Rubidium clock drift correction for HK timing system

Claire Dalmazzone, 16th April 2025

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- Time correction with Cs clock

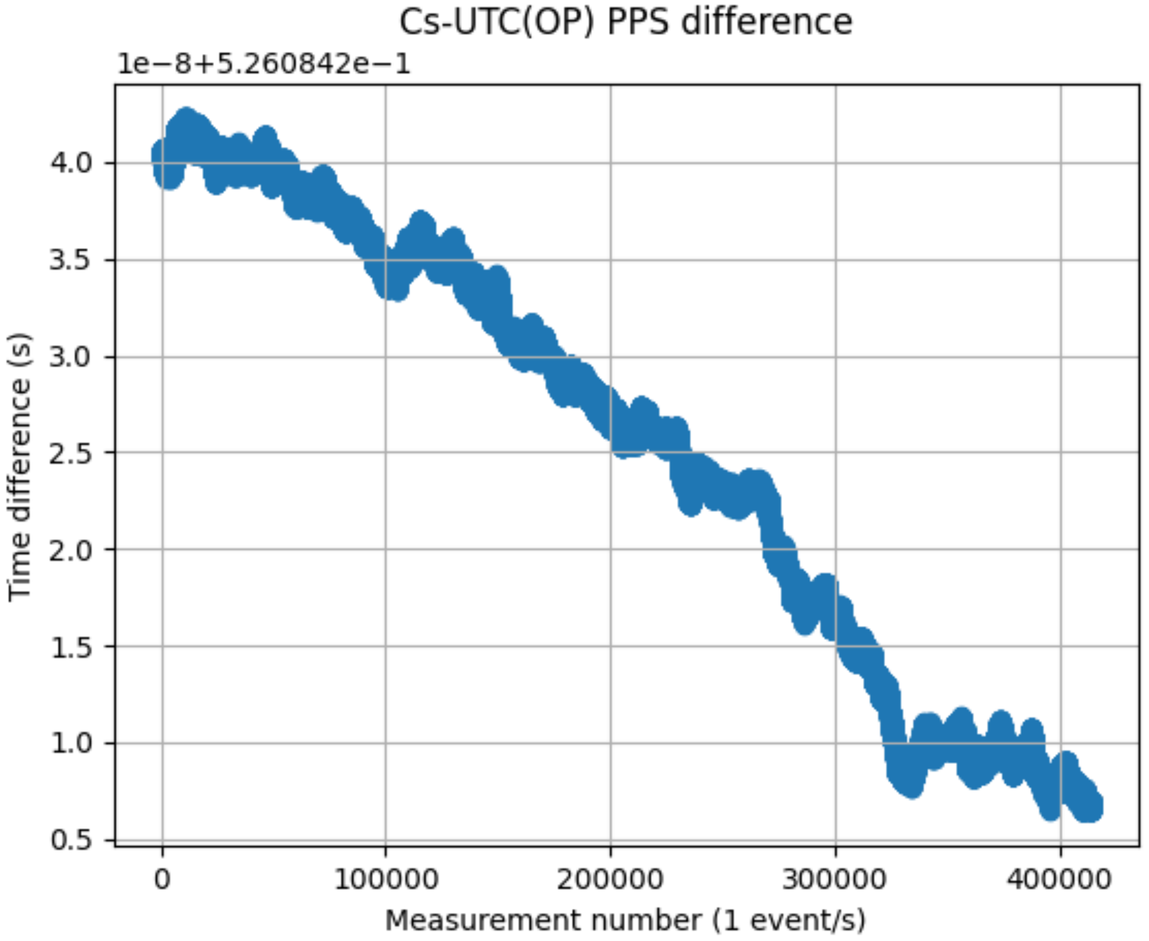
Timing correction with Cs clock

Cs clock

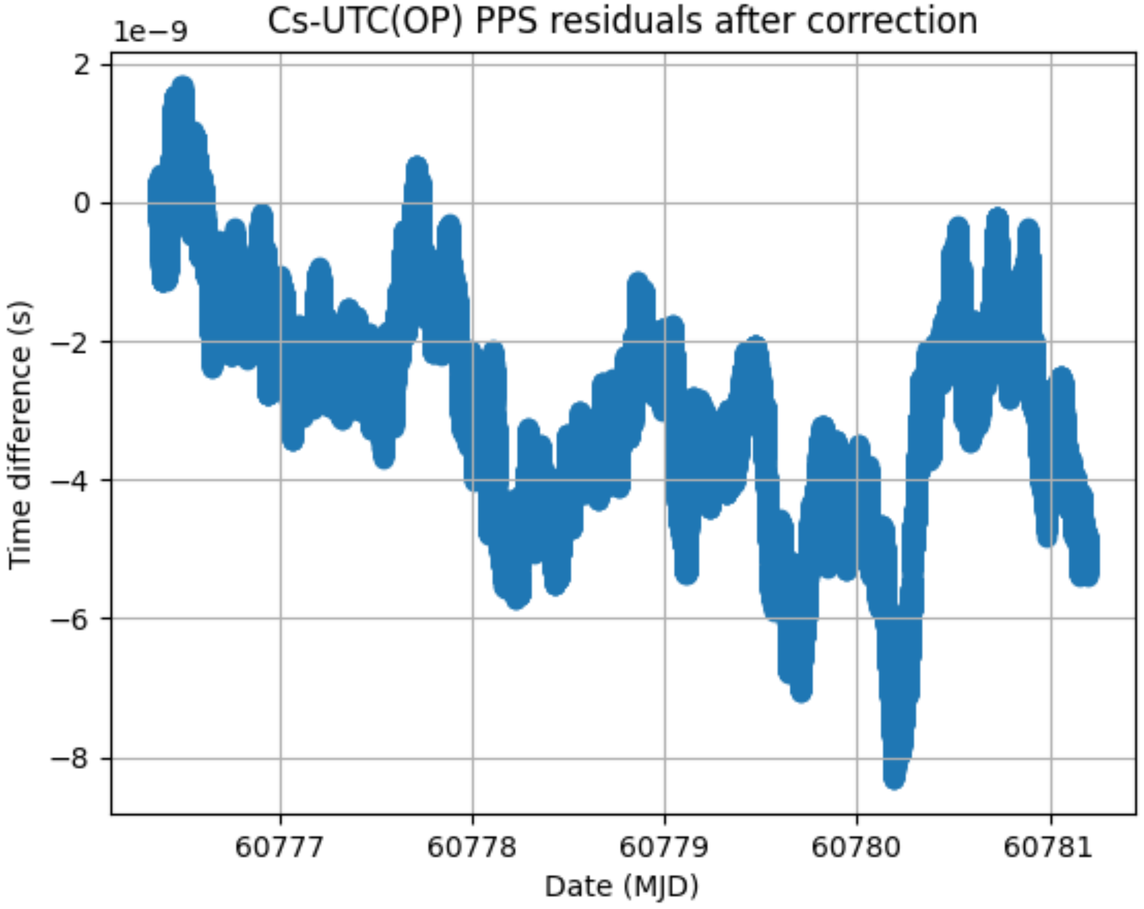
Changed the setup to perform the timing correction with Cs clock

- Keysight 2 measures UTC(OP) - Cs PPS
- Cs PPS and 10MHz are sent to 5th floor and input on the receiver. The Cs PPS was not aligned with the UTC(OP) so the Septentrio measures Cs - UTC(OP) modulo 1ms (500ms difference between the Keysight and the seotentrio measurement).
- Correction of the Keysight measurement is switched on using the last 100 Septentrio measurements.

First tests with the Cs



Not corrected: 35 ns drift in ~5 days



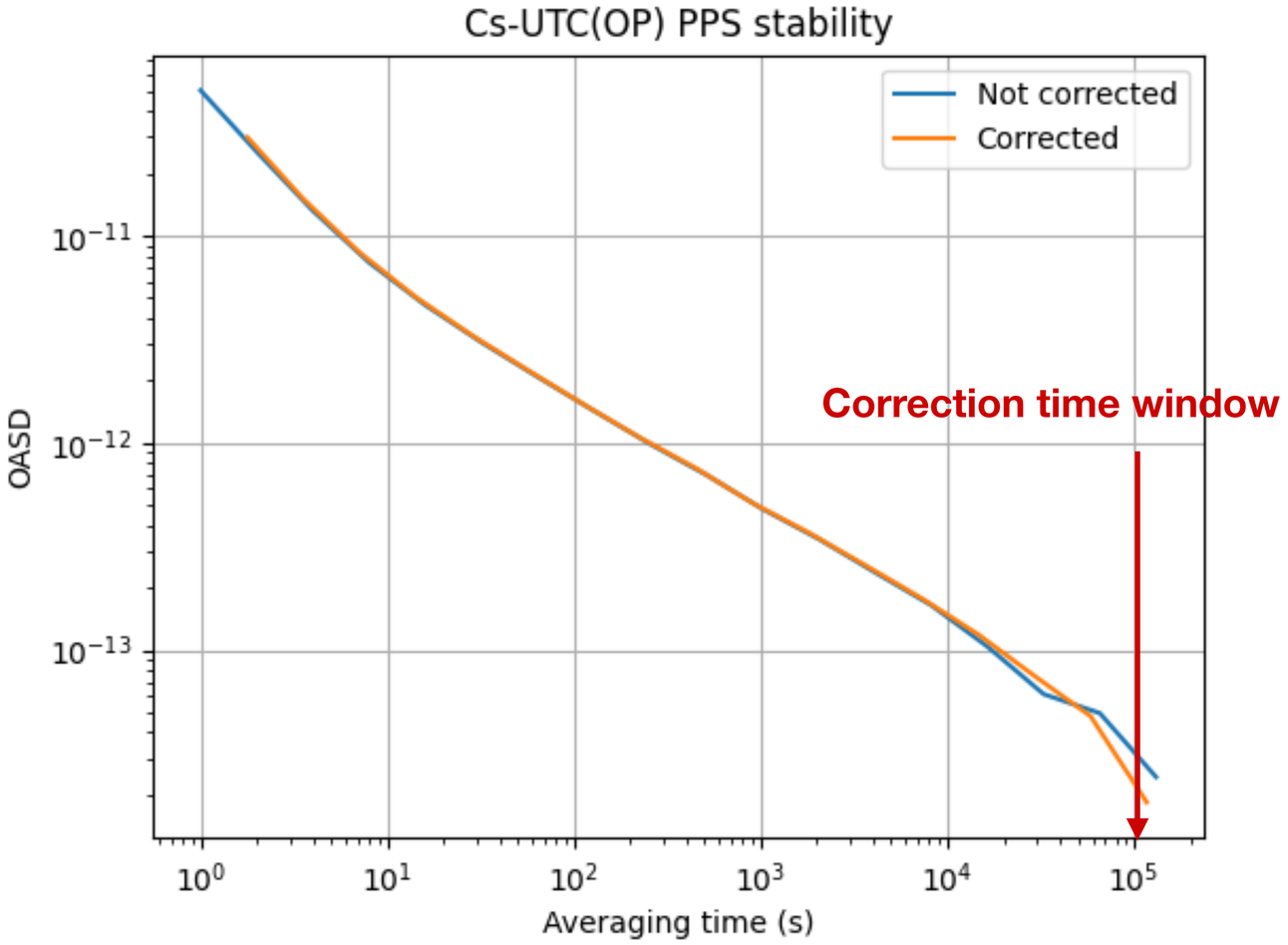
Corrected: residuals = (-3.0 ± 1.7) ns

First tests with the Cs

Correction with 100 points allowed to

- Keep the Cs clock stability intact at least up to 10^4 seconds averaging time
- Partially correct the slow drift of the Cs clock (bump at ~7×10^4 s).

Can maybe do better with a smaller correction time window (30 points).



Conclusion

- Correction method seems to work also with Cs clock. With 100 points, the short term stability is not degraded.
- Plan for the future:
  - Keep the current run going to have more stats (OASD up to $\tau = 5 \times 10^5$ s) and check the long term stability
  - Test other correction time windows (30 points)
  - PPS alignment of the Cs clock with UTC(OP)