Questionnaire on activities in radiometry and photometry

Reply from: MIKES

Delegate: Erkki Ikonen

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 EMRP 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.

**Newstar:** This project aims for further development of the Predictable Quantum Efficient Detector (PQED). A new process of producing n type PQED photodiodes instead of the earlier p type photodiodes has been studied. Preliminary results of the n type photodiodes indicate that for the first time independent 3D modelling of the photodiode responsivity is in agreement with the independently measured responsivity. Another significant result is that the earlier p type photodiodes produced in 2010 still have the same responsivity within 100 ppm as six years ago. This is at least ten times slower aging rate than that of trap detectors built from Hamamatsu photodiodes.

**Siqute:** The MIKES contribution to this project developed a predictable single-photon source based on a silicon vacancy centre in a nano diamond which is optically excited by a pulsed laser. At an excitation rate of 70 million pulses per second, the source delivers a photon flux large enough to be measured by a sensitive analog-mode silicon detector. By changing the repetition rate of the pulsed laser, we are able to reduce in a controlled manner the photon flux of our single-photon source.

**XDreflect:** The angular profiles of emission and reflectance of fluorescent surfaces have been shown to deviate from Lambertian behaviour, however, in industry and calibration facilities single geometry measurements are often used, which requires assumptions to be made on the angular distributions. In the MIKES contribution to this project, a novel material was developed which demonstrates more Lambertian emission and reflectance profiles than conventional polytetrafluoroethylene based materials and a smaller dependence of angular reflectance on the absorbance of the sample.
PhotoLED: This project aims to develop LED standard lamps to be used in photometric calibrations and comparisons in order to allow lower measurement uncertainty at NMIs and at test laboratories. One of the early achievements is the promising result on testing a fisheye camera for angular non-uniformity correction of integrating spheres in luminous flux measurements. The new method promises lower uncertainty, lower costs, and easier measurement as compared with earlier methods based on goniophotometers.

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

- **Newstar:** New primary standards and traceability for radiometry (2013–2016)
- **Siqute:** Single-photon sources for quantum technologies (2013–2016)
- **XDreflect:** Multidimensional reflectometry for industry (2013–2016)
- **Traceability for atmospheric total column ozone** (2014–2017)
- **Metrology for Earth observation and climate II** (2014–2017)
- **Metrology for III-V materials based high efficiency multi-junction solar cells** (2014–2017)
- **traceable characterisation of thin-film materials for energy applications** (2014–2017)
- **Towards an energy-based parameter for photovoltaic classification** (2014–2017)
- **Metrology for efficient and safe innovative lighting** (2014–2017)
- **Metrology for the photonics industry – optical fibres, waveguides and applications** (2015–2018)
- **PhotoLED:** Future photometry based on solid state lighting products (2016–2019)

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.

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.

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

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?

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

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


Consultative Committee for Photometry and Radiometry (CCPR)

23rd Meeting (22 - 23 September 2016)


Conference papers


