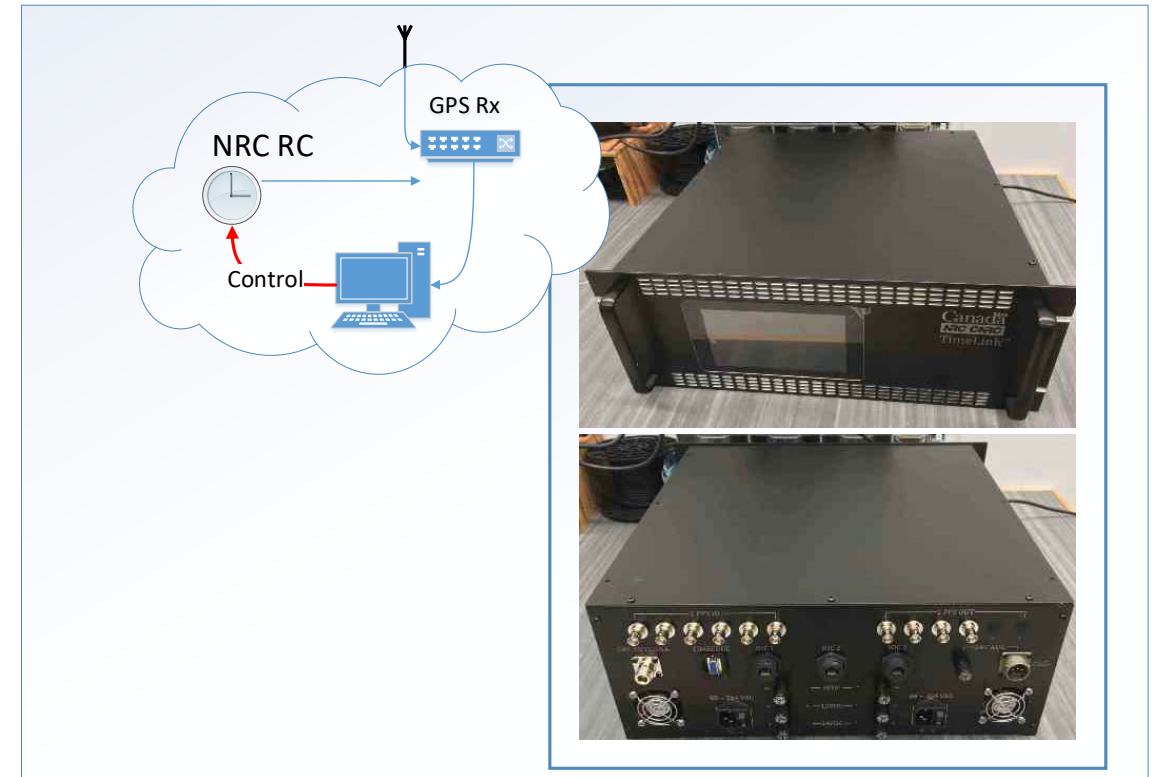
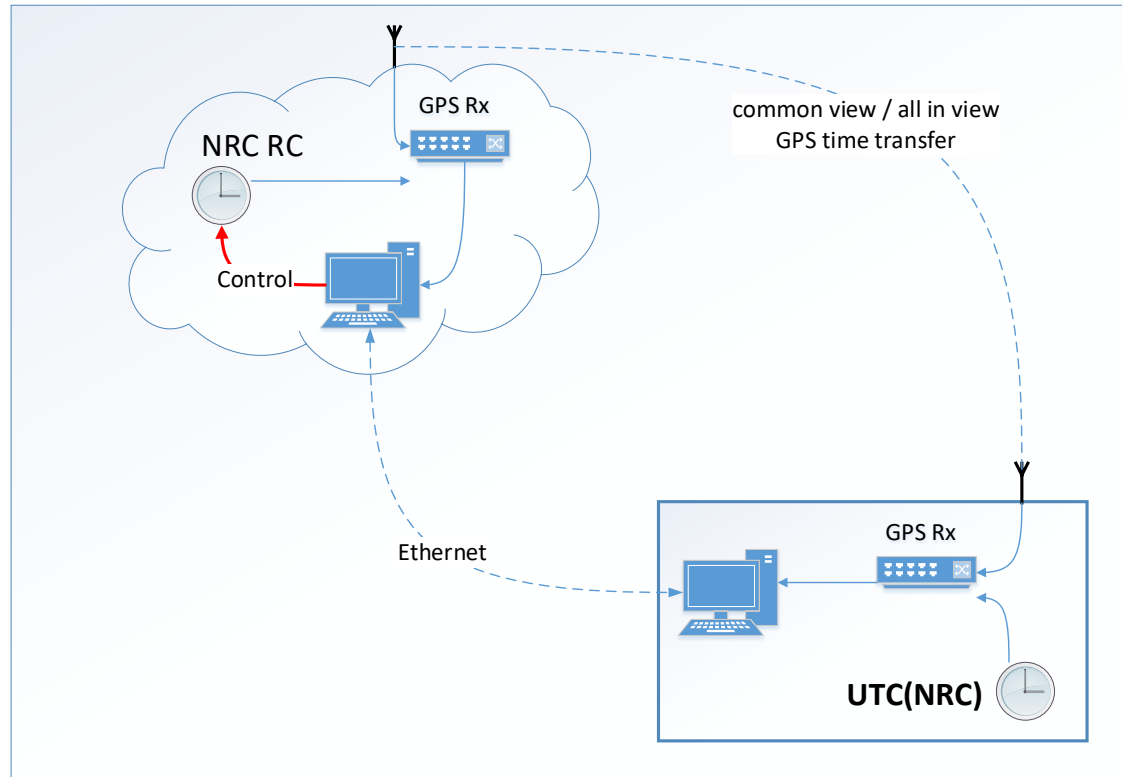


PTP Equipment Study

Hai Pham and Marina Gertsvolf
ITSF 2018

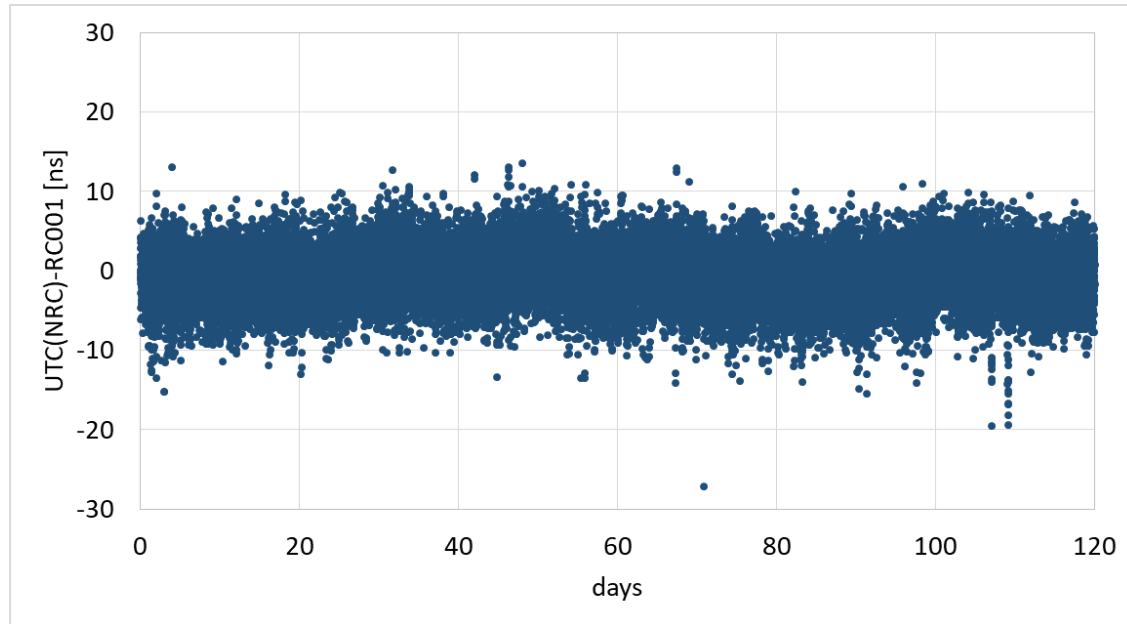
NRC – TimeLink™

Traceable Time Dissemination



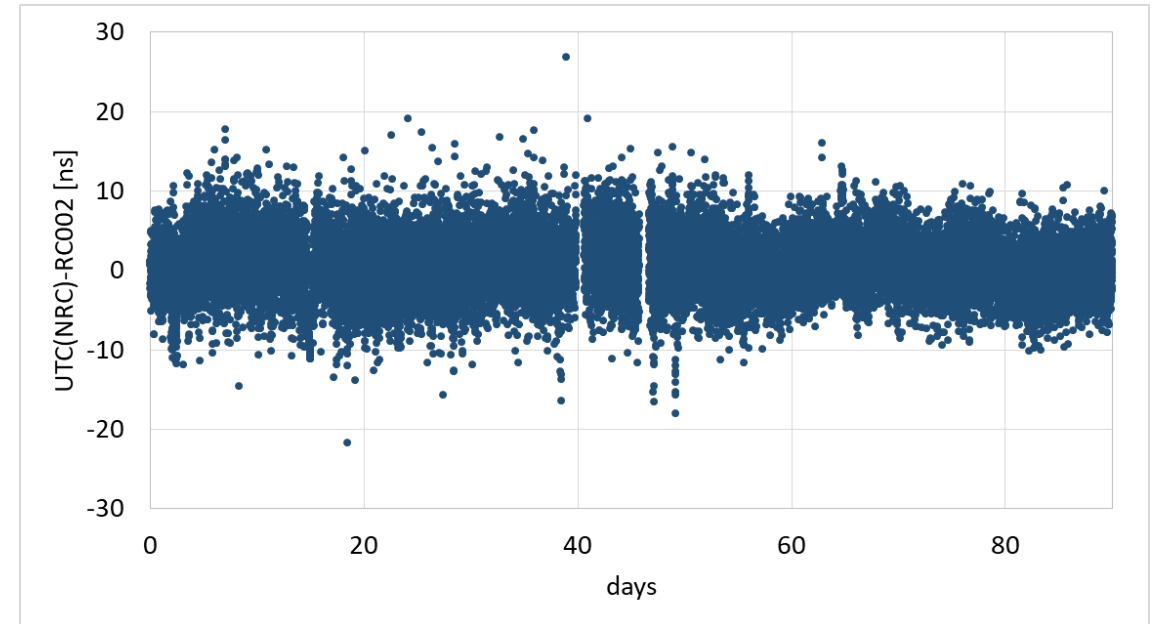
NRC – TimeLink™

Remote Traceable Time Dissemination with *ns* accuracy



April - August

RC-001	
MEAN [ns]	-0.7
STDEV [ns]	3.3

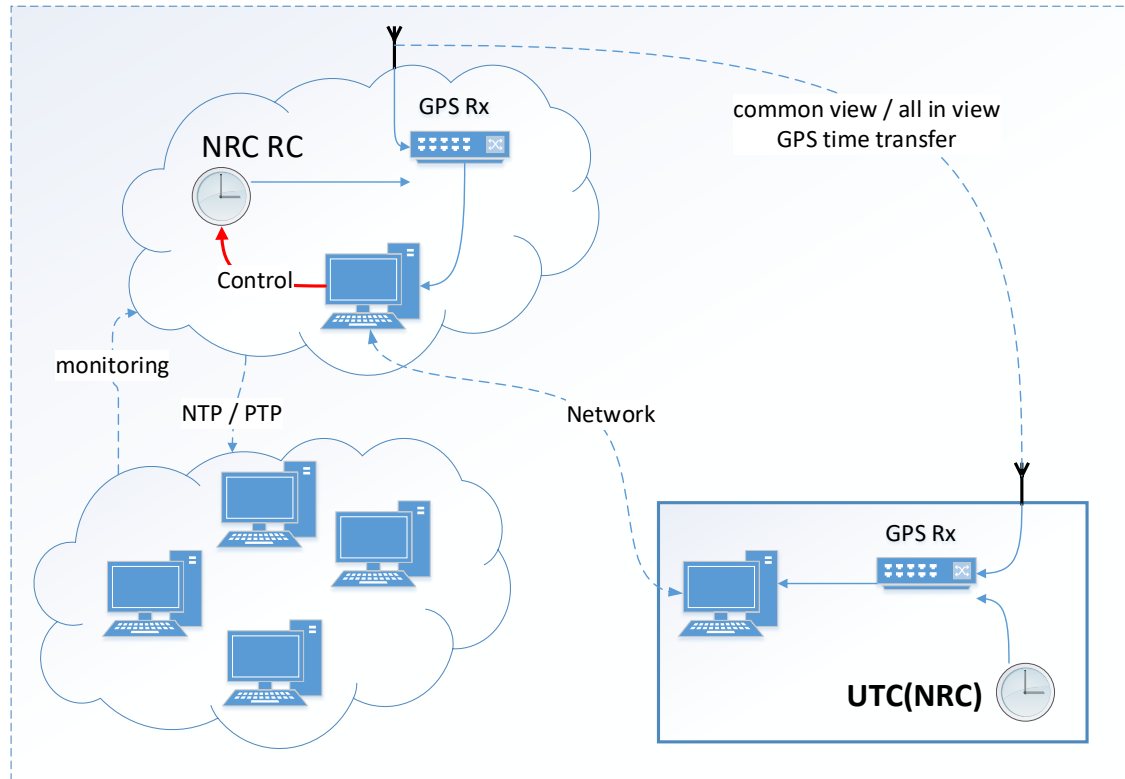


June - September

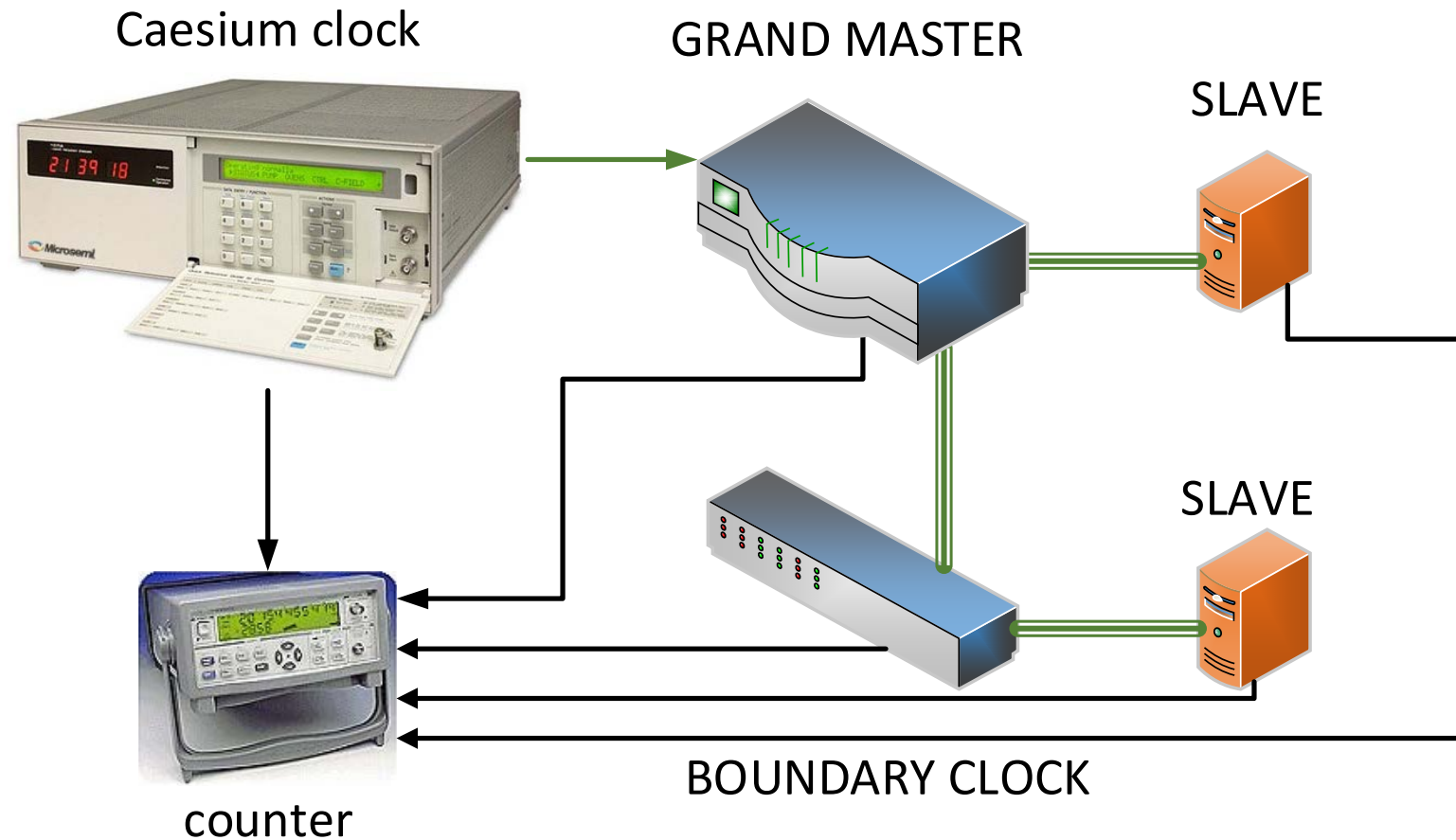
RC-002	
MEAN [ns]	0.7
STDEV [ns]	3.7

NRC – TimeLink™

Traceable time dissemination to sub-networks



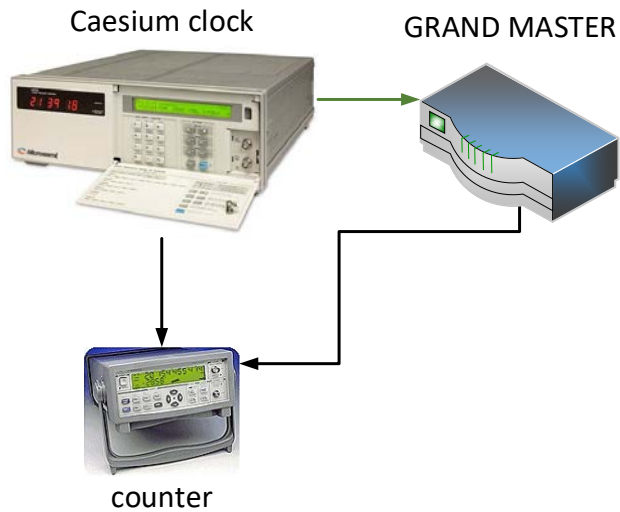
Equipment Performance: PTP



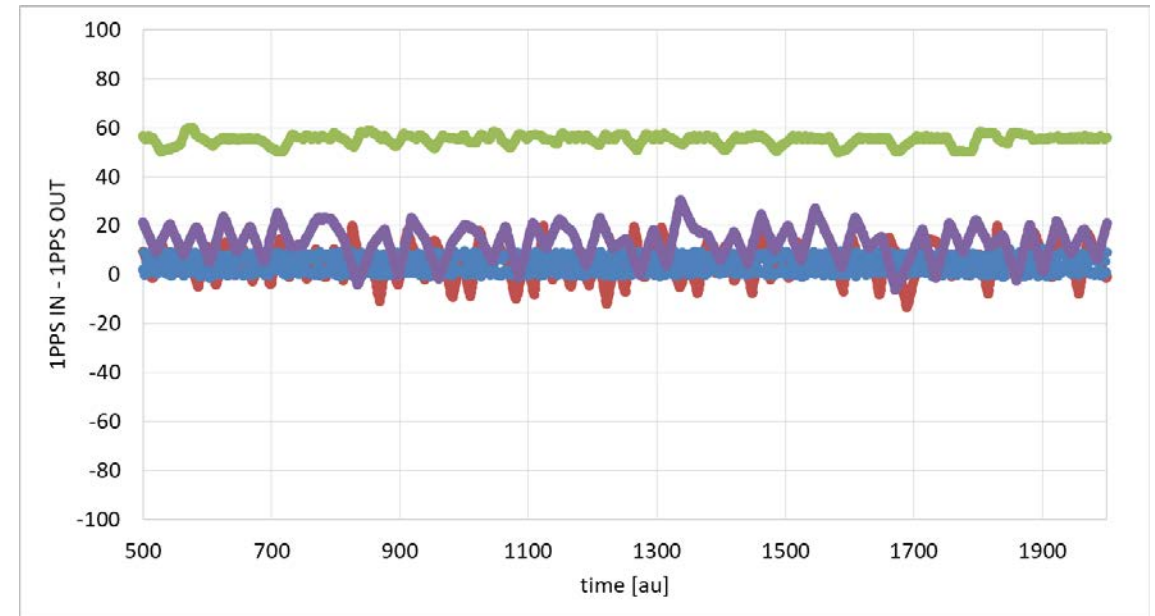
PTP Equipment Vendors	A	B	C	D	E	F
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Cs – GM

[ns]

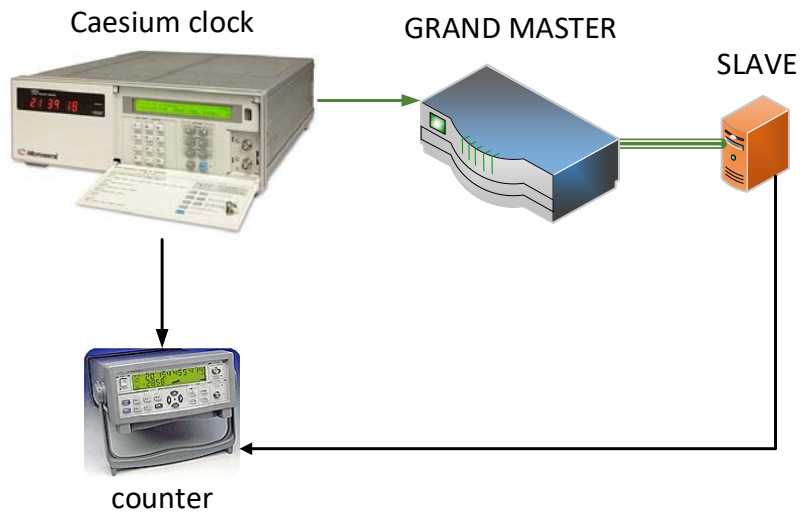


	AVERAGE	STDEV
A.GM.1	55	2
B.GM.1	4	3
C.GM.1	5	6
C.GM.2	13	6

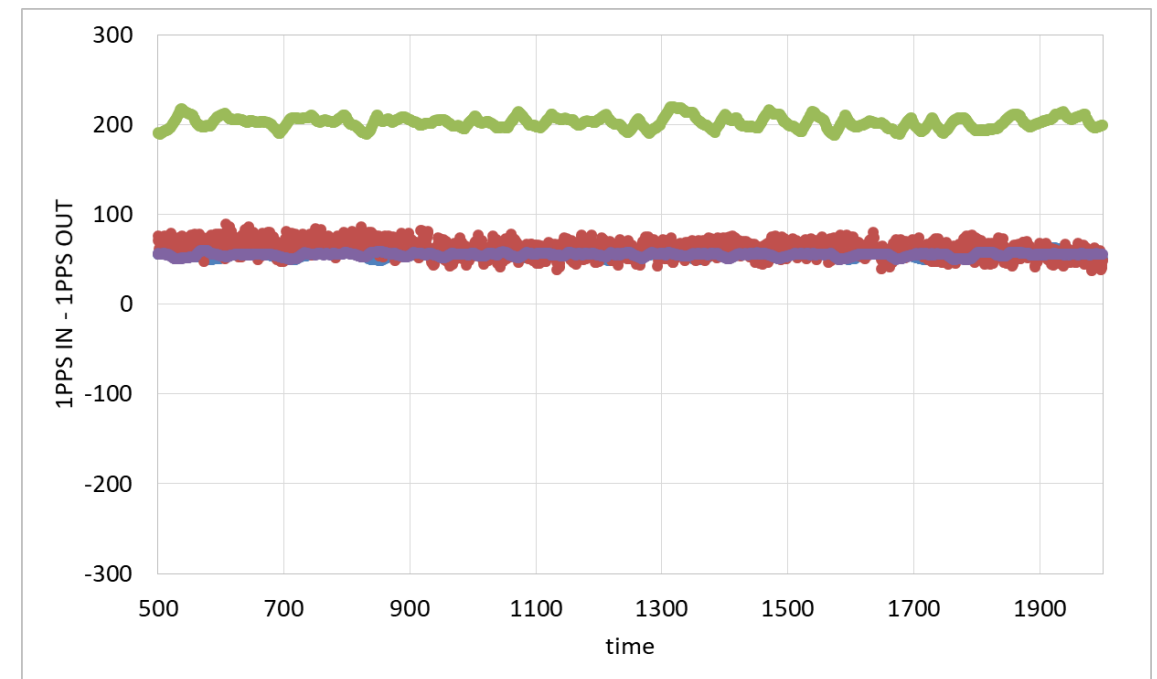


Cs – GM – SL

[ns]

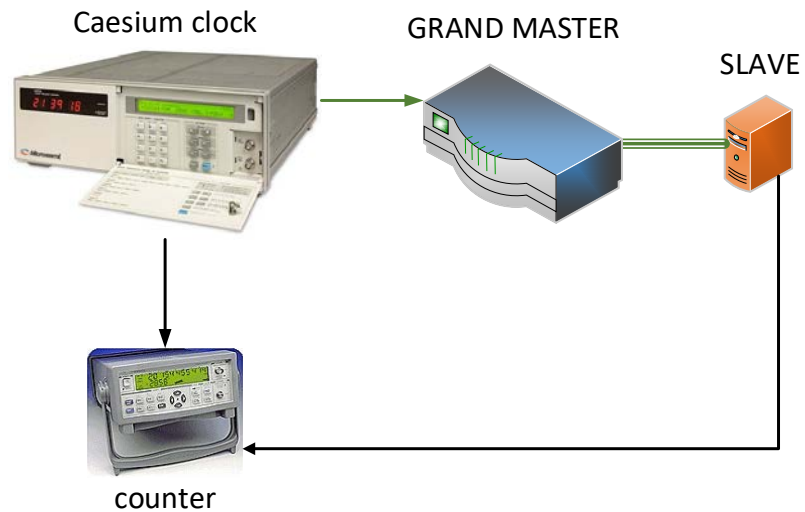


	AVERAGE	STDEV
A.GM.1 – C.SL.1	203	6
A.GM.1 – A.SL.1	56	3
A.GM.1 – A.SL.2	62	9
A.GM.1	55	2

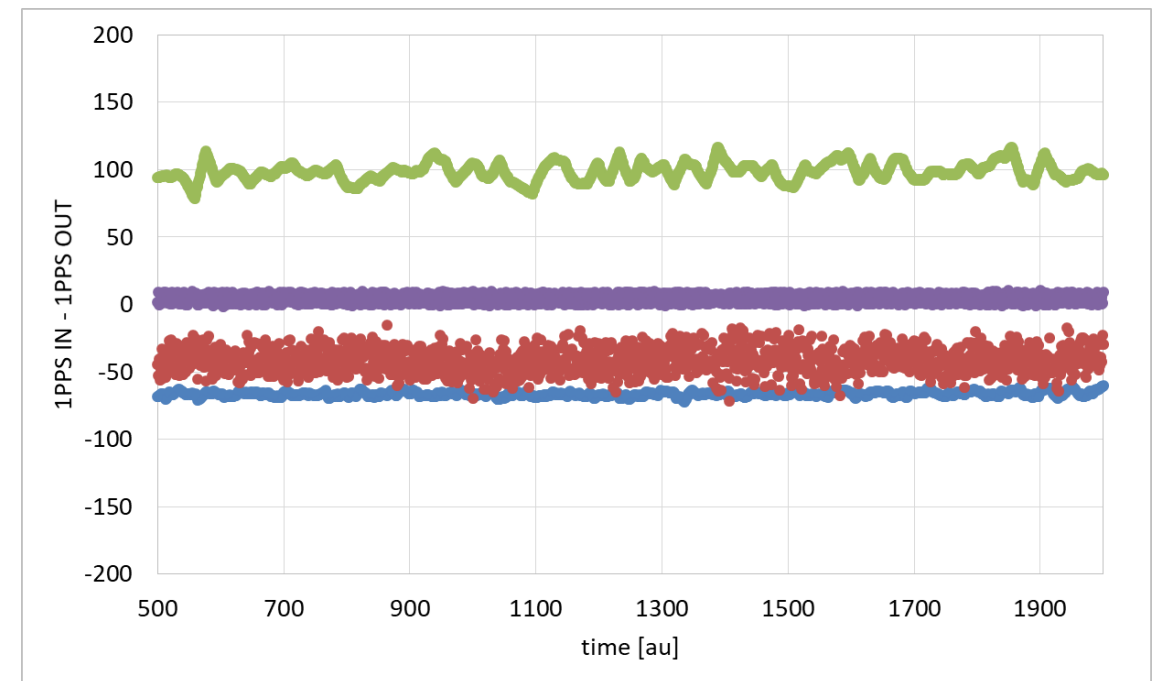


Cs – GM – SL

[ns]

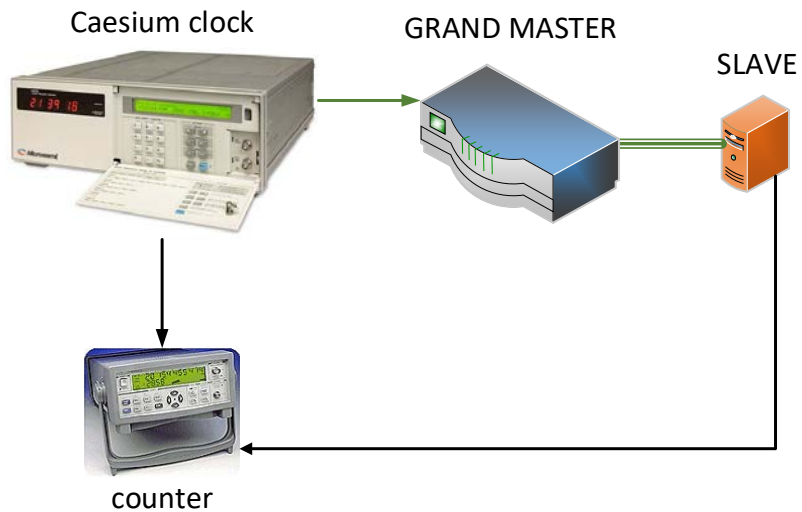


	AVERAGE	STDEV
B.GM.1 – C.SL.1	99	6
B.GM.1 – A.SL.1	-66	2
B.GM.1 – A.SL.2	-41	9
B.GM.1	4	3

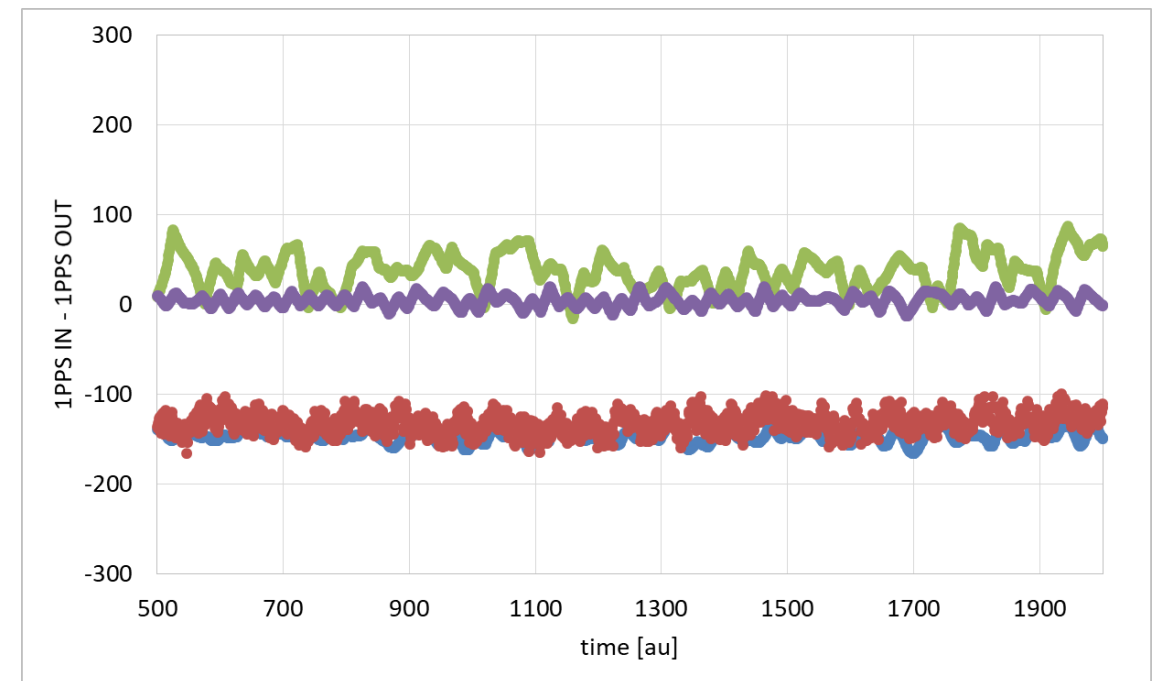


Cs – GM – SL

[ns]

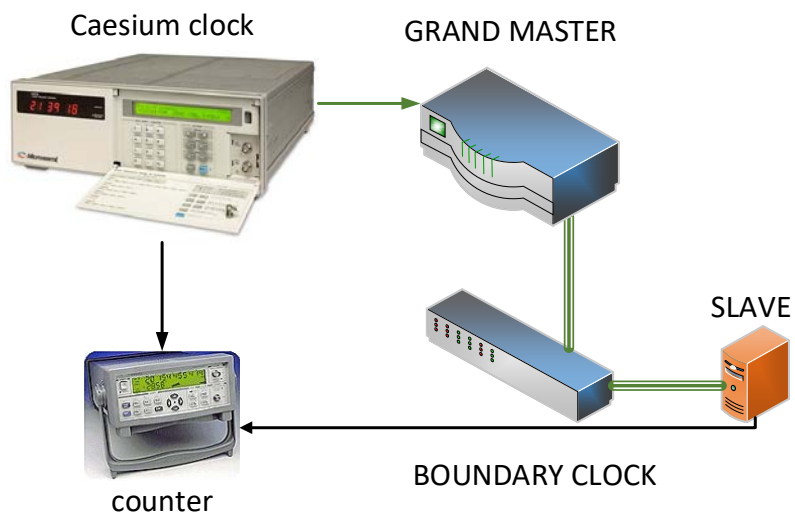


	AVERAGE	STDEV
C.GM.1 – C.SL.1	37	20
C.GM.1 – A.SL.1	-147	7
C.GM.1 – A.SL.2	-132	11
C.GM.1	5	6

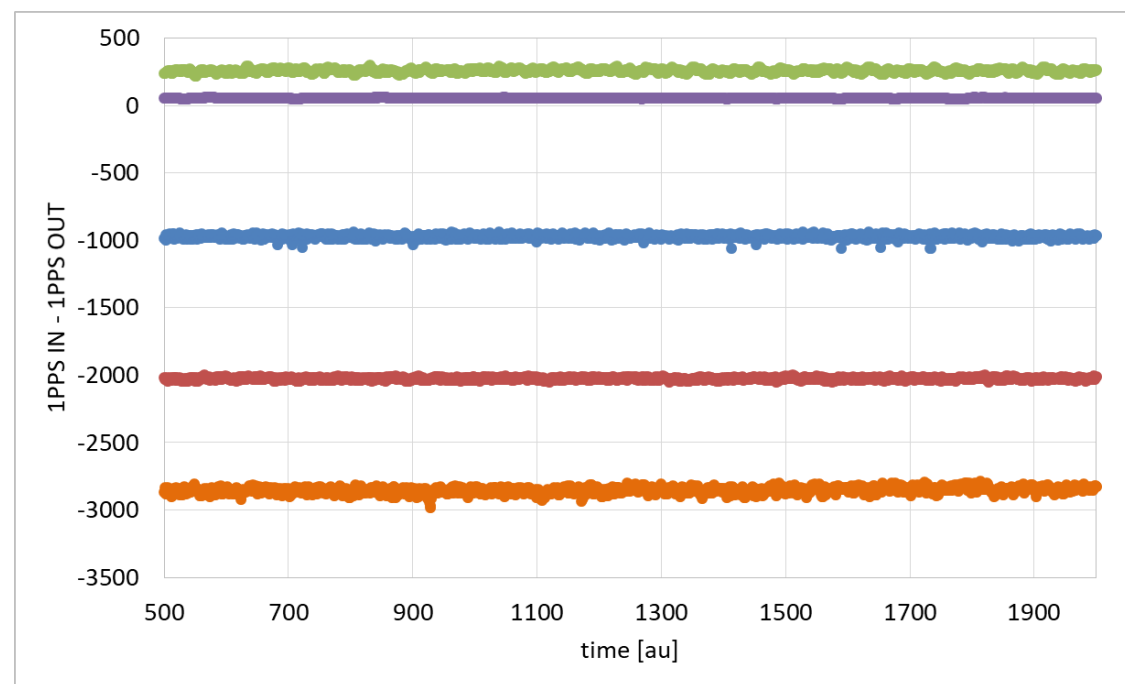


Cs – GM – BC – SL

[ns]

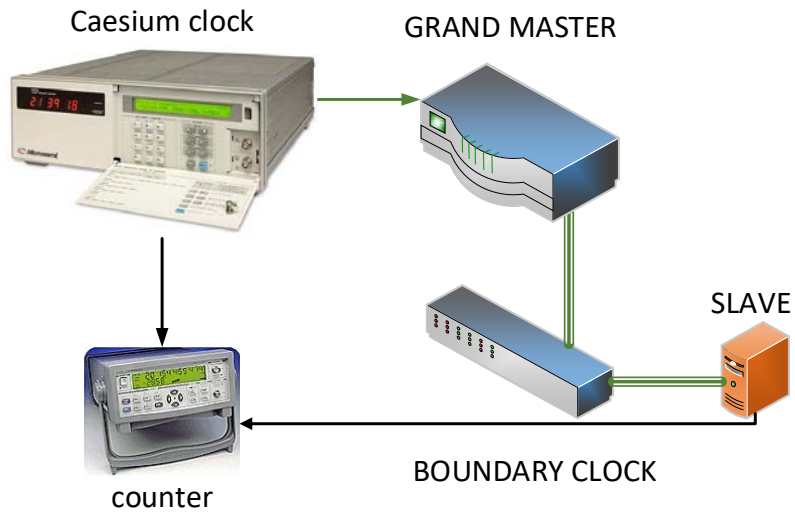


	AVERAGE	STDEV
A.GM.1 – E.BC.1 – A.SL.2	258	12
A.GM.1 – E.BC.2 – A.SL.2	-974	14
A.GM.1 – D.BC.1 – A.SL.2	-2026	9
A.GM.1 – F.BC.1 – A.SL.2	-2853	23
A.GM.1	55	2

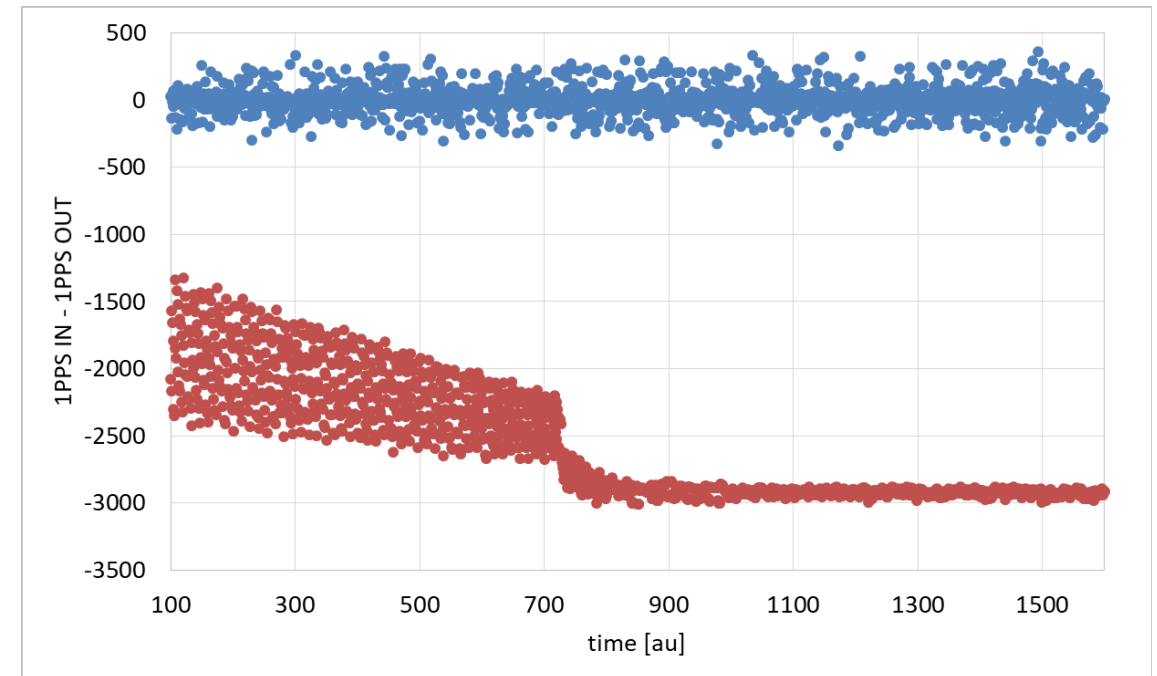


Cs – GM – BC – SL

[ns]

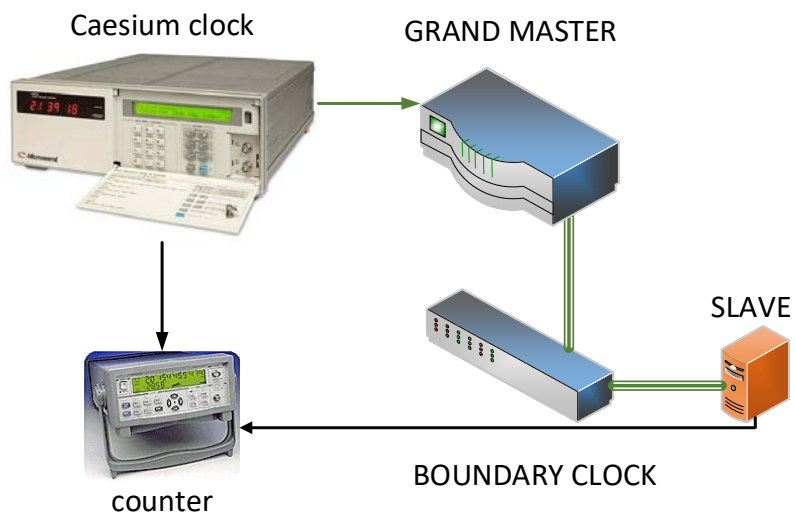


	AVERAGE	STDEV
A.GM.1 – D.BC.1 – A.SL.2	-2925	23
A.SL.2 Offset PTP STATS	1	107

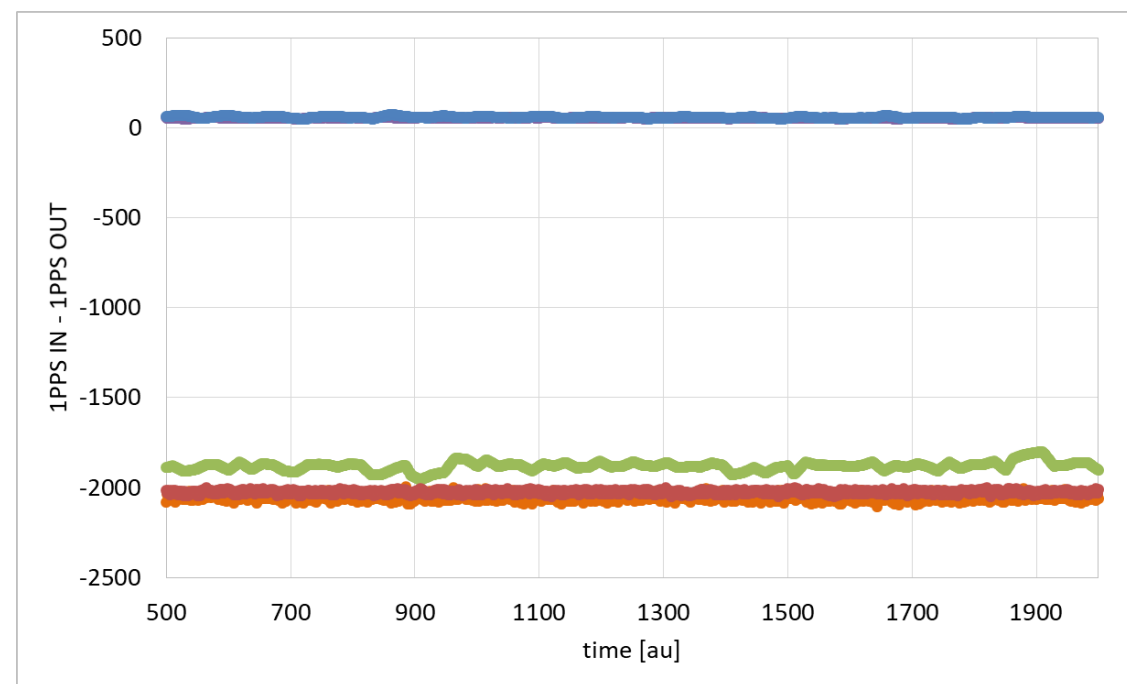


Cs – GM – BC – SL

[ns]

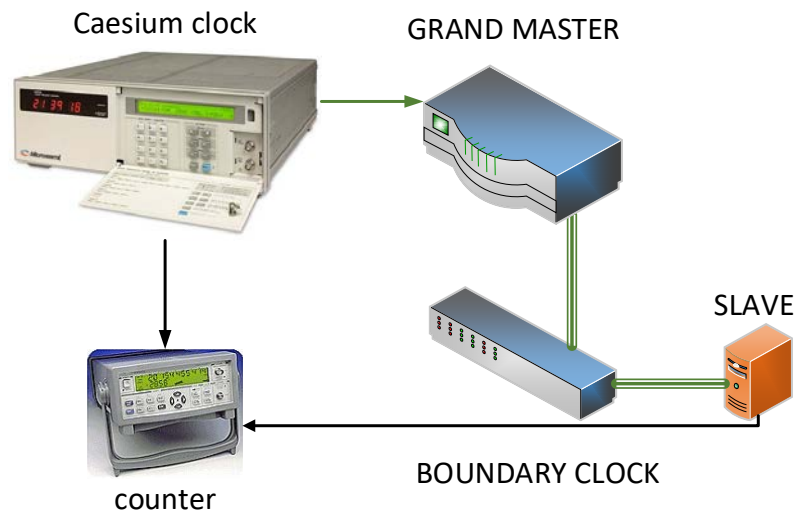


	AVERAGE	STDEV
A.GM.1 – D.BC.1 – C.SL.1	-1882	23
A.GM.1 – D.BC.1 – A.SL.1	59	5
A.GM.1 – D.BC.1 – A.SL.2	-2026	9
A.GM.1 – D.BC.1 – A.SL.3	-2052	16
A.GM.1	55	2

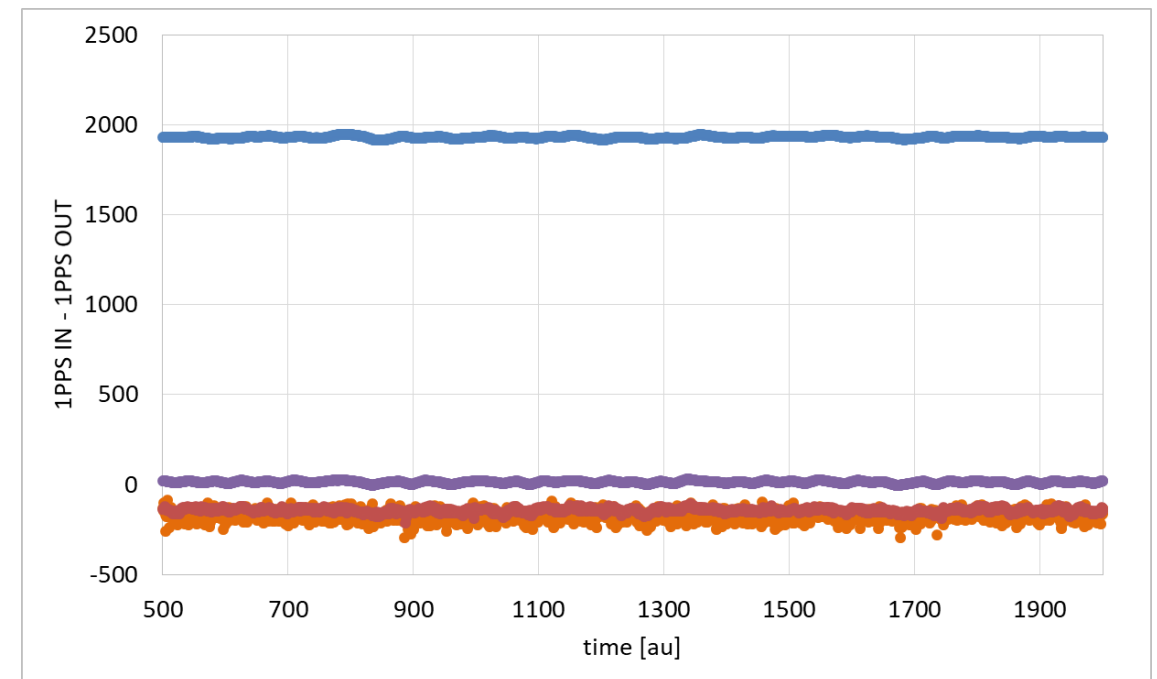


Cs – GM – BC – SL

[ns]

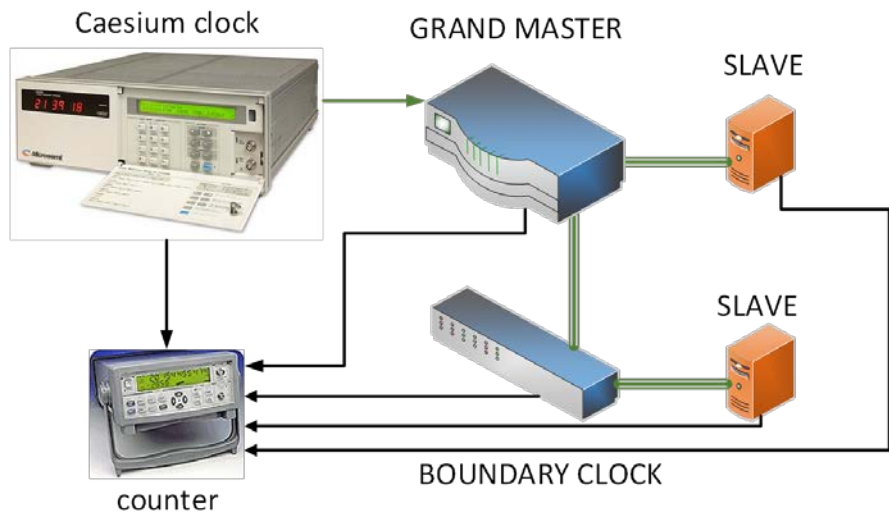


	AVERAGE	STDEV
C.GM.2 – D.BC.1 – A.SL.1	1932	6
C.GM.2 – D.BC.1 – A.SL.2	-144	12
C.GM.2 – D.BC.1 – A.SL.3	-179	29
C.GM.2	13	6

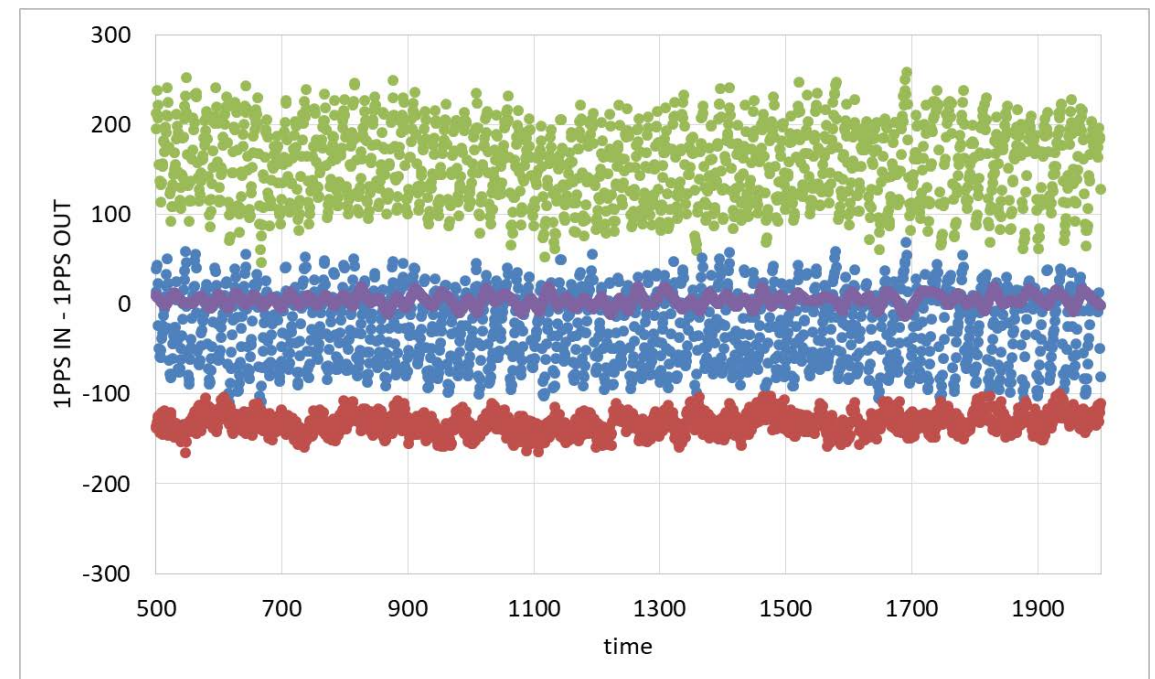


Cs – GM – BC – SL

[ns]

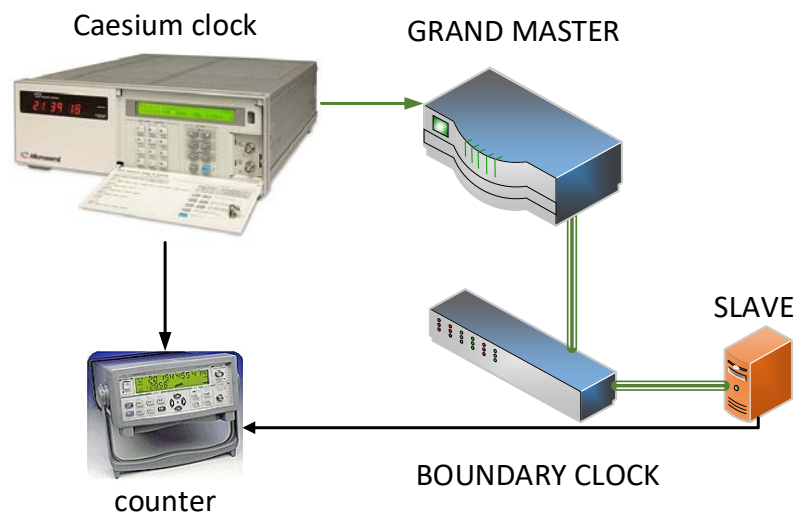


	AVERAGE	STDEV
C.GM.1 – E.BC.1 – A.SL.2	156	44
C.GM.1 – E.BC.1	-26	41
C.GM.1 – A.SL.2	-132	11
C.GM.1	5	6

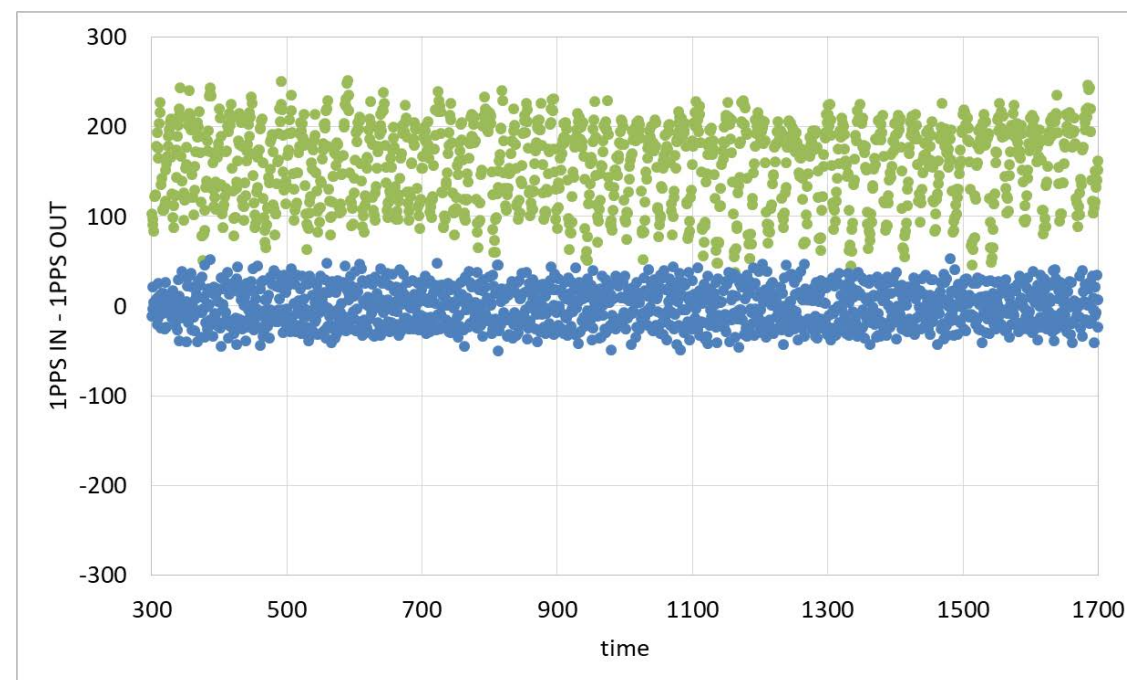


Cs – GM – BC – SL

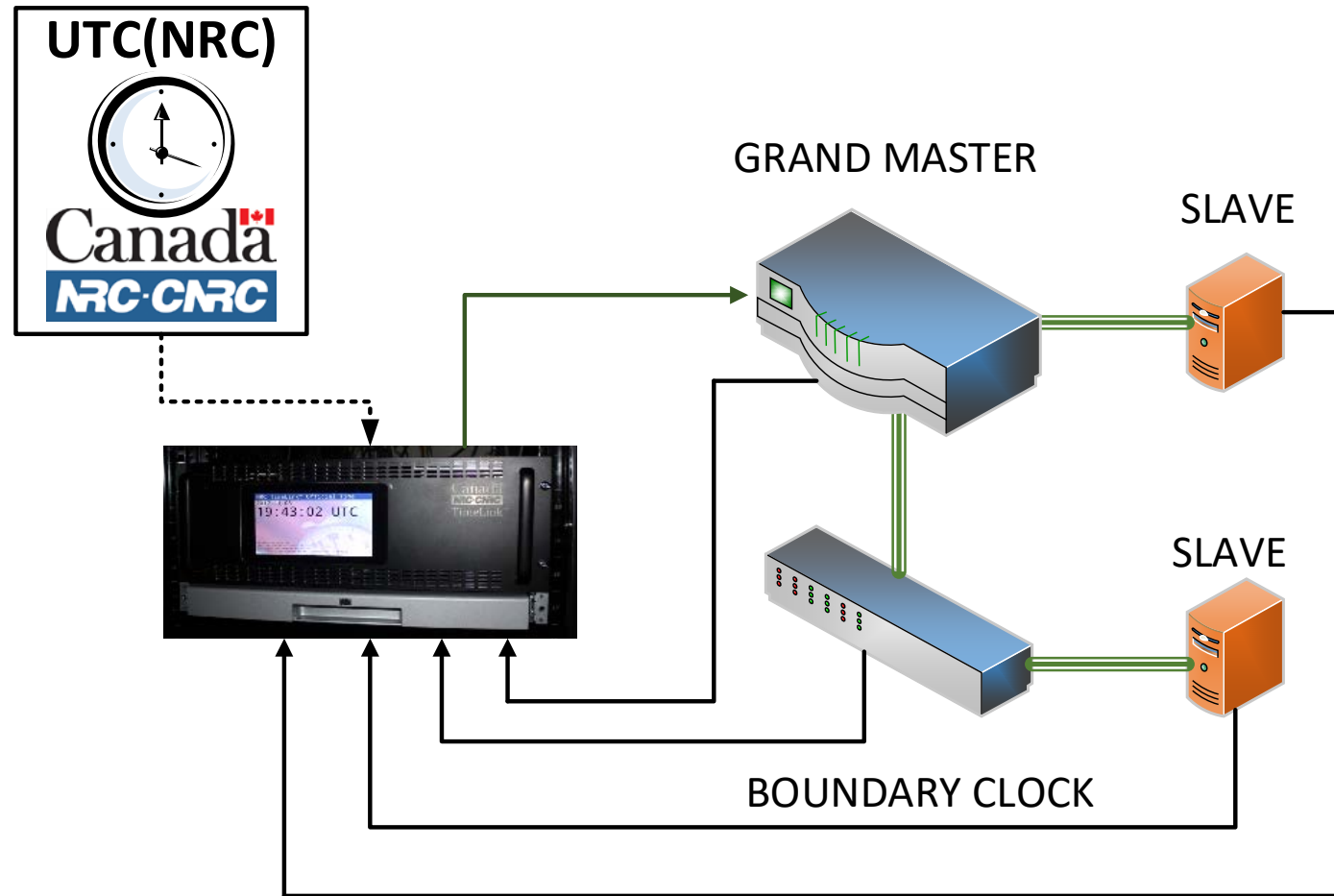
[ns]



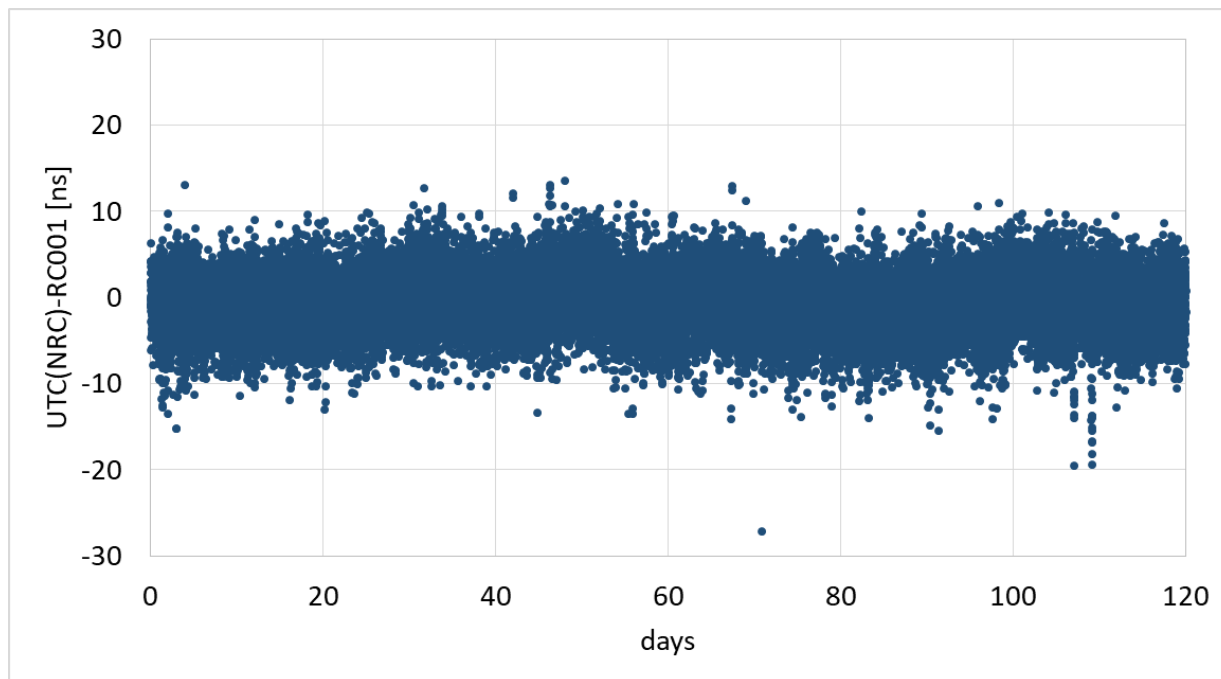
	AVERAGE	STDEV
C.GM.1 – E.BC.1 – A.SL.2	158	46
A.SL.2 Offset PTP STATS	0	22



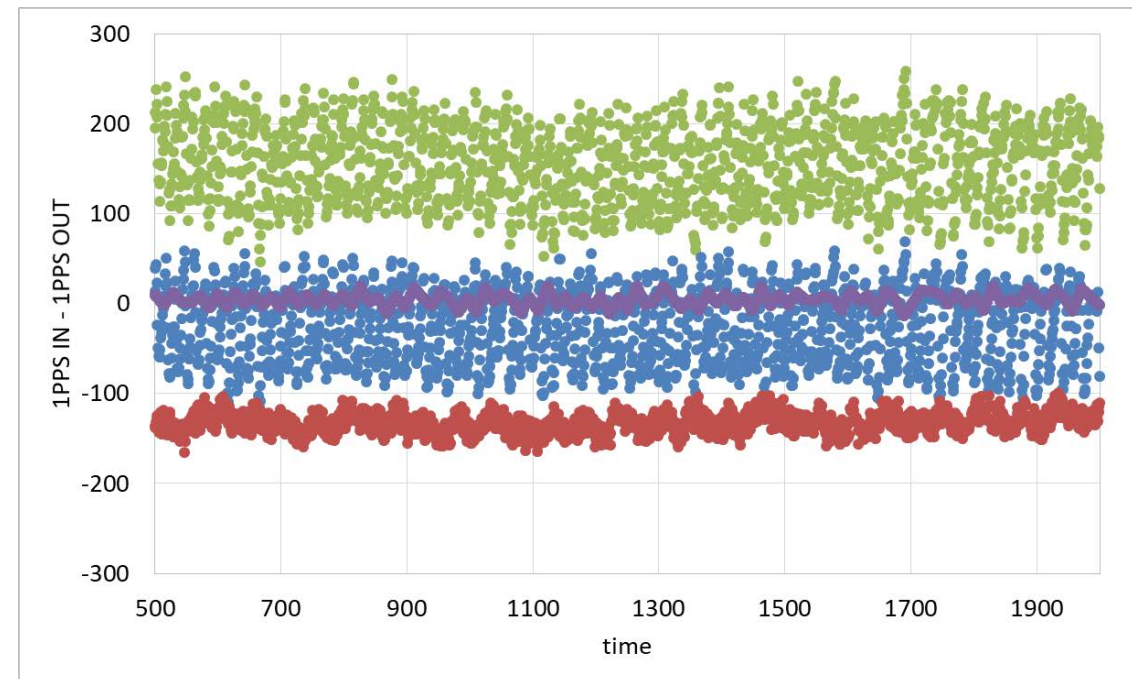
PTP traceable to UTC(NRC)



Uncertainty Impact



RC-001	
MEAN [ns]	-0.7
STDEV [ns]	3.3



	AVERAGE	STDEV
C.GM.1 – E.BC.1 – A.SL.2	156	44
C.GM.1 – E.BC.1	-26	41
C.GM.1 – A.SL.2	-132	11
C.GM.1	5	6

Summary

Configuration	1PPS offset
Grand Master sync to 1PPS	< 100 ns
Slave direct sync to Grand Master	-150 ns to +100 ns
Slave sync via Boundary Clock to Grand Master	-2925 ns to +1932 ns
Correlation between 1PPS and PTP Stats	Unreliable

Thank you

Dr. Marina Gertsvolf

Team Leader, Frequency & Time

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