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Notations

As presented in [Petit et al., 2001] for the Z12-T, the calibration of a geodetic system is divided in (up to) 6 different parts (Figure 1)

- X_P = Delay of the 1PPS-in with respect to the laboratory reference
- X_O = Delay of the "internal reference" with respect to the 1PPS-in

(X_P + X_o) = REFDLY.

- X_C = antenna cable delay
- [X_D = short cable + splitter delay]

(X_C + X_D) = CABDLY. In practice, X_D is generally not used.

- X_R = receiver internal delay, measured from the "internal reference"
- X_S = antenna delay

(X_R + X_S) = INTDLY.

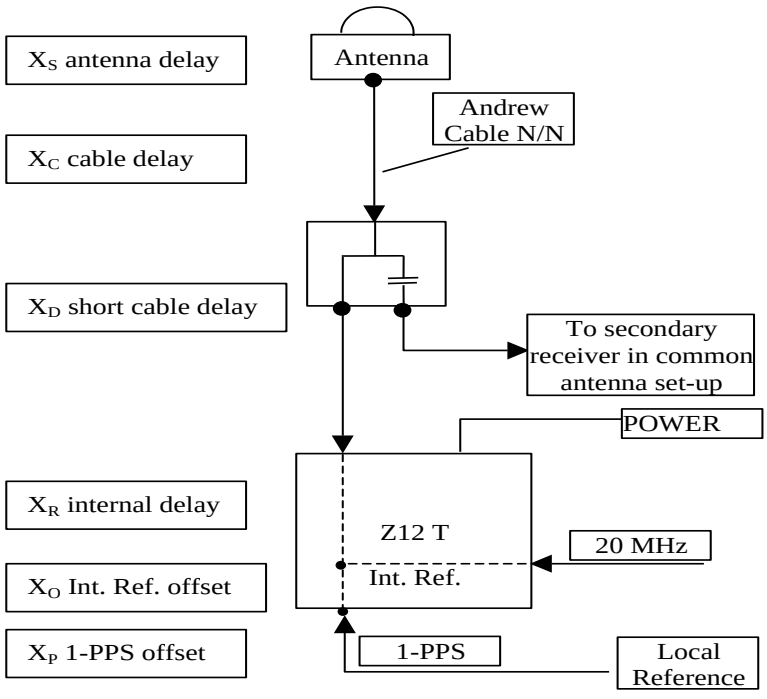


Figure 1: Definition of the different delays used in the most general set-up of a geodetic system (here shown for a Z12-T) from [Petit et al, 2001].

4/ phase 4

Laboratories: BIPM, SU

4.1/ BIPM (21298)

Period

MJD 59512 to 59519

Delays

BP2D: (cf page 4)
REFDLY = 43.37 ns (58.38-15.01)
CABDLY = 176.85 ns (C210)

BP21: (cf page 4)
REFDLY = 43.30 ns (58.31-15.01)
CABDLY = 140.80 ns (C201)

Setup at the BIPM

Annex A - Information Sheet

(to be repeated for each calibrated system)

Laboratory:	BIPM
Date and hour of the beginning of measurements:	MJD 59512
Date and hour of the end of measurements:	MJD 59519

Information on the system

	Local:	**Travelling:**
4-character BIPM code	BP21	BP2D
• Receiver maker and type: Receiver serial number:	Septentrio PolaRx5TR 4701229	Mesit GTR55 201001
1 PPS trigger level /V:		
• Antenna cable maker and type: Phase stabilised cable (Y/N):	LMR-195	HYLM195
Length outside the building /m:	~ 15 m	~ 15 m
• Antenna maker and type: Antenna serial number:	Septentrio SEPCHOKE B3E6 5253	Novatel GNSS-850 NMLK17440001C
Temperature (if stabilised) /°C		

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	43.30 ns	43.37 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	PPSin compensation enable	
• Antenna cable delay:	140.80 ns	176.85 ns
Splitter delay (if any):		(1)
Additional cable delay (if any):		(1)

Data used for the generation of CGGTTS files

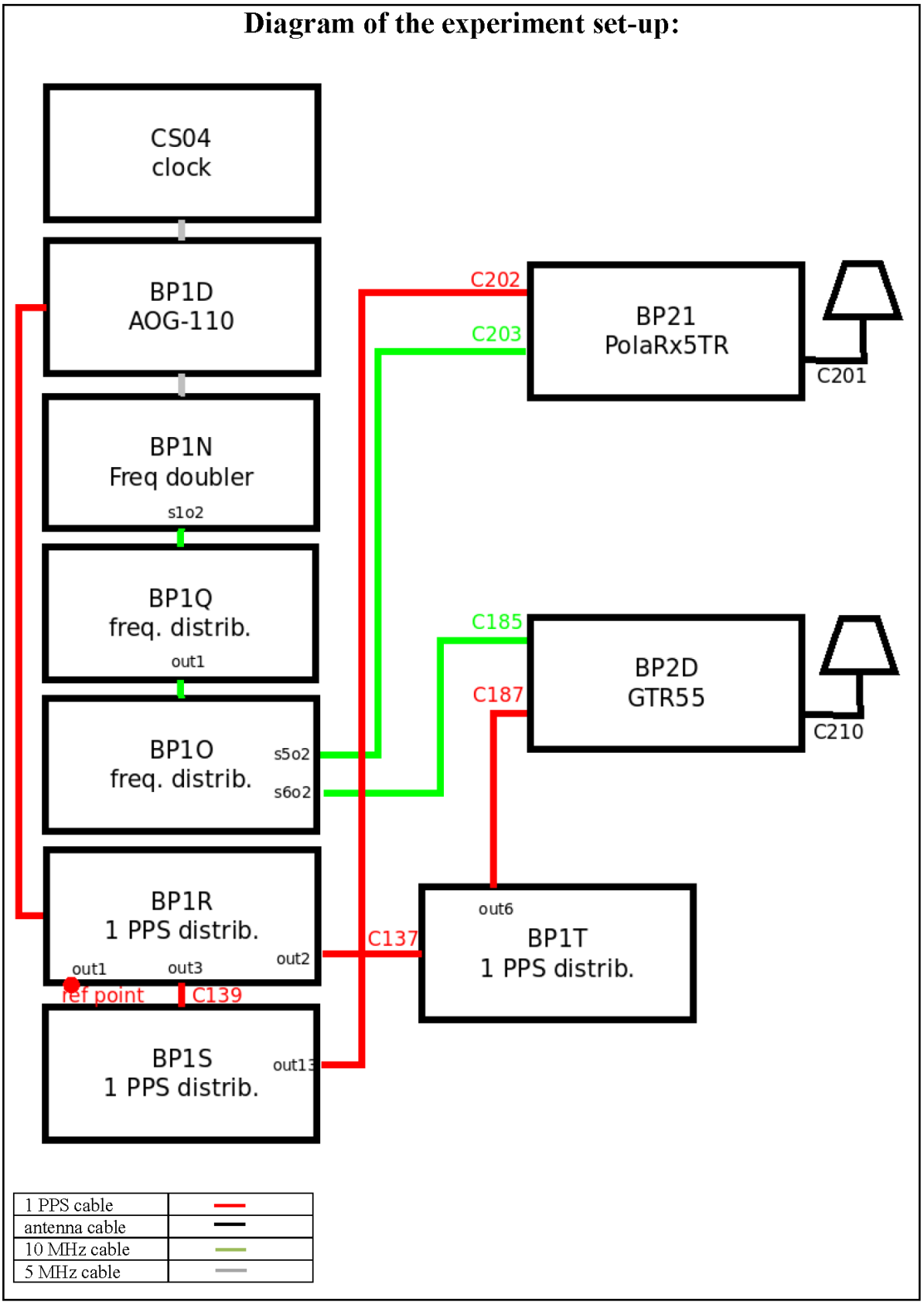
• INT DLY (GPS) /ns:	
• INT DLY (Galileo) /ns:	
• INT DLY (GLONASS) /ns:	
• CAB DLY /ns:	
• REF DLY /ns:	
• Coordinates reference frame:	
Latitude or X /m:	
Longitude or Y /m:	
Height or Z /m:	

General information

• Rise time of the local UTC pulse:	
• Is the laboratory air conditioned:	
Set temperature value and uncertainty:	22 ± 1°C
Set humidity value and uncertainty:	

(1) For a trip with closure, not needed if the traveling equipment is used in the same set-up throughout.

Diagram of the experiment set-up:



Log of Events / Additional Information :

All measurements at BIPM carried out by L. Tisserand.

Equipment used to measure delays is a Time Interval Counter (TIC), model 53230A, maker Keysight, S/N MY58390132, with measurement uncertainty typically less than 0.5 ns (using external reference frequency as timebase).

BP2D-BP21

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 151811
Compute baseline with sin(elev) between 0.05 and 0.90
Apriori codes biases from 30690 high elev obs : 6.174 7.442
Iteration 0: Obs used = 239152; Huge residuals = 3; Large residuals = 5712
Iteration 1: Obs used = 239150; Huge residuals = 0; Large residuals = 5711
Computed code bias (P1/P2)/m = 5.899 7.162
Computed baseline (X,Y,Z)/m = -3.463 -0.354 3.364
RMS of residuals /m = 0.620

Number of phase differences to fit baseline
L1/L2 = 147167
L5 = 75057
A priori baseline (X,Y,Z)/m = -3.463 -0.354 3.364
23028 clock jitters computed out of 23028 intervals
AVE jitter /ps = -0.5 RMS jitter /ps = 4.8

Iter 1 Large residuals L1= 4
Iter 1 Large residuals L2= 3
Iter 1 Large residuals L5= 9
Computed baseline L1 (X,Y,Z)/m = -0.165 -0.155 -0.024
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.148 -0.150 -0.008
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.168 -0.150 -0.003
RMS of residuals L5 /m = 0.004

Iter 2 Large residuals L1= 4
Iter 2 Large residuals L2= 3
Iter 2 Large residuals L5= 9
Computed baseline L1 (X,Y,Z)/m = -0.165 -0.155 -0.024
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.148 -0.150 -0.008
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.168 -0.150 -0.003
RMS of residuals L5 /m = 0.004

New iteration of baseline
New apriori baseline (X,Y,Z)/m = -3.620 -0.507 3.349
23028 clock jitters computed out of 23028 intervals
AVE jitter /ps = 0.4 RMS jitter /ps = 0.3

Iter 3 Large residuals L1= 4
Iter 3 Large residuals L2= 3
Iter 3 Large residuals L5= 9
Computed baseline L1 (X,Y,Z)/m = -0.001 -0.044 -0.007
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = 0.016 -0.039 0.009
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = 0.008 -0.041 0.011
RMS of residuals L5 /m = 0.004

Final baseline L1 (X,Y,Z)/m =	-3.621	-0.551	3.341
Final baseline L2 (X,Y,Z)/m =	-3.604	-0.546	3.357
Final baseline L5 (X,Y,Z)/m =	-3.612	-0.548	3.359

COMPUTATION OF CODE DIFFERENCES

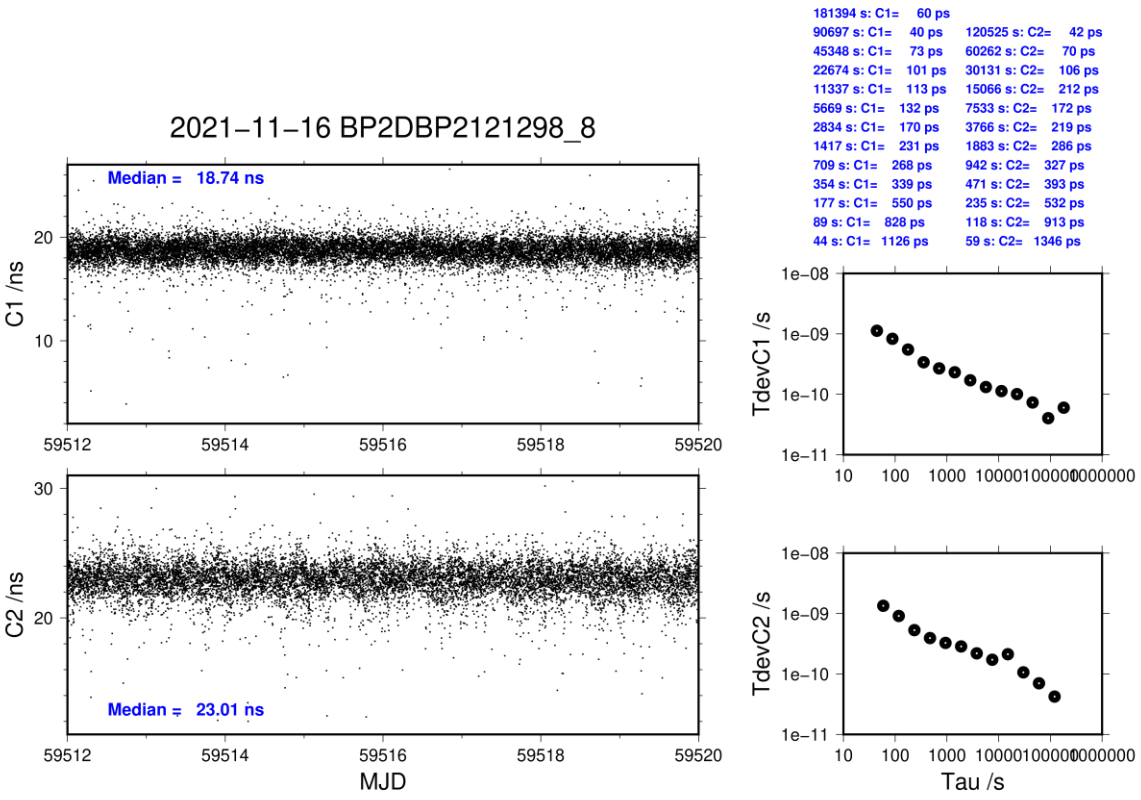
Total number of code differences = 608569

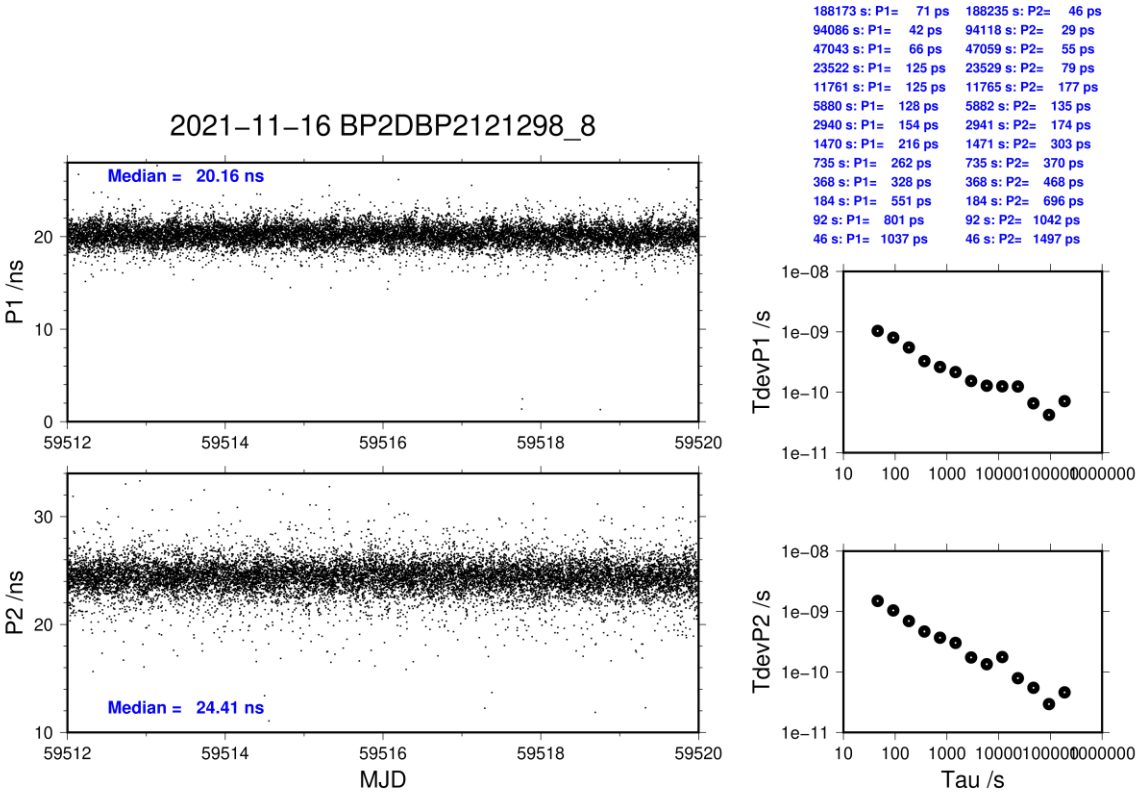
Global average of individual differences

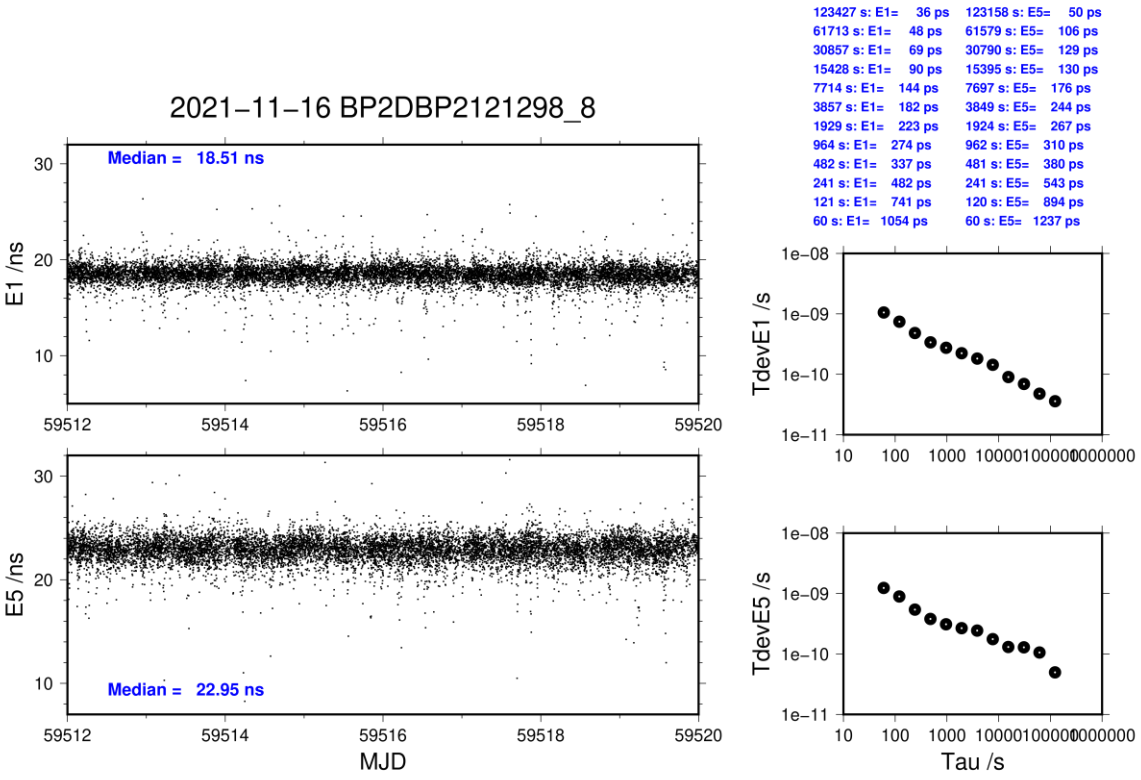
Code	**#pts**	**ave/ns**	**rms/ns**
C1	155923	18.692	2.045
C2	117483	22.943	2.057
P1	151022	20.120	1.836
P2	150900	24.349	2.495
E1	114728	18.481	1.798
E5	115120	22.900	1.779

Number of 300s epochs in out file = 2304

Code	**#pts**	**median/ns**	**ave/ns**	**rms/ns**
C1	15602	18.740	18.699	1.138
C2	11741	23.006	22.938	1.297
P1	15040	20.163	20.163	1.088
P2	15035	24.412	24.369	1.471
E1	11465	18.510	18.474	1.051
E5	11490	22.946	22.873	1.242


2021−11−16 BP2DBP2121298_8
Median = 18.74 ns
Median = 23.01 ns
C1 /ns
C2 /ns
MJD
181394 s: C1= 60 ps
90697 s: C1= 40 ps
45348 s: C1= 73 ps
22674 s: C1= 101 ps
11337 s: C1= 113 ps
5669 s: C1= 132 ps
2834 s: C1= 170 ps
1417 s: C1= 231 ps
709 s: C1= 268 ps
354 s: C1= 339 ps
177 s: C1= 550 ps
89 s: C1= 828 ps
44 s: C1= 1126 ps
120525 s: C2= 42 ps
60262 s: C2= 70 ps
30131 s: C2= 106 ps
15066 s: C2= 212 ps
7533 s: C2= 172 ps
3766 s: C2= 219 ps
1883 s: C2= 286 ps
942 s: C2= 327 ps
471 s: C2= 393 ps
235 s: C2= 532 ps
118 s: C2= 913 ps
59 s: C2= 1346 ps
TdevC1 /s
TdevC2 /s
Tau /s


2021−11−16 BP2DBP2121298_8
Median = 20.16 ns
Median = 24.41 ns
P1 /ns
P2 /ns
MJD
188173 s: P1= 71 ps
94086 s: P1= 42 ps
47043 s: P1= 66 ps
23522 s: P1= 125 ps
11761 s: P1= 125 ps
5880 s: P1= 128 ps
2940 s: P1= 154 ps
1470 s: P1= 216 ps
735 s: P1= 262 ps
368 s: P1= 328 ps
184 s: P1= 551 ps
92 s: P1= 801 ps
46 s: P1= 1037 ps
188235 s: P2= 46 ps
94118 s: P2= 29 ps
47059 s: P2= 55 ps
23529 s: P2= 79 ps
11765 s: P2= 177 ps
5882 s: P2= 135 ps
2941 s: P2= 174 ps
1471 s: P2= 303 ps
735 s: P2= 370 ps
368 s: P2= 468 ps
184 s: P2= 696 ps
92 s: P2= 1042 ps
46 s: P2= 1497 ps
TdevP1 /s
TdevP2 /s
Tau /s


2021−11−16 BP2DBP2121298_8
Median = 18.51 ns
Median = 22.95 ns
E1 /ns
E5 /ns
MJD
59512
59514
59516
59518
59520
123427 s: E1= 36 ps
61713 s: E1= 48 ps
30857 s: E1= 69 ps
15428 s: E1= 90 ps
7714 s: E1= 144 ps
3857 s: E1= 182 ps
1929 s: E1= 223 ps
964 s: E1= 274 ps
482 s: E1= 337 ps
241 s: E1= 482 ps
121 s: E1= 741 ps
60 s: E1= 1054 ps
123158 s: E5= 50 ps
61579 s: E5= 106 ps
30790 s: E5= 129 ps
15395 s: E5= 130 ps
7697 s: E5= 176 ps
3849 s: E5= 244 ps
1924 s: E5= 267 ps
962 s: E5= 310 ps
481 s: E5= 380 ps
241 s: E5= 543 ps
120 s: E5= 894 ps
60 s: E5= 1237 ps
TdevE1 /s
TdevE5 /s
Tau /s

4.2/ SU (21331)

Period

MJD 59545 to 59553

Delays

BP2D: (cf page 12)

REFDLY = 194.00 ns
CABDLY = 176.85 ns (C210)

SU19: (cf page 12)

REFDLY = 193.90 ns
CABDLY = 122.40 ns

SU31: (cf page 13)

REFDLY = 193.90 ns
CABDLY = 143.20 ns

Setup at the SU

Information Sheet

Laboratory:	SU
Date and hour of the beginning of measurements:	**2021-11-27 00:00:00 UTC (MJD 59545)**
Date and hour of the end of measurements:	**2021-12-05 23:59:30 UTC (MJD 59553)**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	SU19	BP2D
• Receiver maker and type: Receiver serial number:	PikTime TTS-4 0119	DICOM (MESIT) GTR55
1 PPS trigger level /V:	1.0 V	
• Antenna cable maker and type: Phase stabilised cable (Y/N):	Andrew FSJ-1 Y	
Length outside the building /m:	Approx. 15 m	Approx. 15 m
• Antenna maker and type: Antenna serial number:	Leica Geosystems LEIAR25.R3 LEIT 09330030	
Temperature (if stabilised) /°C	-	

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	193.9 ns	194.0 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	0.8 ns	-
• Antenna cable delay:	122.4 ns	
Splitter delay (if any):	-	-
Additional cable delay (if any):	-	-

Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	-
• INT DLY (Galileo) /ns:	-
• INT DLY (GLONASS) /ns:	-
• CAB DLY /ns:	-
• REF DLY /ns:	-
• Coordinates reference frame:	-
Latitude or X /m:	-
Longitude or Y /m:	-
Height or Z /m:	-

General information

• Rise time of the local UTC pulse:	2 ns
• Is the laboratory air conditioned:	Y
Set temperature value and uncertainty:	19.5 °C ± 0.5 °C
Set humidity value and uncertainty:	-

Information Sheet

Laboratory:	SU
Date and hour of the beginning of measurements:	**2021-11-27 00:00:00 UTC (MJD 59545)**
Date and hour of the end of measurements:	**2021-12-05 23:59:30 UTC (MJD 59553)**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	SU31	BP2D
• Receiver maker and type: Receiver serial number:	DICOM (MESIT) GTR51 1604031	DICOM (MESIT) GTR55
1 PPS trigger level /V:	1.0 V	
• Antenna cable maker and type: Phase stabilised cable (Y/N):	Andrew FSJ-1 Y	
Length outside the building /m:	Approx. 15 m	Approx. 15 m
• Antenna maker and type: Antenna serial number:	Leica Geosystems LEIAR25.R4 LEIT 726435	
Temperature (if stabilised) /°C	45.0 °C	

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	193.9 ns	194.0 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	-	-
• Antenna cable delay:	143.2 ns	
Splitter delay (if any):	-	-
Additional cable delay (if any):	-	-

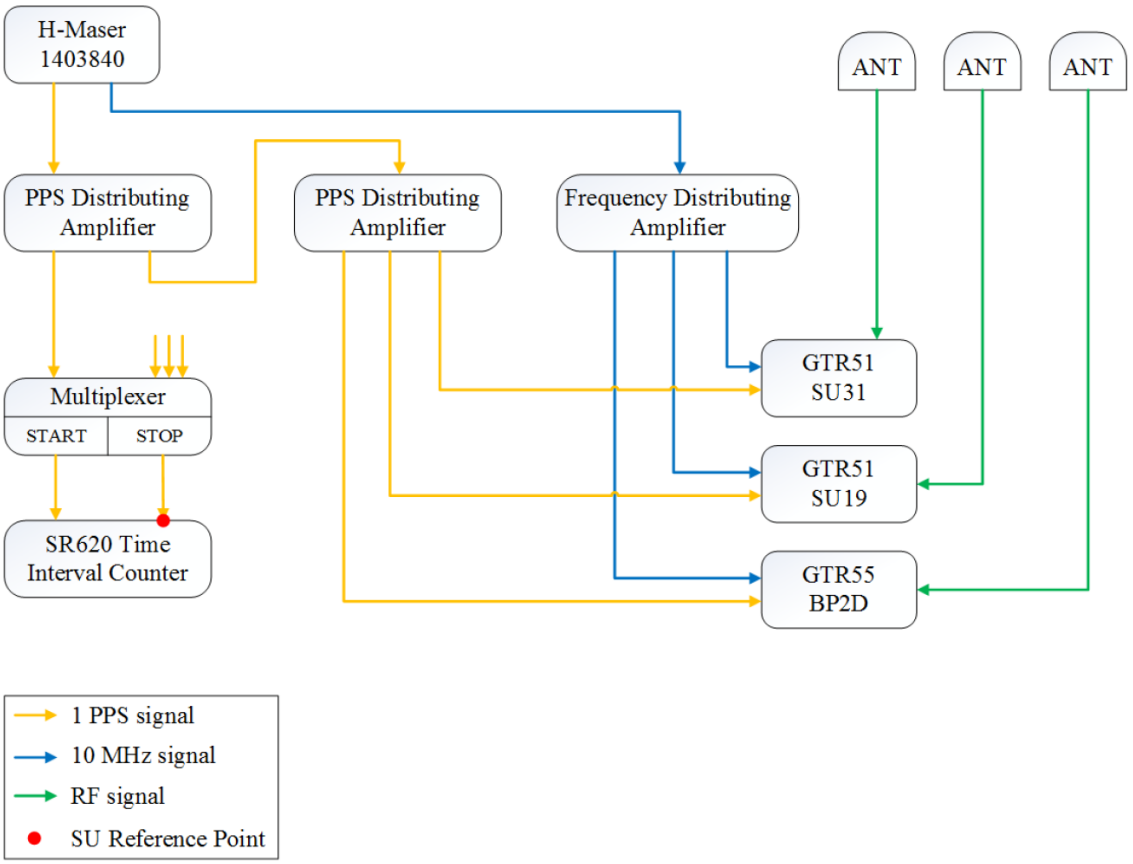
Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	-
• INT DLY (Galileo) /ns:	-
• INT DLY (GLONASS) /ns:	-
• CAB DLY /ns:	-
• REF DLY /ns:	-
• Coordinates reference frame:	-
Latitude or X /m:	-
Longitude or Y /m:	-
Height or Z /m:	-

General information

• Rise time of the local UTC pulse:	2 ns
• Is the laboratory air conditioned:	Y
Set temperature value and uncertainty:	19.5 °C ± 0.5 °C
Set humidity value and uncertainty:	-

Diagram of the experiment set-up:



Log of Events / Additional Information :

Reference delay measurements were carried out using Portable Hydrogen Maser (PHM) VCH-1007 and a TIC SR620 with typical measurement uncertainty of 0.5 ns (when connected to external reference frequency source). Each delay estimate includes two measurements:

- between laboratory reference source UTC(SU) and PHM;
- between 1 PPS input connector of a receiver and PHM.

SU31 and SU19 antenna cable delays were taken from 1001-2018 calibration report.

Measured delays:

Delay type	Value, ns	
	MJD 59545	**MJD 59553**
Between laboratory reference source UTC(SU) and the 1 PPS input connector of the SU31 receiver	193.9	194.0
Between laboratory reference source UTC(SU) and the 1 PPS input connector of the BP2D receiver	194.0	194.1
Between laboratory reference source UTC(SU) and the 1 PPS input connector of the SU19 receiver	193.9	193.8
Between the 1 PPS input connector and the 10 MHz input connector of the SU19 receiver	38.3	38.2
1 PPS – frequency correction of the SU19 receiver (after measured delays being input into TTS)	0.8	0.7
Antenna cable delay of SU31 receiver	143.2	-
Antenna cable delay of SU19 receiver	122.4	-

SU19-BP2D

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 240329
Compute baseline with sin(elev) between 0.05 and 0.90
Apriori codes biases from 30266 high elev obs : -2.602 -3.079
Iteration 0: Obs used = 421325; Huge residuals = 3; Large residuals = 1071
Iteration 1: Obs used = 421324; Huge residuals = 0; Large residuals = 1068
Computed code bias (P1/P2)/m = -2.699 -3.226
Computed baseline (X,Y,Z)/m = 1.275 -1.385 -0.075
RMS of residuals /m = 0.487

Number of phase differences to fit baseline
L1/L2 = 238218
L5 = 115111
A priori baseline (X,Y,Z)/m = 1.275 -1.385 -0.075
25885 clock jitters computed out of 25885 intervals
AVE jitter /ps = -0.0 RMS jitter /ps = 4.4

Iter 1 Large residuals L1= 0
Iter 1 Large residuals L2= 1
Iter 1 Large residuals L5= 2
Computed baseline L1 (X,Y,Z)/m = 0.029 0.005 0.087
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = 0.013 0.004 0.077
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = 0.016 0.002 0.074
RMS of residuals L5 /m = 0.004

Iter 2 Large residuals L1= 0
Iter 2 Large residuals L2= 1
Iter 2 Large residuals L5= 2
Computed baseline L1 (X,Y,Z)/m = 0.029 0.005 0.087
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = 0.013 0.004 0.077
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = 0.016 0.002 0.074
RMS of residuals L5 /m = 0.004

New iteration of baseline
New apriori baseline (X,Y,Z)/m = 1.296 -1.380 0.006
25885 clock jitters computed out of 25885 intervals
AVE jitter /ps = 0.0 RMS jitter /ps = 0.1

Iter 3 Large residuals L1= 0
Iter 3 Large residuals L2= 1
Iter 3 Large residuals L5= 2

Computed baseline L1 (X,Y,Z)/m = 0.010 0.001 0.008
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.007 -0.001 -0.003
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.003 -0.003 -0.005
RMS of residuals L5 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 1.306 -1.380 0.014
Final baseline L2 (X,Y,Z)/m = 1.289 -1.381 0.004
Final baseline L5 (X,Y,Z)/m = 1.293 -1.383 0.001

COMPUTATION OF CODE DIFFERENCES

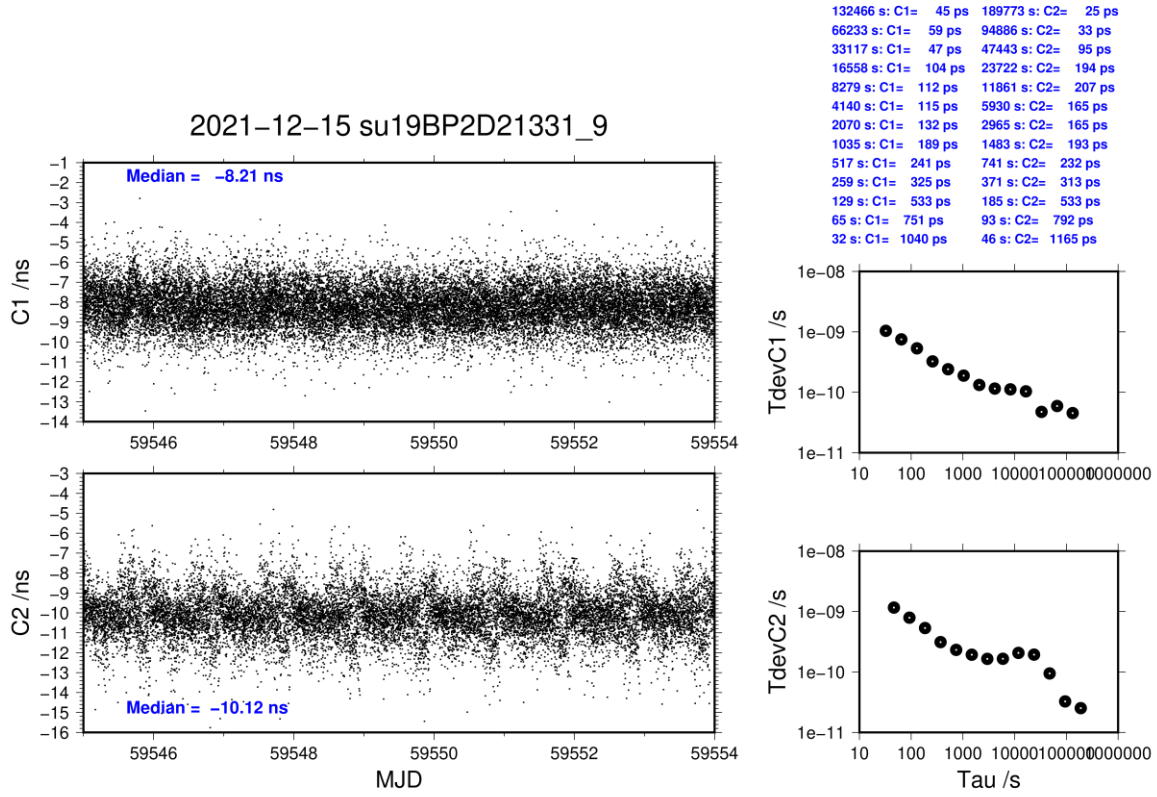
Total number of code differences = 609781

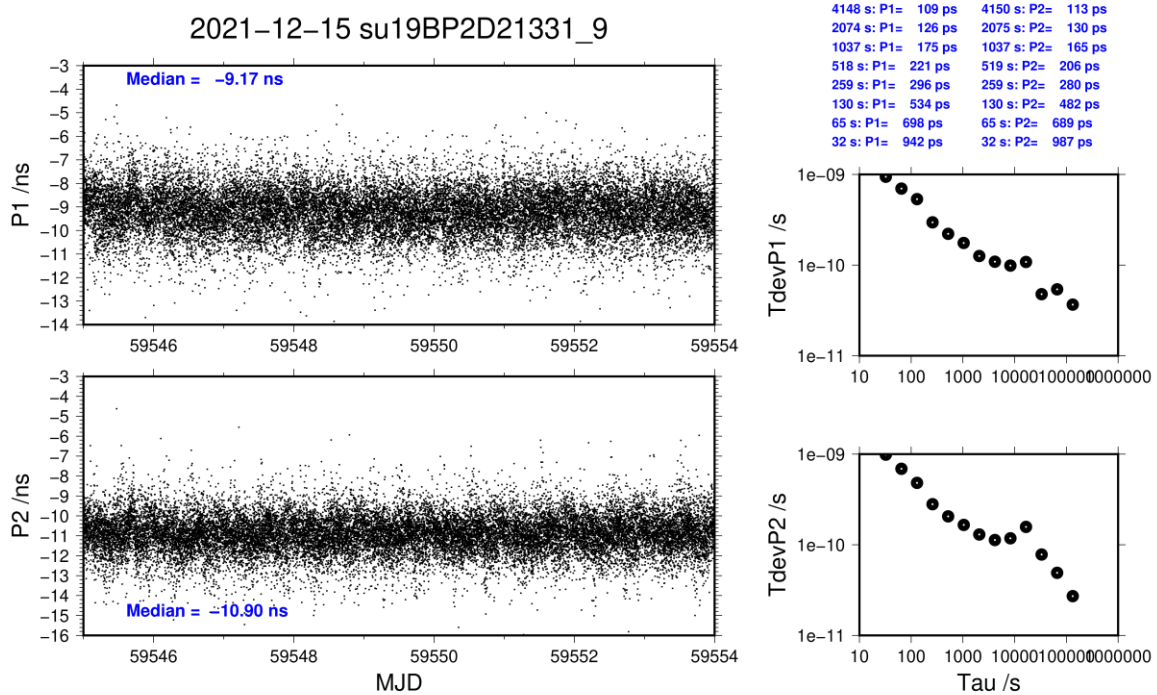
Global average of individual differences

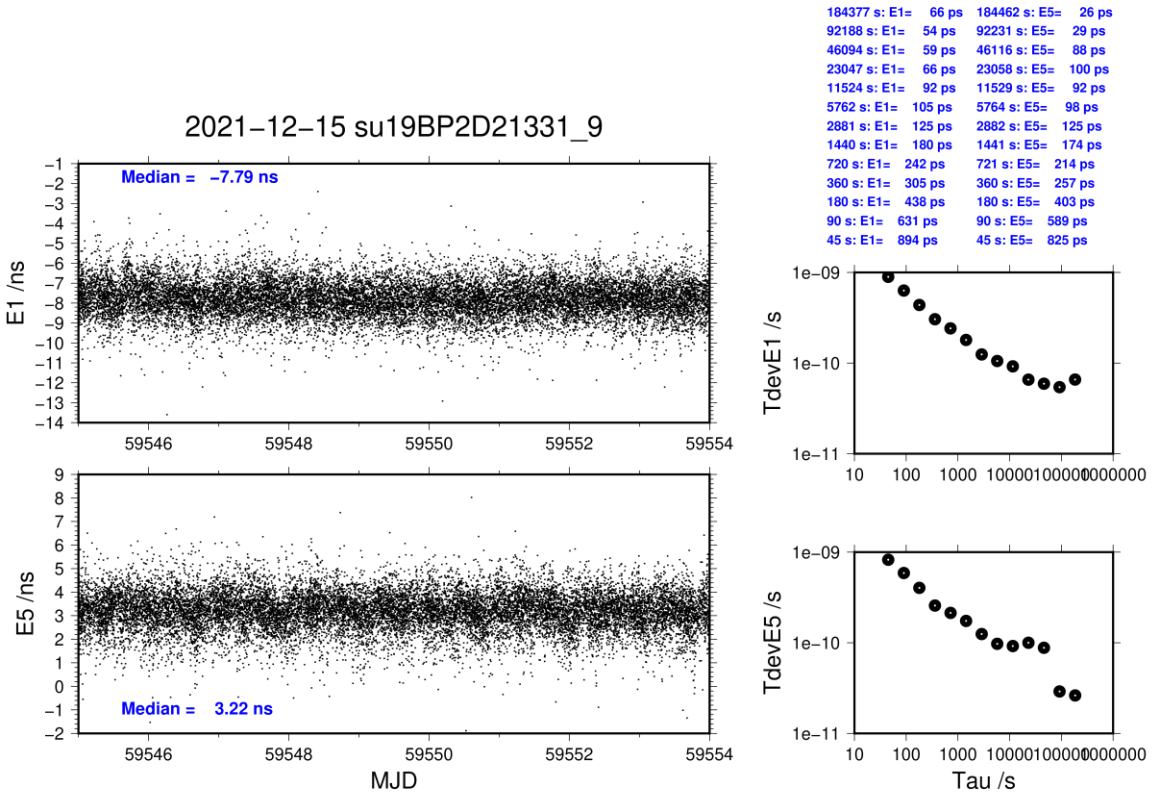
Code	#pts	ave/ns	rms/ns
C1	240697	-8.214	1.944
C2	168044	-10.128	1.991
P1	240187	-9.196	1.588
P2	240111	-10.921	1.599
E1	172669	-7.806	1.672
E5	172651	3.177	1.290

Number of 300s epochs in out file = 2592

Code	#pts	median/ns	ave/ns	rms/ns
C1	24036	-8.207	-8.193	1.048
C2	16778	-10.121	-10.110	1.142
P1	23988	-9.173	-9.187	0.977
P2	23976	-10.902	-10.910	0.976
E1	17269	-7.790	-7.790	0.904
E5	17261	3.216	3.187	0.834


2021−12−15 su19BP2D21331_9
Median = −8.21 ns
Median = −10.12 ns
C1 /ns
C2 /ns
MJD
59546
59548
59550
59552
59554
132466 s: C1= 45 ps
66233 s: C1= 59 ps
33117 s: C1= 47 ps
16558 s: C1= 104 ps
8279 s: C1= 112 ps
4140 s: C1= 115 ps
2070 s: C1= 132 ps
1035 s: C1= 189 ps
517 s: C1= 241 ps
259 s: C1= 325 ps
129 s: C1= 533 ps
65 s: C1= 751 ps
32 s: C1= 1040 ps
189773 s: C2= 25 ps
94886 s: C2= 33 ps
47443 s: C2= 95 ps
23722 s: C2= 194 ps
11861 s: C2= 207 ps
5930 s: C2= 165 ps
2965 s: C2= 165 ps
1483 s: C2= 193 ps
741 s: C2= 232 ps
371 s: C2= 313 ps
185 s: C2= 533 ps
93 s: C2= 792 ps
46 s: C2= 1165 ps
TdevC1 /s
TdevC2 /s
Tau /s


2021−12−15 su19BP2D21331_9
Median = −9.17 ns
Median = −10.90 ns
P1 /ns
P2 /ns
MJD
59546
59548
59550
59552
59554
132731 s: P1= 37 ps
66366 s: P1= 54 ps
33183 s: P1= 48 ps
16591 s: P1= 108 ps
8296 s: P1= 99 ps
4148 s: P1= 109 ps
2074 s: P1= 126 ps
1037 s: P1= 175 ps
518 s: P1= 221 ps
259 s: P1= 296 ps
130 s: P1= 534 ps
65 s: P1= 698 ps
32 s: P1= 942 ps
132798 s: P2= 27 ps
66399 s: P2= 49 ps
33199 s: P2= 78 ps
16600 s: P2= 157 ps
8300 s: P2= 118 ps
4150 s: P2= 113 ps
2075 s: P2= 130 ps
1037 s: P2= 165 ps
519 s: P2= 206 ps
259 s: P2= 280 ps
130 s: P2= 482 ps
65 s: P2= 689 ps
32 s: P2= 987 ps
TdevP1 /s
TdevP2 /s
Tau /s


2021−12−15 su19BP2D21331_9
Median = −7.79 ns
E1 /ns
Median = 3.22 ns
E5 /ns
MJD
184377 s: E1= 66 ps
92188 s: E1= 54 ps
46094 s: E1= 59 ps
23047 s: E1= 66 ps
11524 s: E1= 92 ps
5762 s: E1= 105 ps
2881 s: E1= 125 ps
1440 s: E1= 180 ps
720 s: E1= 242 ps
360 s: E1= 305 ps
180 s: E1= 438 ps
90 s: E1= 631 ps
45 s: E1= 894 ps
184462 s: E5= 26 ps
92231 s: E5= 29 ps
46116 s: E5= 88 ps
23058 s: E5= 100 ps
11529 s: E5= 92 ps
5764 s: E5= 98 ps
2882 s: E5= 125 ps
1441 s: E5= 174 ps
721 s: E5= 214 ps
360 s: E5= 257 ps
180 s: E5= 403 ps
90 s: E5= 589 ps
45 s: E5= 825 ps
TdevE1 /s
TdevE5 /s
Tau /s

SU31-BP2D

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 240471
Compute baseline with sin(elev) between 0.05 and 0.90
Apriori codes biases from 30294 high elev obs : -3.248 -4.714
Iteration 0: Obs used = 422039; Huge residuals = 0; Large residuals = 585
Iteration 1: Obs used = 422039; Huge residuals = 0; Large residuals = 585
Computed code bias (P1/P2)/m = -3.205 -4.651
Computed baseline (X,Y,Z)/m = -2.433 1.087 1.138
RMS of residuals /m = 0.348

Number of phase differences to fit baseline
L1/L2 = 238238
L5 = 114811
A priori baseline (X,Y,Z)/m = -2.433 1.087 1.138
25885 clock jitters computed out of 25885 intervals
AVE jitter /ps = 0.1 RMS jitter /ps = 4.3

Iter 1 Large residuals L1= 2
Iter 1 Large residuals L2= 0
Iter 1 Large residuals L5= 1
Computed baseline L1 (X,Y,Z)/m = -0.034 -0.025 -0.092
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.048 -0.030 -0.106
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.042 -0.023 -0.105
RMS of residuals L5 /m = 0.004

Iter 2 Large residuals L1= 2
Iter 2 Large residuals L2= 0
Iter 2 Large residuals L5= 1
Computed baseline L1 (X,Y,Z)/m = -0.034 -0.025 -0.092
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.048 -0.030 -0.106
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.042 -0.023 -0.105
RMS of residuals L5 /m = 0.004

New iteration of baseline
New apriori baseline (X,Y,Z)/m = -2.474 1.060 1.039
25885 clock jitters computed out of 25885 intervals
AVE jitter /ps = -0.0 RMS jitter /ps = 0.2

Iter 3 Large residuals L1= 2
Iter 3 Large residuals L2= 0
Iter 3 Large residuals L5= 1

Computed baseline L1 (X,Y,Z)/m = 0.004 0.002 0.004
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.009 -0.004 -0.010
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.003 0.004 -0.010
RMS of residuals L5 /m = 0.004

Final baseline L1 (X,Y,Z)/m = -2.469 1.061 1.043
Final baseline L2 (X,Y,Z)/m = -2.483 1.056 1.029
Final baseline L5 (X,Y,Z)/m = -2.476 1.064 1.030

COMPUTATION OF CODE DIFFERENCES

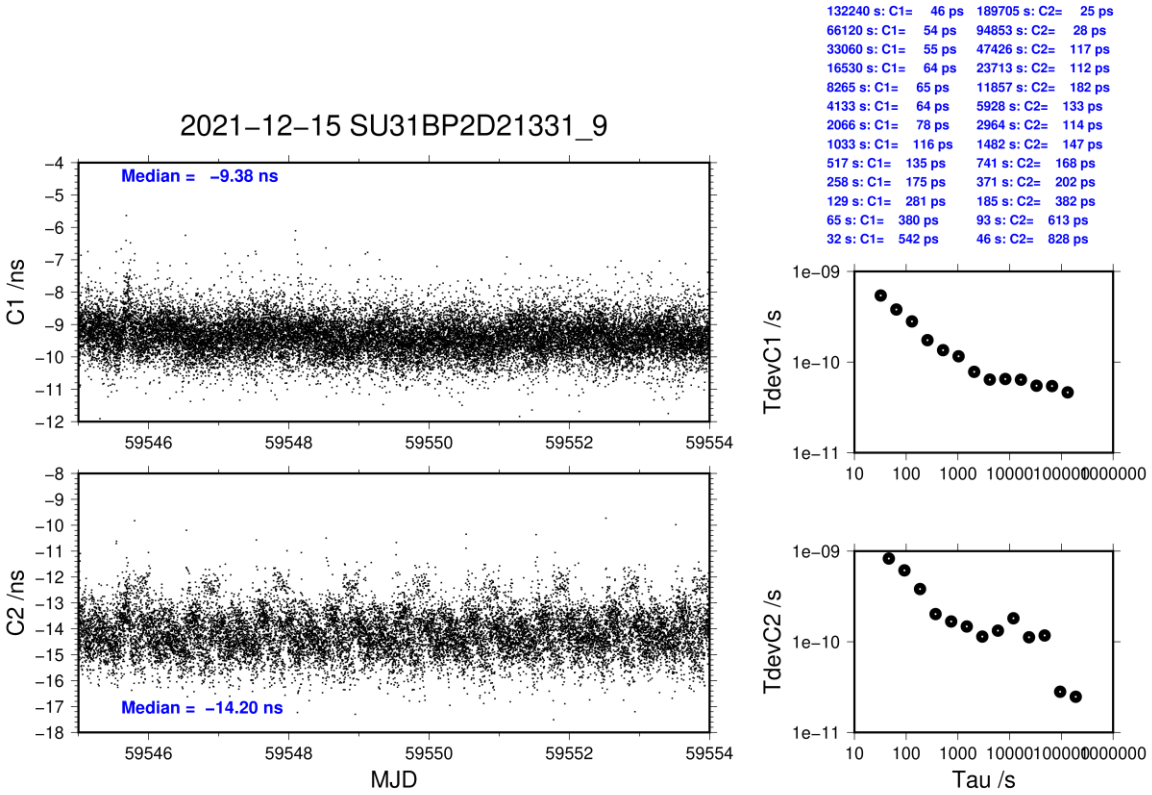
Total number of code differences = 587408

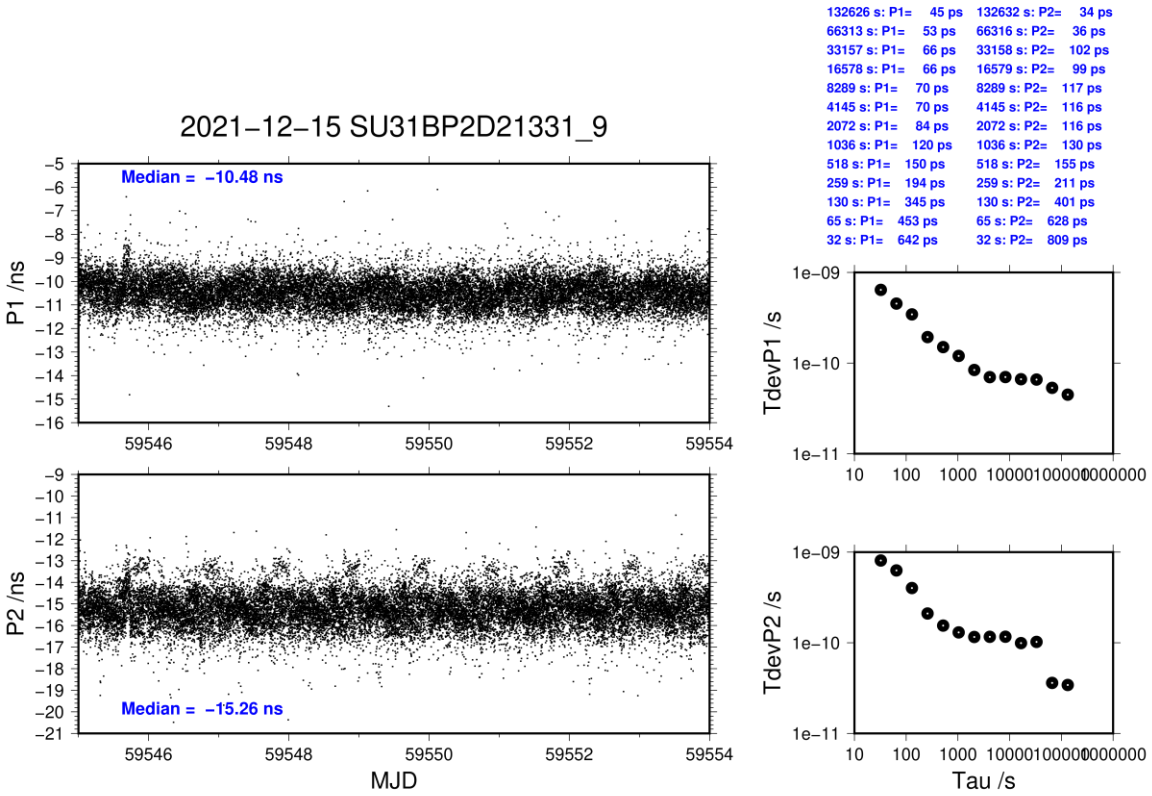
Global average of individual differences

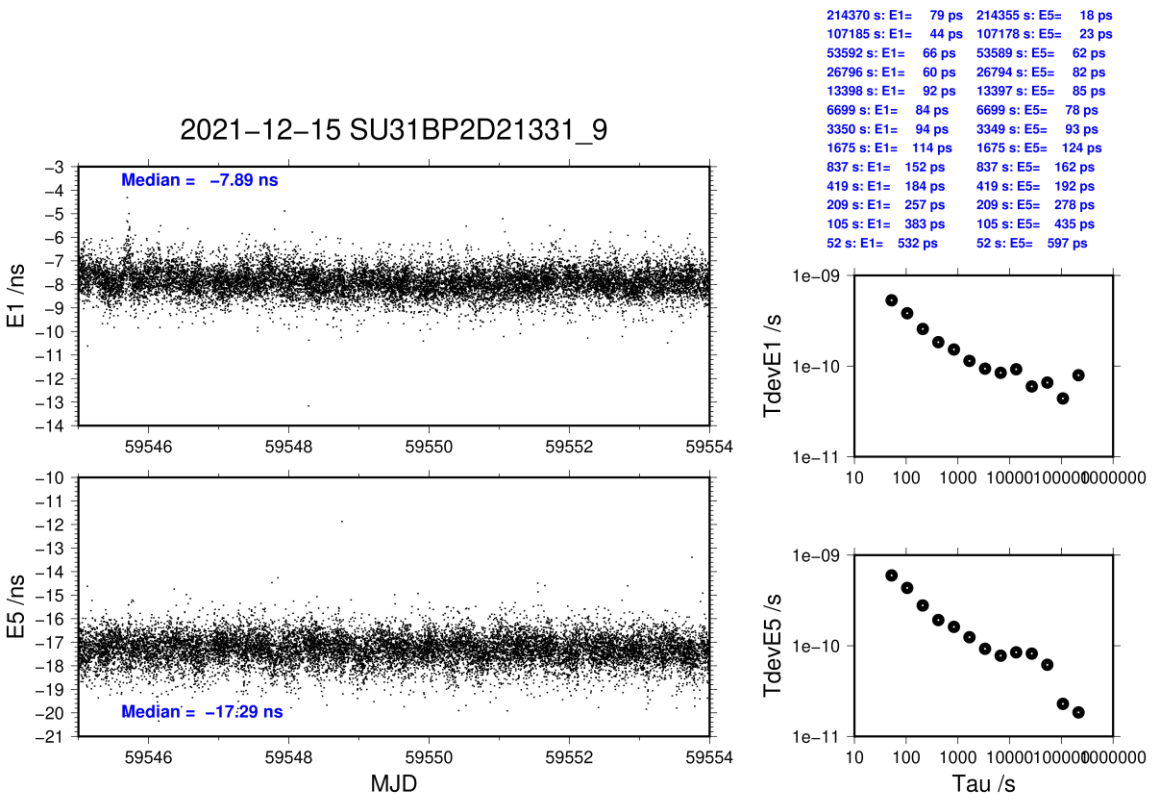
Code	#pts	ave/ns	rms/ns
C1	240984	-9.369	0.912
C2	168073	-14.170	1.173
P1	240400	-10.487	1.107
P2	240346	-15.257	1.212
E1	148543	-7.882	0.832
E5	148529	-17.307	0.829

Number of 300s epochs in out file = 2592

Code	#pts	median/ns	ave/ns	rms/ns
C1	24077	-9.380	-9.368	0.557
C2	16784	-14.203	-14.167	0.840
P1	24007	-10.478	-10.485	0.654
P2	24006	-15.264	-15.252	0.825
E1	14853	-7.894	-7.881	0.557
E5	14854	-17.287	-17.306	0.610


2021−12−15 SU31BP2D21331_9
Median = −9.38 ns
Median = −14.20 ns
C1 /ns
C2 /ns
MJD
59546
59548
59550
59552
59554
132240 s: C1= 46 ps
66120 s: C1= 54 ps
33060 s: C1= 55 ps
16530 s: C1= 64 ps
8265 s: C1= 65 ps
4133 s: C1= 64 ps
2066 s: C1= 78 ps
1033 s: C1= 116 ps
517 s: C1= 135 ps
258 s: C1= 175 ps
129 s: C1= 281 ps
65 s: C1= 380 ps
32 s: C1= 542 ps
189705 s: C2= 25 ps
94853 s: C2= 28 ps
47426 s: C2= 117 ps
23713 s: C2= 112 ps
11857 s: C2= 182 ps
5928 s: C2= 133 ps
2964 s: C2= 114 ps
1482 s: C2= 147 ps
741 s: C2= 168 ps
371 s: C2= 202 ps
185 s: C2= 382 ps
93 s: C2= 613 ps
46 s: C2= 828 ps
TdevC1 /s
TdevC2 /s
Tau /s
1e−09
1e−10
1e−11
10
100
1000
10000
100000
1000000
10000000


2021−12−15 SU31BP2D21331_9
Median = −10.48 ns
Median = −15.26 ns
P1 /ns
P2 /ns
MJD
59546
59548
59550
59552
59554
132626 s: P1= 45 ps
66313 s: P1= 53 ps
33157 s: P1= 66 ps
16578 s: P1= 66 ps
8289 s: P1= 70 ps
4145 s: P1= 70 ps
2072 s: P1= 84 ps
1036 s: P1= 120 ps
518 s: P1= 150 ps
259 s: P1= 194 ps
130 s: P1= 345 ps
65 s: P1= 453 ps
32 s: P1= 642 ps
132632 s: P2= 34 ps
66316 s: P2= 36 ps
33158 s: P2= 102 ps
16579 s: P2= 99 ps
8289 s: P2= 117 ps
4145 s: P2= 116 ps
2072 s: P2= 116 ps
1036 s: P2= 130 ps
518 s: P2= 155 ps
259 s: P2= 211 ps
130 s: P2= 401 ps
65 s: P2= 628 ps
32 s: P2= 809 ps
TdevP1 /s
TdevP2 /s
Tau /s
1e−09
1e−10
1e−11
10
100
1000
10000
100000
1000000
10000000


214370 s: E1= 79 ps
107185 s: E1= 44 ps
53592 s: E1= 66 ps
26796 s: E1= 60 ps
13398 s: E1= 92 ps
6699 s: E1= 84 ps
3350 s: E1= 94 ps
1675 s: E1= 114 ps
837 s: E1= 152 ps
419 s: E1= 184 ps
209 s: E1= 257 ps
105 s: E1= 383 ps
52 s: E1= 532 ps
214355 s: E5= 18 ps
107178 s: E5= 23 ps
53589 s: E5= 62 ps
26794 s: E5= 82 ps
13397 s: E5= 85 ps
6699 s: E5= 78 ps
3349 s: E5= 93 ps
1675 s: E5= 124 ps
837 s: E5= 162 ps
419 s: E5= 192 ps
209 s: E5= 278 ps
105 s: E5= 435 ps
52 s: E5= 597 ps
2021−12−15 SU31BP2D21331_9
Median = −7.89 ns
Median = −17.29 ns
E1 /ns
E5 /ns
MJD
TdevE1 /s
TdevE5 /s
Tau /s

4.3/ SU (21340)

Period

MJD 59554 to 59562

Delays

BP2D: (cf page 25)

REFDLY = 135.40 ns
CABDLY = 176.85 ns (C210)

SU22: (cf page 25)

REFDLY = 135.50 ns
CABDLY = 122.60 ns

SU52: (cf page 26)

REFDLY = 134.80 ns
CABDLY = 149.10 ns

Setup at the SU

Information Sheet

Laboratory:	SU
Date and hour of the beginning of measurements:	**2021-12-06 13:00:00 UTC (MJD 59554)**
Date and hour of the end of measurements:	**2021-12-14 07:00:00 UTC (MJD 59562)**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	SU22	BP2D
• Receiver maker and type: Receiver serial number:	DICOM (MESIT) GTR51 1309022	DICOM (MESIT) GTR55
1 PPS trigger level /V:	1.0 V	
• Antenna cable maker and type: Phase stabilised cable (Y/N):	Andrew FSJ-1 Y	
Length outside the building /m:	Approx. 15 m	Approx. 15 m
• Antenna maker and type: Antenna serial number:	Leica Geosystems LEIAR25.R3 NONE 10050007	
Temperature (if stabilised) /°C	45.0 °C	

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	135.5 ns	135.4 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	-	-
• Antenna cable delay:	122.6 ns	
Splitter delay (if any):	-	-
Additional cable delay (if any):	-	-

Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	-
• INT DLY (Galileo) /ns:	-
• INT DLY (GLONASS) /ns:	-
• CAB DLY /ns:	-
• REF DLY /ns:	-
• Coordinates reference frame:	-
Latitude or X /m:	-
Longitude or Y /m:	-
Height or Z /m:	-

General information

• Rise time of the local UTC pulse:	2 ns
• Is the laboratory air conditioned:	Y
Set temperature value and uncertainty:	19.5 °C ± 0.5 °C
Set humidity value and uncertainty:	-

Information Sheet

Laboratory:	SU
Date and hour of the beginning of measurements:	**2021-12-06 13:00:00 UTC (MJD 59554)**
Date and hour of the end of measurements:	**2021-12-14 07:00:00 UTC (MJD 59562)**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	SU52	BP2D
• Receiver maker and type: Receiver serial number:	Septentrio PolaRx5TR 3048452	DICOM (MESIT) GTR55
1 PPS trigger level /V:		
• Antenna cable maker and type: Phase stabilised cable (Y/N):	Andrew FSJ-1 Y	
Length outside the building /m:	Approx. 15 m	Approx. 15 m
• Antenna maker and type: Antenna serial number:	Javad GNSS JAVRINGANT_DM NONE 00316	
Temperature (if stabilised) /°C	45 °C	

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	134.8 ns	135.4 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	-	-
• Antenna cable delay:	149.1 ns	
Splitter delay (if any):	-	-
Additional cable delay (if any):	PolaRx5TR PPS-in internal delay compensation is enabled	-

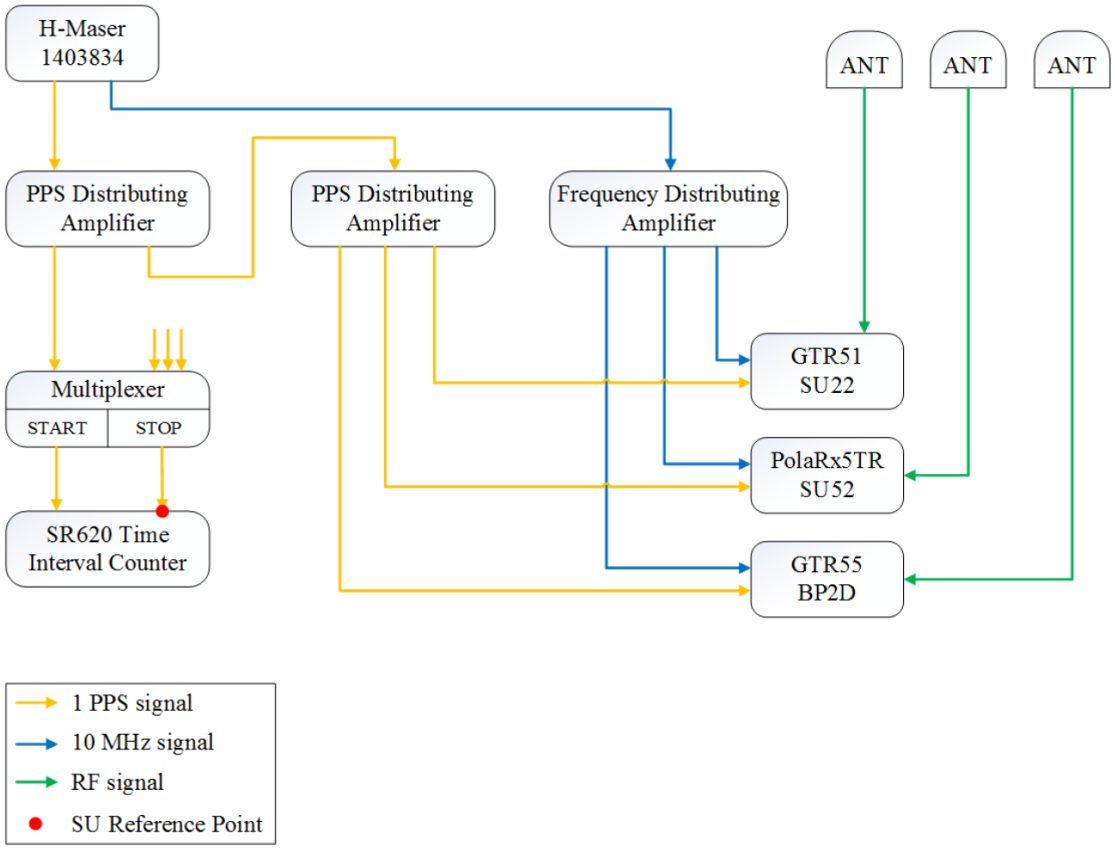
Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	-
• INT DLY (Galileo) /ns:	-
• INT DLY (GLONASS) /ns:	-
• CAB DLY /ns:	-
• REF DLY /ns:	-
• Coordinates reference frame:	-
Latitude or X /m:	-
Longitude or Y /m:	-
Height or Z /m:	-

General information

• Rise time of the local UTC pulse:	2 ns
• Is the laboratory air conditioned:	Y
Set temperature value and uncertainty:	19.5 °C ± 0.5 °C
Set humidity value and uncertainty:	-

Diagram of the experiment set-up:



Log of Events / Additional Information :

Reference delay measurements were carried out using Portable Hydrogen Maser (PHM) VCH-1007 and a TIC SR620 with typical measurement uncertainty of 0.5 ns (when connected to external reference frequency source). Each delay estimate includes two measurements:

- between laboratory reference source UTC(SU) and PHM;
- between 1 PPS input connector of a receiver and PHM.

SU22 and SU52 antenna cable delays were measured using Vector Network Analyzer Rohde & Schwarz ZVB4.

Measured delays:

Delay type	Value, ns	
	MJD 59554	MJD 59562
Between laboratory reference source UTC(SU) and the 1 PPS input connector of the SU22 receiver	135.5	135.4
Between laboratory reference source UTC(SU) and the 1 PPS input connector of the SU52 receiver	134.8	134.8
Between laboratory reference source UTC(SU) and the 1 PPS input connector of the BP2D receiver	135.4	135.4
Antenna cable delay of SU22 receiver	143.2	-
Antenna cable delay of SU52 receiver	122.4	-

SU22-BP2D

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 135073
Compute baseline with sin(elev) between 0.05 and 0.90
Apriori codes biases from 17156 high elev obs : -9.386 -10.795
Iteration 0: Obs used = 236689; Huge residuals = 0; Large residuals = 409
Iteration 1: Obs used = 236689; Huge residuals = 0; Large residuals = 409
Computed code bias (P1/P2)/m = -9.385 -10.714
Computed baseline (X,Y,Z)/m = -1.419 -0.674 1.230
RMS of residuals /m = 0.345

Number of phase differences to fit baseline
L1/L2 = 133827
L5 = 65330
A priori baseline (X,Y,Z)/m = -1.419 -0.674 1.230
14492 clock jitters computed out of 14492 intervals
AVE jitter /ps = 0.1 RMS jitter /ps = 4.3

Iter 1 Large residuals L1= 0
Iter 1 Large residuals L2= 2
Iter 1 Large residuals L5= 1
Computed baseline L1 (X,Y,Z)/m = -0.052 -0.047 -0.099
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.059 -0.045 -0.105
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.058 -0.045 -0.104
RMS of residuals L5 /m = 0.004

Iter 2 Large residuals L1= 0
Iter 2 Large residuals L2= 2
Iter 2 Large residuals L5= 1
Computed baseline L1 (X,Y,Z)/m = -0.052 -0.047 -0.099
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.059 -0.045 -0.105
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.058 -0.045 -0.104
RMS of residuals L5 /m = 0.004

New iteration of baseline
New apriori baseline (X,Y,Z)/m = -1.475 -0.720 1.128
14492 clock jitters computed out of 14492 intervals
AVE jitter /ps = 0.0 RMS jitter /ps = 0.2

Iter 3 Large residuals L1= 0
Iter 3 Large residuals L2= 2
Iter 3 Large residuals L5= 1

Computed baseline L1 (X,Y,Z)/m = 0.002 -0.003 -0.000
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.005 -0.001 -0.006
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.003 -0.001 -0.005
RMS of residuals L5 /m = 0.004

Final baseline L1 (X,Y,Z)/m = -1.473 -0.723 1.128
Final baseline L2 (X,Y,Z)/m = -1.480 -0.721 1.122
Final baseline L5 (X,Y,Z)/m = -1.477 -0.721 1.123

COMPUTATION OF CODE DIFFERENCES

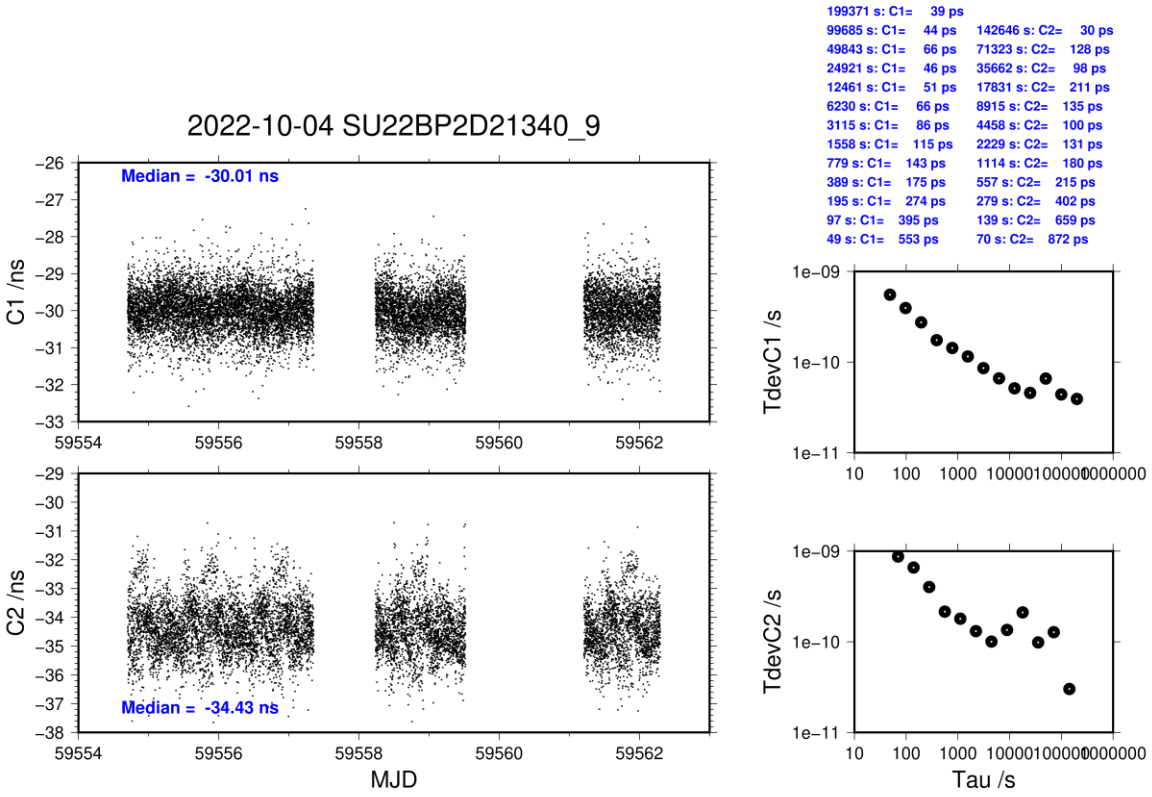
Total number of code differences = 341913

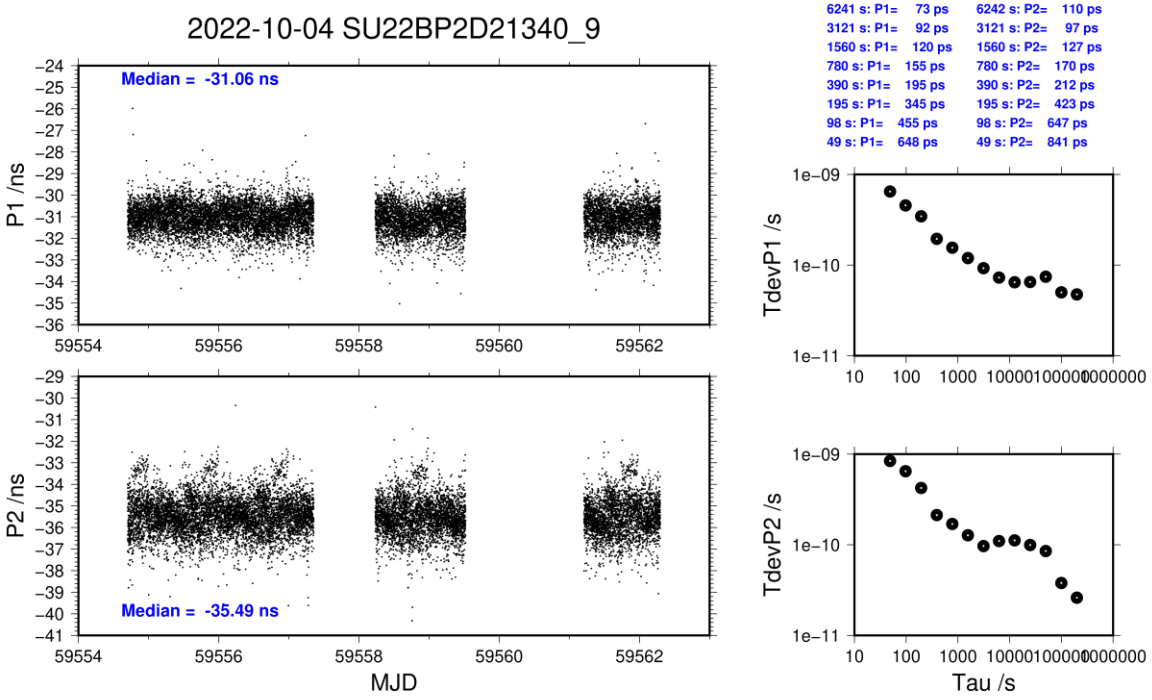
Global average of individual differences

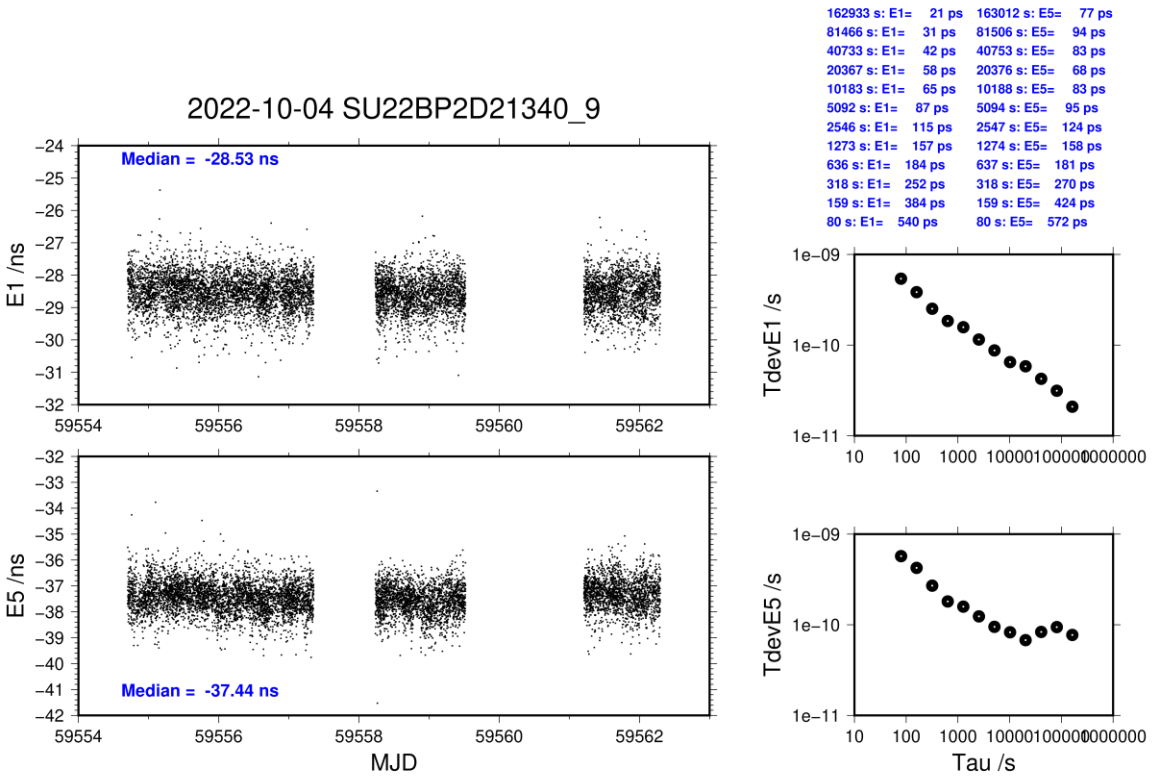
Code	#pts	ave/ns	rms/ns
C1	135151	-30.020	0.903
C2	94492	-34.392	1.182
P1	134879	-31.082	1.062
P2	134876	-35.484	1.209
E1	82635	-28.548	0.820
E5	82598	-37.447	0.815

Number of 300s epochs in out file = 1509

Code	#pts	median/ns	ave/ns	rms/ns
C1	13505	-30.007	-30.014	0.561
C2	9438	-34.428	-34.388	0.888
P1	13481	-31.056	-31.073	0.655
P2	13480	-35.492	-35.477	0.852
E1	8263	-28.529	-28.545	0.547
E5	8259	-37.437	-37.443	0.600


2022-10-04 SU22BP2D21340_9
Median = -30.01 ns
Median = -34.43 ns
C1 /ns
C2 /ns
MJD
199371 s: C1= 39 ps
99685 s: C1= 44 ps
49843 s: C1= 66 ps
24921 s: C1= 46 ps
12461 s: C1= 51 ps
6230 s: C1= 66 ps
3115 s: C1= 86 ps
1558 s: C1= 115 ps
779 s: C1= 143 ps
389 s: C1= 175 ps
195 s: C1= 274 ps
97 s: C1= 395 ps
49 s: C1= 553 ps
142646 s: C2= 30 ps
71323 s: C2= 128 ps
35662 s: C2= 98 ps
17831 s: C2= 211 ps
8915 s: C2= 135 ps
4458 s: C2= 100 ps
2229 s: C2= 131 ps
1114 s: C2= 180 ps
557 s: C2= 215 ps
279 s: C2= 402 ps
139 s: C2= 659 ps
70 s: C2= 872 ps
TdevC1 /s
TdevC2 /s
Tau /s


2022-10-04 SU22BP2D21340_9
Median = -31.06 ns
Median = -35.49 ns
P1 /ns
P2 /ns
MJD
199726 s: P1= 47 ps
99863 s: P1= 50 ps
49931 s: P1= 74 ps
24966 s: P1= 65 ps
12483 s: P1= 65 ps
6241 s: P1= 73 ps
3121 s: P1= 92 ps
1560 s: P1= 120 ps
780 s: P1= 155 ps
390 s: P1= 195 ps
195 s: P1= 345 ps
98 s: P1= 455 ps
49 s: P1= 648 ps
199740 s: P2= 26 ps
99870 s: P2= 38 ps
49935 s: P2= 85 ps
24968 s: P2= 99 ps
12484 s: P2= 112 ps
6242 s: P2= 110 ps
3121 s: P2= 97 ps
1560 s: P2= 127 ps
780 s: P2= 170 ps
390 s: P2= 212 ps
195 s: P2= 423 ps
98 s: P2= 647 ps
49 s: P2= 841 ps
TdevP1 /s
TdevP2 /s
Tau /s


2022-10-04 SU22BP2D21340_9
Median = -28.53 ns
Median = -37.44 ns
E1 /ns
E5 /ns
MJD
162933 s: E1= 21 ps
163012 s: E5= 77 ps
81466 s: E1= 31 ps
81506 s: E5= 94 ps
40733 s: E1= 42 ps
40753 s: E5= 83 ps
20367 s: E1= 58 ps
20376 s: E5= 68 ps
10183 s: E1= 65 ps
10188 s: E5= 83 ps
5092 s: E1= 87 ps
5094 s: E5= 95 ps
2546 s: E1= 115 ps
2547 s: E5= 124 ps
1273 s: E1= 157 ps
1274 s: E5= 158 ps
636 s: E1= 184 ps
637 s: E5= 181 ps
318 s: E1= 252 ps
318 s: E5= 270 ps
159 s: E1= 384 ps
159 s: E5= 424 ps
80 s: E1= 540 ps
80 s: E5= 572 ps
TdevE1 /s
TdevE5 /s
Tau /s

SU52-BP2D

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 135110
Compute baseline with sin(elev) between 0.05 and 0.90
Apriori codes biases from 17163 high elev obs : -2.746 -4.793
Iteration 0: Obs used = 236515; Huge residuals = 0; Large residuals = 643
Iteration 1: Obs used = 236515; Huge residuals = 0; Large residuals = 643
Computed code bias (P1/P2)/m = -3.077 -5.051
Computed baseline (X,Y,Z)/m = 2.955 -2.748 -0.599
RMS of residuals /m = 0.470

Number of phase differences to fit baseline
L1/L2 = 133889
L5 = 65465
A priori baseline (X,Y,Z)/m = 2.955 -2.748 -0.599
14505 clock jitters computed out of 14505 intervals
AVE jitter /ps = 0.0 RMS jitter /ps = 4.2

Iter 1 Large residuals L1= 0
Iter 1 Large residuals L2= 4
Iter 1 Large residuals L5= 1
Computed baseline L1 (X,Y,Z)/m = 0.092 0.063 0.233
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = 0.082 0.057 0.214
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = 0.083 0.067 0.214
RMS of residuals L5 /m = 0.004

Iter 2 Large residuals L1= 0
Iter 2 Large residuals L2= 4
Iter 2 Large residuals L5= 1
Computed baseline L1 (X,Y,Z)/m = 0.092 0.063 0.233
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = 0.082 0.057 0.214
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = 0.083 0.067 0.214
RMS of residuals L5 /m = 0.004

New iteration of baseline
New apriori baseline (X,Y,Z)/m = 3.041 -2.688 -0.375
14505 clock jitters computed out of 14505 intervals
AVE jitter /ps = 0.0 RMS jitter /ps = 0.4

Iter 3 Large residuals L1= 0
Iter 3 Large residuals L2= 4
Iter 3 Large residuals L5= 1

Computed baseline L1 (X,Y,Z)/m = 0.009 0.006 0.016
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.002 -0.001 -0.003
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.001 0.008 -0.002
RMS of residuals L5 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 3.050 -2.682 -0.359
Final baseline L2 (X,Y,Z)/m = 3.040 -2.689 -0.379
Final baseline L5 (X,Y,Z)/m = 3.041 -2.680 -0.377

COMPUTATION OF CODE DIFFERENCES

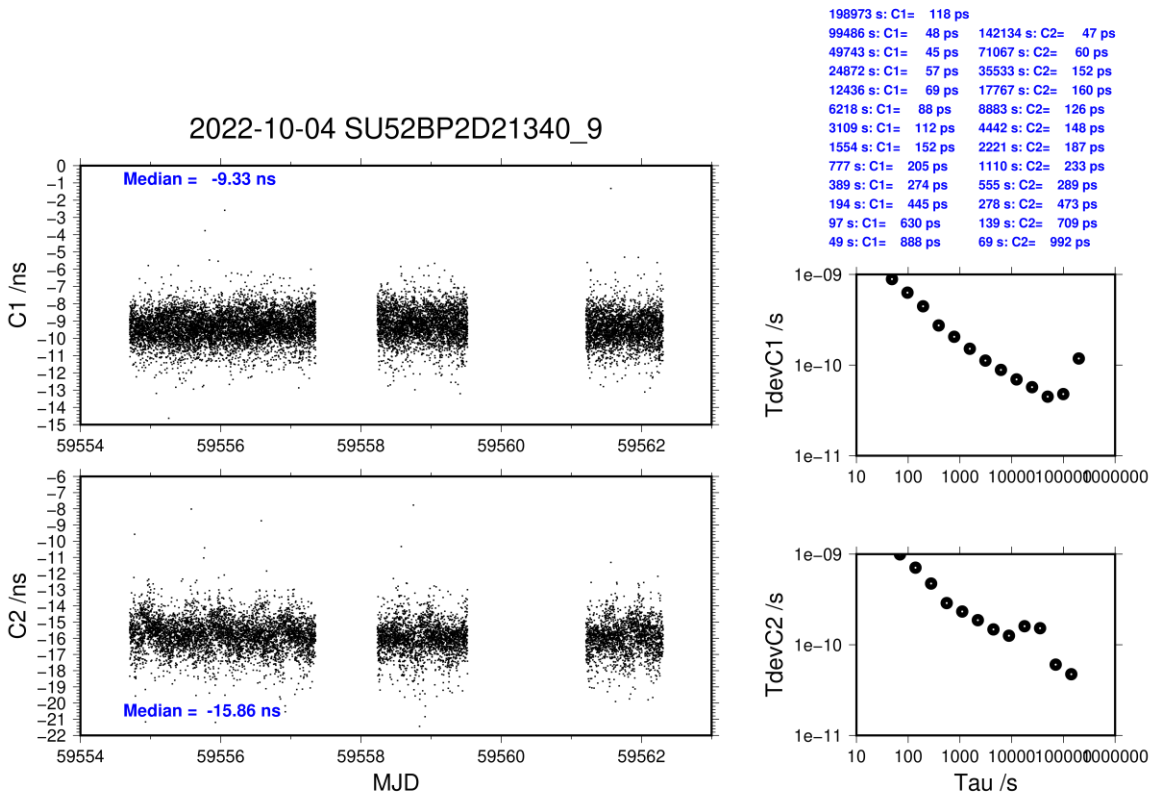
Total number of code differences = 536935

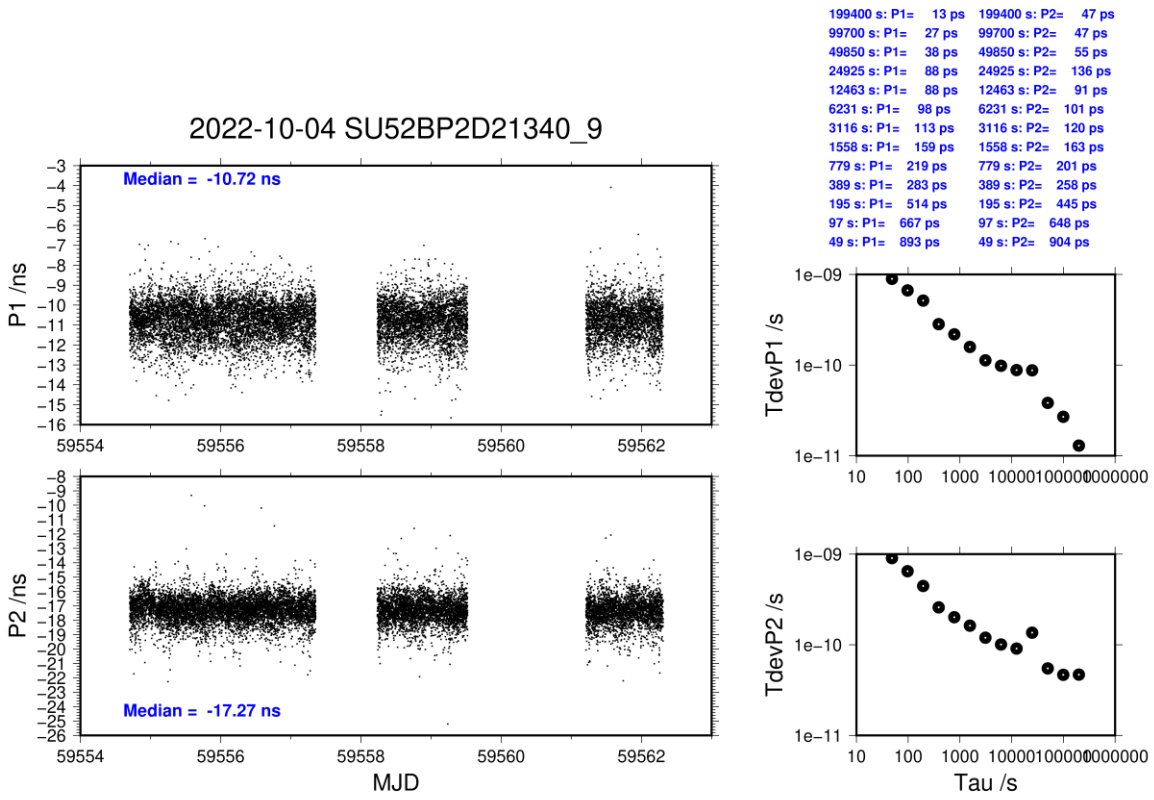
Global average of individual differences

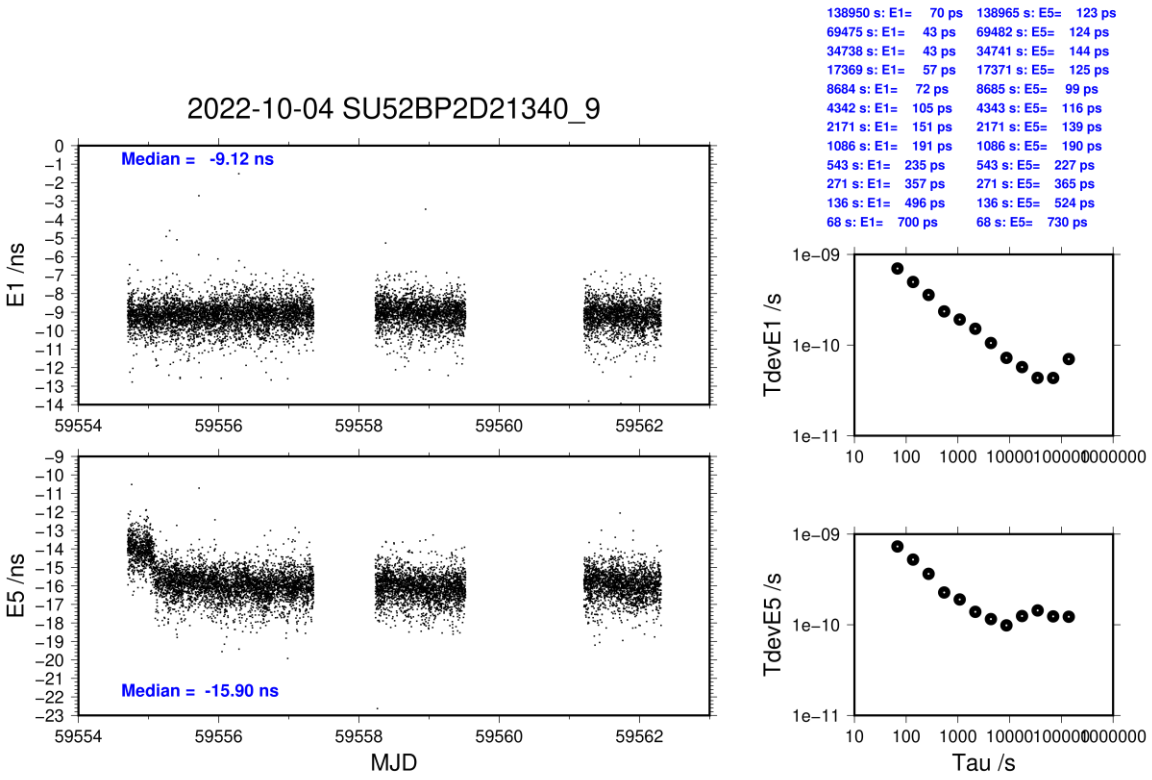
Code	#pts	ave/ns	rms/ns
C1	135326	-9.339	1.702
C2	94718	-15.889	1.791
P1	135012	-10.784	1.720
P2	135008	-17.304	1.329
E1	96823	-9.164	1.368
E5	96810	-15.858	1.284

Number of 300s epochs in out file = 1497

Code	#pts	median/ns	ave/ns	rms/ns
C1	13532	-9.328	-9.327	0.885
C2	9472	-15.864	-15.878	1.007
P1	13503	-10.723	-10.775	0.927
P2	13503	-17.268	-17.299	0.903
E1	9689	-9.118	-9.151	0.715
E5	9688	-15.902	-15.850	0.908


198973 s: C1= 118 ps
99486 s: C1= 48 ps
49743 s: C1= 45 ps
24872 s: C1= 57 ps
12436 s: C1= 69 ps
6218 s: C1= 88 ps
3109 s: C1= 112 ps
1554 s: C1= 152 ps
777 s: C1= 205 ps
389 s: C1= 274 ps
194 s: C1= 445 ps
97 s: C1= 630 ps
49 s: C1= 888 ps
142134 s: C2= 47 ps
71067 s: C2= 60 ps
35533 s: C2= 152 ps
17767 s: C2= 160 ps
8883 s: C2= 126 ps
4442 s: C2= 148 ps
2221 s: C2= 187 ps
1110 s: C2= 233 ps
555 s: C2= 289 ps
278 s: C2= 473 ps
139 s: C2= 709 ps
69 s: C2= 992 ps
2022-10-04 SU52BP2D21340_9
Median = -9.33 ns
Median = -15.86 ns
C1 /ns
C2 /ns
MJD
TdevC1 /s
TdevC2 /s
Tau /s


199400 s: P1= 13 ps
99700 s: P1= 27 ps
49850 s: P1= 38 ps
24925 s: P1= 88 ps
12463 s: P1= 88 ps
6231 s: P1= 98 ps
3116 s: P1= 113 ps
1558 s: P1= 159 ps
779 s: P1= 219 ps
389 s: P1= 283 ps
195 s: P1= 514 ps
97 s: P1= 667 ps
49 s: P1= 893 ps
199400 s: P2= 47 ps
99700 s: P2= 47 ps
49850 s: P2= 55 ps
24925 s: P2= 136 ps
12463 s: P2= 91 ps
6231 s: P2= 101 ps
3116 s: P2= 120 ps
1558 s: P2= 163 ps
779 s: P2= 201 ps
389 s: P2= 258 ps
195 s: P2= 445 ps
97 s: P2= 648 ps
49 s: P2= 904 ps
2022-10-04 SU52BP2D21340_9
Median = -10.72 ns
Median = -17.27 ns
P1 /ns
P2 /ns
MJD
TdevP1 /s
TdevP2 /s
Tau /s


2022-10-04 SU52BP2D21340_9
Median = -9.12 ns
Median = -15.90 ns
E1 /ns
E5 /ns
MJD
138950 s: E1= 70 ps
69475 s: E1= 43 ps
34738 s: E1= 43 ps
17369 s: E1= 57 ps
8684 s: E1= 72 ps
4342 s: E1= 105 ps
2171 s: E1= 151 ps
1086 s: E1= 191 ps
543 s: E1= 235 ps
271 s: E1= 357 ps
136 s: E1= 496 ps
68 s: E1= 700 ps
138965 s: E5= 123 ps
69482 s: E5= 124 ps
34741 s: E5= 144 ps
17371 s: E5= 125 ps
8685 s: E5= 99 ps
4343 s: E5= 116 ps
2171 s: E5= 139 ps
1086 s: E5= 190 ps
543 s: E5= 227 ps
271 s: E5= 365 ps
136 s: E5= 524 ps
68 s: E5= 730 ps
TdevE1 /s
TdevE5 /s
Tau /s

4.4/ SU (21349)

Period

MJD 59563 to 59574

Delays

BP2D: (cf page 38)

REFDLY = 135.40 ns

CABDLY = 176.85 ns (C210)

SU04: (cf page 38)

REFDLY = 259.00 ns

CABDLY = 122.50 ns

Setup at the SU

Information Sheet

Laboratory:	SU
Date and hour of the beginning of measurements:	**2021-12-15 00:00:00 UTC (MJD 59563)**
Date and hour of the end of measurements:	**2021-12-26 23:59:30 UTC (MJD 59574)**

Information on the system

	Local:	**Travelling:**
4-character BIPM code	SU04	BP2D
• Receiver maker and type: Receiver serial number:	DICOM (MESIT) GTR51 1404004	DICOM (MESIT) GTR55
1 PPS trigger level /V:	1.0 V	
• Antenna cable maker and type: Phase stabilised cable (Y/N):	Andrew FSJ-1 Y	
Length outside the building /m:	Approx. 15 m	Approx. 15 m
• Antenna maker and type: Antenna serial number:	Javad GNSS JAVRINGANT_DM NONE 00323	
Temperature (if stabilised) /°C	45.0 °C	

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	259.0 ns	266.3 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	-	-
• Antenna cable delay:	122.5 ns	
Splitter delay (if any):	-	-
Additional cable delay (if any):	-	-

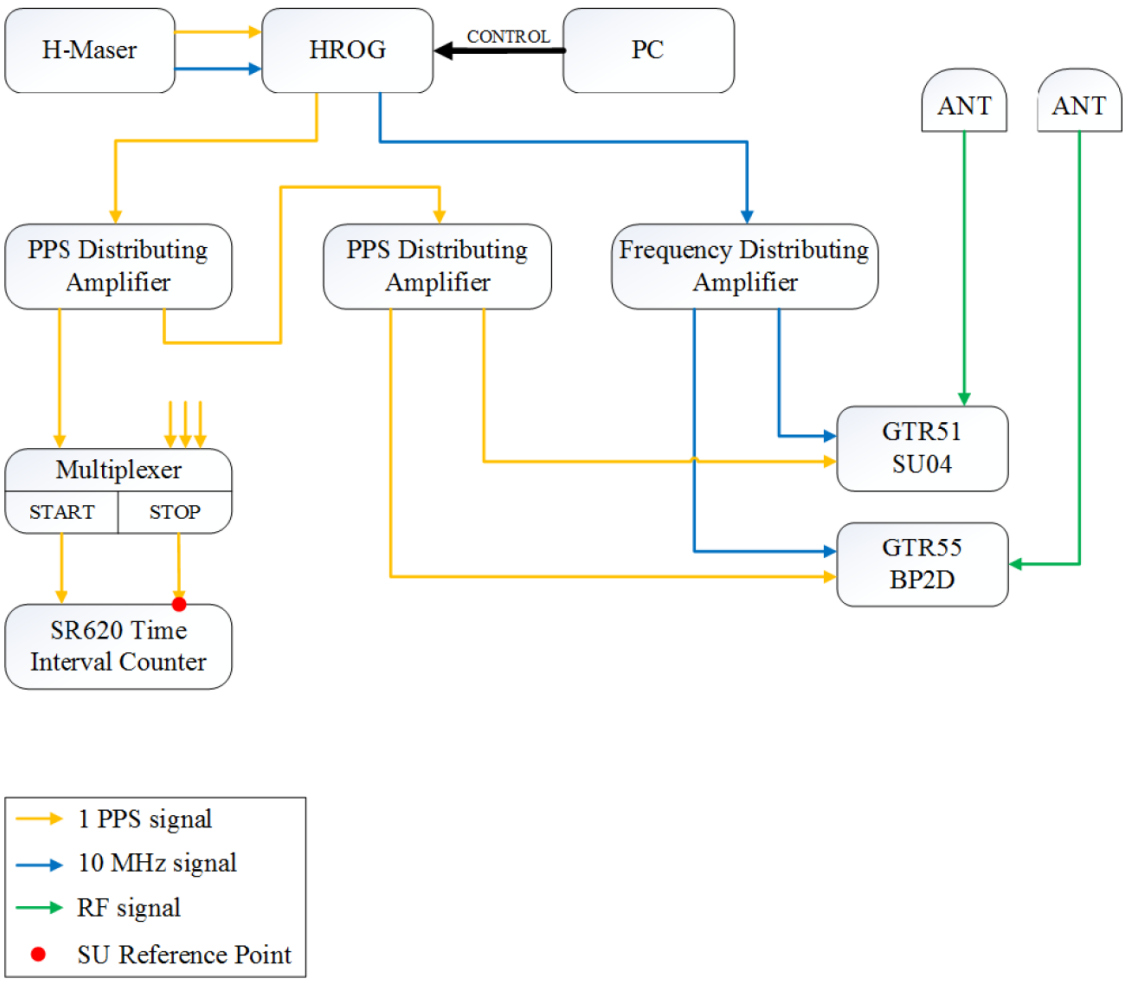
Data used for the generation of CGGTTS files

• INT DLY (GPS) /ns:	-
• INT DLY (Galileo) /ns:	-
• INT DLY (GLONASS) /ns:	-
• CAB DLY /ns:	-
• REF DLY /ns:	-
• Coordinates reference frame:	-
Latitude or X /m:	-
Longitude or Y /m:	-
Height or Z /m:	-

General information

• Rise time of the local UTC pulse:	2 ns
• Is the laboratory air conditioned:	Y
Set temperature value and uncertainty:	19.5 °C ± 0.5 °C
Set humidity value and uncertainty:	-

Diagram of the experiment set-up:



Log of Events / Additional Information :

Reference delay measurements were carried out using Portable Hydrogen Maser (PHM) VCH-1007 and a TIC SR620 with typical measurement uncertainty of 0.5 ns (when connected to external reference frequency source). Each delay estimate includes two measurements:

- between laboratory reference source UTC(SU) and PHM;
- between 1 PPS input connector of a receiver and PHM.

SU04 antenna cable delay was measured using Vector Network Analyzer Rohde & Schwarz ZVB4.

Measured delays:

Delay type	Value, ns	
	MJD 59563	MJD 59574
Between laboratory reference source UTC(SU) and the 1 PPS input connector of the SU04 receiver	259.0	258.8
Between laboratory reference source UTC(SU) and the 1 PPS input connector of the BP2D receiver	266.3	266.4
Antenna cable delay of SU04 receiver	122.5	-

SU04-BP2D

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 312915
Compute baseline with sin(elev) between 0.05 and 0.90
Apriori codes biases from 37950 high elev obs : -7.298 -9.524
Iteration 0: Obs used = 551627; Huge residuals = 0; Large residuals = 1225
Iteration 1: Obs used = 551627; Huge residuals = 0; Large residuals = 1225
Computed code bias (P1/P2)/m = -7.437 -9.562
Computed baseline (X,Y,Z)/m = -2.380 -1.241 2.197
RMS of residuals /m = 0.362

Number of phase differences to fit baseline
L1/L2 = 309673
L5 = 153563
A priori baseline (X,Y,Z)/m = -2.380 -1.241 2.197
34546 clock jitters computed out of 34546 intervals
AVE jitter /ps = 0.1 RMS jitter /ps = 4.5

Iter 1 Large residuals L1= 5
Iter 1 Large residuals L2= 4
Iter 1 Large residuals L5= 0
Computed baseline L1 (X,Y,Z)/m = -0.014 -0.016 -0.025
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.028 -0.019 -0.043
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.027 -0.013 -0.039
RMS of residuals L5 /m = 0.004

Iter 2 Large residuals L1= 5
Iter 2 Large residuals L2= 4
Iter 2 Large residuals L5= 0
Computed baseline L1 (X,Y,Z)/m = -0.014 -0.016 -0.025
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.028 -0.019 -0.043
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.027 -0.013 -0.039
RMS of residuals L5 /m = 0.004

New iteration of baseline
New apriori baseline (X,Y,Z)/m = -2.401 -1.258 2.163
34546 clock jitters computed out of 34546 intervals
AVE jitter /ps = -0.0 RMS jitter /ps = 0.1

Iter 3 Large residuals L1= 5
Iter 3 Large residuals L2= 4
Iter 3 Large residuals L5= 0
Computed baseline L1 (X,Y,Z)/m = 0.007 0.001 0.008
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.008 -0.002 -0.010
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.006 0.003 -0.006
RMS of residuals L5 /m = 0.004

Final baseline L1 (X,Y,Z)/m =	-2.394	-1.257	2.171
Final baseline L2 (X,Y,Z)/m =	-2.409	-1.261	2.153
Final baseline L5 (X,Y,Z)/m =	-2.407	-1.255	2.157

COMPUTATION OF CODE DIFFERENCES

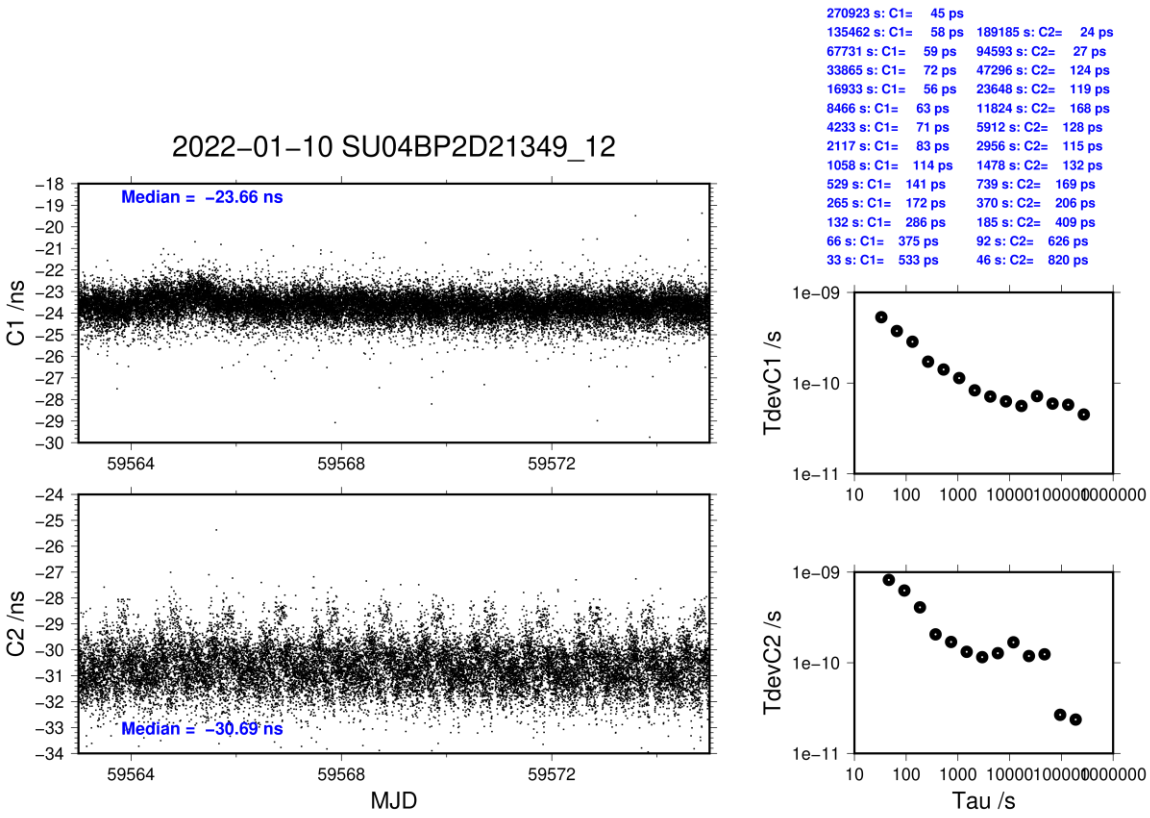
Total number of code differences = 795235

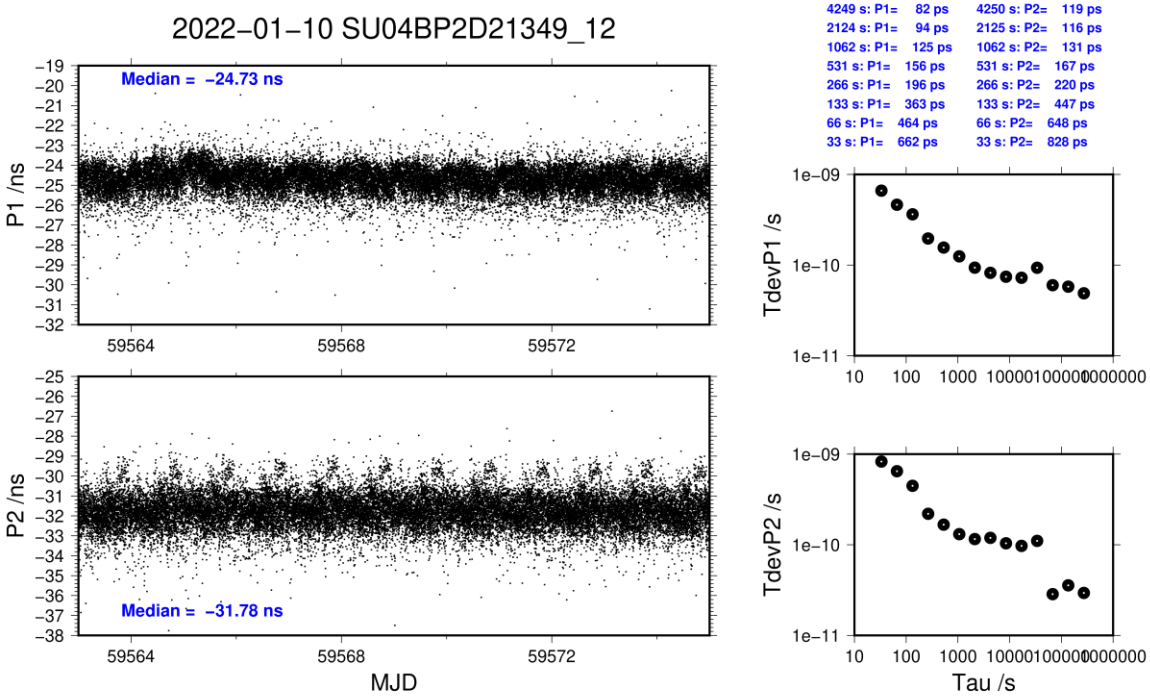
Global average of individual differences

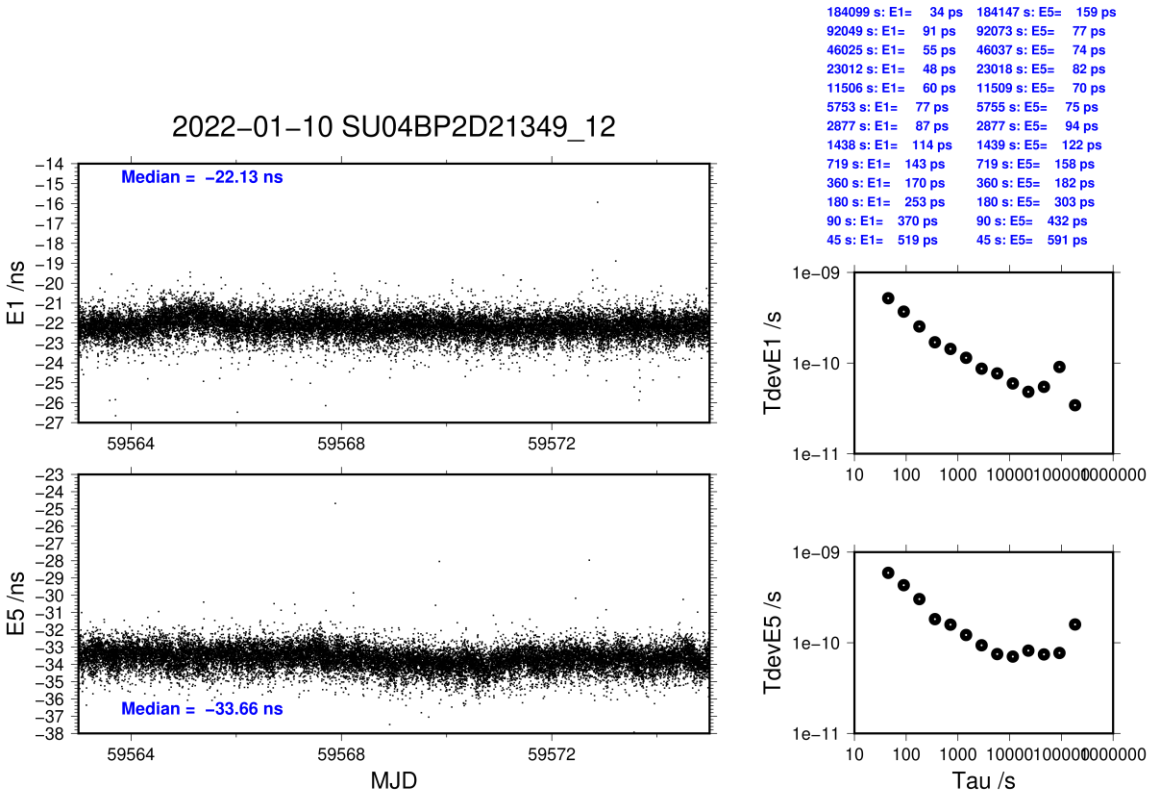
Code	#pts	ave/ns	rms/ns
C1	313738	-23.676	0.928
C2	224849	-30.668	1.171
P1	312760	-24.761	1.141
P2	312738	-31.781	1.288
E1	230735	-22.150	0.846
E5	230691	-33.683	0.849

Number of 300s epochs in out file = 3456

Code	#pts	median/ns	ave/ns	rms/ns
C1	31342	-23.655	-23.671	0.560
C2	22442	-30.690	-30.663	0.848
P1	31227	-24.727	-24.751	0.681
P2	31221	-31.784	-31.772	0.857
E1	23062	-22.131	-22.145	0.542
E5	23056	-33.658	-33.682	0.638


2022−01−10 SU04BP2D21349_12
Median = −23.66 ns
Median = −30.69 ns
C1 /ns
C2 /ns
MJD
59564
59568
59572
270923 s: C1= 45 ps
135462 s: C1= 58 ps
67731 s: C1= 59 ps
33865 s: C1= 72 ps
16933 s: C1= 56 ps
8466 s: C1= 63 ps
4233 s: C1= 71 ps
2117 s: C1= 83 ps
1058 s: C1= 114 ps
529 s: C1= 141 ps
265 s: C1= 172 ps
132 s: C1= 286 ps
66 s: C1= 375 ps
33 s: C1= 533 ps
189185 s: C2= 24 ps
94593 s: C2= 27 ps
47296 s: C2= 124 ps
23648 s: C2= 119 ps
11824 s: C2= 168 ps
5912 s: C2= 128 ps
2956 s: C2= 115 ps
1478 s: C2= 132 ps
739 s: C2= 169 ps
370 s: C2= 206 ps
185 s: C2= 409 ps
92 s: C2= 626 ps
46 s: C2= 820 ps
TdevC1 /s
TdevC2 /s
Tau /s


2022−01−10 SU04BP2D21349_12
Median = −24.73 ns
Median = −31.78 ns
P1 /ns
P2 /ns
MJD
59564
59568
59572
271921 s: P1= 49 ps
135961 s: P1= 58 ps
67980 s: P1= 60 ps
33990 s: P1= 93 ps
16995 s: P1= 72 ps
8498 s: P1= 74 ps
4249 s: P1= 82 ps
2124 s: P1= 94 ps
1062 s: P1= 125 ps
531 s: P1= 156 ps
266 s: P1= 196 ps
133 s: P1= 363 ps
66 s: P1= 464 ps
33 s: P1= 662 ps
271973 s: P2= 29 ps
135987 s: P2= 36 ps
67993 s: P2= 29 ps
33997 s: P2= 110 ps
16998 s: P2= 97 ps
8499 s: P2= 104 ps
4250 s: P2= 119 ps
2125 s: P2= 116 ps
1062 s: P2= 131 ps
531 s: P2= 167 ps
266 s: P2= 220 ps
133 s: P2= 447 ps
66 s: P2= 648 ps
33 s: P2= 828 ps
TdevP1 /s
TdevP2 /s
Tau /s


2022−01−10 SU04BP2D21349_12
Median = −22.13 ns
Median = −33.66 ns
E1 /ns
E5 /ns
MJD
184099 s: E1= 34 ps
92049 s: E1= 91 ps
46025 s: E1= 55 ps
23012 s: E1= 48 ps
11506 s: E1= 60 ps
5753 s: E1= 77 ps
2877 s: E1= 87 ps
1438 s: E1= 114 ps
719 s: E1= 143 ps
360 s: E1= 170 ps
180 s: E1= 253 ps
90 s: E1= 370 ps
45 s: E1= 519 ps
184147 s: E5= 159 ps
92073 s: E5= 77 ps
46037 s: E5= 74 ps
23018 s: E5= 82 ps
11509 s: E5= 70 ps
5755 s: E5= 75 ps
2877 s: E5= 94 ps
1439 s: E5= 122 ps
719 s: E5= 158 ps
360 s: E5= 182 ps
180 s: E5= 303 ps
90 s: E5= 432 ps
45 s: E5= 591 ps
TdevE1 /s
TdevE5 /s
Tau /s

4.5/ BIPM (22249)

Period

MJD 59828 to 59834

Delays

BP2D: (cf page 46)
REFDLY = 48.42 ns (63.45-15.03)
CABDLY = 176.85 ns (C210)

BP21: (cf page 46)
REFDLY = 43.29 ns (58.32-15.03)
CABDLY = 140.80 ns (C201)

Setup at the BIPM

Annex A - Information Sheet

(to be repeated for each calibrated system)

Laboratory:	BIPM
Date and hour of the beginning of measurements:	MJD 59828
Date and hour of the end of measurements:	MJD 59834

Information on the system

	Local:	**Travelling:**
4-character BIPM code	BP21	BP2D
• Receiver maker and type: Receiver serial number:	Septentrio PolaRx5TR 4701229	Mesit GTR55 201001
1 PPS trigger level /V:		
• Antenna cable maker and type: Phase stabilised cable (Y/N):	LMR-195	HYLM195
Length outside the building /m:	~ 15 m	~ 15 m
• Antenna maker and type: Antenna serial number:	Septentrio SEPCHOKE B3E6 5253	Novatel GNSS-850 NMLK17440001C
Temperature (if stabilised) /°C		

Measured delays /ns

(if needed fill box "Additional Information" below)

	Local:	**Travelling:**
• Delay from local UTC to receiver 1 PPS-in:	43.29 ns	48.42 ns
Delay from 1 PPS-in to internal Reference (if different): (see section 2 for details)	PPSin compensation enable	
• Antenna cable delay:	140.80 ns	176.85 ns
Splitter delay (if any):		(1)
Additional cable delay (if any):		(1)

Data used for the generation of CGGTTS files

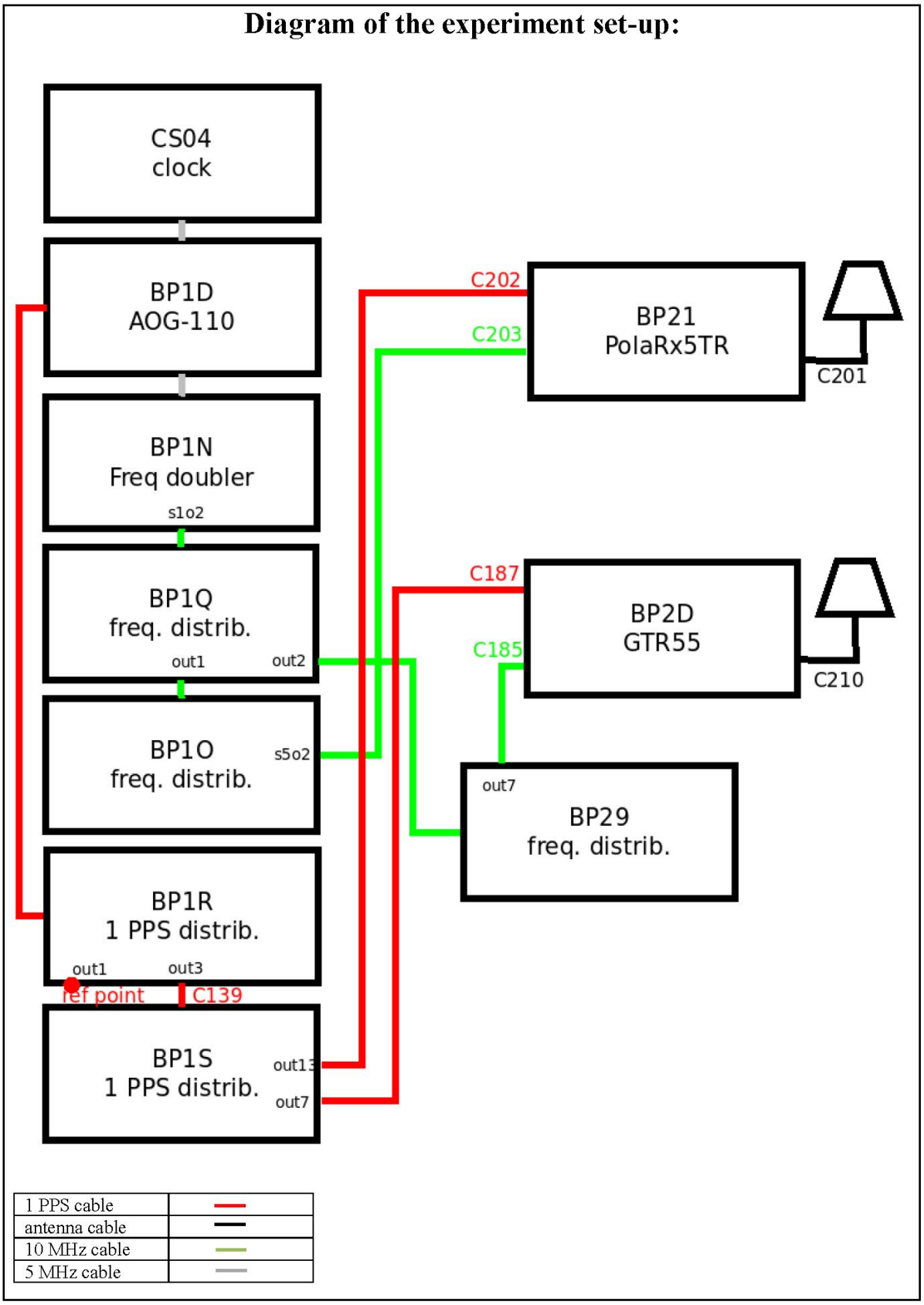
• INT DLY (GPS) /ns:	
• INT DLY (Galileo) /ns:	
• INT DLY (GLONASS) /ns:	
• CAB DLY /ns:	
• REF DLY /ns:	
• Coordinates reference frame:	
Latitude or X /m:	
Longitude or Y /m:	
Height or Z /m:	

General information

• Rise time of the local UTC pulse:	
• Is the laboratory air conditioned:	
Set temperature value and uncertainty:	22 ± 1°C
Set humidity value and uncertainty:	

(1) For a trip with closure, not needed if the traveling equipment is used in the same set-up throughout.

Diagram of the experiment set-up:



Log of Events / Additional Information :

All measurements at BIPM carried out by L. Tisserand.

Equipment used to measure delays is a Time Interval Counter (TIC), model 53230A, maker Keysight, S/N MY58390132, with measurement uncertainty typically less than 0.5 ns (using external reference frequency as timebase).

BP2D-BP21

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 151811
Compute baseline with sin(elev) between 0.05 and 0.90
Apriori codes biases from 30690 high elev obs : 6.174 7.442
Iteration 0: Obs used = 239152; Huge residuals = 3; Large residuals = 5712
Iteration 1: Obs used = 239150; Huge residuals = 0; Large residuals = 5711
Computed code bias (P1/P2)/m = 5.899 7.162
Computed baseline (X,Y,Z)/m = -3.463 -0.354 3.364
RMS of residuals /m = 0.620

Number of phase differences to fit baseline
L1/L2 = 147167
L5 = 75057
A priori baseline (X,Y,Z)/m = -3.463 -0.354 3.364
23028 clock jitters computed out of 23028 intervals
AVE jitter /ps = -0.5 RMS jitter /ps = 4.8

Iter 1 Large residuals L1= 4
Iter 1 Large residuals L2= 3
Iter 1 Large residuals L5= 9
Computed baseline L1 (X,Y,Z)/m = -0.165 -0.155 -0.024
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.148 -0.150 -0.008
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.168 -0.150 -0.003
RMS of residuals L5 /m = 0.004

Iter 2 Large residuals L1= 4
Iter 2 Large residuals L2= 3
Iter 2 Large residuals L5= 9
Computed baseline L1 (X,Y,Z)/m = -0.165 -0.155 -0.024
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = -0.148 -0.150 -0.008
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = -0.168 -0.150 -0.003
RMS of residuals L5 /m = 0.004

New iteration of baseline
New apriori baseline (X,Y,Z)/m = -3.620 -0.507 3.349
23028 clock jitters computed out of 23028 intervals
AVE jitter /ps = 0.4 RMS jitter /ps = 0.3

Iter 3 Large residuals L1= 4
Iter 3 Large residuals L2= 3
Iter 3 Large residuals L5= 9

Computed baseline L1 (X,Y,Z)/m = -0.001 -0.044 -0.007
RMS of residuals L1 /m = 0.004
Computed baseline L2 (X,Y,Z)/m = 0.016 -0.039 0.009
RMS of residuals L2 /m = 0.004
Computed baseline L5 (X,Y,Z)/m = 0.008 -0.041 0.011
RMS of residuals L5 /m = 0.004

Final baseline L1 (X,Y,Z)/m = -3.621 -0.551 3.341
Final baseline L2 (X,Y,Z)/m = -3.604 -0.546 3.357
Final baseline L5 (X,Y,Z)/m = -3.612 -0.548 3.359

COMPUTATION OF CODE DIFFERENCES

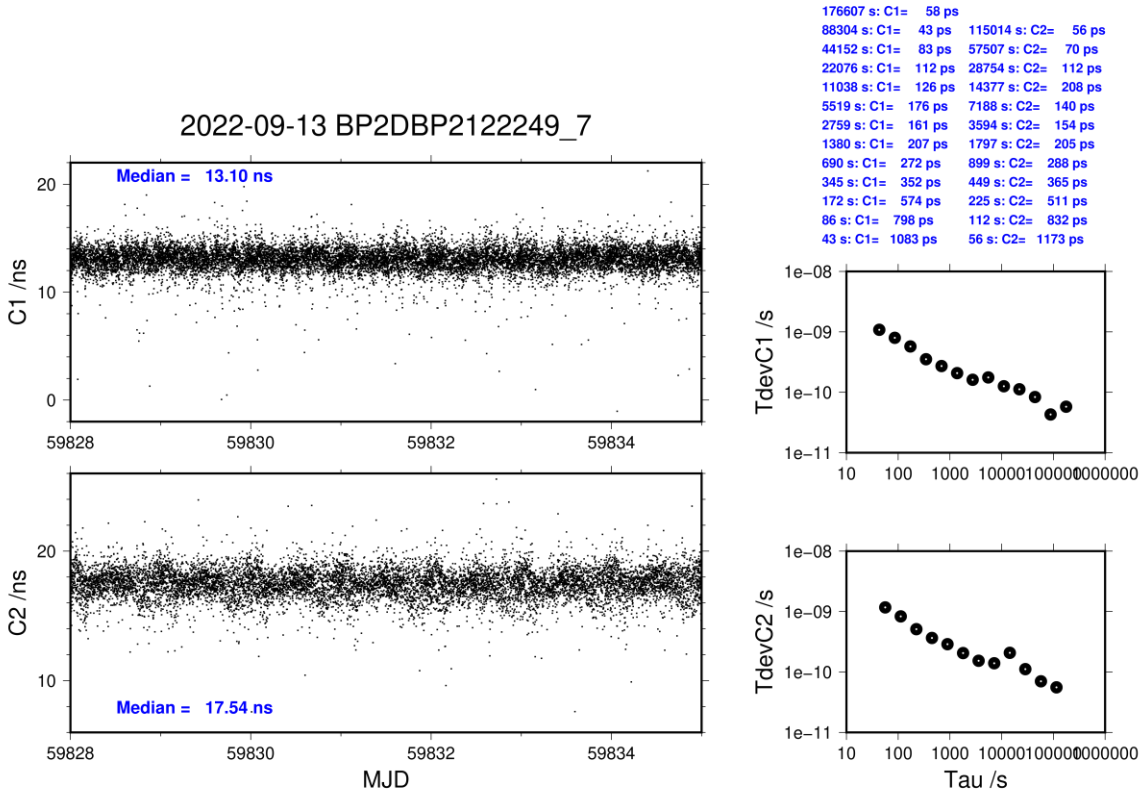
Total number of code differences = 608569

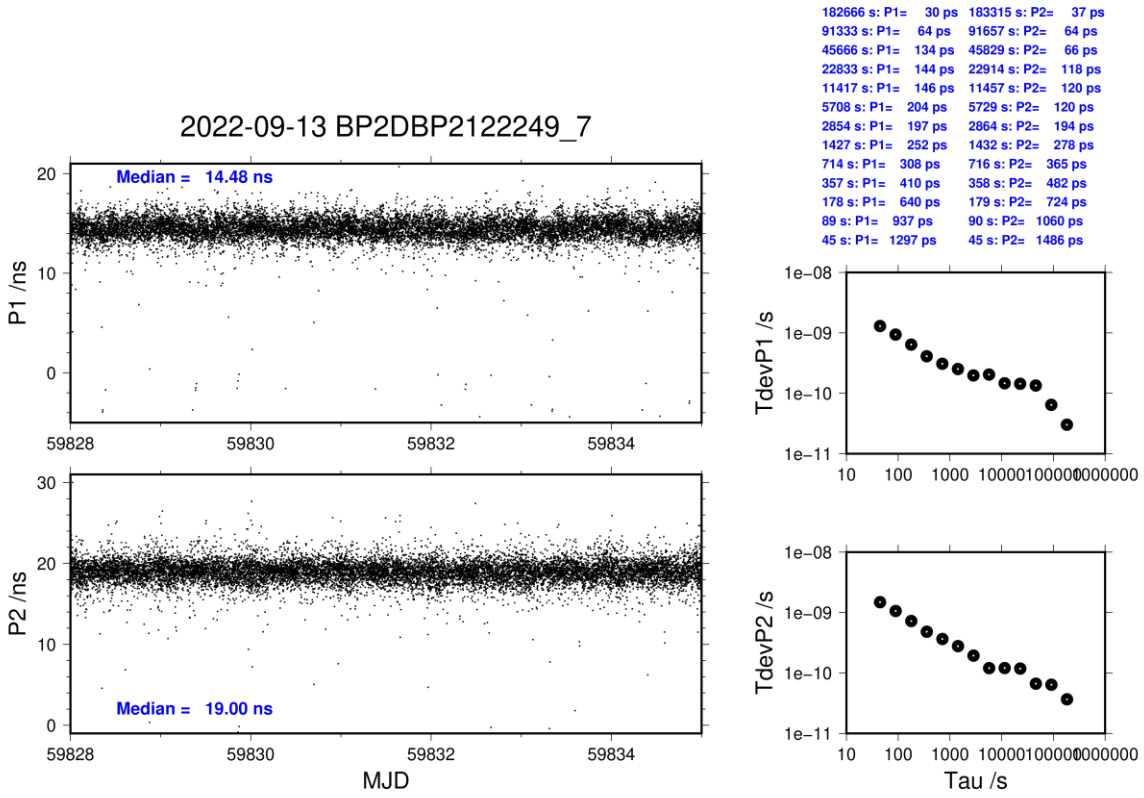
Global average of individual differences

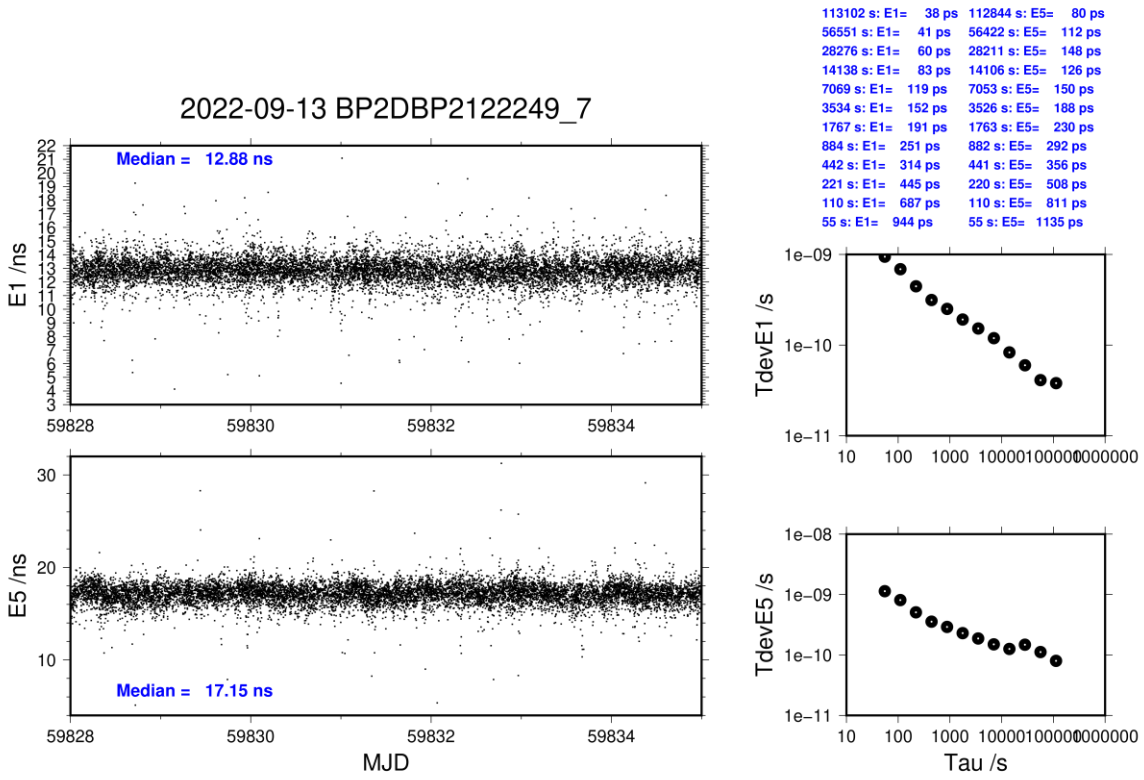
Code	#pts	ave/ns	rms/ns
C1	155923	18.692	2.045
C2	117483	22.943	2.057
P1	151022	20.120	1.836
P2	150900	24.349	2.495
E1	114728	18.481	1.798
E5	115120	22.900	1.779

Number of 300s epochs in out file = 2304

Code	#pts	median/ns	ave/ns	rms/ns
C1	15602	18.740	18.699	1.138
C2	11741	23.006	22.938	1.297
P1	15040	20.163	20.163	1.088
P2	15035	24.412	24.369	1.471
E1	11465	18.510	18.474	1.051
E5	11490	22.946	22.873	1.242


2022-09-13 BP2DBP2122249_7
Median = 13.10 ns
Median = 17.54 ns
C1 /ns
C2 /ns
MJD
176607 s: C1= 58 ps
88304 s: C1= 43 ps 115014 s: C2= 56 ps
44152 s: C1= 83 ps 57507 s: C2= 70 ps
22076 s: C1= 112 ps 28754 s: C2= 112 ps
11038 s: C1= 126 ps 14377 s: C2= 208 ps
5519 s: C1= 176 ps 7188 s: C2= 140 ps
2759 s: C1= 161 ps 3594 s: C2= 154 ps
1380 s: C1= 207 ps 1797 s: C2= 205 ps
690 s: C1= 272 ps 899 s: C2= 288 ps
345 s: C1= 352 ps 449 s: C2= 365 ps
172 s: C1= 574 ps 225 s: C2= 511 ps
86 s: C1= 798 ps 112 s: C2= 832 ps
43 s: C1= 1083 ps 56 s: C2= 1173 ps
TdevC1 /s
TdevC2 /s
Tau /s


2022-09-13 BP2DBP2122249_7
Median = 14.48 ns
Median = 19.00 ns
P1 /ns
P2 /ns
MJD
182666 s: P1= 30 ps 183315 s: P2= 37 ps
91333 s: P1= 64 ps 91657 s: P2= 64 ps
45666 s: P1= 134 ps 45829 s: P2= 66 ps
22833 s: P1= 144 ps 22914 s: P2= 118 ps
11417 s: P1= 146 ps 11457 s: P2= 120 ps
5708 s: P1= 204 ps 5729 s: P2= 120 ps
2854 s: P1= 197 ps 2864 s: P2= 194 ps
1427 s: P1= 252 ps 1432 s: P2= 278 ps
714 s: P1= 308 ps 716 s: P2= 365 ps
357 s: P1= 410 ps 358 s: P2= 482 ps
178 s: P1= 640 ps 179 s: P2= 724 ps
89 s: P1= 937 ps 90 s: P2= 1060 ps
45 s: P1= 1297 ps 45 s: P2= 1486 ps
TdevP1 /s
TdevP2 /s
Tau /s


2022-09-13 BP2DBP2122249_7
Median = 12.88 ns
Median = 17.15 ns
E1 /ns
E5 /ns
MJD
59828
59830
59832
59834
113102 s: E1= 38 ps
112844 s: E5= 80 ps
56551 s: E1= 41 ps
56422 s: E5= 112 ps
28276 s: E1= 60 ps
28211 s: E5= 148 ps
14138 s: E1= 83 ps
14106 s: E5= 126 ps
7069 s: E1= 119 ps
7053 s: E5= 150 ps
3534 s: E1= 152 ps
3526 s: E5= 188 ps
1767 s: E1= 191 ps
1763 s: E5= 230 ps
884 s: E1= 251 ps
882 s: E5= 292 ps
442 s: E1= 314 ps
441 s: E5= 356 ps
221 s: E1= 445 ps
220 s: E5= 508 ps
110 s: E1= 687 ps
110 s: E5= 811 ps
55 s: E1= 944 ps
55 s: E5= 1135 ps
TdevE1 /s
TdevE5 /s
Tau /s