



DuraMAT
Durable Module Materials Consortium

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DuraMAT Capability 5 Field Deployment for Reliability

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Energy Materials Network
U.S. Department of Energy

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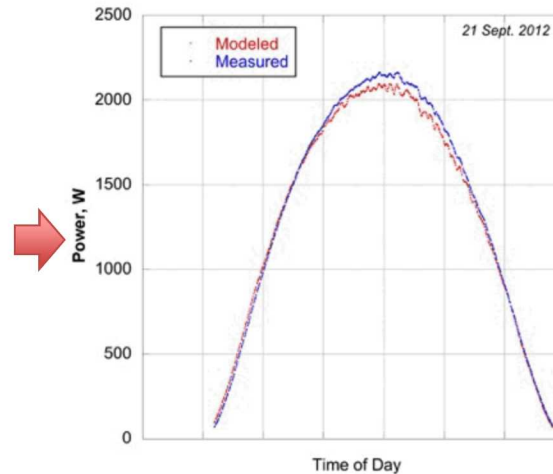
Brief Outline

- Field Deployment Capability Overview
- Capability Development Project: Non-Destructive Field Evaluation

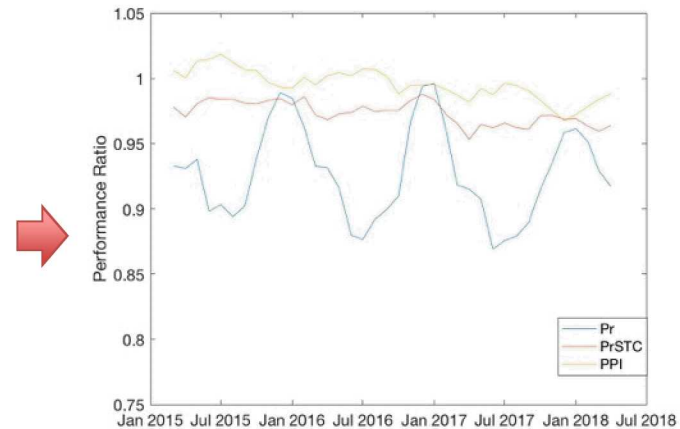
Fielded PV Systems Research



Daily Power



Year-over-year Performance Trends



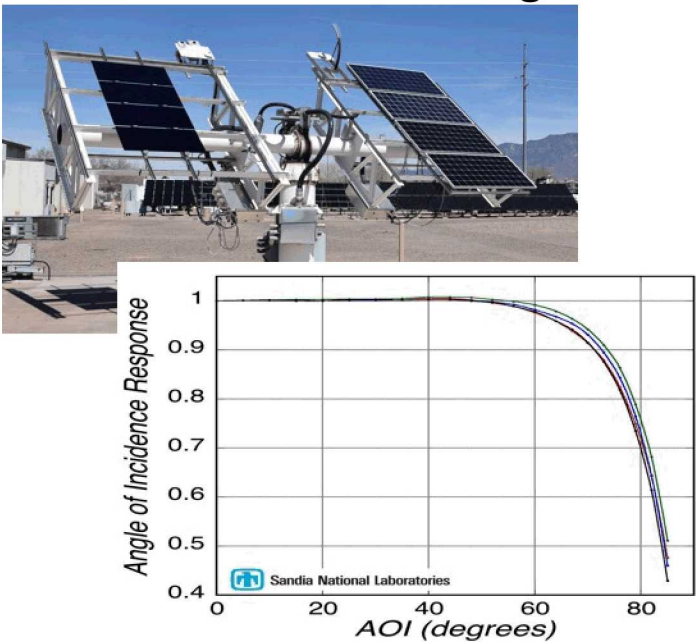
- Tracker Testing - Full electrical performance (IV curves, temperature coefficients, angle of incidence)
- System Instrumentation - DC Voltage and Current, In-situ IV curves, local irradiance
- Combine measured PV system performance with modeled power predictions
 - Evaluate system reliability and degradation rates
 - Evaluate technology improvements
 - Validate energy yield calculations

Emerging Technologies Characterization Examples

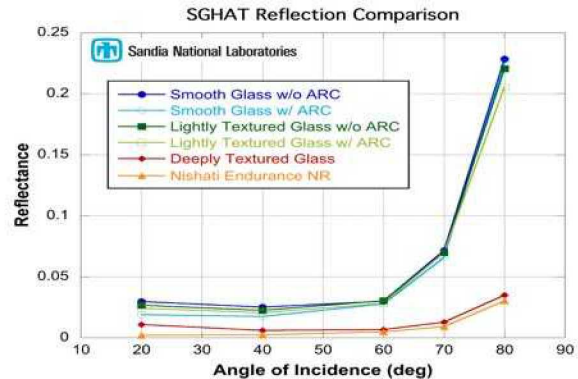
Roofing Products - BIPV



Angle of Incidence - Effect of Different Coatings



Optimization of Novel Packaging Methods



Component Research

Anti-soiling/anti-reflective coatings

DuraMAT BAPVC Project – CUNY/NREL
(late Q4 – FY18)

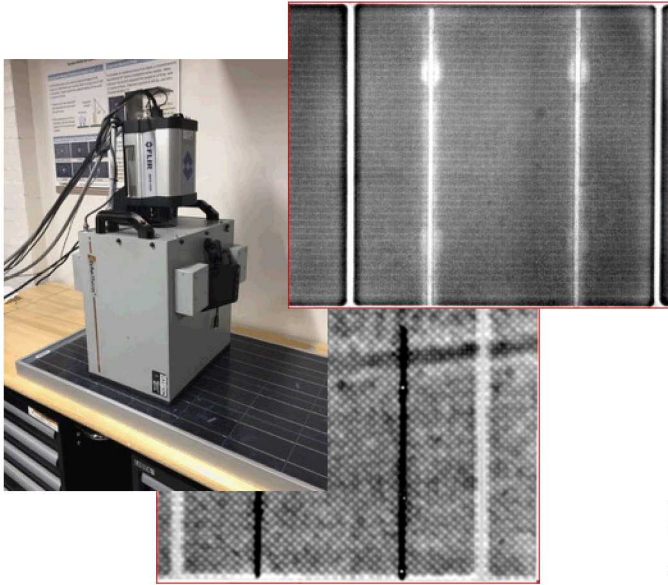


Connector Reliability Study



- 1-month to multi-year installations
- Evaluate materials and component reliability and degradation rates
- Flexible, stand-alone platforms at any orientation
- Two-axis tracker installations for maximum sun exposure
- Supported by comprehensive weather data
 - Irradiance, spectrum, temperature, humidity, etc.

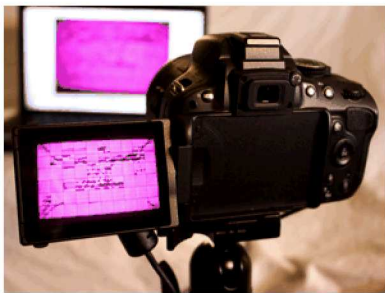
Non-destructive fielded module evaluation capabilities



Flash Thermography

- Cells, gridlines, bus bars are easily visible
- Difficult to image thin-film modules
- Equipment is not easily portable, not sized well for full-size modules, throughput is low.
- No further work planned

Field Electroluminescence



- Acquired fieldable EL camera from Brightspot Automation (7/18)

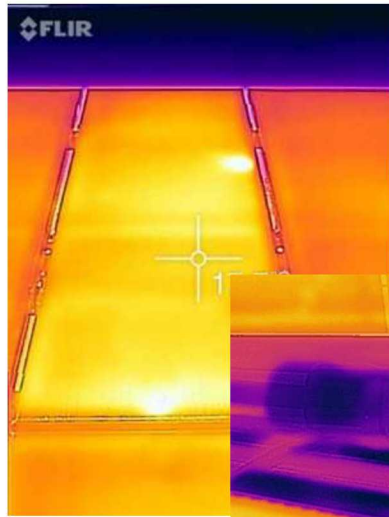
Field LED Flash Tester

- LED simulator for in situ IV characterization
- Full-size, up to 72-cell modules
- AAA
- 30 m/s pulse
- Expected delivery FY19

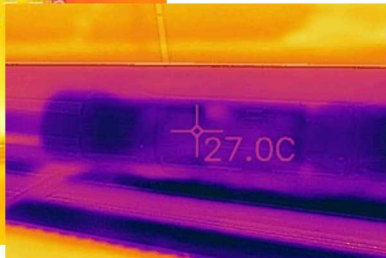


Non-destructive fielded module evaluation capabilities

Infrared (IR) Imaging (existing capability)

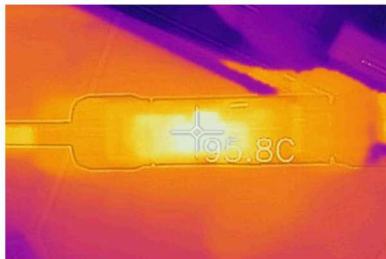


Module Hotspot



Normal
Connector

Failing
Connector



- FLIR A6700 Mid-Wave IR camera for high end inspection (1 - 5 μm)
- FLIR One Long-Wave IR for quick inspection (8 – 14 μm)

Additional Capabilities under consideration:

- Hand-held FTIR (commercial)
- Flash UV imaging (not well developed)