

Independent atomic timescale in Poland—organization and results

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Abstract

The Polish independent atomic timescale TA(PL) was officially started on 4 July 2001. It is currently based on the indications of nine clocks from several Polish laboratories and Lithuania. The clocks at the laboratories are compared using TTS-2 multi-channel GPS receivers developed in cooperation with the Bureau International des Poids et Mesures (BIPM). The participating institutions are linked to the Central Office of Measures (GUM) in Warsaw. TA(PL) is computed as a weighted average of the participating clocks. This paper presents the clock ensemble, the data processing outline, and some experimental results.

1. Introduction

Until the year 2001 two Polish laboratories participated in International Atomic Time (TAI) and Coordinated Universal Time (UTC): the Time and Frequency Laboratory of the Central Office of Measures (GUM), and the Astrodynamical Observatory of the Polish Academy of Sciences (AOS). Their timescales were based on single caesium clocks, which were neither stable enough nor accurate enough to provide a local realization of UTC with an accuracy of several tens of nanoseconds [1, 2].

In recent years a number of high-quality caesium Hewlett-Packard HP 5071A clocks, mostly high performance versions, have been installed at several Polish public and commercial institutions. The idea thus developed to start to compare data from all available clocks in the country, using a precise method of time transfer [3]. An appropriate tool was already available: a GPS multi-channel receiver Time Transfer System 2 (TTS-2) constructed at AOS Borowiec in cooperation with the Bureau International des Poids et Mesures (BIPM) in Sèvres [4].

The uncertainty of comparisons between the participating laboratories is currently between 2 ns and 5 ns (root-mean-square, rms). Common-view observational data are gathered weekly, and a weighted average of the indications from all participating clocks is computed at the end of each month. In this way the independent Polish atomic timescale has been computed since August 1999 and officially published in the BIPM's Circular T since 4 July 2001. The aims of the new timescale are

- to improve the stability and accuracy of the Polish national timescale UTC(PL);

- to connect local atomic clocks, operating at a number of institutions, to Polish Official Time;
- to enable estimation of the quality of the participating atomic clocks;
- to increase the number of Polish clocks participating in TAI.

2. Constitution of the Polish clock ensemble

Several Polish scientific and commercial institutions are equipped with caesium frequency standards. Among them are

- the Time and Frequency Laboratory of the Central Office of Measures (GUM), Warsaw—three Cs clocks;
- the Astrodynamical Observatory of the Polish Academy of Sciences (AOS), Borowiec—one Cs clock;
- the National Institute of Telecommunication (IŁ), Warsaw—two Cs clocks;
- the Central Laboratory of the Polish Telecom (TPSA), Warsaw—one Cs clock;
- the Tele-Radio Research Institute (ITR), Warsaw—one Cs clock.

Also participating in the formation of Polish independent atomic timescale TA(PL) since 1 January 2001 is

- the Time and Frequency Standard Laboratory of the Semiconductor Physics Institute (LT), Vilnius, Lithuania—one Cs clock.

This constitutes an ensemble of nine Cs clocks, most of which are of type HP 5071A. Several other Polish institutions are