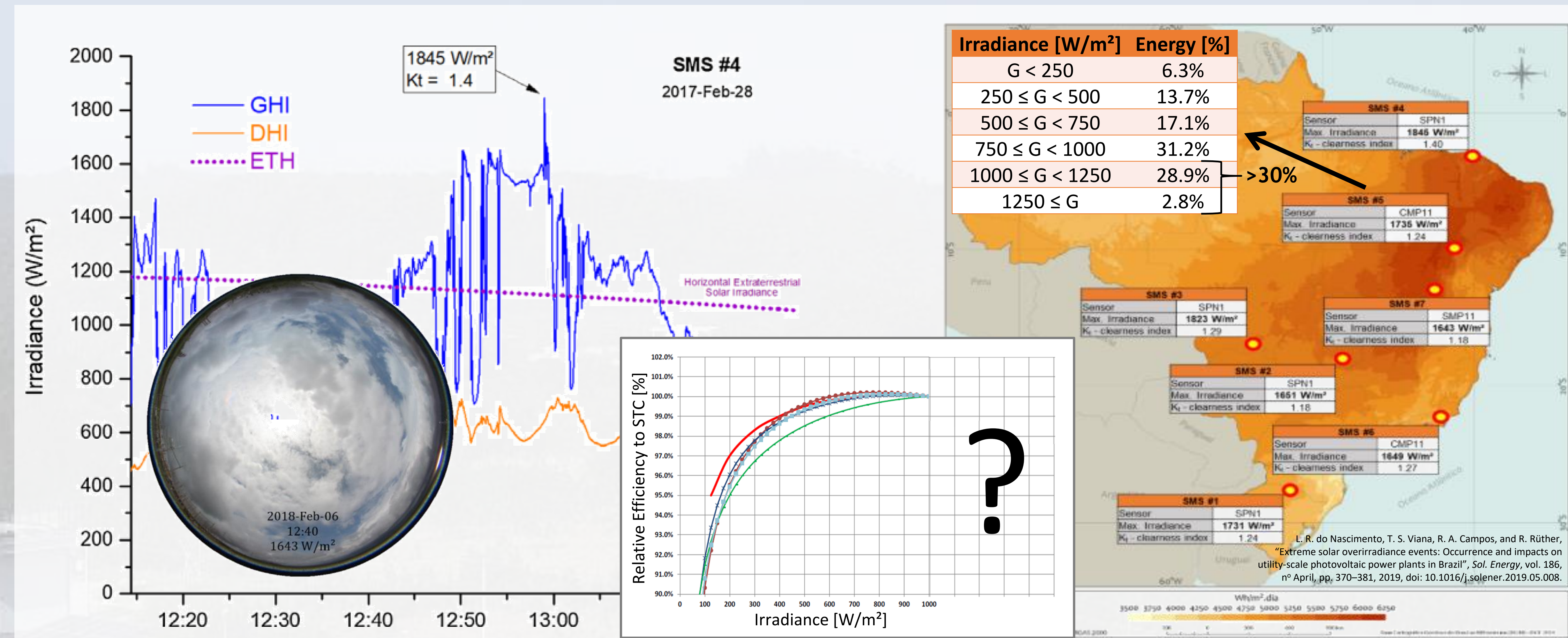


OVERIRRADIANCE UNVEILED: UNDERSTANDING AND ENHANCING SOLAR ENERGY PERFORMANCE

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OVERIRRADIANCE EVENTS

- Usually associated with cloud-edge effects, overirradiance (OI) events occur when ground irradiance levels surpass the incident extraterrestrial irradiance and are classified as extreme when exceed the solar constant value (1361.1 W/m^2).
- The highest irradiance value recorded in the literature at sea level (second highest overall) was registered in Florianópolis-SC, Brazil: 1845.5 W/m^2 .
- In certain regions of Brazil, more than 30% of all incident energy occurs at irradiance levels surpassing 1000 W/m^2 .
- These events have several impacts on a PV system:
 - Operation and Maintenance: Fuse-blowing occurrences due to high irradiance levels added to elevated device operating temperature.
 - System Performance: Underestimated inverter clipping losses calculated based on low temporal resolution irradiance data.
 - Device Performance: The efficiency and degradation of PV devices under irradiances above STC (1000 W/m^2) remains relatively unexplored.



PROJECT OVERVIEW AND PRELIMINARY RESULTS

- R&D project aiming to evaluate and optimize performance of PV devices under Brazilian climatic conditions, with a focus on OI events.
- The site is located at the Fotovoltaica-UFSC research lab (www.fotovoltaica.ufsc.br) in Florianópolis-SC (27°S , 48°W) in the south of Brazil. The Köppen-Geiger climate classification for the location is humid subtropical (Cfa).
- The PV devices under evaluation include commercially available PV modules from various cell technologies and manufacturers, as well as custom-made perovskite devices tailored specifically for the project.
- Outdoor capability encompasses automatic IV curve measurements taken every minute, with an additional trigger for OI events. It also includes monitoring device temperature, irradiance, and spectral measurements, along with a range of ambient sensors.
- The indoor lab is equipped with electroluminescence imaging and a solar simulator capable of reaching high irradiance levels. This LED-based solar simulator offers a range of spectral distributions and provides continuous illumination for extended testing periods.

