Flash Measurement System for the 250 – 2100 nm Wavelength Range

J. Blanke and G. Mathe
Instrument Systems GmbH, Munich, Germany

Modern flash lamp systems are extensively used by manufacturers of solar panels for quality assurance as well as research and development issues. Demands on the state-of-the-art solar panels for terrestrial and space applications are very high. Therefore a reliable characterization and calibration of the test equipment on a regular basis is essential. The measurement of the spectral irradiance of flash lamp systems has evolved to an important application.

A solar-like spectral distribution (AM1.0, AM1.5) with total irradiance levels of one or multiple solar constants (1 SC = 1371 W/m^2) and perfect homogeneity over areas of several square meters is required to test large panels. A realization with steady-state solar simulators is difficult. Therefore solar simulators equipped with flash tubes are used to irradiate the solar panels.

The spectrum varies during the rising and falling flanks of the flash signal. A fast and reliable shutter controlled by electronic timers is needed to limit the "effective" flash measurement time to the stable plateau only.

Figure 1 shows a time resolved flash measurement as an example: A steep rising of the irradiance followed by a stabilization period within the first roughly 500 µs. The stable plateau typically lasts from one to ten milliseconds.

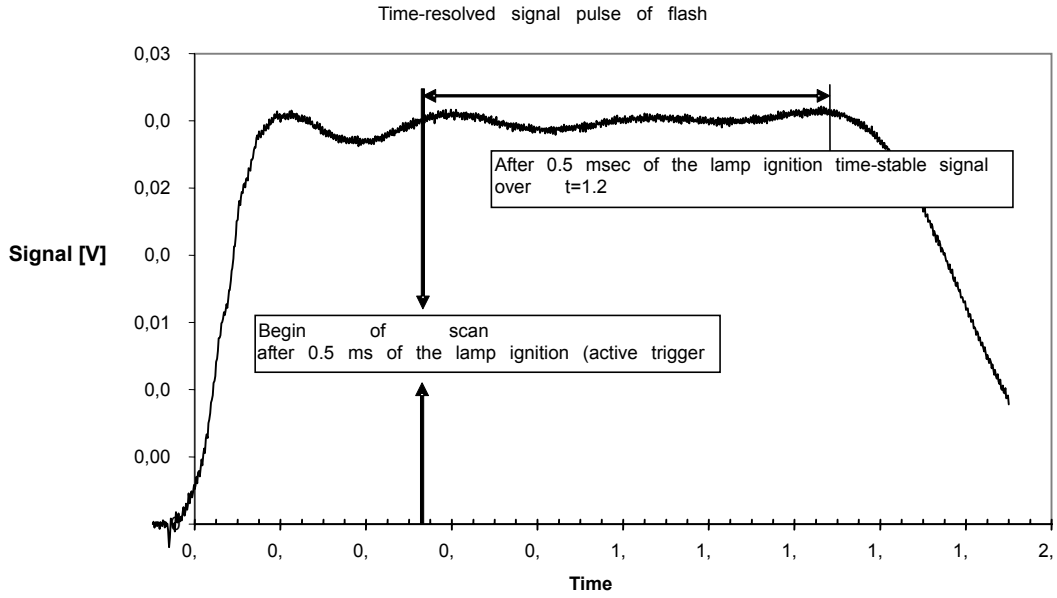

Figure 1. Flash measurement of a solar simulator. A stable plateau is reached about 0.5 ms after the lamp ignition.

Array spectroradiometers are ideal for measuring these types of light sources.

In contrast to scanning spectrometers a broad spectral range can be captured simultaneously and within a few milliseconds. However, a single array spectrometer is not able to measure the whole solar spectrum with a sufficient spectral resolution. Therefore a setup with three different array spectrometers that are connected to a single optical probe via a trifurcated fiber bundle has been developed by Instrument Systems Germany.

Figure 2 describes the setup schematically. The UV/VIS spectrometer covers a wavelength range between 200 nm and 850 nm, the IR1 model is equipped with an InGaAs array and can be used from 800 nm to 1650 nm. The IR2 model makes use of an extended InGaAs array offering a spectral range from 1400 nm to 2150 nm.

The flash measurement system is able to measure the spectral irradiance of a minimum 1ms flash plateau from 200nm up to 2150nm and the sensitivity ranges from ~ 1–20 solar constants (1.4 - 28 kW/m^2). The software controls high speed triggering and prepares the data for evaluation.

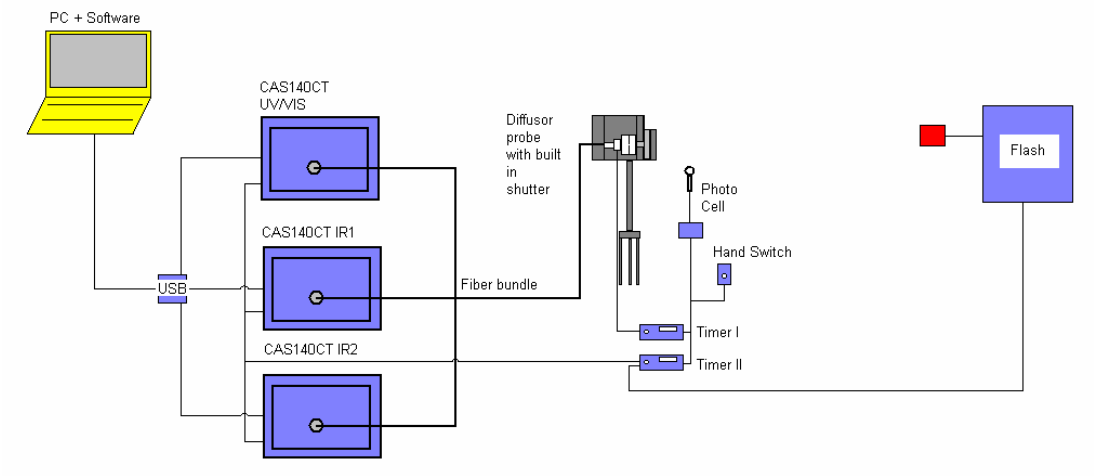

Figure 2. Layout of the measurement setup. The system can be triggered either by actively triggering the flash or by the signal of a photocell.

References

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