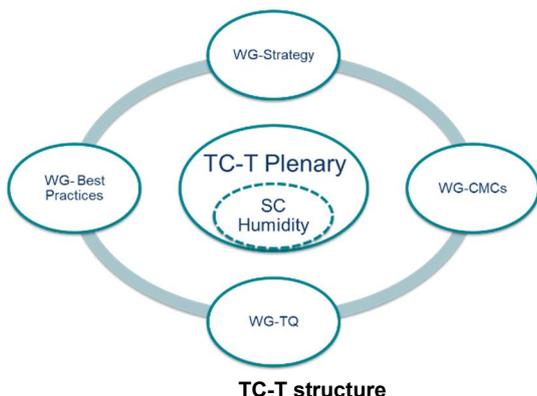


### 1. General Aspects

The TC-T is structured in one Sub-Committee for humidity and moisture (SC-H) and four very active working groups dealing with the TC general strategy (WG-Strategy), capacity building and knowledge transfer (WG- Best Practices), CMCs evaluation (WG-CMCs) and Thermophysical Quantities (WG-TQ). These groups develop and coordinate the most important activities of the TC between plenary meetings.



Since several years the plenary meetings have been structured in one day for a technical workshop, one half day for the SC-H and one day for the TC plenary. The WGs also have satellite meetings in the same period. The attendance to the 2019 meeting can be summarize as follows:

- WG meetings: averaging 23 attendees per meeting (including observers and invitees)
- Technical Workshops: 73 attendees
- SC-H: 55 attendees
- TC-T plenary (2 sessions): averaging 73 attendees per meeting. CMC WG: 21

The TC-T and SC-H count on 35 and 18 contact persons respectively.



2019 TC-T meeting Group Photograph

### 2. Projects

At the moment of writing this report there were 24 projects in progress. Except for 1 case (project 1400) the coordinators have reported timely and in due form the activities performed during the year. All these projects are of the comparison type except the project numbers 1294, 1400 and 1459 that are classified as research projects. Since the last GA 4 new projects started (project numbers 1446, 1447, 1457 and 1459) approved by the TC-T in the 2018 plenary meeting or by e-mail.



During the TC-T plenary a very interesting project proposed by the WG-TQ was approved. The project will carry out a wide survey to define measurement capabilities in the field of thermophysical properties of materials. The survey will mainly focus on gathering basic metrological information, more specifically on the type of measured quantity, measurement range and combined measurement uncertainty. This information will be made available to the TC-T.

### 3. Comparisons

There are several running comparisons at CCT and regional level that involve most of the TC-T members:

- CCT.K8: Comparison of realizations of local scales of dew-point temperature of humid gas. The measurements have finished. The instruments behave well and with good reproducibilities. There will be an anonymous presentation at the TEMPMEKO 2019 conference and the draft A of the comparison will be distributed before the end of 2019.
- EURAMET project 1352: Comparison of the realisations of the relative humidity (RH) in the range from 10%rh to 95%rh at temperatures from -40 °C to +1 °C. This comparison is behind schedule due to re-organisation problems of the coordinator, but a lot of work has been done: the protocol is ready and has been developed following the new CCT-WG-Hu policy of “less is more”, it has been restricted to just two temperatures and 3 RH values
- EUROMET.T-K8 (project 717): Comparison in dew-point temperature (high range). The data evaluation strategy was presented and discussed with the participants at the TC-T 2018 meeting. Intense work to complete draft A was invested by the coordinating laboratory. Draft A is now on a good way to be finalized.
- EURAMET project 1189: Comparison of the realisations of the relative humidity in the range from 10%rh to 95%rh at temperatures from -10 °C to 70 °C. Consistency tests on the data were performed and the final results with the comparison reference values proposed have been presented during the 2019 TC-T meeting. After the meeting all the participants will be asked to comment/confirm the draft B results and the final report. The final results will then be presented during the TEMPMEKO 2019 Conference.
- CCT.K10: Realization of the ITS-90 between 960 °C and 3000 °C. The Draft A report will be issued before the 2020 CCT meeting.
- EURAMET.T-K9 (project 1318): ITS-90 SPRT Calibration from the Ar TP to the Zn FP. The measurements have been finished long ago. The coordinator have not issued the Draft A report waiting for the parent comparison CCT.K9 that is delayed for many years. During the 2019 TC-T meeting the coordinator has been asked to prepare the comparison report regardless the completion of the CCT.K9 comparison because the linkage can be done afterwards.
- EURAMET.T-S3 (project 1268): Comparison of the calibration of thermocouples in fixed points and/or by comparison from 419,527 °C (freezing point of zinc) up to 1492 °C (Pd-C eutectic fixed point). The Draft A report is being discussed by the participants. There will be a presentation of the results at the TEMPMEKO 2019 Conference.

There are other comparisons that involve a lower number of participants: EURAMET projects number 1145, 1149, 1167, 1193, 1357, 1358, 1401, 1403, 1422, 1434, 1442, 1446, 1447 and 1457; the coordinators have sent a progress report that can be consulted in the EURAMET web page.

Since the previous report two comparisons have been completed corresponding to the EURAMET project numbers 1392 (EURAMET.T-S5) and 1429.

#### **4. CMCs**

The CMCs are reviewed by the members of the WG-CMCs that is currently chair by D. del Campo. The members are appointed by the TC-T plenary based on their different expertise. There are 2 members (VSL and NPL) to review the CMCs for SPRTs and fixed points, 2 (PTB and MIRS/UL-FE/LMK) to review the CMCs for industrial thermometers, 1 (CEM) to review the CMCs for thermocouples, 2 (PTB and LNE-CNAM) to review the CMCs in radiation thermometry and 2 (INRiM and MIRS/UL-FE/LMK) to review the CMCs in humidity.

Due to the change of coordination there has been some delays in the revision of the CMCs in the last year. However 2 submissions with new or modified CMCs have been published during this period December 2018 and February 2019 that can be summarized as follows (the text changes only are not included):

- 8 new/modified on humidity from 3 countries
- 7 new/modified on SPRTs from 2 countries
- 3 new/modified on thermocouples from 1 country
- 1 withdrawal for thermocouples from 1 country
- 7 withdrawals in radiation thermometry from 2 countries

During this period six submissions from other RMOs have been reviewed (3 from AFRIMETS, 2 from APMP and 1 from SIM).

The deadline for the 2019 review cycle was the end of February and a number of CMCs from 6 countries are being examined.

It is important to mention that some problems have arisen during the inter-RMO reviews. Despite the existence of agreed CCT review protocols there has been some differences of opinion with other regions, especially APMP. It is expected that these problems will be discussed during the next CCT-WG-CMCs meeting that will take place during the TEMPMEKO 2019 conference.

#### **5. Activities of the Subcommittees**

The TC-T has only one sub-committee regarding Humidity and Moisture. The Sub-Committee Humidity (SC-H) is concerned with all issues of measurement of humidity and moisture, as well as with standards and references necessary for developing the metrology in the field.

The SC-H is coordinated by Vito Fericola (INRiM) with Domen Hudoklin (MIRS/UL-FE/LMK) as sub-convener and met prior to the TC-T plenary meeting in the morning of 11th April 2018.

The meeting started with the presentations of the attendees and the revision of the previous meeting minutes and actions. A review of the ongoing comparisons was made, including the presentation of some draft results like project 1189. It was pointed out the real need for a comparison in the trace water range in which special care should be taken on the definition of the measurand.

The SC-H was also informed about the most recent news and activities of the CCT-WG-Hu, in special about the documents in preparation and the ongoing discussion in reducing the burden of comparisons under the concept of "less is more".

With respect the EMPIR calls, some discussions about the proposals for the current call took place, in addition to the presentations of the outputs of some projects of interest for the sub-committee.

## 6. Participation in EMRP/ EMPIR

The EMPIR project “Implementing the new kelvin2” (InK2) formally finishes in May 2019. There will be a keynote address and also a themed session concerning the outcomes of the InK2 project at the TEMPMEKO 2019 conference in Chengdu June 2019. The overall target is to have all the results ready for presentation to the appropriate working group at CCT March 2020.

The 2018 SI EMPIR call was prepared in advance thanks to the organization of a workshop in December 2017 by CNAM. One out of the 2 JRP submitted was finally selected for funding: RealK. The overall goal of this project is to take the kelvin redefinition (and the MeP-K-19) and begin to turn it into a reality, therefore this project is strategic and of the highest importance for the thermal community. In addition, in the normative call there were another project funded that is linked to our community: INCIPIT. This project has, as its main objective, to create a reference for precipitation for non-catching systems. Its linkage to the TC-T comes from the dependence on temperature of this instruments, the full traceability is a real challenge.

The thermal community was very involved in the Energy and Environment 2019 call collaborating in the preparation of the call scopes through the Task Groups and participating in the preparative workshops. During the 2019 TC-T plenary meeting there were some discussions regarding the preliminary list of the SRTs, in special the one for environment as thermodynamics plays an essential role in all issues related to climate change. There was a unanimous concern regarding the non-selection of SRTs related to these topics that were supported for important stakeholders like presidents of WMO committees. In consequence the recently created EMN Climate and Ocean Observation will start its works with a partial lack of research projects. The TC-T is expecting with great interesting the explanations of the EMPIR Committee for the non-selection of the ideas linked to the committee to improve the proposals in the future.

## 7. Capacity Building: Activities of the last year and future needs

The TC-T is really engaged with all the capacity building activities organized by EURAMET and in fact it is one of the main objectives of the WG-BP, discussed within the Strategy Group and there is always a slot on the TC-T agenda for the Euramet CB Officer to give a presentation.

2018 was in particular really successful at this respect with the organization of the first EURAMET Summer School (SS) on Thermal Metrology. It was hosted by EIM in Thessaloniki 17<sup>th</sup>-21<sup>st</sup> September and the whole TC-T was deeply involved, in particular the WG-BP and WG-S, highlighting the work of Evmorfia Kokkini from EIM. The SS counted on 44 students from 32 countries, including 8 guests from other RMOs. There were 28 lecturers, 22 from EURAMET, 1 from COOMET, 1 from BIPM and 4 from other institutions. It was structured in 3 main topics: temperature, humidity and thermophysical properties. The teaching method was through lectures and hands-on laboratory sessions (up to 7 in parallel). The concept of SS has been proven as successful, it could replace several short training courses increasing the efficiency of the training and reducing the costs. It was unanimously agreed by the TC-T plenary to run a second one on 2022/3.

Among the ideas that were discussed with the EURAMET CB officer during the TC-T meeting was the possibility to organize a course on the organization and data treatment of comparisons. The reason was that most of the delays in the completion of inter-laboratory comparisons was the complexity of the data treatment, so if there were more people able to do it maybe the issues with the delays could be partially solved.



The EURAMET Summer School on Thermal Metrology

## 8. Meetings

The TC-T has been invited by INTiBS to hold the next meeting in Wrocław (Poland). The meeting will take place at the institute itself from 21<sup>st</sup> to 24<sup>th</sup> April 2020. The meeting will include, as usual, the SC-H and WG satellite meetings. In addition, and to speed up the final wording of the calibration guides that are under elaboration, it has been agreed to organize a workshop, previous to the TC-T plenary meeting, with groups working in parallel on the different calibration guides.

To prepare the 2020 EMPIR call, the TC-T has also agreed to organize a specific workshop in the last third of 2019, dates and place will be decided before the summer.

## 9. Issues

In addition to the issues mentioned in the previous points some of the TC-T members are concerned by the uptake of the EURAMET calibration guides by the accredited laboratories in some countries. Several accreditation bodies hinder the implementation of the EURAMET guides because they do not consider them as mandatory. It was suggested to encourage EA at the highest levels to boost the implementation of these guides.

The TC-T is also concerned on how to implement an efficient interaction with the recently created EMNs. In the past it has been highlighted the poor interaction among the different TCs so the arrival of the EMNs could increase this problem. It was decided to invite representatives from the relevant EMNs to the thermal community to the 2020 meeting to foster this interaction.

Regarding the effecting closer integration of the Thermal Quantities community in the Euramet region into TC-T activities remains with no significant changes. However the possible new EURAMET project to carry out a survey to define measurement capabilities in the field of thermophysical properties of materials in our community could give a clear picture of the involvement of the different NMIs in this field.

## 10. Strategic Planning

The TC-T Strategic Planning falls within the responsibility of the WG-S currently chaired by Steffen Rudtsch (PTB).

During the second half of 2018 a document formulating a Strategic Plan for Comparisons within EURAMET TC-T was developed. The document has the intention to establish a long term plan for the high level TC-T comparisons that is mainly based on the plan developed by the CCT with the inclusion of some secondary comparisons developed at a regional level. The document was presented in the 2019 plenary meeting and is available for the TC-T members in the restricted area of the EURAMET web page.

It has been also discussed within the WG-S about the need to update the roadmaps. Although it does not seem to be essential for the preparation of future research programs it is consider important to give an overview of the future research needs in thermal metrology so it is probably that the TC-T will start the update of the roadmaps by 2021.

## **11. Outlook for 2019/2020**

In 2019-2020 TC-T activities will include, apart from the routine activities like CMC review:

- Major participation from the EURAMET Thermal Metrology community in the TEMPMEKO Conference to be held in Chengdu in June 2019. The most important outputs of the different EMPIR projects that are ongoing or which have recently finished will be presented. In particular four of the invited keynote addresses are from the Euramet TC-T community; Graham Machin will be speaking about the redefined kelvin, Stephanie Bell will be speaking about humidity quantities, Andrea Merlone about the activities of the CCT Working Group on Environment and Dolores del Campo will present the EURAMET coordinated approach to address the societal and industrial challenges in the field of thermal metrology.
- Organisation of a dedicated workshop to prepare the Fundamental and Industry 2020 EMPIR calls.
- Next TC-T meeting to be held in Wrocław (Poland), 21<sup>st</sup> to 24<sup>th</sup> April 2020.
- Organisation of a workshop to finish the works of some calibration guides that are on preparation