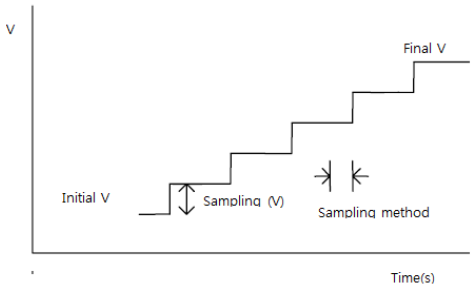
Solar Cell IV Curve

Purpose

This test is to demonstrate solar cell's IV curve test. You can use Potentiostatic IV curve technique or Galvanostatic IV curve technique for this purpose.

These two techniques use stair case wave form (Potentiostatic stair case wave form for Potentiostatic IV curve and Galvanostatic stair case wave form for Galvanostatic IV curve.

Smart manager will apply stair case waveform using constant DAC value increment or decrement with constant time duration. Smart Manager calculate DAC increment/decrement value nearby step height(or sampling interval) which user defined and time duration to meet nearby scan rate which user defined.
User can select averaging sampling condition.



This demonstration's test condition is;

- Potentiostatic IV Curve
  - Voltage range: From Eoc to 0V
  - Scan rate: 20mV/sec
  - Staircase height: 20mV
  - Data sampling (100% average at each step)

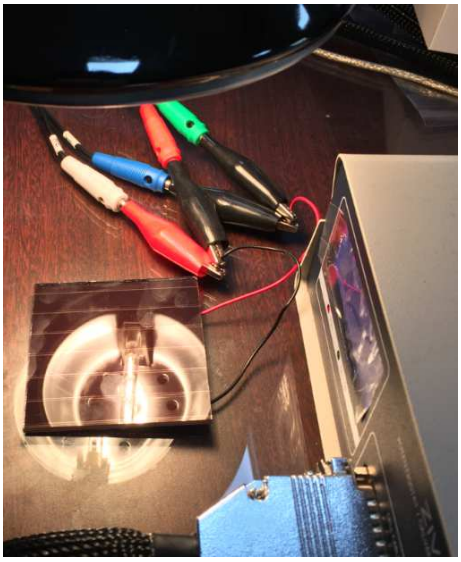
- Galvanostatic IV Curve
  - Current scan rate: 0A to -10mA
  - Cutoff potential: 0V
  - Scan rate: 100uA/sec
  - Staircase height: 100uA
  - Data sampling (100% average at each step)

Preparation

- ZIVE SP/MP electrochemical workstation
- Solar cell
- Light source (75Watt halogen lamp)

Cell Connection

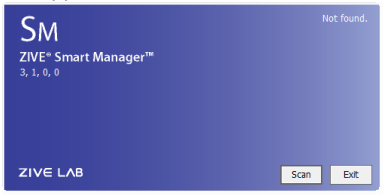
+ electrode(Green lead & Blue lead)
- electrode(White lead & Red lead)



Procedure

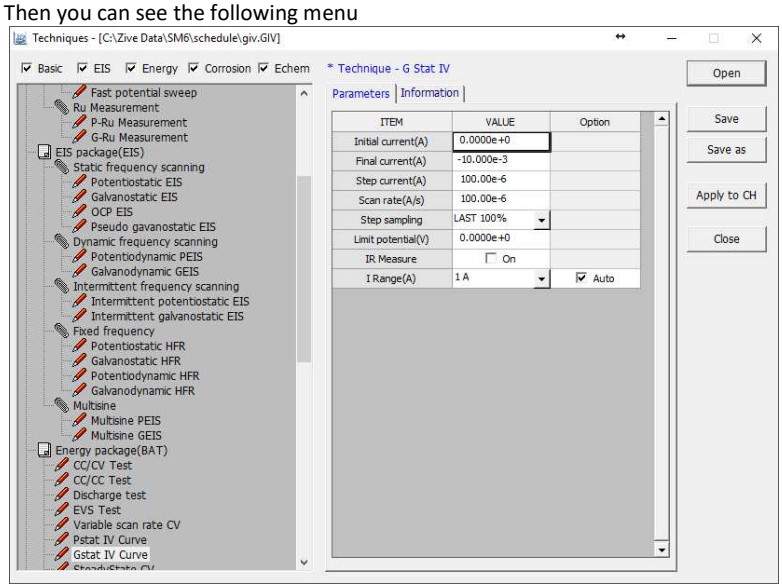
1. Turn the Power switch on the ZIVE SP/MP electrochemical workstation
2. Open the SM software by clicking the SM icon. The following progress box will appear, and will show the progress of checking instrument configuration and communication between ZIVE SP/MP electrochemical workstation and PC.

If the link is successfully connected, Click “OK” button on the box then the progress box will automatically disappear and SM software will appear. If the link failed, The following progress box will display then click the “Retry” button.



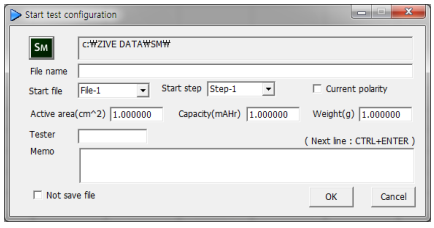
If the link failed again after clicking “Retry” button, you need to check USB cable connection.

3. Galvanosatic IV curve technique file: Click New technique function icon  (or select Experiment-Techniques on Experiment menu) Then you can see the following menu

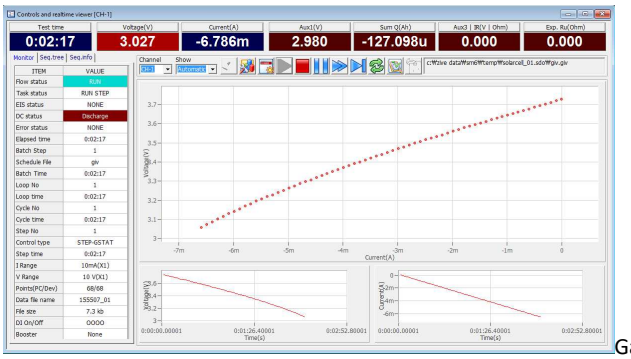


4. Click “Save” button to save the technique file which contains the above parameter and save it as “solarcell.giv” file name and click “Apply CH” button to assign this technique file on channel.

5. To start experiment, click Start button 
6. After click start button, you can see the following box.

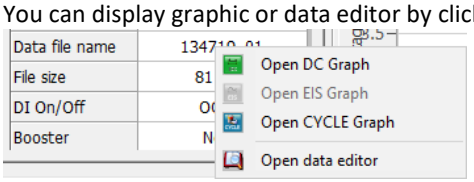


You can see real time plot as the following.

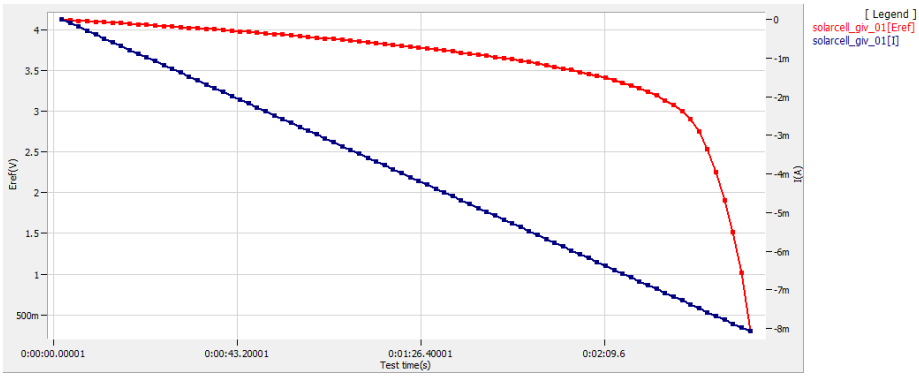


Galvanostatic IV curve

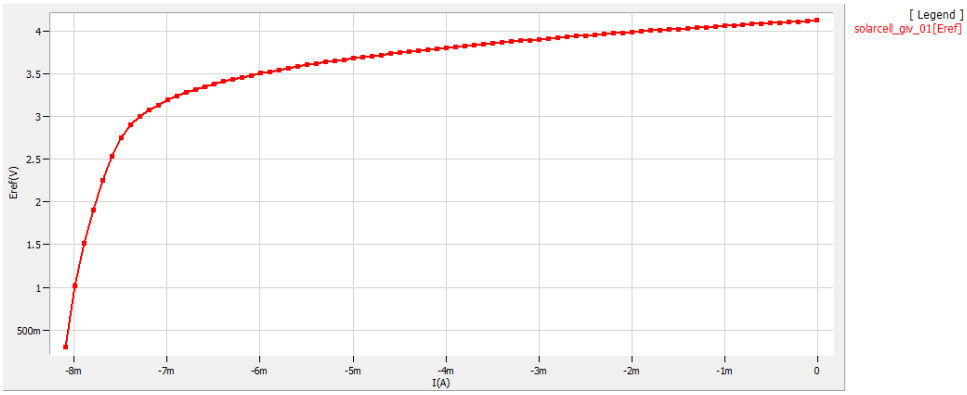
You can display graphic or data editor by clicking right mouse on data file name



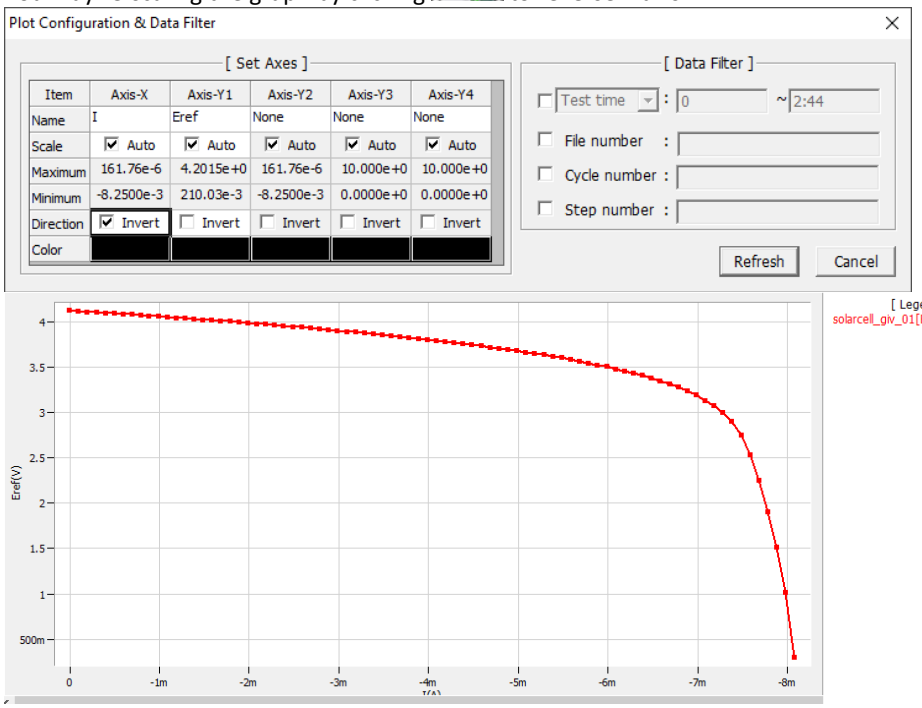
7. You can see voltage, current vs test time when you selected those parameter on DC graph



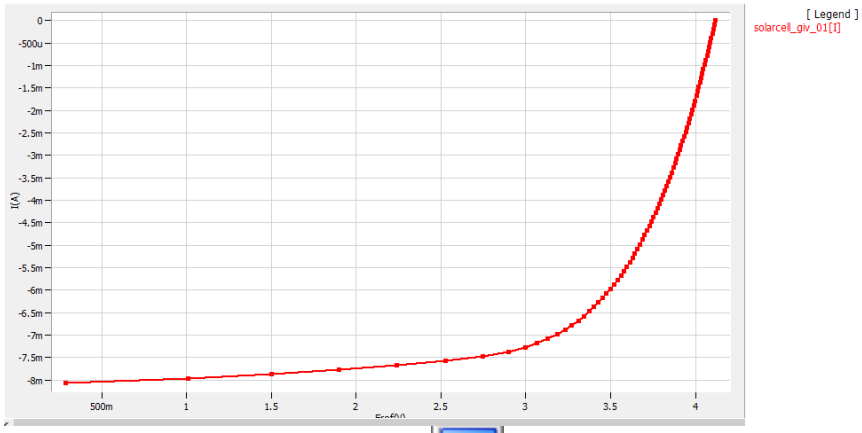
8. You can see voltage vs. current when you selected those parameter on DC graph



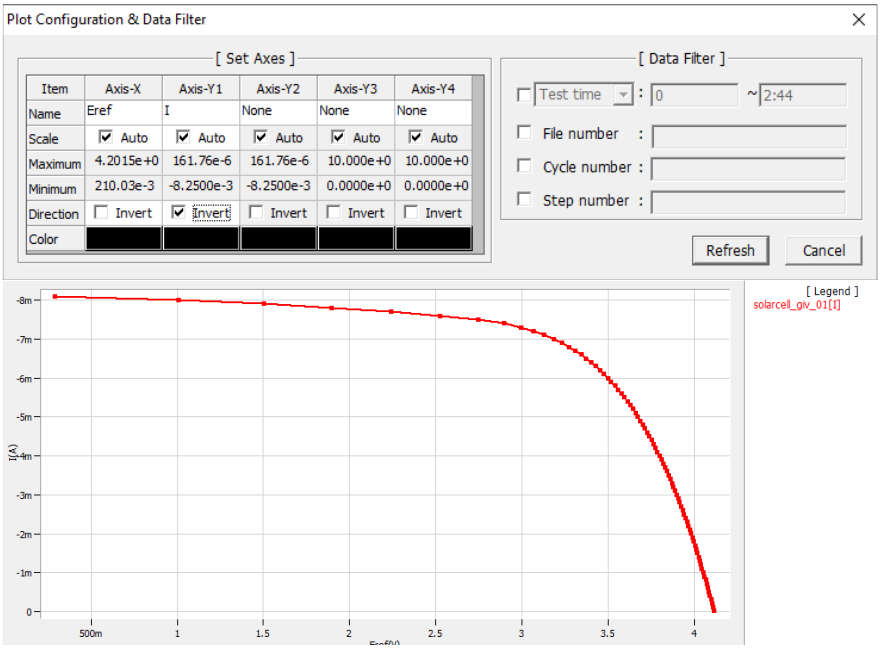
You may re-scaling the graph by clicking  to reverse X axis.



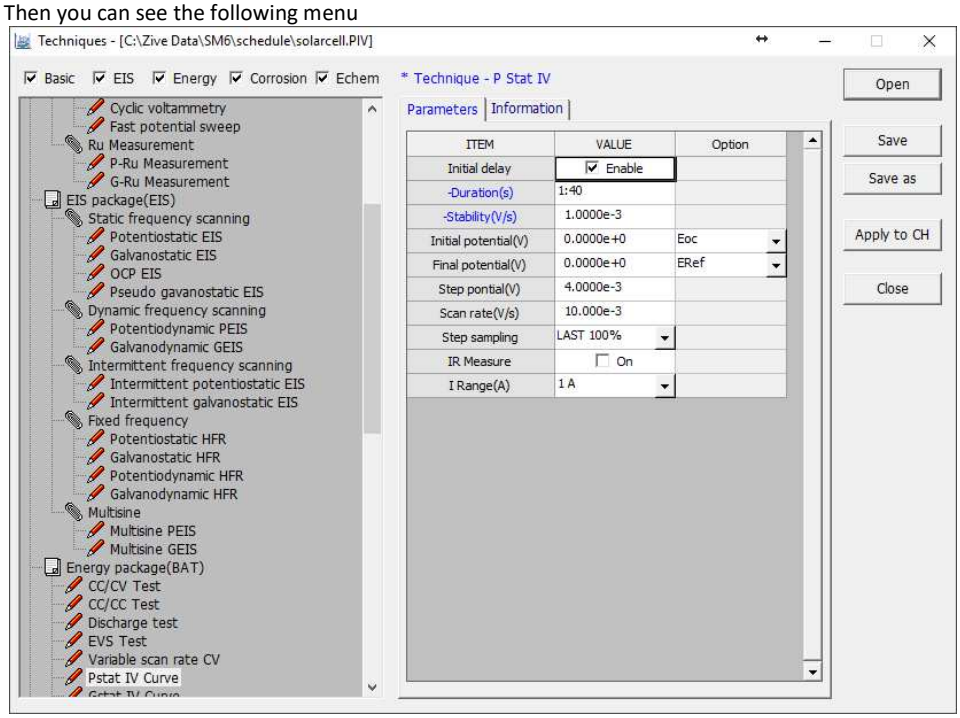
9. You can see Current vs. voltage by clicking  on DC graph



You may re-scaling the graph by clicking  to reverse X axis & Y axis.



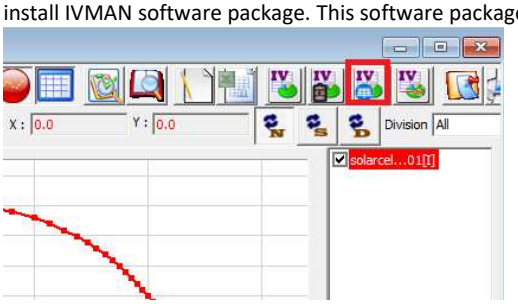
10. Potentiostatic IV curve technique file: Click New technique function icon  (or select Experiment-Techniques on Experiment menu) Then you can see the following menu



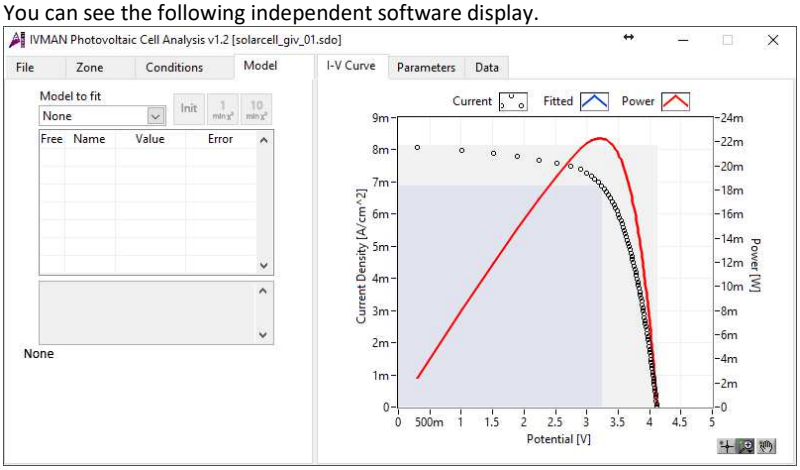
11. Click “Save” button to save the technique file which contains the above parameter and save it as “solarcell.piv” file name and click “Apply CH” button to assign this technique file on channel.

Data Analysis

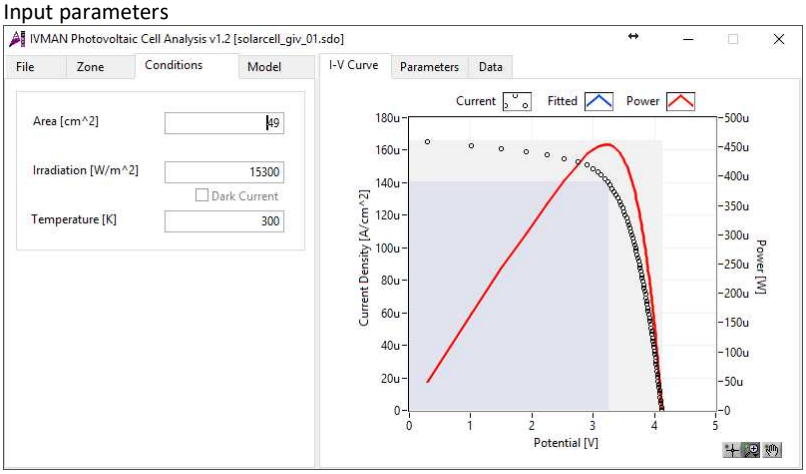
1. Open “IVMAN photo voltaic analysis” by clicking IVMAN photo voltaic icon  . To use this analysis software, you must install IVMAN software package. This software package is on setup CD.



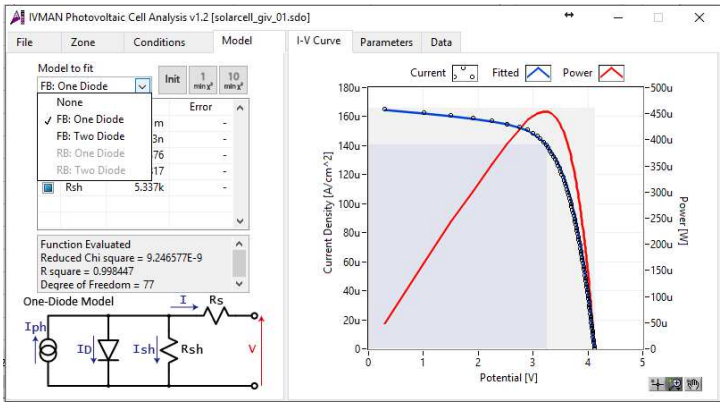
2. You can see the following independent software display.

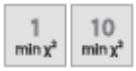


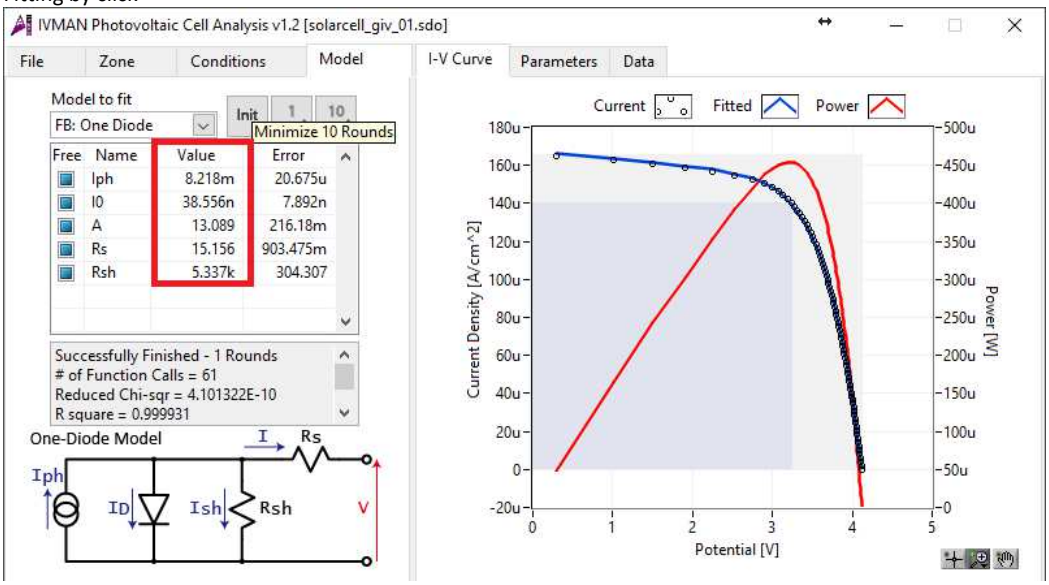
3. Input parameters



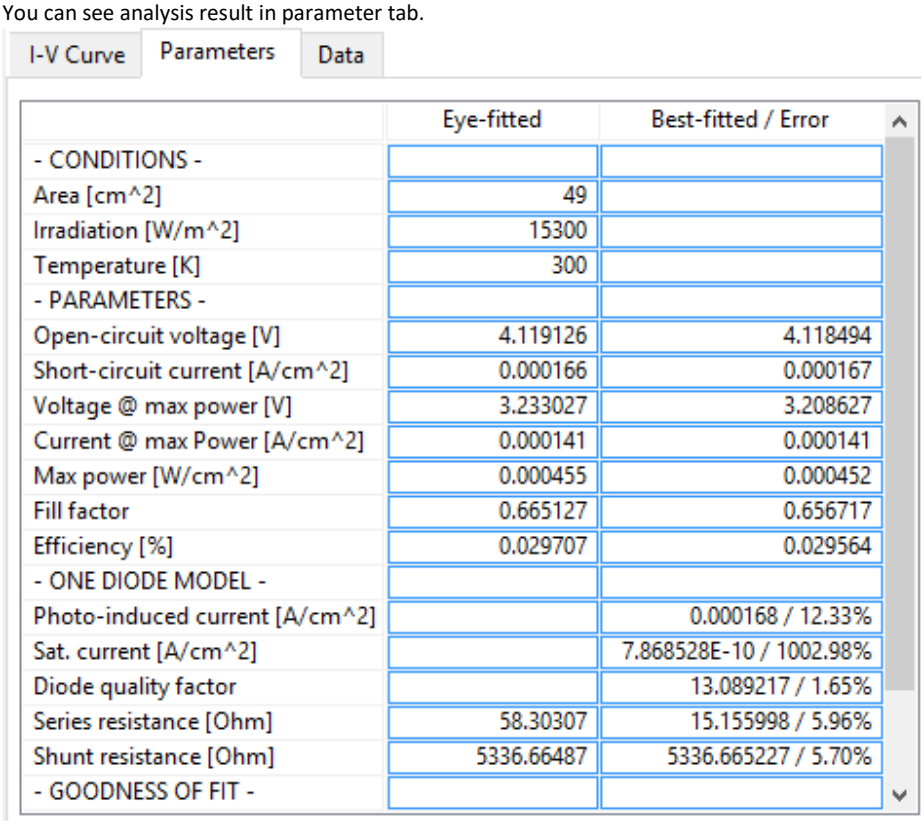
4. Select one diode model for fit



5. Fitting by click 



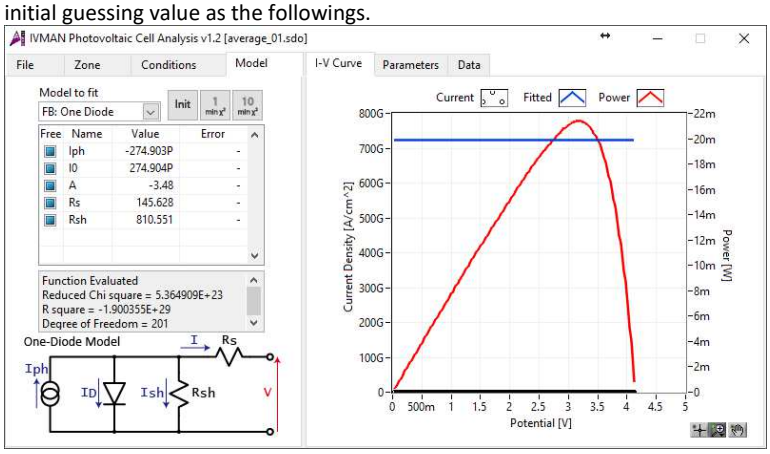
6. You can see analysis result in parameter tab.



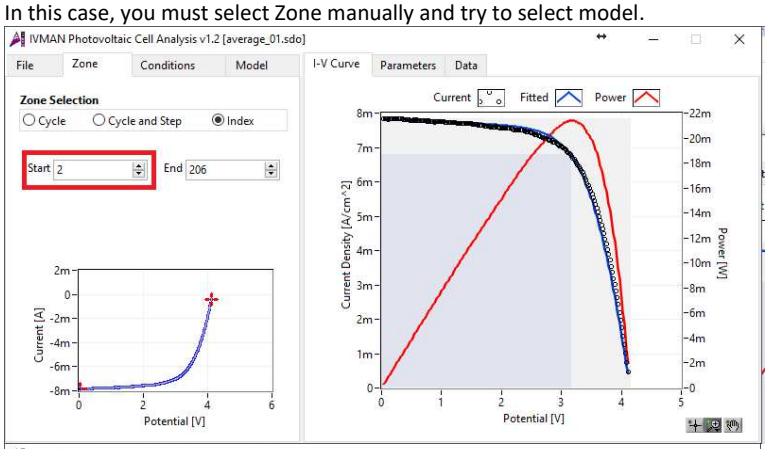
I-V Curve | Parameters | Data

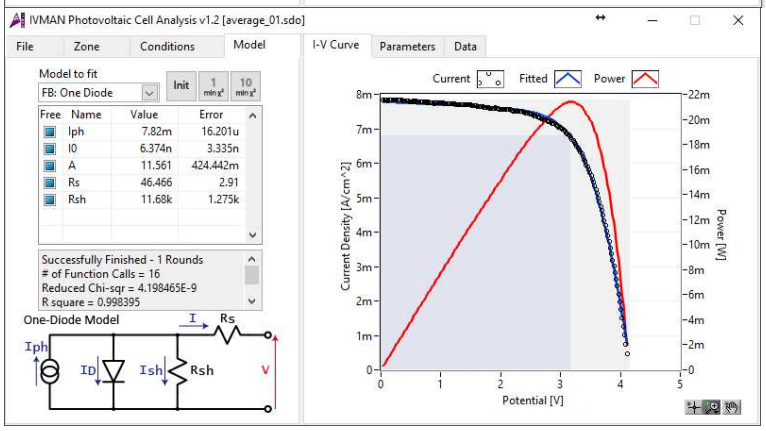
	Eye-fitted	Best-fitted / Error
- CONDITIONS -		
Area [cm^2]	49	
Irradiation [W/m^2]	15300	
Temperature [K]	300	
- PARAMETERS -		
Open-circuit voltage [V]	4.119126	4.118494
Short-circuit current [A/cm^2]	0.000166	0.000167
Voltage @ max power [V]	3.233027	3.208627
Current @ max Power [A/cm^2]	0.000141	0.000141
Max power [W/cm^2]	0.000455	0.000452
Fill factor	0.665127	0.656717
Efficiency [%]	0.029707	0.029564
- ONE DIODE MODEL -		
Photo-induced current [A/cm^2]		0.000168 / 12.33%
Sat. current [A/cm^2]		7.868528E-10 / 1002.98%
Diode quality factor		13.089217 / 1.65%
Series resistance [Ohm]	58.30307	15.155998 / 5.96%
Shunt resistance [Ohm]	5336.66487	5336.665227 / 5.70%
- GOODNESS OF FIT -		

7. To fit the model, this software use first 2 point and last 2 point to make initial guessing. Some of data file may show incorrect initial guessing value as the followings.



In this case, you must select Zone manually and try to select model.





ZIVE LAB