



# Report from the BIPM Director

## Highlights from the Work Programme

Martin MILTON

15<sup>th</sup> November 2022

A decorative graphic on the right side of the slide, consisting of multiple overlapping, concentric arcs in a rainbow color palette (red, orange, yellow, green, blue, purple, magenta). The arcs are arranged in a circular pattern, creating a sense of depth and movement.

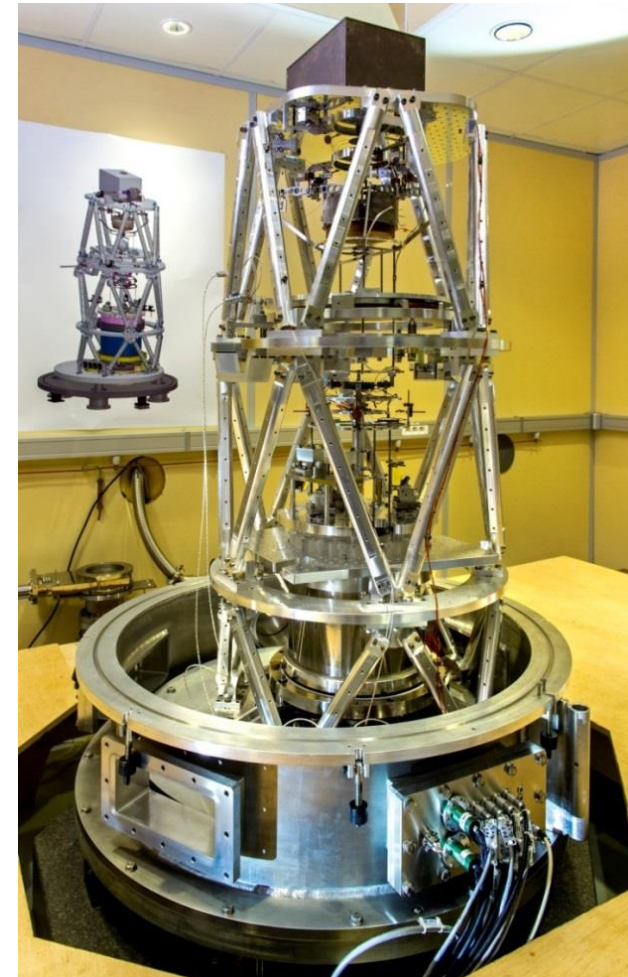
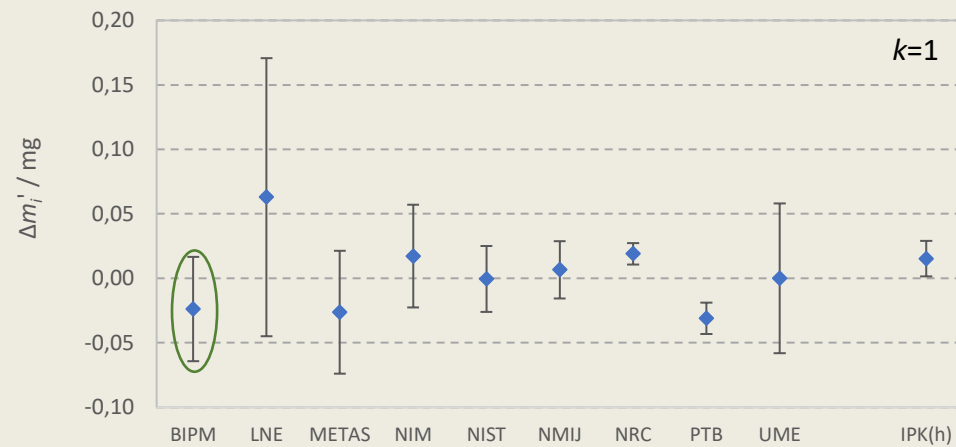
27<sup>e</sup> réunion de la  
Conférence générale  
des poids et mesures

# Laboratory highlights – Physical metrology

## Comparison of the kg realization using the BIPM Kibble balance

- Organized two key comparisons of kg realizations (CCM.M-K8.2019 and K8.2021)
- BIPM KB standard uncertainty in 2021: 41  $\mu\text{g}$  at 1 kg ( $4.1 \times 10^{-8}$ )

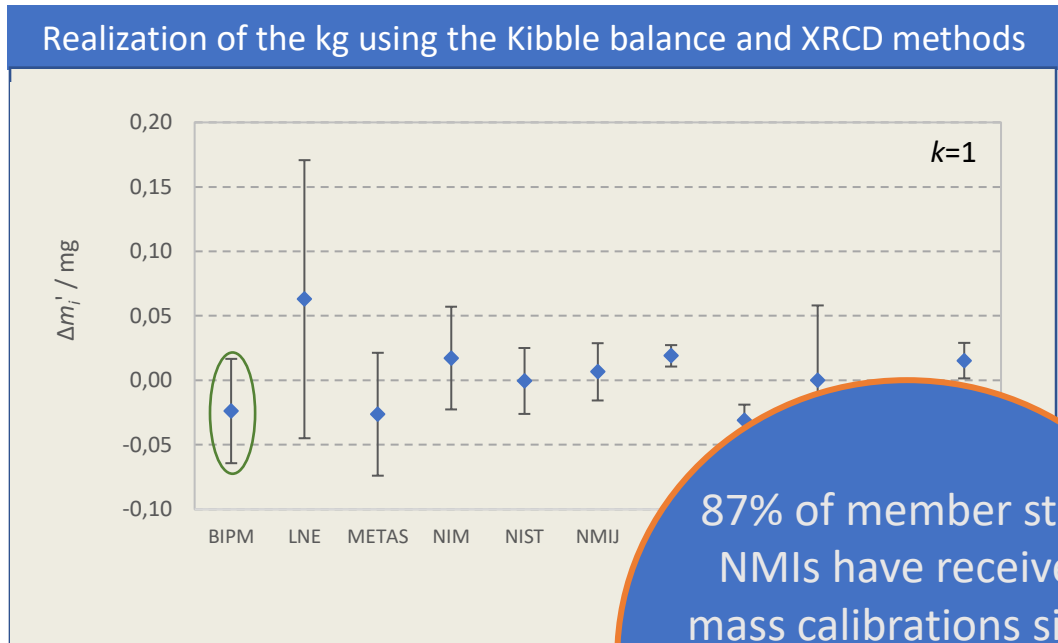
Realization of the kg using the Kibble balance and XRCD methods



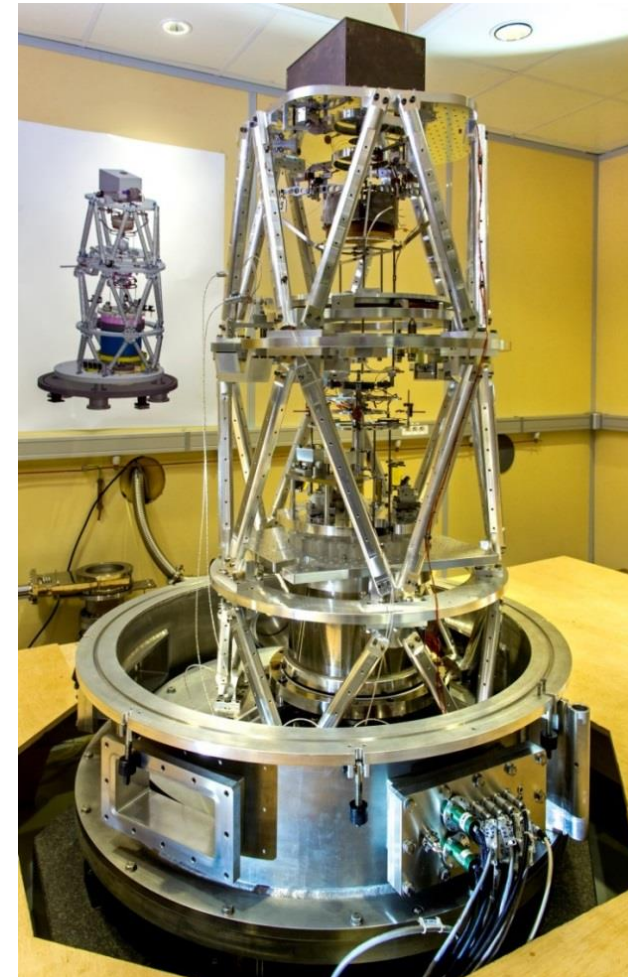
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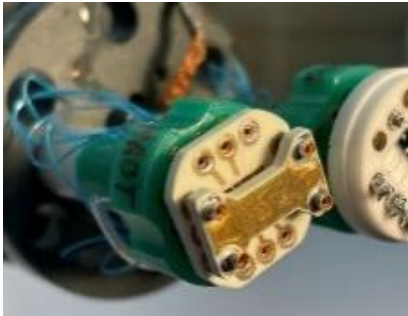
87% of member state NIMs have received mass calibrations since 2012 (55 from 63)



# Laboratory highlights – Physical metrology

## upgrading quantum standards for on-site comparisons

### Two types of graphene QHR samples tested



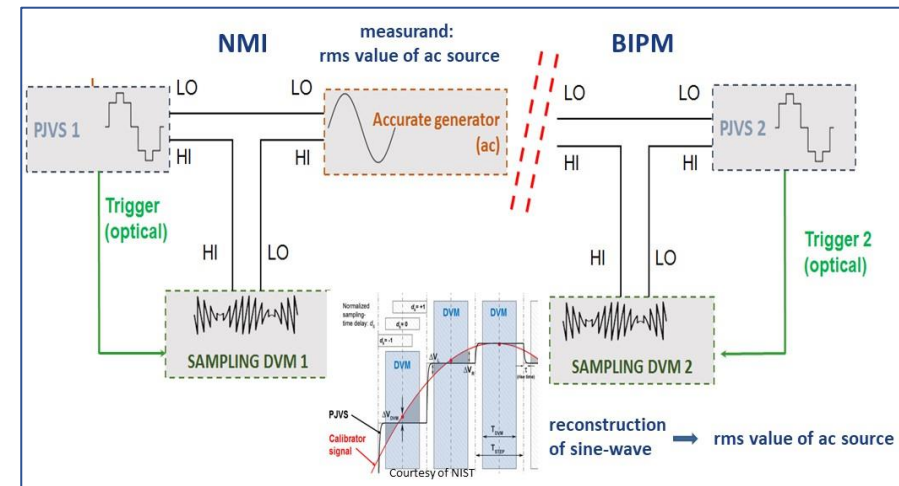
Commercial samples from Graphene Waves based on NIST technology



PTB sample developed within the GIQS EURAMET project

- satisfactory performance confirmed at target operation parameters (4.2 K and 3.5 T).
- more easily transportable with reduced operating costs and without liquid cryogenes

### New comparison scheme for AC voltage



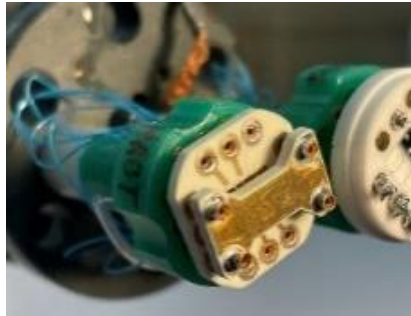
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# Laboratory highlights – Physical metrology

upgrading quantum standards for on-site comparisons

## Two types of graphene QHR samples tested



Commercial samples from Graphene Waves based on NIST technology

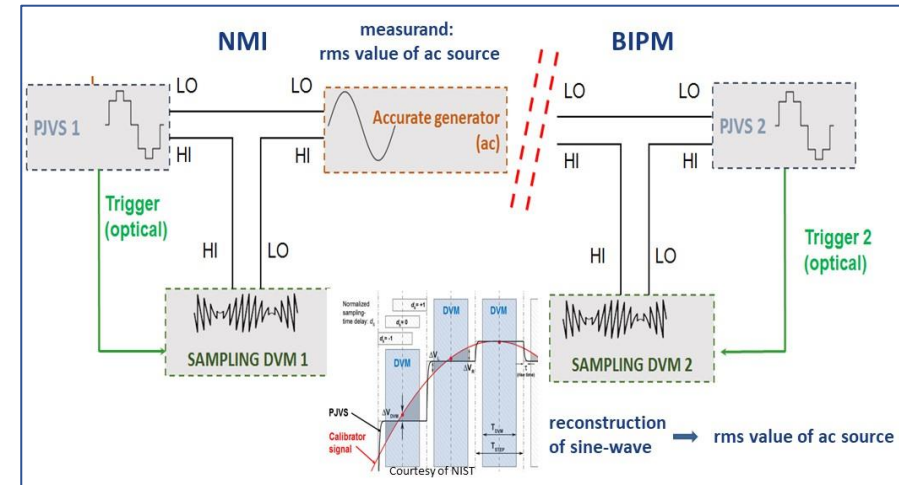


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86% of member state NMIs have used the electrical measurement services since 2012 (54 from 63)

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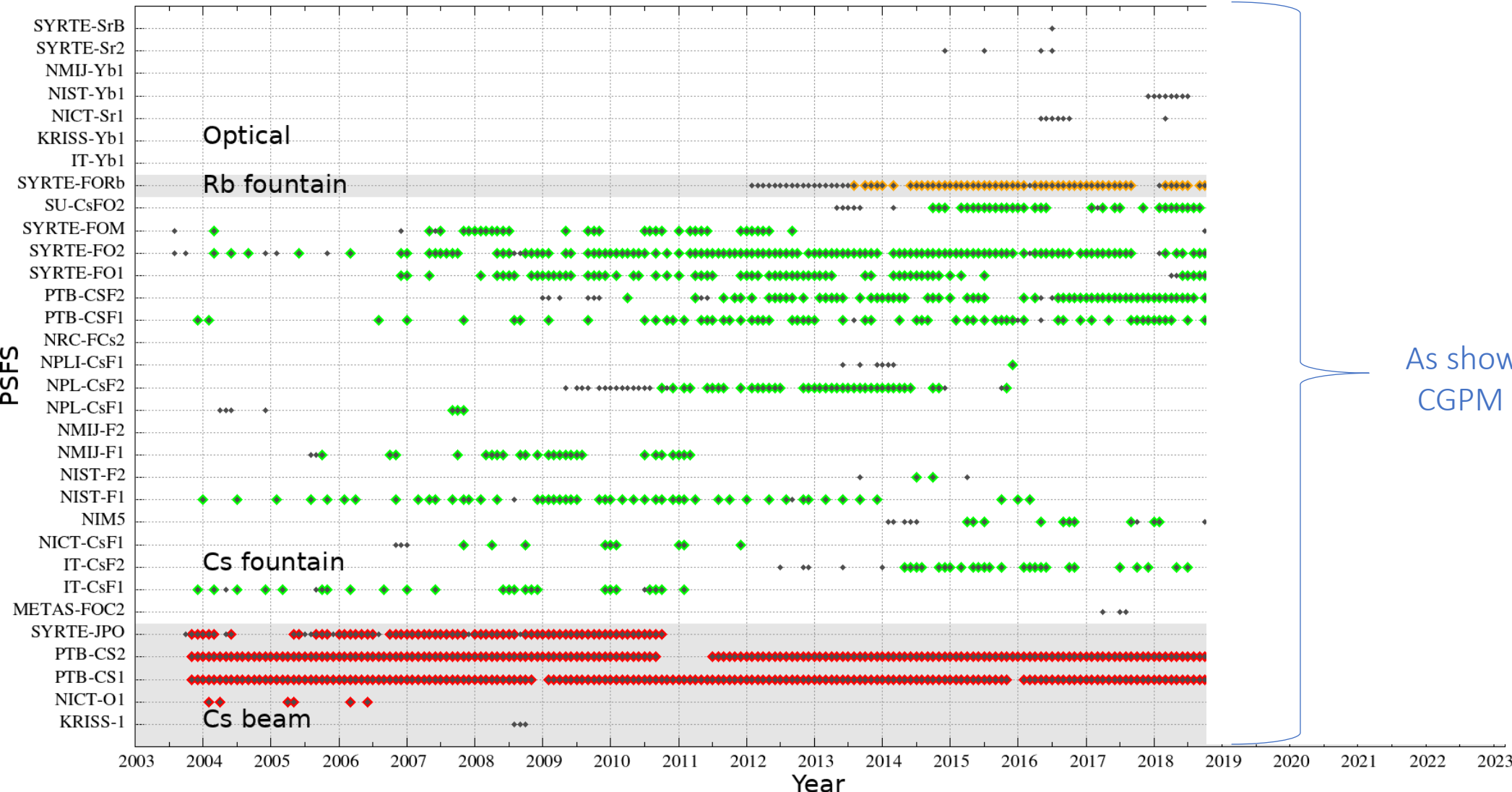


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# Laboratory highlights - UTC

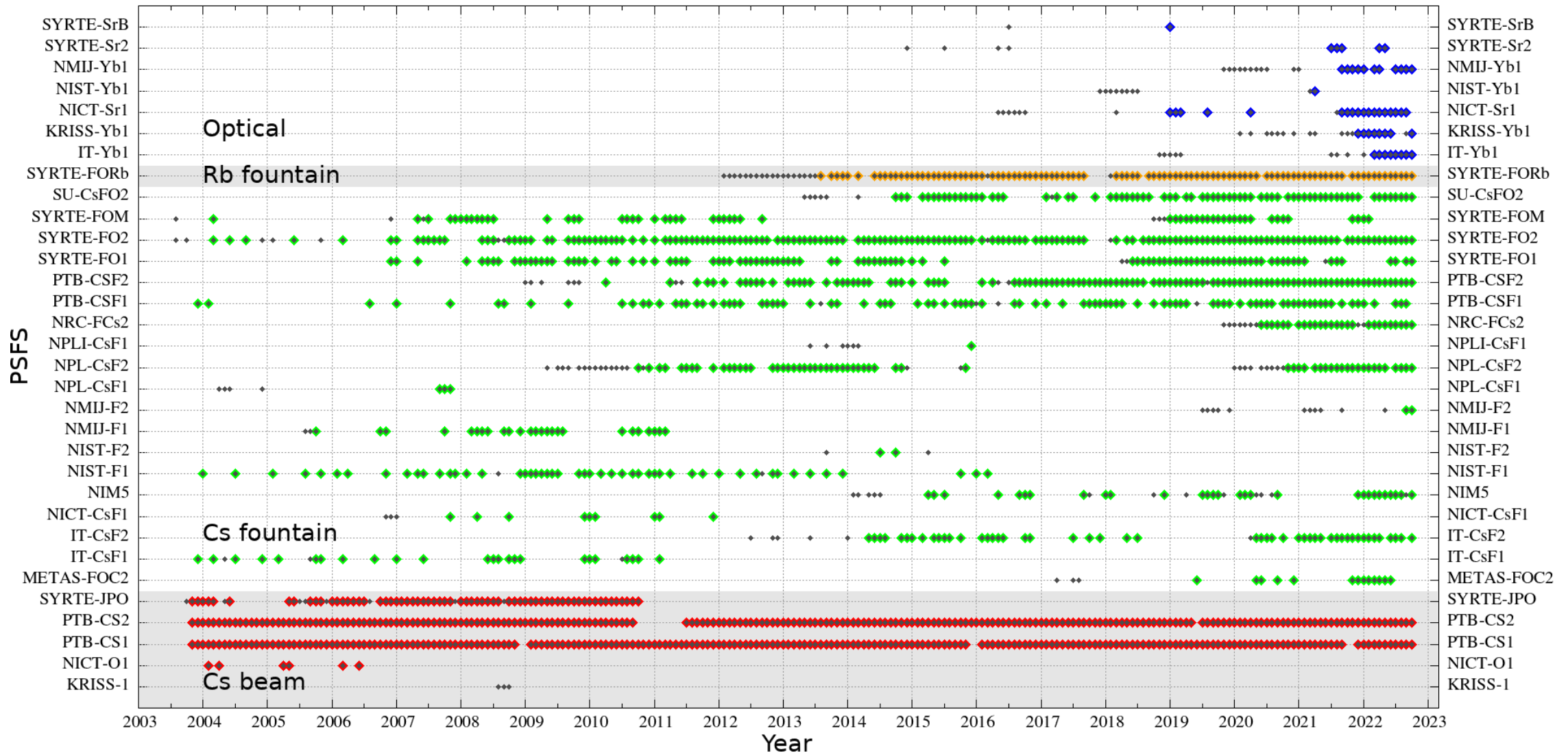
Increasing participation by optical clocks



As shown at the  
CGPM in 2018

# Laboratory highlights - UTC

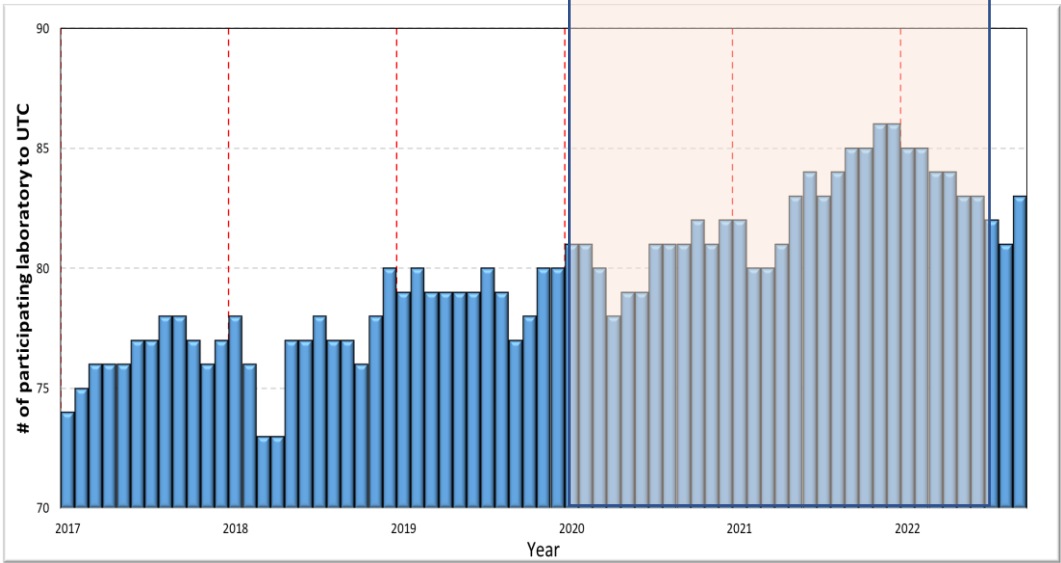
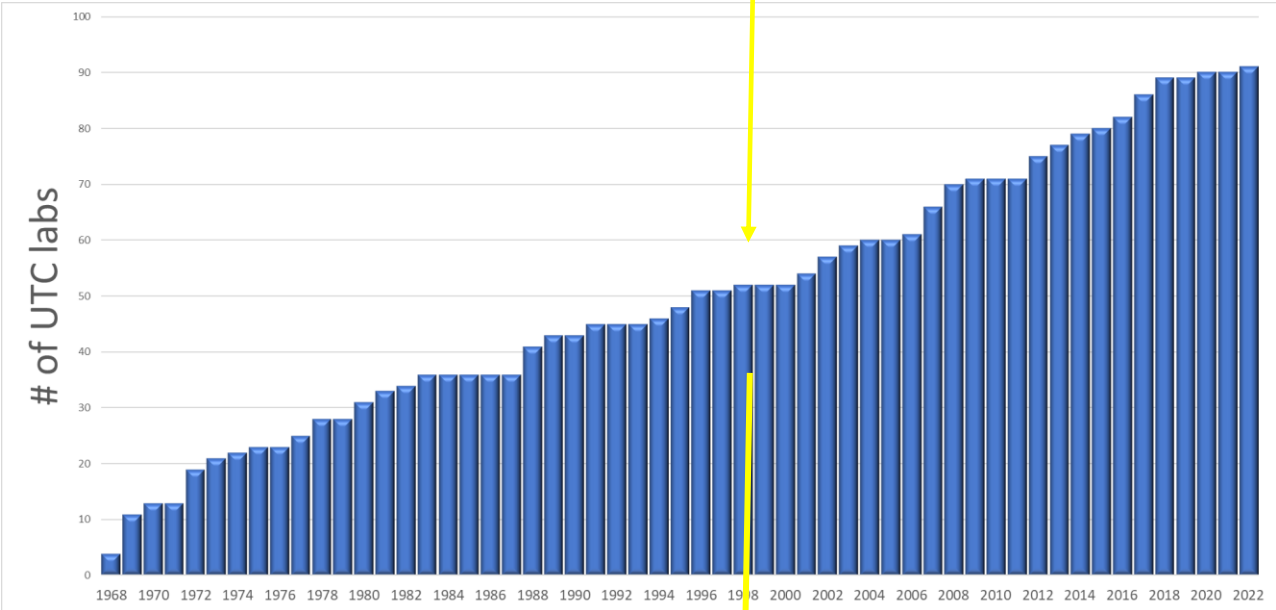
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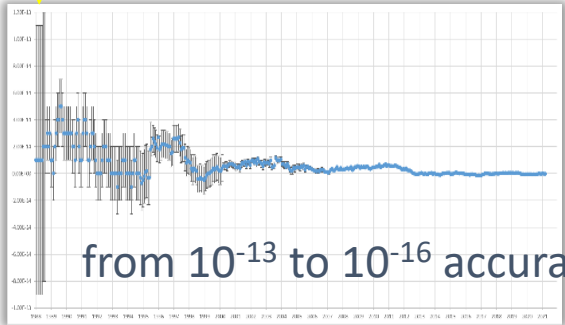
# Laboratory highlights – Time metrology

UTC is growing, becoming more accurate and more resilient

UTC transferred to BIPM from BIH in Jan 1988



The resilience of UTC is growing



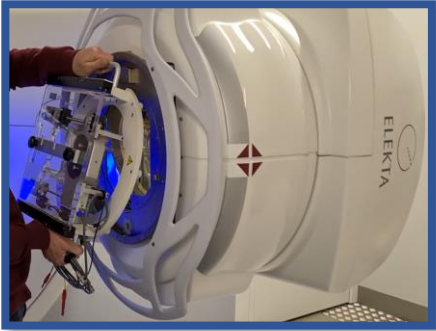
from  $10^{-13}$  to  $10^{-16}$  accuracy

NMI participation in UTC increased during the period of global pandemic. Now 90 labs



# Laboratory highlights – Ionizing radiation

upgrading and extending dosimetry capabilities

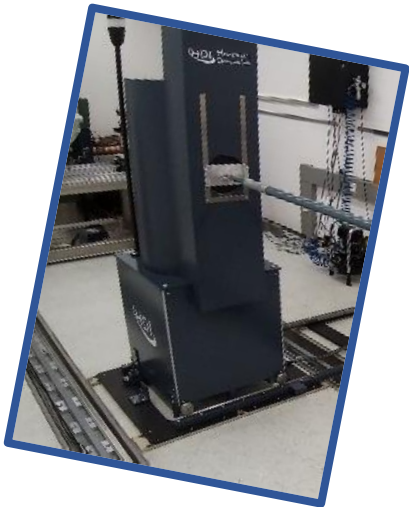


## High-energy x-ray beams (6 MV - 18 MV) at DOSEO (Saclay, France)

- Launch of the calibration service for secondary standards for NMIs/DIs.
- Full range of services available

## $^{137}\text{Cs}$ beam at the IAEA (Vienna)

- Commissioning of the facility with IAEA
- Relaunch of comparison /calibration services in 2023



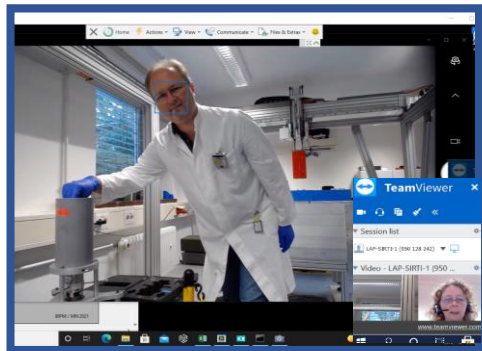
# Laboratory highlights – Ionizing radiation

new and improved radionuclide services



## SIR extension for $\beta$ -emitters (ESIR) based on TDCR instrument at the BIPM

- Successful Pilot study of Co-60 with 13 participants
- **System ready for high-energy beta-emitter comparison services.**



## SIR Transfer Instrument (SIRTI) for short-lived radionuclides

- First successful remote SIRTI comparisons at the PTB and KRISS
- **Supporting RMOs in developing copies of SIRTI**
- **Increased number of comparisons of short-lived radionuclides**

# Laboratory highlights – Ionizing radiation

new and improved radionuclide services

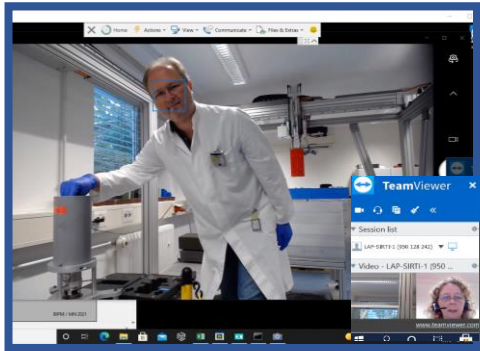


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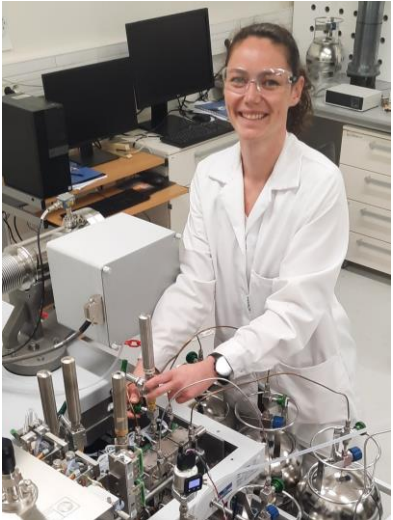
- First successful remote SIRTI comparisons at the PTB and KRISS
- **Supporting RMOs in developing copies of SIRTI**
- **Increased number of comparisons of short-lived radionuclides**



76% of CCRI members and observers have participated in RI department comparisons (29 out of 38)

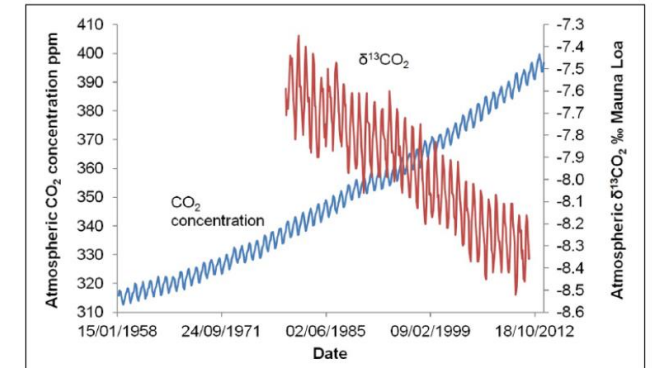
# Laboratory highlights - Chemistry

## New comparison services for gases and organics



### Carbon dioxide (CO<sub>2</sub>) isotope-ratio reference facility

- 20 participants and 162 results submitted
- Sample homogeneity better than repeatability of instruments
- Impact of different traceability schemes under assessment



### Reference Methods for pure and solution Mycotoxin Standards

- Purity Evaluation and Calibrant Assessment Guidelines published in 2022 for
  - Patulin
  - Deoxynivalenol
- Supports CRM development at NMIs

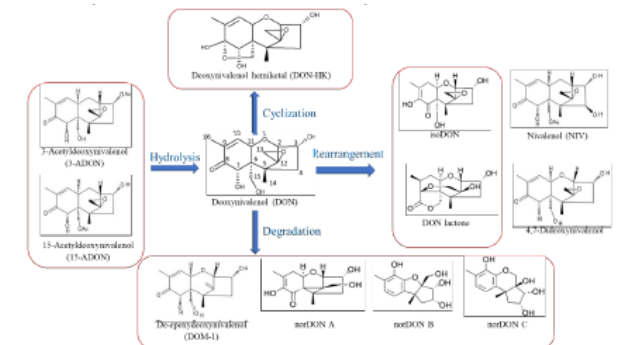


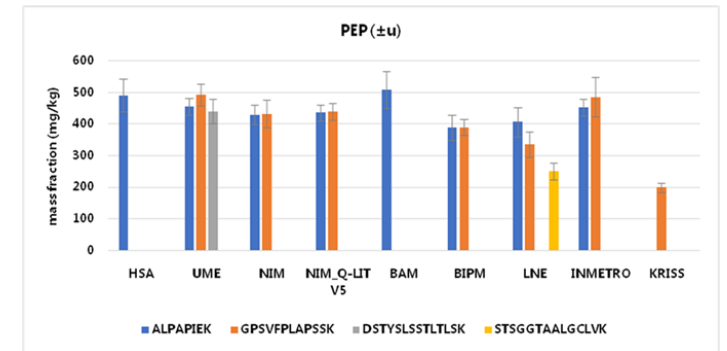
Fig. 2: Structures and relationship of DON precursors and transformation products

# Laboratory highlights - Chemistry

## Comparison services for diagnostic standards

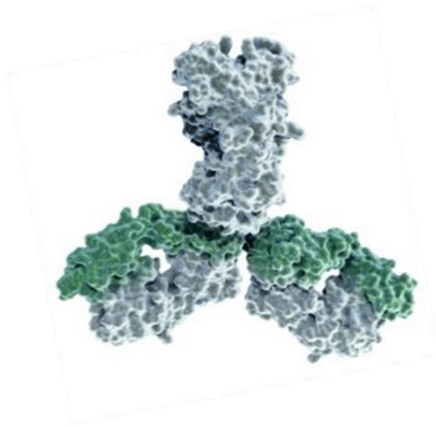
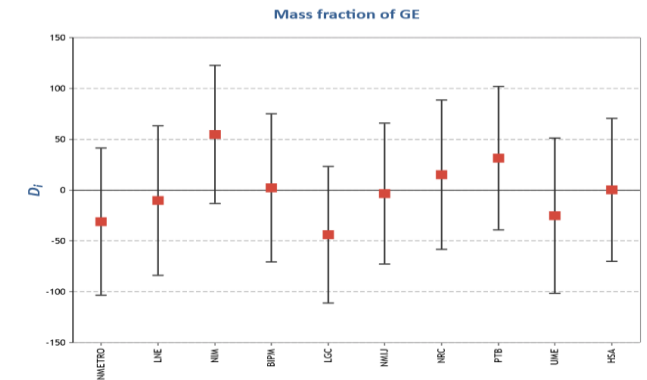
### Comparisons supporting COVID-19 diagnostic measurements at NMIs

- CCQM-P216: SARS-CoV-2 Monoclonal Antibody quantification
- Coordinated by NIM, NRC and BIPM
- First comparison of protein with MW of 150 kDa



### Comparisons supporting diabetes diagnostics and treatment

- Comparisons on glycated and non-glycated haemoglobin hexapeptide pure standards completed and published (CCQM-K115.c)
- Support for reference materials and measurement services for HbA1c being provided by NMIs



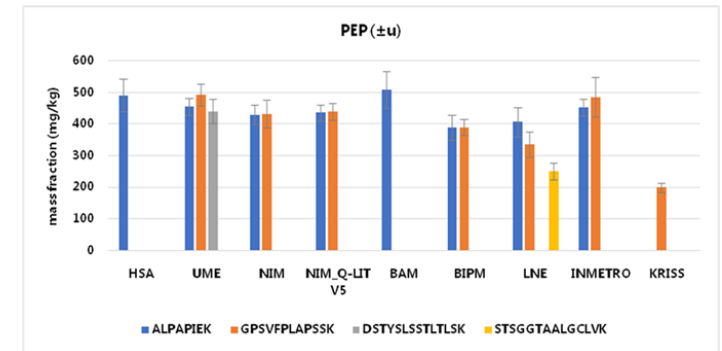


# Laboratory highlights - Chemistry

## Comparison services for diagnostic standards

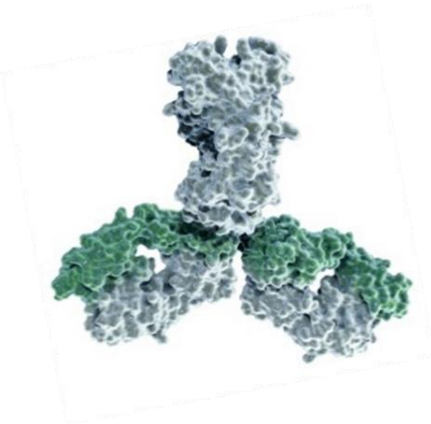
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### Comparisons supporting diabetes diagnostics and treatment

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- Support for 89% of CCQM members and observers have participated in chemistry department comparisons (32 out of 36) measurement services for NMIs



89% of CCQM members and observers have participated in chemistry department comparisons (32 out of 36)

# Laboratory highlights - Chemistry

## Knowledge Transfer Services

### FTIR for Gas Standard Characterization: Online courses

- NIMT and NMISA scientists completed course and new FTIR facilities at both NIMT and NMISA now operational (2022)
- BIPM online assistance continues
- Support from NPL (Primary Standards)



### Organic Analysis for CRM Characterization: Online courses

- Over 100 subscriptions to online course in 2021
- Knowledge transfer measurement study in 2022
- 14 participating NMIs/DIs
- Includes first time participants



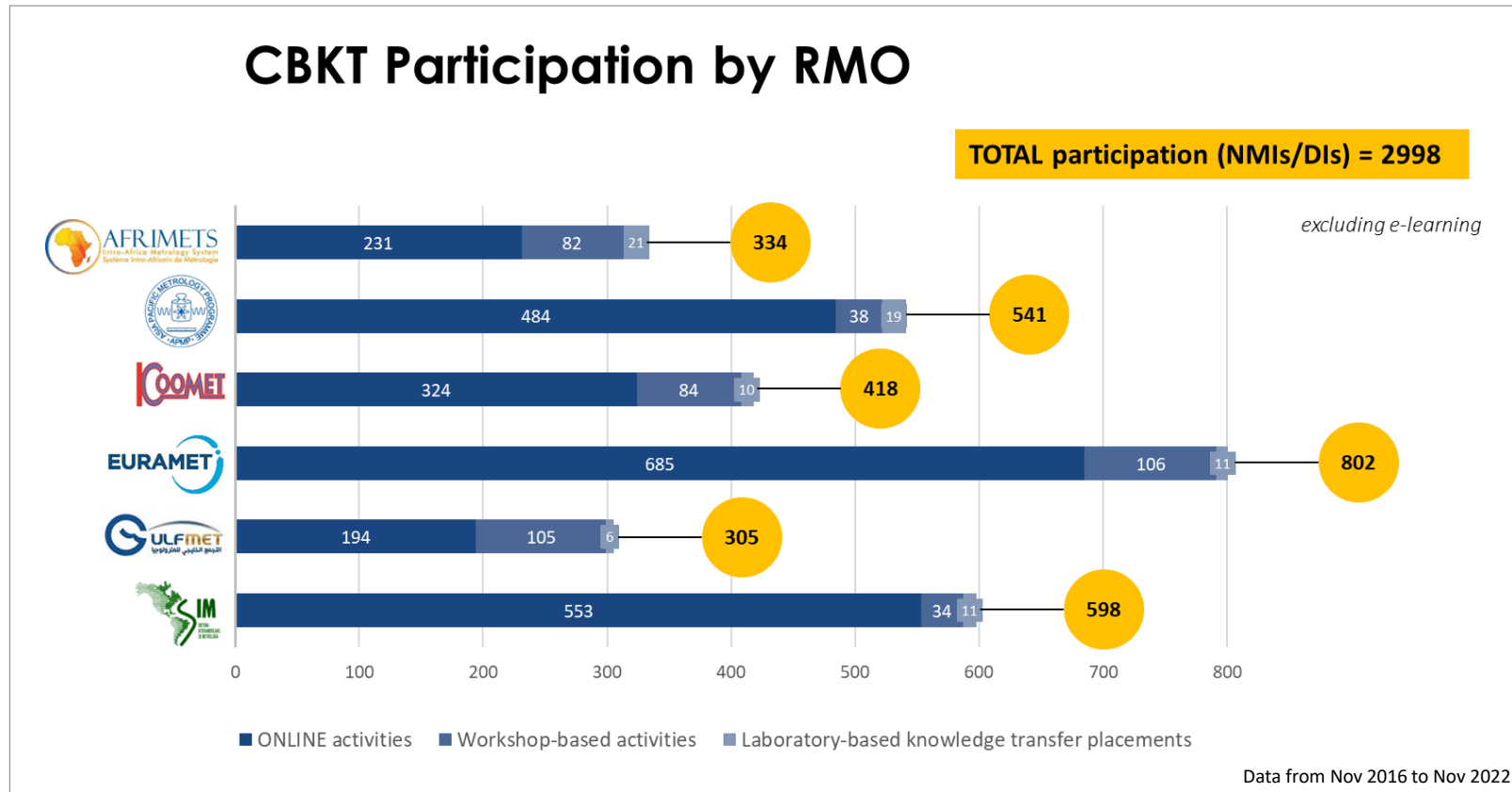
Chemistry and Biology  
Metrology for Clean Air KT



Chemistry and Biology  
Non Structure-Related Impurity Content in Orgar

# Capacity Building and Knowledge Transfer

Collaboration with all six RMOs

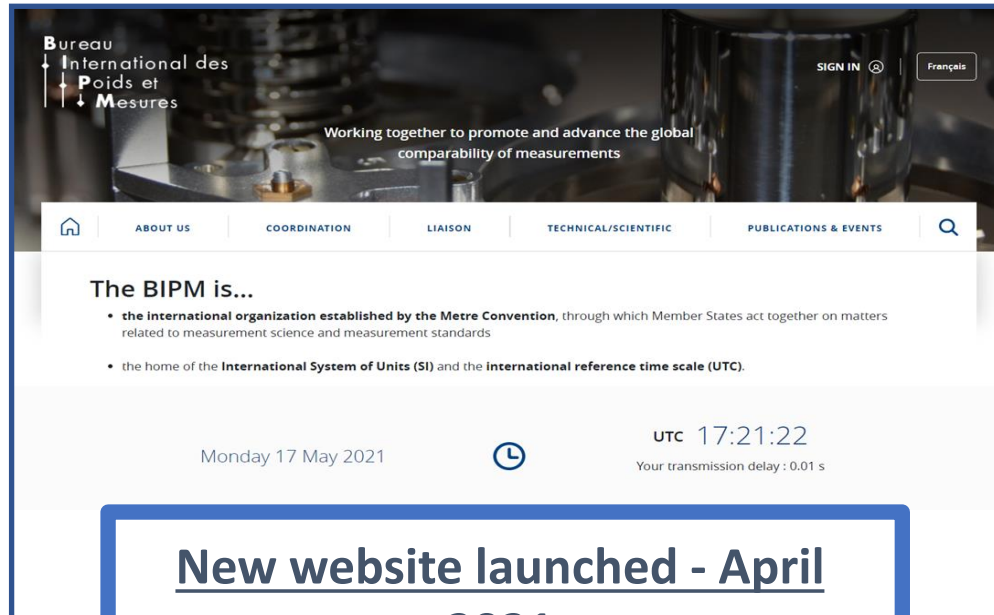


#### Thanks for support from:

- METAS, Switzerland
- NIM, China
- NIST, USA
- NMISA, South Africa
- NPL, United Kingdom
- PTB, Germany
- SCL, Hong Kong, China
- TÜBITAK UME, Türkiye
- IEEE, USA
- Plus
- All the RMOs

# Communications

Increasing the impact from our websites and databases



## New website launched - April 2021

26 023 working documents  
10 074 individual user accounts

Approx 2000 different users per day  
40 800 visits in October 2022



## Three years of successful operation

- The time needed for the inter-regional review of CMCs has been **reduced by a factor of 2.**
- The same technology now applied to the JCTLM database.

# Communication and liaison with International Organizations

Promoting metrology to external communities

September 2022 – 1078 participants

## METROLOGY FOR CLIMATE ACTION



- Developing a consensus plan of metrology priorities between the WMO and the NMI communities.

BIPM accepted as an official observer to UNFCCC



- Opens the opportunity to submit papers and information to future COP meetings from the new CIPM Horizontal Forum on “Environment and Climate”



# Communication and liaison with International Organizations

## Promoting metrology to external communities



### World Metrology Day – 20<sup>th</sup> May 2022

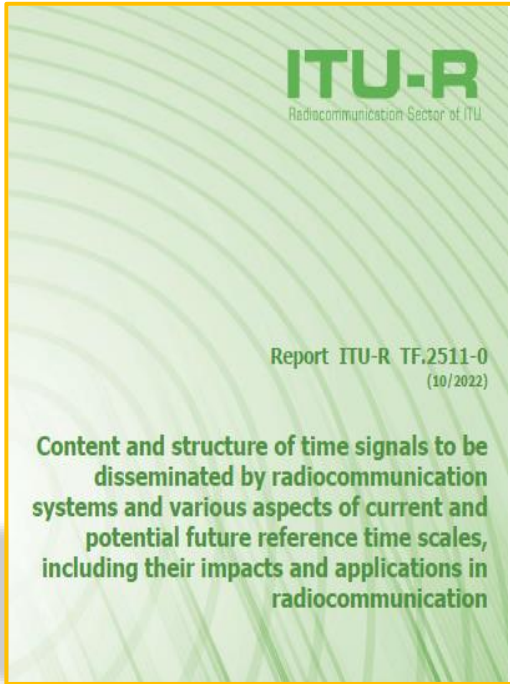
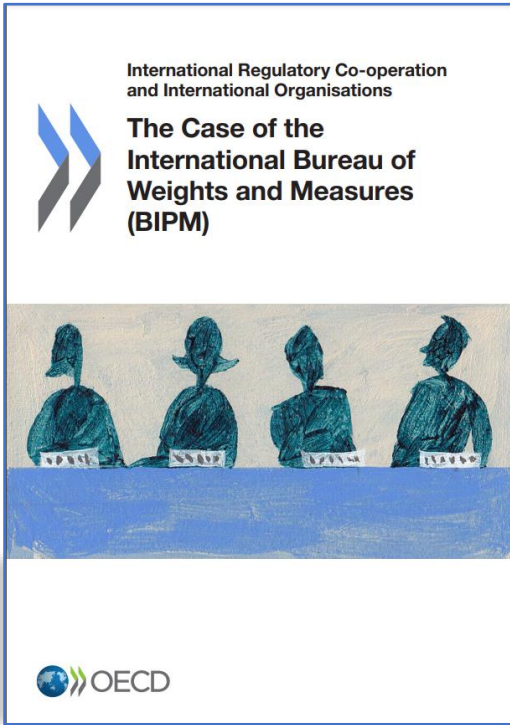
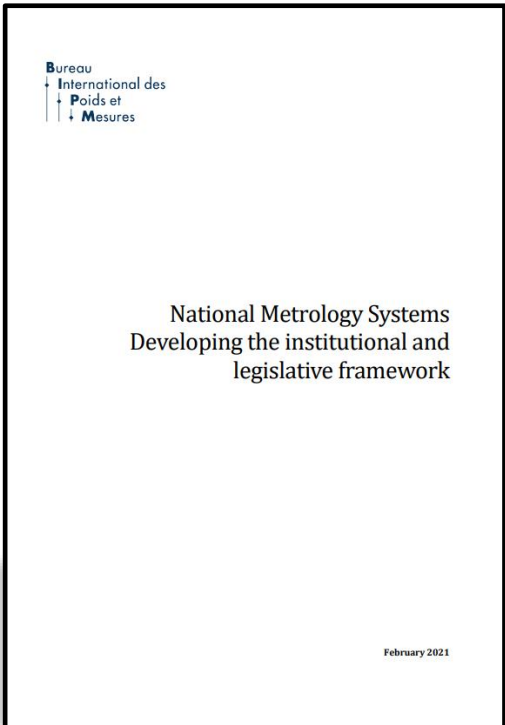
- Poster designed by the **National Scientific Centre "Institute of Metrology", Ukraine** (in association with COOMET).
- *Translations into 44 local poster versions*
- Events listed in 28 countries

### On 13<sup>th</sup> October 2022

- The UNESCO Executive Board took a key step towards recognizing World Metrology Day as a UNESCO event ,
- Proposal formally presented by Kazakhstan and supported by the BIPM and OIML.
- Written support from 42 UNESCO Member States
- We strongly expect formal recognition in 2024.

# Liaison with International Organizations

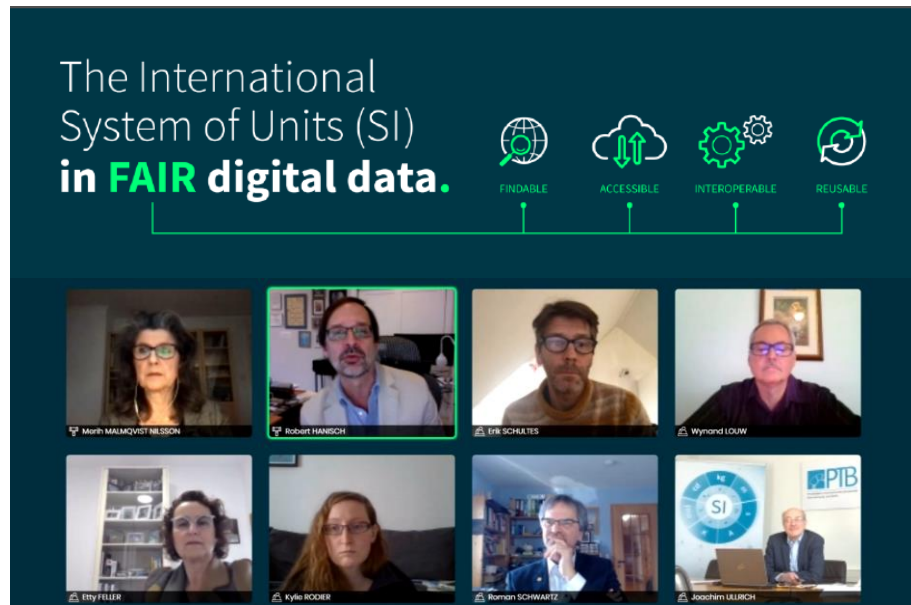
Promoting metrology to external communities



# Digital transformation

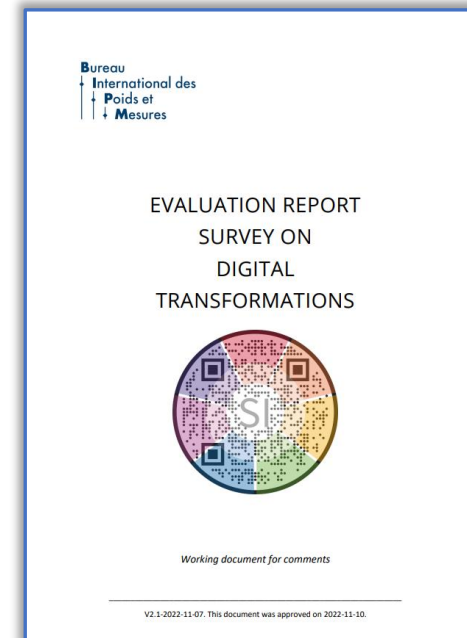
## Facilitating dialogue between NMIs and stakeholders

### SI-Digital Workshop – 600 participants



- Engaged the metrology community with the CIPM's proposal for an SI Digital Framework

### Survey of the Consultative Committees



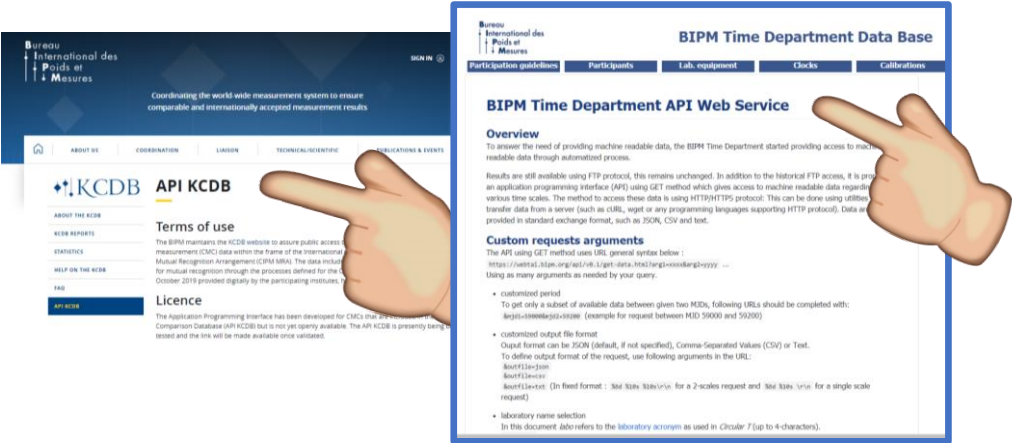
- 56 % of all responders have at least one digital project or plans to start one.
- 67% of responders are working on DCC projects.
- Only 15 % of these were able to articulate how metrological traceability to the SI could be addressed in a DCC.

Survey report available for comment from [www.bipm.org](http://www.bipm.org)

# Digital transformation

## Some examples of new digital services

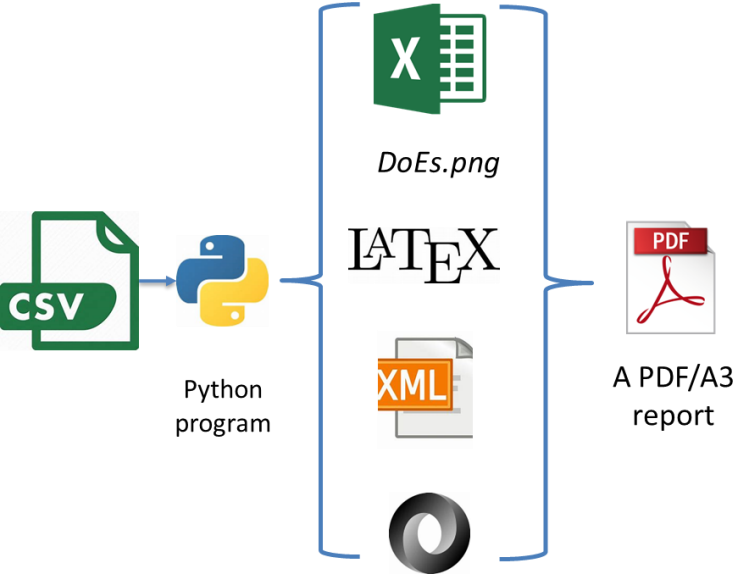
### Programming interfaces for Time and the KCDB



*“The API is very intuitive and easy to use ...we plan to include it in our automatic real-time processing very soon!”*

*“it seems to work OK ....I would like to encourage you to develop the API further, and if possible make ClockData, d-data, r-data available also through the API”.*

### A prototype digital comparison report



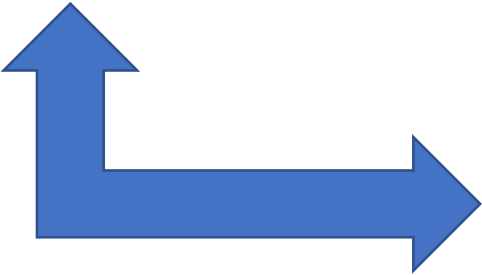
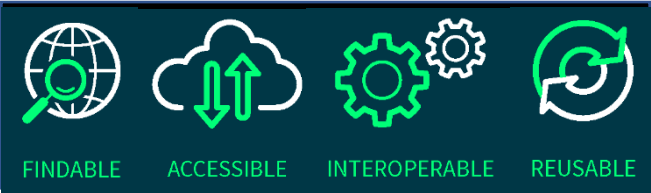
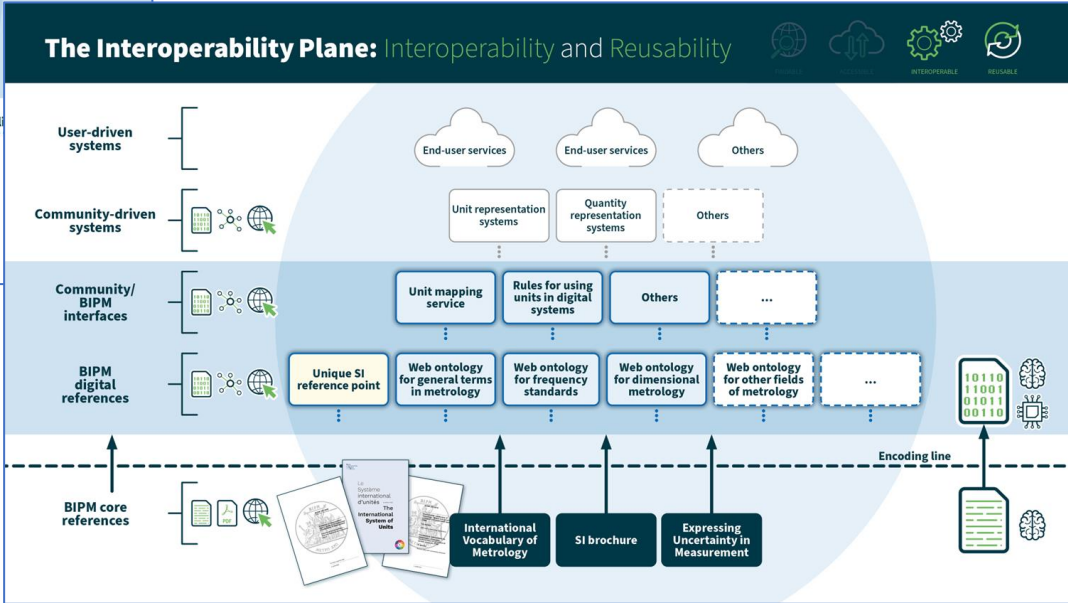
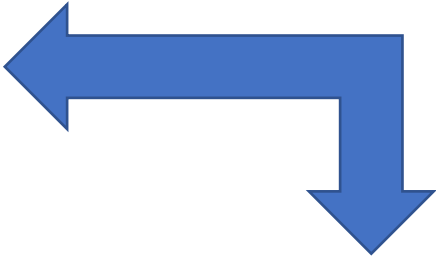
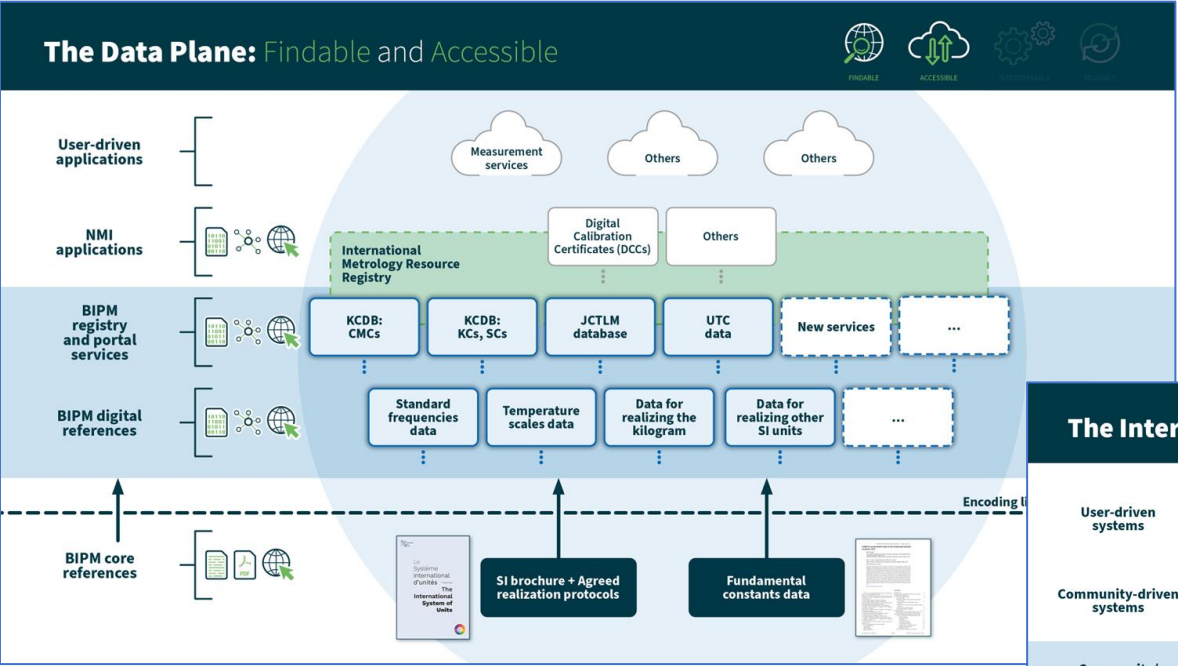
New practices to meet the FAIR principles



# Digital transformation

## Supporting the digital transformation

Please look at the Digital Transformation poster downstairs for more details



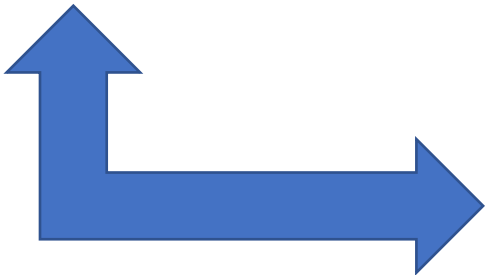
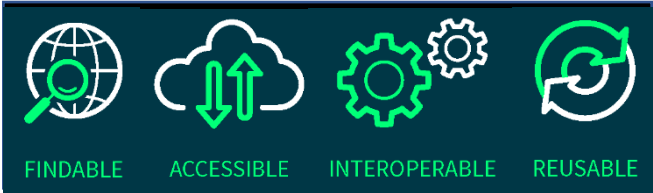
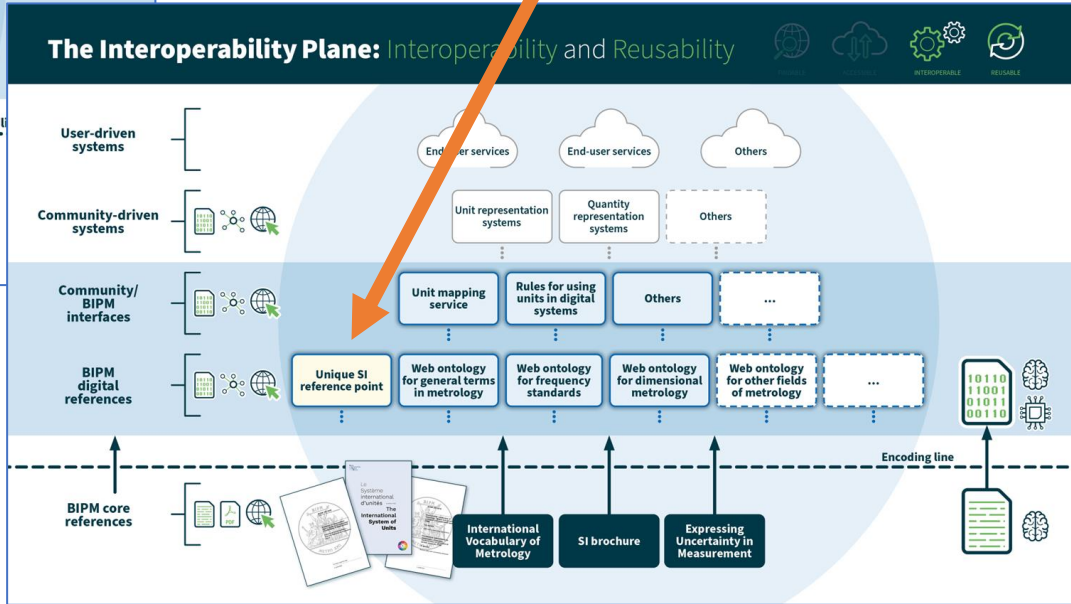
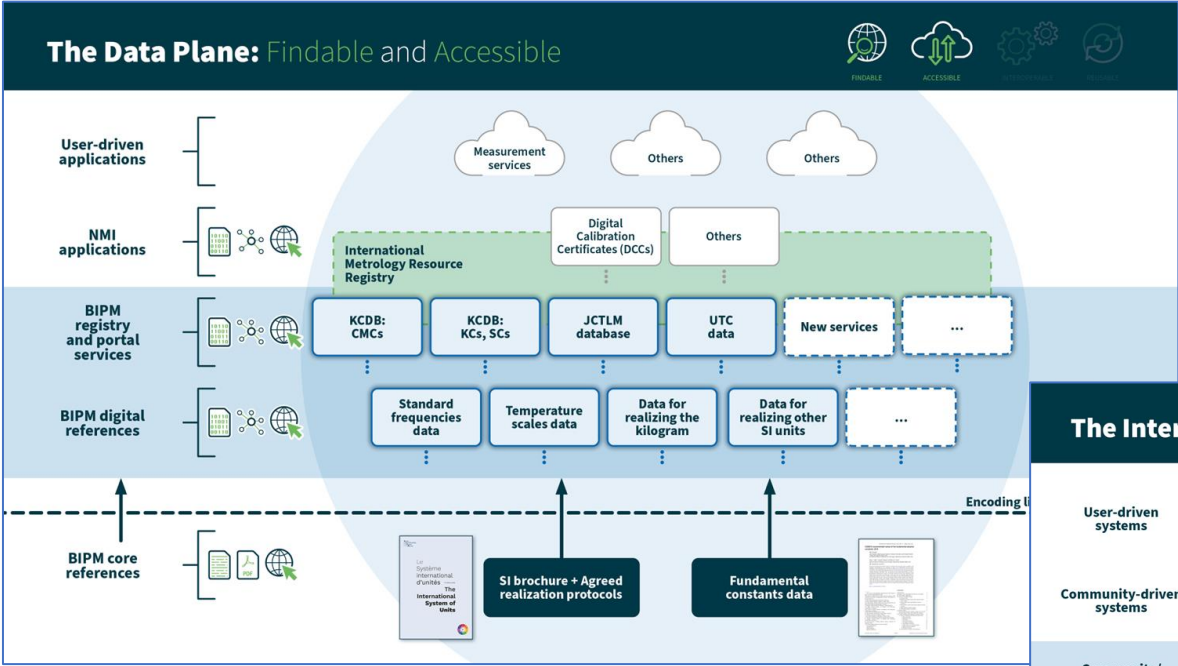


# Digital transformation

## Supporting the digital transformation

### “The unique SI reference point”

- a structured database that can be interrogated by all users in a variety of encodings.
- and will be fully FAIR.
- meet the digital needs of all the community that currently uses the “SI Brochure”.
- will replace the current tendency for users to access Wikipedia etc as the reference for the SI in a non-systematic way.



# Summary



**69** staff

- 23 PhD  
plus 6 full-time  
equivalent secondes

## Congratulations !

### **Patrizia Tavella**

- Enrico Fermi Prize (Italian Physical Society)
- European Frequency and Time Award (EFTF)

### **Gerard Petit**

- Marcel Ecabert Award (EFTF)

### **Andy Henson**

- Wildhack Award (NCSLI)

## Two new Department Directors

### **Vincent Gressier**

- Director, Ionizing Radiation Department  
Since August 2021

### **Anna Cypionka**

- Director, International Liaison, Communication  
and Strategy  
From 1st Jan 2023

# Summary

**69** staff



- 23 PhD  
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equivalent secondees

**640** “days”



of meetings

20 410 participations

**419** Calibrations



- 405 calibration  
certificates
- 14 study notes

**687** NMI/DI



participations in the  
BIPM comparisons

**2692** CBKT



125 countries

participation

- 47 laboratory KT
- 174 CB workshops
- 2471 online

**670** users



e-learning

from 115 countries

- 16 e-learning courses  
from BIPM and 4 RMOs



*Thank you*

Bureau  
International des  
Poids et  
Mesures

Document de travail de la CGPM

Octobre 2022

CGPM Working Document

October 2022

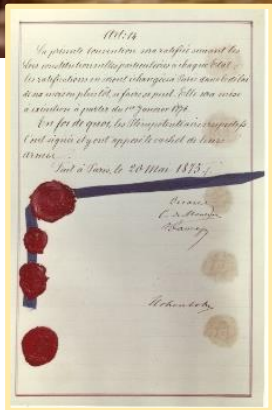


Spare slides



# BIPM – an international organisation

The Metre Convention was signed in Paris by 17 nations on **20 May 1875** “to assure the international unification and perfection of the metric system”



**CGPM – Conférence générale des poids et mesures**

*Official representatives of Member States*



**CIPM – Comité international des poids et mesures**

*14 then 18 members all from different nationalities and elected by the CGPM.*



**Headquarters (Scientific and technical secretariat, Sèvres, France)**



**1875**

**17 Member States**

**14 CIPM Members**

**Director + 2 Assistants**

**2022**

**64 Member States**

**18 CIPM Members**

**Director + 70 staff**

# BIPM – an international organisation



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**Headquarters (Scientific and technical secretariat,  
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## The “Agora” actions of the CIPM

The CIPM ... “may initiate the cooperation of specialists in metrological matters and coordinate the results of their work” AR 10 (1921).

- Consulting with experts from the NMIs through the CCs.
- Preparing the MRA between NMI Directors and working with the RMOs to implement it.
- Convening Joint Committees with other organizations.

**1875**

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**2022**

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