

# The BIPM key comparison database



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International des  
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Mesures



# The BIPM key comparison database

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The KCDB is a **public-access website**

<http://www.bipm.org/kcdb>

built up upon a number of databases and  
maintained by the BIPM



“The BIPM key comparison database” is a historic term that does not describe its actual content. It is generally known as “The KCDB”.

All the information it contains is  
**internationally reviewed and recognized**  
through the procedures described in the text of the CIPM MRA and  
**always kept up to date**

# The CIPM MRA operation

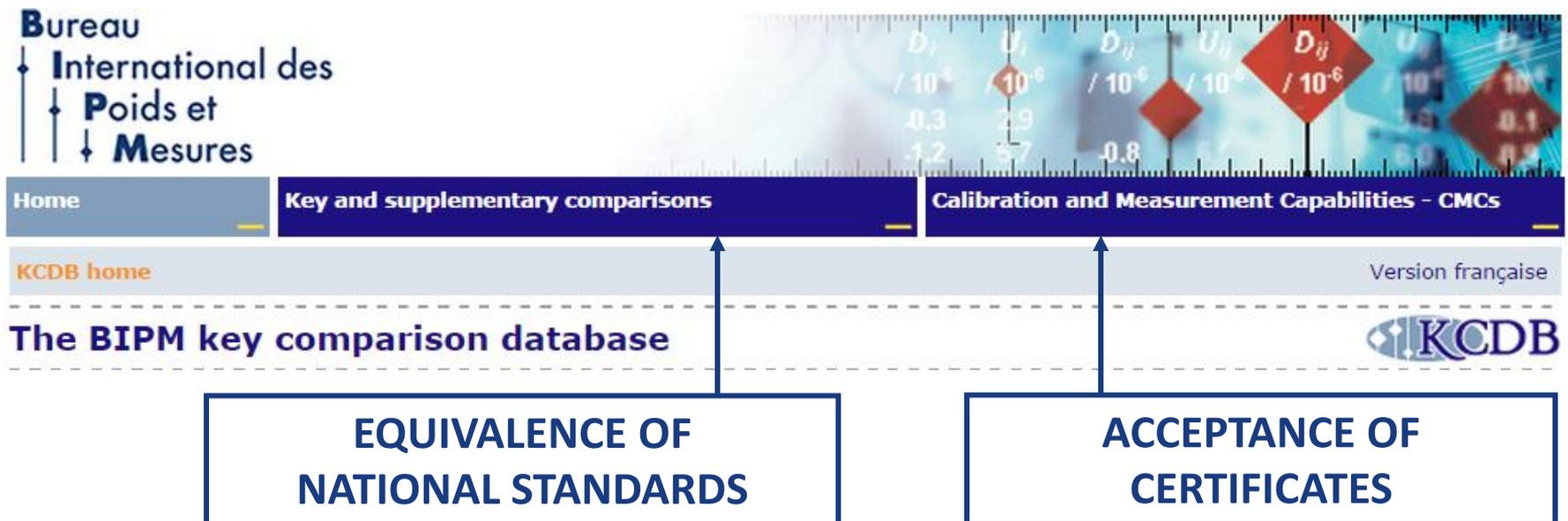
## Participants in the CIPM MRA:

- ◆ participate in “**key comparisons**” organized by the CIPM’s Consultative Committees or by the Regional Metrology Organizations, chosen to characterize activities and calibration services in a particular technical area,
- ◆ declare the uncertainties associated with **their Calibration and Measurement Capabilities (CMCs)** used in day to day services and have these validated by international experts on the basis of results obtained in key and other international comparisons, and
- ◆ have installed an approved Quality System.

Participants in the CIPM MRA: more than 240 Metrology Institutes (National Metrology Institutes and Designated Institutes), from 92 countries all over the world (plus 4 international organizations), maintaining national standards and delivering traceability to the SI in their respective countries.

# Data available in the KCDB

- ◆ Results of these **key** (and other international) **comparisons** when they are approved by the appropriate body (CIPM's Consultative Committees or Regional Metrology Organizations), and
- ◆ Lists of **Calibration and Measurement Capabilities (CMCs)** declared by each participant in the CIPM MRA when these have been validated.



# Calibration and Measurement Capabilities - CMCs

## Recognition: the CIPM MRA Logo and Statement

CMCs published in the KCDB are drawn up by the declaring Institute, reviewed and validated by international experts from the different Regional Metrology Organizations (through **approval by the JCRB**: Joint committee of the RMOs and the BIPM) and **covered by an approved QS** (compliant with ISO/IEC 17025 or Guide 34).

Certificates supported by CMCs published in the KCDB are accepted worldwide by all participants in the CIPM MRA at whatever accuracy is stated in the KCDB.



*Under the CIPM MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in the KCDB*

# Key comparisons

## Definition:

A key comparison is one of the set of comparisons **selected by a Consultative Committee (CC) of the CIPM** to test the principal techniques and methods in the field

## Results: interpreted in terms of equivalence

**degrees of equivalence** of each participant relative to an agreed reference value (offset + uncertainty) are shown in **graphs of equivalence**

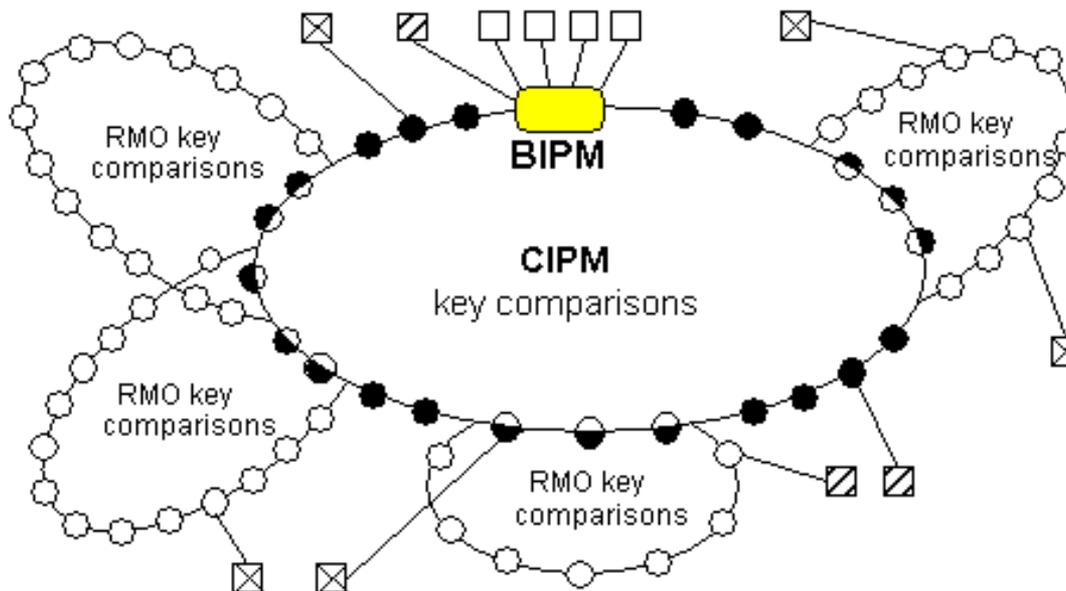


**EQUIVALENCE OF  
NATIONAL STANDARDS**

Since 1999, more than 1280 comparisons have been recorded in the KCDB, among which ~ 70 % are key comparisons. They cover all Metrology areas.

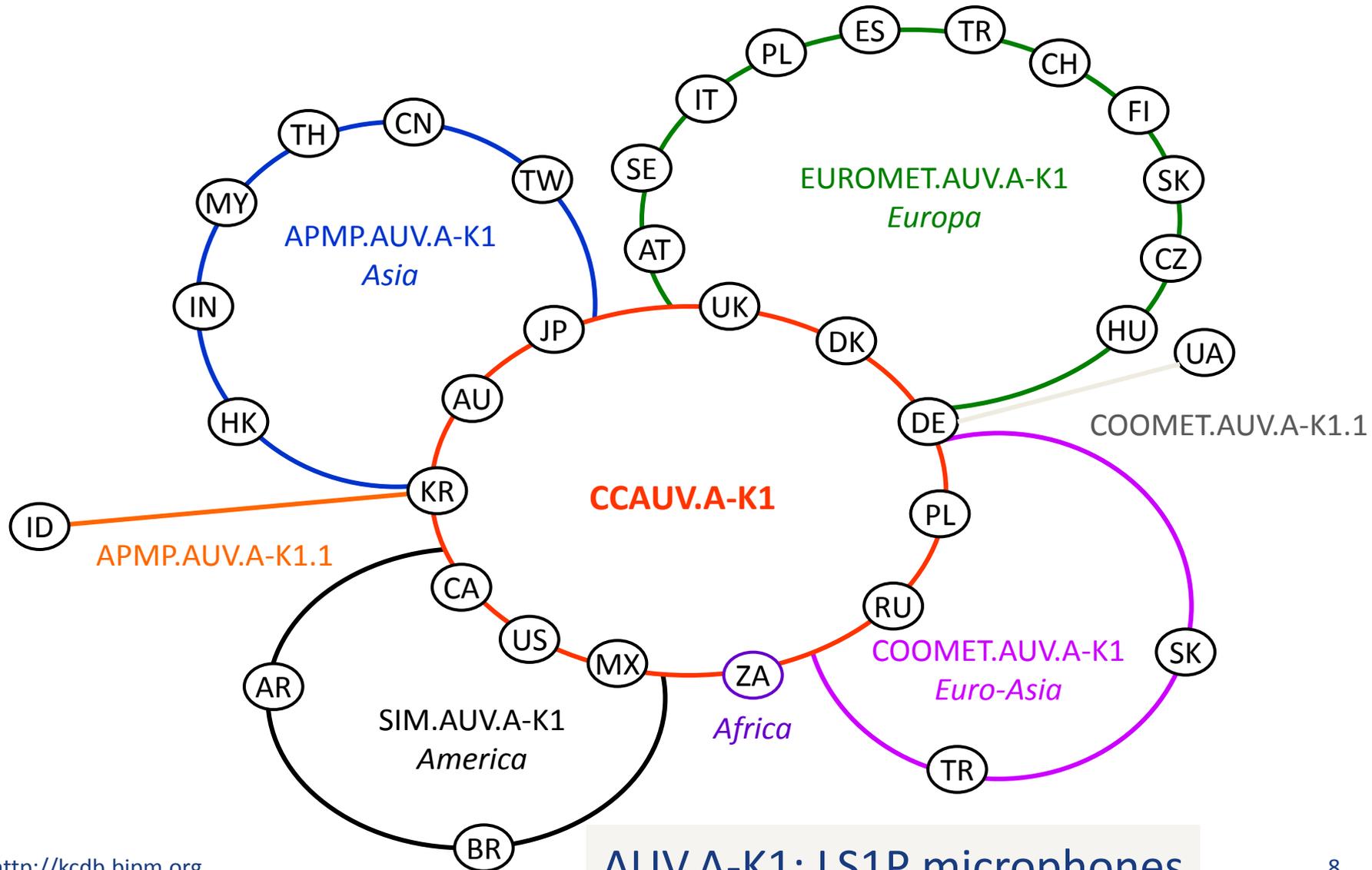
# Key comparisons

## Organization to form families: equivalence and linkage



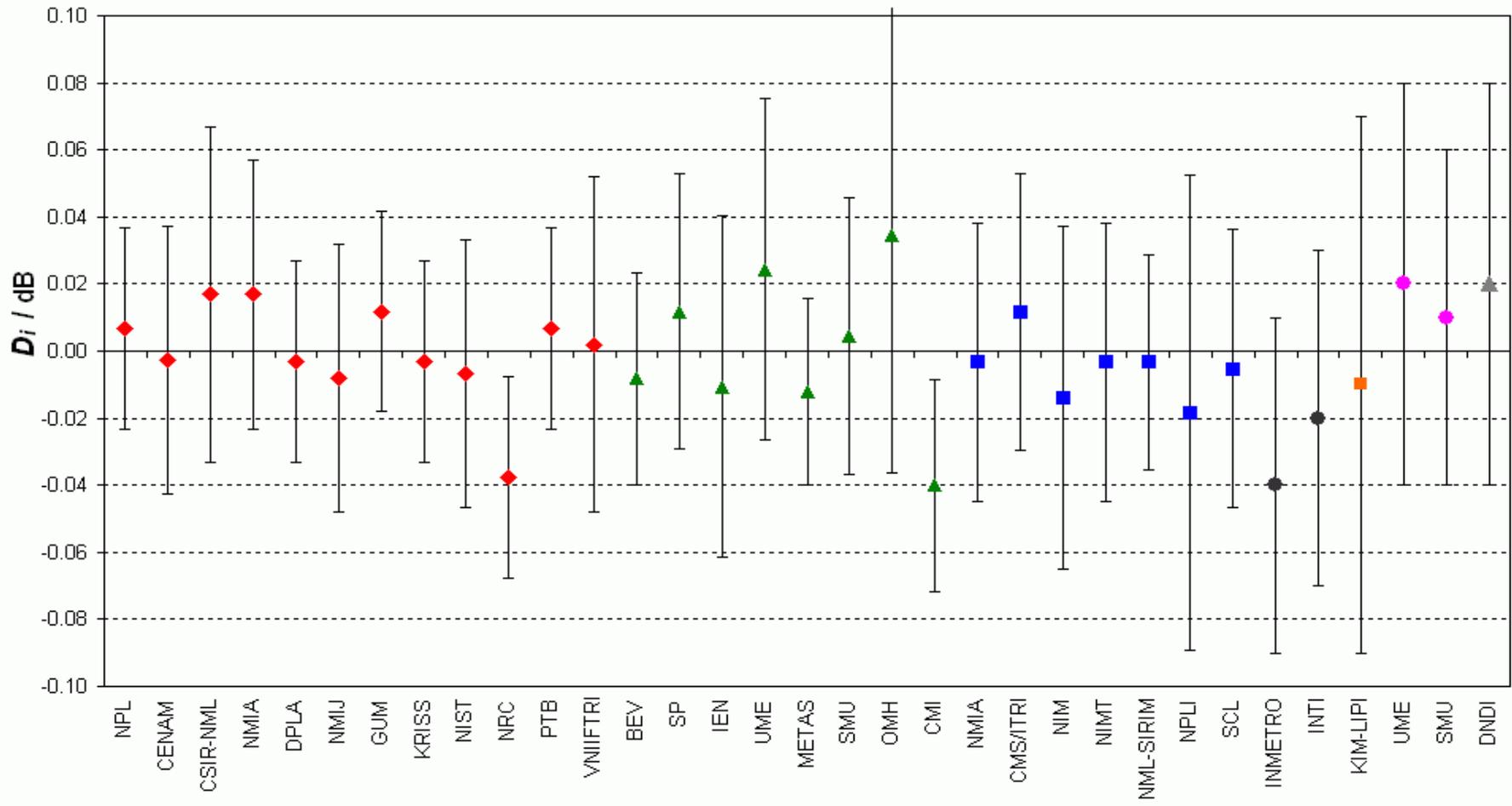
- ◆ Results of key comparisons are interpreted to show equivalence between any one of the participants in any comparison of the family.
- ◆ Comparison results in the KCDB are publicly available, ensuring the transparency of the whole CIPM MRA process.

# Example: seven linked key comparisons



CCAUV.A-K1, and EUROMET, APMP, and SIM.AUV.A-K1, APMP.AUV.A-K1.1, COOMET.AUV.A-K1, and COOMET.AUV.A-K1.1 - Microphone LS1P, frequency 250 Hz

Degrees of equivalence [ $D_i$  and its expanded uncertainty  $U_i$  ( $k = 2$ )]



Red diamonds : CCAUV.A-K1 participants

Green triangles : EUROMET.AUV.A-K1 participants only

Blue squares : APMP.AUV.A-K1 participants only

Black circles : SIM.AUV.A-K1 participants only

Orange square : APMP.AUV.A-K1.1 participant only

Pink circles : COOMET.AUV.A-K1 participants only

Grey triangle : COOMET.AUV.A-K1.1 participant only

The KCDB currently displays some 2 280 graphs of equivalence.



# Key and other international comparisons

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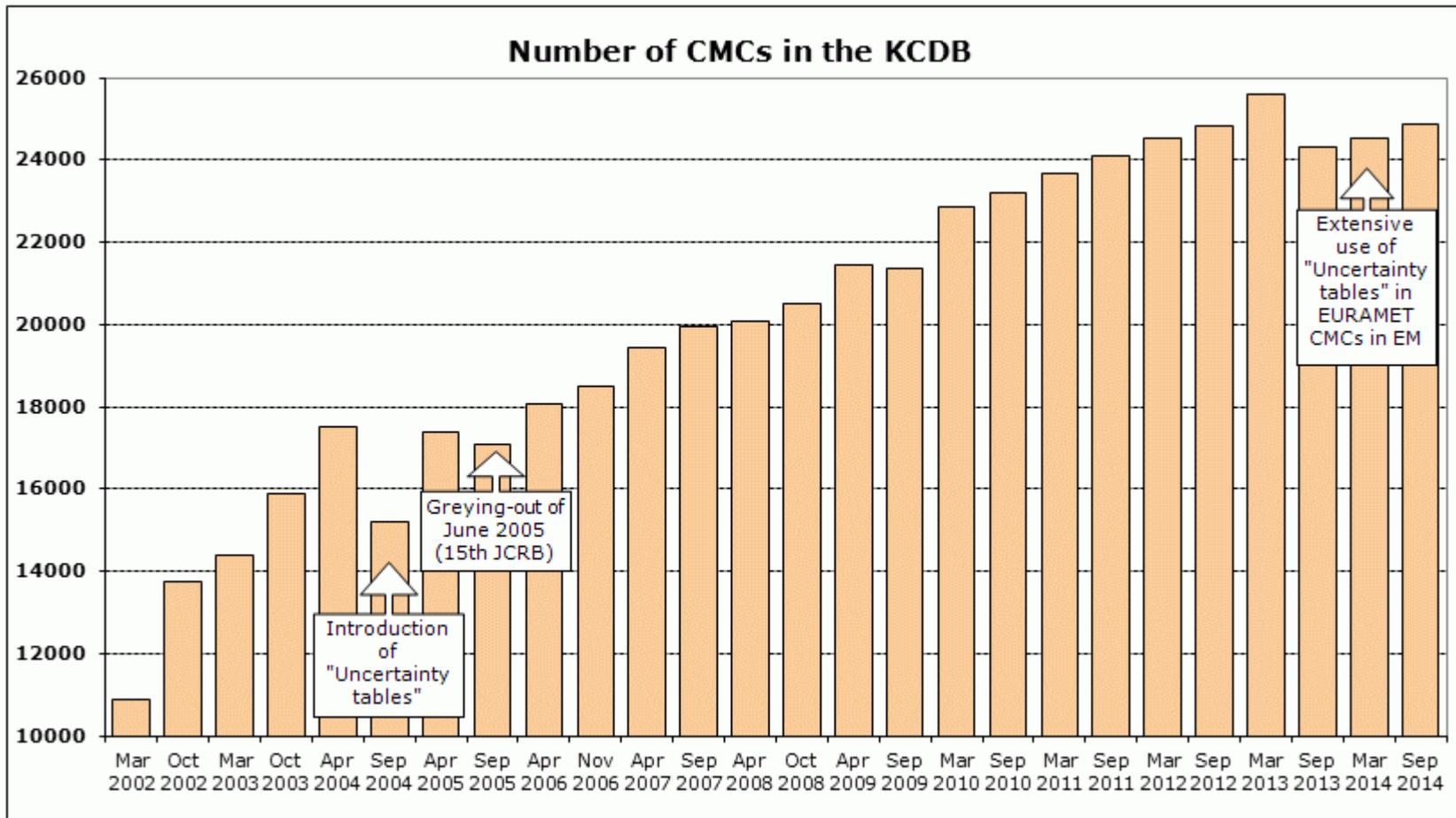
After more than fourteen years of operation...

We have observed a clear improvement in the overall quality of international comparisons in metrology.

The KCDB is the preferred place to find results on the comparability of national standards of measurement and thus get information on their equivalence.

# Calibration and Measurement Capabilities - CMCs

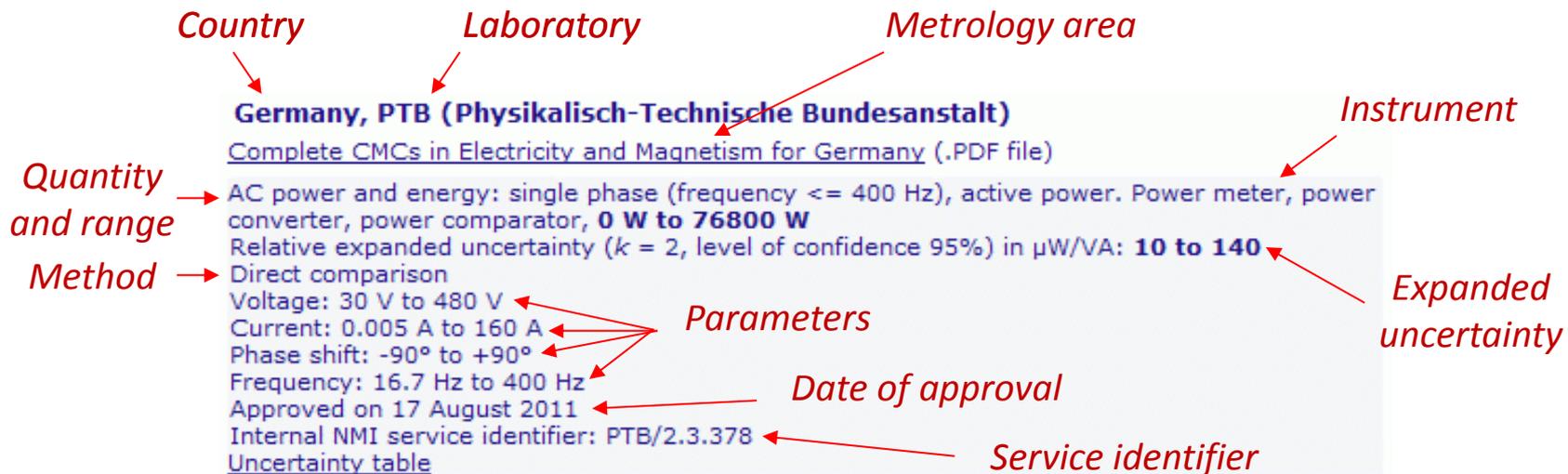
In October 2014: ~ 24 900 CMCs published in the KCDB



# Calibration and Measurement Capabilities - CMCs

## Presentation of CMCs information in the KCDB

The CMCs information are made available in the KCDB in **open access**, under the form of **pdf files** and **html pages** returned by the web after a query has been made using one of the proposed search engines.



When the range of uncertainty does not correspond to a linear variation with the value of the measurand, the expanded uncertainty can be described using an uncertainty table

# CMCs: organized according to Classifications of Services

Available from the [KCDB](#) or from the [CIPM MRA Documents page](#)



## Example in Electricity and Magnetism

BRANCH: AC VOLTAGE, CURRENT AND POWER

5. AC voltage (up to the MHz range)

5.1...

6. AC current

6.1...

7. AC power

7.1 AC power and energy

7.1.1 Single phase (frequencies  $\leq 400$  Hz): *power meter, energy meter, power converter, wattmeter*

7.1.2 Single phase (frequencies  $> 400$  Hz): *power meter, energy meter, power converter, wattmeter*

7.1.2 Three phase: *power meter, energy meter*

The KCDB “Advanced search engines” proposed by the KCDB for each Metrology area are based on these Classifications of Services.

# Calibration and Measurement Capabilities - CMCs

## Temporary removal (“greying-out”) and re-instatement

- ◆ CMCs that are approved by the JCRB and published in the KCDB may be **temporarily removed from the KCDB**. It generally happens when the QS that covers them is no more approved by the corresponding RMO. There may be other reasons such as temporary lack of staff or failure of the equipment.
- ◆ These CMCs are **not visible** from the KCDB web site but they remain in the appropriate EXCEL files (available to the declaring NMI) where they are shown on a **grey** background for a maximum of five years.
- ◆ They are re-instated once the problem is solved.
- ◆ The greying-out and re-instatement of CMCs was the source of much movement from 2004 to 2010. Since then, the sets of CMCs that are proposed for approval by the JCRB are generally known to be covered by an appropriate QS.

**130 CMCs are currently greyed-out from the KCDB**  
(about 0.5 % of the total number of CMCs)

# Analysis of the visits to the KCDB website

January 2013 to December 2013:

~ 10 900 visits per month (against ~ 9 200 over 2012)

~ 1 080 000 pages consulted over the year 2013

Our “key” communities (NMIs, DIs, Regulators, Accreditors, Calibration and Testing Laboratories, Industrial and Commercial Companies, etc.) show a growing interest in the information displayed by the KCDB

- ◆ All pages equally visited.
- ◆ Visitors come from all over the world.
- ◆ 30 % of them reach the KCDB from links proposed in other websites, 60 % reach via personal bookmarking, direct URL address typing or using links given in e-mails, and 10 % from Internet search engines.

# Conclusions

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After more than fourteen years of implementation ...

The KCDB is a unique tool that serves as the ultimate reference for all actors in metrology and for users in the regulatory, accreditation, and industrial sectors

# Web addresses of interest

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KCDB Home Page: <http://kcdb.bipm.org/>

The access-restricted JCRB CMC website is at <http://www.bipm.org/JCRBCMCs/>

Username: **tcguest** and Password: **tcontact** (allow to download files)

For uploading files, please contact the JCRB Executive Secretary at [jcrb\\_es@bipm.org](mailto:jcrb_es@bipm.org)



# Demonstration: Search engines for CMCs in the KCDB

## Calibration and Measurement Capabilities - CMCs



### What's new about CMCs ?

- [Fluid Flow - Korea](#)  
12 June 2012
- [Mass Standards - Bosnia and Herzegovina](#)  
08 June 2012
- [All news](#)

→ Choose your search engine to access CMCs information

### Free search

Type your keywords

[Send us your feedback](#)

→ Search

Two search engines: free-text search or advanced search by metrology area

### Physics

- [Acoustics, Ultrasound, Vibration](#)
- [Electricity and Magnetism](#)
- [Length](#)
- [Mass and related quantities](#)
- [Photometry and Radiometry](#)
- [Ionizing Radiation](#)
- [Thermometry](#)
- [Time and Frequency](#)

### Advanced search

Select a Metrology Area

→ Search

### List of Metrology Areas

Acoustics, Ultrasound, Vibration

Electricity and Magnetism

DC and AC measurements, impedance, electric and magnetic fields, radiofrequencies and measurements on magnetic materials.

### Chemistry

- [Chemistry](#)

# Search for specific CMCs in the KCDB

## Calibration and Measurement Capabilities - CMCs



### What's new about CMCs ?

- [Fluid Flow - Korea](#)  
12 June 2012
- [Mass Standards - Bosnia and Herzegovina](#)  
08 June 2012
- [All news](#)

### Physics

- [Acoustics, Ultrasound, Vibration](#)
- [Electricity and Magnetism](#)
- [Length](#)
- [Mass and related quantities](#)
- [Photometry and Radiometry](#)
- [Ionizing Radiation](#)
- [Thermometry](#)
- [Time and Frequency](#)

### Chemistry

- [Chemistry](#)

→ Choose your search engine to access CMCs information

### Free search

Type your keywords

pressure sensitivity level LS1P microphone

[Send us your feedback](#)

→ Search

Enter your keywords and click on "Search"

### Advanced search

Select a Metrology Area

→ Search

### List of Metrology Areas

Acoustics, Ultrasound, Vibration

Electricity and Magnetism

DC and AC measurements, impedance, electric and magnetic fields, radiofrequencies and measurements on magnetic materials.

## Refine your search

### CMC AREA

CMCs General Physics (70)

### PHYSICS

Sound in air (70)

### GEOGRAPHIC LOCATION

- APMP (28)
  - Malaysia (6)
  - Indonesia (5)
  - Korea, Republic of (4)
  - Japan (4)
  - Chinese TAIPEI (3)
  - Hong Kong, China (3)
  - India (2)
  - Australia (1)
- EURAMET (15)
  - France (8)
  - Austria (3)**
  - Bulgaria (3)
  - Czech Republic (1)
- COOMET (12)
  - Russian Federation (12)
- SIM (11)
  - Canada (5)
  - Argentina (3)
  - Brazil (3)
- AFRIMETS (4)
  - South Africa (4)

## Result of the search

Your query 'pressure sensitivity level LS1P microphone' produced **70 results**

[New search](#)

1 2 3 [Next >>]

Refine your search by clicking on the left

### Czech Republic, CMI (Czech Metrology Institute)

[Complete CMCs in Acoustics, Ultrasound, Vibration for Czech Republic \(.PDF file\)](#)

Pressure sensitivity level. Measurement microphone type LS1P, **-24 dB (reference: 1V/Pa) to -28 dB (reference: 1V/Pa)**

Absolute expanded uncertainty ( $k = 2$ , level of confidence 95%) in dB: **0.05**

IEC 61094-2:1992

Frequency: 63 Hz to 1.0 kHz

### Brazil, INMETRO (Instituto Nacional de Metrologia, Qualidade e Tecnologia)

[Complete CMCs in Acoustics, Ultrasound, Vibration for Brazil \(.PDF file\)](#)

Pressure sensitivity level. Measurement microphone type LS1P. Measurand unit, **dB (reference: 1 V/Pa)**

Absolute expanded uncertainty ( $k = 2$ , level of confidence 95%) in dB: **0.05**

IEC 61094-2:1992 (reciprocity)

Frequency: 63 Hz to 3.15 kHz

Internal NMI service identifier: INMETRO/8323

Pressure sensitivity level. Measurement microphone type LS1P. Measurand unit, **dB (reference: 1 V/Pa)**

Absolute expanded uncertainty ( $k = 2$ , level of confidence 95%) in dB: **0.07**

IEC 61094-2:1992 (reciprocity)

Frequency: 4 kHz to 6.3 kHz

Internal NMI service identifier: INMETRO/8323

Pressure sensitivity level. Measurement microphone type LS1P. Measurand unit, **dB (reference: 1 V/Pa)**

Absolute expanded uncertainty ( $k = 2$ , level of confidence 95%) in dB: **0.11**

IEC 61094-2:1992 (reciprocity)

Frequency: 8 kHz to 10 kHz

Internal NMI service identifier: INMETRO/8323

# Results of the search

## The BIPM key comparison database



### Refine your search

#### CMC AREA

CMCs General Physics (3)

#### PHYSICS

Sound in air (3)

#### GEOGRAPHIC LOCATION

EURAMET (3)

Austria (3)

### Result of the search

Your query 'pressure sensitivity level LS1P microphone' produced 3 results

[New search](#)

#### **Austria** BEV (Bundesamt für Eich- und Vermessungswesen)

[Complete CMCs in Acoustics, Ultrasound, Vibration for Austria](#) (.PDF file)

Pressure sensitivity level. Measurement microphone type LS1P. Measurand unit, **dB**

**(reference: 1 V/Pa)**

Absolute expanded uncertainty ( $k = 2$ , level of confidence 95%) in dB: **0.05**

IEC 601094-2: 1992

Frequency: 63 Hz to 4 kHz

Pressure sensitivity level. Measurement microphone type LS1P. Measurand unit, **dB**

**(reference: 1 V/Pa)**

Absolute expanded uncertainty ( $k = 2$ , level of confidence 95%) in dB: **0.07**

IEC 601094-2: 1992

Frequency: 5 kHz to 8 kHz

Pressure sensitivity level. Measurement microphone type LS1P. Measurand unit, **dB**

**(reference: 1 V/Pa)**

Absolute expanded uncertainty ( $k = 2$ , level of confidence 95%) in dB: **0.09**

IEC 601094-2: 1992

Frequency: 10 kHz

Thank you

Dr Claudine Thomas

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**B**ureau  
International des  
Poids et  
Mesures

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