OCA – UMR GeoAzur

Grasse – France

D. Albanese: Optics

C. Courde: Campaign, Laser

P. Exertier: Data Analysis CMS

M. Laas Bourez: TF Manager

JL. Oneto: TF Lab

J. Paris: Software

F. Pierron: FTLRS

E. Samain: T2L2 Prime Investigator

J.M. Torre: Laser sations ILRS

OP

Paris– France

J.Achkar: TT Comparison

D. Rovera: TWSTFT

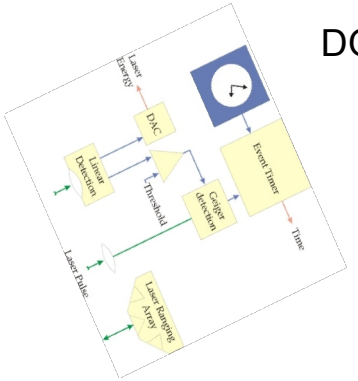
T2L2 : scientific objective 2012 - 2014

T2L2 Principle
Ground Space time transfer

- 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_{start} T_{return} Space : T_{board}
- From these 3 dates → difference between the ground and space clock

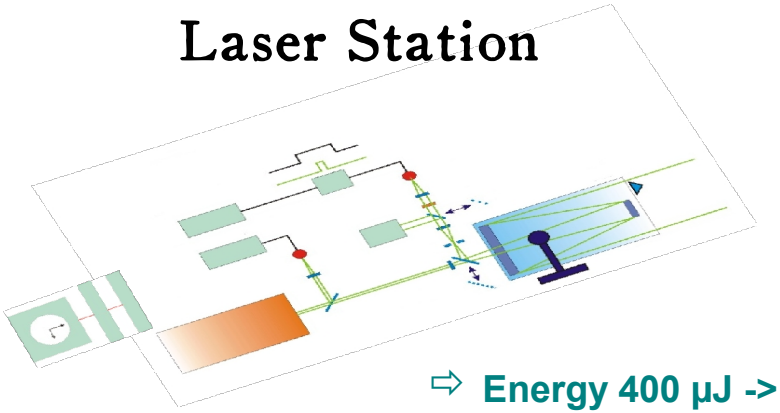
T2L2 on Jason2

DORIS



- ⇨ **Masse: 10.4 kg**
- ⇨ **Power Consumption: 50 W**
- ⇨ **Volume : 20 l**

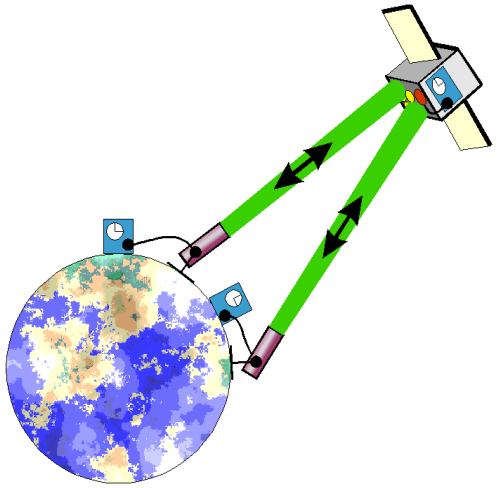
Laser Station

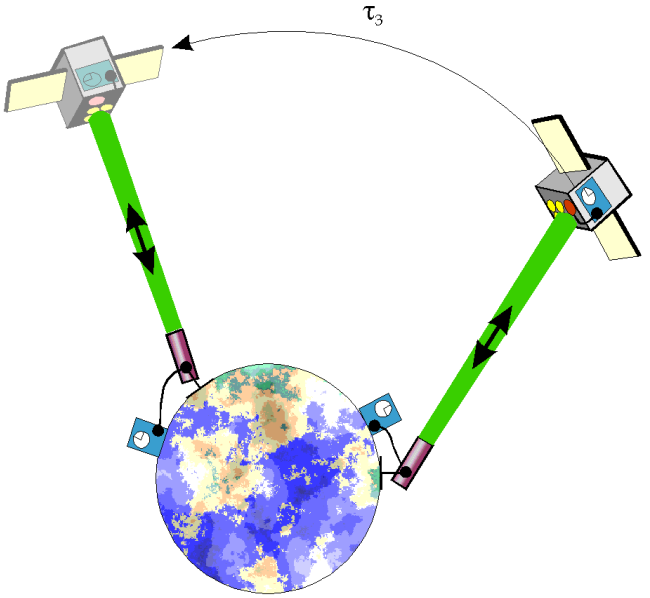


- ⇨ **Energy 400 µJ -> 200 mJ**
- ⇨ **PulseWidth 20 -> 200 ps**

- Comparison between ground to space time transfers coming from the whole laser station network permits to realize ground to ground time transfer

Common view and non common view Ground to ground time transfer





Common View

No noise added from the onboard oscillator

Non common View

Noise added from the onboard oscillator during

Scientific objectives 2012 - 2014

- ✓ **Characterizations of T2L2 ultimate performance**, with contributions of the calibration links of time-frequency RF and of the comparison of cold atom clocks.
- ✓ Measurements around the **Lorentz invariance** and possible **anisotropy of the speed of light**.

- → **Evolution** of the **CMS** and **website T2L2** to set up a **synthetic time scale** production.
- → **Calibration** and **mastery** of configurations of main laser stations.
- → Development and implementation of **architectures** and **signal distribution systems** compatible with **required performance**.

Two Ground to ground Time Transfer Experiments in 2013 - 2014

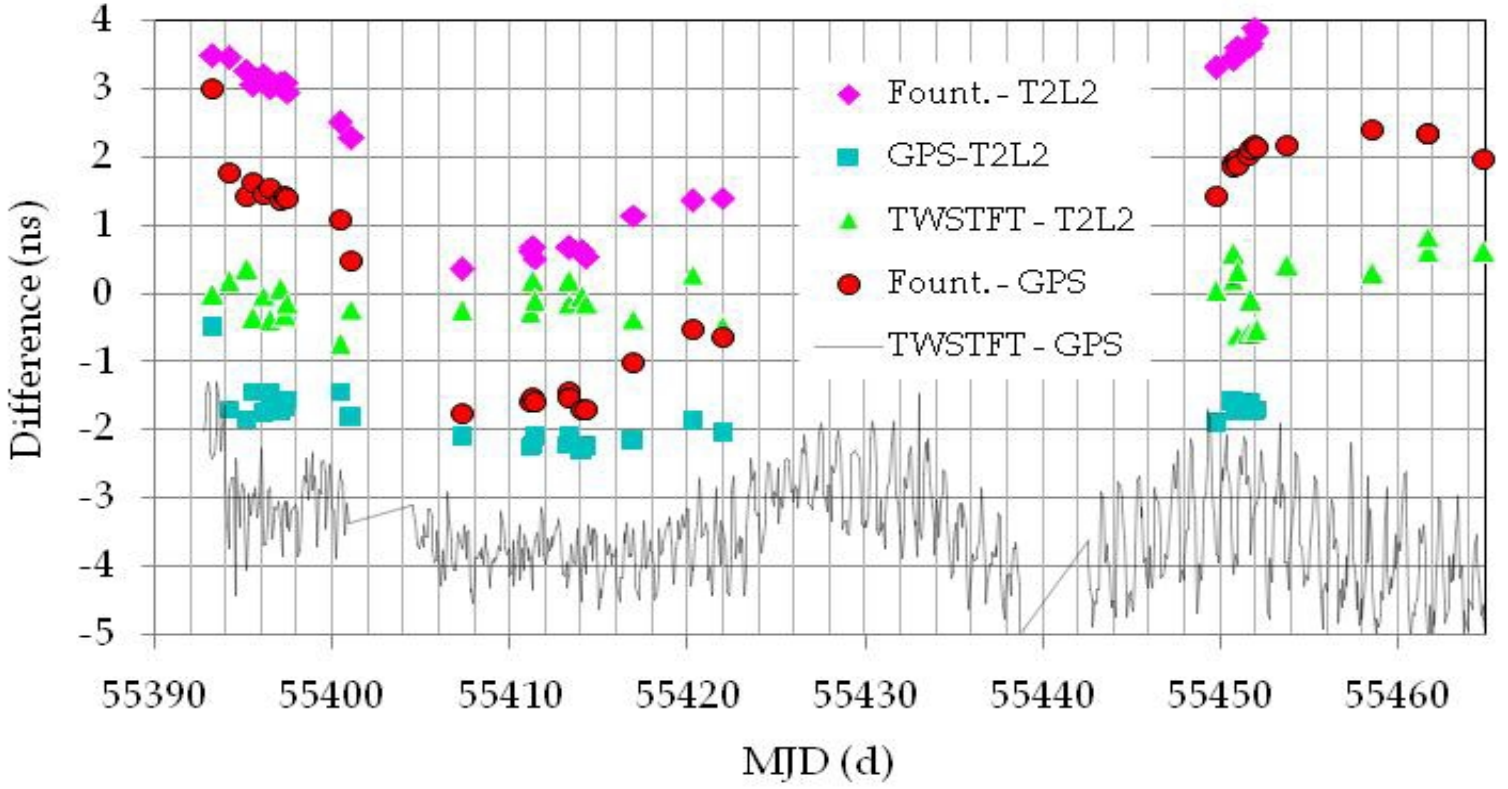
Title	TF link comparison OP-OCA 2013
Objective	Short campaign dedicated to the comparison of time-frequency links on the link OP / OCA
Requirements and constraints	FTLRS review, validation link budget Performance validation maser OCA Time-frequency distribution high performance OCA & OP Calibration Laser, GPS and TWSTFT OCA & OP Agreement to proceed with the DGAC laser shots
Technical Resources	FTLRS station, Calibration of laser stations, GPS and TWSTFT, T2L2 calibration station : STX Clocks signal distribution

Two Ground to ground Time Transfer Experiments in 2013 - 2014

Title	TF link comparison OP-OCA 2014
Objective	Long term campaign dedicated to time frequency common view comparison. The link will be made with 4 stations: OP, OCA, Herstmonceux (UK), Wettzell (D)
Requirements and constraints	Campaign Results 2013 Revision of FTLRS Calibration Laser, GPS and TWSTFT OCA, OP & Wettzell & Herstmonceux Agreement to proceed with the DGAC laser shots
Technical Resources	Station transportable laser FTLRS TWSTFT mobile station needed ? Laser & Herstmonceux station Station Wettzell, T2L2 calibration station : STX Clocks signal distribution

OCA – OP 2010 Campaign:

Residual noise fluctuations of the differences techniques



- calibration of the links not included;
- voluntary offsets applied to facilitate the reading of plots;
- 2 ns fluctuations observed over a 2-month measurement period;
- fountains-masers comparison: significant increase of the noise in the mid-term.