

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 EMRP/EMPIR, where many NMI/DI are collaborating very actively.

2. Projects

The actual number of proposed, agreed and completed projects listed for TC-M in the EURAMET Projects database is shown in the table below. Projects are divided by category with number in brackets for last year (* 2 comparisons were deleted).

	Comparison	Research	Traceability	Consultation	Total
Proposed	2 (10)	0 (1)	0	0	2 (11)
Agreed	16 (18)	1 (1)	2 (2)	0 (1)	19 (22)
In progress	5	-----	-----	-----	5
Completed	73 (66)	45 (45)	8 (8)	18 (17)	144 (136)
Cancelled	4	2	-----	-----	6
Total	100 (94)	48 (47)	10	18	176 (169*)

3. Comparisons

In the following tables there is information about the status of comparisons that were active in the area of Mass and Related Quantities since the last year annual report.

EURAMET Key comparison in Table 1, EURAMET Supplementary Comparisons in Table 2 and EURAMET projects in 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
EURAMET.M.F-K1	535	5 kN to 10 kN	Force	MIKES	A. Pusa	Report in progress draft B
EURAMET.M.F-K3	505	500 kN to 4 MN	Force	PTB	R. Kumme	In progress
EURAMET.M.G-K2	1368	Free-fall acceleration	Gravity	VUGTK/ RIGTC	V. Palinkáš	Approved for Equivalence
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
EURAMET.M.P-K1.c	1179	0.7 MPa to 7 MPa	Pressure	Force	A. Atlintas	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-K8	1041	25 kPa to 200 kPa	Pressure	METAS	C. Wuethrich	Approved for Equivalence
EURAMET.M.P-K15.1	1405	Absolute range 0.1 mPa to 1 Pa	Pressure	PTB	K. Jousten	Protocol complete

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 30 and 125 g)	Density	CEM	N. Medina	Protocol Complete/ Agreed/started
EURAMET.M.F-S2	1262	5 N to 250 kN	Force	BEV	C. Buchner	In progress
EURAMET.M.F-S3	-	1 kN to 10 kN	Force	NPL	A. Knott	Approved and published
EURAMET.M.F-S4	1311	10 kN to 20 kN	Force	LNE	P. Averlant	Approved and published
EURAMET.M.M-S3	-	100 mg to 50 kg	Mass	UME	U. Y. Akcadag	Report in progress draft B
EURAMET.M.M-S5	-	100 mg to 1 kg	Mass	NSAI	R. Hanrahan	Planned
EURAMET.M.M-S7	1300	500 kg	Mass	CMI MIRS	I. Kriz Matej Grum	In progress
EURAMET.M.M-S9	1310	0.5 mg to 0.05 mg	Mass	NPL	J. Berry	In progress/ Draft A in preparation
EURAMET.M.P-S5	931	50 MPa to 500 MPa	Pressure	PTB	W. Sabuga	Report in progress draft B
EURAMET.M.P-S7	1040	0.1 mPa to 1 Pa	Pressure	METAS	C. Wuethrich	Approved and published
EURAMET.M.P-S9	1170	-950 hPa to 0 hPa	Pressure	MIKES /LNE	S. Saxholm / I. Morgado	Loop 2 Approved and published
EURAMET.M.P-S13	1252	10 MPa to 100 MPa	Pressure	UME	Y.Durgut	In progress
EURAMET.M.P-S14	1306	50 MPa to 1 GPa	Pressure	PTB	J. Koneman	In progress
EURAMET.M.P-S15	1376	100 Pa to 3,5 kPa	Pressure	GUM	A. Brzozowski	Protocol Complete/ agreed/started
EURAMET.M.P-S16	1375	250 MPa	Pressure	GUM	A. Brzozowski	Protocol Complete/ finished – reporting 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/FSB -LPM	L. Bermanec G.	Report in progress draft A
EURAMET.M.T-S2	1141	100 Nm	Torque	PTB	D. Roeske	Approved and published
EURAMET.M.T-S4	1304	0,1 N.m at 50 N.m	Torque	LNE	C. Dufion	Planned

Table 2: Status of EURAMET Supplementary Comparisons in KCDB.

EURAMET Project no.	Title/Range	Subfield	Pilot	Contact	Status
1097	0 kN, 5 kN, 10 kN	Force	BIM	V. Dikov	Cancelled
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
1253	10 MPa to 100 MPa	Pressure	UME	Y.Durgut	Cancelled
1278	1 MN/ up to 20 kNm	Force/ Torque	MIKES	A. Pusa	Completed
1314	liquid density hydrometers	Density	LNE	-----	Deleted
1316	density and volume of solid using quartz sinker	Density	LNE	-----	Deleted
1350	sub-multiples of the kilogram	Mass	MIRS	Goran Grgić	Agreed/Started
1416	Bilateral study comparison in the high vacuum range from 5E-7 Pa to 9E-4 Pa	Pressure	CMI	D. Prazak	Agreed/started

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

4. CMCs

The following tables 4 and 5 are an update of new submissions since May 2016.

Concerning EURAMET submissions

CMCs Submission	NMI	Field	State
EURAMET.M.46.2016	NPL, United Kingdom	Mass	published
EURAMET.M.48.2017	MIKES-VTT, Finland	Mass	under revision
EURAMET.M.49.2017	HMI/FSB-LIMS, Croatia	Force	under revision

Table 4: EURAMET CMC's Submissions

Concerning Review of CMCs for other RMO's submissions

CMCs Submission	NMI	Country	Field	State
APMP.M.41.2016	NIM	China	Density, Force, Torque and Hardness	under revision
APMP.M.42.2016	A*Star	Singapore	Mass	under revision
COOMET.M.28.2017	UNIIM	Russian Federation	Torque	under revision
SIM.M.34. 2017	INM	Colombia	Density	under revision
SIM.M.35. 2017	IBMETRO	Bolivia	Mass	under revision
SIM.M.36. 2017	CENAMEP	Panama	Force	under revision
SIM.M.37. 2017	INM	Colombia	Force	under revision

Table 5: Other RMO's CMC's Submissions

5. Activities of the TC-M Subcommittees

Calibration Guides

Published:

EURAMET cg 17 "Guidelines on the Calibration of Electromechanical and Mechanical Manometers" has been revised and published (04/2017).

In Revision:

EURAMET cg 4 "Uncertainty of Force Measurements".

New Calibration Guides:

EURAMET cg-NN "Liquid density measurement using a hydrostatic weighing apparatus"

Under project EMPIR 14IND06 (pres2vac):

EURAMET cg-NN "Calibration of Negative Gauge Pressures"

EURAMET cg-NN "Calibration of Force-Balanced Piston Gauges"

5.1 SC Density and Viscosity:

Status of EURAMET comparisons

- EUROMET 627, Density of liquids, PTB: published
- EURAMET 1031, Solid density, PTB, draft A in discussion
- EURAMET 1404, Solid density comparison, PTB + CEM, measurements completed

New Comparison EURAMET NN, Liquid surface tension, GUM, agreed

Participants: GUM, IPQ, PTB, UME, LNE? Questionnaire to be sent

Status of CCM comparisons

- CCM.D-K3, Density of Stainless Steel Weights, NMIJ, EURAMET participants: BEV, INRIM, METAS, PTB, UME
- CCM.D-K5, Oscillation-type density meters, BEV, agreed EURAMET comparison
- CCM.D-K6, Refractive index of liquids, NMIJ, agreed
- CCM.D-Kx, Liquid density under high pressure, agreed
- CCM.V-K3, Viscosity of liquid standards, NMIJ, Draft B
- CCM.V-K4, Viscosity in wide temperature range, CENAM, agreed

Other projects

- EMRP project ENG59 “Sensor development and calibration method for inline detection of viscosity and solids content of non-Newtonian fluids”
- EMPIR project 14IND06 “Industrial standards in the intermediate pressure-to-vacuum range”
Development of an interferometric oil micro-manometer with in-situ measurement of the oil density
- “Guideline on liquid density measurement using a hydrostatic weighing apparatus”, First Draft

5.2 SC Force and Torque

Status of force and torque EURAMET projects

Comparison projects:

- EURAMET 1278 MIKES, bilateral force + torque comparison with PTB, completed and published
Presentation from Jani Korhonen, MIKES VTT, Project 1278, Comparison VTT-PTB
- EUROMET 535 MIKES, 5 kN + 10kN comparison,
Draft B, meeting at IMEKO in Helsinki planned to finish report
- EUROMET 505 PTB, 1 MN + 500 kN force comparison, measurements to be finished in June 2017
- EURAMET 1304 LNE, 0.1Nm to 50 Nm comparison with PTB, measurements started
- EURAMET 1097 BIM, bilateral force comparison with PTB, cancelled

Research projects:

- EURAMET 913 LNE, strain cylinder calibration, research, cancelled
- EURAMET 890 PTB, dynamic force measurement, research, to be cancelled

Revision of EURAMET Calibration Guides in Force and Torque (cg4 + cg14):

- Proposal from NPL and INRIM of a new EURAMET TC-M Project “Revision of EURAMET cg4 Uncertainty of Force Measurements” Presentation from Andy Knott, NPL
- Future Projects in Force and Torque “Calibration guides of force and torque traceability” Participants: NPL, INRIM, LNE, PTB, CEM, CMI, UME

EMRP and EMPIR Projects in Force and Torque

- EMRP SIB63 Force finished in 2016
- EMPIR 14IND14 MNm Torque
- Topics for future EMPIR Calls in Force and Torque.

The IMEKO TC3, TC5, TC22 conference will be held in Finland 2017.

5.3 SC Mass:

- a) Presentations/updates on agreed/completed projects

Matej Grum

EURAMET 1300 Comparison of 500 kg stainless steel standard

- ✓ Standard provided by CMI, fully characterised
- ✓ The Pilot laboratory is MIRS
- ✓ There are 21 participants, additional participants (from NMIs or Dis) could potentially be considered
- ✓ Four participants still need to sign and return form G-OPS-TMP-035
- ✓ The protocol has been agreed
- ✓ Circulation will start June 17
- ✓ The weight will return to CMI twice during the comparison for stability checks
- ✓ Participants will have 1 month to make measurements and to send weight to the next participant.

Stuart Davidson

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

- ✓ The measurements have been completed
- ✓ 3 stability checks were made at the pilot laboratory (NPL)
- ✓ Draft A of the comparison report has been prepared but the pilot is still waiting for a response form 1 participant with discrepant results
- ✓ (Anonymous) Results were presented. Most participants agreed with the calculated reference values.
- ✓ 3 weights (0.2 mg 0.2D mg and 0.1 mg) were stable. The others (0.5 mg and 0.05 mg) were modelled with a linear drift in the reference value
- ✓ Draft A will be circulated after the CCM meetings in May 2017

Zoltan Zelenka

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

- ✓ A steering committee has been set up
- ✓ There are currently 29 participants listed to participate
- ✓ The weights have been characterised by BEV and are ready to circulate
- ✓ Issues with linking to CCM.M-K4 still exist, the possibility of repeating K4 could be explored at the CCM WGD-kg meeting in May.

Goran Grgić

EURAMET 1350 Comparison of sub-multiples of the kilogram

- ✓ The transfer standards consisted of weights from 200 g to 200 mg
- ✓ Measurements were completed between January and October 2015
- ✓ Draft A of the comparison report was prepared in May 2016
- ✓ Issues with the stability of the 200 mg weight - further measurements at the pilot laboratory may help with regard to the modelling of this drift

Sevda Kacmaz

EURAMET 1406 Comparison of mass standards (EURAMET.M.M-S3)

- ✓ Weight used were 100 mg, 10 g, 100 g, 1 kg, 10 kg and 50 kg
- ✓ 50 kg was damaged during transit so not included in the final results
- ✓ Draft B is completed and will be submitted to the CCM for approval

b) Project proposals (inc. EMPIR PRTs)

The answers to the TC-M questioners on new Key Comparisons (KC) and EMPIR proposals were reviewed.

- The major requirement for a KC was identified as for (sub-) multiples of the kilogram. A EURAMET RMO KC to link to CCM.M-K7 should be organised
- The main area for EMPIR or other collaboration was identified in the area of training. This will be coordinated at a strategic level by the EURAMET Board of Directors Working Group on Capacity Building (outlined as part of the Contact Persons Meeting).
- Some proposal for Kibble balance (and Micro-KB) collaboration were received.

Other comparisons

- UME is piloting two comparisons in the GULFMET area to link to CCM.M-K4 and K7. The linking laboratories will be INRIM, METAS and KRISS.

c) Proposed CMC submissions and issues

A number of issues have been noted with regard to new CMC submissions particularly with regard to supporting evidence. Another concern is the need to check that the results of new KCs are in agreement with existing CMC submissions. These and other issues will be addressed in the "Review Protocol for Calibration and Measurement Capability (CMC) submissions in the area of Mass and Related Quantities" being drafted by the TC-M WG-Strategy.

d) Mass area technical roadmap – review and update

The SC convenor will update the extant Mass area roadmap and circulate for comment by the end of May 2017.

e) Other presentations

Matej Grum

Progress of EMPIR 14RPT02 AWICal - Calibration of automatic weighing instruments.

- The aim of the project is to provide guidance on traceable dynamic measurements for;
 - ❖ Catchweighers
 - ❖ Gravity filling instruments
 - ❖ Road vehicles in motion
- The validation of protocols has been agreed using on site measurements. Local measurements on a range of instrument will be carried out after this.
- Presentations will be made at IMEKO TC3 and CIM 2017
- The project will be completed at the end of May 2018
- Additional details of the work can be found on the website for the project at www.awical.eu

Michael Stock

Update on the CCM Pilot Study of realizations of the kilogram

- The completion of a pilot study comparing realisations of the kilogram is one of the requirements for redefinition outlined on CCM-CCU roadmap <http://www.bipm.org/utis/common/pdf/SI-roadmap.pdf>
- The measurements have been completed, and involved participants sending weights calibrated using their realisation experiments to the BIPM
- Participants used the CODATA value for the Planck constant, h , to assign values to transfer standards
- All the results are consistent, the uncertainty calculated for the Reference Value was 10 μg ($k=1$)

f) New redefinition – Kibble Balance Session with invited talks:

- Michael Stock BIPM Kibble balance progress
- Haji Ahmadov The UME oscillating magnet watt balance
- Mathieu Thomas Planck constant determinations at LNE/CNAM: achievements and future
- Stuart Davidson NPL work on a next-generation Kibble balance

5.4 SC Pressure

Status of EURAMET comparisons

Y. Durgut (UME)

Project 1252, EURAMET.M.P-S13, "Digital pressure gauge comparison in the range of 10 MPa to 100 MPa of liquid pressure"

- 17 participants, measurements finished, results evaluated, CRV median, all $En < 1$, Draft A in June 2017

W. Sabuga (PTB)

Project 1405, EURAMET.M.P-K15.1, "Key comparison of four national vacuum standards from $3 \cdot 10^{-4}$ Pa to 1 Pa with SRGs as transfer standards"

- PTB, UME, CEM, NIMT, TS – 2 SRGs, March-July 2017

A. Altintas (FORCE Technology)

Project 1179, EURAMET.M.P-K1.c, "Pressure standard comparison, gas media and gauge mode, from 0.7 MPa to 7 MPa"

- Pilots FORCE & UME, 23 participants, measurements finished, results evaluated, KCRV weighted mean, all $En < 1$, Draft A in progress, link to CCM.P-K1c will be done, piston rotation speed is an issue to be studied

Needs for new comparisons,

- 50-500 MPa, BEV, IMBiH, SMU, GUM, HMI, RISE, pilot & TS provisionally RISE, link PTB, start 2018
- 7 other comparisons by 7 different NMIs, to be realised as BCs

EMPIR Projects

- ❖ W. Sabuga (PTB): "Industrial standards in the intermediate pressure-to-vacuum range"
EMPIR 14IND06 pres2vac, Project progress
- ❖ D. Pražák (CMI): "Developing research capabilities for traceable intraocular pressure measurements",
- ❖ New EMPIR project InTENSE
- ❖ S. Saxholm (VTT MIKES): "Dynamic pressure issues"
- ❖ Pilot study VTT MIKES – KRISS

EMPIR PRT

- ❖ VTT MIKES dynamic pressure measurement facilities
- ❖ W. Sabuga (PTB): "Optical pressure measurement"
Idea for EMPIR Broader Scope PRT call 2018, potential partners - PTB, SP, LNE, INRIM, LNE/CNAM, UmU?

Research projects

- Research of interest (FORCE Technology): Effect of piston rotation speed on pressure.
- D. Bentouati, M. Plimmer (LNE, LNE/CNAM): new cg "Calibration of Negative Gauge Pressures"
Identified methods presented
Contributions from NMIs for different methods required
Draft will be distributed next months
- EURAMET cg 17 "Guidelines on the Calibration of Electromechanical and Mechanical Manometers" has been revised and published (04/2017).
- W. Sabuga (PTB): new cg "Calibration of Force-Balanced Piston Gauges" planned
SP, CEM, LNE, TUBITAK will develop draft. Other NMIs invited to collaborate

6. Participation in EMRP/ EMPIR

Information of the participation in projects on-going or finished in 2017:

For EMRP call 2013 (area Energy & Environment):

Number	Short name	Full Name
ENG 59	NNL	Sensor development and calibration method for inline detection of viscosity and solids content of non-Newtonian fluids

This project started in the last term of 2014 and ended in April 2017.

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

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

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

➤ Training

Training on pressure was delivered by SP in 2016.

Requirement for training in mass have been identified “Calibration and dissemination of mass unit at E1 level”:

Technicians from Croatia
Technicians from Lithuania
Technicians from FYR Macedonia

➤ RMG

Researcher mobility grants (RMG):

Colleague from IPQ have gone for a RMG(s) in an EMRP project (i.e. ENG59 NNL), for 7 months + 5 months at PTB.

Colleagues from Macedonian NMI expressed interest to go for a RMG(s) in an EMPIR project (i.e. AWICal).

1 Application from CEM for 3 months RMG(s), in an EMPIR project (14IND06 Pres2vac) to go to INRIM.

1 Application from CEM for 3 months RMG(s) in an EMPIR project (14IND14 MNm Torque) to go to PTB.

➤ Others

Training and exchange of expertise on the calibration of automatic weighing instruments (AWIs) is being promoted by EMPIR 14RPT02 AWICal.

8. Meetings

The TC - Mass and Related Quantities 2017 meetings were held in Helsinki, from the 26th April to the 28th April.

EURAMET –TC Mass and Related Quantities Meeting 2017

26th – 28th April 2017, Espoo, Finland

Day /time	Tuesday 25th May	Wednesday 26th April		Thursday 27th April	Friday 28th April	Saturday 29th April
09:00-10:30		SC Pressure Meeting	EMPIR AWICal Mass (Closed session)	SC Mass Meeting	TC Mass Contact Persons Meeting	
10:30-11:00		Coffee break		Coffee break	Coffee break	
11:00-12:30		SC Pressure Meeting	EMPIR AWICal Mass (Closed session)	SC Mass Meeting/ New redefinition	TC Mass Contact Persons Meeting	
12:30-13:30		Lunch		Lunch	Lunch	
13:30-15:30		SC Density & Viscosity Meeting	EMPIR AWICal Mass (Closed session)	SC Force & Torque Meeting	EMPIR Projects / continuation of TC Mass Contact Persons Meeting	
15:30-16:00		Coffee break		Coffee break	Coffee break	
16:00-17:30		Discussion of a new guide on liquid density (hydrostatic weighing apparatus)		Strategy-WG meeting (open session)		
17:30-18:30		Strategy-WG meeting (closed session)				
18:30-19:00		Transportation to MIKES				
19:00-20:00		Lab & Exhibition tour		Helsinki Sightseeing		
20:00-21:00		Salad buffet + wine				
20:00-22:00/23:00				Social Dinner		

Schedule v2

Table 6: Meeting schedule of EURAMET TC-M 2017.

The TC-M Contact Persons meeting was held in Helsinki, on the 28th 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.

We had a closed session for EMPIR RPT02 AWICal - Traceable calibration of dynamic weighing instruments. And a special session on the New redefinition.

During the TC Contact Persons meeting we enjoyed the following invited talks:

Presentation of MIKES Metrology - VTT Technical Research Centre of Finland Ltd (Mikko Merimaa)

1. Invited talks (New redefinition - Avogadro Experiment)
Carlo Paolo Sasso Experiment for the determination of the lattice parameter of Si
Horst Bettin Progress of the Avogadro experiment
2. Kilogram redefinition - Kibble balance session report - Stuart Davidson
3. BIPM Informations - Michael Stock
4. EURAMET informations – Isabel Spohr
5. Session on EMPIR - Erkki Ikonen Vice-Chair (EMPIR)
6. Reports of subcommittees technical sessions:
 - i. Density and Viscosity - Horst Bettin
 - ii. Force and Torque - Rolf Kumme
 - iii. Mass - Stuart Davidson
 - iv. Pressure - Wladimir Sabuga
7. Reports of Strategy WG session - Stuart Davidson
8. Session on Capacity Building - Omer Altan BOD-WGCB Convenor

Apart from representatives of the BIPM it has become usual to have representatives from GULFMET in our meeting.

The manufacturers from M-T and Sartorius attended the EMPIR RPT02 AWICal meeting (closed session) and the New redefinition – Kibble Balance Session.

In total around 90 people attended the EURAMET TC Mass meeting itself or the other sessions in Helsinki this year.

In the TC-M meetings this year there was no representation from Bulgaria, Montenegro, Latvia or Luxembourg.

Malta has no contact person appointed for TC-M.



Photograph of the TC-M 2017 meeting at VTT

The TC-M 2018 meeting will be held in Dublin in April.

9. Issues

A key technical issue is the linking of EURAMET.M.M-K4 (kilogram comparison) to CCM.M-4, due to the adjustment in the BIPM as-maintained mass scale.

Problems with existing EURAMET CMCs for liquid density will have to be solved:

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

TC-M now has a Strategy WG.

The updating of the TC-M Mass SC roadmap is underway.

The TC-M Pressure SC roadmap, last version of 2012, is under revision. Some targets have been reached some become obsolete, new identified and are to be added.

The TC-M Force and Torque SC Roadmap update 2012 was discussed and also the roadmap for Dynamic Force, Torque and Pressure.

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

11. Outlook for 2016/2017

A steering committee has been set up to address issues with EURAMET.M.M-K4 (see Section 9) but this need to be dicussed at the CCM WGD-kg meeting in May 2017. Coordination of PRTs for the 2018 EMPIR SI JRPs call will be required. Extension of CMC to submissions below 1 mg for participants in the comparison EURAMET.M.M- S9 will be possible.