

Operating Instructions

SPECEL-2000-UV-VIS-NIR MAPPING-12-INCH-SE

Revision 0141110315

Read this manual before you attempt to use this instrument

Table of Contents

Safety Instructions	1
Description of Measurement Principle	2
SpecEI-2000 options.....	2
System Description	3
The Main User Interface with Scout.....	8
The Main User Interface without Scout.....	8
Init	10
Continuous on and adjust sample stage height	10
Auto intensity.....	11
Simulate	11
Measure	11
Analyze	11
Continuous mode	12
Fitness	12
Lamp Replacement.....	13
Trouble Shooting.....	14
No Correct Measurement	14
Calibration (Init)	15
Contact	15
Warranty	16

Safety Instructions

Instructions: All the safety and operating instructions should be read before the unit is operated. Before using the power supply for the first time check for transport damage.

Warning: All warnings on the unit and in the operating instructions should be adhered to.

Operating Environment:

Moisture:

The unit is designed for operation in dry rooms only

Ventilation:

The unit should be situated so that its location or position does not interfere with its proper ventilation

Heat:

The unit should be situated away from radiators, hot bodies, ovens or other heat sources

Power sources:

The unit should be connected to a power supply only of the type described in the operating instructions or as marked on the unit

Object and liquid entry:

Care should be taken that objects do not fall, or liquids spilled into the enclosure through openings.

Contents:

Your package should contain

- SpecEI-2000-UV-VIS-NIR
- Power Supply
- Power Cable with Country Connector
- Computer with Keyboard and Mouse
- USB Interface Cable
- Serial Interface Cable (male-female)
- Serial Interface Cable (female-female)
- Software CD
- SpecEI-2000-UV-VIS-NIR Operating Instructions
- Scout Software CD
- Scout Protection Key (USB-Dongle)
- Scout Manual

Unpacking:

1. Unpack your new assembly carefully. Dropping this instrument can cause permanent damage
2. Inspect the outside of the instrument and make sure that there is no damage to your unit. In case of damage contact the dealer immediately and **DO NOT USE THE INSTRUMENT!**
3. Use this instrument in a clean laboratory environment

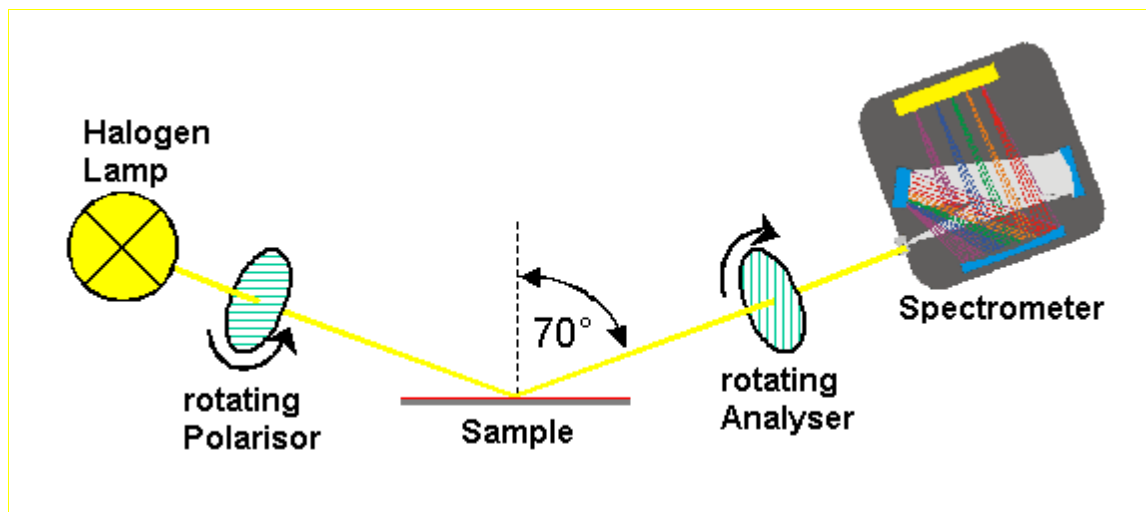
Instrument Description and Options

SpecEI-2000-(UV-)VIS-NIR is a system to extract the thickness and optical data of thin and transparent layers on different plane substrates

Description of Measurement Principle

In general ellipsometry is a non-contact, non-destructive, optical technique for the characterization of thin films on surfaces. When a surface or interface is struck by polarized light, ellipsometers measure the change of the reflected light beam by detecting and quantifying the change in the amplitude ratio and phase induced by the reflection of light on the sample surface. In case of a spectroscopic ellipsometer like the SpecEI-2000 these changes are measured not only for different polarization angles but also over a wide range of spectral wavelength.

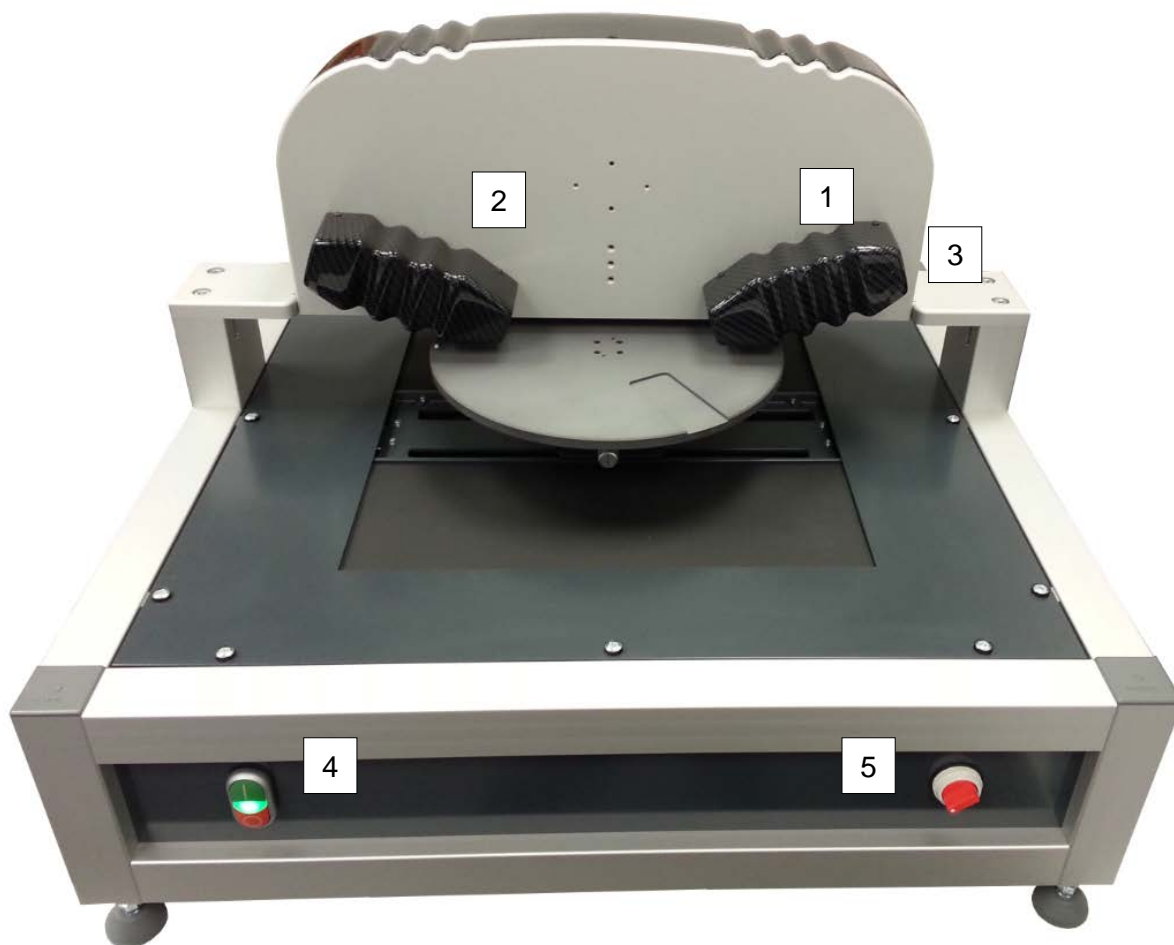
Spectroscopic ellipsometer requires neither reference nor reference beam.



SpecEI-2000 options

- Measurement of multi layers (weakly absorbing or transparent) on top of a substrate
- Highly accurate thickness measurements between 1nm (10\AA) up to about $10\mu\text{m}$ with a resolution of 0,1nm (1\AA).

System Description



- 1 Satellite 1 (sending module, polarizer)
- 2 Satellite 2 (receiving module, analyzer)
- 3 switch, Lightsource on/off (only when Power switch is on)
- 4 Power switch ON/OFF – complete system on/off, with power indicator
- 5 Vacuum ON/OFF

Installation

The ellipsometer system consists of the mapping table, ellipsometer on top, the power supply and the system controller (PC). Connections between computer and ellipsometer and mapping table are established through different connection cables.



Connector Details



Left to right:

1. Power connector (to mapping table)
2. Serial connector (to mapping table)
3. USB (to PC)



Upper left connector:
Serial connection (to SpecEI)
Upper right connector:
Power connection (to SpecEI)

Lower left connector:
Serial connection (to PC)
Lower right connector:
Power connection (to power supply)

Connect the USB cable between the PC USB-port and the SpecEI main system
Connect the Serial cable from COM 1 of the PC to the lower serial port of the mapping table
Connect the Power Unit-EL cable to the mapping table
Connect the power cable of the Power supply
Connect the power cable of the PC
Connect the cable between the upper DSub9 of the mapping table and the SpecEI
Connect the cable from the upper DIN plug to the DIN plug at the SpecEI

Switch On Instruction

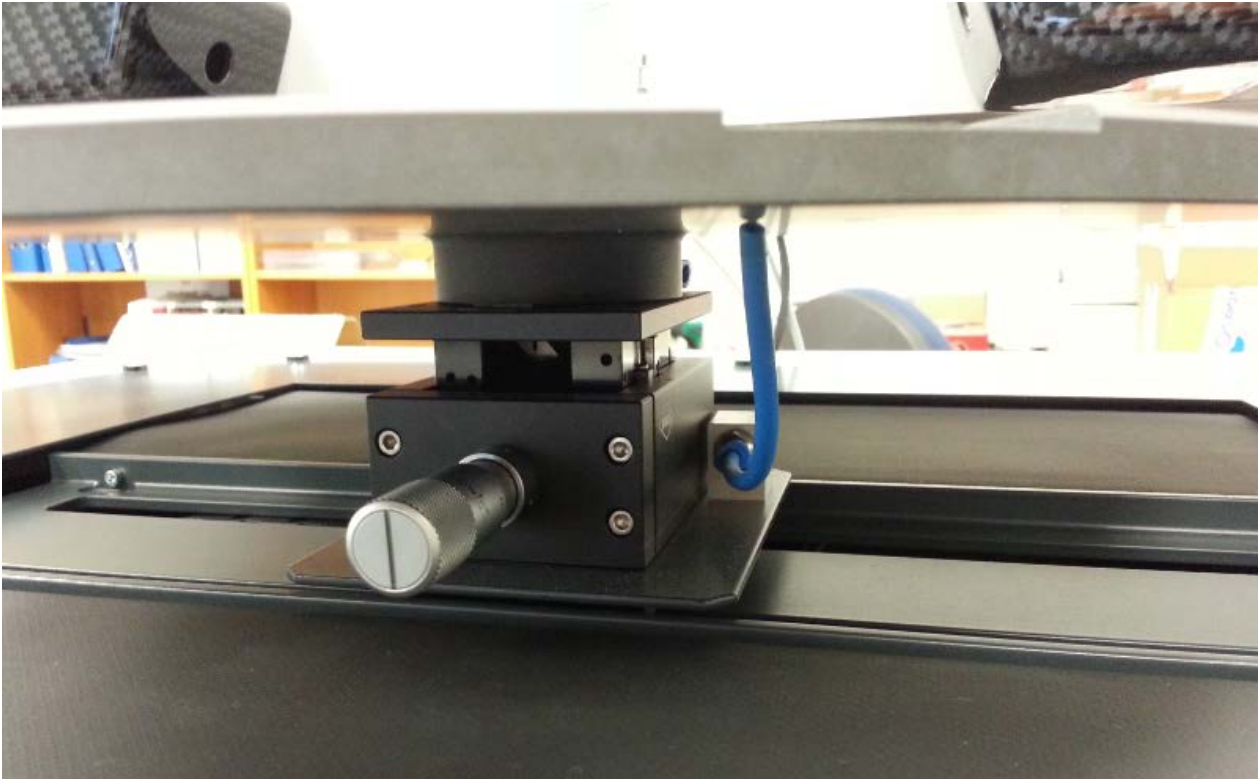
After all cables are connected as described above, the PC, the mapping table and the ellipsometer can be switched on. To avoid problems all devices should use a common power line connection. Please tighten all plugs with the corresponding screws to secure proper connection.

Starting Sequence: Wait until Windows is completely started. Switch on power at the power-supply. Switch on the mapping-table. Switch on the lightsource of the SpecEI. Start the ElliCalc software.

Chuck Height Adjustment

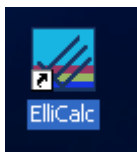
The default height setting is for wafers!

The SpecEI-2000 system accepts a wide range ($\pm 1,5\text{mm}$) of height difference of sample thickness. If this tolerance is not enough to achieve a good signal, the chuck height can be adjusted using the screw below the chuck. SpecEI will accept samples between 0 and 10mm thickness.

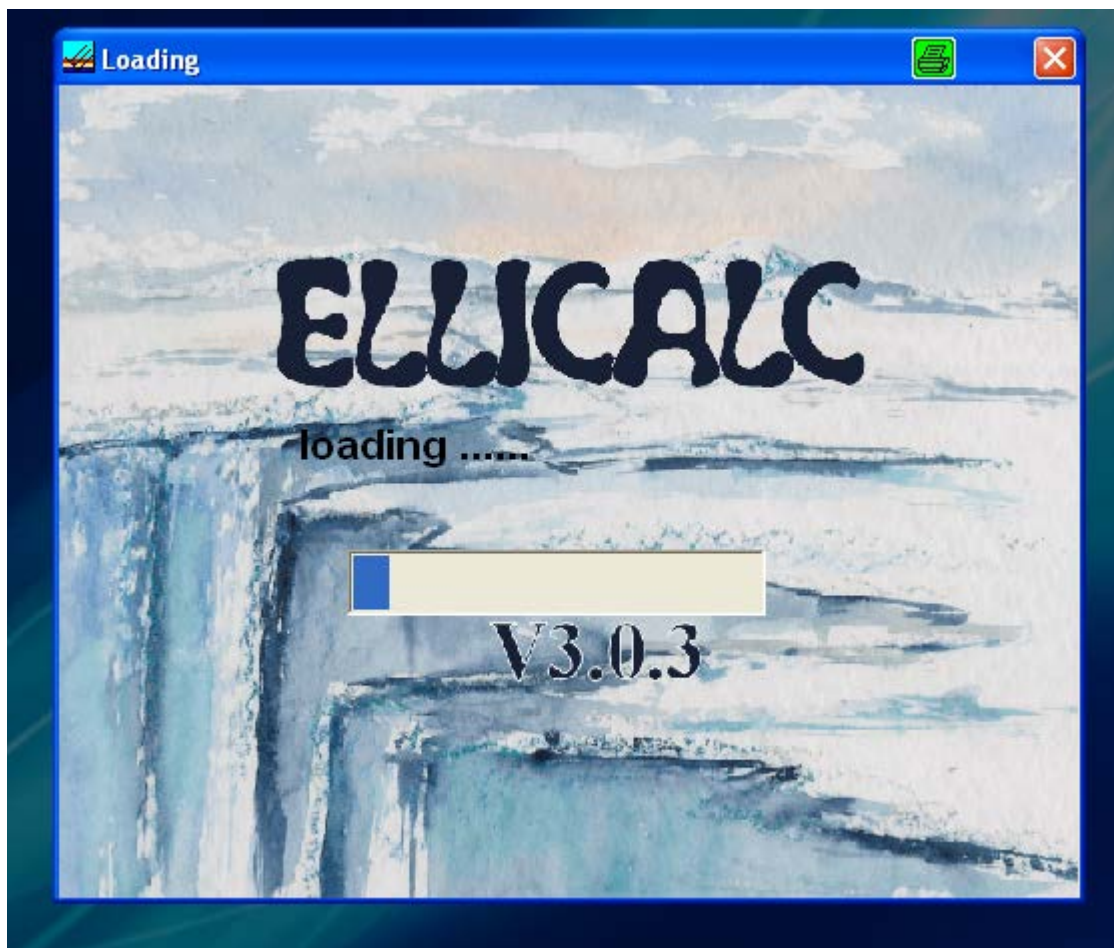


See chapter 0 Continuous on and adjust sample stage height or the height adjustment procedure to get an optimized signal.

Starting the SpecEI Software Start the program by double clicking on the ElliCalc icon on your desktop.



First the following dialog box informs you that the instruments is initializing. This takes several seconds for resetting the motors, etc.

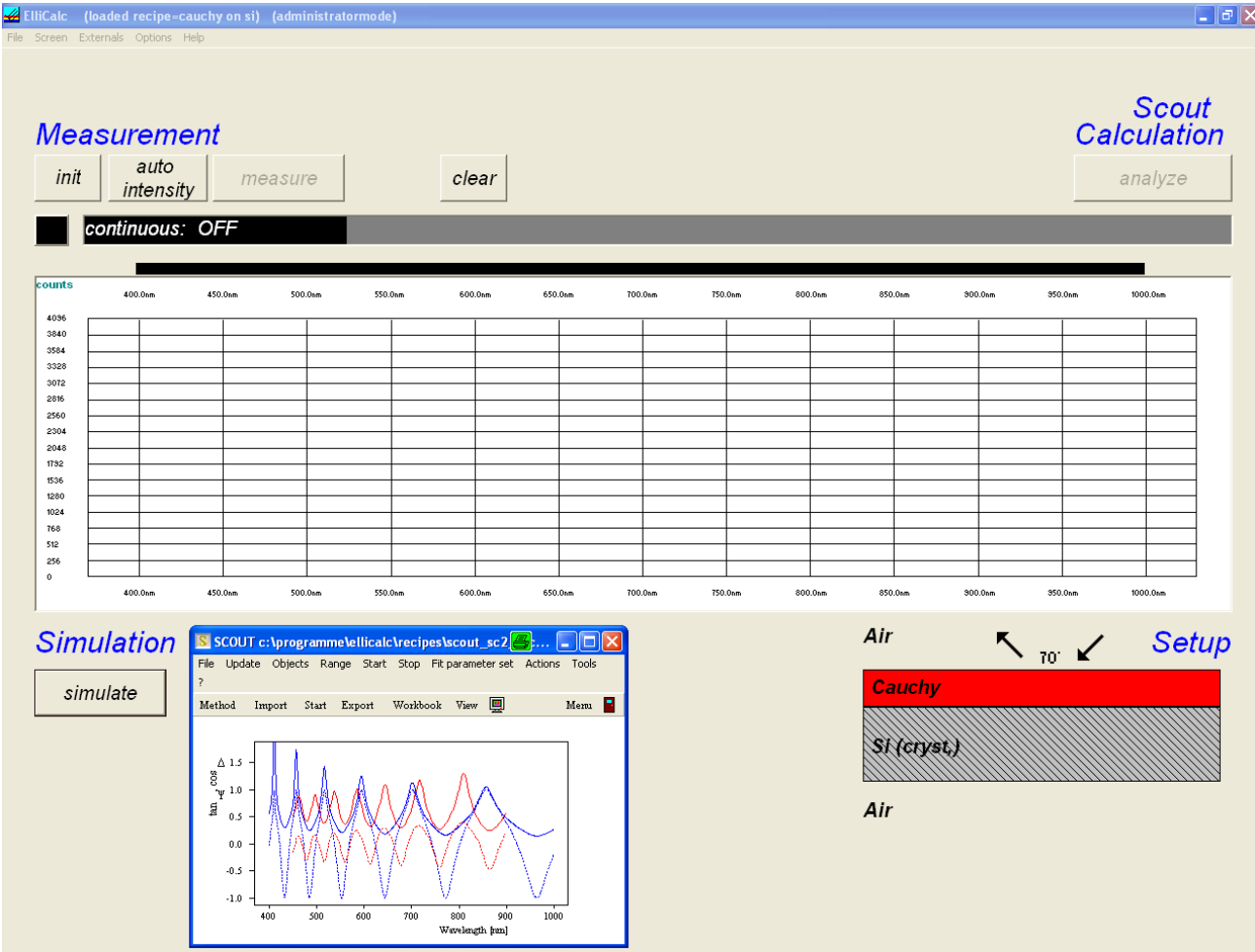


If the SpecEI software does not start after this initialization message, please check that the SpecEI system has power. If the system was without power, stop the ElliCalc.EXE Software by using the Task Manager of Windows (Ctrl + Alt + Del). In some cases it is necessary to disconnect the USB cable from the PC or the SpecEI device. Then start the software again after turning on.

Software

The Main User Interface with Scout

The working area on the screen is divided into two sections. A general screen for ellicalc measurement and in the lower left corner a screen view for scout.



The Main User Interface without Scout
(File: Load Ellicalc Layer recipe)

Measurement

init auto intensity measure clear

continuous: OFF

Calculation

analyze

Simulation

simulate

edit structure

Air

SiO2(therm) n1=1.4571

Si(100) n0=3.8714

Air

On the right side you find the button edit structure for edit the layer structure

Click with the left mouse button, the edit layer structure button opens.

edit layer structure

File Setup Layers Help

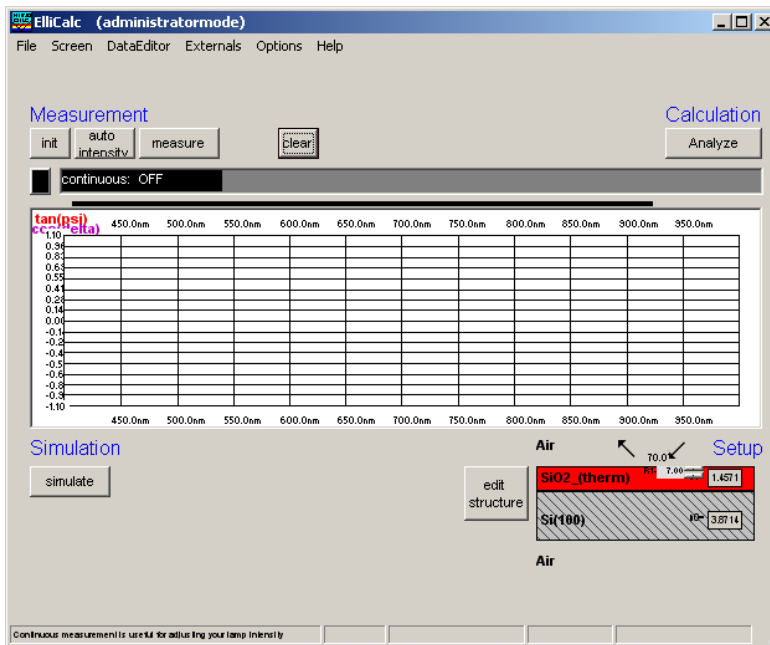
Layer	catalogue	material	d	R	n	k	f	estimated lower limit	estimated value	estimated upper limit	limits mode
L3	semiconductors	Si_poly_50	0.0					0.0	3.0	93.0	narrow
L2	oxides	Al2O3	0.0					0.0	40.0	130.0	narrow
L1	oxides	SiO2(therm)	0.0					0.0	500.0	1100.0	wide
L0	semiconductors	Si(100)									

number of layers: 3

OK cancel

Basic features of ElliCalc

Init



This button performs 2 tasks:

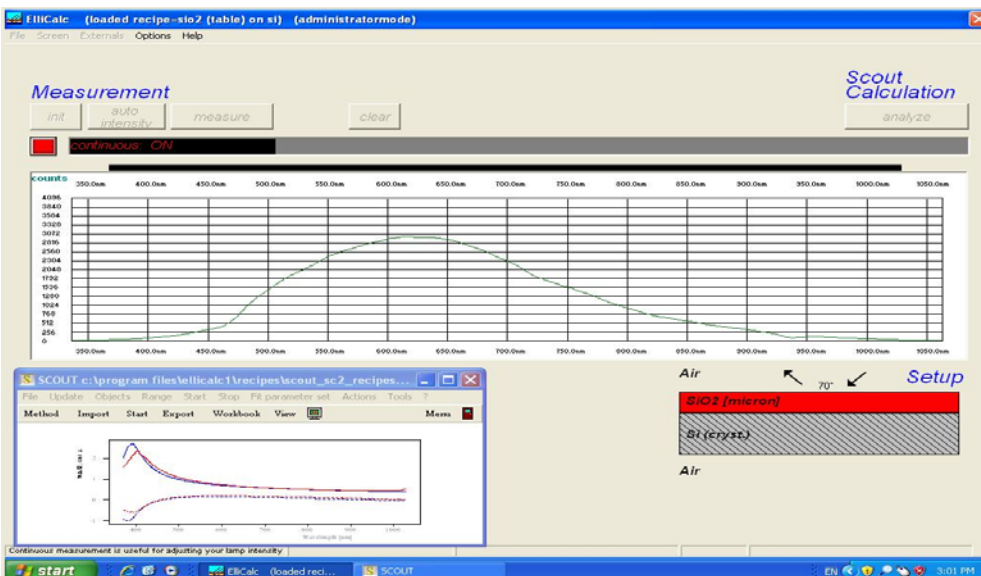
- initialize the motors for polarizer and analyzer (e.g. end positions)
- automatically set the integration times to good values (so there is no need to press “auto intensity” directly after an init procedure).

Hint:

If you change your sample you may run into saturation of the spectrometer = a (nearly) horizontal part in some of the measured curves near to the upper limit of the plot.

Continuous on and adjust sample stage height

Put the reference stepwafer (uncoated position) on the chuck and press the continuous on button to get the maximum intensity by adjusting the sample stage height.



Auto intensity

This option automatically adjusts integration times.

This button has to be pressed if you use a completely different sample (each sample has a different reflectivity, so a different integration time). Normally the "init button" already has performed such an auto intensity procedure.

If your sample is of the same type as your last sample (=has nearly the same reflectivity) it is not necessary to press this button.

AutoIntensity tries to get 75% of the maximum allowed value.

Simulate

This routine simulates a spectrum.

- in SCOUT-mode: from the .sc2-layer recipe data within SCOUT
- in ElliCalc internal mode: from the data in EditStructure (identical to the data in Thinfilm.ini-file)

Hint:

If you want to have a short check which structure is simulated at the moment, put the mouse cursor over the appropriate layer for some seconds and you see the layer thickness.

OR:

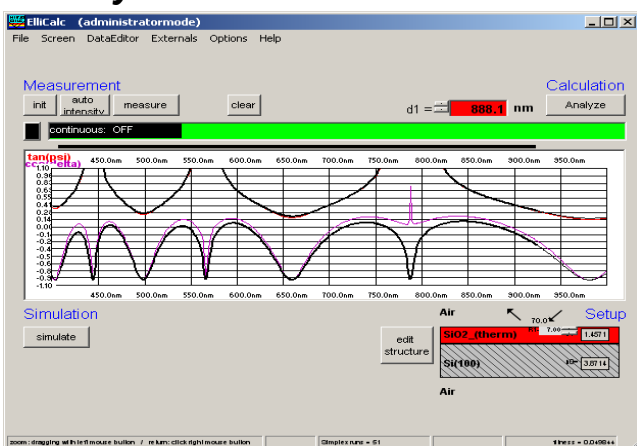
Leave your mouse cursor for some seconds over the button SIMULATE and look at the text in the status bar.

Measure

This routine measures the ellipsometric spectra of your test device.

If you use a double spectrometer, you had to adjust the crossover wavelength. Below this wavelength the data are collected from channel A ("master spectrometer"), above this wavelength they are collected from channel B ("slave spectrometer").

Analyze



This routine analyzes a spectrum (either simulated or measured) within the data extraction limits.

- In SCOUT-mode: SCOUT is doing the calculations. The structure that is simulated may only be changed within SCOUT.
- In ElliCalc's internal mode: ElliCalc is doing the calculations (only thickness at the moment)

Hint:

To have a short check which structure is simulated at the moment, put the mouse cursor over the appropriate layer for some seconds and you see the layer thickness.

OR:

Leave your mouse cursor for some seconds over the button SIMULATE and look at the text in the status bar.

Continuous mode

The continuous button switches between continuous mode (=red button) and “stop continuous” (button =black). Then there will be a continuous measurement of the signal (necessary to adjust the height and tilt of your stage !!)

All others buttons of ElliCalc are disabled until you finish the continuous mode.

Fitness

Any extraction of parameters is accompanied by a value of "fitness". This is the sum of the mean square deviations between measured and simulated curve (normalized to the range of extraction). The fitness is a rough guide whether your thickness value is "good" or not.

In the file “Thinfilm.ini” you will find 3 entries in section [fit]:

Failure_RedLevel=1

Failure_YellowLevel=0.1

RYG_LevelsAreDisplayed=False

If you change the variable RYG_LevelsAreDisplayed from “False” to “True” (in main menu “Fitparameters”), the usual rainbow pattern on the screen will disappear and a simple color will show up.

- If the fitness is below Failure_YellowLevel=0.1 you will see a GREEN color.
- If the fitness is between Failure_YellowLevel=0.1 and Failure_RedLevel=1 you will see a YELLOW color.
- If the fitness is above Failure_RedLevel=0.1 you will see a RED color

Attention:

If you measure very thick layers (with a good correlation between maxima positions, but bad correlation between signal heights) you may end up with high values of fitness, but nevertheless the thickness results may be o.k.

For detailed measurement information, see in the ElliCalc manual!

Lamp Replacement

Replacement of UV-VIS module **SPECEL-2000-BM-UV**

General information:

Lifetime is approx. 1000h

The warm-up time is within seconds for measurement $\geq 50\text{nm}$ (500\AA). For high performance and $\leq 50\text{nm}$ (500\AA) wait approx. 10 min for lamp stabilization)

To save lifetime you can switch on and off the light source by using Light source switch for every Measurement campaign.

Replacement

Please refer to SPECEL-2000-UV-VIS-NIR Replacement light source module document for detailed instructions.

Order Information:

SPECEL-2000-BM-UV lightsource module for replacement

Replacement of the bulb at the supplier or factory side: Service - Repair

Trouble Shooting

No Correct Measurement

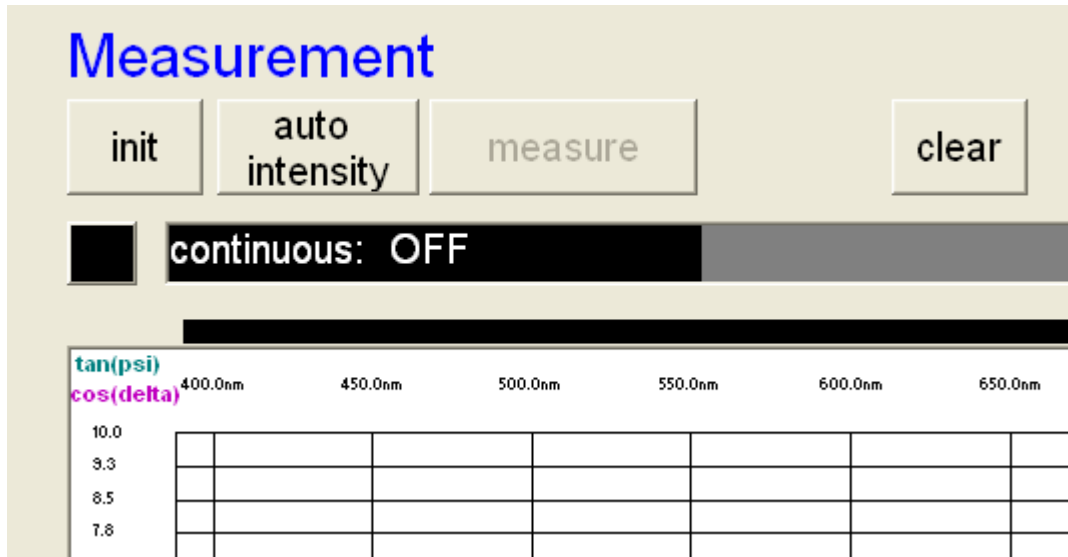
Go to configuration and run the Automatic mode for adapt Integration time and do measuring again.

- Check recipe
- Check the correct sample stage height , see chapter 0 Continuous on and adjust sample stage height and try it again

Light source may be weak, replace light source , see chapter 0

- Lamp Replacement
- If there has been a mains power interruption, restart you PC, switch off and on the SpecEI-2000-(UV-)VIS-NIR system

Calibration (Init)



The screenshot shows the 'Measurement' software interface. At the top, there are four buttons: 'init', 'auto intensity', 'measure', and 'clear'. Below these buttons is a status bar that reads 'continuous: OFF'. Underneath the status bar is a progress bar. At the bottom of the interface is a data table with two rows of headers: 'tan(psi)' and 'cos(delta)'. The columns are labeled with wavelengths: 400.0nm, 450.0nm, 500.0nm, 550.0nm, 600.0nm, and 650.0nm. The table has four rows of data, with the first row containing the values 10.0, 9.3, 8.5, and 7.8.

	400.0nm	450.0nm	500.0nm	550.0nm	600.0nm	650.0nm
tan(psi)	10.0					
cos(delta)	9.3					
	8.5					
	7.8					
	--					

The calibration needs some time, please wait till the progress bar is ready .

Contact

Ocean Optics Germany GmbH
ThinFilm Metrology
Maybachstrasse 11
73760 Ostfildern
Germany

Phone: +49 (0)711 34 16 96 0
Fax: +49 (0)711 34 16 96 85
E-Mail: thinfilm@oceanoptics.eu

Warranty

Ocean Optics Germany GmbH warrants to the Original User of this instrument that it shall be free of any defects resulting from faulty manufacture of this instrument for a period of 12 months from the original date of shipment. There are no warranties for the Halogen Bulb(-Module).

This **instrument should not be used for any Clinical or Diagnostic Purposes.** Data generated is not warranted in any way by Ocean Optics Germany GmbH. Any defects covered by this Warranty shall be corrected either by repair or by replacement, as determined by Ocean Optics Germany GmbH.

There are no warranties which extend beyond the description herein.

This Warranty is in lieu of, and excludes any and all other warranties or representation, expressed, implied, or statutory, including merchantability and fitness, as well as any and all other obligations or liabilities of Ocean Optics Germany GmbH, including, but not limited to special or consequential damages. No person, firm, or corporation is authorized to assume for Ocean Optics Germany GmbH. Any additional obligation or liability not expressed provided for herein except in writing duly executed by an officer of Ocean Optics Germany GmbH.

Warranty Handling

Clear with your local distributor the problem or fault.

In case of warranty your local distributor will give you a RMA number.

Send your instrument free of charge and insured to your local distributor.

Please take care of secure and proper packaging. Use a wooden box on a wooden pallet!

Your distributor will inform you on delivery time. If there is repair out of warranty you will be informed about repair cost. The system will be on hold till you have officially ordered the repair.

The system will be send back to you free of transport cost and insured (in case of warranty)