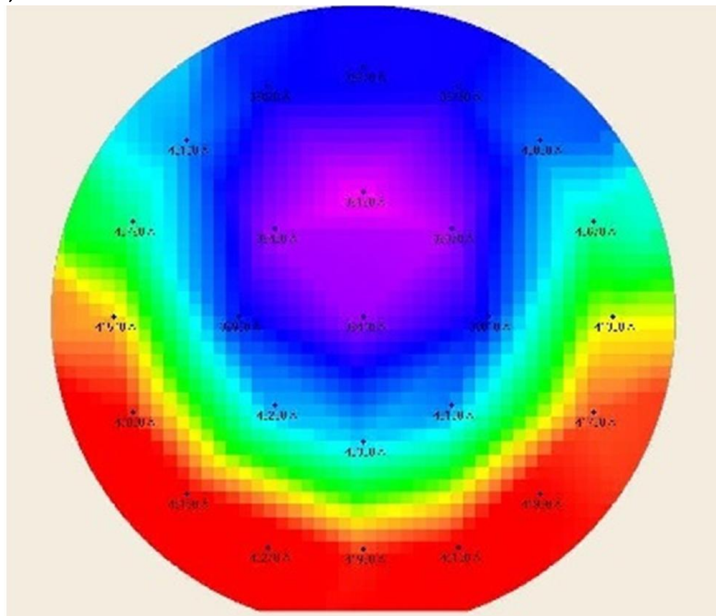
Minnesota Nano Center
Standard Operating Procedure

Equipment Name: Filmetrics

Badger Name:	Filmetrics	**Revision Number:**	2
Model:	F50-EXR	**Revisionist:**	Tony Whipple
Location:	Bay 1	**Date:**	9/03/13

1 Description

The Filmetrics is a thin film measuring system that can measure normal semiconductor films. Transparent films are easiest to measure but it can also be used on thin opaque layers. You should know the expected film thickness within 1000 Ang for the best accuracy. The light source reflection is measured by fiber optic cable. The wavelength range is from 380nm to 1700nm. Most recipes are for Si substrates, other substrates can be used, such as GaSa, InP, Glass, and more.



The system can measure and graph thickness with color, it can also subtract layers between process steps, as measuring etch rates. The n and k values can be found for certain films.

2 Safety

a Keep your hands clear of the wafer stage as it moves very fast. Do NOT move or adjust anything on the system. If this is done, the damage to the machine could be irreversible. Do not move or adjust the fiber optical cable above the wafer stage.

3 Restrictions/Requirements

a Completed the Short Course

4 Required Facilities

a Vacuum – but this is not necessary.

5 Definition

Wafer stage - Where the wafer sits while being measured.
GOF – goodness of fit quality of data, higher is better.

6 Setup

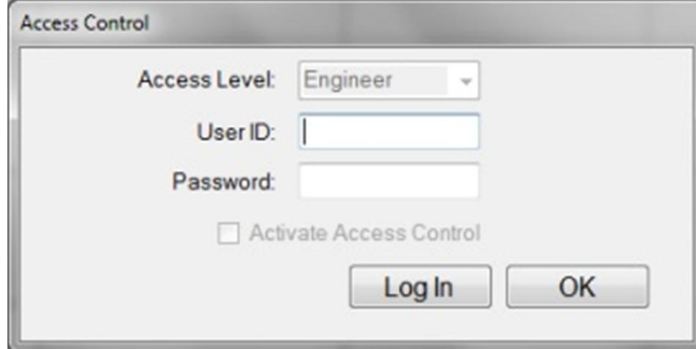
a Start the software if it is not already running, click the Filmapper Icon.

b The lamp power switch to the unit then should be switched on, located on

front of the main unit, switch will turn green.

c Warm up time is needed for light, about 5 min, 15 min for more precision.

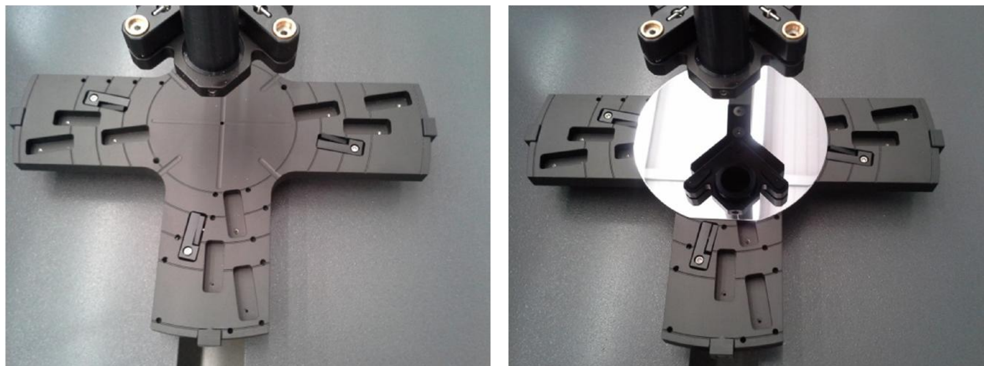
d You will need to log in by typing ***measure*** for the User ID and password.



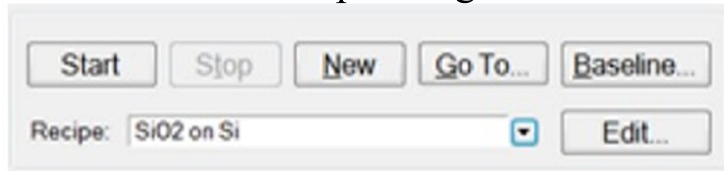
Log in screen use the word measure for both lines then **Login In** button

7 Operating Instructions

a Once the program is started click the top tab labeled **Wafer Map**.



A bare Si wafer is needed to be placed on the center stage. Never move or rotate the wafer stage!



Recipe selection can be done by the arrow pointing down

b Click the box on the bottom labeled ***Baseline***. You will need to click two more buttons. First one says' Take Sample Reflectance' click it, the second item says ' Take reflectance standard'. In ~ 10 seconds the box will be gone and you can now remove bare Si sample and load your wafer to measure.

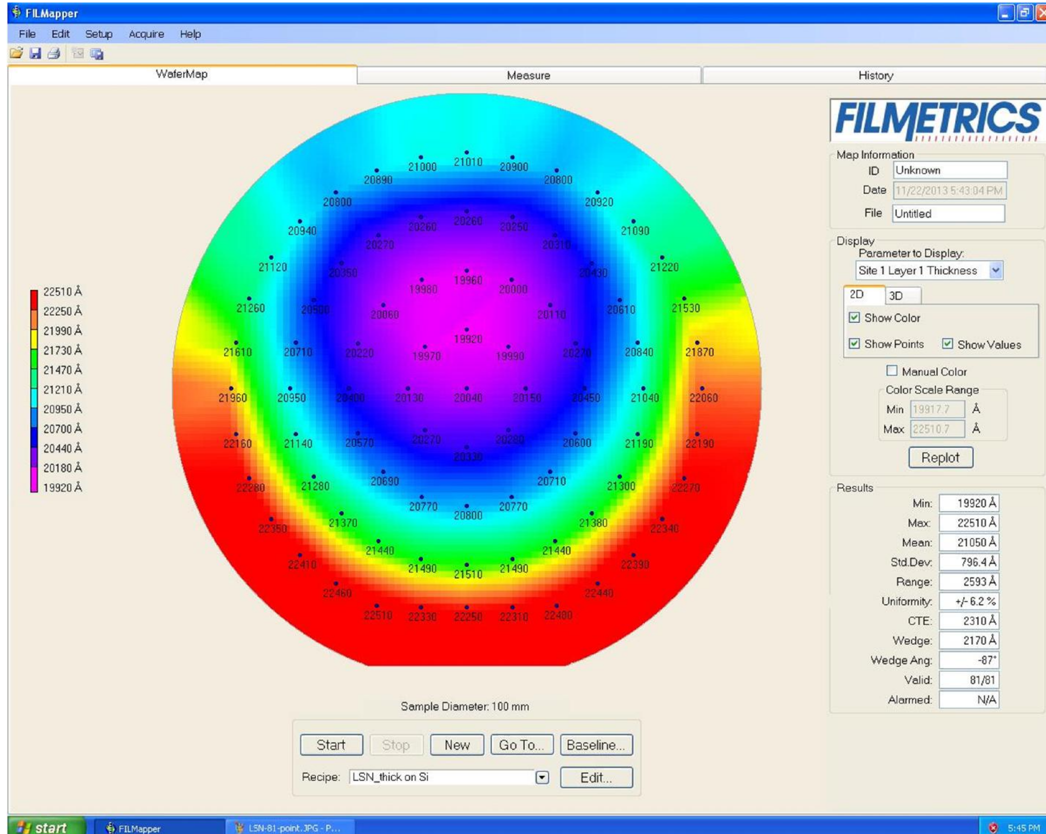
c The stage will move fast – keep hands away while it measures the wafer.

d Once the system is baselined you can then select the correct recipe to measure the film of interest.

e Load the wafer to be measured. (small samples can be placed in the center stage area select a single measuring point recipe)

f Then click the **Start button**.

g Your measurement values will appear on the screen. Click **REPLOT** button if the display does not update.



WaferMap tab displaying thickness values with statistics lower right.

h After the measurement is done click on the **Measure** tab and check the graph and the lower right box for measurement results Goodness of fit

Measurement Results
SiO2 = 6298 A
n(632.8 nm)=1.7860
Goodness of fit = 0.9927 The closer this value is to 1.0 the better the measurement was compared to expected film characteristics.

i Record the data, this can be copied on to USB drive, but not internet.

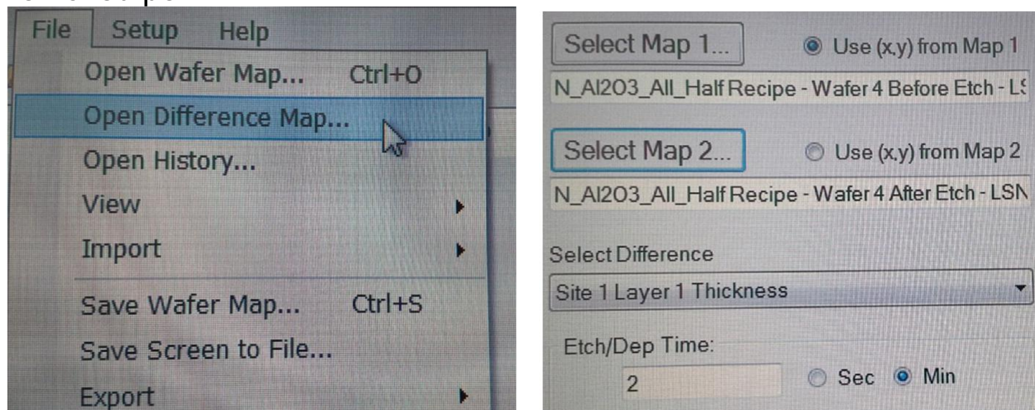
j When done switch off the lamp power if it is night time or weekend, leave it on during week days.

k More information and data can be found from the history tab.

l Other substrates can be used – you must first do a baseline for that substrate. Contact staff if you have questions and need recipe review.

m The screen image can be saved by selecting the option under 'File' and click on the ' Save Wafer Map ' option the file can be saved in .png, . jpg, or .bmp format. Save Wafer Map.

o The system software allows the difference between two maps to be compared. Example : film thickness measured before it was etched and then measured after etching. The difference between the two maps can then be solved, resulting in map of the etching, and you can even enter the etch time so that you can get a rate. Such as how much film was removed per min.



Difference map screen images

To makethe difference map function to work only 4 steps are needed:

1) pre-measure and save wafer map
2) do the etching or deposition
3) post-measure and save map
4) open difference map function and select maps then click the [**Display Difference Map**] button at bottom. Save image if needed.

8 Problems/Troubleshooting

a If there seems to be a problem with the software not seeing the system, you can exit the Filmetrics software and try restarting it. If this does not solve the problem, do a normal shutdown **[restart]** of the operating system. Select user account **mnc**, no password needed. Then click on the Filmetrics icon. Everything should be working after that, if not contact staff or log system down on Badger.

b If the computer has a problem with communicating with the unit, the main power switch to the Filmetrics unit should be switched off for ~ 10 seconds and then back on, located on back of the main unit.

9 Appendix

A Specifications:

Performance Specifications of the F50-EXR system listed from the manufacture:

Wavelength Range:	**380-1700 nm**
Thickness Measurement Range*	**150 Ang – 250 um**
Thickness Req'd to Measure n and k	**1000 Ang**
Accuracy*	**The greater of 0.4% or 20 Ang**
Precision (1)	**1 Ang**
Stability (2)	**0.7 Ang**
Spot Size	**Standard 1.5 mm**
Light Source	**Tungsten-Halogen**

* Material dependent.
(1) 1σ of 100 measurements of 500 nm SiO-on-Si. Average of 1σ over 20 successive days.
(2) 2σ of daily average of 100 measurements of 500 nm SiO -on-Si over 20 successive days