

Length, Angle and Dimensions

The Consultative Committee for Length (CCL)

The CCL provides a global forum for NMIs on best practices, state of the art and innovations

- Focus Issue of *Metrologia* on Length, 15 papers published (more papers are under review)
- Improved description of the practical realization of the metre (*mise en pratique*)
- Improved accuracy of Coordinate Measuring Machines
- Non-contact dimensional measurements
- Optical scanners, X-ray computed tomography, laser trackers

SI Brochure – 9th edition (2019) – Appendix 2

20 May 2019

Mise en pratique for the definition of the metre in the SI

Consultative Committee for Length

1. Introduction

The purpose of this *Mise en Pratique*, prepared by the Consultative Committee for Length (CCL) of the International Committee for Weights and Measures (CIPM), is to indicate how the definition of the SI base unit, the metre, symbol m, may be realized in practice.

In general, the term 'to realize a unit' is interpreted to mean the establishment of the value and associated uncertainty of a quantity of the same kind as the unit that is consistent with the definition of the unit. A primary method of realizing a unit is a method having the highest metrological properties; whose operation can be completely described and understood; for which a complete uncertainty statement can be written down in terms of SI units; and which does not require a reference standard of the same quantity.

Focus Issue on Length Metrology

Guest editors:
Andrew Nicol, National Physical Laboratory
Andrew Lewis, National Physical Laboratory

Scope
As part of the 2019 redefinition of the SI, the definition of the metre was updated alongside those of the six other base units. At the same time, a substantial change was made to the recommended way of realizing the SI metre in practice (the so-called *Mise en Pratique*) with more explicit guidance given on using the line of light frequency, speed and wavelength measurement methods together with the addition of new traceability routes for dimensional metrology, via the silicon lattice parameter.

In collaboration with the President of the Consultative Committee for Length, the journal *Metrologia* is organizing a Focus Issue on Length Metrology to highlight recent developments in fundamental length metrology and its applications. Papers can be submitted for publication any time up until the call date. Revised papers will be published online (with DOI) immediately after completion of the refereeing process and added to the Focus Issue which will be published later.

For this Focus Issue, contributions are requested which deal with latest research in traceable dimensional and angle metrology, across all length scales, in particular papers which have one or more of the following criteria:

- report on novel research into providing traceability to the SI metre
 - describe work which benefits from the revised metre definition and updated *Mise en Pratique*
 - discuss research being used to address issues and applications in industrial measurement contexts relating to fundamental metrology
 - make contributions to the accuracy of the length-related component of derived units like pressure, acceleration or other units with length-related component
 - report on novel contributions to length-related constants that are of fundamental importance to physics.
- The Focus Issue will be edited by Andrew Nicol and Andrew Lewis from the National Physical Laboratory. Standard Metrology submission and review processes will apply.
- Please inform one of Andrew.Lewis@npl.co.uk or Andrew.Nicol@npl.co.uk in their instance if planning to submit a paper to this special issue.



The CCL facilitates dialogue between NMIs and established stakeholders

Important CCL relationships with NMIs and other international organizations

Members, Observers and Liaisons

- 25 members
- 6 observers



New Member

- NIS (Egypt)

New Observers

- GUM (Poland)
- INTI (Argentina)
- NIMT (Thailand)
- NSC IM (Ukraine)

A liaison between CCL and ISO/TC 213 has been formalized.

ISO/TC 213 is responsible for the ISO-GPS (Geometrical Product Specification) system of standards.

The CCL and the Digital Transformation

Involvement of the CCL in the digitalization project:

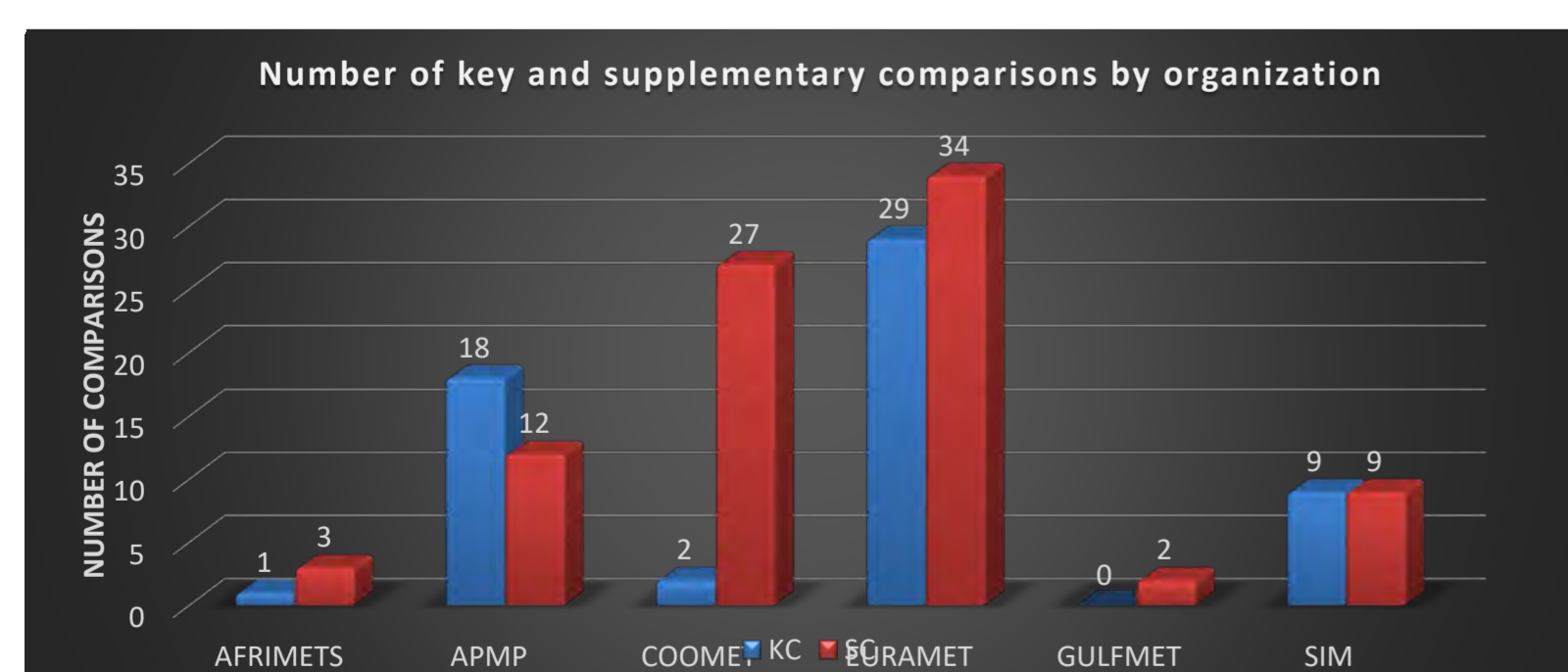
- Pilot survey on the digitalization of the SI metre
- A new Task group (CCL-TG-DIG) has been created for the format of laser frequency data for submission to the CCL-CCTF-WGFS.
- Collaboration with BIPM to develop an API for the MeP (standard frequencies of the Annex 2 of the SI Brochure) for the metre and the second.

This survey is addressed to CCL members to investigate on aspects of a 'digital SI metre' to introduce the discussion on the meaning of 'Digitalization of the SI metre', on the use of it and on how it might benefit all stakeholders in the SI.

Continuous improvement of the global comparability of measurements

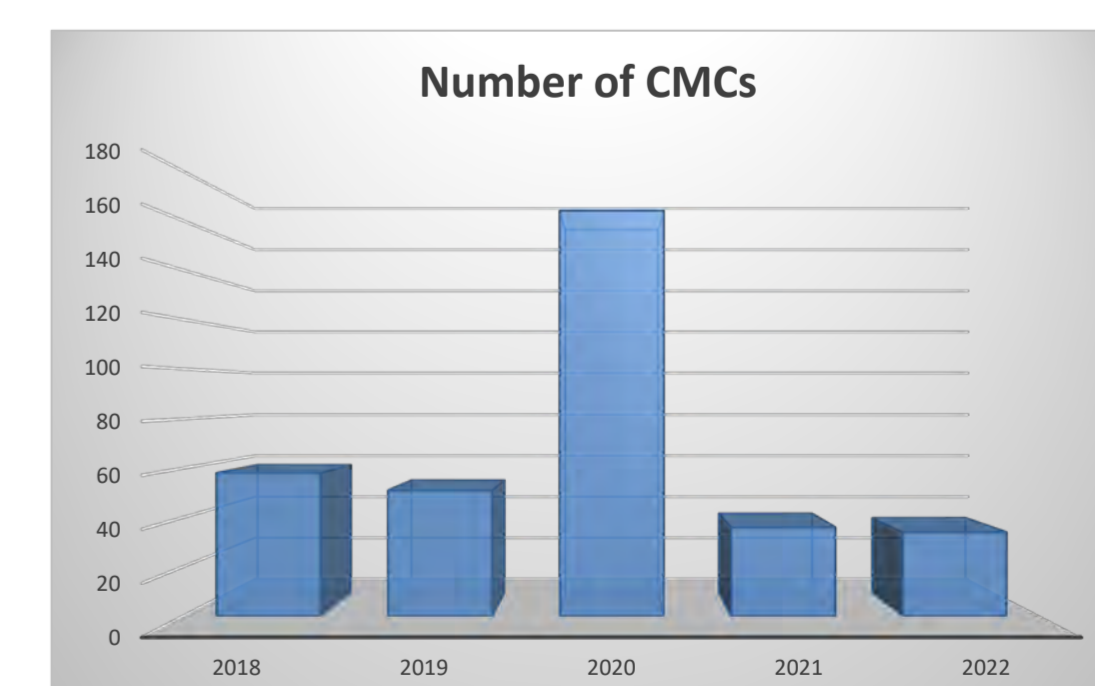
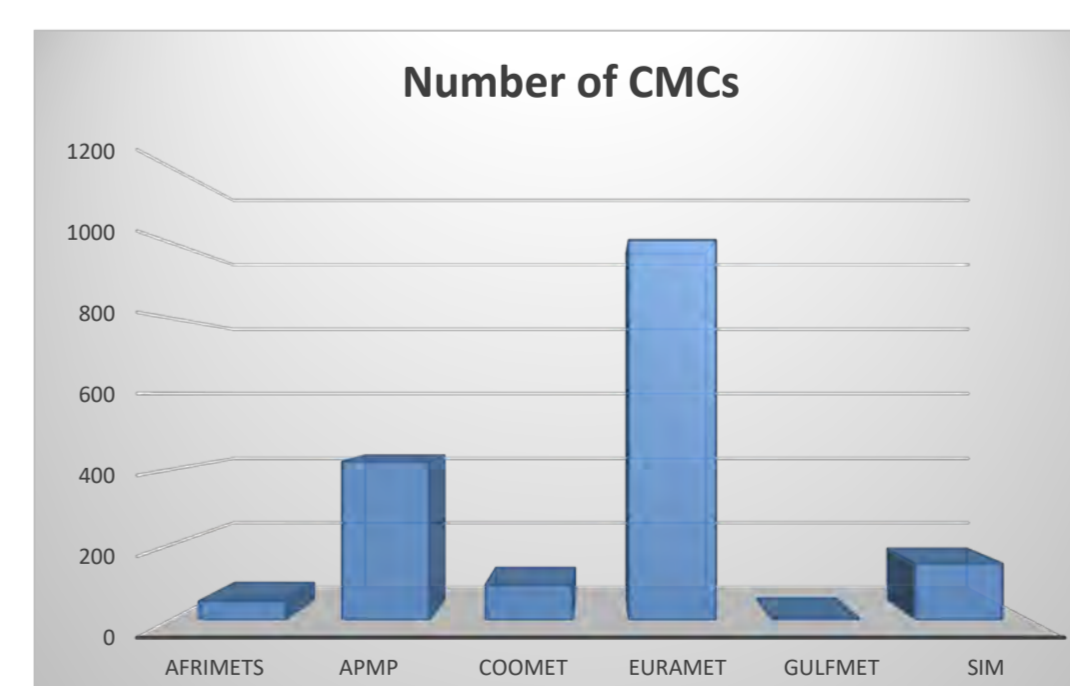
The CCL is the focus for TRACEABILITY in dimensional measurements

- Guidance documentation for comparisons and CMC validation published on the BIPM website for **Open Access**
- New guidelines
 - CCL-GD-08 titled CMCs on frequency stabilized lasers
 - CCL-GD-07 on List of Good Practice Guides and similar sources of information in length metrology
- Harmonized terminology for dimensional metrology in 14 languages - DimVim
- CMC foresight: anticipating workload with corrective actions after comparison reports
- Migration of CMCs in quantity equations is in progress.



The planning process for KCs involves optimization of the resource requirements needed to respond to the needs of its stakeholders.

Total Number of CMCs – 1722
204 laser
1518 dimensional metrology



- Standards organizations (for example ISO)
Significant CCL member presence
- Accreditors and regulators
CCL technical decisions are used by all members to support accreditors and regulators



Science (geodetic measurement for particle accelerators, interferometry for satellite missions, etc.) Energy generation (wind, civil nuclear) - Semiconductor manufacture, Automotive industry, Aerospace industry.