

Overview: Metrology Hierarchy, the CCRI, and the Radionuclide Therapy and Quantitative Imaging Working Group



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Chair, CCRI RTQI WG

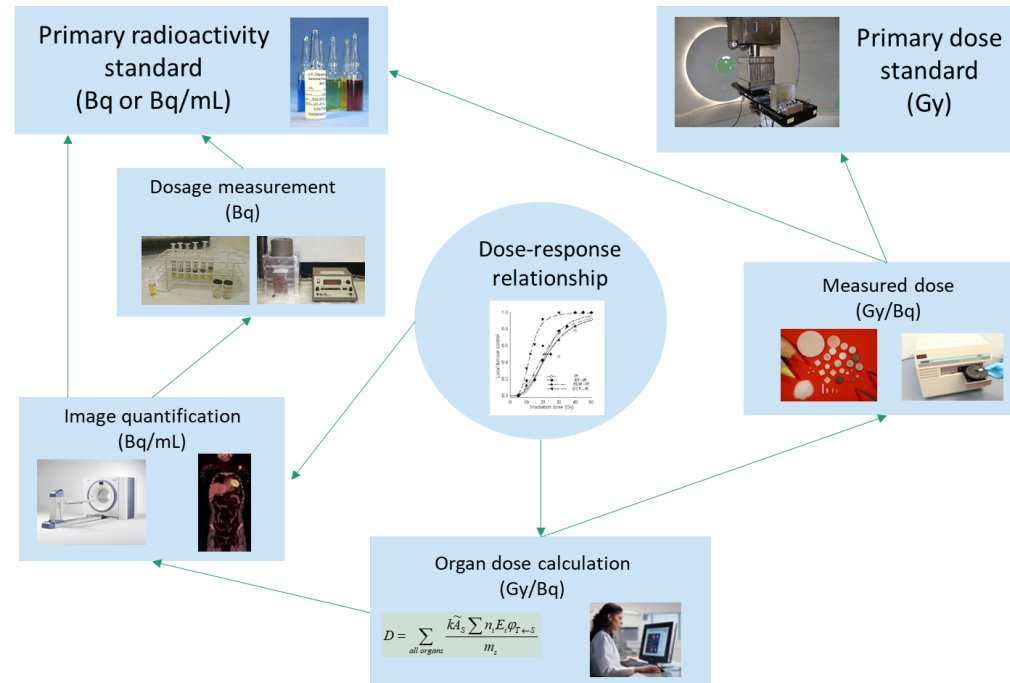
*International Workshop on Standards and Measurements for
Alpha Emitting Nuclides in Therapeutic Nuclear Medicine*

*BIPM Headquarters
22-23 February 2024*

“Both for radiation protection and to optimise treatment, it is now time for a fundamental change in the way that radionuclide therapies are conducted. Individual treatment planning and assessment, based on accurate absorbed dose estimates, will significantly improve treatment efficacy and will provide the foundation for significant advances in radionuclide therapy.”

G. Flux, et al. (2007), EJNMMI, 34:1699-1700.

Accurate absorbed dose estimates start with accurate radioactivity measurements, which requires calibrations traceable to national standards.



Precision measurements of activity in RT:



- Ensure that repeated imaging studies are based on same activity measurements
- Ensure accurate therapeutic dosages
- “Ground truth” for model development, validating new imaging techniques
- When tied to traceable dose measurements, allows dose-response relationships to be established (*personalized dosimetry*)



Traceability

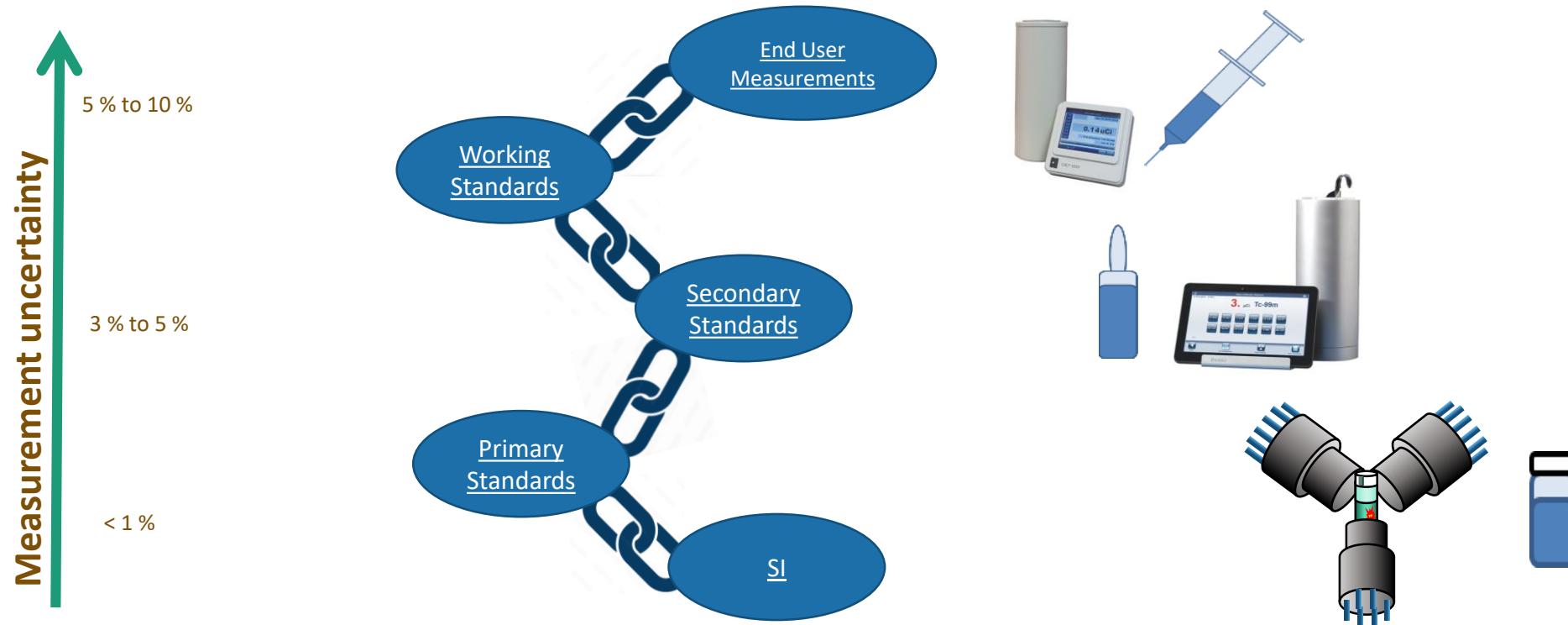
“The property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty”
(*VIM*, 2021 draft)

- Unbroken chain of comparisons (or calibrations) back to a primary standard (realization of SI unit).
- Uncertainty assessment is a critical component
- Is a property of a *measurement*, not a laboratory or instrument

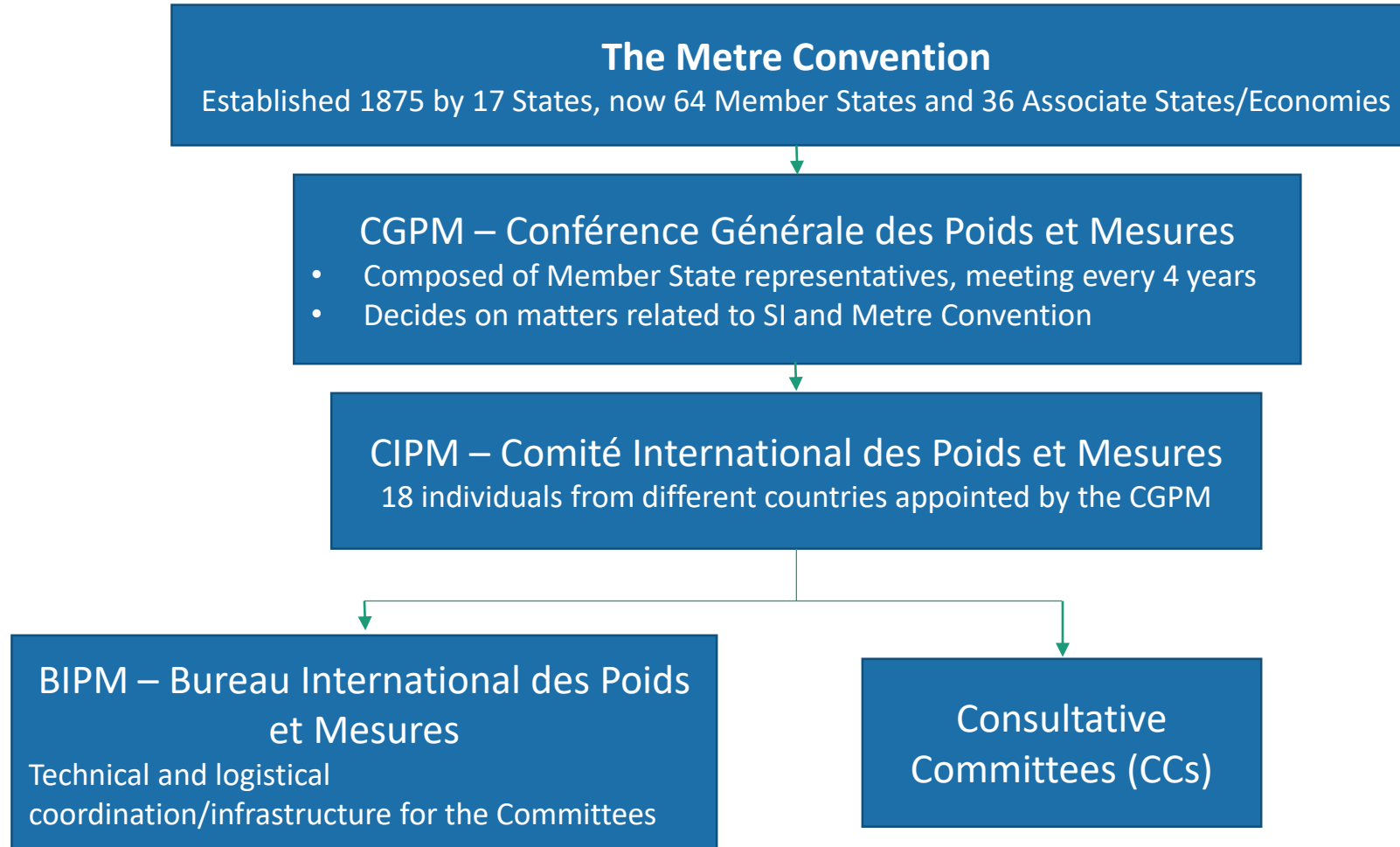


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Traceability chain (*calibration hierarchy*)



The Metre Convention



BIPM and its Consultative Committees



- International Bureau of Weights and Measures (BIPM) and its International Committee on Weights and Measures (CIPM) formed in 1875 to administer the Meter Convention

Consultative Committees of the BIPM

CCAUV (Acoustics, US, Vibration)

CCEM (Electricity, Magnetism)

CCL (Length)

CCM (Mass)

CCPR (Photo-, radiometry)

CCQM (Amount of substance)

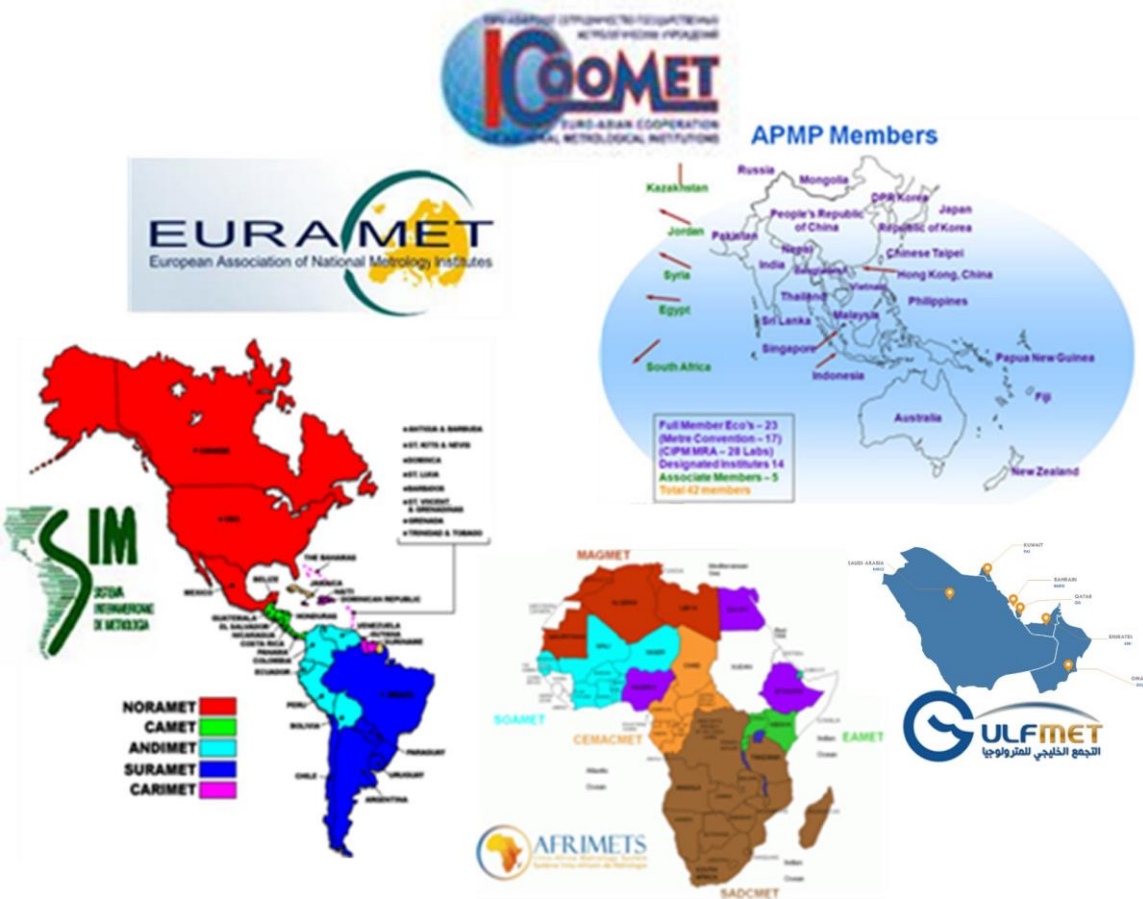
CCRI (Ionizing Radiation)

CCT (Thermometry)

CCTF (Time and Frequency)

CCU (Units)

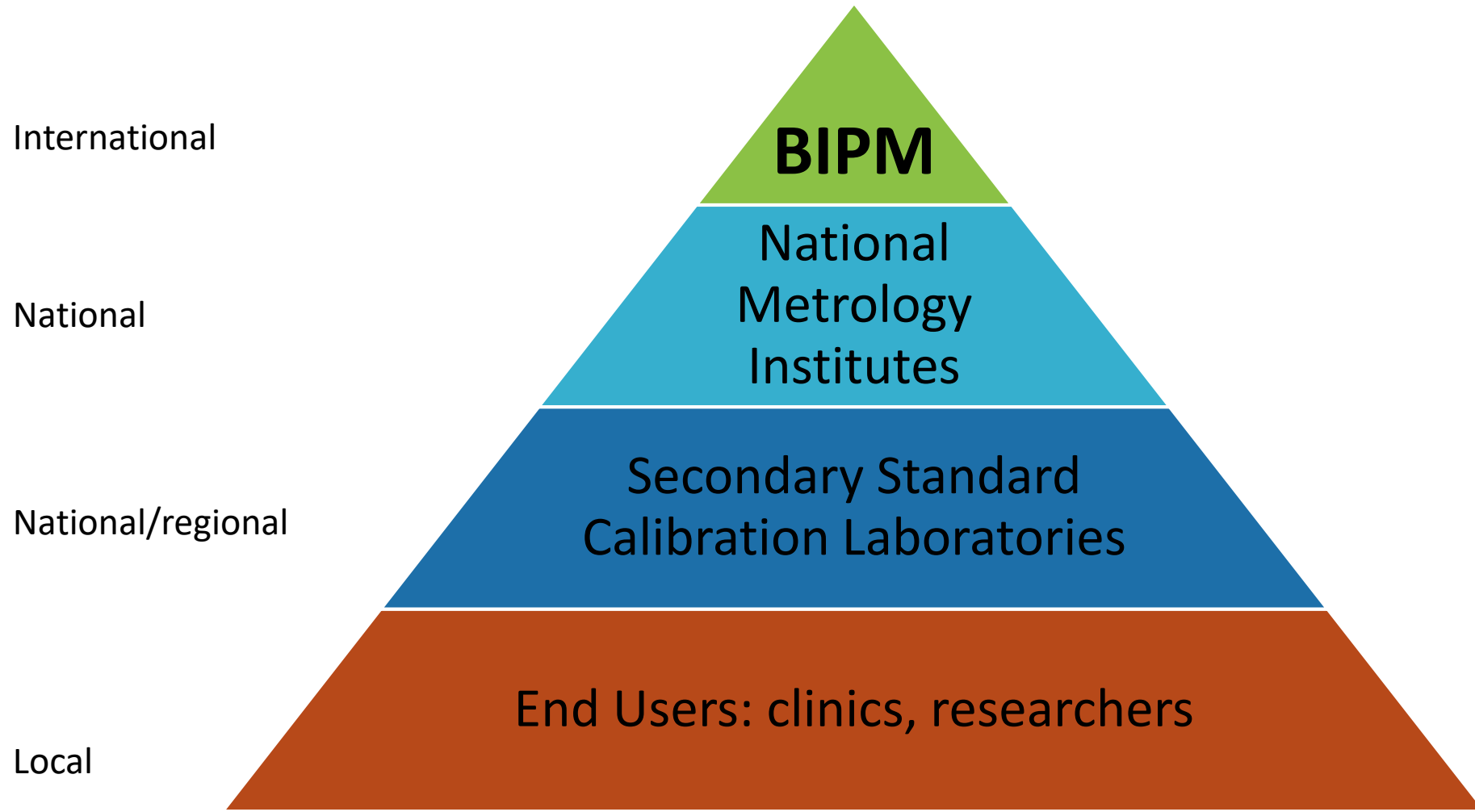
BIPM serves as liaison between NMIs/Dis, Regional Metrology Organizations (RMOs), and Inter- and Non-governmental Organizations



IGOs/NGOs

- IAEA
- WHO
- WTO
- OIML
- ILAC
- Etc.

Metrology hierarchy



Consultative Committee for Ionizing Radiation of the BIPM



- First version of the CCRI formed in 1958 and originally encompassed all radiation measurements – provides guidance to CIPM
- Divided into 3 Sections
 - CCRI(I): Radiation Dosimetry
 - CCRI(II): Measurement of Radioactivity
 - CCRI(III): Measurement of Neutrons
- Tasks carried out by 10 Working Groups

CCRI Radionuclide Therapy and Quantitative Imaging Working Group

- Formed in late 2019
- Aims
 - Enable the CCRI and its sections to identify where radionuclide (and dosimetry) metrology can improve the effectiveness of radiopharmaceutical therapy (RT)
 - Coordinate activities to address this, particularly in the fields of quantitative imaging and patient dosimetry.
- Brings together international experts from the field of Metrology and RT to understand where metrology can impact the effectiveness of RT.
- Originally was meant to include dosimetry as well, but more fundamental work needed in that field; immediate impact could be realized by focusing on radioactivity measurements

Short-term Plan: 2020-2025

- **Provide advice** to NMIs/DIs on the relevant standards needed to enhance RT practice;
- **Propose new comparison exercises** in order to validate claimed competencies;
 - Radionuclides
 - Phantoms
- **Develop best practice guidance**
 - Developing measurement capabilities
 - Running comparison exercises
- **Assist in establishing** inter-laboratory research, pilot studies, clinical trials, and other work.
- **Build links** with appropriate stakeholders, including those responsible for developing good practice guidance around measurements in clinical settings.
- **Report its findings** to CCRI Sections I and II and advises on any implications for radionuclide metrology and radiation dosimetry.

Activities since formation

- Virtual Meetings
- Webinars
 - “Bringing Communities Together to Improve Therapeutic Nuclear Medicine” (May 2021)
 - “Engagement Between NMIs/DIs and End-Users” (January 2022)
 - “Needs for clinical measurements of alpha-emitting radionuclides” (in planning phase, Fall 2023)
- Interacting with professional societies and other partners to encourage collaboration between metrologists and RPT practitioners (SNMMI, AAPM, EANM, ASTRO, etc.)
- Provide advice to other CCRI WGs on measurement needs, comparisons related to RPT
- Development of good practice documents where metrology community can provide impact

Good Practice Guides

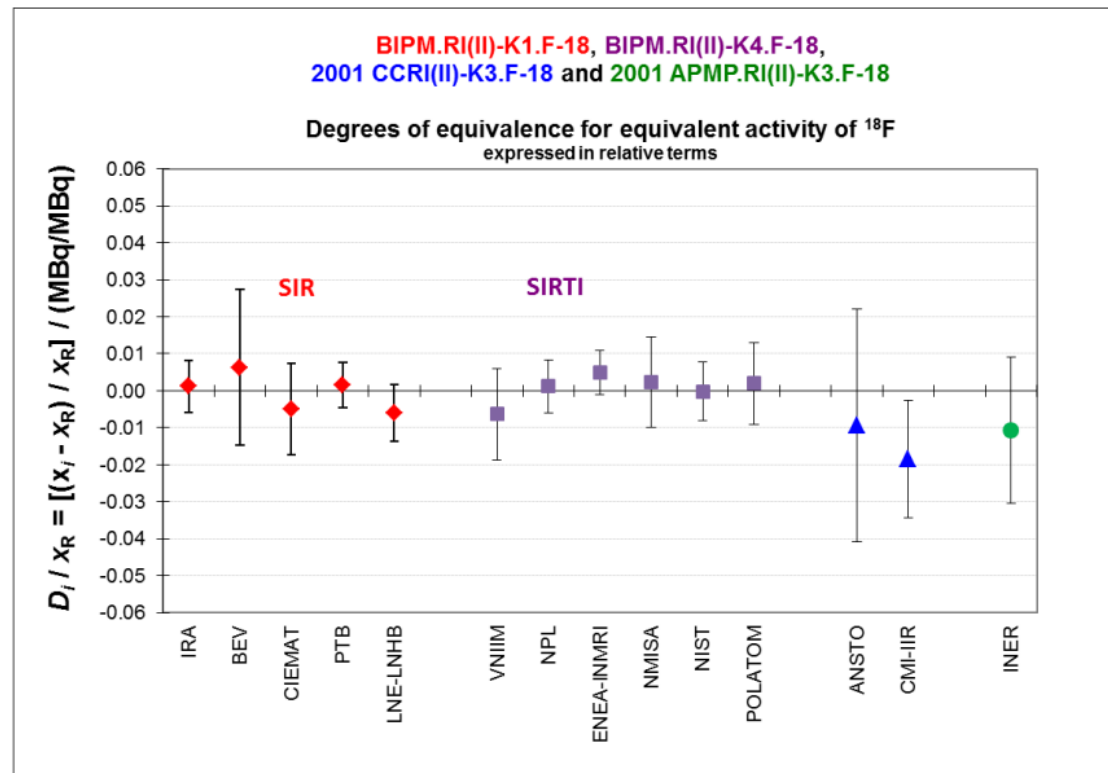
- Guidance on Traceability and Establishment of Secondary Standards Laboratories (in progress)
- Guidance on Measurement Issues Associated with Targeted Alpha Therapy (starting mid-2024)

The CIPM Mutual Recognition Arrangement (MRA)

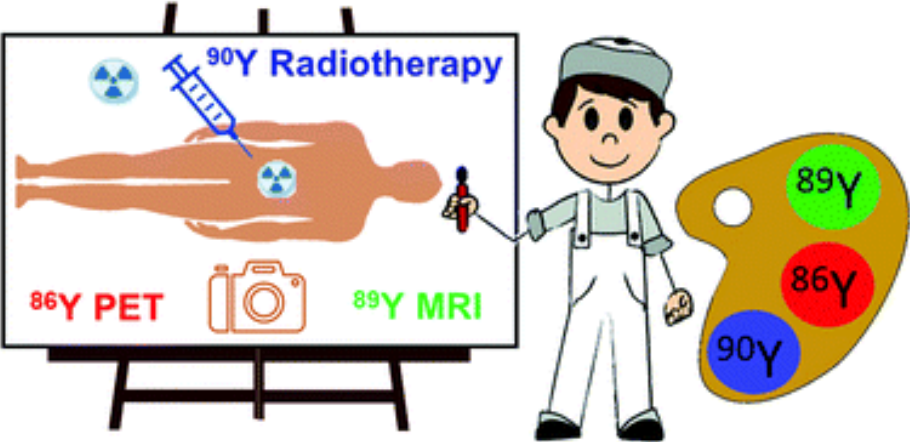


- Established in 1999 to provide the technical basis for worldwide acceptance of national measurement standards, calibrations, and certificates from signatories
- 250 signatories, including 97 NMIs, 149 DIs, and 4 International Organizations
- From practical standpoint, enables an NMI's standards to be recognized and applied internationally, even in countries without an NMI
- Each laboratory's Quality Management System is key to demonstrating how traceability is established and maintained

Lead-in: CIPM MRA requires (among other things) demonstration of equivalence of standards in order to work. This is done through participation in comparison exercises.



Thanks!



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