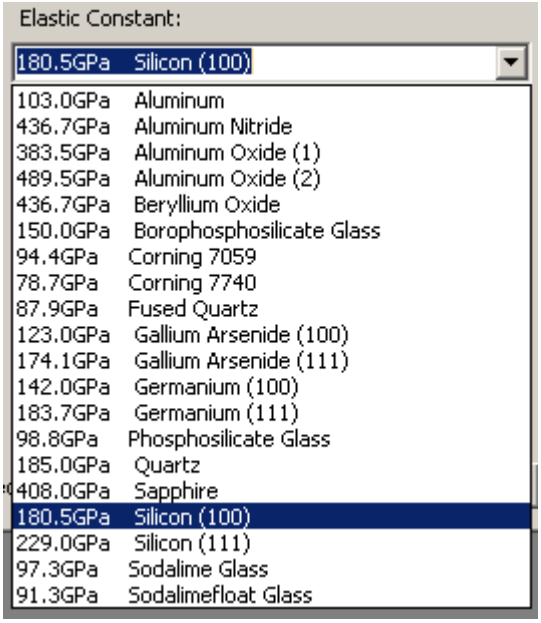
For a single, post-stress measurement, enable the 'Calculate on Post Stress Data Only' checkbox and Load Post Stress File.

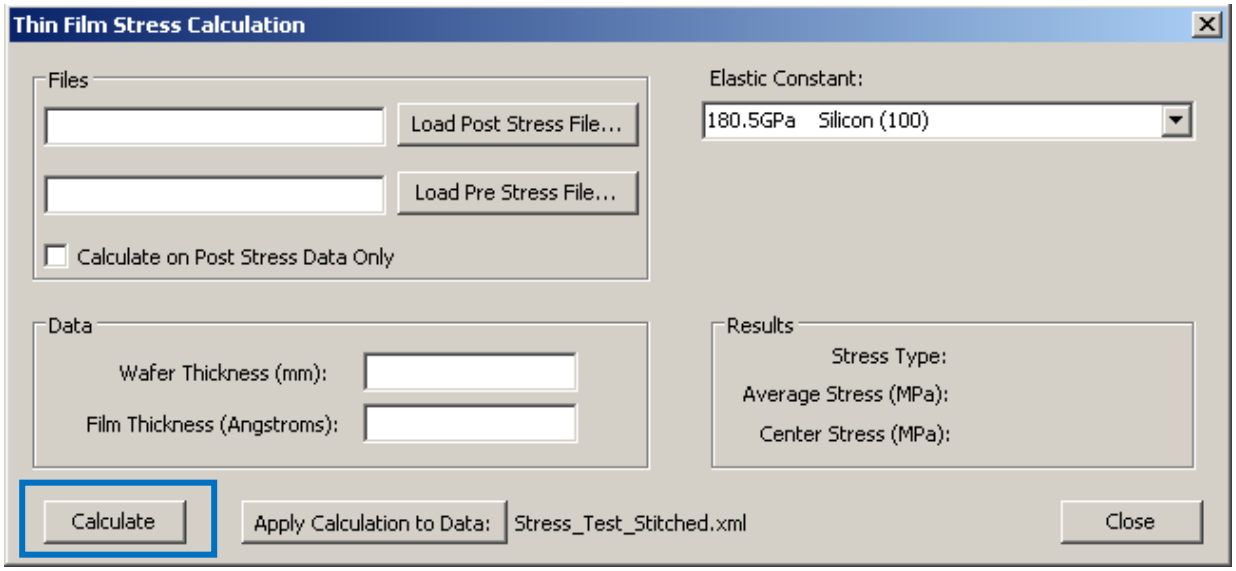
Give the stress parameters: Wafer Thickness (mm), Film Thickness (Å), and Elastic Constant.

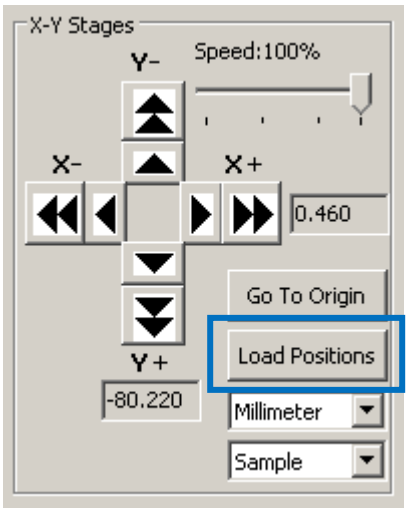
Click 'Calculate'.

*If you want to compare the pre- and the post-process data files, it's recommended to book the tool until the post-process stress measurement.







17.	**UNLOAD SAMPLE:** Click “Load Positions” and use the stored Load/Unload position (0,0,-10) to bring the stage to the loading position. Open the stage cover and remove the sample. Take the wafer stress chuck out and place the chuck and pins back where you found. Close the stage cover. **Close the AlphaStep software.**	 
18.	**BADGER LOGOUT:** Don’t forget to disable the tool in badger after you’re done.