Cesium clock drift correction for HK timing system

Claire Dalmazzone, 30th April 2025

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- Time correction with Cs clock

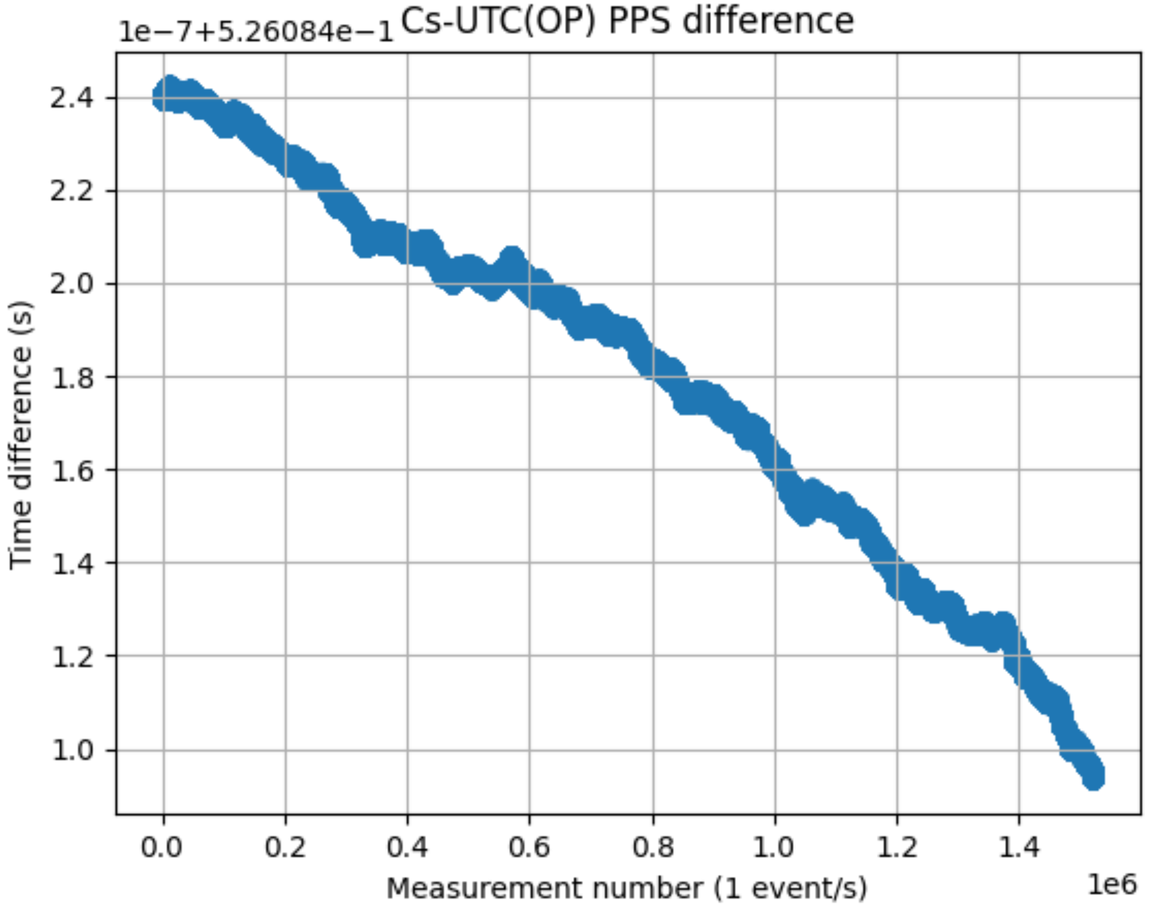
Timing correction with Cs clock

Cs clock

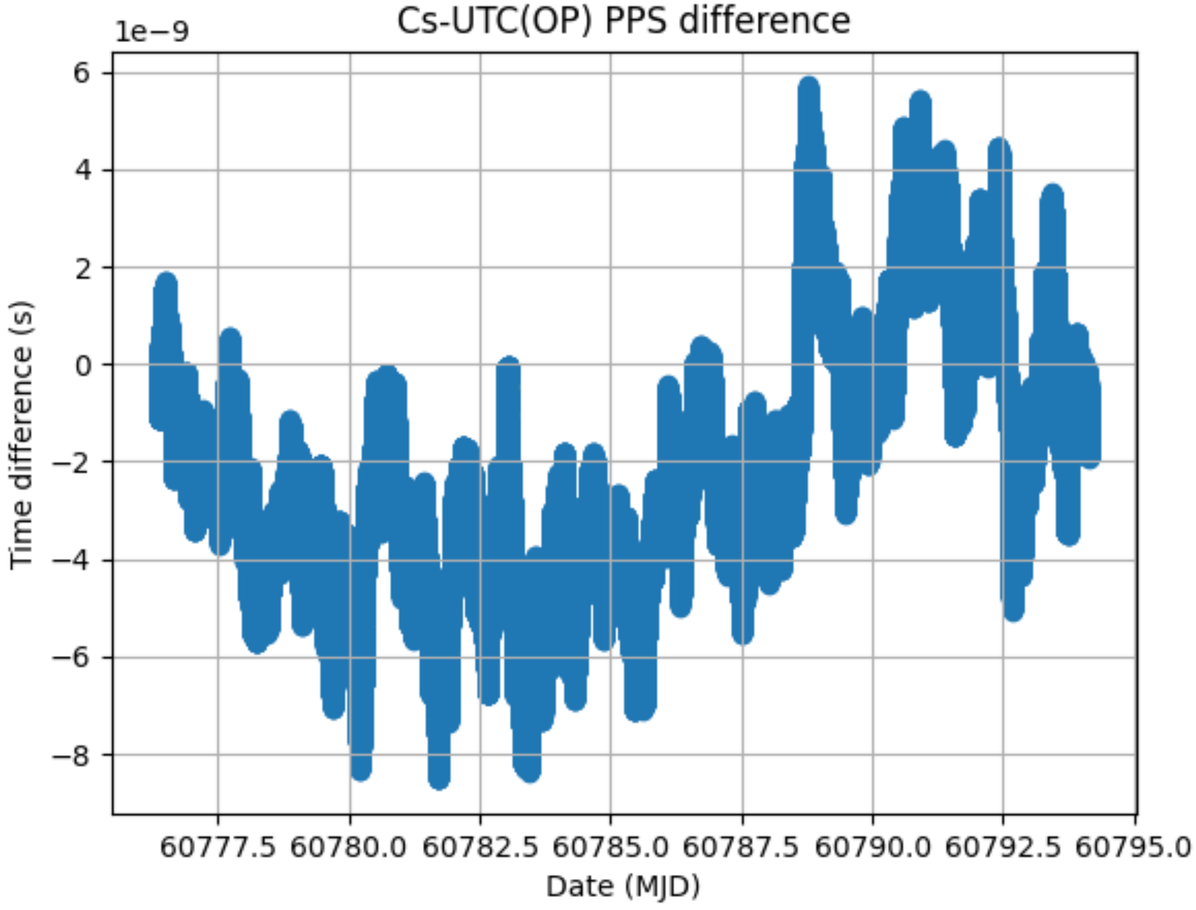
Changed the setup to perform the timing correction with Cs clock

- 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 septentrio measurement).
- Correction of the Keysight measurement is switched on using the last 100 Septentrio measurements.

First tests with the Cs



Free-running: 150 ns drift in 18 days (frequency calibrated at the 10^{-13} precision level)



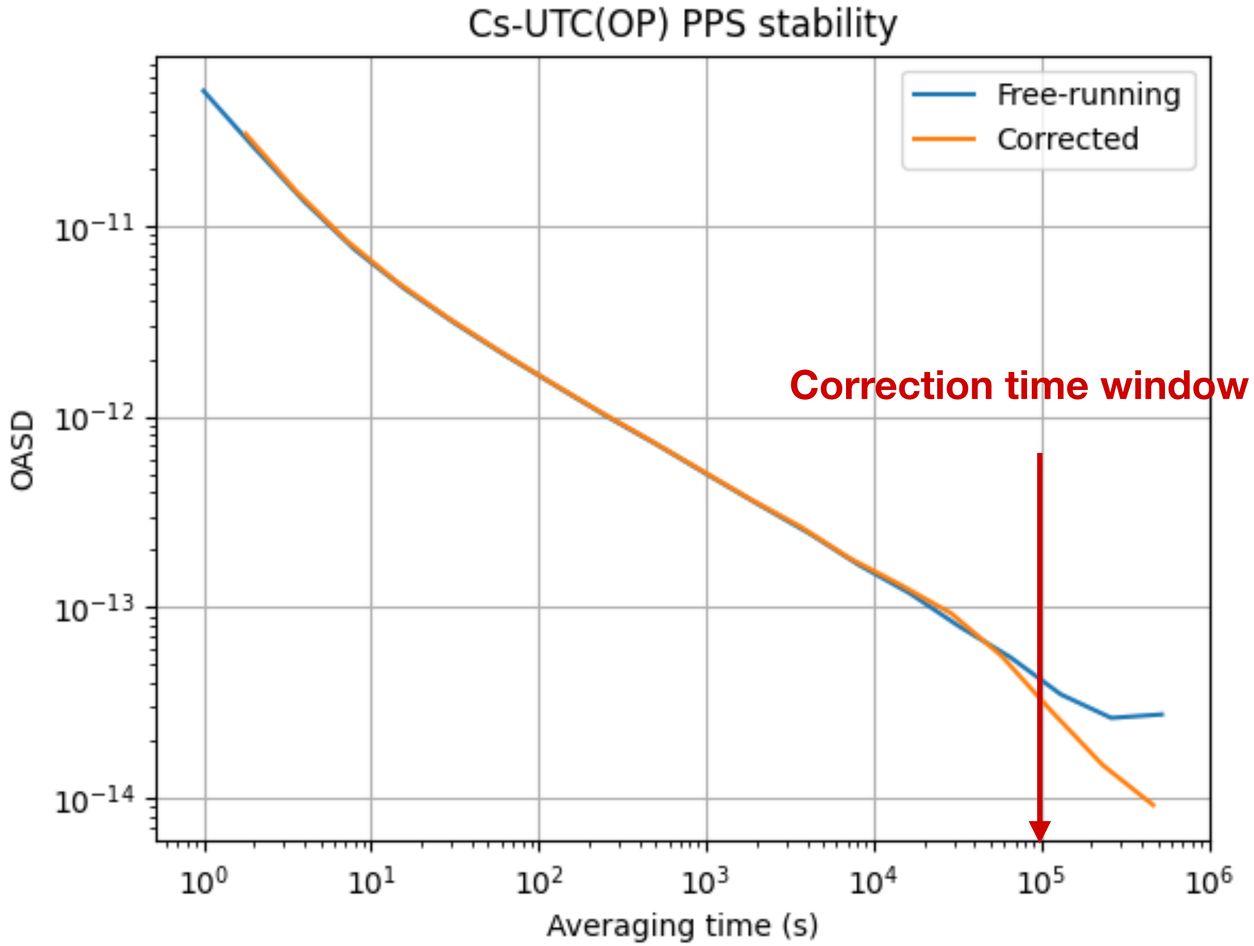
Corrected: residuals = (-2.2 ± 2.6) ns

First tests with the Cs

Correction with 100 points allowed to

- Keeps the Cs clock stability intact at least up to 10^4 seconds averaging time
- Partially corrects the slow drift of the Cs clock.

Can maybe do better with a smaller correction time window (30-50 points).

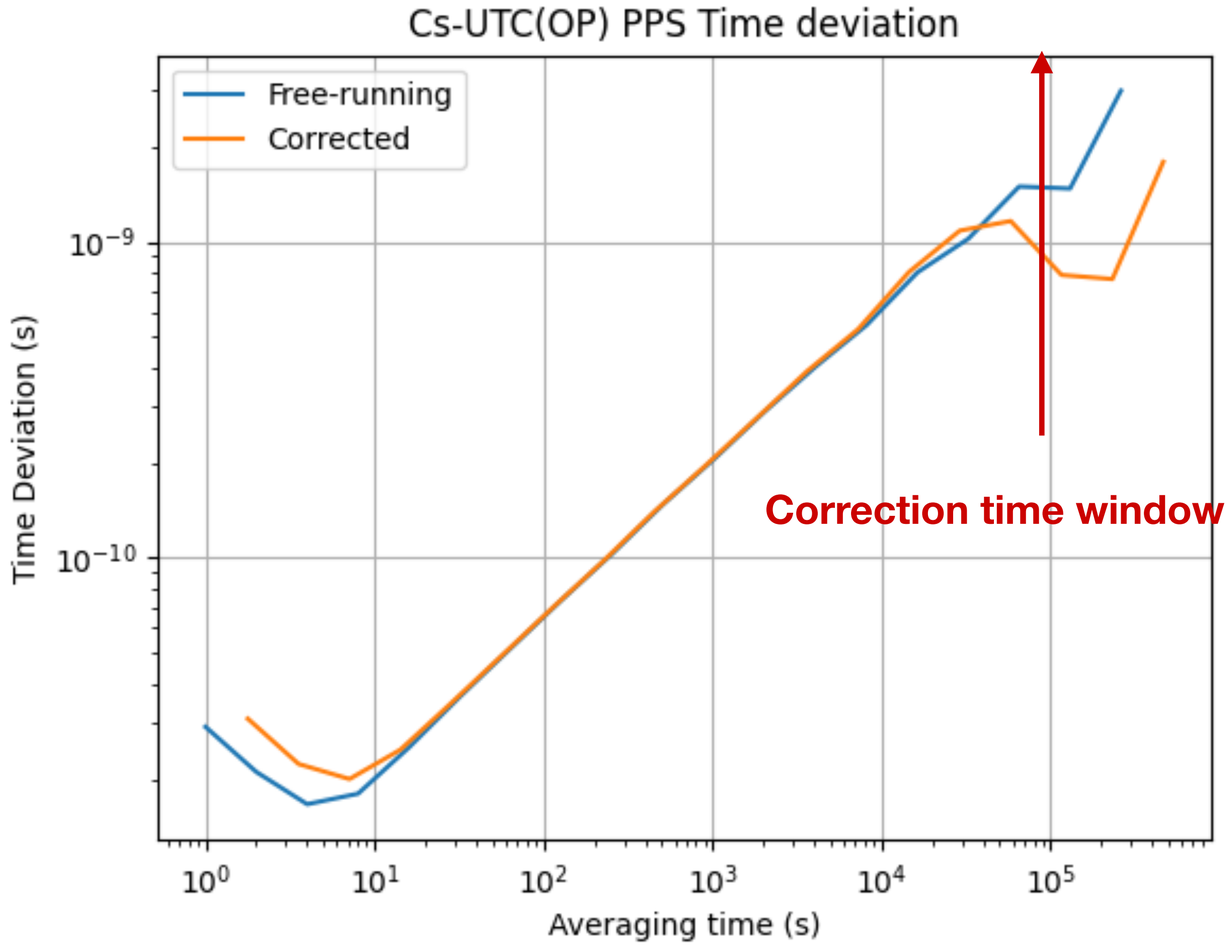


First tests with the Cs

Correction with 100 points allowed to

- Slightly higher tides at $\tau \leq 10$ s
- Partially corrects the slow drift of the Cs clock.

Can maybe do better with a smaller correction time window (30-50 points).



Conclusion

- The setup has been running smoothly for ~20 days now
- Correction method seems to work also with Cs clock. With 100 points, the short term stability is preserved and the drift is limited in a ± 10 ns range.
- Plan for the future:
  - Keep the current run going for 10 more days? (Not sure if it is necessary)
  - Test other correction time windows (30 points)
  - PPS alignment of the Cs clock with UTC(OP)