

2018 Group 1 GPS calibration trip (Cal_Id 1001-2018)

Summary

The 2018 visit to Group 1 laboratories is the third Group 1 trip and started in March 2018.

The trip is decomposed into several phases, each enclosed with closure at the BIPM. Some phases may be run in parallel.

- Phase 1 (March-September 2018). BIPM-TL-NICT-NIM-BIPM with the traveling receivers BP1C and BP0U;
- Phase 2 (April-October 2018): BIPM-SU-BIPM with the traveling receivers BP1K;
- Phase 3 (November 2018-February 2019): BIPM-PTB-ROA-OP-BIPM with the traveling receivers BP1C and BP1X;
- Phase 4 (March-XXX 2019): BIPM-USNO-NIST-BIPM with the traveling receivers BP1C and BP25;

The full report of the Group 1 trip is split in several sub-reports

All files indexed in this report can be accessed [here](#)

- **Reports of operations and raw data processing (one for each phase)**

- [1001-2018-Phase1-cv.pdf](#)
- [1001-2018-Phase2-cv.pdf](#)
- [1001-2018-Phase3-cv.pdf](#)

- **Excel sheet for differential calibration computations**

- [1001-2018-calcul.xls](#)

- **Reports of differential calibration computations (one for each phase)**

- [1001-2018-Phase1-report.pdf](#)
- [1001-2018-Phase2-report.pdf](#)
- [1001-2018-Phase3-report.pdf](#) (draft as of 15/03/2019)

- **Report on selecting reference values to compute final results of this trip**

[TM266_Group1-followon-values.pdf](#)

- **Final results for the visited systems**

Table 1 lists the final values of P1/P2/C1 INTDLY values from the 1001-2018 Group 1 trip, along with information on the REFDLY and CABDLY values used in the processing of the calibration results.

For any link A-B, the uncertainty resulting from the calibration, $U_B(A-B)$, is computed as

$$U_B(A-B)^2 = (U_{CAL0}^2 + \Delta U_{CAL}(A)^2 + \Delta U_{CAL}(B)^2)^{1/2} \quad (1)$$

where U_{CAL0} is the conventional value chosen for the whole calibration trip and where ΔU_{CAL} is generally zero, except for some systems for specific reasons. See the reports of differential calibration computations for all information on U_{CAL0} and ΔU_{CAL} . The values ΔU_{CAL} are indicated in Table 1.

For P3 links, U_{CAL0} is 1.5 ns.

For single frequency links, U_{CAL0} is 1.2 ns but should be complemented by an additional component to represent systematic errors in the ionospheric model.

Table 1. Final P1/P2/C1 INTDLY values from the 1001-2018 Group 1 trip. Values of REFDLY and CABDLY at the epoch of calibration are also indicated for reference (all values in ns). “Meas. Date” refers to the first day of the differential calibration, to which the calibration results can be applied.

| System | BIPM code | Meas. Date | INTDLY P1 | INTDLY P2 | INTDLY C1 | REFDLY | CABDLY | Note | Implem. date | ΔU_{CAL} |
|--------------------------------|-----------|------------|-----------|-----------|-----------|--------|--------|------|--------------|------------------|
| BP1J | BP1J | | 53.0 | 52.6 | 54.4 | | | (1) | | |
| PHASE 1 (TL, NICT, NIM) | | | | | | | | | | |
| TLT1 | TLT1 | 2018/04/21 | 415.3 | 424.3 | 415.1 | N/A | N/A | (2) | 58421 | 0.0 |
| TLT2 | TLT2 | 2018/04/21 | -35.6 | -36.5 | -33.8 | 24.5 | 140.3 | | 58421 | 0.0 |
| TLT4 | TLT4 | 2018/04/21 | 117.8 | 117.3 | 119.2 | 0.0 | N/A | (3) | 58421 | 0.0 |
| NC01 | NC01 | 2018/06/01 | 218.3 | 222.3 | 221.4 | 406.0 | 213.4 | | 58421 | 0.8 |
| NC5G | NC5G | 2018/06/01 | -30.9 | -19.0 | -38.5 | 168.3 | 268.7 | (4) | 58421 | 0.8 |
| NC4S | NC4S | 2018/06/01 | 276.7 | 276.4 | 278.1 | 312.7 | N/A | (3) | 58421 | 0.8 |
| BJNM | IM05 | 2018/08/15 | 74.4 | 81.7 | 76.1 | 331.6 | 125.0 | | 58421 | 0.0 |
| IM20 | IM20 | 2018/08/15 | -22.0 | -3.6 | -20.5 | 147.1 | 205.1 | | 58421 | 0.0 |
| IM21 | IM21 | 2018/08/15 | -25.9 | -33.4 | -24.9 | 131.5 | 215.0 | | 58421 | 0.0 |
| IMEJ | IM06 | 2018/08/15 | -31.8 | -18.4 | -31.0 | 121.7 | 248.7 | (4) | 58421 | 0.0 |
| IMEL | IM12 | 2018/08/15 | -40.9 | -40.4 | -38.9 | 147.1 | 201.4 | (4) | 58421 | 0.5 |
| IMEU | IM03 | 2018/08/15 | -24.8 | -12.1 | -23.4 | 120.1 | 250.3 | | 58421 | 0.0 |
| TF10 | IM30 | 2018/08/15 | -26.6 | -37.8 | -25.7 | 153.0 | 215.0 | | 58421 | 0.0 |
| TF11 | IM31 | 2018/08/15 | -29.8 | -40.3 | -28.6 | 130.5 | 215.0 | | 58421 | 0.0 |
| PHASE 2 (SU) | | | | | | | | | | |
| SU19 | SU19 | 2018/05/26 | -30.3 | -28.9 | -28.3 | 194.5 | 48.2 | | 58451 | 0.0 |
| SU31 | SU31 | 2018/05/26 | 36.5 | 34.5 | 38.5 | 207.5 | 143.2 | (4) | 58451 | 0.0 |
| SUCL | SUCL | 2018/05/26 | -35.6 | -35.4 | -33.6 | 207.5 | 128.2 | (4) | 58451 | 0.0 |
| PHASE 3 (PTB, ROA, OP) | | | | | | | | | | |
| PTBB | PT02 | 2018/11/20 | 305.5 | 320.7 | 306.1 | 74.6 | 301.7 | | 58571 | 0.0 |
| PTBG | PT03 | 2018/11/20 | 302.2 | 324.9 | 302.6 | 46.5 | 251.4 | | 58571 | 0.0 |
| PT07 | PT07 | 2018/11/20 | -36.9 | -24.6 | -35.5 | 43.4 | 245.8 | (4) | 58571 | 0.0 |
| PT09 | PT09 | 2018/11/20 | 56.7 | 55.7 | 58.1 | 183.2 | 198.7 | | 58571 | 0.0 |
| PT10 | PT10 | 2018/11/20 | -26.5 | -33.2 | -24.5 | 52.0 | 250.0 | | 58571 | 0.0 |
| RO_5 | RO_5 | 2016/10/28 | 8.4 | 26.5 | 7.0 | 306.9 | 91.5 | (4) | 58571 | 0.0 |
| RO_6 | RO_6 | 2018/12/14 | 54.7 | 53.5 | 56.3 | 484.9 | 82.0 | | 58571 | 0.0 |
| RO_7 | RO_7 | 2018/12/14 | 55.0 | 53.9 | 56.3 | 452.3 | 89.9 | | 58571 | 0.0 |
| RO_8 | RO_8 | 2018/12/14 | -22.8 | -23.3 | -20.6 | 20.4 | 202.7 | | 58571 | 0.0 |
| RO_9 | RO_9 | 2018/12/14 | 55.5 | 54.4 | 56.9 | 451.8 | 59.7 | | 58571 | 0.0 |
| RO10 | RO10 | 2018/12/14 | 28.6 | 27.5 | 30.4 | 5.1 | 204.8 | | 58571 | 0.0 |
| OPMT | OP02 | 2019/01/17 | 308.4 | 320.2 | 309.0 | 155.9 | 156.5 | | 58571 | 0.0 |
| OP71 | OP71 | 2019/01/17 | 55.2 | 53.8 | 56.7 | 191.7 | 128.7 | | 58571 | 0.0 |
| OPM9 | OPM9 | 2019/01/17 | -34.1 | -37.3 | -32.1 | 60.5 | 173.3 | | 58571 | 0.0 |

Notes:

- (1) BP1J is included in order to provide reference for BIPM-led specific calibrations.
- (2) Results are Total Delay values (TOTDLY).
- (3) Results are System Delay values (SYSDLY).
- (4) For GTR50/51 the listed INTDLY values are total values. Direct results of the calibration are changes with respect to the values previously entered in the receiver (all values in ns):

| BIPM code | P1 | P2 | C1 |
|------------------|-----------|-----------|-----------|
| NC5G | 0.1 | 0.2 | 0.0 |
| IM06 | -0.5 | -0.5 | -0.6 |
| IM12 | -7.4 | -5.2 | -11.5 |
| SU31 | -1.8 | -2.3 | -0.7 |
| SUCL | -1.0 | -0.9 | 0.2 |
| PT07 | 0.0 | -0.3 | -0.1 |
| RO_5 | -1.9 | -0.8 | -1.5 |
| | | | |

Version history

V1.0 2018/11/15: Final APMP results from version V1.1 of the report [1001-2018-Phase1-report.pdf](#), to be implemented in G1 receivers as coordinated by the BIPM Time Department.
Draft COOMET results from V1.0 of the report [1001-2018-Phase2-report.pdf](#).

V1.1 2018/11/30: APMP results unchanged, but link to version V1.2 of the report [1001-2018-Phase1-report.pdf](#).
Final COOMET results, unchanged from draft, from V1.0 of the report [1001-2018-Phase2-report.pdf](#).

V1.2 2018/12/10: Correction in Table 1 to the NC5G INTDLY values, and a typo in TF10.

V1.3 2019/03/15: Final EURAMET results from version V1.0 of the report [1001-2018-Phase3-report.pdf](#) to be implemented in G1 receivers as coordinated by the BIPM Time Department.