

Meeting of the CCTF GNSS Working group

Torino, April 10, 2018 17h30

Pascale Defraigne, chair of the WG, opened the meeting and presented the meeting's [agenda](#).

1. Calibration status: Group 1 and Group2

P. Defraigne presented a [table](#) of the advancement of calibrations in time laboratories that she established from the content of the BIPM Time department database. She showed that the number of recently calibrated labs is rapidly increasing but about half of the labs are still to be visited. She asked whether a proactive action should be needed and whether there are enough G1 labs.

G. Petit presented a short [update](#) on the calibration work at the BIPM. The second Group 1 trip is now considered closed. The visit to the SU Group 1, which has been delayed to 2018, is going to start soon and will be considered part of the third (2018) Group 1 trip. The APMP part of the third G1 trip is now starting. He presented also the list of the most recently completed Group 2 trips. He indicated that a new feature in the Calibrations Guidelines will allow laboratories to transfer calibration from an existing calibrated receiver to a new receiver while keeping the traceability of the calibration in Circular T. This feature is implemented and already in use for some labs. C. Lin asked whether a sample report for such a transfer of calibration will be available and whether small labs will be able to perform this exercise. G. Petit replied that the Guidelines will be updated soon and that a sample report could be included if the need arises.

In a round of table, representatives of G1 laboratories reported on their calibration work:

- A. Bauch for PTB indicated plans to calibrate the labs AOS, GUM and LT and also got a request from INPL.
- S. Mitchell for USNO indicated plans to carry out calibrations in the NRL and in Argentina.
- T. Ido, reporting for R. Ichikawa, for NICT indicated (see [slide](#)) that KRISS and NPLI have been calibrated and that LIPI and SG are planned in 2018.
- N. Kosheliaevskii for SU indicated (see [slides](#)) that the official paperwork was ready to carry out the G1 visit by BIPM, to be started before end of May 2018. After that exercise, G2 trips to COOMET laboratories should be conducted, initially at BY, KZ, LT and UA.

2. Absolute calibration

N. Kosheliaevskii indicated (see [slides](#)) that VNIIFTRI has facilities to perform absolute calibration of receivers and antennas for all four GNSS systems. Such calibrations can be performed for the BIPM receiver which is about to travel for the G1 visit and for any other receiver under proper contract between VNIIFTRI and laboratories. Such work should pave the way for the future publication in Circular T of "Relations of UTC and TAI with predictions of UTC disseminated by GNSS" for the Galileo and BeiDou systems, following Recommendation CCTF 2 (2015).

J. Delporte presented results (see [slides](#)) comparing relative and absolute calibration for a CNES system for the GPS P1 and P2 codes. The differences for absolute calibration of receiver delays

using two different simulators was below 0.5 ns. The differences between the Group 2 relative calibration and the absolute calibration are below 1.6 ns, well consistent with the overall uncertainty. He added that absolute calibration has also been carried out for GPS C5 and Galileo E1 and E5a codes.

P. Defraigne presented results (see [slides](#)) of the AKAL project concerning absolute calibration at the ESTEC. The difference between Group 1-2 results and absolute calibration was of order 1 ns on average, i.e. consistent with the overall uncertainty but with opposite sign with respect to the CNES results. One absolutely calibrated station will be sent to the CNES for cross-checking the GPS and the Galileo results. She reported that, when two receivers of different models are put in common clock, important satellite-dependent biases (up to 2 ns peak to peak) are observed for GPS but not for Galileo.

3. Studies towards introduction of Galileo and Beidou for UTC

G. Petit presented results (see [slides](#)) of work carried out at the BIPM to prepare the future introduction of Galileo in the ensemble of time links for UTC. First comparisons of short and long distance dual frequency code links using data from five laboratories in Europe and Asia indicate that the stability of Galileo links is equivalent or slightly better than that GPS links, despite the number of Galileo observations being about 50% lower. He concluded that Galileo dual frequency code links computed with the standard method of UTC (All-in-view, corrected for precise ephemerides and clocks) are readily usable and, after proper testing, should be introduced as additional links in the UTC ensemble before the end of 2018.

P. Defraigne presented results (see [slides](#)) of comparison of time links on one short baseline ORB-PTB and one long baseline between ORB and Argentina. The study used GPS, Galileo and BeiDou data, and included the combination of all systems in a single All-in-view computation. The combination GPS+Galileo showed an improvement in stability by a factor 1.4 at short time averaging with respect to each system, while Galileo or GPS+Galileo provide similar results at longer averaging.

The meeting was closed at 19h00.

Published 3 May 2018 (P. Defraigne, G. Petit)

List of participants

Jerzy Nawrocki	AOS
Pawel Nogas	AOS
Gérard Petit	BIPM (WG secretary)
Jérôme Delporte	CNES
Pierre Waller	ESA
Giancarlo Cerretto	INRIM
Daniele Rovera	LNE-SYRTE
Pierre Urich	LNE-SYRTE
Tetsuya Ido	NICT
Bin Jian	NRC
Pascale Defraigne	ORB (WG chair)
Andreas Bauch	PTB
Kenneth Jaldehag	RISE
Carsten Rieck	RISE
Shinn-Yan (Calvin) Lin	TL
Stephen Mitchell	USNO
Nikolay Kosheliaevskii	VNIIFTRI