

ANNUAL REPORT 2000/2001
EUROMET subject field Photometry and Radiometry

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1. GENERAL ASPECTS

A significant workload has been caused by the various comparison measurements conducted during 2000-2001. In addition to comparison projects, the subject field has many traceability projects between EUROMET NMIs. In fact, one third of all EUROMET traceability projects is in Photometry and Radiometry. Finally, the contact persons have successfully carried out the analysis of the first set of CMCs declared by EUROMET NMIs and by NMIs of other RMOs.

2. CONTACT PERSONS MEETING

The annual contact persons meeting was held at BEV, Austria, 24-26 January 2001. It was attended by 30 persons of whom 26 were from AT, CEC, CH, CZ, DE, DK, ES, FI, FR, GB, GR, HU, IT, NL, NO, PL, SE, SK, TR, BG, RU, and UA and four observers from BIPM, APMP, SADC MET, and NIST.

The meeting was held at a critical stage of the first inter-regional review of calibration and measurement capabilities (CMCs) in the subject field Photometry and Radiometry. It was agreed in the meeting how the inter-regional CMC review for the JCRB meeting in March 2001 will be completed. In particular, it was decided to limit the first round of inter-regional CMC review to quantities, which are closely related to key comparison quantities.

The contact persons agreed the list of seven past comparisons to be entered into the key comparison database as bibliographic references.

The contact persons also decided to propose to the EUROMET Committee that the abbreviation of the subject field PHOTO is changed to PHORA.

3. PROJECTS

3.1 EUROMET projects

EUROMET projects in Photometry and Radiometry are listed below, with project coordinators (underlined) and participants.

Agreed comparison projects

- 156 Comparison of high laser power (DE GB FR SE DK PL UA NL CH RO US)
- replies to the first questionnaire have been received from the partners

- 353 Transmittance measurements of V(λ) filters (SE DK FI FR NL)
 - measurements of one partner are still missing
- 538 EUROMET key comparison (EUROMET.PR-K6) of spectral regular transmittance
 (FR AT CZ PL PT SE RO CH HU NL TR FI IT ES GB DE SK)
 - participants received the filters in January-February 2001
 - link laboratories to CCPR-K6 are included as participants
- 569 Key comparisons of luminous intensity (EUROMET.PR-K3.a) and luminous flux (EUROMET.PR-K4)
 (DE FR IT AT CZ FI GB NL PL SE TR)
 - measurements should be started by the end of 2001
- 583 Comparison of NIR diffuse reflectance scales (GB PT SE)
 - samples have been sent to partners for measurement
- 587 EUROMET key comparisons on spectral responsivity (EUROMET.PR-K2.b) (ES AT NL NO PL SE TR CH CZ)
 - start in autumn 2001, ES and NL establish the link to CCPR-K2.b
- 619 Key comparison of spectral diffuse reflectance (EUROMET.PR-K5)
 (HU DE FR CZ SE PL CH)
 - project is just registered

EUROMET.PR-K1.a will be registered by NPL, start earliest October 2001
 EUROMET.BPR-K2.a1/a2 will be registered by NMI-VSL

Agreed projects in cooperation in research

- 359 Wavelength standards for optical communication (DK GB PT SE UA FI)
 - from 2001 onwards the project will be closely linked to an EU 5th Framework Programme project and a Nordic Industrial Fund project
- 562 Two photon metrology (IT FR GB HU DK CH NL ES US)
 - possibilities for EU funding have been considered
- 582 Investigation into the differences between diffuse reflectance measured using conventional sphere based techniques and goniophotometric techniques (GB PL FR DE)
 - preliminary discussions have been held with the partners

Agreed projects in consultation on facilities

- 437 Evaluation of the radiometric performance of UV photodetectors
 (DE DK ES FI FR HU NL SE GB US)
 - the project has arranged a series of workshops linked to related events
- 581 Fibre optic consultation working group
 (SE AT CZ DK FI FR DE IT NL NO PL PT SK ES CH TR GB UA)
 - the first task of the WG is to analyze EUROMET CMCs in fiber optics

Agreed traceability projects

- 6 Reflectance of diffusing materials (DE GB FI SE)
 36 UV radiometric scales and calibration services (DE GB)

- 37 Transfer standards for spectrophotometry and colorimetry (GB IT PT)
- 38 Fiber optic standards (GB CH ES IT PT)
- 40 Traceability of spectral irradiance scales (GB CH IT)
- 204 Measurement of diffusion of retroreflectors and ref. standards (IT GB)
- 374 Spectral responsivity scales (GB CH)
- 539 Radiometric calibration of French UV and VUV source standards (DE FR)
- 603 Spectral irradiance scales using detector based standard lamps (DE AT)

Proposed projects

- 375 Comparison of characterization techniques for filter radiometry (GB DE FR HU SK FI)
- 443 Comparison of UV power meters (GB FR DE IT NL SE)
- 444 Comparison of luminance meters (GB DE ES FI FR HU IT SE PL)

New projects

Final report of EUROMET.BPR-K3.a will be made by PTB. This is a bilateral photometric comparison between PTB and UME carried out in identical conditions with CCPR-K3.a.

Present number of agreed EUROMET projects:

Cooperation in Research	3
Comparison	7
Traceability	9
Consultation	2

Figure 1 shows the total number of agreed projects participated by the EUROMET members and corresponding members. The uppermost part of the columns indicates the number of coordinated projects for GB, DE, SE, FR, IT, ES, DK, AT, and HU.

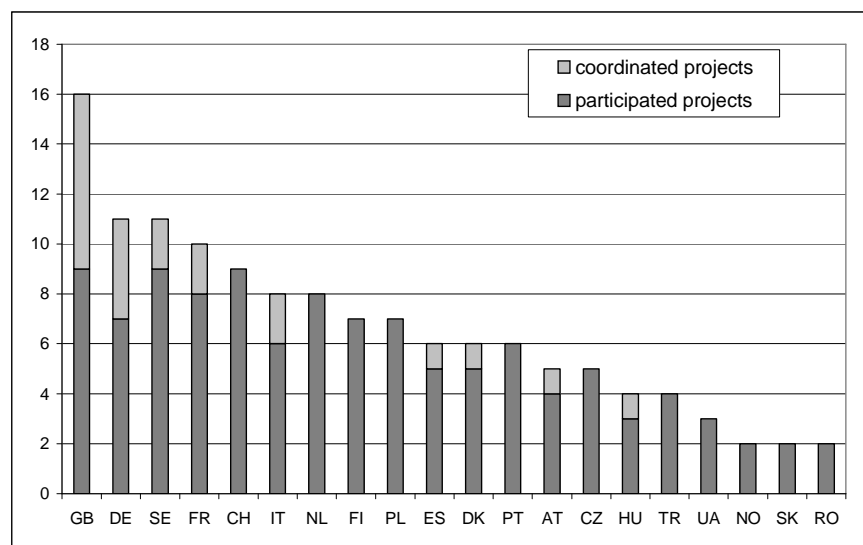


Figure 1. Participants of Euromet projects in Photometry and Radiometry

3.2 EU projects

These projects are initiated by the contact persons group and discussed in the contact persons meetings:

Fiber Optic Thematic Network (FOToN)

(GB PT ES DK BE FI FR NL SE GR IE IT DE)

- EU funding available until the end of 2001

Thematic Network for Ultraviolet Radiation Measurements

(FI DK FR DE IT NL NO PT ES SE GB + about 40 additional partners)

- EU funded part of the project was completed in November 2000

Improving the Accuracy of Ultraviolet Radiation Measurements

(GB DE NL FI FR)

- project will be completed by the end of 2001

4. MUTUAL RECOGNITION ARRANGEMENT

4.1 Key comparisons

Present status of CIPM key comparisons in Photometry and Radiometry is given below. The corresponding EUROMET key comparisons described in Sec. 3.1 are referred if their organization is already agreed.

Spectral irradiance

CCPR-K1.a: (GB) problems with the facilities have caused delay, lamps to be sent out again in February, measurements hopefully complete in May 2001

CCPR-K1.b: (DE) start after NEWRAD conference in October 2001

For EUROMET.PR-K1.a see Sec. 3.1.

Spectral responsivity

CCPR-K2.a: (US) measurements complete, preliminary results available by CCPR meeting April 2001

CCPR-K2.b: (BIPM) measurements of first round ready, second round will start by end of January, Draft A ready by October 2001

CCPR-K2.c: (DE) problems with production of detectors, half a year delay

For EUROMET.PR-K2.a and EUROMET.PR-K2.b see Sec. 3.1 (project 587).

Luminous intensity and luminous flux

CCPR-K3.a, CCPR-K4: (DE) comparisons completed

For EUROMET.PR-K3.a and EUROMET.PR-K4 see Sec. 3.1 (project 569).

Spectral diffuse reflectance

CCPR-K5: (US) discussion on transfer standards in progress

For EUROMET.PR-K5 see Sec. 3.1 (project 619).

Spectral regular transmittance

CCPR-K6: (FR) most of the filters are returned to the pilot, preliminary results will be available by CCPR April 2001

For EUROMET.PR-K6 see Sec. 3.1 (project 538).

4.2 Supplementary comparisons

The ongoing CIPM supplementary comparisons are:

CCPR-S1 Comparison of spectral radiance (RU)

CCPR-S2 Comparison of aperture area measurements (US)

EUROMET supplementary comparisons are (for more details see Sec. 3.1):

156 Comparison of high laser power (DE GB FR SE DK PL UA NL CH RO US)

443 Comparison of UV power meters (GB FR DE IT NL SE)

444 Comparison of luminance meters (GB DE ES FI FR HU IT SE PL)

4.3 Calibration and measurement capabilities

The contact persons group decided to analyze the EUROMET CMCs in two stages: The *first stage* consists of analysis of the key comparison quantity CMCs. This stage was completed in March 2001 when the JCRB meeting approved the EUROMET CMCs to be entered into the key comparison database. The *second stage* consists of analysis of other than key comparison quantity CMCs. This analysis is presently going on. Five working groups have been formed which are responsible for analysis of the non-KC quantities associated with spectral irradiance, spectral responsivity, photometry, spectrophotometry, and fiber optics.

The unanimously agreed acceptance criteria of EUROMET CMCs in the subject field Photometry and Radiometry are listed in the Appendix. The Appendix also includes the agreed principles for maintenance of the CMCs.

Some comments on the first set of EUROMET CMCs were received from APMP. The necessary modifications of the CMC tables were agreed with APMP before the JCRB meeting March 2001. Other RMOs did not present any comments on the EUROMET CMC data before the JCRB meeting.

For the inter-regional CMC review, a EUROMET review team was formed of the Rapporteur, the two candidates for the next Rapporteur mandat, and the Chairs of the five working groups responsible for the internal EUROMET CMC analysis. The review team found it necessary to make a thorough analysis of the CMCs submitted by APMP and SIM. In subsequent email discussions with APMP, agreement was found in all but 18 CMC entries declared by APMP NMIs. EUROMET also asked APMP to review the CMCs submitted by SADC MET. From SIM, no reply was received before the JCRB meeting to the initial comments made by the EUROMET review team.

The total number of EUROMET CMC entries approved to Appendix C during the first round is 148 (from 14 NMIs). The total number of APMP CMC entries approved to Appendix C is 44 (from 5 NMIs).

EUROMET CMC ACCEPTANCE CRITERIA FOR PHOTOMETRY AND RADIOMETRY

Appendix

0. The CMC tables must be prepared according to the CCPR instructions of 12 July and 14 September 2000.
1. The CMC entries cannot be accepted without supporting evidence as described in the letter of Dr. Quinn of 24 November 1999 and in the EUROMET project 512. The supporting evidence is most likely comparison data.
2. A significant deviation in comparison is noted in the supporting comparisons column of the CMC file. The deviation is significant if it is larger than the uncertainty of the comparison or the uncertainty listed in the CMC file (at 95% confidence level).

CMCs of Key Comparison quantities

The acceptance criteria for KC quantity CMCs are:

- 1.1. All CMC entries during the provisional period must be traceable to primary realisations of KC quantities for which there is comparison evidence to justify the stated uncertainty of the primary realisation.
- 1.2. The CMC uncertainty cannot be lower than that reported for the results of the supporting comparison.
- 1.3. NMIs without a primary realisation and who have not participated in a supporting comparison will submit uncertainty budgets to justify their claimed uncertainties.

Informal bilateral comparisons can be used as comparison evidence until the end of 2002.

Other than Key Comparison quantity CMCs

Results of KCs and of informal bilateral comparisons of KC quantities are used to give general confidence in an NMI's capabilities in a wider field. For other than KC quantity CMCs the acceptance criteria are:

- 2.1. Each quantity is associated with a KC quantity. The service category number of the associated KC quantity is listed in the supporting comparisons column of the CMC file.
- 2.2. The supporting evidence is provided by the CMC entry of the associated KC quantity or by a supplementary comparison.
- 2.3. The CMC uncertainty must be compatible with the associated KC quantity CMC or with the uncertainty of the results reported for the supplementary comparison.

Maintenance of CMCs

- 3.1. After Draft B of a key or supplementary comparison and the KC reference value (with its uncertainty) are accepted, the Rapporteur examines if there is need to *increase* the uncertainties of the CMCs of the KC and associated quantities of any participating EUROMET NMI. If the need arises, the concerned NMI is informed with a request to submit revised entries to Appendix C.
- 3.2. The revised entries from the concerned NMI are passed, with supporting statements of the Technical Committee Chairmen of other RMOs, to the manager of the BIPM MRA database for updating the data.
- 3.3. If agreement on the revised entries is not reached within a reasonable time, the Rapporteur asks the manager of the BIPM MRA database to add a note in Appendix C as described in T.7 of MRA and the dispute is transferred to be solved by the EUROMET Chairman or the JCRB.
- 3.4. All other revisions of CMCs supported by the results of key and supplementary comparisons are initiated by the NMIs and treated by the normal EUROMET and JCRB procedures.