ON IMPROVING TWO-WAY LINKS IN EUROPE: PARAMETERS, EFFECTS AND POSSIBLE ISSUES

by

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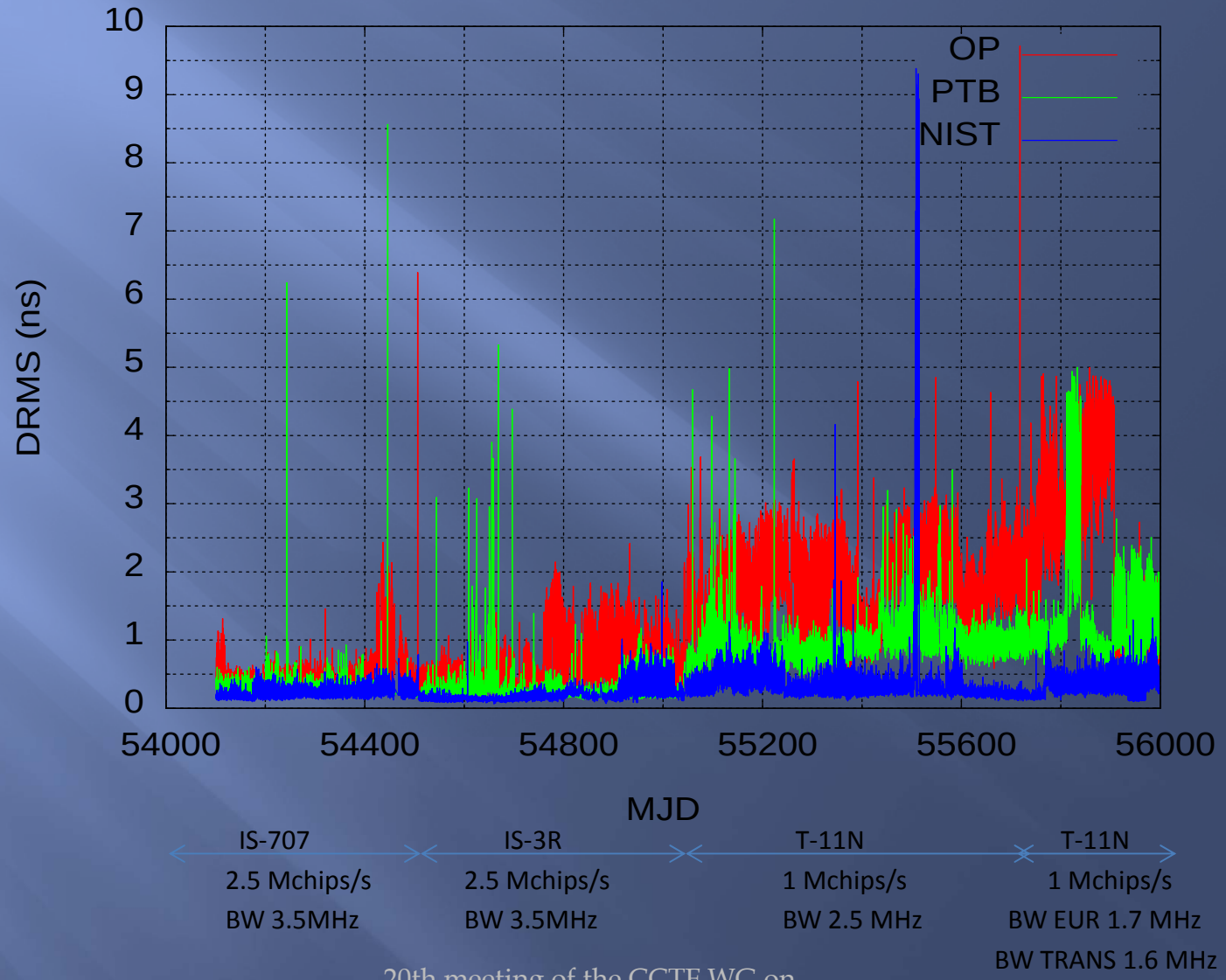
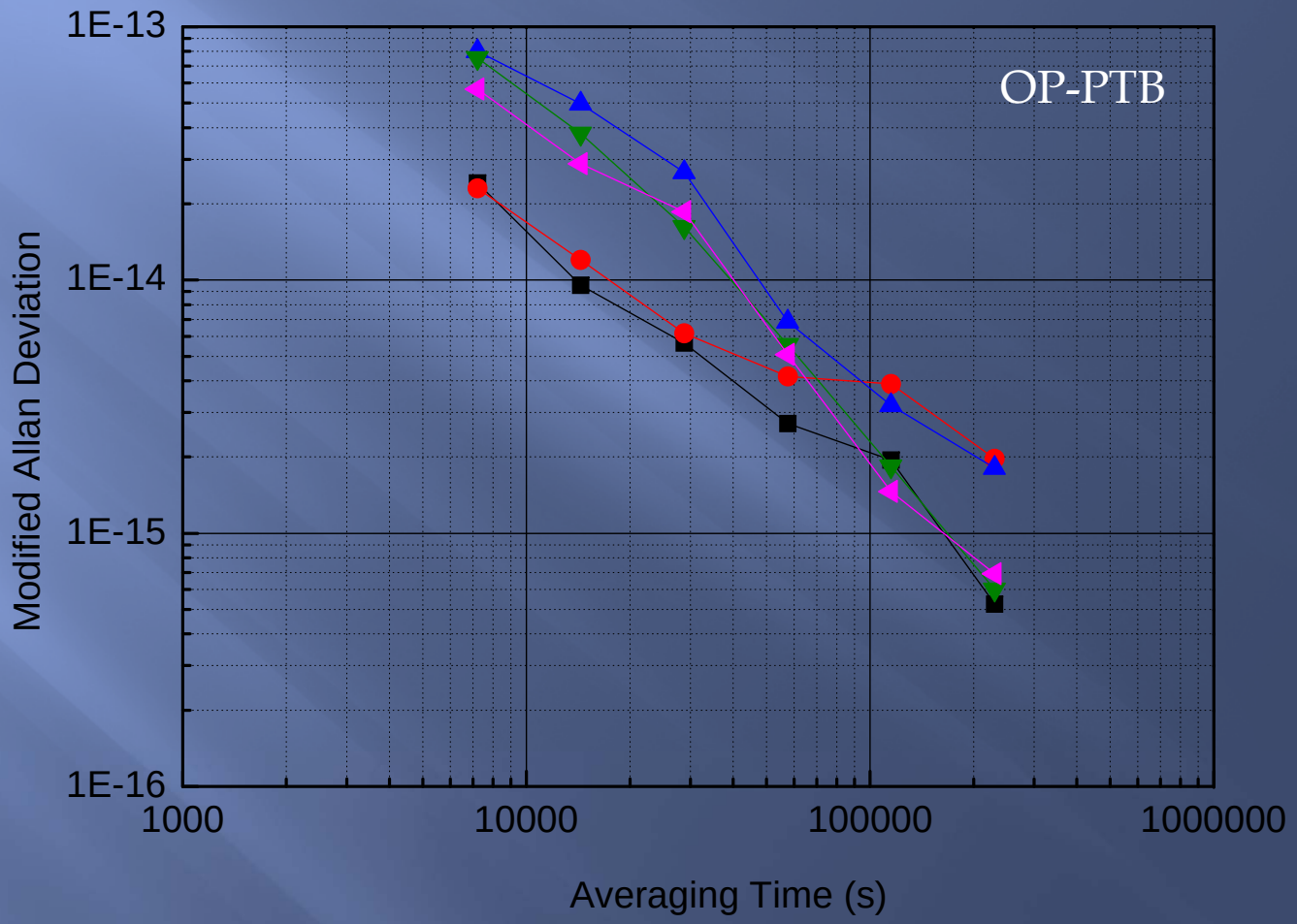
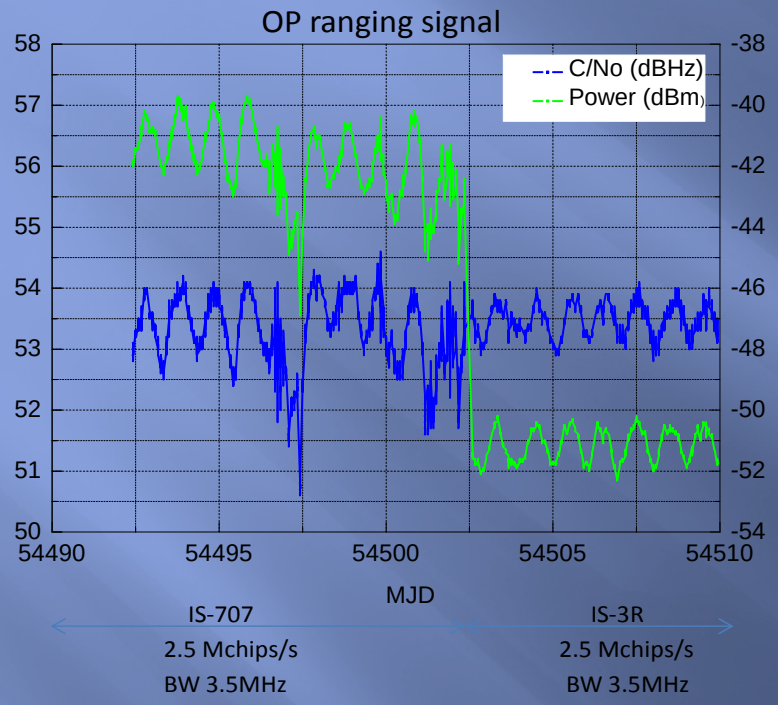
Motivation - 1

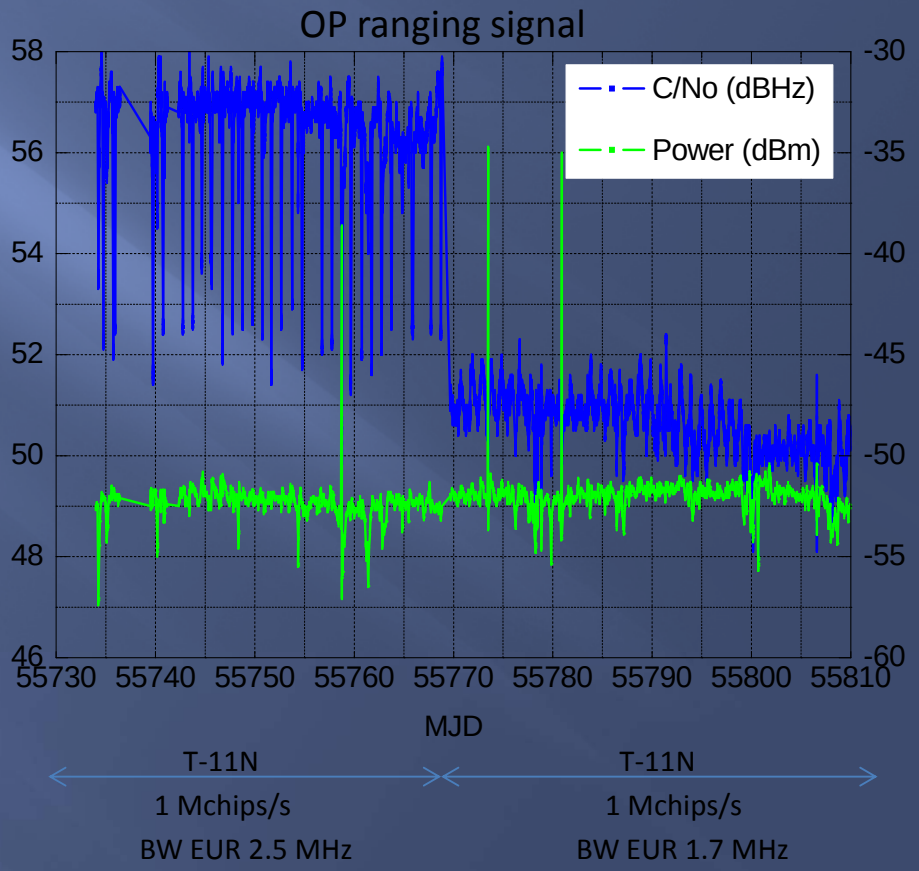


Motivation - 2

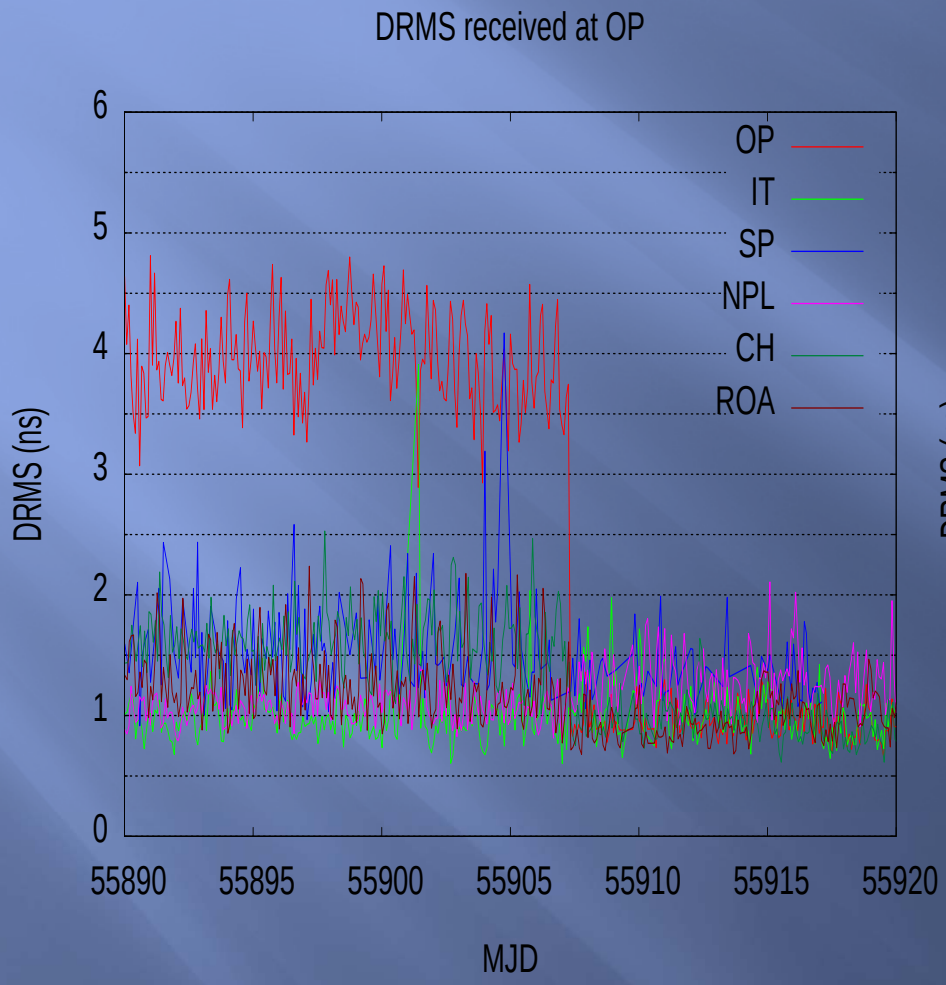


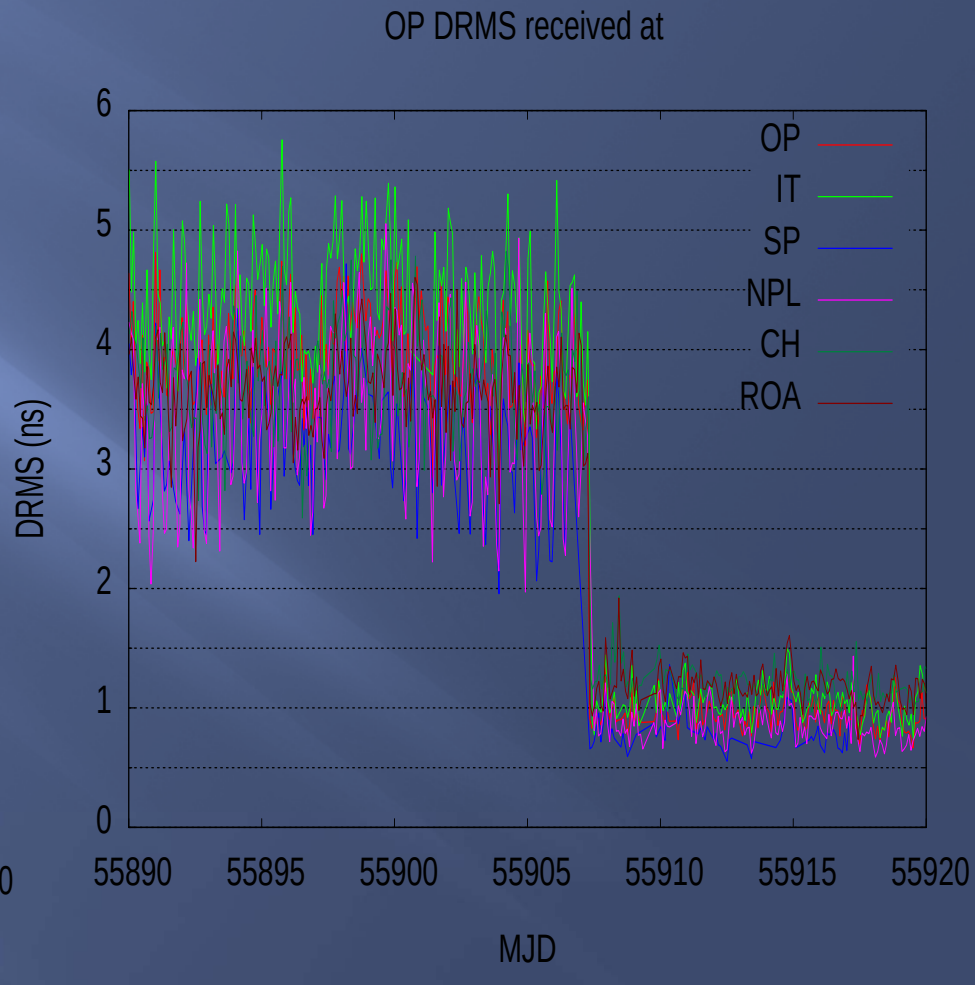
Satellite (transponder, BW) change
C/N_0 and Rx power observations



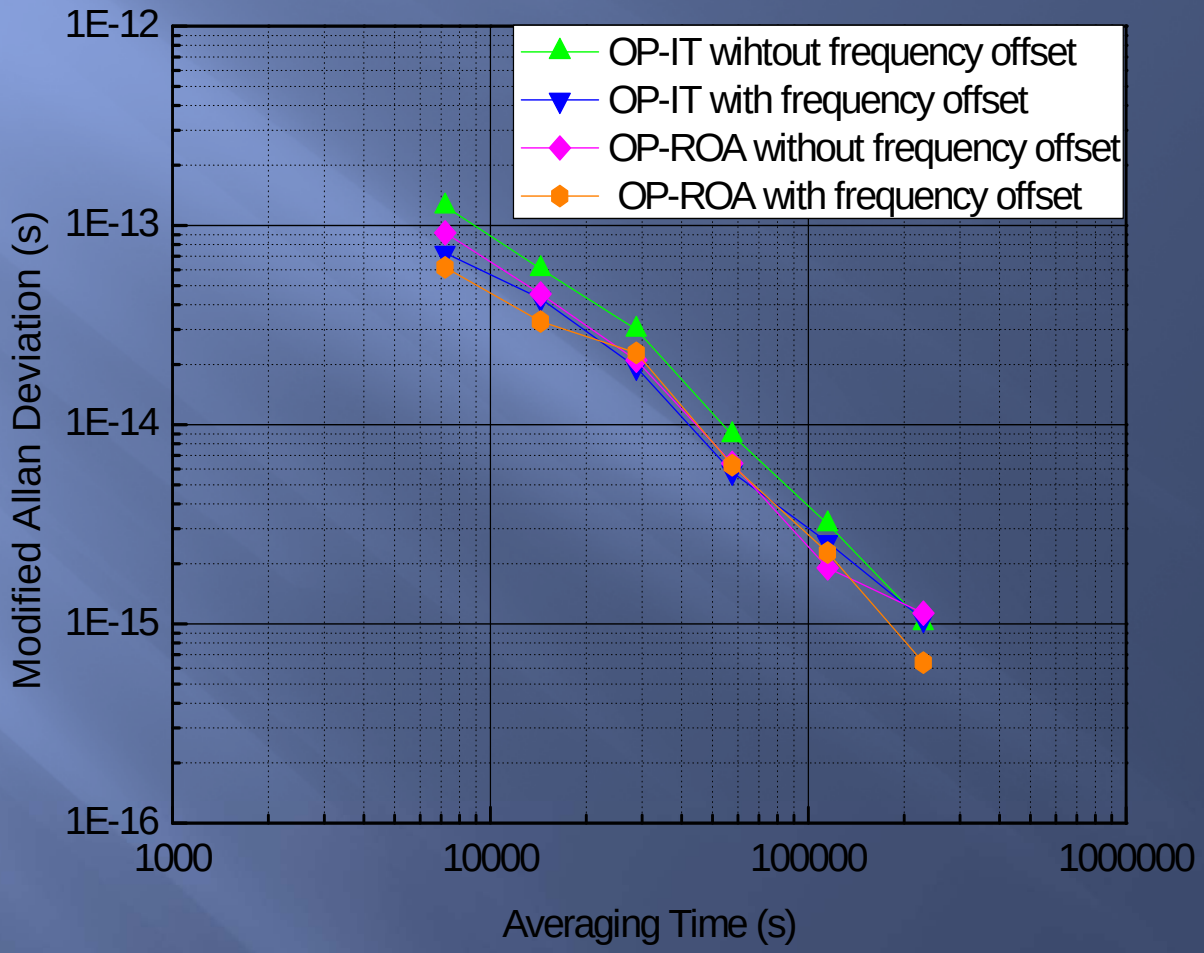


Use of 1 Mchip/s – Frequency offsets applied
DRMS observations

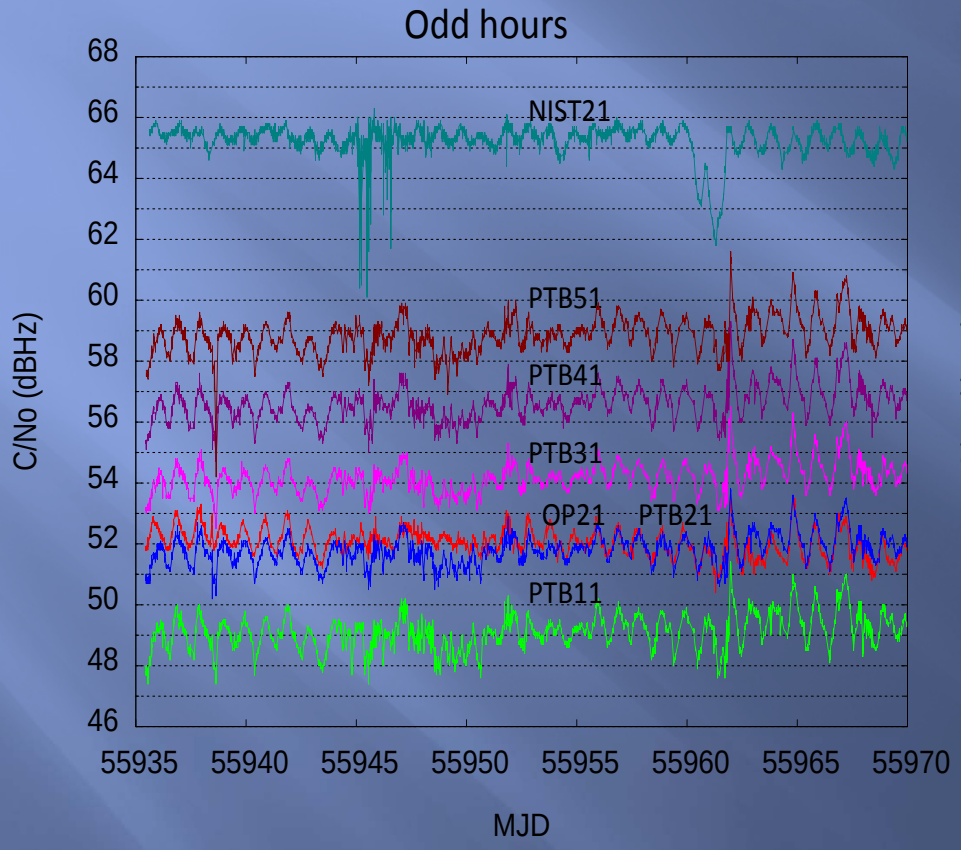


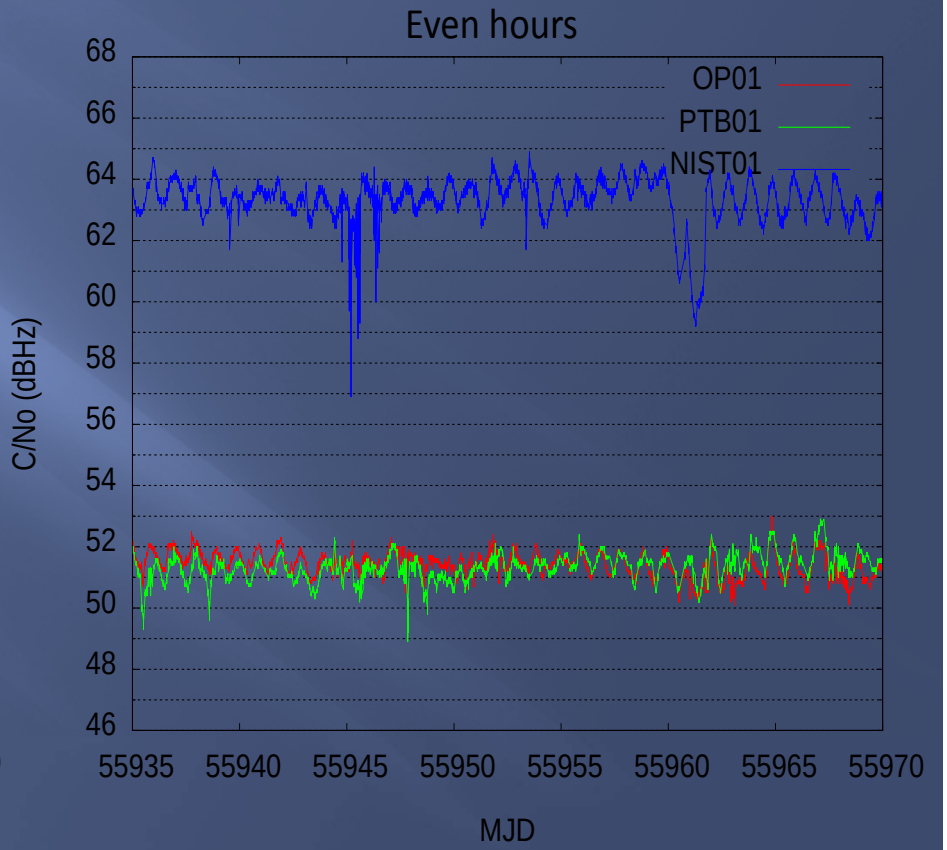


Use of 1 Mchip/s – Frequency offsets applied
Frequency stability

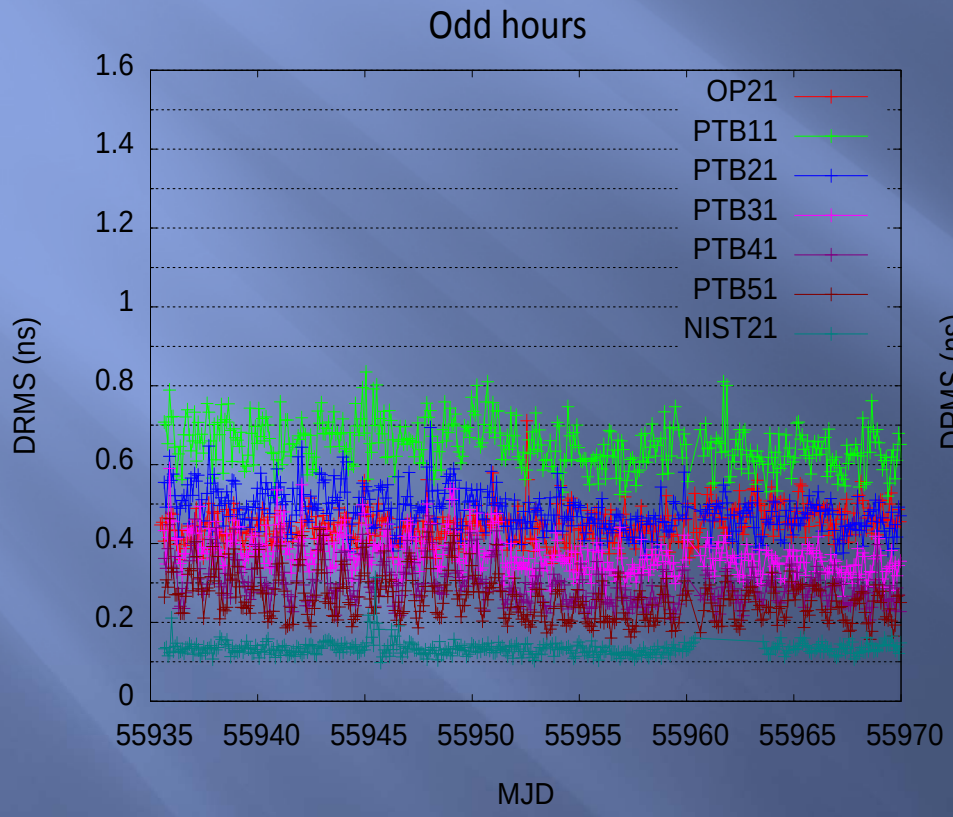


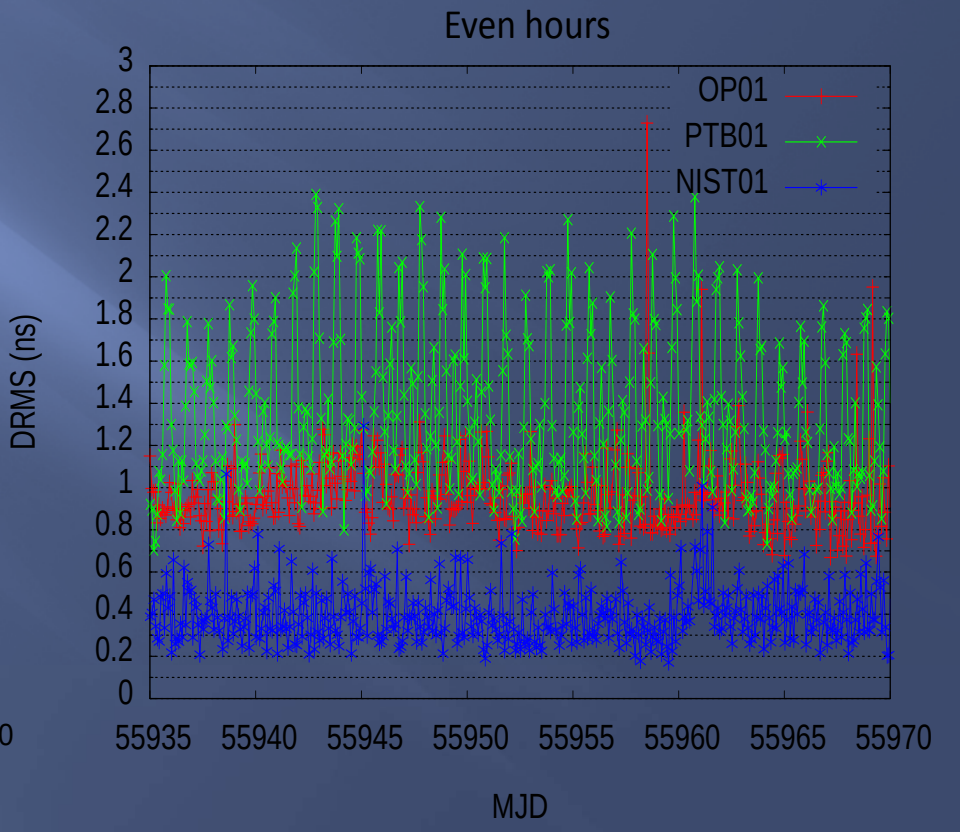
Use of 1 Mchip/s – Frequency offsets applied
Variation of the transmitted power
C/N_0 observations



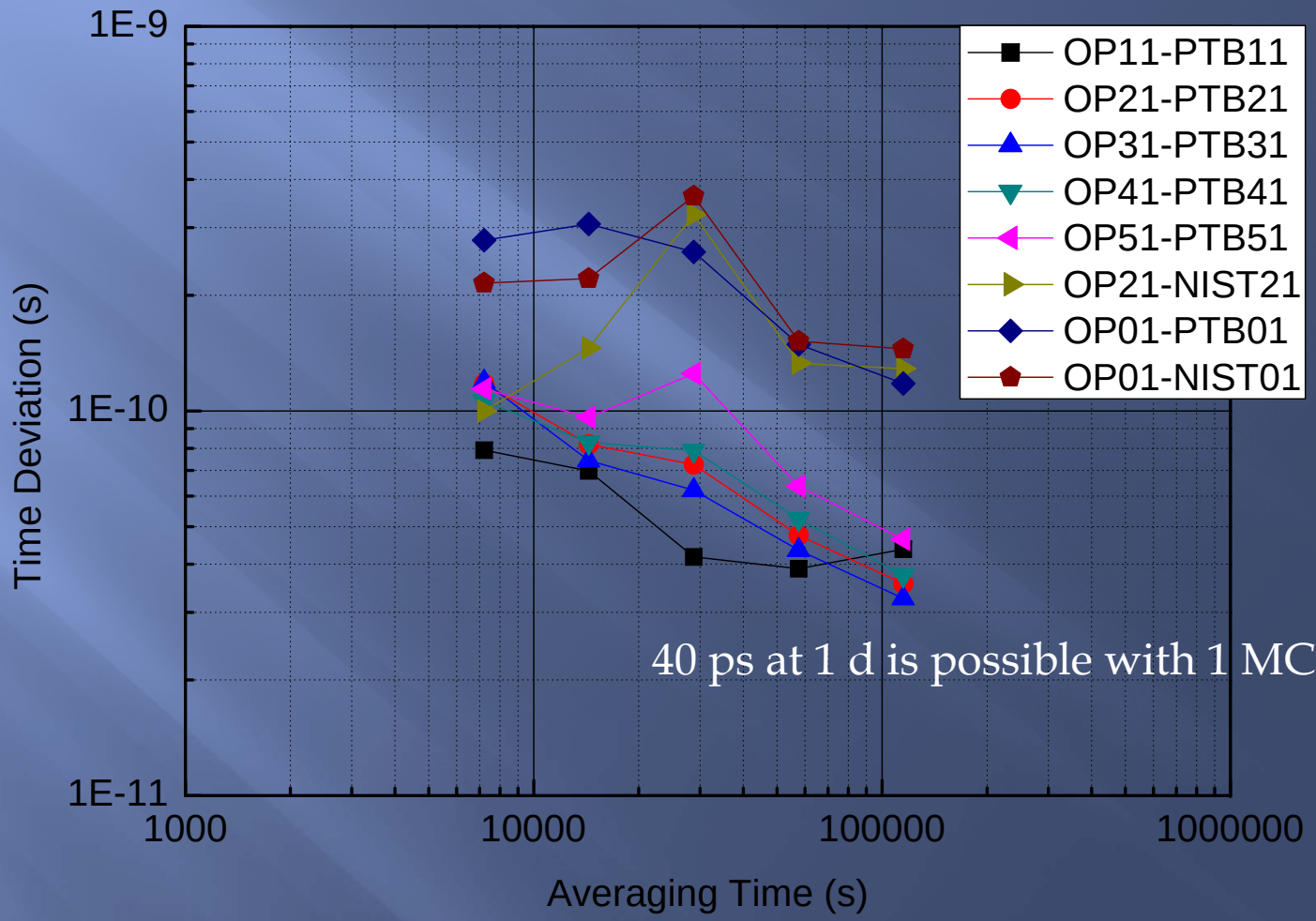


Use of 1 Mchip/s – Frequency offsets applied
Variation of the transmitted power
DRMS observations





Use of 1 Mchip/s – Frequency offsets applied
Variation of the transmitted power
Time stability (diurnal effect)



40 ps at 1 d is possible with 1 MChip/s !

Conclusion

- The code 0 at 1 Mchips/s seems to be more sensitive to interference than the other codes;
- The 1 Mchips/s codes present orthogonality problems which caused interference between two-way signals;
- By applying the frequency offset, the codes interference has been reduced;
- By increasing the transmit power, DRMS and the carrier to noise ratio have been improved;
- The use of a quiet transponder at 1Mchips/s improves the DRMS, measurement noise, diurnal effect and links stability;
- An excellent stability (40 ps at 1 day), using 1 Mchips/s, can be obtained within the European two-way network if all of the above requirements are respected (and of course, with the use of best clocks).

Question

should we modify the two-way schedule to achieve the best performance on the European two-way links?

Possible issues for the European network !

- Should ALL the stations have a link with PTB ? YES
- Should EACH station have links with ALL the other stations of the network? Are data really computed by EACH station for all the links and really used ? If NO and we will go thru, it will be an unfriendly and unpopular issue !
- Should SOME stations have a link with PTFs ? YES
- For the UTC calculation, BIPM implemented a genious computation of the TWSTFT + GPSPPP combined data; the 12 two-way sessions per day are still needed or can be reduced ?
- Is there any sense to have reduced two-way sessions per day (6 instead of 12) and to have extended duration of a two-way session (3 to 5 min instead of 2 min) ?
- Is it appropriate to use the transponder in both Even and Odd hours ? Is it possible/acceptable (cost, availability) to have an additional transponder for the European network (1 Mchip, 1,7 MHz BW, polarisation) OR to have expanded BW (2,5 Mchip, 3,7 MHz BW) ? Save Money !

Alternatively, are we HAPPY with the present situation and the situation to come ?

Acknowledgement

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1- PTB (D. Piester) and NIST (V. Zhang) for their contribution to the tests done in 2012;

2- The CCTF WG on TWSTFT for their collaboration during the tests (use of a quiet transponder in the odd hours, use of data from different institutes).