

Report of the CCM WGD-kg

Chris Sutton
(Chair)

Stuart Davidson
(co-chair)

Last meeting: 16 May 17

37 Attendees

21 of 22 members represented

WGD-kg Membership

	Institute	Country	Primary contact
1	BEV	Austria	Zoltan Zelenka
2	BIPM		Michael Stock
3	CEM	Spain	Maria Nieves Medina
4	CENAM	Mexico	Luis Omar Becerra
5	DFM	Denmark	Lars Nielsen
6	INRIM	Italy	Andrea Malengo
7	KRISS	Korea	Sungjun Lee
8	LNE	France	Patrick Pinot

Request from UME to become WGD-kg members

11	NMIIA	Australia	Nilly Pell
12	NMISA	South Africa	Benjamin Van der Merwe
13	VSL	The Netherlands	Adriaan van der Veen
14	NMI	Japan	Shigeki Mizushima

RMO TC-Chairs

15	AFRIMETS	Egypt	ALAAELDIN A. ELTAWIL
16	APMP	Malaysia	Dr Shih Mean Lee
17	NRC	Canada	Irina Kolozinskaya
18	METAS	Switzerland	Isabel Spohr
19	MSL	New Zealand	Christos Mitsas
20	PTB	Germany	Aldo Quiroga
21	SMU	Slovakia	Laurene Štopková
22	VNIIM	Russian Federation	Leonid Vitushkin

WGD-kg Terms of Reference

The terms of reference of CCM-WGD-kg are:

- To study, develop and advise the CCM on issues related to mass standards and their dissemination;
- To define, organize and approve the necessary key

Need to add terms relating to the review of KC results and the review and approval of CMCs

the kilogram (WGR-kg) and other relevant WGs, and

- To collaborate with the BIPM in defining and delivering on their program of work in the mass area.

WGD-kg and WGR-kg

- Proposal to merge the WGs after the official revision of the SI (World Metrology Day - 20 May 2019)

WGD-kg CMC service categories

- Suggestion of including XRCD and Kibble (watt) balance capability in CMCs (as a new service category)

WGD-kg KC issues

Strategy

- KC repeat period
- 1 kg K1, K4

CCM.M- K1	Comparison of mass standards 1995 - 1998
Comparison type, Field	Key comparison in Mass, Mass Standards Mass: 1 kg
Status	Approved for equivalence, Results available

CCM.M- K4	Comparison of mass standards 2011 - 2012
Comparison type, Field	Key comparison in Mass, Mass Standards Mass: 1 kg
Status	Approved for equivalence, Results available

- 1998, 2012, **2022**

- 50 kg K3, K7

CCM.M- K3	Comparison of mass standards 2001 - 2002
Comparison type, Field	Key comparison in Mass, Mass Standards Mass: 50 kg
Status	Approved for equivalence, Results available

CCM.M- K3.1	Comparison of mass standards 2009
Comparison type, Field	Key comparison in Mass, Mass Standards Mass: 50 kg
Status	Approved for equivalence, Results available

CCM.M- K6	Comparison of mass standards 2011 - 2013
Comparison type, Field	Key comparison in Mass, Mass Standards Mass: 50 kg
Status	Approved for equivalence, Results available

- 2002, (2009), 2013, **2024**

WGD-kg KC issues

Strategy

- KC repeat period (sub-)multiples
- K2, K3, K6

CCM.M- K2	Comparison of mass standards 1998 - 1999
Comparison type, Field	Key comparison in Mass, Mass Standards Mass: 100 mg, 2 g, 20 g, 500 g and 10 kg
Status	Approved for equivalence, Results available
CCM.M- K5	Comparison of mass standards 2000 - 2003
Comparison type, Field	Key comparison in Mass, Mass Standards Mass: 200 mg, 1 g, 50 g, 200 g and 2 kg
Status	Approved for equivalence, Results available
CCM.M- K7	Comparison of mass standards 2014 - 2015
Comparison type, Field	Key comparison in Mass, Mass Standards Mass: 500 mg, 5 g, 10 g, 100 g and 5 kg
Status	Approved for equivalence, Results available

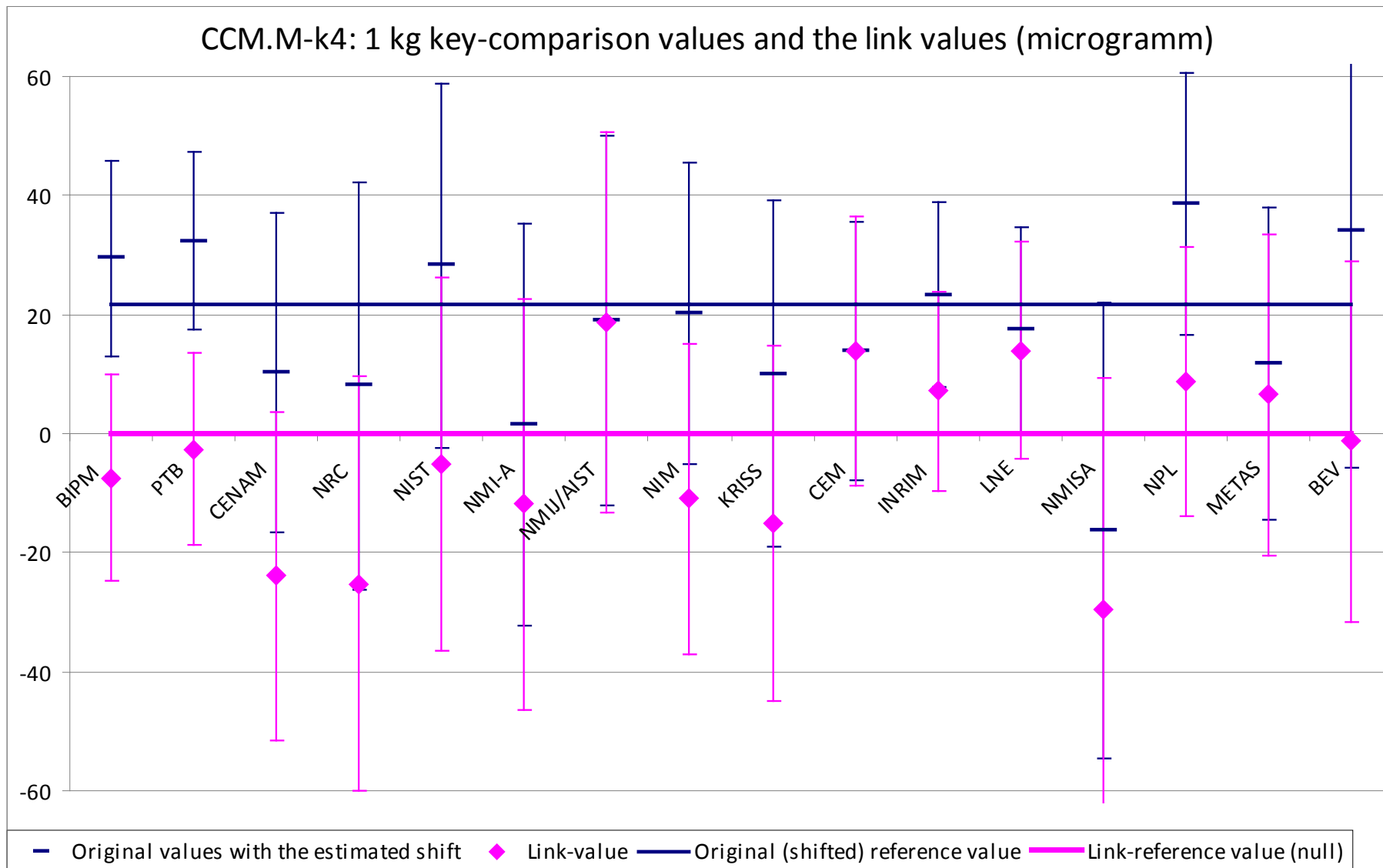
- K2 (1999) 100 mg – 10 kg
- K3 (2003) 200 mg – 2 kg
- K6 (2015) 500 mg – 5 kg

WGD-kg KC issues

- Update to CCM strategy document re. KC timetable

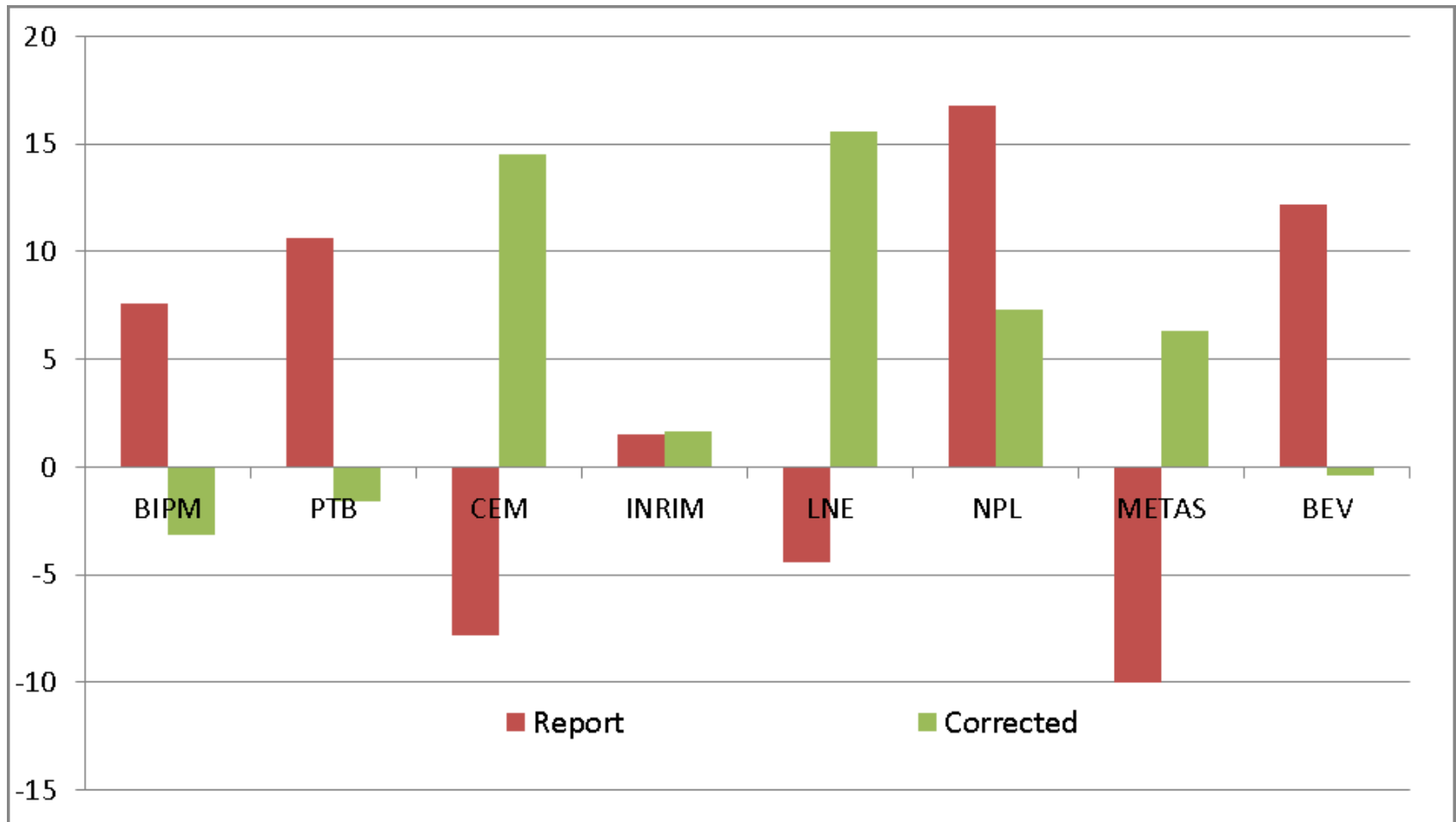
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
CCM.M-K1 CCM.M-K4 (1 kg)						X							
CCM.M-K2 CCM.M-K5 CCM.M-K7 ((sub-)multiples)										X			
CCM.M-K3 CCM.M-K6 (50 kg)								X					

CCM.M-K4 – Amended participant values



CCM.M-K4 – Amended EURAMET values

- Values are shown relative to old (reported) and new (corrected) KCRVs respectively
- Linking of comparisons strongly dependant on linking labs chosen



Evaluation of KCs: NIST consensus builder

Antonio Possolo (NIST)

<https://consensus.nist.gov/>

<https://uncertainty.nist.gov/>

NIST Consensus Builder

About the NIST Consensus Builder

Enter data

Choose a method for analysis

DerSimonian-Laird

Hierarchical Bayes

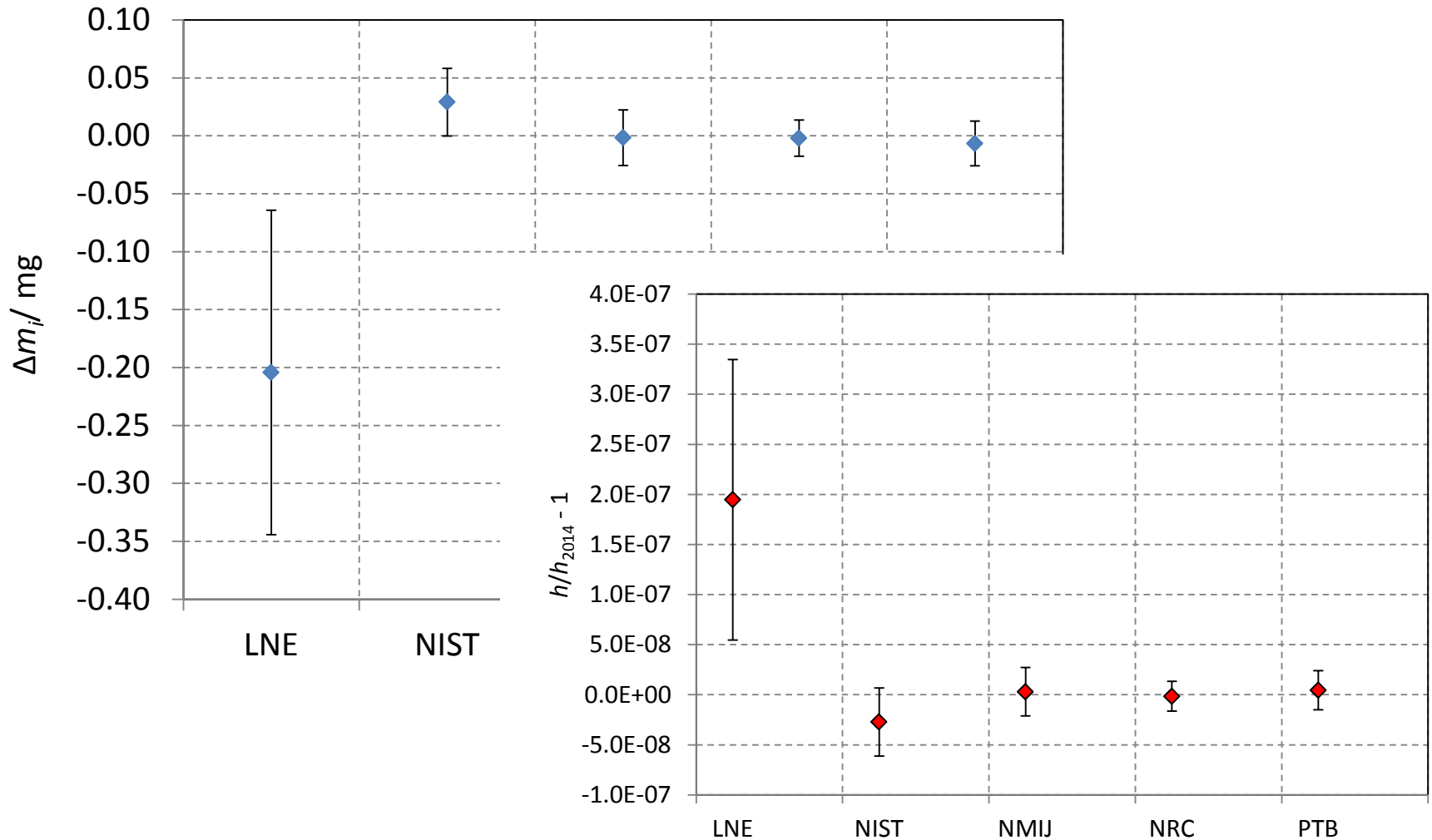
Linear Pool

Presentations from the BIPM

- BIPM mass calibrations of national prototypes of the kilogram from the Extraordinary Calibrations to 2017
- Update on the BIPM Ensemble of Reference Mass Standards
- Summary of the results of the Pilot Study of future primary realizations of the kilogram
- Dissemination of the mass unit after the redefinition

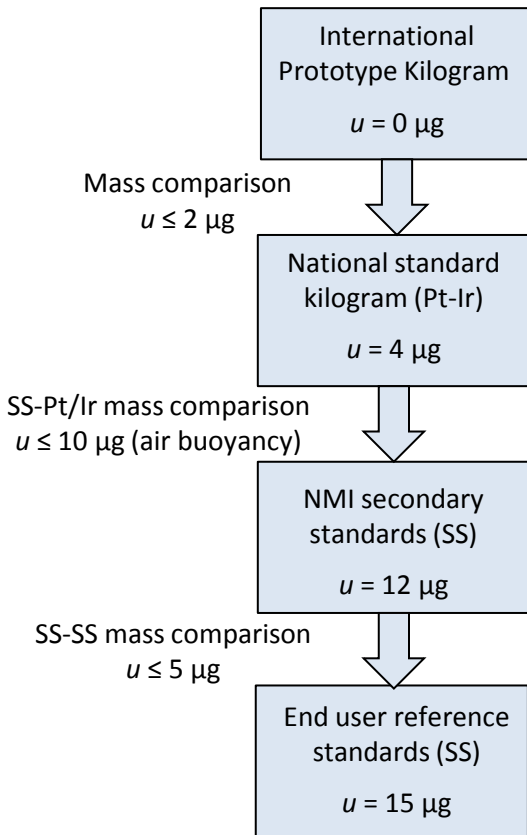


Summary of the results of the Pilot Study of future primary realizations of the kilogram

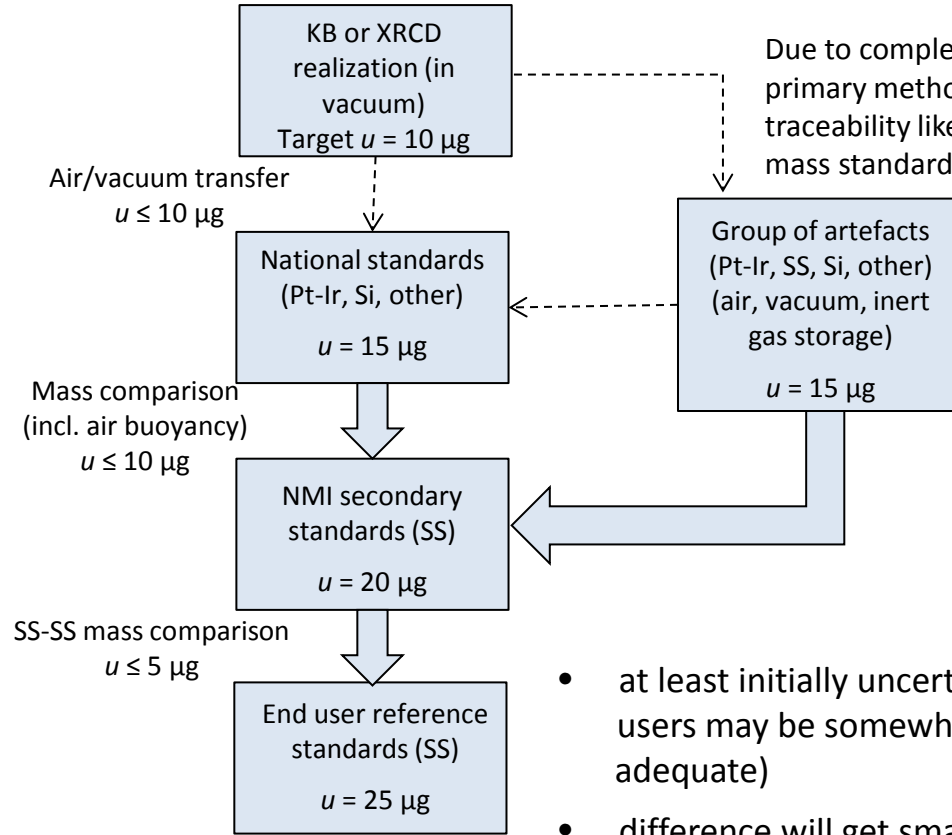


Dissemination of the mass unit after the redefinition

Current Traceability



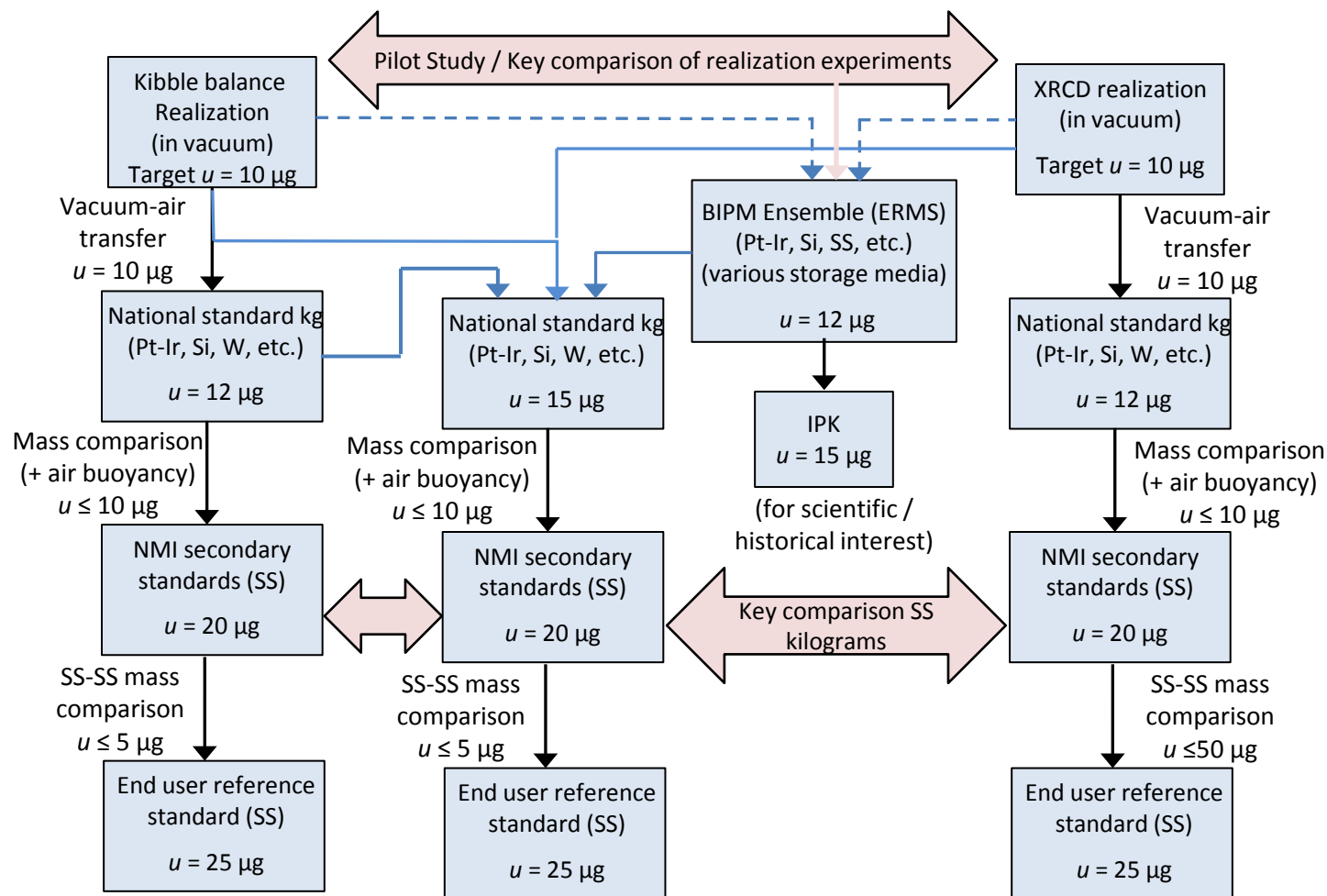
Proposed Future Traceability



Uncertainties are indicative only

- at least initially uncertainty for end users may be somewhat higher (but adequate)
- difference will get smaller in time

Dissemination of the mass unit after the redefinition



Uncertainties are indicative only

Completed KCs

CCM.M-K7 Sungjun Lee (KRISS)

- 5 kg, 100 g, 10 g, 5 g, 500 mg stainless steel weights
- Evaluation post BIPM adjustment
- 2 discrepant results but do not effect published CMCs

	Country		Institute
	China		NIM
	Egypt		NIS
	Italy		INRIM
	Mexico		CENAM
	Russia		VNIIM
	Spain		CEM
	Switzerland		METAS
	USA		NIST
pilot	Korea		KRISS
co-pilot	Germany		PTB

RMO reports

- AFRIMETS.M.M-S6 (sub-)multiples - Draft B complete
- AFRIMETS.M.M-S3 (sub-)multiples - Draft A circulated
- AFRIMETS.M.M-K7 (sub-)multiples - planned

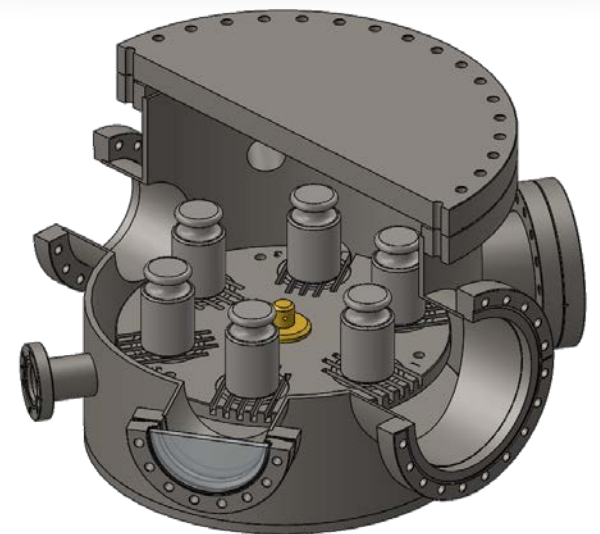
- EURAMET.M.M-K4 kilogram – protocol agreed
- EURAMET.M.M-S3 (sub-)multiples – Draft B prepared
- EURAMET.M.M-S7 500 kg – Start June 17
- EURAMET.M.M-S9 sub-mg – Draft A complete

- GULFMET.M.M-S1 (sub-)multiples – Draft B prepared
- GULFMET.M.M-S1 (sub-)multiples – In progress

- APMP – issues with delays in completion of KCs. Impose deadlines on delivery/review of results and potentially exclude participants.

Short presentations on scientific activities (focus on dissemination after the re-definition of the kilogram)

- Conclusions from the EURAMET NewKILo Joint Research Project on dissemination of the new kilogram
- Mass Calibration and Dissemination Research at the National Research Council of Canada
- PTB activities in preparation of the maintenance and dissemination of the redefined kilogram
- The NIST *Mise en Pratique* for the Dissemination of the kilogram as part of the “New SI”



Report of the CCM WGD-kg

Thank you for your attention