

1. General Aspects

The EURAMET Mass and Related Quantities Technical Committee, TC-M, is characterized by the number of related quantities and by the diversity of techniques employed in the realization of the corresponding units. Nevertheless, nowadays there are two dominant issues, one is the redefinition of the kilogram, which has definitely determined the activities of some NMIs and is reflected in EURAMET projects, and the other one is the EMRP, where many institutes are collaborating very actively.

On the other hand, there has been an increase in the number of projects, especially for comparisons, in contrast with previous year when the number of projects was stopped.

2. Projects

In the period under review (May 2011 – May 2012) in TC area of the numbers of proposed, agreed and completed projects in the various categories are shown in the table below. The previous year's numbers are shown in brackets.

	Comparison	Research	Traceability	Consultation	Total
Proposed	3 (4)	2 (3)	1	-	6 (7)
Agreed	19 (14)	9(8)	2(3)	-	30 (25)
Completed	47 (45)	36 (34)	7 (6)	15 (15)	105 (100)
Total	69 (63)	47 (45)	10 (9)	15 (15)	141 (132)

The projects can be broken down by technical area as follows:

	Proposed	Agreed	Completed	Total
Density	2 (0)	2 (2)	8 (8)	12
Force	0 (2)	6(7)	6 (5)	12
Hardness			1 (1)	1
Mass	1(0)	7(7)	40 (39)	48
Pressure	2 (5)	13 (6)	42 (40)	58
Torque		1 (1)	2 (2)	3
Viscosity		0 (1)	5 (4)	5
Gravimetry		1 (1)	1 (1)	2

Three completed projects dealing with general issues were placed under mass for simplicity.

The new projects which have been proposed during this year are:

Ref.	Title	Institute	Collaboration
1222	Comparison of 10 kg Mass Standard For south East European Countries (SEE)	BEV	comparison
1215	Primary mercury columns using floats - exchange of experiences	CEM	research
1214	Density measurement of viscous oils	VSL	research
1210	Best practice for the dissemination of the kilogram	VSL	traceability
1207	Bilateral comparison to determine the effective area of the piston cylinder unit by cross-floating	MIKES	comparison
1206	Bilateral comparison in the barometric absolute pressure range 800 to 1100 hPa	MIKES	comparison
1205	Review of EURAMET cg 18: Guidelines on the Calibration of Non-Automatic Weighing Instruments	CEM	research
1198	Bilateral comparison of 20g, 500g, 10 kg standards provided by EIM	BoM	comparison
1197	Bilateral comparison of pressure in the range of 0 MPa to 50 MPa	UME	comparison
1190	Calibration of hydrometers at several temperatures	INRIM	comparison
1186	Comparison of absolute gravimeters	METAS	comparison

The active projects which are not comparisons:

Ref.	Title	Institute	Year	Collaboration
1215	Primary mercury columns using floats - exchange of experiences	CEM	2012	research
1214	Density measurement of viscous oils	VSL	2011	research
1210	Best practice for the dissemination of the kilogram	VSL	2011	traceability
1205	Review of EURAMET cg 18: Guidelines on the Calibration of Non-Automatic Weighing Instruments	CEM	2011	research
1125	Evaluation of cross-float measurements with pressure balances	LNE	2010	research
1121	Transferring of knowledge in the field of gas pressure balance calibration	EIM	2009	research
1110	Determination of magnetic properties of mass standards	PTB	2009	research
911	Study of standard leaks performance for different gas, in the transition regime	INRIM	2006	research
890	Dynamic Force Measurement	PTB	2006	research
803	FPG-type digital piston manometer – exchange of experiences	MIKES	2004	research
402	Mass measurement (Guide to the mass determination)	SMU	1997	research
351	Workshop on 'Secondary and Reference Mass Standard	LNE	1995	research
286	Traceability in force measurement at national laboratory level in range up to 2 MN	PTB	1993	traceability
285	Calibration of precision force measuring devices and transfer standards of the capacities up to 16,5 MN.	PTB	1993	traceability

3. Comparisons

There are 33 registered European key comparisons in the area of Mass and Related Quantities, of which 13 are active, 4 have provisional equivalence, 1 is approved for equivalence and 15 have been approved and published. Two were bilateral key comparisons between PTB (EURAMET) and CENAM (SIM). Details are provided in Table 1.

Comparison ID	Project no.	Title/Range	Subfield	Pilot	Contact	Status	Years
EUROMET.M.M-K1	215	Kilogram	Mass	NPL	I. Severn	Approved and Published	1992-1999
EUROMET.M.M-K2	445	(Sub-)multiples	Mass	SP	M. Perkin	Approved and Published	2001-2003
EUROMET.M.M-K2.1	786	(Sub-)multiples	Mass	SP	M. Perkin	Approved and Published	2004-2008
EURAMET.M.M-K2.2	1120	(Sub-)multiples	Mass	BEV	D. Steindl	Approved and Published	2009-2010
EURAMET.M.M-K2.3	1198	(Sub-)multiples	Mass	EIM	C. Mitsas	In progress, Draft A	2011
EUROMET.M.M-K4	510	Kilogram	Mass	NPL	S. Davidson	Approved and Published	1999-2003
EUROMET.M.M-K4.1	1029	Kilogram	Mass	MIRS	M. Grum	Approved and Published	2007-2008
EURAMET.M.M-K4.2	1120	Kilogram	Mass	BEV	D. Steindl	Approved and Published	2009-2010
EUROMET.M.D-K1	339	Solid (3 Si spheres)	Density	METAS	P. Richard	Provisional equivalence	1998-1999
EURAMET.M.D-K1.1	1031	Solid (3 ceramic sph.)	Density	PTB	H. Bettin	In progress	2008-2010
EUROMET.M.D-K2	627	Liquid density	Density	PTB	H. Bettin	Report in progress, Draft B	2001-2002
EURAMET.M.D-K2	1019	Liquid density	Density	BEV	C. Buchner	In progress, Draft A	2007-
EUROMET.M.D-K4.Prev	236	Hydrometers	Density	IMGC	S. Lorefice	Provisional equivalence	1993-1994
EUROMET.M.D-K4	702	Hydrometers	Density	IMGC	S. Lorefice	Approved for equivalence	2003-2006
EUROMET.M.P-K1.a	442	0.1 Pa to 1000 Pa	Pressure	BNM-LNE	J.C. Legras	Approved and Published	1999-2002
EUROMET.M.P-K1.b	442	0.3 mPa to 9 Pa	Pressure	BNM-LNE	J.C. Legras	Approved and Published	2000-2002
EURAMET.M.P-K1.c	1179	0.7 MPa a 7 MPa	Pressure	FORCE	A. Altintas	In progress	2011-2013
EUROMET.M.P-K2	305	1 MPa to 4 MPa	Pressure	PTB	W. Sabuga	Approved and Published	1994-1995
EUROMET.M.P-K3.a	439	0.05 MPa to 1 MPa	Pressure	LNE/NPL	J.C. Legras	Approved and Published	1999-2001
EUROMET.M.P-K3.b	439	0.05 MPa to 1 MPa	Pressure	NPL	I. Severn	Approved and Published	1999-2001
EUROMET.M.P-K4	389	10 MPa to 100 MPa	Pressure	NPL	I. Severn	Approved and Published	1998-1999
EURAMET.M.P-K4 2010	1047	0.5 Pa to 15 kPa	Pressure	CMI	D. Prazak	In progress	2007
EUROMET.M.P-K5	045	50 MPa to 500 MPa	Pressure	BNM-LNE	J.C. Legras	Provisional equivalence	1993-1995
EUROMET.M.P-K6	110	100 MPa - 1000 MPa	Pressure	BNM-LNE	J.C. Legras	Provisional equivalence	1992-1994
EURAMET.M.P-K7	881	50 MPa to 500 MPa	Pressure	MIKES	M. Rantanen	Report in progress, Draft B	2005-2007
EURAMET.M.P-K8	1041	25 kPa to 200 kPa	Pressure	METAS	C. Wuethrich	In progress	2007-
EURAMET.M.P-K13	1091	50 MPa to 500 MPa	Pressure	UME	I. Kocas	In progress	2009-
EUROMET.M.F-K1	535	5 kN to 10 kN	Force	MIKES	A. Pusa	Report in progress, Draft B	2002-2004
EUROMET.M.F-K2	518	50 kN to 100 kN	Force	NPL	A. Knott	Report in progress, Draft B	2003-
EUROMET.M.F-K3	505	500 kN to 4 MN	Force	PTB	R. Kumme	In progress	2005-2007
EURAMET.M.G-K1	1186	Free fall acceleration	Gravimetry	METAS	H. Baumann	In progress	2011
SIM-EUROMET.M.P-BK3		3 mPa to 0.9 Pa	Pressure	PTB/CENAM	K. Jousten	Approved and Published	2001-2002
SIM-EUROMET.M.P-BK4		10 MPa to 100 MPa	Pressure	PTB/CENAM	W. Sabuga	Approved and Published	2002

Table 1: Status of EURAMET Key Comparisons. In red, new entries. In bold, changes in status

There are also 23 supplementary comparisons (three more than last year). Among these comparisons, 16 have been published and 7 are in progress.

Comparison ID	Project no.	Title/Range	Subfield	Pilot	Contact	Status	Years
EUROMET.M.V-S1	273	(0.989-4600) mm ² /s	Viscosity	PTB	H. Wolf	Published	1992-1993
EUROMET.M.V-S2	303	(0.4- 67743 mm ² /s	Viscosity	PTB	H. Wolf	Published	1993-1996
EUROMET.M.V-S3	415	(190- 774000 mm ² /s	Viscosity	PTB	H. Wolf	Published	1997-2000
EUROMET.M.V-S4	415	(0.33-144000) mm ² /s	Viscosity	PTB	H. Wolf	Published	1997
EURAMET.M.M-S1	461	500 kg	Mass	CMI	I. Kriz	Report in progress, Draft B	2001-2005
EURAMET.M.M-S2	1054	0.1 mg to 100 g	Mass	NPL	S.Davidson	Approved and Published	2008-
EURAMET.M.M-S3		100 mg to 50 kg	Mass	UME	U. Y. Akcadag	In progress	2011-2012
EUROMET.M.P-S1	788	0.05 MPa to 1 MPa	Pressure	METAS	C. Wuethrich	Approved and Published	2004-2006
EUROMET.M.P-S2	922	30 Pa to 7 kPa	Pressure	PTB	K. Jousten	Approved and Published	2006-2007
EUROMET.M.P-S3	884	80 kPa to 110 kPa	Pressure	LNE	P. Otal	Approved and Published	2006-2008
EUROMET.M.P-S4	861	40 kPa to 1.75 MPa	Pressure	UME	I. Kokas	Approved and Published	2005-2006
EURAMET.M.P-S5	931	50 MPa to 500 MPa	Pressure	PTB	W. Sabuga	Report in progress, Draft B	2007-2008
EURAMET.M.P-S6		1.5 kPa to 300 kPa	Pressure	PTB	W. Sabuga	Approved and Published	2007-2008
EURAMET.M.P-S7	1040	0.1 mPa to 1 Pa	Pressure	METAS	C. Wuethrich	In progress	2007-
EURAMET.M.P-S8	1131	-100 kPa to +100 kPa	Pressure	MIKES	S. Saxholm	Approved and Published	2009-2010
EURAMET.M.P-S9	1170	-950 hPa to 0 hPa	Pressure	LNE	I. Morgado	In progress	2011
EURAMET.M.P-S10		0.005 Pa a 100 Pa	Pressure	CEM	N. Medina	Approved and Published	2010-2011
EURAMET.M.P-S11	1197	0 MPa a 50 MPa	Pressure	UME	I. Kocas	Approved and Published	2011
EURAMET.M.T-S1	1055	1 N.m to 1000 N.m	Torque	PTB	D. Roeske	Approved and Published	2008-2010
EURAMET.M.T-S2	1141	100 N m	Torque	PTB	D. Roeske	Rep. in progress, Draft A	2008-
EURAMET.M.T-S3		10 N.m to 1 kN.m	Torque	CEM	N. Medina	Approved and Published	2010
EURAMET.M.G-S1	1093	<i>g</i>	Gravimetry	METAS	H. Baumann	Approved and Published	2008-2009
EUROMET.M.F-S1		5 kN to 5 MN	Force	NPL	A. Knott	Approved and Published	2005-2006

Table 2: Status of EURAMET Supplementary Comparisons. In red, new entries. In bold, changes in status

4. CMCs

Over the last year, 4 CMCs from other RMOs were reviewed. All of them have been approved.

As concerns EURAMET submissions, the following is an update since May 2011.

Submission	NMI	Field	CMCs	State
EURAMET.M.18.2010	EIM, Greece	mass	revision	published
EURAMET.M.22.2011	LNE, France	mass	new	published
EURAMET.M.23.2011	IMBIH, Bosnia and Herzegovina	mass	new	under revision
EURAMET.M.24.2011	CEM, Spain	torque	new	published
EURAMET.M.24.2011	CEM, Spain	mass	revision	published

Peer reviews have also been an important issue inside the TC. They were carried out in various subfields at CEM, IPQ and INRIM.

5. Participation EMRP

TC Mass members are actively involved in EMRP call 2010 (area Industry) taking part in the following projects:

Number	Short name	Full Name
IND 03	HIGHpress	High Pressure Metrology for Industrial Applications
IND09	Dynamic	Traceable Dynamic Measurement of Mechanical Quantities
IND12	Vacuum	Vacuum metrology for production environments

These projects have just started in the last term of 2011.

Two workshops have already been organized:

- Workshop on High Pressure Metrology for Industry (14th June 2012).
- Workshop on measurement characteristics and use of quadrupole mass spectrometers for vacuum applications (12th-13th April 2012).

For EMRP call 2011 (area SI Broader Scope) the following JRPs have been selected:

Number	Short name	Full Name
SIB03	KNOW	Realisation of the awaited definition of the kilogram - resolving the discrepancies
SIB05	NewKILO	Developing a practical means of disseminating the new kilogram

These new projects will provide very important results for the “new definition of the kilogram” and its practical realization. They will start in June 2012.

It can be concluded that the participation at EMRP is rather successful because, although there are not many proposals, most proposals are always selected.

For EMRP call 2012 (area SI Broader Scope) the following SRTs have been proposed:

SRT s13	Outgassing rate control and pascal realisation in the extremely low pressure range
SRT s14	Force traceability within the meganewton range
SRT s15	Traceable small force metrology

6. Meetings

The 2012 Mass and related quantities TC Contact Persons meeting was held in Vienna, Austria on 2nd March and, as usual, was preceded by technical meetings for the various subfields to review progress in projects in mass, force, pressure, density and viscosity.

There were also other meetings related to EMRP projects in progress and in negotiation.

The next meeting will be held in Croatia, probably in April.

7. Roadmaps

For TC Mass 4 different roadmaps have been defined, one per subcommittee (mass, density and viscosity, force and pressure). These roadmaps have been included in an annex at the end of this document. The roadmap for density and viscosity is a first draft.

8. Sub-Committees

Two mayor issues have been solved during this period.

On the one hand, SC Density and Viscosity did not exist officially. This situation has been clarified and the “new “SC has been officially approved. Dr Horst Bettin has been appointed as the convenor of this SC. He had already been acting like that unofficially.

On the other hand, Dr Stuart Davidson has been officially appointed as the convenor of SC Mass, a task he was carrying out unofficially also.

It is also important to mention that, as a consequence of the increasing importance of measurements in dynamic conditions, it has been approved to apply for the creation of a new subcommittee “Dynamic measurements”, which will deal with dynamic measurements in mechanical quantities, especially in force, torque and pressure.

9. Issues

EURAMET Calibration Guidance Documents

The EURAMET Calibration Guide 18 “Guidelines on the Calibration of Non-Automatic Weighing Instruments” had been revised and version 3 had been published.

Concerns were expressed by some influential users that the document, which is being adopted also by other RMOs as mandatory, is too complicated and needs some further adjustment. As a consequence it was agreed to make an improved revision of the guide where harmonization was more achievable and solution to issues not covered before were provided. This work is under EURAMET project 1205.

For this work we have the active cooperation of two important manufacturers of non automatic weighting instruments as well as 17 NMIs. It is expected to have a first draft of the document at the beginning of the summer.

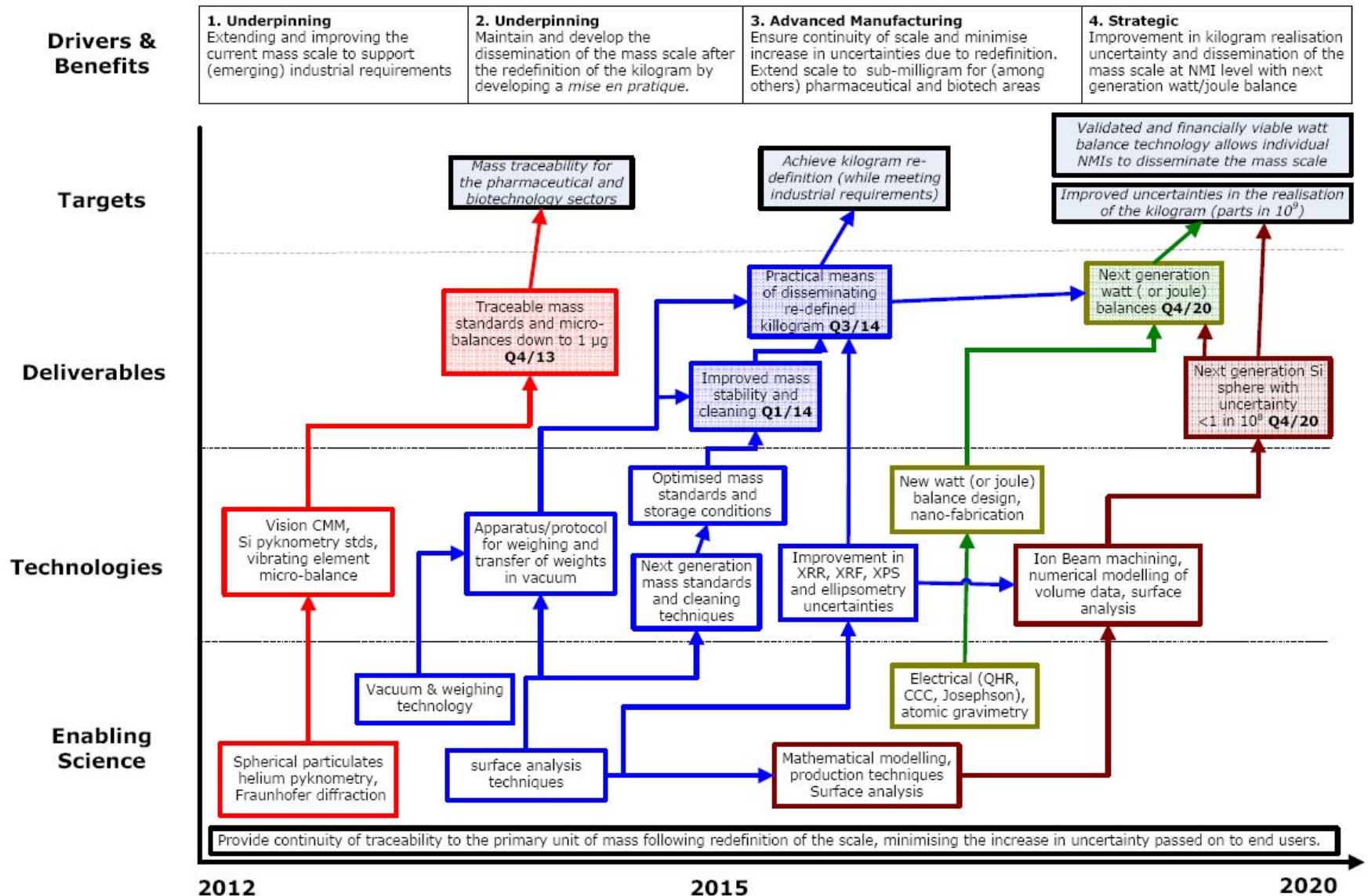
10. Outlook for 2012/2013

Next year's activity will be largely dominated by work on the kilogram redefinition, especially concerning its *mise en pratique* in close cooperation with BIPM, and by EMRP-related work.

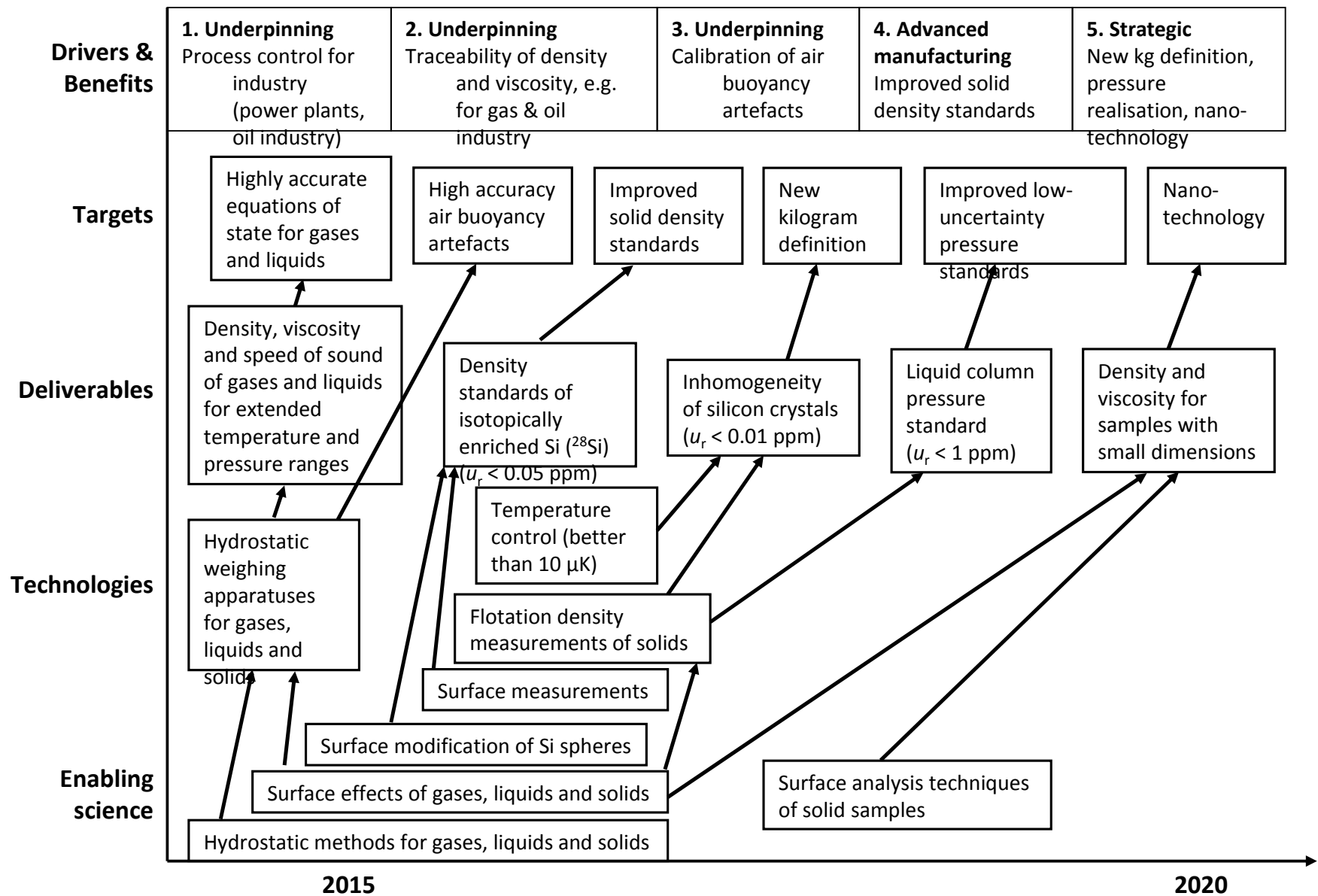
Nieves Medina, CEM,
TC-M Chair
2012-05-18

ANNEX: Roadmaps

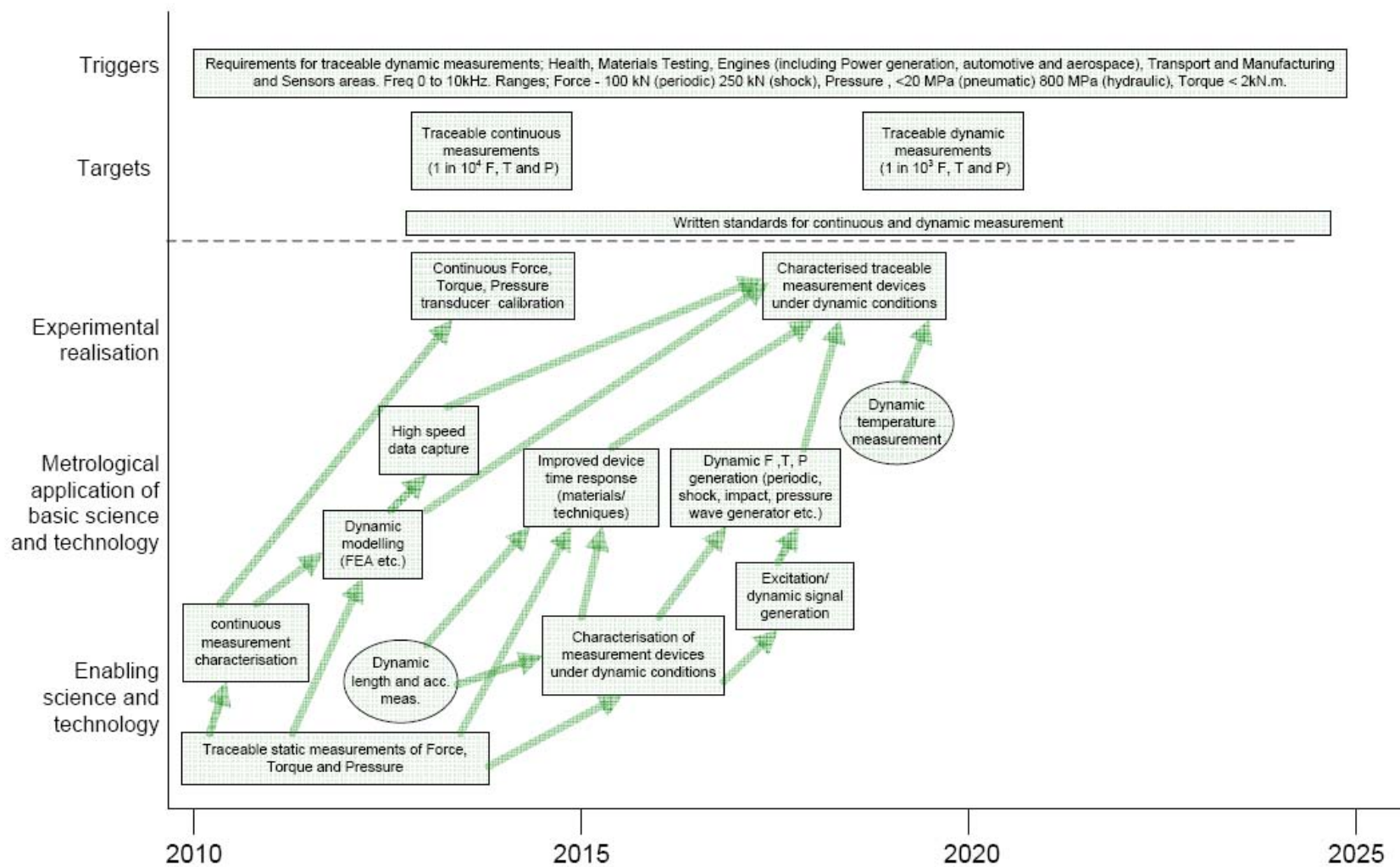
EURAMET TC-M, Mass Area Roadmap



EURAMET TC-M, Density and Viscosity Area Roadmap



EURAMET TC-M Force Area Roadmap



EURAMET TC-M, Pressure Area Roadmap

