T2L2 /J2: how to distribute the data

**Topic:** C. Instrument Processing (ID 49)

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**ABSTRACT**

The T2L2 (Time Transfer by Laser Link) experiment has been developed by CNES and FOAL and deployed aboard the GMTO satellite. It provides a precise time transfer between Earth observatories where the satellite has a visibility. The experiments on board the satellite are monitored on the ground. This paper aims at describing the complete processing chain from the raw data acquisition to the final phase value. The description includes the various steps of the ground segment, the data processing for both SLR and time transfer, and the final product distribution.

**Principle**

The satellite is a two-way time transfer technique based on the timing of optical pulses sent by an on-board Laser Transmitter and detected by a distributed space-based network of 1 to 2 laser stations (1) T2L2 was not accepted in a previous version of this paper).

The space instrument is based on a photon detector and an actuator linked to the space clock. A Laser Ranging (LR) signal is sent to the laser that produces a laser pulse (2) The on-board clock of the satellite is provided by an atomic clock (3) The clock is distributed to the GNSS receivers onboard the ground stations (4) and satellite (5).

The on-board clock of the satellite is provided by an atomic clock (3) The clock is distributed to the GNSS receivers onboard the ground stations (4) and satellite (5). The ground segments are the network of ground stations on the earth surface responsible for the reception of the photon detector and the determination of the time difference between the satellite and the ground station. The on-board clock (6) is distributed to the GNSS receivers onboard the ground stations and satellite.

The data are transferred between the ground stations and the satellite through the laser link. The data are transferred over 191 links between them, and the results are then sent back to the satellite. The base stations are responsible for the satellite's position and the data are then transferred to the satellite's onboard computer.

**Ground SLR full data**

For the T2L2 experiment, SLR stations are equipped with Full Time ranging data (4) generated on-board the satellite, and a network of ground stations connected to the same tracking center. The ground stations are distributed around the world, providing a global coverage. The data acquisition is performed using a specific equipment. The data is then transmitted to the tracking center where it is processed to obtain the final results.

**47 SLR stations from the EPS network, 14 fixed on Jason2, and 22 stations are regularly sending Full Rate (FR) data for T2L2 (red, SLR stations used the FRD format).**

The SLR station is using a 1-m mirror for the period of time, its level is at around 3.10^{-11} Hz per day.

**OVER 1 PASS: the stability of a ground to space time transfer (1-Maker dock-on-ground) each 6 ps @ 30-60 sec.**

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**CONCLUSION**

The T2L2 (Time Transfer by Laser Link) experiment provides a precise time transfer between Earth observatories where the satellite is visible. The experiments on board the satellite are monitored on the ground. This paper aims at describing the complete processing chain from the raw data acquisition to the final phase value. The description includes the various steps of the ground segment, the data processing for both SLR and time transfer, and the final product distribution.

**REFERENCES**

2. CNES Report, 2013, 12, 060009