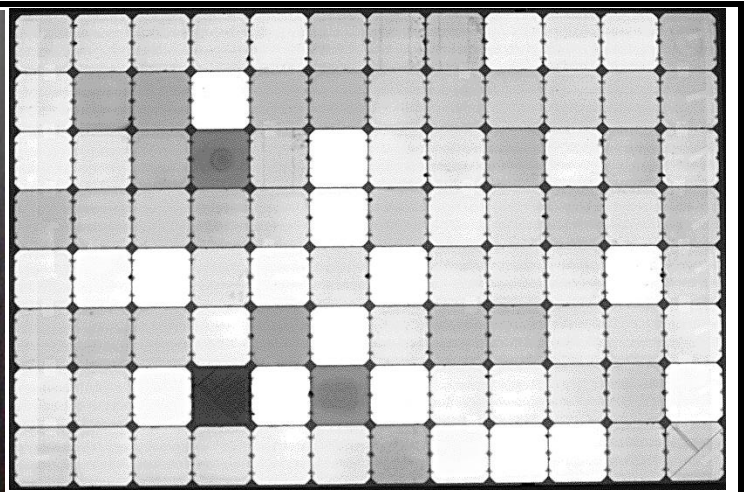
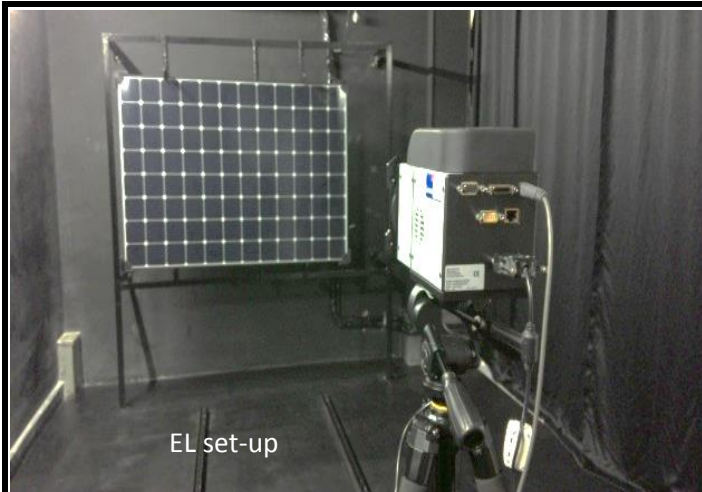
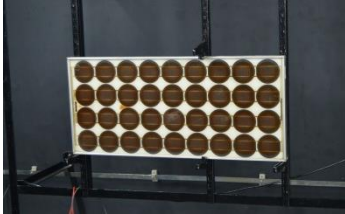


Standard Operating Procedure (SOP) for Electroluminescence (EL) Measurement of Solar Module

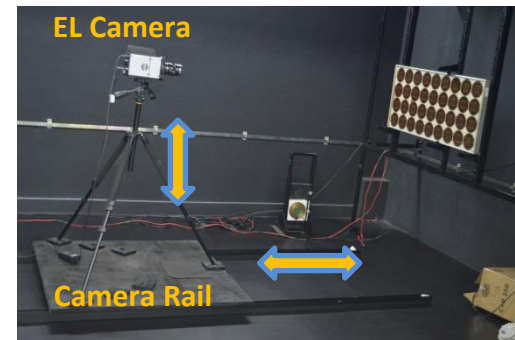


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(NCPRE), IIT Bombay**

Step A:

- ✓ Measure the length and width of module to be tested.
- ✓ Note down the electrical parameters of module (V_{oc} , I_{sc})
- ✓ Place the sample on the mounting rack as shown in picture → 
- ✓ Identify the polarities of module wires (by measuring the DC voltage of module using multimeter)
- ✓ In order to bias the module in forward biased condition, Connect positive wire of module to positive wire of Aplab DC power supply & negative wire of module to negative of Aplab DC power supply.

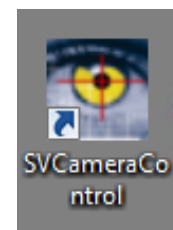
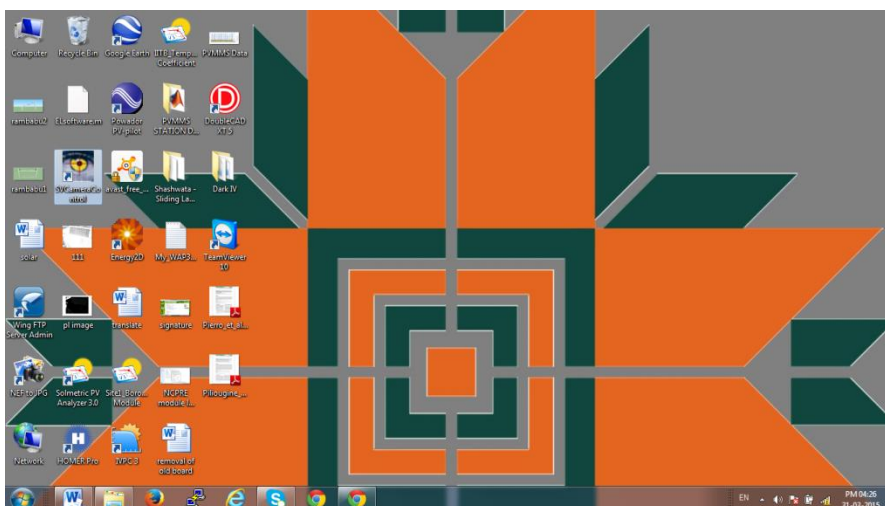
- ✓ Adjust the EL camera height and length from module rack, so that it could capture entire module area. →

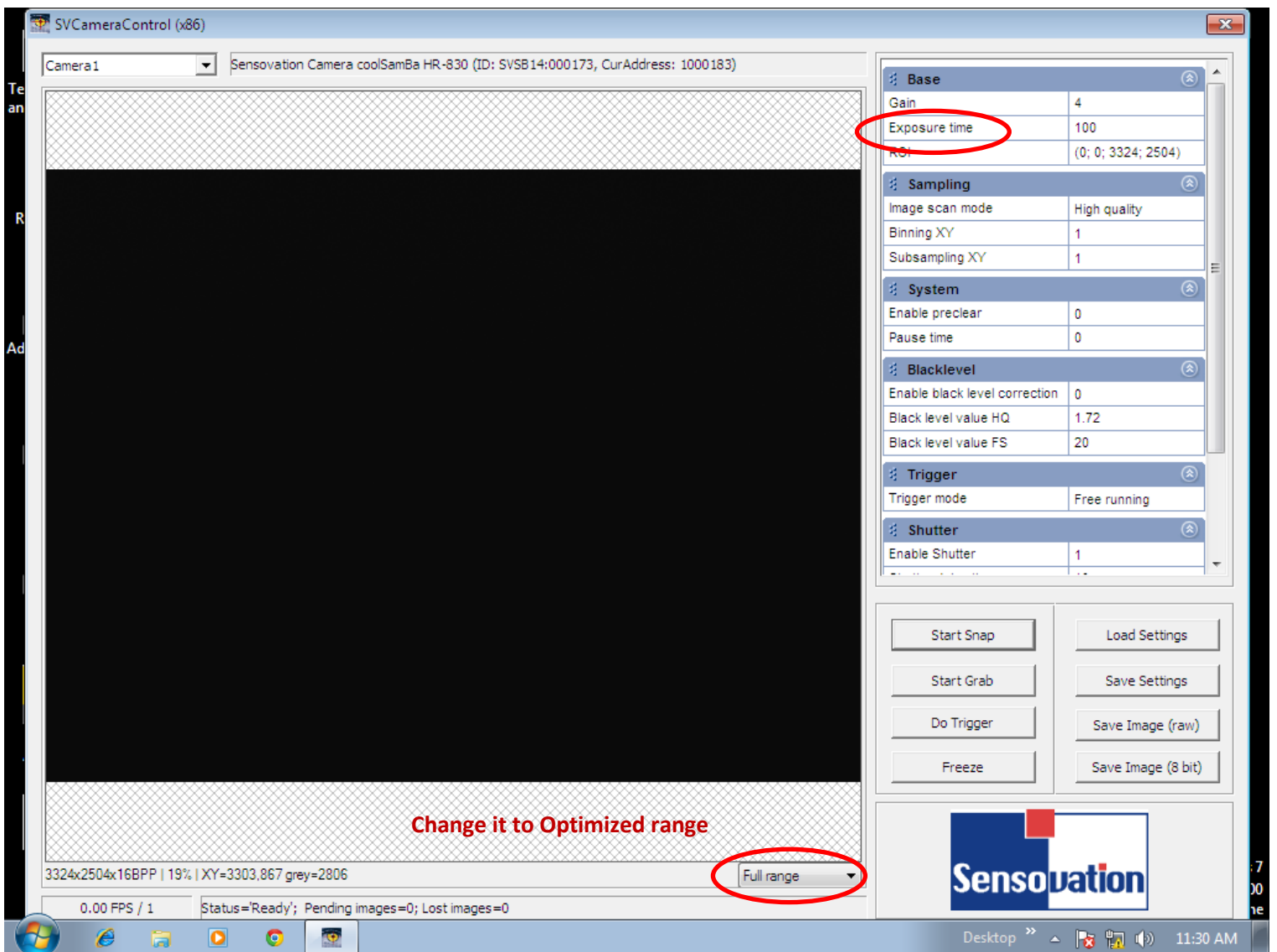


- ✓ Turn ON the EL camera power supply from switch board and remove the camera lens cover. →



- ✓ Open the EL camera software (SV Camera control) from EL computer desktop





- ✓ Change full range to optimized range.
- ✓ Change exposure time from 100 to 10000 just for getting the ideal of image. (1 sec = 1000 so 10 sec = 10000)
- ✓ Now click on **gain** and then click on **start snap**, you will be getting some image on the computer screen that you have to check whether you are getting entire module image or not but if not then you have to move camera rail and then slowly rotate the camera lens (clockwise or anticlockwise) to get a focus and entire module image.
- ✓ Once you get the focused image save it in your folder.



Note: Please do not change any of the default setting accept for Exposure time and Full range circle values from EL software. It's a default setting. For detail about the options please refer the usual manual.

Step B:

- ✓ Choose Aplab DC power supply (80V/15A, 120V/5A) based on your module V_{oc} & I_{sc} .
- ✓ Close the curtain clothes, turn OFF the EL room lights in order to avoid stray lights.
- ✓ Turn ON the DC power supply, set the V_{oc} & I_{sc} values in the power supply by pressing the nob switch, adjust it and then press ON button (just below SET button). If you are not getting the set V_{oc} & I_{sc} values on power supply then slightly increase the V_{oc} .
- ✓ Change exposure time to 30000 (30sec) and then click on start snap.
- ✓ You will get EL image on the EL computer screen, after getting the EL image immediately turn Off the ON button of DC power supply. Save the EL image in E-Drive/NCPRE/EL/"Your name"(Folder)/Date_of_expt folder (image can be saved in 8 bit – processed image & raw image-true color image)
- ✓ Once you done the measurement turn OFF the EL camera, DC power supply and then close the EL software.
- ✓ Close the lens cover and then cover the EL camera, disconnect the module connection from DC power supply.
- ✓ Take your module sample from the mounting rack.
- ✓ Make the entry in the EL logbook.



Note: make sure you clean the area where your sample kept for measurement and keep the instrument & cable at its original place. Violation of this will result in suspension of your authorization.

Specification of components used in EL measurement

1. Electroluminescence Camera (EL)

- Manufacturer : Sensovation
- Model No : cool Samba HR-830
- Pixel Resolution : 8.3Mpixel (3324 X 2504)
- Pixel size : 5.4 μm
- Max. Frame rate : 1.5 fps
- Adapter : 12V/5A
- LP filter : 850nm



2. DC power supplies

- Manufacturer : Aplab
- Model No : VSP 12005 & VSP 8015
- DC Voltage range : 0.1-120V & 0.1-80V
- DC current range : 0-5A & 0-15A

