Consultative Committee for Photometry and Radiometry (CCPR)

24th Meeting (19 - 20 September 2019)

Questionnaire on activities in radiometry and photometry

Reply from: VTT MIKES

Delegate: Erkki Ikonen

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

Answers to questions 1) and 2) are highlighted below and their relation to the indicated EMPIR projects is also specified by the project abbreviation. These are results where many project partners have contributed and the references in the bibliography in point 8) give a more complete description of some of the results.

PhotoLED: This project has developed LED standard lamps to be used in photometric calibrations and comparisons in order to allow lower measurement uncertainty at NMIs and at test laboratories. Also, a reference spectrum for photometric calibrations has been proposed to CIE within this project. Furthermore, a fisheye camera method for angular non-uniformity correction of integrating spheres in luminous flux measurements has been developed and validated. The new method allows lower uncertainty, lower costs, and easier measurement as compared with earlier methods based on goniophotometers.

Siqust: The MIKES contribution to this project uses a predictable single-photon source based on a silicon vacancy centre in a nano diamond, which is optically excited by a pulsed laser. By changing the repetition rate of the pulsed laser, we are able to reduce in a controlled manner the photon flux of the single-photon source. This project aims also for further development of the Predictable Quantum Efficient Detector (PQED) for measurement of low optical flux.

MIKES and/or Aalto University participate in the following EMPIR projects in the technological areas relevant to the CCPR:

- **PhotoLED:** Future photometry based on solid state lighting products (2016-2019)
- Advanced PV energy rating (2017–2020)
- Metrology for Earth observation and climate III (2017–2020)
- Towards documentary standards for BRDF based quantities (2017–2020)

- Pavement surface characterization for smart and efficient road lighting (2017–2020)
- Improvement of emissivity measurements on reflective insulation materials (2017–2020)
- **Siqust:** Single-photon sources as new quantum standards (2018–2021)
- Self-calibrating photodiodes for the radiometric linkage to fundamental constants (2019–2022)
- New quantities for the measurement of appearance (2019–2022)

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.

   reply

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.

   reply

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

   reply

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?

   reply

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

   reply

8. Bibliography of radiometry and photometry papers of your laboratory since the last CCPR (September 2016)?

   Refereed journal publications

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A. Kokka, T. Pulli, T. Poikonen, J. Askola and E. Ikonen, "Fisheye camera method for spatial non-uniformity corrections in luminous flux measurements with integrating spheres," Metrologia **54**, 577–583 (2017).

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