

Initial Group 1 calibration trip

Several visits of the BIPM equipment 'METODE' to Group 1 laboratories have been carried out between April 2013 and September 2014 to carry out tests of the equipment. These visits were successful and it was decided to consider them as the start of the initial Group 1 calibration trip.

Because the set-up of the METODE was not constant in all visits, the trip is actually separated in several phases:

- Phase 1 (March-April 2013). BIPM-OP-BIPM with the two traveling receivers BP0T and BP0U;
- Phase 2 (April 2013-September 2014). BIPM-PTB-BIPM-TL-BIPM-NMIJ-NICT-BIPM-NIM-BIPM-ROA-BIPM with the two traveling receivers BP1C and BP0U;

The starting session (at BIPM) for the second phase corresponds to the closing session of the first phase.

- Phase 3 (XXXX 2014). BIPM-SU-BIPM with the traveling receiver BP1K;
- Phase 4 (starting January 2015). BIPM-NIST-USNO-BIPM with the two traveling receivers BP1C and BP0U.

Trip 1001-2014: Report of phase 2

1. Description of equipment and operations

1.1 Traveling equipment

- Traveling systems:

Two systems are included in the BIPM traveling calibrator: BP0U and BP1C, see Table 1 and the report of operations [1001-2014-Phase2-cv.pdf](#).

The long term stability of the two systems is described in the [BIPM Technical Memorandum 204](#).

- Other traveling equipment:

See Annex 1 of the Guidelines (TO BE CHECKED)

1.2 Visited equipment

See a summary in Table 1. The detailed information on the set-up and on the measurements performed is in the report of operations [1001-2014-Phase2-cv.pdf](#).

- Summary table

Table 1. Summary information on phase 2 of the calibration trip 1001-2014

Institute	Status of equipment	Dates of measurement	BIPM code	RINEX name	Receiver type
BIPM	Traveling		BP1C	BP1C	Septentrio PolaRx3eTR
BIPM	Traveling		BPOU	BPOU	Dicom GTR50
BIPM	BIPM reference	56407-56412	BPOR	BPOR	Septentrio PolaRx2eTR
PTB	G1 reference	56464-56470	PT02	PTBB	Ashtech Z12-T
PTB	G1 backup	56464-56470	PT03	PTBG	Ashtech Z12-T
BIPM	BIPM reference	56572-56579	BPOR	BPOR	Septentrio PolaRx2eTR
TL	G1 reference	56603-56609	TL1Z	TWTF	Ashtech Z12-T
TL	G1 reference	56646-56649	TL1Z	TWTF	Ashtech Z12-T
BIPM	BIPM reference	56667-56673	BPOR	BPOR	Septentrio PolaRx2eTR
NMIJ	G2 reference	56715-56721	NM0C	NM0C	Ashtech Z12-T
NICT	G1 reference	56724-56731	NC02	NC02	Septentrio PolaRx2
NICT	G1 backup	56724-56731	????	SEPA	Septentrio PolaRx2
BIPM	BIPM reference	56762-56769	BPOR	BPOR	Septentrio PolaRx2eTR
NIM	G1 reference	56819-56825	IM06	IMEJ	Dicom GTR50
NIM	G1 backup	56819-56825	IMEU	IMEU	Javad E_GGD
NIM	G1 backup	56819-56825	????	BJNM	PolaRx3eTR
BIPM	BIPM reference	56863-56866	BPOR	BPOR	Septentrio PolaRx2eTR
PTB	G1 reference	56877-56885	PT02	PTBB	Ashtech Z12-T
PTB	G1 backup	56464-56470	PT03	PTBG	Ashtech Z12-T
ROA	G1 backup	56894-56903	????	RO_4	Septentrio PolaRx2
ROA	G1 backup	56894-56903	RO_5	RO_5	Dicom GTR50
ROA	G1 reference	56894-56903	ROAP	RO_6	Septentrio PolaRx3eTR
ROA	G1 backup	56894-56903	????	RO_7	Septentrio PolaRx4TR
BIPM	BIPM reference	56912-56916	BPOR	BPOR	Septentrio PolaRx2eTR

2. Data used

Rinex files have been obtained from all receivers participating to this trip. They are available in G:\calib\Group1\2013-2014\dclrinex\

3. Results of raw data processing

- The raw code differences have been generated by the DCLRINEX procedure (see Guidelines Annex 3). Each run for a pair of stations generates 3 files (summary .sum, data .dif, plot .pdf). All files are available in G:\calib\Group1\1001-2014. All P1/P2 measurements are indicated with 2 digits numeric precision in order to minimize rounding errors in computing P3 values.
- For each pair (traveling – visited) or (traveling – reference):
 - Plots of the data differences and of the statistical analysis (Tdev) are in the report of operations [1001-2014-Phase2-cv.pdf](#);
 - The inferred RAWDIF(P1) and RAWDIF(P2) are taken as the median of the raw differences. The associated uncertainties are taken as the floor of the Tdev values, with a minimum of 0.1 ns.
- Summary tables.

For this report, the BIPM system BP0R is considered to be the reference and has been visited between each leg of the trip.

Table 2.1 Raw differential results for all pairs (Traveling – Reference) (ns)

Labo	Date	Pair	RAWDIF(P1)	Unc	RAWDIF(P2)	Unc
BIPM	56407-56412	BP1C-BP0R	0.50	0.1	2.35	0.1
BIPM	56572-56579	BP1C-BP0R	-78.44	0.1	-76.26	0.1
BIPM	56667-56673	BP1C-BP0R	-77.68	0.2	-75.53	0.1
BIPM	56762-56769	BP1C-BP0R	-53.84	0.1	-51.50	0.2
BIPM	56863-56866	BP1C-BP0R	-54.15	0.2	-51.95	0.1
BIPM	56912-56916	BP1C-BP0R	-54.45	0.1	-52.22	0.1
BIPM	56407-56412	BP0U-BP0R	-82.39	0.1	-79.30	0.2
BIPM	56572-56579	BP0U-BP0R	-114.31	0.2	-110.90	0.2
BIPM	56667-56673	BP0U-BP0R	-114.46	0.1	-111.11	0.1
BIPM	56762-56769	BP0U-BP0R	-93.14	0.1	-89.93	0.2
BIPM	56863-56866	BP0U-BP0R	-92.82	0.1	-89.39	0.2
BIPM	56912-56916	BP0U-BP0R	-93.20	0.1	-89.72	0.2

Table 2.2 Raw differential results for all pairs (Traveling – Visited) (ns)

Labo	Date	Pair	RAWDIF(P1)	Unc	RAWDIF(P2)	Unc
PTB	56464-56470	BP1C-PTBB	-493.38	0.1	-504.14	0.1
PTB	56464-56470	BPOU-PTBB	-548.75	0.1	-558.47	0.1
PTB	56464-56470	BP1C-PTBG	-467.58	0.1	-485.38	0.1
PTB	56464-56470	BPOU-PTBG	-522.94	0.1	-539.73	0.1
TL	56603-56609	BP1C-TWTF	-319.27	0.2	-323.92	0.5
TL	56603-56609	BPOU-TWTF	-381.23	0.2	-384.57	0.4
TL	56646-56649	BP1C-TWTF	-319.29	0.2	-323.16	0.4
TL	56646-56649	BPOU-TWTF	-381.10	0.2	-383.84	0.3
NMIJ	56715-56721	BP1C-NM0C	-438.12	0.1	-446.04	0.1
NMIJ	56715-56721	BPOU-NM0C	-497.57	0.1	-504.58	0.1
NICT	56724-56731	BP1C-NC02	-416.86	0.1	-418.63	0.1
NICT	56724-56731	BPOU-NC02	-473.06	0.1	-473.66	0.1
NICT	56724-56731	BP1C-SEPA	-403.12	0.1	-403.58	0.2
NICT	56724-56731	BPOU-SEPA	-459.29	0.1	-458.62	0.2
NIM	56819-56825	BP1C-IMEJ	-78.42	0.1	-76.28	0.1
NIM	56819-56825	BPOU-IMEJ	-120.94	0.1	-117.47	0.1
NIM	56819-56825	BP1C-IMEU	-185.18	0.1	-193.96	0.1
NIM	56819-56825	BPOU-IMEU	-227.68	0.1	-235.09	0.2
NIM	56819-56825	BP1C-BJNM	40.25	0.2	36.79	0.1
NIM	56819-56825	BPOU-BJNM	-2.25	0.1	-4.41	0.1
PTB	56877-56885	BP1C-PTBB	-526.42	0.1	-537.28	0.1
PTB	56877-56885	BPOU-PTBB	-585.51	0.1	-595.15	0.1
PTB	56877-56885	BP1C-PTBG	-500.71	0.1	-518.69	0.1
PTB	56877-56885	BPOU-PTBG	-559.75	0.1	-576.56	0.1
ROA	56894-56903	BP1C-RO_4	-218.63	0.1	-218.81	0.1
ROA	56894-56903	BPOU-RO_4	-278.93	0.1	-277.66	0.1
ROA	56894-56903	BP1C-RO_5	-22.26	0.1	-15.49	0.2
ROA	56894-56903	BPOU-RO_5	-82.54	0.1	-74.39	0.1
ROA	56894-56903	BP1C-RO_6	76.37	0.1	83.41	0.1
ROA	56894-56903	BPOU-RO_6	16.14	0.1	24.54	0.1
ROA	56894-56903	BP1C-RO_7	13.60	0.1	20.04	0.1
ROA	56894-56903	BPOU-RO_7	-46.61	0.1	-38.84	0.1

4. Calibration results

In the first step, one computes ΔSYSDLY , the differences of SYSDLY for all pairs (Traveling-Reference) and (Traveling-Visited), from

$$\Delta\text{SYSDLY}_{A-B}(\text{Code}) = \text{RAWDIF}_{A-B}(\text{Code}) + \text{REFDLY}_A - \text{REFDLY}_B \quad (1)$$

where RAWDIF(Code) is read in Table 2 and where the values REFDLY are in the report of operations [1001-2014-Phase2-cv.pdf](#);

The ΔSYSDLY values are reported in Table 3 for the pairs Traveling-Reference (section 4.1) and in Table 4 for the pairs Traveling-Visited (section 4.2).

In the second step one computes ΔSYSDLY (Visited-Reference) for all visited systems.

$$\Delta\text{SYSDLY}_{V-R} = \Delta\text{SYSDLY}_{T-R} - \Delta\text{SYSDLY}_{T-V}. \quad (2)$$

One can then compute ΔINTDLY (Visited-Reference) for all visited systems.

$$\Delta\text{INTDLY}_{V-R} = \Delta\text{SYSDLY}_{V-R} - \text{CABDLY}_V + \text{CABDLY}_R \quad (3)$$

where the values CABDLY are taken from the report of operations [1001-2014-Phase2-cv.pdf](#);

Tables 5 reports the $\Delta\text{INTDLY}_{V-R}$ results for the pairs Visited-Reference (section 4.3).

Using assumed INTDLY_R values for the Reference system, Table 6 then reports INTDLY_V for all visited systems (section 4.4).

4.1 Traveling system with respect to the reference system

Table 3. Traveling vs. Reference system (all values in ns)

Pair	Date	REFDLY _T	REFDLY _R	Note	L1 (ns)		L2 (ns)	
					RAWDIF	ΔSYSDLY	RAWDIF	ΔSYSDLY
BP1C-BPOR	56407-56412	216.6	282.6		0.50	-65.50	2.35	-63.65
BP1C-BPOR	56572-56579	261.7	250.9		-78.44	-67.64	-76.26	-65.46
BP1C-BPOR	56667-56673	260.9	251.0		-77.68	-67.78	-75.53	-65.63
BP1C-BPOR	56762-56769	257.2	270.2		-53.84	-66.84	-51.50	-64.50
BP1C-BPOR	56863-56866	257.9	270.5		-54.15	-66.75	-51.95	-64.55
BP1C-BPOR	56912-56916	257.9	270.3		-54.45	-66.85	-52.22	-64.62
		Misclosure				2.28		1.98
BP1C-BPOR		Mean				-66.89		-64.74
BPOU-BPOR	56407-56412	54.2	282.6		-82.39	-310.79	-79.30	-307.70
BPOU-BPOR	56572-56579	54.2	250.9		-114.31	-311.01	-110.90	-307.60
BPOU-BPOR	56667-56673	54.2	251.0		-114.46	-311.26	-111.11	-307.91
BPOU-BPOR	56762-56769	52.6	270.2		-93.14	-310.74	-89.93	-307.53
BPOU-BPOR	56863-56866	52.6	270.5		-92.82	-310.72	-89.39	-307.29
BPOU-BPOR	56912-56916	52.6	270.3		-93.20	-310.90	-89.72	-307.42
		Misclosure				0.54		0.62
BPOU-BPOR		Mean				-310.90		-307.58

4.2 Traveling system with respect to the visited systems

Table 4. Traveling vs. Visited systems (all values in ns)

Pair	Date	REFDLY _T	REFDLY _V	Note	L1 (ns)		L2 (ns)	
					RAWDIF	ΔSYSDLY	RAWDIF	ΔSYSDLY
BP1C-PTBB	56464-56470	249.4	75.3	*	-493.38	-319.28	-504.14	-330.04
BPOU-PTBB	56464-56470	61.5	75.3	*	-548.75	-562.55	-558.47	-572.27
BP1C-PTBG	56464-56470	249.4	48.2		-467.58	-266.38	-485.38	-284.18
BPOU-PTBG	56464-56470	61.5	48.2		-522.94	-509.64	-539.73	-526.43
BP1C-TWTF	56603-56609	234.1	52.0		-319.27	-137.17	-323.92	-141.82
BPOU-TWTF	56603-56609	52.6	52.0		-381.23	-380.63	-384.57	-383.97
BP1C-TWTF	56646-56649	234.1	52.0		-319.29	-137.19	-323.16	-141.06
BPOU-TWTF	56646-56649	52.6	52.0		-381.10	-380.50	-383.84	-383.24
BP1C-NMOC	56715-56721	216.7	32.4	*	-438.12	-253.82	-446.04	-261.74
BPOU-NMOC	56715-56721	33.2	32.4	*	-497.57	-496.77	-504.58	-503.78
BP1C-NC02	56724-56731	666.5	429.7	**	-416.86	-180.06	-418.63	-181.83
BPOU-NC02	56724-56731	479.6	429.7	**	-473.06	-423.16	-473.66	-423.76
BP1C-SEPA	56724-56731	666.5	406.1	**	-403.12	-142.72	-403.58	-143.18
BPOU-SEPA	56724-56731	479.6	406.1	**	-459.29	-385.79	-458.62	-385.12
BP1C-IMEJ	56819-56825	364.6	0.0	***	-78.42	286.18	-76.28	288.32
BPOU-IMEJ	56819-56825	163.6	0.0	***	-120.94	42.66	-117.47	46.13
BP1C-IMEU	56819-56825	364.6	115.5		-185.18	63.92	-193.96	55.14
BPOU-IMEU	56819-56825	163.6	115.5		-227.68	-179.58	-235.09	-186.99
BP1C-BJNM	56819-56825	364.6	315.3		40.25	89.55	36.79	86.09
BPOU-BJNM	56819-56825	163.6	315.3		-2.25	-153.95	-4.41	-156.11
BP1C-PTBB	56877-56885	282.5	75.3	*	-526.42	-319.22	-537.28	-330.08
BPOU-PTBB	56877-56885	98.2	75.3	*	-585.51	-562.61	-595.15	-572.25
BP1C-PTBG	56877-56885	282.5	48.2		-500.71	-266.41	-518.69	-284.39
BPOU-PTBG	56877-56885	98.2	48.2		-559.75	-509.75	-576.56	-526.56
BP1C-RO_4	56894-56903	309.3	218.9		-218.63	-128.23	-218.81	-128.41
BPOU-RO_4	56894-56903	125.7	218.9		-278.93	-372.13	-277.66	-370.86
BP1C-RO_5	56894-56903	309.3	0.3	***	-22.26	286.74	-15.49	293.51
BPOU-RO_5	56894-56903	125.7	0.3	***	-82.54	42.86	-74.39	51.01
BP1C-RO_6	56894-56903	309.3	218.3		76.37	167.37	83.41	174.41
BPOU-RO_6	56894-56903	125.7	218.3		16.14	-76.46	24.54	-68.06
BP1C-RO_7	56894-56903	309.3	171.5		13.60	151.40	20.04	157.84

* Values of REFDLY_V taken from the CGGTTS header.

** Values from messages by T. Gotoh 9/3/2014, 20/3/2014, 23/6/2014; I have added 8.7 ns to comply with the conventional definition for PolaRx2.

*** Value of REFDLY_V = 122.2 ns already accounted for in the Rinex files

4.3 Visited systems with respect to reference system

The Table 5 provides the values obtained by differencing Tables 3 and 4. CABDLY values are taken from the report of operations [1001-2014-Phase2-cv.pdf](#).

Table 5. Visited vs. Reference (all values in ns)

Pair	Date	CABDLY _V	CABDLY _R	Note	L1		L2	
					ΔSYSDLY	ΔINTDLY	ΔSYSDLY	ΔINTDLY
PTBB-BPOR via BP1C	2013.5	301.7	133.4		252.39	84.09	265.30	97.00
PTBB-BPOR via BPOU	2013.5	301.7	133.4		251.65	83.35	264.69	96.39
PTBG-BPOR via BP1C	2013.5	251.4	133.4		199.49	81.49	219.44	101.44
PTBG-BPOR via BPOU	2013.5	251.4	133.4		198.74	80.74	218.85	100.85
TWTF-BPOR via BP1C	2013.9	119.8	133.4		70.28	83.88	77.08	90.68
TWTF-BPOR via BPOU	2013.9	119.8	133.4		69.73	83.33	76.39	89.99
TWTF-BPOR via BP1C	2014.0	119.8	133.4		70.30	83.90	76.32	89.92
TWTF-BPOR via BPOU	2014.0	119.8	133.4		69.60	83.20	75.66	89.26
NMOC-BPOR via BP1C	2014.2	234.1	133.4		186.93	86.23	197.00	96.30
NMOC-BPOR via BPOU	2014.2	234.1	133.4		185.87	85.17	196.20	95.50
NC02-BPOR via BP1C	2014.2	248.5	133.4		113.17	-1.93	117.09	1.99
NC02-BPOR via BPOU	2014.2	248.5	133.4		112.26	-2.84	116.18	1.08
SEPA-BPOR via BP1C	2014.2	213.4	133.4		75.83	-4.17	78.44	-1.56
SEPA-BPOR via BPOU	2014.2	213.4	133.4		74.89	-5.11	77.54	-2.46
IMEJ-BPOR via BP1C	2014.4	0.0	133.4	*	-353.07	-219.67	-353.06	-219.66
IMEJ-BPOR via BPOU	2014.4	0.0	133.4	*	-353.56	-220.16	-353.71	-220.31
IMEU-BPOR via BP1C	2014.4	250.3	133.4		-130.81	-247.71	-119.88	-236.78
IMEU-BPOR via BPOU	2014.4	250.3	133.4		-131.32	-248.22	-120.59	-237.49
BJNM-BPOR via BP1C	2014.4	125.0	133.4		-156.44	-148.04	-150.83	-142.43
BJNM-BPOR via BPOU	2014.4	125.0	133.4		-156.95	-148.55	-151.47	-143.07
PTBB-BPOR via BP1C	2014.6	301.7	133.4		252.33	84.03	265.34	97.04
PTBB-BPOR via BPOU	2014.6	301.7	133.4		251.71	83.41	264.67	96.37
PTBG-BPOR via BP1C	2014.6	251.4	133.4		199.52	81.52	219.65	101.65
PTBG-BPOR via BPOU	2014.6	251.4	133.4		198.85	80.85	218.98	100.98
RO_4-BPOR via BP1C	2014.7	217.5	133.4		61.34	-22.76	63.67	-20.43
RO_4-BPOR via BPOU	2014.7	217.5	133.4		61.23	-22.87	63.28	-20.82
RO_5-BPOR via BP1C	2014.7	0.0	133.4	*	-353.63	-220.23	-358.25	-224.85
RO_5-BPOR via BPOU	2014.7	0.0	133.4	*	-353.76	-220.36	-358.59	-225.19
RO_6-BPOR via BP1C	2014.7	66.7	133.4		-234.26	-167.56	-239.15	-172.45
RO_6-BPOR via BPOU	2014.7	66.7	133.4		-234.44	-167.74	-239.52	-172.82
RO_7-BPOR via BP1C	2014.7	81.9	133.4		-218.29	-166.79	-222.58	-171.08
RO_7-BPOR via BPOU	2014.7	81.9	133.4		-218.49	-166.99	-222.94	-171.44

* Value of CABDLY_V = 248.7 ns already accounted for in the Rinex files

4.4 Provisional INTDLY values of visited systems

Table 6 lists provisional INTDLY values of the visited systems using BIPM standard reference values for BP0R (L1=221.5 ns; L2=224.5 ns).

Final INTDLY values will be based on a reference computed after the completion of phases 1 and 2 of the trip 1101-2014. This reference will be provided in [TM243 Group1-reference-values V6.pdf](#). Final INTDLY values are reported in the global report of the trip 1001-2014 available [here](#).

Table 6. Provisional INTDLY values of Visited systems using BIPM reference values for the reference systems BP0R (all values in ns)

Pair	Date	P1	P2
		INTDLY _v	INTDLY _v
PTBB-BP0R via BP1C	2013.5	305.59	321.50
PTBB-BP0R via BP0U	2013.5	304.85	320.89
PTBG-BP0R via BP1C	2013.5	302.99	325.94
PTBG-BP0R via BP0U	2013.5	302.24	325.35
TWTF-BP0R via BP1C	2013.9	305.38	315.18
TWTF-BP0R via BP0U	2013.9	304.83	314.49
TWTF-BP0R via BP1C	2014.0	305.40	314.42
TWTF-BP0R via BP0U	2014.0	304.70	313.76
NMOC-BP0R via BP1C	2014.2	307.73	320.80
NMOC-BP0R via BP0U	2014.2	306.67	320.00
NC02-BP0R via BP1C	2014.2	219.57	226.49
NC02-BP0R via BP0U	2014.2	218.66	225.58
SEPA-BP0R via BP1C	2014.2	217.33	222.94
SEPA-BP0R via BP0U	2014.2	216.39	222.04
IMEJ-BP0R via BP1C	2014.4	1.83	4.84
IMEJ-BP0R via BP0U	2014.4	1.34	4.19
IMEU-BP0R via BP1C	2014.4	-26.21	-12.28
IMEU-BP0R via BP0U	2014.4	-26.72	-12.99
BJNM-BP0R via BP1C	2014.4	73.46	82.07
BJNM-BP0R via BP0U	2014.4	72.95	81.43
PTBB-BP0R via BP1C	2014.6	305.53	321.54
PTBB-BP0R via BP0U	2014.6	304.91	320.87
PTBG-BP0R via BP1C	2014.6	303.02	326.15
PTBG-BP0R via BP0U	2014.6	302.35	325.48
RO_4-BP0R via BP1C	2014.7	198.74	204.07
RO_4-BP0R via BP0U	2014.7	198.63	203.68
RO_5-BP0R via BP1C	2014.7	1.27	-0.35
RO_5-BP0R via BP0U	2014.7	1.14	-0.69
RO_6-BP0R via BP1C	2014.7	53.94	52.05
RO_6-BP0R via BP0U	2014.7	53.76	51.68
RO_7-BP0R via BP1C	2014.7	54.71	53.42

5 Uncertainty estimation

In this section, we determine the uncertainty of the differential calibration process i.e. we estimate all components that can affect the accuracy. We determine a value U_{CAL} that is to be used as the accuracy of all P3/PPP links (Visited – Reference) at the epoch of calibration.

$$U_{CAL} = \sqrt{u_a^2 + u_b^2},$$

with the statistical uncertainty u_a and the systematic uncertainty u_b . (all are 1-sigma).

The statistical uncertainty u_a originates from RAWDIF (see section 3) and is given by the statistical analysis of the raw code differences for (Traveling-Reference) and (Traveling-Visited).

The systematic uncertainty is given by $u_b = \sqrt{\sum_n u_{b,n}^2}$.

where all possible terms to be considered in the sum are listed in Table 7 and some detail on their estimation is provided at the end of this section. Values appear separately for each code and for the difference of the two codes (P1, P2 and P1-P2) so as to compute a value u_{CAL} applicable to P3 links. We choose to compute U_{CAL} using for u_b the uncertainty u_{bSYS} of $\Delta SYSDLY_{V-R}$ from equation (2)¹ Table 7 presents all components of the uncertainty budget along with the uncertainty u_{bSYS} of $\Delta SYSDLY_{V-R}$ from equation (2) and the resulting uncertainty value U_{CAL} .

The value $u_{CAL} = 1.7$ ns from Table 7 is applicable to all P3 links except links with TWTF for which a small extra uncertainty should be added in quadrature to account for the larger value $u_a(P2)$.

Table 7. Uncertainty contributions. Values P3 are computed as $P1 + 1.545 \times (P1 - P2)$
Note *: u_a (T-V) values for system TWTF of TL are larger (0.3-0.4 ns for P2, 0.4-0.5 ns for P1-P2)

Unc.	Value P1 (ns)	Value P2 (ns)	Value P1-P2 (ns)	Value P3 (ns)	Description
u_a (T-V)	0.1-0.2	0.1-0.2*	0.15-0.3*		RAWDIF (traveling-visited)
u_a (T-R)	0.1-0.2	0.1-0.2	0.15-0.3		RAWDIF (traveling-reference)
u_a	0.15-0.3	0.15-0.3	0.2-0.4	0.35-0.7	
Misclosure					
$u_{b,1}$	0.5	0.6	0.2		observed mis-closure
Systematic components related to RAWDIF					
$u_{b,11}$	0.05	0.05	0.05		Position error at reference
$u_{b,12}$	0.05	0.05	0.05		Position error at visited
$u_{b,13}$	0.3	0.3	0.4		Multipaths at reference
$u_{b,14}$	0.3	0.3	0.4		Multipaths at visited
Link of the Traveling system to the local UTC(k)					
$u_{b,21}$	0.5	0.5	0		REFDLY _T (at ref lab)
$u_{b,22}$	0.5	0.5	0		REFDLY _T (at visited lab)
$u_{b,TOT}$	1.0	1.0	0.6	1.4	
Link of the Reference system to its local UTC(k)					
$u_{b,31}$	0.5	0.5	0		REFDLY _R (at ref lab)
Link of the Visited system to its local UTC(k)					
$u_{b,32}$	0.5	0.5	0		REFDLY _V (at visited lab)
$u_{b,SYS}$	1.2	1.2	0.6	1.5	Components of equation (2)
u_{CAL}				1.7	Composed of u_a and $u_{b,SYS}$

¹ It is somewhat arbitrary to choose SYSDLY to estimate the link accuracy. This reflects the fact that the REFDLY is subject to change e.g. with change of reference clock or distribution and that its uncertainty should better be taken into account.

The components in Table 7 are separated in several categories:

- $u_{b,1}$ accounts for the mis-closure between the reference measurements; it is proposed to take the full mis-closure as $u_{b,1}$ even though the mis-closure may be partly accounted for by other components of the table
- $u_{b,11}$ and $u_{b,12}$ account for errors in the differential position (Travel – Local), including for L1-L2 a possible error in using only one position for the phase centers. All are estimated to be 1.5 cm (50 ps). Standard uncertainty of the differential positioning is typically at or below this level.
- $u_{b,13}$ and $u_{b,14}$ account for multipaths. This is difficult to estimate and could be conventionally defined.
- $u_{b,21}$ and $u_{b,22}$ account for the measurement between the reference point of the traveling system and the local UTC(k). They include at least one measurement with a TIC and are taken to be 0.5 ns..
- $u_{b,31}$ and $u_{b,32}$ account similarly for the measurement between the reference point of the local system and the local UTC(k). They include at least one measurement with a TIC and are taken to be 0.5 ns..

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