State report of current developments for picosecond precision Time-of-Flight / Time-Tagging systems

Victors Kurtenoks
Eventech, Pulka iela 3, Riga, LV-1007, Latvia

Since 2011, the Eventech team has demonstrated high competence in event timing, producing the fully CE certified ET33 time-tagging system with 2.5 (ps) precision recognized as a standard for SLR by NASA&ESA and used in more than half of the SLR stations in the world.

Recently, we have implemented certain updates for ET33 timer, including USB3.0 interface implementation, that allowed us to implement 20 (Mevents/sec) registration speed and ever more stabilize over temperature operation. These products are commercially available.

Our current development is focused on multi-channel picosecond precise time-tagging system. Target is to develop specialized timing devices platform which allows to combine several different functional, synchronized devices (PPM modulator, laser PWM, photon counter with ability to detect both edges of a pulse) in one measurement equipment. The technology should allow multiple independent measurement channels and provide stability and binding time scales of all these channels with the required picosecond precision, as well allowing easy implementation of multiple wavelengths SLR. This can significantly increase the precision of the measurements and open new opportunities in the satellite position field.

Our technology has been accepted by ESA for space application, closest mission is the 2024 HERA asteroid mission. It includes a centimeter-resolution PALT planetary altimeter, the main electronic unit of which is a precision time interval meter. The range of measured time intervals is from 0.4 to 134(μs) with a precision of 10 (ps). The calibration system of the meter allows maintaining its parameters in difficult conditions of deep space in the temperature range - 40C° ÷ +60C° and radiation level up to 100 (krad). Despite the use of the low-class generator, special compensation system keeps the accuracy value at 0.5 (ppm). Even though the mass conditions dictated severe restrictions on PCB dimensions and power consumption, the meter has a self-control system and redundancy of individual nodes.