

Introduction to international metrology

Tanasko Tasić
Capacity Building Officer

Slides by EURAMET Secretariat, BIPM
(Sussanne Picard), MIRS (Rado Lapuh)

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INM, Chisinau, 7 - 8 November 2018

- BIPM and the Metre Convention
- Regional Metrology Organisations
- CIPM MRA
- Revision of the SI

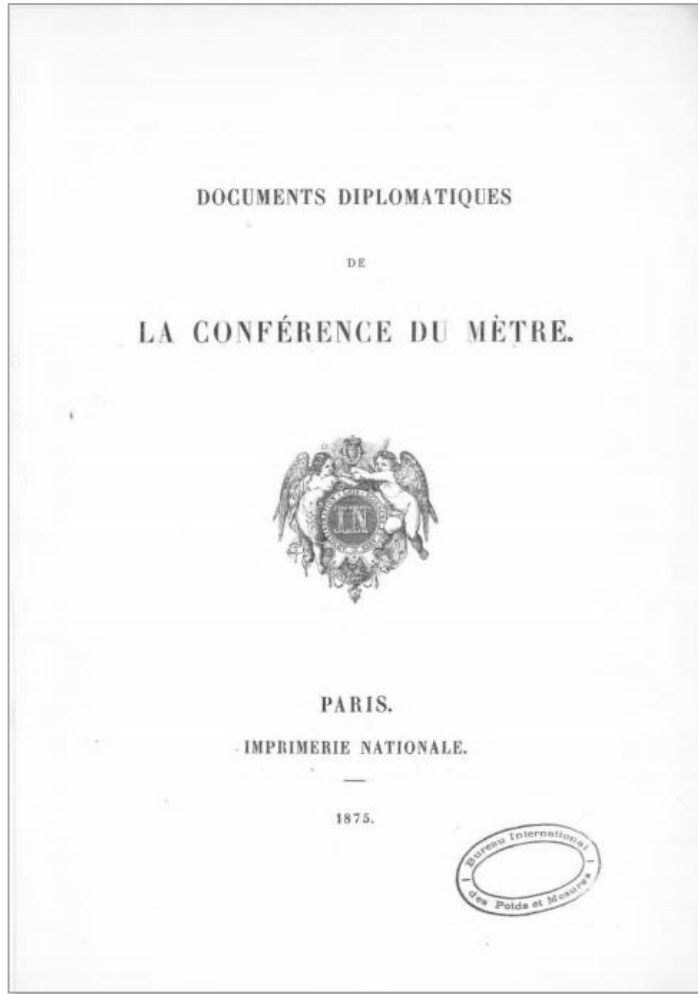
Birth of the BIPM

- The International Bureau of Weights and Measures was founded in Paris in 1875 by 17 Member States(*) and based at the *Pavillon de Breteuil* in Sevres in the Paris outskirts.



(*) Argentina; Austria-Hungary; Belgium; Brazil; Denmark; France; Germany; Italy; Peru; Portugal; Russia; Spain; Sweden and Norway; Switzerland; Turkey; United States of America; Venezuela.

...and the Metre Convention



*“The BIPM is an intergovernmental organization established by the **Metre Convention**, through which Member States act together on matters related to measurement science and measurement standards”.*

Scheme 1889

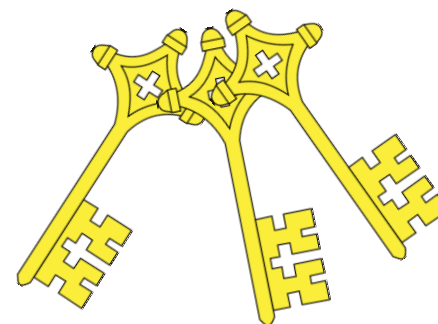


General Conference on Weights and Measures 1889

International Committee for Weights and Measures

International Bureau of Weights and Measures
18 Members having signed the Metre Convention

Office and laboratories



*Distribution of kg
and metre
prototypes,
accompanied by a
calibrated
thermometer*

Scheme today



General Conference on Weights and Measures

International Committee for Weights and Measures

International Bureau of Weights and Measures

Members of the BIPM

104 bodies

having signed the CIPM MRA

Office and laboratories

CCAUV

CCEM

CCL

CCM

CCPR

CCQM

CCRI

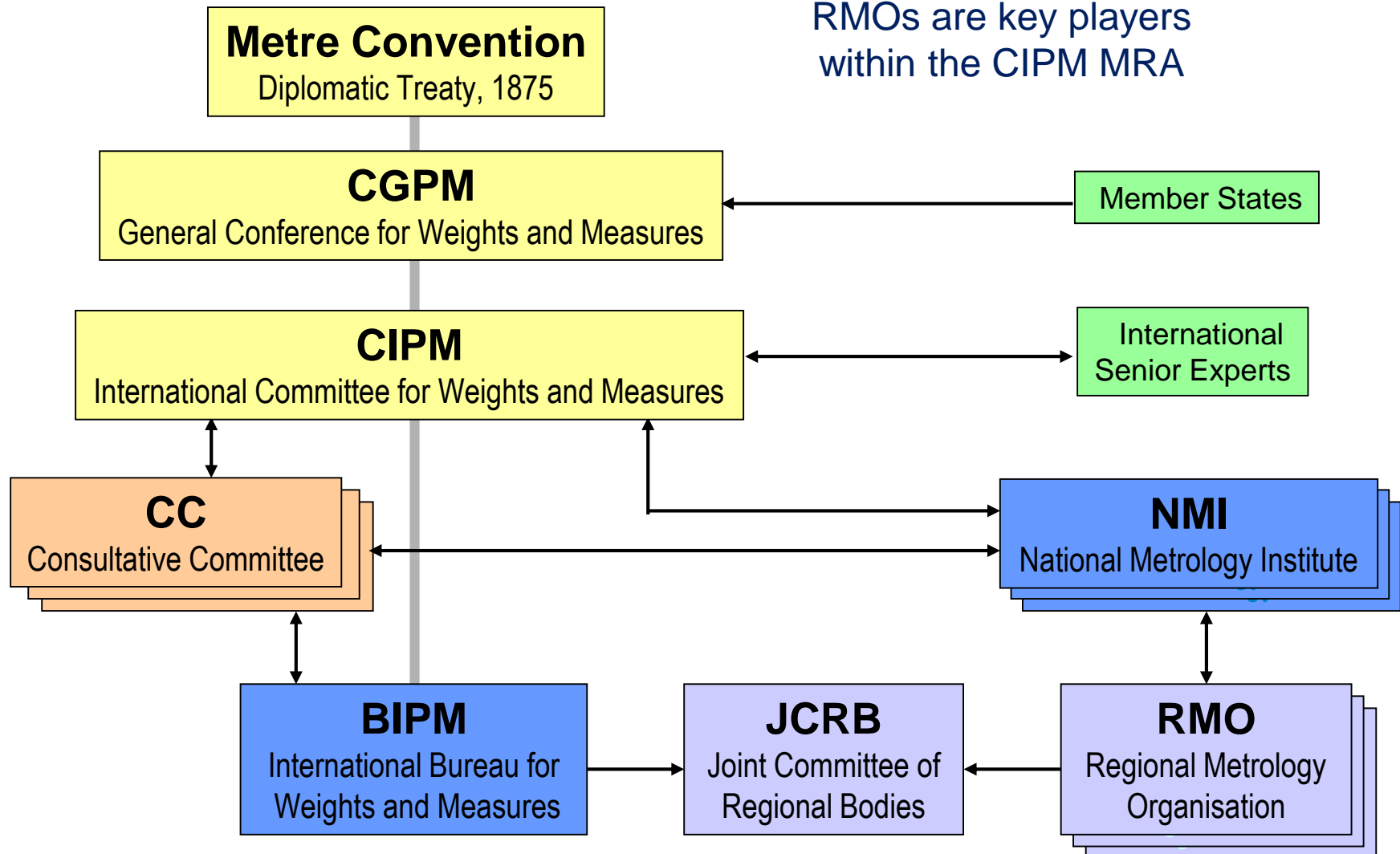
CCT

CCTF

Metre Convention and Organisation of International Metrology



RMOs are key players
within the CIPM MRA



Outline

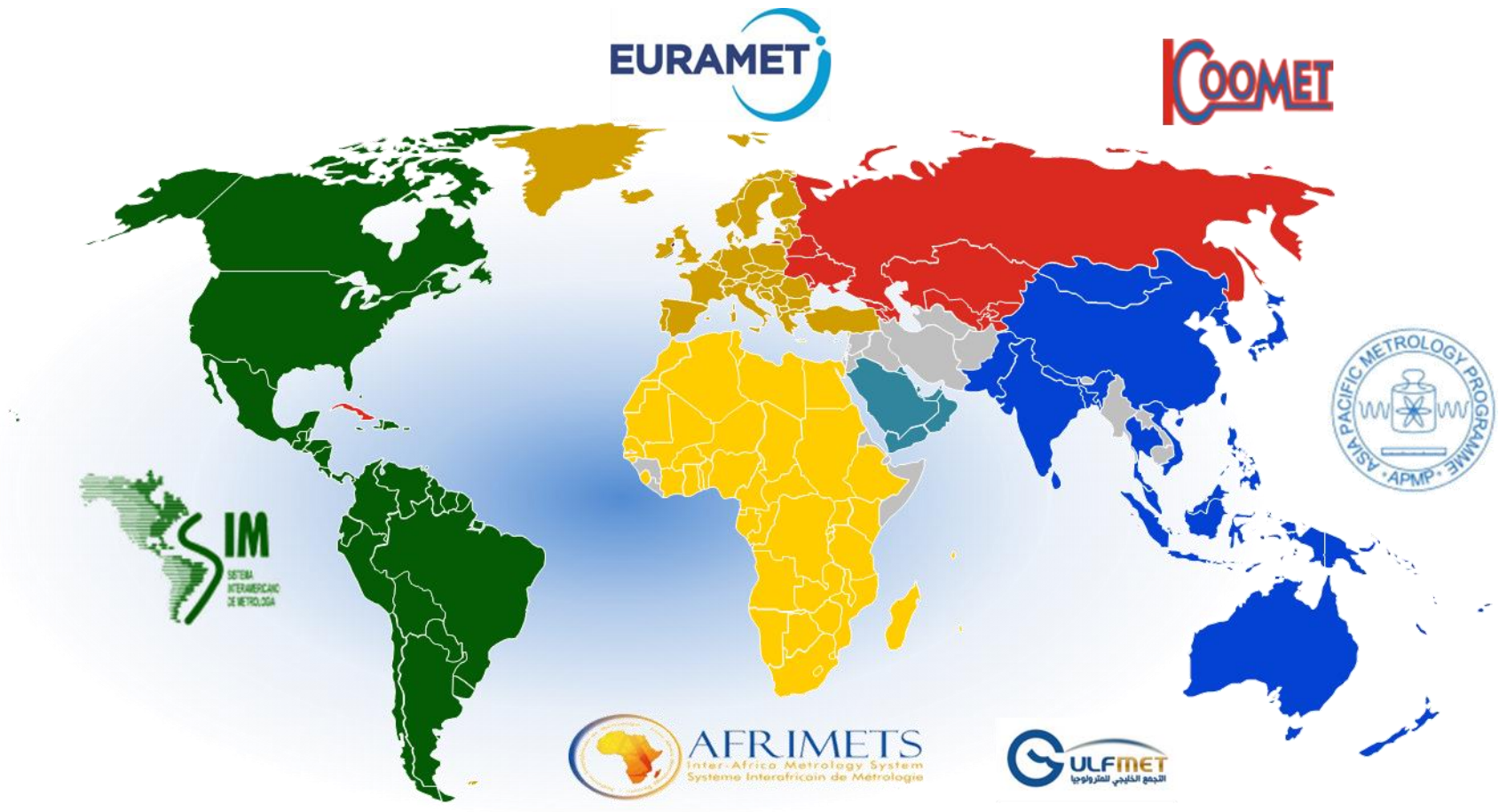


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Regional Metrology Organisations (RMO) ...



... coordinate the collaboration between
National Metrology Institutes (NMI) within a region



Typical activities of RMO



- Contributing to equivalence and international recognition of national measurement standards & services of their members
 1. Facilitating traceability to primary realisations of the SI
 2. Coordination of inter-comparisons of national measurement standards
 3. Mutual review of technical competencies and quality systems
- Cooperation in metrology research and development
- Joint training and consultation
- Sharing of technical capabilities and facilities
- Development of standardised procedures and guidance documents
- Policy advice to decision makers
- ... and others more

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Mutual Recognition Arrangement



To give access to reliable quantitative information on the comparability of national metrology services and to provide the technical basis for wider agreements negotiated for international trade, commerce and regulatory affairs



The CIPM MRA: Mutual Recognition Arrangement



Reconnaissance mutuelle
des étalons nationaux de mesure
et des certificats d'étalonnage et de mesurage
émis par les laboratoires nationaux de métrologie
Paris, le 14 octobre 1999



Mutual recognition
of national measurement standards
and of calibration and measurement certificates
issued by national metrology institutes

Paris, 14 October 1999

Comité international des poids et mesures

Bureau
international
des poids
et mesures

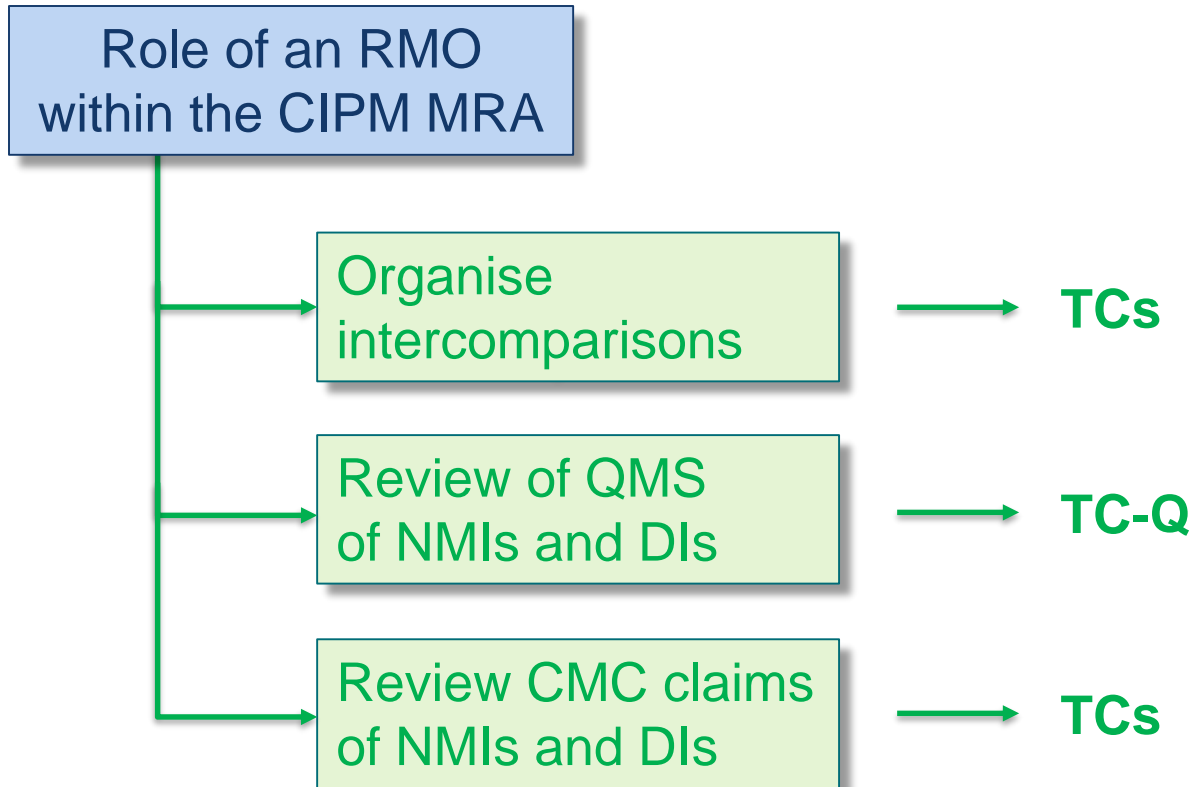
Organisation
intergouvernementale
de la Convention
du Mètre



1999

- Establishes the degree of **equivalence of national measurement standards**
- Provides for **mutual recognition of calibration and measurement certificates** issued by NMIs
- Provides governments and other parties with a sound technical foundation for wider arrangements

The CIPM MRA: Mutual Recognition Arrangement



Furthermore:

- Represent the RMO at the JCRB
- Support its members towards CMCs

Outline



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- Revision of the SI:

SI: Seven base units

3 definitions based on **constants**:

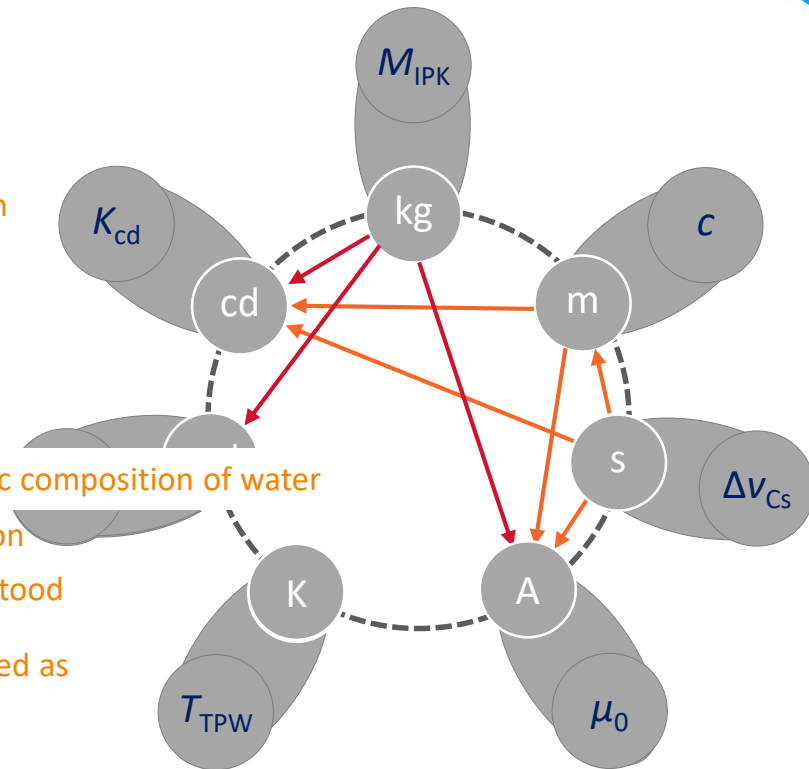
- metre (c)
- ampere (μ_0) ... not suitable for practical realization
- candela (K_{cd})

3 definitions based on **atomic or material properties**:

- second ($\Delta\nu_{Cs}$)
- kelvin (T_{TPW}) ... dependent on purity and isotopic composition of water
- mole ($m^{12}C$) ... dependent on mass and definition

1 definition based on **an artefact**: often misunderstood

- kilogram (M_{IPK}) ... artefact – has been demonstrated as not stable and can be destroyed



In „new“ SI all definitions are based on natural constants

Changes



Definitions of kilogram, ampere, kelvin and mole will be changed (values will remain the same)

The values will be fixed for natural constants $\Delta\nu_{\text{Cs}}$, c , h , e , k_{B} , N_{A} , K_{cd} .

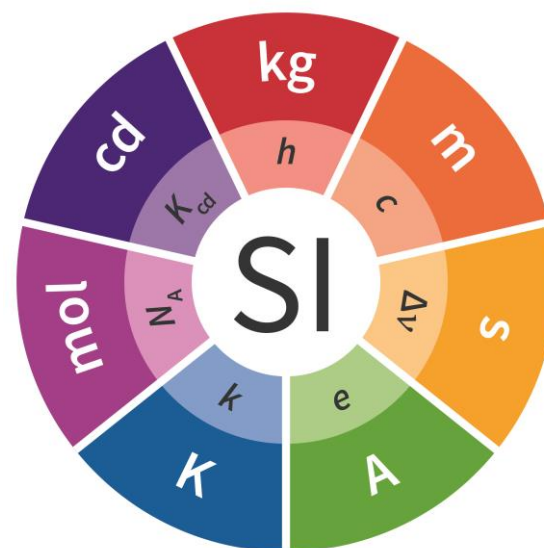
The realisation of mass unit will be more stable

Possibility of realisation of units anywhere and at any time

Implementation of the „new“ SI



- ❖ Approval by the CGPM expected in November 2018
- ❖ No immediate impact on every man's life
- ❖ We continue to work as until now
- ❖ Impact on high-precision measurements and long term stability
- ❖ Start on World Metrology Day on 20 May 2019



<https://www.bipm.org/en/measurement-units/rev-si/>

FAQs: Frequently Asked Questions about the Revised SI

[**https://www.bipm.org/en/measurement-units/rev-si/faqs.html**](https://www.bipm.org/en/measurement-units/rev-si/faqs.html)