Comité Consultatif de Photométrie et Radiométrie (CCPR)
Minutes of the 17th meeting of Working Group on Strategic Planning (WG-SP)
NPL, London, with online participation
Friday, 8 September 2023
(2 pm to 6 pm)

Attendees:

Codes for participation mode: (i) in person; (o) online

CCPR Officials

Maria Nadal, WG-SP Chair (i)
Joële Viallon, BIPM, CCPR Executive Secretary (o)
Maria Luisa Rastello, CIPM, CCPR President (o)
Haiyong Gang, WG-KC Chair (o)
Marek Smíd, CCPR-WG-CMC chair (i)

CCPR-WG-SP members

Giorgio Brida, INRIM (o)
Joaquin Campos Acosta, CSIC, EURAMET, (i)
Dong-Hoon Lee, KRISS, (i)
Seondo Lim, KRISS, (i)
Gael Obein, LNE (i)
Jimmy Dubard, LNE (o)
Peter Blattner, METAS (i)
Annette Koo, MSL, (i)
Neil Swift, MSL, (i)
Catherine Cooksey, NIST, (i)
Howard Yoon, NIST, (i)
John Lehman, NIST (i)
Yoshi Ohno, NIST (o)
Yuqin Zong, NIST (o)
Hiroshi Shitomi, NMIJ/AIST (i)
Rheinhardt Sieberhagen, NMSIA (o)
Emma Woolliams, NPL (i)
Martin Dury, NPL (i)
Mira Naftali, NPL (i)
Nigel Fox, NPL (i)
Teresa Goodman, NPL (o)
Andrea Peruzzi, NRC (o)
Andrew Todd, NRC (o)
Angela Gamouras, NRC (i)
Arnold Gaertner, NRC (o)
Jeongwan Jin, NRC (o)
Lilin Tay, NRC (o)
Liviu Ivanescu, NRC (o)
Luke Sandilands, NRC, (o)
Armin Sperling, PTB (o)
Stefan Kück, PTB, (i)
Jarle Gran, JV, (i)

Observers

Erkki Ikonen, MIKES (i)
Errol Atkinson, NMIA, (i)
Gilbert Wu, CMS-ITRI (o)
Juan Pablo Babaro, INTI, SIM (i)
Marek Smíd, CMI, (i)
Mohammad AlFohaid, SASO, GULFMET TC-PR Chair, (i)

Mohammad Almefi, SASO, (i)
Thiago Menegotto, INMETRO, SIM TC-PR Chair (o)

1. **Opening of the meeting**
   Maria Nadal opens the meeting and thanks NPL for the venue, welcomes all participants and invite each to introduce themselves starting by NMI alphabetic order from those participating in person and then online.

2. **Appointment of the recording secretary**
   Maria appoints Thiago Menegotto (TM) has rapporteur for this meeting.

3. **Introduction**
   Members
   INRIM (National Institute of Metrological Research/Istituto Nazionale di Ricerca Metrologica)
   IO-CSIC (Instituto de Optica 'Daza de Valdés')
   KRISS (Korea Research Institute of Standards and Science)
   LNE (Laboratoire National de Métrologie et d'Essais)
   METAS (Federal Institute of Metrology METAS)
   MSL (Measurement Standards Laboratory of New Zealand)
   NIST (National Institute of Standards and Technology, United States)
   NMIJ/AIST (National Metrology Institute of Japan, AIST)
   NMISA (National Metrology Institute of South Africa)
   NPL (National Physical Laboratory)
   NRC (National Research Council of Canada)
   PTB (Physikalisch-Technische Bundesanstalt)
   VSL (VSL Dutch Metrology Institute)

   CCPR officials
   See list of CCPR officials present on page 1

   Observers
   See list of Observers present on page 1 and 2

4. **Approval of agenda**
   Agenda was circulated by email on August 25, 2023. *(2023 CCPR WG-SP Agenda V5.pdf)*

   Agenda is approved without any comments.

5. **Approval of the minutes of the 2022 CCPR WG-SP meeting**
   Minutes available on the report of the 25th Meeting of the CCPR emailed on September 15, 2022 *(https://www.bipm.org/documents/20126/75089457/CCPR25.pdf/2b983f2b-8af9-1de9-0ee5-30f7f18f7fe6)*

   Minutes were considered approved as no comment were received.

(8) New WG-SP Business
Maria invites Peter Blattner to talk about the recently constituted formed TG on digitalization (this agenda item was pulled to the beginning after a request from the presenter).

a) TG15 - The Impact of Digitalization on Matters Related to the CCPR (Chair: Peter Blattner)

Peter presented slides showing the Term of Reference (ToR) and Goals for this new TG (https://www.bipm.org/en/committees/cc/ccpr/wg/ccpr-wg-sp-tg15)

The first TG meeting was on 2023/08/30. During this meeting, NMIs shared their work on Digital Calibration Certificates (DCC) and file formats for data.

Peter commented on some of BIPM effort on digitalization; KCDB has a digital interface (API), that can be accessed by machines and make the *mise en pratique* machine readable.

Peter asked to the attendants if there is need to turn documents like the "Principles Governing photometry" into machine readable documents. CIE has also recently launched the data tables present in technical reports as metadata available on the website. Peter asked about the formulas if this would be useful to turn into digital. Emma Woolliams commented that some of the notation used in the document might be misinterpreted by machines.

Maria Luisa Rastello said she understands the technical problems, but she considers this as an opportunity to a better and wider use of photometric quantities. Peter commented that other organization including ISO and IEC are investigating how to make their documents machine readable.

Peter was asked by the BIPM to provide support in the conversion of photometry and radiometry quantities in term of codes formed by four letters. There are many problems with this assignment like difficult quantities to define in terms of others, such as transmittance, also with the definition of responsivity, where there are different ways to relate to other quantities, so that there is no single option (it could be A/W, V/W or reading/W). Emma Woolliams mentioned that for the area of Earth observation this is also difficult where there are similar quantities to the ones used in the field of radiometry. In the CIPM, there will be a horizontal forum dealing with matters of digitalization. Maria Luisa will probably have more information within one month, after the CIPM meeting.

Stefan Kück asked about the coordination of the activities and Peter commented that the community is still discussing and deciding how the activities will be deployed.

Maria Nadal commented this is a new TG and that if anyone would like to join, this is welcome. She also commented that volunteer would be welcome to filling in the Excel file mentioned previously by Peter (the one with codes for SI Reference Point). She also commented it would be a good idea to held this in close collaboration with WG-CMC.

Joële commented on the need to update the ToR on the website to better reflect what is being done. The ToR currently only mentions on monitoring. However, there are other activities being performed.
Peter agreed and mentioned he would prepare a revised text for the ToR. Maria thanked Peter for the comprehensive presentation.

AP-2023-01. Peter to provide a proposal of ToR that better reflect the activity of TG15.

6. **Reports of WG and TG Chairs and Matters Arising:**
Maria invites TG chairs to present their reports.

TG6: Discussion Forum on Fibre Optics (Jimmy Dubard)
Jimmy presented TG6 progress report *(SP TG6 Fibre Optics Report-2023.pdf)*. He gave a brief overview of the activities of the TG since 2010. There was a Workshop on Fibre Optics held on 2022/11/15, with focus on metrology needs in the field. He also gave a detailed overview of discussions and conclusions of the workshop for the different areas in the field of fibre optics, which can be found in the slides of the report.

Maria thanked Jimmy for the report and asked to the participants if there were questions.
Stefan Kück commented on some joint committees on communication technologies. He asked Jimmy if there was any interaction with standardization organizations?
Jimmy informed that, at least, Giorgio and Jacques had some interaction with IEC.

TG7: Discussion Forum on Few Photon Metrology (Dong-Hoon Lee – Angela Gamouras)

Dong-Hoon presented the TG7 progress report *(SP TG7 DF Few Photon Metrology Report_2023.pdf)*. He reported on the CIE Reportership DR 2-87 on terminology for few photon metrology, whose first draft circulation was delayed. The document is being prepared a technical note (TN), which will be freely available. Dong-Hoon added that NIST experts prepared and independent "single-photon dictionary" that contains more terms than the CIE TN. There was some work to harmonize both two documents.

He also mentioned the TG meeting on Seoul on November 2022 in which the change of TG chairmanship was proposed.

Dong-Hoon commented on the result of a survey with four questions asking the TG members to rate different dimensions of the field. The survey also asked to list major activities in standardization and the urgent needs for traceability at NMIs in this field. Five responses were collected. Based on the survey results, a list of important publications from the last three years and a list of important events in the field were included in the report.

Dong-Hoon is stepping down as the chair and Angela Gamouras is the new chair. Angela mentioned that she is now working with few photon metrology at NRC.

Maria thanked Dong-Hoon for the work and Angela for accepting to chair the TG.

AP-2023-02. Joële to update CCPR website to reflect the new chair.

TG8: Discussion Forum on THz Metrology (Andreas Steiger)

Mira Naftaly presented TG8 progress report on behalf of Andreas. Andreas is proposing a new Term of Reference (ToR) for TG8. The ToR would include the development of reference materials for THz time-domain spectroscopy non-destructive testing. Mira explained the need for materials with standardized reflectivity for THz, which is not trivial for this spectral region. Andreas is proposing to test a variety of materials and to perform a pilot study among the participants. The proposal is that the pilot study is conducted by 2025, after the artifacts for comparison are identified in 2024.

Maria asked if this was already proposed to the members of TG8?
Mira said it was. That everybody in the field would like to have such reference for reflectance.

Maria asked if there were any comments from members of TG8.
It was commented that TG8 has only four members, the other two NMIs being NPL and NIST.
Angela from NRC mentioned that she would like to become a member, but she will have to check with a collaborator.

Nigel Fox commented that it seems what is being proposed is a new task group because a new activity is being proposed, considering some need raised during the work of TG8. Maria agreed with Nigel, since TG8 is a discussion forum.
Dong-Hoon comment that something similar happened in the field of photon metrology when a new TG was formed to carry on a pilot study.
Joële added that the current ToR already does not seems appropriate for a discussion forum as they aim at performing a pilot study.

AP-2023-03. Andreas should propose a new task group for the aimed pilot study. This should go to all members so that they have opportunity to show interest in participating.
AP-2023-04. Andreas should revise the ToR of TG8 to make them more appropriate for a Discussion Forum.

TG9: OTDR length comparison (Jacques Morel)

Maria presented TG9 report on behalf of Jacques *(SP TG9 OTDR_2023.pdf)*. She reported three new CMC entries proposed to cover OTDR. These CMCs were already approved and published by WG-CMC: two for distance scale calibration and one for attenuation. After these CMCs were published, some comparisons

were realized to support the new entries (APMP-PR.S8 and AFRIMETS (which is still being organized, piloted by NIS, measurements should start in 2024)).

Nigel commented that the activity of this type of TG is typically to organize pilot studies, but not supplementary comparison which is an activity of RMOs. Maria added that all the technical work was done at RMO level, and that Jacques is just reporting.

TG10: CCPR Strategy Document (Maria Nadal)

Maria reported on TG10 activities *(SP TG10 Report_2023.pdf)*. She thanked current members and stated that new members are welcome.
She described that, in preparation for the revision of the strategic planning and roadmap, the CCPR conducted a survey in 2022 to gain knowledge on the metrological needs and priorities of the CCPR stakeholders. The survey had 33 questions, 24 NMIs responded among members and observers of CCPR. Results are summarized in *2022 CCPR Survey Summary Results.pdf*.

Maria presented the *CCPR Roadmap 2022-2032.pdf*. Some of the priorities areas already have ongoing activities, as the case of the TGs on digitalization and on cone fundamentals. For other priorities areas, the need for TG is still being evaluated (e.g., near field goniophotometry and UV metrology). Both documents will be available as part of the documents presented during the meeting.

TG11: Single Photon Radiometry (Stefan Kück)

Stefan reported on TG11 activities *(SP TG11 Single Photon Radiometry.pdf)*. He described the issues that delayed the progress of the pilot study, such as the pandemic period, when it was difficult to ship the detectors. There was also request for remeasuring the detectors and intermediate checks at PTB. The good news is that now the detectors have been traveling for eight years around the world with very stable responses.
There were new requests for measurements at MSL and AIST, which were agreed by the participants.
Stefan commented that reports marked as preliminary will be considered final if no response is received in the due time. Marek thanked PTB for the organization of the pilot study.

TG12: Discussion Forum on the Use of White LED Sources for Photometry (Hiroshi Shitomi)

Hiroshi Shitomi reported the progress of TG12 *(SP TG12 DF Use of White LED Sources for Photometry_2023.pdf).*

Member list of TG12 was updated before last CCPR meeting in 2021. TG12 has now a total of 24 experts.

Hiroshi commented on some issues that were pointed during last WG-SP meeting with respect to the survey report. It was pointed that some responses might have been overlooked. He rechecked the messages and did not find errors. He distributed on the day before the WG-SP meeting the report of the survey to TG members.

Hiroshi mentioned he cannot continue as chair (this was circulated before the meeting). He hopes that a new chair can be found to move forward with the activity.

Hiroshi displayed the survey report *(20230908-TG12 Survey Report.pdf)*. TG12 conducted a survey among members in 2018. The questionnaire was distributed by the previous TG chair. The questionnaire was composed of five questions about LED sources for photometry, which can be found in the report. Ten NMIs responded the questionnaire.
Hiroshi assign main issues with the use of white LED Sources: to find out a new photometric system suitable for LED (instrumentation, metrological standards). He commented that the extension of the scope should be considered CIE L41 (reference spectral distribution of LED), as well as a broader spectral region, encompassing for example the UV and IR.

Maria thanked the comprehensive summary and for all the years serving as chair of TG12. She commented a new chair is still to be found.

Armin thanked Hiroshi for the report on the survey. He noted also that the market lifetime of LED is very short compared to incandescent lamp types. This is because LEDs are constantly improving. If one tries to choose one LED type for realization of the candela. The LED can be phased out of market in a couple of years.
Yuqin Zong noted that the community may be more open minded to consider spectrometers as reference, which would mean a change from source to detector.
Marek commented this situation strengthen the detector-based traceability. However, this is not in the scope of the TG.

AP-2023-05. Joële to send an email to all CCPR members seeking a volunteer to chair TG 12

TG13: Optical fibre power responsivity (John Lehman)

John Lehman reports on the progress of TG13. *(SP TG13 Fibre Report.pdf and CCPR 2023 TG13 (fiber) presentation.pdf)*
He gave a brief overview of the activities and objectives of the TG. A pilot study was introduced in 2019 but delayed by the pandemic. He reported that Zeus (CENAM researcher) was at CMI and at NIST for measurements.
The trap detector type used in the comparison were developed about 20 year ago by NIST.
John went on describing the lessons learned from the measurement campaign. A summary is found in the presentation. Next step needs to be discussed. New trap detectors for the pilot study have been built and calibrated at NIST.
Martin Dury asked how the detectors of the pilot study were shipped.
Marek and John confirmed that Zeus carried them in the luggage.
Marek commented that at CMI this has been an opportunity to learn new things, however it has been challenging.
John commented that it is a very good radiometer, but there are several challenges at the level they want to do the measurements.
John will organize a new pilot study. A new call for participants will be sent.

AP-2023-06. John to send a new call should for participants of the pilot study for optical fibre responsivity.

TG 14: Discussion Forum on Improved 1 W Laser Power Responsivity (John Lehman)

John Lehman reported the progress of TG14, summarizing the activities done so far and the background motivation of the TG. *(SP TG14 DF Improved 1 W Laser Power Responsivity.pdf and CCPR 2023 TG14 (LIGO) presentation.pdf)*.
John commented on the PCAL sensor, which is an integrating sphere detector for 300 mW power.
NIST-PTB bilateral pilot study with results that will be presented at NEWRAD 2023. Currently NIST is doing calibrations for the LIGO observatory in the USA.

7. Report from BIPM/CIPM (Maria Luisa Rastello)

Maria Luisa presented a preview of her talk at the upcoming CIPM meeting in October, and she shared part of the questionnaire on CIPM2030+ strategy related to candela. *(Candela in the Wind for CIPM Questionnaire 2023.pdf and Questionnaire on CIPM203 Strategy V2 (2).pdf)*.

The strategy contains key scientific challenges. The redefinition of the candela is one of the key challenges. 23 NMIs responded they have in place program for the redefinition of the candela. This finding is surprising because she is no aware of NMIs programs for redefinition of the candela. She asked if anyone would like to explain how they responded to this question.

Dong-Hoon asked what the redefinition of the candela means.

Maria Luisa explained she did not participate in the preparation of the questionnaire. She had prepared a document on the key challenges for the candela. This was circulated among members of WG-SP. The key challenge point there in was the redefinition by the CIE of cone fundamentals. However, this will be subject of a workshop next year.

John commented that the candela may look different in the new SI.

Armin commented it may be not clear what is meant by redefinition. He added he is coordinating the project EMPIR mentioned by Maria Luisa. The project deals with how to implement spectral measurements within the realization and calibration scheme for NMIs. He mentioned that nearly no NMI deal with correlation in spectral data. He commented that someone may have understood that this (inclusion of spectral data correlation) as the redefinition of the candela.

Maria asked if the Maria Luisa if she had the timeframe when all results of the survey would be available. Maria Luisa informed that a second questionnaire was sent to the NMIs asking more details on the responses provided. She believes that she will have more details by the next CCPR meeting in 2024.

8. New WG-SP Business

Continuation…

b. TG16: Cone Fundamental-based Photometry (Yoshi Ohno)

Yoshi reported that the new TG was established in the beginning of the year (*TG16 Progress Report to WG-SP 2023.pdf*). He briefly overviewed the ToR.

The main task is to organize a Workshop that will be held in Paris in 2024. Members from CIE were invited to the TG (Tony Bergen – D2, Kaida Xiao – D1, Dong-Hoon – D2). Yoshi commented he may consider a few more members. Anyone interested could write him.

There was an online meeting on August 21, 2023 (all participants attended that meeting). *(Minutes of Aug 21 TG16 meeting (2023-9-4).pdf)*

He proceeded showing some slides with the history of the $V(\lambda)$. In 2024, it will be the 100-year anniversary of it. Yoshi went through two publications: CIE 170-1 (2006) and CIE 170-2 (2015). The first one defined the cone-fundamentals, and it is a big milestone. The second publication made possible applications. Yoshi put some points for discussion when comparing the colorimetric functions of 1931 and 2015 (cone fundamentals). He mentioned that all colorimetry is essentially based on 10° color-matching functions, while photometry still used 2° CMF.

He mentioned TC 1-98 of CIE on the roadmap toward basing CIE colorimetry on cone fundamentals. A document should be published in a few months. He also commented the Research Forum (RF) of CIE on the implementation of CIE 2006 Cone Fundamentals. This is open to a broad range of experts, including from outside the CIE. Tony Bergen is convener of the RF.

Yoshi mentioned it was agreed during first TG meeting a workshop for 2024. This will be likely on June 3, 2024. The workshop is called CCPR/CIE Joint Workshop – 100 years of $V(\lambda)$. It is hoped about 50 participants. The registration is expected to be free. Yoshi presented the essential ideas of the workshop. But this must be approved as well as to fix invited speakers.

Erkki commented that the proposed week conflicts with other Euramet activities and that the date should be changed. Maria Luisa informed that the room at BIPM was booked a long time ago. The data of the meeting cannot move. She will try to accommodate the agenda so that people can participate in the events. She asked for people to contact her with the details of the need. She also mentioned she is concerned about CCPR officers. Emma commented on the possibility to organize a room for remote participation from NPL, considering that the Euramet meeting will happen at NPL.

Maria thanked Yoshi for the comprehensive presentation.

No objection was raised regarding the organization of the workshop mentioned by Yoshi. It is considered approved.

Yoshi asked if one of the task group members could do a short announcement of the meeting during NEWRAD. Maria offered to do that. Yoshi will share information so that Maria could do the announcement.

DP-2023-01. Approved the realization of a joint workshop with CIE for the 100 years of the $V(\lambda)$. This will be held at the BIPM during CCPR meetings in 2024.

AP-2023-07. Maria to announce during NEWRAD the workshop on cone fundamental based photometry.

c. CCU/CCQM workshop on "The metrology of quantities which can be counted" as it relates to the Candela (Stefan Kück)

Maria introduced the agenda item informing that Stefan represented CCPR in the Workshop "The metrology of quantities which can be counted". Stefan reports on the 2023 CCU/CCQM workshop, providing an overview of his presentation on behalf of CCPR. *(Report on CCU CCQM Workshop 2023 Counting Quantities.pdf).* There is a new task group of CCU on angle and dimensionless quantities - Focus Group: Counting and number of quantities. Stefan is part of the TG.

Stefan gave an example of usage of mol for counting photons. Emma commented she also saw that kind of unit for vegetation measurement in the satellite community. John made a comment on how the quantity can be traced to the kibble balance at the level of one mol per seconds of photons. Peter commented that the usage of mol is that photobiologist considers the interaction between photons and molecules in living organisms.

d. Climate and Environmental Observations – update from Emma Woolliams

Emma prepared some slides on Metrology for climate and environmental observation *(2023-CIPM-STG-CENV to CCPR WG-Strategy.pdf)*. The workshop was held in September 2022 with over 1000 registrations. The report of the workshop and the presentations are available on the website www.bipmwmo22.org. 100 recommendations were drafted during the workshop.

There is a CIPM Sectorial Task Group on Climate Change and Environment, which was set up to look at how the recommendations get implemented. Emma is the liaison of CCPR to this TG.

The workplan is, among other things, develop input to the COP-28 (CIPM representatives should attend). Request to CCPR from the CIPM Sectorial TG: if a task group on metrology for satellite observation could be established. Emma also shown a proposal of ToR.

Emma suggested there should be a call for people interested who could discuss the ToR and discuss among themselves the right chairs.

AP-2023-08. Joële will put out a call for people interested in a task group on metrology for satellite observation.

AP-2023-09. The group of interest people should discuss the ToR proposed by Emma in her presentation.

9. Next meeting date: June 3 – 7, 2024

This was discussed previously in the meeting (8.b)

10. Closing of the meeting

All members congratulated Maria for her conduction of the meeting and WG-SP activities. Maria thanked all participants and closed the meeting.

11. Action Points

AP-2023-01. Peter Blattner to provide a proposal of ToR that better reflect the activity of TG15.

AP-2023-02. Joële to update CCPR website to reflect the new chair.

AP-2023-03. Andreas should propose a new task group for the aimed pilot study. This should go to all members so that they have opportunity to show interest in participating.

AP-2023-04. Andreas should revise the ToR of TG8 to make them more appropriate for a Discussion Forum.

AP-2023-05. Joële to send an email to all CCPR members seeking a volunteer to chair TG 12.

AP-2023-06. John to send a new call should for participants of the pilot study for optical fibre responsivity.

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12. Decision Points

DP-2023-01. Approved the realization of a joint workshop with CIE for the 100 years of the $V(\lambda)$. This will be held at the BIPM during CCPR meetings in 2024.