BIPM KCDB Office

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KCDB REPORT TO THE 37th JCRB MEETING

1 September 2016 to 1 March 2017

Introduction

This report summarizes the major progress and evolution of the BIPM Key Comparison Database (KCDB) over the last six months.

The EXCEL files used as a basis for the CMC statistics are available on the access-restricted JCRB CMC website (on "KCDB statistics"). They are updated successively during the year and the CMCs that have been modified are highlighted in pink according to previous JCRB decisions.

Further information on the KCDB may be found on the BIPM KCDB web pages. Notably, the number of key and supplementary comparisons, as well as the number of CMCs by metrology area and by country, are updated successively during the year and may be consulted on the KCDB Statistics web page[1].

The status of the database concerning **Calibration and Measurement Capabilities** are given in Section 1. In Section 2, recent information concerning **comparisons** carried out within the frame of the CIPM MRA is summarized. Section 3 highlights the status of **Associates** of the BIPM, and a short summary on progress made on the **revision of the KCDB**, in the context of the Review in the CIPM MRA, is presented in Section 4.

1. CIPM MRA Appendix C : Calibration and Measurement Capabilities

1.1. Status of the KCDB CMC database

End of February 2017, the KCDB included a total of 25 896 CMCs:

- 19 699 in Physics,
- 6 227 in Chemistry.

Over the last six months 39 countries published CMCs. The total number of CMCs increased by 310 over the last 12 months, corresponding to a relative increase of 1 % evenly distributed over Chemistry and Physics.

The evolution of the number of CMCs since 2008 is depicted in Figure 1. The number of CMCs presently published in the KCDB by state/economy and metrology area is constantly available on KCDB Statistics.

[1] On request, the KCDB Office may provide an EXCEL file listing information on the present contents of the CIPM MRA Appendix B.

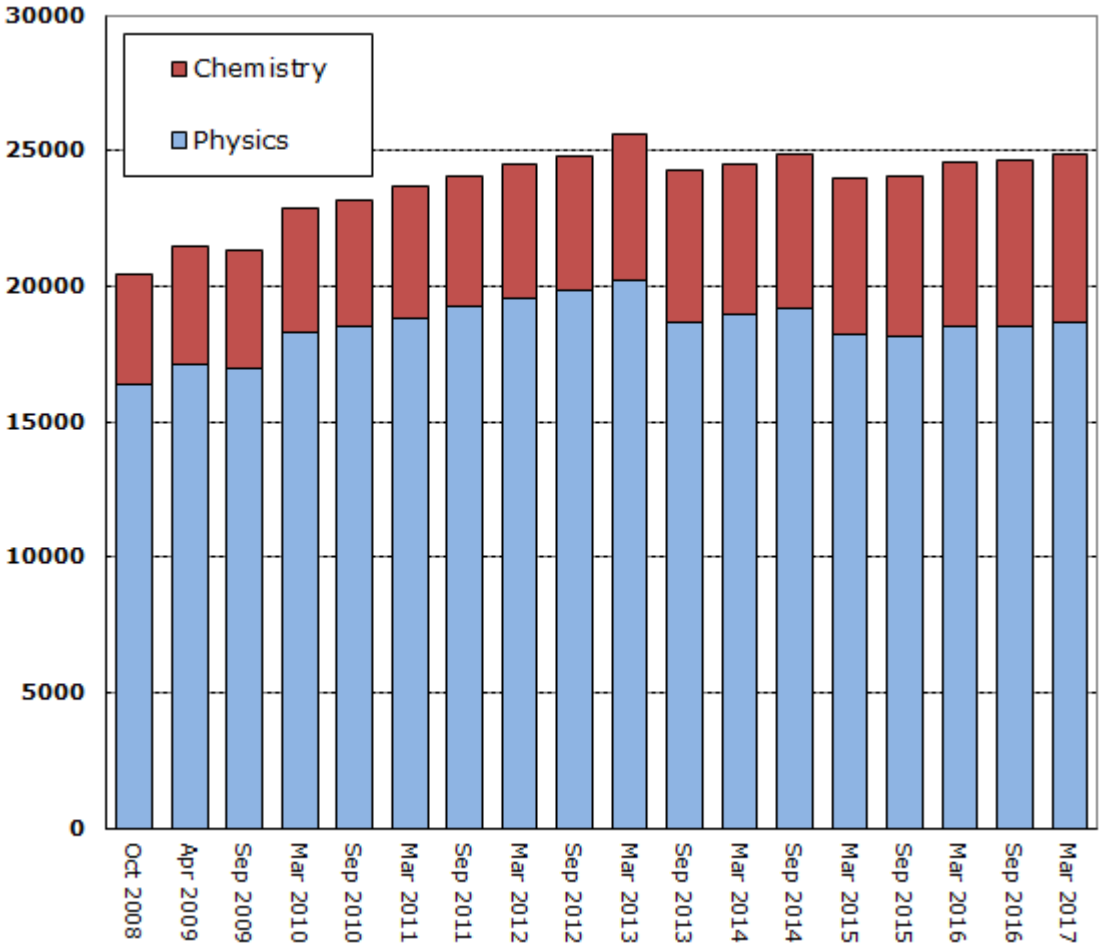

Figure 1. *Number of CMCs registered in the KCDB since October 2008.*

1.2. CMC publications (excluding revisions)

CMCs treated by the BIPM KCDB Office between 1 September 2016 and 1 March 2017 are listed in Table 1[2]

Table 1. *Published CMCs from 1 September 2016 and 1 March 2017 (revised CMCs not included)*

	RMO / economy	Field	CMCs
September 2016	APMP: TH	TF	+ 2
	EURAMET: BA	TF	+15
	COOMET: UA	EM	+1
	LV*	EM	–30
	EURAMET: BA, BK, PL	T	+19
	EURAMET: FR	RI	+40
	EURAMET : BG, CZ, DE, DK, PL, PT, RS, TR, UK	L	+36
October 2016	EURAMET: UK	QM	+1
	EURAMET: HR, NO	L	+4
	APMP: CN, HK, SG, TH, TW	QM	+65
	APMP: SG, JP	TF	+7
	IT*	QM	–2
	UK	AUV	–31
	EURAMET: AT, DE, FR, IT, PT, TR, UK	M	+6
November 2016	COOMET: BY, RU, UA	L	+6
	EURAMET: UK	M	–1
	IT*	M	–2
	COOMET: MD	RI	+2
	COOMET: KZ, UA	T	+23
	UK	L	–3
December 2016	APMP: AU CN ID JP NZ TH TW	EM	+84
	AFRIMETS: TN	EM	+4
	IT*	L	–1
January 2017	CN	AUV	+3
	DK	L	–1
	MX*	AUV	16
	SIM: BR, MX	L	+19
	SIM: PY	M	1
February 2017	MX*	PR	–22
	MX*	TF	–9
	DE	L	–8
	BE	L	–3

* : result of greying out

[2] Published CMCs are announced in **"**CMCs News**".**

Bosnia Herzegovina provided their first CMCs in Time-Frequency and Thermometry, Macedonia published their first CMCs in Thermometry and Moldova registered their first CMCs in Ionizing Radiation.

1.3. Deleted CMCs, Greying out and Re-instatements

Greying-outs, deletion and reinstatements of CMCs are coordinated by the JCRB Executive Secretary, and carried out by the KCDB Office. Table 2 lists the CMCs concerned during the last six months.

Table 2. *Deleted, greyed-out or reinstated CMCs from 1 September 2016 and 1 March 2017*

	State/economy	Field	Action
12 September	Latvia	EM	Greyed out 30 CMCs in EM
13 October	Italy	QM	Greyed out 2 CMCs in QM
	UK	AUV	Deleted 31 (all) CMCs in acoustics
24 October	France	M	2 CMCs reinstated in fluid flow
10 November	Italy	M	Greyed out 2 CMCs in density
30 November	UK	L	Deleted 3 CMCs in dimensional metrology
21 December	Italy	L	Greyed out 1 CMC in dimensional metrology
3 January	Korea	QM	Deleted 5 CMCs in pH
5 January	Denmark	L	Deleted 1 CMC in dimensional metrology
	Mexico	AUV	16 CMCs reinstated in AUV
27 February	Mexico	PR	Greyed out 22 CMCs in photometry
	Mexico	TF	Greyed out 9 CMCs in time and frequency

The present situation regarding temporary removal ("greying-out") of CMCs is available on-line of the Statistics page of the KCDB at the JCRB restricted web, illustrated in Table 3. **In total 231 CMCs are presently greyed out**.

The dates of the greying-out of CMCs are listed in the spreadsheet "Dates of CMCs greying-out" of the EXCEL file "CMCsNumber_2017, available from the access-restricted JCRB CMC website (see "KCDB statistics").

Table 3. *Number of CMCs temporary removed ("greyed-out") from the KCDB, by country and by metrology area, as at 1 March 2017.*

Distribution of CMCs that are temporarily removed ("greyed-out") from the KCDB

	AUV	M	PR	EM	T	RI	L	QM	TF	Total
AFRIMETS										
ZA		2								2
								Total AFRIMETS:		2
APMP										
AU				27						27
NZ										0
TH						3				3
								Total APMP:		30
COOMET										
KZ								1 partially Cat. 6		0
								Total COOMET:		0
EURAMET										
BE				25					6	31
FI		6								6
FR		1		3						4
IAEA						1				1
IRMM										
IT		30		15			1	2		48
LV				30						30
PT							1			1
SK	6						2			8
								Total EURAMET:		129
SIM										
MX	16		25					2	9	52
AR							1			1
CA							0			0
US		3	1	8		1				13
BR								4		4
								Total SIM:		70
								TOTAL:		231

1.4. CMC statistics of RMOs

(Follow-up of Action 17/1 from the 17th JCRB meeting)

Table 4 summarizes the repartition of CMCs on the different RMOs and international signatories of the CIPM MRA.

Table 4. *Information on CMC statistics per RMO*

Entity	Total number of CMCs 1 March 2017
AFRIMETS	525
APMP	5776
COOMET	2431
EURAMET	11041
GULFMET[3]	0
SIM	4877
ESA	0
IAEA	26
IRMM	217
WMO	3

[3] The GULFMET was approved as an RMO on a provisional basis by the CIPM in October 2015.

2. CIPM MRA Appendix B : Key and supplementary comparisons

2.1. Present status

On 1 March 2017 the KCDB covered **1467 comparisons** distributed as listed in Table 5; 970 key comparisons and 497 supplementary comparisons. In fact, 68 of the 92 BIPM key comparisons are all part of the BIPM.RI(II)-K1 (SIR equivalent activity). On the other side, 22 continuous BIPM[4] comparisons cover each tens of completed comparisons carried out between the BIPM and different metrology institutes. It may be noted that GULFMET has started their first key comparison since the last JCRB meeting – a bilateral comparison in thermometry. They have also increased their participation in supplementary comparisons by 5 and are hence demonstrating comparison activities within four different fields.

Figure 2 shows the evolution of the total number of key (green) and of supplementary (violet) comparisons registered in the KCDB since September 2003. The annual increase of key comparisons seems to have stabilized to around some +40 taking into account the history since 2004. The annual increase of key- and supplementary comparisons is around 6 %. The ratio of Supplementary comparisons, 1 out of 5 in 2006, has progressively increased to 1 out of 3.

Table 5. *Key and Supplementary Comparisons on 1 September 2016.*

Entity	KC	SC
BIPM	92	1
CC	474	28
AFRIMETS	4	18
APMP	134	102
COOMET	47	82
EURAMET	156	176
GULFMET[5]	1	6
SIM	62	84

The number of new key and supplementary comparisons registered in the KCDB over the one-year period ending at the date indicated on the the abscissa is illustrated in Figure 3.

Updated graphs illustrating the participation in key and supplementary comparisons were made available on the Statistics page of the KCDB in March 2017.

[4] Of which two
[5] The GULFMET was approved as an RMO on a provisional basis by the CIPM in October 2015.

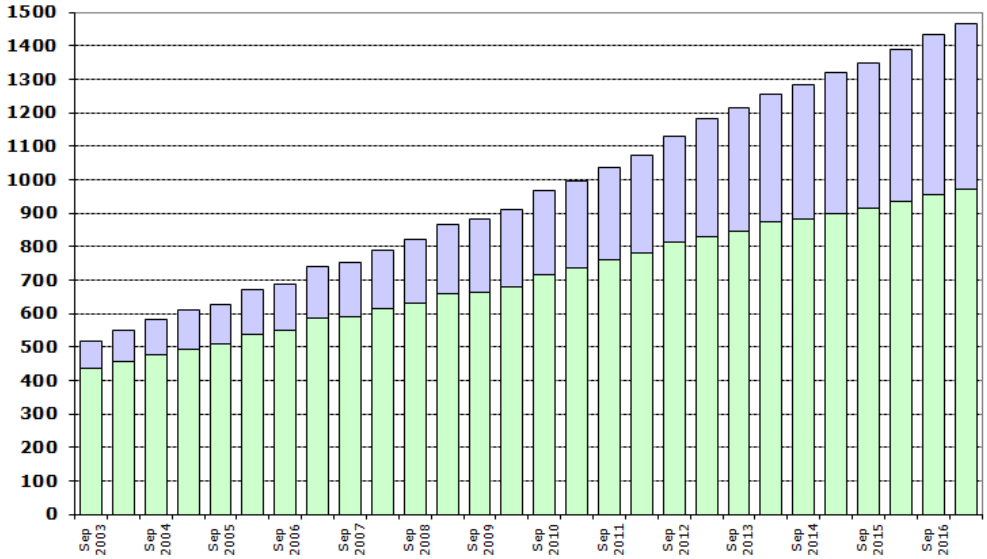

Figure 2. *Total number of key comparisons and supplementary comparisons registered in the KCDB: evolution since September 2003*

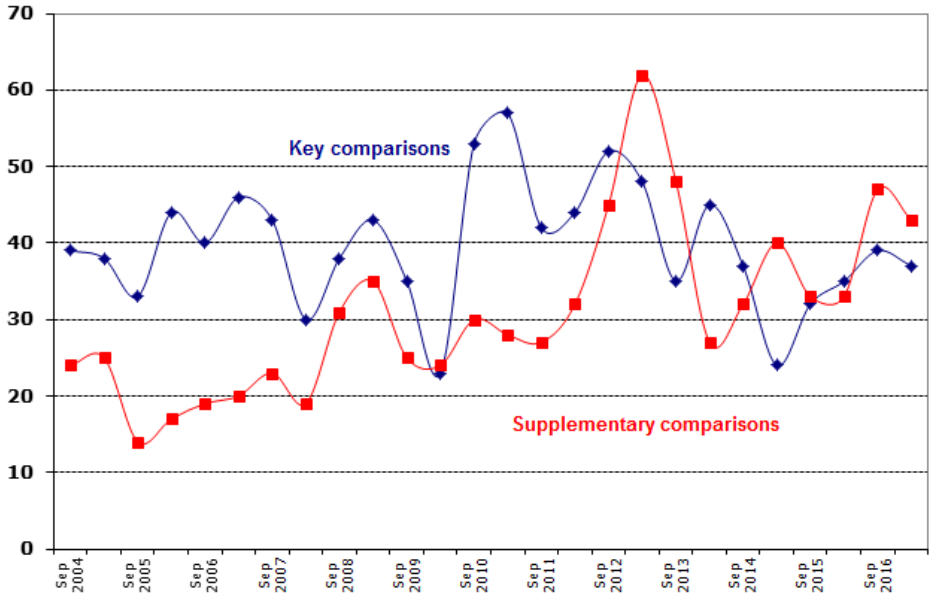

Figure 3. *Number of new comparisons registered in the KCDB over the one-year period ending at the date indicated on the abscissa.*

2.2. Registrations and modifications of comparisons

From 1 September 2016 the following 34 comparisons were registered as new:

AFRIMETS.EM.RF-S1	COOMET.EM-K5	GULFMET.EM.BIPM-K11
APMP.M.FF-S2.2016	COOMET.EM-S20	GULFMET.EM.RF-S1
APMP.M.F-S3	COOMET.M.P-K15	GULFMET.EM-S1
APMP.M.M-K6.1	COOMET.M.P-S2	GULFMET.EM-S2
APMP.M.P-S7.TRI	COOMET.PR-S10	GULFMET.EM-S3
APMP.T-K9	COOMET.PR-S9	SIM.L-K7.2016
APMP.T-S15	EURAMET.L-K3.2009.2	SIM.M.M-K6
BIPM.RI(II)-K4.C-11	EURAMET.L-K4.2015	SIM.M.M-S16
CCEM-K4.2017	EURAMET.L-K5.2016	SIM.PR-K6.2010
CCM.G-K2.2017	EURAMET.M.P-K15.1	SIM.T-K6.6
CCQM-K145	EURAMET.RI(I)-S16	SIM.T-S9
CCQM-K150		

End of August, 45 abandoned or superseded key and supplementary comparisons were kept in the KCDB archives.

2.3. Published results of key and supplementary comparisons

From 1 September 2016 the following 49 reports were published:

APMP.L-K3	CCAUV.V-K3	COOMET.EM-K4
APMP.M.FF-K2.a	CCL-K11 (2014)	COOMET.EM-K6.a
APMP.M.F-S1	CCL-K11 (2015)	COOMET.EM-S1
APMP.M.T-S1	CCM.D-K4 (linking report)	COOMET.EM-S14
APMP.QM-K91	CCM.FF-K2.2015	COOMET.EM-S4
APMP.RI(I)-K1.1.2010	CCM.M-K7	COOMET.M.G-S1
APMP.RI(I)-S2	CCM.P-K15	COOMET.M.T-S1
APMP.T-S6	CCM.P-K15.1	EURAMET.L-S22
BIPM.EM-K13	CCQM-136	EURAMET.L-S23
BIPM.QM-K1	CCQM-48.2014	EURAMET.M.P-K8
BIPM.RI(I)-K3	CCQM-K101	EURAMET.M.P-S9
BIPM.RI(I)-K5	CCQM-K115	EURAMET.M.T-S2
BIPM.RI(II)-K1.Co-60	CCQM-K130	EUROMET.M.D-K2
BIPM.RI(II)-K4.F-18	CCQM-K140	SIM.EM.RF-K5.b.CL
BIPM.RI(II)-K4.Tc-99m	CCQM-K97	SIM.M.F-S5
BIPM.RI(II)-K4.Tc-99m	CCT-K3.2	SIM.M.M-S15

CCAUV.U-K4

2.4. Follow-up on JCRB Action 33/3

Action 33/3: *The BIPM KCDB office, as part of the KCDB report to the JCRB, to identify Key and Supplementary Comparisons which were started 5 or more years ago and have not reached a conclusion.*

Information on the number of comparison of this category is not large enough to conclude whether or not the observed increase is significant, as illustrated in Figure 4 where statistics regarding key and supplementary comparisons have been illustrated for the period September 2015 to March 2017. A list of the comparisons concerned may be found in Appendix.

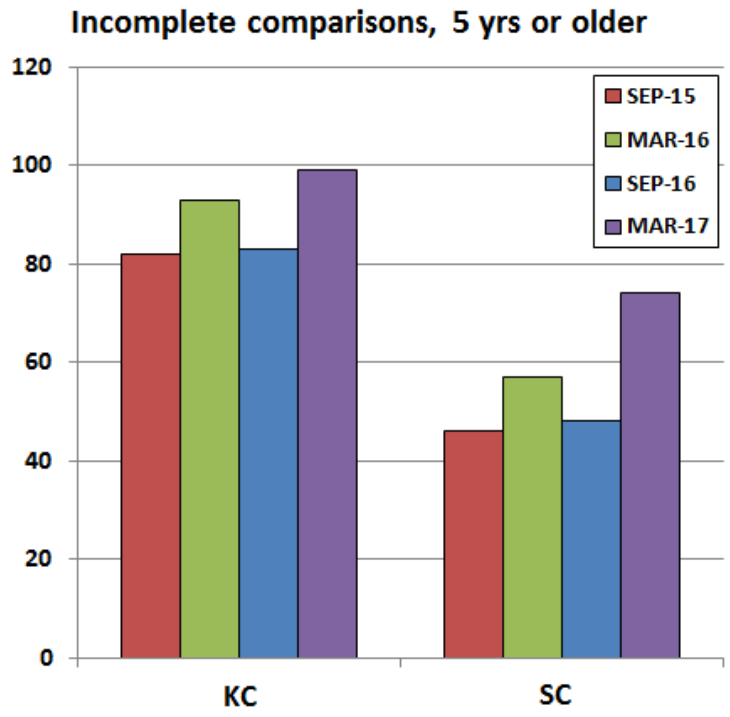

Figure 4. *Histogram showing the number of incomplete comparisons that started more than 5 years ago.*

3. Participation of Associates of the CGPM in CIPM MRA activities

Table 6 summarizes the participation of the 41 Associates of the CGPM in CIPM MRA activities as at 1 March 2017.

The increase of CMCs corresponds to 2 %. CMCs within new areas were published for Bosnia Herzegovina and Macedonia, but only half of the Associates have CMCs published in the KCDB. One country requested a number of CMCs to be greyed out which is the first time for an Associate. The repartition of CMCs among Associates is illustrated in Figure 5. The increase in Associate piloting and participation in comparisons increased by 8%, slightly more than the increase of the global the number. The comparison participation by Associates is illustrated in Figure 6.

Table 6. *CIPM MRA activity of the NMIs of Associates of the CGPM: important dates, number of published CMCs and participation in key and supplementary comparisons.* [6,7]

Associate of the CGPM	Date of becoming an Associate	Date of signature of the CIPM MRA	Published CMCs	Greyed-out CMCs	Date of publication of the first CMC	Area of the first CMC	Key comparisons	Supplementary comparisons
Albania	10 September 2007	10 October 2007	**7**	0	05 April 2013	Mass Standards	**9**	**3**
Azerbaijan	01 January 2015	28 January 2015	**0**	0	-	-	**1**	**6**
Bangladesh	29 March 2010	25 March 2011	**0**	0	-	-	**0**	**2**
Belarus	05 May 2003	14 October 2003	**236**	0	07 April 2004	Acoustics, Ultrasound and Vibration	**36**	**46**
Bolivia	04 April 2008	16 May 2008	**2**	0	19 July 2016	Chemistry	**5**	**17**
Bosnia and Herzegovina	24 May 2011	15 June 2011	**33**	0	08 June 2012	Mass Standards	**11**	**5**
Botswana	30 May 2012	26 July 2012	**0**	0	-	-	**1**	**3**
CARICOM	10 October 2005	12 October 2005	**0**	0	-	-	**0**	**10**
Chinese Taipei	26 April 2002	04 June 2002	**371**	0	21 October 2003	Mass Standards, Force, Hardness, Pressure	**101**	**48**
Costa Rica	29 January 2004	06 October 2004	**67**	0	26 November 2008	Mass Standards	**20**	**23**
Cuba	19 December 2000	18 June 2001	**113**	0	02 May 2005	Ionizing radiation (I and II)	**6**	**21**
Ecuador	20 November 2000	15 April 2001	**20**	0	16 September 2011	Mass Standards	**6**	**19**
Estonia	27 January 2005	23 March 2005	**4**	0	05 May 2014	Humidity	**8**	**10**
Georgia	01 January 2008	17 June 2008	**30**	0	20 March 2014	Thermometry	**6**	**11**
Ghana	17 September 2009	24 February 2010	**0**	0	-	-	**2**	**4**
Hong Kong, China	08 April 2000	31 May 2000	**238**	0	13 December 2000	Length (Laser, Dimensional)	**80**	**29**
Jamaica	15 September 2003	21 July 2004	**22**	0	24 August 2006	Mass Standards	**8**	**10**
Latvia	11 January 2001	13 March 2001	**29**	30	23 March 2005	Length (Dimensional)	**13**	**7**
Luxembourg	29 January 2014	01 October 2014	**0**	0	-	-	**2**	**1**
Macedonia (fmr Yugoslav Rep. of)	10 October 2006	14 November 2007	**21**	0	02 July 2013	Fluid Flow	**8**	**8**
Malta	11 April 2001	20 June 2001	**0**	0	-	-	**5**	**4**
Mauritius	05 October 2010	09 March 2011	**0**	0	-	-	**2**	**1**
Moldova, Republic of	01 January 2007	14 November 2007	**42**	0	26 September 2013	Thermometry	**2**	**15**
Mongolia	07 August 2013	23 October 2013	**0**	0	-	-	**3**	**3**
Montenegro	01 August 2011	19 October 2011	**19**	0	20 November 2015	Thermometry	**8**	**4**
Namibia	10 August 2012	16 October 2012	**0**	0	-	-	**0**	**2**
Oman	08 May 2012	20 November 2014	**0**	0	-	-	**0**	**1**
Panama	03 August 2003	16 September 2003	**34**	0	11 September 2006	Mass Standards	**9**	**17**
Paraguay	06 May 2009	27 October 2009	**24**	0	31 January 2011	Mass Standards	**2**	**15**
Peru	28 May 2009	17 November 2009	**106**	0	03 August 2010	Mass Standards	**18**	**35**
Philippines	01 June 2002	19 December 2002	**31**	0	18 December 2013	Mass Standards	**12**	**8**
Qatar	10 March 2016	16 March 2016	**0**	0	-		**0**	**0**
Seychelles	10 September 2010	12 November 2010	**0**	0	-	-	**0**	**2**
Sri Lanka	14 November 2007	14 November 2007	**0**	0	-	-	**5**	**2**
Sudan	26 June 2014	26 June 2014	**0**	0	-	-	**0**	**1**
Syrian Arab Republic	31 May 2012	17 September 2012	**0**	0	-	-	**12**	**3**
Ukraine	19 August 2002	14 October 2003	**259**	0	10 January 2005	Length (Laser, Dimensional)	**55**	**77**
Viet Nam	10 October 2003	16 September 2004	**31**	0	21 July 2010	Time and Frequency	**31**	**7**
Yemen	21 July 2014	17 November 2014	**0**	0	-	-	**0**	**0**
Zambia	10 December 2010	3 February 2011	**0**	0	-	-	**1**	**5**
Zimbabwe	14 September 2010	14 January 2011	**0**	0	-	-	**1**	**5**

[6] These numbers take into account all comparisons registered in the KCDB, disregarding status, for which at least one laboratory of the Associate is listed in the participants list.

[7] As the numbers on participation in key and supplementary comparisons change comparatively slowly with time, the corresponding KCDB statistics are updated every six months (in May and November of each year). However, the numbers of CMCs published in the KCDB varies more rapidly and are updated in "real-time". The numbers given here show the situation as at 1 March 2017.

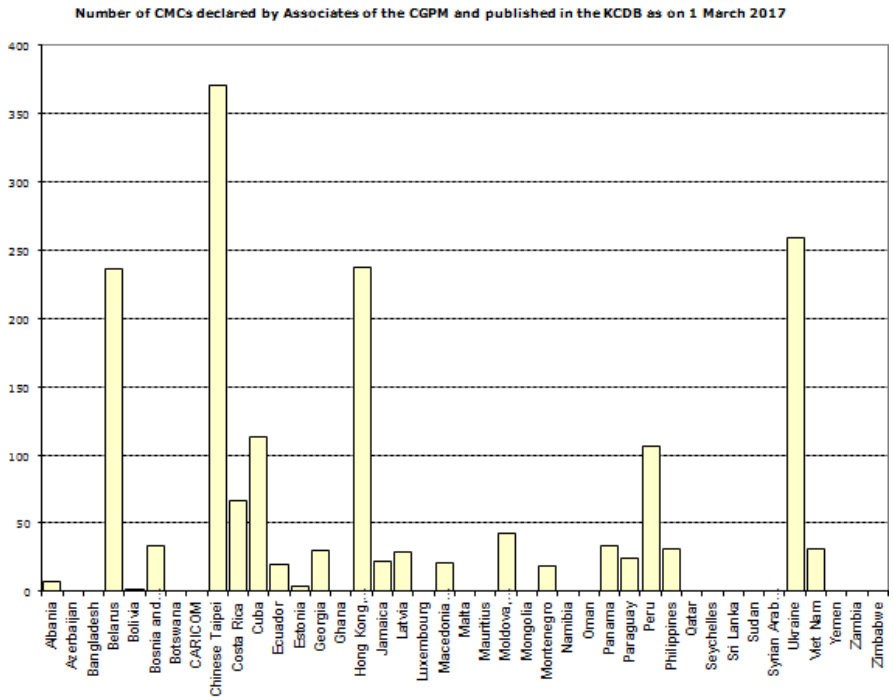

Figure 5. *Graph on the number of CMCs declared by Associates of the CGPM*

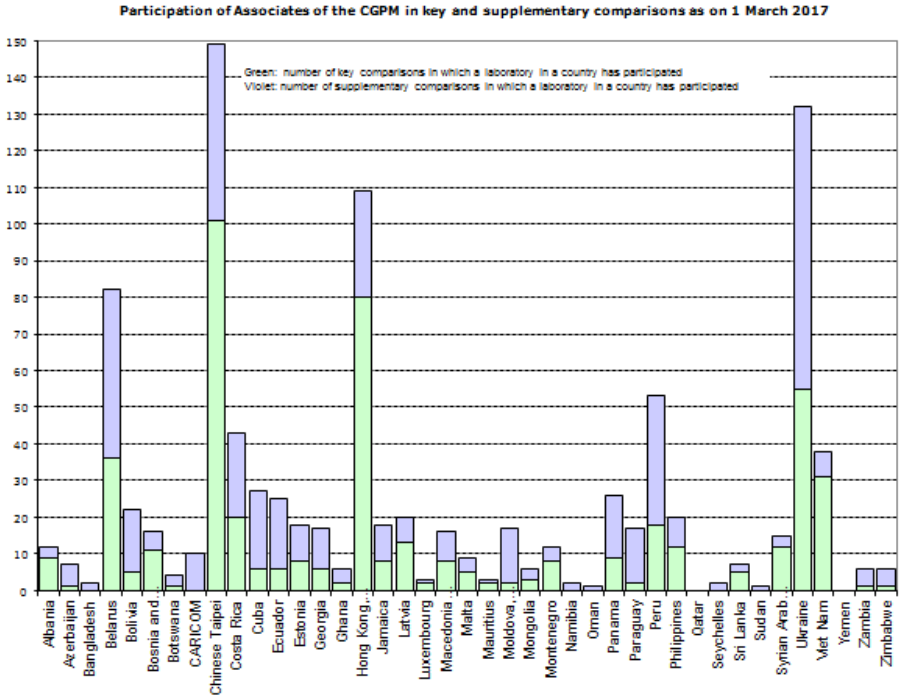

Figure 6. *Graph on the participation of Associates of the CGPM in key and supplementary comparisons*

4. Revision of the BIPM KCDB

Since the last JCRB meeting, the following progress has been achieved on the revision of the BIPM KCDB, here under the working name "KCDB 2.0":

Information on the possible design of the future web-platform was communicated to the JCRB and the Consultative Committees in August 2016, and feedback on a number of issues related to the *Report of the Working Group on the Implementation and Operation of the CIPM MRA* was requested from the CCs, received in October 2016. A tele-conference meeting was held with the CCQM *ad hoc* Working Group on the CIPM MRA revision in September where it was decided to remove independent information on Certified Reference Material in the KCDB 2.0. The issued recommendations by the Working Group on the Implementation and Operation of the CIPM MRA were adopted at the 105th meeting of the CIPM in October 2016, where several recommendations concerned a revision of the KCDB.

The BIPM is presently completing the Functional and Technical Specifications for the KCDB revision. A document has recently been drafted to inform the partners that are directly concerned by the revision on the facilities that have been foreseen.

Following the Working Group recommendations, the following main targets have been identified for the KCDB revision:

1) To create a restricted-access web-based CMC platform for exchange of CMC data and support of the entire CMC review process.

   The approach is to abandon the Excel file as source for the CMC data. Excel files will no longer be sent to the actors. Instead, data will be made accessible in a DRAFT on the CMC Web Platform with the possibility for WRITER, REVIEWER and TC-CHAIR to alter the DRAFT at distinct occasions. The approved DRAFT can be automatically uploaded onto the KCDB.

   The CMC Web Platform will have restricted and controlled access supported by user accounts.

   The CMCs from different countries within the same field will still be regrouped for identification. However, possible problems encountered by one country will no longer delay the publication of approved CMCs of another country from the same group.

2) To create Improved search facilities

   The search facilities will be enlarged with a possibility to obtain the numerical range for the measurand and uncertainties of CMCs, which are not available today.

3) To create the possibility to track comparison in "real-time"

   Registration of new comparisons will be made by the Pilot using a web form which contents will be stored in a database. The pilot may supply supporting documents, e.g. the Technical protocol. Information on progress may be updated by the pilot. The database will allow searching on comparison progress. If the form has not been updated during the last 6 months, the Pilot will receive an automatic e-mail requesting to update the form if progress has been achieved.