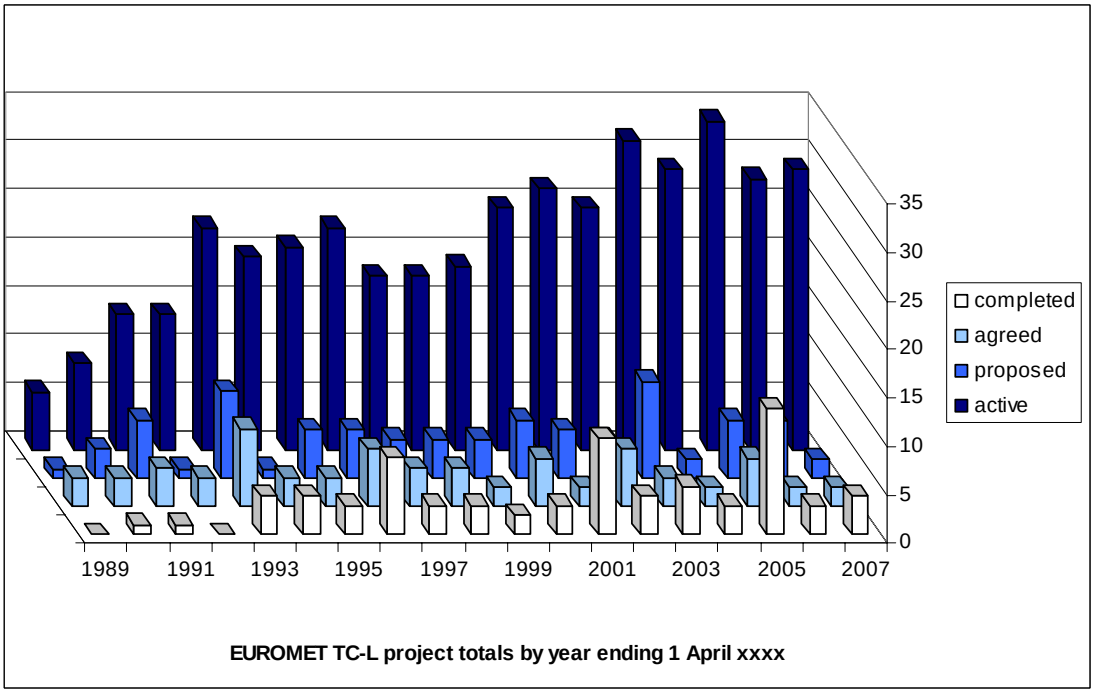
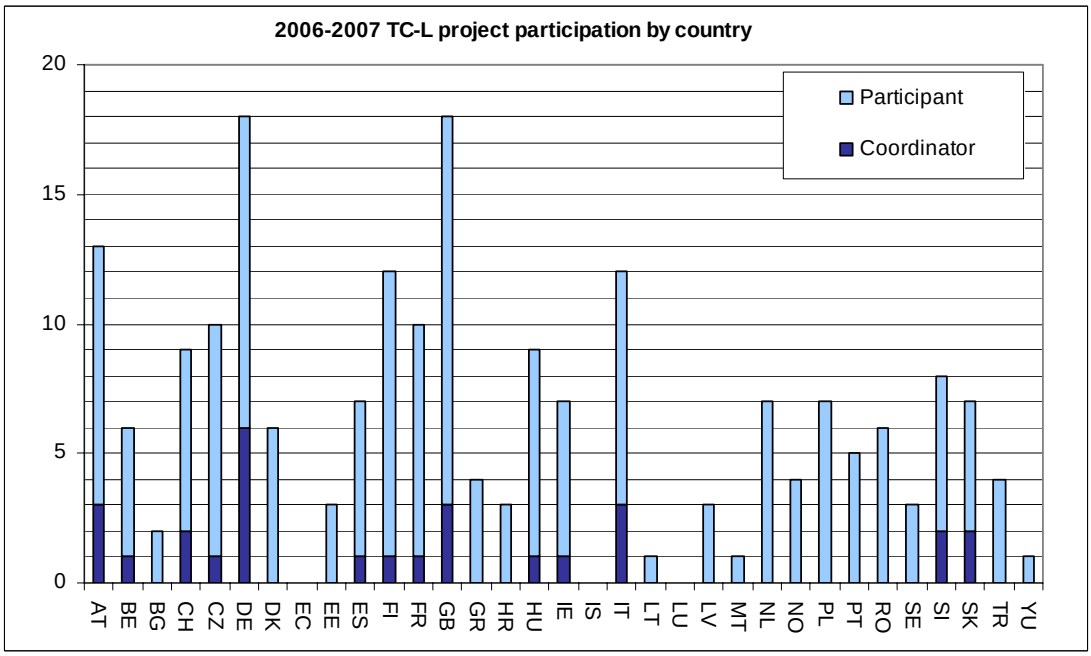
EUROMET TC-Length
Chairman's Annual Report 2006-2007

1. Projects

In the period under review (from 1 April 2006, to 30 March 2007) in TC-Length there were a total of 29 active projects (15 comparisons, 1 consultation, 8 cooperation, 5 traceability). In the period, 4 projects were completed, 2 proposed and 2 agreed. In total, across all projects, there were 178 participations and 14 different NMIs acted as project coordinators.



EUROMET TC-L project totals by year ending 1 April xxxx



2. Status of comparisons in length metrology

The current status of key and supplementary comparisons in length is shown in the following tables.

The first (and only round) of CCL comparisons is completed, though final reports are not yet all received or approved. In the last year, the Draft B report on K3 and the final reports on K4 and K5 have been received.

At its last meeting, the CCL decided to stop running CCL comparisons, and to ensure inter-RMO linking through a new style of CCL-RMO key comparison (see below). It has also re-classified the main topics for these comparisons, combining K2 (long gauges blocks) with K1, removing K6 (2D CMM) as a topic and adding K7 (linescales) and K8 (surface texture). However, in the last year, the CIPM has voiced concerns about the operation of key comparisons in CCL and the WGDM has had to defend the decision, on behalf of the CCL (see §5 of this report).

CCL key comparisons

Number	Subject	Status	Report
CCL-K1	Gauge blocks	Complete	Metrologia paper
CCL-K2	Long gauge blocks/length bars	Complete	Metrologia paper
CCL-K3	Polygons	Complete	Draft B
CCL-K4	Ring & Plug gauges(a:internal, b:external)	Complete	Final report
CCL-K5	1D CMM artefacts	Complete	Final report
CCL-K6	2D CMM artefacts	Complete	Draft A

The CCL has also been running several comparisons in nanometrology, though as these were not all operating as measurement services at the time of planning or artefact circulation, these were initially decided to be classed as ‘pilot studies’, i.e. similar to a cooperation style project. However, they were all run under MRA comparison guidelines and have been so successful, to date, that completed comparisons have been re-classified by the CCL as supplementary comparisons which can support CMC claims.

CCL NANO pilot studies

Number	Subject	Status	Report
NANO1	Linewidth	Starts in 2007	-
NANO2 (CCL-S2)	Step height	Complete	Final report
NANO3 (CCL-S3)	Linescales	Complete	Final report
NANO4 (CCL-S1)	1D gratings	Complete	Final report
NANO5	2D gratings	Complete	Draft A

EUROMET has either completed or is about to complete a large range of RMO key comparisons, aligned with the CCL comparison topics. K1 and K2 are completed and now fully reported, K4, K5 and K7 are running. K6 is preparing the full Draft A report (initial data release to participants has already occurred, to enable confirmation of results). Additionally, EUROMET has available the results from recent (previous) comparisons in subjects K1 through K5, which are temporarily being used for CMC evidence.

EUROMET key comparisons

Number	Subject	Project no.	Report/status
EUROMET.L-K1	Gauge blocks	471	Final report
EUROMET.L-K1.1	Gauge blocks	643	Final report
EUROMET.L-K2	Long gauge blocks/length bars	602	Final report
EUROMET.L-K3.2006	Angle	---	Withheld
EUROMET.L-K4.2005	Diameter	812	**Running**
EUROMET.L-K5.2004	1D CMM artefacts	777	**Running**
EUROMET.L-K6	2D CMM artefacts	743	**Awaiting Draft A report**
EUROMET.L-K7.2006	Linescales (up to 100 mm)	882	**Running**

Of note are comparisons EUROMET.L-K5.2004, EUROMET.L-K4.2005 and EUROMET.L-K7.2006 which are all of the new style of CCL RMO key comparisons. These are running already. These are RMO comparisons (run by EUROMET) with inter-RMO participation, which it was intended would replace the old style of CCL key comparison.

EUROMET supplementary comparisons

Number	Subject	Project no.	Report/status
EUROMET.L-S1	Linescales	252	BNM/LNE, 1995
EUROMET.L-S2	Thermal expansion of gauge blocks	275	Metrologia paper Final report
EUROMET.L-S3	Depth setting standards	301	Metrologia paper
EUROMET.L-S4	Wires (diameter)	308	Metrologia paper
EUROMET.L-S5a	Roundness	BCR	Metrologia paper
EUROMET.L-S5b	Roundness	361	Metrologia paper
EUROMET.L-S6	Thermal expansion of long gauge blocks	390	PTB Report
EUROMET.L-S7	Surface plates	BCR	EUR 14059 EN, 1992
EUROMET.L-S8	Nd YAG lasers	Bilateral	Metrologia paper
EUROMET.L-S9	Grid plates	BCR 3442	3442/1/0/189/91/7
EUROMET.L-S10	Squares	570	Metrologia paper
EUROMET.L-S11	Surface texture	600	Metrologia paper Final report (web), 6MB file
EUROMET.L-S12	Gauge blocks by comparison	601	Draft - B
EUROMET.L-S13	Cylindrical artefacts	369	Final Report (PTB)
EUROMET.L-S14	Steel tapes	677	Final report
EUROMET.L-S15	Step heights by SPM	707	Final report
EUROMET.L-S16	Gauge blocks by comparison	797	Draft - A
EUROMET.L-S17	Steel tape, trilateral (link to S14)	875	Final report
EUROMET.L-S18	Granite square, bilateral (link to S10)	905	**Running**
EUROMET.L-S19	Steel cylindircal square, bilateral (link to S10)	910	**Running**

Comparison EUROMET.L-S11 on surface texture is accepted as EUROMET's alternative to the new CCL topic CCL-K8 on surface texture. EUROMET.L-S14 on steel tapes is sufficient to cover most EUROMET NMIs in the subject of long line scales, part of CCL-K7 (the remainder being covered by EUROMET.L-K7.2006, currently running).

Linking to the squares comparison (project 570) have been two subsequent comparisons (bi-laterals) for NMIs wishing to improve on their results in the previous comparison. Also a tri-lateral follow on to the previous tape comparison (project 677) has now been successfully completed.

In summary, with the completion of EUROMET.L-K6 in 2006, EUROMET had completed matching comparisons for all first round CCL key comparison topics, plus the two additional topics added recently by the CCL. EUROMET is also running 3 of the new style CCL-RMO key comparisons as well as a set of supplementary comparisons.

Planning for the angle comparison (EUROMET.L-K3) has been put on hold pending decisions about the inter-regional balance of comparisons in length and agreement from CIPM on the proposed future comparisons to be undertaken in length metrology.

3. CMCs

The fifth set of length (& angle) CMCs, EUROMET.L.4.2006, was approved by inter-RMO review and entered the KCDB in May 2006, bringing to end 12 months of reviewing process. Only minor questions were raised by the other RMOs (answered by the TC-Length chairman) and no changes were requested.

Data collection for the next set of CMCs, EUROMET.L.5.2006 was immediately started and these were collated and sent for internal EUROMET review in August 2006. EUROMET internal review was completed in March 2003 and these CMCs were submitted for inter-RMO review on 2007-03-30. This set contains 16 updated or new submissions from 6 NMIs. Additionally a few minor updates were sent directly to the KCDB manager, under categories (a) and (b) of JCRB-8/10 (*Procedure for modifying CMCs already in Appendix C*). Whilst the L.5.2007 set of CMCs is being reviewed by other RMOs, a new set of CMCs has started being collected together.

EUROMET CMC submissions in Length

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.4.2006	24 minor updates and 35 new submissions.	May 05 - Jan 06	**Complete - on KCDB, 2006-05-10**
EUROMET.L.5.2007	19 updated or new CMCs from 7 NMIs	Aug 06 - Mar 07	**Undergoing inter-RMO review**
EUROMET.L.6	Being collected and collated now	-	Being collected

In other RMOs, two sets of CMCs have entered the KCDB during the year, set L.3 from COOMET (Belarus) and set L.3 from APMP (India). A new set of CMCs from Indonesia (APMP.L.4) is undergoing inter-RMO review. Some technical questions were raised by

EUROMET and SIM during this review (status of QMS for the CMCs and two technical questions).

Other RMO CMC submissions in Length

Designation	Comment	EUROMET review date	Status
SADCMET.L.1.2001	First main submission from SADCMET.	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	Complete - on KCDB, 2005-05-25
COOMET.L.3.2005	Next main submission from COOMET. Belarus (was part of COOMET.L.2.2004).	Mar 05	Complete - on KCDB, 2005-06-17
APMP.L.3.2006	23 new CMCs from NPL-India	Feb 06	Complete - on KCDB, 2007-01-08
APMP.L.4.2006	3 new CMCs from Indonesia	Aug 06	Undergoing inter-RMO review

4. Meetings and workshops

Previous

- 11th Meeting of the **CCL-WGDM**: 30-31 October 2006, CENAM, Querétaro, Mexico
- 2006 EUROMET **TC-L CP** Meeting: 2-3 October 2006, FSB, Zagreb, Croatia
- 2006 EUROMET **TC-L CP** Workshop: Recent advances in length metrology, 3-4 October 2006, FSB, Zagreb, Croatia

TC-Length meeting, Zagreb, Croatia

Upcoming

- 2007 EUROMET **TC-L CP** Meeting: 29-31 October 2007, San Anton, Malta
- 12th Meeting of the **CCL-WGDM**: 11-12 September 2007, BIPM, Sèvres, France
- 12th Meeting of the **CCL-CCTF-FSWG**: 10-11 September 2007, BIPM, Sèvres, France
- 13th Meeting of the **CCL**: 13-14 September 2007, BIPM, Sèvres, France

5. Other news

CCL-WGDM Chairmanship

During the 2006 CCL-WGDM meeting, the chairmanship changed. The outgoing chairman, Nick Brown from NMIA was replaced by Ruedi Thalmann from METAS.

CIPM issues on length key comparisons

At the 2006 CCL-WGDM meeting, the JCRB Secretary delivered a message from the CIPM directly to the WGDM that the CIPM was unhappy with the operation of the key comparisons in dimensional metrology. The questions/points raised by the CIPM were:

- Why gauge block comparisons warrant a different approach from other artefact-based comparisons, (been triggered by concern about the large number of comparisons being organized).
- In future comparisons the linking should be included as part of the protocol. (There were many schools of thought in calculating reference values, and encouraged participants to be open-minded.)
- The question of stability could easily be resolved by adopting a star formation for the comparisons.
- Recommend that the WGDM meets at the BIPM occasionally.
- Develop a self-standing document from the CCL on how future comparisons would be organized.
- Develop a paper on the limitations of gauge-block comparisons and the consequences for linkages.

The WGDM was disappointed because it had been following processes that had been agreed with the CCL and with the BIPM Director as an effective and efficient way of undertaking the increased comparison workload of the MRA. It was only now, in the CIPM, that these processes were being questioned.

The WGDM hoped that its chairman would be allowed to present the WGDM arguments to the CIPM (or a sub-meeting of its members). It also decided to re-examine the portfolio of length key comparisons, with a view to changing the majority of the existing comparisons to supplementary comparisons and limiting the key comparisons portfolio to just 3 subjects: a laser wavelength comparison, a linescale comparison and an angle comparison.

6. EMRP/ERA-NET+ planning and potential projects

Following the announcements regarding the delay to the planned EMRP activities under Article 169 status and the interim funding under ERA-NET+, TC-Length has started to collect together ideas for potential collaborative R&D projects under ERA-NET+ funding. The timing is quite difficult, since TC-Length usually meets in October each year and this is so late in the planning cycle for ERA-NET+ that much of the planning will have been completed and indeed the TC-Length meeting has been delayed by one week in order to allow participation at the EMRP

decision conference the week before (which was the originally planned date for TC-Length to meet).

Project ideas for ERA-NET funding are mostly those aligned with the topics in 3 of the 4 TC-Length EMRP roadmaps which were prepared the previous year. The fourth roadmap concerned support for other technical areas and the possible projects in this area are already being described in other ERA-NET submissions (e.g. thermal work, Boltzmann etc).

The TC-Length chairman has solicited ideas for projects from all other EUROMET NMIs and has received details from METAS, CEM, PTB, MIKES and INRIM. UME has expressed interest in taking part. The potential project areas identified so far are:

Area	Topic
1	Nanoparticles: Characterisation methods and applications in metrology
1	Particle analysis by means of light scattering
1	Traceability for non-spherical particles
1	Tip-sample-interactions in SFM and their effect on dimensional metrology in the nanometre range
1	Nano roughness standards for 2D and 3D parameters
1	Crystalline surfaces as standards for calibration or as base for new sensors
1	X-ray interferometry for dimensional measurements in the mm range
1	High precision straightness metrology on planar substrates with graduations
1	High-resolution sub-wavelength interferometry
1	Investigations of influences on the uncertainty of optical structure position metrology
2	Metrological measuring machines
2	Large gears, large objects
2	Numerical geometrical standards
2	Computed Tomography for small 3D objects (possibly including x-ray tomography)
2	High accurate 3D cylinder form calibration
2	Double-ended gauge block interferometry for measurement of absolute length
2	Double-ended gauge block interferometry for measurement of absolute thermal expansivity
3	Multi-wavelength interferometry for measuring of distances up to 1 km
3	Refractive index measurement over long distance by using two-wavelength interferometry and spectroscopic humidity measurement
3	Traceable absolute interferometry by using absorption lines
3	Long distance measurement using material standards
3	Long distance interferometry test facility for long range metrology systems
3	Length measurements using the Frequency Comb

The roadmap areas identified in the table above are:
[1] Nano/Micrometrology (incl. Nanoparticles, Scanning Probe Microscopy)
[2] Metrology for Advanced Production, Manufacturing
[3] Large scale / long range metrology

As can be seen, the projects that are proposed are very much aligned with the traditional R&D areas performed in many NMIs, but this is to expected as this TP3 in the Call will be based on the TC-Length roadmaps and these in turn were based on the long term R&D goals expressed by several leading NMIs. TP3 is a vertical activity of the Call rather than a horizontal action e.g. the Health TP.

At the moment, the main issues for the ERA-NET work in TC-Length are: merging the interest areas together into sufficiently large projects that will benefit from co-funding; coordinating the response to the forthcoming Call (perhaps using a micro-CMM workshop as a suitable meeting venue); the timescale involved!

The outgoing Chairman would like to take the opportunity in this, his final submitted report to the General Assembly, to thank all of his colleagues in TC-Length for their support, help, knowledge and friendship during the 4 years in which I have served as Chairman. I hope the support and genuine willingness to work together will continue under the next Chairman, to whom I wish every success!

Andrew Lewis
TC-Length Chairman, 15 May 2007