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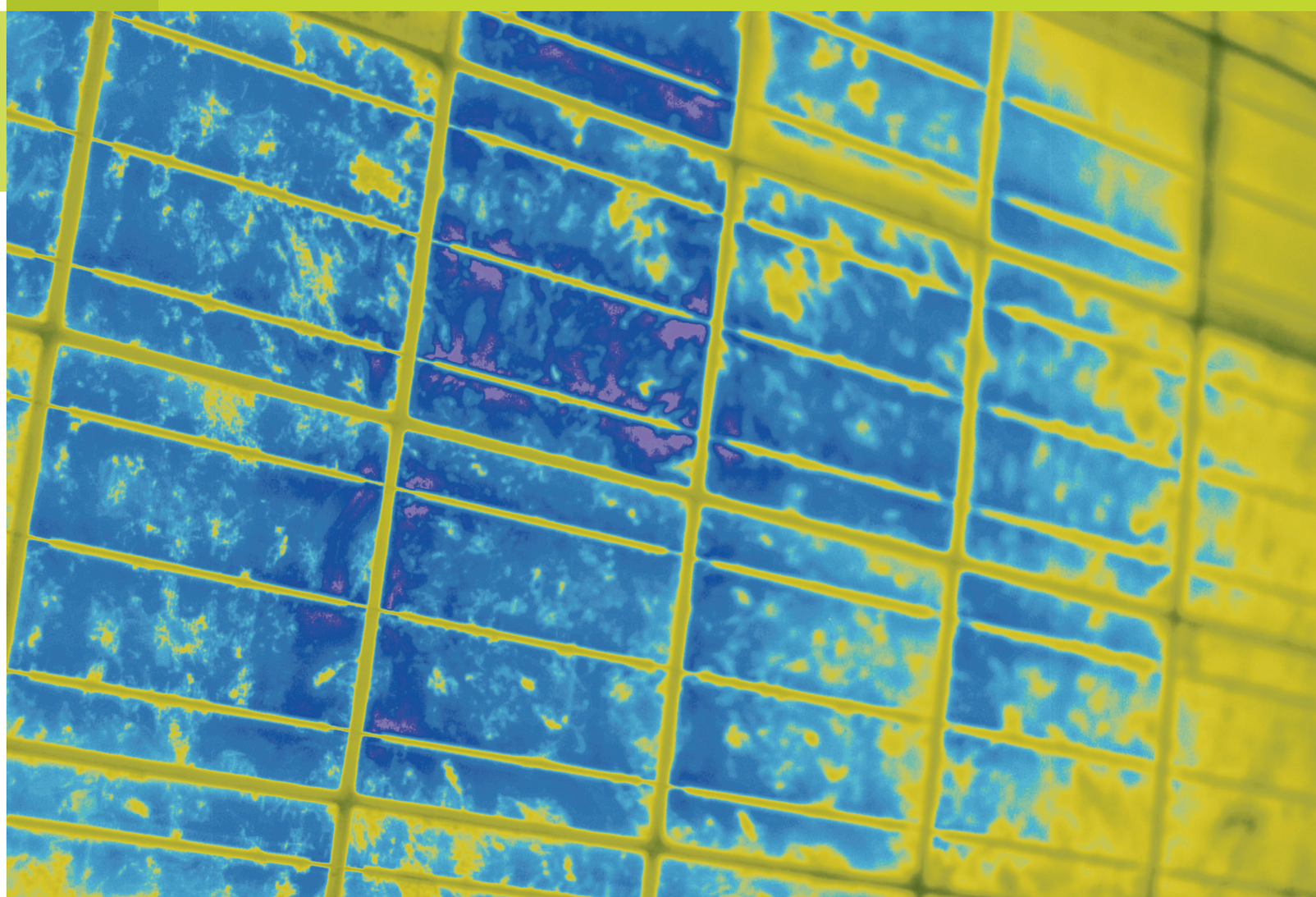
DISCOVER WHAT THE EYE CAN‘T SEE

I|01

LumiSolarOutdoor System

Electroluminescence (EL) Inspection of Solar Modules directly on-site



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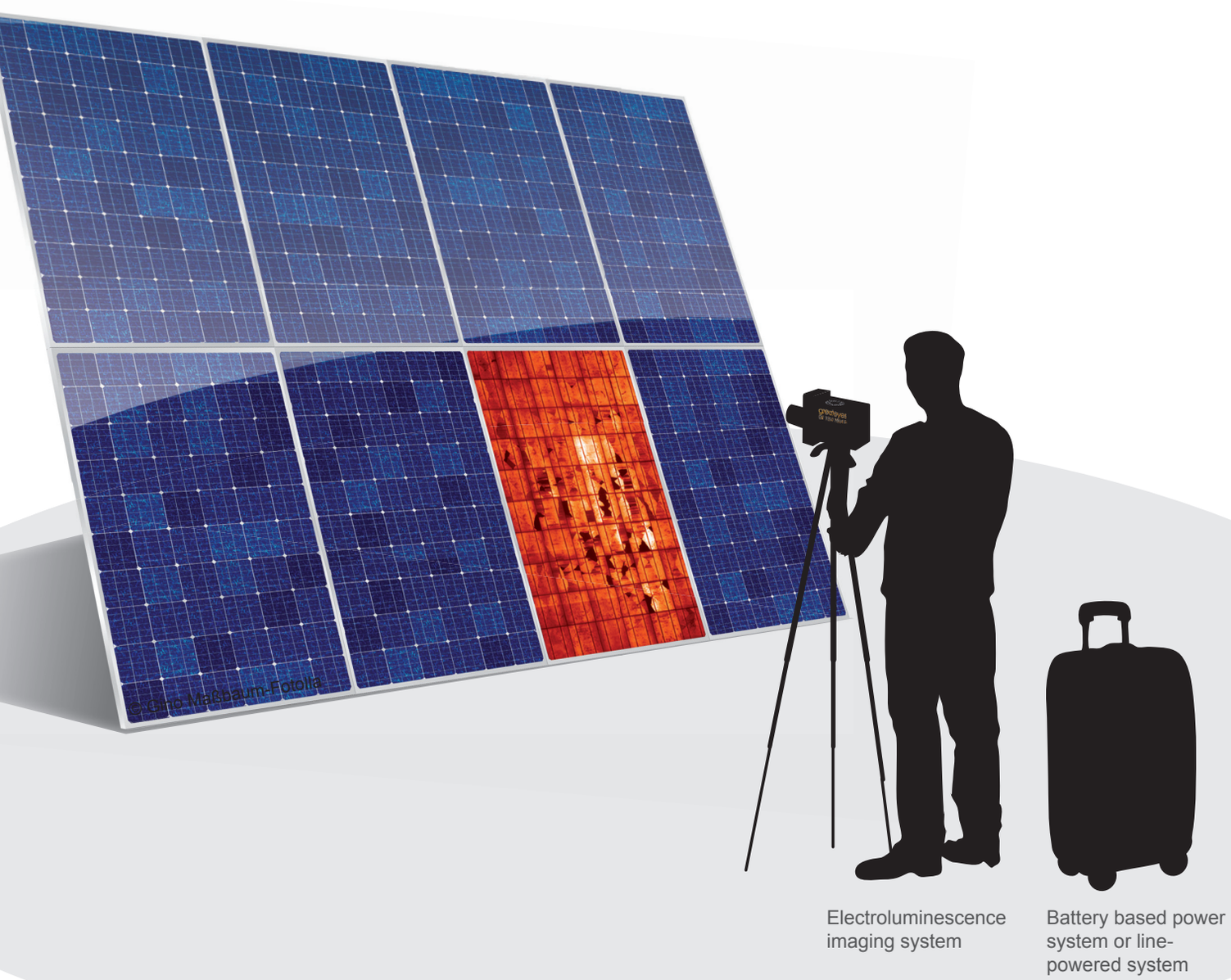


Schematic measurement set-up

The award-winning [1] LumiSolarOutdoor system enables to investigate the quality of solar modules on-site. Defects can be identified quickly. Modules don‘t need to be demounted from their substructure. Measurements can be performed directly in the solar park or at rooftop PV installation after twilight or during the night.

In contrast to other systems the LumiSolar-Outdoor system does not require a dark box or enclosure. It is the first system capable of performing measurements in the open air. This results in a cost and time saving method since modules don‘t need to be demounted. Moreover damages due to transportation are prevented.

There are two versions of the LumiSolar-Outdoor system available. A battery powered equipment enables to measure single solar modules without the need of an external power supply. A complete string of solar modules can be measured in a stepwise procedure using the line-powered Lumi-SolarOutdoor system if an external power supply is accessible.

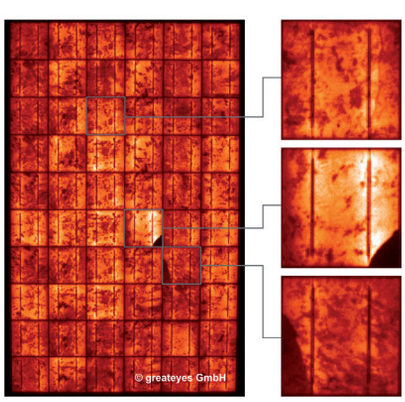
	Battery powered LumiSolarOutdoor	Line-powered LumiSolarOutdoor
Application	Electroluminescence inspection of single modules directly on-site	Electroluminescence inspection of strings directly on-site
Image size	1024 × 1024 pixel, 16 bit or 2048 × 2048 pixel, 16 bit	1024 × 1024 pixel, 16 bit or 2048 × 2048 pixel, 16 bit
Image output data	BMP, JPEG, TIFF, TXT, raw data	BMP, JPEG, TIFF, TXT, raw data
Measurement time	~2 sec for c-Si solar modules	~2 sec for c-Si solar modules
Min. distance camera↔module	0.5m	0.5m
Typ. distance camera↔module	3 - 5m	3 - 5m
Outdoor light conditions	Night sky, late twilight time	Night sky, late twilight time
Output power supply	0-100V / 0-7,5A / max. 750W	0-1200V / 0-8,5A / max. 10,2kW
Number of measurements	200-500 with single battery charge	not limited, line-powered operation
Total system weight	40kg	48kg

The battery based version of the Lumi-SolarOutdoor system does not need any external power supply. A battery generates the electricity to power single solar modules. Therefore an independent operation of the battery based version is possible.

The line-powered version is designed to measure strings of modules. The modules are biased by a remotely operated power supply. For this purpose an electric three-phase power is required. The line-powered version is designed for high throughput operation.

LumiSolarOutdoor Software

- Save, quicksave, load images
- Supported file formats: BMP, JPEG, TIFF, TXT, and raw data
- Single image mode, video mode
- Automatic background subtraction
- False-colour-representation of images
- Intensity slices in x, y direction
- Linear/logarithmic scaling
- Zoom functions / image viewer
- Remote control of module power supply



[1] The LumiSolarOutdoor system was awarded the 3rd prize - Innovation Award 2012 at the Bad Staffelstein Photovoltaic Symposium.

Features of the LumiSolarOutdoor System

Inspection capabilities:	Micro-Crack identification | Shunt detection | Finger defects | Dead cells | Broken cells | Inhomogeneities and impurities | partially hot spots
Areas of application:	Pre-delivery inspection at the manufacturer | Receiving/pre-delivery control at the retail company | Final inspection before installation of solar modules | Documentation purposes | Acceptance tests | Direct inspection of modules in the solar park | Inspection of rooftop PV installations | Failure analysis of defect solar modules
Advantages of the system:	No need to demount solar modules (save time & cost) | Direct outdoor measurements possible | Excellent sensitivity and image quality | Quick measurements (~2 sec for c-Si solar modules) | No dark box or cover needed | Mobile solution, no transport vehicles needed | Battery based system allows independent operation | Measurements of whole strings with the line-powered system | Flexible solution for indoor and outdoor usage
Successfully tested on various solar module types:	Monocrystalline silicon (mono-Si) | Polycrystalline silicon (poly-Si) | Amorphous silicon (a-Si) | Copper indium sulfide (CIS) | Copper indium gallium selenide (CIGS) | Cadmium telluride (CdTe) | Heterojunction with intrinsic thin layer (HIT)

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