

# Portable LED Flasher

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## A Cost Effective Tool to Improve Quality of Field Tests

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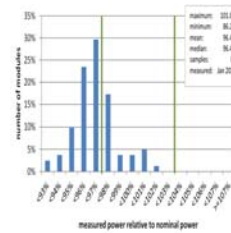
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## Approach: Portable LED Flasher in the field



## Market needs : individual Module Power Measurement

To confirm insufficient nominal power of a PV plant, the PV module manufacturer claims the **power measurement of each PV module!**

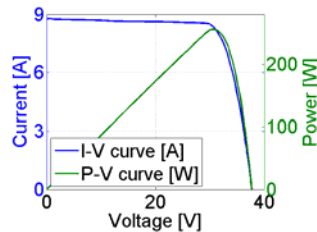
### State of the art solutions to measure low power performance:

1. Less kWh measured of a large set of PV Modules – by the use of PV inverter or standard electrical meter
2. Field-test of individual modules or strings (problems unstable outdoor sun irradiance, standard field tester incl. sensors > 5% uncertainty)
3. Colourful IR Images – individual module power data are still lacking
4. Certified nominal power measurements in indoor test labs:  
Problem:  
The measurement costs are higher than the price of the PV module  
Standard solution:  
small sample size taken but each PV module has to be dismantled.

## Specification / Performance of the Portable LED Flasher – Generation 2 in 2016

### Specification Generation 2

- Weight 32 kg (without battery)
- Size 1.1m x 2m
- 11 LED wavelengths used
- Flash time 10 to 200 ms
- Module temperature meas.
- By-pass diode test [1]
- Low light performance
- Off grid battery power supply



### Quality Data of Portable LED Flasher Generation 2

- Uniformity over time: 0.1%rms at 100ms; +/- 0.43%
- Uniformity over area: +/- 1.9%  
Class A
- Spectral Characteristics  
Class A (below 2%)

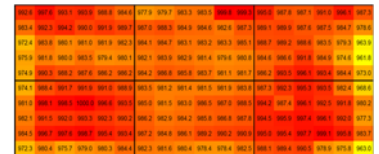
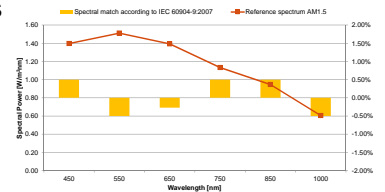


Fig. 2 Non uniformity @ 4" Si cell



## Methods "high sample numbers" in the PV plant

- Method 1 - Test all :** rack mounted PV Modules, flat roof
- Method 2 - Test all Modules of a string :** IR image as indication
- Method 3 -** combine the set of measurements with a small sample number tested at certified stationary PV Labs

- For smaller module sizes (CdTe) only 1/3 of LEDs are needed – they can be dismantled into 3 Mini Flashers !



## Results and Outlook

### Throughput of Generation 1

- Up to 400 PV Modules a day (costs <10€/m)
- Measurements at night possible

### Field Test of Generation 2

- will be performed in summer 2016 in Switzerland including reference measurements in certified PV Labs
- Gen 2 lower weight, higher throughput
- Uncertainty calculation will be conducted

## References / Collaboration / Funding

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[1] Schär, Daniel; Baumgartner, Franz. (2014). PORTABLE LED FLASHER WITH IMPLEMENTED BYPASS DIODE TESTER. 29th European Photovoltaic Solar Energy Conference and Exhibition (29th EUPVSEC) in Amsterdam

