

## DEAR FRIENDS DEAR COLLEAGUES,

Since February, many things have happened in IMEKO, and there is much to look forward to. The second issue of the Newsletter, April, brings you the latest on all these activities.

Important news: IMEKO signed a Joint Statement of Intent "On the digital transformation in the international scientific and quality infrastructure" with OIML, CIML, BIPM, ISC, CODATA.

We had the long announced Technical Committees Workshop, and our Presidential Board had many fruitful meetings. IMEKO is preparing several events this year. Among the most important ones, our General Council Sessions will be held in Berlin on the 27<sup>th</sup> and the 28<sup>th</sup> of August 2022. Finally, after all this time, in-person conferences are possible again. Several Technical Committees are busy arranging the last bits of their events.

This issue includes details of these IMEKO events and the recent TC workshop. The Technical Committee TC12 is introducing itself and another of our Industrial supporters, Swiss SENIS AG. Professor Ken Grattan, active since 1985, reflects on his years with IMEKO.

## JOINT STATEMENT ON DIGITAL TRANSFORMATION



A [joint statement](#) of intent was signed on the digital transformation in the international scientific and quality infrastructure on the 30<sup>th</sup> of March 2022 by the International Bureau of Weights and Measures (Bureau International des Poids et Mesures BIPM), the International Organization of Legal Metrology (OIML), the International Measurement Confederation (IMEKO), the International Science Council (ISC) and its Committee on Data (CODATA).

The joint statement provides a platform for the signatory organizations to come together to indicate their support, in a way appropriate to their particular organization, for the development, implementation, and promotion of the SI Digital Framework as part of a wider digital transformation of the international scientific and quality infrastructure.

This act is part of an ongoing initiative by the International Committee for Weights and Measures (CIPM) and its Task Group on the Digital SI (CIPM-TG-DSI) to develop and establish a worldwide uniform and secure data exchange format based on the International System of Units (SI).

Prof. J. Ullrich, Chair of the CIPM-TG-DSI, commented that the signing marks a ground-breaking step in transforming the highly successful international scientific and quality infrastructure, with the SI as an anchor of trust, into the era of digitalization.

To further reinforce the CIPM's commitment to digital transformation, Draft Resolution B On the global digital transformation and the International System of Units will be presented at the 27<sup>th</sup> meeting of the General Conference on Weights and Measures (CGPM) in November 2022.

On the picture clockwise from top left: Wynand Louw, CIPM President (on behalf of the BIPM); Mathieu Denis, ISC Science Director and Acting CEO; Barend Mons, CODATA President; Roman Schwartz, CIML President (on behalf of the OIML); Frank Härtig, IMEKO President.

## TECHNICAL COMMITTEE WORKSHOP

The very successful IMEKO Technical Committee workshop took place on the 25<sup>th</sup> of March 2022. It was a two hours, very well attended event led by Professor Paolo Carbone, Chair of the Technical Board and IMEKO President-Elect. The presentations on "Technical Committee Functioning", "Technical Committee Events", "IMEKO's Publishing Activities", and the "Technical Board Functioning" were impressive results of the several meetings on each topic. The presentations of the working groups ended with recommendations that will be finalized and presented at the General Council Sessions. Among them is the idea of a yearly survey by the "Technical Committee Functioning" to be sent to all the members of the TCs, which allows for reorientation, data updates, and closer contact. Updating the "How to organize events" will allow better, more efficient handling of event organizing. The publishing of Acta IMEKO, our online journal, is going through transformations. With the increasing involvement of the Technical Committees, Acta aims for higher quality. The "Technical Board Functioning" resolves some long-standing debates. It renews the Board in several aspects, making important changes regarding its efficiency and functioning.

### Participants

#### Technical Board participants:

TC3: Dr Andy Knott, Chair, UK  
Dr Dirk Röske, Vice-Chairperson and IMEKO Information Officer, Germany  
Dr Koji Ogushi, Scientific Secretary, Japan

TC4: Prof Alexandru Salceanu, Chair, Romania  
Jan Saliga, Scientific Secretary, Slovakia

TC5: Dr Renato Reis Machado, Chair, Brazil

TC6: Sascha Eichstadt, Germany  
Hugo Gasca, Vice-Chair, Mexico

TC7: Dr Eric Benoit, Chair, France  
Dr Joao A. Sousa, Vice-Chair, Portugal  
Prof Elisabeth Costa Monteiro, Scientific Secretary, Brazil

TC8: Michela Segal, Chair, Italy  
Mr Thomas Wiedenhöffer, Scientific Secretary, Germany

TC10: Dr Zsolt Viharos, Chair and MO Hungary  
Prof. Lorenzo Ciani, Vice-Chairperson, Italy

TC12: Prof Davor Zvizdic, Chair, Croatia

TC13: Prof. Karel Roubik, Chair, Czech Republic  
Prof Ron Summers, UK

TC14: Prof Yasuhiro Takaya, Chair, Japan  
Dr Adam Gaska, Scientific Secretary, Poland

TC15: Prof Dan Kytir, Chair, Czech Republic

TC16: Dr Dominik Prazak, Vice Chair, Czech Republic

TC17: Dr Zafar Taqvi, Chair, USA  
Prof. Simone Keller Fuchter, Scientific Secretary, Brazil

TC18: Prof Yasuharu Koike, Chair, Japan

TC19: Prof Aimé Lay-Ekuakille, Chair, Italy

TC22: Dr Gustavo Ripper, Chair, Brazil

TC23: Mr Joris van Loco, Chair, Belgium

TC24: Tatjana Tomic, temporary Chair Croatia  
Leonardo Ianucci, Scientific Secretary, Italy  
Sandra Babic, Member

TC25: Mrs Barbara Goldstein, Chair, USA  
Mr Nicolas Spethmann, Vice-Chair, Germany

#### Participating IMEKO Officers:

Prof Frank Härtig, President-Elect, Germany  
Prof Paolo Carbone, President-Elect and TB chair Italy  
Prof Pasqual Daponte Advisory Board member, Italy  
Prof Francesco Lamonaca Editor in Chief for Acta-IMEKO, Italy  
Mr Zoltan Zelenka Secretary-General, Hungary

#### Working group members otherwise not mentioned:

Prof George Milushev MO Bulgaria (TC Functioning)  
Prof Jaromir Volf MO Czech Republic (IMEKO Publishing activity)  
Dr Malcolm McEwen MO Canada (TB Functioning)

## GENERAL COUNCIL SESSIONS 2022



This year, at the invitation of IMEKO President Professor Frank Härtig, the General Council Sessions will take place on the 27<sup>th</sup> and 28<sup>th</sup> of August in Berlin, Germany. The Technical Board meeting will be held on the 27<sup>th</sup> and the General Council Session on the 28<sup>th</sup>. GC participants are very welcome to the TB session, and at the GC, there will only be a summary of all that will be presented at the TB. Adjoining meetings shall take place

beforehand online. More details will be available soon. Please save the date and attend these very important events! IMEKO is counting on your presence at the GC.

## NEW MEMBERS OF THE TECHNICAL COMMITTEES

TC3: Sejla Alisic; Bosnia and Herzegovina, TC6: Alen Bosnjakovic; Bosnia and Herzegovina, Sari Saxholm; Finland, Kruno Milicevic; Croatia, TC11: Haris Memic; Bosnia and Herzegovina, TC12: Semir Cohodarevic; Bosnia and Herzegovina, TC16: Likit Sainoo, Thailand; Jeerasak Pitakarnnop, Thailand; TC24: Katarina Hafner-Vuk; Bosnia and Herzegovina, Luisa Vigorelli; Italy, Zhechao Qu; Germany, TC25: Marco Genovese, Italy. IMEKO wishes the new members a lot of success!

## FIRST TIME IN IMEKO

### METROLOGY DAY 2022



The theme for World Metrology Day 2022 is "Metrology in the Digital Era".

IMEKO will celebrate the day with a special issue newsletter. In it, the Technical Committees mark the role digitalization has in their area of expertise.

Almost all the articles prepared for this occasion have already landed at the Secretariat, ready for the last arrangement before publishing.

IMEKO thanks the Technical Committees for their hard work.

### IMEKO SUPPORTS THE UN GOALS FOR SUSTAINABLE DEVELOPMENT



Another collaboration with the Technical Committees is a summary by each TC on how its activities support the UN Goals.

This will be published on the IMEKO Homepage.

To all those Technical Committees who contributed to this project, thank you very much for your efforts and input!

## REFLEXIONS BY PROFESSOR KENETH GRATTAN



I was first introduced to IMEKO by Professor Ludwik Finkelstein (as indeed I was introduced by him to the UK member organization, the Institute of Measurement & Control, a few years before). This was 1985, and I had joined City, University of London as a young lecturer in the field of measurement and instrumentation a little while before. Ludwik spoke warmly of IMEKO and his long standing contacts with the organization, developed by him since the 1960s and taking full advantage of his talents as a polyglot. I was encouraged to submit a couple of papers to the 1985 World Congress - and they were accepted - and in September of that year, I was off to Prague - my first trip behind the 'Iron Curtain' as it was then widely described. It was a fascinating trip - I got to know a number of people from the UK member organization delegation at that time, as well as quite a few IMEKO people from across the world, and we stayed in what was then a new hotel, just beside the Conference Centre that has been built only a short time before.

The World Congress provided a forum to meet a new group of people who were introduced to me by Ludwik and see a wide spectrum of work in the measurement field from IMEKO's Technical Committees. I remember the unusual system of paying for food in the restaurant - we were issued with a series of coupons by the hotel which could be used widely in Prague - and by the end of the trip (as there were a number of Conference events being held) we had a surplus of coupons - so we had an interesting last dinner at the hotel trying to spend them on anything that was available. My memories are of seeing the beauty of Prague, the Charles Bridge and other of the city sights.

What was noticeable was how few cars there were driving around on a Saturday evening - just a few of the old model Skodas. Having been back several times since Prague has got noticeably busy as one of the prime tourist cities of Europe - and, as expected, the congestion on the roads today contrasts with those days in 1985.

I was invited to join one of the Technical Committees, TC2, then labelled 'Optical Detectors' (now 'Photonics') and the next year, we met for a Symposium at Varna, in Bulgaria. However, this was held just a few days after the explosion at Chernobyl, and so it was noticeable that green vegetables (which may have been contaminated with fallout from the explosion) were off the menu. Again another memorable event, with great hospitality shown by our Bulgarian hosts and an opportunity to enjoy the beautiful Black Sea coast.

I went to Texas for the 1988 World Congress in the Houston Astrodome - I recall Michael Yates (who was the Chief Executive of the UK Institute of Measurement & Control and a regular attendee at IMEKO General Council events) having bought a cowboy hat. He told us of his success in a Conference 'cow chip' throwing contest (I will leave you to find out what actually was being thrown at that time). I missed the last TC2 event that was held in East Berlin (just before the Berlin Wall came down) but had the good fortune to attend the 1991 World Congress in Beijing. My wife was able to come with me, and we had a fascinating visit to the city - at that time, a city of millions of bicycles (my more recent trips have been those where I have been stuck in the traffic on my way to the airport around the many ring roads that have been built since then in the city). Again we were well looked after, and the UK Measurement & Control party enjoyed themselves very much. We had the rare honour of a banquet in the Great Hall of the People in Tiananmen Square - an event that I recall because I had a stomach upset

a day or so before and so was not feeling up to the lavish banquet that our hosts offered.

IMEKO life seems to be measured in triennials - from one World Congress to the next. I have attended most of them since 1985, and it always was a pleasure to meet old friends and stop to have a drink and dinner to catch up. Many academics we met at IMEKO were invited to the UK by Ludwik who arranged for accommodation at a time when hard currency was very difficult to come by. Fortunately, things changed very quickly, and over the years, we have been able to interact at City, University of London with many academics we met from the IMEKO community as we continue our engagement across the world.

Over the years, I have attended many General Council meetings held in different places across the world since I joined as one of the UK representatives in the 1990s. That has given me a fascinating perspective on what IMEKO does and an opportunity to influence its future in a positive way. It has been a great annual event - held in many wonderful venues as well - and an opportunity to meet friends and colleagues and catch up when we do.

With my colleague Professor Sanowar Khan, we have been able to host a number of IMEKO events in London. I had also joined TC17 - Robotics and attended a number of that TC's ISMCR Symposia over the years. We were able to host the 2001 ISMCR in London and have an excellent event, co-organized with the UK Institute of Physics Sensors & their Applications Conference. Ludwik Finkelstein 'retired' from the University in 1993, but his enthusiasm and work for IMEKO was undiminished, and he attended a number of IMEKO events after that and was always keen to make invited presentations. He developed an interest in 'soft measurement' and was instrumental in getting IMEKO, which in particular espoused more traditional types of measurement, to think more broadly and embrace this and other developing subjects in the measurement field.

A key part of my IMEKO experience was succeeding Ludwik as Editor of *Measurement* - the Journal of the International Measurement Confederation. The journal was started in the 1980s and run in a small scale way by the UK member organization. However in order to expand, it needed to bring in the resources of a major publisher and it was sold to Elsevier just before I became Editor-in-Chief. I was particularly pleased to be able to see the growth of the journal, in terms of numbers of papers received and its reputation and impact. When I took over as Editor, we typically received 60 or 70 papers per year all handled on paper and by hand, with 'hard copy' posted to reviewers and received back in the same way. I completed my term in 2016, handing over to Professor Paolo Carbone, who has taken the journal from strength to strength - with now about 100 times the number of papers received annually. *Measurement* is the flagship journal for IMEKO and in recent years we have been able to see the spin off of *Measurement: Sensors* and *Measurement: Food*, as well as the growth of *Acta IMEKO*. All these journals bring IMEKO to a much wider audience internationally than see its work at the Symposia, Conferences and the World Congress.

Ludwik's last contribution was indeed given at the TC1/TC7 Symposium held in London in 2010, and sadly, he died the next year. Both Sanowar Khan and myself see it as our legacy from him to carry on the good work and strengthen the connection between the UK and IMEKO. The UK scientific and engineering community still sees itself as a key player in and with European organizations and IMEKO is an excellent vehicle in which to do this.

One of the highlights of my involvement with IMEKO had been to be elected as President-Elect in 2013 (and Chair of the Technical Board) and then to become President in 2015, having taken over from Pasquale Daponte at the World Congress in Prague - back again in that same Conference Centre 30 years after my first IMEKO event.

I was greatly honoured to be IMEKO President - especially coming from Northern Ireland, the smallest country of the of the UK but indeed the home of the last UK President in the 1970s, Sam Carlisle we both graduated from The Queen's University of Belfast. It was thus a great pleasure to be able to bring the 2018 IMEKO World Congress to Belfast we had a great event there, with some excellent presentations from Nobel Prize Winners Bill Phillips and Klaus von Klitzing and I was able to show off my University city, where I spend seven great years, to my IMEKO friends and colleagues.

What of the future? The last few years, both have seen some problems for IMEKO, with many events being cancelled or postponed and the 2021 World Congress being held entirely as a virtual event. However, this has given the impetus for some changes to the IMEKO management creating more dynamic and active management with monthly Presidential Board meetings being held between General Council meetings to allow us to respond to the rapidly changing situation. The General Council meetings themselves very successfully transferred to being online events.

As I reflect on nearly 40 years of active involvement with IMEKO I am encouraged. IMEKO is in sound financial health, has a number of highly respected journals and runs many events which are the world leaders in their fields all this in spite of competition from many different organizations worldwide.

We have a dynamic, active management, an excellent programme of events and a series of topical Technical Committees, with many people working very hard to promote their areas of expertise. The plans for the World Congress in Germany in 2024 and coming along well, and Paolo Carbone, the current Editor-in-Chief of *Measurement*, will lead us forward from 2024 when our current President, Frank Hartig, completes his term at the end of the World Congress in 2024. IMEKO can be the leader in a number of areas of measurement and be dynamic to embrace new devices, new fields and new opportunities.

I must say I have enjoyed my time with IMEKO it has been a very important part of my career and a great opportunity to meet and work with so many different people from across the world. My wish is that the young, early career researchers involved with IMEKO today will have as good and exciting an experience as I have had and become the enthusiastic leadership of IMEKO well into the middle of this century and beyond, as IMEKO looks to its centenary in 2058. There has never been such an interest in measurement, sensors and instrumentation and we live in a world of new measurement standards.

I wish my successors every success as they take IMEKO forward to that future.

Written by Professor Kenneth Grattan

## IMEKO CONFERENCES, WORKSHOPS, SPECIAL SESSIONS



IMEKO TC6 "Digitalization" organizes the first international conference on "Metrology and Digital Transformation", the M4Dconf 2022, on 19<sup>th</sup> - the 21<sup>st</sup> of September 2022. The conference will be organized as a hybrid event - with a limited number of places for physical attendance in Berlin.

## Special Sessions

### Pathways to digital transformation

The session led by Blair Hall and Jon Barthomolew will consist of experience reports or innovative solutions relating to the following topics or other aspects of transformation journeys.

### Modelling metrology in software for digital transformation

This session with Blair Hall and Mark Kuster will focus on modelling metrological concepts and processes.

### Digitalization of Metrology in the Pharma Industry

The pharmaceutical industry as a whole (including the rapid development of new vaccines) is heavily regulated and competitive at the same time. The regulatory issues and its high-risk products make it often the leader among manufacturing industries in adopting new technologies, bringing new regulations. This session is led by Sinisa Prugovecki and Tatjana Jurkovic.

### Sensor Network Metrology

Sensor networks are becoming a standard approach in many applications, ranging from regulated areas such as energy, water, gas and heat consumption (Legal Metrology) to low-cost Internet of Things (IoT) for Industry 4.0 (Industrial Metrology),

even multi-sensor secondary realizations (fundamental metrology) and other areas such as healthcare, chemical and pharmaceutical industries. Led by Federico Grasso Toro, PhD, Martin Koval, PhD, Sascha Eichstädt, PhD.

### Machine-readable Digital Calibration Certificates (DCC)

One of the first and highest priority steps for the metrology community is recognized in the replacement of paper-based calibration certificates with their digital counterparts, Digital Calibration Certificates (DCCs). A DCC is not a simple digitalization of the paper-based certificate in the sense of an exact copy in electronic formats like PDF or Word. DCCs provide the calibration data in fully machine-readable data structures in a way that software can automatically read the data from a DCC without error-prone human transcription. DCCs potentially allow automated and machine-aided approaches to be used throughout all parts of calibration and measurement processes are essential for many organizations on the road to full digital transformation. The adoption of DCCs will thus lead to increased efficiency within those processes. This session will be led by Shanna Schönhals, PhD, Clifford Brown, PhD, Daniel Hutzschenreuter, PhD.

<https://www.m4dconf2022.ptb.de/home>

## SAVE THE DATE



1 day workshop: "Traceability the backbone of metrology"

8 November 2022 12:00 - 15:00 (CET, UTC +1)

- organized by IMEKO TC 8 "Traceability in Metrology"
- free of charge but full of new ideas and challenges
- chance for ACTA IMEKO publication
- registration starts on 1 July 2022

Presentations and discussions in the fields of

- classic traceability and its application today
  - traceability in digitalization
  - special issues
  - interdisciplinary traceability
- ⇒ followed by an open discussion



TC8 Traceability in Metrology is organizing a workshop on the 8<sup>th</sup> of November 2022.

The topic is: "Traceability is the Backbone of Metrology".

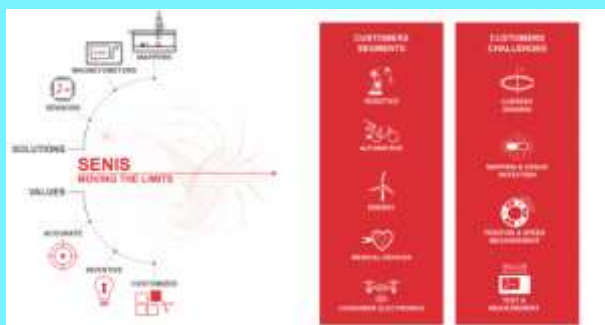
Registrations will start on the 1<sup>st</sup> of July 2022.



The joint IMEKO TC3, T5, TC16 and TC22 will take place in Cavtat, Dubrovnik, Croatia, 11-13 October 2022. (24<sup>th</sup> IMEKO TC3, 14<sup>th</sup> IMEKO TC5, 6<sup>th</sup> IMEKO TC16 and 5<sup>th</sup> IMEKO TC22 Conference).

<https://www.imeko.org/index.php/tc3-homepage/tc3-events/tc3-2022>

## INTRODUCING SENIS AG



The Swiss company SENIS is a well-established player in the field of magnetic measurement and metrology. It regularly participates in IMEKO events and will organize the IMEKO TC4 Symposium 2023. SENIS provides smart, innovative and accurate sensors and instruments for magnetic field and electric current measurements, for test & measurement, automotive and other industrial applications. Moreover, as one of the most innovative companies in this market, SENIS regularly participates as an industrial partner in European projects, for example, with CERN in HITRI (Heavy Ion Therapy Research Infrastructure), with PTB Germany in Nano-Scale Metrology Standards, with CSEM Switzerland in Energy Autonomous Wireless Current Sensors.

SENIS is steadily trying to move the limits of the feasible in magnetometry and sensor technology. The company was founded in 2004 by Prof. Radivoje S Popovic, who in 2021 received the Lifetime Contribution Award of the UK Magnetics Society. For its novel Hall magnetic sensors SENIS recently received the Seal of Excellence from the European Commission and the

AMA (Germany) Innovation Award.

The first contact with IMEKO started in 2014 when SENIS was invited by CERN to give a presentation on its innovative 3D Teslameter. Since then, SENIS regularly participates in the IMEKO TC4 events and IMEKO world congresses, organizes special sessions, gives presentations and demonstrates its innovative products at conference booths.

SENIS was founded to provide magnetic Metrology to Industry and to solve the future needs of its customers. Building on academic experience of its founder, only intensive collaboration with industry allowed the development of the very advanced sensors and instruments SENIS is selling today. SENIS strongly believes in the importance of collaboration of Academia and Industry and supports it in various ways. For example, SENIS will organize the next IMEKO TC4 Symposium in 2023 under the motto "Academia meets Industry". This event will be supported by the international trade show COILTECH Italy, which will sponsor the conference space. This conference shall enhance the cooperation between academic researchers and engineers from industry and foster the exchange of scientific knowledge.

SENIS is looking forward to meeting you at the next IMEKO TC4 conferences in Brescia in 2022 and in Pordenone in 2023!






Written by Dr Dragana Popovic Renella  
SENIS AG

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**INTRODUCING TC12 TEMPERATURE AND THERMAL MEASUREMENTS**

The Technical Committee 12 of IMEKO (IMEKO TC12) was established in 1979. A group of people met in Prague (Czechoslovakia) in November 1979 to discuss the organization of an international conference tentatively titled "Symposium on Temperature Measurements in Industry and Science", which was held in October 1981 in Karlovy Vary (Czechoslovakia). IMEKO recognized that group as its Technical Committee 12 on temperature measurement, and therefore the Prague meeting became the founding event of TC12. The founders were:

	F. Bernhard (DDR, East Germany)		P. Bloembergen (Netherlands)
	A.R. Colclough (United Kingdom)		J.P. Issi (Belgium)
	J. Jencik (Czechoslovakia)		T. Kovacs (Hungary)
	L. Michalski (Poland)		F. Righini (Italy)



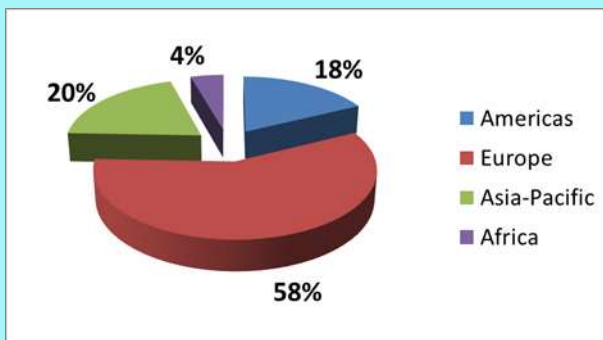
Initially, TC12 had two Co-Chairs: J. Jencik, organizer of the first Symposium in 1981 and F. Bernhard, organizer of the Second Symposium in 1984.

The committee's responsibility then passed to F. Bernhard, and later on to F. Righini at the end of TEMPMEKO 1993 in Prague. D. Zvizdic, the organizer of TEMPMEKO 2004 Scientific secretary of TC12, became TC12 Chair at the end of TEMPMEKO 2013 in Madeira.

A rare photo of three TC12 Chairs who span almost 30 years:

F. Bernhard, F. Righini and D. Zvizdic, during TEMPMEKO 2016, Zakopane, Poland.

The IMEKO Technical Committee 12, TC12 - Temperature and Thermal Measurements, provides a forum at the international level for the exchange of opinions and experiences among experts in the field of temperature, thermal measurements, and humidity, discussing the main trends of research, development, and applications. Attention is not only paid to sensors and to new measurement methods but also to the instrumentation for temperature, thermal measurements, and humidity. Emphasis is given to accurate measurements and to the improvement of efficiency in scientific, industrial, environmental, and medical applications. TC12 is a community made of thermal metrologists, researchers and operators involved in the wide range of temperature, thermal and humidity measurements. IMEKO TC12 is truly global, with 45 members from 39 countries, reflecting the global scope of IMEKO itself.



IMEKO TC12 aims to provide a forum for the discussion of the latest developments and achievements in temperature, thermal, and humidity measurements and to promote and organize scientific events all over the world.

In the recent years, the members of TC12 have significantly contributed to the:

- New SI by research and state-of-the-art measurements for the kelvin redefinition.
- New results reported for the difference between Thermodynamic temperatures and T90 temperatures (T90 are temperatures defined by the ITS-90, the International Temperature Scale of 1990) and the difference between Thermodynamic temperatures and T2000 temperatures (T2000 is the Provisional Low Temperature Scale of 2000. It was introduced because the lower limit of ITS-90 is 0,65 K. This scale is based on the 3He melting curve and spans the range 0,0009 K to 1 K).
- Advances in new primary thermometry techniques.
- Research in sensor development,
- Temperature fixed points (new types, impurities, and thermal effects).
- Progress in radiation thermometry.
- The standardization and application of thermal imaging in humidity.
- Moisture in materials and water in non-air gases at various pressures and temperatures.
- Understandings of traceability and uncertainties of physical and chemical quantities describing the environment and climate evolution.
- Measurement of temperature in air as the most frequently measured temperature in the world.
- Cooperation with World Meteorological Organization (WMO) on techniques and uncertainty estimations of temperature and humidity measurements in contribution to determination of global climate change. The cooperation is continuous through joint membership in committees, lectures, papers, and joint events.



TC12 meeting in Zakopane 2016.

The TC12 meetings are held during TEMPMEKO symposia and IMEKO World Congresses.

### The TEMPMEKO Conference

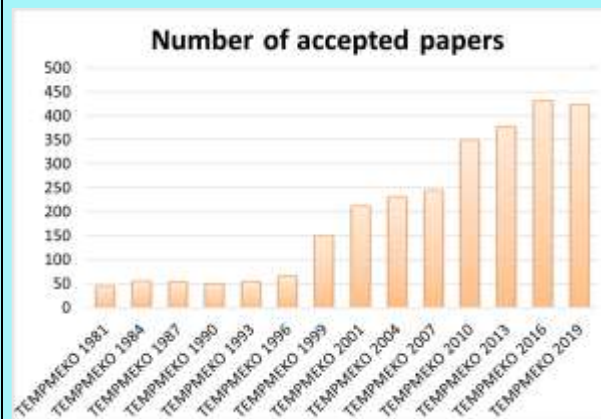
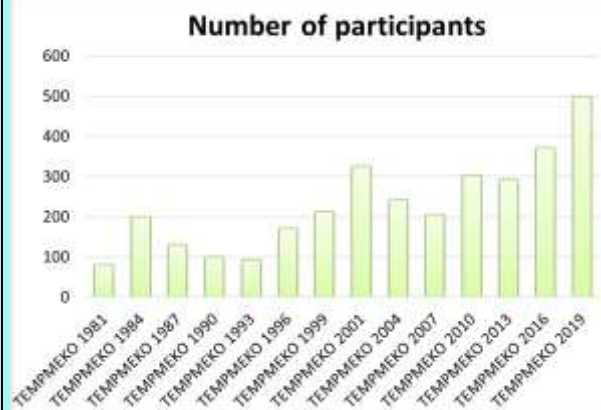
TC12 organizes a main symposium (TEMPMEKO) every three years and other specialist scientific events (workshops, seminars). TEMPMEKO as the IMEKO TC12 Conference provides fora for Temperature, Humidity and Thermophysical properties. Its aim is the exchange of information and views among the members of international scientific community, professional metrologists, manufacturers of measurement equipment, engineers and students working in the field of the temperature, thermal measurements and humidity metrology.

Also, scientifically TEMPMEKO confirmed itself to be the most important triennial global temperature, thermal properties, and humidity event. It has been running for many years with outstanding scientific contributions and providing contributions to IMEKO budget as well.

In the years up to the early 1990s, one of the main purposes of IMEKO was to maintain open scientific relations between Eastern and Western European countries. In this context the possibility to meet, often in East Europe due to the difficulty of Eastern scientists to travel, took precedence and the Proceedings of events were simply an assembly of submitted manuscripts with no peer review. TC12 started the peer review of its

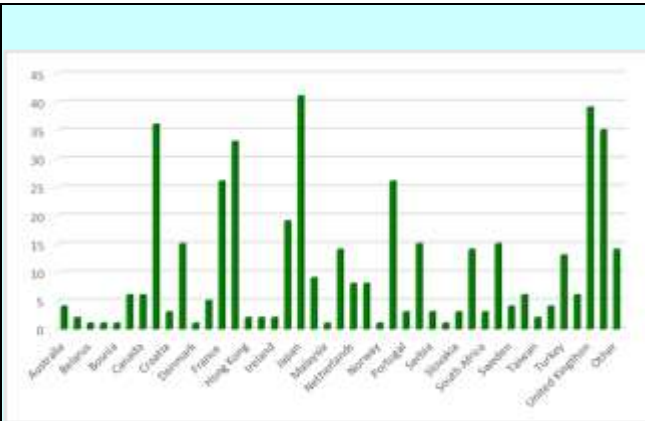
Proceedings at TEMPMEKO 1996 in Torino, Italy and published peer-reviewed volumes up to TEMPMEKO 2004 in Cavtat-Dubrovnik, Croatia. From TEMPMEKO 2007 in Lake Louise, Canada, onward, the Proceedings took the form of Special Issues of the International Journal of Thermophysics (IJOT) with the IPC Chair(s) of the event acting as Guest Editor(s), and from TEMPMEKO 2019 in Chengdu, China, in several world-leading Journals.

TEMPMEKO Symposia: The number of participants and number of accepted papers.



The following table presents a summary of the TEMPMEKO symposia organized by TC12.

Year	Place	Country	Organizers	Attendance	IPC Chairs	Accepted papers	Published papers
1981	Karlovy Vary,	Czechoslovakia	CSVTS Czechoslovak Scientific and Technical Society	80	J.Jencik	43	1 volume, 35 papers, 303 pages
1984	Suhl	East Germany	TU Ilmenau, Kammer der Technik, Suhl, DDR	200 (25 countries)	F.Bernhard	56	1 volume, 53 papers, 545 pages
1987	Sheffield	UK	Institute of Measurement and Control UK	130	R.Barber	54	1 volume, 29 papers, 322 pages
1990	Helsinki	Finland	Finnish Society of Automatic Control, Helsinki, Finland	100	F. Bernhard, H.K.Graubner	50	1 volume, 49 papers, 430 pages
1993	Prague	Czech Republic	Tech-Market, Prague, Czech Republic	94	J.Ptacek, J.Kral	54	1 volume, 59 papers, 386 pages
1996	Torino	Italy	IMGC-CNR, Politecnico Torino, AIPT, Italy	171 (34 countries)	F. Righini, T. Ricolfi, P. Marcarino	66	1 volume, 101 papers, 607 pages
1999	Delft	The Netherlands	NMI Van Swinden Laboratorium (VSL), The Netherlands	213 (39 countries)	P.Bloombergen, M.DeGroot, J.Dubbeldam	171	2 volumes, 120 papers, 742 pages
2001	Berlin	Germany	Physikalisch Technische Bundesanstalt (PTB), VDI/VDE, Germany	325 (44 countries)	J.Fisher, E.Tegeler, B.Fellmuth	212	2 volumes, 193 papers, 1208 pages
2004	Dubrovnik-Cavtat	Croatia	FSB-LPM University of Zagreb, Croatia, HMD - Croatian Metrological Society	241 (41 countries)	D.Zvizdic	231	2 volumes, 209 papers, 1404 pages
2007	Lake Louise	Canada	Institute of National Measurement Standards, National Research Council of Canada	205 (34 countries)	K.Hill, A.Steele, D.Brown	245	Special Issues Int J Thermophys, 194 papers
2010	Portorose	Slovenia	Slovenian Society of Process Control and Measurements, Metrology Institute of Slovenia, Faculty of Electrical Engineering University of Ljubljana, Slovenia	303 (49 countries)	S.Bell, J.Bojkowski, F.Righini, J.Fischer, J.Lovell-Smith, J.Drnovsek	349	Special Issues Int J Thermophys, 207 papers
2013	Funchal, Madeira	Portugal	Portuguese Society of Metrology SPMet, Portuguese Network of Accredited laboratories RELACRE, Madeira Regional Authorities, Portuguese Institute for Quality IPQ	291 (42 countries)	E.Filipe, F.Righini, R.White	378	Special Issues Int J Thermophys, 162 papers
2016	Zakopane	Poland	Wl. Trzebiatowski Institute of Low Temperature and Structure Research of the Polish Academy of Sciences	372 (45 countries)	G.Machin, R.Rusby	432	Special Issues Int J Thermophys, 130 papers
2019	Chengdu	China	National institute of Metrology Chinese Society for Measurement	500 (47 countries)	A.Todd (TEMPMEKO) Y.Duan (TEMPMEKON) A.Merlone (MMC)	424	Several Journals, 187 papers



Truly global distribution of 432 accepted papers at TEMPMEKO 2016 in Zakopane Poland



TEMPMEKO 2016 Symposium in Zakopane

The total number of attendances was 373 from 46 countries of all continents.

Apart from the Temperature Symposium (organized every ten years by the American Institute of Physics, last edition in 2012, TC12 is the only group that regularly organizes global event dedicated to temperature measurements. This is an important asset, and IMEKO TC12 continues to keep the highest organizational and scientific level of the event for very successful TEMPMEKO symposia:

- Continuous efforts and improvements to keep the highest scientific quality of the TEMPMEKO events.
- Full peer review of contributions before publication.
- Publication of reviewed and accepted papers either in a journal or in a Proceedings volume.

- Distinguished keynote lectures by world-leading scientists and top experts from industry.
- Organizers that are always complimented for their great efforts.
- The distinguished IPC Chairs and IPC members that provide their time, work, and expertise to select relevant scientific and technical papers for oral and poster presentations.
- Top manufacturers in the field to arrange exhibition space at the Symposium.
- Numerous satellite meetings that complement the conference.
- Wonderful social events for the participants and their company.

But, perhaps most important of all, colleagues from all over the world meet at TEMPMEKO Symposia to listen to lectures, meet around posters, discuss the fine points in person and spend precious informal time with each other.



The opening session of TEMPMEKO & TEMPBEIJING 2019 and MMC 2019.

The most recent Symposium was TEMPMEKO&TEMPBEIJING 2019 and MMC 2019, that was held in Chengdu, China, from the 10th of June to the 14th of June, 2019. The TEMPMEKO conference in Chengdu China was a resounding success, with possibly greatest number of attendees surpassing 500.

The organization was excellent, with impressive, top-of-the-line conference rooms and facilities and great hospitality exerted by the Chinese hosts: the Chinese Society for Measurement and the Chinese National Institute for Metrology - NIM. The main topics included:

- Fundamentals, realizations of the new kelvin, mise en pratique of the new kelvin.
- Fixed points of ITS-90, eutectic fixed points.
- Standard thermometers.
- Temperature Measurement Science and Technology.
- Humidity and moisture.
- Thermometric traceability and dissemination.
- Applications of thermometry.
- Humidity and moisture measurements.
- Thermophysical properties, Quantities and Reference materials.
- Metrology for Meteorology and Climate which promotes understandings of traceability and uncertainties of physical and chemical quantities describing the environment and climate evolution.

As during every TEMPMEKO, numerous other (satellite) meetings were held: CIPM CC-T meetings, including WG-6, WG - CMC, WG KG, TG - GoTh, WG - CTh, WG - Env, WG - NCTh, WG-Hu, CCT-ThQ, Thermal imagers, WG - CTh and others. The truly impressive exhibition space featured the most relevant temperature and humidity equipment providers in the world.

Scientifically TEMPMEKO confirmed itself to be the most important global triennial temperature, thermal properties, and humidity event.

The hard work at TEMPMEKOs always continues after the scientific programme, this time in the Chinese theatre in Chengdu with a truly unforgettable programme.



The success of every TEMPMEKO is also owed to hosts, organizers and a small army of colleagues and students. This work is very much appreciated and always acknowledged at every TEMPMEKO closing session. Those are the moments that they will always remember!

- **TC-12 and IMEKO World Congresses**
- The members of TC12 actively take part in all aspects of every IMEKO World Congress:
  - Plenary lectures from TC12
  - Oral sessions related to TC12 activities
  - Posters from TC12 in WC Poster sessions
  - Members of WC IPC
  - Reviewers of WC papers
  - Ex officio members of editorial boards of IMEKO publications
  - Reviewer for IMEKO publications.



Joachim Fischer, from PTB and a member of TC12, gave a lecture on the new definition of the kelvin as an invited speaker at a plenary session of the IMEKO World Congress in Prague.

### The IMEKO TC12 Newsletter

The newsletter originated as a simple tool to connect committee members in between meetings, held every three years on the occasion of the main Symposium. The initial newsletter circulated by post and addressed mainly topics of strict interest to TC12 members. The TC12 Chair, Francesco Righini, took responsibility for preparing and distributing the various issues. When the Internet became widely available, the issues became email attachments, and the recipients, along with TC12 members, included the membership of similar committees in sister organizations like Euramet, Coomet, APMP and other regional groups. A. Merlone took the responsibility of the newsletter in 2010 from Francesco, and significant changes were introduced, covering different aspects of the temperature and thermal metrology community. All the names in the TC12 database now receive the Newsletter issues, reaching more than 2000 people, including scientists, manufacturers, university staff, private companies, and public institutions worldwide. The topics are of general interest with the aim to update the readers on the key achievements of thermal metrology. The content ranges from primary metrology (reports on experiments for the determination of the

Boltzmann's constant) to new fields of thermal sciences applied to the environment, energy, industry and more. The Newsletter is open to contributions and "stories to tell" from all the readers, keeping its core focus on the multitude of aspects regarding metrology in the field of thermal measurements. Reports, figures, and organizational aspects of TEMPMEKOs are constantly covered.

The TC-12 Information Officer and Scientific Secretary, A. Merlone, keeps the TC12 website constantly updated, where relevant information on the committee may be found. A Newsletter is published and sent to all people that have come in contact with TC12: A large number of all present and past issues of the TC12 Newsletter are freely available for download to everybody from the IMEKO website on TC-12 pages. [TC12-Documents \(imeko.org\)](http://TC12-Documents(imeko.org)) "A TEMP-MEKO tale" by Francesco Righini is also found there - you will enjoy reading it!

When you look at these pages, many memories might be revoked. Of friends and colleagues, some of which have retired or are not with us anymore, of wonderful excursions and visits to magical places, of impressive scientific papers and presentations - it might touch your heart (Cor non mentitur) or, if you are young - it might show you the way to go.

It is my personal hope that these words find your interest and help to preserve and maintain the story of a key area of metrology through the events, people and facts served by the Technical Committee 12 of IMEKO.

I am deeply honored to be a part of it!  
Written by Davor Zvizdic IMEKO TC12 Chair

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