The work of the Consultative Committees to increase the impact of the CIPM MRA

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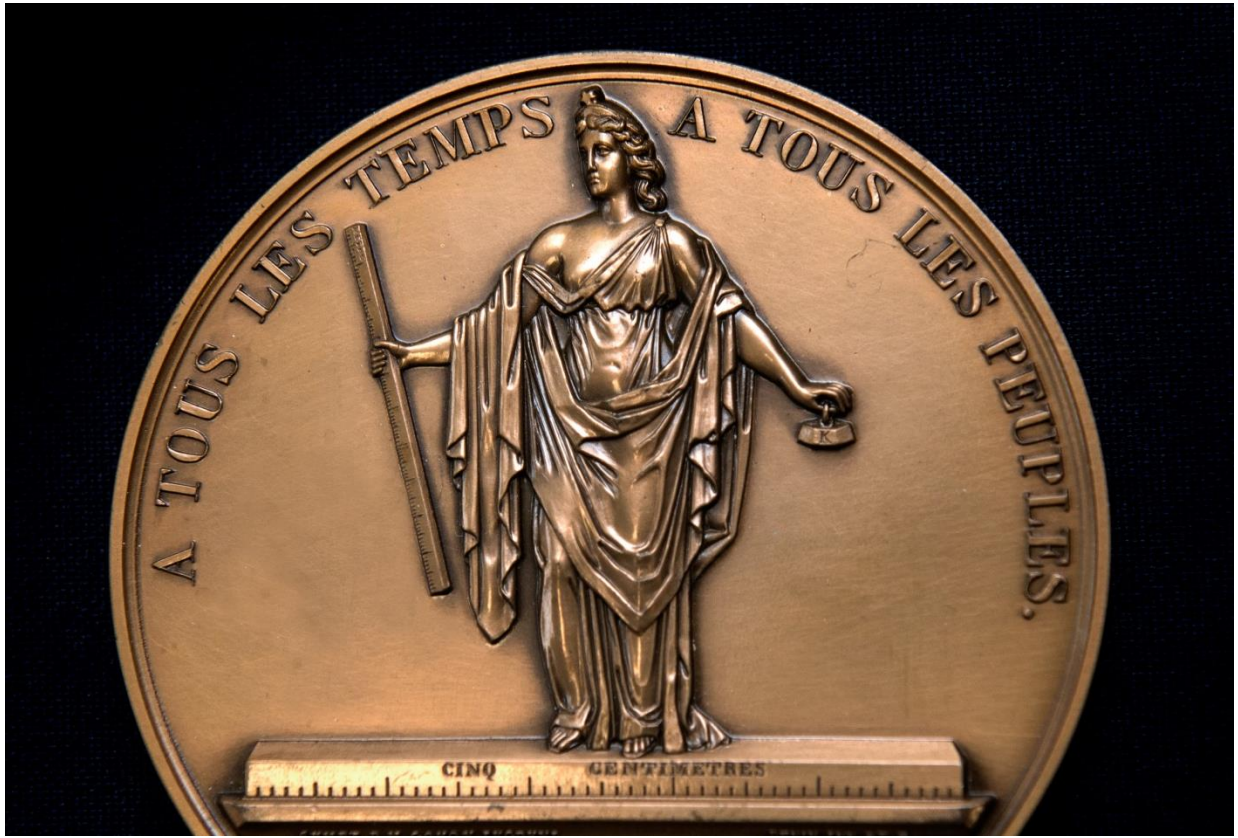
A visionary statement…



The CIPM MRA

International equivalence of measurements:

"The CIPM Mutual Recognition Arrangement (CIPM MRA) is the framework through which National Metrology Institutes *demonstrate the international equivalence of their measurement standards and the calibration and measurement certificates they issue*.

The outcomes of the Arrangement are the internationally recognized (peer-reviewed and approved) Calibration and Measurement Capabilities (CMCs) of the participating institutes. Approved CMCs and supporting technical data are publicly available from the CIPM MRA database (the KCDB)."

25th CGPM and the CIPM MRA

- **On the importance of the CIPM Mutual Recognition Arrangement**

Resolution 5

The General Conference on Weights and Measures (CGPM), at its 25th meeting,

considering

- the relevance and importance of the CIPM MRA as expressed in particular by the CGPM in Resolution 6 (2003) adopted at its 22nd meeting and in Resolution 4 (2007) adopted at its 23rd meeting,

noting

- that after fifteen years of successful operation of the CIPM MRA, there is a need to review its implementation and operation,

invites

- the Consultative Committees and the JCRB to continue their ongoing efforts to streamline operations within the existing framework, and to prepare for and contribute to the wider review in 2015,
- the CIPM to establish a working group under the chairmanship of its President, with membership to be determined at the 2015 workshop, to conduct a review of the implementation and operation of the CIPM MRA,

Recommendations from the

Working Group on the Implementation and Operation of the CIPM MRA

CIPM MRA working group August 2016 report :

- 9 recommendations
- 28 actions

https://www.bipm.org/en/cipm-mra-review/

The CIPM MRA – Key Comparison DataBase

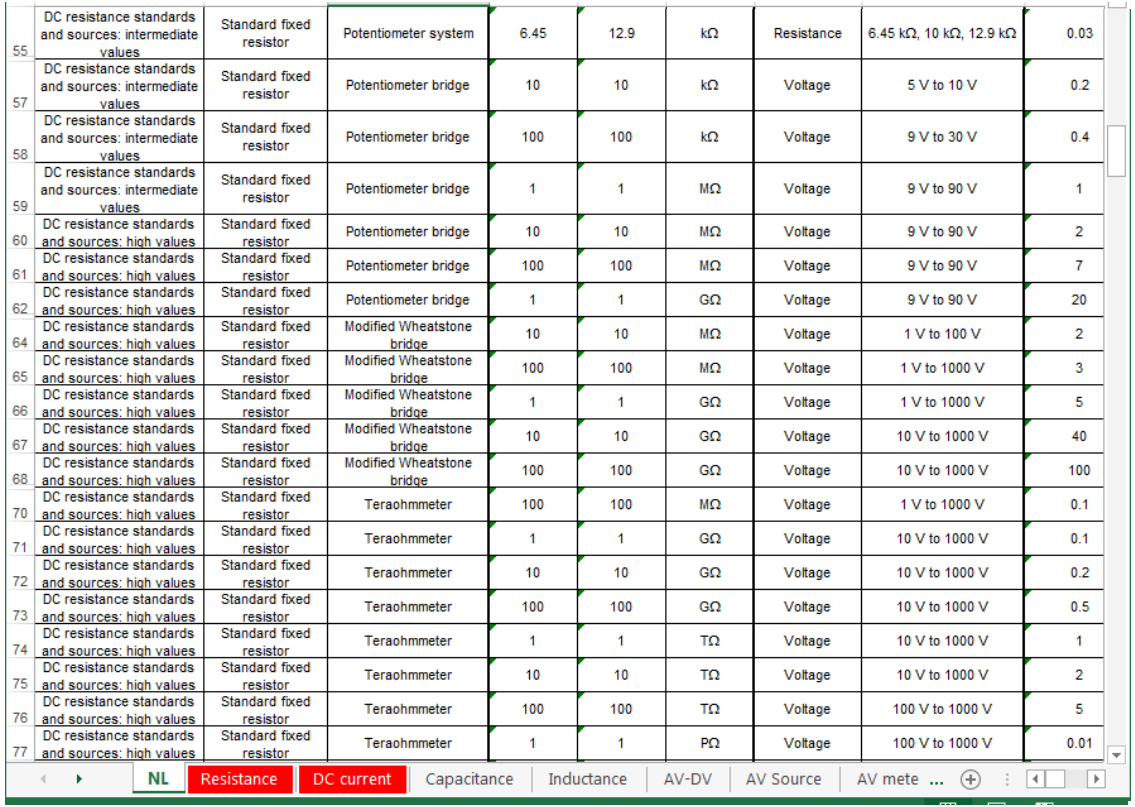
https://kcdb.bipm.org/

17 of the 28 actions are on:

- CMC visibility in the KCDB (3)
- KC participation (3)
- Constraining proliferation of CMCs (5)
- CMC review process (6)

11 actions relate to the CIPM CCs

CMC proliferation - matrices



55	DC resistance standards and sources: intermediate values	Standard fixed resistor	Potentiometer system	6.45	12.9	kΩ	Resistance	6.45 kΩ, 10 kΩ, 12.9 kΩ	0.03
57	DC resistance standards and sources: intermediate values	Standard fixed resistor	Potentiometer bridge	10	10	kΩ	Voltage	5 V to 10 V	0.2
58	DC resistance standards and sources: intermediate values	Standard fixed resistor	Potentiometer bridge	100	100	kΩ	Voltage	9 V to 30 V	0.4
59	DC resistance standards and sources: intermediate values	Standard fixed resistor	Potentiometer bridge	1	1	MΩ	Voltage	9 V to 90 V	1
60	DC resistance standards and sources: high values	Standard fixed resistor	Potentiometer bridge	10	10	MΩ	Voltage	9 V to 90 V	2
61	DC resistance standards and sources: high values	Standard fixed resistor	Potentiometer bridge	100	100	MΩ	Voltage	9 V to 90 V	7
62	DC resistance standards and sources: high values	Standard fixed resistor	Potentiometer bridge	1	1	GΩ	Voltage	9 V to 90 V	20
64	DC resistance standards and sources: high values	Standard fixed resistor	Modified Wheatstone bridge	10	10	MΩ	Voltage	1 V to 100 V	2
65	DC resistance standards and sources: high values	Standard fixed resistor	Modified Wheatstone bridge	100	100	MΩ	Voltage	1 V to 1000 V	3
66	DC resistance standards and sources: high values	Standard fixed resistor	Modified Wheatstone bridge	1	1	GΩ	Voltage	1 V to 1000 V	5
67	DC resistance standards and sources: high values	Standard fixed resistor	Modified Wheatstone bridge	10	10	GΩ	Voltage	10 V to 1000 V	40
68	DC resistance standards and sources: high values	Standard fixed resistor	Modified Wheatstone bridge	100	100	GΩ	Voltage	10 V to 1000 V	100
70	DC resistance standards and sources: high values	Standard fixed resistor	Teraohmmeter	100	100	MΩ	Voltage	1 V to 1000 V	0.1
71	DC resistance standards and sources: high values	Standard fixed resistor	Teraohmmeter	1	1	GΩ	Voltage	10 V to 1000 V	0.1
72	DC resistance standards and sources: high values	Standard fixed resistor	Teraohmmeter	10	10	GΩ	Voltage	10 V to 1000 V	0.2
73	DC resistance standards and sources: high values	Standard fixed resistor	Teraohmmeter	100	100	GΩ	Voltage	10 V to 1000 V	0.5
74	DC resistance standards and sources: high values	Standard fixed resistor	Teraohmmeter	1	1	TΩ	Voltage	10 V to 1000 V	1
75	DC resistance standards and sources: high values	Standard fixed resistor	Teraohmmeter	10	10	TΩ	Voltage	10 V to 1000 V	2
76	DC resistance standards and sources: high values	Standard fixed resistor	Teraohmmeter	100	100	TΩ	Voltage	100 V to 1000 V	5
77	DC resistance standards and sources: high values	Standard fixed resistor	Teraohmmeter	1	1	PΩ	Voltage	100 V to 1000 V	0.01

NL | Resistance | DC current | Capacitance | Inductance | AV-DV | AV Source | AV mete ...

CCEM:

-40 %

- 2013: 7100 CMCs
- 2018: 4400 CMCs

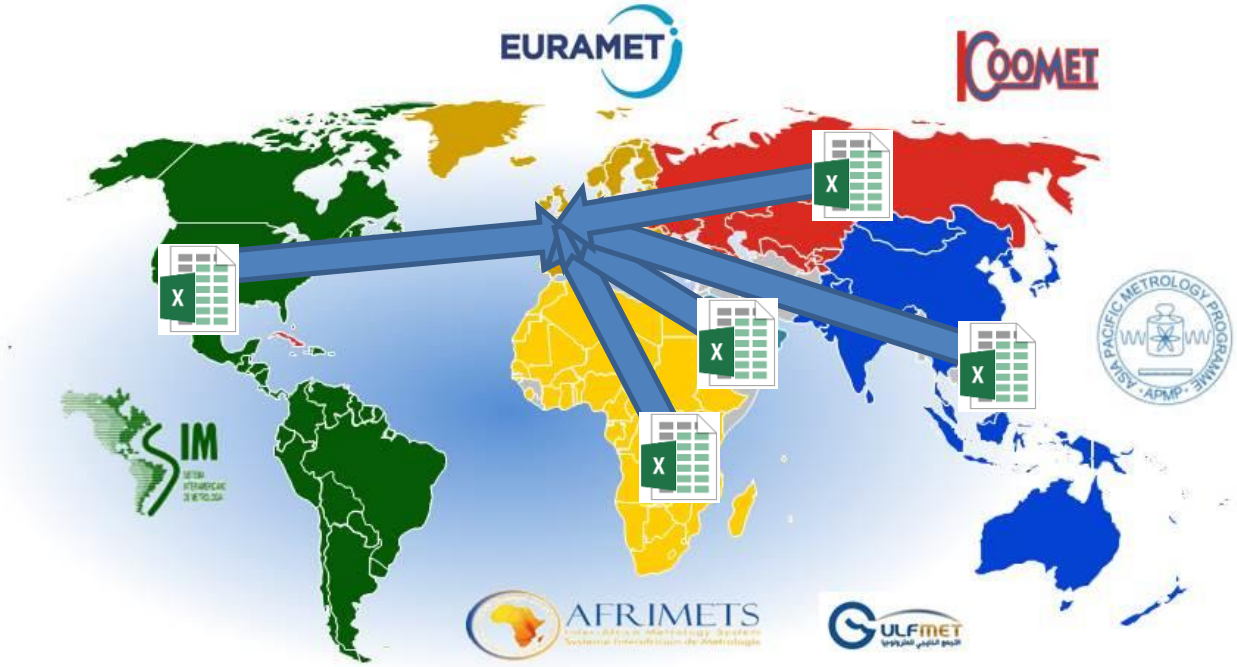
The same information,

better presented,

less administration

Reduction of the number of CMCs is not an aim in itself!

CMC review processes

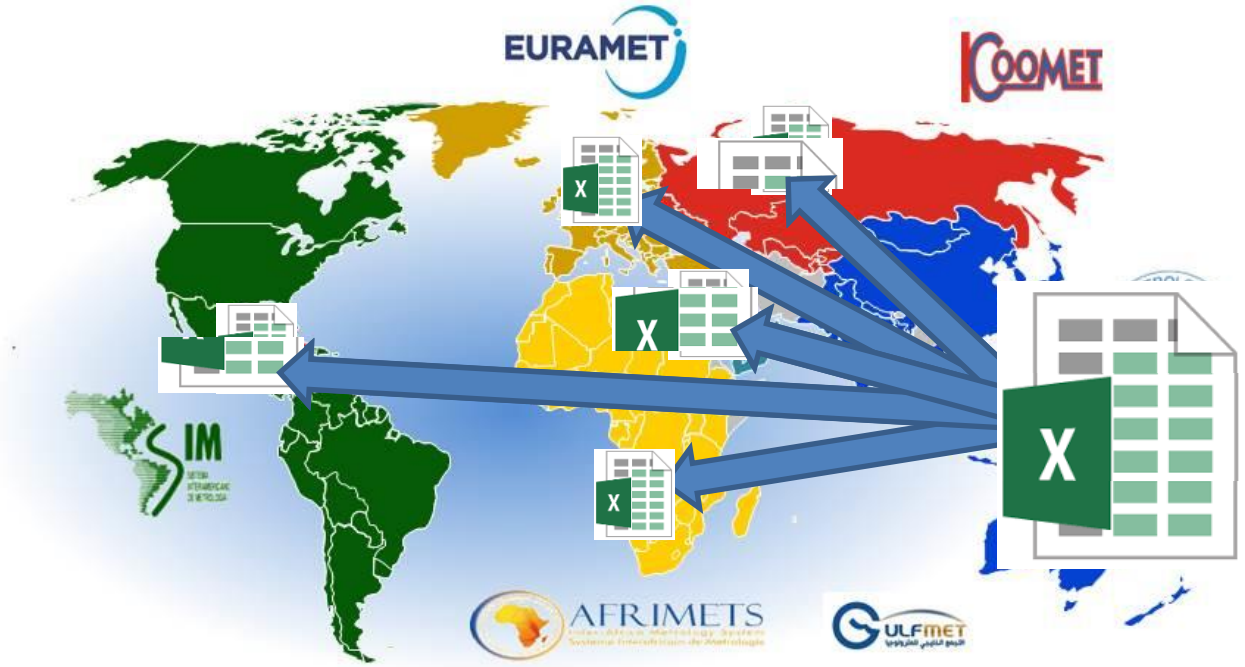


One review for all CMCs during a meeting at the BIPM

Works well for TCs with:

- Not too many CMCs
- New areas (CCQM)

CMC review processes



CCEM:

All CMCs are reviewed within the region (intra-RMO review)

As the MRA matures and trust between RMOs and NMIs increases, the inter-RMO reviews can be optimised

CCEM inter-RMO CMC review process

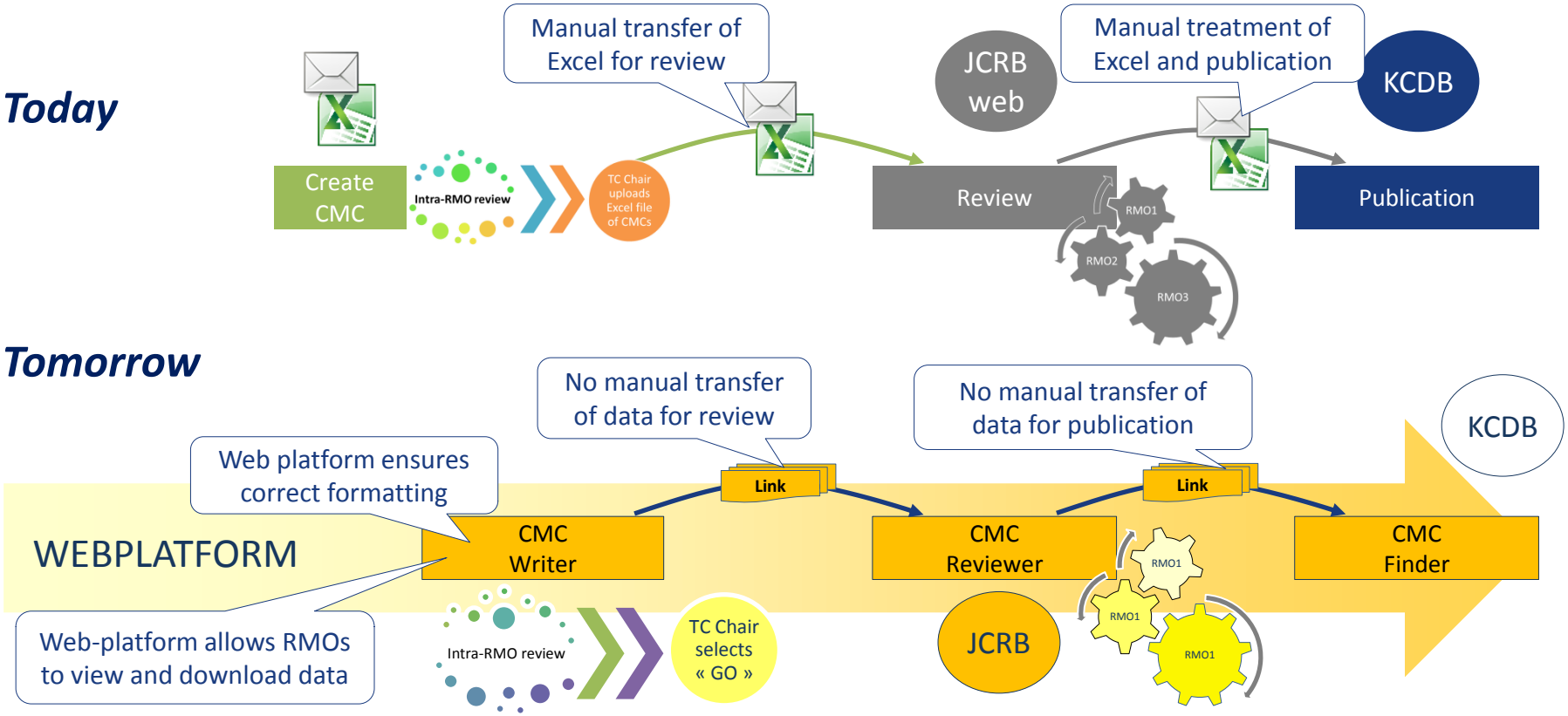
- Prior to CCEM 2011: 400 % review (4 RMOs each reviewing entire set)
- Since CCEM 2011: 100 % review (2-4 RMOs collectively reviewing set)
- After CCEM 2015: selective review (<100 %, based on sampling)

Upon submission of a CMC set, a proposal for the *scope of inter-RMO review* is made by the Chair of WGRMO or designate, based on agreed criteria such as:

- Magnitude of change
- History of previous reviews
- Coverage by on-site technical reviews
- Rotation
- High-level technical judgement

The final decision on the scope of review lies with RMOs!

KCDB 2.0 – a step change in MRA impact



Comparisons

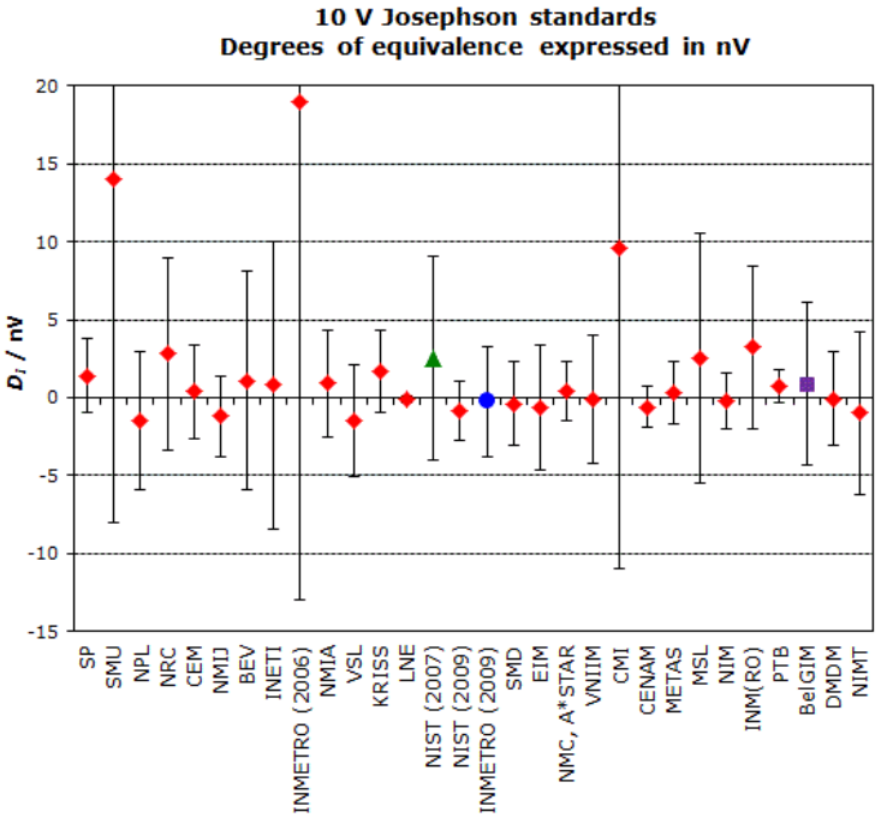
Less NMIs in loop:

- CMC
- RMO coverage
- RMO follow-up loop

Parallel loops

- Only key quantities
- Strategic planning
- Training (CBKT!)

The BIPM and CCEM comparisons



Quantum standards (still) require comparisons

- BIPM travelling standards for JAVS (DC and AC) & QHE very effective for performing KCs
- Learning experience for *all* participants, including 'leading' NMIs

Recent BIPM-led 'star approach' comparison finished < 2 yrs (record!)

Summary

The CIPM MRA is a *great success* in reducing or eliminating trade barriers

A significant increase of the CIPM MRA *efficiency and impact* achieved via:

- Reduction of the number of CMCs (matrices)
- More efficient CMC review process
- Strategic planning of KCs
- BIPM-led comparisons

The efficiency CIPM MRA is discussed at the yearly CC presidents meetings; experiences are exchanged, and progress of all CCs on the actions is tracked

Thank you!

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