

# Development of National Metrology System and the Ways for International Cooperation

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Center for Physical Sciences and Technology (FTMC) Metrology Department (MD) was authorized to perform and implement functions of the National Metrology Institute (NMI) since 1 July 2014. The CIPM MRA agreement on behalf of FTMC was resigned on 17 November 2014 by Director Dr. Gintaras Valušis. Year 2018 was historical for metrologists all over the world. BIPM's Member States voted on 16 November 2018 to revise the International System of Units (SI), changing the world's definition of the kilogram, the ampere, the kelvin and the mole. The decision, made at the 26<sup>th</sup> General Conference on Weights and Measures (CGPM), means that all SI units will now be defined in terms of constants that describe the natural world. This will assure the future stability of the SI and open the opportunity for the use of new technologies, including quantum technologies, to implement the definitions. Two researchers dr. Rimantas Vaitkus and dr. Evaldas Naujalis from FTMC MD were authorized by the Decree of Prime Minister of Lithuania to represent Republic of Lithuania in the 26<sup>th</sup> CGPM in Versailles, France [1]. The new definitions came into force on 20 May 2019.



Fig. 1. New logo of SI

FTMC Metrology Department maintains national standards in seven different measurement fields: time and frequency, temperature, electrical standards, mass, length, ionizing radiation and chemical measurements. Time and Frequency Standard Laboratory (TFSL) is reproducing values of the unit of time, the second (s) and the unit of frequency- hertz (Hz). Its mission is representation of Lithuanian Coordinated Universal Time UTC(LT), ensuring the traceability of the magnitudes reproduced to the International System of Units (SI), disseminating them to Lithuanian scientific establishments, personal and legal bodies by calibrating their working standards and measurement devices, disseminating Lithuanian time scale and other relevant means. TFSL, in cooperation with the JSC "BaltStamp", provides time stamping services, which meet the eIDAS regulations. In collaboration with the Swiss company "GVR Trade" and the Lithuanian JSC "MitSoft" Time and Frequency Standard Laboratory pursue the EUROSTARS-2 project entitled „System of passive SAW sensors exploiting UWB hyperbolically frequency modulated Signals“ (UWB\_SENS).

The mission of the Electrical Standards Laboratory (ESL) is maintaining and developing the standards of unit of voltage, the volt (V), and unit of resistance, the ohm ( $\Omega$ ), ensuring their traceability to the SI, calibrating working standards and measurement devices, pursuing research in the field of measurement of voltage, resistance and electrical current.

The Temperature Unit Standard Laboratory (TUSL) is realizing the international temperature scale ITS-90 and the value of the unit of temperature the kelvin (K) ensuring its

traceability to SI. Lithuanian National Standard of temperature unit in the range from  $-195^{\circ}\text{C}$  to  $+961,78^{\circ}\text{C}$  is primary level standard and  $+1084,62^{\circ}\text{C}$  reference point of freezing point of copper (Cu) - secondary level.

The Ionizing Radiation Metrology Laboratory (IRML) was piloting the EURAMET Project No.1437 "The follow-up interlaboratory comparison of the radionuclide calibrators". The secondary standard equipment for radionuclide measurement in a high activity range (above 1 MBq) used in Lithuania was compared with the similar equipment used in national metrology institutes of Czech Republic and Slovakia. The radionuclides applied in a nuclear medicine such as  $^{18}\text{F}$ ,  $^{67}\text{Ga}$ ,  $^{99\text{m}}\text{Tc}$ ,  $^{111}\text{In}$ ,  $^{123}\text{I}$ ,  $^{125}\text{I}$ ,  $^{131}\text{I}$ ,  $^{137}\text{Cs}$  (as a check source),  $^{201}\text{Tl}$  and  $^{223}\text{Ra}$  have been standardized with the well-type ionizing chambers Fidelis and Capintec 15R and the uncertainty budget have been evaluated. The results confirmed that consistent, safe and effective radionuclide activity measurement services to the medicine community are provided in Lithuania.

Metrology is not restricted only to standards of physical units but also reliable and accurate chemical measurements in sectors of health care, food safety and environment protection which could be provided by the Laboratory for Metrology in Chemistry (LMiC). The laboratory successfully participating in ALCOREF Project 16RPT02 „Certified forensic alcohol reference materials“ [2] in the frame of



Fig. 2. EMPIR project consortium partners.

European Metrology Programme for Innovation and Research (EMPIR) since September 2017. It is a great example of international collaboration between 10 partner's NMIs from 10 different European countries. Federal Institute for Materials Research and Testing (BAM, Germany) is coordinating this project. The main objectives of the project are research on accurate measurements, homogeneity, short and long term stability estimation for production of ethanol/water certified reference materials (CRMs) and building of a new regional metrological capacity for certification of CRMs for breath alcohol analyzers control.

The vision of EURAMET and its members is to ensure Europe has a world-leading metrology capability, based on high-quality scientific research and an effective and inclusive infrastructure, that meets the rapidly advancing needs of end users. New possibilities of realising this aim is EURAMET's European Metrology Networks (EMNs). FTMC MD together with partners from Nordic and Baltic countries started the action of establishing of such a network.

## REFERENCES:

- [1] <https://www.bipm.org/en/cgpm-2018/>
- [2] <https://www.bam.de/Content/EN/Projects/Alcoref/alcoref.html>
- [3] <https://www.euramet.org/european-metrology-networks/>