Bureau International des Poids et Mesures

BIPM Liaison Report

to the WTO TBT Committee

March 2022

THE VISION, MISSION AND OBJECTIVES OF THE BIPM

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

Its **vision** is to be universally recognised as the world focus for the international system of measurement.

Its **mission** is to work with the NMIs of its Member States, the RMOs and strategic partners world-wide and to use its international and impartial status to promote and advance the global comparability of measurements for:

- Scientific discovery and innovation,
- Industrial manufacturing and international trade,
- Improving the quality of life and sustaining the global environment.

THE OBJECTIVES OF THE BIPM

- **To represent the world-wide measurement community**, aiming to maximize its uptake and impact.
- **To be a centre for scientific and technical collaboration between Member States**, providing capabilities for international measurement comparisons on a shared-cost basis.
- **To be the coordinator of the world-wide measurement system**, ensuring it gives comparable and internationally accepted measurement results.

Fulfilling our mission and objectives is underpinned by our work in:

- *capacity building*, which aims to achieve a global balance between the metrology capabilities in Member States;
- *knowledge transfer*, which ensures that our work has the greatest impact.

KEY HIGHLIGHTS

- As of February 2022, the BIPM had 63 Member States, and 40 Associate – The Republic of Zimbabwe was reinstated as an Associate of CGPM after ceasing to be Associate on January 1, 2021.
- The 27th meeting of the CGPM will be held on 15-18 November 2022 at the Palais des Congrès de Versailles. The webpage are now available at https://www.bipm.org/en/cgpm-2022.
- The online Workshop on Metrology for Climate Action, to be hosted by the BIPM and the WMO on 26-30 September 2022, is now open for preregistration.
- The World Metrology Day (20 May) theme for 2022 is "Metrology in the Digital Era". The 2022 World Metrology Day Resource Website https://www.worldmetrologyday.org/ is live now. The 2021 theme was related to the measurements in health.
- GULFMET (Gulf Association for Metrology) became fully recognized as an RMO within the CIPM MRA.
- The BIPM participated in the 8th Annual IO Meeting held within the OECD initiative IO Partnership and contributed to the publication of the *Compendium of International Organisations' Practices: Working Towards More Effective International Instruments*.
- The BIPM-ILAC organized for the first time a joint webinar entitled "Mining KCDB 2.0 in the context of accreditation". It was held in January 2021 with the participation of more than 600 accreditation experts.
- Virtual workshop on 'The SI in FAIR digital data' was organized in February 2021 involving 600 participants.
- The BIPM launched its new website in the beginning of 2021, based on an updated Content Management System and with a new graphic design.
- The BIPM's e-learning platform was launched in 2021. It was extended in January 2022 to allow RMOs to publish their training material on the platform, complementing the BIPM material.
- The Application Programming Interface has been developed for CMCs that are included in the Key Comparison Database (API KCDB) and is openly available.

THE SI

International Atomic Time (TAI) achieves its stability from more than 450 atomic clocks world-wide and its accuracy from a small number of primary and secondary frequency standards which aim at realizing the SI second with the smallest uncertainty. Each month the BIPM publishes, in section 3 of Circular T[1], an estimation of the TAI frequency accuracy as measured by those individual frequency standards, as well as an ensemble average computed by the BIPM. In November 2021, sixteen different frequency standards operated in eleven laboratories contributed to this estimation, including ten Cs fountains, one Rb fountain, one Sr optical lattice and two Yb optical lattice clocks, in addition to the two legacy Cs beams operated by the PTB. This constitutes a record level of participation, both in terms of the number of different standards and the number of different laboratories.

THE CIPM

Session I of the 111th meeting of the CIPM will be held online in March 2022. All CIPM Decisions are available on the BIPM webpage at https://www.bipm.org/en/committees/ci/cipm/outcomes.

The equipment installed by CENAM is the second of two frequency combs that were identified as being worth offering to NMIs for use in their work programmes, following the dismantling of the former BIPM Length Section's laser laboratory. Information about the frequency combs was circulated among the NMIs after consultation with the Consultative Committee for Length (CCL). The first comb was successfully installed by INTI (Argentina) in 2019. The two frequency combs had originally been built by the BIPM and are used in comparing microwave to optical frequency radiations.

The second comb has been installed in the CENAM (Mexico) frequency comb laboratory and initial tests were carried out at the end of 2021. The tests proved that each of the systems is operating correctly, and an optical supercontinuum was generated. The CENAM length group expects to start using the frequency comb to provide calibration services, mainly to dimensional metrology laboratories, in the second quarter of 2022.

Digital transformation

Industry 4.0 and digital transformation are notions that are frequently encountered today. Most of the digital tools that accompany our lives are based on exchange of data, ruled by specific protocols. The GO-FAIR initiative [https://www.go-fair.org/], launched in 2017, promotes realizations compliant with the FAIR guiding principles, where data should be Findable, Accessible, Interoperable and Reusable, the cornerstones for the robust management of data exchange [M.D. Wilkinson *et al*. *Scientific Data*, 2016 18 https://doi.org/10.1038/sdata.2016.18].

These activities have also been picked up by the metrology community. The CIPM, whose mission is to promote world-wide uniformity in units of measurement, has formed a task group on the digital SI (CIPM TG DSI) to develop and establish a world-wide uniform, unambiguous and secure data exchange format based on the International System of Units (SI) described in the current SI Brochure [https://www.bipm.org/documents/20126/41483022/SI-Brochure-9.pdf/fcf090b2-04e6-88cc-1149-c3e029ad8232].

An Expert Group, under the auspices of the CIPM TG SI, is presently examining the possible alternatives to provide a basis for interoperability.

The BIPM is presently engaged in several projects in digitalization that are closely linked to the task group outcome, and intimately associated with the services provided by the BIPM to its stakeholders and signatories of the Metre Convention. The initial goal is to make data machine readable, but where

[1] https://webtai.bipm.org/ftp/pub/tai/Circular-T/cirthtm/cirt.407.html

interoperability is to be integrated, dependent on the CIPM TG DSI outcome.

The following project are in progress at the BIPM:

- Making the SI brochure, and associated documents for the *Mise en Pratique*, machine readable, including unique identifiers of definitions and going towards an interoperable inclusion of SI units.
- Providing digital and interoperable Calibration and Measurement Capabilities (CMCs) as listed in the Key Comparison Database (KCDB). The integration of interoperable information to become FAIR is an extension of the realization of an Application Programming Interface (API) for search of CMCs, implemented in 2021, giving access to machine readable data [https://www.bipm.org/en/cipm-mra/kcdb-api].
- Giving machine readable access to recommended frequencies for the realization of the Metre.
- Digitized dissemination of the UTC. A beta version of an API is presently available [https://webtai.bipm.org/api/index.html].
- New web and database support for the Joint Committee for Traceability in Laboratory Medicine (JCTLM), where data will become FAIR [https://www.bipm.org/jctlm/home.do]
- Development of a database on key values linked to comparisons of radioactive elements https://www.bipm.org/en/radionuclide-metrology.

Other projects are planned (list not exclusive):

- Creating an accessible database on reference standards in gas metrology, supporting environmental issues.
- Creating an accessible database on quantitative nuclear magnetic resonance reference (qNMR) data in organic chemistry.
- Implementing digital calibration certificates for the calibration services provided by the BIPM.

The 27th meeting of the CGPM (2022)

The 27th meeting of the CGPM will be held on 15-18 November 2022 at the Palais des Congrès de Versailles. A "Special procedure" has been proposed by the CIPM to introduce the special technical arrangements for a hybrid meeting. The meeting webpage is available at: https://www.bipm.org/en/cgpm-2022.

INSTITUTIONAL NEWS

Liaison with Member States and Associates of the CGPM

As of February 2022, the BIPM had 63 Member States, and 40 Associate States and Economies of the General Conference on Weights and Measures (CGPM). On February 8, 2022, the Republic of Zimbabwe was reinstated as an Associate of CGPM after ceasing to be Associate on January 1, 2021.

The list of Member States and Associates of the CGPM is annexed to this report and is also available at the BIPM website.

Liaison with international organizations

The BIPM has a series of ongoing institutional and technical interaction with over 30 international organizations and international bodies.

World Metrology Day

Each year on 20 May, the world-wide metrology community celebrates the day the *Metre Convention* was signed in 1875. The project is run jointly by the BIPM and the OIML. The theme for World Metrology Day 2022 is *"Metrology in the Digital Era"*. This theme was chosen because digital technology is revolutionizing our community and is one of the most exciting trends in society today. The 2022 poster was designed under the auspices of the COOMET Regional Metrology Organization. The poster is expected to be translated into many languages and information on national celebratory events will be provided on the 2022 World Metrology Day Resource Website https://www.worldmetrologyday.org/ which is live now.

Liaison with the WMO

The online workshop on Metrology for Climate Action, to be hosted by the BIPM and the World Meteorological Organization (WMO) on 26-30 September 2022, is open for preregistration of interest, with an open call for papers and posters planned for mid-March. Potential partner and stakeholder organizations are also invited to register their interest.

The aims of this workshop are to present progress and identify requirements for further development of advanced measurements, standards, reference data, comparisons, calibrations and metrological techniques to support the physical science basis for and adaptation to climate change, as well as efforts to mitigate greenhouse gas emissions.

The workshop will cover the themes of metrology in support of the physical science basis of climate change and climate observations, as well as metrology towards a coordinated system to evaluate greenhouse gas emission budgets based on accurate observations. The output of the workshop will be a set of recommendations on key technical challenge areas for metrology over the next decade.

This workshop follows on from two previous events, one in 2010 on Measurement Challenges for Global Observation Systems for Climate Change Monitoring and the second in 2015 on Global to Urban Scale Carbon Measurements.

Liaison with the OECD

The OECD established the *Partnership of international organisations for effective international rulemaking (IO Partnership)* as a voluntary platform of IOs, academics and OECD Regulatory Policy Committee delegates, to exchange good practices and promote greater quality, effectiveness, and impact in international rulemaking. The French version of the *Compendium of International Organisations' Practices: Working Towards More Effective International Instruments* published during the 8th Annual IO Meeting on 13 September 2021, will be launched in March 2022.

The Compendium lists the BIPM practices such as World Metrology Day, CBKT Programme, CIPM MRA Review, JCGM, etc. in five core focus areas.

The BIPM is the focal point of the WG2: Enhancing inclusiveness of international rulemaking.

CIPM MRA AND KCDB

The CIPM MRA is the *'Mutual Recognition Arrangement of National Measurement standards and of calibration and measurement certificates issued by National Metrology Institutes'.* Participation in the CIPM MRA continues to grow: it has been signed by representatives from 63 Member States, 40 Associates of the CGPM, and four international organizations – and covers a further 152 institutes designated by the signatory bodies.

As of February 2022, the KCDB included a total of 25 833 CMCs. There are 1113 key comparisons and 651 supplementary comparisons registered in the KCDB.

CAPACITY BUILDING AND KNOWLEDGE TRANSFER (CBKT) PROGRAMME

The BIPM Capacity Building and Knowledge Transfer Programme aims to increase the effectiveness with which Member States and Associates engage in the world-wide coordinated metrological system.

So far, around 500 participants from 102 countries, covering all six RMOs, have benefited from the CBKT initiatives. At the time of writing, over 76 % of Member States and Associates have participated in the CBKT

Programme (as trainees, lecturers and sponsors).

In April 2021, the BIPM launched an e-learning platform. This platform is designed to offer tailored courses related to the CIPM MRA mechanisms and other scientific metrology activities. A significant advantage of this platform is that participants have 24-hour access on any device. In 2022 the e-learning platform was expanded to enable it also to host the material from the interested RMOs.

Chemical metrology activities include on-line knowledge transfer courses and studies on Metrology for Food Safety focusing on primary reference materials and calibration solution characterization. The first course covers 'Quantification of Non-structurally Related Impurity Content in Organic Pure Materials', previously provided as an on-site course for National Metrology Institutes and Designated Institutes developing mycotoxin standards for food testing applications.

Since May 2020, fifteen online projects have been organized involving more than 1310 participants from NMI/DI community and 604 from ILAC community.

Metrology for Safe Food: Pesticides and Residues was launched in 2021.

Metrology for Clean Air: on-line Knowledge Transfer Programme on the application of FT-IR for Gas Standard Characterization was launched in 2021 as a replacement for the on-site training secondments for NMIs scientists, which have been in operation until 2020.

Metrology for Clean Air: on-line Knowledge Transfer Programme on the Dynamic gas standard generation will be launched in 2022.

Metrology for Laboratory Medicine: Peptide standards will be launched in 2023.

The joint initiative "BIPM–TÜBİTAK UME project placements" was extended for another two cycles, which will be delivered in 2022 and 2023. This extension follows the success of the previous four cycles.

Over four cycles of this initiative (from 2018 to 2021), the BIPM and TÜBİTAK UME have hosted thirty-seven talented metrologists from twenty-four countries for a period of 1 to 3 months at the TÜBİTAK UME laboratories. The reports received from the participants on completion of their placements have demonstrated that the projects were an extremely valuable method of knowledge transfer. The research projects have covered a diverse range of subjects from decreasing the uncertainty of measurement standards through to expanding metrological capabilities in the laboratory to underpin scientific activities, healthcare, and industry.

Full details of the BIPM CBKT Programme are available at:
https://www.bipm.org/en/committees/cb/cbkt

For highlights of the BIPM scientific programme for the period, please refer to the BIPM Annual Review 2020/2021:
https://www.bipm.org/en/publications/annual-review

ANNEX

63 Member States

(as of February 2022)

Argentina
Australia
Austria
Belarus
Belgium
Brazil
Bulgaria
Canada
Chile
China
Colombia
Croatia
Czechia
Denmark
Ecuador
Egypt
Estonia
Finland
France
Germany
Greece
Hungary
India
Indonesia
Iran
Iraq
Ireland
Israel
Italy
Japan
Kazakhstan
Kenya
Korea (Republic of)
Lithuania
Malaysia
Mexico
Montenegro
Morocco
Netherlands
New Zealand
Norway
Pakistan
Poland
Portugal
Romania
Russian Federation
Saudi Arabia
Serbia
Singapore
Slovakia
Slovenia
South Africa
Spain
Sweden
Switzerland
Thailand
Tunisia
Turkey
Ukraine
United Arab Emirates
United Kingdom
United States of America
Uruguay

40 Associates of the CGPM (States and Economies*)

(as of February 2022)

Albania
Azerbaijan
Bangladesh
Bolivia
Bosnia and Herzegovina
Botswana
Cambodia
CARICOM*
(11 members:
Antigua and Barbuda
Barbados
Belize
Dominica
Grenada
Guyana
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Suriname
Trinidad and Tobago)
Chinese Taipei*
Costa Rica
Cuba
Ethiopia
Georgia
Jamaica
Kuwait
Hong Kong (China)*
Ghana
Latvia
Luxembourg
Malta
Mauritius
Moldova
Mongolia
Namibia
North Macedonia
Oman
Panama
Paraguay
Peru
Philippines
Qatar
Seychelles
Sri Lanka
Sudan
Syrian Arab Republic
Tanzania
Uzbekistan
Viet Nam
Zambia
Zimbabwe

Bureau international des poids et mesures

BIPM - Pavillon de Breteuil

F-92312 Sèvres Cedex FRANCE