



CIPM Update on Actions in response to the CGPM Resolutions

adopted at the 27th meeting of the CGPM

A large, colorful graphic on the right side of the slide. It consists of multiple concentric, overlapping rings in a rainbow spectrum of colors (red, orange, yellow, green, blue, purple, magenta). The rings are slightly offset from each other, creating a sense of depth and movement.

Working together to
promote and advance
the global comparability
of measurements

Resolution 1

On the report prepared by the International Committee for Weights and Measures on the “Evolving Needs in Metrology”

The General Conference on Weights and Measures (CGPM), at its 27th meeting,

recalling

- Resolution 2 adopted by the CGPM at its 23rd meeting (2007) that invited the International Committee for Weights and Measures (CIPM) to report to subsequent General Conferences on the evolving needs in metrology and to prepare proposals for initiatives to be taken by the International Bureau of Weights and Measures (BIPM) at the international level,
- Resolution 1 adopted by the CGPM at its 26th meeting (2018) on the revision of the International System of Units (SI) that defined the seven base units in terms of fixed numerical values of the defining constants that introduced new opportunities for the realization of the units,
- Resolution 3 adopted by the CGPM at its 26th meeting (2018) that welcomed the development of a long-term strategic view which, together with a consolidated planning process, underpins the development of the BIPM work programme in consultation with Member States,

noting

- the essential role of the International System of Units (SI) in providing confidence in the accuracy and global comparability of measurements needed for international trade, manufacturing, human health and safety, protection of the environment, global climate studies and scientific research,

noting

- the critical role of metrology in addressing global challenges, including climate change and environment, health and life sciences, food safety, energy, advanced manufacturing, digital transformation and countering global pandemics,
- the increasingly multidisciplinary nature of measurement in new or disruptive technologies, and the new requirements for metrology in digital technologies, sensor networks, and big data,

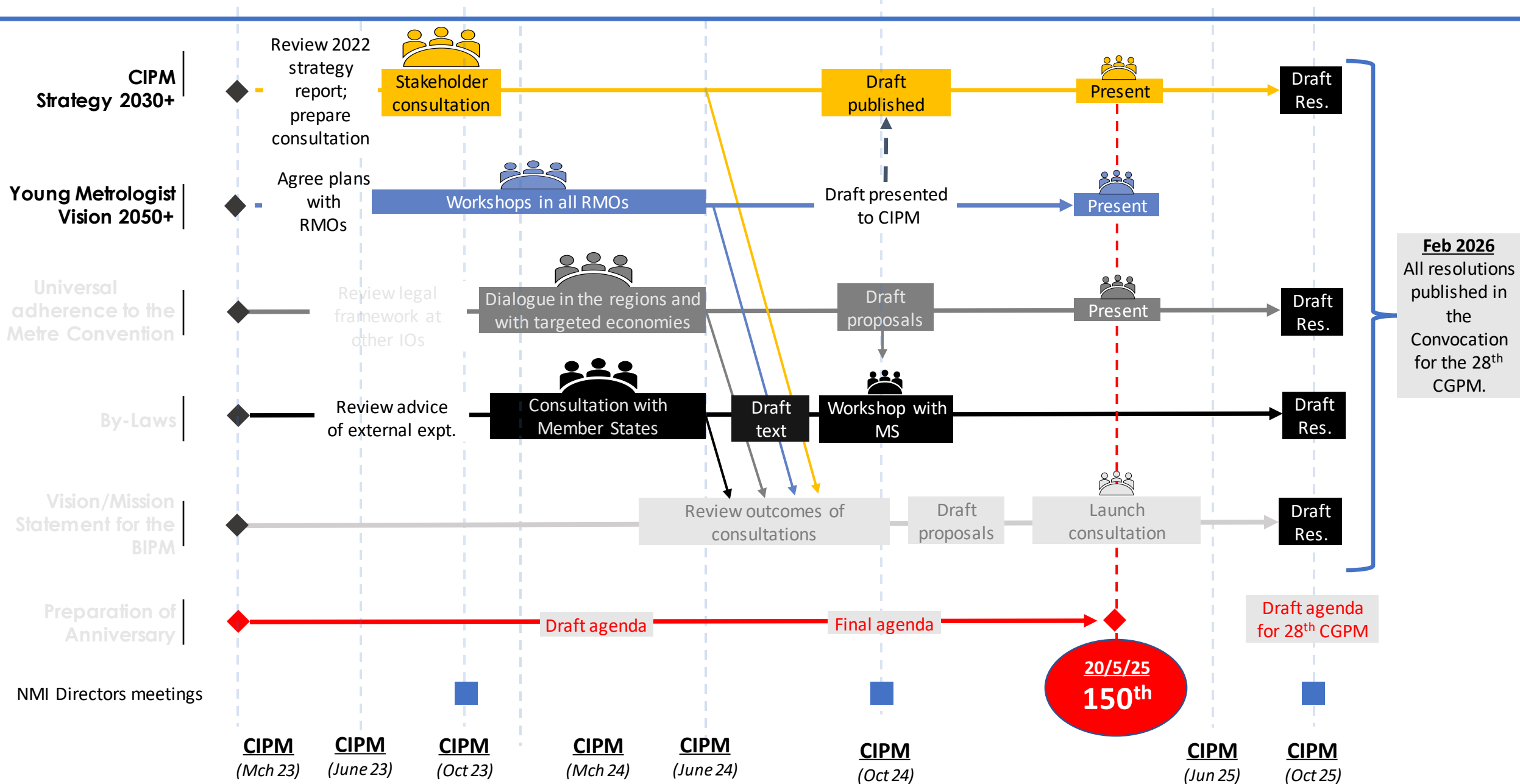
welcoming the report of the CIPM on the “Evolving needs in metrology”,

encourages the CIPM

- to develop a long-term vision for an international measurement system that will remain relevant and adequately address new metrological challenges,
- to establish inter-disciplinary (“horizontal”) groups that will address these new challenges and will be complementary to the existing quantity-based (“vertical”) structure of its Consultative Committees,
- to mark the 150th anniversary (on 20 May 2025) of the signing of the Metre Convention by outlining a new vision for the BIPM that builds on the CIPM report on the “Evolving Needs in Metrology” and is based on a review of the achievements of the BIPM and the future requirements for its work,
- to consult widely on its proposal for a new vision for the BIPM to be presented at the 28th meeting of the CGPM (2026),

and invites Member States and National Metrology Institutes to contribute to the work of the CIPM in addressing the evolving needs for metrology and in developing a new vision for the BIPM.

Timelines for external actions: consultations, publications and presentations



Resolution 2

On the global digital transformation and the International System of Units

The General Conference on Weights and Measures (CGPM), at its 27th meeting,

considering

- that governments, industry, academia, and civil society have been working toward a comprehensive digital transformation for many years, and, in so doing, are:
 - establishing systems to collect, aggregate, analyse and interpret digital data,
 - introducing networked sensor systems for diverse scientific and industrial applications,
 - sharing data at local, national, regional and international levels,
- the essential role of the International System of Units (SI) in providing confidence in the accuracy and global comparability of measurements needed for international trade, manufacturing, human health and safety, protection of the environment, global climate studies and scientific research,

anticipating that

- maintaining and building confidence in the accuracy and global comparability of measurements will require the creation of a full digital representation of the SI, including robust, unambiguous, and machine-actionable representations of measurement units, values and uncertainties,

- successfully effecting such a comprehensive digital transformation will require engagement with a wide range of stakeholders including, but not limited to, the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Organization of Legal Metrology (OIML), International Laboratory Accreditation Cooperation (ILAC), Committee on Data for Science and Technology (CODATA) of the International Science Council, and other scientific, regulatory, and quality infrastructure communities,

welcomes

- the recent efforts to articulate guiding principles for a digital transformation in metrology,
- the establishment of a flexible and inclusive governance structure supporting the development and implementation of that transformation,

encourages

- the CIPM to continue its outreach and engagement initiatives to ensure that the Metre Convention naturally extends its role as the globally accepted anchor of trust for metrology into the digital era,
- the CIPM to undertake the development and promotion of an SI Digital Framework, that will include the following features:
 - a globally accepted digital representation of the SI, compatible with, and useable within, digital data exchange standards and protocols, whilst maintaining compatibility with existing non-digital solutions,
 - facilitating use of digital certificates in the existing robust infrastructure for the world-wide recognition and acceptance of calibration and measurement capabilities,



- the adoption of the FAIR principles (Findable, Accessible, Interoperable, and Reusable) for digital metrological data and metadata, ensuring that other communities recognize the critical importance of metrological traceability for measurement data, the latter being an established requisite for building trust,

invites

- **National Metrology Institutes, Regional Metrology Organizations and other stakeholders to maintain and, where possible, increase their existing level of commitment and collaboration with the CIPM to continue the development, promotion and implementation of the SI Digital Framework,**
- **all organizations with an interest in, or activities related to, the quality infrastructure – that relies on metrology, standardization, accreditation, conformity assessment, and market surveillance – to consider joining the collaborative venture of the digital transformation to ensure that the SI Digital Framework meets the needs of all stakeholders.**

Organizing an International Workshop

- ◆ 785 Participants,
- ◆ 1287 Registrations
- ◆ 33 Talks
- ◆ Representative from
 - International QI
 - Science and industry
 - NMIs and RMOs



The International System of Units (SI) in FAIR digital data.

FINDABLE ACCESSIBLE INTEROPERABLE REUSABLE

Prof. Dr. Joachim Ullrich
CIPM Vice President
CCU and TG "Digital SI" Chair
22 February 2021

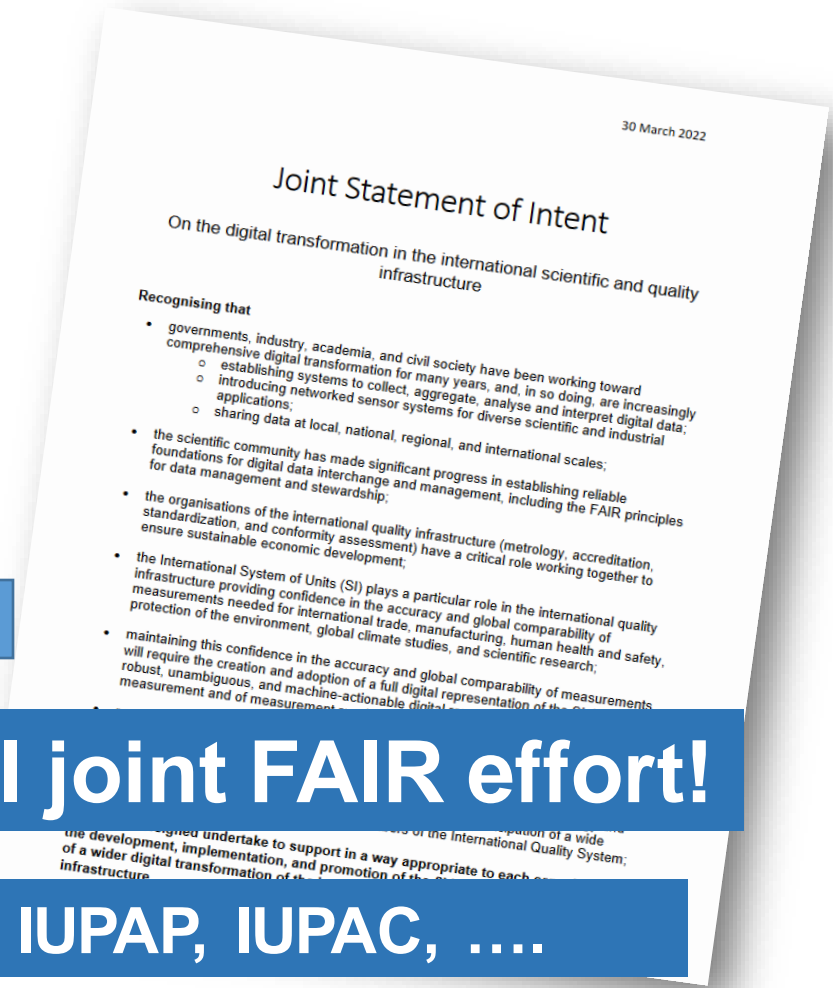
Signing the Joint Statement



NCSLI

... a QI joint FAIR effort!

+ IUPAP, IUPAC, ...



<https://www.bipm.org/en/-/2022-03-30-digital-statement>

Resolution 3

On the extension of the range of SI prefixes

The General Conference on Weights and Measures (CGPM), at its 27th meeting,

recalling that decisions were made at previous meetings when it was considered timely to extend the range of SI prefixes including Resolution 12 (paragraph 3) adopted by the CGPM at its 11th meeting (1960), Resolution 8 adopted by the CGPM at its 12th meeting (1964), Resolution 10 adopted by the CGPM at its 15th meeting (1975), and Resolution 4 adopted by the CGPM at its 19th meeting (1991),

considering

- the essential role of the International System of Units (SI) in providing confidence in the accuracy and global comparability of measurements needed for international trade, manufacturing, human health and safety, protection of the environment, global climate studies and scientific research,
- the benefits of encouraging the use of SI units by providing new SI prefixes for scientific communities that depend on measurements that are not covered by the current range,
- the needs of data science in the near future to express quantities of digital information expressed using orders of magnitude in excess of 10^{24} ,
- the importance of timely action to prevent unofficial prefix names being *de facto* adopted in other communities,

decides to add to the list of SI prefixes to be used for multiples and submultiples of units the following prefixes:

<u>Multiplying factor</u>	<u>Name</u>	<u>Symbol</u>
10^{27}	ronna	R
10^{-27}	ronto	r
10^{30}	quetta	Q
10^{-30}	quecto	q

Resolution 4

On the use and future development of UTC

Resolution 5

On the future redefinition of the second

CGPM 2022 Resolution 4 - On the use and future development of – Universal Coordinated Time (UTC)

decides that the **maximum value for the difference (UT1-UTC) will be increased in, or before, 2035**,
requests that the CIPM consult with the ITU, and other organizations that may be impacted by this decision in order to

- propose a **new maximum value** for the difference (UT1-UTC) that will ensure the continuity of UTC for at least a century,
- prepare a **plan to implement by, or before, 2035 the proposed new maximum** value for the difference (UT1-UTC),
- propose a time period for **the review** by the CGPM of the new maximum value following its implementation, so that it can maintain control on the applicability and acceptability of the value implemented,
- draft a resolution including these proposals for agreement at the 28th meeting of the CGPM (2026),

encourages the BIPM to work with relevant organizations to identify the need for updates in the different services that disseminate the value of the difference (UT1-UTC) and to ensure the correct understanding and use of the new maximum value.

Towards continuous UTC

A CCTF task group was established

- to prepare a draft resolution for CGPM 2026 (new max limit for UT1-UTC, implementation date and procedure)
- to support the preparation to the **ITU World Radio Conference in Nov 2023**

CIPM decision (CIPM/112-14) in its 112th meeting (Session I) in March 2023:

*“**The CIPM** noted that the trend projected by the International Earth Rotation and Reference Systems Service (IERS) would lead to a negative leap second for the first time before 2035 and **asked the CCTF to identify the best way forward and the necessary steps to allow a timely application of Resolution 4** adopted by the CGPM at its 27th meeting (2022) working together with the International Telecommunication Union (ITU)”.*

Working with ITU:

- Strengthened interactions with ITU (MoU, meetings, publications, ..)
- Networking with national and regional ITU delegations to explain Resolution 4 in preparation of the ITU World Radio Conference in Nov 20, 2023

Each NMI Director and MS representative to check his/her national ITU delegation is well informed before World Radio Conference in Nov 20, 2023

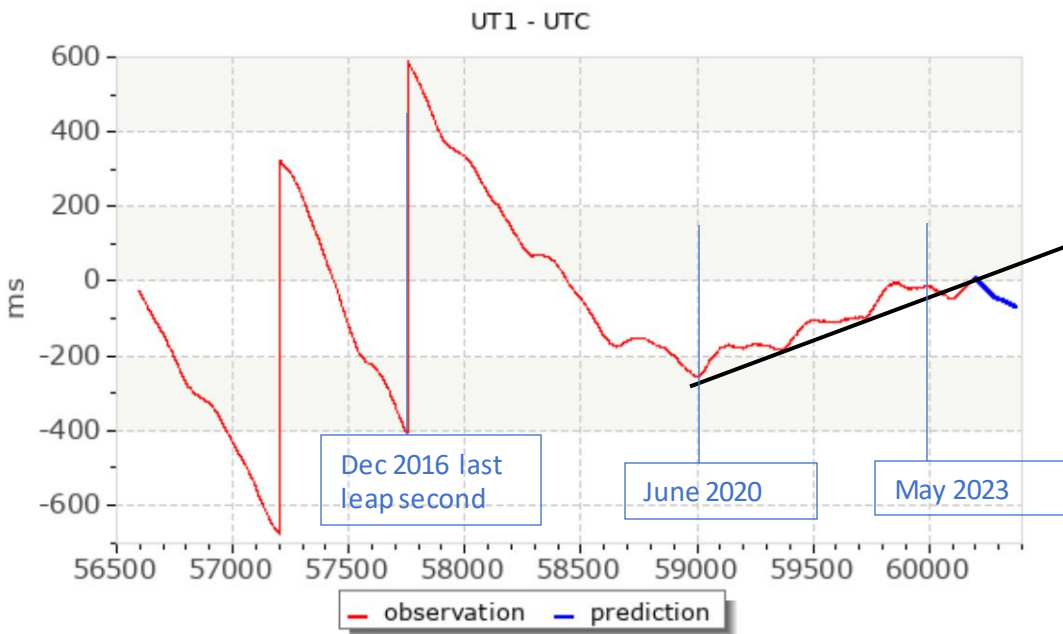
LATEST EARTH ORIENTATION PARAMETERS

Look at the latest evolution of the Earth rotation changes and their prediction

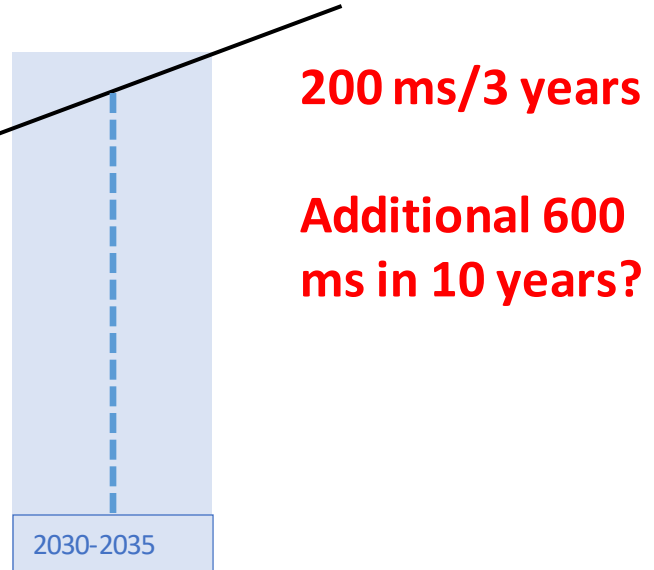
I want to look at the latest days and day prediction Remove tidal variations from UT1/LOD¹

- EOP C04 daily + 182 day prediction
- x / date
- y / date
- Polhody (x,-y)
- UT1-UTC / date
- UT1-TAI / date
- LOD / date
- dψ UAI 1980 / date
- dε UAI 1980 / date
- dX UAI 2000 / date
- dY UAI 2000 / date

Submit request Reset



Is the Earth deciding for us?
Possibility for the first negative leap second in the next decade



CGPM 2022 Resolution 5 - On the future redefinition of the second

encourages the International Committee for Weights and Measures (CIPM)

- to promote the importance of achieving the objectives in the roadmap for the redefinition of the second,
- to bring proposals to the 28th meeting of the CGPM (2026) for the **choice of the preferred species, or ensemble of species** for a new definition of the second, and for the **further steps** that must be taken for a **new definition to be adopted at the 29th meeting of the CGPM (2030)**,

and **invites** Member States to support research activities, and the development of national and international infrastructures, to allow progress towards the adoption of a new definition of the second.

Working towards CGPM 2026

In preparation to CGPM 2026, we need a consensus on:

1. Which definition option, which radiation(s) (or a few possibilities)
2. Clear achievable and verifiable roadmap to satisfy mandatory criteria by 2029



Re-organization of the Task Force for the redefinition of the **second** with membership to ensure an international/all countries point of view:

SG 1 - Redefinition options

Provide analysis of concrete proposals focused on Options 1 (one species) and 2 (ensemble of species)

SG 2 - Criteria

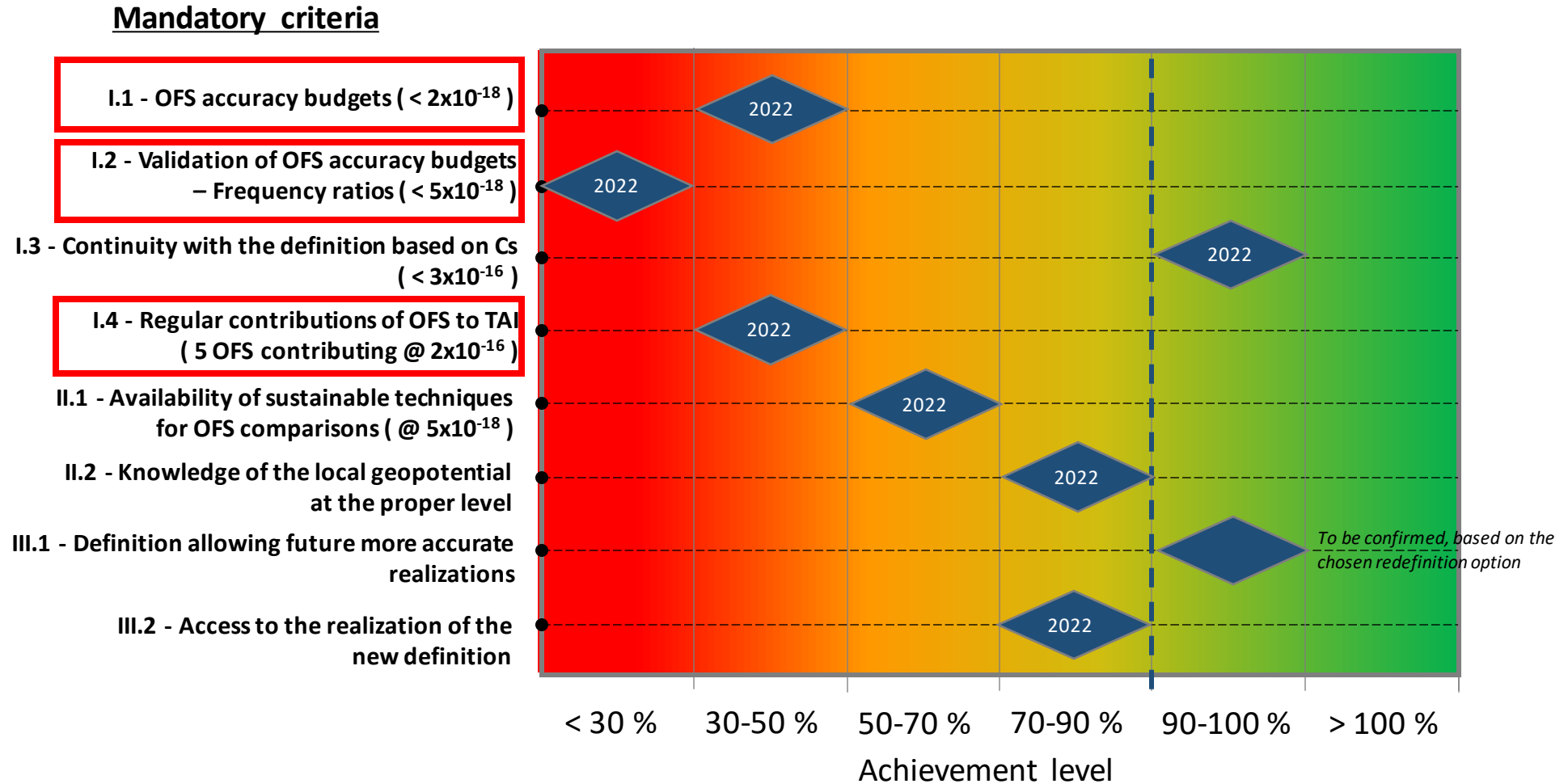
Monitor fulfilment levels of mandatory criteria and promotion of NMIs progress and achievements

SG 3 – Education

Educational activities towards CCTF members, scientific community, stakeholders, teachers, scholars, ...

- Task Force action plan and deliverables to be able to propose at CCTF 2025 and CGPM 2026:
- **a new definition** to be adopted at CGPM 2030
 - **or an update of the roadmap with a postponed redefinition** date if there is no consensus on a preferred option or no insurance that the mandatory criteria are fulfilled before 2030.

Fulfilment level of mandatory criteria (2022)



Resolution 6

On universal adherence to the Metre Convention

invites the CIPM

- to review the membership practices of other international organizations,
- to examine the current application of Article III of the Metre Convention and report to the CGPM at its 28th meeting on how this Article might be applied in order to facilitate lasting and universal adherence to the Convention,
- to consider the implications of wider participation in the work programme and services of the BIPM,
- to propose appropriate actions for consideration by the CGPM at its 28th meeting.

Draft Resolution 7

On the dotation of the International Bureau of Weights and Measures for the years 2024 to 2027

The General Conference on Weights and Measures (CGPM), at its 27th meeting,

considering

- the increased importance of the work of the International Bureau of Weights and Measures (BIPM) to international trade, to industrial innovation, to monitor the global environment, to human health and medicine, to food and forensic science in all Member States,
- the recognition of the BIPM as the scientifically expert intergovernmental organization in metrology and the added value and cost efficiency it provides to all Member States in technical and economic terms,
- the manner in which the BIPM continues to adopt best management practice and to improve the efficiency of its operation,
- Resolution 7 adopted by the CGPM at its 16th meeting (1979) establishing a principle for the determination of the base dotation,

noting

- the current world financial situation and the financial constraints that Member States continue to experience,
- the requirements for the BIPM to develop expertise in the digital transformation of metrology both to transform its own services and to support the work of the CIPM,

welcomes

- the support of all kinds provided to the BIPM by National Metrology Institutes, in particular by way of secondment of staff to the BIPM, and support for the BIPM Capacity Building and Knowledge Transfer programme,

decides that

- the annual dotation of the BIPM, as defined in Article 6 (1921) of the Regulations annexed to the Metre Convention, will be set in such a way that, for those States that are Parties to the Metre Convention at the time of the 27th meeting of the CGPM, it shall be²:

13 161 218 euros in 2024

13 358 636 euros in 2025

13 559 016 euros in 2026

13 762 401 euros in 2027

encourages

- **Member States, as well as international organizations, private organizations and foundations to maintain the provision of additional voluntary support of all kinds to support specific BIPM mission-related activities, particularly those that facilitate participation in the activities of the BIPM by those countries without well-developed metrology infrastructure.**

² Costa Rica is not included in the total dotation because its accession was notified after the CIPM meeting in June 2022.