

Table of contents

1.1/ BIPM (13088) 3
1.2/ OP (13103)..... 22
1.3/ OP (13108)..... 28
1.4/ BIPM (13115) 34

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

$(X_P + X_O) = \text{REFDLY.}$

- X_C = antenna cable delay
- $[X_D = \text{short cable} + \text{splitter delay}]$

$(X_C + X_D) = \text{CABDLY.}$ In practice, X_D is generally not used.

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

$(X_R + X_S) = \text{INTDLY.}$

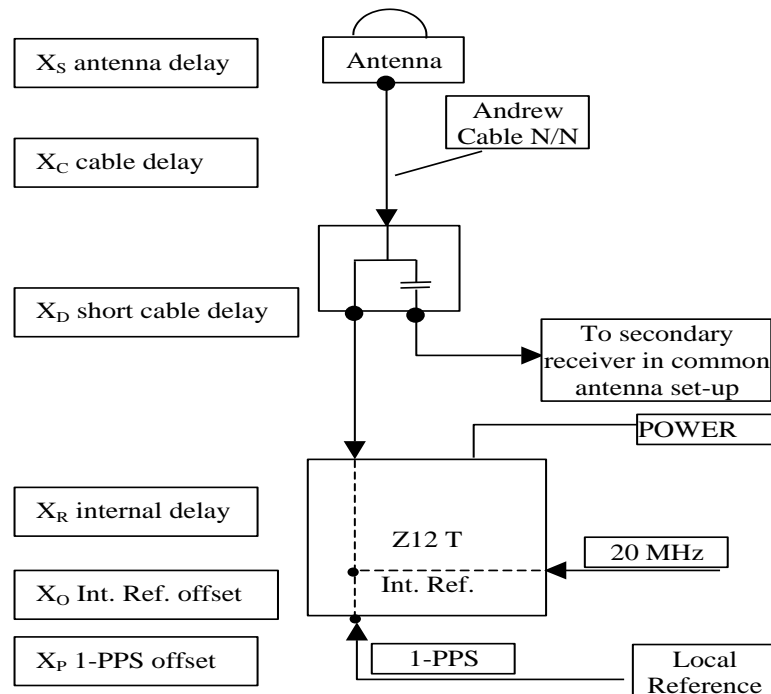


Figure 1: Definition of the different delays used in the most general set-up of a geodetic system (here shown for a Z12-T) from [Petit et al, 2001].

1/ Phase 1

Laboratories: BIPM, OP

1.1/ BIPM (13088)Period

MJD 56380 to 56387 (Air conditioning was faulty between MJD 56381.3 to 56387.5)

Delays

All measurements carried out by L. Tisserand.

Equipment used to measure internal delay of Z12T receivers is an oscilloscope, model TDS3032, maker Tektronix, s/n: B021903 with measurement uncertainty typically about 0.8 ns.

Equipment used to measure internal delay of other receivers is a time interval counter (TIC), model SR620, maker Stanford Research Systems, s/n: 4680, with measurement uncertainty typically less than 0.5 ns (using external reference frequency as timebase).

BP0C:

$$X_O = 18.6 + 15.8 = 34.4 \text{ ns}$$

$$X_P = 54.7 \text{ ns} \quad (\text{C2+C67})$$

$$\text{REFDLY} = 89.1 \text{ ns}$$

$$\text{CABDLY} = X_C = 234.4 \text{ ns} \quad (\text{C107})$$

BP0M:

$$X_O = 16.0 + 15.8 = 31.8 \text{ ns}$$

$$X_P = 36.4 \text{ ns} \quad (\text{H3+C125})$$

$$\text{REFDLY} = 68.2 \text{ ns}$$

$$\text{CABDLY} = X_C = 130.7 \text{ ns} \quad (\text{C12})$$

BP0R:

$$X_O = 249.4 \text{ ns} \quad (274.4-33.7+8.7)$$

$$X_P = 33.2 \text{ ns} \quad (\text{H1+BIPM9})$$

$$\text{REFDLY} = 282.6 \text{ ns}$$

$$\text{CABDLY} = X_C = 133.4 \text{ ns} \quad (\text{C113})$$

BP1C:

$$X_O = 183.1 \text{ ns} \quad (216.8-33.7)$$

$$X_P = 33.5 \text{ ns} \quad (\text{I1+C126})$$

$$\text{REFDLY} = 216.6 \text{ ns}$$

$$\text{CABDLY} = X_C = 235.7 \text{ ns} \quad (\text{C131})$$

BP0T:

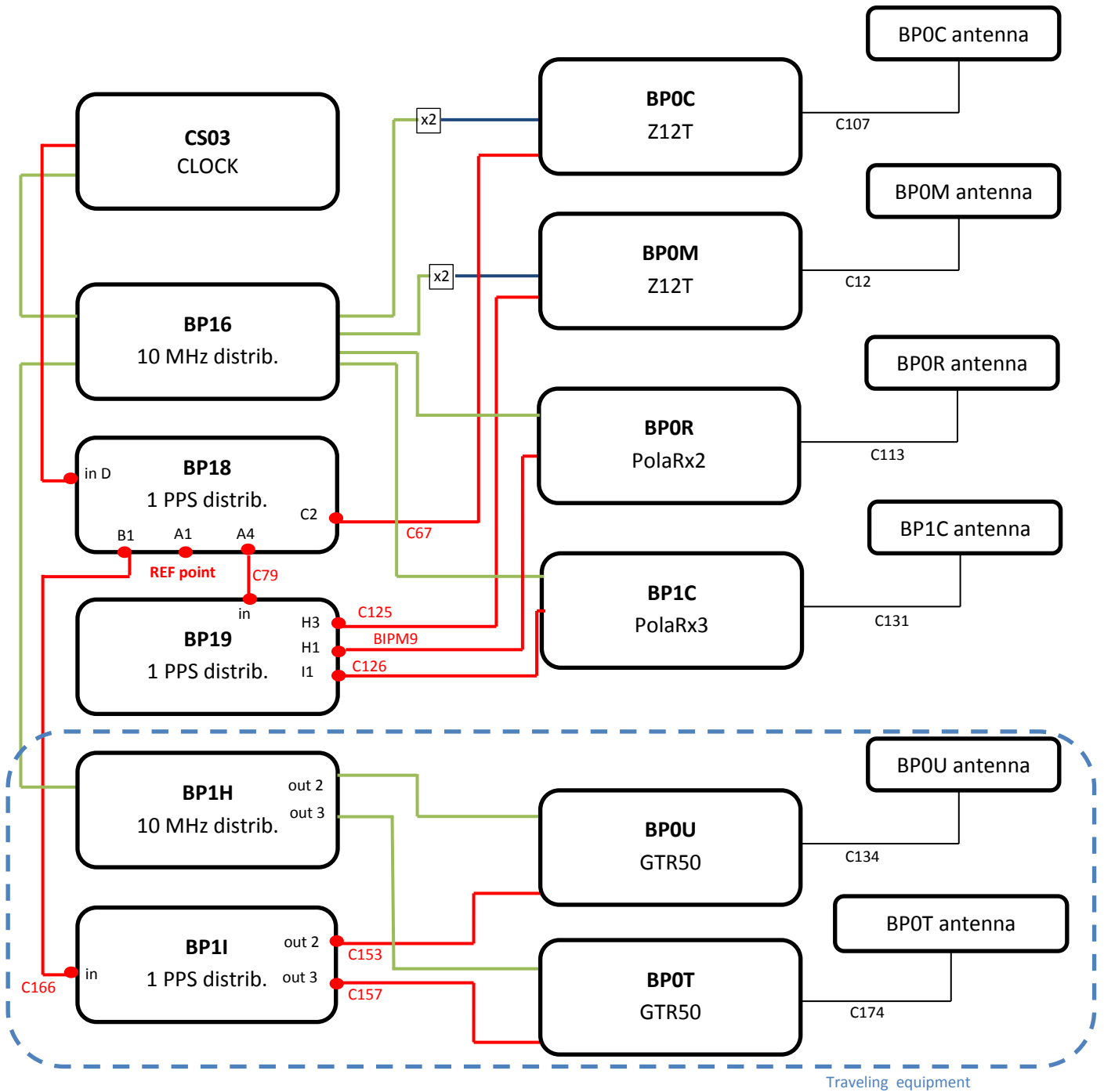
REFDLY = X_P = 54.2 ns (B1+C166+BP1I+C157)
CABDLY = X_C = 176.9 ns (C174)

BP0U:

REFDLY = X_P = 54.2 ns (B1+C166+BP1I+C153)
CABDLY = X_C = 182.0 ns (C134)

Setup at the BIPM

- 1 PPS ————
- 10 MHz ————
- 20 MHz ————



BP0U-BP0R

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 106359
 Computed code bias (P1/P2)/m = -24.418 -23.567
 Computed baseline (X,Y,Z)/m = 3.907 2.882 -3.840
 RMS of residuals /m = 0.625

Number of phase differences to fit baseline = 100370
 A priori baseline (X,Y,Z)/m = 3.907 2.882 -3.840
 19949 clock jitters computed out of 19956 intervals
 AVE jitter /ps = -0.1 RMS jitter /ps = 28.0

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.100 0.015 0.179
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.102 0.023 0.179
 RMS of residuals L2 /m = 0.004

Final baseline L1 (X,Y,Z)/m = 4.007 2.897 -3.661
 Final baseline L2 (X,Y,Z)/m = 4.009 2.905 -3.661

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 106453

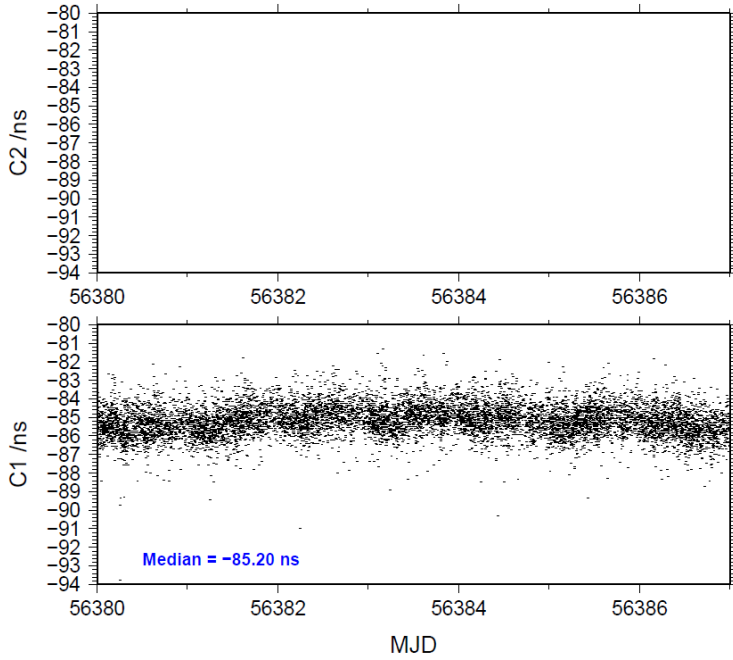
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 106415 -85.179 1.423
 C2: 0-NaN -NaN
 P1: 106321 -81.930 2.127
 P2: 106318 -79.098 2.330

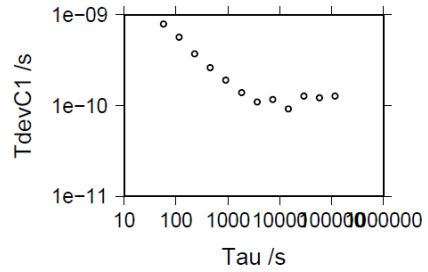
Number of 300s epochs in out file = 2010

Code #pts, median/ns, ave/ns, rms/ns
 C1: 10548 -85.201 -85.180 0.826
 C2: 0 0.000-NaN -NaN
 P1: 10538 -81.976 -81.947 1.211
 P2: 10538 -79.069 -79.078 1.389

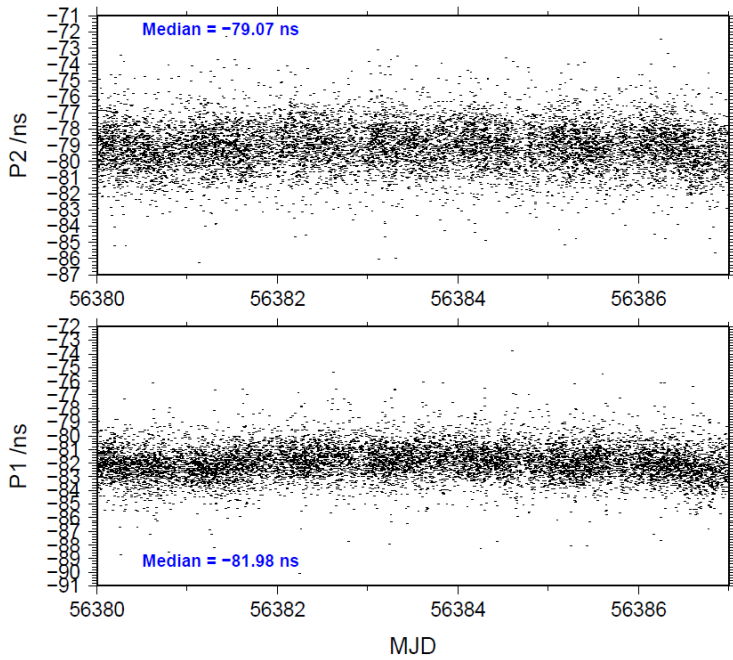
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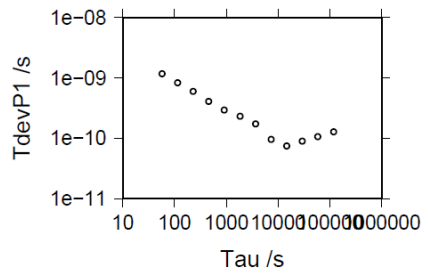
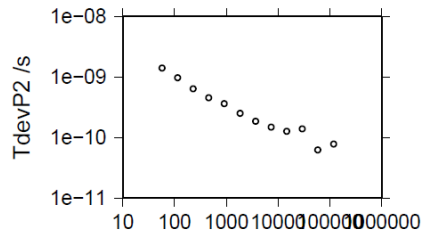
- 117381 s: C1= 128 ps
- 58690 s: C1= 122 ps
- 29345 s: C1= 127 ps
- 14673 s: C1= 92 ps
- 7336 s: C1= 117 ps
- 3668 s: C1= 110 ps
- 1834 s: C1= 139 ps
- 917 s: C1= 190 ps
- 459 s: C1= 261 ps
- 229 s: C1= 370 ps
- 115 s: C1= 565 ps
- 57 s: C1= 788 ps



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- 117492 s: P1= 128 ps 117492 s: P2= 78 ps
- 58746 s: P1= 106 ps 58746 s: P2= 62 ps
- 29373 s: P1= 90 ps 29373 s: P2= 138 ps
- 14687 s: P1= 75 ps 14687 s: P2= 127 ps
- 7343 s: P1= 96 ps 7343 s: P2= 149 ps
- 3672 s: P1= 173 ps 3672 s: P2= 186 ps
- 1836 s: P1= 232 ps 1836 s: P2= 253 ps
- 918 s: P1= 295 ps 918 s: P2= 363 ps
- 459 s: P1= 406 ps 459 s: P2= 454 ps
- 229 s: P1= 598 ps 229 s: P2= 639 ps
- 115 s: P1= 835 ps 115 s: P2= 978 ps
- 57 s: P1= 1177 ps 57 s: P2= 1402 ps



BP0U-BPIC

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 106412
 Computed code bias (P1/P2)/m = -24.568 -24.278
 Computed baseline (X,Y,Z)/m = 2.954 2.636 -3.066
 RMS of residuals /m = 0.587

Number of phase differences to fit baseline = 100509
 A priori baseline (X,Y,Z)/m = 2.954 2.636 -3.066
 19932 clock jitters computed out of 19943 intervals
 AVE jitter /ps = -0.2 RMS jitter /ps = 27.9

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.158 0.020 0.183
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.167 0.020 0.193
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 3.112 2.656 -2.883
 Final baseline L2 (X,Y,Z)/m = 3.121 2.656 -2.873

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 106448

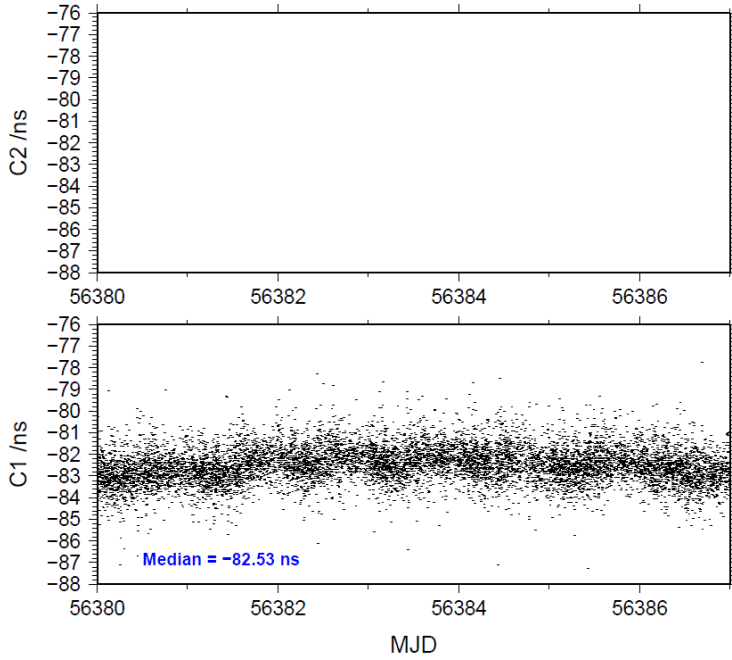
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 106410 -82.500 1.410
 C2: 0-NaN -NaN
 P1: 106374 -82.542 1.839
 P2: 106373 -81.606 2.277

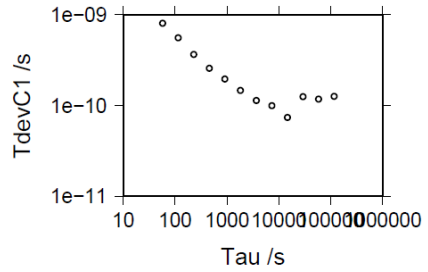
Number of 300s epochs in out file = 2009

Code #pts, median/ns, ave/ns, rms/ns
 C1: 10553 -82.525 -82.504 0.830
 C2: 0 0.000-NaN -NaN
 P1: 10550 -82.580 -82.548 1.040
 P2: 10550 -81.614 -81.596 1.317

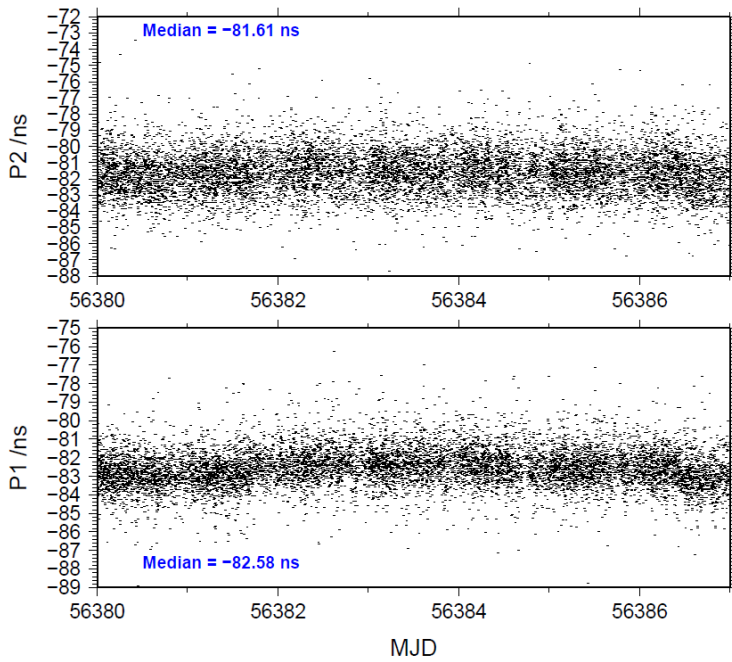
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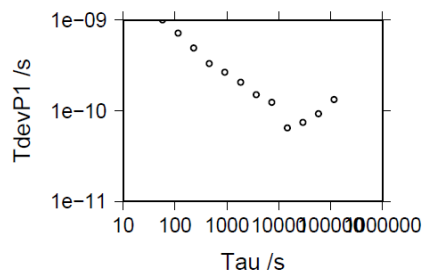
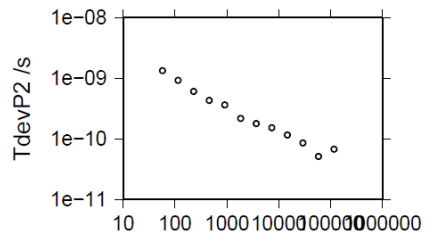
- 117325 s: C1= 126 ps
- 58663 s: C1= 117 ps
- 29331 s: C1= 125 ps
- 14666 s: C1= 74 ps
- 7333 s: C1= 100 ps
- 3666 s: C1= 114 ps
- 1833 s: C1= 147 ps
- 917 s: C1= 195 ps
- 458 s: C1= 257 ps
- 229 s: C1= 365 ps
- 115 s: C1= 554 ps
- 57 s: C1= 804 ps



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- 117359 s: P1= 133 ps 117359 s: P2= 67 ps
- 58679 s: P1= 92 ps 58679 s: P2= 51 ps
- 29340 s: P1= 74 ps 29340 s: P2= 85 ps
- 14670 s: P1= 65 ps 14670 s: P2= 115 ps
- 7335 s: P1= 124 ps 7335 s: P2= 153 ps
- 3667 s: P1= 150 ps 3667 s: P2= 179 ps
- 1834 s: P1= 207 ps 1834 s: P2= 219 ps
- 917 s: P1= 266 ps 917 s: P2= 365 ps
- 458 s: P1= 332 ps 458 s: P2= 432 ps
- 229 s: P1= 489 ps 229 s: P2= 606 ps
- 115 s: P1= 717 ps 115 s: P2= 921 ps
- 57 s: P1= 1000 ps 57 s: P2= 1336 ps



BPOU-BPOC

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 103395
 Computed code bias (P1/P2)/m = -137.913 -141.643
 Computed baseline (X,Y,Z)/m = -1.846 1.190 1.494
 RMS of residuals /m = 0.643

Number of phase differences to fit baseline = 99350
 A priori baseline (X,Y,Z)/m = -1.846 1.190 1.494
 19944 clock jitters computed out of 19958 intervals
 AVE jitter /ps = 0.1 RMS jitter /ps = 27.9

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.106 0.024 0.110
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.111 0.022 0.110
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -1.741 1.213 1.604
 Final baseline L2 (X,Y,Z)/m = -1.735 1.211 1.604

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 103480

Global average of individual differences

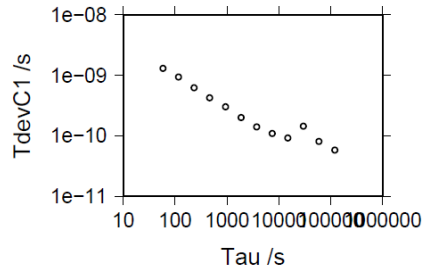
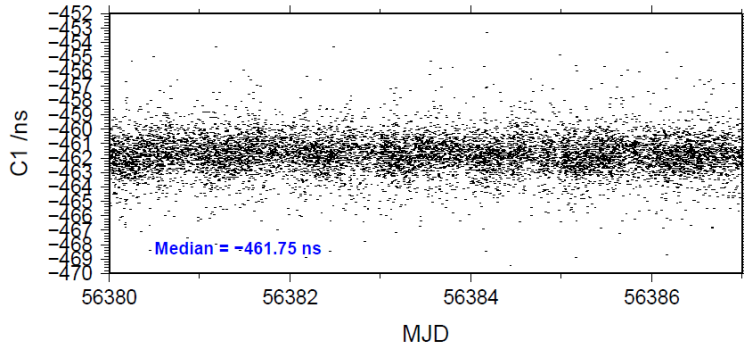
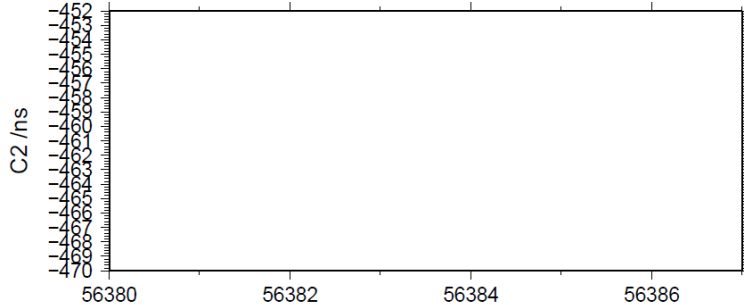
Code #pts, ave/ns, rms/ns
 C1: 103434 -461.719 2.917
 C2: 0-NaN -NaN
 P1: 103358 -460.414 2.277
 P2: 103379 -472.865 2.359

Number of 300s epochs in out file = 2010

Code #pts, median/ns, ave/ns, rms/ns
 C1: 10360 -461.750 -461.752 1.293
 C2: 0 0.000-NaN -NaN
 P1: 10351 -460.460 -460.424 1.200
 P2: 10352 -472.842 -472.850 1.261

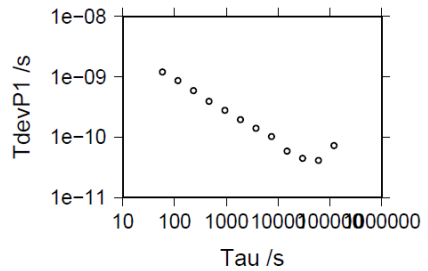
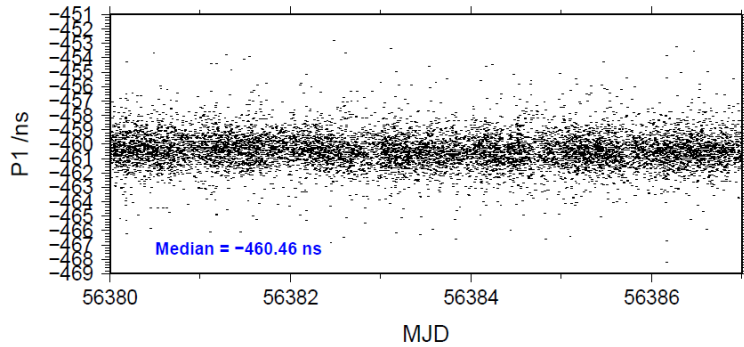
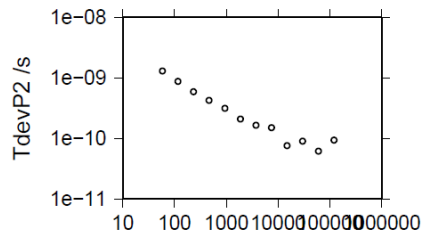
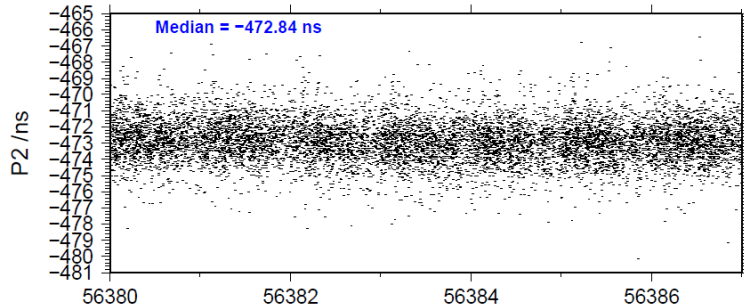
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119511 s: C1= 59 ps
 59756 s: C1= 82 ps
 29878 s: C1= 144 ps
 14939 s: C1= 93 ps
 7469 s: C1= 109 ps
 3735 s: C1= 140 ps
 1867 s: C1= 201 ps
 934 s: C1= 300 ps
 467 s: C1= 427 ps
 233 s: C1= 626 ps
 117 s: C1= 933 ps
 58 s: C1= 1303 ps



03/20/15 bp0ubp0c13088_7

119615 s: P1= 73 ps 119604 s: P2= 93 ps
 59808 s: P1= 42 ps 59802 s: P2= 61 ps
 29904 s: P1= 45 ps 29901 s: P2= 90 ps
 14952 s: P1= 59 ps 14950 s: P2= 75 ps
 7476 s: P1= 103 ps 7475 s: P2= 149 ps
 3738 s: P1= 142 ps 3738 s: P2= 166 ps
 1869 s: P1= 195 ps 1869 s: P2= 209 ps
 934 s: P1= 278 ps 934 s: P2= 316 ps
 467 s: P1= 394 ps 467 s: P2= 424 ps
 234 s: P1= 592 ps 234 s: P2= 588 ps
 117 s: P1= 871 ps 117 s: P2= 873 ps
 58 s: P1= 1200 ps 58 s: P2= 1299 ps



BP0U-BP0M

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 103454
 Computed code bias (P1/P2)/m = -112.994 -117.262
 Computed baseline (X,Y,Z)/m = -0.952 1.479 0.373
 RMS of residuals /m = 0.632

Number of phase differences to fit baseline = 99348
 A priori baseline (X,Y,Z)/m = -0.952 1.479 0.373
 19949 clock jitters computed out of 19960 intervals
 AVE jitter /ps = 0.1 RMS jitter /ps = 27.9

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.163 0.035 0.152
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.176 0.033 0.161
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -0.789 1.513 0.525
 Final baseline L2 (X,Y,Z)/m = -0.776 1.512 0.534

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 103489

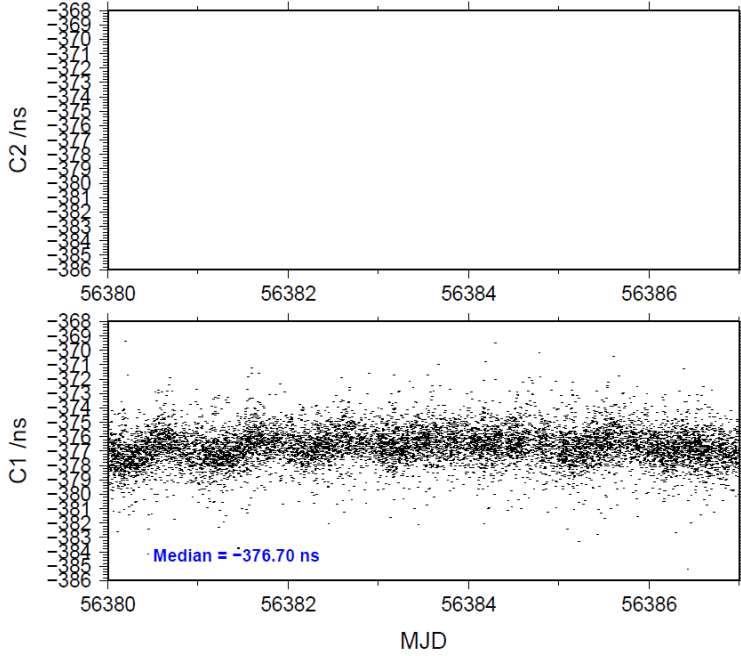
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 103448 -376.670 2.718
 C2: 0 -NaN -NaN
 P1: 103416 -377.475 2.219
 P2: 103421 -391.750 2.357

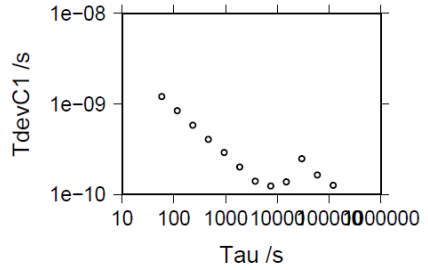
Number of 300s epochs in out file = 2010

Code #pts, median/ns, ave/ns, rms/ns
 C1: 10357 -376.697 -376.692 1.237
 C2: 0 0.000 -NaN -NaN
 P1: 10354 -377.508 -377.487 1.171
 P2: 10354 -391.707 -391.732 1.310

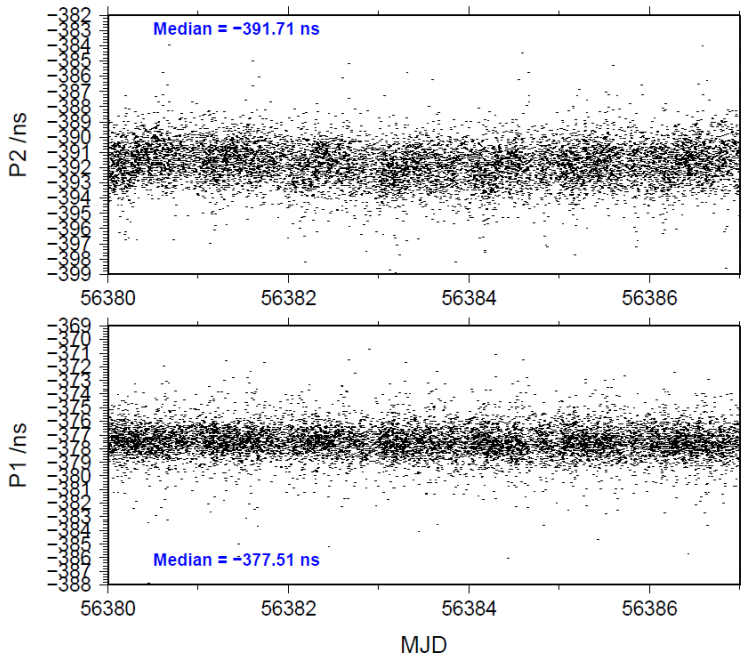
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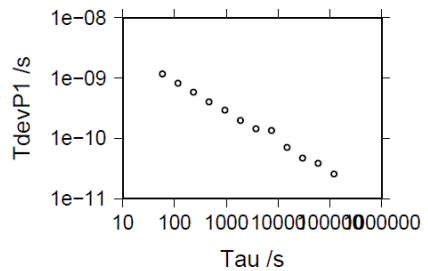
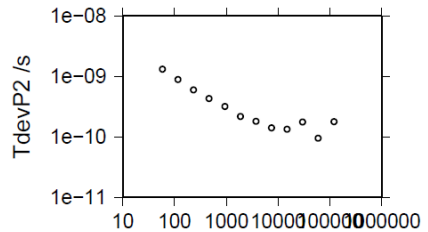
119546 s: C1= 127 ps
 59773 s: C1= 164 ps
 29886 s: C1= 249 ps
 14943 s: C1= 138 ps
 7472 s: C1= 124 ps
 3736 s: C1= 141 ps
 1868 s: C1= 201 ps
 934 s: C1= 292 ps
 467 s: C1= 405 ps
 233 s: C1= 582 ps
 117 s: C1= 841 ps
 58 s: C1= 1204 ps



03/20/15 bp0ubp0m13088_7



119580 s: P1= 26 ps 119580 s: P2= 178 ps
 59790 s: P1= 39 ps 59790 s: P2= 95 ps
 29895 s: P1= 47 ps 29895 s: P2= 175 ps
 14948 s: P1= 71 ps 14948 s: P2= 134 ps
 7474 s: P1= 136 ps 7474 s: P2= 141 ps
 3737 s: P1= 145 ps 3737 s: P2= 180 ps
 1868 s: P1= 197 ps 1868 s: P2= 217 ps
 934 s: P1= 293 ps 934 s: P2= 319 ps
 467 s: P1= 404 ps 467 s: P2= 433 ps
 234 s: P1= 584 ps 234 s: P2= 600 ps
 117 s: P1= 826 ps 117 s: P2= 884 ps
 58 s: P1= 1174 ps 58 s: P2= 1321 ps



BP0T-BP0R

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 103684
 Computed code bias (P1/P2)/m = -25.179 -25.442
 Computed baseline (X,Y,Z)/m = 3.618 1.095 -3.625
 RMS of residuals /m = 0.590

Number of phase differences to fit baseline = 95763
 A priori baseline (X,Y,Z)/m = 3.618 1.095 -3.625
 18612 clock jitters computed out of 18669 intervals
 AVE jitter /ps = -0.4 RMS jitter /ps = 33.2

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.183 0.012 0.220
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.179 0.020 0.222
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 3.800 1.106 -3.405
 Final baseline L2 (X,Y,Z)/m = 3.797 1.114 -3.403

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 103782

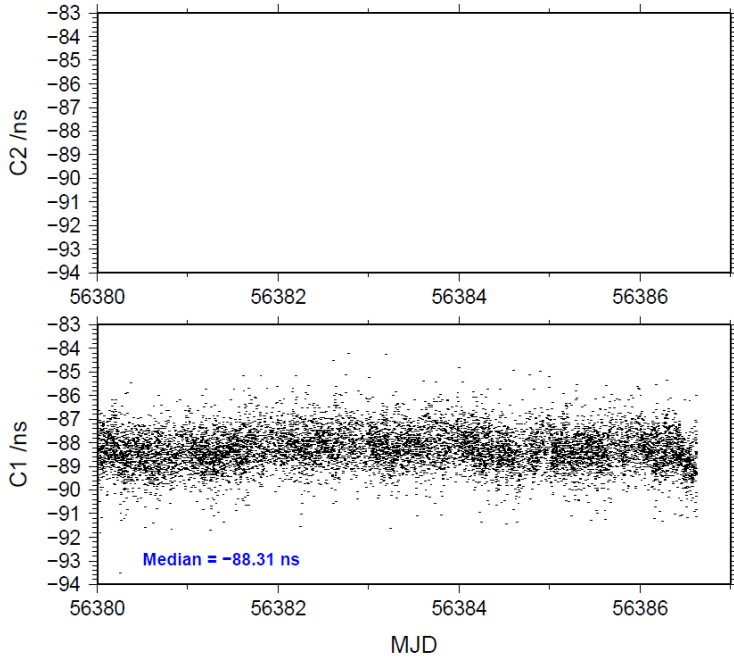
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 103750 -88.279 1.403
 C2: 0-NaN -NaN
 P1: 103649 -84.675 2.023
 P2: 103648 -85.552 2.136

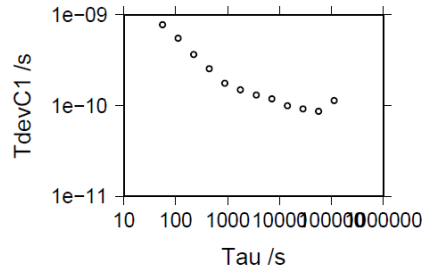
Number of 300s epochs in out file = 1903

Code #pts, median/ns, ave/ns, rms/ns
 C1: 10319 -88.306 -88.282 0.799
 C2: 0 0.000-NaN -NaN
 P1: 10311 -84.728 -84.690 1.149
 P2: 10311 -85.574 -85.543 1.227

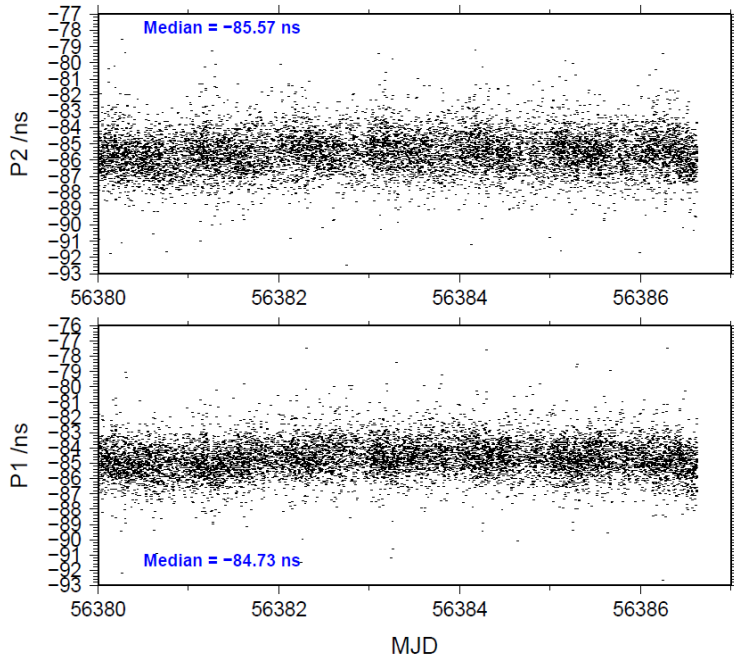
03/20/15 bp0tbp0r13088_7



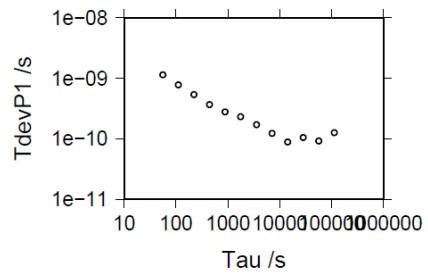
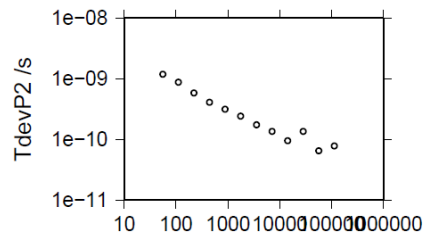
- 113615 s: C1= 114 ps
- 56807 s: C1= 86 ps
- 28404 s: C1= 92 ps
- 14202 s: C1= 100 ps
- 7101 s: C1= 119 ps
- 3550 s: C1= 131 ps
- 1775 s: C1= 149 ps
- 888 s: C1= 177 ps
- 444 s: C1= 255 ps
- 222 s: C1= 364 ps
- 111 s: C1= 552 ps
- 55 s: C1= 772 ps



03/20/15 bp0tbp0r13088_7



- 113703 s: P1= 127 ps 113703 s: P2= 78 ps
- 56851 s: P1= 92 ps 56851 s: P2= 64 ps
- 28426 s: P1= 106 ps 28426 s: P2= 135 ps
- 14213 s: P1= 89 ps 14213 s: P2= 95 ps
- 7106 s: P1= 124 ps 7106 s: P2= 136 ps
- 3553 s: P1= 172 ps 3553 s: P2= 173 ps
- 1777 s: P1= 231 ps 1777 s: P2= 241 ps
- 888 s: P1= 279 ps 888 s: P2= 313 ps
- 444 s: P1= 368 ps 444 s: P2= 410 ps
- 222 s: P1= 539 ps 222 s: P2= 585 ps
- 111 s: P1= 779 ps 111 s: P2= 878 ps
- 56 s: P1= 1144 ps 56 s: P2= 1193 ps



BP0T-BP1C

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 103761
 Computed code bias (P1/P2)/m = -25.375 -26.205
 Computed baseline (X,Y,Z)/m = 2.703 0.855 -2.807
 RMS of residuals /m = 0.545

Number of phase differences to fit baseline = 95941
 A priori baseline (X,Y,Z)/m = 2.703 0.855 -2.807
 18592 clock jitters computed out of 18648 intervals
 AVE jitter /ps = -0.5 RMS jitter /ps = 33.1

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.203 0.012 0.184
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.203 0.011 0.189
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 2.906 0.867 -2.622
 Final baseline L2 (X,Y,Z)/m = 2.906 0.866 -2.618

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 103785

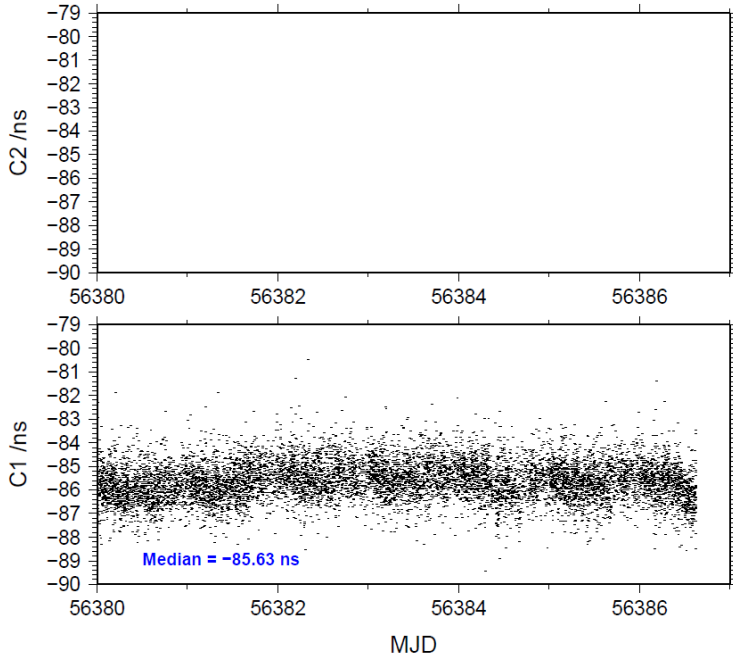
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 103753 -85.619 1.392
 C2: 0-NaN -NaN
 P1: 103729 -85.307 1.731
 P2: 103725 -88.083 2.075

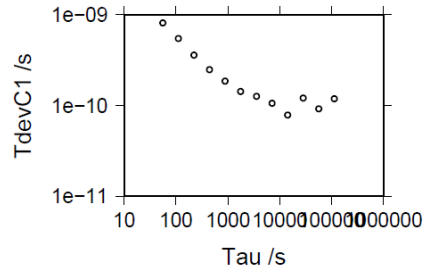
Number of 300s epochs in out file = 1902

Code #pts, median/ns, ave/ns, rms/ns
 C1: 10316 -85.634 -85.619 0.814
 C2: 0 0.000-NaN -NaN
 P1: 10315 -85.356 -85.313 0.993
 P2: 10315 -88.121 -88.076 1.164

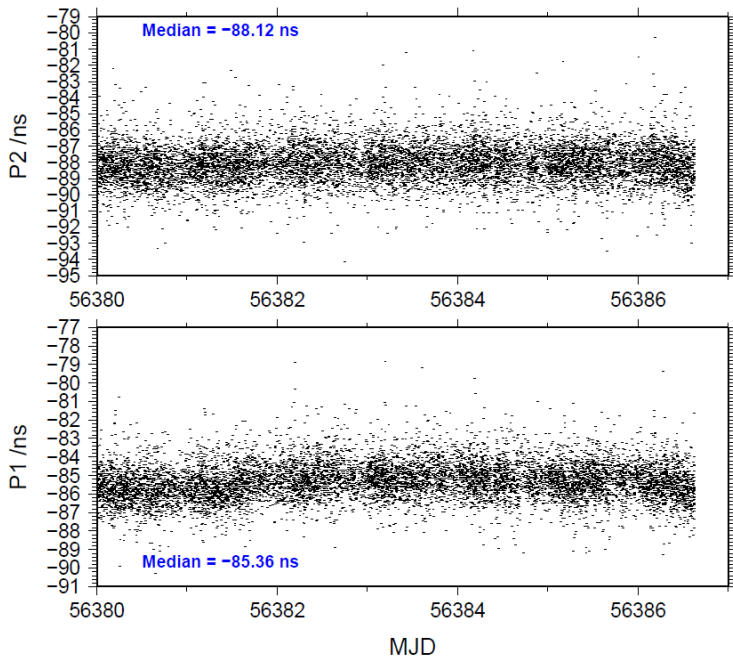
03/20/15 bp0tbp1c13088_7



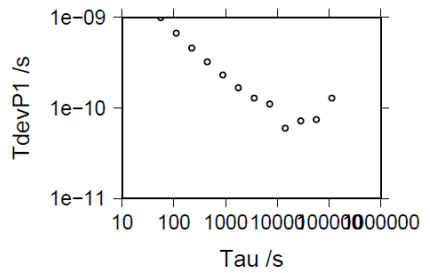
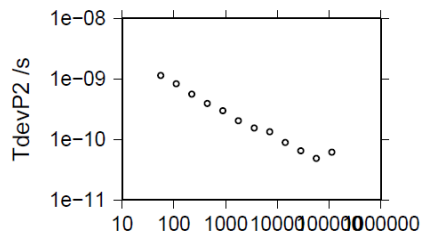
- 113648 s: C1= 119 ps
- 56824 s: C1= 92 ps
- 28412 s: C1= 121 ps
- 14206 s: C1= 79 ps
- 7103 s: C1= 106 ps
- 3551 s: C1= 126 ps
- 1776 s: C1= 142 ps
- 888 s: C1= 186 ps
- 444 s: C1= 248 ps
- 222 s: C1= 358 ps
- 111 s: C1= 547 ps
- 55 s: C1= 812 ps



03/20/15 bp0tbp1c13088_7



- 113659 s: P1= 129 ps 113659 s: P2= 62 ps
- 56829 s: P1= 75 ps 56829 s: P2= 48 ps
- 28415 s: P1= 72 ps 28415 s: P2= 64 ps
- 14207 s: P1= 60 ps 14207 s: P2= 88 ps
- 7104 s: P1= 110 ps 7104 s: P2= 134 ps
- 3552 s: P1= 129 ps 3552 s: P2= 153 ps
- 1776 s: P1= 167 ps 1776 s: P2= 204 ps
- 888 s: P1= 231 ps 888 s: P2= 298 ps
- 444 s: P1= 323 ps 444 s: P2= 395 ps
- 222 s: P1= 459 ps 222 s: P2= 563 ps
- 111 s: P1= 671 ps 111 s: P2= 833 ps
- 56 s: P1= 990 ps 56 s: P2= 1144 ps



BP0T-BP0C

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 99930
 Computed code bias (P1/P2)/m = -138.580 -143.422
 Computed baseline (X,Y,Z)/m = -2.250 -0.637 1.658
 RMS of residuals /m = 0.610

Number of phase differences to fit baseline = 94506
 A priori baseline (X,Y,Z)/m = -2.250 -0.637 1.658
 18617 clock jitters computed out of 18669 intervals
 AVE jitter /ps = 0.0 RMS jitter /ps = 33.1

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.299 0.040 0.198
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.299 0.043 0.202
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -1.951 -0.597 1.856
 Final baseline L2 (X,Y,Z)/m = -1.951 -0.595 1.860

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 100152

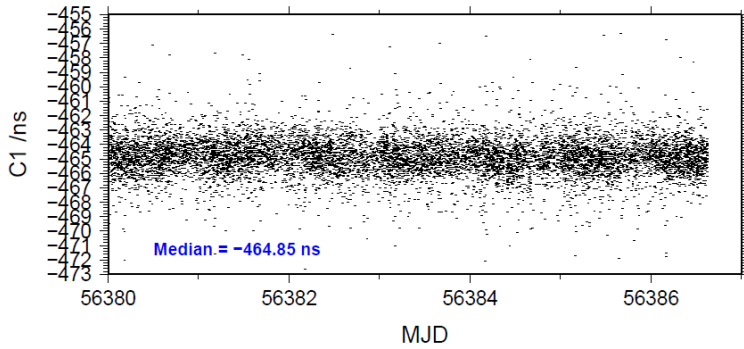
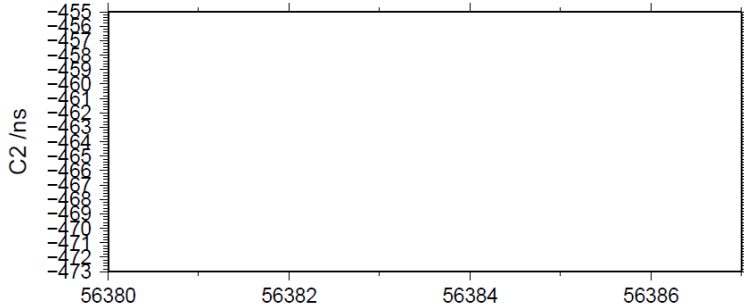
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 100078 -464.814 2.945
 C2: 0-NaN -NaN
 P1: 99895 -463.170 2.223
 P2: 99935 -479.329 2.187

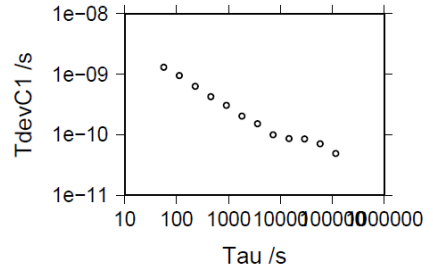
Number of 300s epochs in out file = 1903

Code #pts, median/ns, ave/ns, rms/ns
 C1: 10053 -464.851 -464.849 1.300
 C2: 0 0.000-NaN -NaN
 P1: 10034 -463.234 -463.175 1.163
 P2: 10038 -479.347 -479.334 1.102

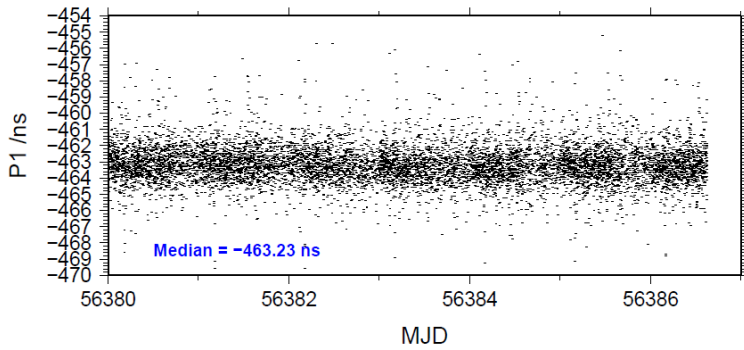
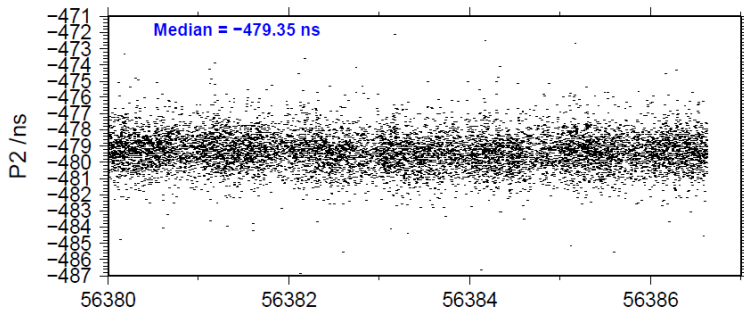
03/20/15 bp0tbp0c13088_7



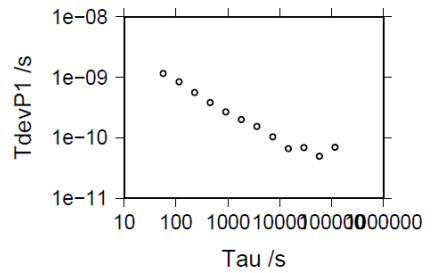
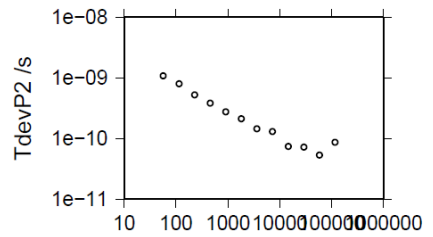
- 116621 s: C1= 49 ps
- 58311 s: C1= 71 ps
- 29155 s: C1= 85 ps
- 14578 s: C1= 87 ps
- 7289 s: C1= 100 ps
- 3644 s: C1= 153 ps
- 1822 s: C1= 203 ps
- 911 s: C1= 305 ps
- 456 s: C1= 426 ps
- 228 s: C1= 633 ps
- 114 s: C1= 946 ps
- 57 s: C1= 1306 ps



03/20/15 bp0tbp0c13088_7



- 116842 s: P1= 70 ps
- 58421 s: P1= 50 ps
- 29210 s: P1= 69 ps
- 14605 s: P1= 66 ps
- 7303 s: P1= 103 ps
- 3651 s: P1= 153 ps
- 1826 s: P1= 201 ps
- 913 s: P1= 268 ps
- 456 s: P1= 384 ps
- 228 s: P1= 563 ps
- 114 s: P1= 846 ps
- 57 s: P1= 1161 ps
- 116795 s: P2= 86 ps
- 58398 s: P2= 53 ps
- 29199 s: P2= 72 ps
- 14599 s: P2= 74 ps
- 7300 s: P2= 131 ps
- 3650 s: P2= 144 ps
- 1825 s: P2= 211 ps
- 912 s: P2= 276 ps
- 456 s: P2= 384 ps
- 228 s: P2= 527 ps
- 114 s: P2= 795 ps
- 57 s: P2= 1079 ps



BP0T-BP0M

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 100261
 Computed code bias (P1/P2)/m = -113.757 -119.141
 Computed baseline (X,Y,Z)/m = -1.255 -0.311 0.591
 RMS of residuals /m = 0.595

Number of phase differences to fit baseline = 94700
 A priori baseline (X,Y,Z)/m = -1.255 -0.311 0.591
 18612 clock jitters computed out of 18668 intervals
 AVE jitter /ps = -0.1 RMS jitter /ps = 33.1

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.260 0.032 0.191
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.269 0.035 0.200
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -0.995 -0.279 0.782
 Final baseline L2 (X,Y,Z)/m = -0.987 -0.275 0.791

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 100343

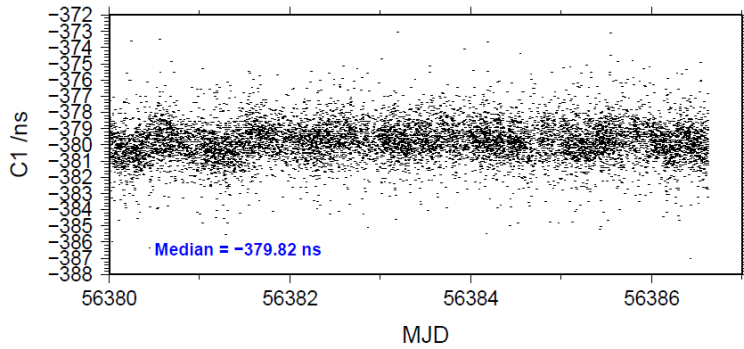
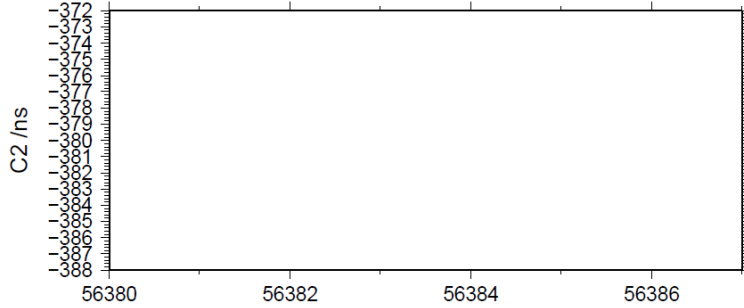
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 100305 -379.782 2.704
 C2: 0 -NaN -NaN
 P1: 100227 -380.262 2.085
 P2: 100246 -398.253 2.126

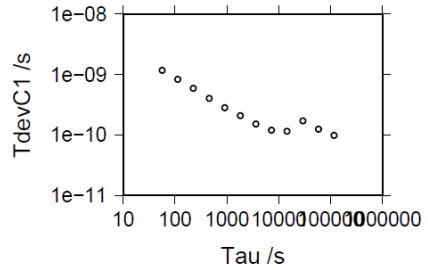
Number of 300s epochs in out file = 1903

Code #pts, median/ns, ave/ns, rms/ns
 C1: 10073 -379.823 -379.806 1.198
 C2: 0 0.000 -NaN -NaN
 P1: 10069 -380.302 -380.260 1.087
 P2: 10070 -398.278 -398.255 1.114

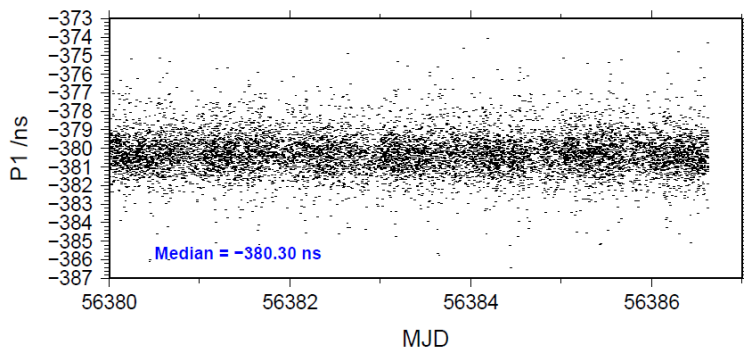
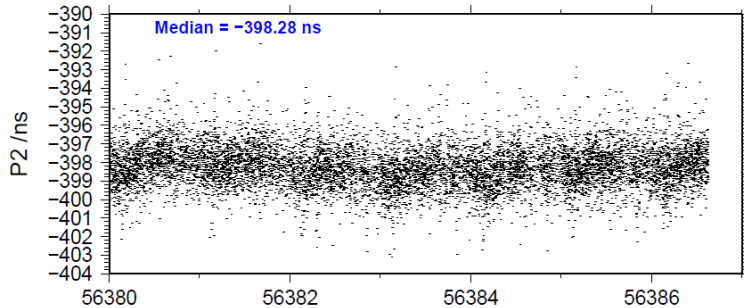
03/20/15 bp0tbp0m13088_7



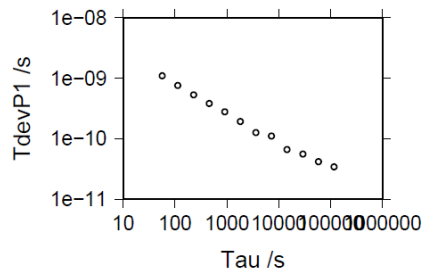
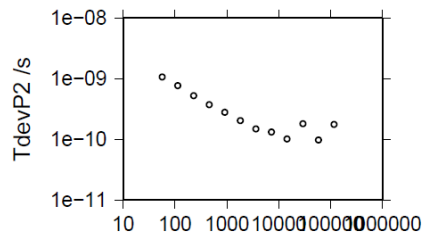
- 116390 s: C1= 99 ps
- 58196 s: C1= 126 ps
- 29097 s: C1= 170 ps
- 14549 s: C1= 116 ps
- 7274 s: C1= 121 ps
- 3637 s: C1= 152 ps
- 1819 s: C1= 208 ps
- 909 s: C1= 282 ps
- 455 s: C1= 401 ps
- 227 s: C1= 589 ps
- 114 s: C1= 830 ps
- 57 s: C1= 1176 ps



03/20/15 bp0tbp0m13088_7



- 116436 s: P1= 34 ps
- 58218 s: P1= 42 ps
- 29109 s: P1= 56 ps
- 14554 s: P1= 66 ps
- 7277 s: P1= 111 ps
- 3639 s: P1= 127 ps
- 1819 s: P1= 193 ps
- 910 s: P1= 281 ps
- 455 s: P1= 380 ps
- 227 s: P1= 531 ps
- 114 s: P1= 758 ps
- 57 s: P1= 1100 ps
- 116424 s: P2= 176 ps
- 58212 s: P2= 98 ps
- 29106 s: P2= 180 ps
- 14553 s: P2= 101 ps
- 7277 s: P2= 132 ps
- 3638 s: P2= 148 ps
- 1819 s: P2= 202 ps
- 910 s: P2= 278 ps
- 455 s: P2= 373 ps
- 227 s: P2= 527 ps
- 114 s: P2= 772 ps
- 57 s: P2= 1064 ps



1.2/ OP (13103)Period

MJD 56395 to 56399

Delays

BP0T:

$$\text{REFDLY} = X_P = 49.96 \text{ ns} \quad (-2.67 + C166 + BP1I + C157)$$

$$\text{CABDLY} = X_C = 176.9 \text{ ns} \quad (C174)$$

BP0U:

$$\text{REFDLY} = X_P = 49.96 \text{ ns} \quad (-2.67 + C166 + BP1I + C153)$$

$$\text{CABDLY} = X_C = 182.0 \text{ ns} \quad (C134)$$

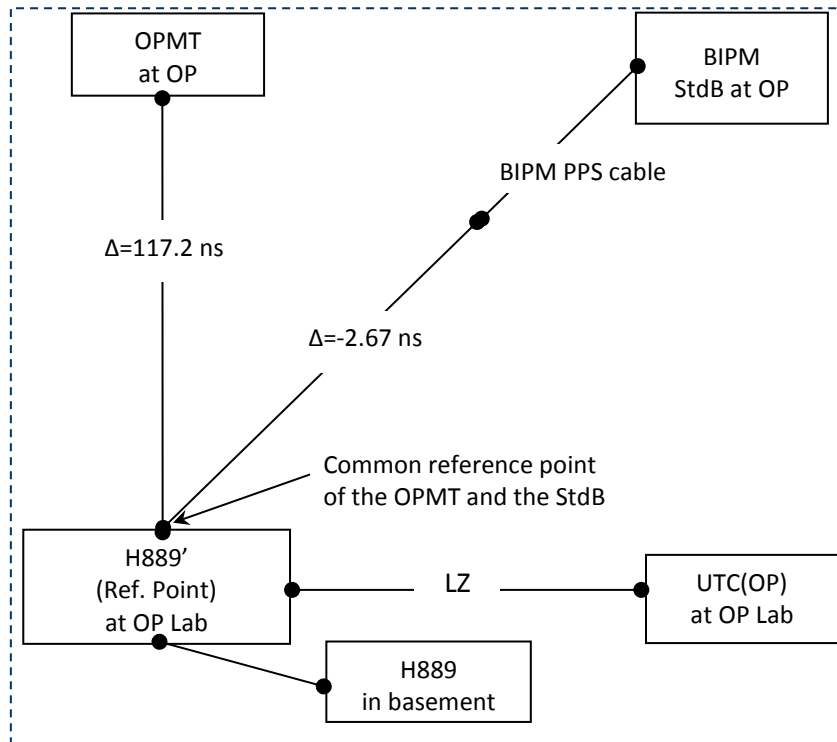
OPMT:

$$\text{REFDLY} = 117.2 \text{ ns}$$

$$\text{CABDLY} = 156.5 \text{ ns}$$

REFDLY value for OPMT documented in a message by P. Urich 4 June 2014.
Measurements carried out in January 2012. Set-up unchanged.

Setup at the OP



BP0U-OPMT

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 66700
 Computed code bias (P1/P2)/m = -105.395 -107.263
 Computed baseline (X,Y,Z)/m = -4.688 -0.859 1.357
 RMS of residuals /m = 0.580

Number of phase differences to fit baseline = 41903
 A priori baseline (X,Y,Z)/m = -4.688 -0.859 1.357
 7774 clock jitters computed out of 8086 intervals
 AVE jitter /ps = 0.7 RMS jitter /ps = 63.8

Iter 1 Large residuals L1= 147
 Iter 1 Large residuals L2= 146
 Computed baseline L1 (X,Y,Z)/m = 0.153 0.003 0.163
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.162 0.009 0.176
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 147
 Iter 2 Large residuals L2= 146
 Computed baseline L1 (X,Y,Z)/m = 0.153 0.003 0.163
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.162 0.009 0.176
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -4.535 -0.857 1.520
 Final baseline L2 (X,Y,Z)/m = -4.526 -0.850 1.533

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 66736

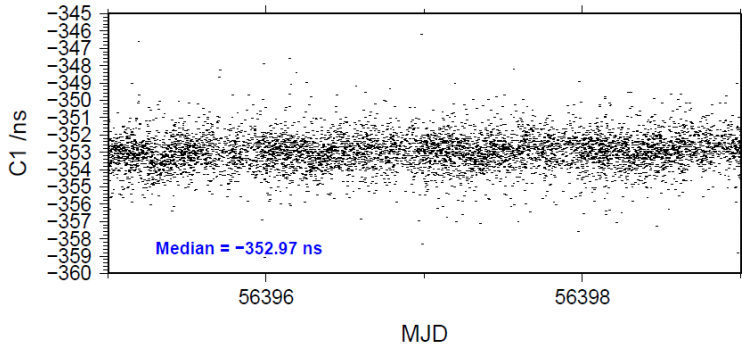
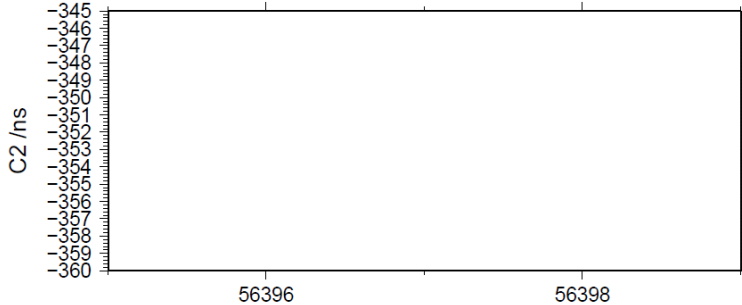
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 66683 -352.963 2.196
 C2: 0-NaN -NaN
 P1: 66652 -352.103 1.959
 P2: 66668 -358.372 2.210

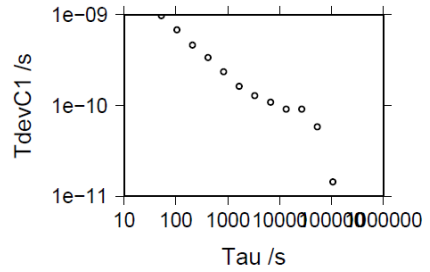
Number of 300s epochs in out file = 1152

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6631 -352.966 -352.975 0.972
 C2: 0 0.000-NaN -NaN
 P1: 6628 -352.178 -352.121 0.976
 P2: 6628 -358.411 -358.376 1.176

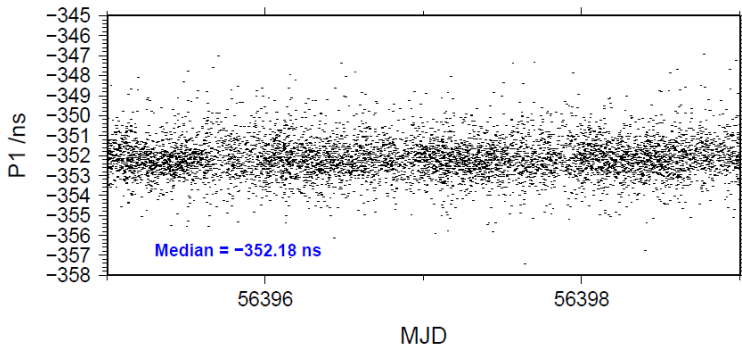
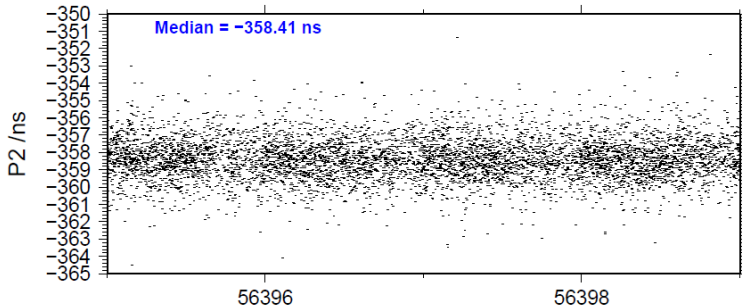
03/20/15 bp0uopmt13103_4



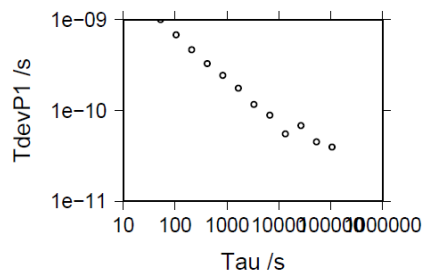
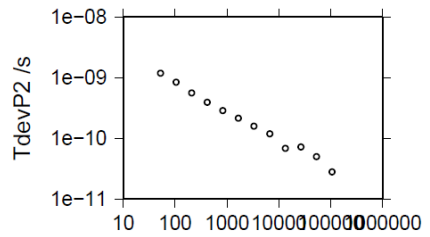
- 106663 s: C1= 14 ps
- 53331 s: C1= 58 ps
- 26666 s: C1= 91 ps
- 13333 s: C1= 91 ps
- 6666 s: C1= 109 ps
- 3333 s: C1= 128 ps
- 1667 s: C1= 163 ps
- 833 s: C1= 236 ps
- 417 s: C1= 337 ps
- 208 s: C1= 464 ps
- 104 s: C1= 680 ps
- 52 s: C1= 975 ps



03/20/15 bp0uopmt13103_4



- 106711 s: P1= 40 ps 106711 s: P2= 28 ps
- 53356 s: P1= 45 ps 53356 s: P2= 50 ps
- 26678 s: P1= 68 ps 26678 s: P2= 72 ps
- 13339 s: P1= 56 ps 13339 s: P2= 69 ps
- 6669 s: P1= 89 ps 6669 s: P2= 118 ps
- 3335 s: P1= 117 ps 3335 s: P2= 159 ps
- 1667 s: P1= 177 ps 1667 s: P2= 216 ps
- 834 s: P1= 243 ps 834 s: P2= 285 ps
- 417 s: P1= 329 ps 417 s: P2= 392 ps
- 208 s: P1= 467 ps 208 s: P2= 558 ps
- 104 s: P1= 681 ps 104 s: P2= 844 ps
- 52 s: P1= 998 ps 52 s: P2= 1187 ps



BP0T-OPMT

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 69672
 Computed code bias (P1/P2)/m = -106.242 -109.244
 Computed baseline (X,Y,Z)/m = -4.170 -1.286 0.931
 RMS of residuals /m = 0.557

Number of phase differences to fit baseline = 43195
 A priori baseline (X,Y,Z)/m = -4.170 -1.286 0.931
 7675 clock jitters computed out of 7970 intervals
 AVE jitter /ps = -0.2 RMS jitter /ps = 64.4

Iter 1 Large residuals L1= 166
 Iter 1 Large residuals L2= 165
 Computed baseline L1 (X,Y,Z)/m = 0.135 0.016 0.150
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.155 0.015 0.166
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 166
 Iter 2 Large residuals L2= 165
 Computed baseline L1 (X,Y,Z)/m = 0.135 0.016 0.150
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.155 0.014 0.166
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -4.035 -1.270 1.080
 Final baseline L2 (X,Y,Z)/m = -4.015 -1.272 1.097

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 69712

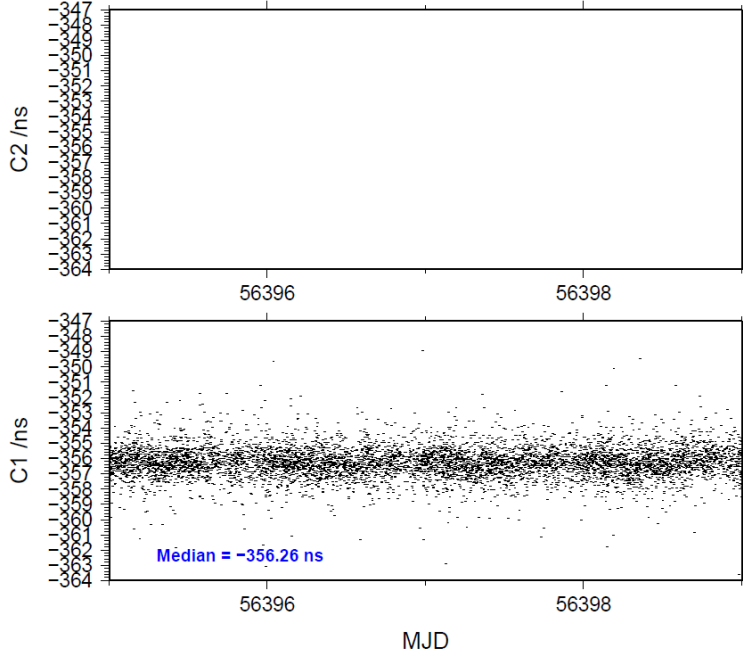
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 69658 -356.231 2.274
 C2: 0-NaN -NaN
 P1: 69622 -354.866 1.936
 P2: 69639 -364.942 2.040

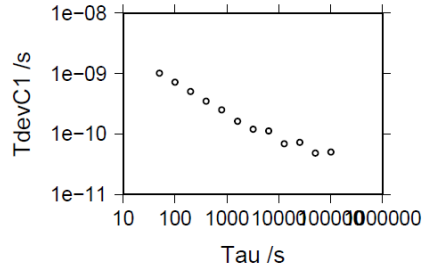
Number of 300s epochs in out file = 1152

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6915 -356.260 -356.252 1.016
 C2: 0 0.000-NaN -NaN
 P1: 6913 -354.934 -354.901 0.965
 P2: 6915 -364.959 -364.938 1.066

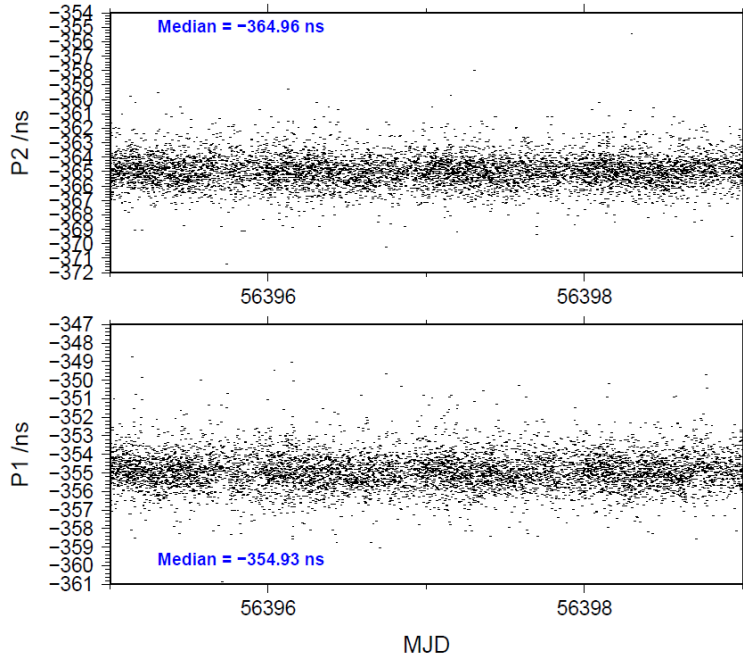
03/20/15 bp0topmt13103_4



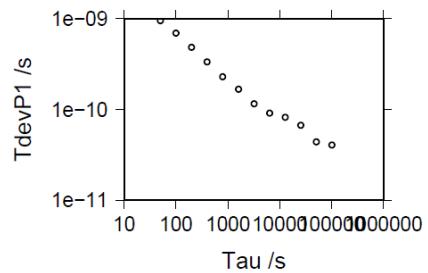
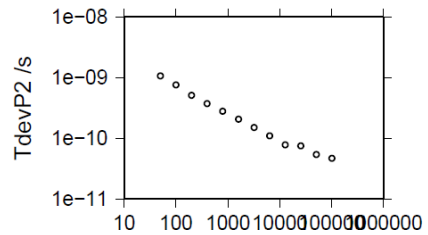
102282 s: C1= 50 ps
 51141 s: C1= 48 ps
 25570 s: C1= 73 ps
 12785 s: C1= 69 ps
 6393 s: C1= 113 ps
 3196 s: C1= 120 ps
 1598 s: C1= 163 ps
 799 s: C1= 251 ps
 400 s: C1= 351 ps
 200 s: C1= 501 ps
 100 s: C1= 722 ps
 50 s: C1= 1014 ps



03/20/15 bp0topmt13103_4



102311 s: P1= 41 ps 102282 s: P2= 47 ps
 51156 s: P1= 44 ps 51141 s: P2= 54 ps
 25578 s: P1= 67 ps 25570 s: P2= 75 ps
 12789 s: P1= 82 ps 12785 s: P2= 78 ps
 6394 s: P1= 91 ps 6393 s: P2= 109 ps
 3197 s: P1= 116 ps 3196 s: P2= 150 ps
 1599 s: P1= 167 ps 1598 s: P2= 207 ps
 799 s: P1= 229 ps 799 s: P2= 280 ps
 400 s: P1= 333 ps 400 s: P2= 372 ps
 200 s: P1= 483 ps 200 s: P2= 513 ps
 100 s: P1= 694 ps 100 s: P2= 754 ps
 50 s: P1= 953 ps 50 s: P2= 1062 ps



1.3/ OP (13108)Period

MJD 56400 to 56404

Delays

BP0T:

$$\text{REFDLY} = X_P = 342.56 \text{ ns} \quad (289.96 + C166 + \text{BP1I} + C157)$$

$$\text{CABDLY} = X_C = 176.9 \text{ ns} \quad (C174)$$

BP0U:

$$\text{REFDLY} = X_P = 342.56 \text{ ns} \quad (289.96 + C166 + \text{BP1I} + C153)$$

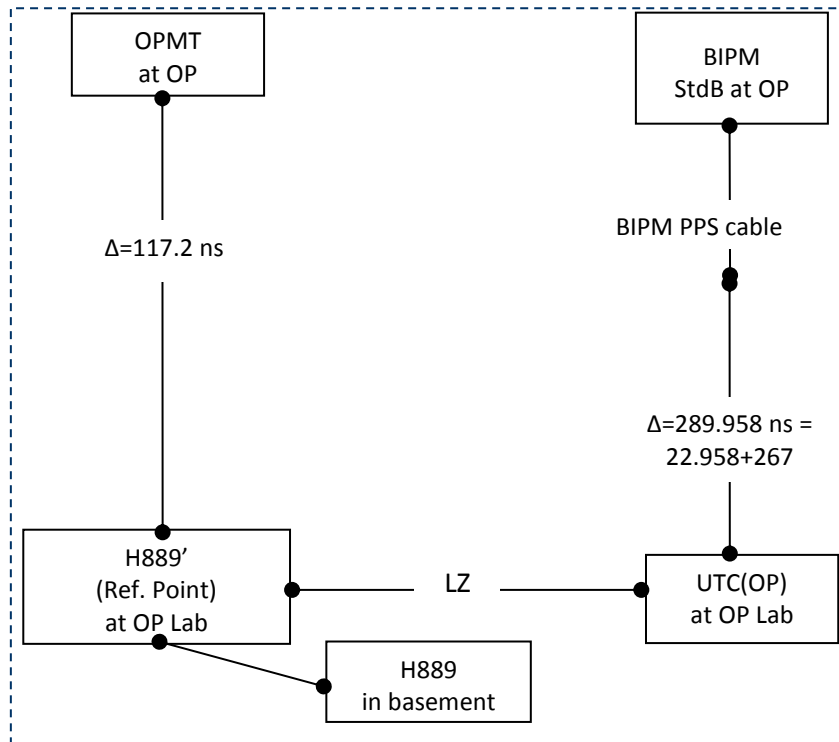
$$\text{CABDLY} = X_C = 182.0 \text{ ns} \quad (C134)$$

OPMT:

$$\text{REFDLY} = 117.2 \text{ ns}$$

$$\text{CABDLY} = 156.5 \text{ ns}$$

REFDLY value for OPMT documented in a message by P. Urich 4 June 2014.
Measurements carried out in January 2012. Set-up unchanged.

Setup at the OP

BP0U-OPMT

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 64584
 Computed code bias (P1/P2)/m = -193.243 -195.107
 Computed baseline (X,Y,Z)/m = -4.695 -0.854 1.341
 RMS of residuals /m = 0.588

Number of phase differences to fit baseline = 37930
 A priori baseline (X,Y,Z)/m = -4.695 -0.854 1.341
 7129 clock jitters computed out of 7515 intervals
 AVE jitter /ps = 1.0 RMS jitter /ps = 63.0

Iter 1 Large residuals L1= 354
 Iter 1 Large residuals L2= 356
 Computed baseline L1 (X,Y,Z)/m = 0.148 0.008 0.165
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.159 0.004 0.187
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 354
 Iter 2 Large residuals L2= 356
 Computed baseline L1 (X,Y,Z)/m = 0.150 0.008 0.167
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.159 0.004 0.187
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -4.545 -0.846 1.509
 Final baseline L2 (X,Y,Z)/m = -4.536 -0.850 1.528

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 64680

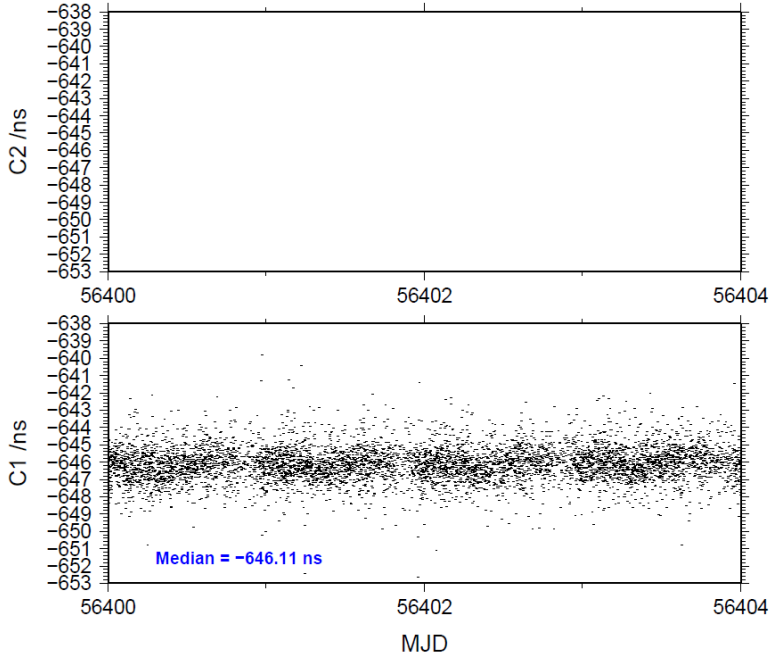
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 64628 -646.090 2.205
 C2: 0-NaN -NaN
 P1: 64535 -645.133 1.994
 P2: 64551 -651.396 2.221

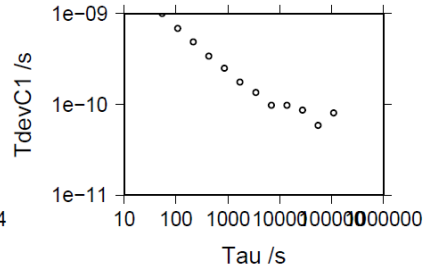
Number of 300s epochs in out file = 1152

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6414 -646.110 -646.105 0.992
 C2: 0 0.000-NaN -NaN
 P1: 6401 -645.186 -645.157 0.998
 P2: 6403 -651.426 -651.387 1.183

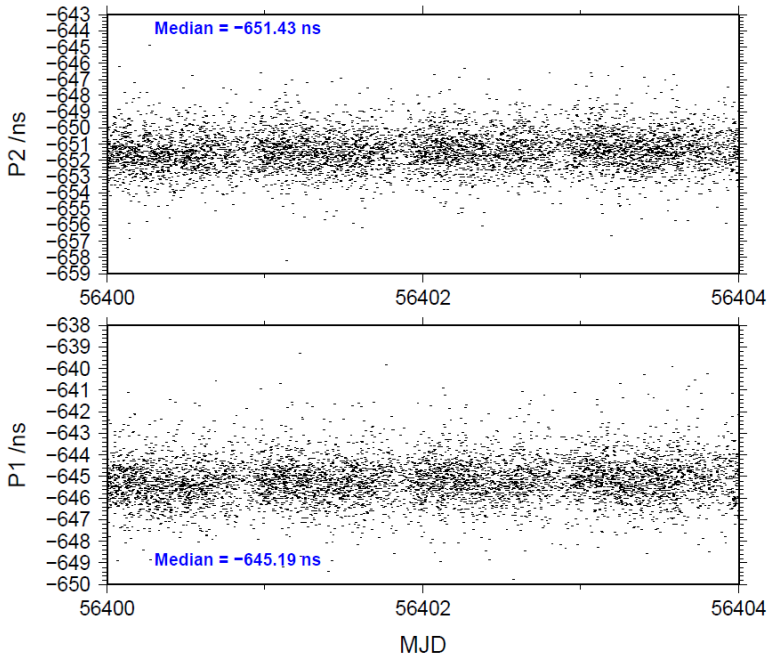
03/20/15 bp0uopmt13108_4



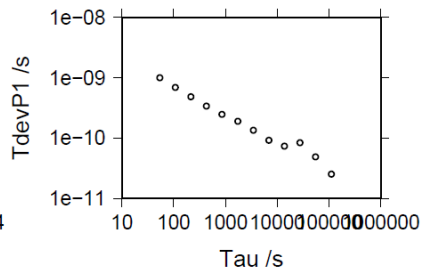
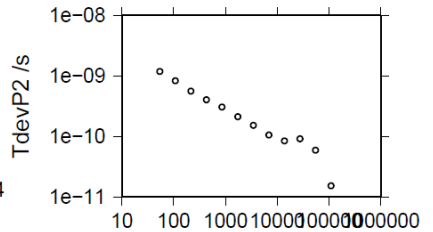
- 110272 s: C1= 81 ps
- 55136 s: C1= 59 ps
- 27568 s: C1= 87 ps
- 13784 s: C1= 97 ps
- 6892 s: C1= 98 ps
- 3446 s: C1= 135 ps
- 1723 s: C1= 176 ps
- 862 s: C1= 260 ps
- 431 s: C1= 341 ps
- 215 s: C1= 487 ps
- 108 s: C1= 686 ps
- 54 s: C1= 998 ps



03/20/15 bp0uopmt13108_4



- 110496 s: P1= 26 ps
- 55248 s: P1= 49 ps
- 27624 s: P1= 84 ps
- 13812 s: P1= 74 ps
- 6906 s: P1= 92 ps
- 3453 s: P1= 136 ps
- 1726 s: P1= 191 ps
- 863 s: P1= 249 ps
- 432 s: P1= 342 ps
- 216 s: P1= 487 ps
- 108 s: P1= 696 ps
- 54 s: P1= 1002 ps
- 110461 s: P2= 15 ps
- 55231 s: P2= 59 ps
- 27615 s: P2= 91 ps
- 13808 s: P2= 85 ps
- 6904 s: P2= 105 ps
- 3452 s: P2= 153 ps
- 1726 s: P2= 210 ps
- 863 s: P2= 307 ps
- 431 s: P2= 402 ps
- 216 s: P2= 559 ps
- 108 s: P2= 834 ps
- 54 s: P2= 1194 ps



BP0T-OPMT

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 67730
 Computed code bias (P1/P2)/m = -194.118 -197.114
 Computed baseline (X,Y,Z)/m = -4.182 -1.285 0.956
 RMS of residuals /m = 0.562

Number of phase differences to fit baseline = 40093
 A priori baseline (X,Y,Z)/m = -4.182 -1.285 0.956
 7206 clock jitters computed out of 7552 intervals
 AVE jitter /ps = -0.4 RMS jitter /ps = 62.1

Iter 1 Large residuals L1= 359
 Iter 1 Large residuals L2= 358
 Computed baseline L1 (X,Y,Z)/m = 0.156 0.008 0.129
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.166 0.002 0.144
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 359
 Iter 2 Large residuals L2= 358
 Computed baseline L1 (X,Y,Z)/m = 0.156 0.008 0.129
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.167 0.002 0.144
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -4.026 -1.276 1.085
 Final baseline L2 (X,Y,Z)/m = -4.015 -1.282 1.100

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 67790

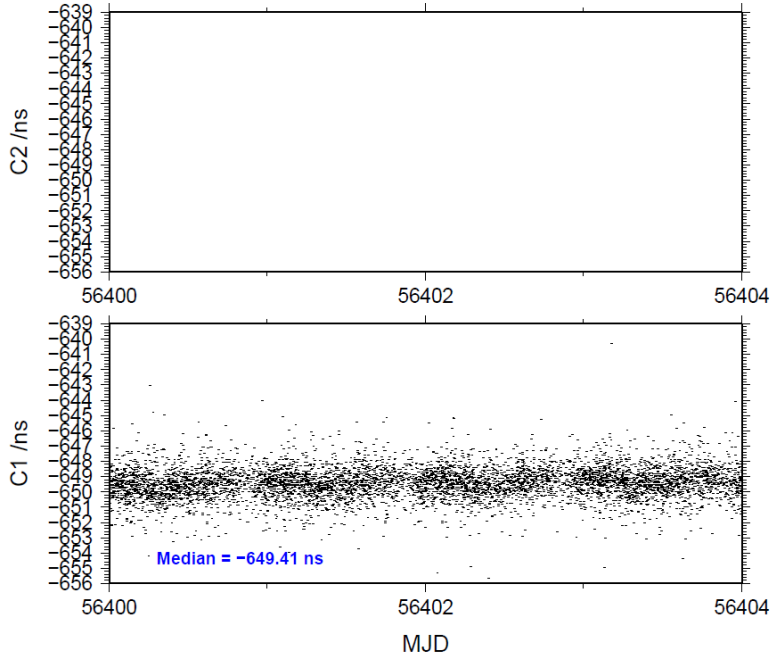
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 67738 -649.411 2.292
 C2: 0-NaN -NaN
 P1: 67681 -647.989 1.965
 P2: 67700 -658.025 2.070

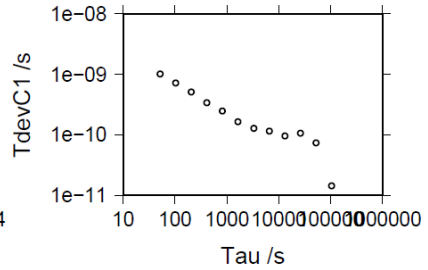
Number of 300s epochs in out file = 1152

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6720 -649.406 -649.424 1.023
 C2: 0 0.000-NaN -NaN
 P1: 6715 -648.031 -648.001 0.989
 P2: 6718 -658.043 -658.031 1.083

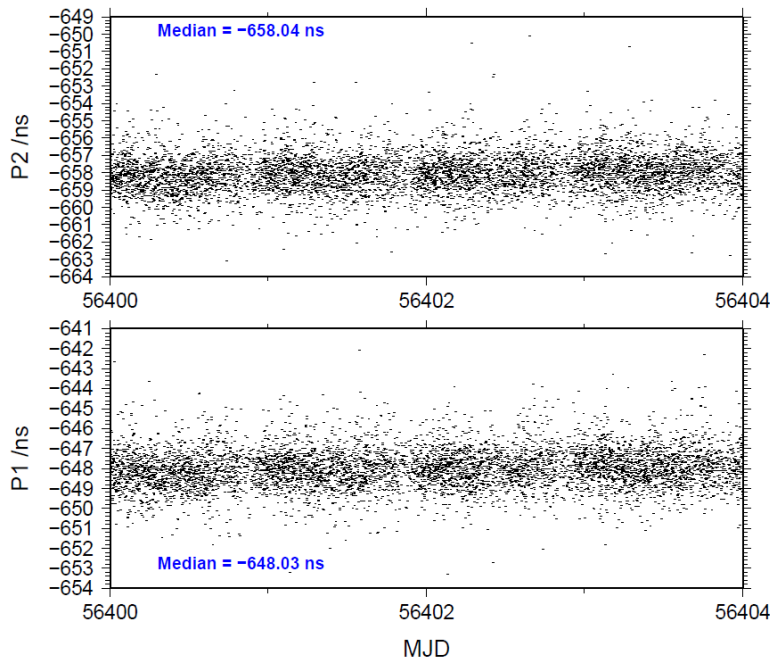
03/20/15 bp0topmt13108_4



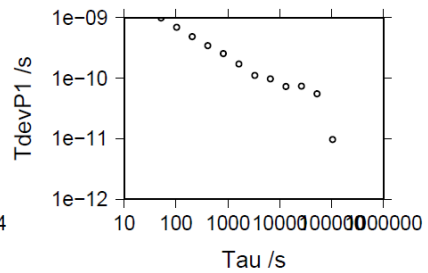
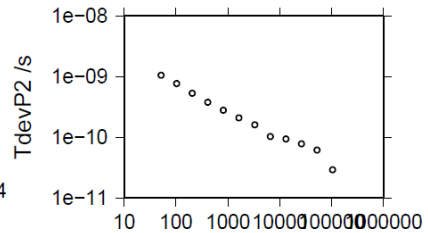
- 105250 s: C1= 14 ps
- 52625 s: C1= 74 ps
- 26312 s: C1= 106 ps
- 13156 s: C1= 96 ps
- 6578 s: C1= 115 ps
- 3289 s: C1= 129 ps
- 1645 s: C1= 165 ps
- 822 s: C1= 249 ps
- 411 s: C1= 339 ps
- 206 s: C1= 512 ps
- 103 s: C1= 718 ps
- 51 s: C1= 1014 ps



03/20/15 bp0topmt13108_4



- 105328 s: P1= 10 ps 105281 s: P2= 29 ps
- 52664 s: P1= 55 ps 52641 s: P2= 61 ps
- 26332 s: P1= 74 ps 26320 s: P2= 78 ps
- 13166 s: P1= 73 ps 13160 s: P2= 94 ps
- 6583 s: P1= 98 ps 6580 s: P2= 103 ps
- 3292 s: P1= 111 ps 3290 s: P2= 161 ps
- 1646 s: P1= 172 ps 1645 s: P2= 208 ps
- 823 s: P1= 256 ps 823 s: P2= 278 ps
- 411 s: P1= 346 ps 411 s: P2= 379 ps
- 206 s: P1= 487 ps 206 s: P2= 533 ps
- 103 s: P1= 694 ps 103 s: P2= 769 ps
- 51 s: P1= 981 ps 51 s: P2= 1053 ps



1.4/ BIPM (13115)Period

MJD 56407 to 56412

Delays

All measurements carried out by L. Tisserand.

Equipment used to measure internal delay of Z12T receivers is an oscilloscope, model TDS3032, maker Tektronix, s/n: B021903 with measurement uncertainty typically about 0.8 ns.

Equipment used to measure internal delay of other receivers is a time interval counter (TIC), model SR620, maker Stanford Research Systems, s/n: 4680, with measurement uncertainty typically less than 0.5 ns (using external reference frequency as timebase).

BP0C:

$$X_O = 18.4 + 15.8 = 34.2 \text{ ns}$$

$$X_P = 54.7 \text{ ns} \quad (\text{C2+C67})$$

$$\text{REFDLY} = 88.9 \text{ ns}$$

$$\text{CABDLY} = X_C = 234.4 \text{ ns} \quad (\text{C107})$$

BP0M:

$$X_O = 17.2 + 15.8 = 33.0 \text{ ns}$$

$$X_P = 36.4 \text{ ns} \quad (\text{H3+C125})$$

$$\text{REFDLY} = 69.4 \text{ ns}$$

$$\text{CABDLY} = X_C = 130.7 \text{ ns} \quad (\text{C12})$$

BP0R:

$$X_O = 249.4 \text{ ns} \quad (274.4-33.7+8.7)$$

$$X_P = 33.2 \text{ ns} \quad (\text{H1+BIPM9})$$

$$\text{REFDLY} = 282.6 \text{ ns}$$

$$\text{CABDLY} = X_C = 133.4 \text{ ns} \quad (\text{C113})$$

BP1C:

$$X_O = 183.1 \text{ ns} \quad (216.8-33.7)$$

$$X_P = 33.5 \text{ ns} \quad (\text{I1+C126})$$

$$\text{REFDLY} = 216.6 \text{ ns}$$

$$\text{CABDLY} = X_C = 235.7 \text{ ns} \quad (\text{C131})$$

BP0T:

$$\text{REFDLY} = X_P = 54.2 \text{ ns} \quad (\text{B1+C166+BP1I+C157})$$

$$\text{CABDLY} = X_C = 176.9 \text{ ns} \quad (\text{C174})$$

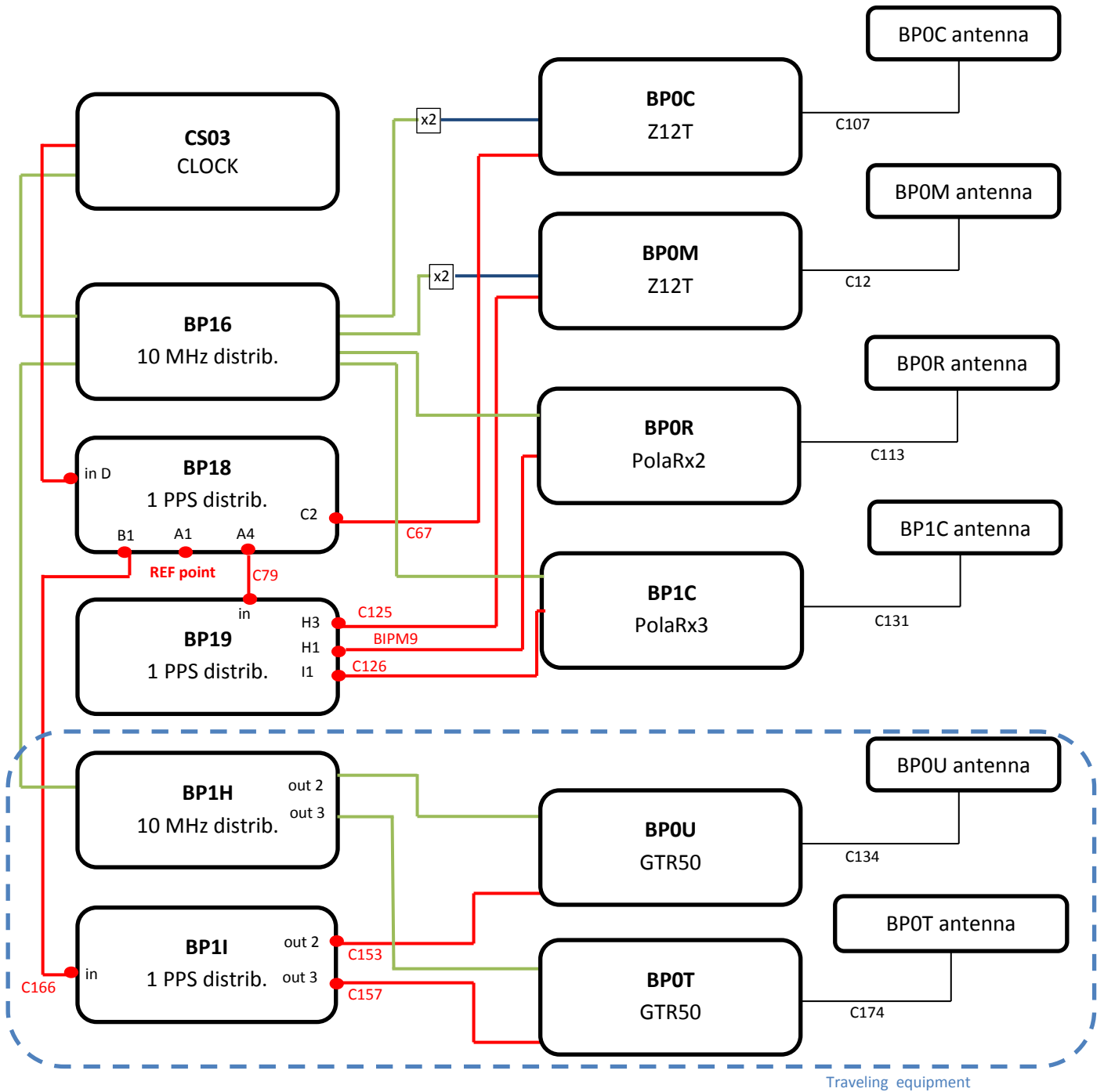
BP0U:

REFDLY = X_P = 54.2 ns (B1+C166+BPII+C153)

CABDLY = X_C = 182.0 ns (C134)

Setup at the BIPM

- 1 PPS ————
- 10 MHz ————
- 20 MHz ————



BP0U-BP0R

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 66733
 Computed code bias (P1/P2)/m = -24.532 -23.608
 Computed baseline (X,Y,Z)/m = 3.882 2.885 -3.853
 RMS of residuals /m = 0.618

Number of phase differences to fit baseline = 62963
 A priori baseline (X,Y,Z)/m = 3.882 2.885 -3.853
 13088 clock jitters computed out of 13105 intervals
 AVE jitter /ps = -0.2 RMS jitter /ps = 29.1

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.116 0.016 0.184
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.123 0.018 0.194
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 3.999 2.901 -3.668
 Final baseline L2 (X,Y,Z)/m = 4.005 2.903 -3.658

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 66762

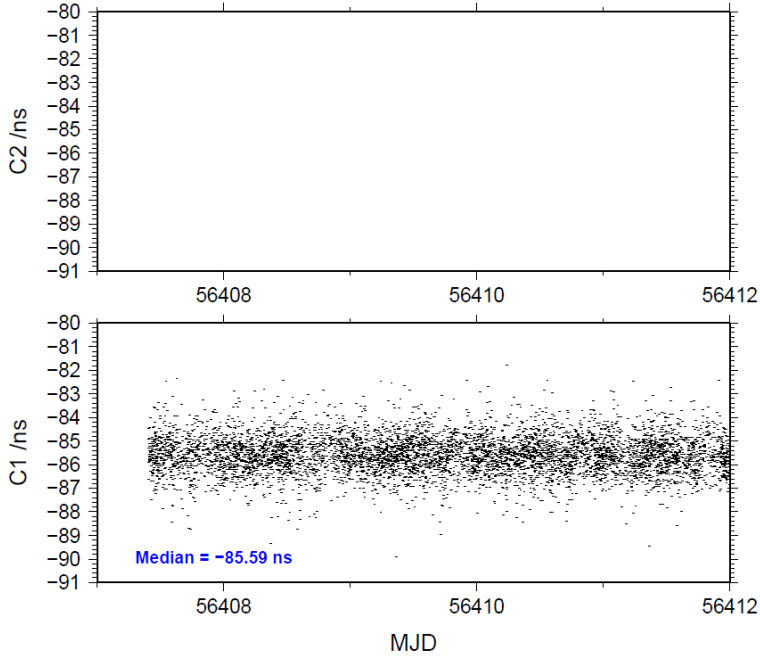
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 66702 -85.576 1.398
 C2: 0-NaN -NaN
 P1: 66673 -82.336 2.119
 P2: 66672 -79.282 2.292

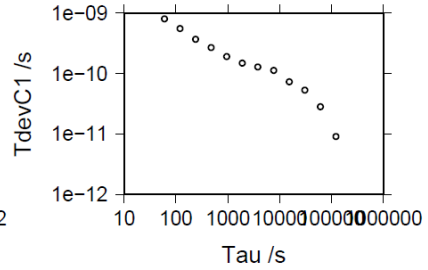
Number of 300s epochs in out file = 1325

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6642 -85.590 -85.573 0.788
 C2: 0 0.000-NaN -NaN
 P1: 6640 -82.385 -82.355 1.188
 P2: 6640 -79.302 -79.274 1.358

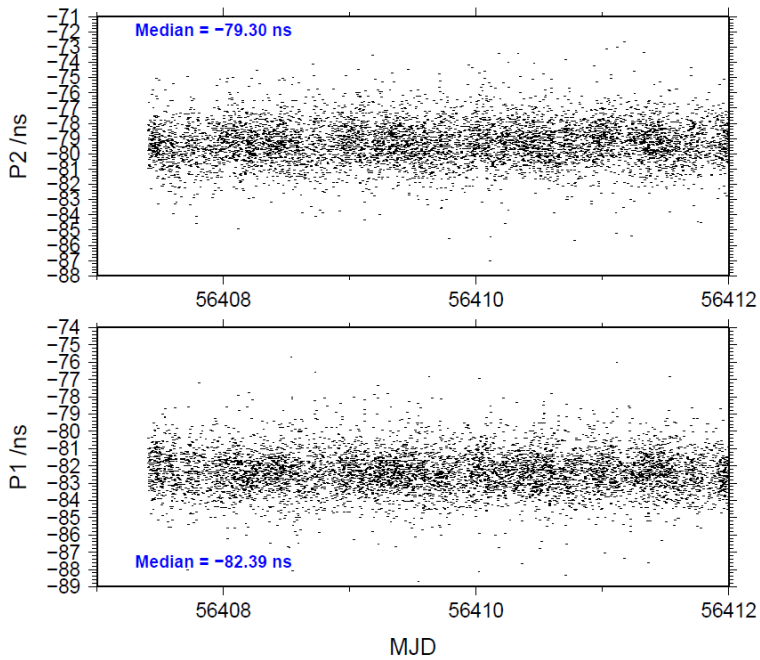
03/20/15 bp0ubp0r13115_5



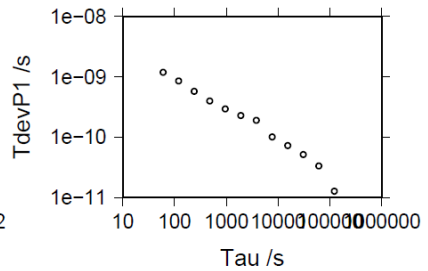
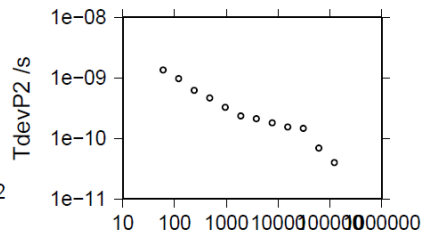
- 122491 s: C1= 9 ps
- 61246 s: C1= 28 ps
- 30623 s: C1= 53 ps
- 15311 s: C1= 73 ps
- 7656 s: C1= 113 ps
- 3828 s: C1= 129 ps
- 1914 s: C1= 149 ps
- 957 s: C1= 190 ps
- 478 s: C1= 267 ps
- 239 s: C1= 367 ps
- 120 s: C1= 555 ps
- 60 s: C1= 797 ps



03/20/15 bp0ubp0r13115_5



- | | |
|---------------------|---------------------|
| 122528 s: P1= 13 ps | 122528 s: P2= 40 ps |
| 61264 s: P1= 33 ps | 61264 s: P2= 69 ps |
| 30632 s: P1= 51 ps | 30632 s: P2= 147 ps |
| 15316 s: P1= 73 ps | 15316 s: P2= 154 ps |
| 7658 s: P1= 102 ps | 7658 s: P2= 181 ps |
| 3829 s: P1= 190 ps | 3829 s: P2= 212 ps |
| 1915 s: P1= 229 ps | 1915 s: P2= 237 ps |
| 957 s: P1= 293 ps | 957 s: P2= 325 ps |
| 479 s: P1= 400 ps | 479 s: P2= 469 ps |
| 239 s: P1= 576 ps | 239 s: P2= 619 ps |
| 120 s: P1= 854 ps | 120 s: P2= 973 ps |
| 60 s: P1= 1181 ps | 60 s: P2= 1355 ps |



BP0U-BPIC

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 66780
 Computed code bias (P1/P2)/m = -24.694 -24.309
 Computed baseline (X,Y,Z)/m = 2.964 2.657 -3.054
 RMS of residuals /m = 0.575

Number of phase differences to fit baseline = 63049
 A priori baseline (X,Y,Z)/m = 2.964 2.657 -3.054
 13092 clock jitters computed out of 13101 intervals
 AVE jitter /ps = -0.3 RMS jitter /ps = 29.1

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.138 0.009 0.169
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.150 0.010 0.183
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 3.102 2.666 -2.885
 Final baseline L2 (X,Y,Z)/m = 3.113 2.666 -2.872

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 66804

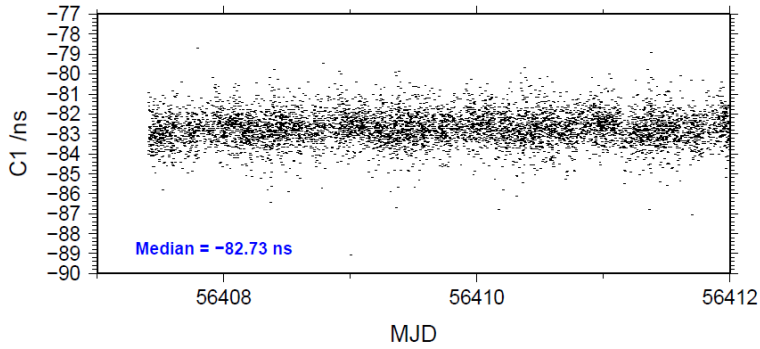
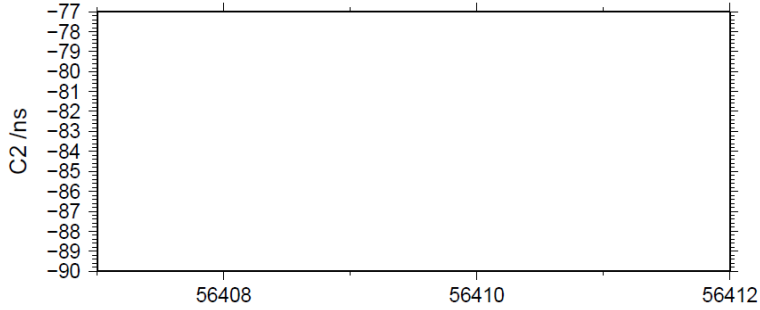
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 66744 -82.717 1.379
 C2: 0-NaN -NaN
 P1: 66720 -82.888 1.815
 P2: 66719 -81.647 2.223

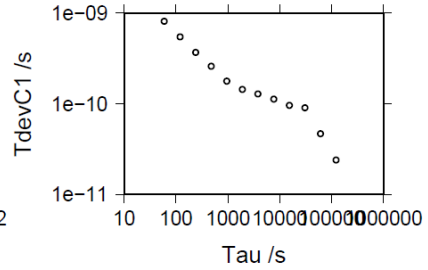
Number of 300s epochs in out file = 1325

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6648 -82.728 -82.716 0.792
 C2: 0 0.000-NaN -NaN
 P1: 6646 -82.925 -82.897 1.007
 P2: 6646 -81.656 -81.639 1.290

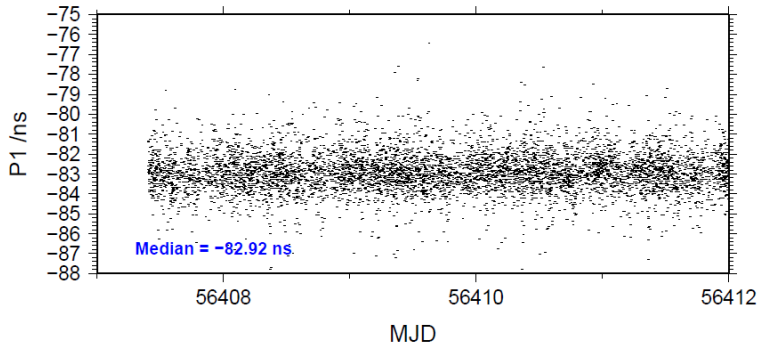
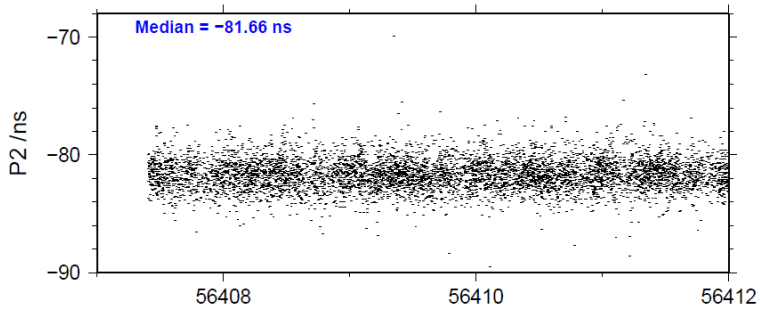
03/20/15 bp0ubp1c13115_5



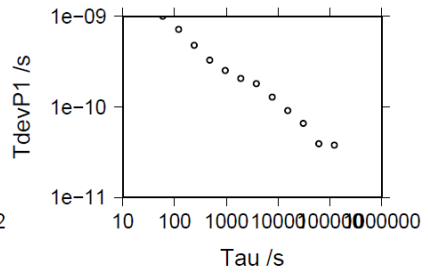
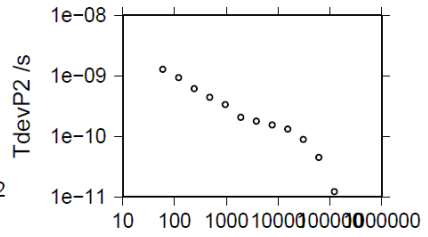
122381 s: C1= 24 ps
 61190 s: C1= 47 ps
 30595 s: C1= 90 ps
 15298 s: C1= 96 ps
 7649 s: C1= 113 ps
 3824 s: C1= 128 ps
 1912 s: C1= 144 ps
 956 s: C1= 178 ps
 478 s: C1= 260 ps
 239 s: C1= 368 ps
 120 s: C1= 546 ps
 60 s: C1= 807 ps



03/20/15 bp0ubp1c13115_5



122418 s: P1= 38 ps 122418 s: P2= 12 ps
 61209 s: P1= 39 ps 61209 s: P2= 45 ps
 30604 s: P1= 66 ps 30604 s: P2= 89 ps
 15302 s: P1= 92 ps 15302 s: P2= 132 ps
 7651 s: P1= 128 ps 7651 s: P2= 154 ps
 3826 s: P1= 181 ps 3826 s: P2= 179 ps
 1913 s: P1= 206 ps 1913 s: P2= 207 ps
 956 s: P1= 253 ps 956 s: P2= 337 ps
 478 s: P1= 329 ps 478 s: P2= 441 ps
 239 s: P1= 481 ps 239 s: P2= 615 ps
 120 s: P1= 715 ps 120 s: P2= 931 ps
 60 s: P1= 997 ps 60 s: P2= 1285 ps



BP0U-BP0C

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 64669
 Computed code bias (P1/P2)/m = -137.937 -141.599
 Computed baseline (X,Y,Z)/m = -1.871 1.198 1.491
 RMS of residuals /m = 0.641

Number of phase differences to fit baseline = 62078
 A priori baseline (X,Y,Z)/m = -1.871 1.198 1.491
 13084 clock jitters computed out of 13097 intervals
 AVE jitter /ps = 0.1 RMS jitter /ps = 29.1

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.128 0.023 0.111
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.130 0.020 0.113
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -1.743 1.221 1.602
 Final baseline L2 (X,Y,Z)/m = -1.741 1.218 1.604

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 64704

Global average of individual differences

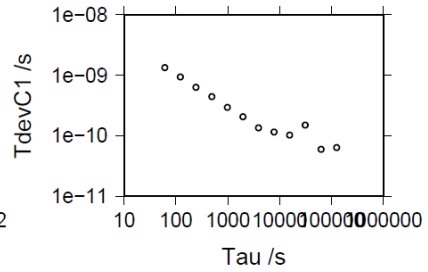
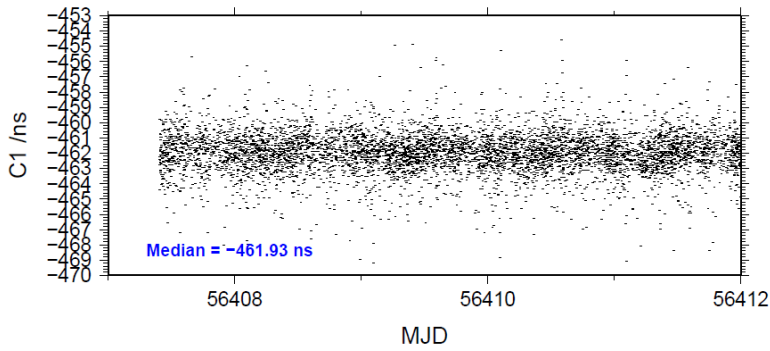
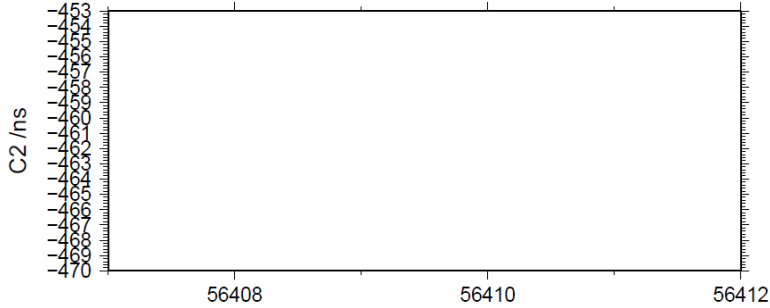
Code #pts, ave/ns, rms/ns
 C1: 64638 -461.899 2.956
 C2: 0-NaN -NaN
 P1: 64609 -460.526 2.286
 P2: 64620 -472.750 2.327

Number of 300s epochs in out file = 1325

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6485 -461.925 -461.950 1.308
 C2: 0 0.000-NaN -NaN
 P1: 6484 -460.559 -460.541 1.214
 P2: 6487 -472.737 -472.741 1.230

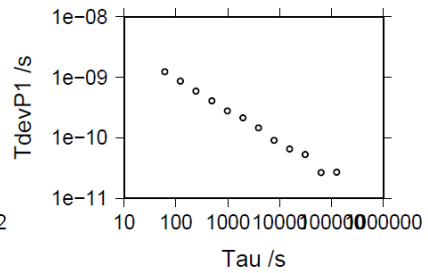
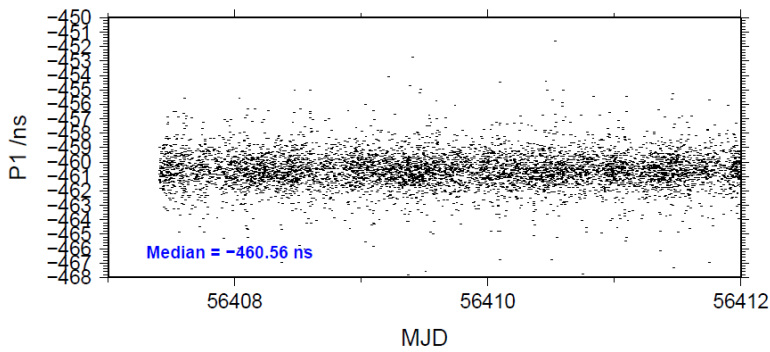
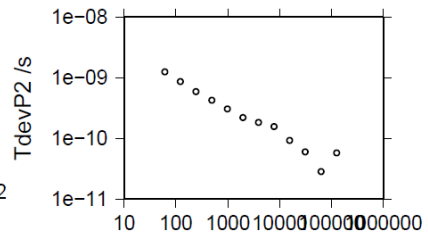
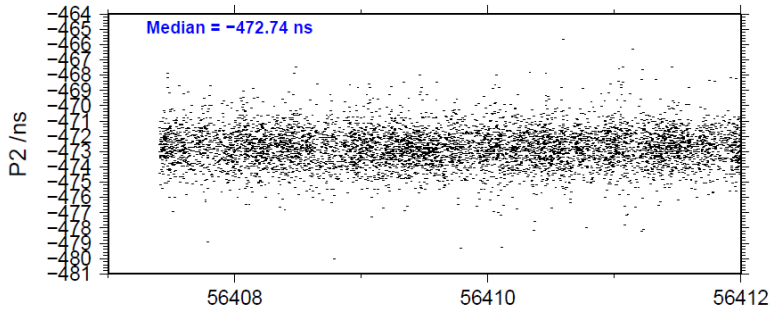
03/20/15 bp0ubp0c13115_5

125457 s: C1= 64 ps
 62729 s: C1= 60 ps
 31364 s: C1= 151 ps
 15682 s: C1= 103 ps
 7841 s: C1= 115 ps
 3921 s: C1= 135 ps
 1960 s: C1= 207 ps
 980 s: C1= 294 ps
 490 s: C1= 444 ps
 245 s: C1= 627 ps
 123 s: C1= 938 ps
 61 s: C1= 1335 ps



03/20/15 bp0ubp0c13115_5

125477 s: P1= 27 ps 125419 s: P2= 68 ps
 62738 s: P1= 27 ps 62709 s: P2= 28 ps
 31369 s: P1= 53 ps 31355 s: P2= 60 ps
 15685 s: P1= 66 ps 15677 s: P2= 93 ps
 7842 s: P1= 91 ps 7839 s: P2= 157 ps
 3921 s: P1= 146 ps 3919 s: P2= 184 ps
 1961 s: P1= 214 ps 1960 s: P2= 219 ps
 980 s: P1= 280 ps 980 s: P2= 307 ps
 490 s: P1= 407 ps 490 s: P2= 425 ps
 245 s: P1= 591 ps 245 s: P2= 589 ps
 123 s: P1= 867 ps 122 s: P2= 865 ps
 61 s: P1= 1242 ps 61 s: P2= 1244 ps



BP0U-BP0M

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 64708
 Computed code bias (P1/P2)/m = -112.975 -117.060
 Computed baseline (X,Y,Z)/m = -0.965 1.475 0.386
 RMS of residuals /m = 0.627

Number of phase differences to fit baseline = 62064
 A priori baseline (X,Y,Z)/m = -0.965 1.475 0.386
 13082 clock jitters computed out of 13092 intervals
 AVE jitter /ps = 0.2 RMS jitter /ps = 29.0

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.170 0.038 0.137
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.188 0.037 0.150
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -0.795 1.512 0.523
 Final baseline L2 (X,Y,Z)/m = -0.776 1.512 0.536

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 64718

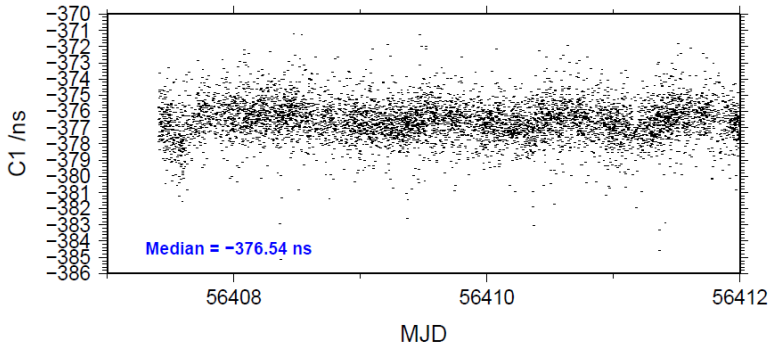
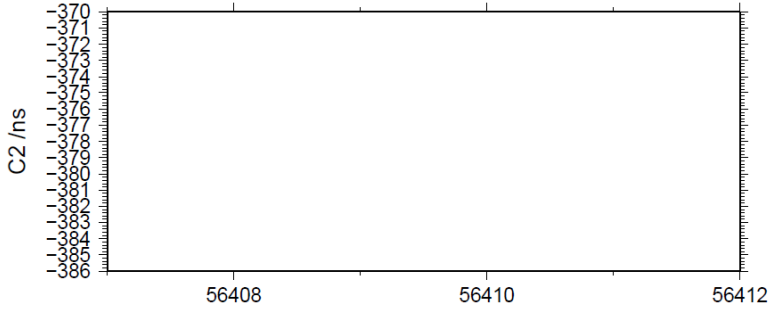
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 64657 -376.519 2.743
 C2: 0 -NaN -NaN
 P1: 64648 -377.389 2.227
 P2: 64652 -391.072 2.312

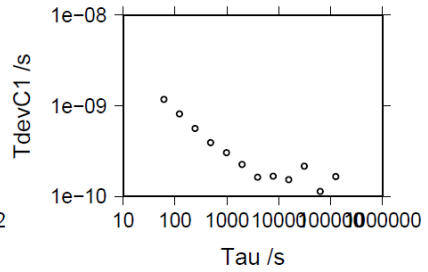
Number of 300s epochs in out file = 1325

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6490 -376.540 -376.549 1.206
 C2: 0 0.000 -NaN -NaN
 P1: 6489 -377.420 -377.407 1.183
 P2: 6490 -391.024 -391.060 1.267

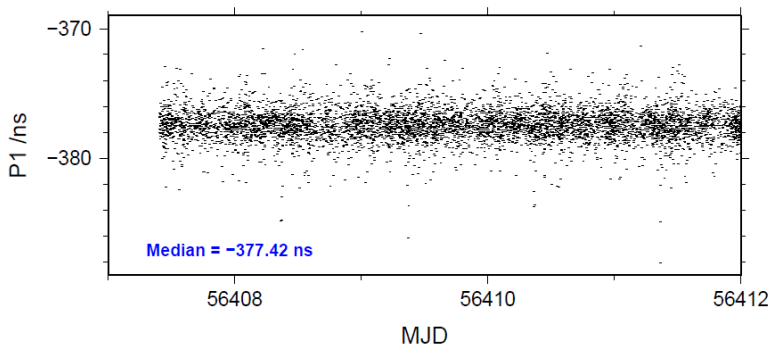
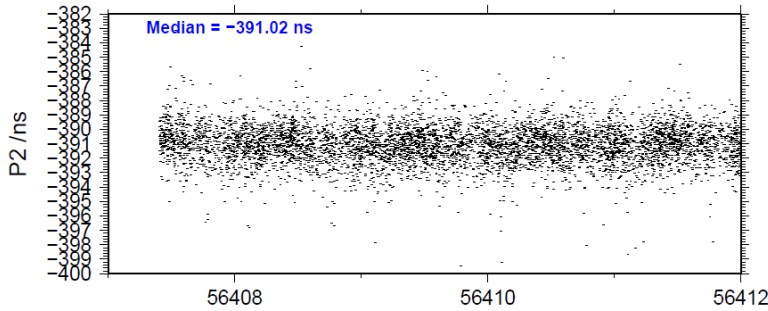
03/20/15 bp0ubp0m13115_5



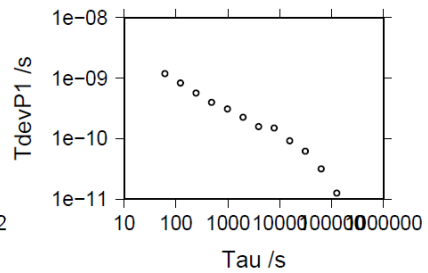
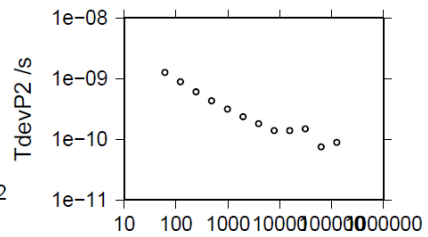
- 125361 s: C1= 166 ps
- 62680 s: C1= 114 ps
- 31340 s: C1= 216 ps
- 16670 s: C1= 153 ps
- 7835 s: C1= 168 ps
- 3918 s: C1= 163 ps
- 1959 s: C1= 226 ps
- 979 s: C1= 304 ps
- 490 s: C1= 392 ps
- 245 s: C1= 563 ps
- 122 s: C1= 816 ps
- 61 s: C1= 1174 ps



03/20/15 bp0ubp0m13115_5



- 125380 s: P1= 13 ps
- 62690 s: P1= 32 ps
- 31345 s: P1= 62 ps
- 15672 s: P1= 92 ps
- 7836 s: P1= 150 ps
- 3918 s: P1= 158 ps
- 1959 s: P1= 227 ps
- 980 s: P1= 310 ps
- 490 s: P1= 400 ps
- 245 s: P1= 570 ps
- 122 s: P1= 829 ps
- 61 s: P1= 1193 ps
- 125361 s: P2= 89 ps
- 62680 s: P2= 75 ps
- 31340 s: P2= 148 ps
- 15670 s: P2= 138 ps
- 7835 s: P2= 138 ps
- 3918 s: P2= 180 ps
- 1959 s: P2= 235 ps
- 979 s: P2= 312 ps
- 490 s: P2= 429 ps
- 245 s: P2= 603 ps
- 122 s: P2= 889 ps
- 61 s: P2= 1263 ps



BP0T-BP0R

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 68540
 Computed code bias (P1/P2)/m = -25.332 -25.559
 Computed baseline (X,Y,Z)/m = 3.619 1.066 -3.688
 RMS of residuals /m = 0.593

Number of phase differences to fit baseline = 64327
 A priori baseline (X,Y,Z)/m = 3.619 1.066 -3.688
 13024 clock jitters computed out of 13033 intervals
 AVE jitter /ps = -0.1 RMS jitter /ps = 28.5

Iter 1 Large residuals L1= 0
 Iter 1 Large residuals L2= 0
 Computed baseline L1 (X,Y,Z)/m = 0.145 0.026 0.237
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.150 0.023 0.247
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 3.764 1.092 -3.452
 Final baseline L2 (X,Y,Z)/m = 3.769 1.089 -3.441

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 68584

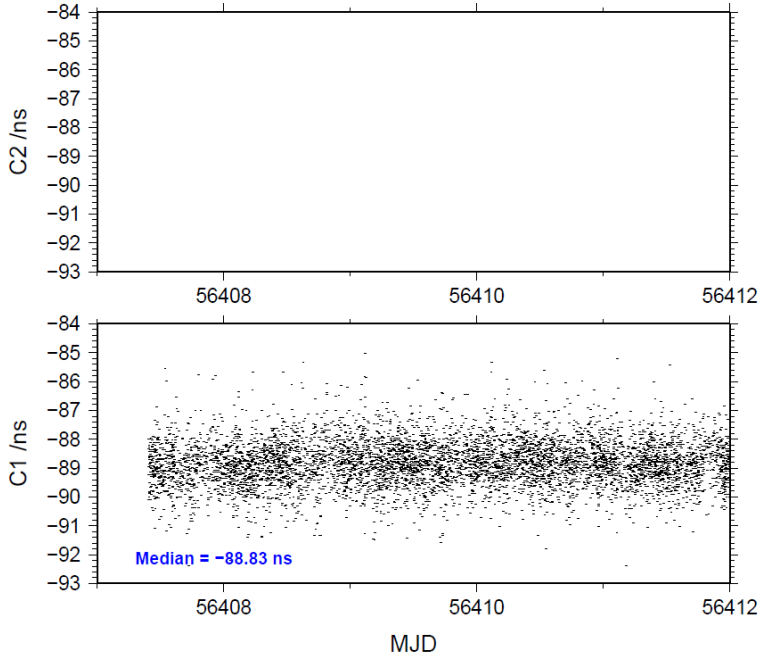
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 68524 -88.833 1.387
 C2: 0-NaN -NaN
 P1: 68481 -85.131 2.031
 P2: 68479 -85.914 2.136

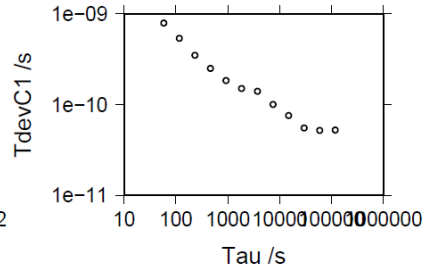
Number of 300s epochs in out file = 1324

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6834 -88.833 -88.829 0.771
 C2: 0 0.000-NaN -NaN
 P1: 6832 -85.166 -85.142 1.139
 P2: 6832 -85.949 -85.898 1.249

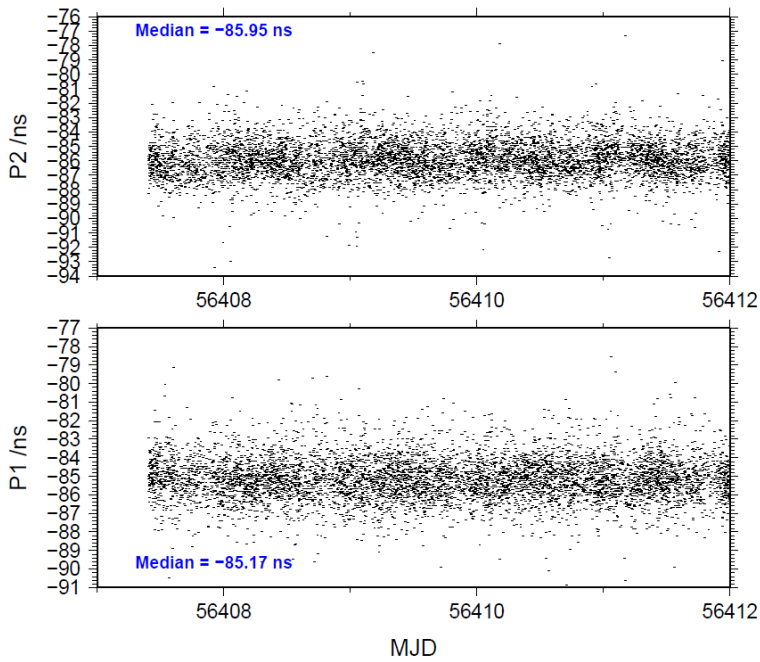
03/20/15 bp0tbp0r13115_5



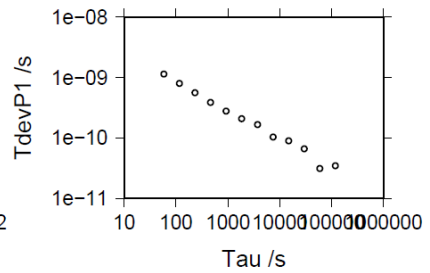
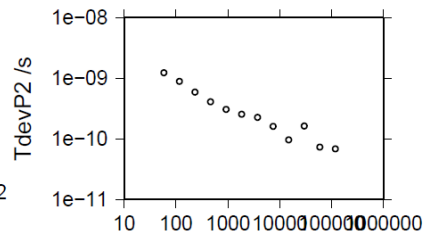
- 118960 s: C1= 52 ps
- 59480 s: C1= 52 ps
- 29740 s: C1= 55 ps
- 14870 s: C1= 76 ps
- 7435 s: C1= 101 ps
- 3717 s: C1= 140 ps
- 1859 s: C1= 150 ps
- 929 s: C1= 184 ps
- 465 s: C1= 251 ps
- 232 s: C1= 348 ps
- 116 s: C1= 534 ps
- 58 s: C1= 788 ps



03/20/15 bp0tbp0r13115_5



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|---------------------|---------------------|
| 118994 s: P1= 35 ps | 118994 s: P2= 68 ps |
| 59497 s: P1= 31 ps | 59497 s: P2= 73 ps |
| 29749 s: P1= 67 ps | 29749 s: P2= 163 ps |
| 14874 s: P1= 90 ps | 14874 s: P2= 96 ps |
| 7437 s: P1= 103 ps | 7437 s: P2= 161 ps |
| 3719 s: P1= 168 ps | 3719 s: P2= 227 ps |
| 1859 s: P1= 208 ps | 1859 s: P2= 253 ps |
| 930 s: P1= 279 ps | 930 s: P2= 305 ps |
| 465 s: P1= 390 ps | 465 s: P2= 408 ps |
| 232 s: P1= 561 ps | 232 s: P2= 590 ps |
| 116 s: P1= 804 ps | 116 s: P2= 887 ps |
| 58 s: P1= 1141 ps | 58 s: P2= 1230 ps |



BP0T-BP1C

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 68615
 Computed code bias (P1/P2)/m = -25.501 -26.275
 Computed baseline (X,Y,Z)/m = 2.710 0.835 -2.881
 RMS of residuals /m = 0.546

Number of phase differences to fit baseline = 64433
 A priori baseline (X,Y,Z)/m = 2.710 0.835 -2.881
 13022 clock jitters computed out of 13033 intervals
 AVE jitter /ps = -0.2 RMS jitter /ps = 28.5

Iter 1 Large residuals L1= 1
 Iter 1 Large residuals L2= 1
 Computed baseline L1 (X,Y,Z)/m = 0.160 0.021 0.219
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.167 0.017 0.227
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 1
 Iter 2 Large residuals L2= 1
 Computed baseline L1 (X,Y,Z)/m = 0.160 0.021 0.219
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.167 0.017 0.227
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = 2.870 0.855 -2.663
 Final baseline L2 (X,Y,Z)/m = 2.877 0.851 -2.655

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 68630

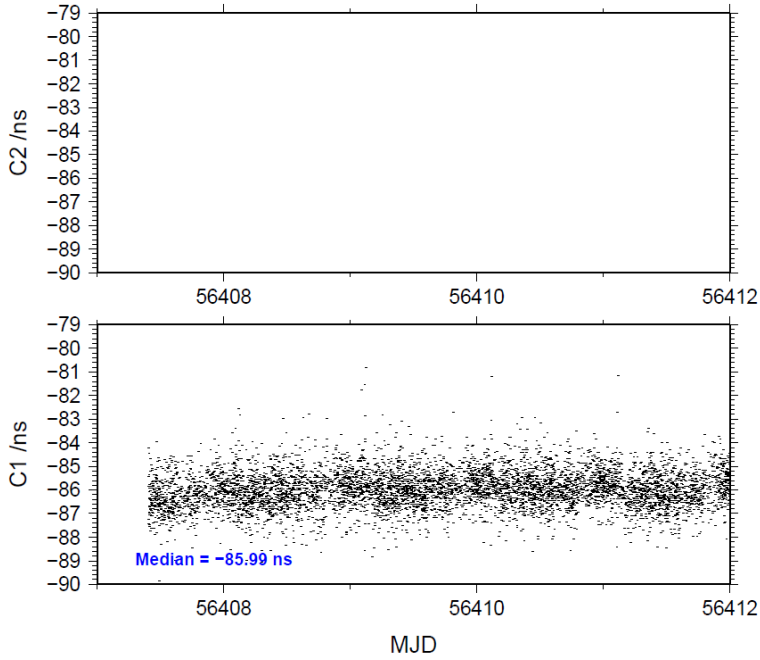
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 68570 -85.982 1.365
 C2: 0-NaN -NaN
 P1: 68555 -85.690 1.723
 P2: 68554 -88.294 2.088

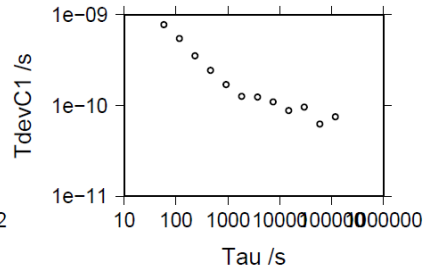
Number of 300s epochs in out file = 1324

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6836 -85.993 -85.977 0.775
 C2: 0 0.000-NaN -NaN
 P1: 6836 -85.728 -85.694 0.944
 P2: 6836 -88.339 -88.296 1.199

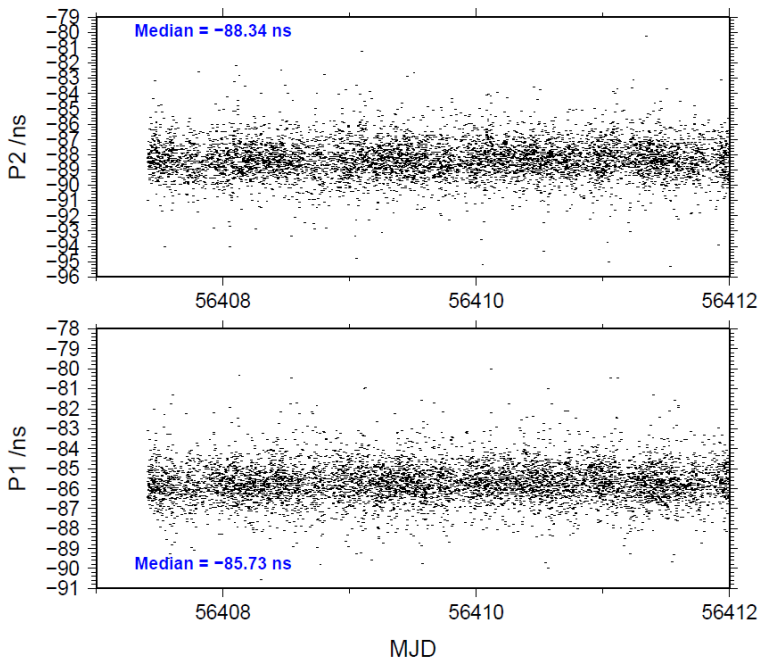
03/20/15 bp0tbp1c13115_5



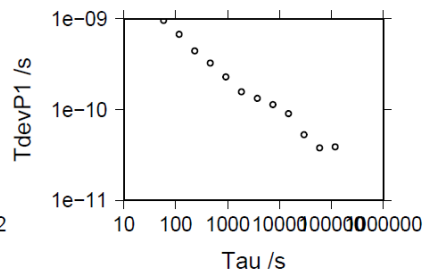
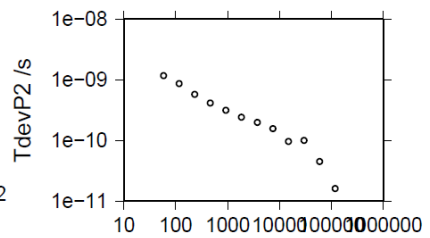
- 118925 s: C1= 75 ps
- 59462 s: C1= 62 ps
- 29731 s: C1= 96 ps
- 14866 s: C1= 88 ps
- 7433 s: C1= 110 ps
- 3716 s: C1= 124 ps
- 1858 s: C1= 127 ps
- 929 s: C1= 170 ps
- 465 s: C1= 244 ps
- 232 s: C1= 351 ps
- 116 s: C1= 545 ps
- 58 s: C1= 772 ps



03/20/15 bp0tbp1c13115_5



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|---------------------|---------------------|
| 118925 s: P1= 39 ps | 118925 s: P2= 16 ps |
| 59462 s: P1= 38 ps | 59462 s: P2= 45 ps |
| 29731 s: P1= 53 ps | 29731 s: P2= 100 ps |
| 14866 s: P1= 90 ps | 14866 s: P2= 96 ps |
| 7433 s: P1= 114 ps | 7433 s: P2= 157 ps |
| 3716 s: P1= 133 ps | 3716 s: P2= 199 ps |
| 1858 s: P1= 157 ps | 1858 s: P2= 243 ps |
| 929 s: P1= 230 ps | 929 s: P2= 313 ps |
| 465 s: P1= 324 ps | 465 s: P2= 412 ps |
| 232 s: P1= 443 ps | 232 s: P2= 574 ps |
| 116 s: P1= 671 ps | 116 s: P2= 861 ps |
| 58 s: P1= 955 ps | 58 s: P2= 1167 ps |



BP0T-BP0C

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 65814
 Computed code bias (P1/P2)/m = -138.714 -143.525
 Computed baseline (X,Y,Z)/m = -2.146 -0.626 1.626
 RMS of residuals /m = 0.614

Number of phase differences to fit baseline = 63155
 A priori baseline (X,Y,Z)/m = -2.146 -0.626 1.626
 13019 clock jitters computed out of 13028 intervals
 AVE jitter /ps = 0.2 RMS jitter /ps = 28.5

Iter 1 Large residuals L1= 1
 Iter 1 Large residuals L2= 1
 Computed baseline L1 (X,Y,Z)/m = 0.172 0.031 0.195
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.174 0.028 0.201
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 1
 Iter 2 Large residuals L2= 1
 Computed baseline L1 (X,Y,Z)/m = 0.172 0.031 0.195
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.174 0.028 0.201
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -1.974 -0.595 1.821
 Final baseline L2 (X,Y,Z)/m = -1.973 -0.597 1.827

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 65886

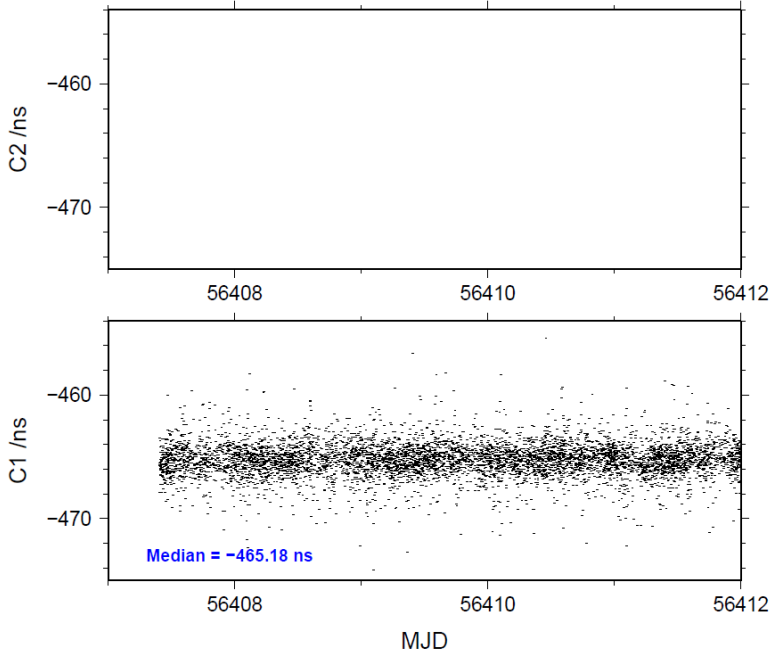
Global average of individual differences

Code #pts, ave/ns, rms/ns
 C1: 65816 -465.154 2.985
 C2: 0-NaN -NaN
 P1: 65756 -463.328 2.239
 P2: 65776 -479.389 2.181

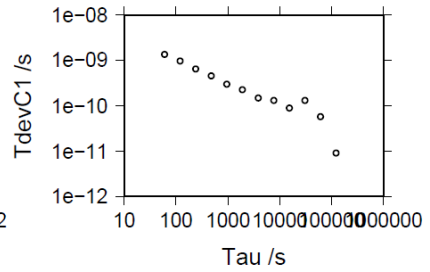
Number of 300s epochs in out file = 1324

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6618 -465.183 -465.207 1.340
 C2: 0 0.000-NaN -NaN
 P1: 6616 -463.375 -463.339 1.155
 P2: 6616 -479.426 -479.391 1.087

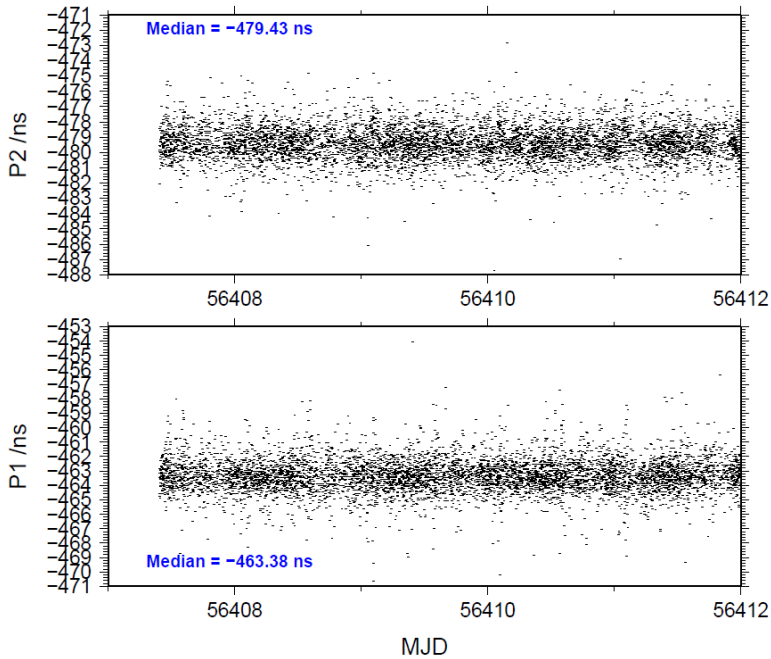
03/20/15 bp0tbp0c13115_5



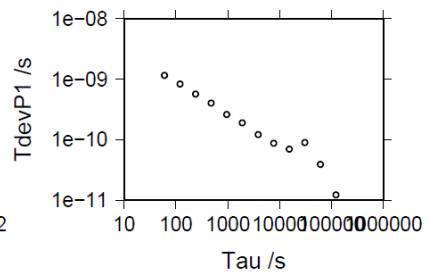
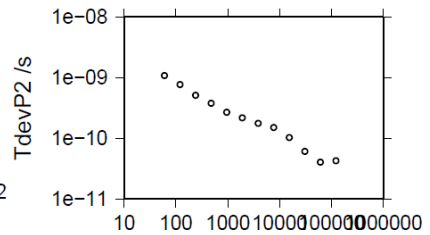
- 122843 s: C1= 9 ps
- 61421 s: C1= 57 ps
- 30711 s: C1= 132 ps
- 15355 s: C1= 89 ps
- 7678 s: C1= 130 ps
- 3839 s: C1= 149 ps
- 1919 s: C1= 225 ps
- 960 s: C1= 299 ps
- 480 s: C1= 454 ps
- 240 s: C1= 652 ps
- 120 s: C1= 964 ps
- 60 s: C1= 1352 ps



03/20/15 bp0tbp0c13115_5



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|---------------------|---------------------|
| 122880 s: P1= 12 ps | 122880 s: P2= 42 ps |
| 61440 s: P1= 40 ps | 61440 s: P2= 40 ps |
| 30720 s: P1= 90 ps | 30720 s: P2= 61 ps |
| 15360 s: P1= 70 ps | 15360 s: P2= 103 ps |
| 7680 s: P1= 88 ps | 7680 s: P2= 149 ps |
| 3840 s: P1= 122 ps | 3840 s: P2= 177 ps |
| 1920 s: P1= 190 ps | 1920 s: P2= 216 ps |
| 960 s: P1= 260 ps | 960 s: P2= 268 ps |
| 480 s: P1= 405 ps | 480 s: P2= 379 ps |
| 240 s: P1= 571 ps | 240 s: P2= 509 ps |
| 120 s: P1= 831 ps | 120 s: P2= 771 ps |
| 60 s: P1= 1158 ps | 60 s: P2= 1084 ps |



BP0T-BP0M

COMPUTATION OF BASELINE

Number of codes to fit baseline and biases = 65905
 Computed code bias (P1/P2)/m = -113.770 -119.004
 Computed baseline (X,Y,Z)/m = -1.227 -0.348 0.538
 RMS of residuals /m = 0.601

Number of phase differences to fit baseline = 63180
 A priori baseline (X,Y,Z)/m = -1.227 -0.348 0.538
 13014 clock jitters computed out of 13024 intervals
 AVE jitter /ps = 0.2 RMS jitter /ps = 28.4

Iter 1 Large residuals L1= 3
 Iter 1 Large residuals L2= 3
 Computed baseline L1 (X,Y,Z)/m = 0.202 0.048 0.204
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.214 0.047 0.213
 RMS of residuals L2 /m = 0.003

Iter 2 Large residuals L1= 3
 Iter 2 Large residuals L2= 3
 Computed baseline L1 (X,Y,Z)/m = 0.202 0.048 0.204
 RMS of residuals L1 /m = 0.004
 Computed baseline L2 (X,Y,Z)/m = 0.214 0.047 0.213
 RMS of residuals L2 /m = 0.003

Final baseline L1 (X,Y,Z)/m = -1.026 -0.300 0.742
 Final baseline L2 (X,Y,Z)/m = -1.014 -0.301 0.751

COMPUTATION OF CODE DIFFERENCES

Number of code differences = 65954

Global average of individual differences

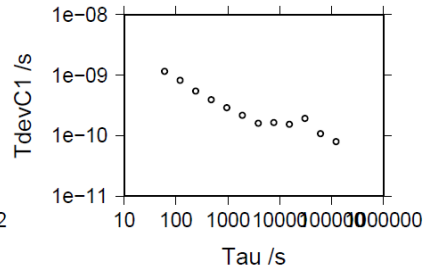
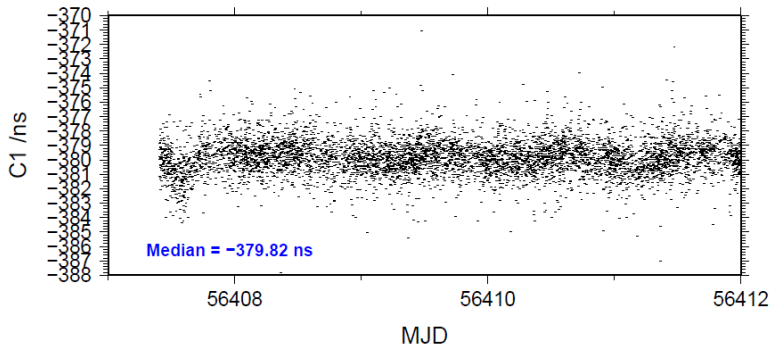
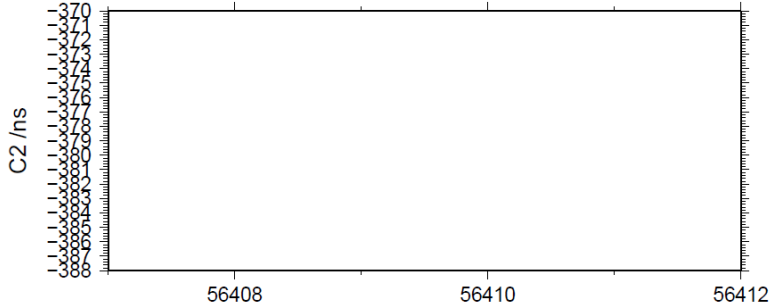
Code #pts, ave/ns, rms/ns
 C1: 65891 -379.790 2.723
 C2: 0-NaN -NaN
 P1: 65846 -380.199 2.095
 P2: 65861 -397.695 2.191

Number of 300s epochs in out file = 1324

Code #pts, median/ns, ave/ns, rms/ns
 C1: 6623 -379.820 -379.820 1.193
 C2: 0 0.000-NaN -NaN
 P1: 6621 -380.227 -380.198 1.031
 P2: 6622 -397.711 -397.689 1.176

03/20/15 bp0tbp0m13115_5

- 122750 s: C1= 80 ps
- 61375 s: C1= 108 ps
- 30688 s: C1= 194 ps
- 15344 s: C1= 154 ps
- 7672 s: C1= 165 ps
- 3836 s: C1= 162 ps
- 1918 s: C1= 218 ps
- 959 s: C1= 292 ps
- 479 s: C1= 392 ps
- 240 s: C1= 549 ps
- 120 s: C1= 820 ps
- 60 s: C1= 1160 ps



03/20/15 bp0tbp0m13115_5

- 122787 s: P1= 10 ps
- 61394 s: P1= 25 ps
- 30697 s: P1= 42 ps
- 15348 s: P1= 62 ps
- 7674 s: P1= 111 ps
- 3837 s: P1= 137 ps
- 1919 s: P1= 189 ps
- 959 s: P1= 260 ps
- 480 s: P1= 358 ps
- 240 s: P1= 498 ps
- 120 s: P1= 736 ps
- 60 s: P1= 1032 ps
- 122769 s: P2= 80 ps
- 61384 s: P2= 71 ps
- 30692 s: P2= 131 ps
- 15346 s: P2= 86 ps
- 7673 s: P2= 156 ps
- 3837 s: P2= 201 ps
- 1918 s: P2= 249 ps
- 959 s: P2= 278 ps
- 480 s: P2= 388 ps
- 240 s: P2= 543 ps
- 120 s: P2= 837 ps
- 60 s: P2= 1168 ps

