CCTF 2012: Report of the Real Observatorio de la Armada

Francisco Javier Galindo
Real Observatorio de la Armada, Spain

Clocks and Time scales:

The Laboratory of the Time Department of the Real Observatorio de la Armada (ROA) maintains an ensemble of 5 cesium clocks, HP5071A model (three of them fitted with high performance tube) and one active Symmetricom H-maser, MHM-2010. Since May 2012, a cesium clock located at the Length Laboratory of the Centro Español de Metrología, Tres Cantos (Madrid), that was being continually monitored and compared to UTC(ROA) since December 2008, is declared to BIPM and contributes to the realization of UTC.

During the period 2009-2012, the physical realisation of the UTC(ROA) time scale has been generated from the frequency output of the H-maser acting as master clock, using the Auxiliary Output Generator output, steered by a new algorithm. This setup constitutes the new realization of UTC(ROA) since 26th February 2009 (MJD 54888). The behaviour of UTC(ROA) with respect to UTC is monitored monthly through the reported data by BIPM's CirT. UTC(ROA) is steered automatically once a week (Tuesday morning), although it allows the manual steering o be governed manually when it is required.

The most popular system for distribution of UTC(ROA) is based on NTP time protocol. ROA has a free access server (hora.roa.es); this service attends continuously more than 3.0M requests of synchronization every day. During last three years, customers with special needs on security and accuracy, demanded from ROA to establish other similar services (P2P) providing access to UTC(ROA) to several administrative governmental services and private networks. The national time scale is also disseminated by means of a Telephone Code ("European Telephone Time Code") server.

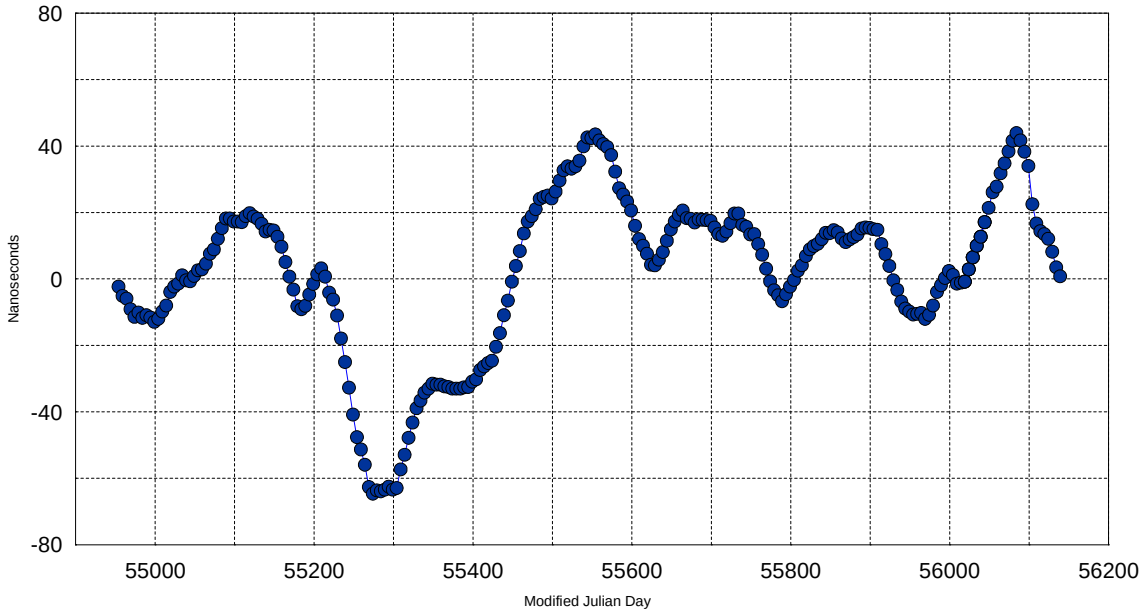

Figure 1. UTC-UTC(ROA) from 2009.5 to 2012.5

Time transfer links

The main link for the contribution of ROA to TAI is based on a TWSTFT Ku-band station. Recently, ROA has taken several measures to improve the behaviour of the main TW station (new antenna of 2,4 m of diameter, external reference frequency for Ku band transceiver, and integration of satellite simulator), and has completed the second TW station acquiring a new Satre modem. ROA has followed every time the changes that have affected to the TW links: from satellite transitions (Intelsat IS-3R to Telstar TS 11N), to the changes of schedule (October 2010), of frequencies and frequency bandwidths (July – August 2011), or frequency offset (December 2011).

A secondary time link is maintained as spare of the TW link; it is based on several geodetic receivers: one PolaRx2 from Septentrio, and one GTR-50 from DICOM. Since September 2009, ROA has a new geodetic GPS/Glonass receiver PolaRx3eTR model from Septentrio (on loan from Centro Español de Metrología CEM), that constitutes the receiver of the International GNSS Service (IGS) station denoted ROAP.

These three receivers use antennas Leica GNSS Choke-ring since February 2011, and they work routinely with either of the usual techniques: PPP or P3 (AV).

Since October 2009, ROA collaborates with INRIM in the MagicGNSS Project, providing data to obtain ODTS net solutions in quasi-real time, as an alternative to the usual time transfer techniques based on GNSS.

Following the CCTF recommendation to RMOs to extend the calibrations performed by BIPM to other regional laboratories, in June 2010 and June 2011, in collaboration with PTB and INRIM, ROA carried out two experiences for recalibrating the link PTB-ROA and calibrate the link PTB-INRIM. For these experiences we used as travelling GPS system composed by a GTR50 receiver and a Novatel GPS-702-GG antenna. The main goal of this campaign was to reduce the level of uncertainty related to the links with PTB, and consequently the uncertainty derived from the UTC – UTC(ROA) comparison. A similar experience among the same laboratories, with another two new partners: NPL and OP, is now carrying out since the beginning of September 2012.

From July 2010 to the end of 2011, ROA has taken part in the Galileo FOC Timing Interface Working Group, established by ESA and EC in order to support the definition of the operational Galileo Time Service Provider (GTSP), the dialog between Galileo system design and procurement (EC, ESA) and the European timing community, as well as to advise EC/ESA on implementation and usage of Galileo timing services.

From March 2011 to June 2012, ROA has collaborated in the ESA/Tas F TVF Project for Galileo. Since June 2012, ROA continues its contribution as an UTC(k) lab in the extension of the TGVF contract, directed to continue the tests of the initial project. The extension will cover until December 2012.

Since January 2012, ROA participates in the pilot experiment aiming to the production of a rapid UTC, that is piloted by the BIPM Time, Frequency and Gravimetry Section.

ROA and INRIM have cooperated to the calibration of the GPS base link for the Borexino experiment involved in the precise measurement of CNGS muon neutrinos speed.

References:

- H. Esteban, J. Palacio, F. J. Galindo, T. Feldmann, A. Bauch, D. Piester (2010). "Improved GPS-Based Time Link Calibration Involving ROA and PTB." IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, Vol. 57, No. 3, pp. 714-720.
- H. Esteban, J. Palacio, A. Bauch, D. Piester, G. Cerretto, T. Feldmann. "EURAMET Project 1156, GPSCALEU: Results of two years GPS receiver calibration campaign". 26th EFTF, Gothenburg, Sweden, April 2012.
- B. Caccianiga, P. Cavalcante, G. Cerretto, H. Esteban, et al. "GPS-based CERN-LNGS time link for Borexino". 2012 JINST 7 P08028.