

PROGRAMME

21st INTERNATIONAL METROLOGY CONGRESS

CIM 2023

LIMITLESS
METROLOGY
AT YOUR FINGERTIPS

07
10 MARCH
LYON
FRANCE

 **CFM** L'ASSOCIATION
DE LA MESURE
INDUSTRIELLE

SUPPORTED & ORGANIZED BY



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LABORATOIRE
NATIONAL
DE METROLOGIE
ET D'ESSAIS **LNE**

CEM
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NPL
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PTB
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Servicio
Metrología
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UNIVERSITÄT BREMEN

VSL
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KEY APPLICATIONS



INDUSTRY 4.0



HEALTH



CLIMATE
CHALLENGES

WITH THE EXHIBITION

**GLOBAL
INDUSTRIE**

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www.cim2023.com

MARDI 7 / TUESDAY 7	CLIMATE WORKSHOP (MetClimVOC) Key parameters for air monitoring ON PRE-BOOKING ONLY, LIMITED SEATS. SUR PRÉ-RESERVATION SEULEMENT, PLACES LIMITÉES. SOLD OUT ROOM C		CLIMATE WORKSHOP (MetClimVOC) Key parameters for air monitoring ON PRE-BOOKING ONLY, LIMITED SEATS. SUR PRÉ-RESERVATION SEULEMENT, PLACES LIMITÉES. SOLD OUT ROOM C		WELCOME OPENING SESSION ON THE METROLOGY VILLAGE TABLE RONDE / ROUND TABLE ROOM B	S1 Mécanique / Mechanics ROOM A	POSTERS • Chimie / Chemistry • Digitalisation / Digitalisation • Electromagnétisme / Electromagnetism • Débitmétrie / Flow • Rayonnement ionisant / Ionising radiation • Mécanique / Mechanics • Apprentissage machine / Machine learning ROOM B	WELCOME APERITIVE
	S2 Électricité radiofréquence / Radiofrequency and Electricity ROOM C	La métrologie peut-elle suivre la révolution de l'hydrogène ? / Can metrology keep up with the hydrogen revolution? ROOM B						

MERCREDI 8 / WEDNESDAY 8	WELCOME S3 Apprentissage machine / Machine learning ROOM A		SESSION PLÉNIÈRE / PLENARY SESSION ROOM B LIMITLESS METROLOGY AT YOUR FINGERTIPS	WELCOME TABLE RONDE / ROUND TABLE ROOM B	Industrie 4.0 : des mesures offline aux mesures inline / Industry 4.0: Offline to Inline measurements ROOM B	S7 Digitalisation / Digitalisation ROOM B	EXHIBITORS' NIGHT PARTY
	S4 Électricité AC/DC / AC/DC Electricity ROOM C	S5 Débitmétrie / Flow ROOM C			S8 Mécanique dimensionnelle / Dimensional mechanics ROOM C		
	La métrologie dans la boucle de l'économie circulaire / Metrology in the loop of the circular economy ROOM B	S6 Chimie / Chemistry ROOM A			S9 Analyse de gaz / Gas analysis ROOM A		

JEUDI 9 / THURSDAY 9	WELCOME TABLE RONDE / ROUND TABLE Impact de la métrologie dans la transition digitale : défis et opportunités / The impact of metrology in the digital transformation: challenges and opportunities ROOM B		POSTERS • Biologie / Biology • Matériaux / Materials • Nanotechnologies / Nanotechnologies • Photonique / Photonics • Qualité & Accréditation / Quality & Accreditation • Thermométrie, Hygrométrie, Incertitudes / Thermometry, Hygrometry, Uncertainties ROOM B	WELCOME TABLE RONDE / ROUND TABLE ROOM B	S12 Certificats d'étalonnage numériques / Digital calibration certificates ROOM A	Nanométrie électrique / Session des stakeholder / Projet ELENA / Electrical Nanometrology Stakeholder session ELENA project ROOM A	SOLD OUT
	S10 Photonique / Photonics ROOM C	S13 Nanotechnologies / Nanotechnologies ROOM C			S14 Qualité, Accréditation / Quality, Accreditation ROOM B		
	S11 Incertitudes, analyse des données / Uncertainties, Data analysis ROOM A	TABLE RONDE / ROUND TABLE Que signifie être métrologue au 21 ^{ème} siècle ? / What does it mean to be a metrologist in the 21 st century? ROOM B					

VENDREDI 10 / FRIDAY 10	WELCOME S15 Biologie / Biology ROOM A		AWARDS CEREMONY
	S16 Thermométrie, Hygrométrie / Thermometry, Hygrometry ROOM B	TABLE RONDE / ROUND TABLE Défis métrologiques dans les mesures médicales : détection, diagnostics et digitalisation / Metrology challenges in medical measurements: detection, diagnosis and digitalisation ROOM B	
	S17 Matériaux / Materials ROOM C	S18 Technologies quantiques / Quantum technologies ROOM A	

21ST INTERNATIONAL METROLOGY CONGRESS
CIM2023
 07/10 MARCH • LYON - FRANCE



FULL PROGRAMME

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Maguelonne CHAMBON

Congress chairwoman

The world is moving rapidly, and so are the technologies:

- in the digital transformation of our society and the industry, with more and more systems and tools including for instance artificial intelligence requiring data security;
- in our lives and health management, with the early detection and diagnosis of new diseases;
- in our environment with climate change and pollution management;
- or regarding future and innovative applications based on quantum technologies; the Nobel Prize in Physics 2022, Alain Aspect, has largely demonstrated this all these years.

The congress will be a true mirror of this evolution of science and technology, of the needs of industry and society, within the framework of the "Global Industrie" exhibition, with a sector dedicated to Measure Control Vision and Instrumentation and a Metrology Village showing that metrology is an integral part of industrial measurement processes and indispensable to the competitiveness of companies.

Come and discover these developments through round tables and meetings with industrialists and scientists.

Welcome to CIM2023!



Cosimi CORLETO

CFM president

The upcoming International Congress of Metrology (CIM2023) is taking place for the second time at Global Industrie. The CIM2023 is riding the wave of digitalization with three oral sessions and a panel discussion dedicated to this key Industry 4.0 topic. Work on how metrology can be used for measurement system validation, including AI, will be presented, as well as a lot of work on digital calibration certificates that pave the way for fully digitized metrology.

Industry 4.0 will of course be the main application of this CIM2023, with smart sensors used in many different measurement applications. A panel discussion with industry leaders will draw parallels between the manufacturing industry and the process industry, where sensors are increasingly moving from offline to online.

But the CIM goes beyond that and has a lot to say about energy (hydrogen) and the environment (gas analysis, chemistry session, circular economy), as well as metrology for health.

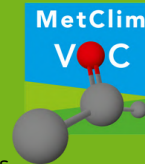
For sound decisions, you need reliable data, you need metrology!

Join us at CIM2023!

MARDI 7 MARS | TUESDAY MARCH 7

SOLD OUT

MetClimVOC



Workshop – Metrology for atmospheric monitoring

This workshop will deal with the monitoring of volatile organic compounds for climate measurements.

Limited seats. By attending this workshop, you will be able to access the restaurant on Tuesday.

ROOM C

Speakers:

Céline Pascale - METAS, Maitane Iturrate-Garcia, Tobias Bühlmann - METAS, Stefan Persijn - VSL, Tatiana Macé - LNE, Stefan Reimann - EMPA, Thérèse Salameh - IMT NORD EUROPE, Ralf Tillmann - FZ-Jülich, Rupert Holzinger - University of Utrecht, Anja Claude - Deutscher Wetterdienst (DWD), Maricarmen Lecuna - Politecnico di Torino, Gang Li - PTB and more...

[See details of the workshop by clicking here](#)

Session 1 9:00-10:30

Needs of atmospheric VOC monitoring - An introduction to MetClimVOC

Towards an unbroken SI-traceable calibration chain for VOCs at monitoring stations

- Preparation of reference gas mixtures (RGMs) of climate relevant VOCs
- Transferring SI-traceability to the field – assessment of new working standards
- New and classical techniques to measure formaldehyde – a laboratory intercomparison

Round-table: Can SI-traceability be achieved at atmospheric monitoring stations? Needs and challenges

10:30 ☕ 11:15

Session 2 11:15-12:45

Projects outcomes on VOC sampling and analysis Improvements on VOC sampling and analytical systems

- Sampling methods – effects of sorbent tubes, scrubbers and filters on VOC measurements
- New calibration protocols for Proton Transfer Reaction Mass Spectrometry (PTR-MS)
- A fit-for-purpose methanol analyser

Remote sensing input data – analysis and improvement strategies

Project outcomes and uptakes: uncertainty tools, open data and guidelines

Round-table: Metrology for atmospheric monitoring – uptake and further steps

12:45 ☕ 13:15

13:15

OPENING SESSION

Mr Thomas COURBE - DGE / France
 Mrs Maguelonne CHAMBON - LNE / France
 Mr Sébastien DENAËS - COLAS / France

METROLOGY
VILLAGE

S1 MECHANICS

Mr Fredrik ARRHEN - RISE / Sweden

ROOM A

KEYNOTE

13:45

Calibration of high accuracy accelerometers for ESA missions at INRIM
 Mrs ASTRUA - INRIM / Italy

14:00

True dynamic pressure calibration by means of a novel secondary pressure generator
 Mr SANDER - TESTO INDUSTRIAL SERVICES / Germany

14:15

Managing the dynamical uncertainty for pressure measurement in an industrial context
 Mrs RAMIANDRISOA - EDF R&D / France

14:30

Metrological characterisation of a commercially available gas pycnometer
 Mr BOINEAU - LNE / France

14:45

Development of a comprehensive software application for realization and dissemination of the mass scale
 Mr MALENGO - INRIM / Italy

15:00

Improved calibration and measurement capabilities - a basis of mechanical engineering
 Mr SCHAFFER - HOTTINGER BRUEL & KJAER / Germany

15:15 ☕ 16:00

S2 RADIOFREQUENCY & ELECTRICITY

Mr Pierre GOURNAY - BIPM / International

ROOM C

KEYNOTE

13:45

Metrology for standardization of emerging wireless technologies
 Mr ALLAL - LNE / France

14:00

Toward the design of a sensor for measuring average power in the Terahertz frequency band [110 - 170 GHz]
 Mrs BECHER - LNE / France

14:15

Developments of antenna calibration facility and RF field probe calibration system at SICT
 Mr KIM - SICT / South Korea

14:30

Traceable S-parameters measurements up to 90GHz in 1.35 mm (E-Band) coaxial
 Mr SKINNER - NPL / United Kingdom

14:45

Comparison of impedance measurement methods in LISN calibration between 9 kHz - 100 MHz
 Mrs KÖSE - VESTEL ELECTRONIC CORPORATION / Turkey

15:00

Uncertainty evaluation using Bayesian and Monte Carlo simulation methods at the automatic RF Power software measurement
 Mr DANACI - TUBITAK UME / Turkey

15:15 ☕ 16:00

CAN METROLOGY KEEP UP WITH THE HYDROGEN REVOLUTION?

Presenter: Mrs Annarita BALDAN - VSL / The Netherlands

ROOM B

13:45

With : Mr Michael DIDERICH - HYDROGEN EUROPE / Belgium
 Mrs Martine CARRE - AIR LIQUIDE / France
 Mr Etienne Smith - AP2E / France
 Mr Revata SENEVIRATNE - TUVSUD / United Kingdom
 Mr Tarek BOUDIBA - ENGIE / France

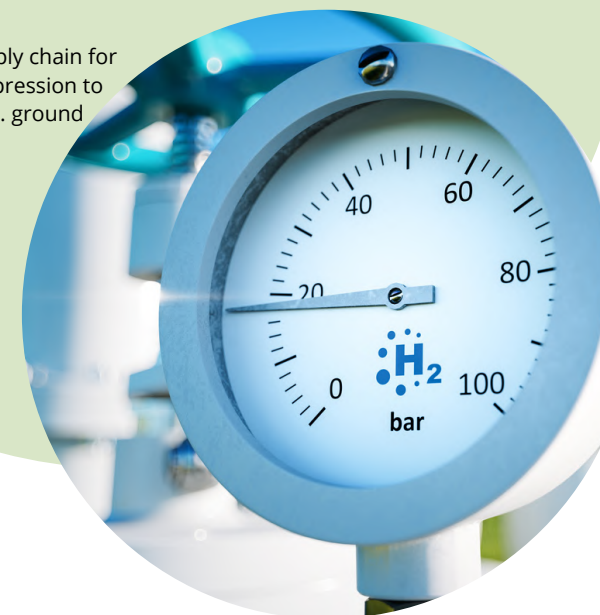
To pursue the goal of producing zero greenhouse emissions and to address the urgent need of finding alternative fuels to replace the conventional ones, large investments are being made to stimulate the scale-up of low carbon hydrogen production and use.

To enable this energy transition, a measurement infrastructure needs to be in place that accelerates research and innovation, in favour of the hydrogen industry, and that guarantees reliable and comparable measurement data for grid operators, regulatory bodies and users.

The metrological efforts needed to support the hydrogen supply chain for mobility applications, for example for ground transportation, are specifically challenging. Key needs to address cover the development of measurement and standards to analyse the quality of hydrogen for fuel cells vehicles and the provision of traceability for flow metering and the demonstration of compliance with legal metrology requirements for type approval of the Hydrogen Refuelling Stations.

Key points to be discussed:

- Define the use case: "hydrogen supply chain for mobility, from production and compression to transportation, storage and use (e.g. ground transportation)
- Identify the standing metrological challenges of the use case
- Prioritisation of these metrology challenges for the short and long term and needs for joint research and development



15:15 ☕ 16:00

POSTERS - 16:00 to 17:30

MECHANICS

- **Investigations on factors affecting force calibration**
Mr BIN AWN - SASO / Saudi Arabia
- **Metrology at the service of weighing**
Mr FOSSI - COFIP / France
- **Prototype of an innovative balance based on the diamagnetism of pyrolytic graphite - optical force balance based on the diamagnetism of pyrolytic graphite (60ng-1µg)**
Mr NOVIANT - LNE / France
- **First measurements with a milligram electrostatic force balance at LNE**
Mr THOMAS- LNE / France
- **Portable Linear Displacement Transducer Calibration as Solution for mechanical manufacturing**
Mr NEVES - IPQ / Portugal
- **Robotisation in pipette calibration**
Mr SHOVAL - QCC CALIBRATION TECHNOLOGIES / Israel
- **The state of the art of metrological control of cinemometers in Spain**
Mrs DEL CAMPO - CEM / Spain
- **Traceability for contact probe and stylus instrument measurements**
Mr YANDAYAN - TUBITAK UME / Turkey
- **Development of a primary standard of periodic pressure disturbances with interface liquid water -dry air**
Mr DIAZ TEY - UNIVERSIDAD DE COSTA RICA / Costa Rica



POSTERS - 16:00 to 17:30

DIGITALISATION

- **Engineering of calibration system for power supplies**
Mr LOGGIA - TRESICAL BENELUX / Belgium
- **A digital calibration certificate generator software application**
Mr BROWN - PTB / Germany
- **VIM* : Beneficial contribution of digitalization in a training sequence**
Mrs CHERIK - LNE / France

MACHINE LEARNING AI

- **Functional safety assessment of an AI sensor according to IEC 61508**
Mr TARRISSE - INERIS / France



ELECTROMAGNETISM

- **Traceability routes for magnetic measurements**
Mr COISSON - INRIM / Italy
- **Fabrication and characterization of a guarded-type low frequency current comparator for resistance ratio measurements**
Mr ROLLAND - BIPM / France

POSTERS - 16:00 to 17:30



CHEMISTRY

- **ACTRIS - CiGas side-by-side interlaboratory comparison of new and classical techniques for formaldehyde measurement**
Mrs SALAMEH - IMT NORD EUROPE / France
- **Toward a better monitoring of ammonia and greenhouse gases emissions from livestock production : the quantiAGREMI project**
Mr FOUQUEAU - LNE / France
- **Substitution weighing in analytical nuclear chemistry**
Mr JACOBSSON - EUROPEAN COMMISSION, JOINT RESEARCH CENTRE (JRC) / Belgium
- **Accurate quantification of the bioaccumulation of titanium dioxide particles**
Mrs NOIREAUX - LNE / France
- **Uncertainty of an empirical equation for primary pHT values of artificial seawater**
Mrs SCHÄFER - PTB / Germany
- **TOXinTRANSPORT : project about toxicological, chemical and physical characterizations of particles in the cabin air of TRANSPORT in movement**
Mrs QUERON - INERIS / France
- **The preparation of certified reference materials of aqueous sucrose solutions for regulatory purposes and industrial control of sugar content in foods**
Mrs SAEZ-SERRANO - CEM / Spain
- **Sensitive real-time detection of metal concentrations in aqueous solution using micro-plasma emission spectroscopy**
Mrs DAS - METROLOGY RESEARCH INSTITUTE, AALTO UNIVERSITY / Finland
- **Trace Water Vapor Analysis with FT-IR Spectrometer**
Mr AHMEDOV - TUBITAKE UME / Turkey
- **Olfactometry (Environmental Odour Pollution). Calibration of Olfactometers for detection according to EN 13725**
Mr SIMOES - TRESICAL / Spain
- **Regulatory framework to water meters for uses other than clean water in Spain**
Mrs CALZADO - CEM / Spain

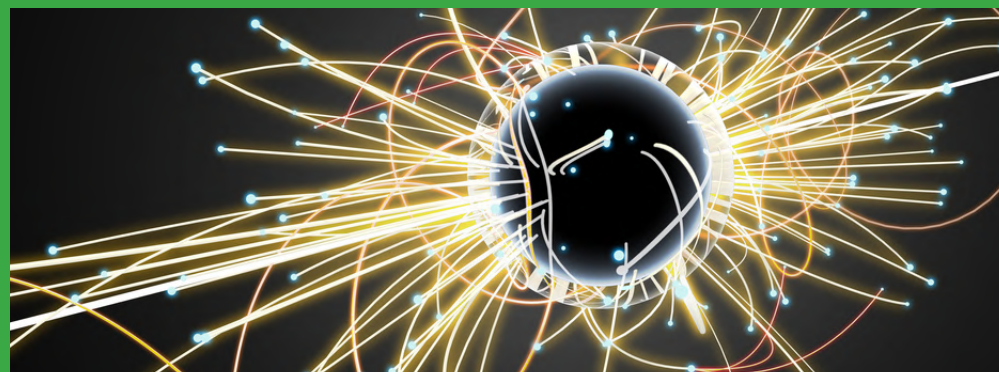
POSTERS - 16:00 to 17:30

FLOW

- **Towards dynamic calibrations in flow metrology**
Mr WARNECKE - PTB / Germany
- **Free sheet measurements in open channels in the region of Madrid**
Mr MARTIN-LOPEZ - CANAL DE ISABEL II / Spain

IONIZING RADIATION

- **High energy photon reference radiation beam for radiation protection based on medical LINAC facility**
Mr BORDY - CEA LIST LNE LNHB / France
- **Development of a primary reference standard for neutron metrology between a few keV and a several MeV neutron energy**
Mr PETIT - IRSN / France
- **The Politecnico di Milano at the service of radiation protection: calibrations and proficiency testing**
Mr GARLATI - POLITECNICO DI MILANO / Italy



WELCOME APERITIVE

17:30



To close this first day, all the CIM participants will meet at the Metrology Village, on the exhibition. A relaxing moment to share a drink all together and dedicated to the good mood!

S3 MACHINE LEARNING

 Mr Nicolas FISCHER - LNE / France

 ROOM A

KEYNOTE

- 09:00** **Input uncertainty propagation in Neural Networks: Application to metrological use cases**
Mr COQUELIN - LNE / France
- 09:15** **Reliable Air Quality Monitoring with Low-Cost Gas Sensor Systems in Smart Cities**
Mr TANDEV - METAS / Switzerland
- 09:30** **Visual inspection on CMM - OPTIV multisensor CMM beyond metrology**
Mr HERMENIER - HEXAGON / France
- 09:45** **The "Metrology for Artificial Metrology in Medicine (M4AIM)" programme of PTB**
Mr RABUS - PTB / Germany
- 10:00** **Epistemic and aleatoric uncertainty in soft metrology systems**
Mrs VALLEJO - INSTITUTO TECNOLOGICO METROPOLITANO / Colombia
- 10:15** **Towards GUM-compliant neural network robustness verification**
Mr LUDWIG - PTB / Germany

10:30  11:15

S4 AC/DC ELECTRICITY

 Mr Oriano BOTTAUSCIO - INRIM / Italy

 ROOM C

KEYNOTE

- 09:00** **The European Metrology Network on Smart Electricity Grids: key metrology support to implementing the EU Green Deal strategy**
Mrs CROTTI - INRIM / Italy
- 09:15** **Dynamic characterization of current transducers with more than 100 A at audio frequencies**
MR OHLROGGE - TESTO INDUSTRIAL SERVICES GMBH/ GERMANY
- 09:30** **Characterization and applications of LNE's new Thompson-Lampard calculable capacitor**
Mr THEVENOT - LNE / France
- 09:45** **Progress in the alignment of the main electrode bars of the BIPM calculable cross-capacitor**
Mr MORENO - BIPM / France
- 10:00** **New calibration system for electric charge meters at CEM**
Mr RASO ALONSO - CEM / Spain
- 10:15** **On alternative DAC linearity testing traceable to length unit**
Mr IMANALIEV - LNE / France

10:30  11:15

METROLOGY IN THE LOOP OF CIRCULAR ECONOMY

 ROOM B

09:00 **Presenter: Mr Jean-Rémy FILTZ - LNE / France**

With: Mrs Paola FISICARO - LNE / France
Mrs Laurence AMALRIC - BRGM / France
Mr Teemu NAYKKI - FINISH ENVIRONMENT INSTITUTE / Finland
Mr Victor MARTIN LOPEZ - CANAL DE ISABEL II / Spain
Mrs Nathalie GUIGUES - AQUAREF / France

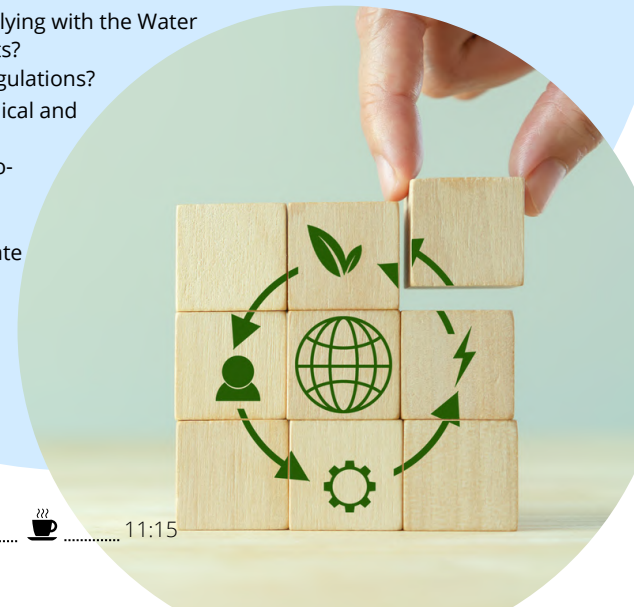
The circular economy is a key concept for the life cycle management of resources. The main objective is to significantly reducing the negative impacts of resources extraction and (re)use on the environment and the human health.

As an example "Water" resource, is a vital element of our life. The management of the life cycle of waters (surface waters, drinking water, and ocean) must now respect the European requirements on water.

As a result, standardized methodologies are applied and are continuously developed. Metrology, research and standards allows contributing to a better monitoring and use of the water.

Key points to be discussed:

- Which are the impacts on the agro-food chain, on the ecosystems and on our healthcare?
- How Metrology can help for complying with the Water Framework Directive requirements?
- What are the related European regulations?
- How metrology is a relevant technical and scientific discipline for monitoring endocrine disruptors, drugs, micro-plastics in water?
- How Metrology can support the development of even more accurate methodologies?



10:30  11:15

11:15

PLENARY SESSION LIMITLESS METROLOGY AT YOUR FINGERTIPS

 ROOM B

Introduction **Mr Thomas GRENON - LNE / France**

CHAIRMAN **Mr Martin MILTON - BIPM / International**



Fueling Industry 4.0 through quantum sensors and standards

Mrs Barbara GOLDSTEIN - NIST / USA



Metrology needs for climate and ocean community

Mr Christoph WALDMANN - MARUM / Germany



Life at cellular scale: observe, detect or measure?

Mr François LACOMBE - MAUNA KEA TECHNOLOGIES / France

INDUSTRY 4.0 "OFFLINE TO INLINE MEASUREMENTS"

ROOM B

13:45 Presenter: Mr Wolfgang LUBCKE - EX-ENDRESS+HAUSER / Switzerland

With: Mr Michael MAIWALD - BAM / Germany
 Mr François HENNEBELLE - UNIVERSITÉ DE BOURGOGNE/ France
 Mr Pete LOFTUS - EVALU8ION / United Kingdom
 Mr Mohamed EL MANSORI - ENSAM / France
 Mr Gilbert Alexander ERDLER - SIEMENS / Germany

Quality-relevant measurements are getting closer to the point of "Process or manufacturing"

Technology advancements, continuous cost pressure combined with challenges for qualified personnel the manufacturing industry measurements already found ways directly to measurements in the shop floor.

To further enlarge this approach the round table takes a closer look at what is called "Lab to field" in the process industry with a long history since over 100 years.

Key points to be discussed:

- Analogies and differences in "Manufacturing and Process industry"
- Best practises in manufacturing "measurement to shopfloor"
- "Lab to process" lessons learned and technology outlook
- Off-line to inline and impact on comparability and traceability
- Outlook on what the manufacturing industry could learn from the process



15:15 ☕ 16:00

S5 FLOW

Mrs Isabelle CARE - CETIAT / France

ROOM C

KEYNOTE

- 13:45** Measurement infrastructure for hydrogen supply chains
Mr VAN DER VEEN - VSL / The Netherlands
- 14:00** Validation of a Primary System for the Measurement of Nano-flow Rates of Liquids
Mr OGHEARD - CETIAT / France
- 14:15** On-site calibration and verification of a mass flowmeter of aerosol samplers
Mrs HEGRON - CT2M / France
- 14:30** Down scale calibration method for small critical flow venturi nozzles
Mr LORENZ - PTB / Germany
- 14:45** Establishing metrology standards in microfluidic devices
Mr OGHEARD - CETIAT / France

15:00 ☕ 16:00

S6 CHEMISTRY

Mrs Michela SEGA - INRIM / Italy

ROOM A

KEYNOTE

- 13:45** Metrology support for carbon capture utilisation and storage
Mrs DE KROM - VSL / The Netherlands
- 14:00** Discovering of molecular markers of particulate matter (PM) sources: Benefits of non-target screening strategy based on HRMS combined with multivariate statistical analyses
Mr ALBINET - INERIS / France
- 14:15** Impact of different particle sources on the measurement of PM by low-cost sensors
Mr SPINELLE - INERIS / France
- 14:30** Autonomous aerial swarm robotics for the management of the environmental and health impact in a post-accident situation
Mr BERTHELOT - INERIS / France
- 14:45** EDC-WFD: a project that successfully improve the reliability of estrogens' measurements in aquatic as required for regulatory monitoring
Mrs LALERE - LNE / France
- 15:00** Uncertainties of spectrophotometric pH from fresh to sea water
Mr PELLEGRINO - IPQ / Portugal

15:15 ☕ 16:00

S7 DIGITALISATION

 Mr Sascha EICHSTAEDT - PTB / Germany

 ROOM B

KEYNOTE

16:00 Metrology for sustainable smart cities
Mrs JUNG - PTB / Germany

16:15 How to federate metrology 4.0 in industries ?
Mrs COURTOIS - DELTAMU / France

16:30 Redesign of metrological services : towards the extension of traceability chain for industrial innovations and applications
Mr GRASSO TORO - METAS / Switzerland

16:45 Digital TILSAM systems – providing FAIR data and SI traceability to smart sensor networks for air quality monitoring
Mr GRASSO TORO - METAS / Switzerland

17:00 Machine-readable data and metadata of international key comparisons in radionuclide metrology
Mr COULON - BIPM / France

17:15 The Units of Measurement Interoperability Service (UMIS) and FAIR Digital Units of measurement
Mr CHALK - UNIVERSITY OF NORTH FLORIDA / USA

S8 DIMENSIONAL MECHANICS

 Mr François HENNEBELLE - UNIVERSITE DE BOURGOGNE / France

 ROOM C

KEYNOTE

16:00 Extending the measurement capabilities of 3D X-ray microscopy to dimensional metrology
Mr VILLARRAGA-GOMEZ - ZEISS / USA

16:15 On the path to autonomous manufacturing
Mr SCHMID - HEXAGON / France

16:30 Investigation of the dimensional performances of industrial XCT
Mrs OBATON - LNE / France

16:45 Modeling of a measuring chain including a CT system to estimate the dimensional uncertainties of additive manufacturing parts
Mr ENNIAFA - CETIM / France

17:00 Cofrac accreditation of an innovative method for checking measuring arms in the shopfloor and assessments of associated uncertainties
Mr HENNEBELLE - UNIVERSITE DE BOURGOGNE / France

17:15 Investigations of precise displacement actuators to provide traceability for contact probe and stylus instruments
Mr YANDAYAN - TUBITAK UME / Turkey

EXHIBITOR NIGHT PARTY - HALL 7 / 6.30 pm

S9 GAS ANALYSIS

 Mrs Martine CARRE - AIR LIQUIDE / France

 ROOM A

KEYNOTE

16:00 Novel SI traceable gaseous reference materials for calibrating chemical ionisation mass spectrometers
Mrs HRISTOVA - NPL / United Kingdom

16:15 Hydrogen Purity Control for Fuel Cells ISO-14687
Mr NATON - AP2E / France

16:30 Purity analysis for the production of primary gas mixtures
Mrs ROLLE - INRIM / Italy

16:45 Production of gaseous reference materials: a technical challenge
Mr LACHAUD - AIR LIQUIDE FRANCE / France

17:00 A new look at the adsorption and desorption dynamics in cylinders
Mr PERSIJN - VSL - The Netherlands

17:15 Sampling and characterisation of some polycyclic aromatic hydrocarbon (PAHs) in natural gas samples by TD-GC-MS
Mr VORIN - GRTGAZ RICE - France



EXHIBITOR NIGHT PARTY

Reserved for the exhibitors only, organised by
Global Industrie. Starts at 6.30 pm in Hall 7.

THE IMPACT OF METROLOGY IN THE DIGITAL TRANSFORMATION: CHALLENGES AND OPPORTUNITIES

ROOM B

09:00

Presenter: Mr Sascha EICHSTAEDT - PTB / Germany

With: Mr Romain COULON - BIPM / France
 Mr Ulrich KAISER - ENDRESS+HAUSER / Germany
 Mrs Dorothea KNOPF - PTB / Germany
 Mr Robert HANISH - NIST / USA
 Mr Sami KOSKINEN - BEAMEX / Finland
 Mr Franck TARENA - TRESICAL / France

Digital technologies have become an essential part of our day-to-day tool set. These digital tools have changed the way we work, communicate and perform businesses rapidly and fundamentally.

This digital transformation has led to novel approaches such as remote access and control, cloud infrastructures and artificial intelligence in all areas. Hence, the digital transformation affects and influences the metrology landscape.

At the same time, metrology can itself impact and benefit the digital transformation in economy and society: machine-readable certificates, digital traceability, data quality, remote calibration, and digital reference standards are just some examples.

Key points to be discussed:

- How will metrological traceability change with digital transformation? What role will it play in digitised industries?
- What are challenges faced by the panelist's organizations in moving forward with digitalisation?
- Reliable and high-quality data is the basis for trust and confidence in AI. What are opportunities for metrology?



10:30 ☕ 11:15

S10 PHOTONICS

Mrs Kate CHERNYSHEVA - VSL / The Netherlands

ROOM C

KEYNOTE

09:00 Development and validation of a real-time gas quantification algorithm for airborne hyperspectral data
 Mr GUYOT - TELOPS / Canada

09:15 RevStdLED: Revision and extension of standards for test methods for LED lamps, luminaires and modules
 Mr ELOI - LNE / France

09:30 Metro-PV: metrology for enhanced performance photovoltaic technologies and application (IoT)
 Mr DUBARD - LNE / France

09:45 BRDF measurements on commercial spectrophotometer
 Mr VAN NIJNATTEN - OMT SOLUTIONS / The Netherlands

10:00 Characterization of pillar hall test chip structures using reflectometry technique
 Mr DANILENKO - AALTO UNIVERSITY, METROLOGY RESEARCH INSTITUTE / Finland

10:15 A multi-wavelength laser calorimeter for optical thin film characterization
 Mr OĞUZ AYTEKIN - TÜBİTAK UME / Turkey

10:30 ☕ 11:15

S11 UNCERTAINTY, DATA ANALYSIS

Mr Alexandre ALLARD - IFREMER / France

ROOM A

KEYNOTES

09:00 MATHMET, the Datascience network for metrology
 Mr FISCHER - LNE / France

09:15 Mathmet measurement uncertainty training activity: lessons learned from a European community workshop
 Mr CAEBERGS - SPF ECONOMY / Belgium

09:30 How virtual experiments can aid a targeted decision about exclusion criteria for patients carrying implants during hyperthermia treatments
 Mr BOTTAUSCIO - INRIM / Italy

09:45 Metrological and statistical logistic regressions in conformity assessment
 Mrs MELIN - RISE / Sweden

10:00 Dynamic metrology in practice: from concepts to calibration services
 Mr ROMIEU - CETIAT / France

10:15 Spatio-temporal uncertainty propagation for interpolated temperatures in measurement rooms
 Mr VEDURMUDI - PTB / Germany

10:30 ☕ 11:15

POSTERS - 11:15 to 12:45

THERMOMETRY, HYGROMETRY

- **Determining water-vapour enhancement factors in ultra high pure process gases at VSL**
Mr PANMAN - VSL / The Netherlands
- **Evaluation of thermal radiation on temperature measurements in climatic chamber**
Mr FAVREAU - CETIAT / France
- **Commissioning of gas-controlled heat pipe (GCHP) temperature generators for thermometers calibration**
Mr FAVREAU - CETIAT / France
- **Investigation of the Self-Heating effect of Pt100 Thermometers for Measurements in Liquid Bath and in Climatic chamber**
Mrs FORSON - GHANA STANDARDS AUTHORITY / Germany
- **Realization of new fixed point cells at the LNE-Cnam**
Mr PAVLASEK - SMU / Slovak Republic
- **Realization of Fe-C Eutectic Point at UME**
Mr OĞUZ AYTEKIN - TÜBİTAK UME / Turkey
- **New high-temperature references for industrial applications**
Mr BOURSON - LNE / France



POSTERS - 11:15 to 12:45

BIOLOGY

- **The discrimination threshold: a new criterion based on measurement uncertainty to define the conditions of use of analytical methods in research**
Mr ANDANSON - INRAE / France
- **New Sterilization Requirements: new Annex 1 EU GMP (steam requirements)**
Mr ESPAGNOL - QTI TRESICAL / Spain
- **Metrology in Health - Electromedecine**
Mr SIMOES - TRESICAL / Spain



MATERIALS

- **Theoretical and numerical studies of the Brillouin function and its inverse**
Mr RICKABY - TRESICAL / United Kingdom
- **An Update on the European Metrology Network (EMN) for Advanced Manufacturing**
Mr FAVRE - LNE / France
- **Sensor for real-time measurement of hydrogen concentration in gas networks**
Mr MOYNET - CMR GROUP / France
- **Influence of the thermal gradients on residual stress and distortions for metallic parts made by additive manufacturing**
Mr FOURNET-FAYARD - LNE / France
- **Eddy-Current directional probe for in-line monitoring of automated carbon fiber reinforced polymers production**
Mr MUSSATAYEV - UNIVERSITY OF BRISTOL / United Kingdom
- **An ellipsometer in reflection to characterize of transparent thin films homogeneity**
Mrs GUILLOT - CEA / France

POSTERS - 11:15 to 12:45



NANOTECHNOLOGIES

- **Area-selective growth of Zinc Oxide nanowire arrays for improved piezoelectric output**
Mrs FORSON - TU BRAUNSCHWEIG / Germany
- **Hybrid metrology for nanometric energy harvesting devices**
Mrs SIAUDINYTE - VSL / The Netherlands

QUALITY, ACCREDITATION

- **ISO 10012: assess staff competence and the impact of a training programme**
Mr BOZONNET - INDEPENDANT / France
- **Accreditation of testing (qualification) in clean rooms**
Mr CAMARGO - TRESICAL BRAZIL / Brazil
- **Performance qualification of a Novel transportable dew point calibrator**
Mr FARLEY - QROMETRIC / United Kingdom
- **Metrology and the Green Deal**
Mrs BLANC - DELTAMU / France
- **State of the art on-site characterization of climatic chambers for industry 4.0**
Mr HAWES / QROMECTIC / United Kingdom
- **Calibration capability of acoustic laboratory at NMCC**
Mr ALADHYANI - NMCC / Saudi Arabia
- **S8000 -100 : First chilled mirror on the market to reach -100°Cdp**
Mr MEILLER - PST / France
- **Market Surveillance Activities of Inmetro and the Case of Electrical Cables-Wires and Jewelry**
Mr SMARCARO DA CUNHA - INMETRO / Brazil

POSTERS - 11:15 to 12:45

UNCERTAINTIES

- **Development of a methodology and software for characterizing nuclear material by weighing**
Mrs HEGRON - CT2M / France
- **Deconvolution-based methods to extract uncertainty components**
Mr JETTI - POLITECNICO DI MILANO / Italy
- **Uncertainty in U-tube Coriolis mass flow meters for liquid hydrogen measurements**
Mrs GUGOLE - VSL / The Netherlands
- **Urine cytology - External quality assessment as a tool to compare laboratory measurement uncertainties**
Mr MOLINIER - AGLAE / France
- **Experience from International Laboratory Comparisons/ILC performed in different fields**
Mr KALLGREN - SWEDISH METROLOGY AND QUALITY AB (SMQ) / Sweden
- **Validation of the choice of methods for evaluation of the uncertainties of micropipette calibration using the Monte-Carlo simulation method.**
Mrs MAKHLOUF / NAFATI - AEQUO LTD / France
- **Interlaboratory comparison for climate chamber characterization**
Mrs PIETTE- FPS ECONOMY / Belgium
- **Towards measuring instruments designed for calibration**
Mrs DOBRE - FPS ECONOMY / Belgium

PHOTONICS

- **Compact type of Illuminometer Calibration System using integrating sphere**
Mr BAE - SICT IN TRESICAL GROUP / South Korea
- **Measuring spectral transmittance of light diffusing samples**
Mr VAN NIJNATTEN - OMT SOLUTIONS BV / The Netherlands
- **Online detection of reactive gases in clean room manufacturing environment**
Mr RAJAMAKI - VTT MIKES / Finland



S12 DIGITAL CALIBRATION CERTIFICATES

 Mrs Miruna DOBRE - SPF ECONOMIE / Belgium

KEYNOTE

 ROOM A

13:45 GEMIMEG-II - How Metrology can go digital...
Mr ENGEL - SIEMENS / Germany

14:00 Digital calibration certificate as part of calibration ecosystem
Mr KOSKINEN - BEAMEX / Finland

14:15 (Smart) Digital Calibration Certificates – An Holistic Data Transaction Implementation
Mr EDELMAIER - BEV / Austria

14:30 Method for verifying measurement uncertainties in a digital calibration certificate by using scope of accreditation
Mr DANACI - TUBITAK UME / Turkey

14:45 Digital calibration workflows – challenges for calibration systems and calibration laboratories
Mr MENDE - SPEKTRA / Germany

15:00  16:00

S13 NANOTECHNOLOGIES

 Mrs Jasmine PETRY - NESTLE / Switzerland

 ROOM C

KEYNOTE

13:45 Traceable refractive index, size, and concentration determination of nanoparticles in liquid by metrological flow cytometry
Mrs KUIPER - VSL / The Netherlands

14:00 ELENA: a European project for electrical nanoscale metrology in industry
Mr PIQUEMAL - LNE / France

14:15 Assessment of the measurement uncertainty related to nanoparticles characterisation by "SINGLE-PARTICLE"-ICP-MS using an in-house data treatment software
Mrs BASTARDO FERNANDEZ - LNE / France

14:30 Thermal nanoimprint lithography fabrication and metrological characterization of step grating structures on polymethyl methacrylate
Mr PAREDES - TEKNIKER / Spain

14:45 Towards calibrated measurements of dopant concentrations on vertical nanowires by scanning microwave microscopy
Mr KAJA - LNE France

15:00 Nanoelectrical characterisation of vertical nanowires used for energy harvesting
Mr ZHI - PTB / Germany

15:15  16:00

WHAT DOES IT MEAN TO BE A METROLOGIST IN THE 21st CENTURY?

 ROOM B

13:45 Presenter: Mr Hugo LEHMANN - METAS / Switzerland

With: Mr Jean-Claire BALLOT - IUT / France
Mrs Michèle DESENFANT - LNE / France
Mr François DAUBENFELD - EX-STELLANTIS / France
Mrs Peggy COURTOIS - DELTAMU / France
Mr Timothy OSBORNE - AWPT / USA
Mr Daniele MARI - EPFL / Switzerland

Technological progress without the pertinent measurement capabilities is simply not possible. Thus, metrology as a basic infrastructure of our modern world contributes to the development of technology.

On the other hand, new technologies and new trends also affect metrology. Artificial intelligence, machine learning, advanced manufacturing, IoT, the second quantum revolution have a huge potential and are or will be broadly used in technology and adopted by society.


It is therefore key to adapt to them whatever your area of expertise. This holds especially for metrology, which is present in most industrial and lab processes.

Key points to be discussed:

- What does it mean to be a metrologist in the 21st century?
- What are the future needs of metrologists?
- Which skills are relevant?



This round table will tackle these questions, share some insights and try to give clues how to adapt to these new trends.

15:15  16:00

Electrical Nanometrology Stakeholder session "ELENA project" 📍 ROOM A

The measurement of electrical properties at the nanoscale allows evaluating the performances of nanomaterials developed for consumer electronics, innovative quantum technologies, and IoT applications. Local DC resistance and high-frequency (HF) impedance are among the most prominent properties to measure for nowadays advanced devices.

Currently, Conductive Atomic Force Microscopy and Scanning Microwave Microscopy are the two main techniques used for the characterisation of these properties. Although powerful, they suffer from major drawbacks: their cost, complicated implementation, and lack of traceability. Measurements are thus unreliable.

The project ELENA aims at pioneering the traceability of such measurements, with stated uncertainties. It also aims at increasing the affordability of these methods by developing and testing cost effective instrumentation and reference standards spanning the range from DC to GHz.

Robust calibration methods and good practice guides using simplified uncertainty budgets will underpin this effort.

WELCOME

16:00 Overview EMPIR project "20IND12 Elena"
Mr PIQUEMAL - LNE / France

16:10 WP 1: Instrumentation for electrical nano-metrology in the frequency range DC to GHz
Mr HOFFMANN - METAS / Switzerland

16:30 WP 2: Calibration methods for two electrical Scanning Probe Microscope (eSPM) techniques: C AFM and SMM
Mr KAJA - LNE / France

16:50 WP 3: 3D multi-physics modelling, based on analytical or numerical approaches
Mr GAUTIER - CNRS / France

17:10 WP4: Simplified uncertainty budgets for industrial use
Mr HERTWIG - BAM / Germany

17:30 DISCUSSION

S14 QUALITY, ACCREDITATION

📍 Mr Sébastien LABORDE - COFRAC / France

📍 ROOM B

16:00 Management of laboratory competence: what is at stake?
Mr PIERSON - LABOPERF / France

16:20 Application of optimisation methods of measuring equipment calibration and verification frequencies at Safran Group
Mr BURY - SAFRAN GROUP / France

16:40 ISO conformity decision risk applications for asset managers
Mr OSBORNE - A2LA WORKPLACE TRAINING / USA

17:00 Uncertainty in measurement for quality control in food industry
Mrs PETRY - NESTLE / Switzerland



SOLD OUT

GALA DINNER

19:30

Take a break from everyday life and climb aboard the restaurant boat Bateaux Lyonnais.

Indulge in a gourmet meal and explore Lyon's majestic landscapes by night, while listening to commentary. There's no doubt: those lucky few who attend this evening dinner will share in a genuine signature moment.

Places are limited.

S15 BIOLOGY

 Mrs Sophie VASLIN - LNE / France

 ROOM A

KEYNOTE

- 09:00** Measurement challenges of quantifying milk protein allergens in foods
Mr BUNK - NIST / USA
- 09:15** Development of a methodology to study the induced effects of particles from the railway environment on lung cells
Mrs DELATER - INERIS / France
- 09:30** Developing SI-traceable reference materials to address challenges in intracellular delivery
Mrs BRIONES - NPL / United Kingdom
- 09:45** New method based on minimum deviation for automated traceable absolute refractive index measurements
Mrs KUIPER - VSL / The Netherlands
- 10:00** Uncovering the importance of nucleic acid extraction for quantification - two bacterial case studies
Mrs BOGOZALEC KOSIR - NATIONAL INSTITUTE OF BIOLOGY / Slovenia

10:15  11:15

S16 THERMOMETRY, HYGROMETRY

 Mrs Dolores DEL CAMPO - CEM / Spain

 ROOM B

KEYNOTE

- 09:00** Techniques for measuring the temperature of cold seas and sea ices
Mr LE MENN - SHOM / France
- 09:15** SI-traceable inline measurements of water content in biomass at CHP plants
Mr KJELDSEN - DTI / Denmark
- 09:30** An industrial approach towards traceable moisture measurements in microwave domain
Mrs TALLAWI - CETIAT / France
- 09:45** Trace water measurement at LNE-CETIAT
Mr GEORGIN - LNE/CETIAT / France
- 10:00** A new measurement infrastructure for trace water in ultra-pure process gases
Mr FERNICOLA - INRIM / Italy
- 10:15** Assigning thermodynamic temperatures to a set high-temperature fixed points in the range 1400 K to 3000 K
Mr SADLI - LNE / France

10:30  11:15

S17 MATERIALS

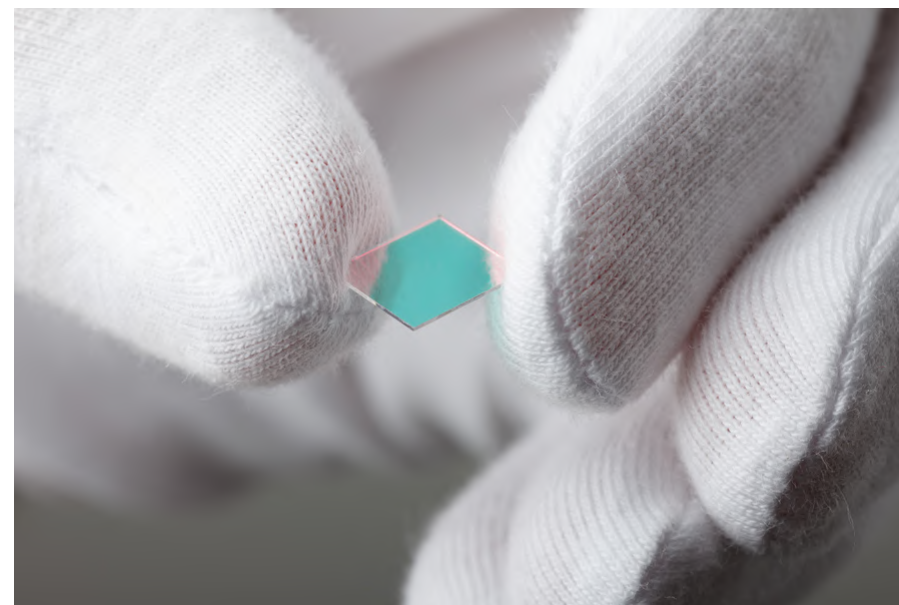
 Mr Jean-Rémy FILTZ - LNE / France

 ROOM C

KEYNOTE

- 09:00** Development and testing of a graphene-based thermal strap for space applications
Mr HOGSTROM - VTT / Finland
- 09:15** Scanning thermal microscopy modeling by 3D FEM in vacuum and in air conditions
Mrs DOURI - LNE / France
- 09:30** Assessment of uncertainty associated with very high temperature thermal diffusivity measurements
Mr HAY - LNE / France
- 09:45** Metrological sound reference products for quality assurance and quality control measures in material emissions testing
Mr RICHTER - BAM / Germany
- 10:00** Metrological traceability of measurement data from nano to small-microplastics for a greener environment and food safety
Mrs PORTESI - INRIM / ITALY
- 10:15** Nondestructive measurement of damage or ageing mechanism at atomic level - New opportunities using non-radioactive positron generators.
Mr REY - POSITHOT / France

10:30  11:15



METROLOGY CHALLENGES IN MEDICAL MEASUREMENTS: DETECTION, DIAGNOSIS AND DIGITALISATION

ROOM B

11:15

Presenter: Mrs Jennifer CLARKE - NPL / United Kingdom

With: Mr Richard LUXTON - INSTITUTE OF BIOSENSING TECHNOLOGY / United Kingdom
 Mr Alex DEXTER - NPL / United Kingdom
 Mr Stéphane GUEU - ESSILOR / France
 Mr Jan WOLBER - GE HEALTHCARE / United Kingdom
 Mr Lionel DREUX - GMED / France

The COVID-19 pandemic has shown that the world needs to be better prepared to respond to global health emergencies.

Access to world class care for as many patients as possible relies on faster and more accurate diagnosis. In addition, there is movement away from clinical settings for treatment, and a trend towards access to home-based healthcare. Supporting earlier diagnostics through improved digital infrastructures will provide more effective disease management to increase confidence and reproducibility in diagnosis and treatment.

Measurement infrastructure is needed to accelerate innovation and technological advances that enable to diagnosis, monitoring, treating, curing and prevention of a wide range of diseases and reduce health inequalities. Metrology supports the translation of technologies from the research environment into novel medical devices.

This round table will see several actors from the medical and healthcare industry sharing their views on the role of metrology in medical measurements and the different roles of industry, metrology, regulators and academia.

Key points to be discussed:

- How do we coordinate to promote the benefits of metrology within medical measurements?
- What challenges will the sector face in future?
- Where should metrologists be focusing their effort?



S18 QUANTUM TECHNOLOGIES

Mr Ivo DEGIOVANNI - INRIM / Italy

ROOM A

KEYNOTE

11:15

The importance of standards in the emerging quantum economy
 Mr PRIOR - NPL / France

11:30

Programmable quantum current generator : new developments
 Mrs DJORDJEVIC - LNE / France

11:45

Quantum information theory and noise characterization in quantum measurements
 Mr AHMEDOV - TUBITAK UME / Turkey

12:00

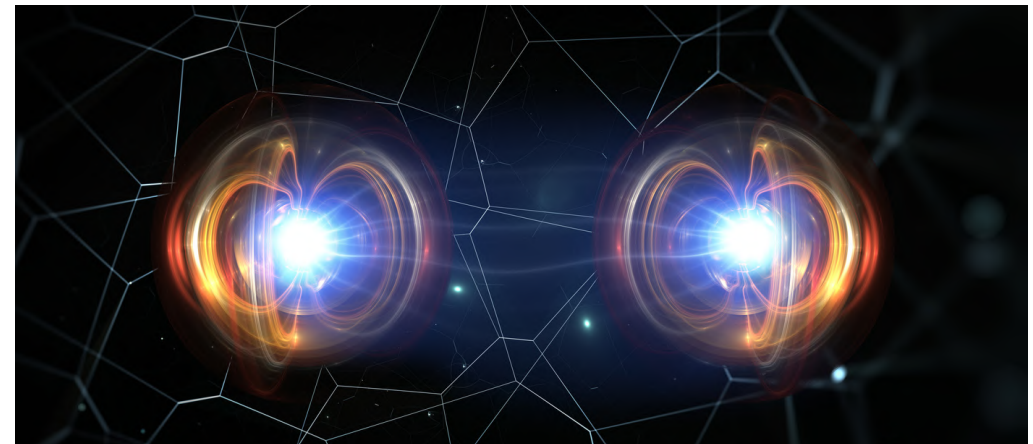
European effort to develop metrology for the implementation security of quantum communication (an EMN-Q Project)
 Mrs MEDA - INRIM / Italy

12:15

Quantum kelvin : towards an optomechanical measurement of temperature using quantum correlations
 Mr FERREUX - LNE / France

12:30

Metrology for quantum computers
 Mr AGARWAL - NPL / United Kingdom



CLOSING SESSION

ROOM B

12:45

Announce of the best lecture and the best poster presentation.
 Prize-giving ceremony.