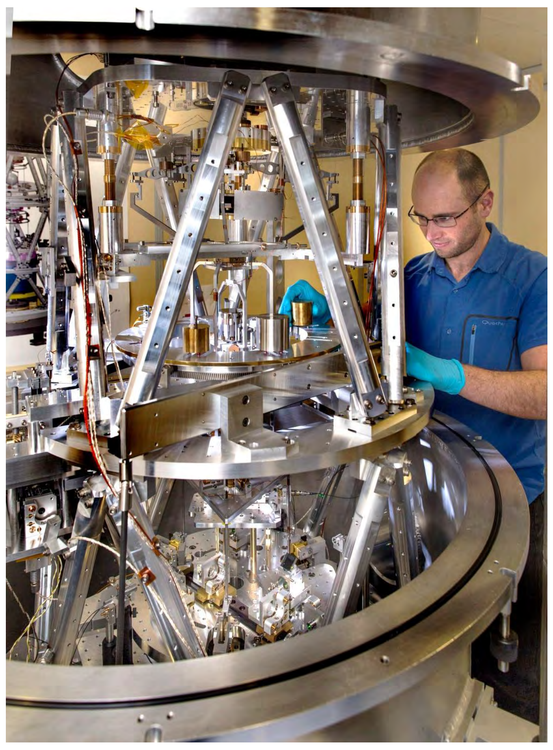
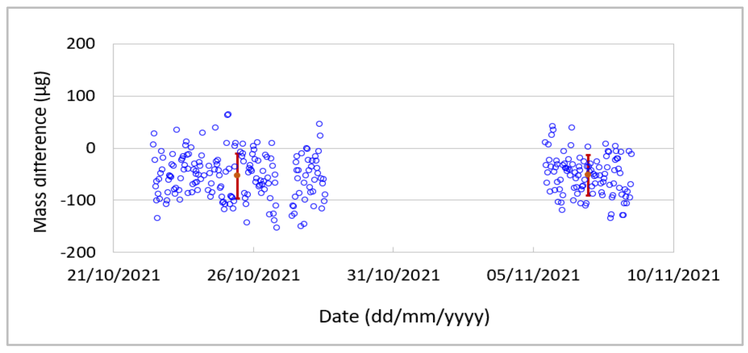
Mass Metrology Projects

The BIPM Kibble balance to realize the new definition of the kilogram on a long-term, cost-shared basis

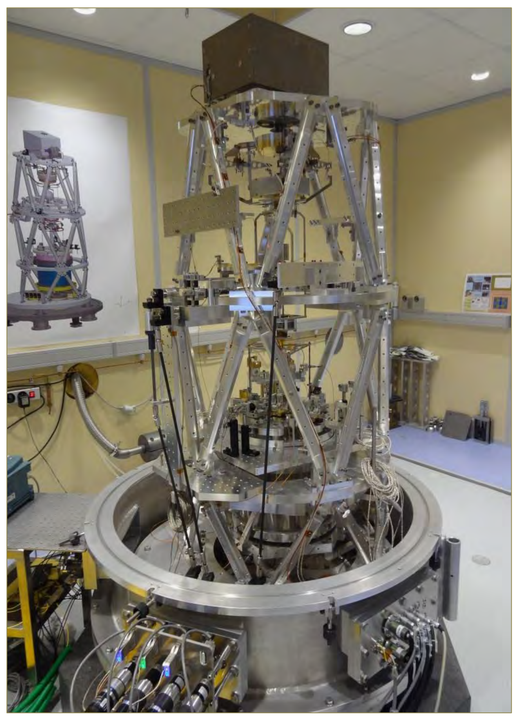


Preparing the Kibble balance for a series of measurements

- Operating at the level of 4 parts in 10^8 (40 µg of 1 kg)
- Participated successfully in two CCM key comparisons of realizations of the definition of the kilogram
- Target uncertainty ≈ 2 parts in 10^8, allowing calibration of a 1 kg mass to within 20 µg
- Can operate in three different measurement schemes to investigate systematic errors



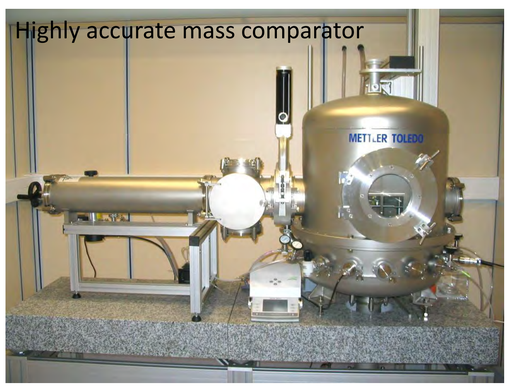
Series of mass determinations with the Kibble balance during several days

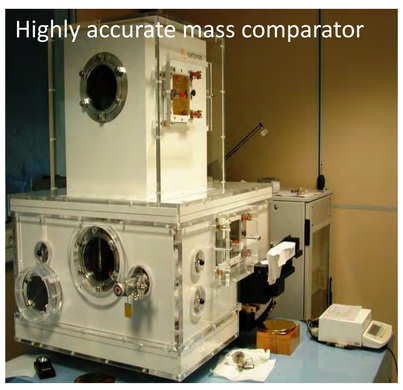


Kibble balance without vacuum chamber

Schematic of the Kibble balance

Mass calibrations for NMIs, in air and under vacuum

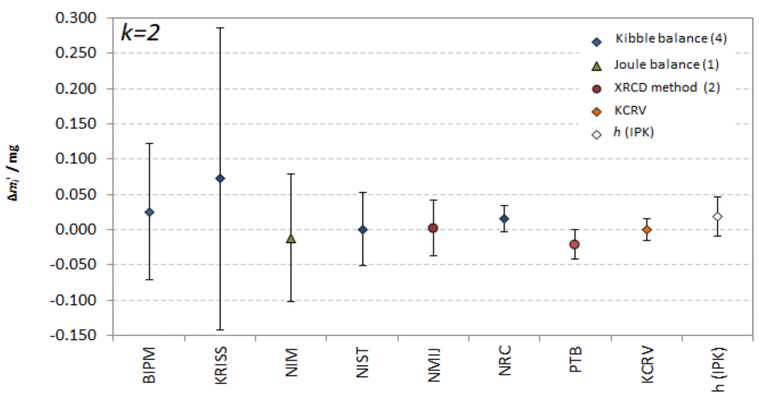




Typical calibration uncertainty: 5 micrograms with respect to IPK, 21 micrograms with respect to CCM consensus value

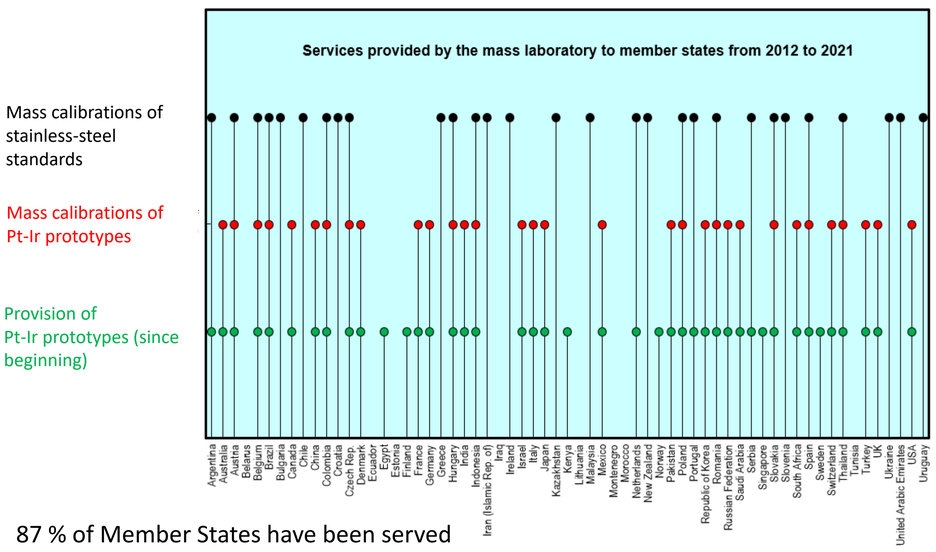
Organization of the first CCM key comparison of realizations of the kilogram, CCM.M-K8.2019

- BIPM organized the comparison and participated with its Kibble balance
- Determination of the agreement of kilogram realizations with independent realization experiments
- Determination of the agreement with the previous definition (IPK)
- Weighted mean of realizations differed from IPK by 0.019 mg
- Discrepancy between two participants with smallest uncertainty
- Second comparison now under way



Differences between mass values attributed to a nominal 1 kg weight by different realization experiments

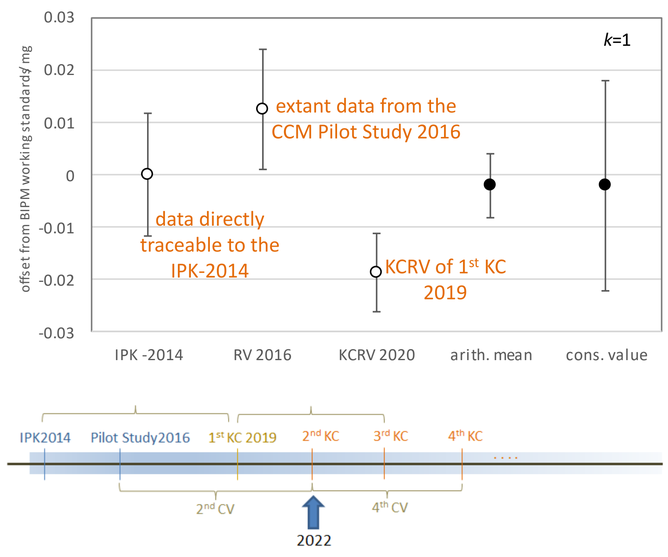
Services provided to Member States



87 % of Member States have been served

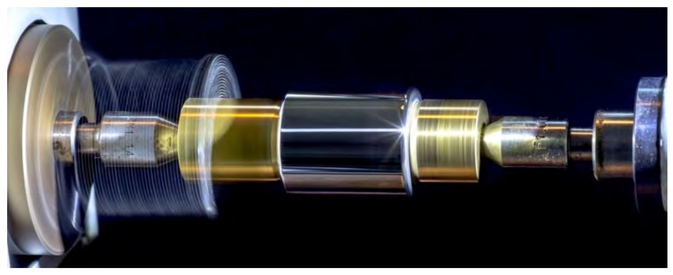
Internationally coordinated mass dissemination based on a 'consensus value'

- CCM decided on internationally coordinated mass dissemination until satisfactory agreement amongst independent realizations
- Key comparison organized every 2 years by BIPM
- Consensus value calculated as arithmetic mean of last 3 reference values
- CV maintained on BIPM working standards
- First CV (2020) differed by 0.002 mg from traceability to the IPK:
  m(IPK) = 0.999 999 998 kg
- New CV will be calculated after second key comparison



Provision of Pt-Ir 1 kg national prototypes for Member States

The BIPM has provided the majority of the Member States with one or more 1 kg Pt-Ir prototypes and continues to do so. Up to now, more than 110 prototypes have been fabricated for 45 Member States and the BIPM.



1 kg Pt-Ir prototype at the final polishing stage in the BIPM workshop

1 kg Pt-Ir prototype in its travel container

1 kg stack of 8 Pt-Ir disks fabricated at the BIPM