



Hagia Sophia, Türkiye



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Head of Mass Laboratory and Vice-Conveyor in EURAMET
Mass and Related Quantities Mass Sub-committee

She received her MSc. degree in Physics from Middle East Technical University (METU), Ankara, Türkiye in 2007 and her PhD. degree in Physics from Concordia University, Montreal, Canada in 2012. From 2006 to 2009 she had been working as an Expert in Mathematics and Computer Science Department of Çankaya University, Ankara, Türkiye. From 2009 to 2012 she had been a Research Assistant in Concordia University, Montreal, Canada. From 2013 to 2015 she has been Postdoctoral Fellow in İzmir Institute of Technology, İzmir, Türkiye. Since 2015 she has been working in TÜBİTAK National Metrology Institute (UME), Kocaeli, Türkiye. Her research interests include high energy physics, mass metrology and quantum metrology.



METROLOGY SYMPOSIUM

DIGITALIZATION AND AUTOMATION IN MASS METROLOGY

Third Edition: Future and New Solutions



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Mass Metrology in TUBITAK UME

Assoc. Prof. Dr. Beste KORUTLU YILMAZ



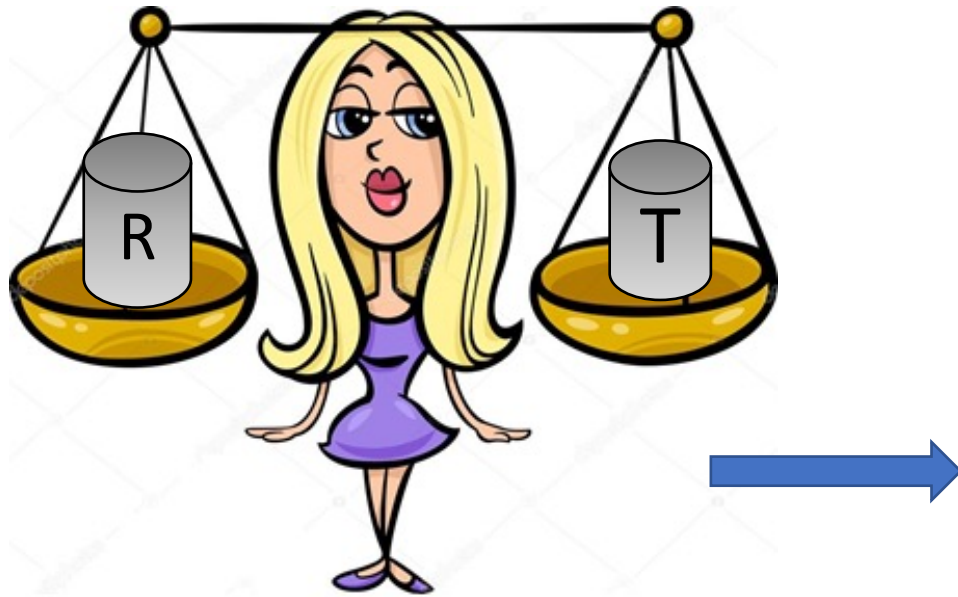
16-18.04.2024, Radom, Poland

TUBITAK UME Mass Laboratory

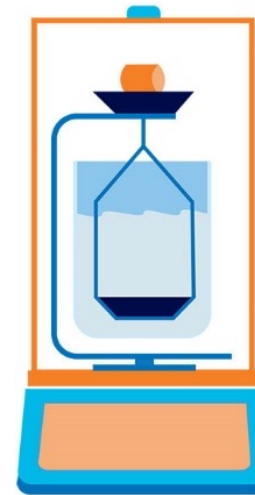
- Calibration Services
- Comparisons
- Projects
- Activities
- Conclusion



Calibration Services



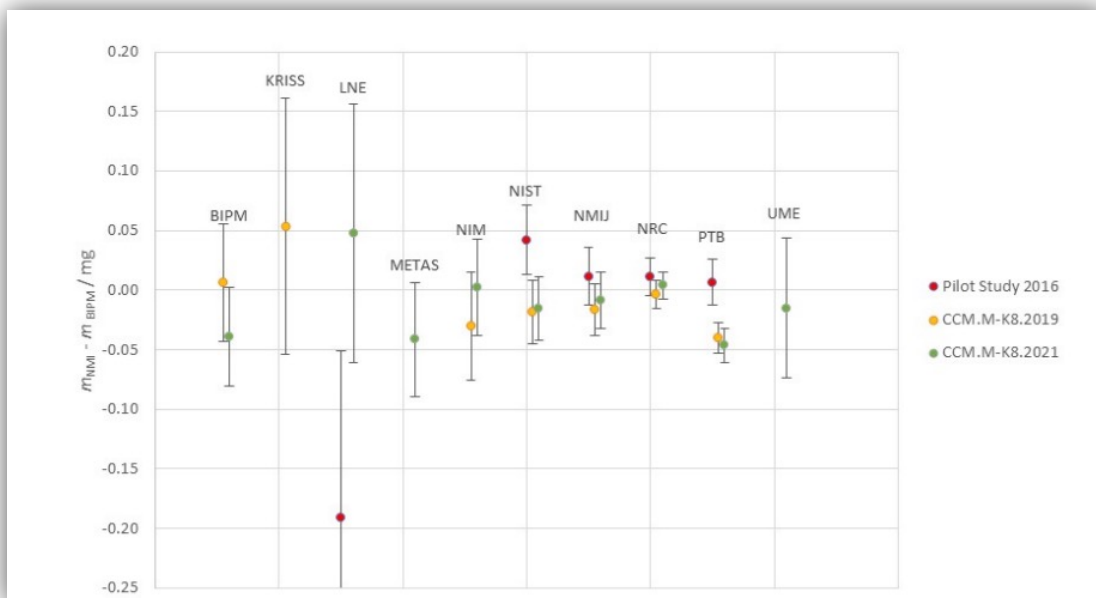
Mass Calibration
1 mg – 1000 kg




Solid Density and Volume Calibration
1 g – 50 kg

Second Phase of Dissemination

2nd Key Comparison: CCM.M-K8.2021



All NMIs would need to **reduce** the mass value of NPK by **7 µg!**



**2023
March
1**

2nd CV

	Value (1 kg +) / µg	Standard Uncertainty / µg
Pilot Study Reference Value (2016)	12.4	11.4 ^t
KCRV of the first CCM.M-K8 (2019)	-18.8	8.1 ^t
KCRV of the second CCM.M-K8 (2021)	-15.2	7.4 ^t
Calculated Consensus Value (arithmetic mean)	-7.2	20^t

In the Certificates it is recommended to state:
“The calibration results stated in this certificate are based on the Consensus Value of the kilogram commencing 1st March 2023”

Calculation of the Consensus Value for the Kilogram 2023

February 2023
 CCM Task Group on the Phases for the Dissemination of the kilogram following redefinition (CCM-TGPFd-kg)

Summary
 The 2023 consensus value for the SI unit of mass, the kilogram, has been determined to be:
1 kg - 7 µg with a standard uncertainty of 20 µg
 with respect to the mass value of the International Prototype Kilogram (IPK), which is equal to the BIPM as-maintained mass unit. That means that the mass of the IPK, based on the consensus value is 1 kg - 7 µg. (The 2023 consensus value is 5 µg lower than the consensus value of 2021).

UME adapted the recommendation

CMCs in Mass Calibration

Value CMC	Expanded Uncertainty CMC	Multiplier to Class E ₁ MPE
1 mg – 100 mg	0.8 µg – 1.6 µg	1/4 – 1/3
100 mg – 1 g	1.6 µg – 2.4 µg	1/3 – 1/4
1 g – 10 g	2.4 µg – 8 µg	1/3 – 1/3
10 g – 100 g	8 µg – 12 µg	1/3 – 1/4
100 g – 1 kg	12 µg – 100 µg	1/4 – 1/5
1 kg – 10 kg	100 µg – 5 mg	1/5 - 1

Value CMC	Expanded Uncertainty CMC	Multiplier to Class E ₂ MPE
10 kg – 100 kg	5 mg – 150 mg	1/3 - 1
100 kg – 500 kg	150 mg – 2 g	1 - 3



CMCs in Solid Volume Calibration

Artefact	Value CMC	Expanded Uncertainty CMC
1 g – 20 g	0.125 cm ³ – 2.5 cm ³	0.5 mm ³ – 0.6 mm ³
20 g – 100 g	2.5 cm ³ – 12.5 cm ³	0.6 mm ³ – 0.8 mm ³
100 g – 1 kg	12.5 cm ³ – 125 cm ³	0.8 mm ³ – 5 mm ³



Ongoing Mass Comparison



Pilot Laboratory
TUBITAK UME

DFM INRIM

NPL

CEM

PTB

Steering Committee

EURAMET.M.M-K7

Transfer Standards



5 kg, 100 g, 10 g, 5 g, 500 mg



Linking laboratories:
CEM, INRIM, METAS and PTB

Draft A – Expected in August

Planned/Required Mass Comparisons

CCM.M-K2



Pilot Laboratory
NRC

Transfer Standards

100 mg, 2 g, 20 g, 500 g, 10 kg

EURAMET
Center of Mass Comparison



Pilot Laboratory
NPL

Transfer Standards

100 g, 500 g, 1 kg

We need to participate
in
comparisons with $TS \geq$
20 kg



Pilot Laboratory
PTB

CENAM

INRIM



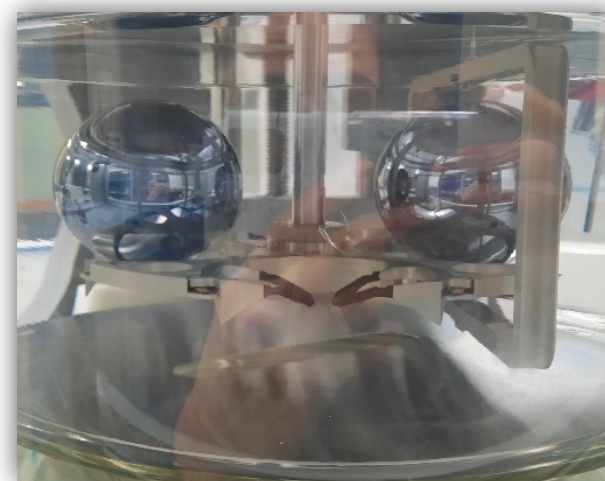
Co-pilot Laboratories

CCM.D-K1.2023

Transfer Standard



1 kg Si-Sphere



Measurement Period:
29/11/2023
20/12/2023

Results Sent:
22/02/2024



CCM.D-K3

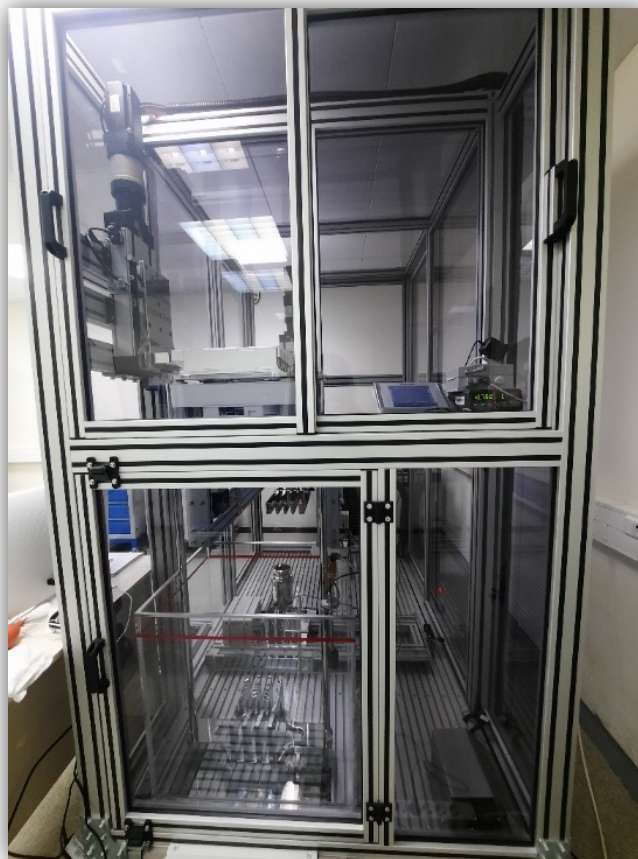


Pilot Laboratory
NMIJ

Transfer Standards

1 kg, 200 g, 20 g

2 kg – 50 kg Volume Comparator



We need to participate
in comparisons
with
 $2 \text{ kg} \geq \text{TS} \geq 50 \text{ kg}$

Virtual Mass Comparison

Pilot:



Participants:



Virtual Mass



Results are submitted



Analyzed by digital expert



Digitally Reported



will be presented at



IMEKO 2024 XXIV World Congress
26 – 29 August 2024 | Hamburg, Germany

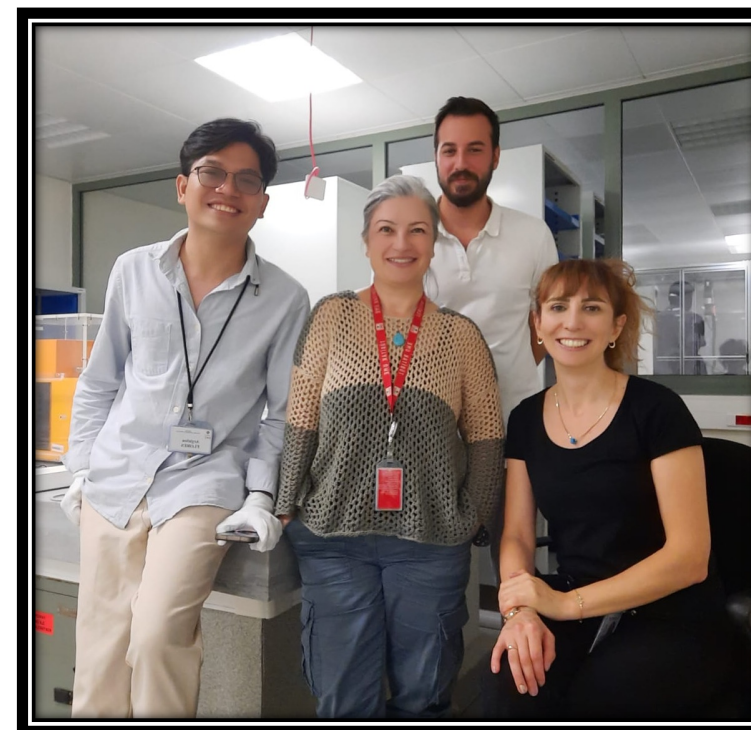


16-18.04.2024, Radom, Poland

BIPM-TUBITAK UME Project Placements



Tanzania Bureau of Standard



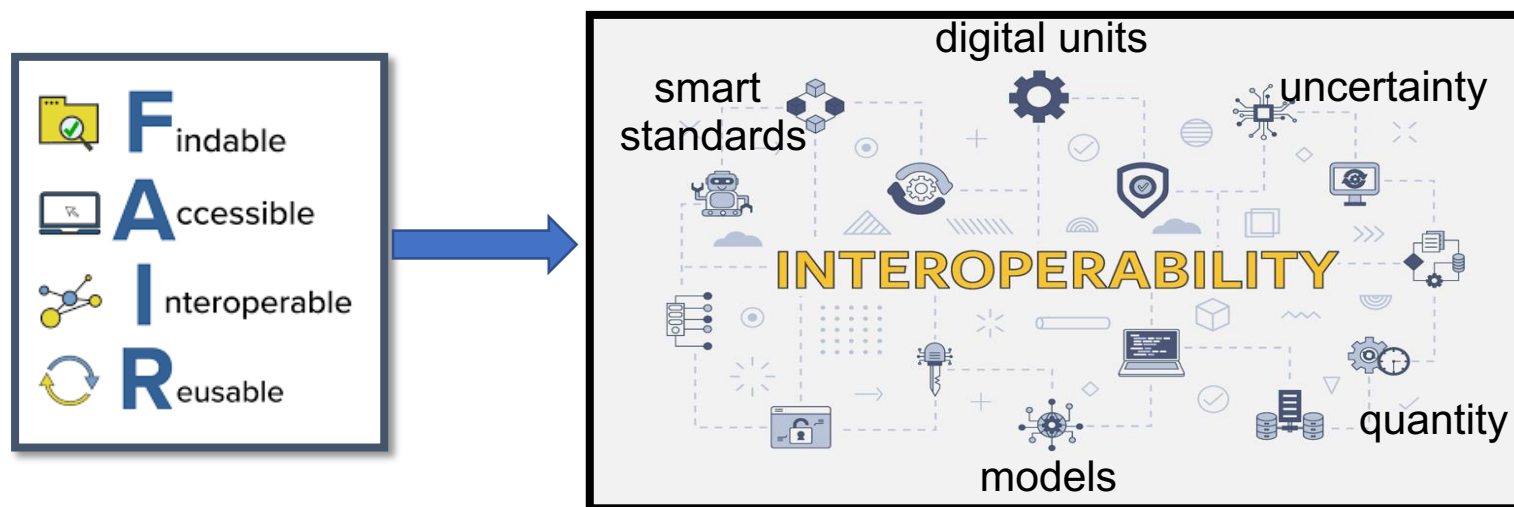
National Metrology Laboratory of the Philippines

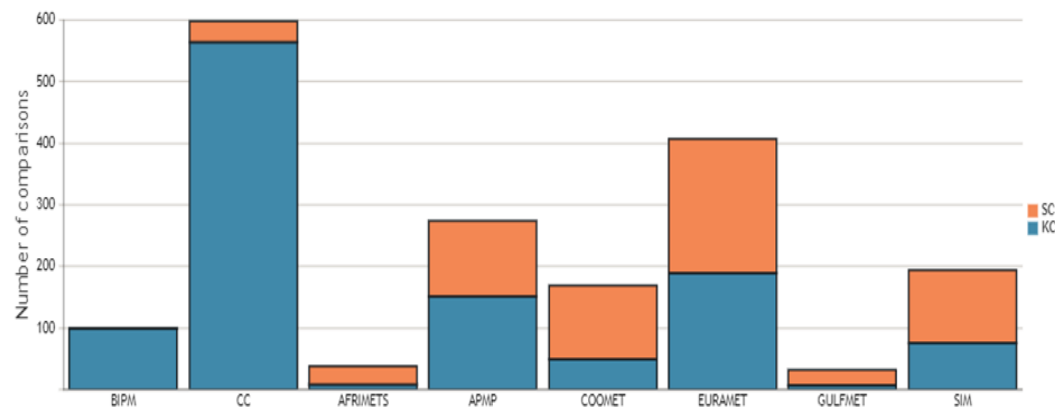
Title: An Interoperable Quality Infrastructure for Automated Interlaboratory Comparison

Coordinator: 

Physikalisch-Technische Bundesanstalt
National Metrology Institute

Participants:



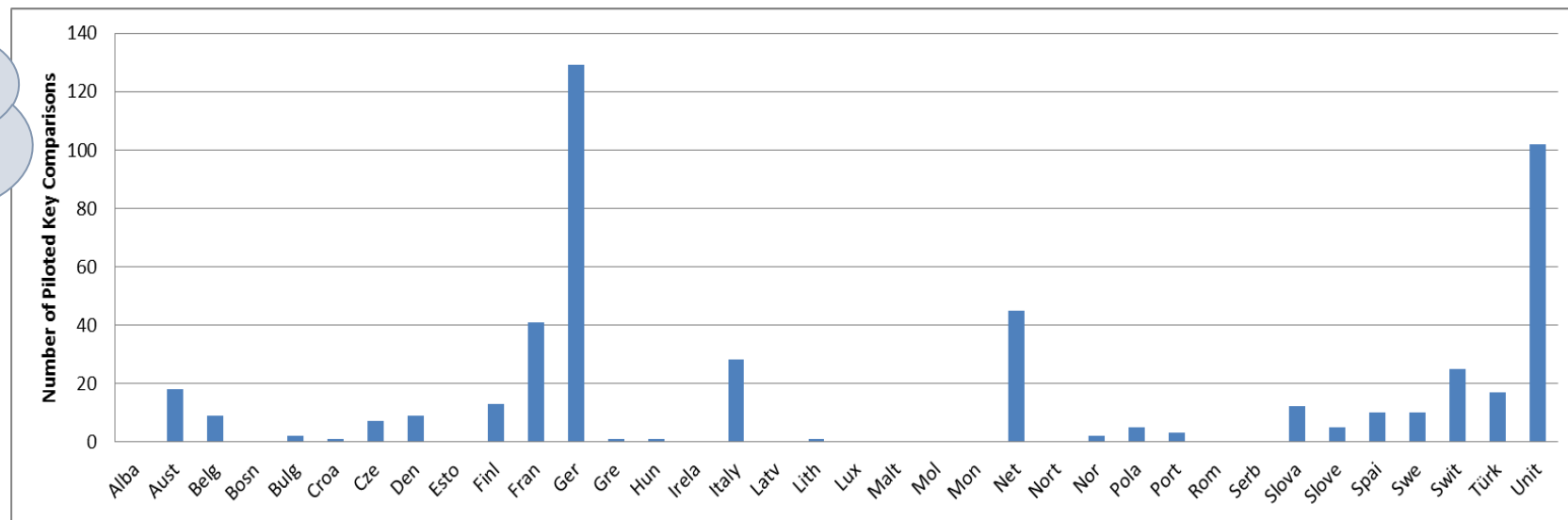


Number of comparisons organized within EURAMET is in the second rank!



Total number of key and supplementary comparisons are given by organization. Given in blue is the number of KCs and in orange is the number of SCs

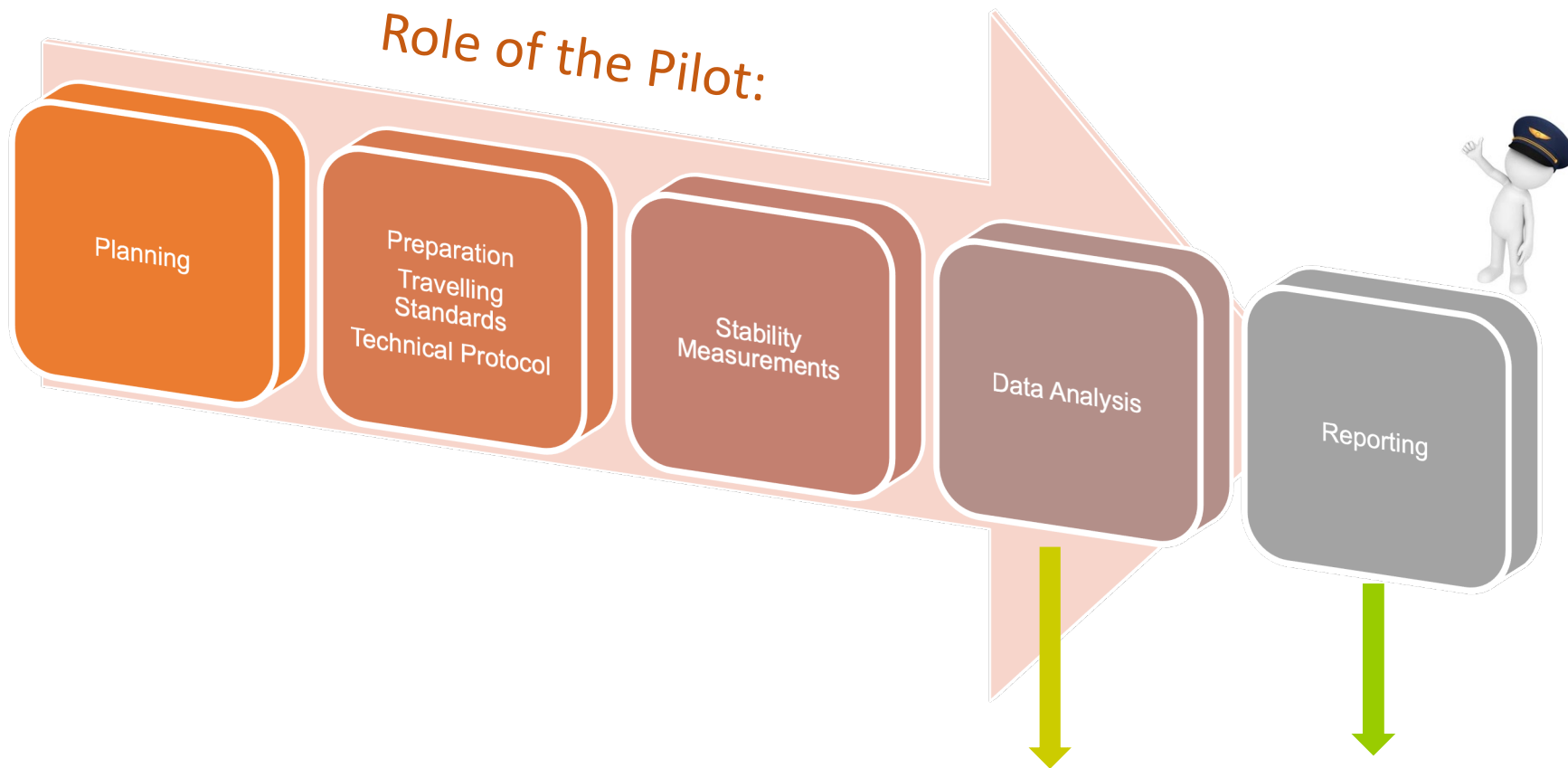
Emerging NMIs have little experience in piloting! Workload on the big NMIs in piloting can be shifted to the growing NMIs.



Number of piloted key comparisons within EURAMET by country.

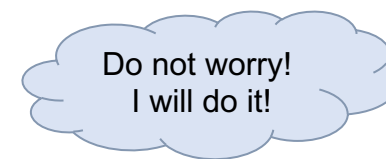


Role of the Pilot:



requires sophisticated background in statistical analysis & programming

Currently not reported in machine readable format



Title: Digital workflows, technical frameworks and e-services for digital reports in metrology

Coordinator: 

Participants:            

Data processing chain for machine-readable digital reports

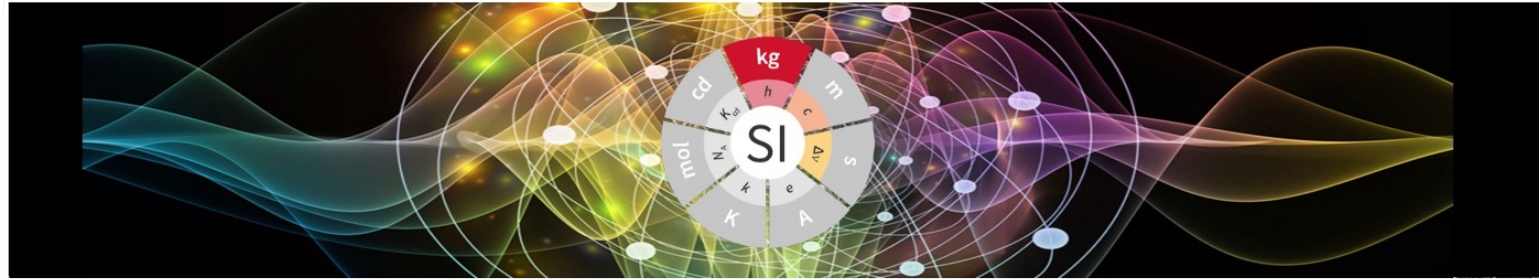


The Past, Present and Future of Mass Metrology

2024
May
20

Kütle Metrolojisinin Dünü Bugünü Yarını Çalıştayı

20 Mayıs 2024
Kocaeli, Türkiye



[Ana Sayfa](#)

[Kayıt](#)

[Katılımcılar](#)

[Toplantı Gündemi](#)

[Çalıştaydan Kareler](#)

Değerli Kütle Metrolojisi Paydaşları,

Düzenleme Komitesi adına, 20 Mayıs 2024 tarihinde hibrit olarak gerçekleştirilecek olan "Kütle Metrolojisinin Dünü, Bugünü ve Yarını Çalıştayı"na sizleri davet etmekten mutluluk duyuyoruz.

Bu çalıştayı amacı, kütle ölçümlerinin ulusal ölçekte nasıl güvence altına alındığı ve uluslararası sisteme entegrasyonunun nasıl sağlandığı konularında paydaşlarımızla bilgi alış-verişi yapılmasının yanı sıra, iyileştirme ihtiyacı duyulan alanların belirlenmesidir.

Toplantı için seçilen konu başlıkları aşağıda verilmiştir:

- Kilogram biriminin yeni tanımı ve yayılımı,
- Kütle kalibrasyonunda karşılaşılan başlıca zorluklar,
- Endüstrinin ve kalibrasyon laboratuvarlarının belirsizliğin azaltılmasına ihtiyacı duyduğu kütle aralıkları,
- Dijitalleşme yönünde atılan adımlar.

Kayıt ücretsizdir, ancak zorunludur!

Kütle Metrolojisinin Dünü, Bugünü ve Yarını Çalıştayı'nda sizlerle buluşmayı sabırsızlıkla bekliyoruz!

Saygılarımızla,
Düzenleme Komitesi

Conclusion



We started our journey in Digital Transformation



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**Thank you for
your attention**

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