

MINUTES FOR THE ONLINE MEETING OF CCT-WG-CTH ON 2020-12-01

Attendees: Christof Gaiser (PTB) chairman, Bernd Fellmuth (PTB), Robin Underwood (NPL), Richard Rusby (NPL), Tohru Nakano (NMIJ/AIST), Laurent Pitre (LNE-CNAM), Patrick Rourke (NRC), Roberto Gavioso (INRiM) Peter Steur (INRiM), Rod White (MSL) (partially), Inseok Yang (KRISS), Jintao Zhang (NIM), Wes Tew (NIST) (partially), Vladimir Kytin (VNIIFTRI), Susanne Picard (BIPM)

Agenda:

- I) Revision of the consensus values for T - T_{90} from 4 K to 303 K (or maybe 430 K)
 - 1) General remarks on the data used for the consensus values in 2011 and necessary input for a new consensus estimate (C. Gaiser)
 - 2) Short presentations of T - T_{90} (2 slides) from each partner (maximum of 5 minutes).
 - a) TIPC CAS LNE : SPRIGT, AGT (Laurent Pitre)
 - b) NPL: AGT (Robin Underwood)
 - c) INRiM: AGT and RIGT (Roberto Gavioso)
 - d) NIM: AGT (Jintao Zhang)
 - e) NRC: RIGT (Patrick Rourke)
 - f) KRISS: AGT (Inseok Yang)
 - g) NMIJ: AGT and JNT (Tohru Nakano)
 - h) VNIIFTRI AGT (Vladimir Kytin)
 - i) PTB: DCGT (Christof Gaiser)
 - 3) Discussion
- II) Recommendation on new measurements of T above 400 K
- III) Revision of appendix on sealed metal fix-point cells.
- IV) Other issues (Ar-contamination in O₂ subgroup ? (P. Steur), additional sub-group meetings? (L. Pitre))

Decision and actions I) Revision of the consensus values for T - T_{90} from 4 K to 303 K (or maybe 430 K)

All partners agreed that an update in the range below 300 K is useful. The next step is that all partners send the published (or submitted) data of their T - T_{90} measurements, which are not included in the 2011 evaluation, to PTB until the end of January 2021. In the following, PTB performs different evaluation schemes (weighted mean values at the temperatures used in 2011 article, least square fits and possibly generalized least square fit to all data sets etc.) to extract new consensus values. The preferred way of PTB and some of the members is to start any evaluation with an overall dataset, where the data used for the 2011 article will not be used as individual ones but as a combined input with already accepted uncertainty estimates (Table 2 of the publication). This is mandatory for traceability reasons and avoids a troublesome re-evaluation discussing outliers etc. Still the references to the data used for the 2011 article will be given as a sign of respect. Regarding a larger number of members (even though co-authors of the 2011 article) being now convinced that the 2011 evaluation was a strange approach. Alternatively, a test with only a post ITS-90 dataset can be helpful. The outcome of the new evaluations will be discussed in early Spring (an additional online meeting will be organized).

The main goals of the publication is to keep the used mathematics as simple and clear as possible and to allow the existing users of the T - T_{90} data to simply substitute their used values and uncertainties.

Decision and actions II) Recommendation on new measurements of T above 400 K

There was agreement that a recommendation is useful for stimulation of new measurements of thermodynamic temperature T above 400 K, but there was a discussion about the formulation. It was mentioned that the two main sentences are partially contradictory. Therefore, the second sentence has been slightly modified to:

that member state NMIs take full advantage of the opportunities for the realization and dissemination of thermodynamic temperature afforded by the kelvin redefinition and the *MeP*-K,

that member state NMIs improve their capabilities in primary thermometry above 400 K resulting in better knowledge on T - T_{90} and herewith more accurate access to thermodynamic-temperature values via the realization of the ITS-90 for a broader community.

Decision and actions III) Revision of appendix on sealed metal fix-point cells.

There was agreement among the members that the sealed metal fix-point cells (SMFPCs) are not forbidden in the ITS-90 and, therefore, they cannot be excluded from the Guide, and the appendix must remain under the responsibility of WG-CTh.

On the other hand, the solution of the occurring problems with SMFPCs is not the task of WG-CTh because the use of SPFPCs does not represent a realisation of the ITS-90 on the highest level. Therefore, future guidance and documentation should be given by WG-CMC and/or TG-GoTh.

The next steps will be an editorial change of Section 2.4 of the Guide and a revision of its appendix. This revision will clarify once more that SMFPCs need an initial calibration, otherwise the worst-case uncertainty estimate has to be used. All further statements concerning uncertainties and treatment of SMFPCs will be contained in a Guide under the responsibility of TG-GoTh.

Decision IV) Ar-contamination-in-O₂ subgroup

Our working group will establish a subgroup that will amend the working document of Peter Steur and Franco Pavese on Ar contamination in O₂-triple-point cells. Bernd Fellmuth, Patrick Rourke, and hopefully Weston Tew will take part in this subgroup and the outcome should be a document that can be posted on the BIPM website.

Decision IV) Meetings

There will be an additional meeting of the whole WG presumably in early Spring (end of March) in order to discuss the first outcome of the evaluation of T - T_{90} data (see action I).

A smaller subgroup meeting (at the moment L. Pitre, J. Engert, B. Fellmuth will take part) is intended to be held in January or February, where T_{90} - T_{2000} data submitted by L. Pitre will be discussed. Other members of the WG are surely welcome.

Decision V) Comprehensive study on Xe-suppliers

P. Rourke and P. Steur have submitted a comprehensive study on possible Xe suppliers. This is important information for an eventual substitution of the Hg-TP by the Xe-TP. Therefore, this document should be posted on the BIPM website with open access.

Decision VI) Other business

L. Pitre initiated the discussion of a comparison of cSPRTs in the low-temperature range. The position of PTB is that there is no difference between such a comparison and an already performed key comparison. NRC and others expressed their opinion in the same direction. PTB is of the opinion that a direct comparison of primary thermometers is the main goal at the moment. It is much more challenging but would help to increase confidence in feasibility of primary thermometry as future way of temperature dissemination.