

# Calculation of the Consensus Value for the Kilogram 2020

December 2020

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

## Summary

The consensus value for the SI unit of mass, the kilogram, has been determined to be:

**1 kg - 2  $\mu$ g with a standard uncertainty of 20  $\mu$ g**

with respect to the mass value of the International Prototype Kilogram (IPK). This means that the mass of the IPK, based on the consensus value is 1 kg - 2  $\mu$ g.

Traceability for the SI unit of mass will be taken from the consensus value of the kilogram commencing 1<sup>st</sup> February 2021.

## Action required

Since the change between mass values based on the current traceability to the Planck constant,  $h$ , through its known relationship with the IPK, and the new values, based on the consensus value and maintained by the BIPM platinum-iridium mass standards, is small in relation to the uncertainties, **no adjustment to the international mass scale needs to be made**. However, adjustments to the CMCs of National Metrology Institutes (NMIs) may be necessary to take into account the increased uncertainty in the consensus value relative to the current uncertainty in the IPK. Draft adjustments will be calculated by an ad-hoc Task Group of the CCM Working Group on Mass and circulated to the affected NMIs for approval.

### 1. Background

The Consultative Committee for Mass and Related Quantities (CCM) has decided in 2017 that the use of a consensus value for the dissemination of the kilogram is necessary due to the existing discrepancy in the values produced by the realisation experiments (Kibble balance and X-ray crystal density experiments). The determination and implementation of the kilogram consensus value has been agreed by the CCM TGPfD-kg. Details of the calculation and use of the consensus value and the dissemination process can be found in [1] and [2].

### 2. Calculation

This is the first consensus value for the kilogram and has been calculated based on an arithmetic (non-weighted) mean of three sets of data:

- Data directly traceable to the IPK (taking into account the additional uncertainty of 10 micrograms and a contribution for the temporal stability of the BIPM working standards).
- Extant data from the CCM Pilot Study of realization experiments (corrected for the shift of 17 parts in  $10^9$  in  $h$  introduced by the CODATA 2017 adjustment and considering the temporal stability of the BIPM working standards) [3]
- The Key Comparison Reference Value (KCRV) of the first CCM Key Comparison (CCM.M-K8.2019) [4]

The consensus value will be reviewed after each Key Comparison of realisations, scheduled to take place every 2 years.

	Value (1 kg +) / $\mu\text{g}$	Standard Uncertainty / $\mu\text{g}$
International Prototype Kilogram	0	11.7 <sup>†</sup>
Pilot Study Reference Value (2016)	12.4	11.4 <sup>†</sup>
KCRV of the first CCM.M-K8 (2019)	-18.8	7.5 <sup>†</sup>
<b>Calculated Consensus Value (arithmetic mean)</b>	<b>-2.1</b>	<b>20<sup>‡</sup></b>

† These uncertainties are given for information only and are not used in the calculation of the consensus value, the uncertainty in the value of the IPK includes a contribution from the stability of the BIPM working standards on which the mass of the IPK is maintained.

‡ The uncertainty in the consensus value was agreed by the CCM-TGPfD-kg

## REFERENCES

- [1] CCM detailed note on the dissemination process after the redefinition of the kilogram, available on the BIPM web site: [www.bipm.org](http://www.bipm.org)
- [2] Report on the Calculation of the CCM Consensus Value for the Kilogram 2020, M Stock, S Davidson, available on the BIPM web site: [www.bipm.org](http://www.bipm.org)
- [3] Report on CCM Pilot Study CCM.R-kg-P1 Comparison of Future Realizations of the Kilogram, available on the BIPM web site: [www.bipm.org](http://www.bipm.org)
- [4] Report on the CCM Key Comparison of Kilogram Realizations CCM.M-K8.2019, *Metrologia*, **57** (2020) Tech. Suppl., 07030