

## 1. General Aspects

EURAMET TC-L currently has contact persons from 34 EURAMET members and 4 named observers: 1 from a DI, 2 from liaison NMIs (EG, ZA) and 1 from liaison organization (BIPM). In the last meeting held at LNE in Oct. 2018 TC-L had 34 participants, 27 contact persons, 1 observer, and 5 guests (GB, PT, HU, 2xSA).

## 2. Projects

In the period under review there were a total of 17 active projects with status “in progress” and 1 with status “ongoing”, 5 projects being MRA comparisons. At the last TC-L meeting 3 new project proposals were discussed and are currently under preparation, however, not yet registered. 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 Key Comparisons

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	Final & Executive report, KCDB
EURAMET.L-K3.2009.2	Bilateral comparison using AC	Final & Executive report, KCDB
EURAMET.L-K4.2015	Diameter standards	In progress
EUROMET.L-K4.2005.1	Diameter standards	Final & Executive report, KCDB
EURAMET.L-K5.2016	Step gauge	In progress
EUROMET.L-K6	2D-CMM artefacts	Final & Executive report, KCDB
EUROMET.L-K7.2006	Line scales	Final & Executive report, KCDB
EURAMET.L-K8	Surface texture - Roughness	Final & Executive report, KCDB

### 3.2 Supplementary comparisons

Recently active supplementary comparisons:

Designation	Title	Status
EURAMET.L-S23	High precision roundness by error separation technique	Final & Executive report, KCDB
EURAMET.L-S25	Comparison of pocket-type laser distance measurement instruments (EDMs)	Final & Executive report, KCDB
EURAMET.L-S26	Measurement of groove depth	In progress

	standards in the range 1 µm up to 1 mm	
EURAMET.L-S27	Measurement of Steel Tapes of 10 m and 50 m	In progress

### 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 2013) and present CMC submission is given in the table below. Red entries changed status during the period reported.

Designation	Comment	Status
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	50 CMCs / 11 countries	published, 2016-10-05
EURAMET.L.18.2017	42 CMCs / 7 countries	published, 2017-10-30
EURAMET.L.19.2018	16 CMCs / 5 countries	published, 2018-09-12
EURAMET.L.20.2019	16 CMCs / 6 countries	Inter-RMO review

During the reporting period 4 CMC sets from other RMOs were treated by TC-L.

### 5. Activities of the Subcommittees

There are no sub-committees in TC-L.

### 6. Participation in EMRP/ EMPIR

In the 2018 EMPIR calls (Health, SI Broader Scope, Normative, ...) there were a few funded JRPs with direct connection to TC-L.

Length related accepted JRPs of EMRP 2012, 2013 and of EMPIR 2014, 2015, 2016, 2017 and 2018 calls are listed below, changes to status of last year are indicated in red:

Call	Project name	Status
EMRP 2012; Metrology for industry	Large volume metrology in industry	Completed
	Metrology for movement and positioning in six degrees of freedom	Completed
	Multi-sensor metrology for microparts in innovative industrial products	Completed
	Traceable in-process dimensional measurement	Completed
EMRP 2012; SI broader scope	Angle metrology	Completed
	Metrology for long distance surveying	Completed

	Crystalline and self-assembled structures as length standards	Completed
EMRP 2013; Energy II	Traceable measurement of drive train components for renewable energy systems	Completed
EMPIR 2014; Industry	Metrology for highly-parallel manufacturing	Completed
	Metrology for length-scale engineering of materials	Completed
	Metrology for the photonics industry	Completed
EMPIR 2015; Health	Metrology for additively manufactured medical implants	In progress
EMPIR 2015; SI	Traceable three-dimensional nanometrology	In progress
	Reference algorithms and metrology on aspherical and freeform lenses	In progress
EMPIR 2017; Industry	Advanced Computed Tomography	In progress
	Large Volume Metrology Applications	In progress
	Multifunctional ultrafast microprobes for on-the-machine measurements	In progress
EMPIR 2017; Normative	Improved traceability chain of nanoparticle size measurements	In progress
	Standards for the evaluation of the uncertainty of coordinate measurements in industry	In progress
EMPIR 2018; Health	Standardization of concentration measurements of extracellular vesicles for medical diagnosis	Start 2019
EMPIR 2018; SI Broader Scope	Large scale dimensional measurement for geodesy	Start 2019
EMPIR 2018; Normative	Measurements of the focal spot size on x-ray tubes with spot sizes down to 100 nm	Start 2019
EMPIR 2018; Research Pot.	Traceability for contact probes and stylus instrument measurements	Start 2019

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

Call	Project name	Status
EMRP 2012; Metrology for industry	Novel electronic devices based on control of strain at the nanoscale	Completed
	Metrology to enable high temperature erosion testing	Completed
EMPIR 2014; Industry	Metrology for manufacturing 3D stacked integrated circuits	Completed
	Metrology for innovative nanoparticles	Completed
EMPIR 2015; SI	Nano-scale traceable magnetic field measurements	In progress
EMPIR 2017; Ind	Metrology for the Factory of the Future	In progress

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

Tanfer Yandayan from TUBITAK UME, TR, acts as TC-L contact person for capacity building issues since summer 2016. Tanfer regularly informed TC-L contacts about the RPOT and RMG calls and other capacity building instruments. He coordinated submissions of 2 JRP's from TC-L for the RPOT call in 2017 and in 2018, one of which was accepted as JRP (starting in 2019). Tanfer also prepared and coordinated the training events for long gauge blocks and tapes in 2018. The trainings were conducted in Montenegro (in MBM as host) with kind of contribution of lectures, Rudolf Thalmann, (METAS, CH), and Helge Karlsson, (Justervesenet, NO). 10 people from 6 different

EURAMET NMIs participated in theoretical and experimental trainings using the premises of MBM. Experimental training regarding to calibration of fixed storage tanks (OIML R71) which was demanded in the last years by EURAMET NMIs, is under discussion for 2019.

## 8. Meetings

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

- 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 was followed by a TC-L EMPIR open workshop and meetings of the CCL WG-MRA and the CCL WG-Nano. In March the Nanoscale 2016 conference was organized in cooperation with the Technical University in Wroclaw, PL: => <http://www.nanoscale.ptb.de>

- 2017 TC-L CP meeting, 16-17 October 2017, VTT-MIKES, Espoo, Finland

The annual TC-L meeting of 2017 was followed by the Macroscale conference and a meeting of the CCL WG-MRA in the same week at VTT-MIKES: => <http://www.macroscale.org>

- 2018 TC-L CP meeting, 15-16 October 2018, LNE, Paris, France

The annual TC-L meeting of 2018 was followed by 2 half day workshops: a) News from NMIs; b) TC-L workshop in preparation for the EMPIR calls in 2019 and 2020

## 9. Issues

One NMI from EURAMET TC-L was involved in 2018 in a so-called APMP hybrid comparison as the provider of a calibration certificate. The issue of hybrid comparison was further discussed at the EURAMET BoD/TCC meeting in February 2019. TC-L is in principle open for the hybrid comparison approach.

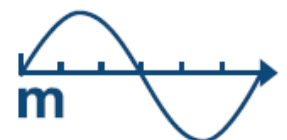
## 10. Strategic Planning

TC-L contributed to the preparation of the CCL meeting in June 2018. The CCL strategy document was updated. The MeP for the unit of length, the metre, has been drafted with strong input from EURAMET NMIs and there are guiding documents prepared on the use of the crystalline Si lattice in nanometrology which will be published on World Metrology Day 2029 at the latest.

=> <http://www.bipm.org/wg/AllowedDocuments.jsp?wg=CCL-WG>

## 11. Outlook for 2019/2020

Next annual TC-L meeting 15.-16. Oct. 2019 at PTB, Braunschweig, DE. TC-L meeting in conjunction with Nanoscale 2019 conference (15./16.10.) and CCL WG-N (17.10.) and CCL-WG-MRA (17./18.10.) meetings. Preparation for EMPIR 2020 calls (PRT's) planned at a stakeholder workshop on Oct. 28/29, 2019 at PTB in Berlin. Next Macroscale conference in 2020 planned to be organized by NMISA in South Africa.



Length