

# 30 years of collaboration in European metrology 1987–2017

## EURAMET Celebrates 30<sup>th</sup> Anniversary

### Latest News

#### It's EURAMET's anniversary in 2017

EURAMET celebrates 20+10=30 years of collaboration in European metrology this year. The organisation was established on 11 January 2007 and 20 years earlier, in 1987, its predecessor EUROMET was founded. For 30 years EURAMET and EUROMET have worked for closer collaboration and innovation in metrology. Read more on page 11

#### EMPIR Call 2017: Stage 2 Open

Stage 2 of the EMPIR Call 2017 is open. The call includes metrology for industry, fundamental, research potential and pre- and co-normative metrology research. Stage 2 of the Call, requesting proposals for Joint Research Projects (JRPs), will close on 2 October 2017. Further details are available at <https://msu.euramet.org>

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## LOOK BACK ON THE PAST AND A VISION FOR THE FUTURE

### Foreword from EURAMET Chairperson Dr Beat Jeckelmann



For EURAMET, 2017 is marked by the organisation's 30th anniversary. We are celebrating EURAMET's 10th birthday and the foundation of its predecessor EUROMET in 1987.

The Memorandum of Understanding founding EUROMET was signed at the Centro Español de Metrología (CEM), the Spanish National Metrology Institute. To commemorate the event, EURAMET's 11th General Assembly (GA) took place at CEM in May. The anniversary symposium, held in conjunction with the GA, provided the perfect setting for the organisation to take a look back on the last 30 years, as well as to provide a vision for the future.

At the GA achievements over the last year and proposals to improve collaboration amongst Europe's measurement community were discussed and elections took place. I would like to congratulate Hans Arne Frøystein who was elected as EURAMET's future Chairperson starting his term in 2018.

In addition, we welcome two new Members of the Board of Directors (BoD) and three new Technical Committee Chairs. On behalf of EURAMET I would like to express our gratitude to

their predecessors: José Angel Robles Carbonell, Jan C. Petersen (both BoD), Richard Barham, Jarle Gran and Ramiz Hamid (all TC Chairs).

The year until the next GA will be marked by the elaboration of a strategy on how EURAMET can best respond to the still growing requirements for quality assured measurements in industry and those associated with the grand societal challenges. The creation of metrology networks, bundling de-centralised competences and resources of institutions working on a thematic focus is one of the possibilities that is considered.

This newsletter edition focusses not only on the anniversary and the GA, but also on 'Metrology for Health'. Improvement in the health of individuals is one of Europe's grand challenges. The newsletter includes an interview with Tobias Schäffter, Convenor of the EURAMET Task Group for Health, explaining why metrology for health is important. Early impact and highlights of completed joint research projects within EMRP's health theme are shown in selected case studies and a comprehensive impact report.

We hope you enjoy reading issue 12 of our newsletter and we wish you an enjoyable summer.

## EVENTS

### NCSLI Workshop and Symposium

13 to 17 August 2017  
Maryland, USA

### International workshop on dimensional metrology for drivetrain components

29 August 2017  
Braunschweig, Germany

### Underwater Acoustics Conference and Exhibition

3 to 8 September 2017  
Skiathos, Greece

### 21st European Conference on Thermophysical Properties

3 to 8 September 2017  
Graz, Austria

### CIM 2017 - 18th International Metrology Congress

19 to 21 September 2017  
Paris, France

### TC-Electricity and Magnetism (TC-EM) Annual Meeting 2017

3 and 4 October 2017  
IPQ, Caparica, Portugal

### EuMW 2017 Workshop

8 to 13 October 2017  
Nuremberg, Germany

### 2017 STAIR EMPIR Meeting

10 October 2017  
CEN-CENELEC meeting centre in Brussels, Belgium

## SAVE THE DATE – 12TH EURAMET GENERAL ASSEMBLY IN 2018

**EURAMET's 12th General Assembly will take place in Bucharest, Romania from 28 May to 1 June 2018. It will be hosted by INM, the Romanian National Metrology Institute. Further information will be available by the end of the year.**



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# Research & Innovation



## METROLOGY FOR HEALTH

Improvements in the life expectancy and health of individuals have been driven by constant innovation in the diagnosis and treatment of diseases and medical conditions. High quality healthcare is underpinned by the accurate physical, chemical and biological measurements used to diagnose health conditions and ensure therapies are delivered safely and effectively.

EURAMET's European metrology research programmes (EMRP and EMPIR) enable a multi-disciplinary collaborative approach to focus research on specific themes and support greater measurement accuracy and improved traceability to SI units.

There are 9 running projects from the first Health call of the current research programme, EMPIR. The next call for Health projects will open in January 2018.

The previous research programme (EMRP) provided Health themed research focussed on the measurement requirements of technologically advanced screening and imaging methods, and diagnoses of chronic diseases, such as cancer, neurodegenerative disorders and cardiovascular conditions. Examples of how project research has been taken up by the medical community and information on each project's key technical achievements are available in the impact report on the EMRP Health theme (see page 8).

Since 2013, a dedicated EURAMET Task Group has been working to develop a strategy on how metrological R&D should evolve in EMPIR regarding the grand challenges in the area of health.

Interview with Tobias Schäffter (PTB, Germany), convenor of the task group 'Metrology for Health':

### **Where do we find metrology for health in our daily lives and why is metrology, the science of measurement, important for challenges in the health sector?**

Health-related measurements are an integral part of the modern care-cycle, i.e. from medical diagnosis to treatment selection and the follow-up of therapies. Such measurements can be rather simple, like heart rate, body temperature or blood pressure, or more complex like blood tests, medical imaging or modern molecular

therapies. People expect health-related measurements to be accurate, reproducible and comparable, attributes which are typical characteristics of metrology. Unfortunately, these measurement approaches are not always able to be applied in medicine and the data can only rarely be traced back to accurate standards. Hence, medical decisions can vary depending on which equipment or technique has been used and have subjective bias based on the knowledge of medical experts. Over recent years, healthcare guidelines have included demands for more quantitative measurements to demonstrate selected therapies have been chosen in an objective manner. Accurate measurements also support the current trend for personalised medicine, where the success of a treatment relies on accurate doses of the prescribed drug delivered at the specified time.

### **What are the tasks and objectives of the EURAMET task group for health?**

The aim of the task group is to form a coherent approach to measurement science (metrology) for health by supporting the development of a measurement infrastructure based on robust methods and rigorous standards. The task group consists of members, who are also active on other technical committees ensuring greater information flow. The Health Task Group liaises with the Joint Committee for Traceability in Laboratory Medicine (JCTLM) and with professional healthcare societies that work on new clinical guidelines based on quantitative measurements. Metrology in health is rather new and many potential topics exist. Therefore, priorities have been identified and a Strategic Research Agenda for research projects within EURAMET's EMPIR programme has been developed. In addition to its task within the metrology community, the task group organises discussions and workshops with stakeholders such as clinical experts and industry.

### **What needs to be done in the metrology community to further support improvements in the health sector?**

There is a growing interest in health measurement science (metrology). One of the major challenges is the enormous diversity of measurements and the strong interdisciplinary nature of the topic.

Therefore, the metrology community needs a strong collaboration with clinical experts and health-related industry. Early involvement of stakeholders is key to identifying areas that will profit most from metrology. Furthermore, it is important to demonstrate the impact of metrology in health, not only to improve accuracy and comparability of measurements but also to assess the benefits of clinical decisions. The demonstration of clinical benefit usually requires costly outcome-studies, which are often part of EU's Horizon2020 projects. The Health Task Group has proposed a call-scope for the imminent EMPIR health call in 2018. This addresses important themes of the Horizon2020 programme to leverage efforts in medical research and metrology. Finally, the metrology community has the unique ability to support harmonisation of medical products with standards and supporting clinical practise through metrological quality assurance in clinical guidelines.

## About Tobias Schäffter

Tobias studied electrical engineering at the Technical University in Berlin (Germany) and did his PhD in magnetic resonance spectroscopic imaging (MRSI) at the University of Bremen in 1996. Between 1996 and 2006, he worked as a principal scientist at the Philips Research Laboratories in Hamburg (Germany), where he created an internationally recognised research team and was responsible for the development of new MR-methods, reconstruction and MT-compatible devices for quantitative and interventional MRI.

In 2006 Tobias took up the post as the Philip Harris Chair of Imaging Sciences at King's College London (UK). A major aim of his research was the investigation of fast and quantitative MR-techniques for cardiovascular applications MRI. His research focuses on rapid translation of new methodology into clinical practice to evaluate the benefit for the patient. In addition, he was director of the doctoral training centre in medical imaging.

Tobias has been head of the 'Division of Medical Physics and Metrological IT' at PTB in Berlin since 2015. In EURAMET he holds the position as convenor of the task group on 'Metrology for Health' and he coordinates an EMPIR joint research project from the first Health call.



## HIGHLIGHTS UNDER THE EMRP HEALTH THEME

### Multidisciplinary measurement solutions for healthcare

For the first time, the European metrology community is working collectively to conduct the healthcare research needed to improve measurements and analysis. EURAMET established a multidisciplinary Health Task Group and a Health research theme under EMRP to bring together metrology expertise in physics, chemistry and biology to support improved diagnosis and treatment of medical conditions. The European Commission and national governments invested 74 million euro in health focused collaborative research, involving research groups in 28 European National Metrology Institutes (NMIs) and Designated Institutes (DIs), 46 academic groups and 40 businesses and healthcare providers. Find here a selection of highlights achieved in the eleven health projects.

### Improved MRI imaging, improved patient safety

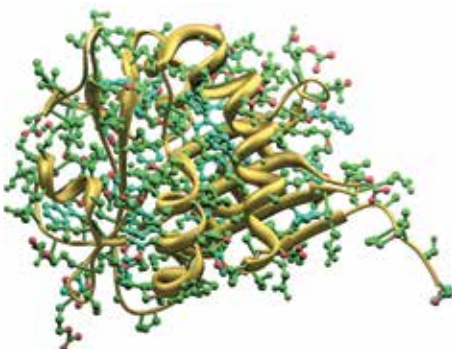
New MRI scanners, using high strength 7 Tesla magnetic fields, provide more detailed images and improve diagnoses. But before these can be used routinely they must comply with international safety standards. EMRP research developed numerical procedures to compute radio-frequency fields throughout the patient's body, and measurement tools to check and validate these simulations. As a result, novel protocols can more accurately calculate safe exposure levels and demonstrate that these scanners are safe to use. Together with contributions to a new international IEC standard for safety verification and certification of new MRI scanners, the research has helped to establish guidelines for safe scanner design, paving the way for their adoption in clinical practice.



Magnetic resonance imaging, iStock.com/Nomadsoul1

### Designing new antibiotics

Diseases are becoming increasingly resistant to antibiotics, limiting treatment options. Developing new antibiotics is costly and time consuming with no guarantee of success or commercial return on the investment. EMRP research established a new design tool that can cost-effectively link the molecular structure of a potential antibiotic to the desired therapeutic effect. This enables the prediction and monitoring of biological processes at the molecular and cellular level for a range of medical applications. The research has, in collaboration with the academic community, already generated a new antibiotic which can be delivered through the skin and has the potential for creating the next-generation of antibiotics.



Serotonin Acetyltransferase, iStock.com/Martin McCarthy

### Innovation in diagnosis

Extracellular vesicles are cell fragments present in body fluids, such as blood and urine. They have a role in inter-cell communication and in the spread of diseases such as cancer. This unique role gives them the potential to be used for new non-invasive methods of early diagnosis, drug efficacy studies and drug delivery. EMRP research identified the optimal procedures for collection, preparation and storage of extracellular vesicles, and standardised ways of measuring their size and population. Many international research groups have adopted these procedures and have improved the comparability of results. A simple extracellular vesicle extraction methods for preparing blood samples for disease study is now commercially available helping to promote the use of these important inter-cellular disease communicators in diagnosis.



Doctor with test tube, iStock.com/Angel Lopez Pelaz

## METROLOGY FOR HEALTH – CASE STUDY: IMPROVING RADIOTHERAPY SUCCESS

Radiotherapy is a powerful tool in modern cancer treatment – around 40 % of people who survive cancer do so because of radiotherapy. MRI-guided radiotherapy can further improve the success of radiotherapy by offering more targeted treatment through real-time imaging. However, before this new technique can be widely adopted in clinics, accurate dosimetry needs to be established to ensure patients are consistently treated with safe and effective doses of radiation.

### Measurement Challenge

Radiotherapy has been a mainstay of cancer treatment for over a century. It most commonly involves using a linear accelerator (linac) to deliver high-energy beams of X-ray radiation to patients, killing cancerous cells by damaging their DNA. Prior to treatment, patients are imaged in a CT scanner (using X-rays) to identify the target site. However, the position, size and shape of tumours around the chest and abdomen can change significantly during treatment because of the patient's breathing, limiting the accuracy with which these tumours can be targeted.

Compared to CT, magnetic resonance imaging (MRI) offers a greater depth of contrast and better visualisation of tissue boundaries, without the ionising radiation. This gives it the potential to provide more detailed images of patients during their treatment. MRI would enable clinicians to track changes to the target site in real time and ensure they are focusing radiation beams as closely as possible on the tumour, improving treatment outcomes for patients.

Delivery of a precise dose of radiation is essential to maximising the success of any radiotherapy treatment, while minimising adverse side effects due to radiation exposure. The problem is the electromagnetic field induced by MRI has the potential to affect a linac's radiation beam and calibration procedures, and consequently the dose delivered to patients. These effects must be well understood and new methods for calibrating specific MRI-linac combinations developed. This will support the introduction of MRI-guided radiotherapy into hospitals and clinics and improve cancer treatments delivered by external beam radiotherapy.

### Solution

The EMRP project 'Metrology for next-generation safety standards and equipment in MRI' developed the first calibration procedure for clinical MRI-guided radiotherapy machines that works in the presence of a magnetic field and allows users to accurately determine the radiation dose delivered to patients. Using a new, compact water calorimeter, MRI-linacs can be calibrated at the hospital and the measurements they make directly linked to national standards. This is a significant improvement over the current calibration method for conventional linacs, in which

the linac ion chamber must be calibrated against another ion chamber, itself calibrated at a National Measurement Institute.

### Impact

Elekta and Philips, two leading European companies in the fields of radiotherapy and MRI imaging, are part of a consortium developing a combined MRI-linac, which hopes to introduce the new treatment to clinical practice in 2017. The new calibration method developed has enabled Elekta and Philips to calibrate the beam strength and improve beam control of the MRI-linac, enabling customers to have confidence in its ability to provide the right quantity of radiation to a small targeted area. This will support improved treatment of tumour cells, while minimising exposure of surrounding healthy tissue.

The robust and easy-to-perform calibration method developed by the project provides essential support to the safe, effective introduction of the improved image quality offered by MRI into standard radiotherapy treatments. Consequently, the project has made a significant contribution to the development of an innovative, high-value medical technology and the benefits it brings to Europe's economy and quality of life for citizens.

Speaking of the MRI-linac's development, Kevin Brown, Global Vice-President of Scientific Research at Elekta, said: "The EMRP project contributes exact and reliable radiation dosimetry to this endeavour, an indispensable precondition before any patient can be treated."

## *The project: Metrology for improved MRI safety (HLT06)*

The EMRP project 'Metrology for next-generation safety standards and equipment in MRI' improved the diagnostic value and efficiency of magnetic resonance imaging (MRI) by developing measurement methods and models which enhance the safety of patients and staff while simultaneously eliminating unnecessarily restrictive exposure limits. A new patient safety concept developed in this project will help manufacturers to speed up innovation cycles, supporting faster market introduction of emerging technologies, and will allow the safe scanning of previously excluded patient groups. In addition, a robust magnetic field compatible traceability chain has been introduced for MRI-guided radiotherapy, a new use for MRI in cancer therapy.

The project is part of EURAMET's European Metrology Research Programme (EMRP), which is jointly funded by the European Union and the EMRP participating countries within EURAMET.

For further information, please go to <https://www.euramet.org/project-hlt06>

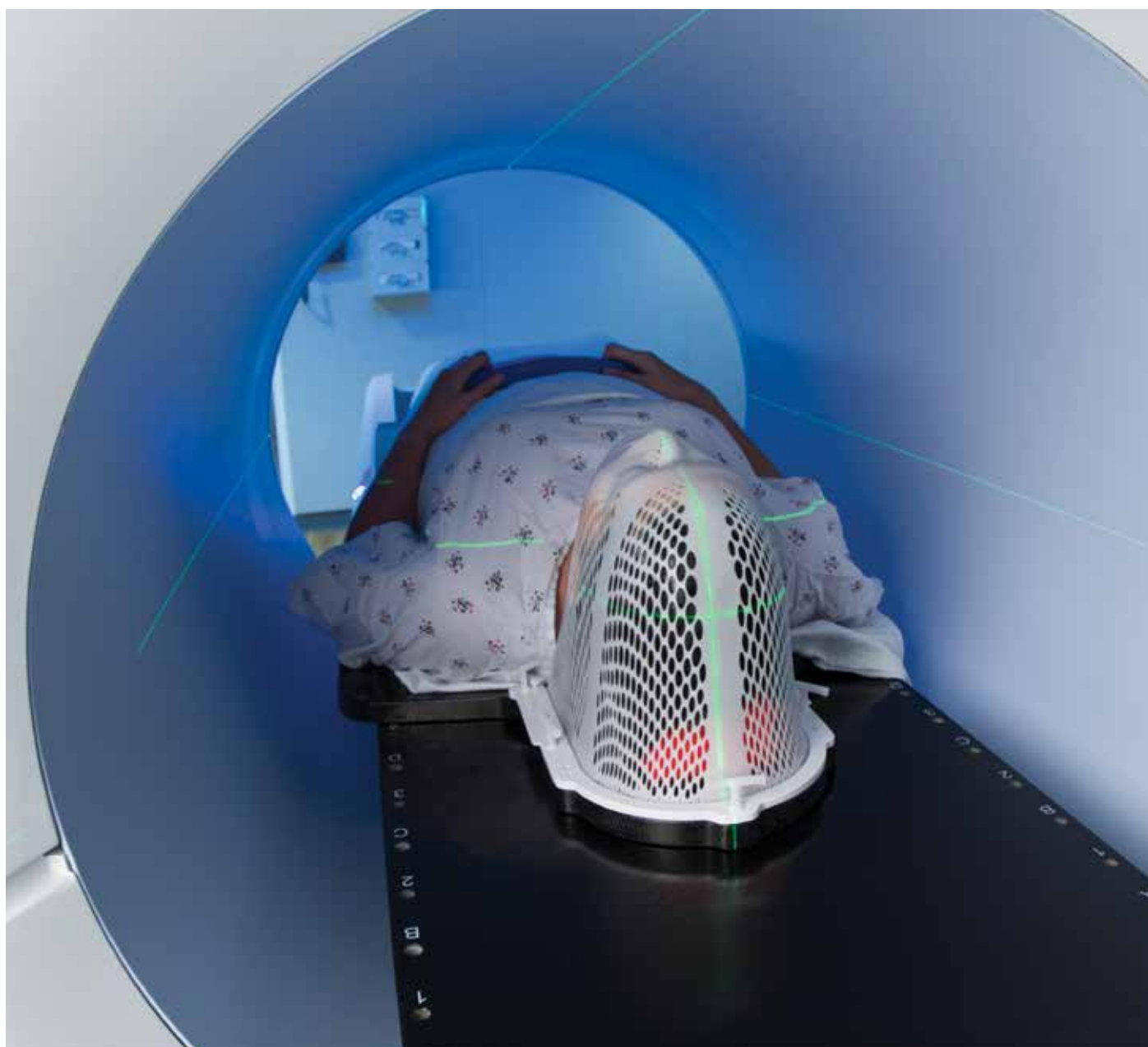
A list of all Metrology for Health projects can be found here <https://www.euramet.org/health>

## *Innovative MRI-guided radiotherapy method rolled out for clinical use in EMPIR project*

Demonstrating that radiotherapy works in the presence of MRI magnetic fields and the radiation dose delivered to patients can be accurately and consistently determined are essential before it can be introduced into clinics.

The feasibility of calibrating clinical MRI-guided radiotherapy machines was successfully demonstrated in the EMRP project 'Metrology for next-generation safety standards and equipment in MRI' (HLT06 MRI safety). This has been further developed to support clinical implementation in the EMPIR project 'Metrology for MR guided radiotherapy' (15HLT08

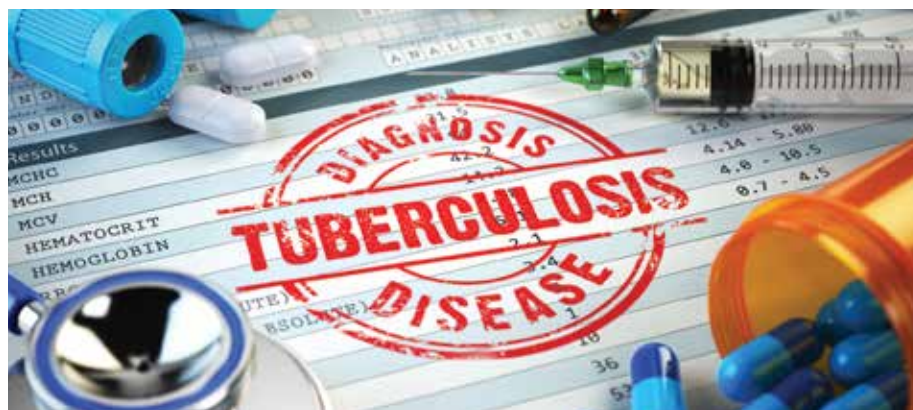
MRgRT). Results from the project have demonstrated that MRI-guided radiotherapy can be reliably linked to the traditional radiotherapy beam calibration method based on water calorimetry measurements to which clinics have existing traceability. This essential development has enabled Elekta, a leading European manufacturer of radiotherapy machines and academic hospitals, to rollout innovative MRI-guided radiotherapy for clinical use. The first patients to benefit from this new method were treated in May 2017.



Patient Receiving Medical Scan Treatment; iStock.com/Snowleopard1



## METROLOGY FOR HEALTH – CASE STUDY: FASTER TB DIAGNOSIS



Tuberculosis diagnosis; iStock.com/Bet\_Noire

Tuberculosis (TB) is caused by bacteria which are becoming increasingly resistant to antibiotics. Doctors in the developing world have to frequently rely on diagnostic techniques that are insensitive or slow leading to the over prescription of antibiotics. By providing access to faster diagnostic methods, doctors will be able to target treatment effectively slowing the development of drug resistant TB bacteria.

### Measurement Challenge

Tuberculosis (TB) is a global problem made more serious by challenges associated with diagnosis and identification of drug resistance. A major challenge is quickly identifying the presence of TB causing bacteria in a patient's sample. Conventionally, for the most accurate diagnoses, samples are cultured for six weeks before being tested and while newer culture methods have reduced this, several days are still needed. Modern laboratories increasingly use an analysis technique called Polymerase Chain Reaction (PCR) which specifically detects bacterial DNA - if the pathogen is present - in a matter of hours.

Many different routine PCR techniques are used in TB diagnosis around the world, and increasingly automated instruments that do not need specialised laboratories and highly trained staff are being introduced. This makes these methods suitable for use in

developing countries where TB prevalence is high. To ensure the accuracy with which labs can routinely detect disease bacteria in patient samples they participate in externally run quality assessment schemes during which all participants analyse the same material. This enables the results to be compared and a lab's disease diagnosis capability to be assessed. However, robustly relating participant results is challenging due to a lack of well characterised reference materials and appropriate highly accurate and traceable analysis methods.

### Solution

The EMRP project 'Metrology for monitoring infectious diseases, antimicrobial resistance, and harmful micro-organisms' developed and validated highly accurate Digital PCR (dPCR) based approaches for counting the quantity of specific bacterial DNA sequences in a sample.

The UCL Centre for Clinical Micro-biology, based at the Royal Free Hospital in the UK, an internationally recognised centre for micro-bacteriology research provided the project with TB bacterial samples to enable the generation of appropriate reference materials. These materials enabled the calibration of other clinical PCR techniques and allowed their direct comparison to the dPCR assigned values. This created a

traceable measurement route for clinical PCR techniques.

The project also identified best practice for sample preparation and storage to enable delivery of the most accurate results across all techniques.

### Impact

The TB reference materials assessed during the project were used in a comparison exercise to evaluate the performance of diagnostic tools by nine project partners and collaborators. Great Ormond Street Hospital, an important TB pathology laboratory in the UK, participated in this exercise and were able to confirm that PCR techniques correctly detect TB bacteria. The project's reference material established a reliable and traceable baseline, allowing organisations to demonstrate the robustness of their techniques in detecting the bacterial DNA.

The reference materials and best practice guidance developed as a result of this project are helping to assure the performance of PCR based measurements and will increase confidence in the accuracy of TB testing. Faster rigorous TB diagnosis will help doctors prescribe and modify drug regimens to maximise effectiveness, minimise side effects, and slow the development of drug resistant bacteria.

## *The project: Metrology for infection control (HLT08)*

The EMRP project 'Metrology for monitoring infectious diseases, antimicrobial resistance, and harmful micro-organisms' developed new measurement methods and materials to enable accurate quantification of infectious disease-causing pathogens in clinical samples. Infectious diseases account for over 20 % of human deaths globally and reliable diagnostic tools, such as these, are vital for public health protection. The project results provide much-needed support to emerging molecular approaches for efficient, harmonised and rapid diagnosis and monitoring of infectious diseases.

The project is part of EURAMET's European Metrology Research Programme (EMRP), which is jointly funded by the European Union and the EMRP participating countries within EURAMET.

For further information, please go to <https://www.euramet.org/project-hlt08>

A list of all Metrology for Health projects can be found here <https://www.euramet.org/health>

## EMRP 'METROLOGY FOR HEALTH' IMPACT REPORT PUBLISHED



### New Impact Report outlines key achievements of the Health focused projects

The newly published Impact Report for EMRP theme 'Metrology for Health' contains examples of the early adoption of EU funded science and technology and information on new measurement developments.

High quality healthcare is underpinned by the accurate physical, chemical and biological measurements used to diagnose health conditions and ensure therapies are delivered safely and effectively. The aim of the EMRP health theme was to develop the measurement methods and techniques to support increased accuracy of disease identification and treatment of serious health conditions.

This report explores new measurement capabilities developed as a result of NMI collaborations within the health projects. 66 research groups from 28 metrology

institutes came together with academia, industry and clinicians to address accurate measurements and high quality assessments of data to support the provision of healthcare in Europe.

The report focusses on two sub-themes: metrology for quantitative disease diagnosis and metrology for safe and effective therapies. In addition, a set of 19 case studies concentrates more closely on the benefits already being delivered to health care professionals and patients.

The eleven health projects were carried out as part of EURAMET's European Metrology Research Programme (EMRP), which combines the knowledge, expertise and facilities of Europe's measurement community to address global challenges in areas such as energy, environment and health.

Link for download:

<https://www.euramet.org/health>

## Collaboration & Network

### INTERNATIONAL METROLOGY CONGRESS: MEASURE TO CREATE THE FUTURE



### Visit EURAMET at the Metrology Village

The 18th International Metrology Congress (CIM) will be held in Paris, France, from 19 to 21 September 2017. The congress has been organised along the theme of 'Measure to Create the Future' and will focus on topics around research and development and best practices for measurement in industry. It comes together with an exhibition dedicated to technologies for measurement, internet of things, vision and optics and others.

The event aims at improving measurements in industry, analysis and test processes and at exploring new developments in research, technology and practical industrial applications. There will be more than 180 presentations and six industrial round tables. Main topics include metrology 4.0 and the factory of the future, new ISO/IEC 17025 standard on general requirements for the competence of testing and calibration

laboratories, metrology for biology, health and pharmaceuticals, measurements for water quality, energy and nanotechnologies and drone-based inspection.

In EURAMET's anniversary year the organisation contributes to the congress in different ways: Beat Jeckelmann, EURAMET's Chairperson, will give a talk about 'Joint metrology research in Europe meeting the needs of industry and wider society' in the plenary session 'Measure and create the future' on Wednesday 20 September 2017. In addition, more than 35 presentations and posters linked to EURAMET's research programmes (EMRP and EMPIR) will be presented during the congress. They are highlighted in the programme with the EURAMET logo.

EURAMET will have a stand in the Metrology Village, alongside several European National Metrology Institutes and Designated Institutes. EURAMET will provide information about the organisation, its

research programmes and instrumentation developed within a number of EMRP and EMPIR projects will be shown at the stand.

Further highlights of the congress include the best oral and poster presentations awards, the talk from Violaine Sautter, mineralogist at the French National Museum of Natural History, and involved in the instrumentation of the rover 'Curiosity' working on Mars, the talk on the revised International System of Units by Joachim Ullrich, (PTB, Germany) and the speech from Christophe Salomone (CNRS-Laboratoire Kastler Brossel, France) about the 'Metrology and space conquest'.

The International Metrology Congress is organised by the Collège Français de Métrologie (CFM) in partnership with many international associations representing end-users, professionals, academia and of course metrology, including EURAMET.

Further information can be found at <http://www.cim2017.com/index-en.html>



## WHAT SHOULD YOU EXPECT AT THIS YEAR'S METROLOGY CONGRESS?

Interview with  
organising committee  
chairpersons of CIM 2017



Co-chairs of CIM's organising committee: Pierre Claudel (CETIAT, France) and Miruna Dobre (SMD, Belgium)

The 18th International Metrology Congress (CIM) will be held in Paris, France, from 19 to 21 September 2017. The theme of this year's congress is 'Measure to Create the Future', and the congress will focus on research and development, and best practice for measurement in industry. EURAMET will participate in the congress and has talked to Pierre Claudel (CETIAT, France) and Miruna Dobre (SMD, Belgium) co-chairs of the organising committee, about their expectations on the event.

**EURAMET: The theme of this year's International Metrology Congress is 'Measure to Create the Future'. What is the rationale behind this theme?**

**Pierre:** There are two main reasons for choosing this theme. The first is the latest digital revolution in industry and with it the concepts of Industry 4.0, concerned with the current trend of automation and data exchange in manufacturing technologies, and industry of the future. It seems clear that industry will be more connected, more communicative and more automated and therefore, needs to rely on an increasing number of sensors. Measurements are going to play a central role in this industry of the future and metrology will be inescapable. People who are interested in this topic should attend the session on 'Metrology 4.0', the round table on 'Dynamic measurement and factory of the future, the metrology input' and the poster session 'IA and Data metrology'. The second reason for choosing this theme is connected to the revision of the International System of Units planned for 2018.

**EURAMET: The International Metrology Congress has a long running tradition and will take place for the 18th time. What is the goal of the International Metrology Congress, and has this evolved over the years?**

**Miruna:** The first International Metrology Congress in 1983 gathered 80 participants,

and we expect 10 times as many this year. From the beginning the congress has been designed as a forum where metrology users and providers exchange ideas about needs, trends and developments. Benefiting from joint organisation with a trade show on innovative technologies the congress grew into a large event reaching 500 attendees in 2003. The unique opportunity to meet end-users of measurement technology, manufacturers of measuring equipment and academics and researchers, attracts metrologists from all over the world.

**EURAMET: How many participants and visitors do you expect?**

**Pierre:** We expect at least 800 participants at the congress, but we are hoping to achieve around 1000. In addition, we hope to increase the number of international participants which was about 30 % during the previous CIM in 2015.

**EURAMET: The programme includes round table sessions, presentations and poster sessions across a broad range of topics. How do you rate the scientific importance of the event?**

**Miruna:** The scientific committee was eager to organise a diverse and high quality conference programme. With 185 presentations covering fields such as electrical and dimensional metrology, uncertainty, mathematical modelling and also applied metrology, in dedicated sections such as metrology for health, we hope to achieve a 360° view of the metrology state-of-the-art. The round tables on emerging topics such as dynamic measurement, or drone-based inspection, will complete the picture.

It is worth mentioning that the conference is also a showcase for collaborative research in Europe, clearly identified in the programme by the EURAMET logo. One third of the speakers are presenting results obtained in the framework of EMRP or EMPIR projects.

**EURAMET: There is an exhibition alongside the conference. What kind of exhibitors can visitors expect to meet there?**

**Pierre:** The exhibition takes place in parallel with the congress and we expect about 5000 visitors over the three days. The Metrology Village consists of an additional 1000 square metres of booths. Visitors can expect to see manufacturers of measurement technologies, metrology service providers, particularly in calibration and also national metrology bodies and associations.

**EURAMET: EURAMET will have a stand at the congress in the metrology village. How can NMIs and DIs participate and profit from the congress?**

**Miruna:** This is a great opportunity for NMIs and DIs to draw the attention of end-users to new services, methods or instruments developed in European joint research projects. I especially encourage project coordinators to seize this chance to increase the impact of research outputs.

**EURAMET: What are your personal highlights of this year's programme?**

**Pierre:** The programme is very rich, so it is difficult to choose. Personally, I am interested in the contributions around the use of drones for measurements. There will be a round table on 'Drone-based inspection and monitoring: new challenges for measuring' and also a demonstration of the use of a drone to scan a voluminous and complex object. Attend CIM 2017, it will be fascinating!

**Miruna:** If you want to feel the pulse of the metrology community attend the poster sessions. Walk among more than 100 diverse research presentations, listen to passionate discussions between authors and future end-users and get the most out of this unique crossroads between R&D and industrial applications. Looking forward to meeting you in September!

# Community News



Participants of EURAMET's General Assembly 2017

## EURAMET WORKS ON FUTURE DEVELOPMENTS AT ITS GENERAL ASSEMBLY

From the 15 to 19 May 2017 Europe's measurement community met in Madrid and Tres Cantos, Spain, for the 11th General Assembly (GA) of EURAMET. The assembly is the main event in the calendar for EURAMET and offers the opportunity to discuss and decide on the future development of the organisation. The 5-day event was hosted by CEM, the Spanish National Metrology Institute, and had up to 150 participants including Delegates, Technical Committee Chairs and representatives from Liaison Organisations. The participants discussed EURAMET's achievements over the last year and proposals to improve collaboration amongst Europe's measurement community.

Topics on the agenda included the possible development of 'European metrology networks' and metrology support for regulation. "The overall objective of the networks is to improve the coordination amongst EURAMET members, and to create sustainable structures in areas of strategic importance for European metrology. They would include not only research activities but also activities to foster knowledge and technology transfer", explains Beat Jeckelmann, EURAMET's Chairperson. The networks would consist of National Metrology Institutes, Designated Institutes and stakeholder organisations.

In a workshop for Technical Committee Chairs and Task and Working Group Convenors options to improve the efficiency and reduce the duration of comparisons were discussed. One option includes a new 'comparison toolbox', a web based application for the management of

comparisons. The Technical Committee for Metrology in Chemistry reported positive feedback from a workshop prior to the GA to support Designated Institutes on the way to their first Calibration and Measurement Capabilities. Such workshops are part of EURAMET's initiatives to support the closer integration of DIs.

Elections took place in a closed session for Delegates only. Hans Arne Frøystein (JV, Norway) was elected as future EURAMET Chairperson starting his term in May 2018. The Board of Directors welcomes one re-elected and two new members: Zijad Džemić (IMBiH, Bosnia-Herzegovina), Robert Edelmaier (BEV, Austria) and Hugo Vos (VSL, Netherlands). In addition, the terms of five Technical Committee Chairs ended and all were re-elected for a second term of office until May 2019, a further three TC-Chairs started their first term in 2017 (see page 17). EURAMET congratulates all news and re-elected officials and wishes them all the best in their positions.

EURAMET also welcomed three new institutes: the National Metrology Institute of the Republic of Moldova was accepted as Corresponding Applicant and the Designated Institutes LABSAGAS and IW, both from Bosnia-Herzegovina, were accepted as Associates (A-DI).

This year's General Assembly was heavily influenced by EURAMET's anniversary. At CEM, 30 years earlier, the Memorandum of Understanding was signed founding EUROMET, EURAMET's predecessor. To mark the occasion, a special symposium was devoted to the celebration of the 30th anniversary (see page 11). Besides the General Assembly several other meetings took place during the week such as the Research Council and EMPIR Committee meeting and the inaugural meeting of a new BoD working group for Designated Institutes.

### The host of the General Assembly: Centro Español de Metrología (CEM)

EURAMET's 11th General Assembly took place in Madrid and Tres Cantos in Spain and was hosted by Centro Español de Metrología (CEM), the Spanish National Metrology Institute.

"It was most kind of CEM to give us the opportunity to come back to the founding place of EURAMET's predecessor for the General Assembly in our anniversary year", commented Beat Jeckelmann, EURAMET Chairperson.

In her welcome address Bregoña Cristeto Blasco, General Secretary of Industry and SMEs in the Ministry of Economy, Industry and Competitiveness and President of CEM, emphasised the importance of metrology for competitiveness of industry and the beneficial collaboration between CEM and EURAMET.

CEM was founded in 1990 and is the highest body of the general state administration in the field of metrology in Spain. CEM is strongly committed to EURAMET; it contributes to all EURAMET Technical Committees and participates in various joint research projects within EURAMET's European Metrology Research Programmes.

José Manuel Bernabé Sanchez, Director of CEM, and José Ángel Robles Carbonell, Director Scientific Division, who ended his term as BoD member at the General Assembly, and their dedicated team, arranged the one week event with great hospitality and professionalism. EURAMET is grateful for the support and perfect organisation of the General Assembly 2017. The extremely convenient and pleasant atmosphere was ideal for a week full of productive meetings.



### Re-elected Technical Committee Chairs

Technical Committee	Re-elected Chair	Period
Electricity and Magnetism	Luca Callegaro (INRIM, Italy)	June 2017 to May 2019
Flow	Petra Milota (BEV, Austria)	June 2017 to May 2019
Length	Harald Bosse (PTB, Germany)	June 2017 to May 2019
Mass and Related Quantities	Isabel Spohr (IPQ, Portugal)	June 2017 to May 2019
Metrology for Chemistry	Hanspeter Andres (METAS, Switzerland)	June 2017 to May 2019

### New Technical Committee Chairs

Technical Committee	New Chair	Period
Acoustics, Ultrasound and Vibration	Stephen Robinson	October 2016 to May 2019
Photometry and Radiometry	Stefan Kück	June 2017 to May 2019
Time and Frequency	Peter Whibberley	June 2017 to May 2019



Speakers of EURAMET's Anniversary Symposium

## ANNIVERSARY SYMPOSIUM

### Celebration of 30 years of collaboration in European metrology

The main lecture room at CEM, the Spanish National Metrology Institute, was filling quickly in the morning of 18 May 2017: Europe's metrology community gathered to celebrate EURAMET's 30th anniversary. In 2017 EURAMET celebrates its 10th birthday; inaugurated on the 11 January 2007. 20 years earlier, in 1987, its predecessor EUROMET was founded. These two important events have resulted in 30 years of close collaboration in European measurement.

To mark the celebration a symposium was held, consisting of contributions from top speakers. All of the speakers were involved in EURAMET's development over the last three decades, for example as Chairpersons or Vice-Chairpersons.

The keynote speech was given by Klaus von Klitzing, Nobel Prize Winner in Physics and member of EURAMET's Research Council. The audience enjoyed his talk about the 'Quantum Hall effect: The driving force for a new international system of units' and the story of its discovery.

In his role as Master of Ceremony, Andrew Wallard (Emeritus Director of the BIPM) led the international participants smartly through the event. The entertaining symposium was divided into several short sessions with very lively contributions and anecdotes about 'What makes EURAMET special'; given by former Chairpersons and staff.

To reflect on how far the metrology community has come one of the sessions gave examples on 'What made EURAMET the organisation it is today?'. This session included a review of the time when EUROMET gave itself a new strategic orientation with a study entitled 'Planning the European Research Area in metrology' and an evaluation of how the EMRP changed the organisation. Another session highlighted the long history of capacity building and knowledge transfer within EUROMET and EURAMET as an important

pillar of the association's development. The presentations can be found on EURAMET's website (<https://www.euramet.org/event-symposium2017>).

A vision for the future of the organisation and the European metrology community was given in a session on 'What are the actual and future challenges?'. It included an outlook by EURAMET's Chairperson, Beat Jeckelmann, on closer coordination in EURAMET and a talk about post-EMPIR research.

The symposium was rounded off with an open discussion on EURAMET's role in national, regional and international metrology, with many contributions from the audience, for example one contributor said that there should be more female metrologists involved in the top committees and bodies of the organisation.

The anniversary symposium took place alongside EURAMET's General Assembly in Madrid and Tres Cantos, Spain. The location for the symposium was very symbolic as it was at CEM, 30 years earlier, that a Memorandum of Understanding was signed founding EUROMET, EURAMET's predecessor.



## EURAMET BOOKLET ON 30 YEARS OF COLLABORATION IN EUROPEAN METROLOGY PUBLISHED

One of the highlights in EURAMET's anniversary year is the publication of the anniversary booklet '30 years of collaboration in European metrology'. It is now available for download on EURAMET's website.

"EURAMET quickly came to the conclusion that an anniversary publication would be a good and lasting way to reflect on how far the metrology community has come," said Beat Jeckelmann, EURAMET Chairperson. "We were lucky enough to have Michael Kühne, former EUROMET and EURAMET Chairperson, as editor of the publication."

The success of EURAMET would not have been made possible without all the people who contributed to its development. Taking this into account, the anniversary publication has been written by 17 different authors; all of whom played an important role in EURAMET's history and present.

The Chairperson and editor have been given special support from EURAMET's anniversary team consisting of Maguelonne Chambon (Board of Directors Member), Janko Drnovšek (DI Contact and former Vice-Chairperson (GA), Duncan Jarvis (General Secretary), Wolfgang Schmid (Member Service Manager) and Anne Trumpfheller (Communications Officer).

"The anniversary booklet is the first document detailing the history of EURAMET. It describes how many visionary people contributed to a new idea of collaboration and made it a success," comments Michael Kühne. "The publication explains where EURAMET found its place in global metrology and developed something unique: The European Metrology Research Programme."

After an intensive period of writing, editing, and designing, the 64-page booklet has been published as part of EURAMET's anniversary symposium and World Metrology Day. It is written for all who contributed to the development of metrology in Europe, for members of the international measurement community and for those who are interested in getting a greater insight into measurement collaboration.

include: Link for download:

<https://www.euramet.org/?news=40:586>



## EURAMET'S GENERAL ASSEMBLY WEEK AND ANNIVERSARY SYMPOSIUM



EURAMET's Chairperson Beat Jeckelmann giving a talk at the anniversary symposium



Thanks for their commitment: The BoD terms of Jan C. Petersen and José Ángel Robles Carbonell ended in May 2017



Elected: Hans Arne Frøystein (future EURAMET Chairperson), Zijad Džemić, Hugo Vos and Robert Edelmaier (all Board of Directors Members)



Giving the key note speech: Klaus von Klitzing, Nobel Prize Winner in Physics and member of EURAMET's Research Council



No birthday celebration is complete without cake



José Manuel Bernabé Sanchez, Director of CEM, at the anniversary symposium





Leading through the symposium:  
Andrew Wallard, Emeritus Director of the BIPM



Andy Henson (BIPM), former EURAMET Manager of MERA, iMERA, iMERA-Plus and EMRP



Former EURAMET Vice-Chairperson (GA)  
Janko Drnovšek



Arnold Leitner,  
former EURAMET Vice-Chairperson (GA)



Kim Carneiro,  
former EUROMET Chairperson



Two former EUROMET Chairpersons:  
Wolfgang Schwitz and Luc Erard



EURAMET's General Secretary  
Duncan Jarvis



Former Chairperson of EUROMET  
and EURAMET: Michael Kühne



Leslie Pendrill, EURAMET's Chairperson from 2009 to 2012



Former EURAMET Vice-Chairperson (EMPIR) Jörn Stenger





Wolfgang Schmid, EURAMET Member Service Manager



EURAMET Chairperson Beat Jeckelmann serving birthday cake



Erkki Ikonen, EURAMET Vice-Chairperson (EMPIR)



Contribution from the audience



EURAMET Vice-Chairperson (GA), Maria Luisa Rastello, during the open discussion



Jarle Gran, Chair of TC Photometry and Radiometry from 2015 to 2017, and Ramiz Hamid, Chair of TC Time and Frequency from 2013 to 2017, receiving thanks from Beat Jeckelmann on behalf of EURAMET



Session at the General Assembly



Paul Hetherington, former EURAMET Chairperson and former EURAMET BoD Member

## HANS ARNE FRØYSTEIN IS CHAIRPERSON-ELECT

Every three years a new EURAMET Chairperson is elected. In 2017 the General Assembly elected Hans Arne Frøystein from Justervesenet (JV), Norway as future Chairperson for the term from 2018 to 2021. EURAMET congratulates Hans Arne and wishes him all the best for his new role.

Hans Arne studied physics and mathematics at the Norwegian Technical University in Trondheim. He joined JV, the Norwegian National Metrology Institute, in 1987 as a metrologist in electricity and thermometry. In 1992 he became head of the National Metrology Laboratory; his tasks included the planning and establishment of the new laboratory facility of JV in Kjeller, lecturing at the University of Oslo and technical assessments for Norwegian Accreditation. Hans Arne is deputy director of JV and was Acting Director General between 2015 and 2017.

Hans Arne has been part of the EURAMET community for almost 30 years, starting as contact person for different Technical Committees. He also has broad experience in other international organisations and projects relating to metrology and quality infrastructure. Today he is the Norwegian Delegate for EURAMET and Deputy of the EMPiR Committee.



Hans Arne will use his time as Chairperson-elect to gain deeper insight into the organisation and prepare himself for taking over the role as Chairperson in June 2018.

"EURAMET is a well-run association aimed at developing a reliable and competitive metrology infrastructure for Europe. It focusses on supporting its members in maintaining and developing confidence in their metrological infrastructures and on running the European Metrology Research Programmes to support innovation, contribute to solving the grand challenges and to develop a European metrological landscape fit for the future. As Chairperson, I will contribute to fulfil these long-term goals together with the EURAMET community.

My focus is on supporting all members in their endeavours to build and maintain their capacity to fulfil national and regional needs; support a coordinated European metrology infrastructure by taking into account the outcomes of the coordination study and develop the EURAMET strategy beyond 2020. In addition, I will support the development of a possible follow-on programme after EMPiR; ensure that EURAMET continues to have a strong voice in global metrology and contribute to an effective CIPM MRA; increase EURAMET's collaboration with other organisations, policy makers and stakeholders and further integrate the Designated Institutes into the association."



## NEW MEMBERS OF EURAMET'S BOARD OF DIRECTORS

The Board of Directors (BoD) is responsible for the governance and the development of the strategy of EURAMET. It is composed of three Chairpersons and six elected members. Congratulations go to two new members of the BoD, elected by the General Assembly. Find out who they are and which topics they will focus on to serve our community.

### Robert Edelmaier – Austria

After his study of physics at the University of Vienna, Robert joined BEV, the Austrian National Metrology Institute, in 1990. In his various roles he has been responsible for the laboratory of radioactivity, the division "Mechanics and Flow" and the Physico-Technical Testing Service. His tasks included the coordination of the maintenance of the national primary standards, the application and acquisition of standard measuring devices and procedures and the collaboration in technical-legal matters concerning metrological questions. Today Robert is the Head of Metrology Service and Vice-President of BEV. Robert is EURAMET Delegate, Deputy in the EMPIR Committee and Chair of EURAMET's Technical Committee of Interdisciplinary Metrology (TC-IM).

"In the next years EURAMET has to take further steps for its future development. This includes EURAMET's role in the process of reviewing the CIPM MRA and an active role in the JCRB. In addition, it is very important to develop a possible successor programme of EMPIR. Therefore, my active



role in the BoD would be to continue the work already done together with TC-IM for example regarding the implementation of the recommendations of the CIPM MRA. I will especially focus on the role of smaller NMIs including the specific tasks of emerging metrology systems. BEV has been very active supporting those systems and NMIs in the last years. This experience enables me to work for a well-balanced European metrology system considering the special needs of smaller and emerging metrology institutes."



### Hugo Vos – The Netherlands

After his study of applied physics at the Technical University of Delft, Hugo started his career in the development of acoustic imaging. In 1988 he joined TNO, the Dutch organisation for applied research, where he became Director of Research in 2011. Through various positions, Hugo has been involved in the development of instrumentation for a wide variety of applications such as seismic exploration, non-destructive testing and material characterisation. In addition to a number of feasibility studies and consultancy assignments, this has led to some innovative product developments. Later his interest gradually shifted to the management aspects of innovation. In the past 20 years Hugo gained experience in R&D management, including the development of consortia with governments and companies, the spin off and privatisation of business activities and the management of teams.

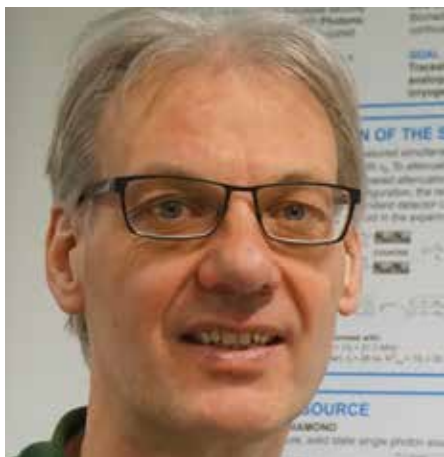
In 2016 Hugo joined VSL, the Dutch National Metrology Institute, as managing director with the ambition to use his experience to further develop the excellent position of VSL to the benefit of the Dutch government and industry.

"In my role as BoD member it is my strong vision that we have to combine excellent science in our research programmes with demonstrable societal and business impact, to ensure that EURAMET remains essential to the EU. This requires strategic alignment with scientific communities, government and industry. In this way, EURAMET can successfully contribute to a long-term cooperation on knowledge development and knowledge sharing in Europe and gradually develop a fit for purpose level of coordination of activities."



## EURAMET WELCOMES THREE NEW TC CHAIRS

EURAMET's scientific and technical collaboration is organised within twelve Technical Committees. Every two years the Chairs of the Technical Committees are elected by the General Assembly. In 2016 and 2017 the terms of Richard Barham (formerly NPL, UK), Ramiz Hamid (UME, Turkey) and Jarle Gran (JV, Norway) ended. EURAMET offers the warmest thanks for their great contribution and engagement. EURAMET is happy to announce that three new Technical Committee Chairs have been elected. EURAMET wishes them all the best and looks forward to working together with them.



### **Stefan Kück – TC for Photometry and Radiometry**

Stefan obtained the state doctorate in physics at the University of Hamburg (Germany) on tunable solid state laser materials in 2001. He joined PTB, the German National Metrology Institute, in 2002 and started working in the 'Laser Radiometry' team. In 2009 he became head of the 'Optical Technologies' department and in 2013 head of the department for 'Photometry and Applied Radiometry'. Today Stefan is head of the division of 'Optics' at PTB. In addition, to being chair of EURAMET's TC for Photometry and Radiometry he joined COOMET's TC-PR and represents PTB in the Consultative Committee of Photometry and Radiometry.

"The TC developed well in the last years due to the excellent work of my predecessors. One of the major topics during my term will be the further development of coordinated research activities within the TC to meet the upcoming challenges in the field of photometry and radiometry. The projects within the European Metrology Research Programmes are one pillar, the other may be joint research centres. The TC should also act as a platform for discussion and planning. Besides research and innovation, there are basic duties to fulfil. I would like to improve the CMC submission process and further enhance the collaboration between all members of the TC. Therefore, it is important to consider the needs of all TC members."



### **Peter Whibberley – TC for Time and Frequency**

Peter joined NPL, the UK National Metrology Institute, from the University of Oxford in 1984, initially working on millimetre-wavelength spectroscopy. After six years Peter moved into time and frequency metrology, working with a small team that constructed and evaluated a prototype caesium fountain primary frequency standard. From 1999, the focus of Peter's research has moved from frequency to time, and today he is the lead scientist for the operation and development of the UTC (NPL) time scale, NPL's satellite-based time and frequency transfer links to other national timing centres, and its time dissemination services. One of Peter's major research interests has been methods for time transfer over optical fibre links. Thus, he has been closely involved in the development of a commercial service to provide traceable time over fibre to the UK finance sector and other users. Peter has also participated in several EMRP joint research projects. Since 2004, Peter has played an active role in representing NPL on international committees, including EURAMET's TC-TF.

"As the new Chair of TC-TF, I would like to continue to develop the cooperation between NMIs in this field, to make the best possible use of new opportunities such as the establishment of optical fibre time and frequency links across Europe and the development of miniature optical clocks for industrial uses."



### **Stephen Robinson – TC for Acoustics, Ultrasound and Vibration**

After joining NPL, the UK National Metrology Institute, from the University of Manchester, Stephen has gained over 30 years' experience in underwater acoustic metrology. He has led numerous collaborative projects, including several EU-funded projects, and has led two CCAUV Key Comparisons. As member of the UK Institute of Physics and the Institute of Acoustics, Stephen is very active in the development of international standards for underwater acoustics, leading work in the according ISO and IEC technical committees. In addition, he has been active within EURAMET, and has been convenor of the TC-AUV Sub-committee on Ultrasound and Underwater Acoustics for four years. He is also a member of the Strategic Planning Working Group of CCAUV.

"My key objectives as TC Chair include supporting emerging NMIs and DIs to establish strong capabilities in AUV measurement; establish a well-coordinated AUV metrology infrastructure and illustrate how AUV supports meeting the Grand Challenges in areas such as health and environment to ensure AUV plays an appropriate role in the metrology research programmes. I would like to promote the importance of AUV measurement and its potential for creating impact in a broad range of industrial and societal sectors. AUV technologies are often an important component in large multidisciplinary pieces of work. It is necessary to establish mechanisms for such projects to be properly conceived and formulated, and gain credit for their multidisciplinary nature."

## BOARD OF DIRECTORS LOSES TWO VALUABLE MEMBERS



The Board of Directors (BoD) is EURAMET's governing body, responsible for the execution of decisions taken by the General Assembly. The BoD consists of the three Chairpersons and six members elected by the General Assembly. The terms of José Ángel Robles Carbonell (CEM) and Jan C. Petersen (DFM) ended in May 2017.

EURAMET expresses its sincere thanks to Jan and José for their commitment and invaluable support.

### **José Ángel Robles Carbonell, Centro Espanol de Metrologia (CEM)**

José was member of the Board of Directors from 2011 to 2017. "It has been an honour and a great personal experience being involved in the activities of the BoD in the last six years. Especially in this interesting time for EURAMET."

José studied industrial engineering at the Politécnica University of Madrid and joined the Spanish National Metrology Institute, Centro Español de Metrología, as laboratory engineer in 1984.

Since 2007 he has been director of CEM's scientific division and was involved in the national development of scientific and legal metrology, regulation, standardisation and accreditation. He has supported the EURAMET community for many years and from 2007 to 2017 he was the Spanish EURAMET Delegate. In addition, he is the Spanish representative in many national and international committees.

"For me metrology is not only a science or a job, it is part of my life since I joined the metrology community in 1984. In the Board of Directors I collaborated with excellent colleagues and friends and learned from all of them. At the same time, I tried to support EURAMET and its members with my experience and inputs."

### **Jan C. Petersen, Danish Fundamental Metrology (DFM)**

Jan was member of the Board of Directors from 2013 to 2017.

Jan is photonics group manager at DFM and as a member of the management team he plays an important role in the strategic development of the institute and in attracting external research funding as well as commercial research. Jan studied physics at the University of Copenhagen and obtained a PhD degree in physical chemistry from the University of Bristol. He joined DFM in 1990. Jan's engagement for EURAMET started in 1990 as Danish Contact Person in the Technical Committee for Photometry and Radiometry. During the period 1994 to 1998 he was EUROMET Secretary. Since 2009 he has been the Danish EURAMET Delegate.

"As BoD member I very much appreciated the diversity of subjects and fields that had to be addressed. I enjoyed working with colleagues coming from different fields of metrology and having different backgrounds, which resulted in very lively discussions. The major topics I was involved in were quality assurance where I worked closely with the Quality Manager and the secretariat to ensure that documents were fit for the EURAMET quality system and, as member of the BoD Core Group, providing guidance in putting together the Strategic Research Agenda for Metrology in Europe."



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