

Standard Operational Procedure

Variable Angle Spectroscopic Ellipsometer Uvisel, Yvon-Jobin

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Instrument location: Room TT6140, North-east corner

Purpose of instrument: determine thickness and optical properties of thin films and multilayers structures (wavelength range is from DUV to NIR [260 – 2100 nm])

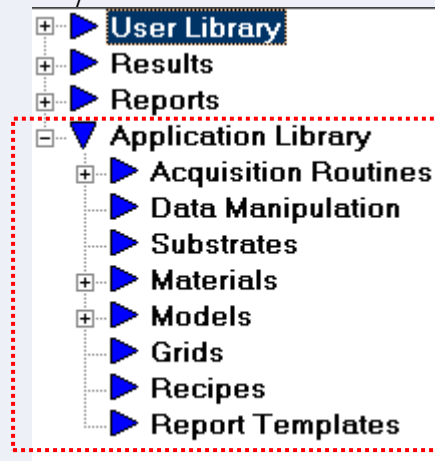
BEFORE STARTING

- ❑ This is a cheat sheet for those who have been trained, but may have forgotten something or are a little rusty with the use of the instrument. **THIS IS NOT A SUBSTITUTE FOR TRAINING.**
- ❑ Those wishing to get trained must contact Simon Trudel at strudel1@sfu.ca or 778.782.8071.

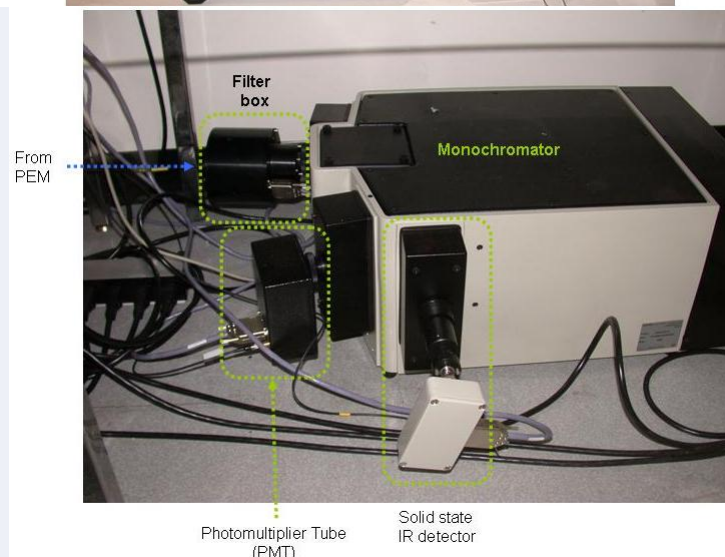
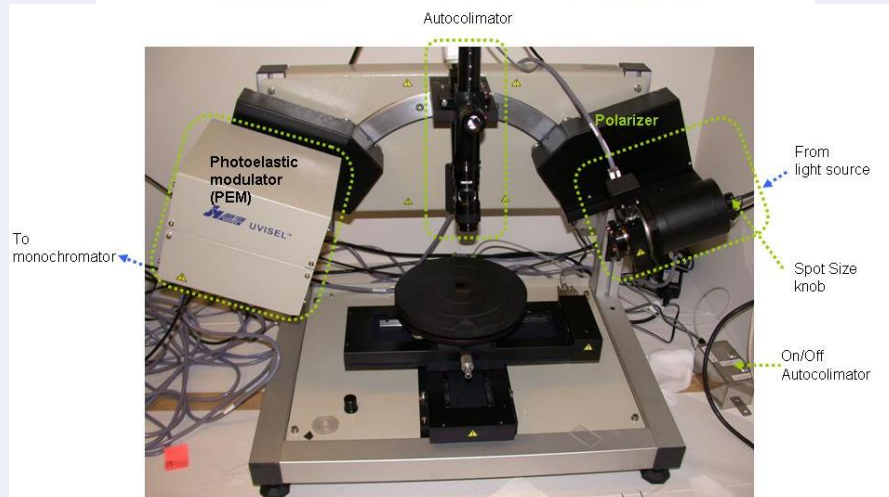
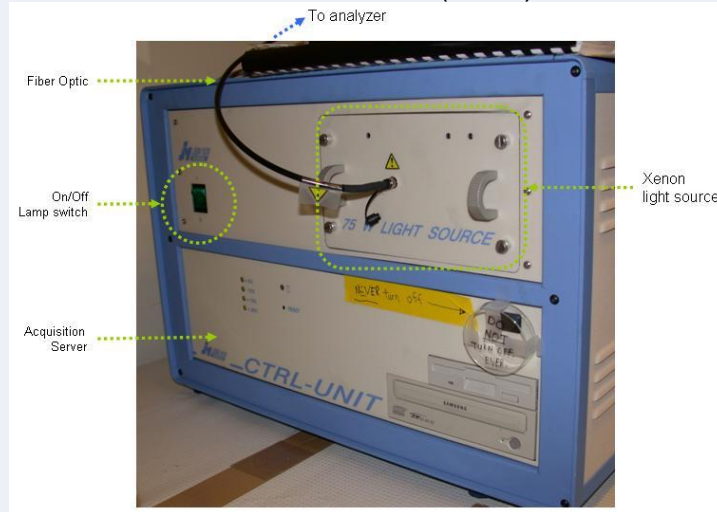
 Don't stare at the output of the lamp 

- ❑ A cool-down period of ~30 minutes is required before restarting the lamp.
- ❑ Don't step, kink, kick, bite or bend the optic fiber. If you do, I'll do the same to you.

NB: All parameters in the **APPLICATIONS LIBRARY** are shared by all users. **DO NOT MODIFY THEM.** If you do modify, let me know, and I can retrieve parameters from the installation CD.



THE INSTRUMENT (FIG.1)




GETTING STARTED

Start the lamp.

Start DeltaPsi2 software.

Make sure you are in your own user library. The current user can be seen in the lower left corner of the screen (Fig 2, left). If you are not the current user:

1. Click on the **SOFTWARE OPTIONS**  tab
2. Select your name, and click **CLOSE**. See Fig. 2.

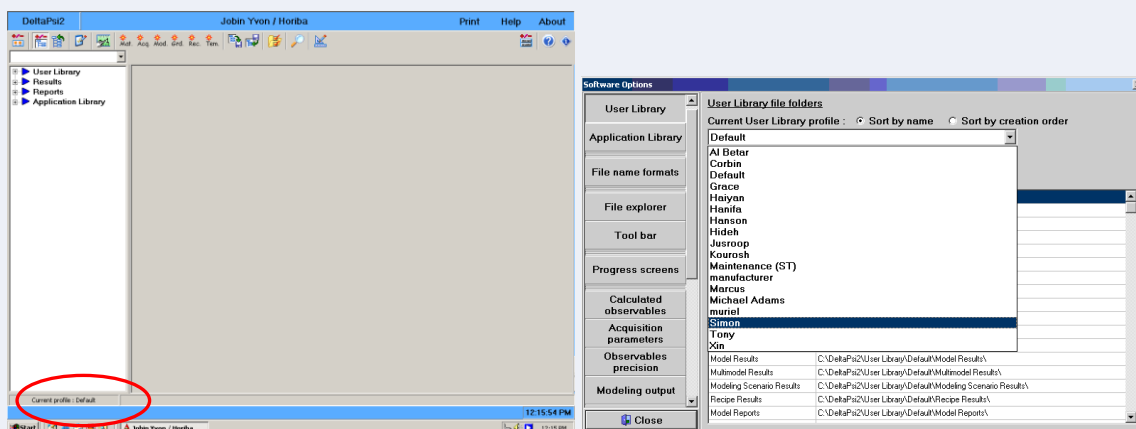



Fig. 2

SAMPLE INSTALLATION AND STAGE ADJUSTMENTS

You will need to adjust the sample levelness, as well as the stage height. Adjusting the levelness properly will get your angle of incidence to within 0.3° of the nominal value, while adjusting the stage height will maximize your signal.

*If your sample is on a silicon substrate, set the angle of incidence at 70° and the wavelength at 450 nm. See **CHANGING THE ANGLE OF INCIDENCE** and **CHANGING THE WAVELENGTH** below.*

Place your sample in the middle of the stage. On the right hand side the instrument, there is a small metallic box. Turn the switch labeled **LAMP**. This turns the autocollimator on.

In DeltaPsi2, click on the **MANUAL MEASUREMENT** button . This will open the shutter, and you will see where the light will hit your sample. Move your sample such that the beam is well away from edges, non-uniformities (scratches, piece of dirt, finger print...). At this point, you may choose to change the spot size. See **CHANGING THE SOT SIZE** below.

First adjust the level of sample. An off-level sample will show non-coinciding cross-hairs in the autocollimator (Fig. 3, left). Using the two **LEVELING SCREWS** under the stage (front left and back right, Fig. 3, center), get the two crosshairs to coincide (Fig. 3, right).

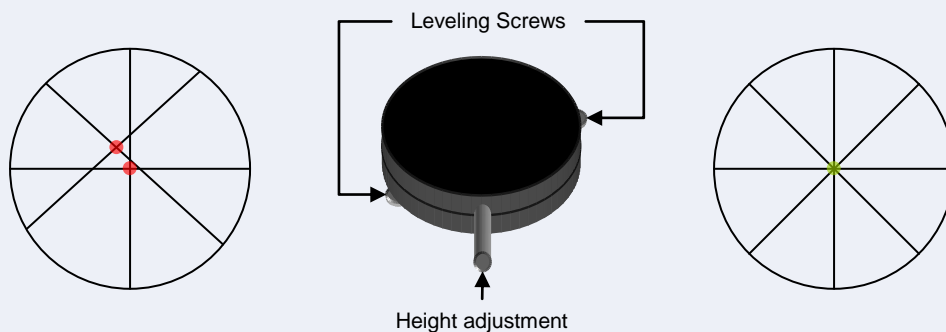




Figure 3

To adjust the height, look at the S_0 signal in the **MANUAL MEASUREMENT** window (see below). Turn the **HEIGHT ADJUSTMENT SCREW** to maximize the S_0 signal. Once you have reached the maximum value, click on the **ADJUST S_0** button. This will automatically adjust the high voltage on the PMT detector.

Signal

<input checked="" type="radio"/> S0	<input type="text" value="-0.027 mV"/>		
<input type="radio"/> S1	<input type="text" value="0.001 mV"/>	Is	<input type="text" value="-0.04074"/>
<input type="radio"/> S2	<input type="text" value="0.009 mV"/>	Ic	<input type="text" value="-0.54448"/>
<input type="radio"/> Rw	<input type="text" value="-0.03179"/>		
<input type="radio"/> R2w	<input type="text" value="-0.79006"/>		<input type="button" value="S0 Adjustment"/>

If you reach the maximum range on the height adjustment and your sample is still too low/high, add/remove height by adding/removing a piece of silicon or microscope slide under your sample. Make sure you recheck the leveling if you do this.

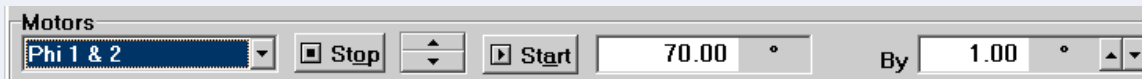
Until you move your sample, no further adjustments are required.

CHANGING THE SOT SIZE

There are 3 nominal spot sizes: 1 mm, 100 μm , and 50 μm . Where the optic fiber attaches into the polarizer, there is a small knob you can move. The positions go from 1 mm to 50 μm from top to bottom. If you change the spot size, please return to the default 1 mm once you are done.

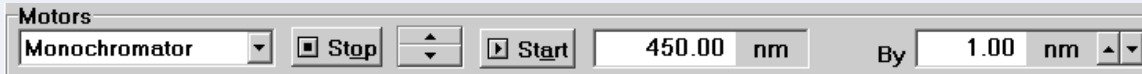
CHANGING THE ANGLE OF INCIDENCE

This is done in **DELTA PSI2**. At the bottom of the **MANUAL MEASUREMENTS** window, choose **MOTORS > PHI 1 & 2**. Type in 70°, and click the **START** Button. This will change both the polarizer and analyzer angles to 70°.



CHANGING THE WAVELENGTH

This is done in **DELTA PSI2**. At the bottom of the **MANUAL MEASUREMENTS** window, choose **MOTORS > MONOCHROMATOR**. Type in 450.00 nm, and click the **START** Button. This will rotate the grating in the monochromator such that the light at 450 nm is being analysed..



REGULAR MAINTENANCE

THERE IS A MAINTENANCE USER PROFILE THAT HAS THE ACQUISITION ROUTINES REQUIRED FOR MAINTENANCE.



BE CAREFUL WHEN HANDLING THE NIST STANDARD, TO KEEP IT FREE OF CONTAMINATIONS AND SCRATCHES.

Measurements on the NIST SiO₂/Si standard sample should be performed on a **weekly** basis, or every time the instrument is used after a long period of inactivity. The appropriate measurement is saved in **ACQUISITION ROUTINE \ NIST TRACKING**. It measures from 300 to 700 nm, every 10 nm.

These steps should be carried out on a semi-regular basis, in particular if the values obtained when measuring the NIST standard sample are a bit off:

1. Turn the lamp **ON** and allow it to warm up.
2. Change the user to Maintenance.
3. With no sample on the stage, run **ACQUISITION ROUTINE \ STEP 1**.
4. Place the aluminum mirror on the stage, adjust height and level (AOI = 70° ; I = 450 nm).
5. Run **ACQUISITION ROUTINE \ STEP 2**.
6. Run NIST standard sample. If every thing seems OK, log in the values obtained from fitting the NIST standard, and you are done.
7. If values obtained after running the NIST standard are a bit off, palce the mirror back on the stage (AOI = 70° ; I = 450 nm) and run **ACQUISITION ROUTINE \ STEP 3**. This will recalibrate the monochromator. This step takes about 1½ hours to complete.
8. Run NIST standard sample. If every thing seems OK, log in the values obtained from fitting the NIST standard, and you are done.