11th Meeting of the CCTF WG on TWSTFT
9-10 October 2003 at the NPL, Teddington, UK

Participating Station Report
PTB

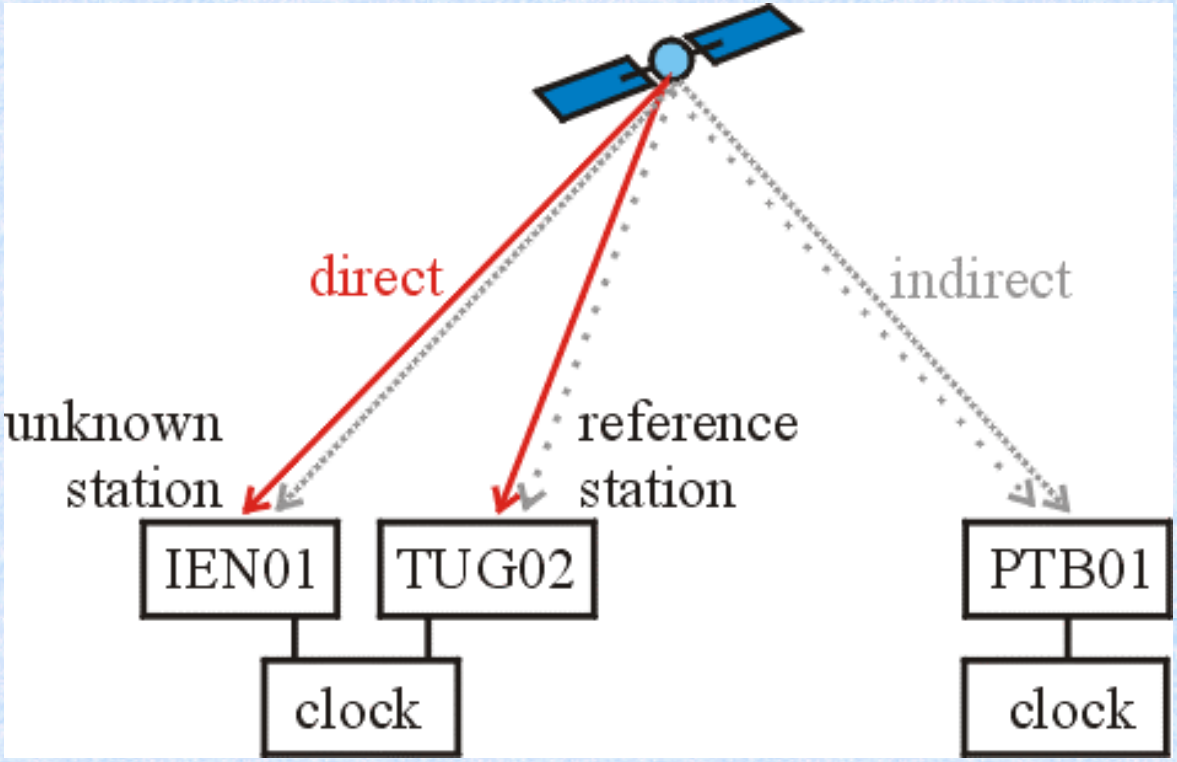
Dirk Piester

Outline

- TWSTFT calibration-techniques
- Comment on link calibration IEN-PTB
- Comment on link calibration USNO-PTB
- Ku-band measurements: USNO-PTB

TWSTFT Calibration-Techniques

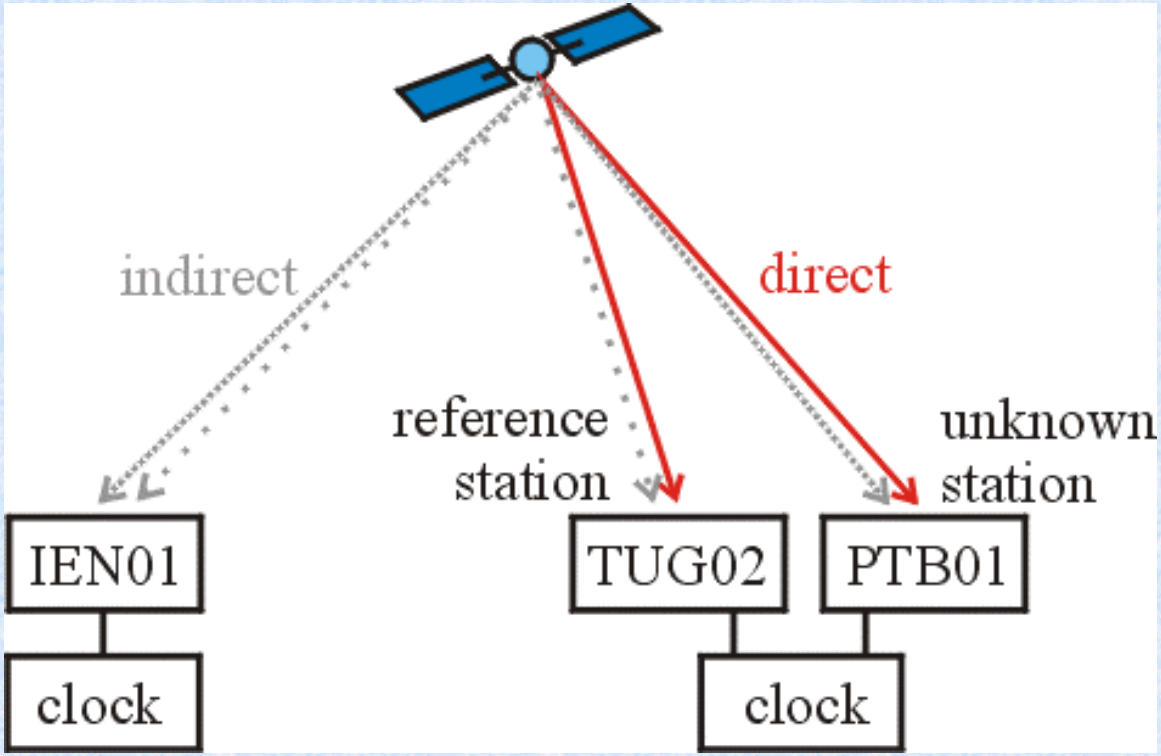
The “TUG style“



- common clock experiment
- direct station delay measurement

TWSTFT Calibration-Techniques

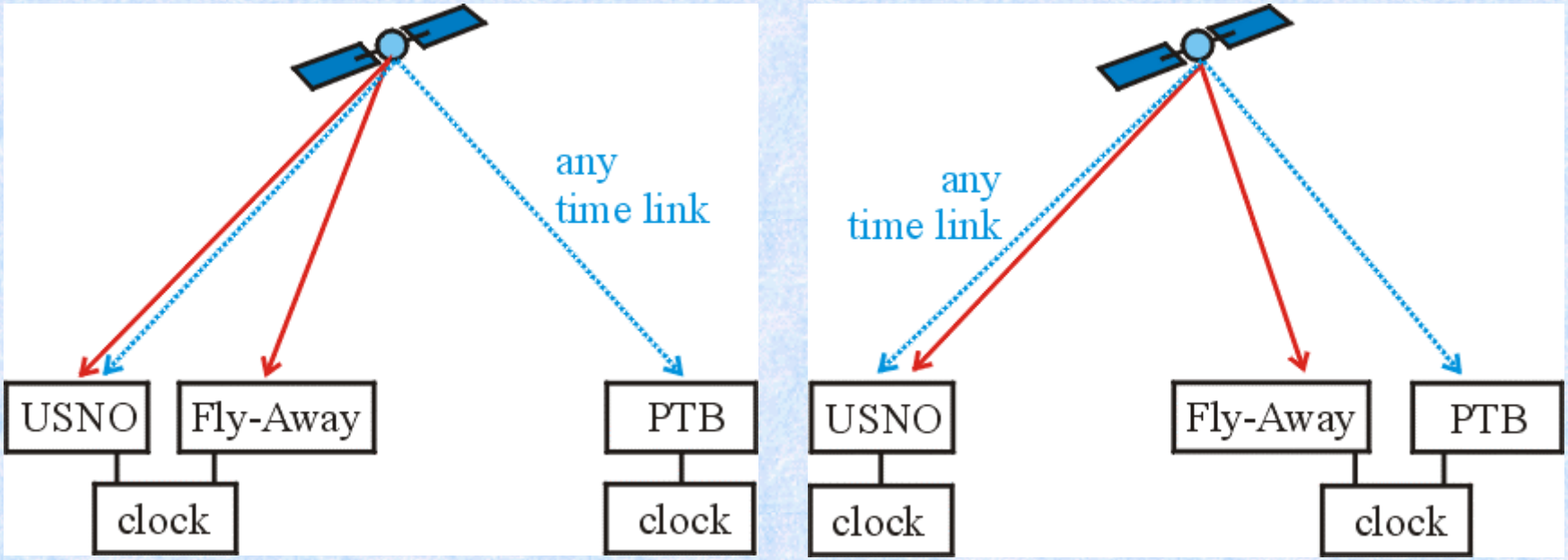
The “TUG style“



+ calibration of further links relativly simple
– TW link required for calibration

TWSTFT Calibration-Techniques

The “USNO style“

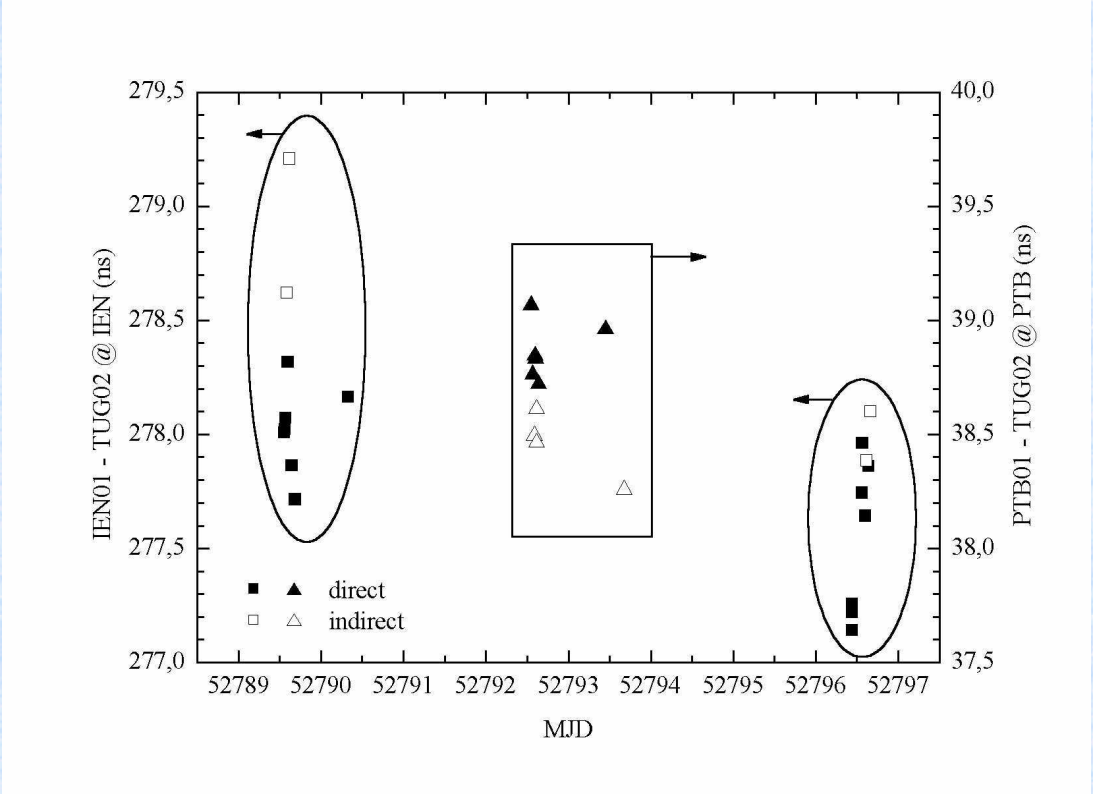


\+ no TW link required

– every single time link has to be calibrated

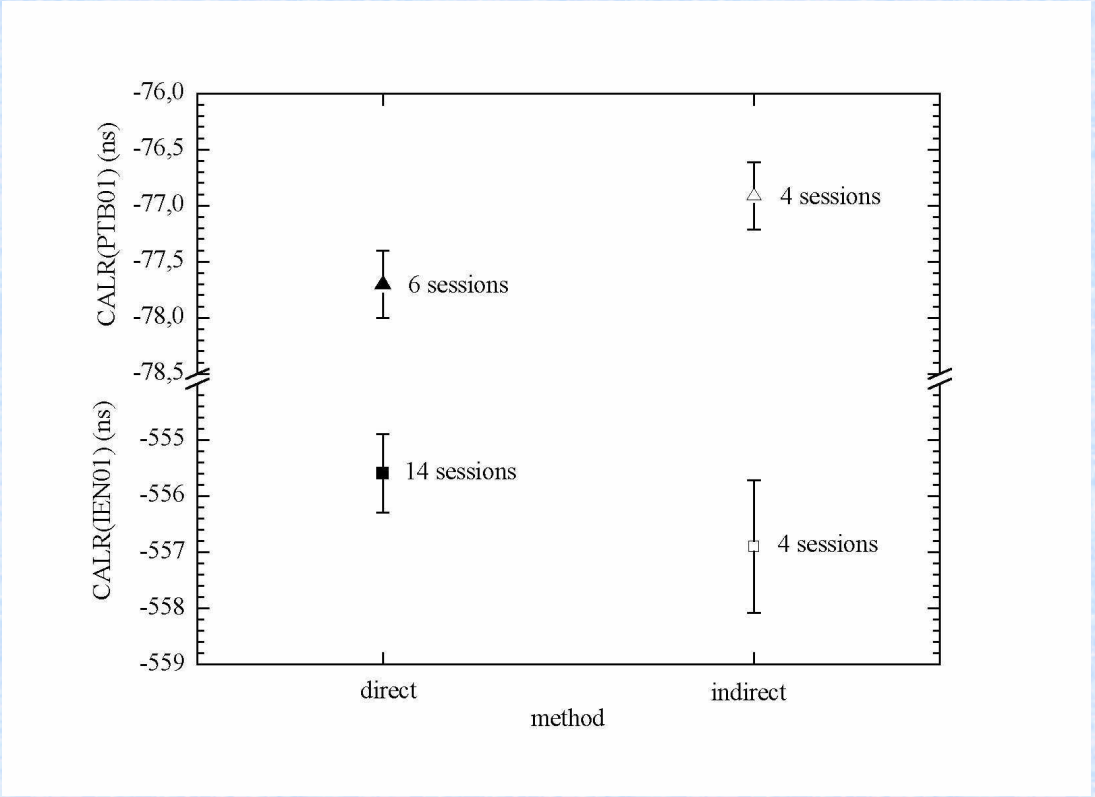
Link Calibration IEN-PTB

- CALR determined directly and with indirect method
- lower uncertainty with direct measurement of CALR



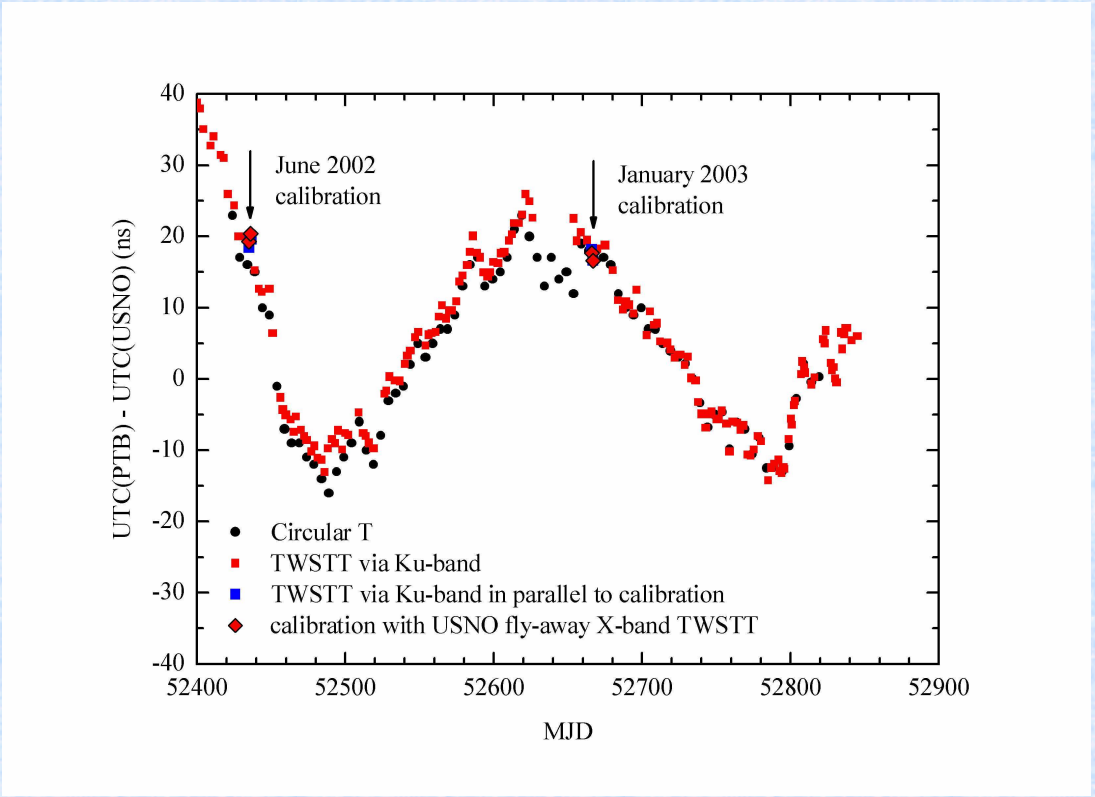
Link Calibration IEN-PTB

- 0.5(CALR(IEN) - CALR(PTB)) + Sagnac =
- MJD52276 CircT -253 ns ± 5 ns
- MJD52796 TW -254 ns ± 0.8 ns



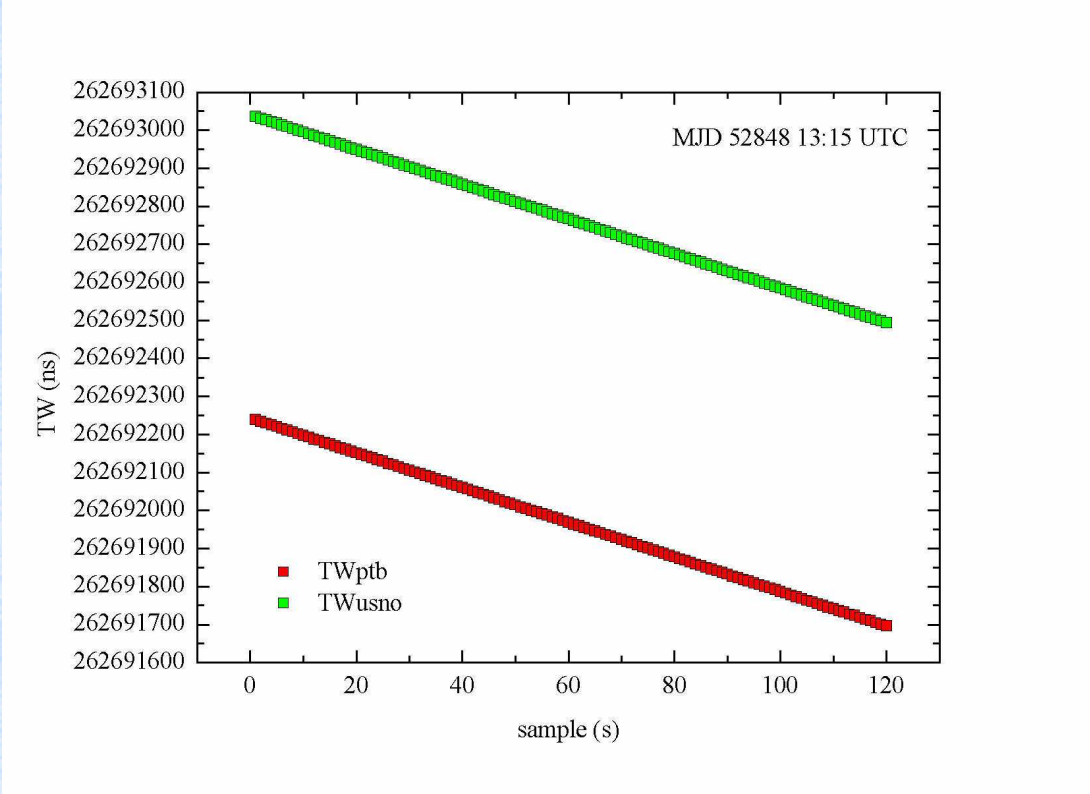
Link Calibration USNO-PTB

- very good reproducibility between summer and winter calibration



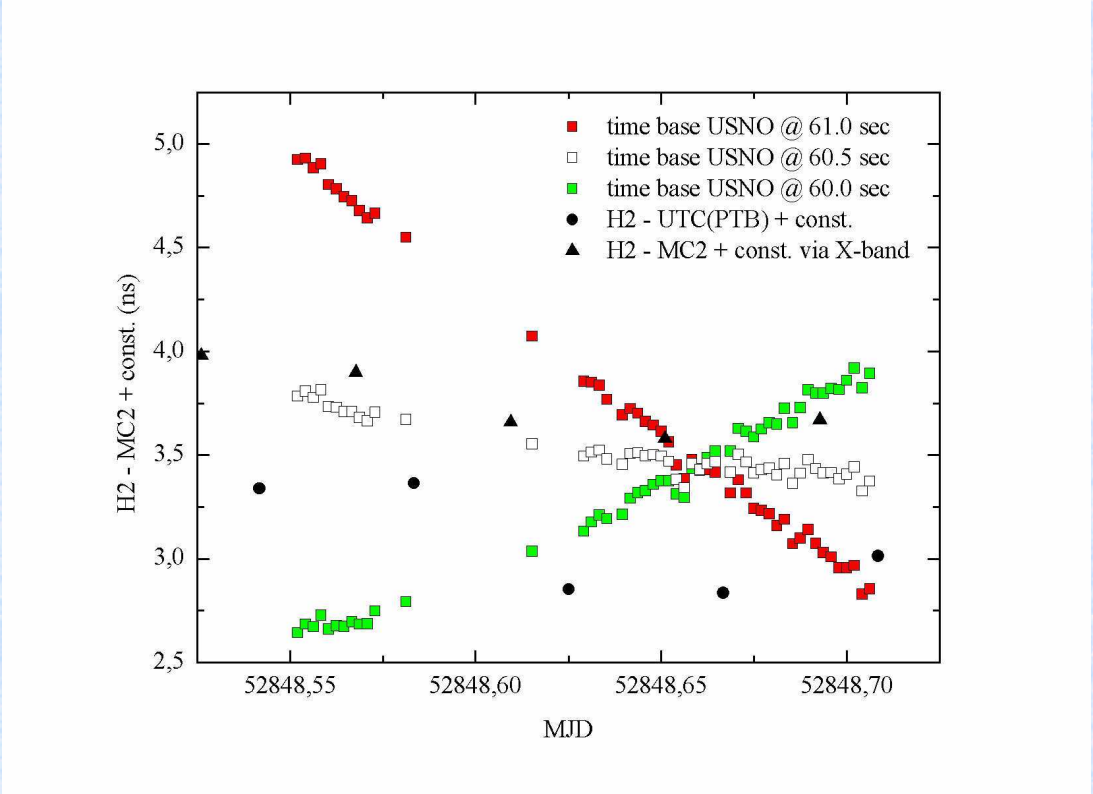
Time Link USNO-PTB

- raw data of a typical TW session
- satellite velocity causes sec-to-sec drift of raw data



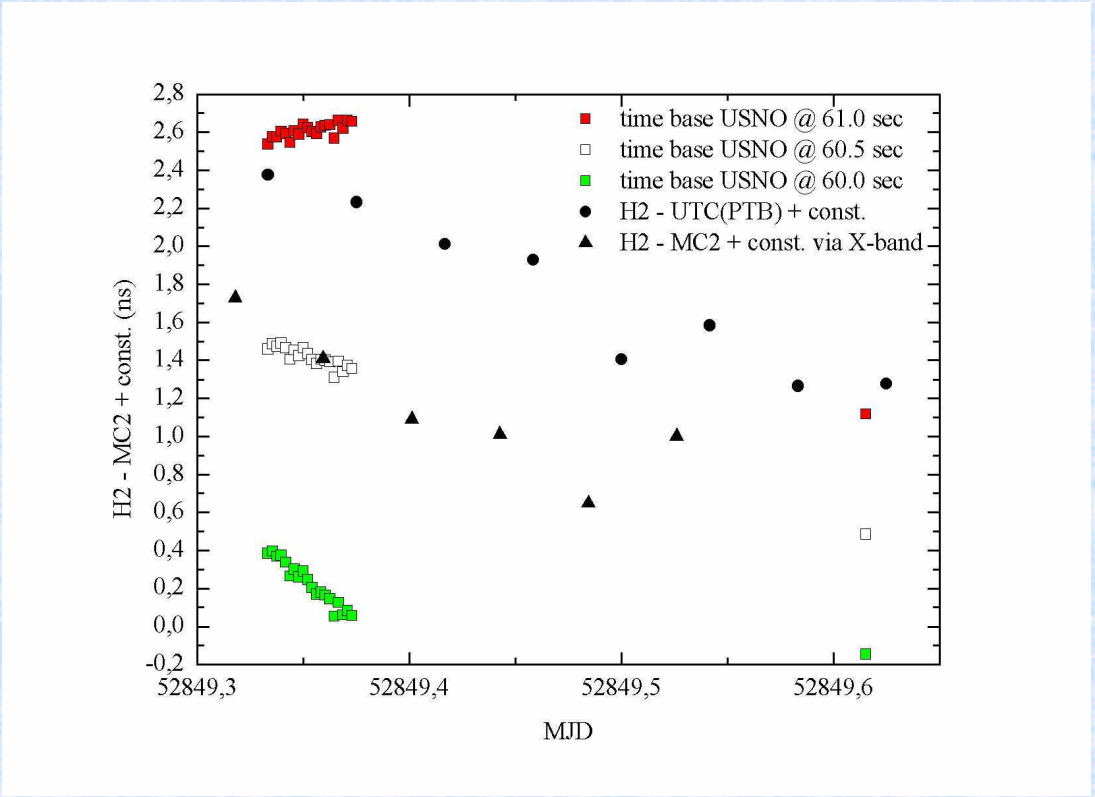
Time Link USNO-PTB

- results showing significant drift by using ITU-evaluation
- drift is adjustable by variing the time tags
- 0.5 s shift fits with x-band data

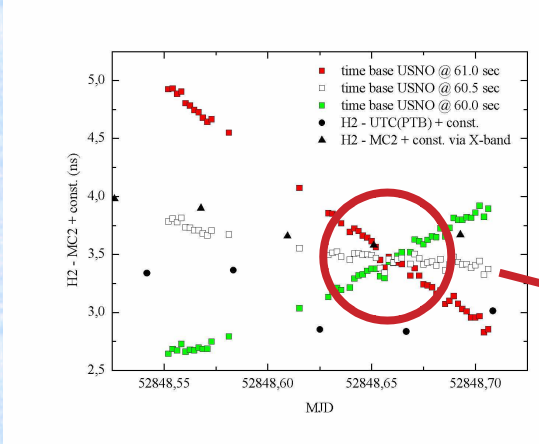


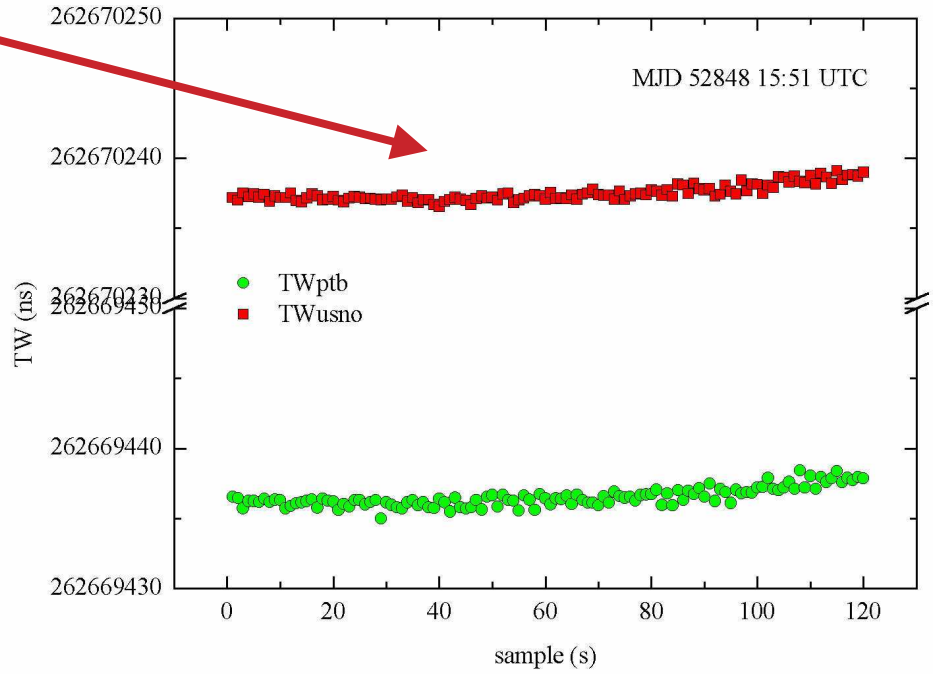
Time Link USNO-PTB

- validity proved by additional measurements on next day



Time Link USNO-PTB

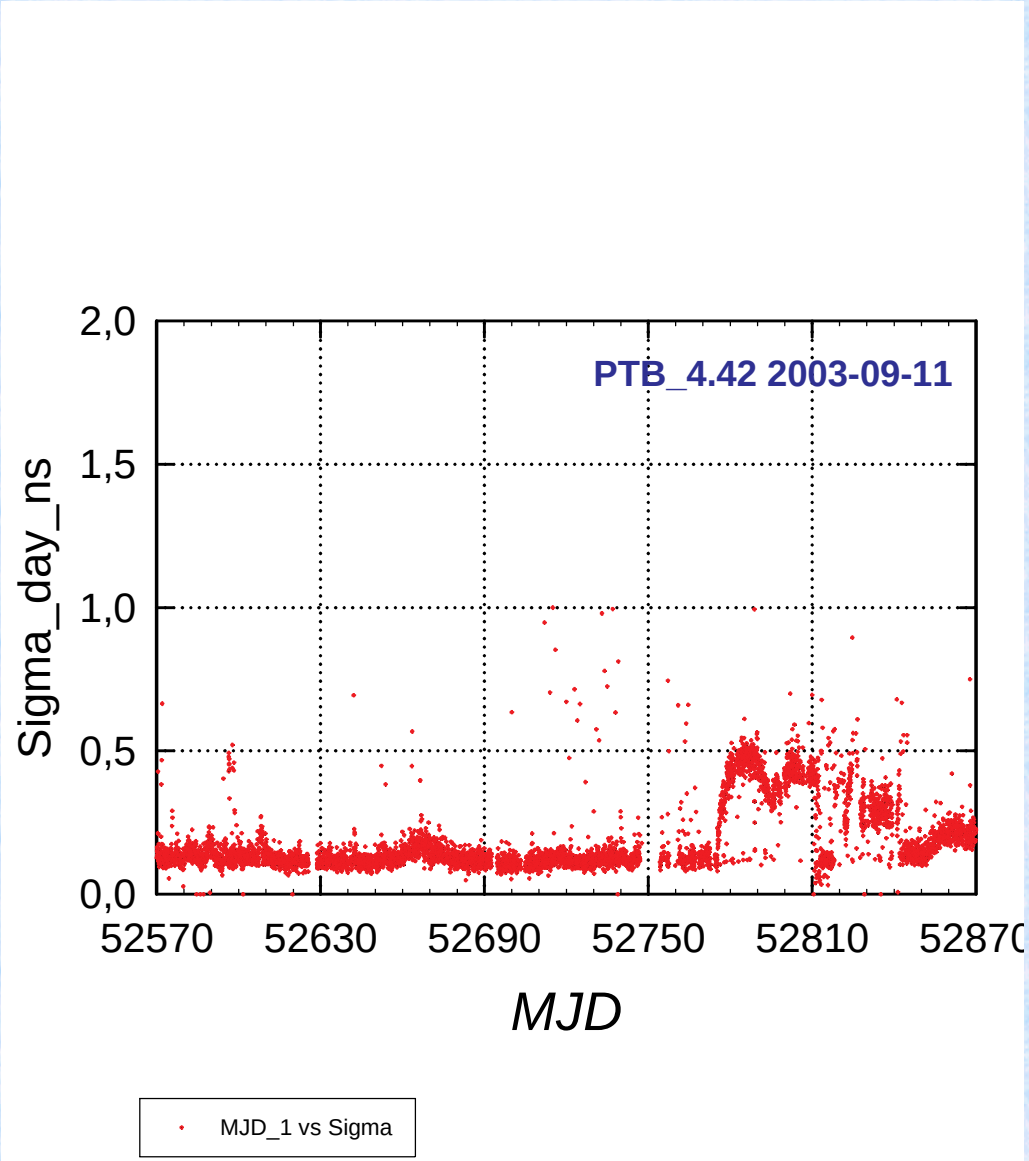




- no variation due to time-tag shift because raw data showing no drift

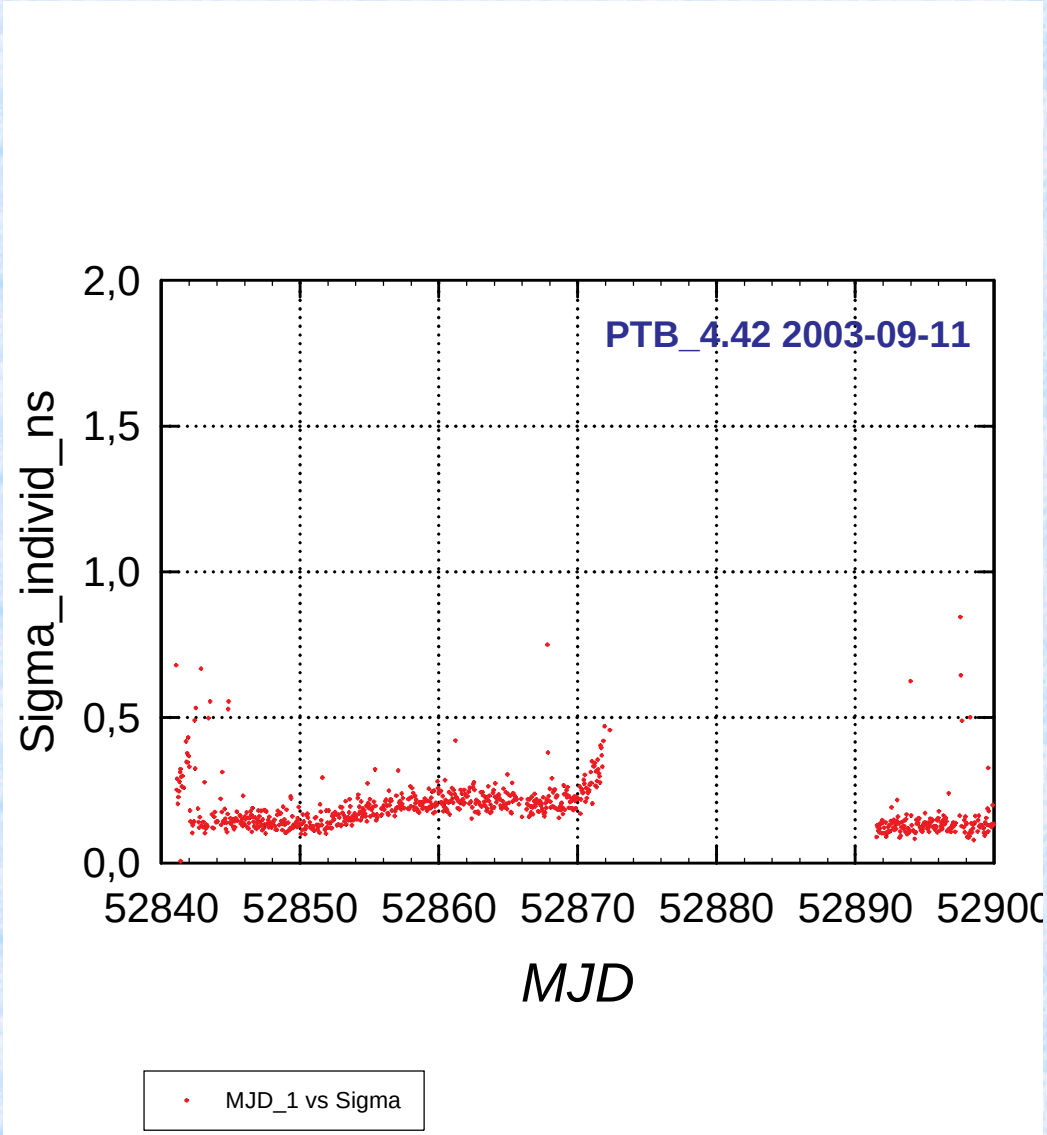
X-band TWSTFT USNO-PTB

- 15-minute means
- one point per hour
- scatter of individual hourly measurment points as reported in USNO-ptx files



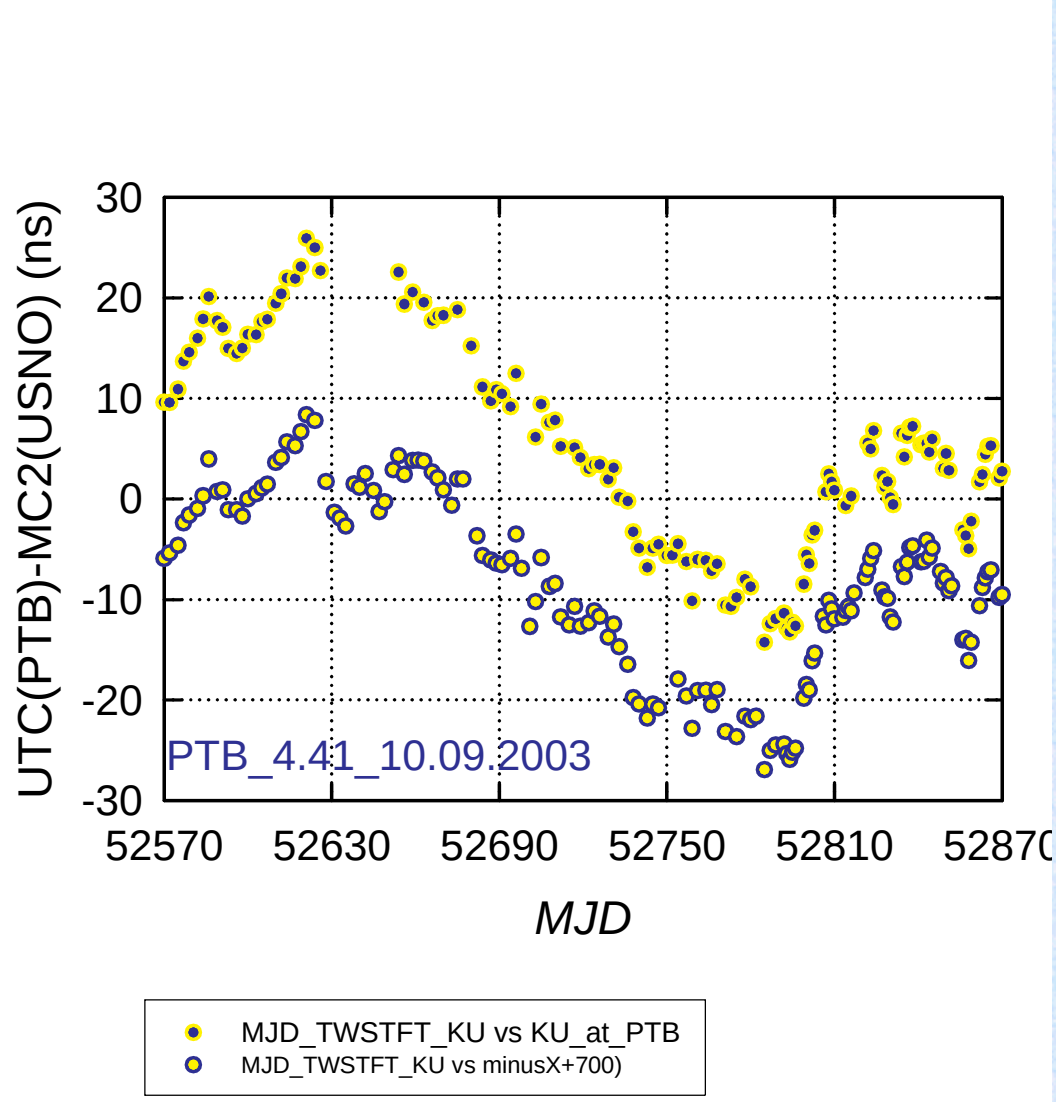
X-band TWSTFT USNO-PTB

- gap due to LNA failure



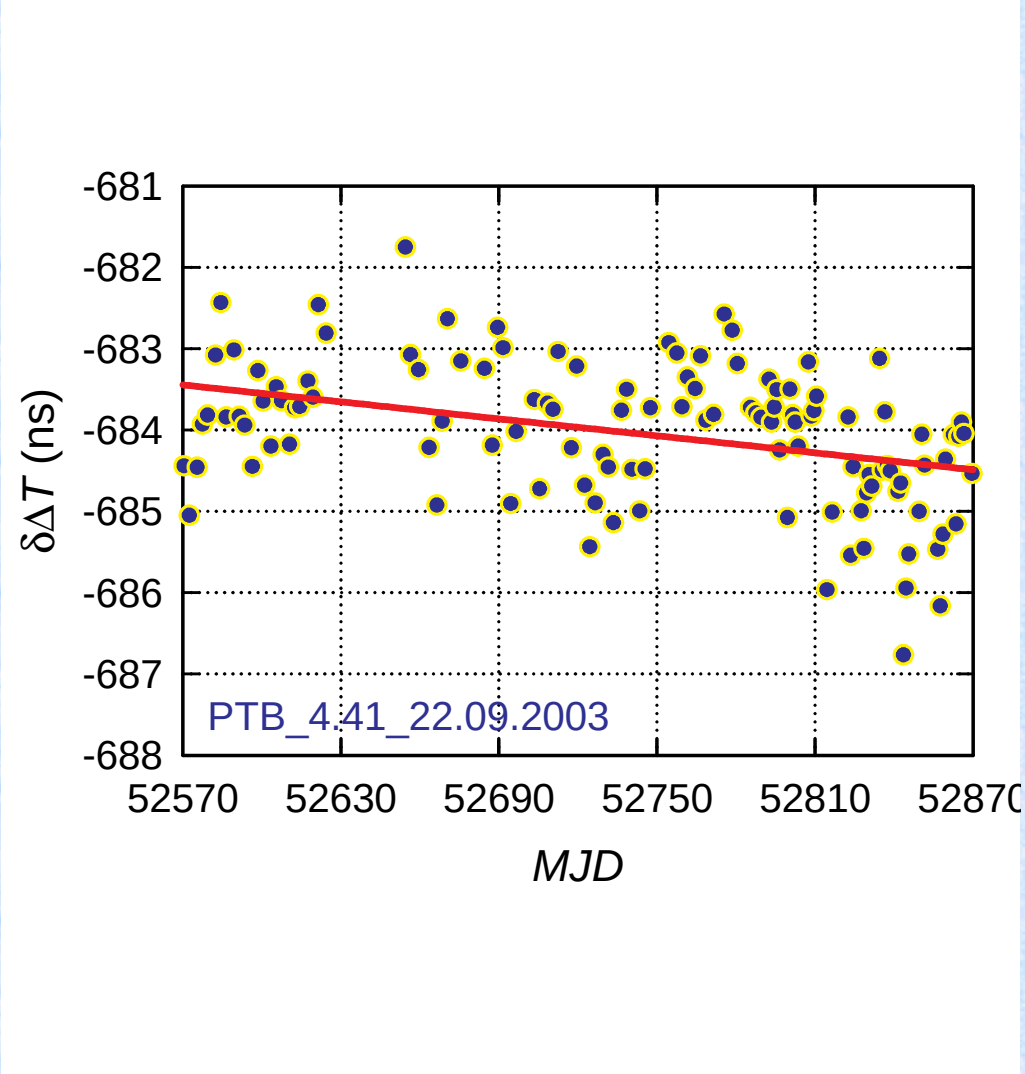
X-band TWSTFT USNO-PTB

- TWSTFT USNO-PTB comparison X-band vs. Ku-band
- one point per day



X-band TWSTFT USNO-PTB

- TWSTFT USNO-PTB comparison X-band vs. Ku-band
- double differences showing small drift



Conclusion

- different calibration techniques for different applications
- IEN-PTB link improved
- no dependence on season for USNO-PTB calibration
- X-band operation between USNO-PTB
- Mind the time tags!

Acknowledgements

- USNO D. Matsakis, A. McKinley, P. Wheeler, A.Smith, E. Newman
- IEN F. Cordara, L. Lorini
- TUG O. Koudelka, H. Ressler, B. Blanzano, C.Karel
- PTB A. Bauch, J. Becker, T. Polewka