

# Report from the BIPM... .... to the 11<sup>th</sup> EURAMET General Assembly

Andy Henson

BIPM

16 May 2017

**Bureau**  
♦ **International des**  
♦ **Poids et**  
♦ **Mesures**



# Outline

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**01 – Member States and Associates**



**02 – CIPM MRA participation**



**03 – The SI – Redefinition and progress**



**04 – World Metrology Day**



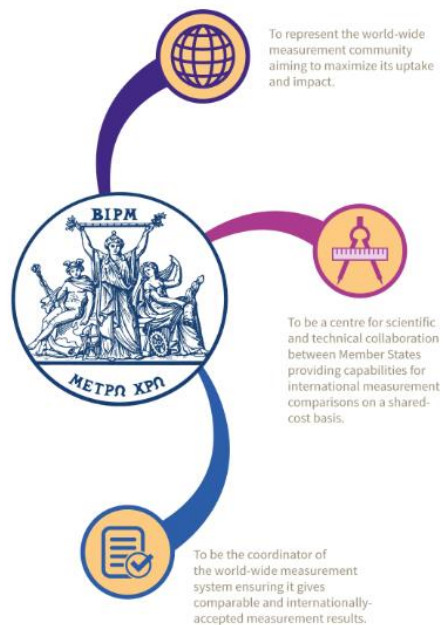
**05 – BIPM Capacity Building & Knowledge Transfer Programme**



**06 – CIPM MRA Review - progress**



## THE OBJECTIVES OF THE BIPM



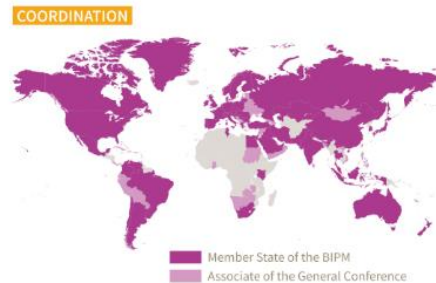
Fulfilling our mission and objectives is underpinned by our work in:

- 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.

## THE VISION AND MISSION OF THE BIPM

The BIPM is an 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 recognized 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.



# Member States and Associates

As of today, there are:

- 58 Member States of the BIPM
- 41 Associates of the CGPM

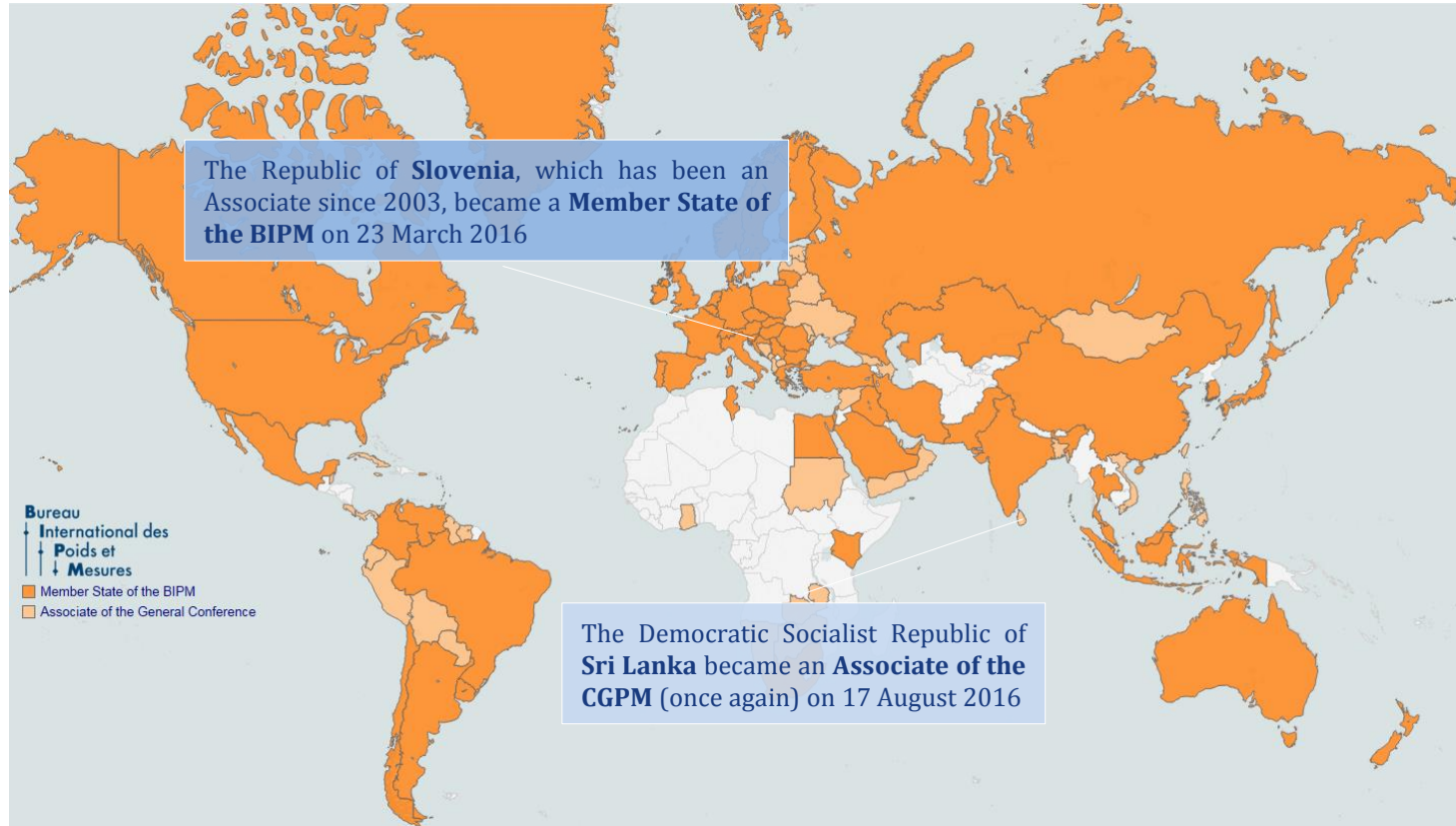
EURAMET:

Member States  
of the BIPM

27

Associates of  
the CGPM

8



# CIPM MRA participation today



## Objectives:

- to establish the **degree of equivalence** of national measurement standards maintained by NMIs
- to provide for the **mutual recognition of calibration and measurement certificates** issued by NMIs

## Participation

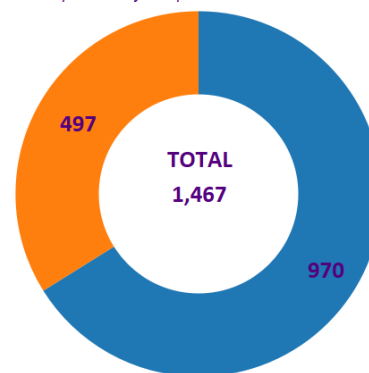
- 98 National Metrology Institutes**
  - 57 Member States
  - 41 Associates
- 4 International organizations**  
(ESA, IAEA, IRMM, WMO)
- plus 156 Designated Institutes**

**Total: 258 Institutes**



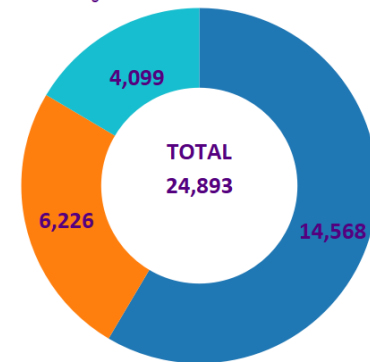
**Comparisons**

- Key comparisons
- Supplementary comparisons



**CMC area**

- General physics
- Chemistry
- Ionizing Radiation



# Regional Metrology Organizations

| RMO      | Year Founded | Member States of the BIPM | Associates of the CGPM |
|----------|--------------|---------------------------|------------------------|
| AFRIMETS | 2007         | 4                         | 8                      |
| APMP     | 1980         | 11                        | 7                      |
| COOMET   | 1991         | 2                         | 6                      |
| EURAMET  | 1987         | 27                        | 8                      |
| GULFMET  | 2009         | 2                         | 3                      |
| SIM      | 1988         | 9                         | 8                      |



# Associates Encouraged to Become Member States (update)

**RESOLUTION 4 of the 24<sup>th</sup> CGPM (2011):**  
Associates who have been encouraged to become a Member States

Discussions re transition AS to MS:

- Bosnia Herzegovina

| Associate               | Date meeting criteria | Period of increasing subscription |        |
|-------------------------|-----------------------|-----------------------------------|--------|
|                         |                       | Start                             | 90% MS |
| Belarus                 | in 2011               | 2013                              | 2017   |
| Costa Rica              | in 2011               | 2013                              | 2017   |
| Cuba                    | in 2011               | 2013                              | 2017   |
| Ecuador                 | in 2011               | 2013                              | 2017   |
| Jamaica                 | in 2011               | 2013                              | 2017   |
| Latvia                  | in 2011               | 2013                              | 2017   |
| Panama                  | in 2011               | 2013                              | 2017   |
| Ukraine                 | in 2011               | 2013                              | 2017   |
| Viet Nam                | in 2011               | 2013                              | 2017   |
| Albania                 | April 2013            | 2015                              | 2019   |
| Macedonia, the FYR of   | July 2013             | 2015                              | 2019   |
| Moldova, Republic of    | September 2013        | 2015                              | 2019   |
| Estonia                 | May 2014              | 2016                              | 2020   |
| Georgia                 | May 2014              | 2016                              | 2020   |
| Paraguay                | May 2014              | 2016                              | 2020   |
| Peru                    | May 2014              | 2016                              | 2020   |
| Republic of Philippines | December 2013         | 2016                              | 2020   |
| Bolivia                 | July 2016             | 2018                              | 2022   |
| Bosnia Herzegovina      | May 2016              | 2018                              | 2022   |
| Montenegro              | August 2016           | 2018                              | 2022   |

Step on ladder:

5

3

2

0



# The base units of the SI

3 definitions based on **fundamental (or conventional) constants**:

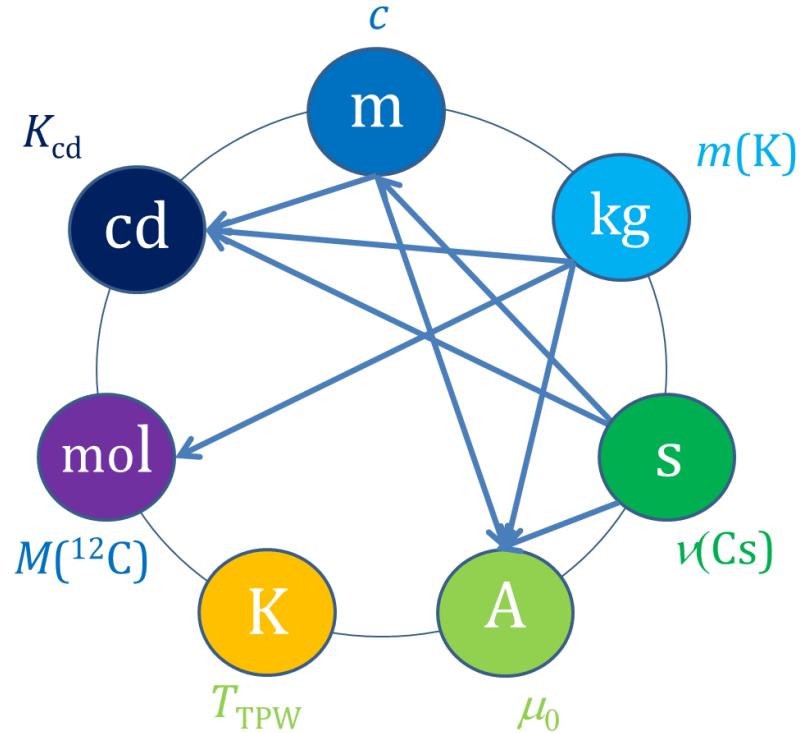
- metre ( $c$ )
- ampere ( $\mu_0$ )
- candela ( $K_{\text{cd}}$ )

3 definitions based on **material properties**:

- second ( $^{133}\text{Cs}$ )
- kelvin ( $\text{H}_2\text{O}$ )
- mole ( $^{12}\text{C}$ )

1 definition based on an **artefact**:

- kilogram (IPK)





# The definition of the kilogram in the SI

**The kilogram is the unit of mass -  
it is equal to the mass of the  
international prototype of the kilogram.**

- manufactured around 1880 and ratified in 1889
- represents the mass of 1 dm<sup>3</sup> of H<sub>2</sub>O at its maximum density (4 °C)
- alloy of 90% Pt and 10% Ir
- cylindrical shape,  $\varnothing = h \sim 39$  mm
- kept at the BIPM in ambient air

**The kilogram is the last SI base  
unit defined by a material artefact.**



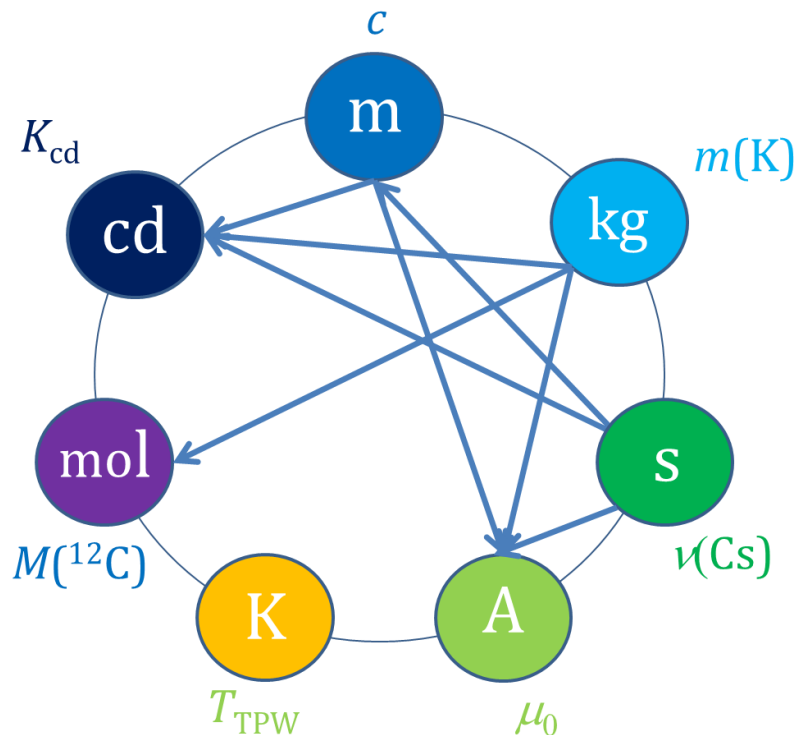
# Proposal for 4 new definitions

Definitions based on **fundamental (or conventional) constants**:

- metre ( $c$ )
- kilogram ( $h$ )
- ampere ( $e$ )
- candela ( $K_{\text{cd}}$ )
- mole ( $N_{\text{A}}$ )
- kelvin ( $k$ )

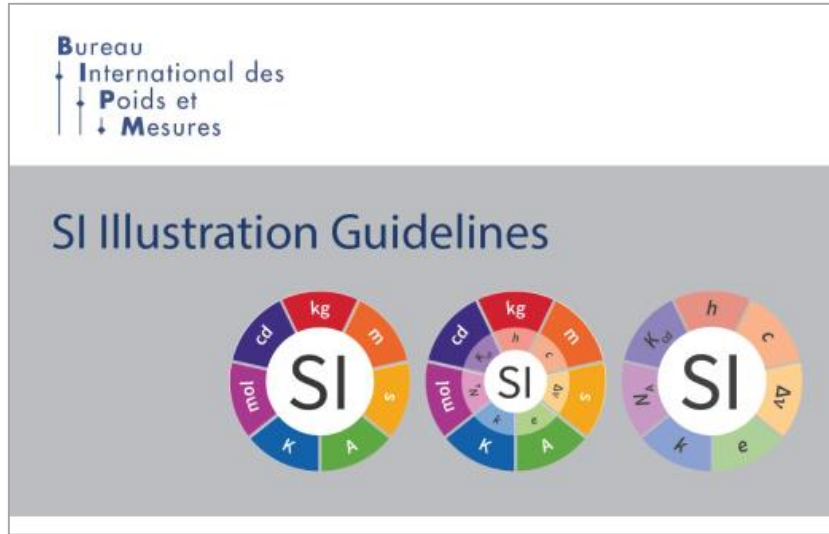
Definition based on **material property**:

- second ( $^{133}\text{Cs}$ )



(I. Mills et al., *Metrologia*, 2006, 43, 227-246)

# The SI – Redefinition and progress



- *Redefinition is expected at the CGPM in November 2018*
- *....BUT...depends on data accepted for publication up to 1 July 2017!*
- *Implementation date 20 May 2019*
- *The Task Group on raising of the public awareness has been created*
- *It has developed a 'brand book' supporting redefinition: will be available on the BIPM website soon.*
- *The awareness campaign will be launched on May 20 (WMD) 2018 and run through to 20 May 2019.*

# World Metrology Day joint BIPM and OIML initiative



EURAMET competition launched!

# Growing impact of World Metrology Day



[www.worldmetrologyday.org](http://www.worldmetrologyday.org)

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## World Metrology Day Past Posters and Websites

The posters from previous years may be downloaded from this page,  
as may the web sites of the 2010, 2011, 2012, 2013, 2014, 2015 and 2016 events.

| Year                      | Theme  | PDF A4 size |
|---------------------------|--|-------------|
| <b>2016</b><br>[Web site] | Measurements<br>in a dynamic world                 |             |
| <b>2015</b><br>[Web site] | Measurements<br>and Light                          |             |
| <b>2014</b><br>[Web site] | Measurements<br>and the global<br>energy challenge |             |
| <b>2013</b><br>[Web site] | Measurements<br>in daily life                      |             |



# World Metrology Day 2017 - “Measurements for transport”



The needs for new and improved means of transport are clear, it is also important that they meet increasing requirements for economy and environmental performance. Some of the most demanding that are underpinned by the work of national metrology institutes include:



accurate and rapid weighing of shipping containers to ensure the safe loading of container ships



characterisation of low friction surfaces and aerodynamic shapes of aircraft to minimize fuel consumption



valid measurements of the chemical composition of vehicle emissions to support regulators and city authorities in controlling pollution levels

# World Metrology Day 2017 - “Measurements for transport”



Safety of Life at Sea (SOLAS) convention requires verification of container weights before loaded containers may be placed aboard ships.

## ***Accurate weighing of shipping containers required for:***

- *Reducing the number of accidents of container ships*
- *Securing the cargo*
- *Application of tax legislation of different countries*
- *Reducing transportation costs*
- *Meeting regulatory requirements*

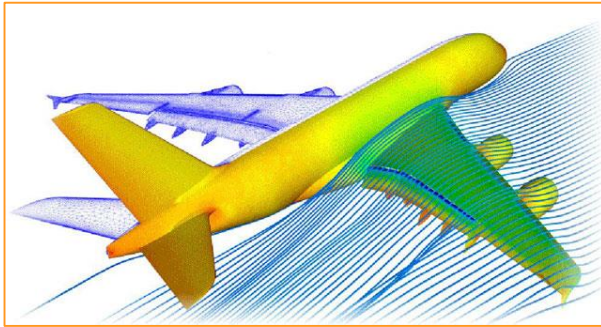




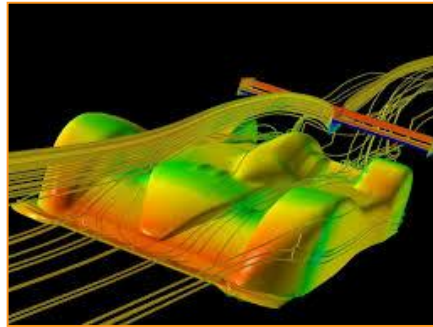
# World Metrology Day 2017 - “Measurements for transport”



Characterisation of low friction surfaces and aerodynamic shapes of aircraft to minimize fuel consumption



*Less fuel = lower emissions and cost*



*Aerodynamics is the utmost important factor in Formula One car performance*



*Minimizing the aerodynamic drag of the train remains a key issue for high-speed trains*

# World Metrology Day 2017 - “Measurements for transport”



Valid measurements of the chemical composition of vehicle emissions to support regulators and city authorities in controlling pollution levels

*The air pollutant emissions from transport are a significant contribution to the overall state of air quality in the world*



*Tough requirements change the technology of vehicles*



# CBKT Programme goals

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**The BIPM Capacity Building and Knowledge Transfer Programme (CBKT) aims to:**

- ◆ reinforce the international metrology system and balance the load among NMIs
- ◆ promote efficient operation of the system
- ◆ aid NMIs from countries and economies with emerging metrology systems engage appropriately and effectively

## Three main thrusts:

Focused capacity building opportunities (typically) at the BIPM

01

Engagement with the Global QI capacity building community

02

Scientific comparisons of particular interest to Member States that are developing countries

03

*The programme is open to ideas from sponsors that contribute to the objectives*

## Within the broad objectives, the sponsor agrees with BIPM:

- ♦ Which type of action they wish to support;
- ♦ The specific topic;
- ♦ Whether to open to Associates;
- ♦ Whether to focus on supporting particular regions.

# CBKT Initiatives

## COMPLETED INITIATIVES



- 2016 BIPM-IPS joint Varenna Metrology School and METAS project
- 2016 "Leaders of Tomorrow" course
- 2016 "BIPM-GULFMET TC Workshop"
- 2017 BIPM-EURAMET TC leadership course

## ONGOING INITIATIVES



- 2016 - 2018 "Metrology for Safe Food and Feed in Developing Economies" project
- 2016 - 2019 Metrology for clean air: capabilities in gas metrology
- 2017–2018 "Support for GULFMET key comparison of Zener voltage standards" project

## FUTURE INITIATIVES



- 2017 "Sound beginning in the CIPM MRA" course
- 2018 "BIPM- TÜBİTAK UME project placements"

A number of other  
ideas under  
development.  
We are open for  
suggestions



## COMPLETED INITIATIVES: 2016 "Leaders of Tomorrow" course

| 2016 "Leaders of Tomorrow" course |                    |              |
|-----------------------------------|--------------------|--------------|
| RMOs                              | Countries          | Participants |
| <b>AFRIMETS - 6</b>               | South Africa       | 3            |
|                                   | Kenya              | 2            |
|                                   | Egypt              | 1            |
| <b>APMP - 1</b>                   | Thailand           | 1            |
| <b>COOMET - 2</b>                 | Belarus            | 1            |
|                                   | Ukraine            | 1            |
| <b>EURAMET - 1</b>                | Bosnia/Herzegovina | 1            |
| <b>GULFMET - 1</b>                | Saudi Arabia       | 1            |
| <b>SIM - 7</b>                    | Argentina          | 1            |
|                                   | Panama             | 1            |
|                                   | Canada             | 1            |
|                                   | Costa Rica         | 1            |
|                                   | Mexico             | 1            |
|                                   | Brazil             | 1            |
|                                   | USA                | 1            |
| <b>Total 15 countries</b>         |                    | <b>18</b>    |



*Dr Lucas di Lillo shares his experiences on CMC review process*



*Group work on CMC review*



## COMPLETED INITIATIVES: 2016 GULFMET-sponsored training Workshop

| 2016 "BIPM-GULFMET TC Workshop" |                 |              |
|---------------------------------|-----------------|--------------|
| RMOs                            | Countries       | Participants |
| GULFMET                         | Bahrain         | 3            |
|                                 | Oman            | 2            |
|                                 | Qatar           | 3            |
|                                 | Saudi Arabia    | 9            |
|                                 | State of Kuwait | 3            |
|                                 | UAE             | 24           |
| Total 6 countries               |                 | 44           |

*This workshop provided the attendees first-hand training from Mr Andy Henson of the BIPM on both requirements and practical knowledge for running successful measurement comparisons, and submitting and reviewing CMCs, as well as Quality Systems.*



*GULFMET technical committee members*





## COMPLETED INITIATIVES: 2017 BIPM-EURAMET TC leadership course

| 2017 BIPM-EURAMET "TC Leadership" course |                       |              |
|--|-----------------------|--------------|
| RMOs                                     | Countries             | Participants |
| EURAMET                                  | Austria (1 NMI, 1 DI) | 2            |
|  | Bosnia & Herzegovina  | 2            |
|  | Spain (2 NMI, 1 DI)   | 3            |
|  | Turkey                | 1            |
|  | Belgium               | 1            |
|  | Germany               | 2            |
|  | Czech Republic        | 1            |
|  | Sweden (1 NMI, 1 DI)  | 2            |
|  | Romania               | 1            |
|  | Poland                | 1            |
|  | Slovakia              | 1            |
|  | Switzerland           | 1            |
| Total 12 countries                       |                       | 18           |



*'Hands-on' discussion on how metrologists around the world can work together with the aim of ensuring the reliability of CMCs published in the KCDB.*



*Dr Andrew Lewis (NPL) coaching participants during a group working session*



# FUTURE INITIATIVES: 2017 "Sound beginning in the CIPM MRA" course

## NIST sponsored 11 day course

Training aimed at relevant staff from NMIs that have signed the CIPM MRA but not yet submitted CMCs (or are early in the process)  
Will help both, to optimize the NMI success rates and minimize the burden on the wider community that will conduct the reviews.

### **Applications:**

The application period for the course has now closed.

### **Course dates:**

13 to 24 November 2017

### **Location:**

BIPM, Sevres

*Places favoured Africa and Americas*

The screenshot shows the BIPM website with the following content:

- Bureau International des Poids et Mesures** – the intergovernmental organization through which Member States act together on matters related to measurement science and measurement standards.
- Search facility:
- Site map | News | Contact us
- Navigation menu: ABOUT US | WORLDWIDE METROLOGY | INTERNATIONAL EQUIVALENCE | MEASUREMENT UNITS | SERVICES | PUBLICATIONS | MEETINGS
- Breadcrumb: > You are here: BIPM CBKT programme > "Sound beginning in the CIPM MRA"
- 2017 "Sound beginning in the CIPM MRA" course**
- The "Sound beginning in the CIPM MRA" course is aimed at technical staff (those responsible for metrology service development and/or quality systems) from NMIs that have signed the CIPM MRA but not yet submitted CMCs (or are early in the process). Training will aim to help debutant NMIs achieve 'right first time' submissions into the CMC peer review system. Training will also give a deeper understanding of the global quality infrastructure and the role of its key elements. A session on priority setting will provide participants with a tool to set relevant metrology goals for their NMIs. This will help both optimize the NMI success rates and minimize the burden on the wider community that will conduct the reviews.
- Application process:**  
The application period for the course has now closed. Candidates will be selected and notified of their placement in the course by 17 April 2017.
- Programme:**  
Preliminary agenda
- Financial support:**  
The course is fully funded by NIST. Support is available for selected applicants covering course participation, air fare, hotel costs and subsistence allowance.
- Course dates:**  
13-24 November 2017, at the BIPM.
- NIST National Institute of Standards and Technology**  
U.S. Department of Commerce
- Capacity Building & Knowledge Transfer** (in a green box)



# FUTURE INITIATIVES: 2017 "Sound beginning in the CIPM MRA" course

Based on group work sessions and case studies.

## BIPM Capacity Building & Knowledge Transfer Programme

### 2017 "Sound beginning in the CIPM MRA" course

#### PRELIMINARY AGENDA

Course Dates: 13 to 24 November, 2017

Location: BIPM, Sèvres Cedex, France

Course content and dates of instruction may change marginally.

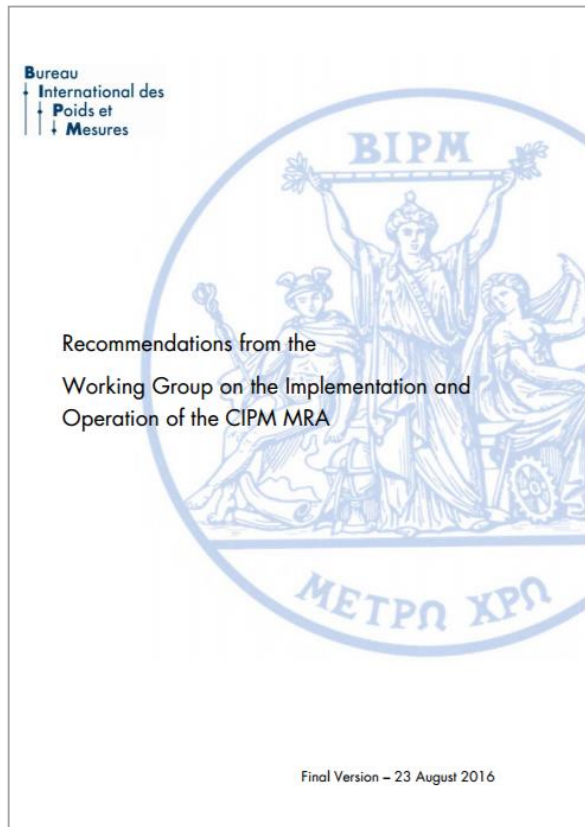
| Date                          | Course Topic  | Outline of content  | Instructors   |
|-------------------------------|---|---|---|
| <b>Week 1</b>                 |   |   |   |
| Day 1<br>Monday<br>Nov. 13    | Global Quality infrastructure and its key components  | <ul style="list-style-type: none"> <li>Importance of Quality Infrastructure</li> <li>International organizations (BIPM, OIML, ISO, ILAC)</li> <li>Roles and responsibilities</li> <li>Role of metrology</li> </ul>  | Invited lecturers BIPM, OIML, ISO, ILAC                 |
| Day 2<br>Tuesday<br>Nov. 14   | Introduction to the Meter Convention, the CIPM MRA and its role in the wider quality infrastructure | <ul style="list-style-type: none"> <li>Interactions with NMI Directors, Member States and Associates</li> <li>Roles and responsibilities specifically related to the CIPM MRA (including JCRB)</li> <li>Roles of Designated Institutes</li> <li>CIPM Requirements and documentation</li> <li>Intra-regional CMC review process</li> <li>JCRB – inter-regional CMC review process</li> <li>KCDB – search facilities</li> </ul> | BIPM  |
| Day 3<br>Wednesday<br>Nov. 15 | Quality management systems<br>Regional metrology organization approaches and specifics              | <ul style="list-style-type: none"> <li>CIPM requirements and documentation on quality system</li> <li>RMO approaches in quality systems and specifics</li> <li>How to organize a metrological laboratory</li> <li>How to establish a quality system acceptable to the RMO</li> <li>Certificates with the CIPM MRA logo and Statement</li> </ul>   | BIPM, Invited lecturers<br>Leading NMI quality managers |
|                               |   | <b>Group work on Quality:</b><br>Establishing metrology laboratory<br>+ Case study  | Expert from Developing NMI                              |
| Day 4<br>Thursday<br>Nov. 16  | Measurement comparisons   | <ul style="list-style-type: none"> <li>CIPM Requirements and documentation</li> <li>Roles and responsibilities in the comparison process</li> <li>Key measurement comparisons (BIPM and CC, RMO)</li> <li>Supplementary measurement</li> </ul>  | BIPM, Invited lecturers<br>Leading                      |

DOCUMENT CB&KT-SB/E/1  
Author: BIPM  
Version 1

DOCUMENT CB&KT-SB/E/1  
Author: BIPM  
Version 1

|                               |  |  |   |
|-------------------------------|--|--|---|
|                               |  | <ul style="list-style-type: none"><li>comparisons</li><li>• Participating in measurement comparisons</li><li>• Planning and monitoring measurement comparisons</li><li>• Piloting a measurement comparisons</li><li>• Calculation of reference values and associated uncertainties</li><li>• Writing Comparison Reports</li><li>• Common pitfalls</li></ul>  | NMI technical experts<br><br>+<br><br>Expert from Developing NMI                                    |
|                               | <b>Group work on comparisons:</b><br><i>How to participate in comparisons?</i><br><i>How to pilot a comparison?</i><br>+ Case study  |  |   |
| Day 5<br>Friday<br>Nov. 17    | Calibration and measurement capabilities   | <ul style="list-style-type: none"><li>• CIPM Requirements and documentation</li><li>• Roles and responsibilities in the CMC process</li><li>• Traceability requirements</li><li>• Preparing CMCs, including supporting evidence</li><li>• Developing uncertainty budgets including consistency with supporting evidence</li><li>• Practical exercise from developing of Excel tables of CMCs to submission</li><li>• Submission of CMCs for regional review and communication with RMO</li><li>• Communication with CMCs Inter-regional review experts</li></ul> | BIPM, Invited lecturers<br><br>Leading NMI technical experts<br><br>+<br>Expert from Developing NMI |
|                               | <b>Group work on CMCs:</b><br><i>How to prepare CMCs and how to modify it?</i><br>+ Case study<br><i>Hitting the target homework</i> |  |   |
| <b>Week 2</b>                 |  |  |   |
| Day 6<br>Monday<br>Nov. 20    | <i>Hitting the target session</i>  | <ul style="list-style-type: none"><li>• Step 1: Define the Impact / Goal</li><li>• Step 2: Define the Purpose / Outcome</li><li>• Step 3: Define the Outputs</li><li>• Step 4: Define the Activities</li><li>• Step 5: Check the vertical logic back up Column</li><li>• Step 6: Define the assumptions at each level</li><li>• Step 7: Re-check the design logic</li></ul>  | External consultant   |
| Day 7<br>Tuesday<br>Nov. 21   | <i>Hitting the target session</i>  |  |   |
| Day 8<br>Wednesday<br>Nov. 22 | <i>Hitting the target session</i>  |  |   |
| Day 9<br>Thursday<br>Nov. 23  | Brainstorming and participants' presentation on their implementation plans   | Implementation of the CIPM MRA<br>How to achieve 'right first time' submissions into the CMC peer review system  | BIPM, Invited lecturers   |
| Day 10<br>Friday<br>Nov. 24   |  |  |   |

# CIPM MRA Review



- ◆ 15 years of successful operation
- ◆ Review triggered at the 2014 CGPM, and conducted by a working group in 2015/2016
- ◆ Extensive workshop and consultation process (NMIs, CCs, JCRB, RMOs, BIPM, ILAC...)
- ◆ 9 Recommendation, 28 action items
- ◆ **Now in the implementation phase**

<http://www.bipm.org/en/cipm-mra-review/>

# CIPM MRA Review progress – Key Points

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Overarching principles:

- ◆ maintain high levels of quality and integrity
- ◆ continue to be inclusive and be built on the appropriately demonstrated and documented assessment of capabilities between the NMIs
- ◆ Reaffirms the purpose of the CIPM MRA:
  - *“establishing the degree of equivalence of national measurement standards maintained by NMIs and DIs;*
  - *providing for the mutual recognition of calibration and measurement certificates issued by NMIs and DIs;*

thereby providing governments and other parties with secure technical foundations for wider agreements related to international trade, commerce and regulatory affairs

# CIPM MRA Review progress – Key Points

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General (continued):

- ◆ the total effort should not rise and should be reduced where possible.
- ◆ steps should be taken to spread the load more widely.
- ◆ the KC/CMC processes should be tailored according to the risk and complexity of the issues being handled.
- ◆ there is a need to upgrade the KCDB and the JCRB databases using new modern IT tools.

## Plus: *Voice of the people*

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- ◆ Use of outdated EXCEL versions and non-validated CMC files produces errors and delays in CMC submissions/revisions
- ◆ Requirements for supporting evidence (QMS, technical) can not be enforced currently: many submissions occur without QMS evidence
- ◆ Batching and debatching (for review purposes) using EXCEL is cumbersome and leads to errors
- ◆ Batched CMC submissions can delay publications if there are problematic entries
  - *CMC review takes too long*
- ◆ Web searching of published CMCs is difficult
- ◆ Comparing published CMCs with similar parameters (ranges, etc.) is difficult

*At current rates of CMC submissions, legacy CMCs will still outnumber new submissions for the next 10 to 20 years*

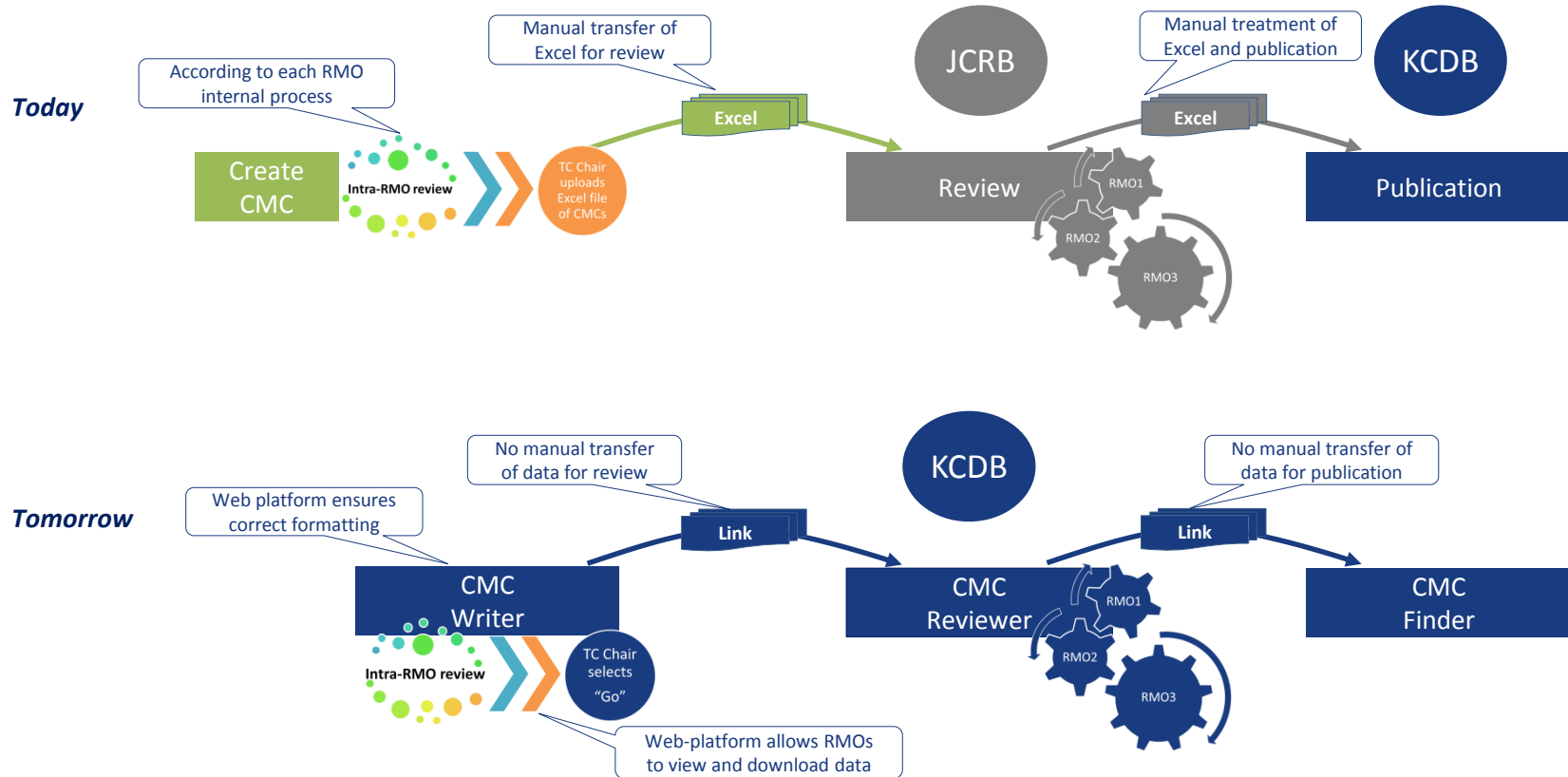


# BIPM process toward KCDB 2.0

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- ◆ External consultancy in August/September 2015 on possible modifications and resources.
- ◆ Input from the NMIs, RMOs, CCs and JCRB and the BIPM and in particular the ***Recommendations from the Working Group on the Implementation and Operation of the CIPM MRA*** guides us towards the specification.
- ◆ **Information solicited from CCs**
- ◆ Information of possible improvements were communicated to the JCRB in March 2017 ***and discussed at JCRB***
- ◆ We do not expect Appendix B (comparisons) to have significant changes
- ◆ Not everything presented may - in the end – prove to be possible/affordable!

# KCDB 2.0 – *General concept*



# BIPM Secondees and guest workers

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**Dr Xiamin Li**, from NIM (China) - BIPM Chemistry Department from 27 February 2017 to 26 February 2018.

**Dr Xiuqin Li**, from NIM (China) - BIPM Chemistry Department from 15 April 2016 to 15 April 2017.

**Dr Kun Liang**, from NIM (China) - BIPM Time Department from 3 January 2017 to 29 December 2017.

**Dr Haoran Liu**, from NIM (China) - BIPM Ionizing Radiation Department from 3 February 2017 to 31 July 2017.

**Dr Christopher Meyer**, from NIST (USA) - BIPM Chemistry Department from 16 January 2017 to 31 July 2017.

**Dr Eliane Pires Do Rego**, from INMETRO (Brazil) - BIPM Chemistry Department from 1 February 2017 to 30 April 2017.

**Dr Mariano Ernesto Simón**, from INTI (Argentina) - BIPM Chemistry Department from 1 February 2017 to 30 April 2017.

**Dr Zhang Tiqiang**, from NIM (China) - BIPM Chemistry Department from 1 November 2016 to 30 April 2017.

**Dr Frank Torma**, from LGC (UK) - BIPM Chemistry Department from 1 February 2017 to 14 April 2017.

**Dr Taichi Yamazaki**, from NMIJ (Japan) - BIPM Chemistry Department from 1 March 2017 to 31 August 2017.

**Dr Steven Yang**, from SCL (Hong Kong) - BIPM Physical Metrology Department from 9 January 2017 to 13 March 2017.

**Mr Nikita Zviagin**, from VNIIM (Russian Federation) - BIPM ILC Department from 1 January 2017 to 31 December 2018.

**Dr Désirée PREVOO-FRANZSEN**, seconded from the NMISA (South Africa) to the Chemistry Department from 2 May to 31 August 2017.

**Dr Sornkrit MARBUMRUNG**, seconded from the NIMT (Thailand) to the Chemistry Department from 2 May to 31 July 2017.

**Dr Isaac MUGENYA**, seconded from the KEBS (Kenya) to the Chemistry Department from 2 May to 31 July 2017.

**Dr Jeong Sik LIM**, seconded from the KRISS (Rep. of Korea) to the Chemistry Department from 2 May to 31 July 2017.

**Dr Ming Li**, seconded from the NIM (China) to the Chemistry Department from 20 April 2017 to 19 July 2018.

# Upcoming meetings and events at the BIPM

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From 9 to 19 May 2017

From 15 to 19 May 2017

From 29 May to 2 June 2017

From 12 to 30 June 2017

From 13 to 14 June 2017

1<sup>st</sup> July 2017

4 September 2017

From 5 to 6 September 2017

From 13 to 14 September 2017

From 19 to 22 September 2017

From 28 to 29 September 2017

From 16 to 20 October 2017

From 18 to 19 October 2017

From 13 to 24 November 2017

From 13 to 16 November 2018

Meetings of the JCGM, GUM, and VIM

16<sup>th</sup> meeting of the CCM

28<sup>th</sup> meeting of the CCT and working groups

Meetings of the CCRI

Meeting of CC Presidents

Cut-off date for data to be accepted for the CODATA-2017 adjustment

CODATA Task Group on Fundamental Constants

23<sup>rd</sup> meeting of the CCU

38<sup>th</sup> meeting of the JCRB

11<sup>th</sup> meeting of the CCAUV (and related meetings)

[BIPM Workshop: The Quantum Revolution in Metrology](#)

106<sup>th</sup> meeting of the CIPM (on 16, 17 and 20 Oct.)

Meeting of NMI Directors and Member State Representatives

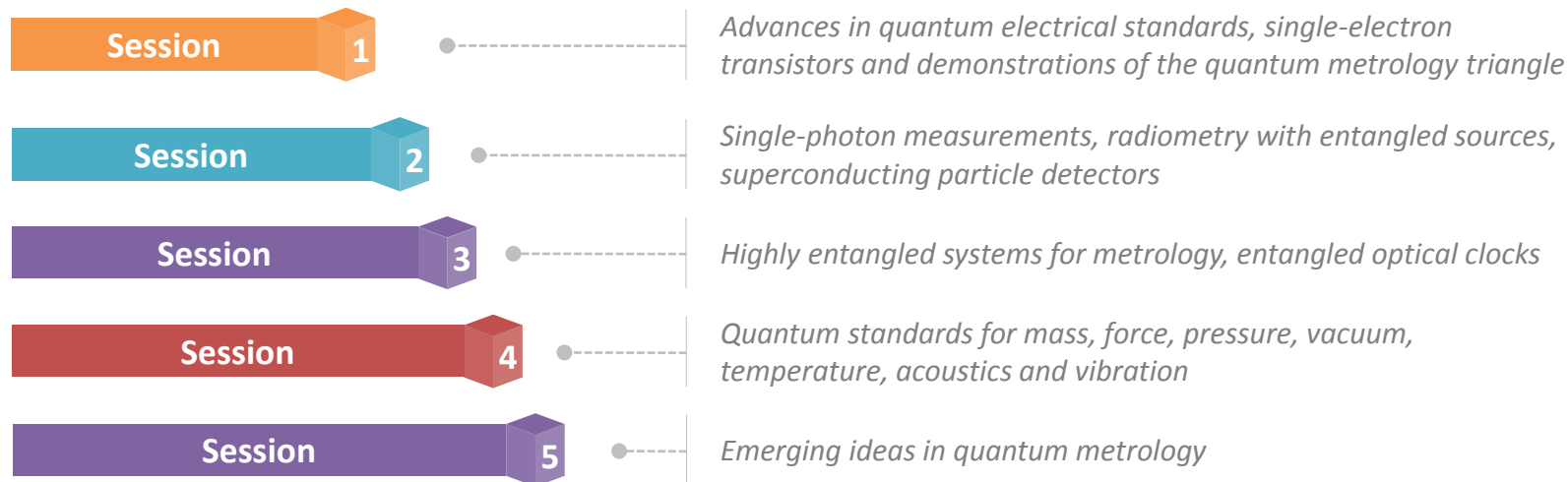
2017 "Sound beginning in the CIPM MRA" course

26<sup>th</sup> meeting of the CGPM

# BIPM Workshop: The Quantum Revolution in Metrology

The objective of the workshop is to promote scientific exchange amongst the National Metrology Institutes and with leading researchers on the applications of quantum-based technologies to metrology.

## WORKSHOP THEMATIC SESSIONS



**Venue:** BIPM, Sevres    **Dates:** 28-29 Sept. 2017    **Deadline for registration:** 26 May 2017

# BIPM Workshop: The Quantum Revolution in Metrology

## INVITED SPEAKERS

- **PD Dr. Uwe Siegener, PTB**

*Electrical quantum standards: foundation of electrical units and measurements*

- **PD Dr. Hans Werner Schumacher, PTB**

*GaAs based single electron pumps for electrical quantum metrology*

- **Dr. Wilfrid Poirier, LNE**

*Practical quantum current standard: performances and perspectives*

- **Dr. Maria-Luisa Rastello, INRIM**

*Quantum optical metrology by photons*

- **Prof. Dr. Stephan Götzinger, Max Planck Institute for the Science of Light**

*A single-emitter sub-shot noise quantum light source: press a button and get one photon*

- **Dr. Ivano Ruo Berchera, INRIM**

*Quantum imaging: challenges and perspectives in radiometry and biophotonics*

- **Prof. Patrick Gill, NPL**

*Atomic clocks, Superpositions and Entanglement*

- **PD Dr. Ekkehard Peik, PTB**

*Optical clocks with single ions*

# BIPM Workshop: The Quantum Revolution in Metrology

## INVITED SPEAKERS

- **Dr. David R. Leibrandt, NIST**

*Optical clock protocols for Heisenberg-limited stability*

- **Dr. Gregory F. Strouse, NIST**

*The Next Generation of Metrology – NIST Quantum SI*

- **Dr. Stephan Schlamming, NIST**

*Putting the Quantum into Mechanics: Quantum Standards for mass and force*

- **Prof. Dr. Francesco Giazotto, NEST, Istituto Nanoscienze-CNR & Scuola Normale Superiore di Pisa**

*Coherent caloritronics in superconducting circuits: from heat interferometers to  $0-\pi$  controllable thermal Josephson junctions*

- **Dr. Kiwoong Kim, KRISS**

*From Quantum Interference to Human Perception*

- **Prof. Dr. Fedor Jelezko, Ulm University**

*New approaches for sensitivity and spectral resolution improvement in diamond quantum metrology*

- **Dr. Junho Suh, KRISS**

*Nanomechanical oscillators in the single-phonon regime*

- **Dr. Jacob Taylor, NIST/JQI**

*Quantum optical explorations of the nanoscale metrology frontier*



Thank you

**B**ureau  
♦ **I**nternational des  
♦ **P**oids et  
♦ **M**esures

