

CCT/20-22



EURAMET TC-T Report

Dolores del Campo
EURAMET TC-T Chair
October 2020



Outline



- EURAMET membership
- TC-T main role and organization
- Strengthening our links with other RMOs
- EURAMET TC-T projects and comparisons
- EMPIR TC-T ongoing research projects
- TC-T knowledge transfer
- European Metrology Networks

EURAMET Membership

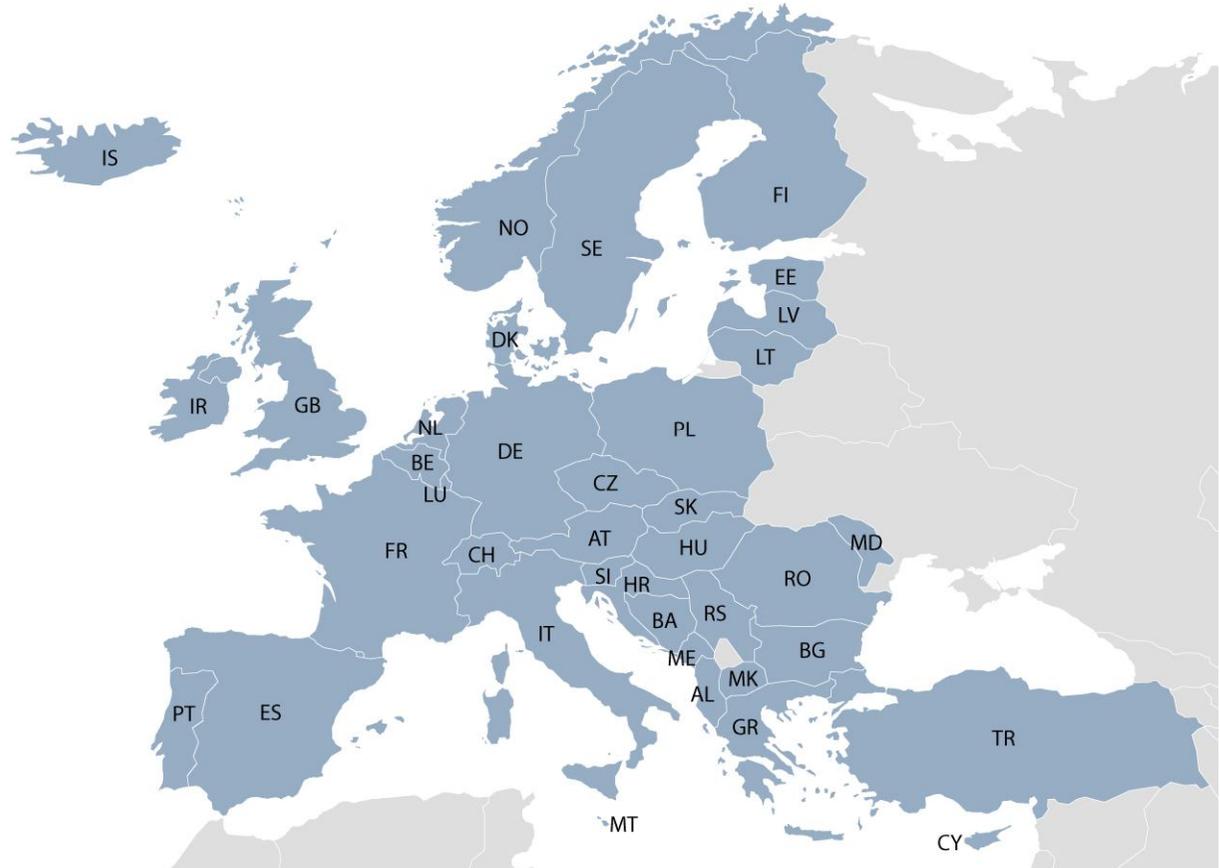


Members

38 NMIs

Associates

77 DIs



TC-T Line of action



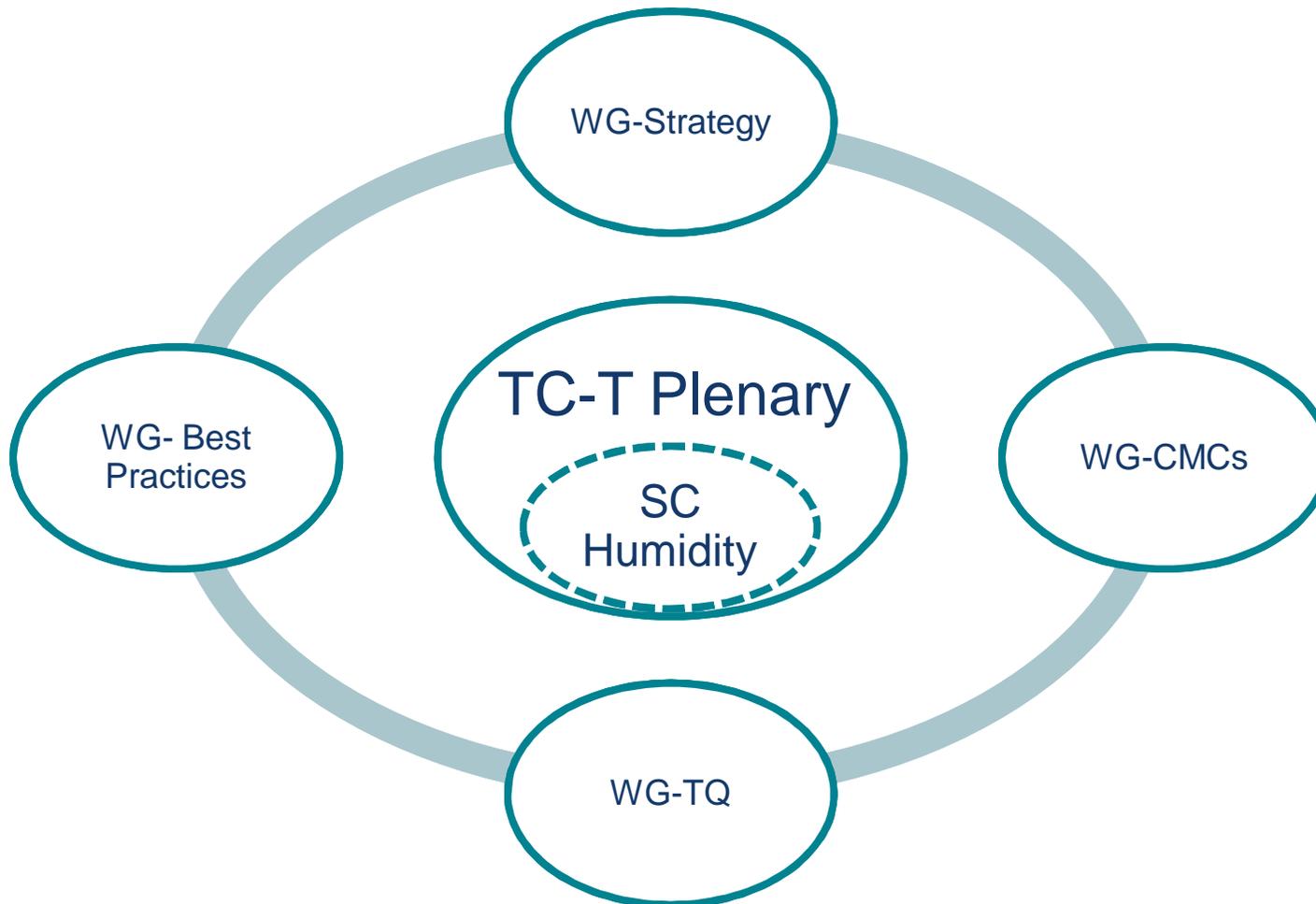
The Technical Committee of Thermometry is concerned with all issues of measurement of

- temperature,
- humidity and moisture, and
- thermophysical quantities of materials
- as well as with scales, standards and reference materials necessary for metrology in these fields.



Thermometry

TC-T Structure



TC-T Plenary



The TC-T is the **forum for scientific and technical cooperation** in the field of thermometry and related quantities. We contribute to the **elaboration and execution** of the Metrology Research Programmes and we are **responsible for the execution of the activities** required by EURAMET as the European Regional Metrology Organisation (RMO) for the fulfilment of the requirements of the CIPM MRA.

2020 Meeting, on-line 1st-2nd September

- WG meetings: averaging 23 attendees per meeting (including observers and invitees)
- SC-H: 69 attendees
- TC-T plenary: 74 attendees

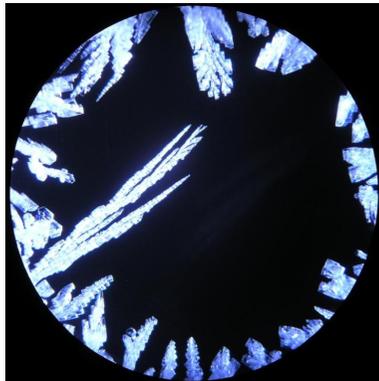


SC-Humidity



The SC-H is chaired by **Vito Fericola** with **Domen Hudoklin** as vice-chair.

The 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:



- It disseminates information about the member NMI initiatives and research;
- It promotes collaborations and comparisons in humidity (and moisture);
- It contributes to EURAMET and CCT strategy (via CCT/WG-Hu).

WG-Thermophysical Quantities

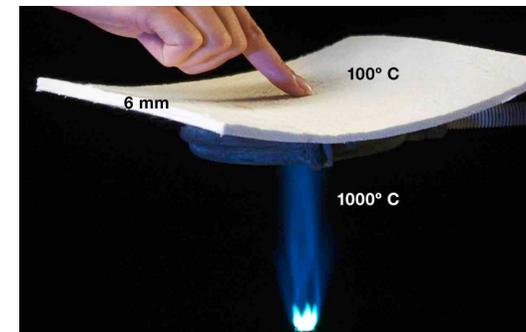


The WG-TQ is chaired by **Bruno Hay** with **Peter Pavlasek** as vice-chair.

This working group is focused on studying **issues of measurement of thermophysical quantities of materials** (TQM).

Its outcomes are used to enhance and support needs and developments of industry and society.

This goal is achieved through mobilizing the TQM community, targeting and completing gaps of the research programs, building capacities, and disseminating scientific knowledge.



WG-Best Practices



The WG-BP is chaired by **Miruna Dobre**.

The purpose of the group is to **transfer knowledge** within the EURAMET member institutes, to accredited calibration laboratories and beyond.

The WG-BP monitors the current status of existing **guidelines** and other best practice documents and identifies needs for new ones. When technically necessary existing documents are updated, new documents are proposed and prepared.



The WG-BP **monitors needs for training** of NMI personnel and stakeholders. When needed, training courses or training programmes are initiated. The WG identifies needs for capacity building among the Euramet NMI TCT community, in coordination with the TCT WG Strategy.

The WG-CMCs is chaired by **Dolores del Campo**.

The aims and purpose of this working group are to provide **input into the CCT WG-CMC** for the development of protocols defining the procedure and technical criteria by which temperature, humidity and thermophysical quantity CMCs are reviewed. Use the agreed protocols **to perform reviews of temperature, humidity and thermophysical quantity CMCs** to verify that claimed values are realistic and to ensure consistency between laboratories.

To **validate** temperature, humidity and thermophysical quantity **CMCs from other RMOs** to ensure consistency of the claimed values between the different metrology regions. To ensure that approved CMCs are published on the KCDB.



WG-Strategy



The WG-Strategy is chaired by **Steffen Rudtsch**.

The role of the TC-T strategy working group is to put in place the necessary structures, foster collaborations and research to ensure that the EURAMET TC-T continually meets its objective in a timely manner.

- Preparing recommendations for TC-T plenary
- Generation and updating of roadmaps
- Identifying and recommending capability development and research priorities
- Encouragement of collaborative projects
- Recommend to TC-T appropriate regional KCs in support of CMCs
- Linkage with CCT Strategy Group and EURAMET TC-T.
- Strengthening the links with key users and stakeholders



Strengthening our links with other RMOs

In 2018 EURAMET and COOMET signed a Memorandum of Understanding



Already put into practice between the EURAMET TC-T and the COOMET TC 1.10:

- Participation in the respective TC meetings
- Participation and collaboration in the training activities
- Development of calibration guidelines

... **in 2021 the first joint EURAMET-COOMET TC meeting will take place.** The meeting will include satellite events like a training course on international comparisons, CMCs and the new KCDB and a workshop on the challenges of the new kelvin definition.

TC-T Comparisons



There are several running and recently finished comparisons at CCT (coordinated by EURAMET members) and regional level that involve most of the EURAMET 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 reproducibility. The draft A of the comparison will be distributed before the end of 2020.

CCT.K10: Realization of the ITS-90 between 960 °C and 3000 °C. The Draft A already circulated among the participants.

EUROMET.T-K8 (project 717): Comparison in dew-point temperature (high range). Draft A has already circulated among the participants and the comments received by the coordinator, the completion of Draft B might be expected within 2021.

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 preliminary (anonymous) results were presented during the TC-T 2020 meeting. The circulation of Draft A is expected by the beginning of 2021.

TC-T Comparisons



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). Final report published in July 2020.

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 being scheduled due to re-organisation problems of the coordinator and the covid-19 issue, 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.

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. Final draft report is under preparation.

Other relevant TC-T projects



Project 1459: Air Temperature Metrology

This EURAMET project, coordinated by Andrea Merlone, includes two main activities:

- Perform a pilot study (in the form of an interlaboratory comparison) to explore issues around calibration in air of temperature sensors;
- Feed into a EURAMET calibration guide the findings from the pilot study.

The output of this project will provide best practice which is currently lacking. This proposal is also expected to bring valuable input to **WMO**, for the definition of best practice and sustained performance classification, **GCOS task team on Global Surface Reference Network**, for inclusion in the requirements of reference grade air temperature measurements and **GRUAN**, for the general aim at documented traceability for radiosondes temperature profiles.

The pilot study is **open to the participation of other RMOs**.

Other relevant TC-T projects



Survey to define the European measurement capabilities in the field of thermophysical quantities of materials

The project, coordinated by Peter Pavlasek, has as objective to conduct a Europe wide survey to define measurement capabilities in the field of thermophysical properties of materials in laboratories and research institutes other than NMIs and DIs.

This survey will mainly focus on gathering basic metrological information: quantities, ranges and uncertainties. The survey will also gather contact information, through which a potential cooperation can be established.

All of the gathered information will form a contact database that will be provided through the EURAMET websites restricted area, or on request by email to the WG on thermophysical quantities of materials.

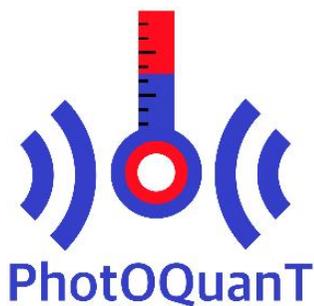
This data will allow the TC-T members to create new scientific contact that will help boost future research and create a pond for possible project members in the specific field of thermophysical properties of materials.

EMPIR research projects



Ongoing research projects on fundamental and primary thermometry

RealK, coordinated by Graham Machin (NPL) started in 2019. 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.



PhotOQuant, coordinated by Stéphan Briaudeau (LNE-Cnam) started in 2018. It aims at developing photonic and optomechanical sensors for realising future quantum and nanoscaled temperature standards.

EMPIR research projects



Ongoing research projects on energy and industry



BIOFMET, coordinated by Jan Nielsen (DTI) has just started with the objective to develop faster, more accurate, reproducible and traceable methods for measuring solid and liquid biofuel calorific value.

Met4FoF, coordinated by Sascha Eichstädt (PTB) started in 2018. It aims at building calibration capabilities for advanced, digital-only industrial sensors and sensor network.



EMPRESS2, coordinated by Jon Pearce (NPL) started in 2018. This project will improve the accuracy of a range of thermometers used in manufacturing and the validation of in-situ reference standards

EMPIR research projects



Ongoing research projects on energy and industry



DynPT, coordinated by Sari Saxholm (MIKES) started in 2018 and is developing traceable calibration methods for dynamic pressure and temperature sensors for use within industrial settings.

HiTrace, coordinated by Bruno Hay (LNE) started in 2018. This project will establish new methods for characterising the thermophysical properties of any solid material up to 3000 ° C, and launch a network of reference facilities and materials available to industry



MetForTC, coordinated by Narcisa Arifovic (TUBITAK UME) started in 2019. The project will develop practical methods and devices traceable to the ITS-90 to enable thermocouple drift to be checked in-situ.

EMPIR research projects



Ongoing research projects on environment



INCIPIT, coordinated by Andrea Merlone (INRIM) started in 2019 aiming at developing metrological traceability and calibration methods for non-catching rain gauges.

SimpleMeteoU, coordinated by Stephanie Bell (NPL) started in 2018. This project will develop a system for the simplified expression of uncertainty in meteorological data, combined with user-friendly graphical representation.

CRS, coordinated by Andrea Merlone (INRIM) has just started. The project will develop 'reference climatological stations' with metrologically validated instruments.

COAT, coordinated by Carmen García (CEM) has just started. The project will contribute to increase the comparability of extreme air temperature measurements for meteorology and climate.

TC-T Publications



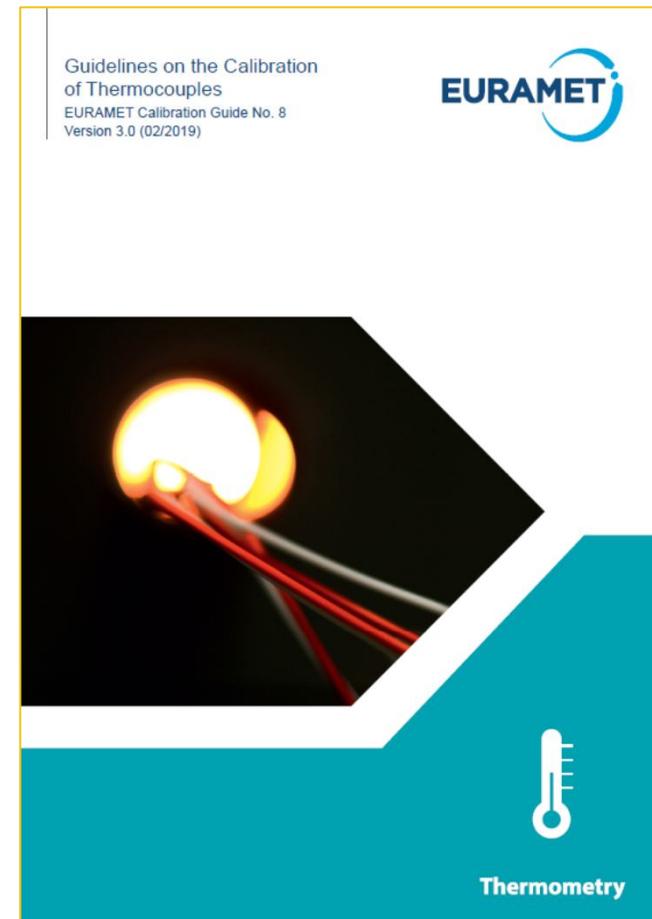
New edition in 2020 of the Guidelines on the Calibration of Thermocouples

The current version contains numerous minor updates to reflect current best practice.

The most significant update concerns the advice on thermoelectric homogeneity considerations.

In particular, the advice is customized for the major thermocouple groups. Guidance is given on the value to be taken in order to account for the effect of inhomogeneity on the uncertainty, in the absence of any useful measurements.

Importantly, these values are derived from a comprehensive survey which is documented in the public scientific literature.



Other Guides in preparation

- Guide on **surface temperature calibrations**, works coordinated by Søren Lindholt Andersen (DTI). **Developed jointly with COOMET.**
- Guide on the calibration of **radiation thermometers**, works coordinated by Dubhaltach MacLochlainn (NSAI). **Developed jointly with COOMET.**
- Guide on **dew point calibrations**, works coordinated by Seda Oguz Aytekin (TUBITAK UME)
- Guide on **relative humidity calibrations**, works coordinated by Eric GeorGIN (CETIAT).
- Guide on **Thermal diffusivity** calibrations, works coordinated by Bruno Hay (LNE)

... Inputs from other RMOs are welcomed!



TC-T Training



EURAMET Summer School on Thermal Metrology.

Hosted by EIM, Thessaloniki, 17-21 Sep 2018



44 students from 32 countries

- 36 from EURAMET NMIs and DIs
- **8 guests from all other RMOs**

28 lecturers

- 22 from EURAMET
- 1 from COOMET / 1 from BIPM
- 4 from other institutions.

Positive side effects:

Good relationship developed between students and lecturers

Inter-RMO collaboration in practice



... we have already agree to run a second one in 2022 or 2023

European Metrology Networks



What is an EMN?

A tool to **improve coordination** in EURAMET:

the way to a truly coordinated and shared metrology infrastructure, a shared vision and the agreement on a common agenda. The EMNs are the first step in this direction which go beyond joint research, and the Technical Committees work.

Which are their objectives?

to create sustainable structures in **areas of strategic importance** for the future of European metrology by:

- Creating and disseminating knowledge,
- Gaining international leadership and recognition, and
- Building coordinated infrastructure.

European Metrology Networks



CLIMATE AND
OCEAN OBSERVATION

The overarching aim of the EMN on **Climate and Ocean Observation** is the promotion of the effective and efficient implementation of high level metrology for Essential Climate Variables (ECVs). ClimOcNet@euramet.org.

Energy Gases has as main objective to provide measurement science expertise to society and industry to support the implementation of the energy transition to renewable gaseous fuels. EnergyGases@euramet.org.



ENERGY GASES



The European Metrology Network for **Quantum Technologies** provides active coordination of European measurement science research to maintain competitiveness in the field of quantum technologies. Quantum@euramet.org.

European Metrology Networks



The European Metrology Network (EMN) for **Mathematics and Statistics** (Mathmet) is a central reference point that addresses the need for integration between measurement science and mathematical and statistical methods. Mathmet@euramet.org.

There are other EMNs already working such as **Traceability in Laboratory Medicine** (TraceLabMed@euramet.org) and **Smart Electricity Grids** (SmartGrids@euramet.org).



And others, very relevant to the thermometry community, like **Advanced manufacturing** (AdvManuNet) are under development. This EMN aims to strengthen the European position in advanced manufacturing by accelerating the development and uptake of innovative metrology, by focusing on the needs of advanced manufacturing and optimising stakeholder interaction with the metrology community.



THANKS FOR YOUR ATTENTION