CCPR WG-SP TG-12
Survey report
- TG12 questionnaire 2018 -

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History of TG-12

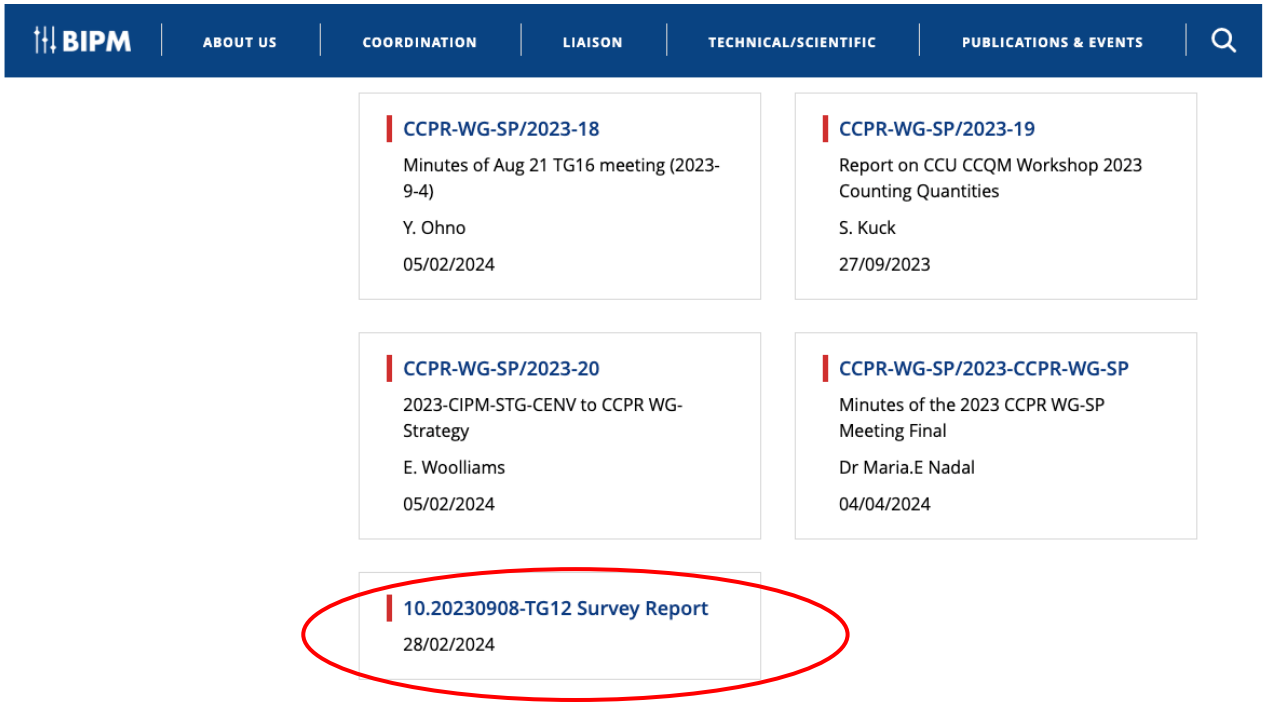
- 2015 (WG-SP/ Beijing)
  - TG12 was established.
- September 2016 (WG-SP/ Sèvres)
  - Action point was given to carry out a survey of activity in NMIs and to identify priorities for future work of the TG.
- July 2018
  - Questionnaire 2018 was distributed to TG12 members by Tatsuya Zama (former TG12 chair).
- September 2019 (WG-SP/ Sèvres)
  - WG-SP agreed to appoint Hiroshi Shitomi as a new TG-12 chair.
- November 2020
  - First draft survey report
- December 2021
  - Follow-up survey
- September 2023 (WG-SP/ Teddington)
  - Survey report was distributed to TG12 members for review.

TG-12 questionnaire 2018

- Q.1:
  What kinds of activity do you have regarding LED sources for photometry?
- Q.2:
  What kind of LED light source is preferable for your purpose?
- Q.3:
  Do/Did you collaborate or do you plan to collaborate with LED manufacturer?
- Q.4:
  Do/Did you collaborate or do you plan to collaborate with other organization (university, research institute or manufacturer association and so on) except for LED manufacturer?

Answers to the questionnaire (2018)

- (10) NMIs replied to the questionnaire from 2018 to 2021.
- All the collected answers are organized into a list and summarized in the survey report. (20230908-TG12 Survey report.pdf)



Highlighted research topics relevant to CCPR

- **Research activity relevant to LED photometry**

1. Development of LED-based standard sources for calibration of various types of LEDs

2. Development of LED standard sources as a replacement of traditional tungsten filament-based standard lamps

3. Evaluation of optical properties of LEDs in terms of energy efficiency as well as physiological and photobiological aspect

4. Involvement in a new technology area such as micro-LEDs

Expected properties of LED-based standard sources

- **LED-based photometric standard sources**

1. Versatility for many applications (e.g. dynamic range, spectrally tunable)
2. Universal specifications for common parts such as an electric connector
3. LED standard sources suitable for photometry (e.g. LED reference spectrum)
4. LED standard sources suitable for spectroradiometry (e.g. spectral flatness)
5. Spectral extension to the outside of visible region (e.g. UV LEDs and IR LEDs)

External collaboration

- **Collaboration with LED manufactures**
  - Some LED manufacturers and luminaire manufacturers have close collaboration to NMI(s).
    1. cross validation and characterization of sample LEDs
    2. joint develop of specially-designed LEDs
    3. joint research aiming for standardization (e.g. new LED quality indices)
- **Collaboration with other stakeholders**
  - Various type of collaboration frameworks
    1. international framework (e.g. IEA 4E SSL Annex, CIE)
    2. regional research consortium (e.g. EMPIR)
    3. national (domestic) research project with universities and other research institutes

Summary of the questionnaire (2018)

- Many NMIs are highly active in the research about LED photometry and relevant measurement technology to provide the measurement basis.
- Some NMIs are trying to develop standard LED sources to be the best candidate for the replacement of conventional tungsten filament-based standard sources.
- Several types of standard LEDs have developed as a prototype or a regular product as outcomes of research cooperation with industry as well as joint research program etc.

Technical discussions

- LED-based photometry
  - Calibration system suitable for LEDs (e.g. CIE L41)
  - Required performance for LED standard sources as replacement of tungsten filament-based standard sources
    - long-term stability
    - Sustainability
    - Spectral properties
  - The best use of LED-based instrumentation for calibration
- Emerging needs
  - Spectral extention from UV to IR
    - LED-based standard source for spectroradiometry
    - UV-C radiometry
    - Non-visual effect
- Metrological consideration
  - Maintenance and update of CMCs
  - Uncertainty evaluation (e.g. correlated of spectral data)

Candidate discussion items for TG12

1. Monitoring progress and technical discussion on practical implementation of the LED reference spectrum (L41) for photometer calibration
2. Monitoring progress and technical discussion on development of LED-based standard sources as a replacement of traditional standard incandescent lamps
3. Future research strategy to address the issue on the replacement of traditional tungsten-based standard sources especially for UV and IR region
4. To find out attracting topics for industry that leads to promote intensive collaboration with manufacturers on the use of LEDs in photometry
5. Discussion about metrological aspects to supplement the emerging LED-based applications (e.g. UV-C disinfection)
6. Discussion about future metrological system in terms of maintenance, update of CMCs, and uncertainty estimation under the situation mainly using LED-based standard sources