

Standard Operating Procedure

Electrochemical Capacitance Voltage (ECV) Dopant Profiler



Prepared by

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Check list before turning on the system

- ✓ Check whether the CDA valve is open and the pressure is around 2mbar.
- ✓ Make sure that the drain can is not full. Replace the can, otherwise.
- ✓ Assure that enough unexpired etching chemical (0.1 m Ammonium Bi fluoride) and DI water are available. Otherwise prepare fresh ABF solution as follows.

0.1 m ABF:

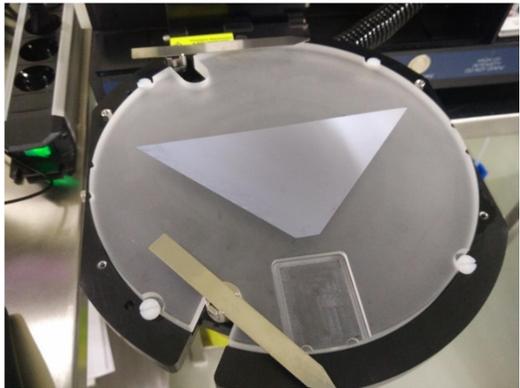
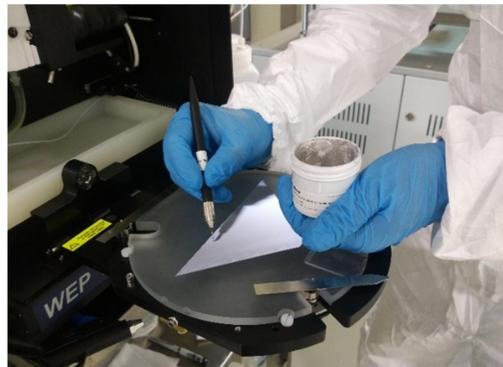
(1) Mix 2.85g ABF salt in 500ml DI water. (Use within one week once prepared.)

(2) Mix 50 ml of 1m ABF solution* in 450 ml DI water.

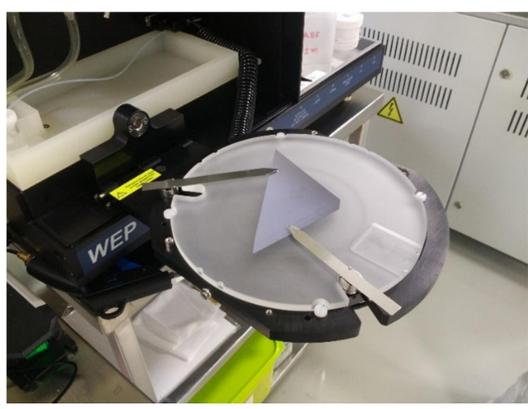
* 1m ABF solution (Mix 28.5g ABF salt in 500 ml DI water) can be stored for a month.

Switch On Process

1. Switch on the power supply and the computer.
2. Open the WEP Profiler software place at the desktop.
3. Follow the instructions as below.

1. Loosen the wafer table screw and place it in horizontal position.	
2. Place the wafer on the wafer table.	
3. Apply In-Ga-eutectic at positions of Front Contacts. Scratch the wafer with In-Ga-eutectic using a sharp steel knife for better	

4. Place the probe over the front contact positions.



5. Clean the wafer with nitrogen pistol, to remove any leftover dust.



6. After end of start-up, the screen should look like this. The Green central button shows "Load Data". In the bottom, the last measurements are shown in the equipment log list.

File name	Date	Comment	Position	Phase	Type	Layer definition	Step width	End depth	Back contact	Ring	End mode	Storage path	Equipment	Origin	Name
Baseline memo_Memo_2	2017/07/18 13:14		0	0	Baseline Silicon	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	0.5	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	Baseline memo
Baseline memo_Memo_1	2017/07/18 13:14		0	0	Baseline Silicon	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	0.5	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	Baseline memo
Baseline memo_Memo_2	2017/07/18 13:14		3.00	-3	Baseline Silicon	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	0.5	0	Large ring ring	Standard	\\SABAA\c:\test	CVI	SABAA	Baseline memo
Baseline memo_Memo_1	2017/07/18 13:14		0	0	Baseline Silicon	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	0.5	0	Large ring ring	Standard	\\SABAA\c:\test	CVI	SABAA	Baseline memo
SABAA_210717_04_1	2017/07/18 13:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.20	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	210717_04
SABAA_210717_04_2	2017/07/18 13:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.20	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	210717_04
SABAA_210717_11_1	2017/07/19 14:44		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.20	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	210717_11
SABAA_210717_11_2	2017/07/19 14:44		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.20	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	210717_11
SABAA_210717_03_1	2017/07/17 12:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.20	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	210717_03
SABAA_210717_03_2	2017/07/17 12:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.20	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	210717_03
SABAA_210717_04_1	2017/07/18 13:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.20	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	210717_04
SABAA_210717_04_2	2017/07/18 13:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.20	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	210717_04
SABAA_211116_01_1	2017/07/22 12:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.00	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	211116_01
SABAA_211116_01_2	2017/07/22 12:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.00	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	211116_01
SABAA_211116_02_1	2017/07/22 12:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.00	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	211116_02
SABAA_211116_02_2	2017/07/22 12:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.00	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	211116_02
SABAA_201616_01_1	2017/06/22 08:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.00	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	160616_01
SABAA_201616_01_2	2017/06/22 08:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.00	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	160616_01
SABAA_201616_02_1	2017/06/22 08:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.00	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	160616_02
SABAA_201616_02_2	2017/06/22 08:14		0	0	Silicon Diffusion	Silicon Diffusion n 1E20++ 5-10-20nm	0.005	1.00	0	Large ring	Standard	\\SABAA\c:\test	CVI	SABAA	160616_02

7. Click Ok Button.

Please select your name!

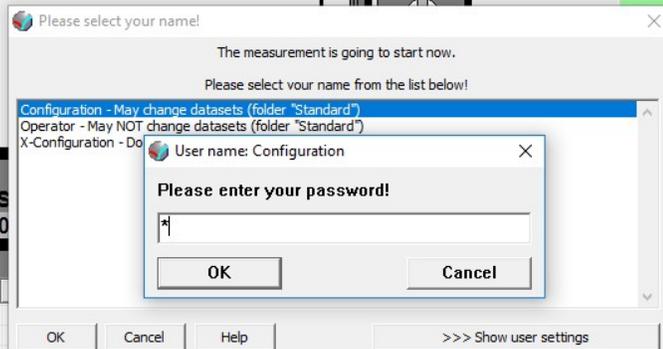
The measurement is going to start now.

Please select your name from the list below!

- Configuration - May change datasets (folder "Standard")
- Operator - May NOT change datasets (folder "Standard")
- X-Configuration - Do not use (Folder "Fix" - install state)

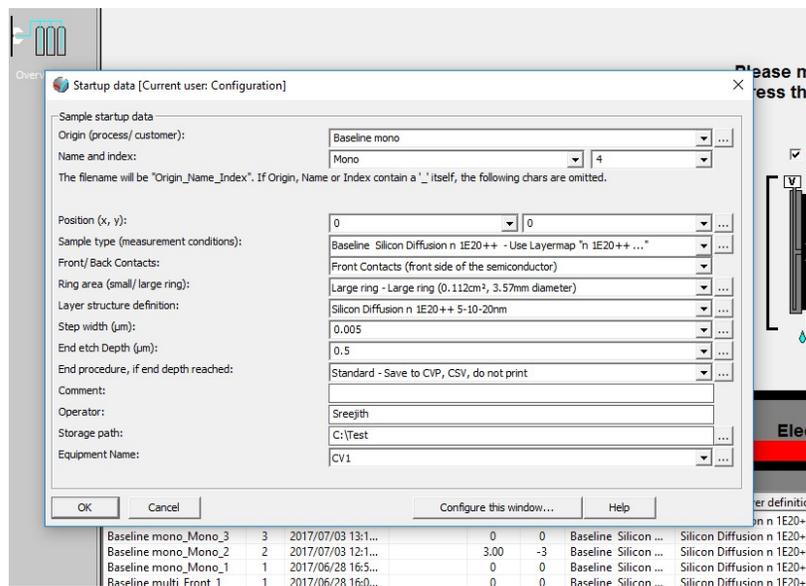
OK Cancel Help >>> Show user settings

8. Enter password and Click Ok.

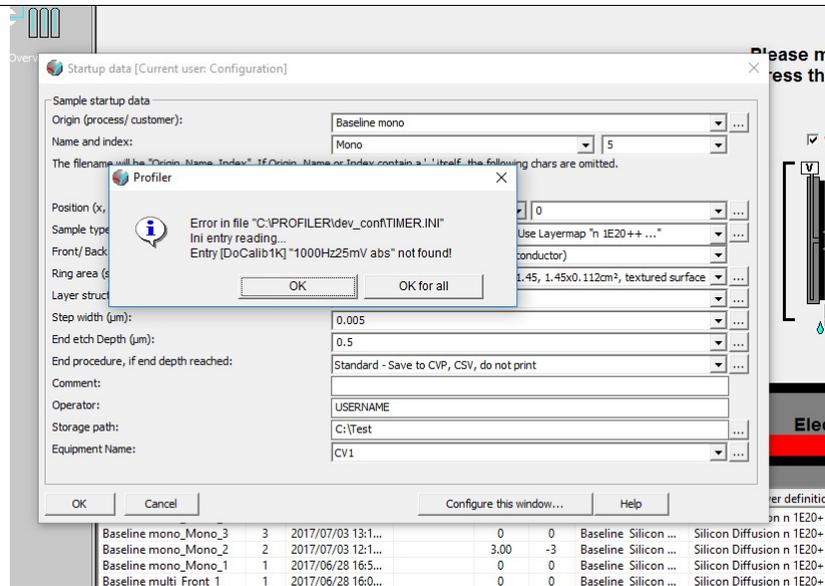


9. Enter proper details in the Startup data window.

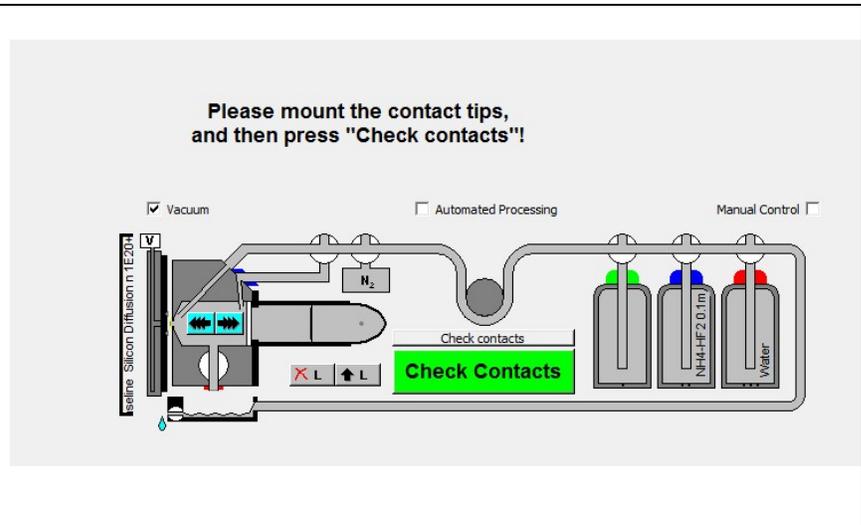
- Enter sample origin and name.
- Select the Sample type
- Select the contact type: Ring Details
- Step width: typically $0.05\mu\text{m}$ for Silicon
- Etch Depth: typically $0.5\mu\text{m}$ or $1\mu\text{m}$ for surface layer analysis (you can adapt in the etch window later)
- End procedure: Select "Standard"
- Comment: Enter any text you want
- User: Enter your short name
- Storage path: Only if you want (Data is stored automatically to the path C:\Pr_Data and C:\Pr_Last – this is only additional possibility) Then press OK.



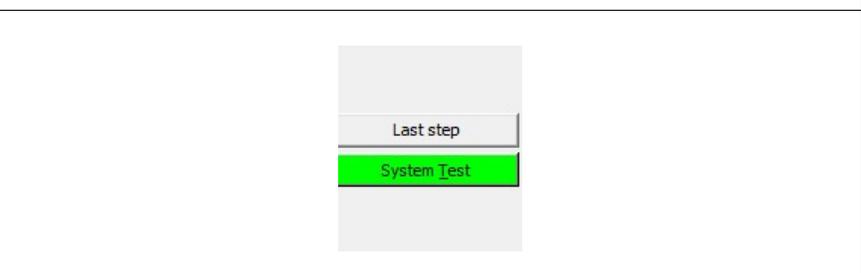
10. Click ok for all.



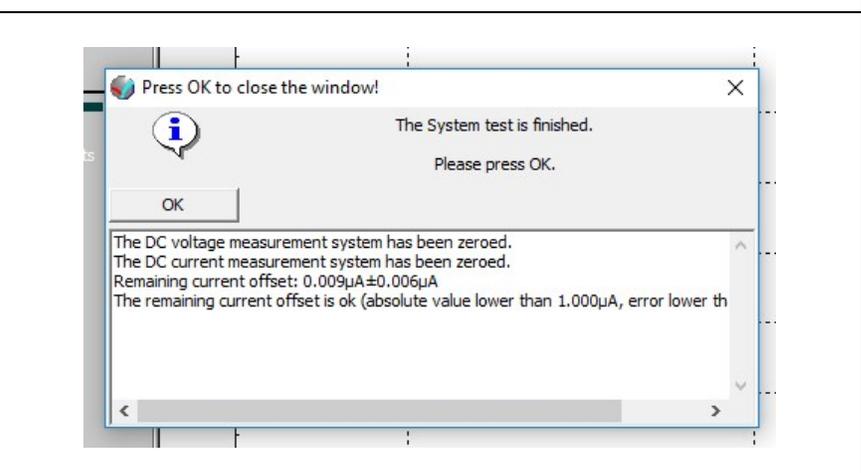
11. Click on Check Contacts.



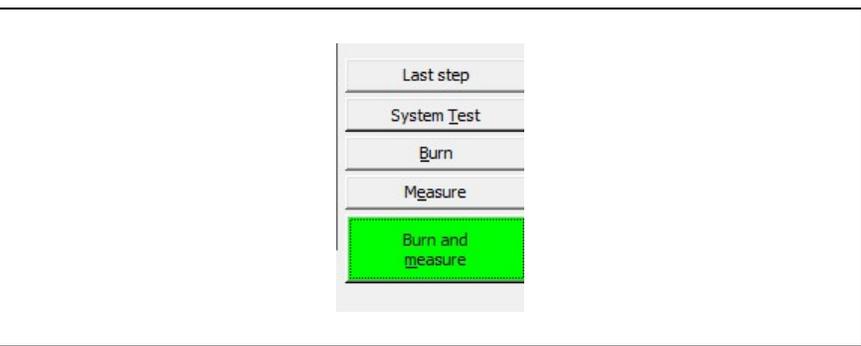
12. Click on System Test.



13. Click on Ok.



14. Click on Burn and measure.



15. Make sure that the curve is linear and the resistance value is in the green limit. Press **Continue** then.

Otherwise, scratch the wafer more with In-Ga-eutectic using the sharp steel knife and click on Burn and measure.



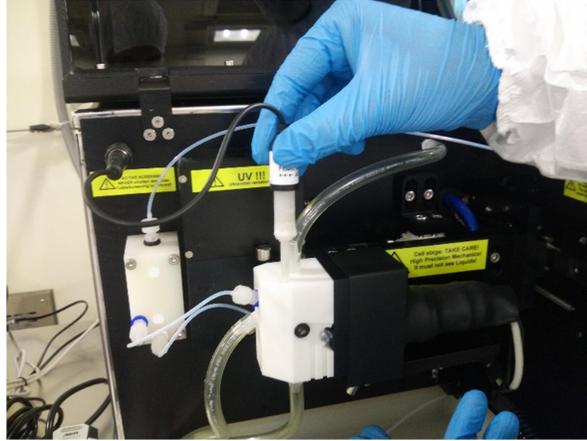
16. Rinse the sealing ring with DI water and dry it using nitrogen pistol.

The front ring lid has dimensions in the micron range and is very sensitive and important for measurements with precise area control.

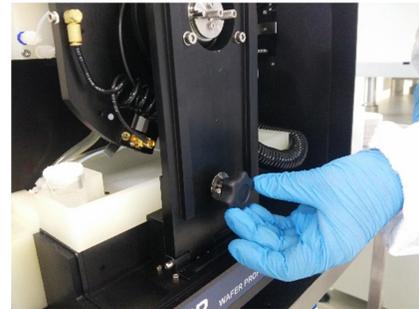
NEVER TOUCH IT!



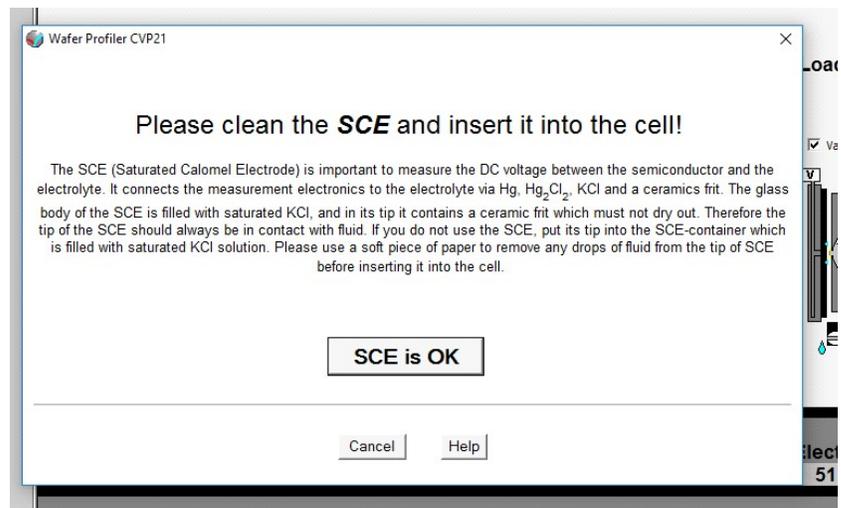
17. Insert the Reference Electrode (SCE) into the cell.



18. Place wafer table vertical. Screw wafer table to fix the vertical position.



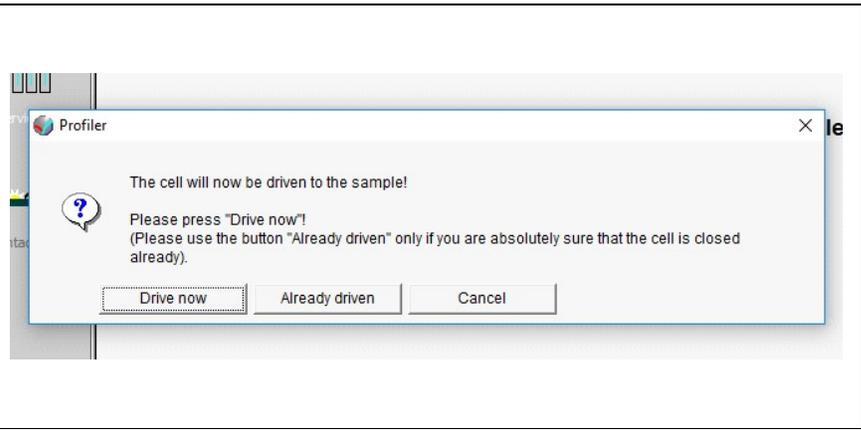
19. Confirmation window will appear: Press "SCE is ok"



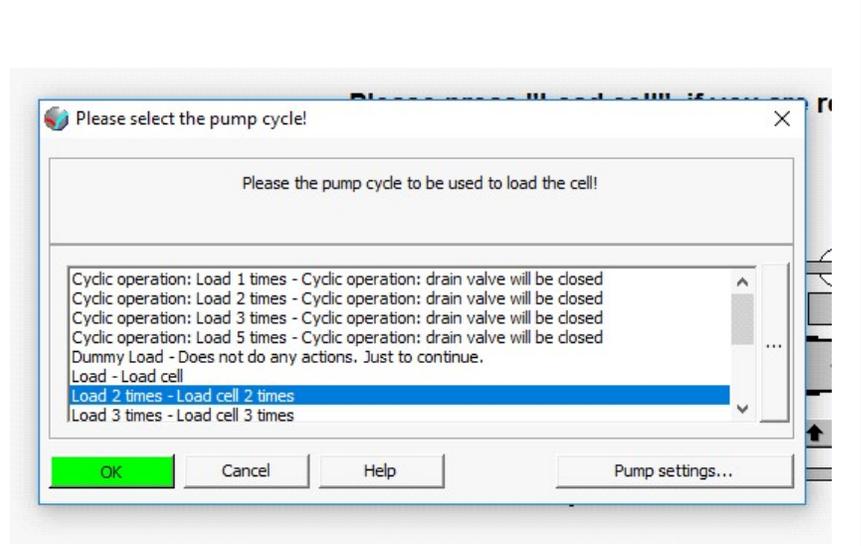
20. Confirmation window will appear.
Check cleaning bottle: Refill if required.
Check electrolyte bottle: If enough electrolyte, press "Enough electrolyte and cleaning"
else refill electrolyte and press "Electrolyte refreshed"



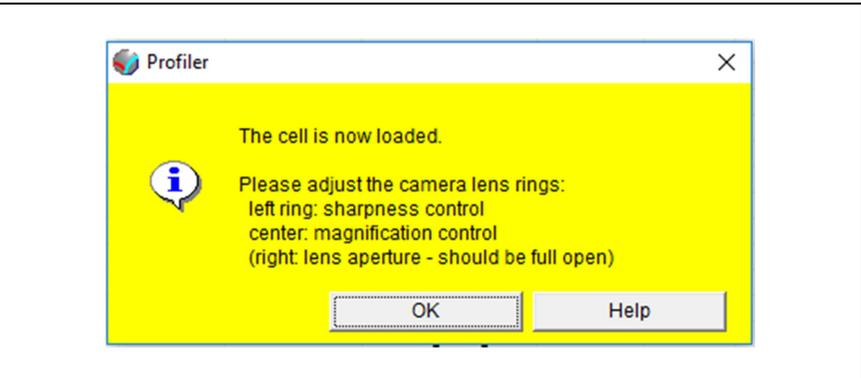
21. Click Drive now.



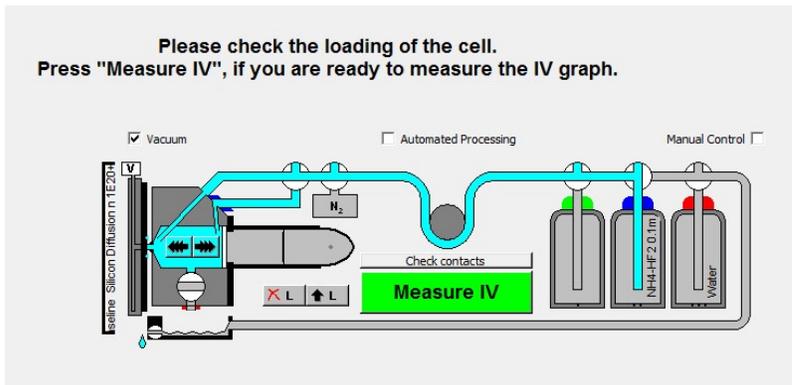
22. Select Load 2 times – Load cell 2 times.
Click Ok.



23. Click Ok.



24. Click on Measure IV.

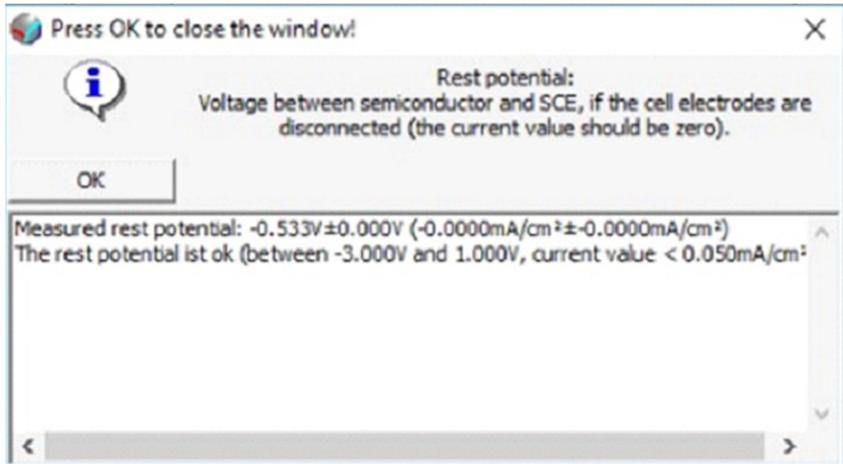


25. Click on Rest Potential.

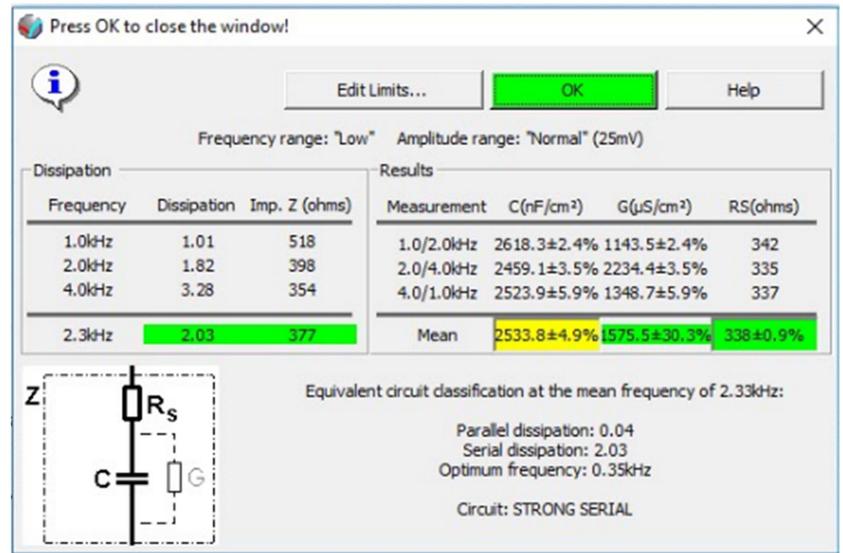


26. Click Ok and then press **Continue** at the bottom right corner of the window.

Click on the **Analysis** icon in the next window.

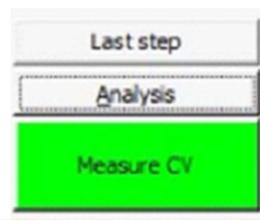


27. Click Ok.

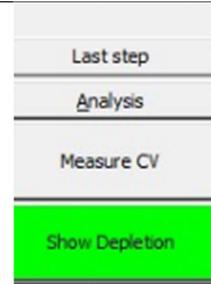


28. Click on Measure CV.

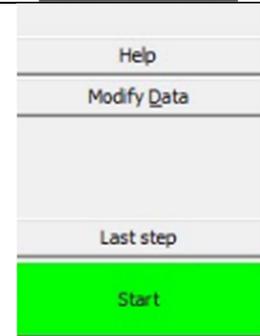
Make sure that the CV curve covers the entire Voltage range. Otherwise, Change the voltage settings by clicking the **Modify data** icon.



29. Click on Show Depletion and then **Continue** on the next window.

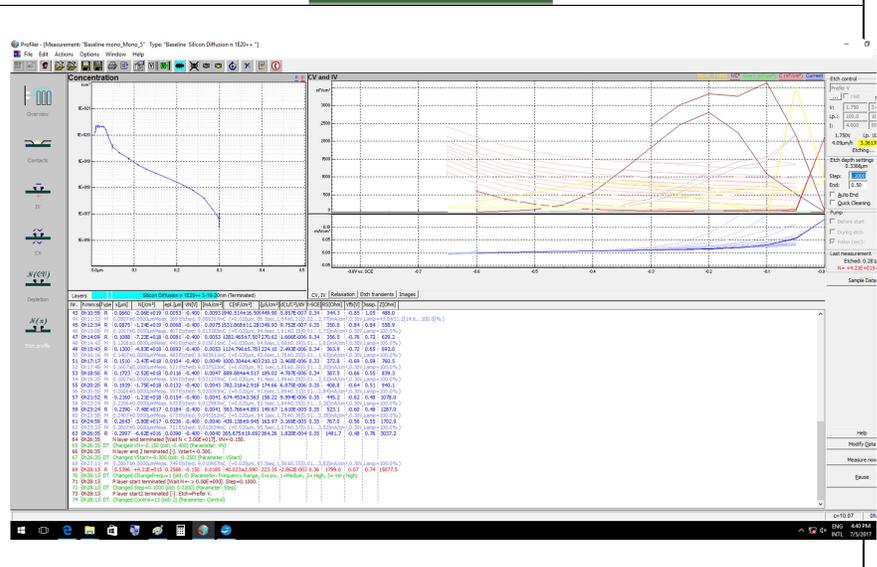


30. Click on Start.



31. Wait until the measurements are done.

Process can be terminated by clicking on the Pause button, if required.



32. Click Continue.

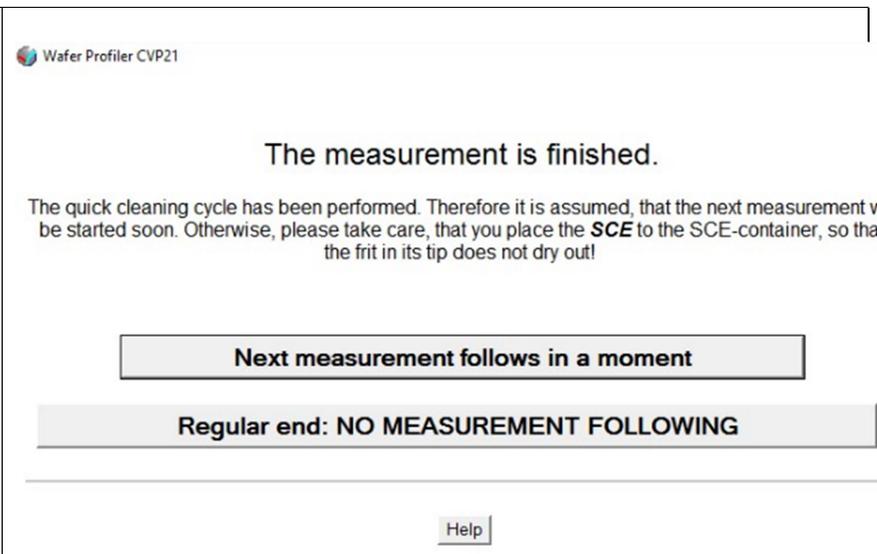
Wafer Profiler CVP21

Please clean the **Sealing ring** after the end of the measurement!

After the end of the measurement, you *cautiously* should rinse the sealing ring with water. Then please dry it *cautiously*, using clean dry air or nitrogen.

The Sealing ring is a very sensitive part of this equipment. It ends to a very fine lid, whose dimensions are in the range 0.1mm (You need a microscope to inspect this lid). If this lid contains scratches, the interfacial area between the semiconductor and the electrolyte is no more well defined. The measurement accuracy will be affected, and in the worst case, electrolyte might leak out of the cell. Therefore it is very important, that the ring and the sample are perfectly clean and that the sample surface is perfectly flat. Please use a dry air or nitrogen, to remove carefully any dust particles!

Ring cleaned

33.	<p>Click on “Next measurement follows in a moment” if there are any more measurements to be done.</p> <p>Otherwise, click on Regular End: No MEASUREMENT FOLLOWING</p>	
34.	<p>The measured data can be saved in cvp (ECV system file) or csv format.</p>	

Procedure for sheet resistance correction.

1. Open the calibration measurement (eg. from the overview window, double click on the measurement.).
2. Use menu “File” / “Recalculate”. Click the check box “Modify parameters” in “Area and geometry data”. In the list box , select “Etch Area Measured Externally” , in “ Real Area (cm2)” . Enter the proper value. Press button “Insert at top of list” (overwrite all). Press button “Recalculate the profile”.
3. In the Nx graph, open mouse rectangle around all measurement points. Inside the rectangle, right mouse click from the pop up menu “Calculate Statistics”. Check the calculated sheet resistance value. Repeat the above procedure, till the sheet resistance matches with the 4 pp measurement.