

How Do Calibration Labs Work On a Global Scale? The BIPM, the CIPM MRA and you!

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Why does it matter?

To fulfil the **McEwen theorem of non-localized measurement integrity***, which states:

- Without a traceability chain and an uncertainty analysis the determination of some specific quantity has no meaning beyond the local environment.
- Without **traceability** there can be no *meaningful comparison* with any other measurement of the same quantity at a different institution and
- Without an **uncertainty estimate** there can be no *meaningful interpretation* of that comparison.

* *Not really a theorem*



Calibrations require units

A brief history of the SI:

1799 – two platinum standards of the metre and kilogram deposited in the Archives de la République in Paris

1875 – Convention du Mètre signed

1889 – 1st CGPM sanctioned a three-dimensional mechanical unit system (mass-length-time)

1954 – 10th CGPM added the ampere, the kelvin and the candela as base units

1960 – SI gets its name!

1971 – mole completes present total of seven units

2019 – redefinition of the SI to be based on fundamental constants:
 c, h, e, K_B, N_A (no more artifacts)

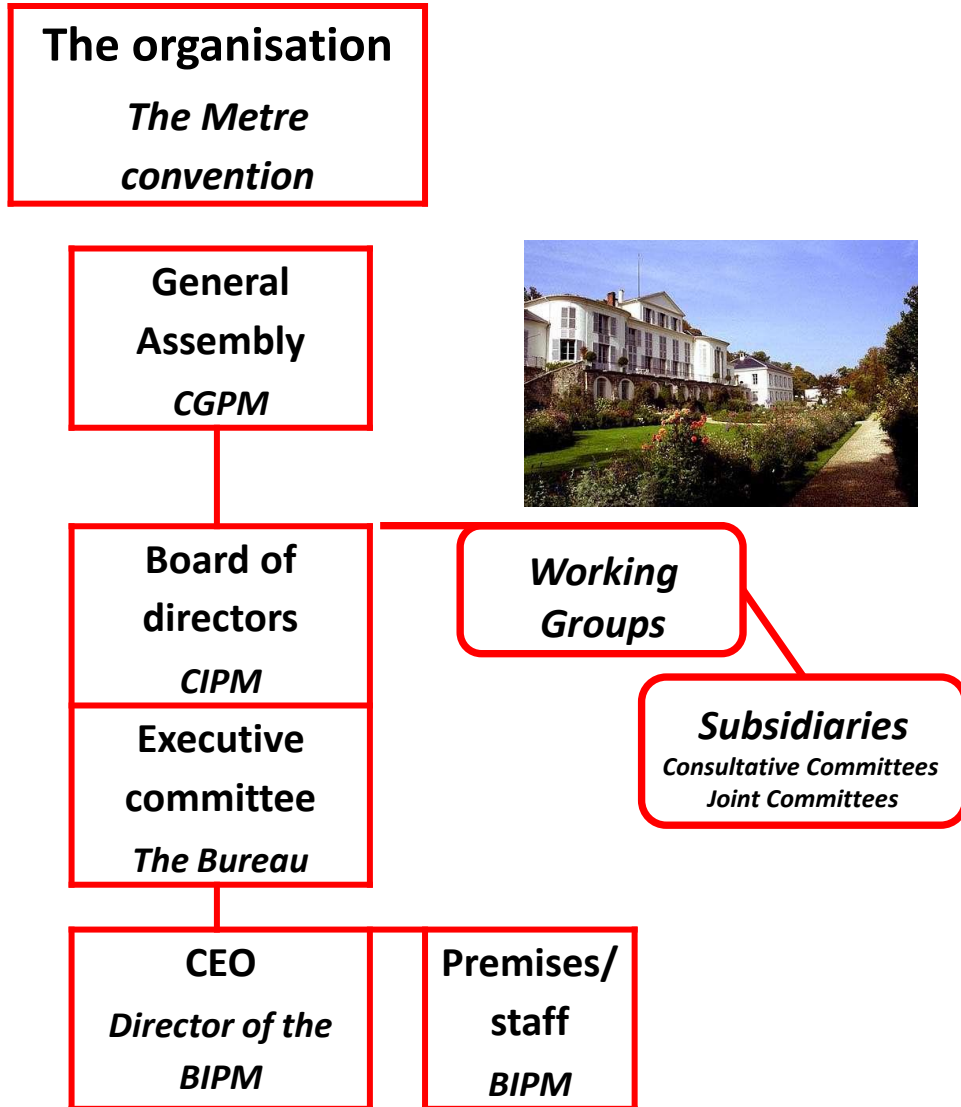


Convention of the Meter/Convention du Mètre

- Signed in Paris in 1875 (representatives of 17 nations)
- Established permanent organizational structure for members on all matters relating to units of measurement
- Created the BIPM – Bureau International des Poids et Mesures
 - Intergovernmental organization (now 62 Member States)
 - Under authority of General Conference on Weights and Measures (CGPM)
 - Under supervision of the International Committee for Weights and Measures (CIPM)
 - Acts in matters of world metrology (demands for increasing accuracy, range and diversity)
 - **Facilitates needs to demonstrate equivalence between national measurement standards**
- Remains the basis of international agreement on units of measurement



Organizational Structure – International Metrology



In Ionizing Radiation BIPM does the following:

- *Establish and run comparisons*
- *Maintain and develop dosimetry standards*
- *Maintain and develop the SIR*
- *Provides support to the Consultative Committee on Ionizing Radiation (CCRI)*



The CIPM MRA – what's that?

- **M**utual **R**ecognition **A**rrangement
- Paris 14 October 1999
- 40 entities originally, now 106 (plus 152 designated institutes)
- Mutual recognition of
 - National measurement standards
 - Calibration and measurement certificates



What does the CIPM MRA do?

- It simplifies the process by which one country recognizes the standards of another
- Removes barriers to trade - previously calibration certificates issued by one country (e.g. where the device was manufactured) were not valid in another
- This resulted in endless negotiations of bilateral agreements
- Note it's an arrangement, not an agreement, although it does have legal standing



M Recognition A – requires equivalency

Equivalency is demonstrated through comparisons

The components of a comparison are:

1. An agreed comparison methodology to be used by each institution involved

This is usually approved by the Consultative Committee

2. Something to reliably transfer measurements from one location to another

An artifact is generally required

3. A consistent approach to estimating uncertainties

The ISO GUM (JCGM 100) is the starting point

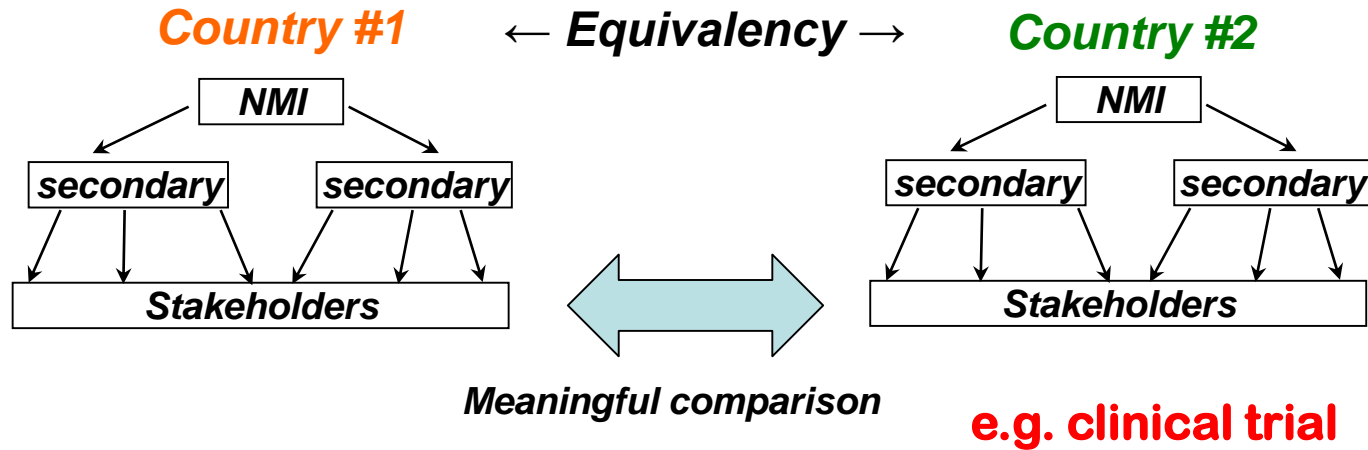
4. A stable comparison reference value (KCRV) to determine variations between participants

Essential as multi-lateral comparisons often take several years to complete

Agreement with KCRV within stated (agreed) uncertainties = equivalency

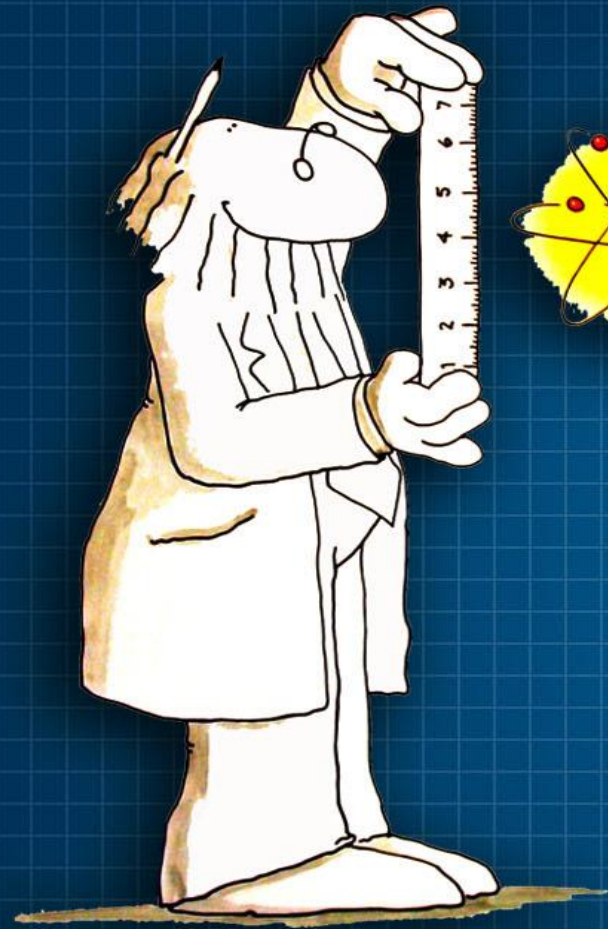


Summary



- “Mutual Recognition” and “Equivalency” allow comparability within stated uncertainties
- Comparisons demonstrate capability and provide confidence to customers
- BIPM and the CIPM MRA provide the framework





THANK YOU



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