

# CCT Strategy refresh

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# CCT Strategy

- Worked in Spring & Summer 2021 to refresh CCT Strategy – complete September 2021
- Many thanks to WG & TG chairs for significant input
- Many thanks to all those who provided editorial comment - it is much better for that!
- Full strategy developed (36 pages)
- One page summary
- Both documents available at:
- <https://www.bipm.org/en/committees/cc/cct/publications>

# CCT Strategy - contents

1. General Information on the Consultative Committee for Thermometry – e.g. members, meetings, president
2. Terms of Reference – what CCT is and does
3. Stakeholders and stakeholder needs - Stakeholders' interests were categorised under the seven priority areas in the “CIPM strategy 2030+: responding to evolving needs in metrology<sup>4</sup>”. These were: climate change and environment, health and life sciences, food safety, energy, advanced manufacturing, digital transformation and “new” metrology

# CCT Strategy - contents

## 4. Structure of the CCT

- Seven Working Groups: WG-SP Strategic Planning, WG-CTh Contact Thermometry, WG-NCTh Non-contact thermometry, WG-Env Environment, WG-Hu Humidity, WG-KC Key comparisons, WG-CMC Calibration and measurement capabilities
- Eight Task Groups – time limited specific activities

## 5. Achievements from 2017 to 2020 and future scan from 2021 to 2030+ - retrospective achievements (e.g. kelvin redefinition) and outlines possible CCT activities to 2030)

## 6. Required Key comparisons and pilot studies 2021-2030+ with indicative repeat frequency – Thermometry, Humidity and Thermophysical Quantities – completed, active and future needs

# CCT Strategy - contents

- Ends with two annexes:
- Annex 1: Published guides in thermometry from CCT: 2017-2021
- Annex 2: CCT Strategy document glossary

# CCT Strategy suggestions

- Organise a *CCT summer school in thermal metrology* as way of rapidly transferring skills and experience to next generation of temperature metrologists hosted by 1 or more NMIs - to be held before 2030.
- WG-SP should (consider) initiating the formation of TGs to report on the impact and requirements for the CIPM identified challenges a) “digital transformation” and b) “New metrology”

Of particular relevance is the rise of *in-situ* traceability and practical primary thermometry leading to traceability at the point of measurement and the possible disruption to established metrological traceability

# CCT Strategy - summary

- Main findings are:
- The influence of the **redefinition of the kelvin (K)** and the associated ***MeP-K-19*** is increasingly being felt by stimulating long term research into primary thermometry approaches for realisation and dissemination of thermodynamic temperature especially:
  - a) at high temperatures by **indirect primary radiometry** through high temperature fixed points
  - b) at low temperatures by **Johnson Noise Thermometry** below  $\sim 5$  K and **Gas Based thermometry approaches (acoustic gas thermometry, dielectric constant gas thermometry, refractive index gas thermometry)**  $> 5$  K ...especially ...for the calibration of CSPRTs

# CCT Strategy - summary

- In the short-medium term, the ITS-90 (**International Temperature Scale**) will still be relevant and continue needing incremental improvements (e.g. to address the possible ban in the use of Hg). It is likely that at high and low temperatures ITS-90 will increasingly be supplanted by primary thermometry ... long term the PLTS-2000 (**Provisional Low Temperature Scale**) could be completely supplanted by primary thermometry
- In the longer term, photonic thermometry, *in-situ* calibration and *in-situ* primary thermometry all have the potential to disrupt current approaches to temperature dissemination



# CCT Strategy - summary

- **A key role of the CCT** will be to monitor this increasingly mixed situation regarding temperature dissemination (i.e. defined scales, primary thermometry and *in-situ* thermometry) and agree how to ensure on-going worldwide equivalence of temperature measurement
- In the **long term, primary thermometry** regulated by the *MeP-K* **may meet temperature dissemination needs.** However, it is prudent to continue investigation into a [range-restricted] future scale (ITS-XX). Any decision to introduce ITS-XX would need to be carefully balanced against real stakeholder needs and cost of implementation

# CCT Strategy - summary

- **Humidity and moisture** metrology is driven notably by environmental needs and climate observations, advanced production processes and future energy gases e.g. hydrogen. The WG ... resolving issues regarding ambiguous definitions of terms and to repeat a KC
- **Key environmental observations** are inextricably linked to temperature and humidity measurements. Collaboration with WMO, GCOS, and IAPWS via CCT WG ENV allows a reciprocal exchange of expertise and advice leading to ever increasing traceability of the measurement of these Essential Climate Variables. Work is on-going to improve the reliability of air temperature measurement

# CCT Strategy - summary

- The TG for **Body Temperature Measurement** is working to improve the metrology of BTM in response to the plethora of inappropriate BTM for triage that was performed during the COVID-19 pandemic
- Reliable determination of **Thermophysical quantities** are particularly valuable to support the energy and advanced manufacturing sectors. Comparisons of key TQ are being led by the TG to support CMCs

**ANY QUESTIONS?**