

# 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)

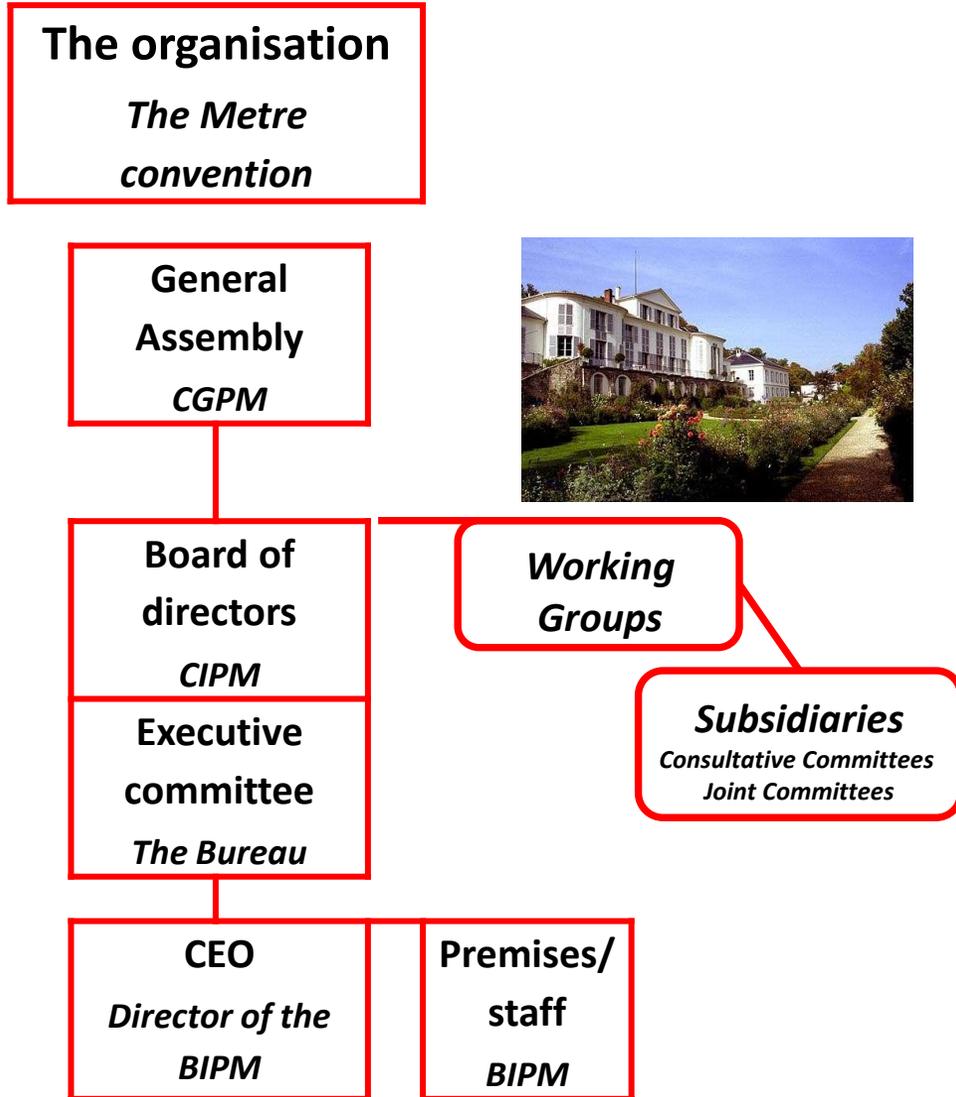


# Convention of the Meter/Convention du Mètre

- 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?

- **Mutual Recognition Arrangement**
- 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**

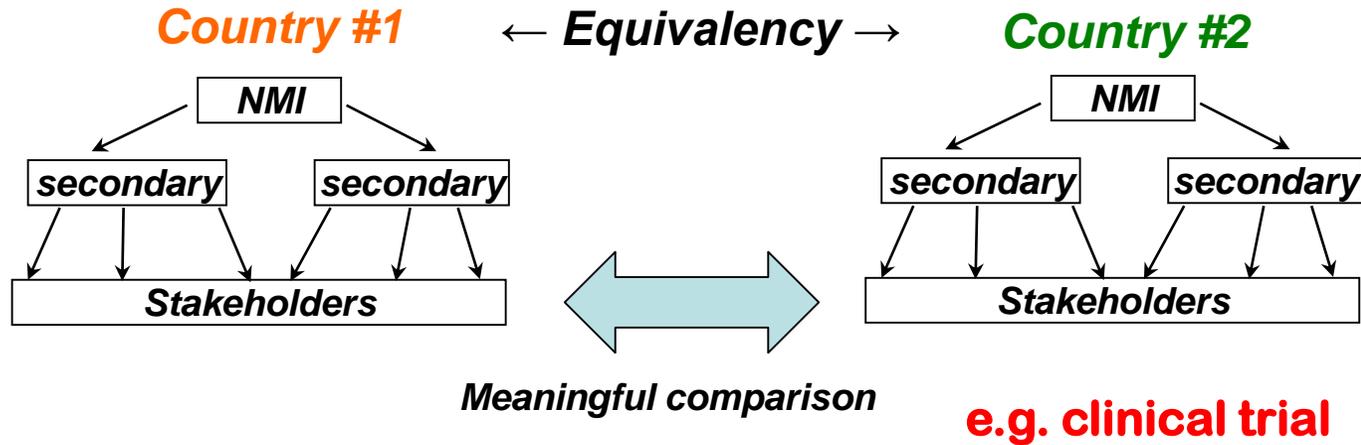
4. A stable comparison reference value (KCRV) to determine variations between participants

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

**Agreement with KCRV within stated (agreed) uncertainties = equivalency**

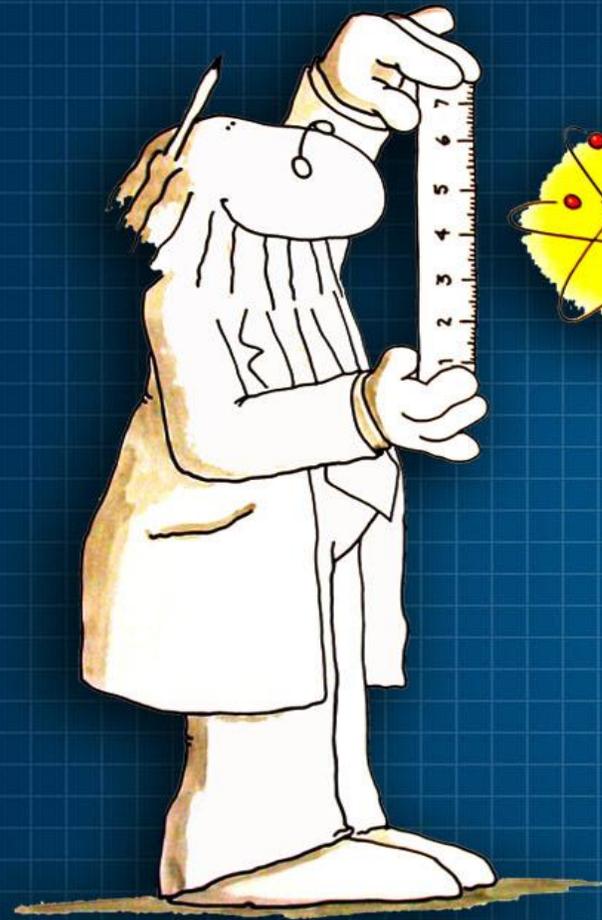


# Summary



- “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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