

# Consultative Committee for Length

Ismael Castelazo, CCL President

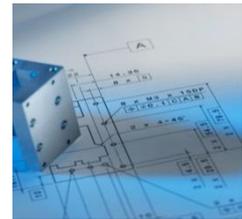
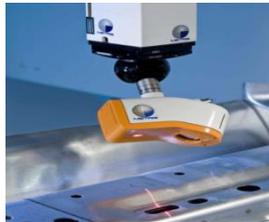
Gianna Panfilo, CCL Executive  
Secretary

**Bureau**  
International des  
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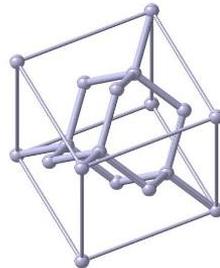
# Global forum for progressing the state-of-the art

- ◆ **Improved description of the practical realization of the metre (mise-en-pratique)**  
Explicit description of time-of-flight and interferometric techniques plus Si lattice parameter as a secondary representation
- ◆ **Secondary representation of the metre for nano dimensional applications**  
Traceability via silicon lattice parameter
- ◆ **Improved accuracy of Coordinate Measuring Machines**  
Increased use for measurements at the NMI level
- ◆ **Non-contact dimensional measurements**  
Optical scanners, X-ray computed tomography, laser trackers



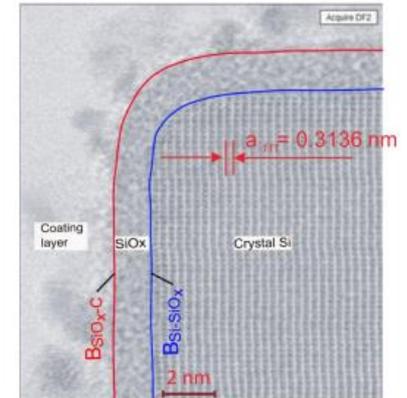
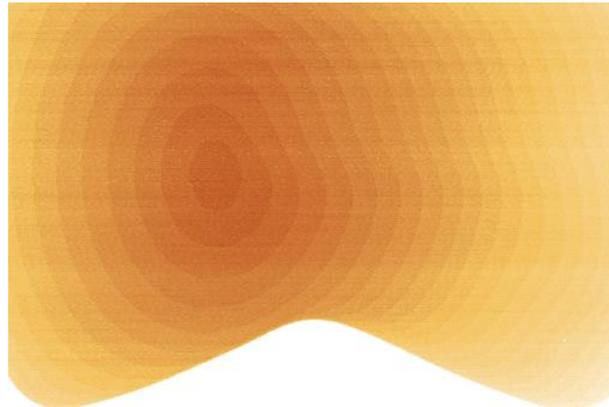
# Secondary representation of the metre for nano dimensional applications

- ◆ Need for a nano dimensional length standard not based on optical fringe division identified by CCL via the CCL WG-N
- ◆ Traceability to metre via silicon lattice parameter
- ◆ Si  $d_{220}$  lattice parameter measured via x-ray interferometry to support Avogadro project and quoted in CODATA
- ◆ Represents a length scale derived from the bottom up and using nature
- ◆ Currently three routes to realization are being incorporated into the updated MeP for the metre



# Use of Si $d_{220}$ lattice parameter

1. Realized via x-ray interferometry which can be used as a 1 dimensional ruler or translation stage with graduations every 192 pm; sub division also possible
2. Silicon monoatomic steps: an amphitheatre of monoatomic steps
3. Counting atoms in pillars of silicon imaged by TEM



# Facilitating dialogue between NMIs and stakeholders

- ◆ **National Metrology Institutes**

  - Inter-NMI Research programmes (e.g. EMPIR)

  - Prioritizing of national programmes

- ◆ **Instrument manufacturers and end users**

  - Major industrial stakeholders include **aerospace, automotive and semiconductor manufacturers** but dimensional metrology touches every aspect of manufacturing

  - “MacroScale” and “NanoScale” conference series

  - Presentations from equipment manufacturers, some end-users and other stakeholders



# Standards organizations, accreditors and regulators

- ◆ **Standards organizations**

- ISO/TC 213 Dimensional and geometrical product specification and verification  
officially accepted a liaison with the CCL

- CCL members play a major role in national, international and industry-based standards organizations

- ◆ **Accreditors and regulators**

- CCL technical decisions are used by members, observers and liaison organizations to support accreditors and regulators

# Global comparability of measurements

- ◆ **A comparison portfolio based on dimensional metrology techniques**

Nine key comparisons test the principal techniques required by a competent dimensional metrology laboratory

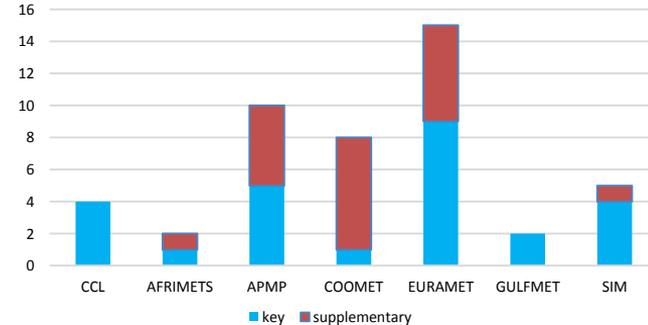
*Example of outreach of the CCL-K1 KC*



- ◆ **CCL-RMO comparisons**

Interlinked RMO comparisons improve the efficiency of the process where there are insufficient numbers of laboratories offering a service to make the classical scheme (of CCL and multiple RMO comparisons) worthwhile

*46 Active Comparisons*

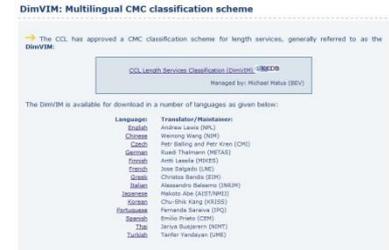


# Guidance on CMCs and comparisons

## ◆ CCL Length Services Classification scheme (DimVIM)

Has been translated into 14 languages and has served as a template for other CCs, accreditation bodies, and other organizations.

<https://www.bipm.org/en/committees/cc/ccl/dimvim.html>



## ◆ Guidance documents

Guidance documents and templates have been developed on formatting CMCs, conducting comparisons, model protocols and final reports.

<https://www.bipm.org/en/committees/cc/ccl/publications-cc.html>



Thank you very much  
for your attention.

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