

1. General Aspects

The EURAMET Mass and Related Quantities Technical Committee, TC-M, is characterized by the mass and a number of related quantities with a diversity of techniques employed in the realization of the corresponding units. There are two dominant issues, one is the redefinition of the kilogram, which has definitely influenced the activities of some NMIs and reflects in EURAMET projects, and the other is EMPIR, where many NMI/DI are collaborating very actively.

2. Comparisons

In the following tables there is the status of comparisons based on information published at KCDB and EURAMET.

Key comparison - Table 1; Supplementary Comparisons - Table 2; EURAMET projects - Table 3.

Comparison ID	Project no.	Title/Range	Subfield	Pilot	Contact	Status
EURAMET.M.D-K1.1	1031	Solid 6 silicon spheres (two petals)	Density	PTB	H. Bettin	Report in progress draft A
CCM.D-K5	1440	Oscillation type density meters	Density	BEV	M. Schiebl	Protocol complete/In progress
EUROMET.M.F-K1	535	5 kN to 10 kN	Force	MIKES	A. Pusa	Report in progress draft B
EUROMET.M.F-K3	505	500 kN to 4 MN	Force	PTB	R. Kumme	In progress/In progress
EURAMET.M.G-K3	1432	Absolute Gravimeters	Gravity	VUGTK	V. Pálinkás	Planned/ In progress
EURAMET.M.M-K2.4	-	100 mg to 10 kg	Mass	DFM	L. Nielsen	Measurements/ Protocol complete
EURAMET.M.M-K4.2015	1346	1 kg mass standards	Mass	BEV	Z. Zelenka	Planned/ In progress
EURAMET.M.P-K1.c	1179	0.7 MPa to 7 MPa	Pressure	Force	A. Atlintas	In progress/ In progress
EURAMET.M.P-K7	881	5 MPa to 500 MPa	Pressure	MIKES	M. Rantanen/ S. Saxholm	Report in progress draft B
EURAMET.M.P-K15.1	1405	Absolute range 0.1 mPa to 1 Pa	Pressure	PTB	K. Jousten	In progress

Table 1: Status of EURAMET Key Comparisons in KCDB.

Comparison ID	Project no.	Title/Range	Subfield	Pilot	Contact	Status
EURAMET.M.D-S3	1404	Solid 3 silicon spheres (1 kg, 125 g and 30 g)	Density	CEM	N. Medina	Protocol Complete/ In progress
EURAMET.M.F-S2	1262	5 N to 250 kN	Force	BEV	C. Buchner	In progress/ In progress
EURAMET.M.M-S3	1406	100 mg to 50 kg	Mass	UME	U. Y. Akcadag	Approved and published/ completed
EURAMET.M.M-S5	-	100 mg to 1 kg	Mass	NSAI	R. Hanrahan	Planned
EURAMET.M.M-S7	1300	500 kg	Mass	MIRS	Matej Grum	In progress/ In progress
EURAMET.M.M-S9	1310	0.5 mg to 0.05 mg	Mass	NPL	J. Berry	Approved and published/ Completed

Comparison ID	Project no.	Title/Range	Subfield	Pilot	Contact	Status
EURAMET.M.P-S5	931	50 MPa to 500 MPa	Pressure	PTB	W. Sabuga	Final Report was published within EURAMET
EURAMET.M.P-S13	1252	10 MPa to 100 MPa	Pressure	UME	Y.Durgut	In progress/ In progress
EURAMET.M.P-S14	1306	50 MPa to 1 GPa	Pressure	PTB	J. Koneman	To be published
EURAMET.M.P-S15	1376	100 Pa to 3,5 kPa	Pressure	GUM	A. Brzozowski	Protocol Complete/ In progress
EURAMET.M.P-S16	1375	250 MPa	Pressure	GUM	A. Brzozowski	Protocol Complete/ In progress
EURAMET.M.P-S17	1385	-920 to 0 hPa. Part II	Pressure	LNE	P. Otal	Planned/ Proposed
EURAMET.M.P-S18	1414	hydraulic pressure balance effective area	Pressure	HMI/FS B-LPM	L. G. Bermanec	To be published
EURAMET.M.T-S4	1304	0,1 N.m at 50 N.m	Torque	LNE	C. Duflon	Planned/In progress
EURAMET.M.T-S5	1428	100 N.m at 5 000 N.m	Torque	LNE	C. Duflon	Planned/Proposed

Table 2: Status of EURAMET Supplementary Comparisons in KCDB.

In the table 3 there is the status of comparisons only registered in EURAMET.

EURAMET Project no.	Title/Range	Subfield	Pilot	Contact	Status
1115	R-134a leak comparison	Pressure	LNE	I. Morgado	finished – reporting in progress
1206	800 to 1100 hPa	Pressure	MIKES	S. Saxholm	finished – reporting in progress
1207	200 kPa to 1,75 MPa	Pressure	MIKES	S. Saxholm	finished – reporting in progress
1350	sub-multiples of the kilogram	Mass	MIRS	Goran Grgić	In progress
1416	Bilateral study comparison in the high vacuum range from 5E-7 Pa to 9E-4 Pa	Pressure	CMI	D. Prazak	In progress
1441	Calibration guides for force and torque traceability	Force and Torque	NPL	A. Knott	In progress

Table 3: Status of EURAMET Projects, in EURAMET site with no link to KCDB Comparisons.

3. Projects

Table below shows the actual number of agreed, proposed, in progress, ongoing, completed, concluded and cancelled projects listed for TC-M in the EURAMET Projects database. Projects are divided by category and the numbers in brackets corresponds to last year information.

	Comparison	Research	Traceability	Consultation	Total
Agreed	0 (16)	0 (1)	2 (2)	0 (0)	2 (19)
Proposed	2 (2)	0 (0)	0 (0)	0 (0)	2 (2)
In progress	21 (5)	2 (–)	2 (–)	1 (–)	26 (5)
ongoing	0 (–)	0 (–)	0 (–)	0 (–)	0 (–)
Completed	77 (73)	44 (45)	8 (8)	19 (18)	148 (144)
Concluded	0 (–)	0 (–)	0 (–)	0 (–)	0 (–)
Cancelled	4 (4)	2 (2)	0 (–)	0 (–)	6 (6)
Total	104 (100)	48 (48)	12 (10)	20 (18)	184 * (176)

4. CMCs

The following tables 4 and 5 are an update of new submissions since May 2017.

Concerning EURAMET submissions

CMCs Submission	NMI	Field	State
EURAMET.M.48.2017	MIKES-VTT, Finland	Mass	published
EURAMET.M.49.2017	HMI/FSB-LIMS, Croatia	Force	Not approved *
EURAMET.M.51.2017	PTB, Germany	Density	published
EURAMET.M.53.2017	METROSERT, Estonia	Mass	published
EURAMET.M.54.2017	BEV, Austria	Mass	published
EURAMET.M.55.2017	METAS, Switzerland	Pressure	under revision
EURAMET.M.56.2018	NPL, United Kingdom	Density	under revision

Table 4: EURAMET CMC's Submissions

* This CMC was not approved by APMP because the only comparison available was from DUNAMET and not from EURAMET. Soon a bilateral comparison will be performed with NPL.

Concerning Review of CMCs for other RMO's submissions

CMCs Submission	NMI	Country	Field	State
AFRIMETS.M.6.2018	NSi	Namibia	Mass	under revision
APMP.M.41.2016	NIM	China	Density, Force, Torque and Hardness	under revision
APMP.M.42.2016	A*Star	Singapore	Mass	under revision
APMP.M.44.2017	NMIA	Australia	Mass	published
COOMET.M.14.2013	NSC IM	Ukraine	Gravity	published
COOMET.M.26.2015	Ukrmetrtest standard	Ukraine	Force	published
COOMET.M.28.2017	VNIIM	Russian Federation	Torque	published
COOMET.M.29.2017	KazInMetr	Kazakhstan	Viscosity	published
COOMET.M.30.2017	VNIIM	Russian Federation	Pressure	Approved by JCRB
COOMET.M.31.2017	AzMI	Azerbaijan Republic	Viscosity	under revision
SIM.M.34. 2017	INM	Colombia	Density	published
SIM.M.35. 2017	IBMETRO	Bolivia	Mass	published
SIM.M.36. 2017	CENAMEP	Panama	Force	under revision
SIM.M.37. 2017	INM	Colombia	Force	Approved by JCRB

Table 5: Other RMO's CMC's Submissions

For Intra EURAMET review there are at the moment under revision (before submission on the KCDB):

NMI	Field
PTB, Germany	Hardness
LNE, France	Pressure
INRIM, Italy	Pressure
INRIM, Italy	Mass
BEV, Austria	Density
IMBiH, Bosnia and Herzegovina	Pressure

Table 6: New CMC's in Intra EURAMET review

5. Meetings

The TC - Mass and Related Quantities 2018 meetings were held in Dublin, from the 16th April to the 19th April.

EURAMET – TC MASS AND RELATED QUANTITIES MEETING 2018

Crowne Plaza All meeting marked *Crowne Plaza take place in the hotel. Please proceed directly to the Fahrenheit Suite for these meetings	NSAI All meetings marked *NSAI are held in the NSAI building . (Swift Square, Santry Dub 9) Please meet bus directly outside hotel to attend these meetings.
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Day /time	Monday 16th April	Tuesday 17th April Registration Crowne Plaza		Wednesday 18 th April Registration Crowne Plaza		Thursday 19th April Registration Crowne Plaza	
09:00-10:30		*Crowne Plaza SC Pressure Meeting	*NSAI Guide Liquid Density (hydrostatic weighing) (Closed session)	*Crowne Plaza SC Mass Meeting	*NSAI Review of EURAMETcg 4 (Closed session)	*Crowne Plaza TC Mass Contact Persons Meeting	
10:30-11:00		Coffee break		Coffee break		Coffee break	
11:00-12:30		SC Pressure Meeting	Guide Liquid Density (hydrostatic weighing) (Closed session)	SC Mass Meeting	Review of EURAMET cg 4 (Closed session)	TC Mass Contact Persons Meeting	
12:30-13:30		Lunch		Lunch		Lunch	
13:30-15:30	*NSAI Strategy-WG meeting (closed session)	*Crowne Plaza SC Density & Viscosity Meeting		*Crowne Plaza SC Force & Torque Meeting		*NSAI EMPIR AWICal Mass Workshop	NML Laboratory visit (14.00 – 15.30) Bus pickups at 14.00 in Crowne Plaza
15:30-16:00		Coffee break		Coffee break		Coffee break	
16:00-18:00	Strategy-WG meeting (closed session)	Strategy-WG meeting (open session)		EMPIR MNm Torque Workshop		EMPIR AWICal Mass Workshop	
18.15 -18.30				Bus pick up for social dinner bus departs at 18.30			
19:00-22:00				Social Dinner			

Table 7: Meeting schedule of EURAMET TC-M 2018.

The TC-M Contact Persons meeting was held in Dublin, on the 19th April and, as usual, was preceded by technical meetings for the various subfields to review progress in projects and discussion of technical issues in mass, force and torque, pressure, density and viscosity.

Two workshops were held for the EMPIR projects ending this year: RPT02 AWICal - Traceable calibration of dynamic weighing instruments and 14IND14 MNm Torque - Torque measurement in the MN·m range. We had also a special session on the New redefinition.

There were 2 sessions for the TC-M Strategic Working group: one closed before the meeting and a second one during the meeting and open to all participants.

5.1 Activities of the TC-M Subcommittees

TC-M has 4 SC (Mass, Pressure, Force, Density- Viscosity) all convenors were reappointed this year for 5 years.

A 2018 questionnaire was sent to all TC-M contact persons, and the results for needs of comparisons and training were sent to all SC convenors prior to the meetings.

5.1.1 SC Density and Viscosity:

EURAMET 1031 (EURAMET.M.D-K1.1, solid density comparison, pilot: PTB/DE)
See EURAMET TC-M website.

New draft will be circulated in the next few weeks. A. Malengo agreed to check the evaluation.

EURAMET 1404 (EURAMET.M.D-S3, solid density comparison, pilot: PTB/DE and CEM/ES)
Draft A was distributed and is under discussion.

EURAMET comparison on surface tension of liquids (pilot: GUM/PL)
LNE confirmed their participation. Measurements will probably be made in 2018.
GUM/PL should send an application to the EURAMET TC-M chair.

CCM.D-K5 and EURAMET comparison No. 1440 (Oscillation-type density meters, pilot: BEV/AT)
Zoltan Zelenka informed that first the money for purchasing the liquids has to be collected. Then the liquids will be bought and characterised at BEV. Afterwards the KCs can start.

CCM.D-K3 (Density measurement of stainless steel weights, pilot: NMIJ/Japan)
Participants from EURAMET are: BEV (co-pilot), INRIM, PTB, METAS and UME.
The comparison will probably start in 2018.

CCM.D-K6 (Refractive index of liquids, pilot: NMIJ/JP),
Participants are NMIJ (Pilot), IPQ and PTB? Status is not clear.

CCM.D-Kx (Liquid density under high pressure, pilot: ?),
Participants from EURAMET will probably be CEM, GUM, IPQ, and PTB.

CCM.V-K3 (Viscosity measurements of standard liquids, pilot: NMIJ/JP)
Draft B report is finished.

CCM.V-K4 (Viscosity of standard liquids, pilot: CENAM/MX),
Questionnaire was distributed.
Bulgaria and Romania are allowed to participate, although they are no members of CCM WGDV.*

*There are no EURAMET comparisons on Viscosity.

Strategic Planning of Comparisons

See EURAMET TC-M website:

Strategic Planning of Comparisons



Service	Comparison	CCM WGDV		CCM WGDV			
		Timeline 2017	2018	2019	2020	2021	2022
Solid density - hydrostatic weighing	CCM.D-K1				Start of new comparison?		
Solid density - hydrostatic weighing	EURAMET.M.D-K1.1 (EURAMET 1031)						
Liquid density - hydrostatic weighing	CCM.D-K2					Start of new comparison?	
Liquid density - hydrostatic weighing	EURAMET.M.D-Kx						
Density of weights - hydrostatic weighing	CCM.D-K3						
Density of weights - hydrostatic weighing	EURAMET.M.D-Kx						
Hydrometer calibration - Cuckow method	CCM.D-K4						Start of new comparison?
Hydrometer calibration - Cuckow method	EURAMET.M.D-Kx		Start of new comparison?				
Liquid density - oscillation-type density meters	CCM.D-K5						
Liquid density - oscillation-type density meters	EURAMET.M.D-Kx (EURAMET 1440)						
Refractive index of liquids	CCM.D-K6						
Refractive index of liquids	EURAMET: not planned?						
Liquid density under high pressure	CCM.D-K7?						
Surface tension of liquids	EURAMET NN						

Physikalisch-Technische Bundesanstalt ■ Braunschweig and Berlin

National Metrology Institute

The CCM.D-K4 comparison on hydrometer calibration is published, thus EURAMET should start a hydrometer comparison. H. Bettin will circulate a short questionnaire.

CMCs

CCM and EURAMET guidelines for review of CMCs are being prepared.

The EMRP project ENG59 "Sensor development and calibration method for inline detection of viscosity and solids content of non-Newtonian fluids"

The project ended in April 2017, see www.eng59-rheology.eu

The EMPIR project 14IND06 “Industrial standards in the intermediate pressure-to-vacuum range” ends in May 2018. It includes the development of an interferometric oil micro-manometer with in-situ measurement of the oil density. See also minutes of the sub-committee pressure.

The EMPIR project RPOT 17RPT02 “Establishing traceability for liquid density measurements (RhoLiq)” will start in May 2018.

The coordinator, Andreia Furtado, asked for ideas and interested persons for RMGs (Research Mobility Grants).

The Kick-off meeting will be at PTB in the week from 14 to 18 May 2018.

This project includes the development of guidelines.

EMPIR PRT about “Realisation and dissemination of the new kg using natural silicon”

See EURAMET TC-M website.

Roadmap (see EURAMET website)

See EURAMET TC-M website.

The TC-M Density Viscosity SC roadmap, last version of 2012, is under revision.

Horst Bettin asked for improvements of the Density and Viscosity Roadmap (text and diagram). What can be deleted? What should be added? He proposed to include small masses below 1 mg (via density of silicon) and digitalisation.

Questionnaire: Training

The following countries ask for training: Albania (VC1005, DMA, hydrometers), Belgium (weights), Croatia (DMA, hydrostatic weighing), Portugal (surface tension).

Questionnaire: Comparisons

The following countries ask for comparisons: Albania (1 g to 1 kg), Germany (hydrometers, weights and liquid density), Portugal (hydrometers).

CCM Working Group on Density and Viscosity

Next meeting of the CCM WGDV will be probably on 13 May 2019.

5.1.2 SC Force and Torque

Revision of EURAMET cg4 - Uncertainty of Force Measurements

Report from Andy Knott, NPL

57 comments discussed and considered

new draft end of June 2018

meeting planned in Sep. 2018 during IMEKO WC or ISO TC164

Comparisons Status

EURAMET 505 PTB, 1 MN + 500 kN force comparison, measurements from April 2013 to June 2018

EURAMET 535 MIKES, 5 kN + 10kN comparison, Draft B, final Report to be finished in 2018

EURAMET 1262 BEV, 5 N to 250 kN comparison with PTB, measurements completed, report in progress

EURAMET 1304 LNE, 0.1Nm to 50 Nm comparison with PTB, measurements performed

“Progress in TENSE Project” presented from Dominik Prazak, CMI

Status of different force and torque projects

EMRP and EMPIR Projects in Force and Torque

“14IND14 – MN·m Torque” www.ptb.de/emrp/torquemetrology.html

Future Projects in Force and Torque

“Comprehensive Traceability for Force Metrology Services (ComTraForce)”?

Roadmaps in Force and Torque and Dynamic (Force, Torque, Pressure)

<https://www.euramet.org/technical-committees/tc-m/annual-reports-documents/>

Other topics

Digitization in Metrology

Competence Center Wind in PTB

5.1.3 SC Mass:

Agreement of previous minutes

Minutes agreed no addition comments.

Presentations/updates on agreed/completed projects

Matej Grum 1300 - Comparison of 500 kg stainless steel standard

The comparison is registered as EURAMET.M.M-S7 in the KCDB. It is jointly piloted by MIRS and CMI (who have provided the transfer standard). Measurements started in June 2017. At present the schedule has slipped by 2 months and Matej will contact the participants to make sure they can accommodate the new timetable. Taking into account the delay the new scheduled completion date for the measurements is July 2019.

Matej also presented details of the EURAMET comparison toolbox designed to assist with the organisation of comparisons. Project 1300 is trialling this package.

Stuart Davidson 1310 - Sub-milligram mass comparison (EURAMET.M.M-S9)

The comparison is complete and the final report has been published in the KCDB (https://www.bipm.org/utis/common/pdf/final_reports/M/M-S9/EURAMET.M.M-S9.pdf).

The majority of participants demonstrated their capability of measuring the transfer standards to their stated level of uncertainty. The stability of the transfer standards proved adequate for the purposes of the comparison with the possible exception of the 0.05 mg weight which had a high drift value and the largest number of discrepant results among the participants.

Zoltan Zelenka 1346 - Key comparison of 1 kg mass standards linked to CCM.M-K4 (EURAMET.M.M-K4)

The circulation of the transfer standards is underway and the first of the two circulation phases is complete. Zoltan noted that some marks had been observed on the transfer standards due to handling with gloves or using uncovered forceps/tongs. The recommended handling process in

future is to use forceps/tongs covered in acid free lens tissue. Despite this the stability of the transfer standards appears good (4 µg average changed, 20 µg maximum change).

Goran Grgić 1350 - Comparison of sub-multiples of the kilogram

Measurement by the participants was completed in the period January 2015 to October 2015, Draft A of the comparison report was circulated in May 2016. Unfortunately there was an issue with the stability of the 200 mg transfer standard which was reported at the last Mass SC meeting (April 2017). Further measurements were made on this weight by the pilot laboratory indicating that its stability was good following the comparison process. The solution, proposed by the pilot laboratory and agreed by the participants, is to omit the final measurement for the 200 mg transfer standard, leaving a coherent set of data. An additional issue with this comparison is that it wasn't registered in the KCDB. This may lead to issues with inter-RMO review if the results are used as supporting evidence for CMC submissions.

(Sevda Kacmaz) 1406 - Comparison of mass standards 100 mg, 10 g, 100 g, 1 kg, 10 kg and 50 kg

Stuart Davidson reported that the comparison was complete and the results had been published in the KCDB (https://www.bipm.org/utis/common/pdf/final_reports/M/M-S3/EURAMET.M.M-S3.pdf). The result of the comparison shows agreement between the UME and the NPL, except for the 10 kg weight where the En value is 1.09. This value is also judged to be reasonable and the discrepancy does not affect the published CMCs of the participants, based on the level of agreement in this comparison.

Rory Hanrahan - EURAMET.M.M-S5 (Six E2 weights)

Rory reported that the protocol for this comparison had been agreed by the participants.

Project proposals (inc. EMPIR PRTs)

EURAMET

Proposals for new comparisons, collaborations, research etc.

The requirements for new comparisons, as reported in responses to the questionnaire circulated by the TC-M chair were reviewed.

The SC-Mass convenor will coordinate the requirements for comparisons and correlate with CCM comparisons with a view to proposing new EURAMET KCs and SCs in time for next year's meeting.

EMPIR

The contents of two PRTs were presented:

Daniela Eppers - Realizing and disseminating the redefined mass unit using natural silicon

Stuart Davidson - Enabling direct end-user traceability to the new SI unit of mass

Proposed CMC submissions and issues

Discussions within the TC-M Strategy Working Group were outlined with regard to the need for supporting evidence and the coordination of guidance between EURAMET and the CCM (See WG-S minutes for detail).

Mass area technical roadmap – review and update

The latest roadmap, updated after the 2017 SC-Mass meeting, was presented and is available in the TC-M area of the EURAMET website.

Other presentations

Matej Grum - Progress of EMPIR 14RPT02 AWICal - Calibration of automatic weighing instruments (AWIs)

Matej presented an update of the project. The work covers traceable dynamic measurements for three groups AWIs; Automatic Catch-weighers, Automatic Gravimetric Filling Instruments and Automatic Instruments for Weighing Road Vehicles in Motion. Draft calibration guides have been developed for the three groups of AWIs (see www.awical.eu). The project has also included validation of methods and intercomparisons.

Michael Stock - BIPM kilogram maintenance, the ensemble & the Pilot Study of realisation experiments

Michael Stock gave an update of the work of the BIPM. The pilot study of realisation experiments had been successfully completed and all results were in good agreement with the calculated reference value and with the IPK. The hierarchy of the BIPM PtIr mass standards and the role of the Ensemble of Reference Mass Standards was outlined. The publication of a special edition of Metrologia concerning the kilogram redefinition was noted ([http://iopscience.iop.org/journal/0026-1394/page/Focus on Realization Maintenance and Dissemination of the Kilogram](http://iopscience.iop.org/journal/0026-1394/page/Focus_on_Realization_Maintenance_and_Dissemination_of_the_Kilogram))

Stuart Davidson - Update on the kilogram redefinition and the interim use of a consensus value

Stuart Davidson outlined the results from the realisation experiments which had contributed to the CODATA value for the Planck constant. The dispersion in the value together with the lack of temporal stability in the results led to the CCM recommending the use of a consensus value for the kilogram following its redefinition. The consensus value will be based on the results of a Key Comparison of realisation experiments to be undertaken soon after the redefinition in May 2019. Once the stability and agreement of the realisation experiments has been demonstrated the CCM will be able to decide on whether a consensus value is no longer necessary and that the mass unit can be disseminated from individual realisation experiments.

5.1.4 SC Pressure

Comparisons, CMCs

Sari Saxholm (VTT MIKES) - Project 1411, Bilateral pilot study, "Dynamic high pressure comparison"

VTT MIKES, KRISS, 2 transfer standards, ½ of measurements finished, preliminary results presented

Wladimir Sabuga (PTB) - Project 1306 (EURAMET.M.P-S14) "Supplementary comparison of hydraulic gauge pressure standards from 50 MPa to 1000 MPa"

PTB, CMI, LNE, METAS, final report submitted, all results agree

All: Status update of active projects: 881, 1115, 1179, 1206, 1207, 1252, 1375, 1376, 1385, 1405, 1411, 1414, 1416

Wladimir Sabuga (PTB) - Needs for new comparisons, CMC submissions

- Gas, gauge pressure, 10 MPa – Albania, Bulgaria, Moldova, Switzerland – by bilateral comparisons
- Oil
 - 100 MPa – Albania, Bulgaria, Hungary, Moldova
 - 500 MPa – Austria, Bosnia and Herzegovina, Hungary

Requests-2017:

50-500 MPa, BEV, IMBiH, SMU, GUM, HMI, RISE, pilot & TS provisionally RISE, link PTB, start 2018

Research projects and activities

Sari Saxholm (VTT MIKES): “Development of measurement and calibration techniques for dynamic pressures and temperatures”,
EMPIR 17IND07 DynPT, Project description

Wladimir Sabuga (PTB): “Industrial standards in the intermediate pressure-to-vacuum range”
EMPIR 14IND06 pres2vac, Project progress

Dominik Pražák (CMI): “Developing research capabilities for traceable intraocular pressure measurements”,
New EMPIR project EMPIR 16RPT03 InTENSE, Project progress

Yasin Durgut (UME): “Development of dynamic calibration machine for pressure transducers”
Description of research at UME

Wladimir Sabuga (PTB): New pressure relating EMPIR PRT submissions
“Towards quantum-based realisations of the pascal” (TOP), PTB & partners
“Ultra-high precision cylinder and sphere metrology” (UltraCyl), TC Length, PTB & partners

Wladimir Sabuga (PTB): Pressure roadmap
Version of 2017, no changes

5.2 Plenary Meeting

Agenda of the TC-M Contact Persons meeting:

- Welcome to NSAI; Presentation of NSAI National Metrology Laboratory (Paul Hetherington)
- Opening of the meeting and adoption of the agenda
- Invited talks:
 - COOMET TC-M Activities - Iryna Kolozinska
 - BIPM Activities - Michael Stock
 - News from EURAMET– Isabel Spohr
 - Capacity Building - Tanasko Tasić
- Report of Strategy WG session – Stuart Davidson

- Reports of subcommittees technical sessions:
 - Mass - Stuart Davidson
 - Density and Viscosity - Horst Bettin
 - Force and Torque - Rolf Kumme
 - Pressure - Wladimir Sabuga
- Gravimetry and Hardness Activities – Alessandro Germak
- Next TC-M Chair
- Date and place of next meeting and any other business

All presentations and list of participants are published on TC-M page under events.

Apart from a representative from the BIPM, there was also a representative from Kosovo at the meeting.

The manufacturers from Mettler-Toledo attended the Workshop for AWICaI - EMPIR RPT02 and the kilogram redefinition Session.

In total around 80 people attended the EURAMET TC Mass meeting itself or other sessions in Dublin this year.



Photograph of the TC-M 2018 meeting in Dublin

This year there was no representation from Bulgaria, Greece, Latvia, Luxembourg, or Montenegro.

Malta has no contact person appointed for TC-M.

The TC-M 2019 meeting will be held in Budapest from the 8 to 12 of April.

The proposed next Chair of TC-M has all the support from the contact persons: Fredrik Arrhén (RISE) from Sweden.

6. Participation in EMRP/ EMPIR

Information of the participation in projects on-going or finished:

For EMPIR call 2014:

Industry call:

Number	Short name	Full Name
14IND06	pres2vac	Industrial standards in the intermediate pressure-to-vacuum range
14IND14	MNm Torque	Torque measurement in the MN·m range

Research potential call:

Number	Short name	Full Name
14RPT02	AWICal	Traceable calibration of dynamic weighing instruments

SIP call:

Number	Short name	Full Name
14SIP01	Vacuum ISO	Technical Specifications for quadrupole mass spectrometers and outgassing rates for assessing the quality of vacuum environments
14SIP08	Dynamic	Standards and software to maximize end user uptake of NMI calibrations of dynamic force, torque and pressure sensors

These projects started in the last term of 2015 and will end in 2018.

For EMPIR call 2015:

No projects. (JRP-s11 SISI was not selected).

For EMPIR call 2016:

Research potential call:

Number	Short name	Full Name
16RPT03	inTense	Developing research capabilities for traceable intraocular pressure measurements

Normative call:

Number	Short name	Full Name
16NRM05	Ion gauge	Towards a documentary standard for an ionisation vacuum gauge

For EMPIR call 2017:

Research potential call:

Number	Short name	Full Name
17RPT02	rhoLiq	Establishing traceability for liquid density measurements

Industry call:

Number	Short name	Full Name
17IND07	DynPT	Development of measurement and calibration techniques for dynamic pressures and temperatures

7. Calibration Guides

In Revision:

EURAMET cg 4 - Uncertainty of Force Measurements (Project EURAMET 1441)

New Calibration Guides from EMPIR Projects:

- Under project EMPIR 14IND06 (pres2vac):
Calibration of Negative Gauge Pressures
Calibration of Force-Balanced Piston Gauges
- Under project EMPIR 14RPT02 (AWICal)
Guidelines on the Calibration of Automatic Catchweighing Instruments
Guidelines on the Calibration of Automatic instruments for weighing road vehicles in motion and measuring axle loads
Guidelines on the Calibration of Automatic Gravimetric Filling Instruments
- Under project EMPIR 17RPT02 (rhoLiq)
Liquid density measurement using a hydrostatic weighing apparatus

8. Capacity Building: Activities and future needs

2 Trainings are schedule:

Conformity assessment of NAWI for 2, 5 days (24-26 September 2018) at IMBiH.

Calibration and dissemination of mass unit E1 level for 3 days (6-8 November 2018) at NPL.

The results of the questionnaire circulated among the Contact Persons of requirements for training were sent to Tanasko Tasić.

9. Issues

Issues with linking EURAMET.M.M-K4 to the corresponding CCM comparison, taking into account the adjustment of the BIPM “as-maintained” mass unit, have largely been resolved. The BIPM will take part on the EURAMET comparison to provide additional linking to CCM.M-K4 and to the new as-maintained unit.

Mass CMCs for a number of EURAMET NMIs will need to be reviewed and adjusted following the redefinition of the kilogram since the way the new definition will be maintained and disseminated will add an additional 10 μg uncertainty (at the kilogram level). This can be performed in conjunction with a review of the results of EURAMET.M.M-K4.

CCM.D-K4 (Hydrometer): LNE, MKEH and several participants in EURAMET 1019 (Density of liquid by hydrostatic weighing) with E n-value > 1.

10. Strategic Planning

The Strategy WG of the TC-M met at the April meeting in Dublin prior to the open meetings. The main areas discussed were;

10.1 CMC review process

A guidance document for the preparation and review of CMCs within the TC-M has been prepared. This particularly focusses on the technical issues for mass and the various derived units. The provision of advice which is harmonious with EURAMET Guide 3 and with a CCM guidance document which is in preparation was highlighted. The need for a basic guide to the CMC submission process, aimed at smaller NMIs and DIs, was noted.

An issue with discrepancies between CMCs published in the KCDB and those in the scope of accreditation published by national accreditation bodies was noted. Often the values in the latter are significantly lower than those in the KCDB raising questions about how they have been validated. It was decided that this should be raised by Contact Persons with their national accreditation bodies but should also be investigated more generally across all the technical areas by EURAMET in consultation with European Accreditation.

10.2 Comparison and Training requirements

The TC-M Chair circulated a questionnaire to Contact Persons requesting details of requirements for comparison and training. These were reviewed by the TC-M technical subcommittees. The need for a structured approach to Key Comparisons was noted with the aim of minimising the number of supplementary comparison and ad-hoc bilateral comparisons.

The need for dissemination of information about the impact of the kilogram redefinition was also noted. This was to some extent addressed by presentations given at the TC-M meetings. Section 8 gives details of the TC-M training strategy.

10.3 Cooperation

Cooperation with the COOMET committee for Mass and Related Quantities (TC 1.6) has been initiated. The Chair of COOMET TC 1.6 actively participated in the last TC-M meeting. The Ukrainian NMI has already taken part in EURAMET.M.M-S9 (a comparison of sub-milligram standard) and the EURAMET TC-M will assist with the delivery and linking of the COOMET comparison of kilogram mass standards.

The TC-M Mass roadmap was updated in 2017 and reviewed at the 2018 TC meeting.

11. Outlook for 2017/2018

The ratification of the redefinition of the kilogram is due to take place at the meeting of the General Conference on Weights and Measures (CGPM) in November 2018. EMPIR PRTs submitted by the TC-M were, in general, not well received by the reviewing committee. Nevertheless the need for collaborative research, particularly with respect to the effective implementation of the kilogram redefinition and the maximisation of end-user benefit, needs to be coordinated.