Consultative Committee for Photometry and Radiometry (CCPR)
23rd Meeting (22 - 23 September 2016)

Questionnaire on activities in radiometry and photometry

Reply from: Inmetro

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1. Summarize the progress in your laboratory in realizing top-level standards of:
   (a) broad-band radiometric quantities
   (b) spectral radiometric quantities
   (c) photometric quantities

Inmetro is extending the traceability of the cryogenic radiometer calibration of Si trap detectors at Ar^+ and HeNe lasers wavelength by modelling the internal quantum efficiency. The method was applied to a PTB calibrated detector showing good agreement using the normalized error criterion from 400 nm up to 900 nm, near the bandgap of the detector. The results were published in the *IEEE Transactions on Instrumentation and Measurement*, p. 1702-1708, 2015 [1]. Additionally, we are extending the scale further into IR, up to 1030 nm, using a characterized pyroelectric radiometer to assist the calibration of the Si trap detector (Figure 1).

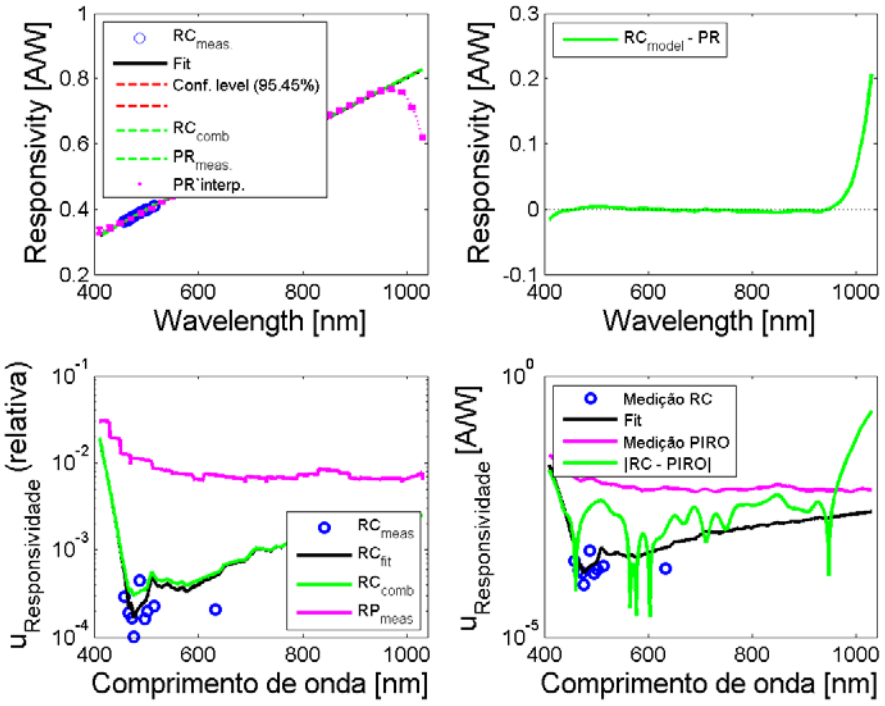

Fig. 1 – Comparison of responsivity results of trap detectors modeled from cryogenic radiometer measurements and obtained using a pyroelectric radiometer.

The absolute power scale of the cryogenic radiometer is supported by a bilateral comparison performed with NIST, which report is currently in draft B stage (results also described in reference [4]).

In the UV range, Inmetro has been working in the construction and characterization of UV radiometers [6-8]. This activity involves the selection of suitable detectors and filters, ageing, measurement of spectral responsivity as well as determination of parameters of the assembled radiometer.
We have also been working in the development of the spectral irradiance scale of tungsten halogen lamps in the VIS range using filter radiometer [9,10].

Regarding spectrally integrated quantities, we are characterizing a goniospectroradiometer for measurement of properties of SSL devices. This is a new automated setup which aims the replacement of the previous instrument reported in [11].

We extended the functionality of our setup for the measurement of angle of rotation the polarization of quartz plates to liquids [12].

2. What other work has taken place in your laboratory in scientific or technological areas relevant to the CCPR?

Research in the area of single photon detectors, quantum communication in optical fibres, metrology of fibres and optical components [16,21];
Research in optical coherence tomography application in the detection of precursor cancer lesions.
Inmetro participated in the round-robin of the project Newstar by measuring a PQED detector last May.
Inmetro is supposed to participate in the round-robin of the EMRP project Mesail (Metrology for Efficient and Safe Innovative Lighting).
Spectral irradiance measurements in the UV range – Cooperation between Inmetro, PTB, INTI;

3. What work in PR has been/will be terminated in your laboratory, if any, in the past /future few years? Please provide the name of the institution if it has been/will be substituted by a DI or accredited laboratory.

   No activity related to the CCPR will be terminated.

4. What are present, new or emerging needs of users of your services that are not being supported sufficiently by current CCPR activities or initiatives? In the light of this information please suggest desirable changes in the future working program of the CCPR.

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5. What priorities do you suggest for new research and development programmes at NMIs in the area of Photometry and Radiometry?

   Traceability to the measurement of efficiency of PV modules and other quantities related to the field.

   LED measurements.

   Health and life science.

6. Are there any research projects where you might be looking for collaborators from other NMIs or are there studies that might be suitable for collaboration or coordination between NMIs?

   Solar energy measurements – There is already an institutional cooperation with PTB in the field of renewable energy sources. Inside the Optics Division, the aim is to address traceability for PV modules testing.

7. Have you got any other information to place before the CCPR in advance of its next meeting?

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8. Bibliography of radiometry and photometry papers of your laboratory since the last CCPR (September 2014)?

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[2] T. Menegotto, T. Ferreira da Silva, M. Simões, W. A. Sousa, e G. Borghi , "Characterization of Radiometric Transfer Standards based on Silicon Trap Detectors," 2014 Conference on Precision Electromagnetic Measurements (CPEM 2014), 24-29 de agosto de 2014;

[3] Luciana Alves, "Characterization of Photodiodes in the Visible Spectral Region," Conference on Precision Electromagnetic Measurements (CPEM 2014), 24-29 de agosto de 2014;

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[6] L. C. Alves, T. Menegotto, T. Ferreira da Silva, J.S. P. M. Corrêa, e I. F. Duarte, "Development and Characterization of Broadband UVA and UVB Radiometers", 12th International Conference on New Developments and Applications in Optical Radiometry (NEWRAD 2014), Espoo/Finlandia, 24-27 de junho de 2014.

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[8] Luciana C Alves, Carla T Coelho, Jaqueline S P M Corrêa, Thiago Menegotto, Thiago Ferreira da Silva, Muriel Aparecida de Souza, Elisama Melo da Silva, Maurício S. de Lima and Ana Paula Dornelles de Alvarenga, Characterisation of optical filters for broadband UVA radiometer, IOP Publishing Journal of Physics: Conference Series, 733, 012062, 2016;

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[11] C L M Costa, R R Vieira, R C Pereira, P V M Silva, I A A Oliveira, A S Sardinha, D D Viana, A H Barbosa, L P Souza and A D Alvarenga, Colorimetric characterization of LED luminaires, Journal of Physics: Conference Series 575, 012018, 2015.

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