REPORT ON THE KCDB TO THE 47TH MEETING OF THE JCRB

v. 2023-09-06
www.bipm.org/
Executive Summary
The KCDB is a platform providing publicly available, peer reviewed, free and, searchable information on CMCs of NMIs and DIs participating in the CIPM MRA, as well as information on the supporting scientific comparisons. The platform also provides behind the scenes tools for the registration, review and publication processes used by the NMI and DI community, and additionally provides a tool for user-generated statistics. The KCDB provides an Application Programming Interface for search on CMCs. Early-stage work is being undertaken with regard to the database so as to understand what further developments might be needed in light of the digital transformation agenda.

The number of CMCs is approximately stable, with increasing information offset by the adoption of wider scope CMCs. The time for review has decreased significantly since the implementation of KCDB 2.0 in late 2019. Compared to the old system, the JCRB review durations have seen a reduction from 140 to 81 median days.

The comparisons record is cumulative, so increases over time, but the rate of increase is also approximately stable, the majority of comparisons launched being repeats of outdated comparisons plus new supplementary comparisons within the RMOs.

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

The key comparison database - KCDB – is a supporting database for the implementation of the Mutual Recognition Arrangement of the International Committee for Weights and Measures (CIPM MRA) that was implemented in 1999. It contains data on Calibration and Measurement Capabilities (CMCs) and comparison results of measurements in physics, ionizing radiation, chemistry and biology. The KCDB is an evidence-based database: all data included have been reviewed by international groups of experts and approved for mutual recognition.

The KCDB website www.bipm.org/kcdb gives access to the following services with open access:

- searching on published CMCs in the KCDB
- searching on published comparison information, reports and results
- information on statistics and recent news on issues linked to CMCs and comparisons

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1 The KCDB Office provides the KCDB report, addressed to the Joint Committee of the Regional Metrology Institutes and the Bureau International des Poids et Mesures (JCRB), every 6 months. Those reports are made publicly available via the BIPM website: https://www.bipm.org/en/cipm-mra/kcdb-reports
supported by a set of guidance documents.

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, and Section 3 highlights the status of Associates of the BIPM. The performance of the system is discussed in Section 4, and a short view on the software status is presented in Section 5. The BIPM KCDB and digitalization is brought to notice in Section 6.

This report reflects the status as of 1 September 2023.

1. CIPM MRA Appendix C: Calibration and Measurement Capabilities

1.1. CMC statistics

There were 25 809 (25 829) CMCs published in the KCDB on 1 September 2023 of which 19 669 (19 645) are in Physics and 6 140 (6184) in Chemistry and Biology, see Figure 1. The total number of published CMCs remains almost the same over the previous year which confirms the observed steady-state trend over the last 5 years period.

The repartition of CMCs on metrology areas, expertise and state or economy is available in real-time from the KCDB home page in “CMC statistics”

https://www.bipm.org/kcdb/cmc/statistics/public

The distribution of published CMCs along the RMOs is listed in Table 1.

The status of not yet published CMCs that are placed on the platform is listed in Table 2; 2723 compared to 2364 half a year earlier. This number can vary considerably, depending on the status of the review campaigns applied by some of the Consultative Committees.

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2 The numbers given within parenthesis represents the number of CMC reported one year earlier.
Figure 1  Number of CMCs registered in the KCDB since September 2009.

Table 1  Number of published CMCs in KCDB per RMO on 1 September 2023 (follow-up of Action 17/1 of JCRB 2006).

<table>
<thead>
<tr>
<th>RMO</th>
<th>Number of CMCs 2023-09-01</th>
<th>Number of CMCs 2022-09-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRIMETS</td>
<td>753</td>
<td>730</td>
</tr>
<tr>
<td>APMP</td>
<td>6763</td>
<td>6756</td>
</tr>
<tr>
<td>COOMET</td>
<td>2197</td>
<td>2580</td>
</tr>
<tr>
<td>EURAMET</td>
<td>11564</td>
<td>11325</td>
</tr>
<tr>
<td>GULFMET</td>
<td>74</td>
<td>46</td>
</tr>
<tr>
<td>SIM</td>
<td>4458</td>
<td>4392</td>
</tr>
<tr>
<td>Total</td>
<td>25809</td>
<td>25829</td>
</tr>
</tbody>
</table>
Table 2 Status of not yet published CMCs in KCDB on 1 September 2023

<table>
<thead>
<tr>
<th>Status</th>
<th>number of CMCs 2023-09-01</th>
<th>number of CMCs 2023-02-23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft</td>
<td>352</td>
<td>355</td>
</tr>
<tr>
<td>RMO: Submitted</td>
<td>462</td>
<td>241</td>
</tr>
<tr>
<td>RMO: Under Review</td>
<td>118</td>
<td>70</td>
</tr>
<tr>
<td>RMO: Review Completed</td>
<td>105</td>
<td>69</td>
</tr>
<tr>
<td>RMO: Accepted</td>
<td>24</td>
<td>344</td>
</tr>
<tr>
<td>RMO: Revision Requested</td>
<td>199</td>
<td>204</td>
</tr>
<tr>
<td>RMO: Revision Completed</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Submitted to the JCRB</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>JCRB: Under Review</td>
<td>278</td>
<td>398</td>
</tr>
<tr>
<td>JCRB: Revision Requested</td>
<td>335</td>
<td>153</td>
</tr>
<tr>
<td>JCRB: Revision Completed</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>JCRB: Approved</td>
<td>329</td>
<td>28</td>
</tr>
<tr>
<td>JCRB: Waiting for VOTE</td>
<td>22</td>
<td>25</td>
</tr>
<tr>
<td>Greyed out</td>
<td>450</td>
<td>454</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2723</strong></td>
<td><strong>2364</strong></td>
</tr>
</tbody>
</table>

The total number of published CMCs during the last 6 months for each metrology area is listed in Table 3. The total number of published CMCs has increased in comparison to the previous 6-month period, noting that 60% of the published CMCs were not subject to JCRB review.

Table 3 Number of published CMCs per metrology area during the last 6 months.

<table>
<thead>
<tr>
<th>Metrology area</th>
<th>Published CMCs 2023-09-01</th>
<th>Published CMCs 2023-02-23</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUV</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>EM</td>
<td>63</td>
<td>95</td>
</tr>
<tr>
<td>L</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td>M</td>
<td>143</td>
<td>30</td>
</tr>
<tr>
<td>PR</td>
<td>63</td>
<td>34</td>
</tr>
<tr>
<td>T</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>TF</td>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td>QM</td>
<td>6</td>
<td>110</td>
</tr>
<tr>
<td>RI</td>
<td>55</td>
<td>6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>373</strong></td>
<td><strong>308</strong></td>
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</tbody>
</table>
1.2. Greyed out CMCs and reinstatements

There are presently 450 greyed out CMCs, compared to 454 CMCs 6 months earlier. Table 4 displays all greyed out CMCs where the most recent events are highlighted in yellow and green for increased and decreased number of greyed-out CMCs, respectively.

Table 4 Status of greyed out CMCs on 1 September 2023

<table>
<thead>
<tr>
<th>RMO</th>
<th>COUNTRY</th>
<th>AUV</th>
<th>EM</th>
<th>L</th>
<th>M</th>
<th>PR</th>
<th>QM</th>
<th>RI</th>
<th>T</th>
<th>TF</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRIMETS</td>
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<td>0</td>
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<td></td>
<td>1</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>APMP</td>
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<td>80</td>
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<td>NZ</td>
<td>1</td>
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<td>8</td>
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<td>11</td>
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<td></td>
<td></td>
<td>4</td>
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<tr>
<td>COOMET</td>
<td>KZ</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>COOMET</td>
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<td></td>
<td></td>
<td>40</td>
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<td></td>
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<tr>
<td>EURAMET</td>
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<tr>
<td>EURAMET</td>
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<tr>
<td>EURAMET</td>
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<td></td>
<td>7</td>
</tr>
<tr>
<td>EURAMET</td>
<td>GB</td>
<td>5</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>EURAMET</td>
<td>IT</td>
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<td></td>
<td></td>
<td>98</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>101</td>
</tr>
<tr>
<td>EURAMET</td>
<td>LT</td>
<td>9</td>
<td>12</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td>21</td>
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<tr>
<td>EURAMET</td>
<td>LV</td>
<td>4</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>EURAMET</td>
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<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>EURAMET</td>
<td>PL</td>
<td>1</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>EURAMET</td>
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<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>EURAMET</td>
<td>SK</td>
<td>10</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>EURAMET</td>
<td>UA</td>
<td>6</td>
<td>1</td>
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<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>EURAMET</td>
<td>JRC</td>
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<td>0</td>
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<td></td>
<td>0</td>
<td></td>
<td></td>
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<td>SIM</td>
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<td>1</td>
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<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>7</td>
</tr>
<tr>
<td>SIM</td>
<td>BR</td>
<td></td>
<td>3</td>
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<td>3</td>
</tr>
<tr>
<td>SIM</td>
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</tr>
<tr>
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<td>MX</td>
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<td>17</td>
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<td></td>
<td></td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>SIM</td>
<td>US</td>
<td></td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

TOTAL: 0 28 17 32 32 216 122 1 2 450
As of 1 September, Table 5 lists the number of greyed-out CMCs in the KCDB that reach its maximum possible 5 years as greyed-out within the next six months.

**Table 5** CMCs reaching the limit of 5 years of stayed greyed-out within the next six months.

<table>
<thead>
<tr>
<th>RMO</th>
<th>Metrology area</th>
<th>number</th>
<th>date limit greyed-out</th>
</tr>
</thead>
<tbody>
<tr>
<td>APMP</td>
<td>Electricity and Magnetism</td>
<td>1</td>
<td>3/2024</td>
</tr>
<tr>
<td>EURAMET</td>
<td>Ionizing Radiation</td>
<td>5</td>
<td>11/2023</td>
</tr>
<tr>
<td>SIM</td>
<td>Mass</td>
<td>3</td>
<td>10/2023</td>
</tr>
</tbody>
</table>

The dynamically updated full list of CMCs greyed-out is available for registered users from the KCDB 2.0 platform under the statistics menu ([https://www.bipm.org/kcdb/cmc/statistics/greyed-out](https://www.bipm.org/kcdb/cmc/statistics/greyed-out)).

2. **CIPM MRA Appendix B: Key and supplementary comparisons**

2.1. **Comparison statistics**

On 1 September 2023 the KCDB listed 1834 comparisons distributed as listed in Table 6; 1157 of them are key comparisons and 677 supplementary comparisons. This represents a total increase of 21 comparisons since 23 February 2023.

**Table 6** Key and Supplementary Comparisons on 1 September 2023.

<table>
<thead>
<tr>
<th>Entity</th>
<th>KC</th>
<th>SC</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIPM</td>
<td>99</td>
<td>1</td>
</tr>
<tr>
<td>CC</td>
<td>573</td>
<td>34</td>
</tr>
<tr>
<td>AFRIMETS</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>APMP</td>
<td>151</td>
<td>123</td>
</tr>
<tr>
<td>COOMET</td>
<td>49</td>
<td>121</td>
</tr>
<tr>
<td>EURAMET</td>
<td>192</td>
<td>219</td>
</tr>
<tr>
<td>GULFMET</td>
<td>7</td>
<td>26</td>
</tr>
<tr>
<td>SIM</td>
<td>78</td>
<td>121</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1157</td>
<td>677</td>
</tr>
</tbody>
</table>
Figure 2 shows the evolution of the total number of key (dark blue) and of supplementary (light blue) comparisons registered in the KCDB since September 2003. The annual increase of key comparisons seems to have stabilized to around 30, corresponding to an increase of 3%. The ratio of supplementary comparisons, 20% in 2006, has continuously progressed to constitute 37% of all comparisons, see Figure 3. The graphs include repeats of key comparisons.

**Figure 2** Total number of key comparisons (dark blue) and supplementary comparisons (light blue).

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

Graphs generated in real-time illustrating the participation in key and supplementary comparisons are available under the Statistics menu on the KCDB home page:

[https://www.bipm.org/kcdb/comparison/statistics/key](https://www.bipm.org/kcdb/comparison/statistics/key)
The following 21 comparisons were registered as new during the last 6 months:

AFRIMETS.L-S6  
AFRIMETS.M.D-S2  
APMP.SIM.M.P-K1c.2023  
CCM.V-K4.A  
CCM.V-K4.B  
CCQM-K10.2018.1  
CCQM-K154.b.1  
CCQM-K157  
CCQM-K73.2018.2  
CCQM-K96.2023  
CCT-K9.3  
COOMET.M.FF-S11  
EURAMET.L-K3.n01.1  
EURAMET.M.D-K5  
EURAMET.M.P-K15.2  
EURAMET.RI(II)-K2.Ho-166m.2024  
GULFMET.RI(I)-S2  
SIM.AUV.A-K6  
SIM.M.F-K3.a  
SIM.M.F-S12  
SIM.QM-S17
The following 38 reports were published during the last 6 months:

<table>
<thead>
<tr>
<th>Report Code</th>
<th>BIPM Code</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFRIMETS.AUV.A-S2</td>
<td>BIPM.RI(I)-K2 (BFHK 2023)</td>
<td>CCT-K9</td>
</tr>
<tr>
<td>AFRIMETS.EM-S3</td>
<td>BIPM.RI(I)-K4 (BFHK 2021)</td>
<td>COOMET.EM-S26</td>
</tr>
<tr>
<td>APMP.EM-S8</td>
<td>BIPM.RI(I)-K6 (ARPANSA 2022)</td>
<td>COOMET.EM-S6</td>
</tr>
<tr>
<td>APMP.M.D-K4</td>
<td>BIPM.RI(I)-K8 (NPL 2022)</td>
<td>COOMET.L-S28</td>
</tr>
<tr>
<td>APMP.T-K3.6</td>
<td>BIPM.RI(II)-K1.Co-60 (update 2023)</td>
<td>COOMET.M.H-S3</td>
</tr>
<tr>
<td>BIPM.EM-K11 (DEFNAT 2022)</td>
<td>BIPM.RI(II)-K4 (ANSTO 2023)</td>
<td>COOMET.T-S4</td>
</tr>
<tr>
<td>BIPM.EM-K11 (NPL 2023)</td>
<td>BIPM-QM-K1 (NIST 2022)</td>
<td>EURAMET.AUV.V-K5</td>
</tr>
<tr>
<td>BIPM.EM-K13 (CEM 2022)</td>
<td>CCPR-K1.a.2017</td>
<td>EURAMET.EM-S43</td>
</tr>
<tr>
<td>BIPM.EM-K13 (INRIM 2023)</td>
<td>CCQM-K150</td>
<td>EURAMET.L-S26.1</td>
</tr>
<tr>
<td>BIPM.EM-K14.a and b</td>
<td>CCQM-K157</td>
<td>EURAMET.RI(I)-S18</td>
</tr>
<tr>
<td>BIPM.QM-K1 (LNE 2023)</td>
<td>CCQM-K68.2019</td>
<td>SIM.QM-S5</td>
</tr>
<tr>
<td>BIPM.RI(I)-K1 (BFHK 2021)</td>
<td>CCT-K7.2021</td>
<td></td>
</tr>
</tbody>
</table>

On 1 September, the number of abandoned or superseded key and supplementary comparisons, stored in the KCDB archives is 102, compared to 86 on 1 September 2022.

### 2.2. Comparisons older than 5 years (Follow-up Action 33/3 of JCRB 2015)

**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.

While uncompleted Key Comparisons, connected to the Consultative Committees, keep reducing in number since the follow-up action was triggered by the JCRB eight years ago, the number of lasting supplementary RMO comparisons is roughly on the same level as in 2015 when this issue was pointed out by the JCRB.

The total number is illustrated in Figure 4. A list of the comparisons concerned is available in Appendix I.
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 7 summarizes the participation of the 36 Associates of the CGPM in CIPM MRA activities as of 1 September 2023.³

³ 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.
Table 7 CIPM MRA activity of the Associates of the CGPM: number of published CMCs and participation in key and supplementary comparisons.

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The repartition of CMCs and comparisons among Associates is illustrated in Figure 5 and Figure 6, respectively.

**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. System’s Performance

An evaluation of the performance of the CIPM MRA activities as documented by the KCDB has been undertaken for the September 2023 Report on the KCDB to the JCRB as follows.

An analysis was started in March 2021 comparing the review duration of CMCs that had been completely processed using the KCDB 2.0. This evaluation is ongoing, and an update is provided in this current report.

Statistical data on JCRB review durations for CMCs are also available from the Statistics Menu of the KCDB 2.0 platform and are illustrated in Fig 7, which shows the average, maximum, and minimum time it took for the CMCs to pass the JCRB review.

![Figure 7: A graph giving a snapshot on 1 September 2023 of the duration of the CMC approval for JCRB review as directly retrieved from the statistics on the CMCs menu of the KCDB. The KCDB 2.0 was launched in 2020.](image)

A more detailed picture is given in Fig. 8 for the last six months (March 2023 to September 2023). Here, the CMC approval time from initial submission to the KCDB, to intra-regional RMO and subsequent JCRB review is depicted for CMCs submitted by the respective RMOs. The JCRB review duration is relatively low, medians of <100 days for all RMOs except one.

As the picture indicated by Fig. 8 shows only the last six months it is interesting to also look at the long-term data. Intra-RMO and JCRB review durations for those CMCs processed fully on the KCDB 2.0 platform since 2020 are displayed in Fig. 9 with a column showing the median value across all RMOs on the right-hand side of the graph.

Based on this, the overall picture is summarized in Table 8 where JCRB review durations are compared to the more recent data of CMCs processed on the KCDB 2.0 platform. The numbers for the current reporting period, column Sep. 2023 in Table 8, have drastically reduced than the March reporting period (from 43 to 22 days minimum and 147 to 71 median days) except for the mean and maximum numbers affected by some CMCs that had very long review durations. There is a slight rise to the KCRB 2.0 figure, from 67 days in March2023 to now 81 days (status 2023-08-24). However, the overall picture as compared to the old system is still quite positive, a reduction from 140 days to 81. The increase of JCRB review durations in the current reporting period is pretty much depending on the metrology area and specific settings at the RMOs.
Since intra-RMO review data was not recorded in the KCDB of the previous system, Table 8 does not contain data for the intra-RMO review. With increasing time working on the new KCDB 2.0 platform, future reports will also comprise the temporal evolution for this review stage.

**Table 8** JCRB review durations in days for CMCs at different times.

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*Computed for CMCs published from 3/2023 to 9/2023
*Computed from the KCDB 2.0 menu ‘Statistics on review performance’ for the whole period since 2020-01-01

![Figure 8](image-url)  
**Figure 8**: Review durations for CMCs published in the KCDB 2.0 from March 2023 to September 2023. The bars reflect median intra-regional review in the bottom panel and median JCRB review durations in the upper panel for CMCs submitted by the RMOs indicated on the x axis.
Review durations are different for different metrology areas as can be seen from Fig. 10. Extremes, in this reporting period (light blue bars), are seen in the JCRB review durations in the areas L and QM. For QM this long JCRB duration was mainly caused by the special arrangement of JCRB review of CMCs. However, the long-term trend from 2020 to September 2023 does reveal a great improvement in JCRB review durations for all areas, as indicated by the dark blue bars in Fig. 10, as compared to the old system.

Due to the special approval process of the CCQM KCWG in the JCRB review, the average duration depends on when the 6-month time window is applied for statistics, and therefore, when the 6-month window is studied. The review duration for the QM area in the longer-term perspective has been computed and displayed in Table 9. March 2023 showed lower JCRB review durations followed by a comparably large median JCRB duration in September 2023. The median JCRB review duration in QM has now increased again to 384 days within this reporting period but with reduced median duration of 119 days computed for CMCs since April 2021.
Figure 10: Median review durations of CMCs published during the last six months (light green and blue bars) and since 2020 (dark blue and green bars) related to metrology areas.

Table 9 Duration of CMCs published in the QM area for JCRB review.

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<tr>
<td>JCRB duration / days</td>
<td>172</td>
<td>384</td>
<td>119</td>
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5. Present Status of the BIPM KCDB 2.0

The KCDB facility is accompanied by providing a variety of guidance material, cf. https://www.bipm.org/en/about-us/kcdb-help.html. Several online demonstrations to users within the frame of the CBKT https://www.bipm.org/en/cbkt/ have been organized during the last 6 months, focused on different user profiles or requested needs.

The KCDB 2.0 software is supported by an Application Management contract, presently giving the opportunity to make smaller adjustments of the software. Anomalies and suggestions for improvements may be communicated by the users by completing the form https://www.bipm.org/utils/common/pdf/KCDB_2.0/Form_for_declaring_an_anomaly_or_request.docx.

The Quality System underpinning the previous version of the KCDB has been updated. An internal audit was held in June 2023.

6. BIPM KCDB and digitalization

The metrology community is progressively noting the importance of FAIR\(^4\) machine-readable data for calibration issues but also for future emerging applications. Industrial sectors request urgently possibilities to use Digital Calibration Certificates which will contribute to versatile technical advantages, cost effectiveness and improvements from a quality perspective.

The BIPM implemented an Application and Programming Interface for the KCDB (API KCDB) in 2021 as a first step in this direction. This interface allows external users to make CMC queries from a support other than the KCDB web and to collect machine readable data: https://www.bipm.org/en/cipm-mra/kcdb-api.

An extension of the service of the KCDB API which provide access to all CMC versions has been launched. In addition of published CMCs, CMCs that are no longer valid can be accessed and traced back when linked to the calibration certificate.

Within the framework of the Digital SI reference system, work is presently progressing towards interoperability of the CMC data.

Acknowledgement

Many thanks to the BIPM IT team Laurent Le Mée and Thierry N'Guyen for their continued support.

\[^4\] Findable Accessible Interoperable Reusable
a) **Key Comparisons**

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