

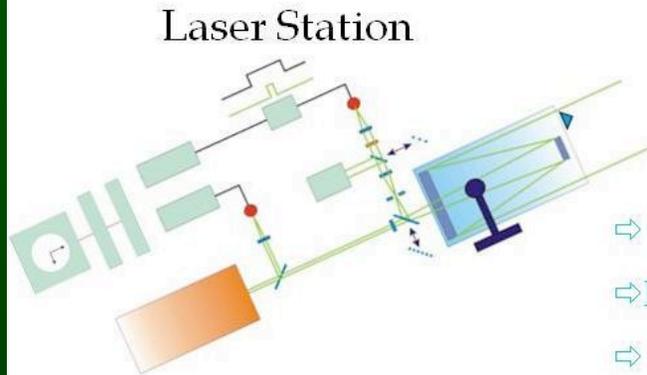
# T2L2 First Results

*E. Samain, P. Exertier*



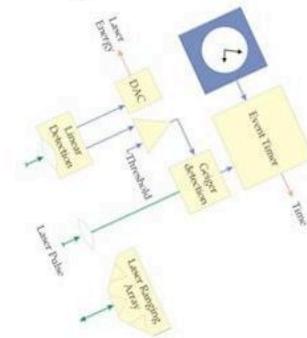
# T2L2 Principle

- T2L2 is a 2 way technique based on the timing of optical pulses emitted (and received) by a laser station and received by a space segment
- Ground :  $T_{\text{start}}$   $T_{\text{return}}$       Space :  $T_{\text{board}}$
- From these 3 dates : phase between the ground and space clock



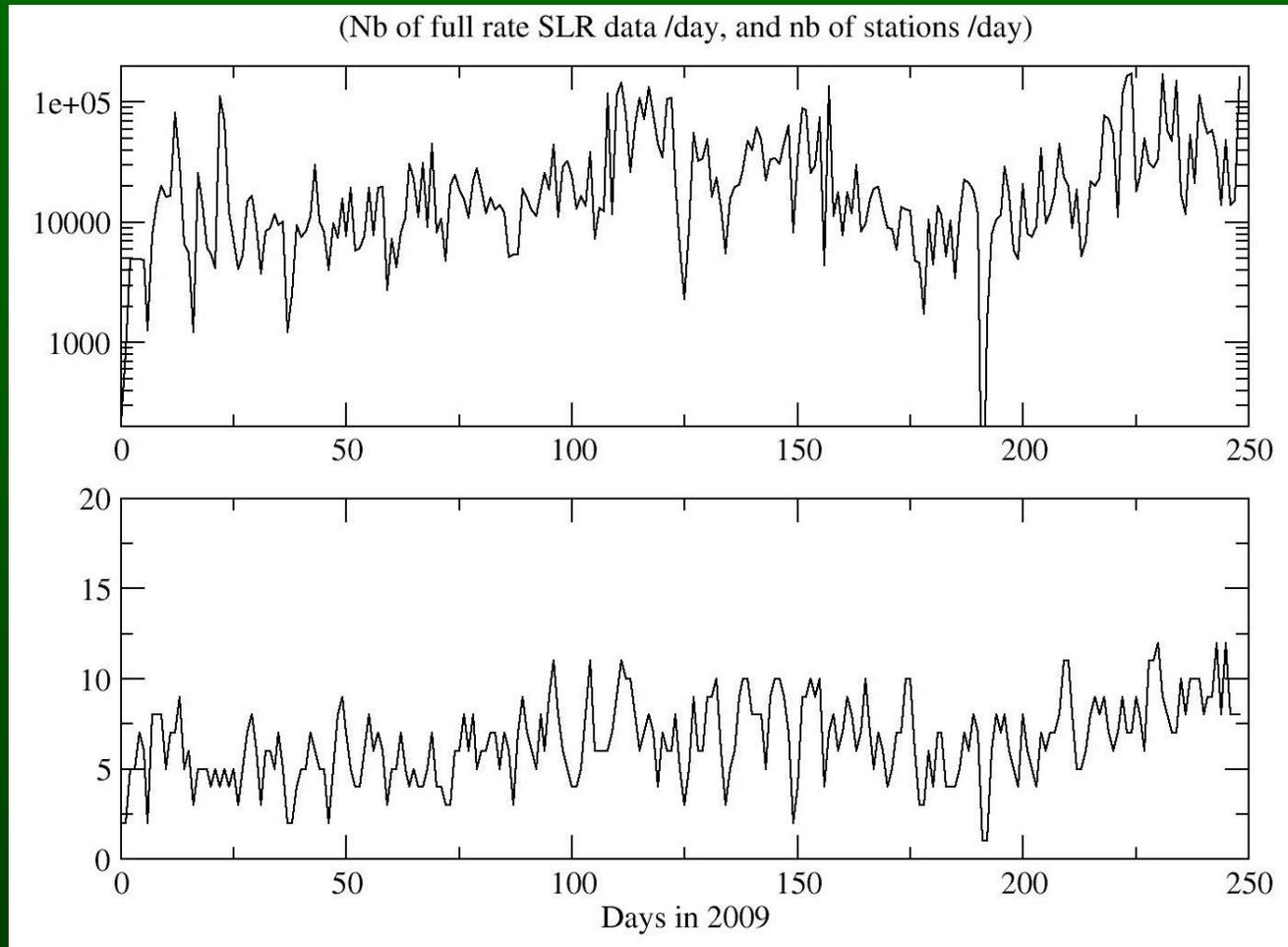
- ⇒ Energy 400  $\mu\text{J}$  -> 1 J
- ⇒ PulseWidth 20 -> 200 ps
- ⇒ Laser rate : 10 -> 2 kHz

## T2L2 Space instrument

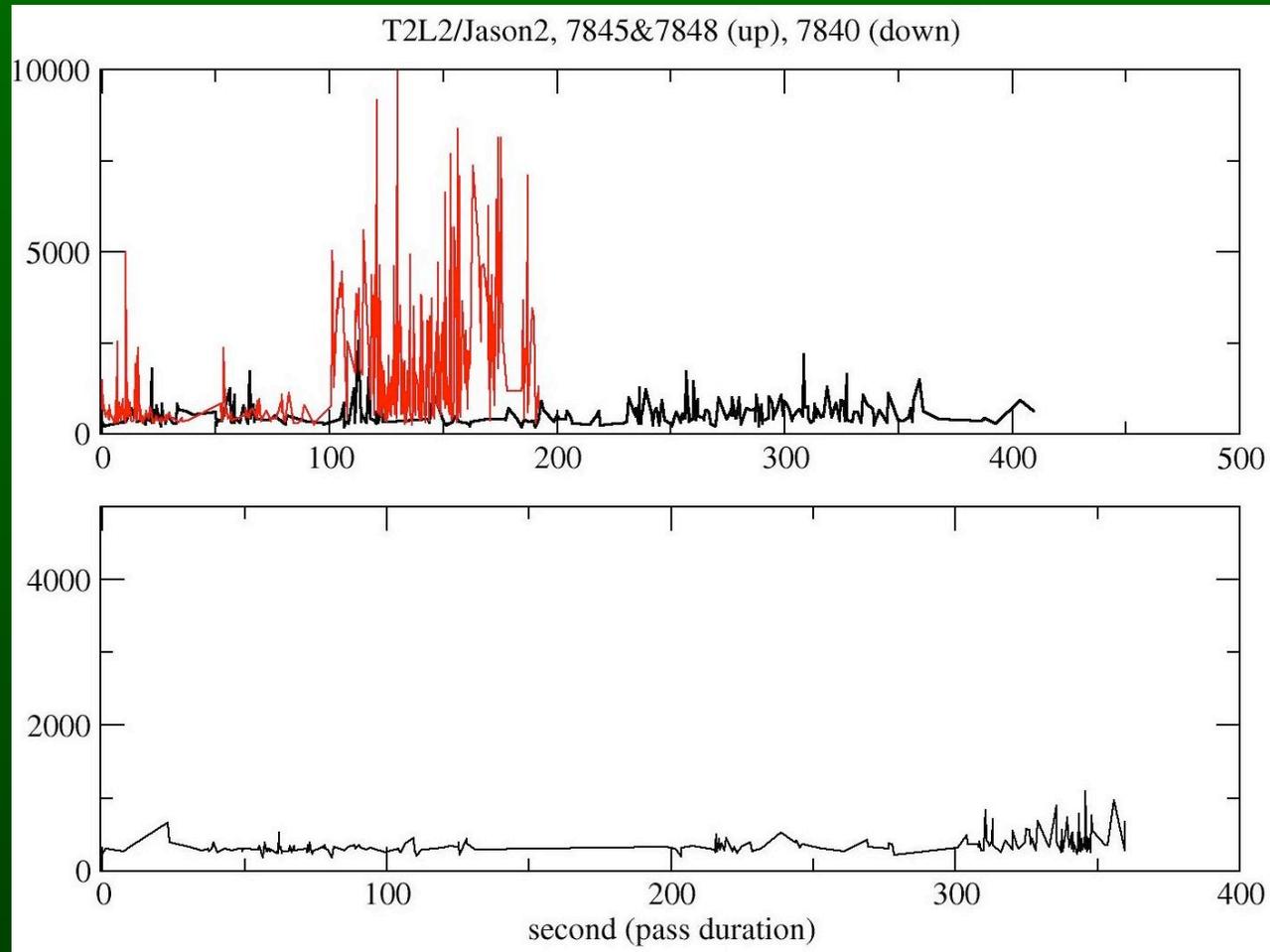


- ⇒ Masse : 8 kg (electronic) + 1.1 kg (optic)
- ⇒ Power Consumption: 42 W
- ⇒ Volume : 270x280x250 mm<sup>3</sup> //  $\varnothing$  30x95 //  $\varnothing$  62x100

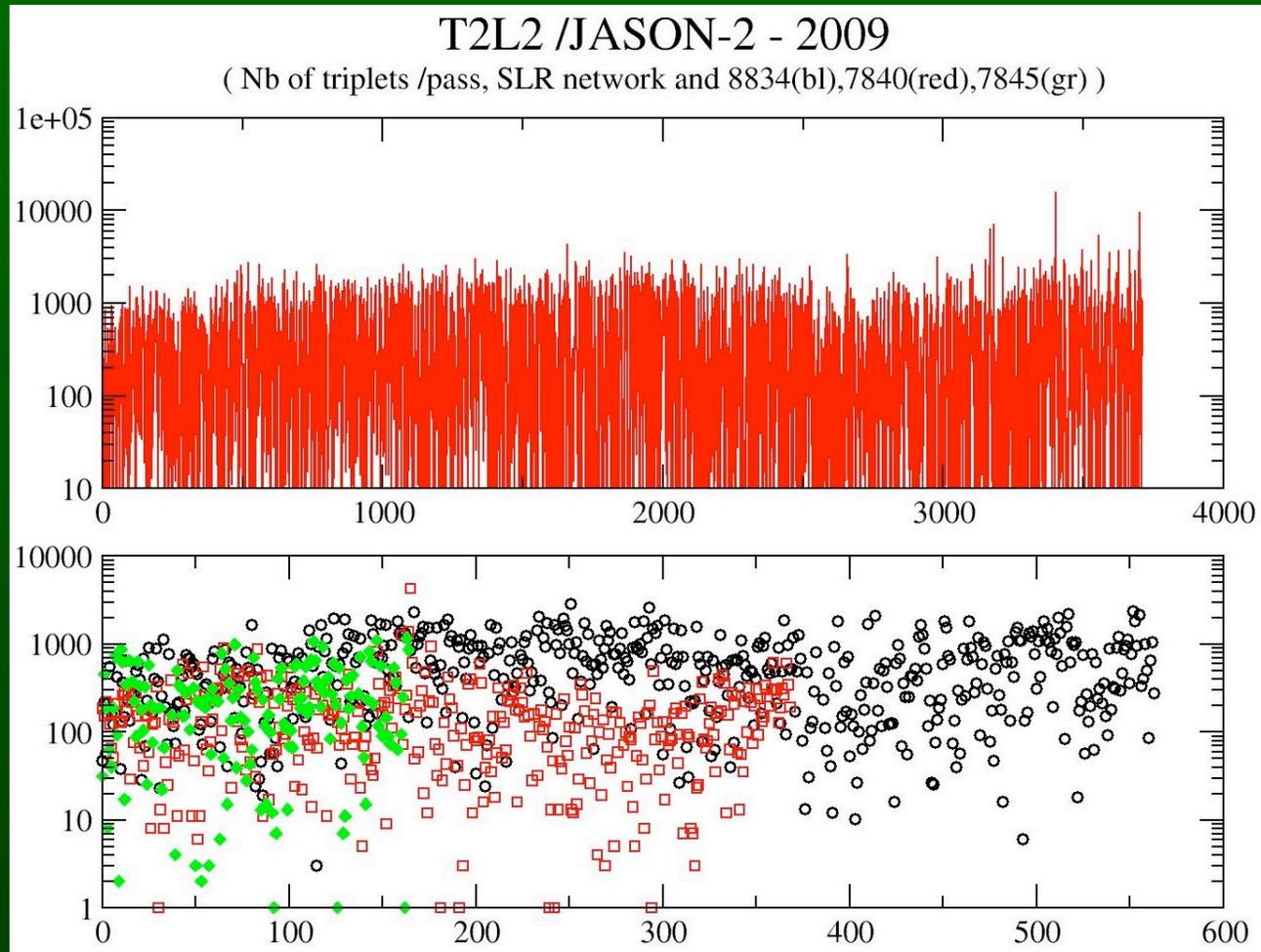
# T2L2 Statistics



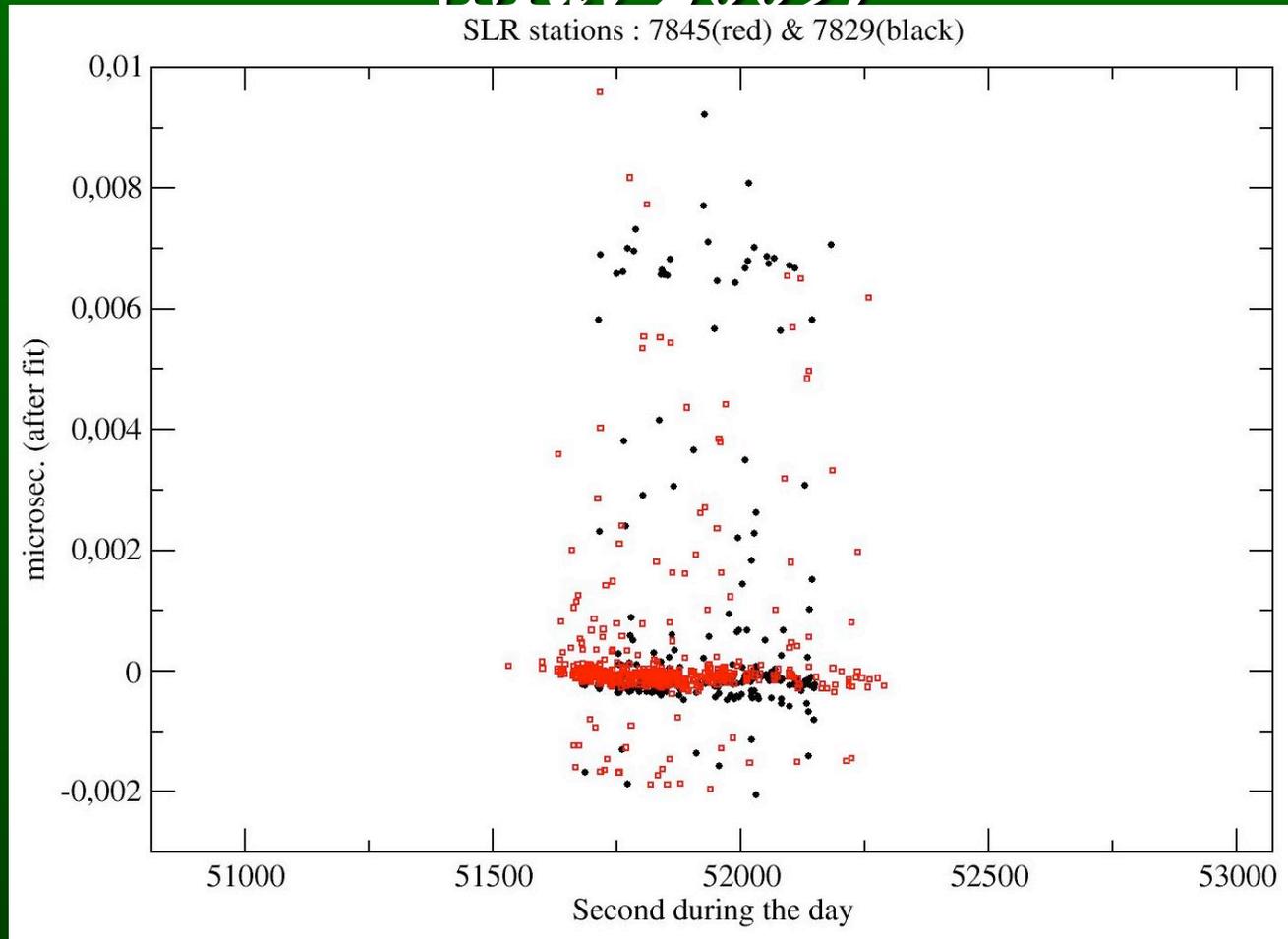
# On-board measured pulse energy



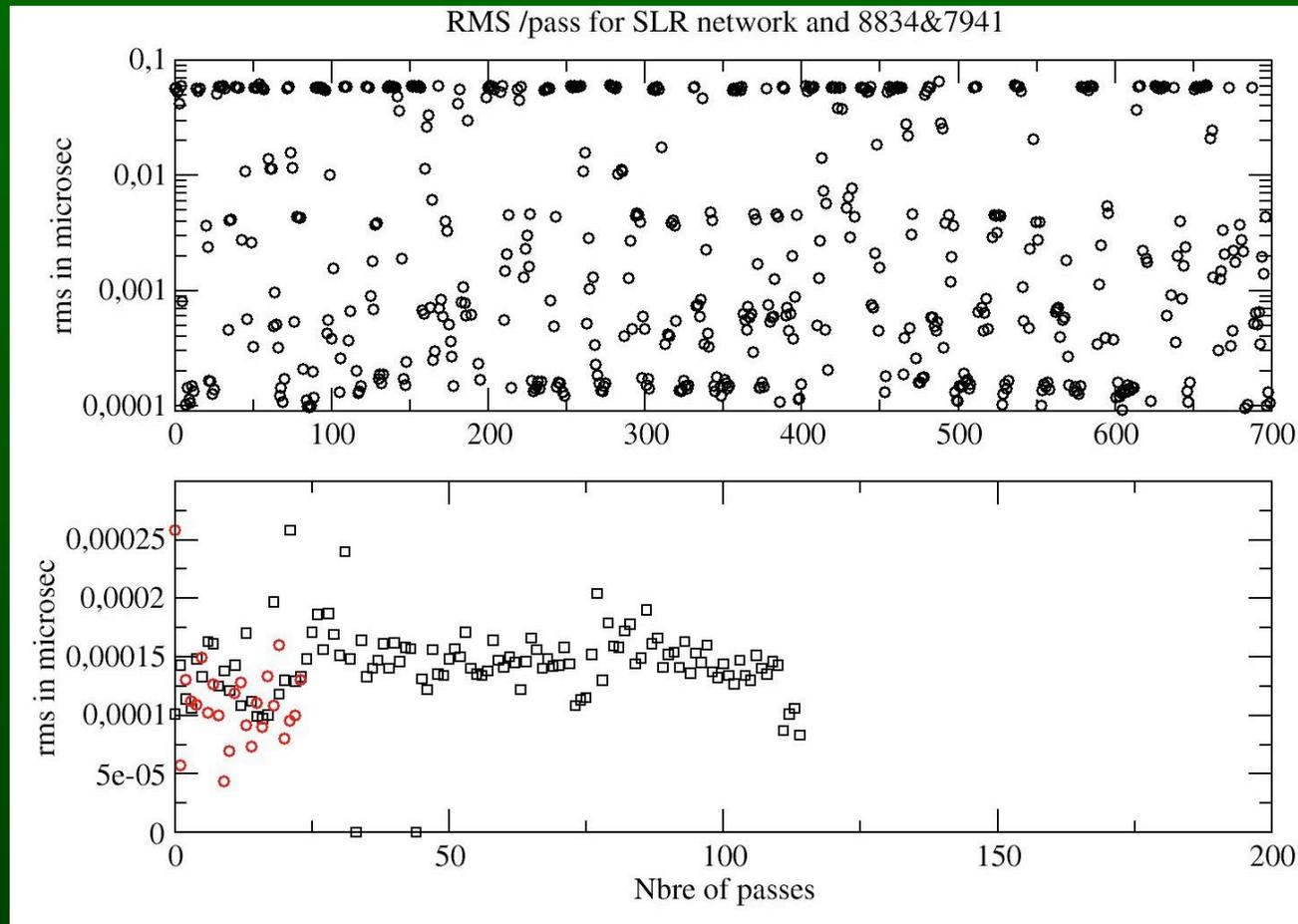
# Number of triplets



# First Time Transfer with T2L2 *(May 2009)*

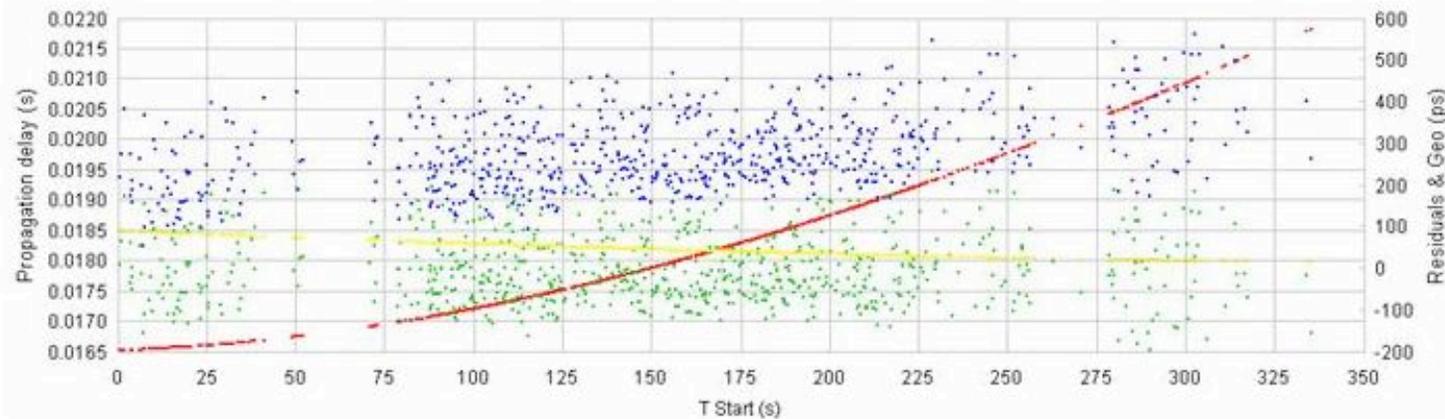


# Ground to space Time Transfer



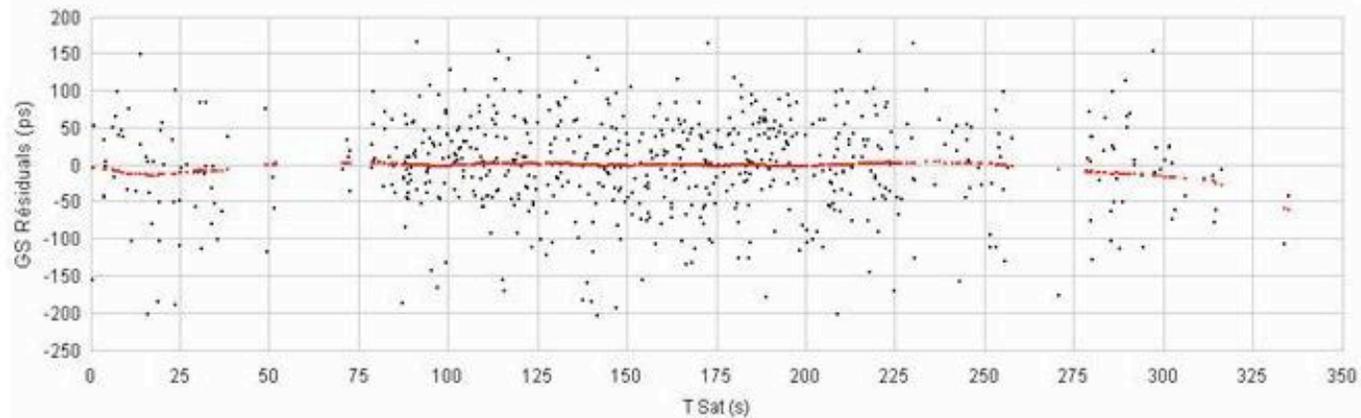


# Time of flight for each event Wettzell (H-maser)



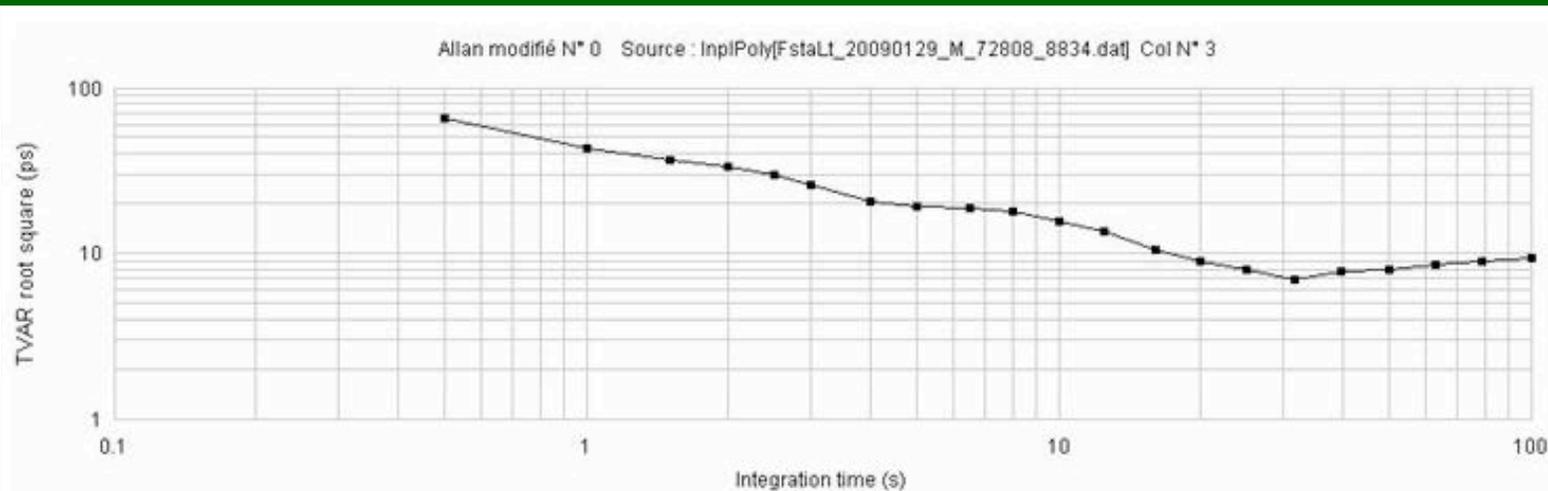
- Red line : time of flight between laser station and space segment
- Blue dot : difference between meas. and the computed orbit
- Green dot : polynomial fit (order 3)
- -> A synthetic measured time of flight integrated over of few seconds

# Ground-Space Time Transfer Wettzell



- Black dot : raw measurement
- Red line : low order polynomial fit over 100 s
  - » Interpolate the time difference in the time scale of the satellite at some precise instant (every second )
  - » ground - ground time transfer

# Time Stability between Wetzell H-maser and DORIS



- TVAR
  - » 40 ps over 1 s ; < 10 ps over 20 s
- In accordance with the characteristics of the DORIS oscillator

# T2L2 Conclusions

Concerning the SLR stations that send CRD data files, Wettzell is one of the greater contributor.

But Matera, HertX, Zimmerwald, Changchun and Grasse (with Mt Stromlo and Hartebeeshoek) contribute a lot to the tracking of T2L2.

Because several SLR systems use as time system a Cesium or a Maser, we should make great progress in the monitoring of DORIS USO in the weeks to come.

Of course, all the data of SLR stations that use the Merit format have been also processed (7090,7080,7110,7105, ...).

7237 & 7840 (kiloHertz system) are seen by T2L2

New participating stations in 2009 : 1873, 1893, 7838, 7821, 7308, and 7080(CRD)