Central Office of Measures (GUM)
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Central Office of Measures (GUM – polish: *Główny Urząd Miar*) is a National Metrology Institute responsible for the highest level of measurement traceability in the most metrology domains in Poland. Established in 1919.

Warsaw, August 26th, 2015

THE RELEVANT ACTIVITIES OF CENTRAL OFFICE OF MEASURES IN TIME AND FREQUENCY DOMAIN
(with given below the indexes from the list of publications and/or the name of the projects:)

- maintenance of national time and frequency standard and physical realisation of UTC(PL), coordination regional comparison and **wide participation of the Polish laboratories in creation of international atomic timescales TAI and UTC** (currently about 15 clocks of PL: 4 local clocks and more than 10 of remote clocks, compared against UTC(PL) with the usage of local time interval measurements, operational optical fiber links and GPS CV links),
(3, 4, UTCrapid)

- **the independent Polish Atomic Timescale TA(PL)**: preparation and analysing input data by Central Office of Measures and final calculation performed by Astrogeodynamical Observatory of Space Research Center of PAS in Borowiec, published in Circular T since July 1st, 2001, development Database for TA(PL),
(5, 9, 12)

- **precise time and frequency transfer over optical fiber links**: maintenance and calibration of operational optical fiber links (long distance (420 km) time and frequency transfer link with stabilization of propagation delay between GUM and AOS, operational since February 2012, and bi-directional time transfer links up to 50 km inside Urban Telecom Network in Warsaw), local experiments with optical fiber in spool and with the usage of real-world Telecom optical fiber in closed loops,
(1, 2, 7, 8, 10, 11, 13)

- **GNSS time transfer system performance monitoring**: long term comparison differences in pair of GNSS receivers connected to the same clock (CCD – Common Clock Difference) and in pair of GNSS receivers connected to different clocks connected by operational optical fiber link (DCD – Double Clock Difference) – earlier works for internal needs and since 2012: EURAMET Project #1152,
(1, 13, #1152 GNSS receiver performance monitoring)

- **precise time interval measurement with Time Interval Counters (TICs)**: analyzing long term (from a few hours) stability of time interval measurements during measurements of constant time intervals and nonlinearity effects during measurements of continuously changed time intervals (resulting influence on estimated values of uncertainty in time interval measurements during calibration time transfer systems), preparing and characterization travelling standards for time interval measurement comparison – earlier and parallel works and EURAMET Project #1288,
(6, #1288 Time interval comparison pilot study)

- active participation in the activities of Technical Committee of Time and Frequency of EURAMET (**Project #1152**: GNSS receiver performance monitoring, #**1130**: Preparation of a EURMAT guideline for the assessment of calibration laboratories using GPS signals for frequency and time traceability, #**1288**: Time interval comparison pilot study), including sharing the knowledge and experience by giving presentations.

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UPDATED LIST OF PUBLICATIONS OF CENTRAL OFFICE OF MEASURES IN TIME AND FREQUENCY DOMAIN
(in English only)

1. Jiang Z., Czubla A., Nawrocki J., Lewandowski W., Arias E. F.: Comparing a GPS time link calibration with an optical fibre self-calibration with 200 ps accuracy, Metrologia, vol. 52 (2015), 384-391
2. Śliwczyński Ł., Krehlik P., Czubla A., Buczek Ł., Lipiński M..: Dissemination of time and RF frequency via stabilized fiber optic link over the distance of 420 km, Metrologia, vol. 50 (2013), 133-145
3. Kaczmarek J., Miczulski W., Kozioł M., Czubla A.: Integrated System for Monitoring and Control of the National Time and Frequency Standard, Instrum. and Meas., IEEE Trans. on, vol. 62, poz. 10 (2013), 2828-2838
4. Czubla A., Konopka J., Nawrocki J.: Realization of atomic SI second definition in the context of UTC(PL) and TA(PL), Metrol. Meas. Syst., vol. 13 (2/2006), 149-160
5. Azoubib J., Nawrocki J., Lewandowski W.: Independent atomic timescale in Poland – organization and results, Metrologia 40 (2003), S245-S248
6. Czubla A., Osmyk R., Szterk P., Krehlik P., Śliwczyński Ł., Szplet R., Jachna Z., Różyc K., Verification of TIC Characteristics for Precise Optical Fiber Time Transfer Links, in Proc. of European Frequency and Time Forum (EFTF), 2014
7. Jiang Z, Czubla A, Nawrocki J, Lewandowski W and Arias F, Towards accurate optical fibre time transfer in UTC, in Proc. of European Frequency and Time Forum (EFTF), 2014
8. Adamowicz W., Bińczewski A., Bogacki W., Czubla A., Dunst P., Igalson J., Kołodziej J., Krehlik P., Lemański D., Lipiński M., Nawrocki J., Nogaś P., Ostapowicz P., Pawszak T., Pieczerak J., Stroiński Maciej, Śliwczyński Ł., Turza K.: OPTIME – time and frequency dissemination system based on fiber optical network – PIONIER, Proceedings of European Frequency and Time Forum & International Frequency Symposium (EFTF/IEC), 2013 Joint
9. Marszalec M., Lusawa M., Czubla A., Lewandowski W.: Research on Timescale algorithms in Database for TA(PL), Proceedings of European Frequency and Time Forum & International Frequency Symposium (EFTF/IEC), 2013 Joint
10. Czubla A., Osmyk R., Szterk P., Adamowicz W., Marszalec M., Śliwczyński Ł.: Optical Fiber Time and Frequency Transfer inside Urban Telecom Network in Warsaw – Results of Initial Tests", Proceedings of 2012 European Frequency and Time Forum, Göteborg, Sweden, April 23-27, 2012, 371-374
11. Czubla A., Śliwczyński Ł., Krehlik P., Buczek Ł., Lipiński M., Nawrocki J.: Stabilization of the propagation delay in fiber optics in a frequency distribution link using electronic delay lines: first measurement results, in Proc. 42nd Annual Precise Time and Time Interval (PTTI) Meeting, 2010, 389-396
12. Marszalec M., Czubla A., Nerkowski D.: Database for TA(PL) and UTC(PL), in Proc. 40th Annual Precise Time and Time Interval (PTTI) Meeting, Reston, VA, USA, 2008, 679-690
13. Czubla A., Konopka J., Górnik M., Adamowicz W., Struś J., Pawszak T., Romsicki J., Lipiński M., Krehlik P., Śliwczyński Ł., Wolczko A.: Comparison of precise time transfer with usage of multi-channel GPS CV receivers and optical fibers over distance of abort 3 km, in Proc. 38th Annual Precise Time and Time Interval (PTTI) Meeting, Reston, VA, USA, 2006, 337-345