

# Meeting of the CCM Task Group on the Phases for the Dissemination of the kilogram following redefinition (CCM-TGPfD-kg)

Friday 21<sup>st</sup> April 2023, 12.00 to 13.30 (BST),  
(On-line Teams meeting)

Present: Stuart Davidson (NPL, Chair)  
Hao Fang (BIPM, CCM Executive Secretary)  
Richard Green (NRC)  
Dorothea Knopf (PTB)  
Naoki Kuramoto (NMIJ)  
David Newell (NIST)  
Lars Nielsen (DFM)  
Michael Stock (BIPM)

## 1. Opening, agenda

Items for discussion;

- Agree CCM recommendation to address the discrepancy between current realisations of the kilogram
- Discuss and provisionally agree schedule for next KC of realisation experiments
- Proposal to change way the KC results contribute to the next Consensus Value
- Discuss strategy to address the discrepancy between realisations

## 2. CCM recommendation to address the discrepancy between current realisations of the kilogram

DK questioned the rationale of publishing a formal recommendation. DN noted that there was a need to acknowledge the discrepancies in the experiments (of NRC and PTB) and it was also agreed that there was a need to demonstrate that work was being done to try to address this. A discussion with the President of the CCM, Philippe Richard, could be undertaken during the International Conference on Weighing in Hamburg (24-26 April).

## 3. Discuss and provisionally agree schedule for next KC of realisation experiments

It was agreed that a comparison to start at the end of 2023 was needed but that after that a period of 3 to 4 years could be left between comparisons to allow NMIs to concentrate on the development of the experiments and to address the discrepancies between experiments. The proposal for the next comparison and subsequent periodicity should be discussed at the CCM WG-Mass meeting in May.

## 4. Proposal to change way the KC results contribute to the next Consensus Value

A proposal to review the way the KCRV contributions to the consensus value was calculated was discussed. The proposed approach was:

- Calculation of the CV (as mean of last three KC results) will remain the same
- Calculation of KCRV needs to be governed by the requirements of the KC and the participants and should be such that it identifies any discrepancies

- Data from KC should be re-analysed separately to calculate the contribution to the CV. For example, by using an additional uncertainty contribution for non-consistent results such as the approach used to determine the CODATA value for the Planck constant.

The benefit of such an approach would be that the consensus value would be less sensitive to the results of the KC with smaller uncertainties (which were not in agreement). This would result in the CV being more stable and hopefully avoid the need for further changes relative to the value of the IPK (such as the 7-microgram change needed due to the 2023 CV). It was suggested that perhaps the best way to achieve this would be to add a fixed uncertainty to non-consistent results. LN agreed to look at options for this approach.

## **5. Discuss strategy to address the discrepancy between realisations**

Based on the results of the NMIs which took part in the KCs, SD made the following suggestions/remarks relating to addressing the experimental discrepancies.

- Can we learn anything from the “evolution” of the experiments where a step change has occurred in the results (see Appendix 1)?
- Can realistic/useful comparisons of sub-systems/measurements be undertaken?
- External audit of experiments by technical expert(s)?
- Secondment of staff between experiments?

Some initiatives are already underway. NIST are modifying NIST-4 to accommodate a silicon sphere and NRC may also undertake such work. NIST and NRC are planning to compare weights below 1 kg (down to 100 g) on their respective Kibble balance experiments. PTB and NMIIJ are planning an exchange of spheres to duplicate (some of) the measurements necessary to realise a kilogram. Beatrice Rodiek from PTB is currently working at NIST on the Kibble balance experiment.

SD suggested that it would be a good idea to produce a roadmap or similar document to summarise the work which is currently taking place and to outline a strategy to try to find out more about the discrepancies in the experiments.

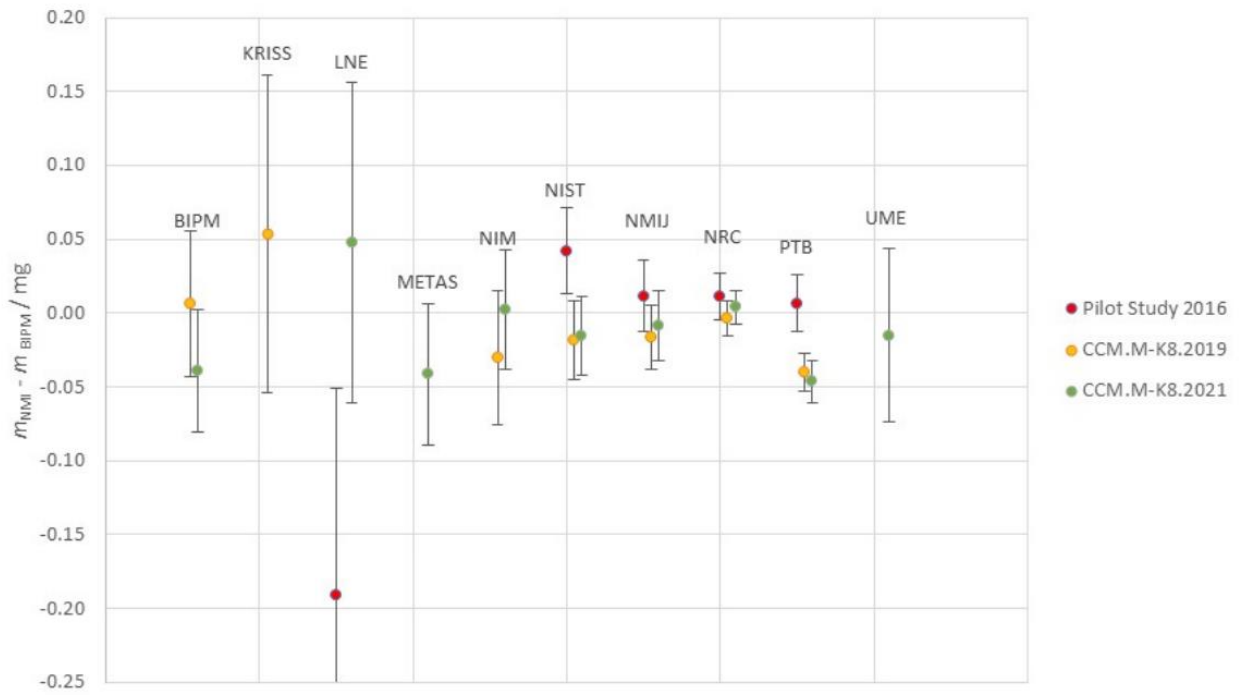
## **6. Any other business**

None

## **7. Date of next meeting**

A meeting during the week of the CCM will be targeted.

## APPENDIX 1: Evolution of experimental results



(Graph from CCM.M-K8.2021 KC report).