

Comparison of Measurements of Spectral Irradiance (UV/VIS) by an International Round Robin Test

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Abstract

In metrology it is often difficult to estimate the uncertainty of measurement. In highly sophisticated and complex technical measurements the uncertainty budget is based on elaborate but mostly pure theoretical work or on poor statistical data. A well established method to substantiate theoretical considerations is to arrange an interlaboratory comparison or a Round Robin test.

A round robin of spectral irradiance measurements was coordinated by a laboratory for photometric and radiometric measurements (ATLAS, Germany) in which ten well established laboratories (some accredited) commercial companies and non-profit institutes took part.

The ISO/IEC guide 43 deals with the organization and evaluation of such kinds of comparison. But due to the small number of participating laboratories the test was done without abiding by all rules and guidelines. However, the procedures were harmonized with all the participants.

The comparisons consisted of measurements of absolute spectral irradiance between 250 nm and 800 nm with the focus on the UV range. It was decided to measure two different kinds of light sources. One was a 1000 W halogen lamp (GE Q1000CL/4CL) as an ex-

ample for an "easy" DC device (temperature radiator), often used as a source for calibration. This device had to be replaced during the test by an Ushio lamp (also 1000 W) due to accidental breakage. The second source was a 1500 W Xenon arc lamp (Heraeus NXe1500A driven in a Suntest CPS weathering device), as an example of an AC source with spectral emission lines and other measurement challenges. Both lamp types were measured first without any spectral filter in the light path and then with a WG280 and a WG335 as well. The Suntest device was operated with a line frequency of 50 Hz or 60 Hz depending on the location/country of the lab, because it is driven unregulated thus the lamp power depends on the line frequency by the inductive reactance of the ballast. If possible both frequencies were to be measured.

It should be mentioned that the participants not measured their individual lamps but received the same one after the other. In addition to the lamps most of the auxiliary equipment (optical benches, diaphragms, ampere and voltmeters, photometer, filters etc.) was also included in the measurement package. Thus all labs worked with the same kit. The only devices which had to be supplied by each participating lab were a voltage stabilizer and a spectrometer.

The measured spectra are kept anonymous for publication. A comparison was performed for all spectra and all different lamps and/or measuring conditions. All results were discussed concerning the aspect of the budget of the uncertainty of measurement with concentration on UV range.

The results will give an overview of the deviation of absolute spectral irradiance measurements in professional labs which are not part of national or international institutes of metrology (such as PTB, NIST, NPL, etc).

Remarks

The comparison was not completed by the deadline of this (abstract) publication. Thus the final list of participants could not be provided. The full set will be given at the conference.

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