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IN SITU MONITORING OF ELECTRICAL PARAMETERS OF PV MODULES UNDER MECHANICAL STRESS

Tatiana DUIGOU¹, Tristan STEVENS¹, Jean-Patrice RAKOTONIAINA²
Julien GAUME¹

¹ Univ. Grenoble Alpes, CEA, LITEN, DTS, SMSP, LAM

² Univ. Grenoble Alpes, CEA, LITEN, DTS, SMSP, LSA

CONTACT :

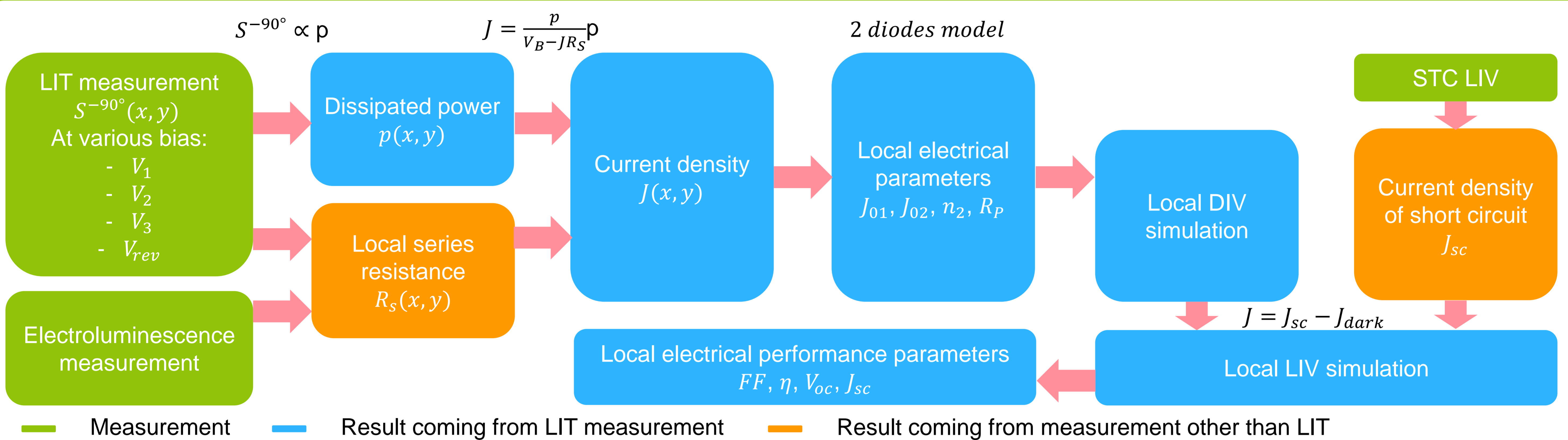
Tatiana DUIGOU

tatiana.duigou@cea.fr

CONTEXT AND AIMS OF THE STUDY

- The global electrical parameters of a module under mechanical stress, measured by dark I-V (DIV), vary. → Research into the local electrical behaviour of the module is of interest. Electroluminescence (EL), lock-in thermography (LIT) and light I-V (flash test / STC LIV) measurements can be used to have a deeper understanding of local electrical phenomena.
- Aims of the study:
 - Adaptation of a protocol for extracting local electrical parameters;
 - Extraction of the local electrical parameters of a mechanically loaded photovoltaic module.

PROTOCOL OF EXTRACTION OF LOCAL ELECTRICAL PARAMETERS



- Use of 2 tools developed by O. Breitenstein at Max Planck Institute: EL-Fit and Local I-V 2.
- Improvement of the extraction protocol:
 - Study of image overlay bias and creation of pre-processing routines for measured images;
 - Maximising the signal-to-noise ratio by choosing suitable measurement parameters: lock-in frequency depending on the materials making up the module, duty factor, acquisition time, voltage bias ...

APPLICATION OF THE PROTOCOL ON THE CASE OF PV MODULES LOADED IN BENDING

Experimental set-up

- 3 point bending test on composite PV modules.
- Bending is applied:
 - Parallel to ribbons
 - Perpendicular to ribbons

Local electrical parameters before bending test

Local electrical parameters of a PV module loaded in bending

Detection of cell break by DIV monitoring

Local electrical parameters after bending test

Global efficiency:

- Before break: 18,2%
- After break: 17,1%

Evaluation of the method's reliability

- Consideration of simulated series resistance under illumination
- Simulated curve is more reliable than the superposition principle based curve.

CONCLUSION

- Improvement and use of a method for the electrical analysis of a module at local level
- Enables the physical cause of a fault to be determined: electrical or not? And if electrical, caused by diffusion, recombination, shunt, series resistance?

PERSPECTIVES

- Application of the method to support the development of new cells, interconnections or module technologies.
- May be used for the monitoring of electrical defects for various ageing tests.