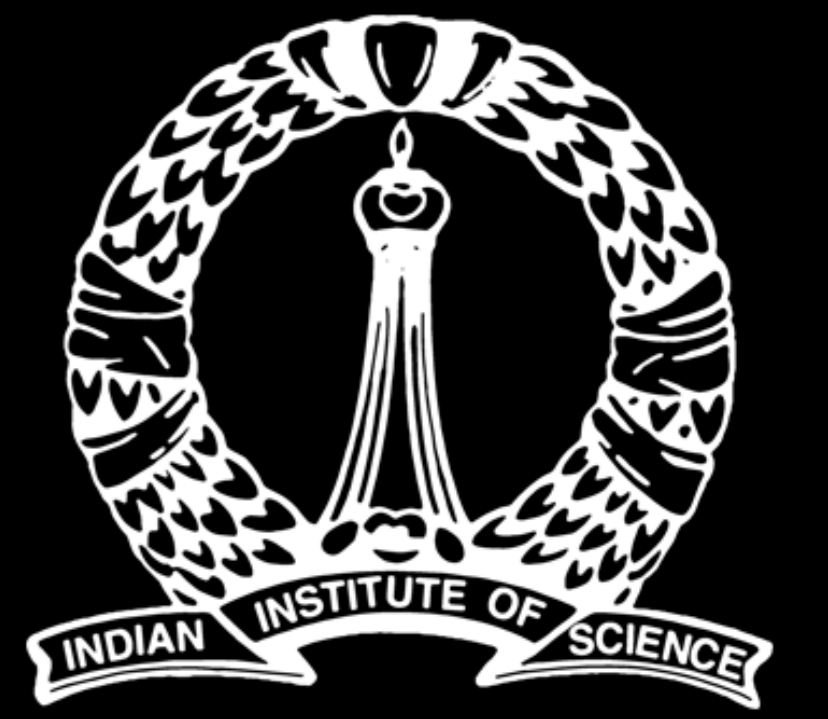


Case study on degradation of 8-year-old BiPV modules in Bangalore, India

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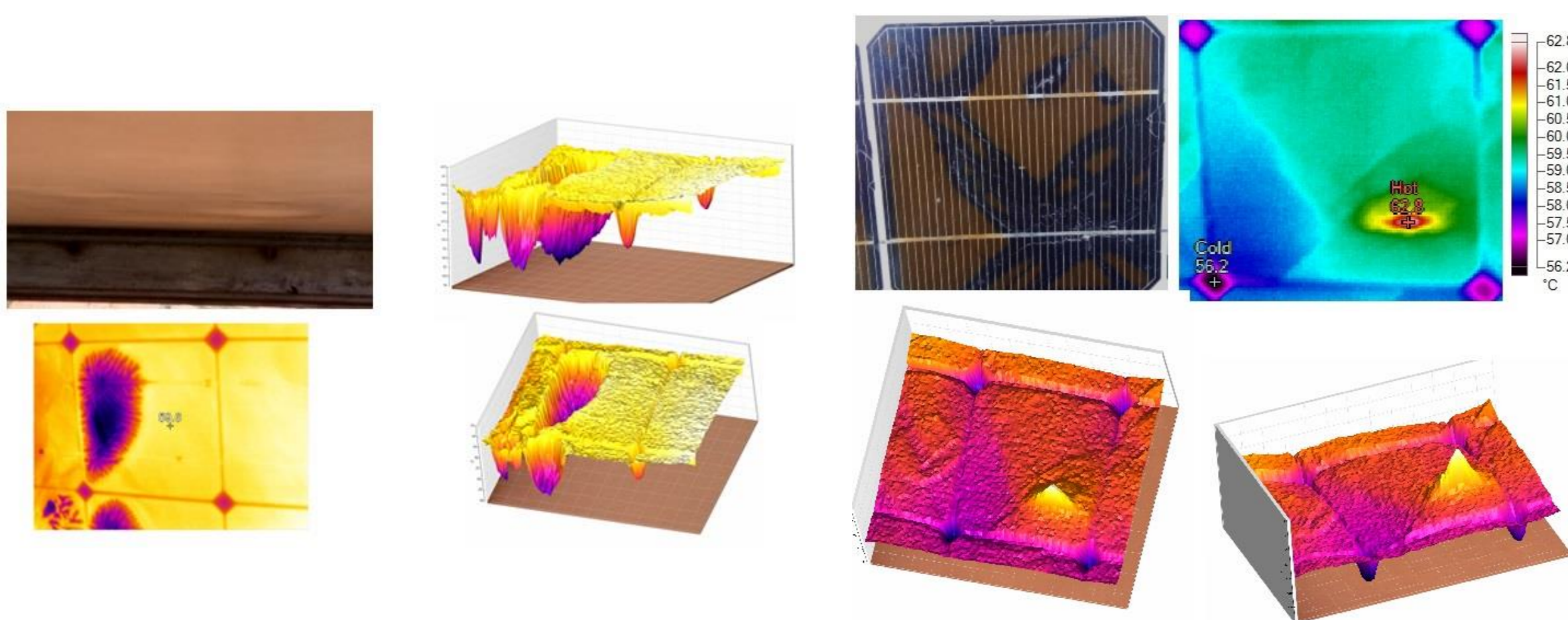
Introduction

- Photovoltaic module performance is determined by multiple factors and concurrent impacts of these factors on PV performance and its degradation is the subject of numerous on-going studies.
- The current study conducts a post-facto performance assessment of thirty three 8-year-old monocrystalline panels (150 Wp), with an aim to correlate the observed visual defects/degradation with their performance.

Methodology

Defect	Picture (RGB image)	Defect	Picture (RGB image)
Snail trail		Wave pattern	
Unbrowned lines		Cracks and burns in the cell	
Browned cells		Bubbles	

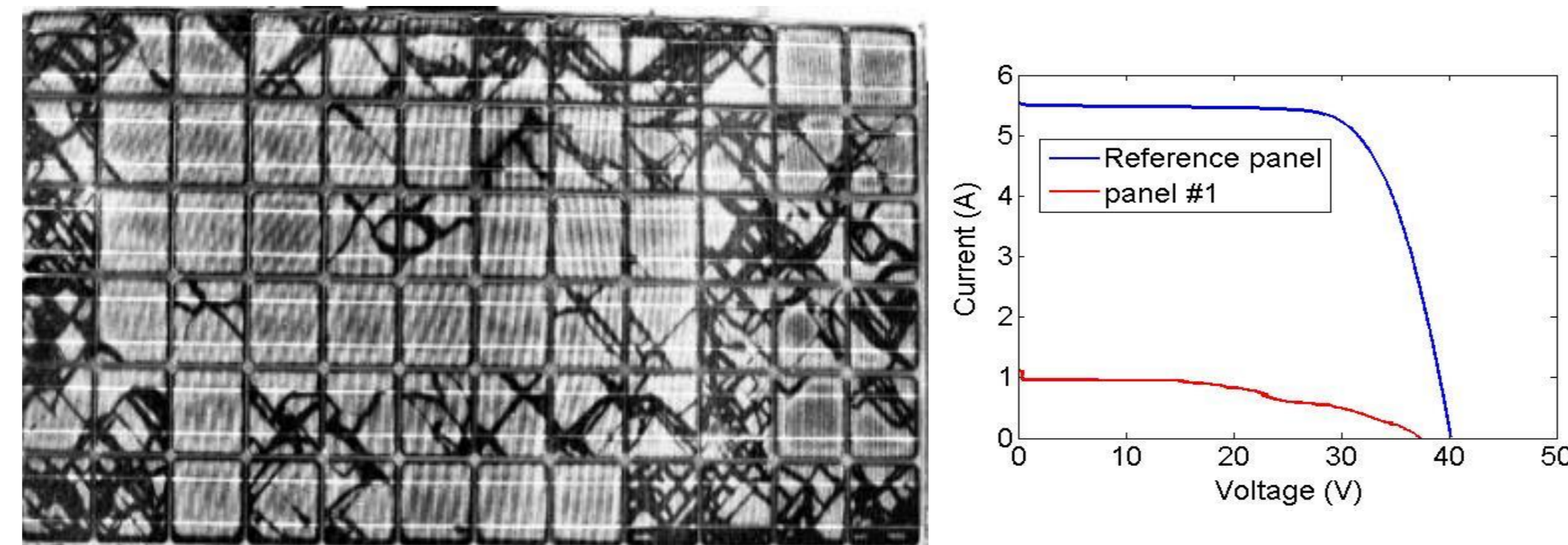
- The study involved a visual inspection with concurrent I-V curve measurements and thermal imaging.



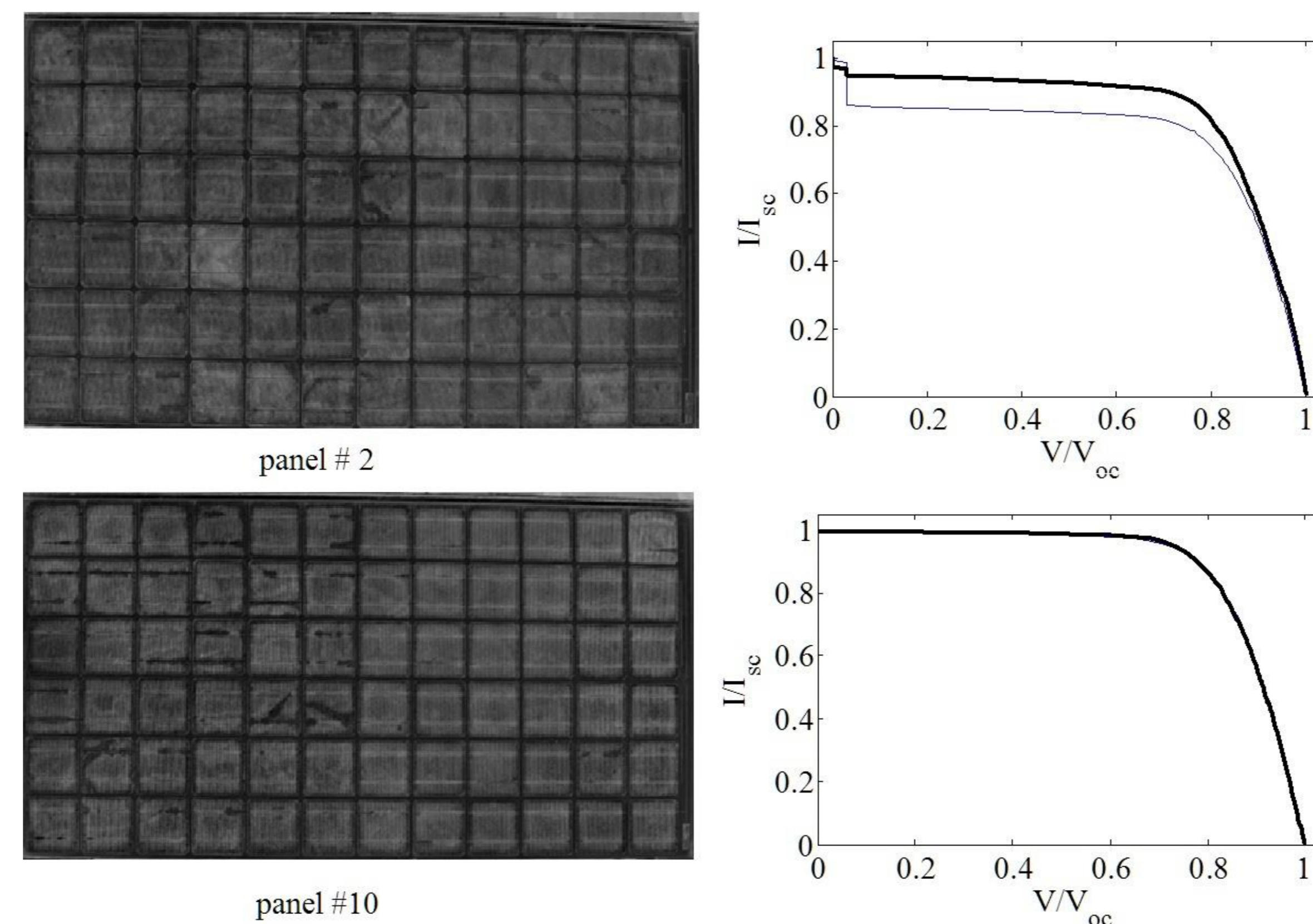
- Formation of a colder region due to air trapped in the bubble formation.

- Formation of a hotter region due to crack in the cell

Results

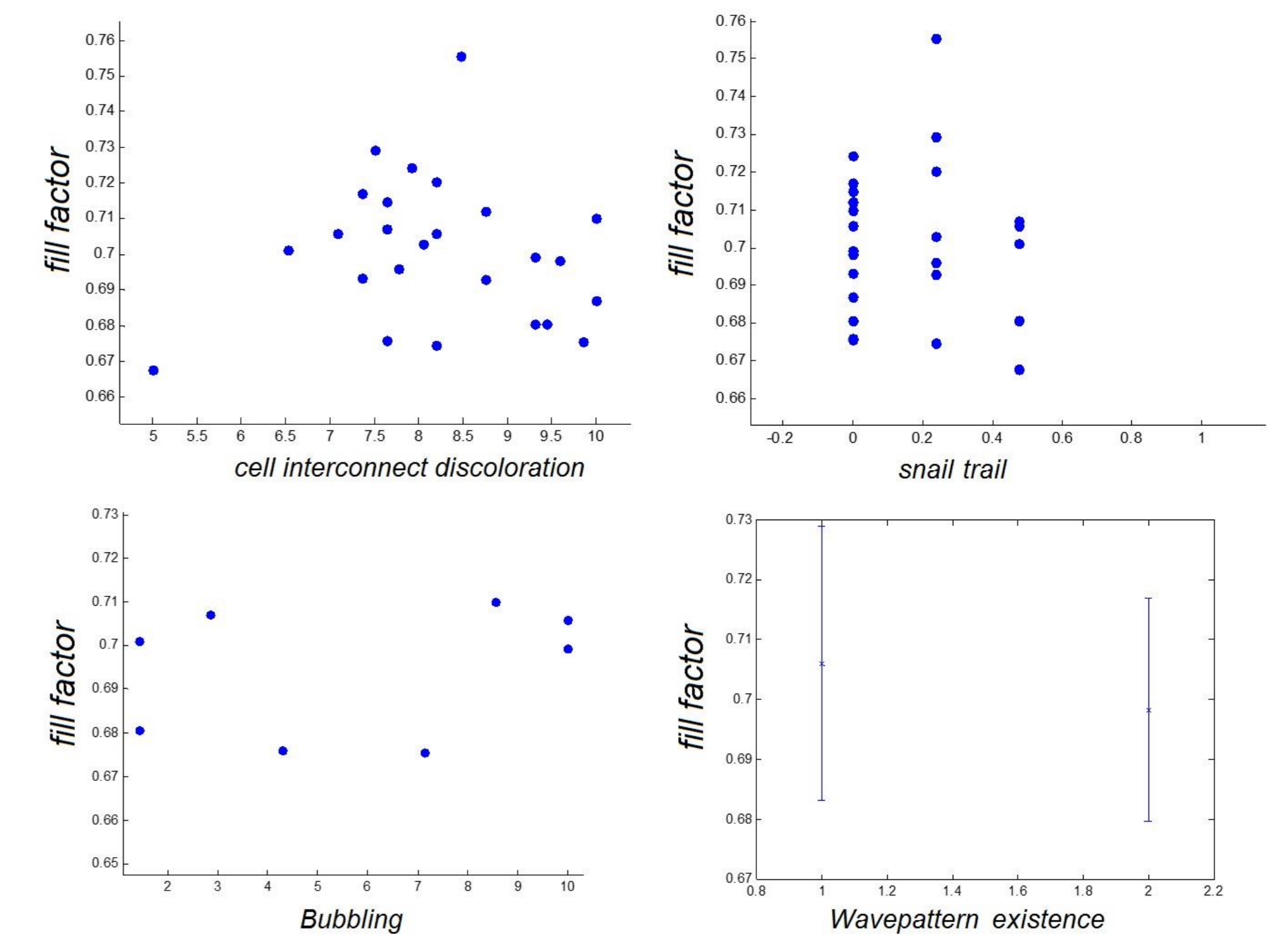


- The performance of each panel was compared with an unused spare panel with no observable defects

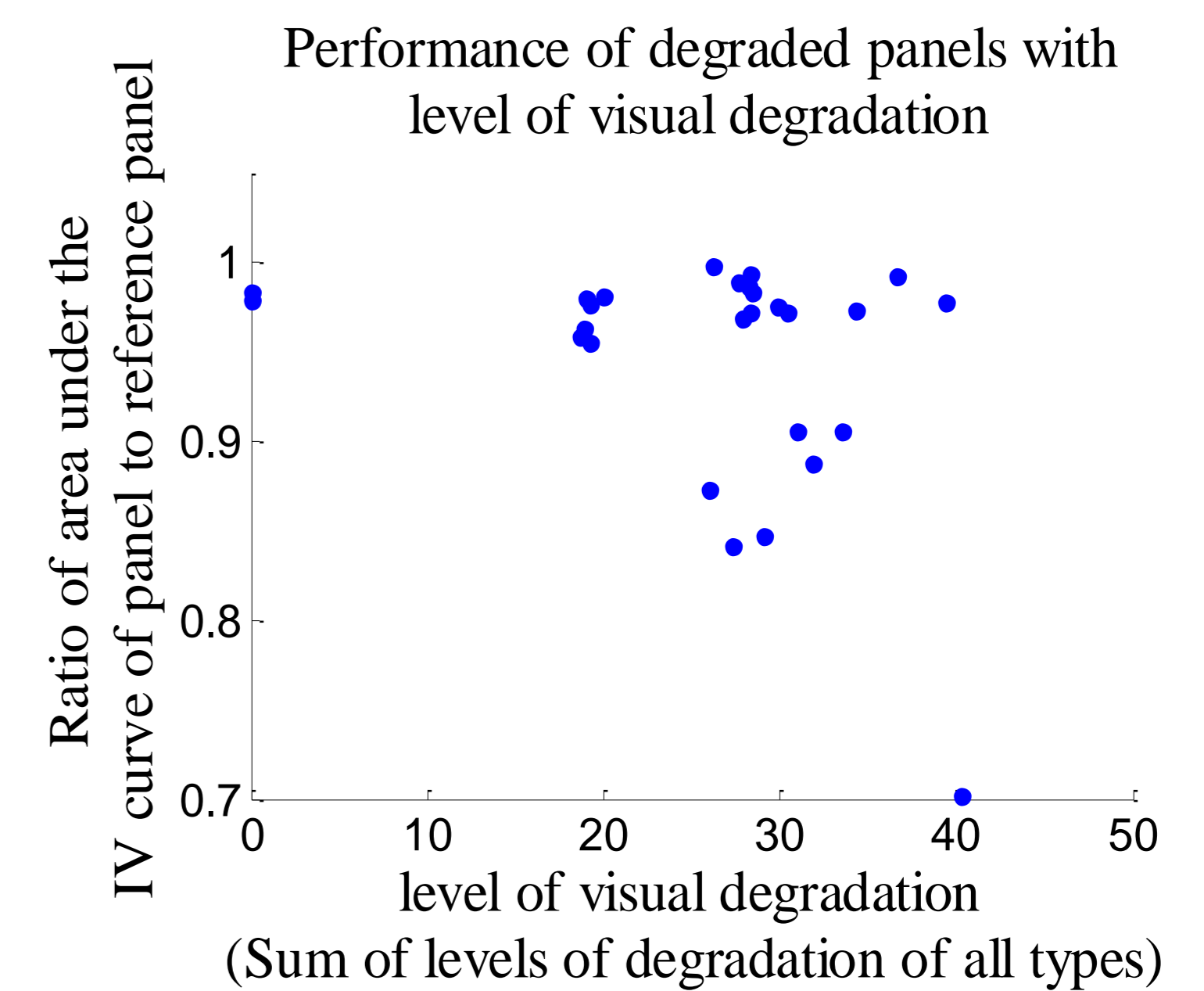


- Two panels (shown above, in saturation component in HSV colour space) with their corresponding I-V curves. I-V curves are normalized to their corresponding V_{oc} and I_{sc} . The bold curve I-V curve is the reference and the thin I-V curve is the one corresponding to the panel with defects.

- Visual defects alone does not explain the drop in the performance.



- Preliminary investigation revealed a weak correlation between the performance of the panels and the level/severity of visual defects



Conclusion

- Performance of the degraded panels with the level/severity of visual degradation has a weak correlation and defects alone does not explain the drop in the performance.
- Future scope of work is to trace the defects to manufacturing process, mode of installation, and to investigate further using Electroluminescence/ Photoluminescence wherein defects are detected which are not visually noticeable.
- Also, the study on interplay of dust with the existing degradations which either aggravate or alleviates the existing degradation is to be explored.