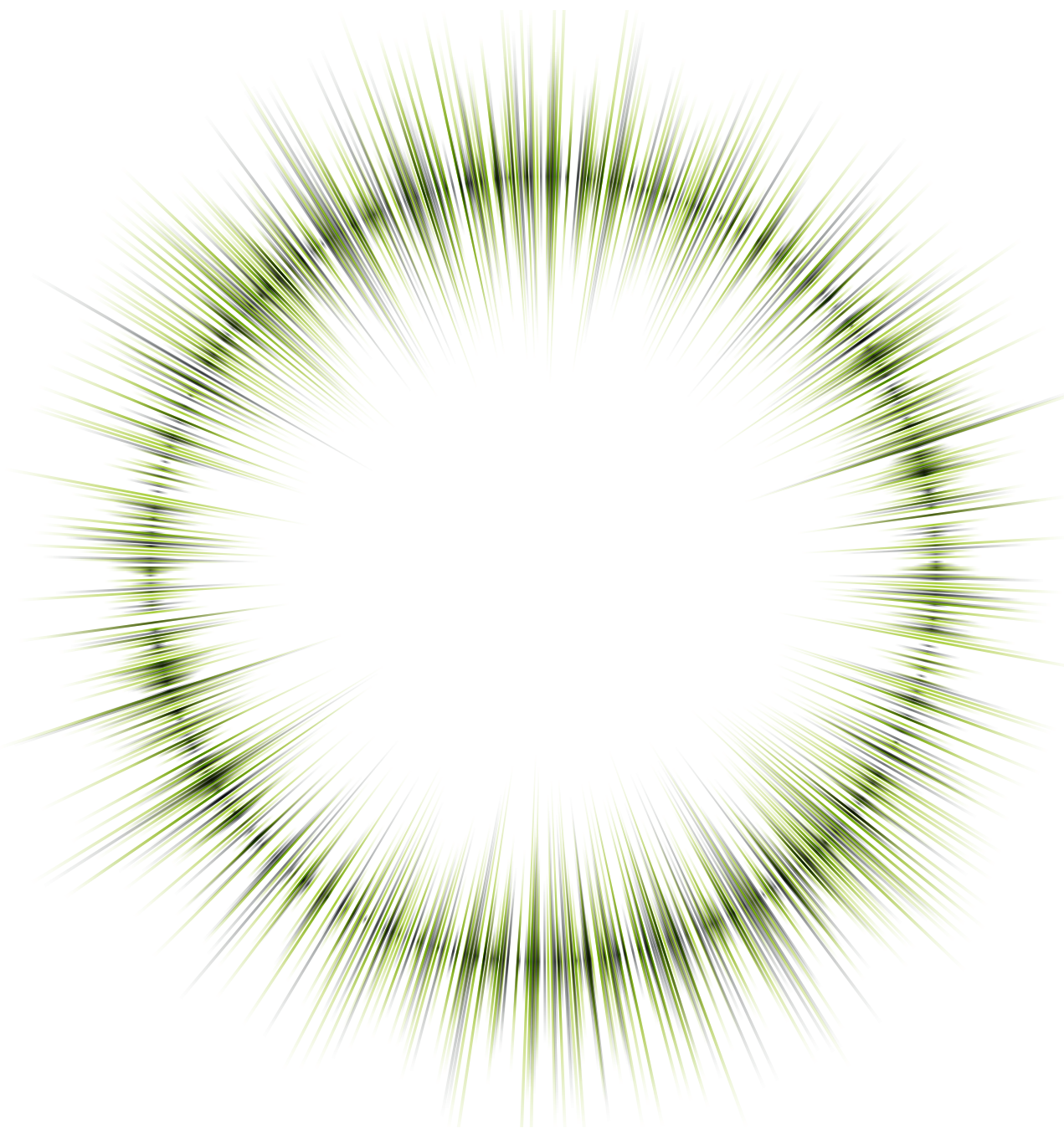




Central
Office
of Measures

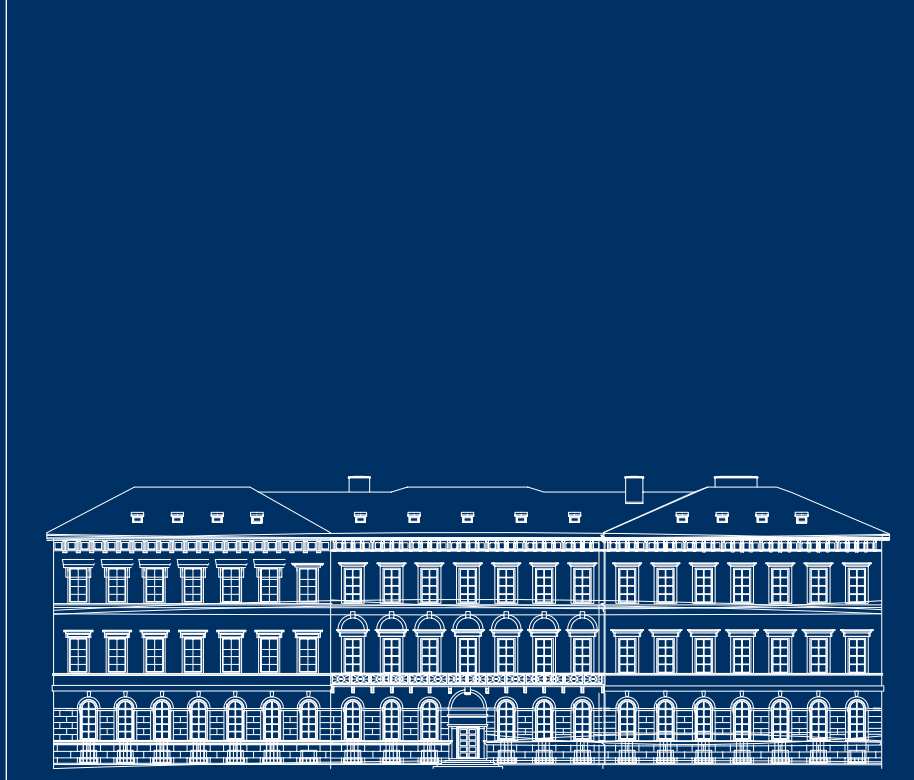


ACTIVITY OF THE CENTRAL OFFICE OF MEASURES
AND REGIONAL UNITS
ANNUAL REPORT 2020



**ACTIVITY OF THE CENTRAL OFFICE OF MEASURES
AND REGIONAL UNITS**
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The Central Office of Measures (GUM) is a national metrology institute addressing theoretical and practical matters involving measures such as: measurement units, technologically advanced measurement standards, measuring systems and methods, as well as transfer of metrological knowledge and legal issues.

The GUM is a primary element of the National Measurement System in Poland

The GUM's activities focus on:

- *ensuring the measurement capabilities necessary for the sustainable development of the economy,*
- *providing the society with appropriate standards of living and protecting the interests of the citizens,*
- *protection of the economic and technical security of the state.*



**Central
Office
of Measures**



President
of the Central Office of Measures

JACEK SEMANIAK

Dear Sir or Madam,

I present to you the annual report of the Central Office of Measures, an institution that has been operating for over a hundred years to guarantee the measurement capabilities necessary for the sustainable development of the economy, to ensure an adequate standard of living and to secure the interests of the state and citizens' needs.

Just as the reach of the COVID-19 pandemic turned out to be global, 2020 brought challenges and changes on a global scale.

Because of the pandemic we are dealing with, both the administration of measures and assay administration worked in a mode adjusted to all of the introduced restrictions. Strict rules of conduct and security measures were upheld during the duties, so that employees and clients were not exposed to danger in any way. Due to the situation caused by SARS-CoV-2 in Poland and abroad, not all planned activities could be carried out.

In 2020, work related to the implementation of the essential long-term projects of the GUM required a lot of commitment:

- "Świętokrzyski Laboratory Campus of the Central Office of Measures – Stage 1 (CAMPUS)";
- "IT Support System for Services of the Regional Administration of Measures – ŚWITEŻ";
- "Launch of e-MiM – a system of mass and dimension measurement of vehicles in Poland".

In order to carry out interdisciplinary projects, EU funding was obtained for two prestigious projects: "IT system for

implementation of public services and tasks of the Central Office of Measures regarding tachographs – TRANS-TACHO" and "e-CzasPL – system for reliable and credible distribution of official time within the Republic of Poland".

Long-term cooperation with national scientific and research centres was continued to improve the quality of measurements done in the country and to facilitate the transfer of knowledge to the economy.

To intensify the international cooperation in the field of metrology, the GUM participated in 20 research projects, in cooperation with foreign partners, under the European Metrology Programme for Innovation and Research (EMPIR). These activities contribute to the development of many branches of the economy and make economic cooperation more effective and less costly.

The activities are aimed at strengthening the position of the GUM as a National Metrology Institute (NMI) for the purposes of social and economic development of the country. By ensuring the accuracy of measurements, they protect the consumers' interest in all areas of life. They also support the protection of the human environment, ensure public safety and protect the fiscal interests of the state. Details concerning our national and international activity can be found in this report.

We have a difficult year behind us, which was filled with new challenges. I would like to thank all of the GUM employees and the field administration of measures and assay administration for taking up these complex challenges, and for their commitment and hard work in the pandemic reality.

GUM – 2020 IN A NUTSHELL

FLAGSHIP GUM PROJECTS

“IT Support System for Services of the Regional Administration of Measures – ŚWITEŻ”

The project is being implemented in accordance with the agreement signed on 11 May 2018, between the President of the GUM and the CPPC (Centrum Projektów Polska Cyfrowa), No. POPC.02.01.00-00-0080/17-00 for financing from European funds for the project under the 7th call for proposals for the Operational Programme Digital Poland, Measure 2.1 “High availability and quality of public e-services”. The subject of the project is to enhance the processes related to the services, to increase the availability and quality of e-services and to launch high-level electronic services performed by the administration of measures institutions for clients. The total project value is PLN 14,304,041.85 (gross), including the EU funds budget of PLN 12,105,510.62. Under the terms of the agreement, the project started on 1 August 2018 and is expected to end on 31 July 2021. Due to the COVID-19 pandemic, the project period was extended by 90 days, i.e., until 29 October 2021.

In 2020, as part of the work on the project, its fifth milestone was accepted in the form of the “ŚWITEŻ” prototype system and the system test environment. This made it possible to start using the cloud infrastructure hosting service. In addition, work was continued in connection with the acceptance of further system service-related functionalities: production of certified reference materials, conformity assessment and calibration of measuring instruments. Furthermore, works were intensified on integrating the designed system with the financial and accounting system. At the same time, documents were prepared for the announcement of tender procedures for the purchase of IT hardware and a marketing campaign for the project.

“Launch of e-MiM – a system of mass and dimension measurement of vehicles in Poland”

Work on the project continued in order to achieve the final effect of improved safety of road users and prevention of road degradation resulting from the traffic of overloaded vehicles. In 2020, the GUM selected a new proposal for the location of the research laboratory at the landing site in Broczyno near Czaplonek. A letter of intent was drawn up, and once it is approved by the General Directorate for National Roads and Motorways (GDDKiA), General Inspectorate of Road Transport (GITD), the GUM and the Czaplonek Commune, it will allow the GDDKiA to start project works. The landing site was visited twice and new assumptions were developed for the construction of an experimental laboratory located in Broczyno. In December, the GITD started the procedure for convening the Steering Committee. The GUM developed both draft new regulations for HS WIM and changes to accompanying regulations.

The following activities were carried out under the Campus project:

- the tender procedure for the selection of the general contractor of construction works was announced and concluded, and a construction works contract was signed;
- the possibility of providing an external investment substitution service was agreed, the tender documentation was drawn up, and the procedure for selecting a substitute investor was initiated;
- negotiations were held with the European Commission concerning the possibility of reducing the economic activity in the project, so that the project funding could be increased by PLN 25.5 million;
- the research agenda and documentation necessary to submit an application for project funding were updated after the change of material scope and increase in funding;
- the Agreement on funding the “Świętokrzyski Laboratory Campus of the Central Office of Measures (ŚKL-GUM)” project was terminated and an application for funding was submitted for the “Świętokrzyski Laboratory Campus of the Central Office of Measures – Stage I” project, which was positively evaluated, which made it possible to sign a new funding agreement;
- the ownership of the land for the construction of the Campus was transferred to the GUM.

ŚWIĘTOKRZYSKI LABORATORY CAMPUS OF THE CENTRAL OFFICE OF MEASURES

– STAGE 1 (CAMPUS)





TRANS-TACHO

IT system for implementation
of public services and tasks
of the Central Office of Measures
regarding tachographs

“IT system for implementation of public services and tasks of the Central Office of Measures regarding tachographs – TRANS-TACHO”

The purpose of the TRANS-TACHO project is to improve the business activity and the performance of a regulated profession in the field of tachographs by introducing four electronic public services, A2B and A2C, which will contribute to reducing formalities on the part of stakeholders.

In 2020, the project received funding under the 5th Round of Competition no. POPC.02.01.00-IP.01-00013/19 announced for Measure 2.1 “High availability and quality of public e-services” under the Operational Programme Digital Poland for 2014–2020. The scheduled project implementation period lasts from 1 April 2020 to 29 June 2023. The total project cost is PLN 8,652,739.20, including 15.37 % (PLN 1,329,926.02) from the state budget, and PLN 84.63 % (PLN 7,322,813.18) from EU funds.

The preparation of one of the most important tasks provided for in the project schedule was started as part of the project implementation, i.e., conducting a tender procedure for the selection of a Technical Advisor responsible for establishing the assumptions for the TRANS-TACHO IT system, its functional and architectural concept, and drawing up the tender documentation for the selection of the System Contractor. The said tender was announced on 31 December 2020. In addition, the Project Team undertook activities for the development of requirements specifications for the TRANS-TACHO system, with many internal and external consultations, including the defining of requirements and the designing of processes and services for the future system.

“e-CzasPL – a system for reliable and credible distribution of official time within the Republic of Poland”

e-CzasPL is a system for reliable and credible distribution of official time within the Republic of Poland. The purpose of the project is to deliver credible and reliable official time signal distribution within the territory of the Republic of Poland and signals of Polish implementation of the international Coordinated Universal Time UTC(PL), generated according to the national standard for units of time and frequency.

In 2020, the project received funding from the Operational Programme Digital Poland for 2014–2020, Measure 2.1 “High availability and quality of public e-services”. The total project cost is PLN 11,898,429.00, including 15.35 % (PLN 1,828,788.54) from the state budget, and PLN 84.63 % (PLN 10,069,640.46) from EU funds. The funding agreement was signed on 27 March 2020, but due to the pandemic, the operational stage of the project started on 1 July 2020. The project is planned to be implemented in 2020–2023. In 2020, technical dialogues were initiated on the detailed features and technical scope of the planned web portal with applications and devices for increasing the reliability and credibility of official time distribution, as well as on the system for distribution of coded time signals on long radio waves. A tender was also launched for the supply of laboratory infrastructure to increase the reliability of the official time system.



Jacek Semaniak

CHANGES TO THE GUM MANAGEMENT

On 9 November 2020, Prime Minister Mateusz Morawiecki appointed Professor Jacek Semaniak as the President of the Central Office of Measures. The document was presented by Jarosław Gowin, Deputy Prime Minister, Minister of Development, Labour and Technology (MRPiT). The President of the GUM is a professor of physical sciences and a graduate of physics studies at the Faculty of Mathematics and Natural Sciences at the Pedagogical University in Kielce. He obtained his doctorate in 1995 at the Andrzej Sołtan Institute for Nuclear Research in Świerk. He obtained his postdoctoral degree in 2002 at the University of Warsaw on the basis of the dissertation titled: Dissociative Recombination in Ion Storage Rings. He was awarded the title of professor of physical sciences on 3 July 2012. From 1988, he was employed at the Jan Kochanowski University in Kielce (as Head of the Department of Molecular Physics, and then the Department Medical Physics and Biophysics). In 1995–1998, he also completed research internships at the Stockholm University of Technology and Stockholm University. He was vice-rector for didactics and student affairs (2005–2008), vice-rector for general affairs (2008–2012) and rector (two terms in the years 2012–2020) of the Jan Kochanowski University of Kielce. Since 2020, he has been a member of the Scientific Policy Committee.

GUM BULLETIN IN THE BAZTECH DATABASE

The Central Office of Measures made an agreement with the Interdisciplinary Centre for Mathematical and Computational Modelling of the University of Warsaw on the transfer to the BazTech bibliographic database of information on the publication of technical articles in the GUM Bulletin: Metrology and Hallmarking.

BazTech is one of the resources of the Virtual Science Library and the Science Library. The metadata is indexed by Google Scholar, Google, and WorldWideScience.org. BazTech is developing towards a full-text citation database.

The BazTech database provides information on the articles of Polish journals in the field of technical sciences, exact sciences and environmental protection: first names and surnames of authors, publication titles, abstracts, keywords, attachment bibliography and publication address. In addition, full texts of published articles are made available with the consent of the publisher. The database realises the idea of open science, the aim of which is to provide a complete and free source of information on the content of Polish technical journals.

Thanks to these activities, BazTech is part of the open science movement and supports the idea of interlibrary borrowing. Therefore, it promotes the achievements of Polish scientific and technical thought.



METROLOGY COUNCIL

On 28 February and 11 December, Professor Ewa Bulska chaired the annual meetings of the Metrology Council – the consultative and advisory body at the President of the GUM.

During the first meeting, the Metrology Council gave a positive opinion on both the *Report on the implementation of the annual action plan of the Central Office of Measures in 2019* and the *Annual action plan of the Central Office of Measures for 2020*. The organisational changes that took place in the GUM in January 2020 were also discussed during the meeting. They concerned the new GUM bylaws assigned by the minister responsible for economy and the organisational regulations of the Office developed in this regard at the GUM.

The second meeting of the Metrology Council was held in a hybrid mode due to the prevailing COVID-19 pandemic. During the meeting, the Metrology Council adopted a resolution issuing a positive opinion on the *Annex II to the Four-year strategic operation plan of the Central Office of Measures 2018–2021*.

Final versions of the abovementioned documents, positively approved by the Metrology Council, were submitted to the minister appropriate for economic affairs.

QUORUM IT SYSTEM

QUORUM is a uniform IT system for the entire administration of measures and assay administration, aimed at improving the day-to-day service and operation of the Offices. The commissioned system covers the full range of administrative services for Offices, i.e., finance and accounting, HR – payroll, warehouse and fixed assets.

“AVAILABLE, JUST LIKE THAT. PERIOD” – SIMPLE LANGUAGE DECLARATION

The initiator of the Simple Language Declaration was the Ministry of Funds and Regional Policy. The primary goal of the initiative is simplifying communication addressed to clients. The declaration is also an attempt to make the staff more receptive to the needs of others, regardless of age, level of disability or education. Signing the declaration means that institutions that join the agreement will promote the idea of simple language, establish language standards and strive for their employees to improve their ability to use simple language in communication with citizens. The GUM also joined this idea.



GUM FOR THE ECONOMY AND SOCIETY

The activities of the GUM include a wide spectrum of metrology-related issues such as units of measurement, their definitions, technologically advanced measurement standards and measurement systems, as well as economic and technical security of the state.

The works carried out at the GUM support the social and economic development of the country. By ensuring the accuracy of measurements, they protect the consumers' interest in all areas of life. They also support the protection of the human environment, ensure public safety and protect the fiscal interest of the state. The effects of the GUM's activities are present in our everyday life: when we fill up at a gas station, check the time or do shopping and pay for products.

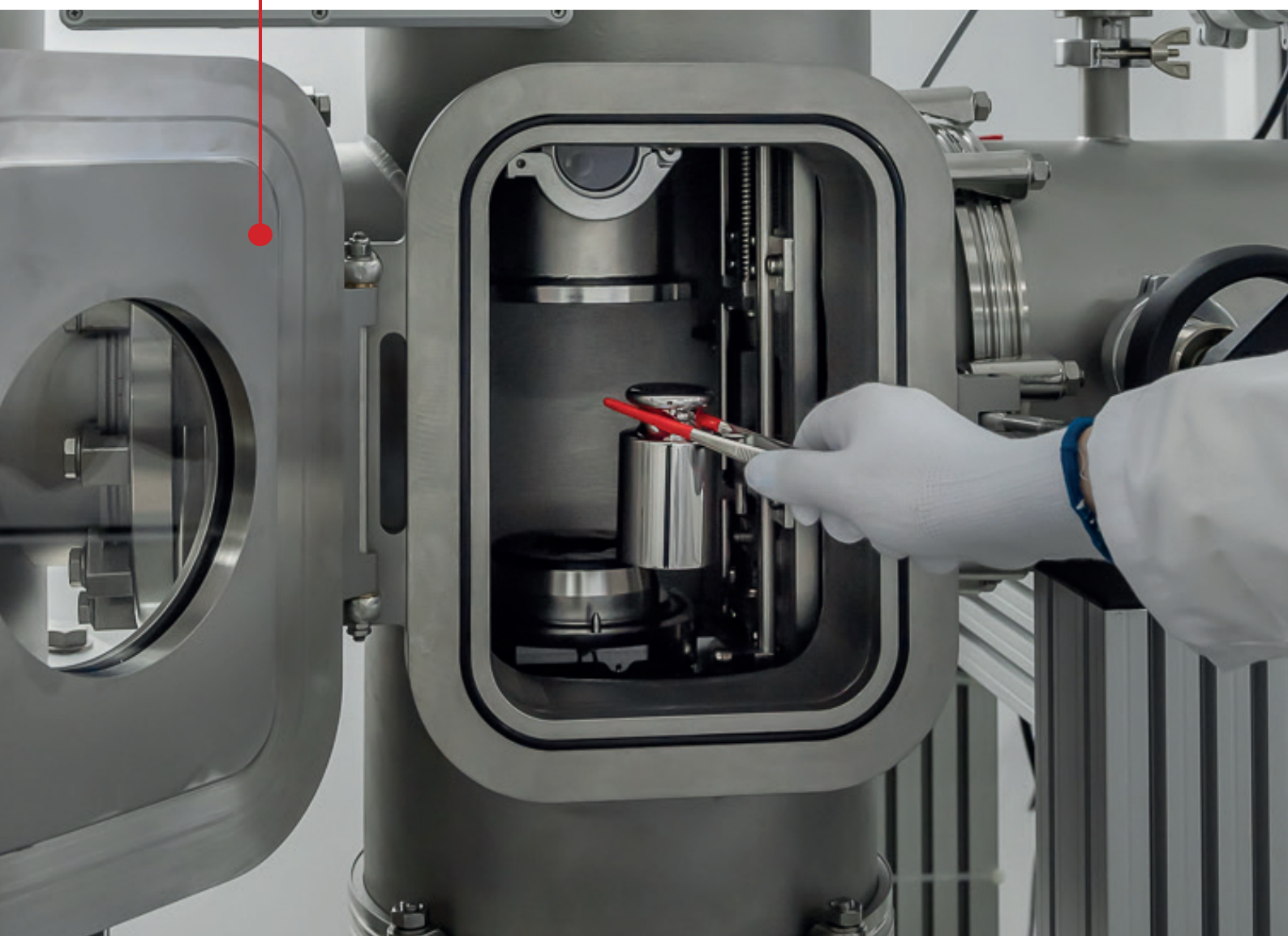
MEASUREMENT STANDARDS AND STAND

Measurement standard of the measurement unit of amount of a substance (mole)

On 13 August, the President of the GUM signed a Decision on the recognition of the measurement standard of measurement unit of amount of a substance as the national measurement standard. The new national measurement standard consists of: a set for precise coulometric analysis, non-automatic electronic balances: ultra-microbalance and analytical balance, mass standards, a set for determination of ions through ion chromatography, and primary reference materials used to represent the quantity value of the amount of a substance. The stand performs a precise constant-current coulometric titration method (basic method) with potentiometric and amperometric detection of the titration end point. This method reproduces the unit of measurement of amount of a substance (mole) by using the measurement unit of electric current (ampere), measurement unit of time (second), measurement unit of mass (kilogram) and Faraday constant.

Modular measuring stand for 1 kilogram prototype No. 51

Work continued on the construction of a modular measuring stand for 1 kilogram prototype No. 51 – national measurement standard of mass, metrology infrastructure providing measurement traceability in the mass domain after the redefinition of the kilogram.



Installation of a vacuum mass comparator for the 1 kg national measurement standard was completed. Measurements were carried out in air and in a vacuum. In addition, preparations started for the transfer of the 1 kg unit after redefinition, which will take place in 2021 after the return of 1 kg national measurement standard No. 51 from comparisons with the legendary IPK (International Prototype of the Kilogram) kept at the International Bureau of Weights and Measures (BIPM). Such a comparison is done every 30–40 years. After thirty years in the safe of the Central Office of Measures, the measurement standard saw the light of day, was packed in a special travel packaging and was sent to the BIPM in Paris for the third time.

The standard was purchased by the GUM in 1952; it is made of an alloy of platinum and iridium (90 % Pt, 10 % Ir) in the shape of a cylinder with a base diameter equal to its height (approx. 39 mm).

Interestingly, the mass of the measurement standard in the year of the first calibration (1951) was greater than 1 kg by 0.185 mg, and in the year of recalibration (1990) it was greater by 0.227 mg.

This means that the “national kilogram” gained 0.042 mg in the first 40 years. Will this trend be confirmed throughout the next 30 years? We will have to wait a while for the measurement results from the BIPM.

A new measurement standard for alternating voltage

The GUM family of measurement standards was extended to include the primary quantum alternating voltage (AC) measurement standard. The stand purchased from Supracon S.A. is a Programmable Josephson Voltage Standard (PJVS) designed for precise voltage measurements in the range from direct current (DC) voltage to the frequency of 2 kHz in the value range of 0 V to 10.0 V. This measurement standard supplements the two measurement standards already operated in the GUM, which use quantum phenomena to represent and transmit the measurement units of electrical quantities (DC voltage and resistance). It contains state-of-the-art technological solutions and is the best representation of AC electrical quantities. The measurement standard is equipped with a modern cooling system based on a two-stage cooling device that utilises a pulsating system.



The PJVS system will ensure the transfer of the unit of measurement of alternating voltage with a measurement uncertainty of no more than $5 \times 10^{-7} \Delta V/V$ (with a coverage probability of 95 % and coverage factor $k = 2$).

The implementation of the PJVS measuring stand as a formal primary measurement standard (which will be a national measurement standard in the future) will be a long-term and labour-intensive process. The measuring stand must go through many stages, from research work to international comparisons. This process may take 3 to 5 years.

The measurement standard will be used for:

- research & development work,
- calibration of secondary AC and DC voltage measurement standards such as multifunction calibrators within the ranges indicated above,
- calibration of the linearity of voltmeters and laboratory calibrators,
- calibration of precise voltage dividers,
- calibration of DC and AC resistance (by measuring resistance ratios with a known value of one of the two measured resistors),
- calibration of alternating current using the technical method,
- calibration of AC/DC shunts.

Measuring stand for calibration shock transducers in accordance with ISO 16063-22 standard

Work was carried out to construct metrology infrastructure to ensure measurement traceability in the mechanical vibrations field in the shock range. The calibration of transducers for external clients and control transducers used in the laboratory was done to test the stability of the measuring stand and to improve the competences of the staff. Calibration of the GUM control transducers was also outsourced to the accredited laboratory of SPEKTRA. The comparison of the results obtained with the results obtained at the GUM's stand confirmed the metrological properties of the measuring stand and the maintenance of its parameters, thereby proving the technical competence of the GUM regarding calibration in the context of mechanical shock.



NEW MEASUREMENT METHODS AND SERVICES

Through advanced metrology infrastructure, the GUM actively supports the development of new technologies based on accurate and precise measurements. Development of new measurement methods and introduction of new metrological services are done for the purpose of adjusting the service range to the needs of the economy.

Three new measurement methods were developed and implemented at the GUM, while another two were introduced at the Regional Offices of Measures (OUM) in Bydgoszcz and Poznań.

The following were developed and implemented:

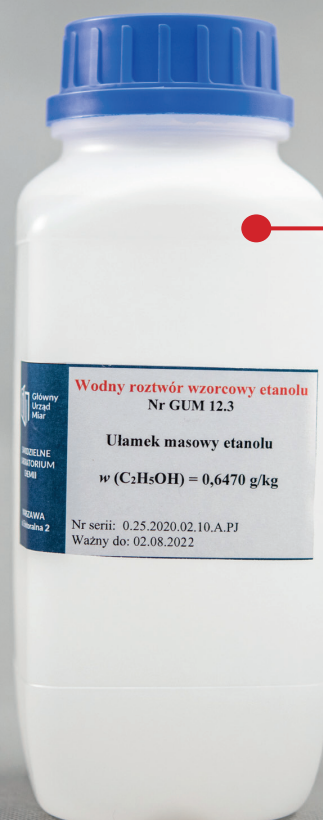
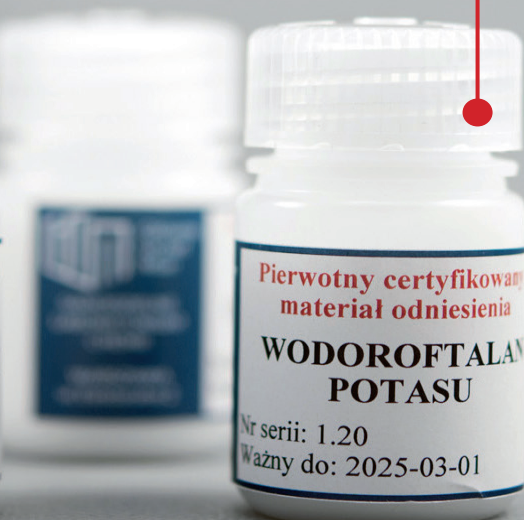
- procedure for the production and calibration of certified reference materials for electrical conductivity in the range from 5 mS/cm to 50 mS/cm;
- uncertainty interpolation method in the MST-90 sub-ranges;
- method for calibrating torque wrenches (OUM Poznań);
- method for calibrating contact profilometers (OUM Bydgoszcz);
- methodology for testing cash registers in the form of software in accordance with the provisions of the new Regulation of the Minister of Finance on cash registers in the form of software of 26 May 2020.

In addition, the technology for the production of legalisation stamps was upgraded to reduce their production costs (OUM Bydgoszcz).

To meet the needs and expectations of clients, the list of certified reference materials offered by the GUM was expanded and the measuring ranges for related services were increased.

Primary certified reference material of amounts of substances

The primary certified reference material of amount of substances for acid-base analysis was developed in the form of high-purity potassium hydrogen phthalate (KHP). The KHP content (purity) of approx. 99.91 % was set by precise coulometric titration (basic method) using the measuring stand of the national measurement standard of measurement unit of amount of a substance.



New secondary conductometric certified reference materials

Secondary conductometric certified reference materials were developed to reproduce the unit of measurement for electrical conductivity in the range from 5 $\mu\text{S}/\text{cm}$ to 50 $\mu\text{S}/\text{cm}$ with uncertainty expanded by 4 % to 0.5 %, respectively. These measurement standards are solutions of potassium chloride in 30 % n-propanol.

In addition, the range of available conductometric certified reference materials representing the unit of measurement of electrical conductivity in the range from 0.005 S/m to 11.5 S/m produced in current series was extended to add the option to order a measurement standard with the electrical conductivity value selected by the client within the above-mentioned range.

Certified reference materials – liquid ethanol standards

Eight types of aqueous ethanol standard solutions were introduced to the range; they represent the mass fraction of ethanol in the solution, ranging from 0.12 g/kg to 5.1 g/kg. Reference materials are intended for use in breath simulators for the production of wet ethanol standards for the calibration and testing of breath analysers. The service is addressed to manufacturers, distributors and service centres of breath analysers and calibration laboratories.

Calibration of redox electrodes

A redox electrode calibration service was developed and implemented. Calibration of redox electrodes is done using the redox potential reference materials manufactured in the GUM; they represent the redox potential in the range from approx. 200 mV to approx. 700 mV against an Ag/AgCl electrode (3 moles/dm³ of KCl).

Extension of the accreditation at Regional Offices of Measures

OUM Kraków extended the scope of force-related accreditation by adding extensometer calibration, and updated the scope of accreditation in the field of electrical thermometry. OUM Bydgoszcz extended the scope of the accreditation by the Polish Centre for Accreditation (PCA) by adding contact profilometer calibration (increasing the range of services in the area of surface geometry) and frequency function calibration for multimeters.





**Central
Office
of Measures**

As an important partner in the industry – science – administration relationship, in 2020 the GUM conducted a dialogue with external economic, expert and research and scientific communities, including through activities in the said Teams.



DIALOGUE WITH INDUSTRY AND SCIENCE

In 2020, we had to face a new situation and a difficult, yet invisible, enemy. The pandemic affected countries all over the world, imposing a lockdown on world economies and drastic restrictions in interpersonal contacts. There is no doubt that for many years to come, the world will struggle with the economic and social consequences of the pandemic. The key will be to tighten cooperation between industry, science and metrology, which is the basis for the economic growth of every country. Being aware of the importance of this collaboration, the GUM undertook a number of activities to increase the effectiveness of this cooperation despite the extremely difficult time during which we worked.

Agreements and arrangements

The signing of eight cooperation agreements in 2020 expressed the strengthening of cooperation between the administration of measures and the scientific community, and economic entities.

■ Warsaw University of Technology and Wrocław University of Science and Technology

The main assumptions of the cooperation agreements between the GUM, and the Warsaw University of Technology and the Wrocław University of Science and Technology concern joint activities to support innovation and technological progress in Poland by:

- initiating and performing joint scientific and R&D works in the fields of mutual interest, in particular, metrology;
- practical use of knowledge and technology in the field of scientific and industrial metrology for the social and economic development of the country;
- mutual assistance in the preparation of diploma, doctoral and habilitation theses by students, doctoral students, university staff and employees of the GUM;
- mutual consultations as well as scientific and technical advice;
- knowledge transfer through co-organisation of training, courses and scientific conferences;
- organisation of internships and apprenticeships for students at the GUM;
- information and promotion campaigns aimed at raising the interest of public and private sector entities in the parties' scientific, research and innovation activities.

■ Cracow University of Technology – Faculty of Mechanical Engineering

The basic goal of signing a letter of intent between the GUM and the Faculty of Mechanical Engineering at the Cracow University of Technology is to ensure the implementation of the projects: “NSMET – National Network of Coordinate Metrology”, and “Świętokrzyski Laboratory Campus of the GUM”, in such a way that they are complementary with each other. This goal is to be achieved through mutual consultations on the scope of current investments and research works resulting from the implementation of both projects. The aim is to introduce specific solutions concerning the purchased instruments and in the field of R&D activities, in such a way that they will complement each other and increase measurement capabilities of coordinate metrology on a national and international scale. It is very likely that in the next years, the cooperation will be extended to include new entities from other European countries. Thanks to this, the cooperation between the GUM and the Cracow University of Technology in the implementation of the NSMET project will contribute to establishing an important European Metrology Network.

■ University of Warsaw – Interdisciplinary Centre for Mathematical and Computational Modelling

Under the agreement between the GUM and the Interdisciplinary Centre for Mathematical and Computational Modelling, publications of employees of administration of measures and assay administration, published in the GUM Bulletin: Metrology and Hallmarking since 2013, are available in the BazTech bibliographic database, which contributes to their dissemination and easier access.

■ Military Centre of Metrology in Oleśnica

The agreement concluded between the Military Centre of Metrology in Oleśnica and the Regional Office of Measures in Wrocław concerns research cooperation and joint actions to extend knowledge in the field of metrology. Joint activities will be aimed at:

- interlaboratory comparison activities;
- internal, technical and system audit activities;
- joint organisation and performance of scientific and technical events, open lectures, training and workshops;
- using the technical potential of both institutions in joint activities;
- automation and computerisation of measuring stands.

■ Military Centre of Metrology in Bydgoszcz

The purpose of the signed Agreement on cooperation between the Regional Office of Measures in Bydgoszcz and the Military Centre of Metrology in Bydgoszcz is to strengthen cooperation in the area of metrology and to undertake joint activities promoting metrological activity in the region.

■ Białystok University of Technology

The agreement between the Regional Office of Measures in Białystok and the Białystok University of Technology provides for the training of specialists, joint research and grants, and professional apprenticeships for students. The first joint projects will focus on promoting the knowledge of metrology, among other things. There are plans to organise a competition for secondary schools and to work with students on the automation and computerisation of measuring stands.

■ University of Białystok

Signing an agreement of intent between the Regional Office of Measures in Białystok and the University of Białystok is the first step to jointly solve practical problems, exchange experiences and apply for additional funds in competitions. Thanks to the cooperation, it will be possible to use the potential of science and support the transfer of knowledge and technology between the signatories. Then, in order to develop an innovative economy, there will also be an opportunity to include local industry in this exchange.

■ State Higher Vocational School (PWSZ) in Suwałki

The cooperation agreement of intent between the Regional Office of Measures in Białystok and the PWSZ in Suwałki was signed to undertake joint projects, exchange experiences, conduct seminars and conferences, obtain grants, and appoint joint task teams to organise internships or apprenticeships. The cooperation will allow the use of the potential of science, supporting the transfer of knowledge and technology to the economy, e.g., through activities done by the OUM in Białystok and the Technology Transfer Centre – a research platform at the school in Suwałki.

CONSULTATIVE TEAMS OF THE CENTRAL OFFICE OF MEASURES

After almost four years of operation of the Consultative Metrology Teams (KZM), changes were made to consolidate the thematic scope of their work, change the names of the teams, and more. The result of the activities was the revocation of the decision to appoint the KZM and the appointment of 6 Consultative Teams of the Central Office of Measures (KZGUM) on 31 August 2020:

1. Consultative Team of the GUM for industrial processes and advanced measurement techniques, KZGUM1;
2. Consultative Team of the GUM for health and food safety, KZGUM2;
3. Consultative Team of the GUM for energy and environmental protection, KZGUM3;
4. Consultative Team of the GUM for market regulations, KZGUM4;
5. Consultative Team of the GUM for hallmarking, KZGUM5;
6. Consultative Team of the GUM for industrial development of the świętokrzyskie voivodeship, KZGUM6.

As part of the dialogue between economic, expert and research and scientific communities, the tasks of the KZGUMs include:

- identifying the needs of the Polish economy regarding measurement technologies, legal regulations and support in solving reported metrological issues;
- determining proposals of priority tasks facing the Central Office of Measures – a modern National Metrology Institute;
- promotion of good measurement practices;
- initiating projects and supporting their implementation, if necessary;
- developing recommendations for the President of the Central Office of Measures.

The situation caused by the COVID-19 pandemic affected the work of Consultative Teams of the GUM, including the ability to organise meetings. Selected works, initiated by the KZMs, are still continued with representatives of economic and scientific communities, as well as the administration of measures and assay administration. The working groups for the regulation on breath analysers and the construction of an ultra-precise breath analyser arranged the issues related to this subject via e-mail correspondence, videoconferences and telephone consultations. Correspondence and telephone consultations were conducted by working groups for tachographs, fuel market and road safety. The 4th meeting of the Working Group for Underwater Acoustics was held in January 2020.

GUM
FOR THE SAFETY
OF THE STATE
AND THE CITIZENS



SUPERVISORY ACTIVITIES

Effective market surveillance and enforcement of legal regulations applicable in business activity is a condition for the efficient operation of an open economy and ensuring the safety of citizens.

To protect the safety of business transactions and consumer rights, supervisory activities were continued for compliance with the law resulting from the following legal acts: Law on measures, Hallmarking law, on packaged goods, on the tachograph system, on conformity assessment systems and market surveillance.

By establishing the directions of supervisory activities, reinforced by appropriate guidelines of the President, emphasis is put on the identification of causes and mechanisms leading to deficiencies by analysing certain issues and the probability of such deficiencies to appear.

The inspection activities included:


- inspections of users of measuring instruments for compliance with the Law on measures;
- inspections of entities authorised to perform initial or subsequent verification of compliance with the Law on measures;
- inspection of the correctness of the internal control system for the quantity of packaged goods used by the packer, and inspection of the correct application/use of the production of measuring bottles by the manufacturer of measuring bottles for compliance with the Act on packaged goods;
- inspection of entrepreneurs for compliance with the Act on tachographs;
- audits of entities authorised to carry out activities involving installation, checking, review or repair of tachographs;
- inspections to check the compliance of measuring instruments with the requirements of the MID (Measuring Instruments Directive) and NAWID (Non-automatic weighing instruments directive);
- locations conducting processing, manufacturing, repair and sales of precious metal wares.

The areas with the highest probability of possible violations of the law are established according to annual risk matrices for the performed inspection tasks. At the same time, for the purposes of improving the supervision and inspection system, the following are analysed:

- the manner of implementation of post-inspection recommendations by entities that did not comply with the obligations arising from the relevant law;
- information from the media;
- requests and complaints from clients, indicating irregularities in the operations of entrepreneurs regarding the issues covered by the supervision of the administration of measures;
- indications of irregularities received from other public administration bodies (e.g., WIIH, UOKIK, NIK, etc.).

6,317 inspections were carried out in various areas, of which 4,119 were inspections in higher risk areas, which was 65.2 % of the total inspections. 77.1 % of post-inspection recommendations were successfully implemented.

Work continued on the implementation of a uniform IT system supporting the performance of both conformity assessment and legal metrological control of measuring instruments for the regional administration of measures.

A person with dark hair is seen from the side, looking down at a white laptop. Their hands are on the keyboard. In the foreground, a light-colored ceramic cup sits on a wooden desk. The background is a bright, out-of-focus window.

The preventive and informative method for controlling online trade in precious metal wares was improved using the experience of other countries. The activities carried out by the Surveillance Division in this regard consisted in monitoring entities engaged in e-commerce, and disseminating information on the principles of e-commerce regarding precious metals, as well as providing entrepreneurs (manufacturers and entities trading in precious metal wares and submitting applications for entering a mark into the register) with written information on the regulations in force. Intensive legislative work was being performed to change the “Hallmarking law” act, including in the area of surveillance, i.e., introduction of regulations which allow the inspection of entrepreneurs engaged in online trading. It was proposed to introduce new obligations to the act for entrepreneurs engaged in e-commerce, including:

- providing information on the type of precious metal from which the product offered for sale was made as well as the assay and weight of this metal;
- submitting a declaration of fulfilling the obligation to mark products with a hallmark and responsibility mark;
- placing graphic images of features on the products.

The proposed changes to the provisions of the act significantly increase the safety of consumers who make purchases online. Precious metal wares offered for sale remotely and outside the company’s premises should meet the same requirements as products sold in a traditional manner. The enactment of the amendment to the act in the proposed form will significantly limit the prohibited practices and exclude the possibility of committing prohibited acts, i.e., selling products without the legally required hallmarks and assays.

REGULATORY ACTIONS

Work was carried out in connection with updating the applicable legal regulations, including:

- a draft act on the change of the Hallmarking law act with drafts of executive acts resulting from the extent of changes contained in the draft act:
 - a draft regulation on the template of application for the establishment of an assay point and the scope of assay point technical devices – the work on the regulation was completed;
 - a draft regulation on the application form for submitting a responsibility mark to the responsibility mark register – the work on the regulation was completed;
 - a draft regulation on precious metal wares – the work on the regulation is ongoing;
 - a draft regulation on fees for the operations of assay administration bodies – the work on the regulation is ongoing;
- a draft regulation of the Council of Ministers on legal units of measurement – the draft regulation was prepared and the new regulation of the Council of Ministers on legal units of measurement was published on 5 June 2020 (Dz. U. 2020, 1024) with the announcement of the Prime Minister of 09 July 2020 on correcting errors (Dz. U. 2020, 1224),
- a draft regulation issued on the basis of Art. 9a of the act – Law on measures – concerning sound level meters,
- a draft regulation issued on the basis of Art. 9a of the act – Law on measures – concerning HS-WIM systems,
- a draft amendment to the regulation on legal metrological inspection of measuring instruments.





Central
Office
of Measures



GUM – EUROPE – WORLD

International cooperation in the field of metrology is dictated by important economic, social and scientific aspects. It results not only from the unification of units of measurement, but also from the fact that no national metrological institution is currently able to independently solve all new and difficult problems considering the pace of technical progress and knowledge development, and therefore this cooperation is now taking on a different character.

The forum of international metrology organisations examines and agrees on the issues related to metrology, which keeps on developing with the progress of science and exceeds the needs of industry, trade, research laboratories and many areas of life on a global scale. International metrology organisations specify the procedures and coordinate the Member States' efforts to ensure mutual trust in measurement results and issued certificates through the use of common units of measurement and common measurement procedures as well as uniform legal regulations.

The cooperation contributes to economic development and makes economic cooperation more effective and less costly.

AREA OF METROLOGY

The GUM actively cooperated with global and regional organisations, as well as with foreign metrology institutes under bilateral agreements. It participated in the work of international metrology organisations.

Representatives of the GUM worked in the Consultative Committees of the International Committee for Weights and Measures (CC CIPM), in the working bodies of the International Organization of Legal Metrology (OIML), the European Association of National Metrology Institutes (EURAMET), and in the European Cooperation in Legal Metrology (WELMEC).

Most of the scheduled sessions and meetings with foreign experts and workshops were held remotely due to the pandemic.

As part of the intensification of activities aimed at increasing the participation in the work of international organisations, a number of steps were taken to maximise the use of the GUM's potential, and thus to measurably increase the involvement of the Office in the work of respective organisations.

In particular:

- the GUM was engaged in work on completing the process of transforming WELMEC into an organisation with an association status (WELMEC e.V.). The GUM delegate actively participated in the first session of WELMEC e.V. and submitted comments on individual documents;
- work in WELMEC working groups was intensified by appointing and selecting a GUM employee as the chairman of the working group for measuring equipment for liquids other than water (WELMEC WG 10);
- work within BIPM was intensified through active participation in the BIPM Reform Advisory Group, issuing opinions on documents prepared by the Group;
- bilateral cooperation was intensified through active participation in the working group for the reform of the Ukrainian administration of measures – together with representatives from Germany, France and Spain;
- as part of bilateral cooperation, contact was established with the NMI of Germany, Switzerland and Austria to prepare the visit of the GUM management in the said institutions;
- work within the OIML was intensified by submitting a number of comments and remarks to draft documents prepared by the OIML;
- the GUM took part in online workshops organised by EURAMET on work time reporting for EMPIR projects.



The GUM participated in 20 research projects in cooperation with international partners, within the framework of the European Metrology Programme for Innovation and Research (EMPIR), of which one project ended in 2020.

As regards the operations of the EURAMET organisation, the GUM continued its work within the European Metrology Networks.

Pursuant to the decision of the European Commission and the project beneficiary (Georgia), a consortium consisting of Poland (GUM), Germany, Portugal, Austria, Romania and Latvia initiated works on launching the Twinning project for its counterpart – the National Metrology Institute in Georgia. The project is titled “Strengthening of institutional as well as human capacities of the Georgian National Agency for Standards and Metrology (GEOSTM) according to international / EU best practices”.

In recognition of the commitment in international activities as part of the work of the European Cooperation in the field of Legal Metrology and WELMEC e.V. – European Organisation in Legal Metrology, the representative of the GUM – Aleksandra Lewicka – was assigned the function of the Chairperson of the WG10 for measuring equipment for liquids other than water.

EMPIR RESEARCH PROJECTS

16RPT03 inTENSE “Developing research capabilities for traceable intraocular pressure measurements”

At the end of May 2020, as per the schedule, the EMPIR 16RPT03 inTense project was completed under the name: Developing research capabilities for traceable intraocular pressure measurements. A representative of the GUM was responsible in the consortium for Work Package 3, i.e., developing the concept of smart specialisation in the field of IOP measurements. The so-called Deliverable 6 White Paper on the smart specialisation concept developed to ensure a coordinated and optimised Central European approach towards IOP metrology was made as part of the task. The document and other deliverables prepared under the project were approved by the MSU. The last work of the consortium was done during the pandemic, so participants had to hold several virtual meetings. A new OIML recommendation Ophthalmic instruments, Non-contact tonometers was also developed during the project. The work was carried out by the technical subcommittee TC 18 OIML “Medical Measuring Instruments”. The document was agreed and is awaiting publication. Due to pandemic restrictions, the final training of participants was postponed to May 2021. It will take place in Most, in the Czech Republic.



Projects in progress – 19:

- 16RPT02 ALCOREF „Certified forensic alcohol reference materials”
- 17IND03 LaVA „Large Volume Metrology Applications”
- 17NRM03 EUCoM „Standards for the evaluation of the uncertainty of coordinate measurements in industry”
- 17RPT01 DOSEtrace „Research capabilities for radiation protection dosimeters”
- 17RPT02 rhoLiq „Establishing traceability for liquid density measurements”
- 17RPT03 DIG-AC „A digital traceability chain for AC voltage and current”
- 17RPT04 VersiCaL „A versatile electrical impedance calibration laboratory based on digital impedance bridges”
- 18RPT01 ProbeTrace „Traceability for contact probe and stylus instrument measurements”
- 18RPT02 adOSSIG „Developing an infrastructure for improved and harmonised metrological checks of blood-pressure measurements in Europe”
- 18SIB01 GeoMetre „Large-scale dimensional measurements for geodesy”
- 18SIB05 ROCIT „Robust Optical Clocks for International Timescales”
- 18SIB08 ComTraForce „Comprehensive traceability for force metrology services”
- 18SIB09 TEMMT „Traceability for electrical measurements at millimetre-wave and terahertz frequencies for communications and electronics technologies”
- 18HLT04 UHDPulse „Metrology for advanced radiotherapy using particle beams with ultra-high pulse dose rates”
- 19ENG05 NanoWires „High throughput metrology for nanowire energy harvesting devices”
- 19ENG08 WindEFCY „Traceable mechanical and electrical power measurement for efficiency determination of wind turbines”
- 19NET01 AdvManuNet „Support for a European Metrology Network on advanced manufacturing”
- 19NET02 EMN-Quantum „Support for a European Metrology Network on quantum technologies”
- 19NET03 supportBSS „Support for a European Metrology Network on reliable radiation protection regulation”

EUROPEAN METROLOGY NETWORKS (EMN)

Networks are an association of National Metrology Institutes and Designated Institutes from various EURAMET member states, which jointly carry out projects in the network’s area of interest.

The purpose of the project is to coordinate European metrology by analysing global and European needs in this regard as well as to align European strategies for metrology research, infrastructure, knowledge and services.

The GUM participated in the work of the European Metrology Networks (EMNs): Energy Gases, Climate and Ocean Observation, Mathematics and Statistics, Quantum Technologies, Smart Electricity Grids.

Energy Gases

This network involved the determination of the measurement needs and technical challenges regarding energy gases, which should be solved as a priority. This will require joint efforts of national metrology institutes and designated institutes with the support of industry. GUM employees participated in developing the *Strategic Research Program of the European Metrology Network “Energy Gases”*.

When preparing the contribution to the above-mentioned strategy, the services provided by the Central Office of Measures were reviewed in the area of energy gases, natural gas, biogas/biomethane and hydrogen to introduce a measurement services platform on the network's website. In addition, the metrological needs and technical challenges of the industry in Poland were analysed. Steps were taken to enable R&D works in the field of energy gas measurements.

Climate and Ocean Observation

Technical work was carried out to maintain and develop the national stand for temperature unit standard, dew point temperature and relative humidity reference standards, as well as work for the development of measurement systems for gas analysis and the characteristics of gas reference standards.

Mathematics and Statistics

A number of documents were prepared, including a proposal of a training project related to measurement uncertainty, and the approval of the document.

Quantum Technologies

The GUM participated in two online meetings organised as part of the joint 19NET02 EMN-Quantum project, and in the preliminary work to be carried out within the agreed work packages.

Smart Electricity Grids

Work was performed to maintain and develop the national measurement standards of: the ratio of alternating voltages and the ratio of alternating currents, and the reference measurement standards of power and electricity.

In addition, cooperation was initiated to establish a new European Metrology Network called **"Radiation Protection"**. These activities are supported by work carried out under the joint 19NET03 supportBSS project, in which the GUM is one of the partners.

AREA OF ASSAYING

Employees of the Regional Assay Offices in Warszawa and Kraków collaborated with foreign experts in research programs involving the testing of samples of precious metal alloys and the analysis of the results:

- Round Robin – issued by the Standing Committee of the Convention – the laboratory of the OUP in Warszawa and all external divisions and chemical laboratories at OUP Kraków;
- Labtest – issued by the Assay Office in Prague – the laboratory of the OUP in Warszawa, WZ Bydgoszcz and Gdańsk and the chemical laboratories at OUP Kraków;
- proficiency tests organised by: Assay Office in Paris, a French laboratory (the laboratory of the OUP in Warszawa and WZ Łódź), Metrology Institute in Sarajevo – the laboratory of the OUP in Warszawa and chemical laboratories at OUP Kraków, Institute of Metrology in Celje (WZ Białystok).

International cooperation was continued within the framework of the Standing Committee of the Vienna Convention, Technical Working Group of that Convention, International Association of Assay Offices (IAAO) and the Visegrad Group (GV4).

Together with the Department of European Affairs at the Ministry of Development, Labour and Technology, the GUM prepared the position of the Republic of Poland for the meeting of the EU Commission on the pilot project of accelerated mutual recognition in the precious metals sector.



KNOWLEDGE TRANSFER

TRAINING AND OTHER EVENTS

GUM employees participated remotely in conferences, seminars and other events, promoting knowledge on the redefinition of basic SI units and new measurement standards and methods. Information on the latest trends in national and international metrology were included in 30 publications, 12 of which are scored publications (5 IF). Despite the pandemic-related restrictions,

46 training courses were conducted at the GUM and JT as part of knowledge transfer, covering the issues of general metrology, calibration methods and testing of measuring instruments, the rules of conduct during legal metrological control and conformity assessment.

Many employees of the GUM and JT increased their competencies by participating in online training held by the Chancellery of the Prime Minister (KPRM) and the National School of Administration (KSAP), and by taking part in on the job training.

Professional development and self-education training courses for employees were held mainly remotely.

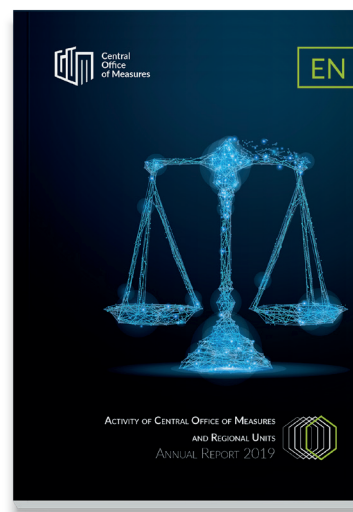
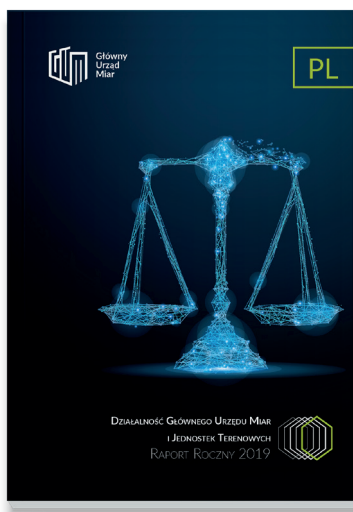
A one-day seminar was organised and conducted, dedicated to the activities of the GUM in the field of acoustics, ultrasound and vibrations, in connection with the International Year of Sound 2020 announced by the International Commission for Acoustics (ICA) in conjunction with the UNESCO resolution: Resolution 39 C/49 25 September 2017 on “The Importance of Sound in Today’s World: Promoting Best Practices”.

PUBLICATIONS

GUM PUBLICATIONS

10 publications were developed and published, including one GUM industry guide on acoustics, ultrasound and mechanical vibrations. The first official translation of the SI Brochure was prepared; it is the basic source of knowledge about the International System of Units (SI). The study is the basis for both the relevant EU directive and the Polish regulation on legal units of measurement. The publication provides the opportunity to promote the knowledge about units of measurement in scientific and economic communities. The brochure is made in the form of a manual explaining the basic principles of measurement units. The solutions it contains are the foundations for the development of legal acts on metrological issues.

The following were prepared and posted on the GUM's website:



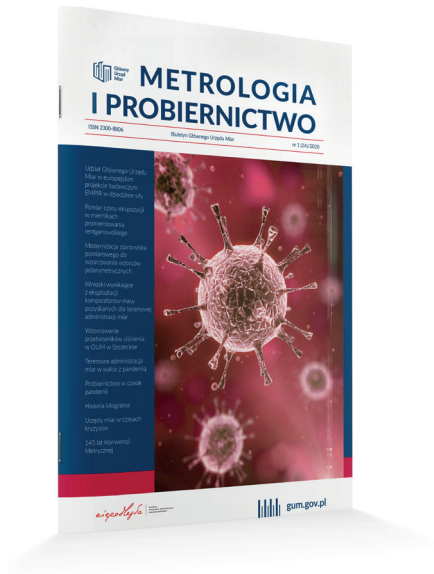
Activities of the Central Office of Measures and Regional Units. Annual Report 2019 in a bilingual (Polish-English) version



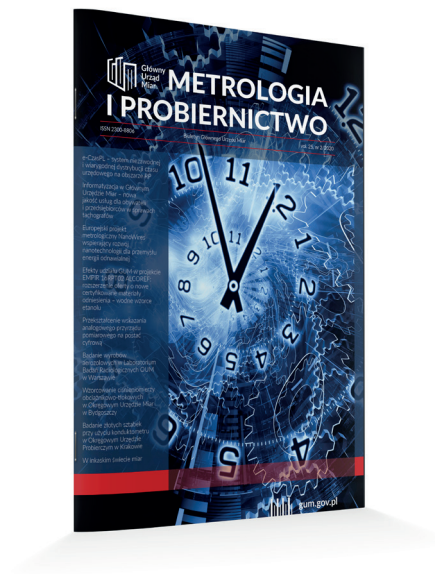
Polish edition of the BIPM brochure International System of Units (SI)



The GUM's industry guide on acoustics, ultrasound and mechanical vibrations



Bulletin Metrology and Hallmarking
vol. 24, 1/2020



Bulletin Metrology and Hallmarking
vol. 25, 2/2020



Glossary of selected terms and definitions
used in metrology and hallmarking
– 3rd edition



Measurement standards with the highest
metrological properties in the country
kept at the Central Office of Measures



Annual action plan of the Central Office of Measures for 2020



Report on the implementation of the annual action plan of the Central Office of Measures in 2019



Annex II to the Four-year strategic operation plan of the Central Office of Measures for 2018-2021

PUBLICATIONS BY GUM EMPLOYEES

The legacy of the GUM employees is represented in the articles and reports published in international and national scientific publications and in the GUM Bulletin.

Most of them in the previous years were conference materials in the form of papers and posters. Due to pandemic restrictions, many conferences were cancelled, which resulted in fewer articles.

Presented below is a summary of the publishing/scientific output of GUM employees in 2020.

IN SCIENTIFIC JOURNALS

1. K. Orłowska, M. E. Mognaschi, K. Kwoka, T. Piasecki, P. Kunicki, A. Sierakowski, W. Majstrzyk, A. Podgórn, B. Pruchnik, P. di Barba, T. Gotszalk: A method of magnetic field measurement in a scanning electron microscope using a microcantilever magnetometer. *Metrology and Measurement Systems*, Vol. 27 (2020).
2. Ewa Malejczyk, Wojciech Hyk: Certyfikacja materiałów odniesienia na przykładzie wybranego ciekłego wzorca gęstości. Cz. II. Ocena stabilności. *Analityka 1/2020*.
3. Ewa Malejczyk, Wojciech Hyk: Certyfikacja materiałów odniesienia na przykładzie wybranego ciekłego wzorca gęstości. Cz. III. Charakterystyka Metrologiczna. *Analityka 2/2020*.
4. A. Hantz: Analiza świadectw wzorcowania na przykładzie wagi i wzorca masy. Jakie korzyści i jakie zagrożenia dla laboratorium niesie za sobą zachowanie lub brak spójności pomiarowej w odniesieniu do wymagań normy PN-EN ISO/IEC 17025:2018-02. *Biuletyn informacyjny POLLAB BI 1/58/2020*. Elementy doskonalenia pracy laboratoriów. Warszawa 2020.
5. Z. L. Warsza, J. Puchalski: Estymacja niepewności rozszerzonej punktów charakterystyki z dwóch pomiarów kontrolnych. *Pomiary Automatyka Robotyka nr 4/2020*.
6. Z. L. Warsza, J. Puchalski: Niepewności pomiarów w metodzie regresji liniowej. Część 1. Prosta i jej pasma niepewności dla nieskorelowanych danych pomiarowych. *Pomiary Automatyka Robotyka nr 3/2020*.
7. Z. L. Warsza, J. Puchalski: Niepewności pomiarów w metodzie regresji liniowej Część 2. Niepewności prostej dla zmiennej Y o skorelowanych danych. *Pomiary Automatyka Robotyka nr 4/2020*.
8. A. Schüller, S. Heinrich, Ch. Fouillade, A. Subiel, L. De Marzi, F. Romano, P. Peier, M. Trachsel, C. Fleta, R. Kranzer, M. Caresana, S. Salvador, S. Busold, A. Schönfeld, M. McEwen, F. Gomez, J. Solc, C. Bailat, V. Linhart, J. Jakubek, J. Pawelke, M. Borghesi, R. P. Kapsch, A. Knyziak, A. Boso, V. Olsovcova, Ch. Kottler, D. Poppinga, I. Ambrozova, C. S. Schmitzer, S. Rossomme, M. C. Vozenin: The European Joint Research Project UHDPulse – Metrology for advanced radiotherapy using particle beams with ultra-high pulse dose rates. *Physica Medica*, Vol. 80, December 2020.
9. J. Fidelus, K. Cybul: Study on short-term creep effect and hysteresis for the HBM Z4A force transducer under compressive and tensile forces. *ACTA IMEKO*, Vol. 9, No 5 (2020).
10. J. D. Fidelus, M. Kozuchowski: GUM's Rockwell hardness standard machines after modernization. *ACTA IMEKO*, Vol. 9, No 5 (2020).
11. Furtado, J. Pereira, R. Quendera, M. Schiebl, E. Lenard, E. Malejczyk, A. Alic, S. Alisic, J. Rauch, F. Lorenz, A. Bescupschii, A. Ciubara, B. Laky, R. Amsüss : First density comparison on viscoelastic samples by oscillation-type densimetry. *ACTA IMEKO*, Vol. 9, No 5 (2020).
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14. M. Kaleník: Porównanie własności użytkowych różnych rodzajów bisektorów analogowych i cyfrowych używanych przy wzorcowaniu płytek wzorcowych metodami interferencyjnymi. Zagadnienia aktualnie poruszane przez Młodych Naukowców. Kraków 2020.
 15. A. Evans, H. Bosse, A. Balsamo, V. Zeleny, D. Czulek, D. O'Connor, T. Yandayan, D. Phillips, F. Meli, C. S. Ragusa, O. Flys: Metrology for advanced manufacturing – the networking project AdvManuNet. The magazine of the Institute of Measurement and Control. Issue 18, Dec. 2020.

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3. K. Drąg: 145 lat Konwencji Metrycznej. Biuletyn Metrologia i Probiernictwo 1(24)/2020.
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5. J. D. Fidelus: Udział Głównego Urzędu Miar w europejskim projekcie badawczym EMPIR w dziedzinie siły. Biuletyn Metrologia i Probiernictwo 1(24)/2020.
6. P. Fotowicz: Historia kilograma. Biuletyn Metrologia i Probiernictwo 1(24)/2020.
7. M. Gruszczyński, A. Czubła, Ł. Czernski: e-CzasPL system niezawodnej i wiarygodnej dystrybucji czasu urzędowego na obszarze RP. Biuletyn Metrologia i Probiernictwo 2(25)/2020.
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9. D. Luśtyk: Przekształcenie wskazania analogowego przyrządu pomiarowego na postać cyfrową. Biuletyn Metrologia i Probiernictwo 2(25)/2020.
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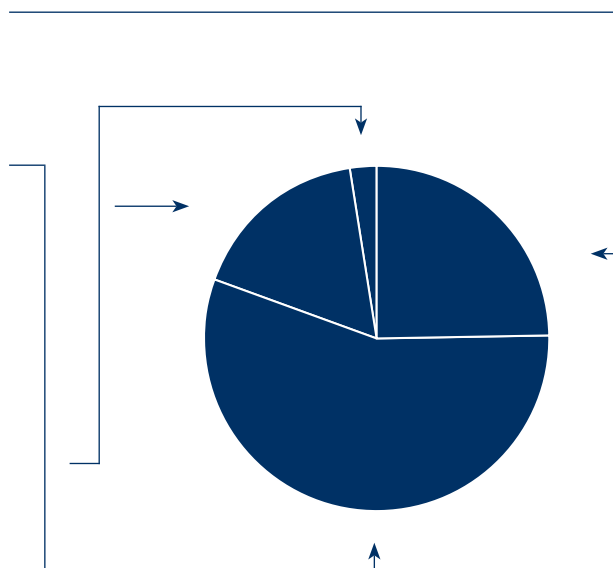
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2. Z. L. Warsza, J. Puchalski: Estimation of Uncertainties in Indirect Multivariable Measurements: Part 2. Influence of the Processing Function Accuracy. Materiały Konferencyjne XXIV Konferencja Naukowo-Techniczna Automatykacja. Warszawa 2020.
3. A. Pietrzak: Portfolio GUM w obszarze materiałów odniesienia. Materiały konferencyjne – Sympozjum Bezpieczne zarządzanie pracą w Laboratorium. Sypniewo 16-18.09.2020 r.

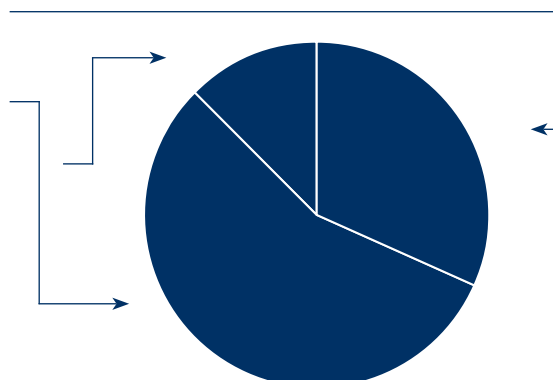
GUM IN NUMBERS

GUM BUDGET IN 2020

Revenues	in thousand PLN	%
Performing official activities	1 522,62	24,8
Performing activities under civil law contracts	3 438,91	55,9
Performing activities related to digital tachographs	1 048,85	17,0
Other revenues	143,72	2,3
Total revenues	6 154,10	100

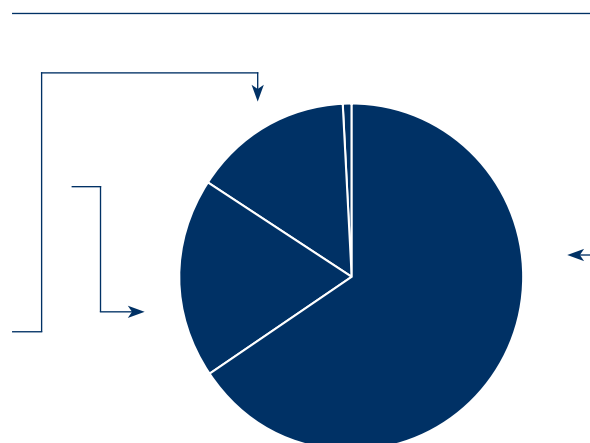


Expenditures	in thousand PLN	%
Ongoing expenditure	15 819,34	31,7
Salaries	27 786,01	55,8
Property-related expenditures	6 208,11	12,5
Total expenditure	49 813,46	100

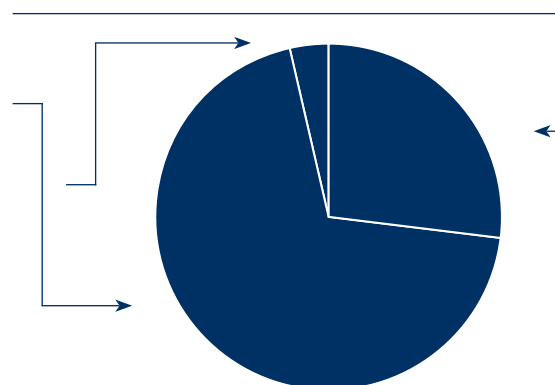


REGIONAL UNITS BUDGET IN 2020

Revenues	in thousand PLN	%
Performing official activities	39 496,25	65,6
Performing activities under civil law contracts	11 294,57	18,8
Performing assay activities	8 879,97	14,8
Other revenues	495,25	0,8
Total revenues	60 166,04	100



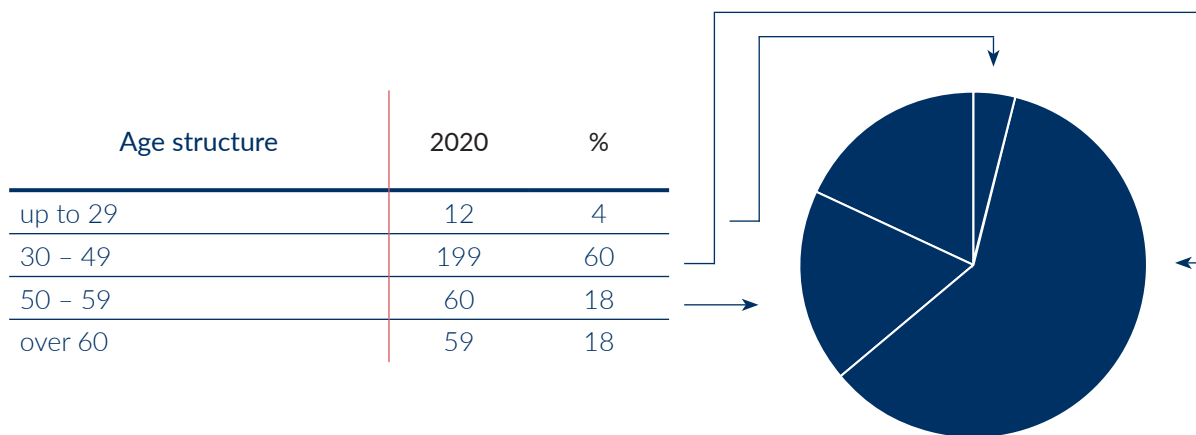
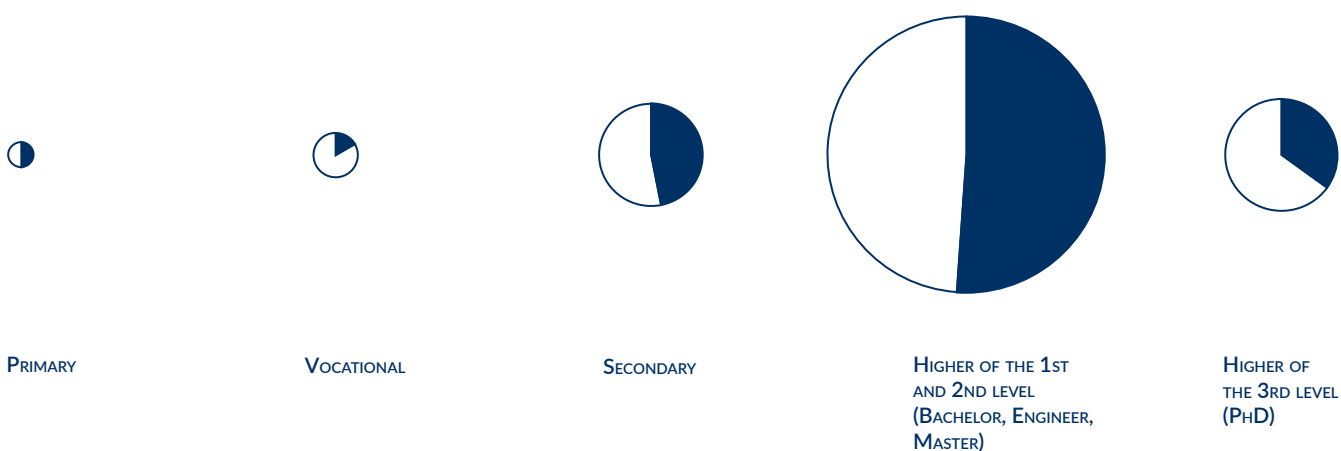
Expenditures	in thousand PLN	%
Ongoing expenditure	30 846,41	27,1
Salaries	79 195,45	69,4
Property-related expenditures	4 022,08	3,5
Total expenditure	114 063,94	100



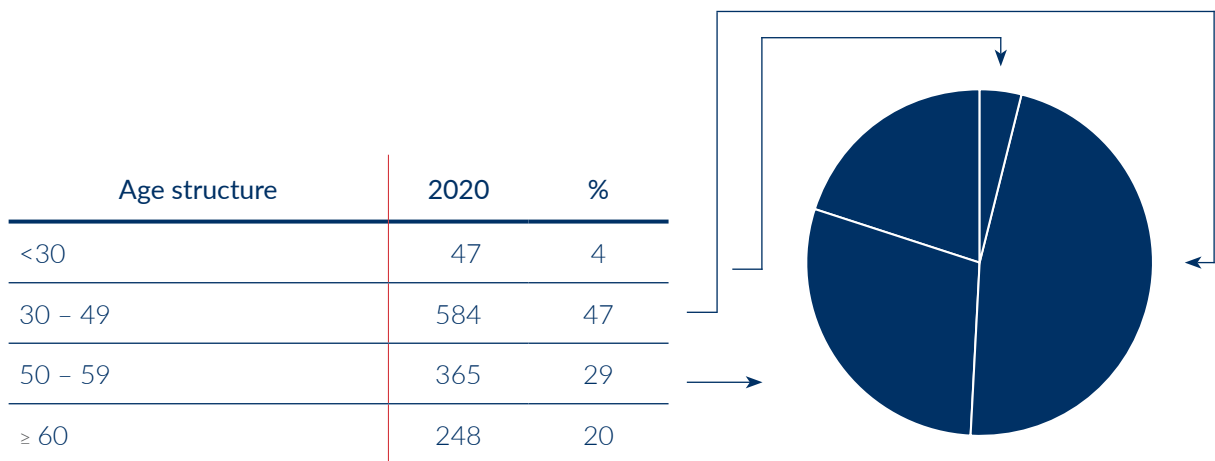
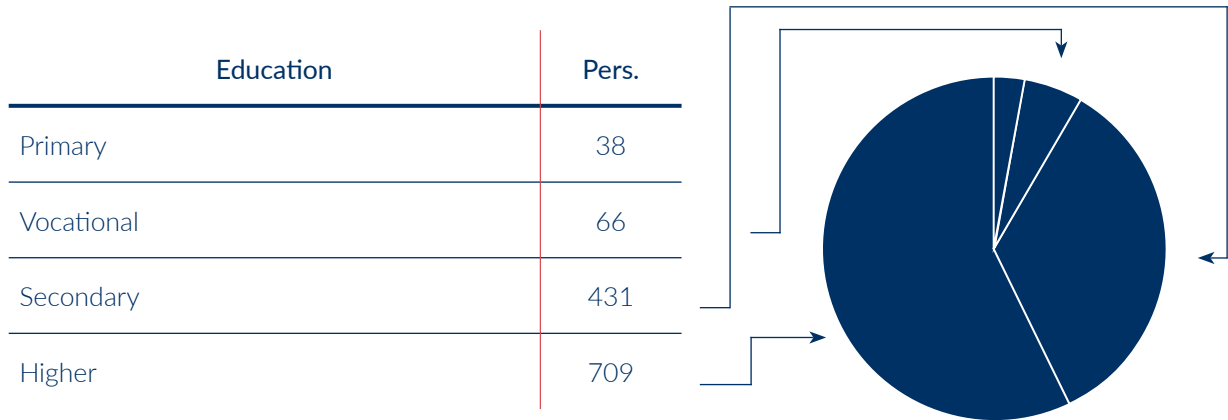
GUM'S PERSONNEL



Education	women	men
Primary	1	1
Vocational	1	5
Secondary	16	18
Higher of the 1st and 2nd level (Bachelor, Engineer, Master)	127	121
Higher of the 3rd level (PhD)	14	26



PERSONNEL – REGIONAL UNITS



SERVICES

Service	number		
	GUM	OUM*	OUP**
Calibrations	11 284	130 577	-
Expertise cases	79	4 272	-
Tests	9	2 126	-
Production and certification of reference materials	1 884	8 008	-
Type approvals (testing and decisions)	105	81	-
Verifications	-	1 161 586	-
Assaying and hallmarking articles of precious metals	-	-	4 022 203
Conformity assessment	8	9 900	-
Certification of cash registers	18	-	-
Organisation of exams	78	-	-
Authorisations for verification	15	-	-
Creation of verification units	59	17	-
Issuing of permits – digital tachographs	551	2	-
Organisation of domestic comparisons	25	6	-
Subcontractors evaluation (suppliers of large standards)	55	-	-
TOTAL	14 170	1 316 577	4 022 203

*) Regional Offices of Measures

***) Regional Assay Offices



**Central
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of Measures**

Central Office of Measures

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