

1. General Aspects

EURAMET TC-L currently has contact persons from **33 EURAMET members and 5 named observers**: 1 from a DI, 2 from liaison NMIs (EG, ZA) and 2 from liaison organization (BIPM, COOMET). In the last meeting held virtually at MBM in Oct. 2020, TC-L had 44 participants, 33 contact persons, 5 observers and 6 guests (1 DE, 1 UK, 1 ME and 3 EURAMET Officers).

2. Projects

In the period under review **14 projects** were active with status “**in progress**”, **9 of them being MRA comparisons**, the last ones (#1545, #1547) proposed and agreed at the last 2021 TC-L meeting.

Project No.	Starting	Title	Co-ordinator	Status	Type	KCDB
1239	2013-08-01	Measurement of surface roughness by AFM	PTB	in progress Waiting for NIST data	Research	
1242	2013-09-01	Measurement of areal roughness parameters	PTB	Draft A1 Tech. protocol including VNIIMS ¹	Research	
1410	2016-10-10	Calibration of Diameter Standards	INRIM	completed	Comparison	EURAMET.L-K4.2015
1433	2018-01-01	Measurement of Steel Tapes of 10 m and 50 m	PTB	Measurements completed. Tech. protocol including VNIIM ¹	Comparison	EURAMET.L-S27
1487	2019-11-01	Measurement of short gauge blocks by interferometry	CEM	completed	Comparison	EURAMET.L-K1.2019
1488	2020-06-01	Measurement of a 1 mm Stage Micrometer	BEV	in progress Contamination of samples reported at the end of 2020. Running under new schedule.	Comparison	EURAMET.L-S29
1489	2020-02-01	High precision roundness measurement by error separation techniques	CEM	completed	Comparison	EURAMET.L-S30
1490	2020-04-01	High precision flatness over 300 mm	PTB	in progress Tech. protocol including VNIIMS ¹	Comparison	EURAMET.L-S28

1495	2020-02-01	Dissemination and verification of dimensional nanometrology technologies	NPL	in progress	Research	
1502	2020-03-01	Calibration of surface roughness standards	PTB	in progress Tech. protocol including VNIIMS¹	Comparison	EURAMET.L-K8.2020
1513	2020-11-01	Calibration of a transducer	MIRS/UM-FS/LTM	in progress	Comparison	EURAMET.L-S31
1527	2021-06-01	Calibration of angle standards	INRIM	in progress	Comparison	EURAMET.L-K3.01
1528	2021-09-01	Calibration of angle encoders	INRIM	in progress	Comparison (pilot study)	
1534	2021-06-18	Measurement of groove depth standards.	MIKES	in progress	Comparison	EURAMET.L-S26.1
1545	2022-07-01	Gauge block by interferometry	NPL	agreed	Comparison	EURAMET.L-K1.n01
1547	2022-07-01	Calibration of 1-D CMM artefacts: Step Gauges	GUM	agreed	Comparison	EURAMET.L-K5.n01

¹Appropriate actions to be taken on #1242, #1433, #1490 and #1502 in response to the EURAMET decision of 2022-03-04 "to suspend or terminate projects and activities with participation of Russia and Belarus under EURAMET" are currently being considered individually by the project participants according to the rules applicable to each project.

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

- **EURAMET #1343 MACROSCALE** conference series

Macroscale 2020 was scheduled for Nov. 2020 in South Africa, organized by NMISA. However, this was postponed to 2022 due to Covid-19, now likely to be further postponed.

- **EURAMET #1342 NANOSCALE** conference series

Next Nanoscale is planned for 2023 at MIKES.

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
EUROMET.L-K1	Gauge blocks	Final report, KCDB
EUROMET.L-K1.1	Gauge blocks	Final report, KCDB
EURAMET.L-K1.2	Gauge blocks	Final report, KCDB
EURAMET.L-K1.2011	Gauge blocks	Final & Executive report, KCDB
EURAMET.L-K1.2019	Gauge blocks	Final report, KCDB
EURAMET.L-K1.n01	Gauge blocks	Planned
EUROMET.L-K2	Long Gauge blocks	Final & Executive report, KCDB
EUROMET.L-K3.1	Optical polygons	Final report, KCDB

EURAMET.L-K3.2009	Angle comparison using an autocollimator	Final & Executive report, KCDB
EURAMET.L-K3.2009.1	Angle blocks	Final report, KCDB
EURAMET.L-K3.2009.2	Bilateral comparison using AC	Final & Executive report, KCDB
EURAMET.L-K3.n01 (new coding agreed by CCL-WG-MRA in Oct. 21)	Intercomparison on calibration of angle standards	In progress
EUROMET.L-K4.2005	Diameter standards	Final & Executive report, KCDB
EUROMET.L-K4.2005.1	Diameter standards	Final & Executive report, KCDB
EURAMET.L-K4.2015	Diameter standards	Final report, KCDB
EUROMET.L-K5.2004	Step gauge	Final & Executive report, KCDB
EURAMET.L-K5.2016	Step gauge	Final & Executive report, KCDB
EURAMET.L-K5.n01	Step gauge	Planned
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	Final report, KCDB
EURAMET.L-K8	Surface texture - Roughness	Final & Executive report, KCDB
EURAMET.L-K8.2013	Surface texture - Roughness	Final & Executive report, KCDB
EURAMET.L-K8.2020	Surface texture - Roughness	In progress

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-S24	Involute gear standards	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 standards in the range 1 μm up to 1 mm	Final report, KCDB
EURAMET.L-S27	Measurement of Steel Tapes of 10 m and 50 m	Measurements completed
EURAMET.L-S28	Measurement of flatness of 300 mm diameter optical flat	In progress
EURAMET.L-S29	Measurement of a Stage Micrometre 10 μm to 1000 μm	In progress Contamination of samples reported at the end of 2020. Running under new schedule.
EURAMET.L-S30	Measurement of sphere diameters 20 mm to 25 mm	Final report, KCDB
EURAMET.L-S31	Transducer displacement error	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’. Since 2006 until now 13 corrective actions took place. The last two were closed in October 2018. Since then no new action have been opened.

4. CMCs

In the period from June 2021 to May 2022

a) intra-RMO CMC reviews of EURAMET TC-L

- 29 CMC submissions from 8 countries
- of these CMCs 18 are published, 4 are still in intra-RMO review and 7 are currently in JCRB review

b) inter-RMO (JCRB) CMC reviews performed by EURAMET TC-L

- 19 CMCs in total:
 - 2 CMCs from SG (8/2021): stage micrometers and step gauges
 - 1 CMC from CL (1/2022): long gauge blocks by comparison
 - 16 CMC from AR (3-5/2022): several measurands

During the reporting period 5 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

Length related accepted JRPs of EMPIR 2014, 2015 and 2016 have been completed. The ones of 2017, 2018, 2019 and 2020 calls are yet in progress and listed below. Changes to status of last year are indicated in red.

Call	Project name	Status
EMPIR 2017 <i>Industry</i>	Large Volume Metrology Applications	Final summary submitted
	Multifunctional ultrafast microprobes for on-the-machine measurements https://www.ptb.de/empir2018/microprobes/home/	Final report published
	Advanced Computed Tomography for dimensional and surface measurements in industry https://www.ptb.de/empir2018/advanct/home/	Final report published
EMPIR 2017 <i>Normative</i>	Standards for the evaluation of the uncertainty of coordinate measurements in industry https://eucom-empir.eu/	Final report published
	Improved traceability chain of nanoparticle size measurements https://www.bam.de/Content/EN/Projects/nPSize/npsize.html	Final report published
EMPIR 2018 <i>Health</i>	Standardization of concentration measurements of extracellular vesicles for medical diagnosis https://www.metves.eu/	In progress
EMPIR 2018 <i>Si Broader Scope</i>	Large scale dimensional measurement for geodesy https://www.ptb.de/empir2019/geometre/home/	In progress
EMPIR 2018 <i>Normative</i>	Measurements of the focal spot size on x-ray tubes with spot sizes down to 100 nm https://www.ptb.de/empir2019/nanoxspot/home/	In progress
EMPIR 2018 <i>Research potential</i>	Traceability for contact probes and stylus instrument measurements http://www.probetrace.org/	In progress
EMPIR 2019 <i>Supp. for Networks</i>	Support for a European Metrology Network on advanced manufacturing	In progress
EMPIR 2019 <i>Energy</i>	High throughput metrology for nanowire energy harvesting devices https://www.ptb.de/empir2020/nanowires/home/	In progress
	Metrology for enhanced reliability and efficiency of wind energy systems https://www.ptb.de/empir2020/met4wind/home/	In progress
EMPIR 2020 <i>Industry</i>	DynaMITE: Dynamic applications of large volume metrology in industry of tomorrow environments (follow-on to the LaVA project which has already attracted many stakeholders) Coordinated by NPL (Andrew Lewis)	In progress
	TracOPTIC: Traceable industrial 3D roughness and dimensional measurement using optical 3D microscopy and optical distance sensors Coordinated by PTB (Uwe Brand)	In progress

	MetExSPM: Traceability of localised functional properties of nanostructures with high speed scanning probe microscopy Coordinated by VTT (Virpi Korpelainen)	In progress
	ATMOC: Traceable metrology of soft X-ray to IR optical constants and nanofilms for advanced manufacturing	In progress
EMPIR 2020 <i>Fundamental</i>	POLight: Pushing boundaries of nano-dimensional metrology by light	In progress

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

Tanfer Yandayan from TUBITAK UME, TR, is the TC-L contact person in charge of capacity building issues since summer 2016. Tanfer regularly informs TC-L contacts about the RPOT and RMG calls and other capacity building instruments.

Capacity Building activities in TC-L were taken into account in the new network project, 19NET01 AdvManuNet: "Support for a European Metrology Network on Advanced Manufacturing". In order to analyze the situation in regards to advanced manufacturing, the capabilities and demands in European states were determined on the basis of questionnaires sent to the experts in EURAMET TC-L for each EURAMET member state. Detailed information can be reached through the paper*. Due to pandemic situation and management orientations, difficulties were observed for RMG applications. No RMG in TC-L related matters were initiated.

*A. Przyklenk et al, Support for a European Metrology Network on advanced manufacturing, MST, 2021.

8. Meetings

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

- 2019 TC-L CP meeting, 14-15 October 2019, PTB, Braunschweig, Germany
The annual TC-L meeting of 2019 was followed by the Nanoscale conference and a meeting of the CCL WG-MRA and WG-N in the same week at PTB: => <http://www.nanoscale.ptb.de>.
- 2020 TC-L CP meeting, 12-13 October 2020, DFM, Copenhagen, Denmark. Virtual.
- 2021 TC-L CP meeting, 19-20 October 2021, MBM, Podgorica, Montenegro. Virtual.

The normal modus to run TC-L workshops and/or conferences in close connection with the TC-L annual meeting has been interrupted by the Covid pandemic. We look forward to revive those initiatives as soon as possible.

9. Issues

- TC-L position with respect to Russia's war in Ukraine
As noted in the **Projects** section, TC-L are running four projects which prior to the invasion of Ukraine involved Russian participation. Following the EURAMET decision from 3 April 2022 to stop cooperation with Russia and Belarus, the pilots and remaining participants are together with the TC-L Chair exploring the routes that are best aligned with the CIPM MRA documents and EURAMET rules.

- Request for clarification
Related to the previous issue, we notice that participation in TC-L projects has rarely been subject to large controversy. While the CIPM MRA-G-11 Section 9 *Disagreements* establishes the hierarchy for interpretation of results, we notice in CIPM MRA-G-11 Section 6 *Participation* that participation in regional comparisons is open “*to other institutes that meet the rules of the regional organization (including institutes invited from outside the region)*” and that we have not been able to identify an explicit hierarchy in EURAMET Guide No 4, Section 2.2.
- *Metrologia* “Focus Issue on Length Metrology”
A *Metrologia* “Focus Issue on Length Metrology”, with contributions from several TC-L members, is approaching finalization.

10. Strategic Planning

A *Metrologia* “Focus Issue on Length Metrology” with contributions from TC-L members is approaching finalization.

An open Special Issue of MST on “Metrology for Manufacturing” (Volume P32, Number 6) to was published in June 2021 including contributions from TC-L members.

https://iopscience.iop.org/journal/0957-0233/page/Special_Issue_Metrology_Manufacturing.

The EMN on Advanced Manufacturing has been approved and is progressing. The EMN covers metrology issues for advanced manufacturing in several key industry sectors (KIS) and is strategic within our group as it relates technical activities of the TC-L with many other fields, linked by the horizontal coverage of this this EMN.

Digitalization and DCC will also play a key role in our future activities at short term.

11. Outlook for 2022/2023

The details for next TC-L meeting in October remain to be settled.

Some of the issues for the next period will surely be:

- Nomination of a contact person as “ambassador” for digitalization and DCC issues.
- Involvement and close collaboration with different EMNs
- Discussion and preparation of the new calls within the European Partnership on Metrology

