Meeting of the CCTF GNSS Working group
Zoom, May 18, 2022 12h00 UTC

The meeting was held as a videoconference.
These minutes and all material presented during the meeting are available at https://www.bipm.org/en/committees/cc/cctf/wg/cctf-wggnss/2022-05-18.

Pascale Defraigne, chair of the WG, opened the meeting, set a brief tour-de-table for the participants to introduce themselves, then presented the agenda.

1. G1 and G2 calibration status

G. Petit (GP) presented the status of the Group 1 calibrations (see slides), reminding that the 2020 trip was continued since last meeting. The COOMET leg is paused with the traveling receiver blocked in Russia. The SIM leg has just been completed and results show good consistency with 2018 so that the G1 reference does not need to be changed and remains realized by the BIPM reference BP21. Overall, the 2020 G1 trip shows very good stability of the results with respect to 2018. The BIPM will shortly start preparing the 2022 trip; with a first leg to APMP. The traveling receivers will then allow determination of BDS2 and BDS3 code delays.
In view of the very good stability, Pierre Uhrich (PU) questioned the 2-year repetition rate. GP replied that anyway the 2022 trip will start, in particular it will allow BDS-2 and BDS-3 calibration, and the repetition rate can be indeed reviewed in the future, but this will also depend on the evolution of the GNSS systems.
P. Defraigne (PD) presented the status of Group 2 calibration (see slides). She updated the study on the consistency between successive G2 calibration trips for new results obtained since the last meeting (7 labs). With the notable exception of one laboratory where a change of set-up is likely, the stability of results is well in line with the standard uncertainty used for G2 links in UTC. She also showed that even if the situation is improving thanks to an important number of calibrations in 2021 and 2022, there are still 33 labs having a calibration age of 5 yr or more.

Representatives of the G1 laboratories presented a summary of their activities.

- B. Patla for NIST reported that the trip to Argentina was closing and should be reported soon. A new trip to South America is planned.
- J. Hanssen for USNO indicated that a calibration for APL should be reported soon and one for NRL was foreseen.
- P. Uhrich (PU) for OP indicated that a trip for Galileo TSP is starting and will include visits to G2 labs INRIM and RISE (see slides). He also mentioned calibration work for French labs participating to UTC(OP).
- Dirk Piester (DP) for PTB reported (see slides) that two traveling systems allowed G2 calibration trips to UFE, VSL, DLR, BEV, MBM, UAE and that IMBH is ongoing and ESTEC is planned. In addition a local direct calibration of UA receiver has been performed, awaiting better conditions to return to Ukraine.
- H. Esteban for ROA reported G2 calibrations for IPQ and NPL (see slides).
- A. Karaush for SU reported G2 calibrations completed for BY and KZ in 2021 (see slides).

- C. Lin for TL reported that the trip to VMI is ongoing and that NPLI, SCL and NIMT are in planning to follow (see slide).
- R. Ichikawa for NICT reported that the trip to NAOJ had been completed and NMIJ is under way (see slide).
- Y. Wang for NIM reported that a G2 trip to KRISS, NMIA and MSL is under completion (see slides).

M. Gertsvolf asked whether UTC laboratories made use of their possibility to request calibration. GP informed that a few laboratories actively searched and found a G1 laboratory, and no lab asked to be placed in the list of "requested calibrations".
C. Plantard (CP) asked about the need for new BDS3 calibration. GP noted that more absolute calibration measurements are always welcome to confirm the present reference values which are based on the mixed calibration of one BIPM station (receiver calibrated at ESTEC, antenna at CNES).
J. Delporte (JD) reminded that CNES has conducted absolute calibration of four of their receivers and noted general good agreement (for GPS and Galileo codes) between the results of absolute calibration and those of the G2 calibration performed by OP in 2021.

2. News from the Task Force on Traceability

PD reported for A. Bauch on the work of the Task Force on Traceability from GNSS measurements (see slides). She explained the different routes proposed (unbroken chain of calibrated measurements) to go from the user signal synchronized on bUTC_GNSS to UTC, and the proposed requirements in terms of calibration depending on the needed user accuracy.

The question of the opportunity of a Recommendation for the coming CCTF 2022 meeting (end June) was raised, specially considering that the proposed Recommendation mentions Guidelines that don't exist yet.
PU also questioned the need for a Rec while the White Paper and the Guidelines are not published.
D. Rovera (DR) discussed the traceability to UTC as it must wait for the UTC publication which has a delay of several weeks. It was clarified that indeed only a traceability to a UTC(k) can be obtained before the Circular T is issued.
JD indicated the need/possibility to inform the International Committee on GNSS (ICG) at the next meeting.

3. BeiDou 3

PD presented options for the use of BeiDou systems BDS2 and BDS3 in the CGGTTS format and the program R2CGGTTS (see slides). She proposed to upgrade the R2CGGTTS to Rinex 4 navigation file in order to get directly the TGDs for BeiDou-3. These indeed are not in the Rinex 3 files, and hence using RINEX 3 would require an external file to be provided plus an additional column in the CGGTTS format to report the used TGD values. She also mentioned the required changes in the naming convention to report BDS-3 results.

GP stated that the choice is between a minimal change to the presently existing CGGTTS V2E or a more extensive change to a new version. Even in the case of minimal change to V2E using Rinex 4

information, some indication of the use of Rinex 4 should appear. In any case the backward compatibility of the new CGGTTS should be ensured.
Alexander Kuna (AKu) indicated that GTR55 already provides Rinex 4. He recommends continuing support of BDS2.
F. Meynadier (FM) noted that a new CGGTTS version may be the opportunity to use extended filenames. AKu added that it could also be the opportunity for more options in CGGTTS e.g. a choice of data interval.

4. Section 4 of Circular T

FM presented the work in progress at the BIPM to update section 4 of Circular T (see slides). The updated processing chain now clearly distinguishes the generation of DUTC values and the generation of [UTC – bUTC_GNSS] for section 4. The DUTC values can be computed from several sources, including the new RINEX 4 format recently introduced by the IGS. The predictions of UTC as broadcasted by GNSS, noted bUTC_GNSS, are computed from the data of several calibrated receivers in Group1 laboratories worldwide and a median value is used to generate the data for section 4. The whole chain is in a final testing stage and the next step is to determine the final content and format of the new section 4.

CP asked if Rinex 3 and Rinex 4 navigation data were mixed for DUTC. FM said the current software can use both, but it is still to be decided what will be chosen in production.
DR reminded that it is not possible to know which satellite the receiver use.
PD indicated that this uncertainty on DUTC is considered in the total uncertainty budget.
PD asked if there is a date to put it in production. GP said no date is fixed yet.
PU stressed the importance of having an uncertainty budget. It was then reminded that PD presented this uncertainty budget in previous meeting.

Later in the meeting, PU asked about the new naming convention (bUTC_GNSS rather than Broadcast_UTC$_{GNSS}$). As nobody opposed to this new naming, it is considered as accepted and will be noted bUTC_GNSS in ASCII and bUTC$_{GNSS}$ when typesetting allows

5. Section 5 of Circular T

GP presented the work in progress at the BIPM to improve calibration information in Circular T (see slides). He presented actions carried out following the previous WG meeting, notably the document "How to get GNSS calibration" at https://webtai.bipm.org/database/readme_clb.html. Based on the information in section 5 of Circular T, he noted that about 25% of UTC labs still lack a valid calibration and that a number of the valid ones are several years old. Proposals to improve the calibration information in Circular T have been presented by the Time Department in a document to be discussed by all relevant WGs of the CCTF. Main changes concern the treatment of very old calibrations (standard ageing uncertainty applied after 8 years, invalid after 12 years), the proposal that uncalibrated laboratories are so indicated in section 1 of Circular T instead of receiving a standard 20-ns uncertainty, and actions to limit the time validity of alignments performed by the Time Department when necessary at the time of Circular T computation.

DP asked if there was a specific reason to choose 8 years to end ageing. GP answered that choices were of conventional nature (no physical reason) and designed to have minimal impact given the present situation of calibrations. DP also asked whether the BIPM alignment was not the same as "Transfer of calibration". GP answered that the BIPM alignment is for a link (typically between the Lab and PTB) to another link, which maybe using another technique. This is different from a local transfer of calibration between GNSS receivers, which is a genuine method for equipment calibration. The BIPM wants to encourage laboratories to keep control of their receiver calibration.
DR expressed his satisfaction with the plan to stop assigning 20 ns uncertainty to uncalibrated equipment. PU also reminded that, in the CCTF survey, some laboratories claimed that they don't need calibration anyway.

6. Any other business

GP announced his retirement foreseen at the end of July 2022, and his replacement by Giulio Tagliaferro as secretary of the WG. PD thanked a lot Gérard for all his work in the WG, and invited him to participate as guest to future meetings.

The meeting was closed at 14h15 UTC.

Published on June 6 2022 (P. Defraigne, G. Petit)

List of participants

Pascale Defraigne	Chair, ORB
Gérard Petit	Secretary, BIPM

WG Members

Group 1 representatives:

Dirk Piester, for Andreas Bauch	PTB
Pierre Uhrich	OP
Hector Esteban	ROA
Ryuichi Ichikawa	NICT
Yuzhuo Wang	NIM
Bijunath Patla	NIST
Calvin Lin	TL
James Hanssen	USNO
Artem Karaush	VNIIFTRI

Giancarlo Cerretto	INRIM
Michael Coleman	NRL
Jérôme Delporte	CNES
Johann Furthner	DLR
Michael Wouters	NMIA
Paul Koppang	USNO
Alexander Kuna	UFE
Andrey Naumov	VNIIFTRI
Wenjun Wu	NTSC
Marina Gertsvolf	NRC
Judah Levine	NIST
Jerzy Nawrocki	AOS
Wenjun Wu	NTSC

Invited

Frédéric Meynadier	BIPM
Giulio Tagliaferro	BIPM
Bin Jian	NRC
Florian Heimbach	PTB
Cédric Plantard	ESTEC
Pawel Nogas	AOS
Arnold Colina	USNO
Tung Thai	INRIM

Excused

Pierre Waller	ESTEC