



Trends in Field and Laboratory Performance of Photovoltaic Modules and Materials

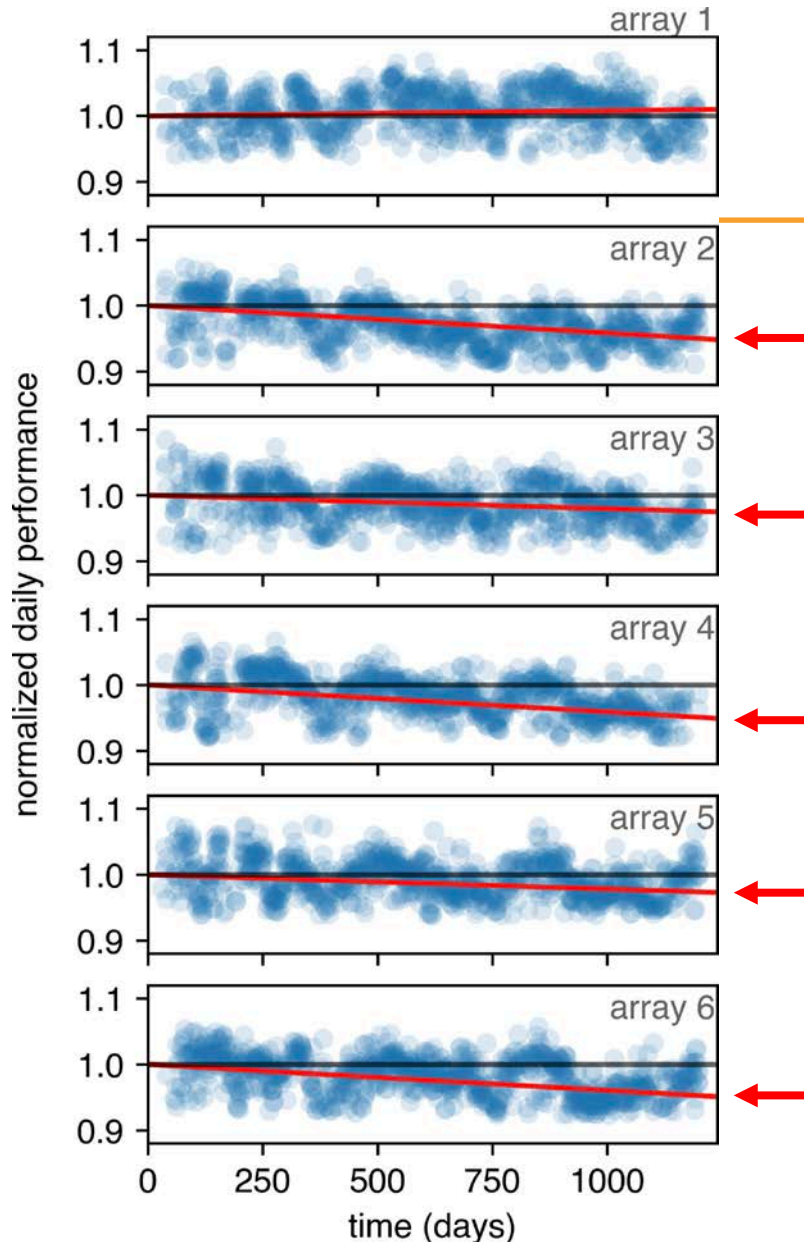
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Motivation for Investigation

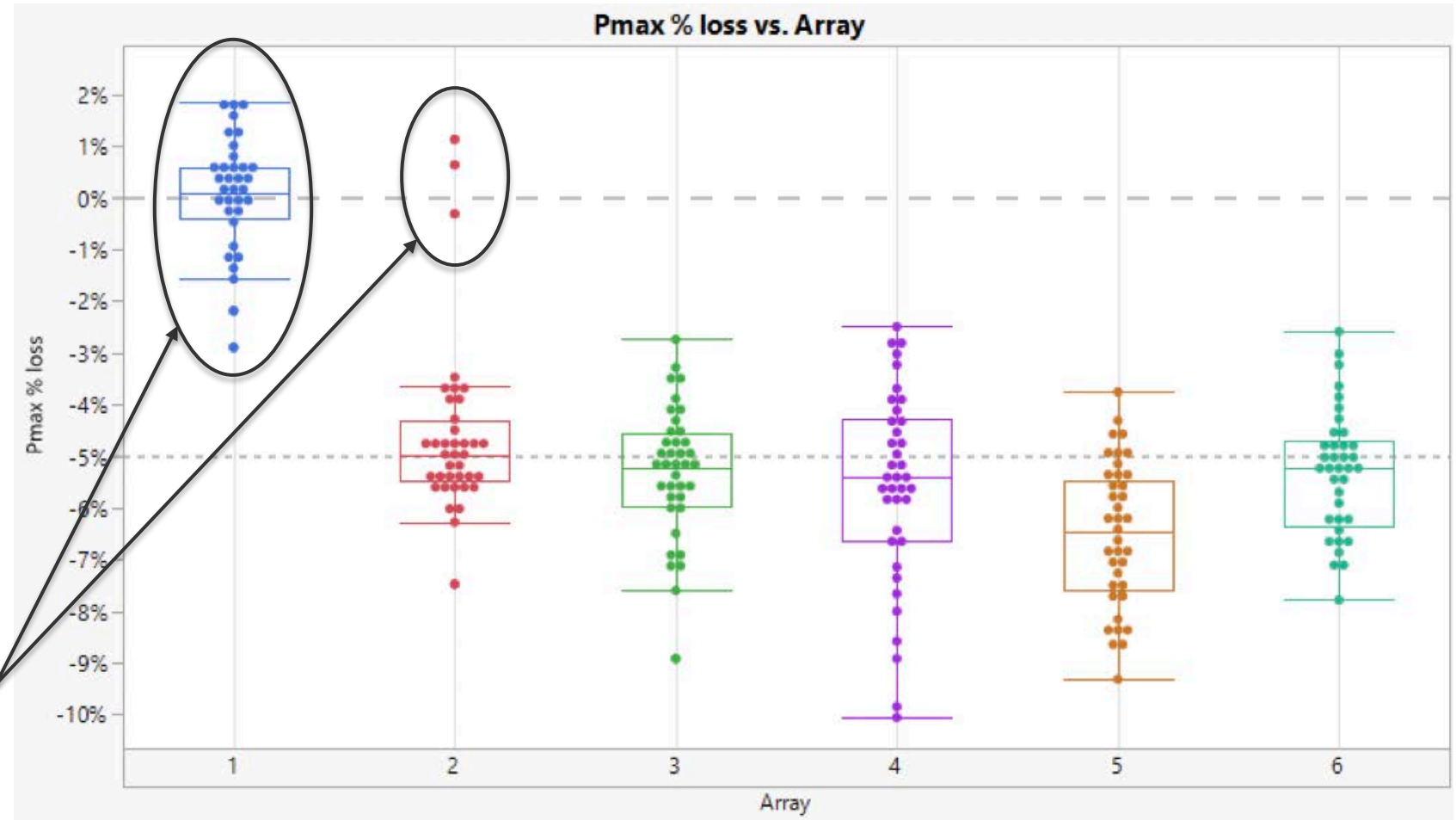


- Identify bill of materials (BOM) and/or process control measures for photovoltaic modules with representative failure modes, as informed by accelerated lab & field performance tests to guide next steps in module and material design
- Apply lessons and observations from accelerated testing to the field, and vice versa.
- Case study: underperformance of manufacturer “Z” modules at a ~5-year-old 15 MW plant in the **mid-Atlantic region** with **6 arrays**.
- Normalized daily performance of each array
 - Red lines show early degradation

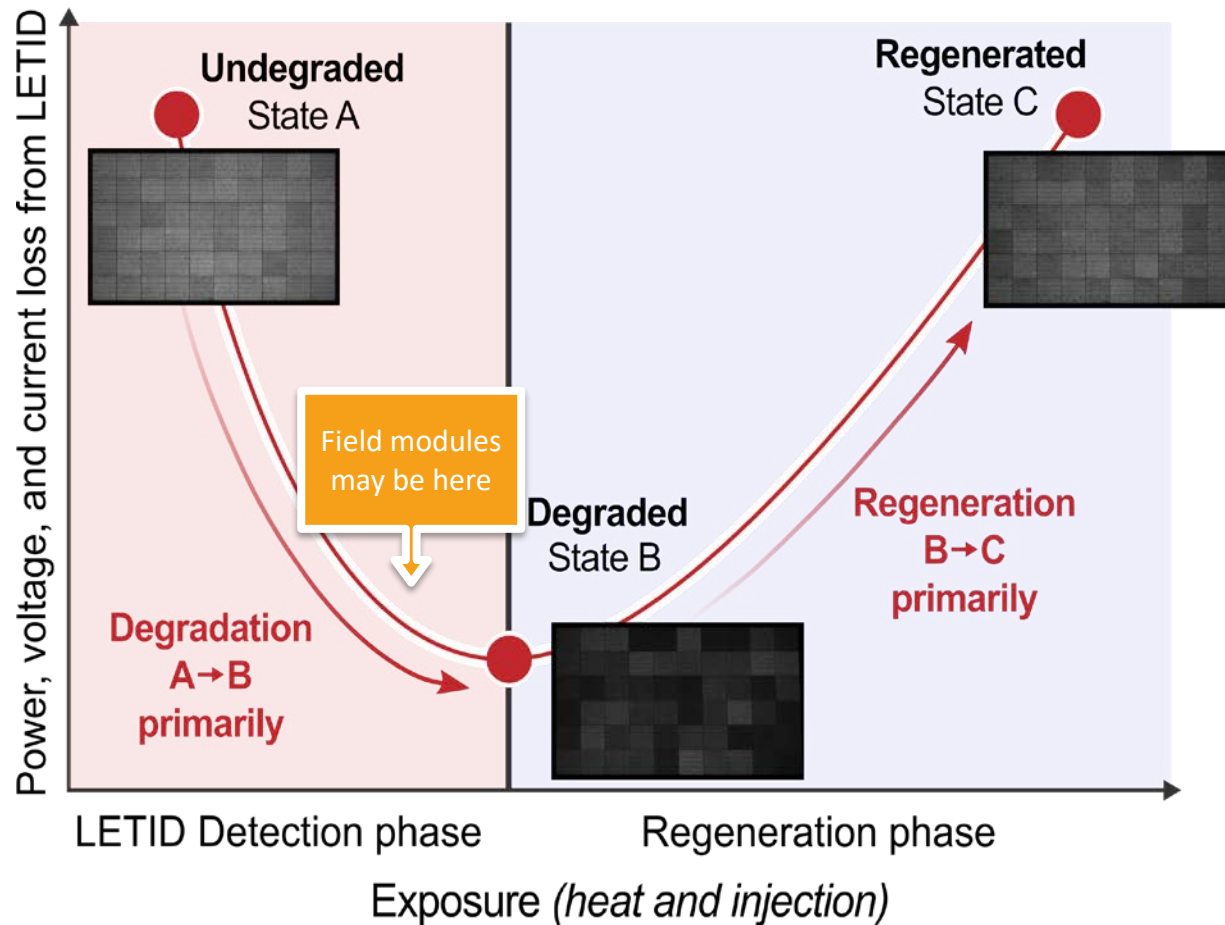
Deceglie, Michael G., et al. "Light and elevated temperature induced degradation (LeTID) in a utility-scale photovoltaic system." *IEEE Journal of Photovoltaics* 10.4 (2020): 1084-1092.

LeTID Observed from Site Analytics for Manufacturer “Z” Modules

- Same module type
- In-field I-V curves were obtained for a subset of modules from each array
- Identified light- and elevated temperature-induced degradation (LeTID) in field for 5 of 6 arrays
- Array 1 and some modules in array 2 did not have LeTID



Planned Experiment: Evaluate Impact of Field Regeneration



- With continued injection (illumination and/or current) at elevated temperature, LeTID eventually regenerates – *not yet observed in field*
- LeTID is *accelerated* by increased injection – but how long does it take in the field? Depends on state of modules in the LeTID curve

LeTID Regeneration Procedure

- In lab, current is increased to the module
- In field, increase injection by leaving module at open circuit – *never done before*

Expectation

- Performance recovery is accelerated at open circuit

Question

- Is in-field regeneration an economically feasible proposition?

J. Karas, et al., “Results from an international interlaboratory study on light- and elevated temperature-induced degradation in solar modules,” Submitted, 2021.

Summary

- Follow on to work previously done on underperformance of manufacturer “Z” modules at a 5 years old plant in the mid-Atlantic region with 6 arrays of 2 MW
- Identified light- and elevated temperature-induced degradation (LeTID) in field for 5 of 6 arrays
- **Planned experiment:** in-field LeTID regeneration
- Expectation of performance recovery, understanding of time to recovery if deploying in-field regeneration strategies is economically viable

Acknowledgements

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