



## EUROMET TC Photometry and Radiometry

### Chairperson's Annual Report 2004-2005

#### 1. Meetings

The Technical Committee for Photometry and Radiometry (TC-PRL) met in Belgrade, Serbia, on April 25-26, 2005, at ZMDM. There were 18 attendees from 18 countries, and 4 apologies. Immediately after the meeting, Contact Persons visited the laboratories ZMDM. Next PHORA meeting will be held at CMI, Prague, Czech Republic. The date will be the 20<sup>th</sup> and 21<sup>st</sup> April 2006.

#### 2. Web-site PHORANET

The TC-PR Web site PHORANET (<http://www.metas.ch/euromet/phora/>) is primarily intended for use by TC-PR Members as a repository for documents and dissemination of information. It has been updated to contain copies of all available project forms and presentations from several TC-PR Annual Meetings.

#### 3. PHORA Projects

Concerning the projects in TC-PR over the last year, in total there were 44 projects listed on the Web-site. Of these, 19 were comparisons, 10 co-operation projects, 12 projects on traceability and 3 consultations. During this 12 month period, 3 new projects were proposed, 5 projects became agreed, 23 projects continued operation and 4 projects were finished. As of 30 April 2005, 29 projects are active. In terms of trends, several projects of short duration were started and completed within the 12 month period. Contact Persons agree to have Progress Reports also when no progress is to be reported on. As a consequence, annual reports of any PHORA project will be found in the PHORANET. The Chair will send to the General Secretary only those reports with some progress reported in.

#### 4. CCPR Key comparisons

The Working Group on Key Comparisons of the CCPR met in 2004. RMO TC chairs or their delegates have observer status. The following terms of reference will be proposed to the CCPR in 2005 for approval:

- to establish and maintain a list of key and other comparisons in the field of photometry and radiometry, which will adequately support CMC claims by NMIs in this field of measurement in the spirit of the global MRA between NMIs;
- to co-ordinate and schedule key comparisons, to review progress in comparisons and to recommend the inclusion of the results of key comparisons in Appendix B of the MRA database;
- to provide supplementary guidelines and/or interpretations to the guidelines on conducting key comparisons included in the MRA, specifically for the field of photometry and radiometry;
- to recommend general principles for the calculation of key comparison reference values in photometry and radiometry;
- to provide advice to the WG-CMC on the range of CMCs supported by particular key comparisons;
- to monitor RMO key comparison activity.

As to current status of **CCPR key comparisons**:

**CCPR-K1a.** Spectral irradiance, 250 - 2500 nm (GB). The pre-draft A uncertainty document was circulated recently, the relative data will be sent to the participants soon. Cut-off value will be determined as proposed in Draft 3 of the "CCPR Guidelines". For outlier identification, statistical

tests will be applied to the data. Their result will be described in anonymous form to the participants which then decide together on the results to be removed from the calculation of the KCRV. Draft B was expected for March 2005.

**CCPR-K1b** spectral irradiance 200 – 400 nm (DE). The first round of participants' calibrations was finished in April 2004. Currently the lamps are re-measured at the PTB. The second round of participants' measurements was scheduled for 06-07/2004. PTB expected to receive all results before the end of August 2004. Draft B could be available for next CCPR, but this depends on the date of reception of the participants' results.

**CCPR-K2a** spectral responsivity, K2.a, 900 – 1600 nm (US). Draft A-2 will be prepared soon. The KCRV will be calculated according to Draft 3 of the CCPR guidance document as a weighted mean with cut-off. Several participants did not provide a detailed uncertainty budget, which was not explicitly required by the protocol. The pilot will request a detailed budget again and laboratories which fail to submit it within one month will not contribute to the KCRV.

**CCPR-K2b** spectral responsivity 300 – 1000 nm (BIPM). Draft B has been prepared according to the guidance given by the last CCPR and WG-KC meetings. The KCRV is a weighted mean with weights limited to 20 %. For each wavelength the cut-off uncertainty has been calculated individually. At 600 nm the cut-off is 0.033 %, increasing to about 0.15 % toward both ends of the wavelength range. The report contains equivalence matrixes and graphs for all wavelengths. It will be formally submitted for approval to the WG-KC soon after the meeting.

**CCPR-K2c** spectral responsivity 300 – 1000 nm (DE). The housing of the PtSi photodiodes has been redesigned to cope with their large temperature coefficient. The revised comparison protocol has been accepted by all participants. The CCPR guidelines shall be applied to this comparison if all participants agree to this. The detectors have been sent to the first participants in August 2004.

**CCPR-K2x** spectral responsivity VUV (DE). The WG-UV recommends that the pilot examines in a first phase the properties of suitable transfer detectors, followed by a pilot comparison with one or two other labs. Based on the experience developed during this exercise the decision on a key comparison can be made later.

**CCPR-K5** spectral diffuse reflectance (US). The pilot was waiting for some participants' results. Draft A shall be available for the next CCPR meeting.

**CCPR-K6** spectral regular transmittance(FR). Measurements are finished and the pilot waits for the detailed CCPR guidelines for the preparation of Draft A.

As to the current status of **CCPR Supplementary key comparisons:**

**CCPR-S1** spectral radiance (RU). The last participants' results were received by the pilot in March 2004. Draft A is currently being prepared and is expected to be completed soon.

**CCPR-S2** aperture area (US) The comparison is currently in the pre-Draft A status, uncertainty budgets and relative data were distributed to the participants. The data analysis of this comparison will be very difficult, since the agreement between participants depends very much on the aperture type.

**New CCPR comparisons:** The WG is increasingly concerned about the time it takes to carry out a comparison, especially since in the future the BIPM can no longer give any support. Comparisons need to be carefully designed to allow an efficient and short process. Maybe in the future a different strategy is needed to maintain the KCDB because comparisons are very expensive (typically 1 M). No new comparisons were initiated.

**Guidelines for CCPR key comparison report preparation:** Draft 3 of the CCPR guidelines was presented and discussed paragraph by paragraph, and a number of modifications were made. The most important changes are described in the following:

- If a participant fails to provide an uncertainty budget in the required detail within a given deadline, the pilot lab may request WG-KC to approve that the participant be removed from the comparison, or from the calculation of the key comparison reference value, as appropriate.
- In case that some data appear anomalous, all laboratories are invited to check their results, without any specific information. This additional step will be included in the CCPR guidelines.

- A new paragraph on the identification of outliers before the calculation of the KCRV will also be added.
- A new paragraph will be added on a general link mechanism and on how the long-term stability can be demonstrated.

**Time-scale of comparisons:** CCPR guidelines will allow to reduce the time for report preparation to one year. This might be somewhat optimistic but it should be tried. The organization of pilot comparisons before large scale comparison in future will also help. For future repetitions of comparisons which were already carried out, the protocols exist already. WG recommends the creation of a task group to propose a strategy to streamline comparisons.

**Data reduction for CCPR key comparison:** In comparing the results of several comparisons with the conditions of the frequentist approach to statistics, one concludes that the participants' uncertainties are clearly calculated on a different basis in different labs and hence of questionable value in calculating KCRVs; there are persistent interlaboratory differences that are unlikely to average to zero; a metric is needed for conveying to customers what is the expected state-of-measurement-quality in a particular quantity throughout the world.

**Next meeting** will be held before the CCPR meeting in the week of 24-28 October 2005.

## 5. EUROMET key comparisons

The current status of EUROMET PhoRa key comparisons is as follows. Six key comparisons are in progress or planned. Underlined countries are the pilot NMIs

**EUROMET. PR-K6** spectral regular transmittance. (FR AT CZ SE RO CH HU NL TR FI IT ES GB DE SK). participants' measurements completed, Draft A by the end of 2005;

**EUROMET PR-K3a** luminous intensity and **EUROMET PR-K4** luminous flux (DE FR IT AT CZ FI GB NL PL SE TR CZ RO). Planned- Protocol end 2005;

**EUROMET.PR.K2b** spectral responsivity (ES AT NL NO PL SE TR CH CZ RO) measurements are almost completed;

**EUROMET.PR-K5** spectral diffuse reflectance (HU DE FR CZ SE PL CH RO). Will start after being completed the CCPR-K5.

**EUROMET. PR-K1a** spectral Irradiance (pilot NPL) waits for completion of CCPR-K1.a

**EUROMET. PR-BK2a1** and **BK2a2** spectral responsivity. Planned. Will be registered by NMI-VSL.

**As to EUROMET supplementary comparisons**, the Supplementary Key Comparison EUROMET.PR-S2 *Radiant Power of High Power Lasers* started in 2004:. Institutes (and countries) participating in PR-S2 are CSIRO (AUS), PTB (D), DFM (DK), LNE (F), NMIJ-AIST (J), NMI-VSL (NL), NILPRP (ROM), SP (S), KSRIM (UA), NPL (UK), NIST (USA), CSIR-NML (ZA). Pilot laboratory is PTB The following lasers, wavelengths and power levels are covered: Argon ion (514.5 nm, 1 W), Nd:YAG (1064 nm, 1 W), Nd:YAG (1064 nm, 10 W), CO<sub>2</sub> (10.6 μm, 1 W), CO<sub>2</sub> (10.6 μm, 5 W) It is expected to be finished by December 2006.

## 6. CMCs

In 2004 there was the meeting of the new CCPR working group on CMCs (WGCMC) to deal with inter-regional CMC reviews in an efficient manner and to handle the definition of service categories. According to the JCRB recommendation, the members of the CMC working groups are the RMO TC chairs of the Regional Metrology Organisations (RMOs) in the field of photometry and radiometry. The RMO TC chairs may appoint representatives to represent them at WG-CMC meetings and are also welcome to include technical advisors in their RMO delegation. Other interested members of the CCPR may be allowed to attend WG-CMC and task group meetings as observers at the discretion of the WG-CMC or task group chairperson, taking into account potential issues of confidentiality related to particular comparisons.

**Terms of Reference of WG-CMC:** the draft to be submitted to CCPR is as follows:

- to co-ordinate and approve the definition of service categories requested by RMOs and to maintain lists of service categories, and - where necessary - rules for the preparation of CMC entries;
- to agree on detailed technical review criteria;
- to co-ordinate and, if necessary, conduct inter-regional reviews of CMCs submitted by RMOs for posting in Appendix C of the MRA;
- to provide guidance on the range of CMCs supported by particular key and supplementary comparisons;
- to suggest to the WG-KC areas where additional key and supplementary comparisons may be needed;
- to co-ordinate the review of existing CMCs in the context of new results of key and supplementary comparisons.

It was clarified that the WG-CMC merely coordinates and approves the definition of service categories to make the system of service categories consistent and logical. It does not have the right under the MRA to refuse the creation of service categories requested by NMIs through their RMOs, if these cover existing services offered by NMIs, no matter how rare or specialized these services might be. However, it was not possible for CMCs to be accepted for publication in the MRA database without appropriate peer review.

**Chairmanship of WG-CMC,** it will rotate on an alphabetical basis between the RMOs. It was decided that F Hengstberger should continue to chair the first meeting in his capacity as SADC MET delegate and that the 2005 meeting would then be chaired in accordance with the alphabetic order by the SIM representative, followed at the meetings after that by the representatives of the APMP, COOMET and EUROMET etc.

**PR service categories:** The sequence of events was presented, which led to the definition of the present service categories and the first two rounds of CMC submissions in photometry and radiometry. The first priority at the time were parameters, which were critical for traceability to SI units. The range of parameters was extended in round two to quantities closely related to these basic parameters. (The process followed was documented clearly in the annotated version of the service category spreadsheet, which she had prepared and which was discussed during the CP meeting in Turin, April 2004).

It was agreed that the range of parameters submitted during rounds one and two now had to be extended further to allow the submission of CMCs in most, if not all, of the outstanding service categories. The main focus of the meeting was to reach agreement on the list of these round-three CMCs. The JCRB would then be informed of the arrangements and RMOs would be invited to submit round-three CMCs in these new service categories.

The annotated spreadsheet of service categories was then discussed in detail. It was decided to delete all "General" service categories from the list and to allow a comment for all existing and new service categories to the effect that other source, detector or material categories etc. (as applicable) could also be measured (with a larger uncertainty). In order to speed up this process and ensure a systematic approach, the WG-CMC will consider all applications for these changes in the comments column of existing CMCs at its next meeting. This is an abridged procedure as it covers lower accuracy services, which are justified on the basis of similar, already approved high accuracy services. Applications for such changes should be submitted by RMOs to the JCRB secretariat well before that date. Service category 1.1.2 (LED luminous intensity) will be retained.

There was agreement that submissions for response uniformity, temperature coefficient, frequency response and linearity would not be included in round three. Experience had to be gained whether these capabilities could not in any case be included as comments in the responsivity service category. Should this prove inconvenient or unacceptable for NMIs, the decision will be reconsidered at a future meeting.

The service categories include some new categories proposed by RMOs. The Executive Secretary of the CCPR will inform the JCRB secretariat accordingly.

**Custodian of the list of the service categories:** it was agreed that the Executive Secretary of the CCPR would be the custodian of the list and that the latest approved version of this list would be made available as soon as possible on the BIPM website.

**Applications for new service categories:** it was decided that they could be submitted to the WG-CMC after the completion of round three at any time on an “on demand” basis. New submissions of round one to three CMCs by RMOs would also be acceptable at any time. Compared to the previous list, the new list of service categories (Appendix 3) reflects some agreed deletions and additions to the potential service categories for future rounds of submissions. These remain open for revision at future meetings.

**Interactions between WG-KC and WG-CMC:** it was agreed that the WG-KC should be asked, when required, to provide advice to the WG-CMC with regard to the key comparisons relevant for parameters, which are not key comparison parameters.

Next WG-CMC meeting will take place in conjunction with the 2005 CCPR meeting, which is scheduled for the last week of October 2005 at the BIPM in Sévres. The WG-CMC meeting will most likely be scheduled for Wednesday, 26 October.

## 7. Analysis of CMCs.

Looking at the latest entries, there is some inconsistency in the way in which the various labs are interpreting the same quantity which means that labs of similar capability have actually submitted (and had approved) very different claims. It is probably up to the individual labs to look at this and adjust their claims if necessary. CPs agree to submit revised claims to bring them in line with the interpretation placed on the quantity by labs, rather than because of a change in technique, a new scale realisation, etc. If this is the case, the reason should be clearly stated in the column for comments.

There is also an increasing tendency to reference as supporting evidence key comparisons that are either in progress, for which the results have not been published, or that have not even started. Some reviewers do not insist on this, some others suggest that in these cases there should be other supporting evidence provided. CPs agree that a comparison that has not been started cannot support evidence and that in such cases it is preferable to ask for a uncertainty budget, or similar evidence. However they agree that evidence can be considered when Draft B is ready.

CPs agree that CMC claims, still pending in sub-fields where KCs do exist (photometry, spectroradiometry, materials), should be reconsidered and updated according to these decisions, whereas CMC claims in the field of fibre optics should be sent for inter-regional review.

The call for submitting CMC claims in Round 3 Categories is open. Dead-line is June 30, 2005

## 8. The iMERA Project

The iMERA project has been presented at the last PHORA meeting in Belgrade, by informing the Contact Persons about the project, and the possibilities it offers. A Working Group was agreed to prepare a list of special activities and to write a draft document as a frame-work for discussion. This WG will meet shortly after the first Workshop for TC persons, to be held within month 7 of iMERA. The NEWRAD Conference in Davos (CH, October 2005) is a possible date for this first meeting. MLR agrees to chair the WG for the first meeting.

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Technical Committee Chairperson for  
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Torino, 30 April 2005