

1. General Aspects

EURAMET TC-L currently has contact persons from 33 EURAMET members and 5 named observers: 1 from a DI, 3 from liaison NMIs (EG, IL and ZA) and 1 from liaison organization (BIPM). In the last meeting held at CEM in Oct. 2015 TC-L had 37 participants, 25 contact persons, 1 Convenor of WG on EMPIR, 2 observers, 8 guests and 1 additional representative from the hosting NMI. As observers there were 2 representatives from Saudi-Arabia.

2. Projects

In the period under review there were a total of 28 active projects with 11 being MRA comparisons. At the last TC-L meeting 3 new project proposals were discussed.

Two of the long-term TC-L projects are related to conference series, organized by TC-L at different locations with colleagues from PTB serving as main contact:

- EURAMET #1343 MacroScale conference series
- EURAMET #1342 NANOSCALE conference series

These triannual conferences collect length metrology researchers globally from NMIs, academia and industry.

3. Comparisons

3.1 KeyComparisons

The current status of EURAMET length key comparisons, in line with the CCL-KC, is as follows. Changes since the last GA meeting are marked in red in the status column.

Designation	Title	Status
EURAMET.L-K1.2011	Gauge blocks	Final & Executive report, KCDB
EUROMET.L-K2	Long Gauge blocks	Executive report, KCDB
EURAMET.L-K3.2009	Angle comparison using an autocollimator	Draft A.0
EURAMET.L-K3.2009.1	Angle comparison, Bilateral	Final Report, KCDB
EUROMET.L-K4.2005	Diameter standards	Final & Executive report, KCDB
EUROMET.L-K4.2005.1	Diameter standards	Draft B1
EURAMET.L-K5.2016	Step gauge	Started
EUROMET.L-K6	2D-CMM artefacts	Final & Executive report, KCDB
EUROMET.L-K7.2006	Line scales	Final & Executive report, KCDB
EURAMET.L-K7.2014	Line scales, bilateral	Final Report, KCDB
EURAMET.L-K8	Surface texture - Roughness	Draft B
EURAMET.L-K8.2013	Surface texture - Roughness	Final & Executive report, KCDB

3.2 Supplementary comparisons

Recently active supplementary comparisons:

Designation	Title	Status
EURAMET.L-S20	Comparison of laser distance measuring instruments	Final & Executive report, KCDB
EURAMET.L-S21	Comparison of parallel thread gauges	Final & Executive report, KCDB

EURAMET.L-S22	Calibration of gauge blocks by mechanical comparison	Draft A
EURAMET.L-S23	High precision roundness by error separation technique	Draft A
EURAMET.L-S24	Involute Gear Standards	Final & Executive report, KCDB
EURAMET.L-S25	Comparison of pocket-type laser distance measurement instruments (EDMs)	Started

3.3 Corrective actions due to insufficient performance in KC/SC

CCL guidance is that so-called executive reports are made after each KC/SC by pilot and accepted by participants and RMO/CCL. In these reports those laboratories with problems to demonstrate their CMC capability are listed and the nature of the problem is explained. If corrective actions have been performed they are also listed. In the annual TC-L meetings any pending issues are discussed. A table is maintained and updated by TC-L where all corrective actions are listed. The DECISION CCL 2 (2015) – ‘*Procedure for discrepant result corrective actions*’ describes the responsibilities: ‘the NMI proposes corrective actions which are agreed by the RMO (e.g. TC-L) within 90 days, informs the pilot of these (for inclusion in the Executive Report) and then implements them’.

4. CMCs

An overview of the past (after 2011) and present CMC submission is given in the table below. Red entries changed status during the period reported.

Designation	Comment	Status
EURAMET.L.10.2011	29 CMCs / 8 countries	published, 2011-08-18
EURAMET.L.11.2011	47 CMCs / 11 countries	published, 2012-10-12
EURAMET.L.12.2012	7 CMCs / 1 country	published, 2012-12-08
EURAMET.L.13.2012	11 CMCs / 3 countries	published, 2013-02-26
EURAMET.L.14.2013	14 CMCs / 3 countries	published, 2013-08-05
EURAMET.L.15.2014	26 CMC / 8 countries	published, 2014-07-21
EURAMET.L.16.2015	49 CMCs / 8 countries	published, 2015-10-15
EURAMET.L.17.2016	47 CMCs / 11 countries	Inter-RMO review

During the reporting period 1 CMC set from other RMOs was treated by TC-L.

5. Activities of the Subcommittees

There are no sub-committees in TC-L.

6. Participation in EMRP/ EMPIR

In the 2015 EMPIR call, Industry there were 8 JRPs with connection to TC-L, 4 of them were selected for funding.

Length related accepted JRPs of EMRP 2010, 2011, 2012, 2013 and of EMPIR 2014 and 2015 calls are listed below, changes to status of last year are indicated in red:

Call	Project name	Status
EMRP 2010; Metrology for	Optical and tactile metrology for absolute form characterization	Finished
	Dynamic Mechanical Properties and Long-term Deformation	Finished

industry	Behaviour of Viscous Materials	
	Thermal design and time-dependent dimensional drift behaviour of sensors, materials and structures	Finished
	Metrology of Small Structures for the Manufacturing of Electronic and Optical Devices	Finished
	Metrology to Assess the Durability and Function of Engineered Surfaces	Finished
	New generation of frequency standards for industry	Finished
EMRP 2011; SI broader scope	Traceability of sub-nm length measurements	Finished
EMRP 2011; New Technologies	Traceable measurement of mechanical properties of nano-objects	Finished
	Traceability for computationally-intensive metrology	Finished
EMRP 2012; Metrology for industry	Large volume metrology in industry	Started
	Metrology for movement and positioning in six degrees of freedom	Started
	Multi-sensor metrology for microparts in innovative industrial products	Started
	Traceable in-process dimensional measurement	Started
EMRP 2012; SI broader scope	Angle metrology	Started
	Metrology for long distance surveying	Started
	Crystalline and self-assembled structures as length standards	Started
EMRP 2013; Energy II	Traceable measurement of drive train components for renewable energy systems	Started
EMPIR 2014; Industry	Metrology for highly-parallel manufacturing	Started
	Metrology for length-scale engineering of materials	Started
	Metrology for the photonics industry	Started
EMPIR 2015; Health	Metrology for additively manufactured medical implants	Contract negotiation
EMPIR 2015; SI	Traceable three-dimensional nanometrology	Contract negotiation
	Reference algorithms and metrology on aspherical and freeform lenses	Contract negotiation

There are also other approved projects with some length related research:

Call	Project name	Status
EMRP 2011; New Technologies	Traceable characterisation of nanostructured devices	Finished
	Metrology with/for NEMS	Finished
	Metrology of electro-thermal coupling for new functional materials technology	Finished
EMRP 2011; Health	Metrological characterisation of microvesicles from body fluids as non-invasive diagnostic biomarkers	Finished
EMRP 2012; Metrology for industry	Novel electronic devices based on control of strain at the nanoscale	Started
	Metrology to enable high temperature erosion testing	Started
EMPIR 2014; Industry	Metrology for manufacturing 3D stacked integrated circuits	Started
	Metrology for innovative nanoparticles	Started
EMPIR 2015; SI	Nano-scale traceable magnetic field measurements	Contract

7. Capacity Building: Activities of the last year and future needs

Training courses on calibration of long gauge blocks 100 mm - 500 mm (NPL, PTB) and on tapes & rules (GUM) were asked for as capacity building activity and were offered by the NMI's shown in brackets. At its last meeting in Oct. 2015 TC-L has appointed a contact person for capacity building issues. Tanfer Yandayan from Tübitak, TR will take over this responsibility in summer 2016.

8. Meetings

The following list shows the TC-L meetings and related activities over the last 3 years:

- 2013 TC-L CP meeting, 21-22 October 2013, PTB, Braunschweig, Germany
- The annual meeting of 2013 was followed by an open EMRP workshop and an EMPIR workshop
- 2014 TC-L CP meeting, 27-28 October 2014, BEV, Wien, Austria
- Macroscale 2014 Conference, 28-30 October 2014, BEV, Wien, Austria

This conference was arranged by BEV and PTB in co-operation with CCL and EURAMET TC-L.

During or around this conference many JRPs had their project meetings

- 2015 TC-L CP meeting, 26-28 October 2015, CEM, Tres Cantos, Spain

The annual meeting of 2015 was followed by a TC-L EMPIR workshop and a workshop on the results of JRP 'Angle metrology'

- 2016 TC-L CP meeting, 17-18 October 2016, VSL, Delft, Netherlands

The annual meeting of 2016 will be followed by a TC-L EMPIR workshop and meetings of the CCL WG-MRA and the CCL WG-Nano

9. Issues

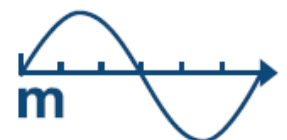
There was a discussion within TC-L about an informal participation of an accredited laboratory in EURAMET.L-K5.2016 on step gauges. Background: In one larger EURAMET NMI the calibration service for step gauges was stopped more than 10 years ago. However, step gauge calibrations with small uncertainties were offered by an accredited lab using a self-developed interferometric measuring instrument. Meanwhile, the NMI has planned to upgrade an existing measuring instrument to also realize step gauge measurements. This NMI and the accredited lab will be given the opportunity to informally join the comparison, i.e. without contributing to the reference values.

10. Strategic Planning

During 2014 and 2015 TC-L contributed to the EMPIR [Strategic Research Agenda](#). Members from TC-L, who also are members of the CCL Working Group on Strategy (CCL WG-S) contributed to generate a condensed version of the [CCL Strategy Document](#). Within the WG on Nanometrology of CCL (CCL WG-N) members of TC-L contributed to a discussion document on „Recommendations of CCLWG-N: Realization of SI Metre using Silicon lattice and Transmission Electron Microscopy for Dimensional Nanometrology“, which is intended to be added to the next version of the Mise en Pratique document for the realization of the Metre.

11. Outlook for 2016/2017

Annual TC-L meeting 17.-18. Oct. 2016 at VSL. Preparation for EMPIR 2017 calls. Preparation of Macroscale conference in Oct. 2017 at VTT-Mikes, FI.



Length