

Electrical Test Probe Station

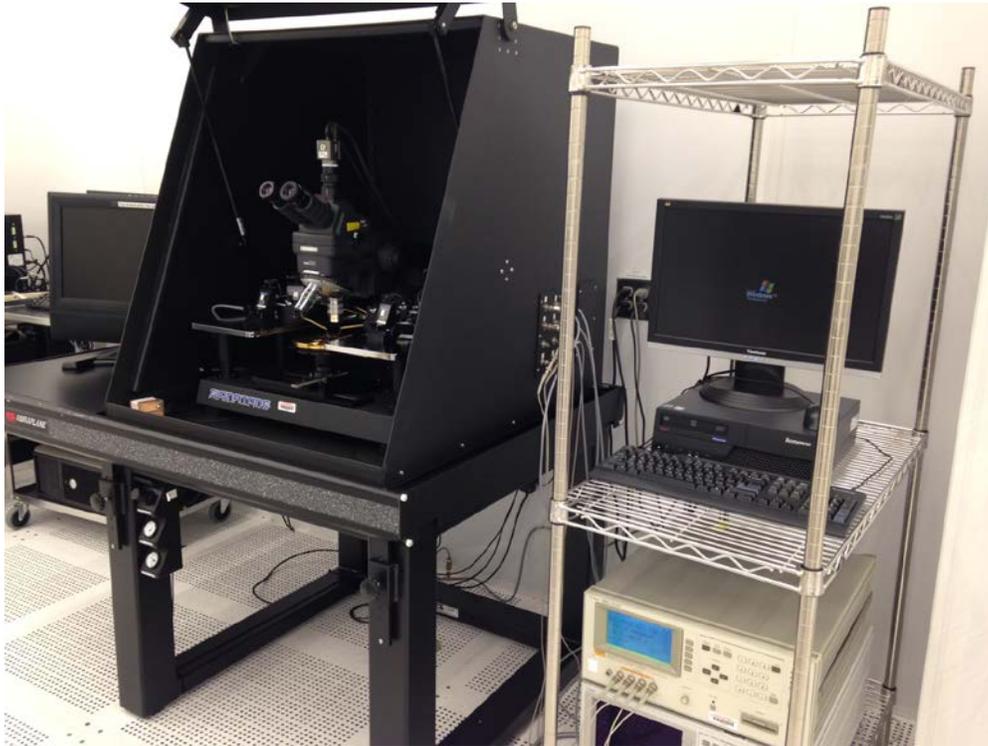


Figure 1: The electrical test station

Introduction

The electrical test probe station is for semiconductor device characterization and analysis at ambient environment. The Agilent 4155C semiconductor parameter analyzer (SPA) has standard test routines for p-n junctions, CMOS, MOSFET, diodes etc. The Agilent 4285A LCR meter is for CV measurements of dielectric materials and capacitors.

Features and Specifications

1. 6" gold plated sample stage with vacuum chuck.
2. Six high-resolution micro-positioners with vacuum base.
3. Triaxial and BNC connectors.
4. Dark box on vibration isolation table.
5. Color video system.
6. EasyEXPERT software and measurement library.
7. The LCR meter measures with frequency from 75 kHz to 30 MHz.
8. The semiconductor parameter analyzer measures current from 1 pA to 100 mA, and applies voltage up to 80 V.

Safety

High DC voltage up to 80 V can be applied. Don't touch the probes, cables and the micro-positioners during measurement.

Precautions

1. Don't scratch the gold plated sample stage.
2. Don't disconnect or reconnect the cables attached to the SPA, LCR meter, dark box, and the micro-positioners.

Operation Procedure

1. Log in on FOM. Switch on the light source (behind the monitor, Figure 2), the monitor, the SPA, and the LCR meter.



Figure 2: Microscope light source

2. Open the dark box and move the sample stage out with the knob in Figure 3.

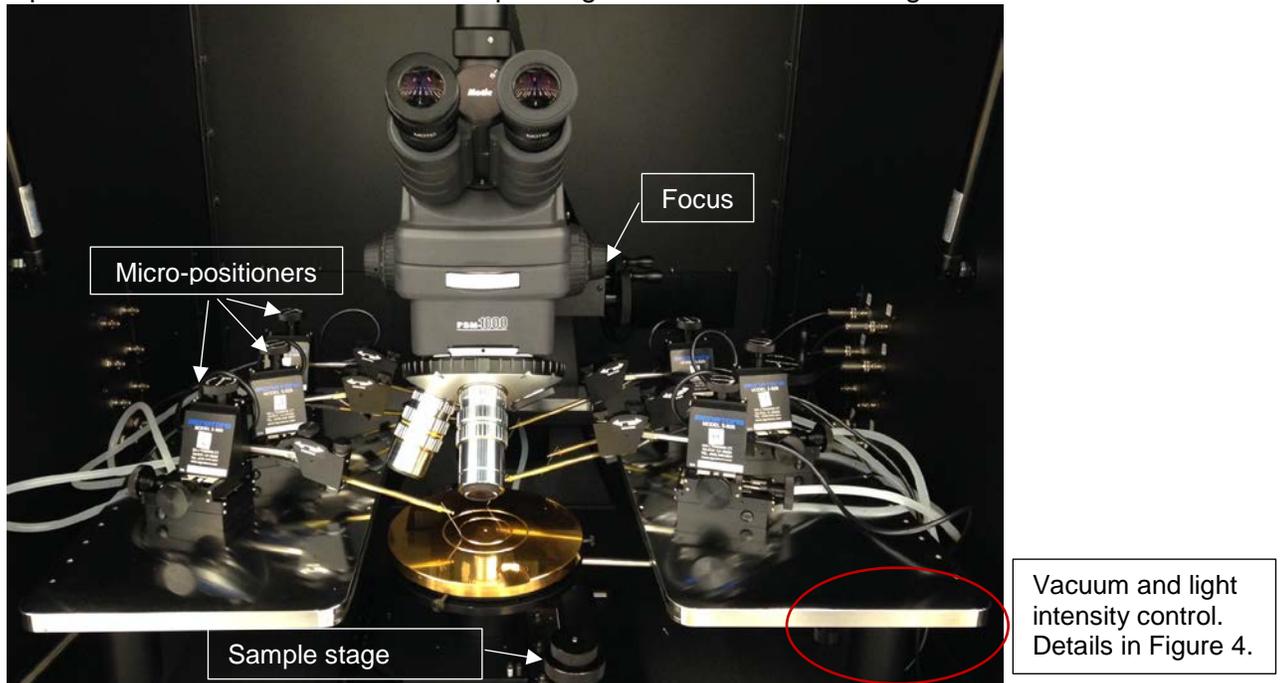


Figure 3: Inside the dark box.

3. Cover the middle hole with your sample and switch on the vacuum on the side of the base (see Figure 4)
4. Choose the micro-positioners to use and move them to the front. The SPA is connected to positioners 1 - 4. The LCR meter is connected to positioners L and H.

5. Switch on the vacuum to hold the positioners (Figure 4).
6. Move your sample under the microscope. Adjust focus, magnification and light intensity. The light intensity can be adjusted on the 'Motic' knob in Figure 4.

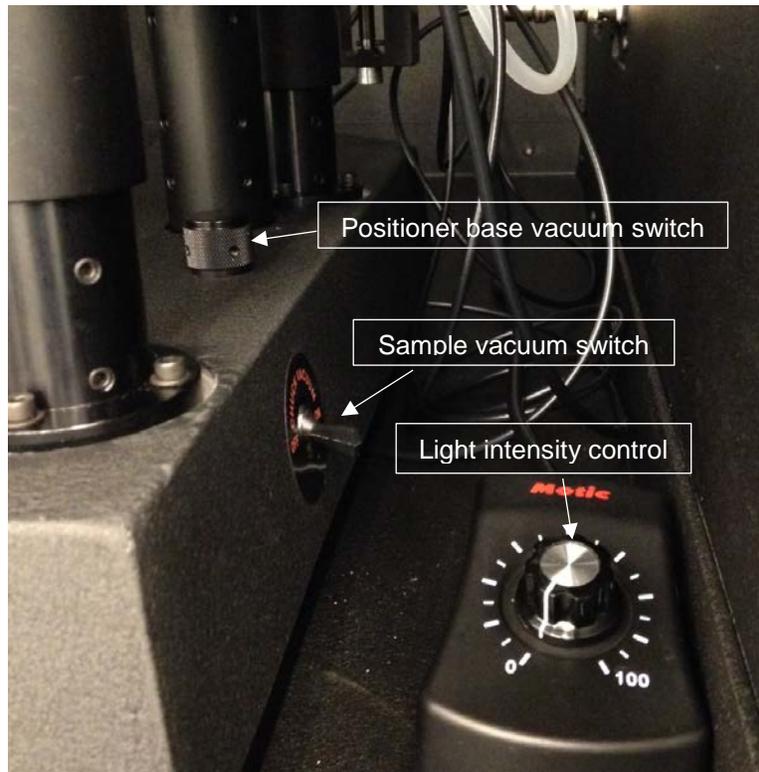


Figure 4: Vacuum and light intensity control

7. Locate the probes on your electrical pads using the knobs in Figure 5. The positioner can be lift up by pressing the button in Figure 5 for a fast movement.

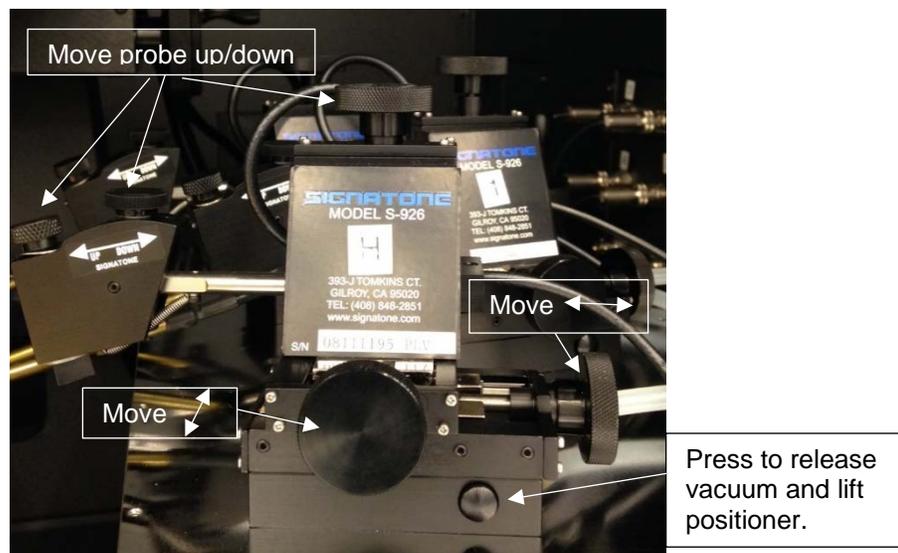


Figure 5: Position control of the probes

- Start EasyEXPERT on the computer desktop. Click 'Start EasyEXPERT' (Figure 6).



Figure 6: Start the measurement software

- Choose a measurement routine from the library on the left or one of the favorite setups on the right.

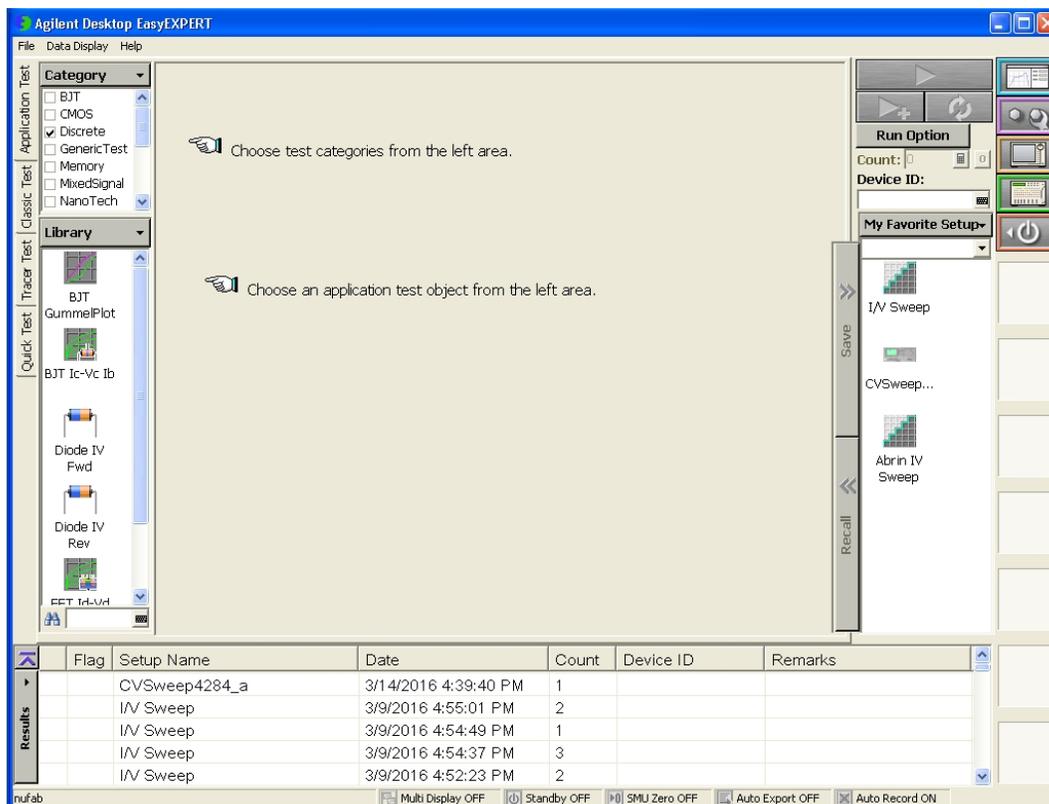


Figure 7: Choose a measurement setup

- Here, we take the I/V Sweep as an example to explain the measurement settings. In the Channel Setup page (Figure 8):
 - Unit: SMU is source-measure unit, VS is voltage source, VM is voltmeter, and label 1 - 4 denotes the positioners in use.
 - 'V name' and 'I name' are arbitrary names provided by users.
 - Mode: common means ground, V means operating in voltage mode, and I is current mode.
 - Function: one variable (VAR) is needed for a measurement. The common, i.e. the grounded probe, should be a constant (CONST).

The settings here can be explained: This is a two-probe measurement. Probe 1 and 3 are contacted to the device. The probe 3 is grounded. A voltage is applied on probe 1, creating a current in the channel. SMU 1 is used to apply the voltage and measure the current. The applied voltage is variable.

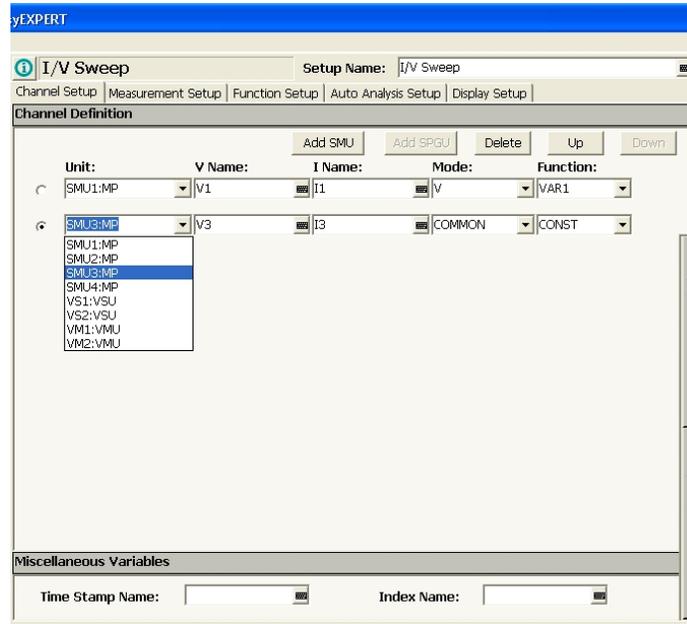
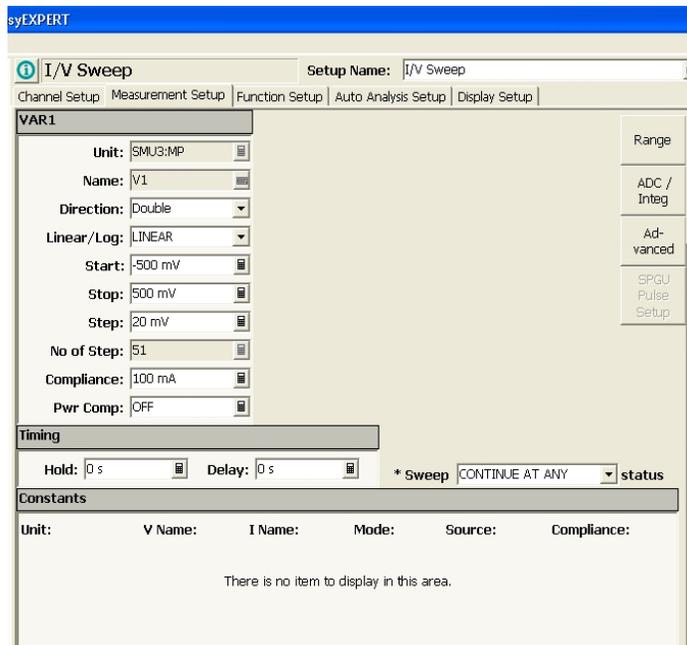


Figure 8: Channel setup of I/V Sweep



11. Input the parameters for the variable in the measurement setup page (Figure 9).

Figure 9: Measurement setup

The setup in Figure 9 can be explained: The voltage sweep range is from -500 mV (start) to 500 mV (stop). The sweep step size of 20 mV. There are 51 steps from -500 mV and 500 mV. After sweeping up from -500 mV to 500 mV, it will also sweep down from 500 mV to -500 mV (double direction). During the measurement, the current will be monitored. Once the current reach 100 mA, the measurement stop automatically to protect the device (compliance setting).

12. Set up the X and Y axis for the graph, see Figure 10.
13. Click the green rectangle in the top right corner to start the measurement.

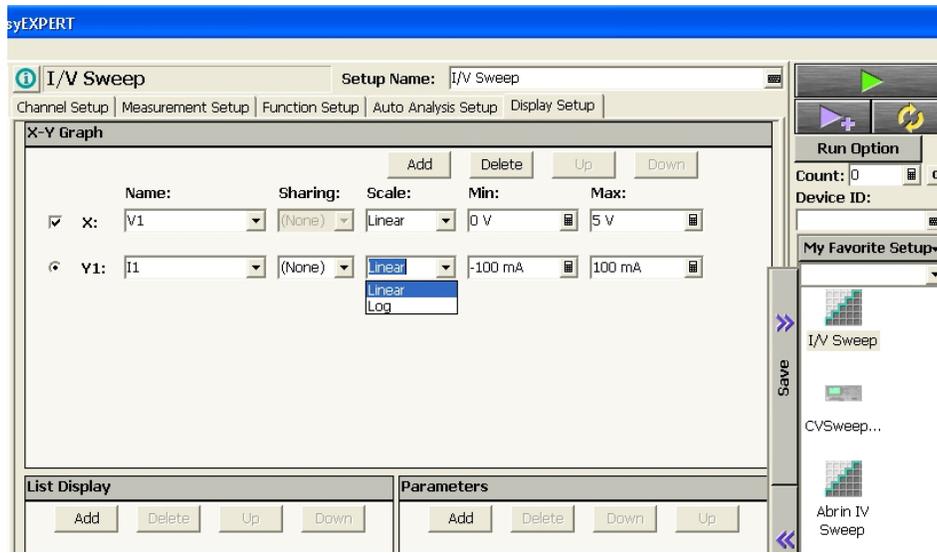


Figure 10: Display setup

14. A graph of measurement result will pop up.

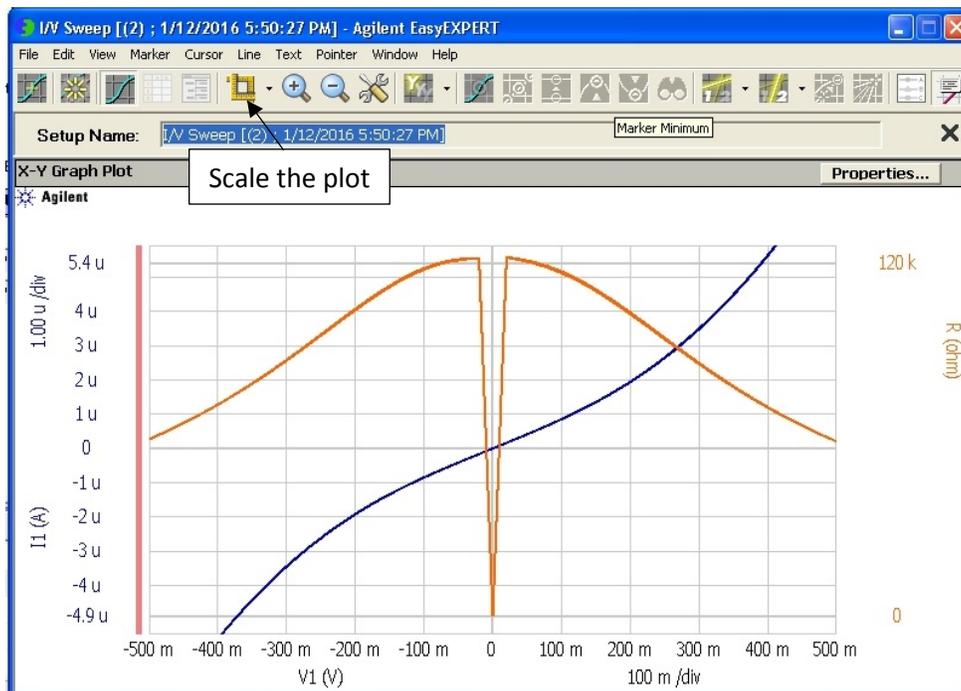


Figure 11: X-Y graph plot

15. To save the data, right click on the first item in the 'Results' (Figure 12). Select 'Transport Data' and choose a format to save.

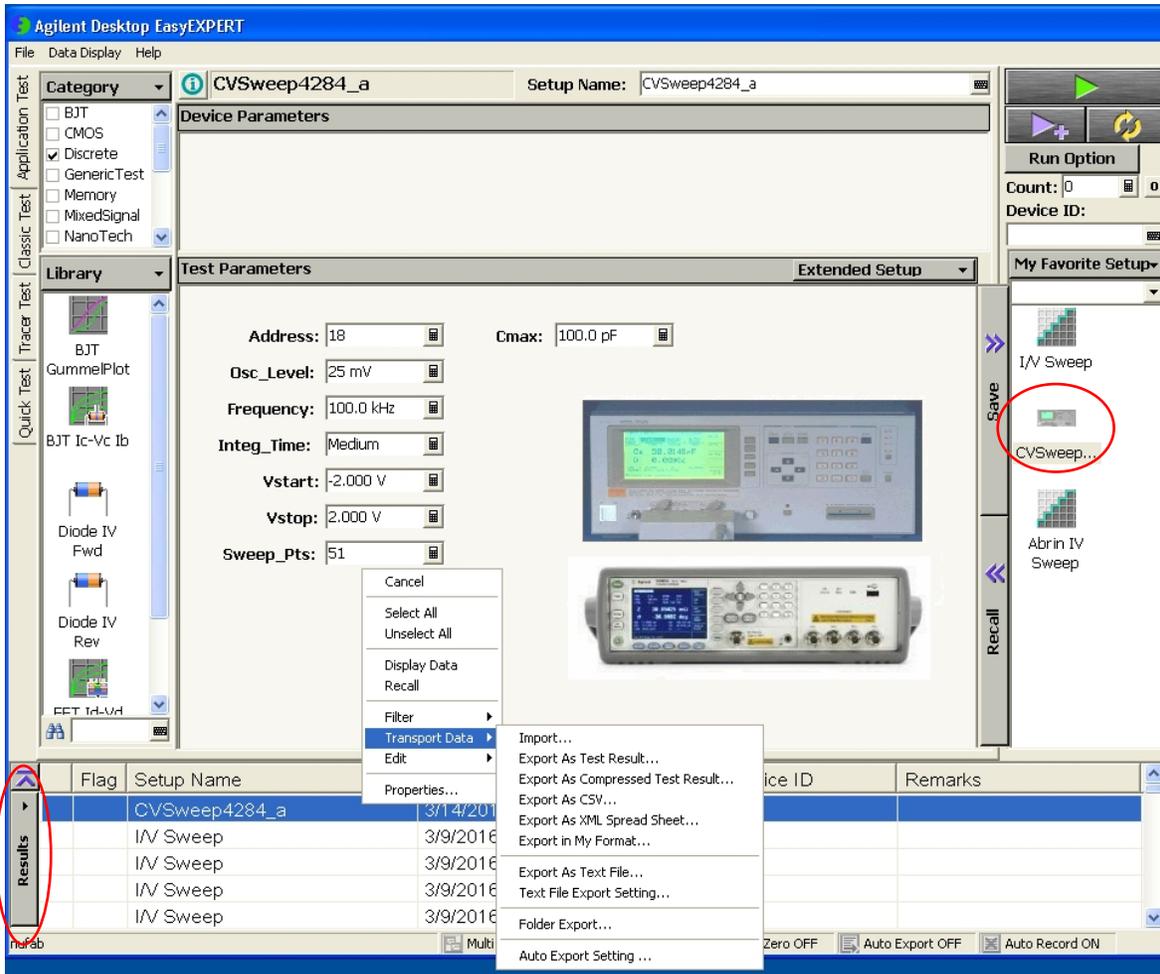


Figure 12. Data saving and CV measurement

16. The probe station is also capable of measuring capacitance as a function of biased voltage. The measurement setting can be selected from my favorite setup, the CVSweep (Figure 12). In the test parameters, input the measurement frequency (75 kHz to 30 MHz) and its magnitude (Osc-Level), the start and stop bias voltage (Vstart and Vstop), the sweep point numbers (Sweep_Pts), and the maximum capacitance value. Then click the green triangle in the top right corner.
17. After the measurement, lift up the probes, remove the sample, and switch off vacuum and microscope light.
18. Turn off the monitor, switch off the light source (behind the monitor) and log off on FOM.