Observatoire de la Côte d'Azur

UMR 6203 GEMINI
Equipe R&D M
Groupe Temps-Fréquence
et Transferts de Temps

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OCA Time & Frequency Equipments

A : Time Station

- Two HP5071A High Performance Clocks
- Comparison System of the 2 Cesiums
- Monitoring of Weather Conditions
- TU/TS & Frequencies Distribution over Calern Site

OCA Time & Frequency Equipments

B : Construction of real-time UTC(OCA)

- Trak Systems 6490A MicroPhase Stepper
- Trak Systems 6460 Multiple Time Scale Generator
- Stanford Research SR620 Counter & Racal 1250 Multiplexer for comparison with TTS2 GPS Reference

OCA Time & Frequency Equipments

C : Time & Frequency Transfer Techniques

- 1 Single Channel TTR5 AOA GPS Receiver
- 1 Multi-Channel TTS-2 VP Oncore Receiver
- 1 Dual Frequency MC Dicom GTR50
- 1 VSAT TWSTFT Station since 1990
- Automated Comparison Systems between:
  - Primary Cs Clock and GPS Receivers
  - UTC(OCA) and GPS Receivers & TWSTFT

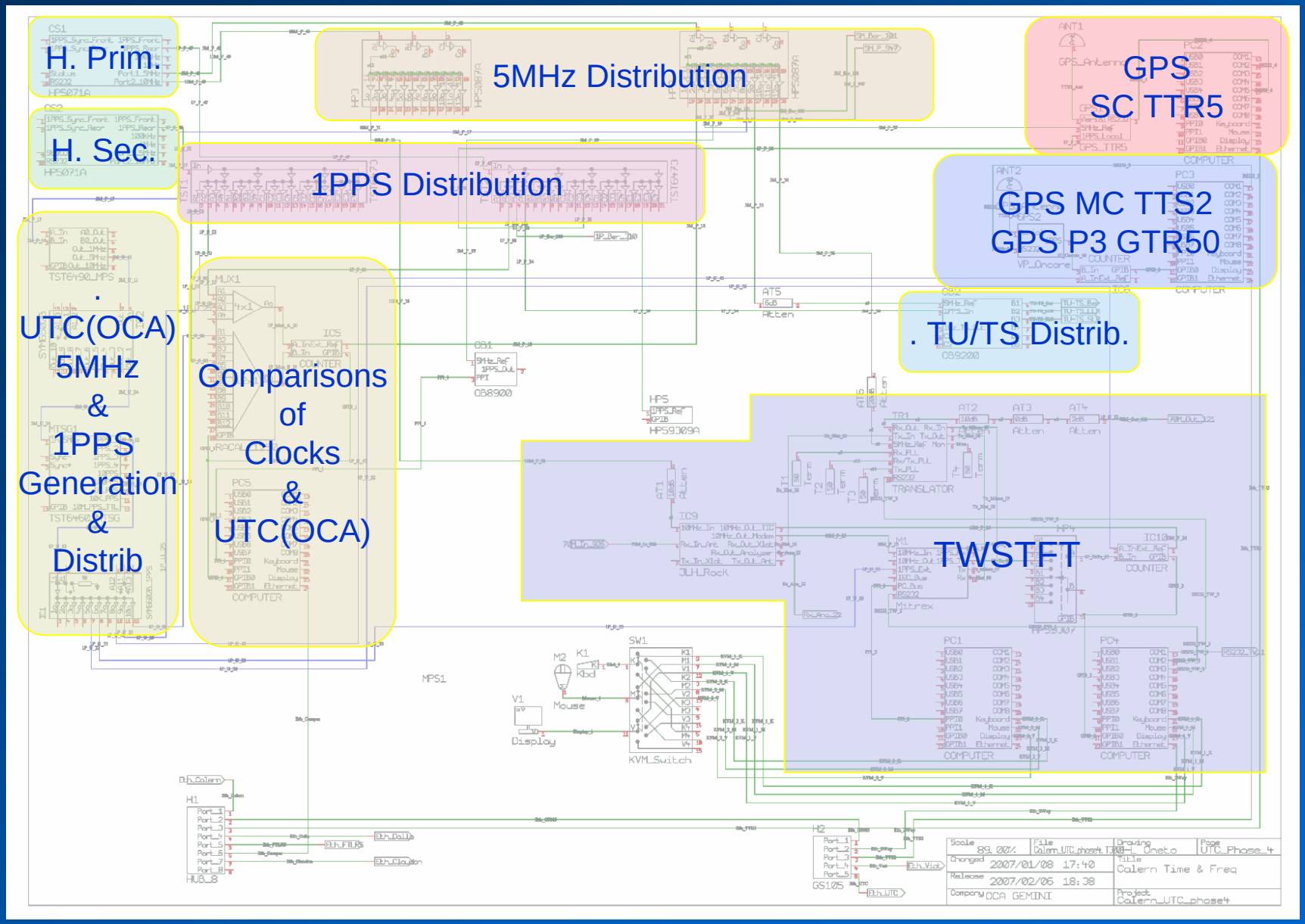
OCA Time & Frequency Participation to Time Scales

- TA(F) via Free-Running Clock :
  - GPS TTR5 “Common View” with the LNE-SYRTE - Paris

OCA Time & Frequency Presentation of TWSTFT Station

- VSAT 1.80m Diameter
- 4 W Anacom Transceiver
- Mitrex Modem
- Operating Everyday in Automatic mode, 12 sessions a day
- Calibration scheduled for 2008, including GPS Receivers

Block Diagram



Data Distribution

To Syrte for TA(F):

- *Clock Comparisons: TA(F) (daily)*
- *GPS SC (TTR5): Syrte: TA(F) (daily)*

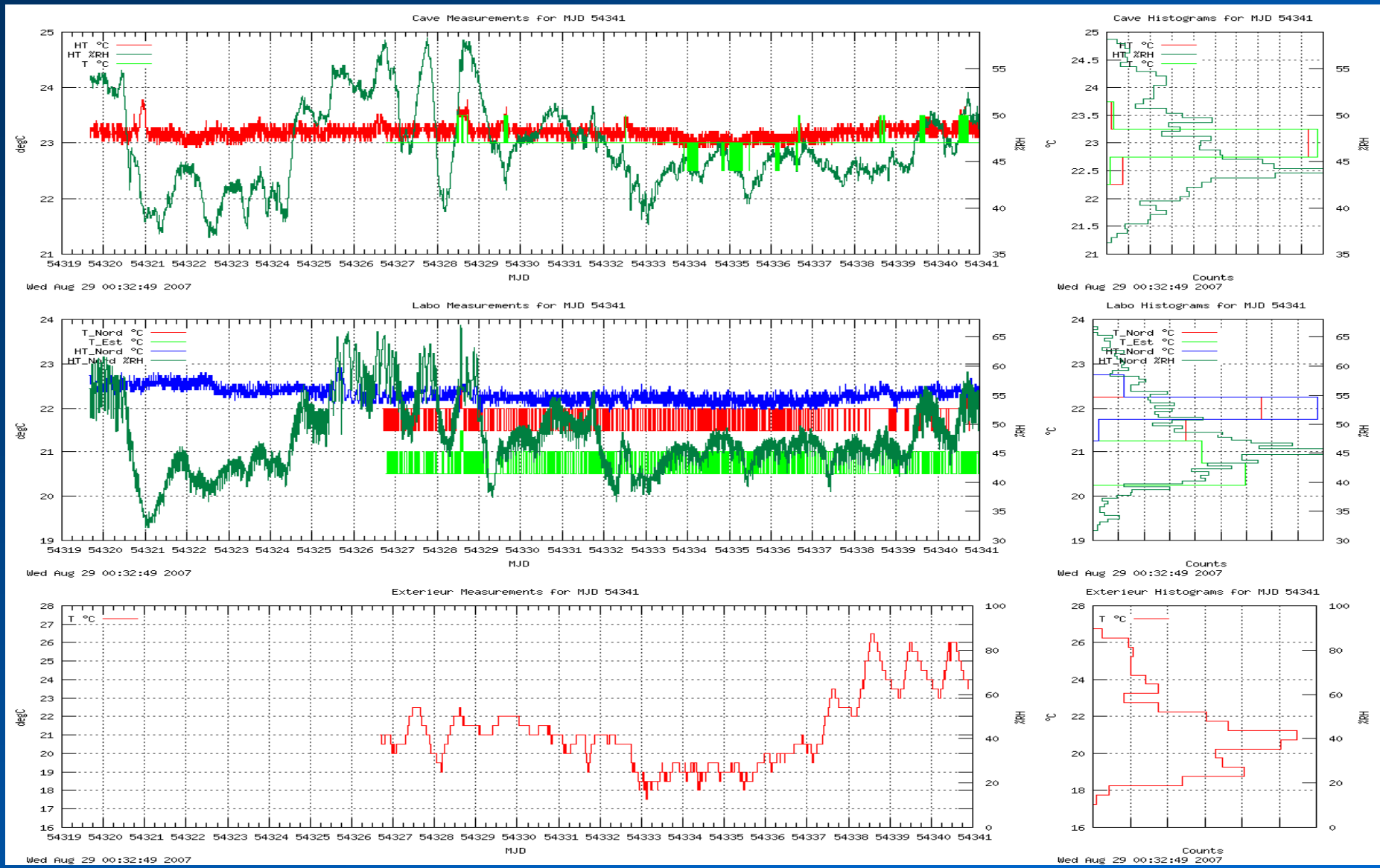
To BIPM:

- *UTC(OCA) - Clock Comparisons: (monthly)*
- *Data UTC(OCA): (monthly)*
- *GPS MC (TTS2): (weekly+monthly)*
- *[GPS MC 2F (GTR50): (weekly+monthly)]*
- *TWSTFT: (12 sessions/day)*

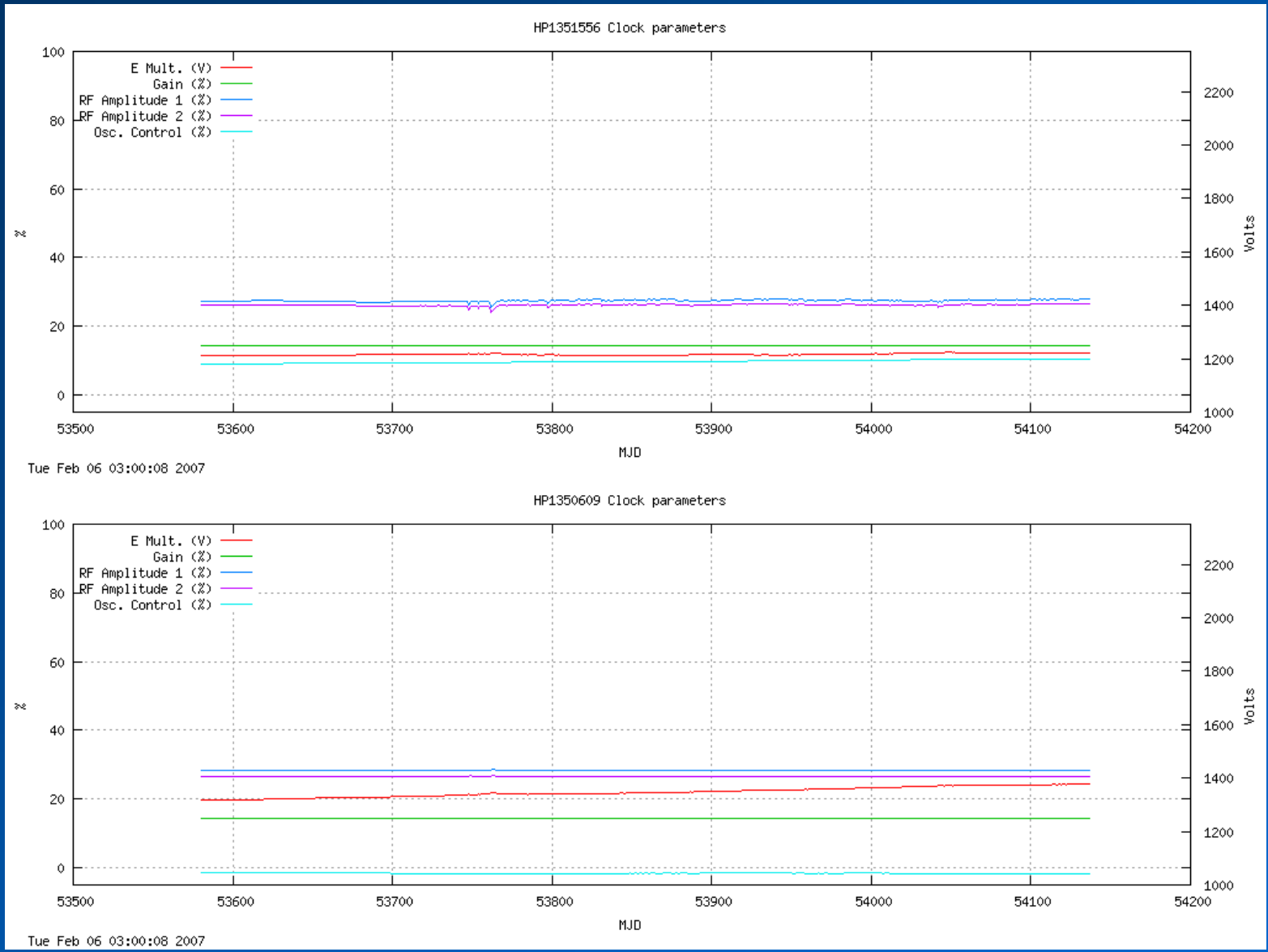
Analyses for local use

- Plots of Temperatures & Humidity
- Parameters of the Clocks
- Plots of clock/UTC(OCA) comparisons
- Plots of GPS MC & SC comparisons
- Plot of Primary Clock - UTC(OP)
- Analyses of TWSTFT sessions
- TWSTFT Spectra

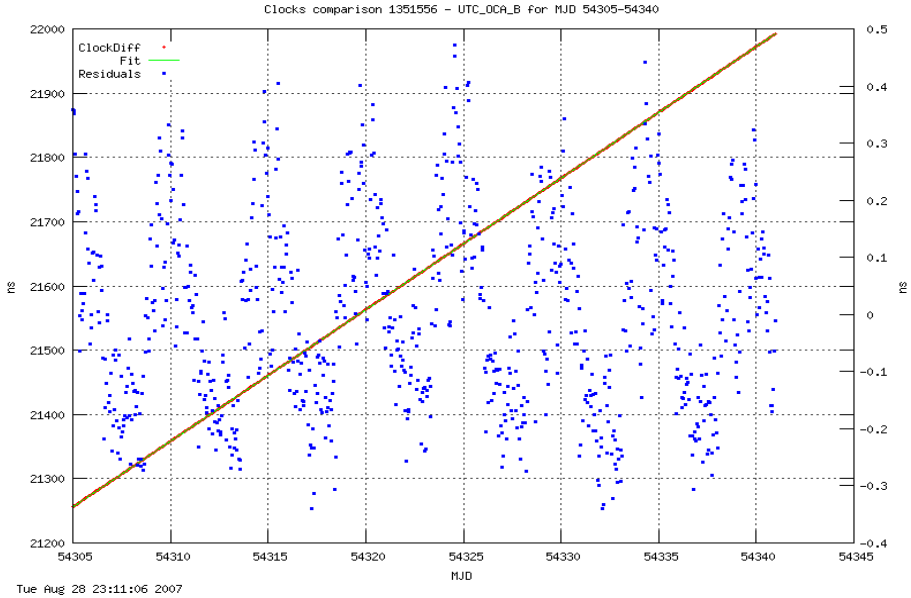
Temperatures & Humidity Plots

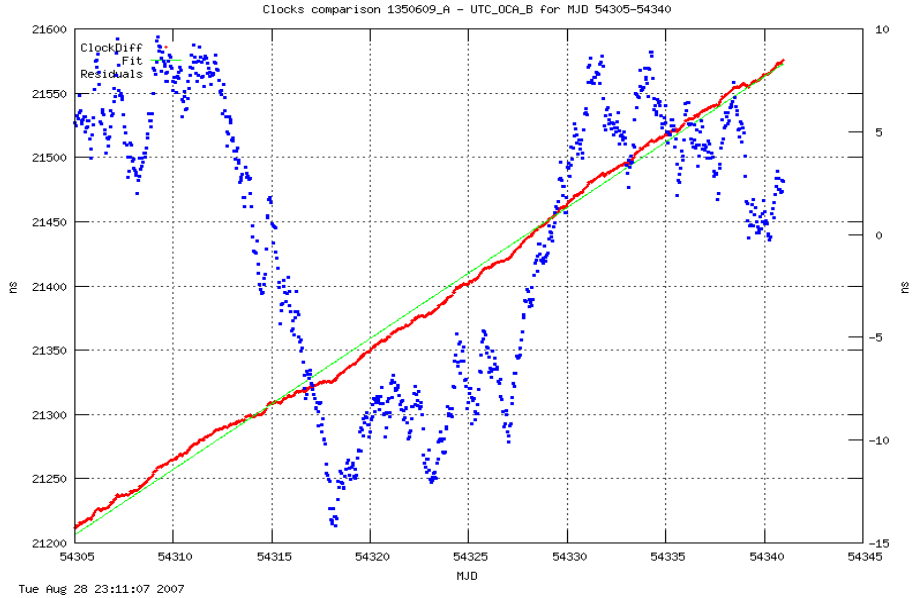


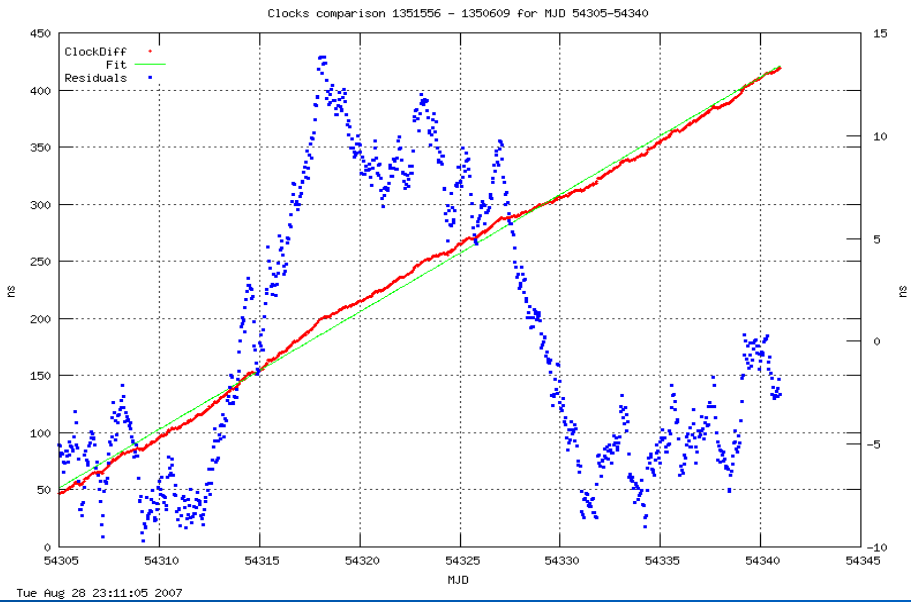
Paramètres des horloges

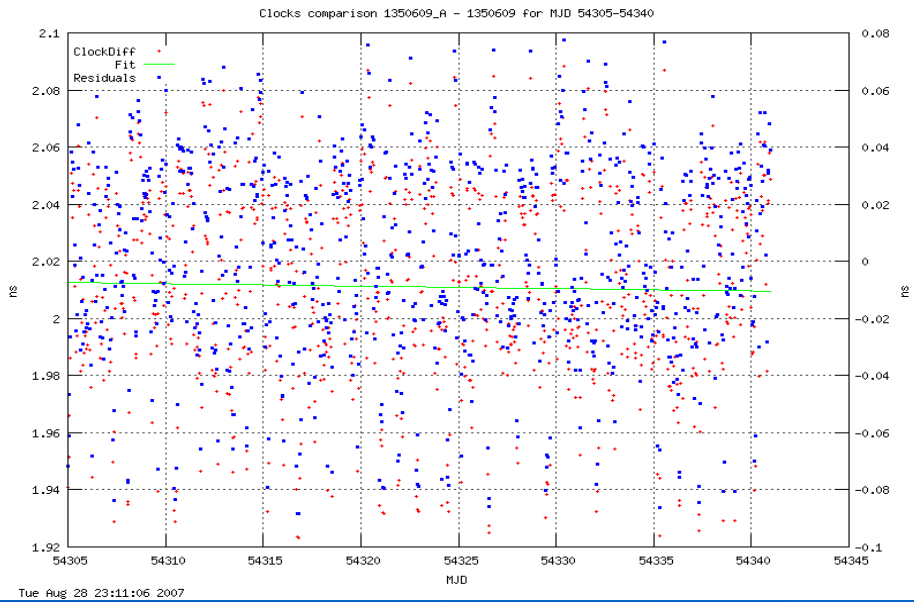


Comparisons of Clocks/UTC(OCA)

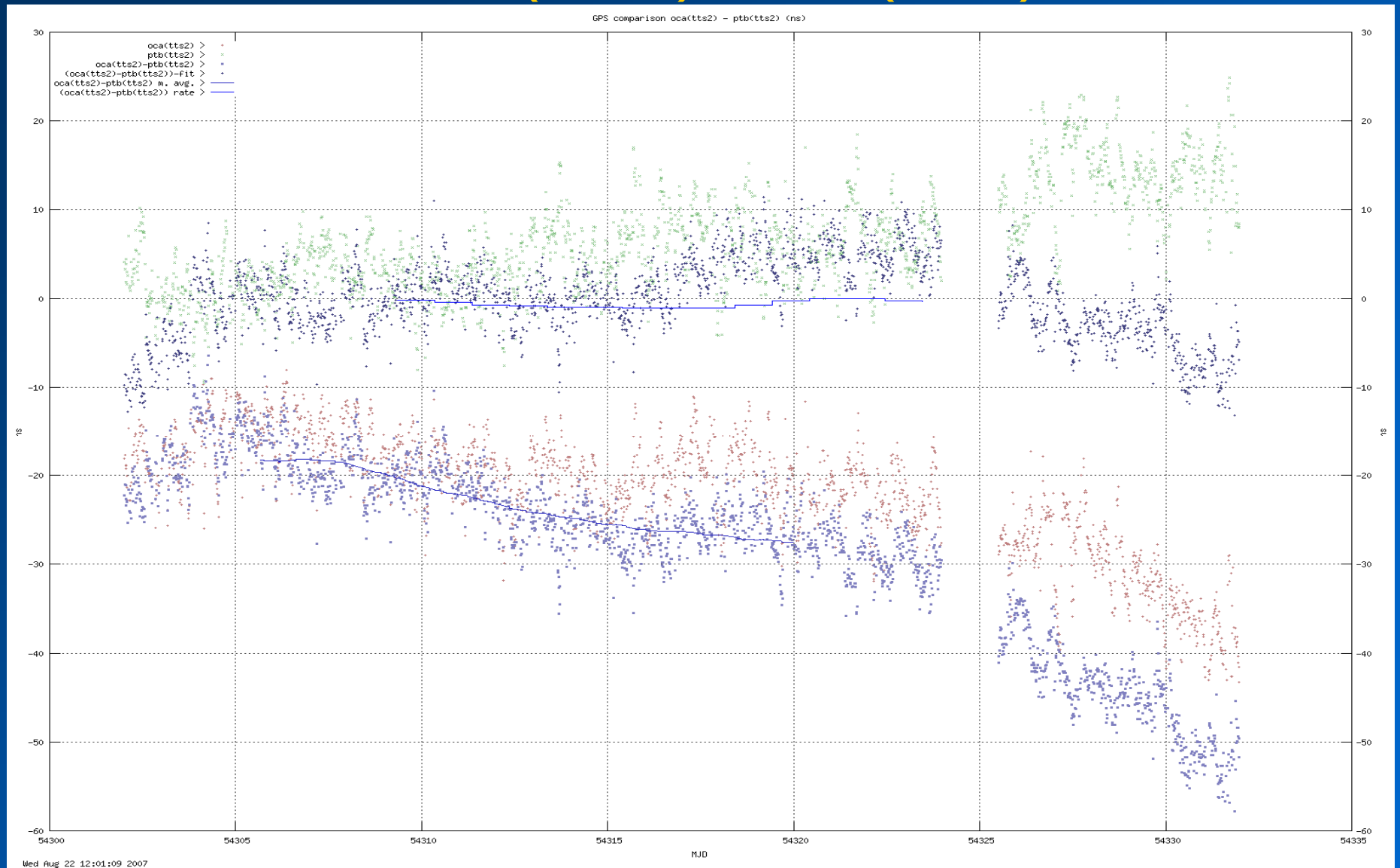




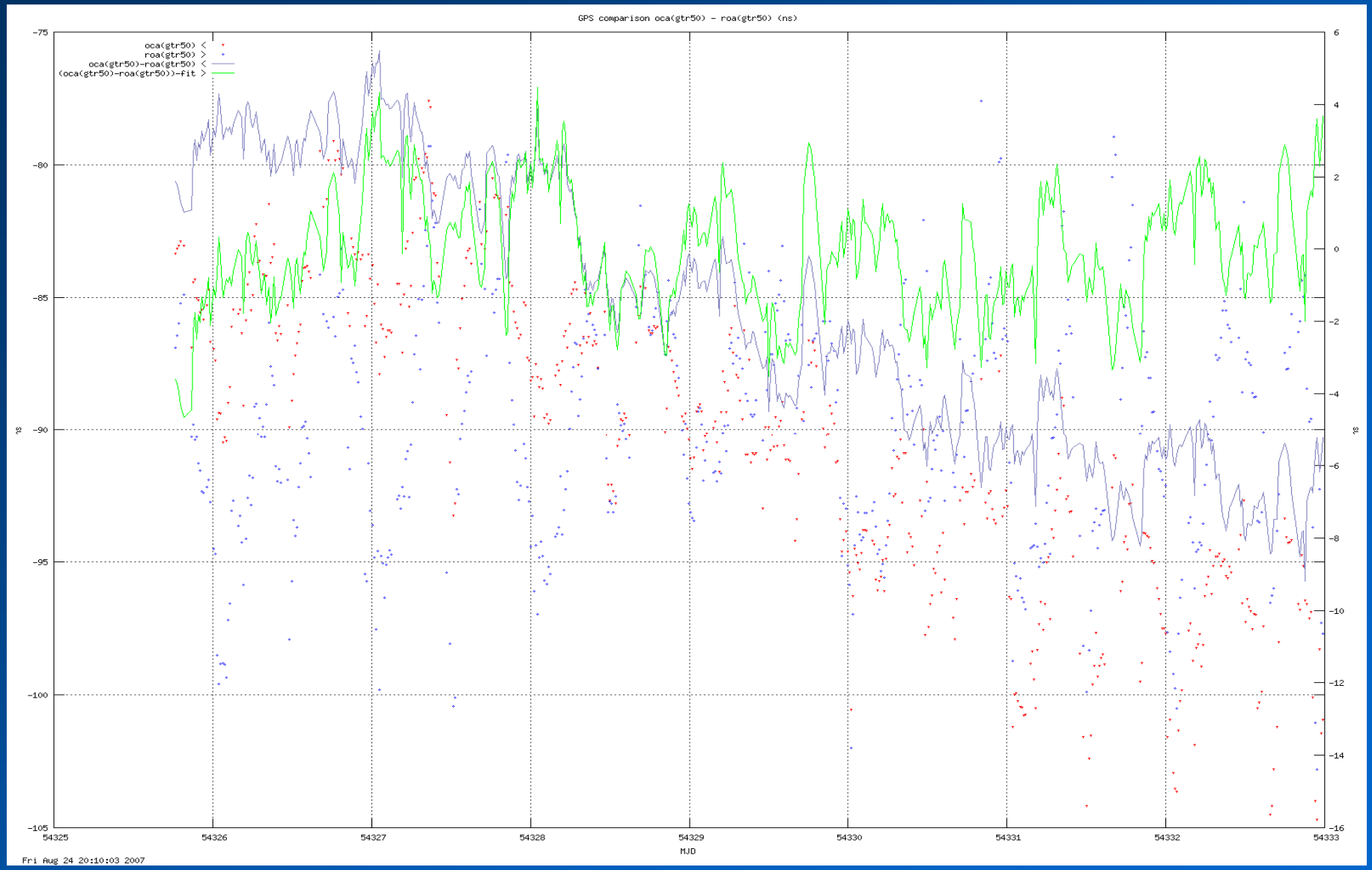




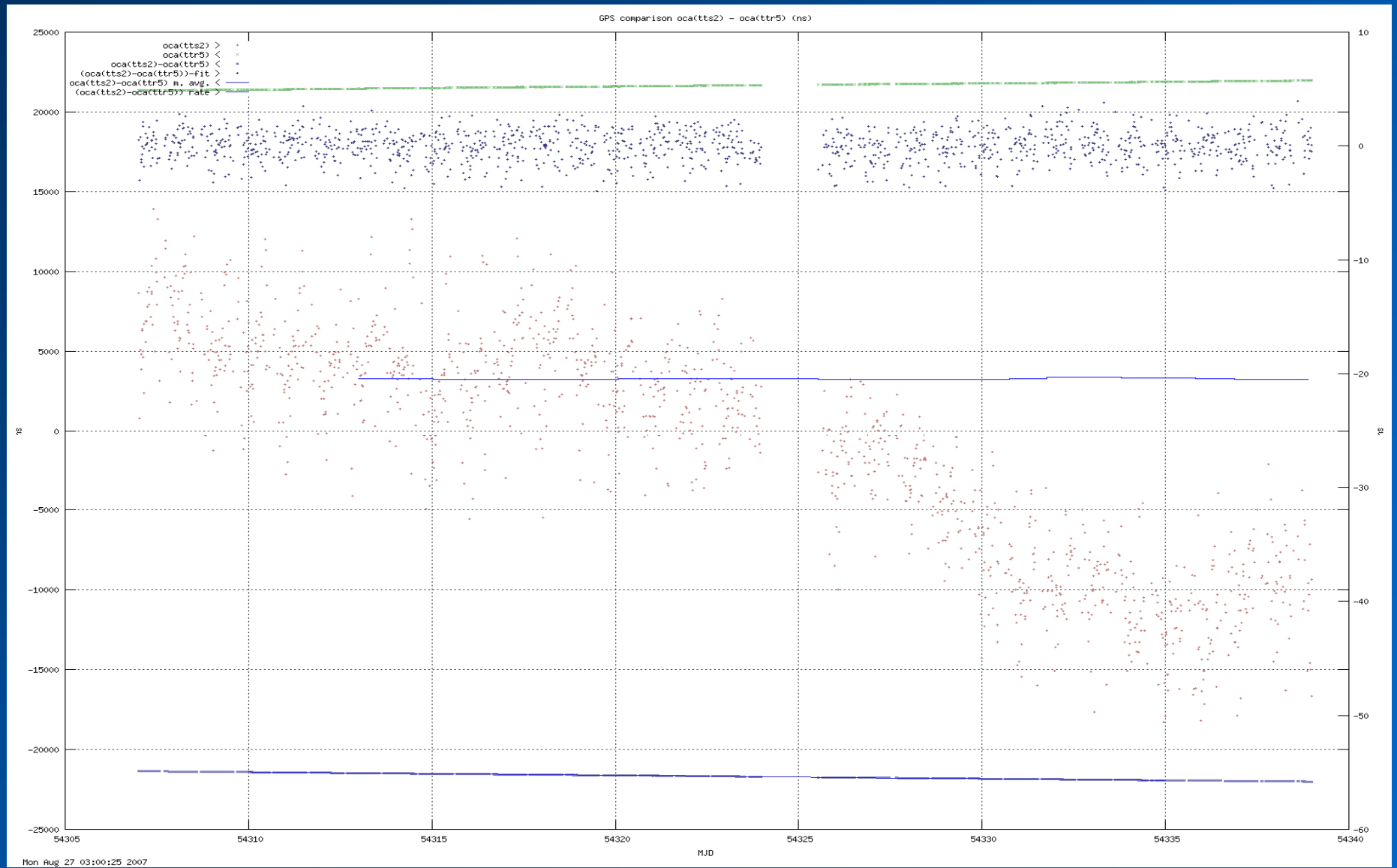
Comparison GPS MC TTS2(OCA)/TTS2(PTB)



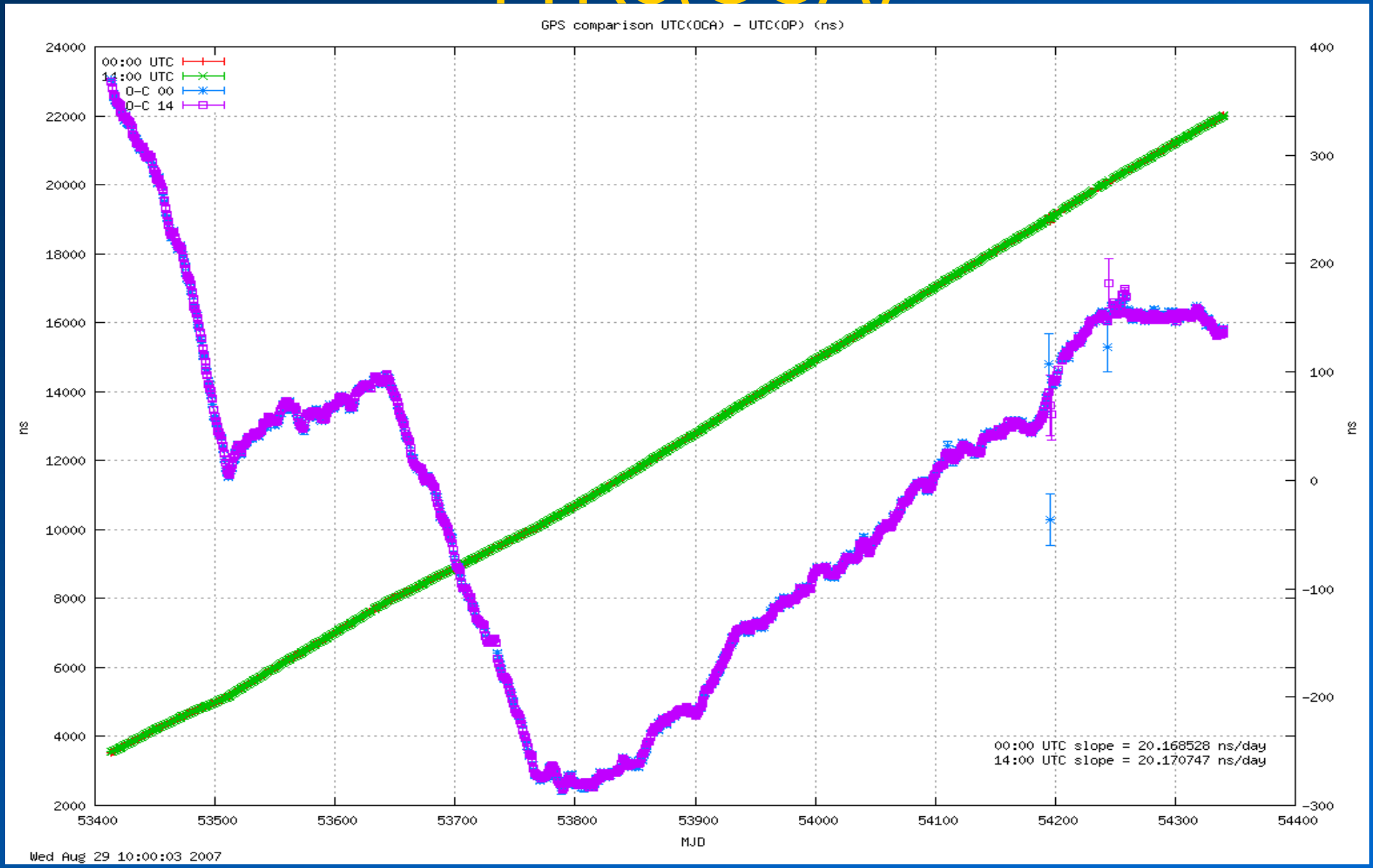
Comparison GTR50(OCA)/GTR50(ROA)



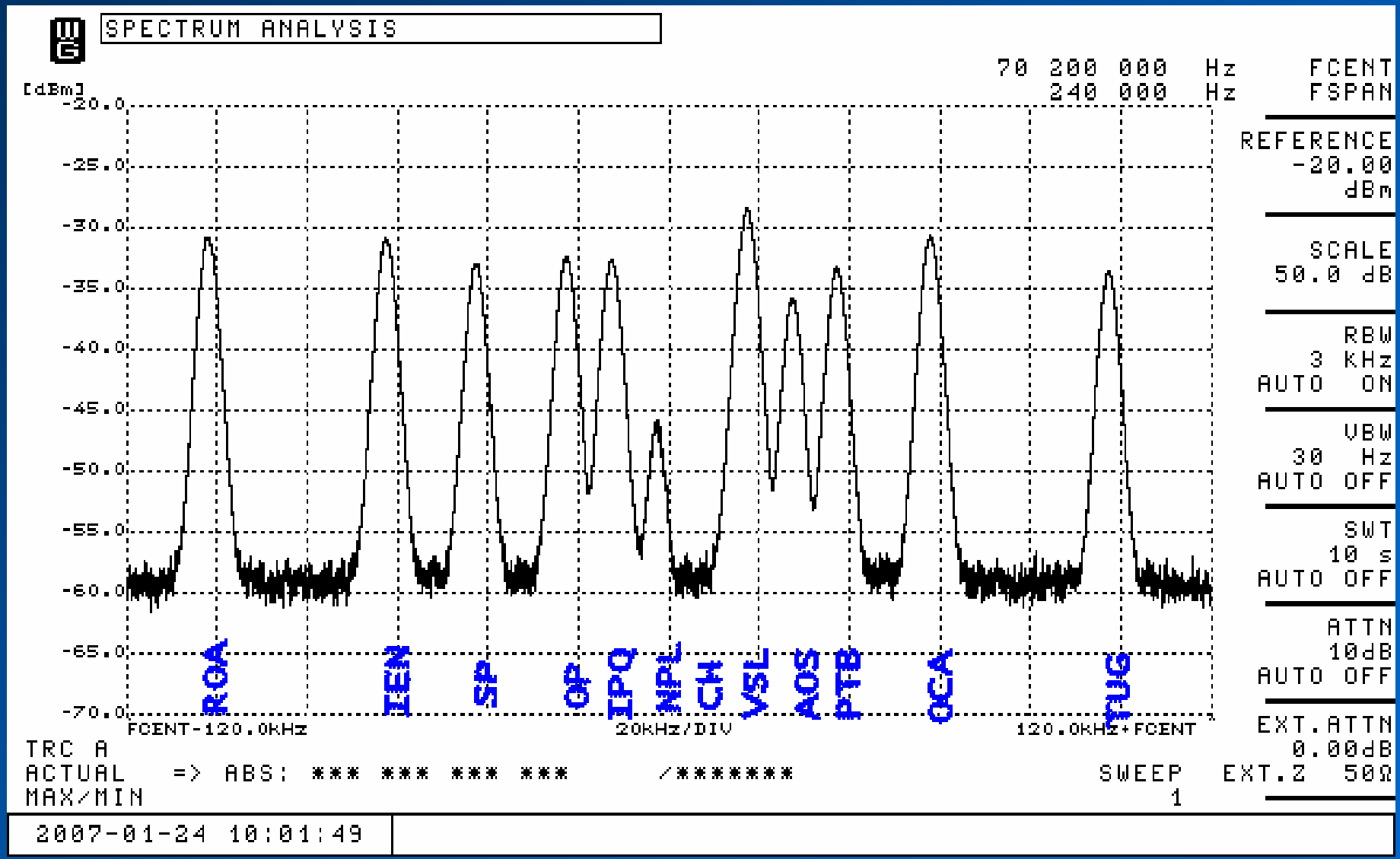
Comparison GPS TTR5(OCA)/TTS2(OCA)



Comparison Primary-UTC(OP) via TTR5(OCA)



TWSTFT Spectrum



Access to OCA T/F Data

Ftp server for TWSTFT Data at OCA:

- server=ssh-g.obs-azur.fr (192.134.15.3)
- user=twstt
- password=TWSTToca
- /users/softs/twstt : current year
- /users/softs/twstt/yyyy : previous years
- /users/softs/twstt/_Uit1sec: 1 second data
- /users/softs/twstt/free_running_clock

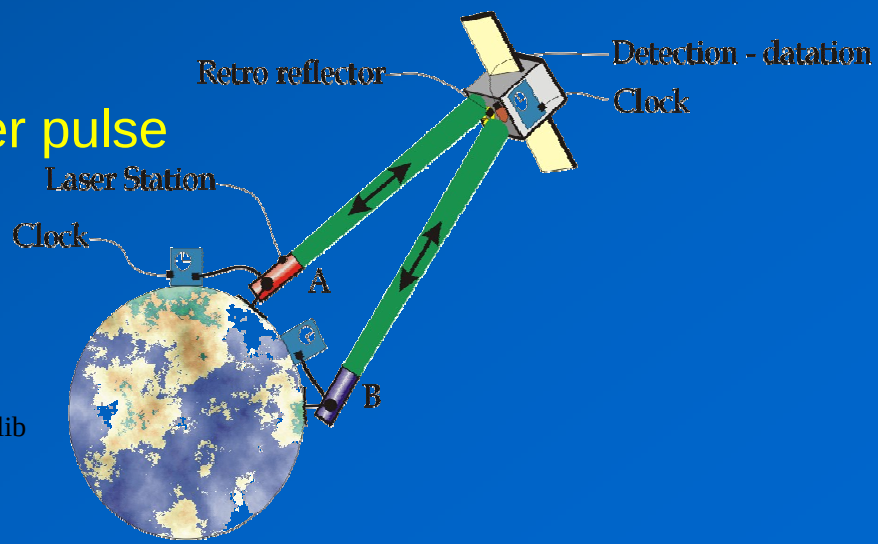
UTC(OCA)

- 25 October 2006: Official application to the Head of LNE for direct participation of OCA clocks to TAI via UTC(OCA)
- 4 June 2007: Negative answer of LNE to OCA Application.

T2L2 Principle

- Time Tagging of laser pulses emitted from a laser station towards the satellite
  - Start Time at ground station $\mathbf{t_s}$ (ground clock)
  - Arrival time at satellite $\mathbf{t_b}$ (on-board clock)
  - Return Time at ground station $\mathbf{t_r}$ (ground clock)
- Time Transfer between Ground clock and space clock
  - Triplet Construction for each laser pulse ($\mathbf{t_s}$, $\mathbf{t_b}$, $\mathbf{t_r}$)
  - Computation of the time offset :

$$x_{AS} = t_s + \frac{t_r - t_s}{2} - t_b + \tau_{Relativiste} + \tau_{Atmosph} + \tau_{Calib}$$



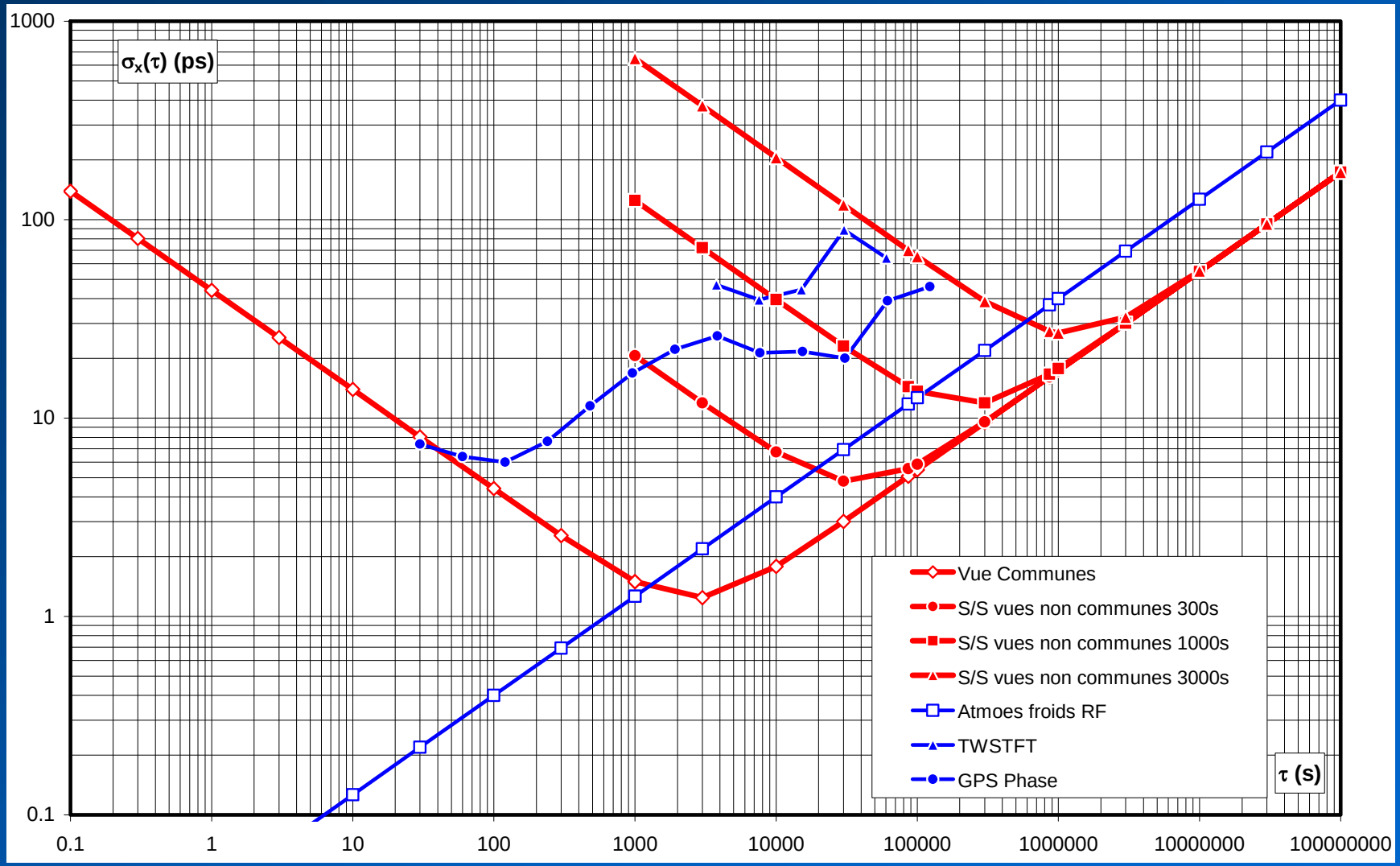
T2L2 Space instrument Development plan

- B Phase: 09/2005 → 02/2006
- CD phases : 03/2006 → 12/06
- Performance tests: 01/07
- T2L2 integration on Jason 2: 05/2007

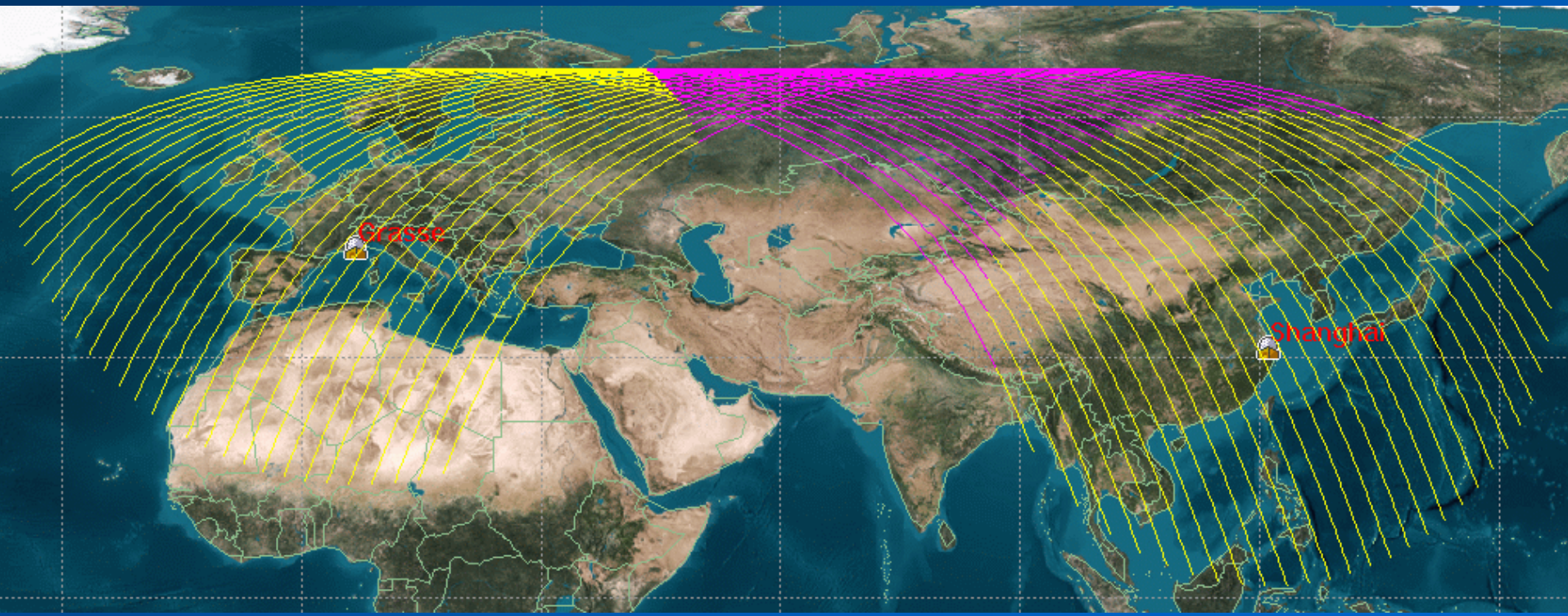
- Jason 2 launch: 06/08

- Exploitation: 06/2008 → 06/2010

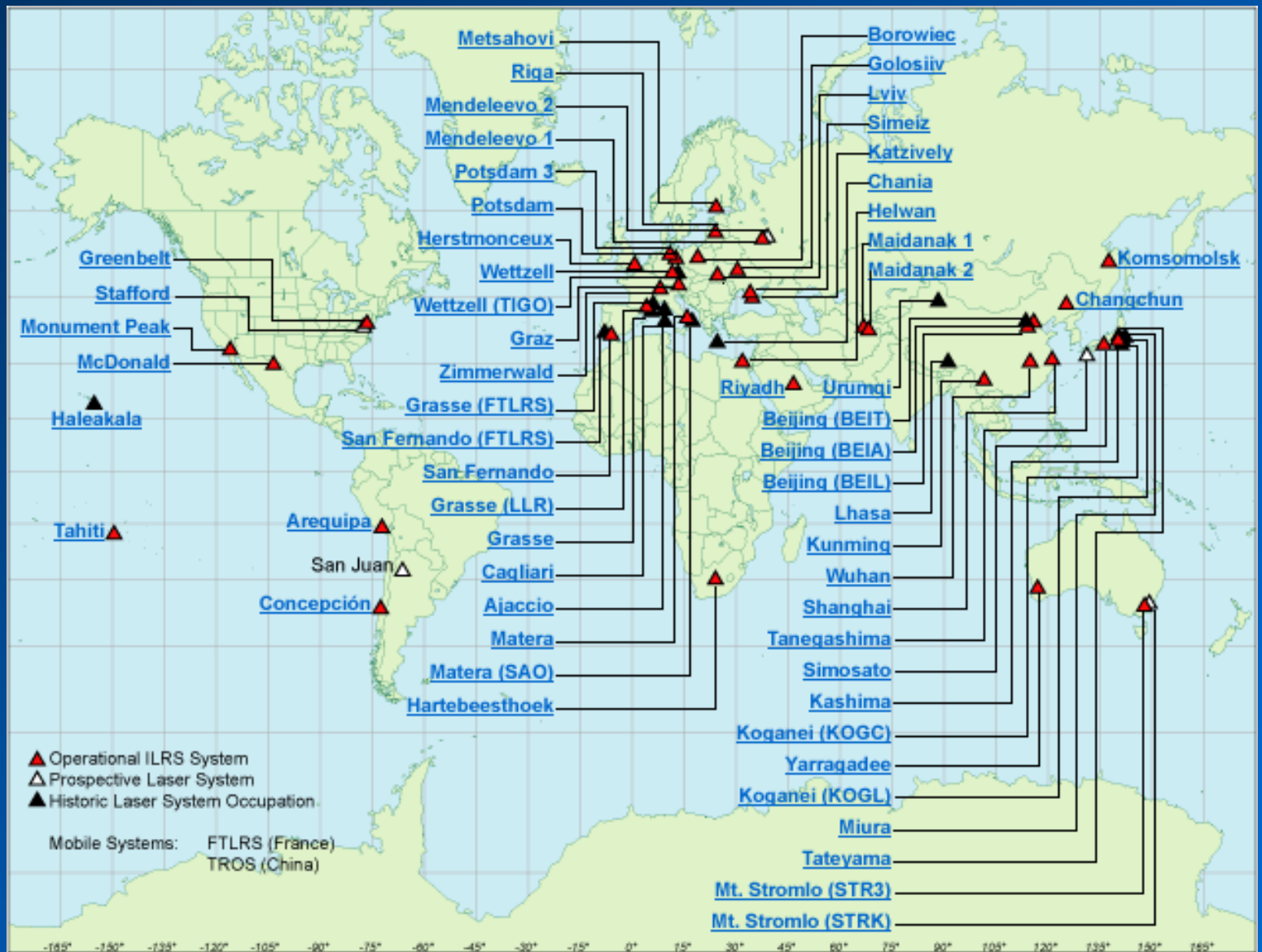
T2L2 time stability as compared to microwave links



T2L2 Field of View
Time transfer in common view



Laser ranging network



Two way time transfer calibration

- 2 mobile laser stations
  - FTLRS (French)
  - TROS1 (China)
- 2 mobile TWSTFT stations
  - TUG
  - TimeTech
- 3 europeans laboratories having both laser and TWSTFT
  - OCA
  - TUG
  - ROA

Calibration campaign

- A first 2 month campaign in June 2008 between :
  - OP via FTLRS
  - OCA connected to Mobile Atomic fountain (SYRTE)
  - TUG
  - ROA
- A long term campaign between
  - OCA
  - TUG
  - ROA
- A second campaign in 2009
  - Primary labs via TROS1(to be defined) : PTB ? Asia ?