TC Chair Annual Report 2020 - 2021

TC for Length (L)
TC Chair: Emilio Prieto
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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 virtually at DFM in Oct. 2020, TC-L had 41 participants, 28 contact persons, 2 observers (DK, ZA) and 9 guests (1 DE, 1 UK, 1 SE, 1 FE, 1 CH, 1 TR, 1 AT and 2 EURAMET Officers).

2. Projects

In the period under review **11 projects** were active with status "**in progress**", **7 of them being MRA comparisons**, the last one (#1513) proposed and agreed at the last 2020 TC-L meeting.

Project No.	Starting	Title	Coordinator	Status	Type	KCDB
1239	2013-08-01	Measurement of surface roughness by AFM	PTB	in progress Waiting for Draft A	Research	
1242	2013-09-01	Measurement of areal roughness parameters	PTB	in progress Draft A1 in Jan. 2020 Draft A2 by the end of 2020	Research	
1410	2016-10-10	Calibration of Diameter Standards	INRIM	in progress Draft B sent to CCL	Comparison	EURAMET.L-K4.2015
1433	2018-01-01	Measurement of Steel Tapes of 10 m and 50 m	PTB	in progress Big delay by Covid-19.	Comparison	EURAMET.L-S27
1463	2018-10-22	Laser sources for interferometry	NPL	**completed**	Research	
1487	2019-11-01	Measurement of short gauge blocks by interferometry	CEM	in progress Draft A2	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	in progress Draft A3 ready to become Draft B	Comparison	EURAMET.L-S30
1490	2020-04-01	High precision flatness over 300 mm	PTB	in progress	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	Comparison	EURAMET.L-K8.2020
1513	2020-11-01	Calibration of a transducer	MIRS/UM-FS/LTM	in progress	Comparison	

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 (in 2021 CCL and CCL WG meetings will take place "virtually" at BIPM).
- **EURAMET #1342 NANOSCALE** conference series
  Nanoscale 2019 took place at PTB Braunschweig in October with more than 100 participants from 25 countries and 5 continents. Next Nanoscale will be organized in 2023 in Europe, one year later than usual, to allow Macroscale to happen in 2022.

  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	Draft A2
EUROMET.L-K2	Long Gauge blocks	Final & Executive report, KCDB
EUROMET.L-K3.1	Optical polygons	Final report, KCDB

EURAMET.L-K3.01 (~~2009~~) (new coding agreed at the last CCL-WG-MRA meeting on 7-10 Dec 20)	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
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	Draft B sent to CCL-WG-MRA sWG-KC
EUROMET.L-K5.2004	Step gauge	Final & Executive report, KCDB
EURAMET.L-K5.2016	Step gauge	Final Report, KCDB Executive Report too
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	In progress Big delay by Covid-19
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	Draft A3 ready to become Draft B

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

An overview of the past (after 2016) and present CMC submission is given in the table below. Red entries changed status during the period reported.

Designation	Comment	Status
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	published, 2020-03-31
EURAMET.L.20.2020	Postponed to 2021, after transformation to quantity equations was finished in 2020 (*)	
EURAMET.L.21.2021	12 CMCs / 4 countries	9 publ., 2 inter-, 1 intra-RMO rev.

(*) EURAMET TC-L has been the first RMO in finishing the transformation from numerical to quantity equations in early July 2020. All revised files of 31 EURAMET NMIs with at least one CMC entry in length were transferred to the BIPM (KCDB manager). Such revised CMC files were integrated into the KCDB at the beginning of August.

1 NMI have to take a fast decision on one greyed-out CMC reaching the limit period for this status. A second NMI on the same issue finally decided to delete its CMC

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

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 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 *Industry*	Large Volume Metrology Applications	In progress (*)
	Partners managed to continue progress despite national lockdowns. However, in order to be able to deliver enough items for the end of project demonstrator, and to avoid the demonstrator taking place at a difficult time in the calendar, a 9M extension from the MSU has been obtained. It is expected the demonstrator to be at WZL Aachen in March 2022. Outputs from LaVA would be useful in mitigating against future lockdowns and this was highlighted by a Tweet from one of the Commissioners (https://twitter.com/DrollPeter/status/1310133911486332929?s=20)	
	Multifunctional ultrafast microprobes for on-the-machine measurements https://www.ptb.de/empir2018/microprobes/home/	In progress - 27M Project Meeting in Sep. 9, 2020. Online. - 2nd Stakeholder Workshop in June 9, 2021. - Final Project Meeting in Nov. 10-11, 2021 at VTT.
	Advanced Computed Tomography for dimensional and surface measurements in industry https://www.ptb.de/empir2018/advanct/home/	In progress - 7M Project Meeting in Sep. 9-10, 2020. Online. - 35M Project Meeting in May 4-5 2021. Online. - 5th annual Dimensional X-ray CT conference at NPL on 17-19 May 2021. - Final Project Meeting in Nov. 14-15, 2021 at NPL.
EMPIR 2017 *Normative*	Standards for the evaluation of the uncertainty of coordinate measurements in industry https://eucom-empir.eu/	In progress - Participation at the XIV International Scientific Conference Coordinate Measuring Technique on March 20, 2020
	Improved traceability chain of nanoparticle size measurements https://www.bam.de/Content/EN/Projects/nPSize/npsize.html	In progress
EMPIR 2018 *Health*	Standardization of concentration measurements of extracellular vesicles for medical diagnosis https://www.metves.eu/	In progress - First progress meeting on 12 Feb. 2020 in Budapest - Midterm progress report on 14 Jan. 2021
EMPIR 2018 *Si Broader Scope*	Large scale dimensional measurement for geodesy https://www.ptb.de/empir2019/geometre/home/	In progress - 9M Project Meeting in Feb. 24-25, 2020 at CNAM, France - 18M Project Meeting in Nov. 17-18, 2020. Online - 27M Project Meeting in June 29-30, 2021. Online

EMPIR 2018 *Normative*	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 - 9M Project Meeting on March 12-13, 2020 in Excillum, Sweden - 18M Project Meeting on Nov./Dec. 2020 at VTT, Finland - 27M Project Meeting on Aug./Sep. 2021
EMPIR 2018 *Research potential*	Traceability for contact probes and stylus instrument measurements http://www.probetrace.org/	In progress - 1st reporting on Sept. 20 - EMPIR Agreement on Nov. 2020 to extend the duration of the project to 42M by Covid-19 - 1st mid-term meeting on 2-4 Feb. 2021. Online - 1st interim report on March 2021
EMPIR 2019 *Supp. for Networks*	Support for a European Metrology Network on advanced manufacturing	In progress - Publication on AdvManuNet, a networking project on metrology for advanced manufacturing, Jun. 2020, Proceedings of the 20th euspen International Conference https://www.euspen.eu/knowledge-base/ICE20374.pdf
EMPIR 2019 *Energy*	High throughput metrology for nanowire energy harvesting devices https://www.ptb.de/empir2020/nanowires/home/	In progress - Kick-Off Meeting on Sep. 17-18, 2020 at PTB 9M Project Meeting on May 10-11, 2021. Online.
	Metrology for enhanced reliability and efficiency of wind energy systems https://www.ptb.de/empir2020/met4wind/home/	In progress - Kick-Off Meeting on Sep. 14-15, 2020. Online. - 9M Project Meeting on May 18-19, 2021. Online.
EMPIR 2020 *Industry*	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)	
	TracOPTIC: Traceable industrial 3D roughness and dimensional measurement using optical 3D microscopy and optical distance sensors Coordinated by PTB (Uwe Brand)	
	MetExSPM: Traceability of localised functional properties of nanostructures with high speed scanning probe microscopy Coordinated by VTT (Virpi Korpelainen)	
EMPIR 2020 *Fundamental*	POLight: Pushing boundaries of nano-dimensional metrology by light	

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* to be published soon. Due to pandemic situation and management orientations, difficulties were observed for RMG applications. One accepted RMG in the length area was cancelled.

*A. Przyklenk et al, Support for a European Metrology Network on advanced manufacturing, MST, 2021 (to be published).

8. Meetings

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

- 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.

- 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.

9. Issues

- A Quality assessment by SWEDAC on a RISE service, involving JV as the lab. issuing the certificate, based on an approach close to that of “hybrid comparisons”, took place in the second half of 2020. As a result, the TC-L Chair acting as impartial referee received separately the certificates and the final report, approving it for the assessment.

- TC-L input to EURAMET on Horizon Europe Work Program for 2021-22
  After looking at the different Clusters and Destinations of the four Draft Programs for 2021-22, the TC-L saw several opportunities to contribute to the Horizon Program. An important part of such opportunities are coincident with those of the Advance Manufacturing Network (AdvManuNet) originated within our TC-L although such EMN have of course other inputs/outputs from/to other Communities due to its horizontal coverage. TC-L summarized in a 3-page Report sent to EURAMET the different Clusters and Destinations which could be involved in.

- The JNP AdvManuNet, also from our TC-L, sent also inputs to the Horizon Europe Work Program. The JNP checked the four draft work programs and identified several links, the largest overlap with the cluster Digital, Industry and Space on themes as Advanced manufacturing, advanced digital tools for manufacturing and construction, advanced materials, smart manufacturing, digital and emerging technologies for advanced manufacturing, AI in manufacturing and advanced manufacturing in space engineering.

- TC-L participated in a CCL Survey on the Digitalized SI metre, sending their inputs to the Task Group on the 'Digital SI' established by the CIPM after the recent BIPM workshop on The International System of Units (SI) in FAIR digital data. Andrew Lewis (NPL) who prepared some slides with ideas for a digital SI metre contributed to this workshop. Both current and incoming TC-L Chairs are members now of this small Task Group within CCL.

- TC-L also participated in a survey carried out by Aalto University with the support from WG M4D and project TC-IM 1448 on the Digital Calibration Certificate (DCC) implementation. The goal was to understand how many actors in the calibration industry are planning to digitalize their calibration certificate management, what are the main drivers for it, identify possible blockers for the digitalization and understand what kind of solutions is needed to achieve industry-wide adoption of DCC.

- TC-L sent their inputs to the Chair of the EURAMET European Metrology Network for Quantum Technologies (EMN-Q), after his request to contribute to establish the different Roadmaps located at the core of their Strategic Research Agenda (SRA). And efficient strategy to establish a stable connection between the TC-L and the EMN-Q to exchange ideas could take place.

10. Strategic Planning

A call for *Metrologia* "Focus Issue on Length Metrology" was promoted within CCL and TC-L colleagues prepared some papers to be published.

An open Special Issue of MST on "Metrology for Manufacturing" (Volume P32, Number 6) to be published in June 2021 collects contributions from TC-L members.
https://iopscience.iop.org/journal/0957-0233/page/Special_Issue_Metrology_Manufacturing.

The proposal for an EMN on Advanced Manufacturing has been submitted by Harald Bosse (PTB) to the GA. The EMN will cover metrology issues for advanced manufacturing in several key industry sectors (KIS) identified after an analysis of the EC industrial sectors. This initiative is really strategic within our group because relates technical activities of the TC-L with many from other fields but linked by this EMN due to its horizontal coverage.

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

11. Outlook for 2021/2022

Next TC-L "virtual" meeting will take place in Podgorica, Montenegro, hosted by the Bureau of Metrology. Dates are 19-21 October 2021. This will be the last meeting of E. Prieto (CEM) as TC-L Chairman and the first for our yet incoming Chair Sten Bergstrand (RISE).

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

The decision on these and other key issues will take place under the mandate of our next Chairman, Sten Bergstrand, who we welcome to.