



EUROMET TC Length Chairman's Annual Report 2004-2005

1. Introduction

The annual Technical Committee for Length (TCL) meeting was held in Torino, Italy over two days in October 2004 and was hosted by IMGC. There were 29 attendees from 28 countries. Immediately after the meeting there was a workshop (covering two half days) on the subject of recent advances in length metrology at the NMIs.

The TCL Web site (www.npl.co.uk/euromet/length) has been updated to contain copies of all available project forms, as well as details of all length key, supplementary and bilateral comparisons (CCL, EUROMET). The site also contains information on the status of Length CMCs from all RMOs and copies of presentations from several TCL workshops. The web site received over 41,500 accesses in the last 12 months (19,000 the year before).

Concerning the projects in TCL over the last year, in total there were 34 projects active at some point during the period 1 April 2004 to 31 March 2005. Of these, 17 were comparisons, 10 cooperation projects, 5 projects on traceability and 2 consultations. During this 12 month period, 6 new projects were Proposed, 5 projects became Agreed, 13 projects continued operation and 12 projects were finished. As of 31 March 2005, 22 projects are active (either Proposed or Agreed – some projects pass directly from Proposed to Finished status, without submission of an Agreed form).

In terms of trends, the following figure shows totals, year by year, for the EUROMET project years commencing in 1988, up to the last year, which started in 2004.

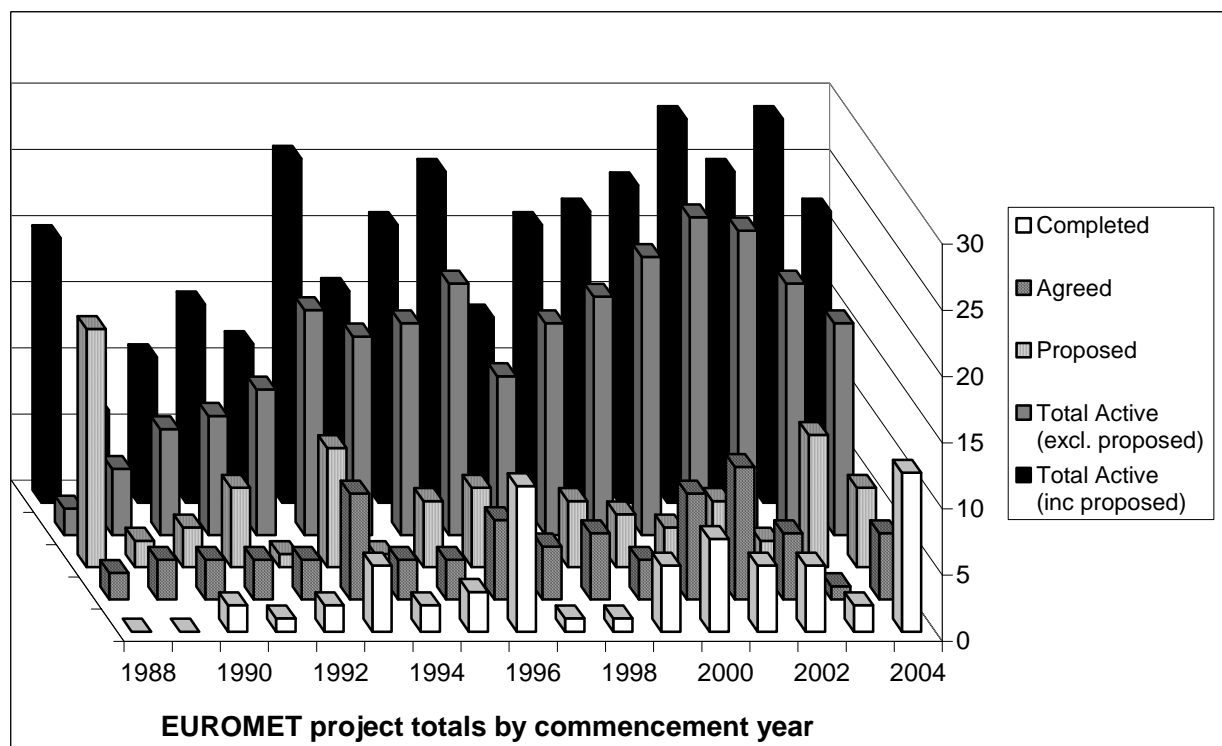


Figure 1 - TCL project totals by year of registration

(Note that before 2004, projects totals were summed on an *ad hoc* basis, whereas for 2004 and later, project totals are summed for each 12 month period ending 31 March.) There appears to be a slight



decrease in the number of projects active at the end of the year, though this is due to a high than average number (12) of projects being completed in the preceding 12 months and the second batch of key comparisons only just being contemplated – only 2 projects for the new comparison cycle are so far included in project lists. Several projects of short duration were started and completed within the 12 month period.

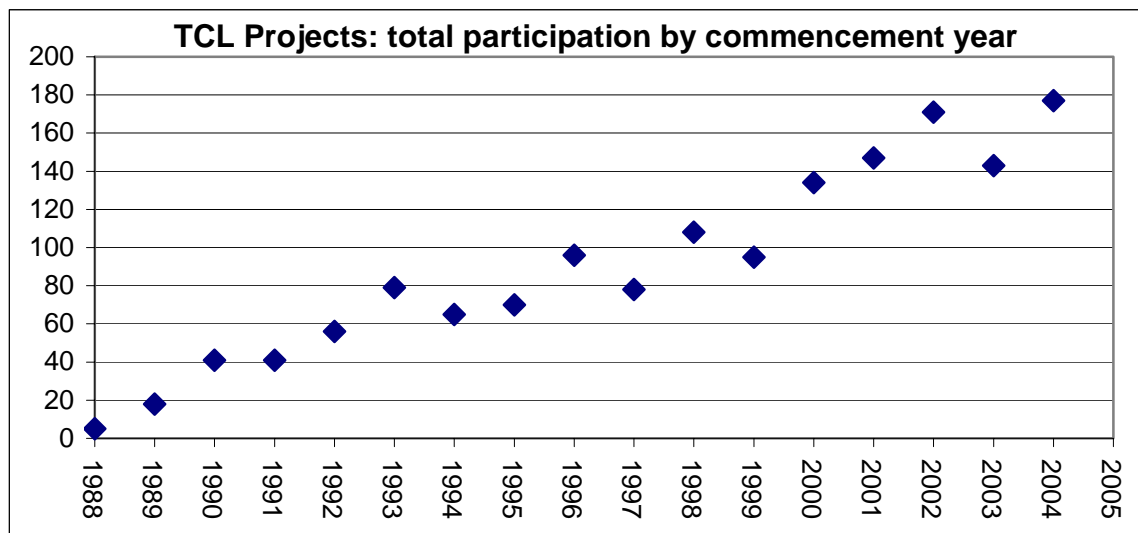


Figure 2 - total participation in TCL projects by year of registration

In terms of participation, the last 12 months have seen an increase in the total number of participants in TCL projects active in the period, to 177. Additionally, there were 5 participants in EUROMET TCL projects from outside EUROMET, including the Israeli NMI, which has the status of Corresponding NMI. The average number of participants per project was 5.2.

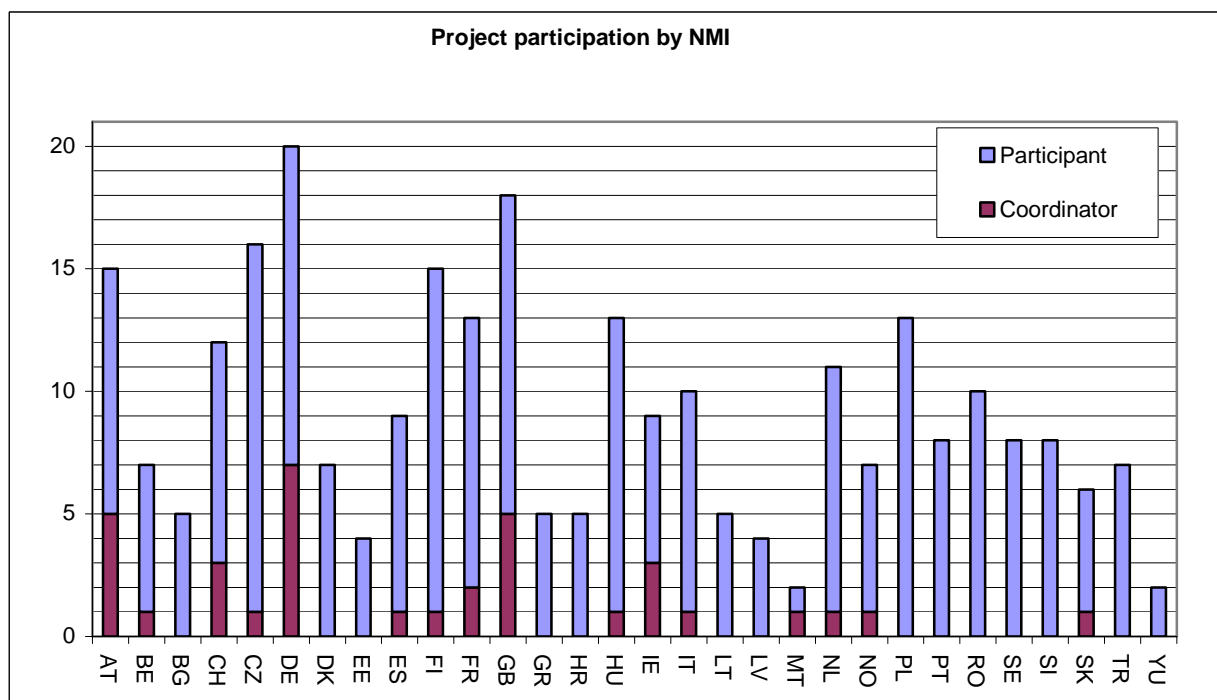


Figure 3 - participation and coordination of TCL projects by country

It is welcome to see that all EUROMET member NMIs participate in at least one project in TCL and the



project coordination workload is being spread over a wider number of NMIs, including some of the smaller laboratories. Also, some Corresponding Applicant NMIs are taking part in projects.

2. Most important issues and outcomes

New style key comparisons

As reported at the last EUROMET GA, the RMO Length TCs are trialling a new style of key comparison, designed to replace the existing sets of CCL and associated RMO key comparisons. The object is to reduce the burden of CCL laboratories having to take part in pairs of comparisons. The CCL key comparisons are no longer run, instead they are replaced by RMO key comparisons, which have inter-RMO participation. These so-called 'CCL RMO key comparisons' are arranged through cooperation of the RMO TCL chairpersons, in order to ensure that they run sequentially with a small delay. This allows NMIs obtaining poor results in one comparison to take part very soon thereafter in the next comparison, rather than waiting another 7 years for the next key comparison cycle, or having to set up a bilateral comparison.

EUROMET has successfully started the first of these comparisons, EUROMET.L-K5.2004 which is on measurement of step gauges. Apart from significant EUROMET participation, 5 NMIs from SIM, APMP and COOMET are also taking part. When this comparison is completed, the next comparison, APMP.L-K5.2006 will start, which will feature 5 NMIs from outside the APMP region. Between them, these two comparisons will have participants from all NMIs with CMCs to support in this area. Laboratories performing poorly in the EUROMET comparison may join the APMP comparison. The CMC claims in this subject will then be valid for 7 years after participation.

The next comparison to follow the same style will be EUROMET.L-K4.2005 on diameter measurements. This will again feature non-EUROMET participants in addition to the large participation from EUROMET. This comparison is in the early planning stage.

Another comparison, EUROMET.L-K3.2006 on angle measurements will follow later.

The CCL's Working Group on Dimensional Metrology (CCL-WGDM) has issued guidance to RMO TCL chairpersons and NMI contacts on how to organise and take part in these new style comparisons.

3. Problems / issues encountered

The only negative issue encountered in the year was the time taken to organise and process the set of CMCs in EUROMET.L.3.2004. These are now on the KCDB, but see comments in section 6.5 of this report.

To help CMC reviewers cope the analysis of comparison data, particularly for comparisons where the Final Report is very long, the CCL-WGDM is encouraging pilots of key comparisons to include, with the Final Report, a so-called Executive Report. This is a short document (only a few pages) giving a summary of the comparison, in particular the degrees of equivalence and any recommendations on corrective actions to be performed by the participants. This Executive Report is mostly for the use of reviewers of CMC claims, as it gives them all the information from the comparison that is pertinent to the review of the CMC claims of the participants. The document is not intended for viewing outside the RMO communities, i.e. it is sent to the WGDM and CCL for information, but does not go to the JCRB, BIPM or KCDB.

4. Inter-regional contacts and collaboration, etc

The majority of inter-regional contacts continue to be at meetings of either the CCL and/or its workgroups (in particular the Working Group on Dimensional Metrology (WGDM)). There was no CCL meeting in 2004, but there was a meeting of the WGDM in Beijing during September 2004.



Additionally there is intra-regional contact at meetings of the European Virtual Institute for Geometrical Measurement (EVIGeM). This is a EU FP5 funded project tasked with the instigation of a so-called Virtual Institute in the subject field of Dimensional Metrology. Several EUROMET NMIs are members of this project, which aims to set up a self-funding one-stop-shop for users of dimensional metrology services, standards and consultancy within the EU. As this could have close links with any future iMERA work, or potentially be a pseudo-competitor, it is important that EUROMET has sufficient representation in both the planning and implementation of this project. So far, NPL, PTB, JV, IMGC, DFM, METAS and CMI are members of EVIGeM, though if EVIGeM becomes a success, it is likely that other EUROMET NMIs will join.

Aside from usual EUROMET collaboration, project 630 – the 'Nano initiative' project, originally conceived in INTMET, is picking up speed after a period of little progress. After rejection of the NANONET and MEMSTAND FP6 project proposals, work almost ceased on this project. However, METAS have taken the initiative to organise a workshop on the subject of 'Micro CMMs'. These devices are being investigated by many EUROMET NMIs as they may prove to be one of the more generic tools that will be required for dimensional nanometrology. A workshop will be held at METAS in April 2005, where there will be experts from NPL, PTB, NMi-VSL, METAS, LNE and several Technical Universities, all of who are actively researching this area and are prepared to discuss, in detail, the operation of their machines.

5. Research trends

Nothing to report, other than interest in the micro-CMM workshop and ongoing work and services offered by one or two NMIs in the area of femtosecond combs for wavelength metrology. There was a visit by scientists from SPRING (Singapore NMI) to NPL, METAS, PTB, IMGC to see aspects of dimensional nanometrology.

6. MRA: Issues of general interest and concern

6.1 CCL key comparisons

All the first round CCL key comparisons have completed their artefact circulations. Final reports have been published for CCL-K1 (gauge blocks), K2 (long gauge blocks).. Draft reports have been circulated for K3 (angle), K4 (diameter) and K5 (1-D CMM artefacts). K6 (2-D CMM artefacts) is yet to make any report (late due to equipment problems at the pilot laboratory), however some early data was shown at the WGDM meeting, September 2004.

KC	Topic	Pilot	Status	EUROMET participants	EUROMET meas. date	Report
CCL-K1	Gauge blocks	CH	Complete	CH, GB, FR	1999	Final (Metrologia)
CCL-K2	Long gauge blocks	GB	Complete	GB, IT, DE	1999	Final (Metrologia)
CCL-K3	Angle	ZA	Draft A seen	FR, IT, CH, DE	2001	-
CCL-K4	Diameter	US	Draft B2 seen	CH, DE, GB, IT	2000/2001	Draft - B2
CCL-K5	1-D CMM artefacts	DE	Draft B4a seen	ES, IT, CH, DE	2000/2001	Draft - B4a
CCL-K6	2-D CMM artefacts	MX	Measurements complete	FR, CZ, NL, GB, DE	2001/2002	-



6.2 NANO studies

The associated NANO pilot studies (organised at the request of the CCL) are half complete. Final reports are available for NANO2 (step height), NANO3 (linescales) and NANO4 (1-D gratings). These have since been re-classified as CCL supplementary comparisons. NANO5 (2-D grids) started in January 2005 but NANO1 (linewidth) is yet to start. This is due to difficulty in finding artefacts (with applicable specification standards) which are amenable to different measuring techniques.

Study	Topic	Pilot	Status	EUROMET participants	EUROMET meas. date	Report
NANO1	Linewidth	US	Planning	DE, DK, IT, NL, PL, GB, FR	-	-
NANO 2 (CCL-S2)	Step height	DE	Complete	DE, ES, CH, DK, PL, IT, NL, GB,	2000/2001	Final
NANO 3 (CCL-S3)	Linescales (<300 mm)	DE	Complete	DE, CH, FI, SE, IT, FR,	2000	Final
NANO 4 (CCL-S1)	1-D gratings	CH	Complete	CH, DK, DE, IT, GB	1999	Final
NANO 5	2-D grids	DK	Running	DK, CH, DE, GB, IT, NL, CZ, FI	2005	-

6.3 EUROMET key comparisons

The current status of EUROMET length key comparisons is as follows:

KC	Topic	Pilot	No.	Status, report	Meas. date	Comments
EUROMET.L-K1	Gauge blocks	FR	471	Final	1999 - 2000	supersedes L-K1.PREV
EUROMET.L-K1(a)	Gauge blocks	NO	643	Draft - B2	2002	subsequent to L-K1
EUROMET.L-K2	Long gauge blocks	GB	602	Running	2002 - 2005	supersedes L-K2.PREV
EUROMET.L-K3.PREV	Angle	DE	371	Completed before MRA	1996 - 1999	L-K3.2006 planning to start
EUROMET.L-K4.PREV	Diameter	CH	384	Completed before MRA	1996 - 1998	L-K4.2005 planning
EUROMET.L-K5.2004	1-D CMM	DE	777	Running	2004 - 2005	supersedes K5.PREV
EUROMET.L-K6	2-D CMM	DE	743	Running	2004-2005	First round KC



6.4 EUROMET supplementary comparisons

Status of the recently or currently active EUROMET supplementary comparisons is as follows:

SC, subject	Pilot	No.	Status, report	Meas. date
EUROMET.L-S10, Squareness	SK	570	Completed	2000 - 2002
EUROMET.L-S11, Surface texture	DE	600	Completed	2001/2002
EUROMET.L-S12, Gauge blocks by comparison	IE	601	Draft A	2001/2002
EUROMET.L-S14, Steel tapes	CH	677	Completed	2003/2004
EUROMET.L-S15, Step height measurement by SPM	DE	707	Draft B2	2004/2005
EUROMET.L-S16, Gauge blocks by comparison	GB	797	Running	2004/2005

6.5 CMCs

EUROMET CMCs

EUROMET.L.3.2004 CMCs have finally been entered into the KCDB. The initial collection of data started 2 years ago, and inter-RMO review started in June 2004. All regions entitled to review these CMCs concluded their review by September 2004. There were no modifications to the CMC file requested by the reviewing RMOs. The TCL chairman had therefore assumed that the CMCs would be immediately approved, however it was still necessary to use the 'Post revised CMC files...' option on the JCRB website to start the actual process of voting on the CMCs. Two RMOs voted for acceptance almost immediately, but one did not vote by the end of the voting period. This RMO was then sent a reminder with an extension period in which to vote. This expired on 21 March 2005. After that, the CMCs were officially accepted.

A summary of the timescale for the collection, review, submission and acceptance of EUROMET.L.3.2004 CMCs is as follows:

- Mar 2003 – initial requests for input of new or amended CMCs
- July 2003 – closure of EUROMET.L.3 entries
- July 2003 – start of EUROMET internal review
- Oct 2003 – review experts contacted again as several were unaware of the review
- Jun 2004 – completion of EUROMET internal review
- Jun 2004 – submission of CMCs to JCRB for inter-RMO review
- Aug 2004 – comments of reviewing RMOs dealt with – no changes to CMCs
- Sep 2004 – final acceptance by reviewing RMOs – no changes requested
- Jan 2005 – CMCs 're-submitted' for voting
- Feb 2005 – voting period expires, one RMO vote outstanding
- Mar 2005 – remaining RMO option to vote expires
- Mar 2005 – CMCs officially added to KCDB

In summary 24 months from start to finish, of which 9 months were within the inter-RMO review and voting. In essence, the CMCs were 'accepted' in Sep 2004, however the procedure continued for 6 months before final entry into the KCDB.

As an aside, it was discovered during the careful checking of the CMCs' formatting by Dr Thomas of the BIPM, that the Slovenian & Romanian institutes submitting length CMCs were not on the official list of



MRA designated institutes. This was corrected after a series of email exchanges.

After completion of the process for CMCs in EUROMET.L.3.2004, the TCL chairman asked for any further CMC updates or new submissions. So far, only a handful of CMCs have been submitted and will form EUROMET.L.4.2005. These will be processed shortly. One or two requests for minor changes or deletions of CMCs were sent directly by the TCL chairman, to the BIPM for direct processing.

Other RMOs' CMCs

The last year saw re-submission of APMP.L.2.2004 after further accreditation of Japan's NMI. However there were still one or two edits necessary and so the file was rejected by EUROMET and SADC MET.

One other RMO requested a change to COOMET.L.2.2004 which had been previously reviewed by EUROMET. This was re-approved after the changes.

COOMET.L.3.2005 was submitted in March 2005 for inter-RMO review. In fact this was just the Belarus CMCs previously submitted as part of COOMET.L.2.2004 which had been removed from that submission during final voting.

A summary of the various length CMC submissions can be found in the following table.

Designation	Comment	EUROMET review date	Status
EUROMET.L.1.2000	Initial top level service submission from most of EUROMET NMIs.	2000	Complete - on KCDB, 2001
EUROMET.L.1.2001	Full submission, almost all services, most EUROMET NMIs, update on .L.1.2000 .	2001	Complete - on KCDB, 2001-10-30
EUROMET.L.2.2002	Minor updates/submissions from GB and FI.	Jun 02	Complete - on KCDB, 2003-01-09
EUROMET.L.3.2004	Submissions from AT, CH, CZ, DE, HU, IT, NO. Also first submission from BG, LT, LV, RO, SI, YU.	Jul 03 - Jun 04	Complete - on KCDB, 2005-03-23
EUROMET.L.4.2005	Minor updates and new submissions.	TBA	Initial data collection
Designation	Comment	EUROMET review date	Status
SADC MET.L.1.2001	First main submission from SADC MET.	N/A	Abandoned
COOMET.L.1.2002	First main submission from COOMET. Re-examined in early 2004.	Oct 02 - Dec 03 and Jan-Mar 04	Complete - on KCDB, 2004-04-06
APMP.L.1.2003	MY, TW submissions. Reviewed by EUROMET TCL Chairman.	Nov 03 - Dec 03	Complete - on KCDB, 2004-02-19
SIM.L.1.2003	Major submission from NIST. Reviewed by EUROMET TCL Chairman.	Sep 03 - Nov 03	Complete - on KCDB, 2004-01-15
SIM.L.2.2003	Submissions from BR, MX, USA.	Dec 03 - Feb 04	Complete - on KCDB, 2004-06-15
COOMET.L.2.2004	Second main submission from COOMET. Ukraine. (Belarus temporarily removed).	Jan 04 - Apr 04	Complete - on KCDB, 2005-01-10
APMP.L.2.2004	Major submission from JP. Review by EUROMET TCL Chairman.	May 04 - May 04 and Mar 05	Re-review, SIM, SADC MET, EUROMET
COOMET.L.3.2005	Next main submission from COOMET. Belarus (was part of COOMET.L.2.2004).	Mar 05	Re-review, APMP, SIM, SADC MET, EUROMET



7. MRA: Lessons learned in implementation of MRA

There is now an agenda item at each TCL meeting, 'Impact of recent key comparison reports on CMC entries'. This is where any problems highlighted by key comparison performance are discussed. In October 2003, some issues were discussed where NMIs had outlying results in key comparisons or NANO studies. The resolution of these problems was discussed and it was decided there was no need to withdraw the relevant CMCs. This was because the technical problems had been solved or the laboratory was suspending the service for the interim period. It was felt that withdrawal of CMCs followed by subsequent re-instatement would take too long. This view has been strengthened by the time taken for EUROMET.L.3.2004 to receive final acceptance in inter-RMO review.

Moreover, the whole process of 'policing' the CMCs, in particular the monitoring of corrective actions suggested by key comparison final reports needs to be discussed in detail. It will form an agenda item for the 2005 WGDM meeting, and may then be taken to the CCL for further discussion or approval of methodology. The TCL webmaster has volunteered to set up web pages on the TCL site for the monitoring of corrective actions within EUROMET. This is to allow the process to be fully transparent, showing a list of corrective actions required by TCL and the review that these are performed and have been signed off to the satisfaction of the relevant CMC expert reviewer.

Andrew Lewis

EUROMET TC Length Chairman

31 March 2005