Grasse topographic survey & time scale distribution between the different geodetic technics on ground

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Géoazur

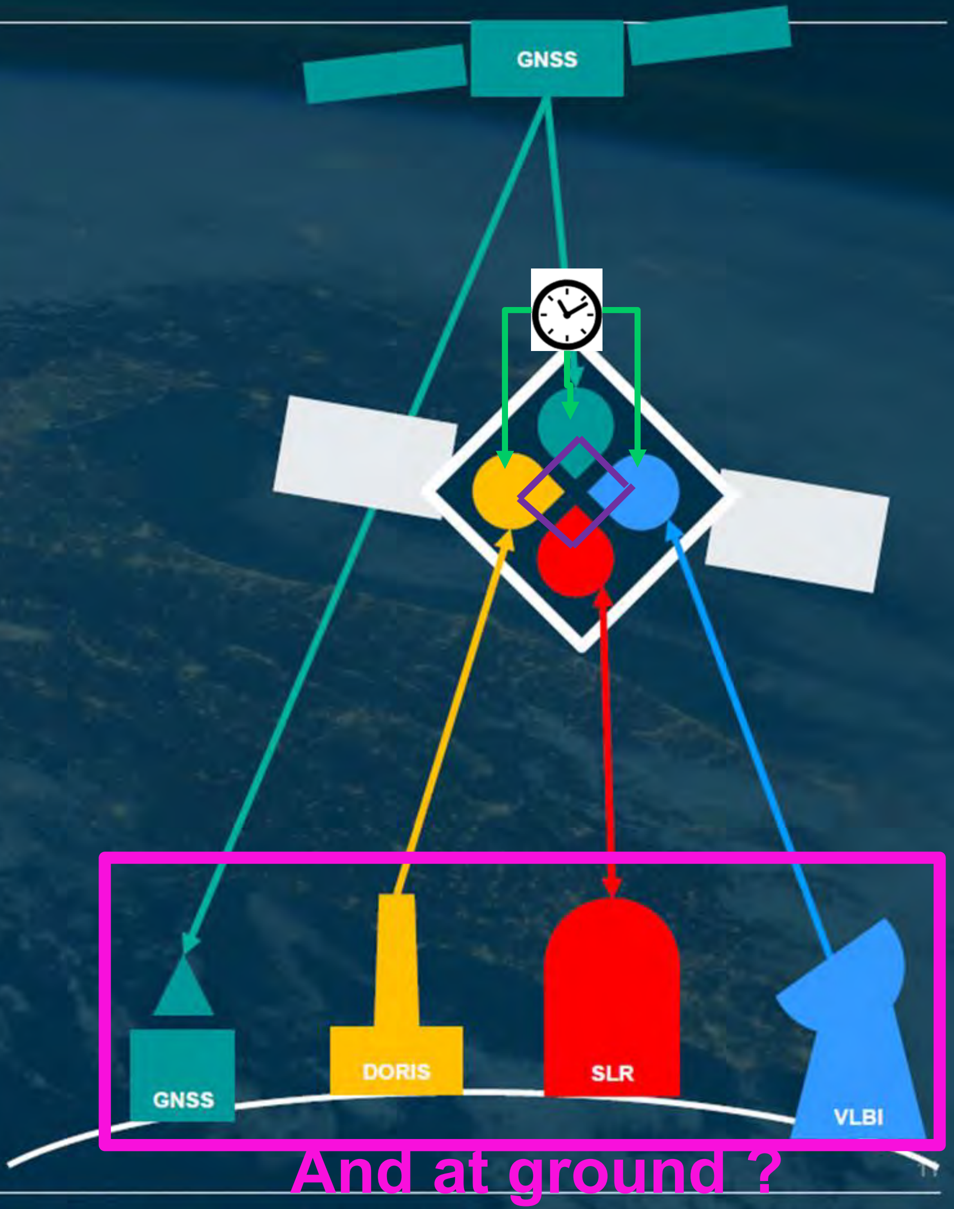
GENESIS Satellite and Payload Overview

Description

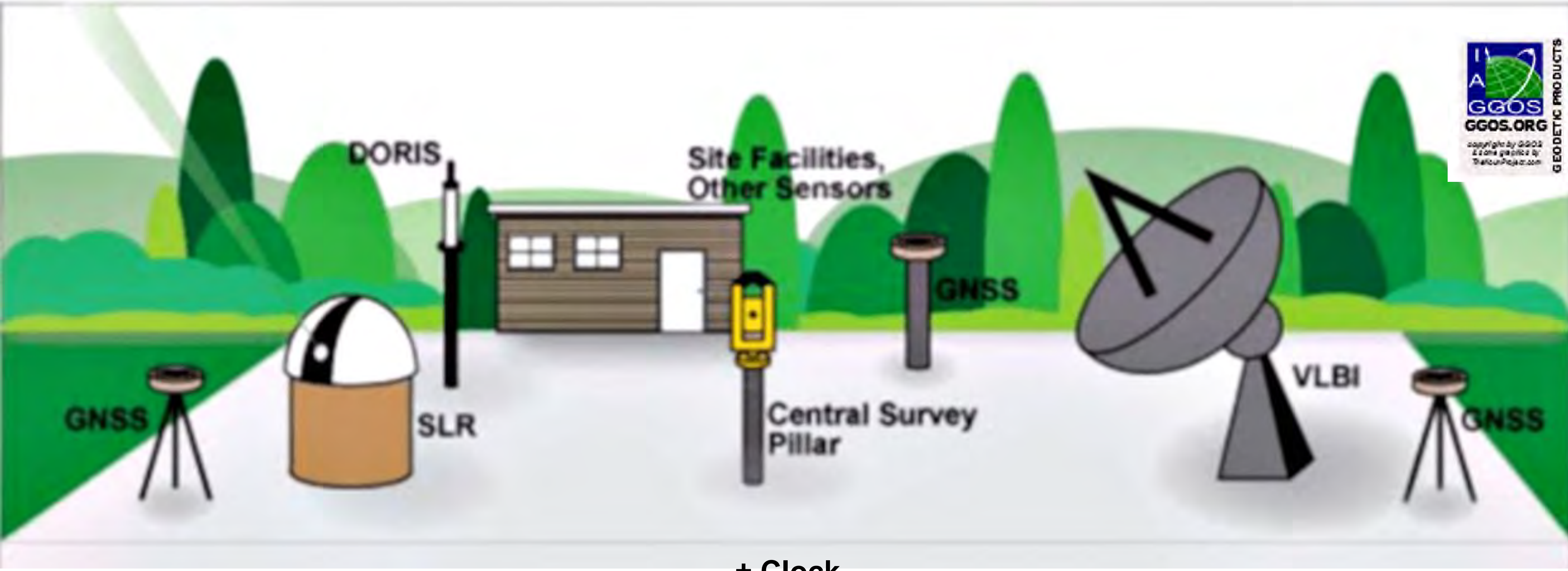
- Single satellite ~250-300kg, ~6000km alt. (MEO), ~95º inclination
- Platform: maximum reuse of qualified equipment
- Payload: 4 co-located instruments (GNSS, DORIS, SLR, VLBI)

Points of attention at satellite and payload level:

- Radiation environment: total dose and single events effects
- Radiofrequency and electromagnetic compatibility of VLBI
- Non-gravitational forces: mechanisms, geometry, materials...
- Spacecraft centre-of-mass and attitude law
- Synchronisation of active instruments to the on-board oscillator
- On-board instruments systematic biases and their calibrations: phase centres + group delays



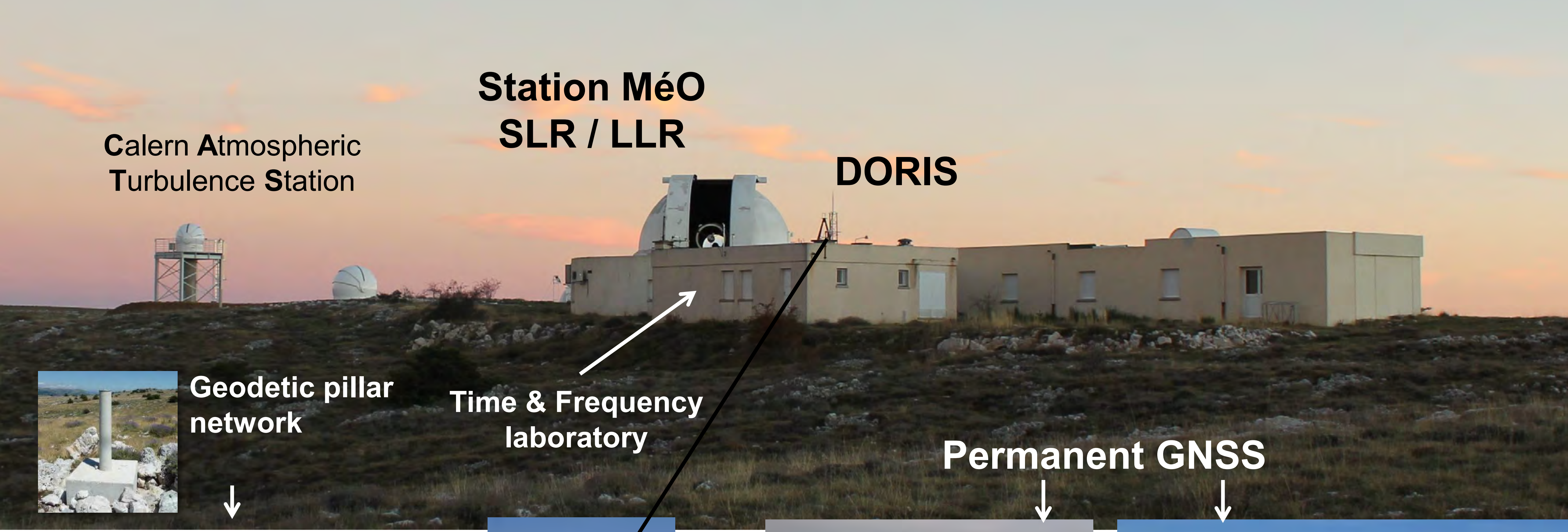
What is a multi-technic geodetic observatory?



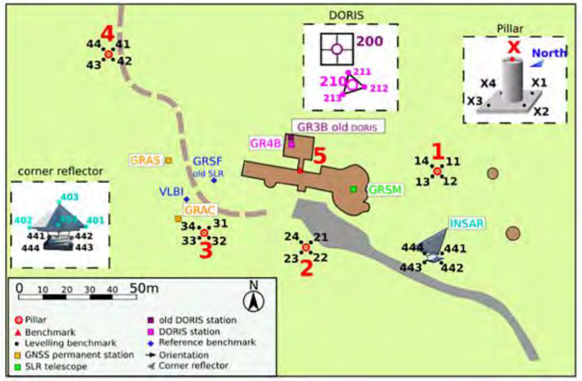
+ Clock

GNSS, VLBI, DORIS, SLR => time & frequency metrology

Grasse multi-technic geodetic observatory



Topographic survey– IGN



Topographic survey at Grasse and location of the telescope's axis intersection

Collaboration IGN-ENSG-Geoazur

Barneoud et al., REFAG 22

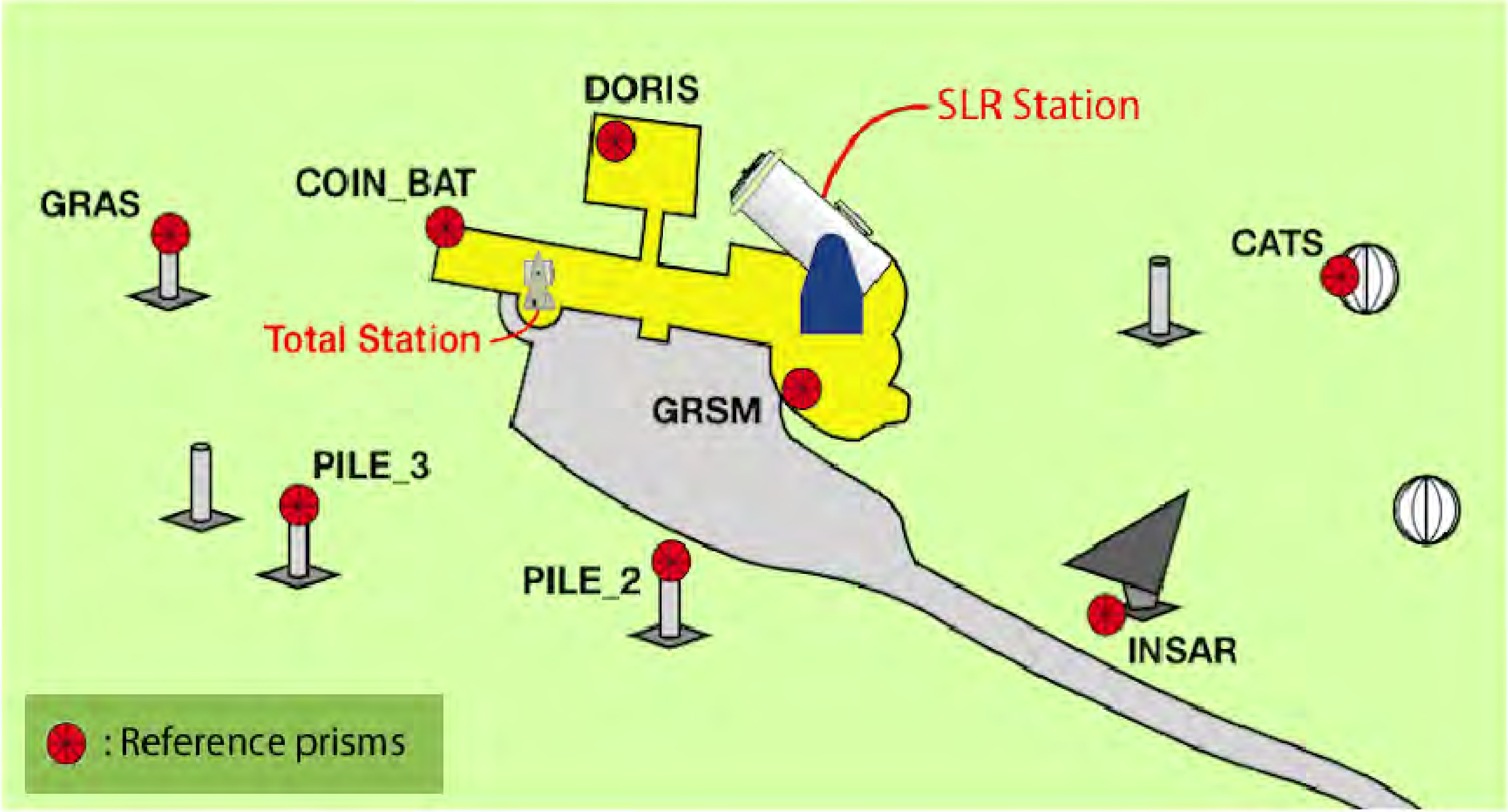


Fig.1 Overview of the Grasse co-location site configuration during a local tie survey.

Absolute Topographic Survey => 1 time/year done by IGN

Location of the telescope's axis intersection

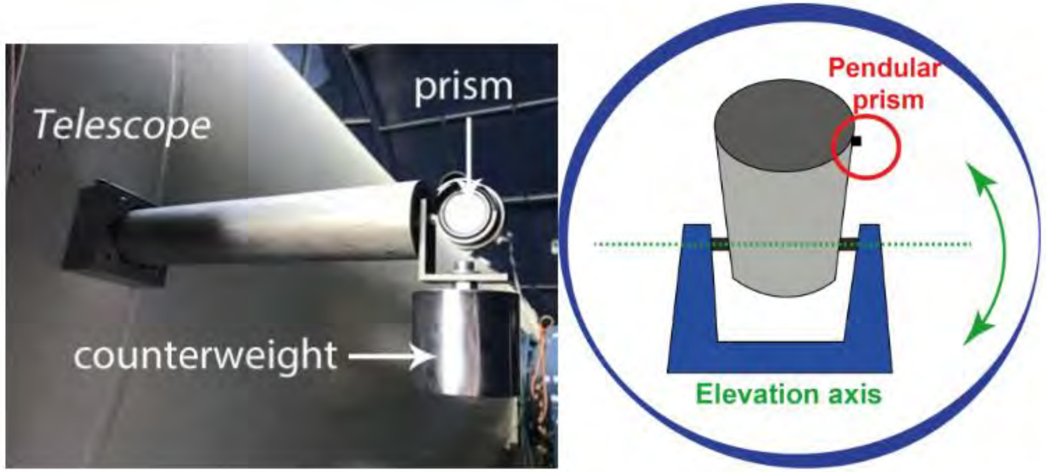


Fig. 3 *Setup of a pendular prism on the telescope (left) and global view during rotation along the elevation axis (right).*

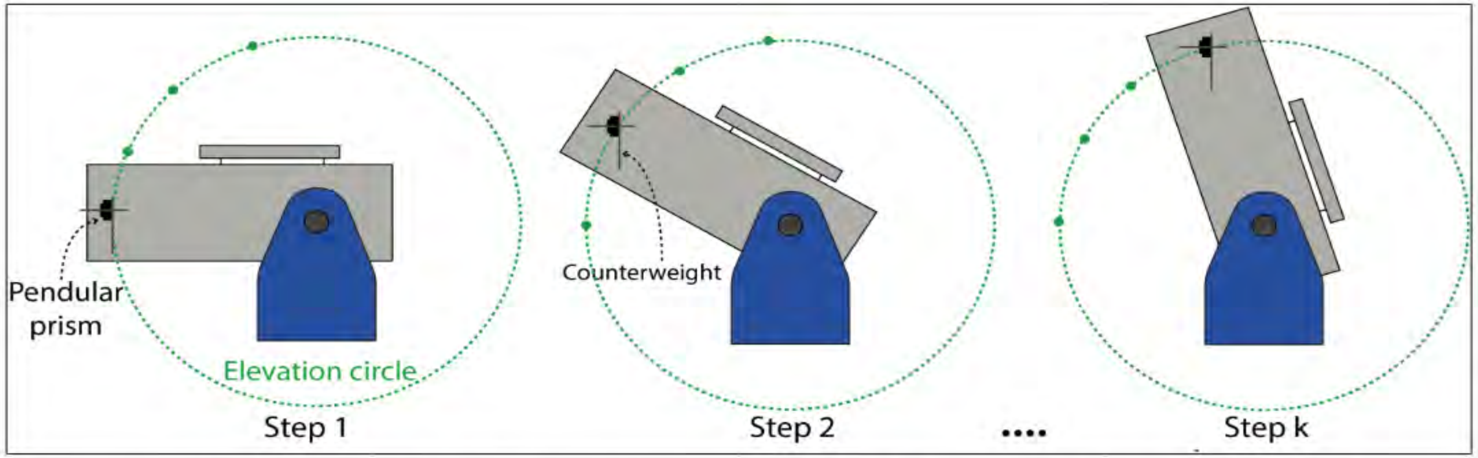


Fig. 4 *Steps of elevation circle measurements. Thanks to counterweights, the pendular prism always faces the total station.*

Location of the telescope's axis intersection

Survey of the relative SLR reference point location with an accuracy below one millimeter => one time/day

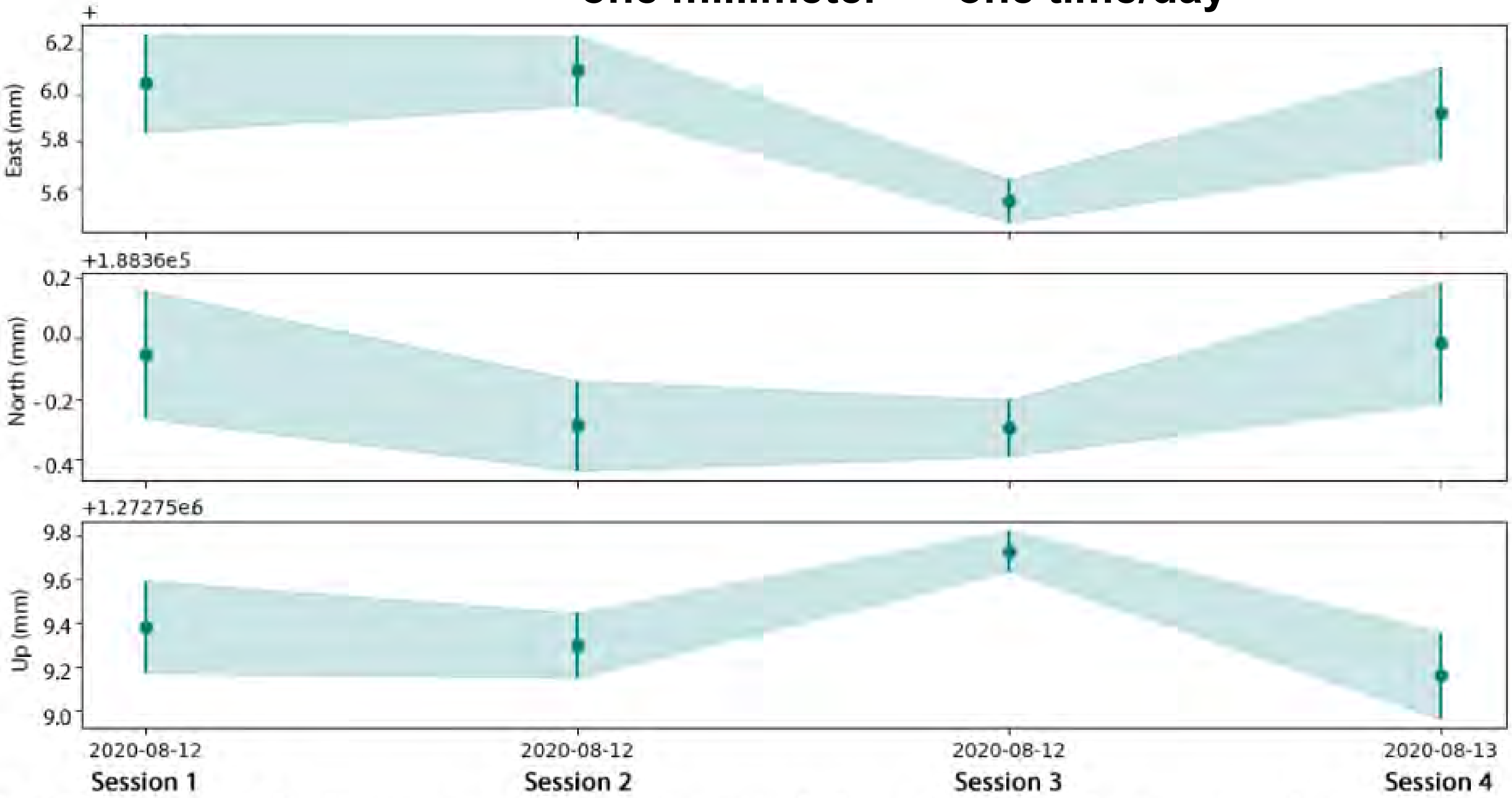
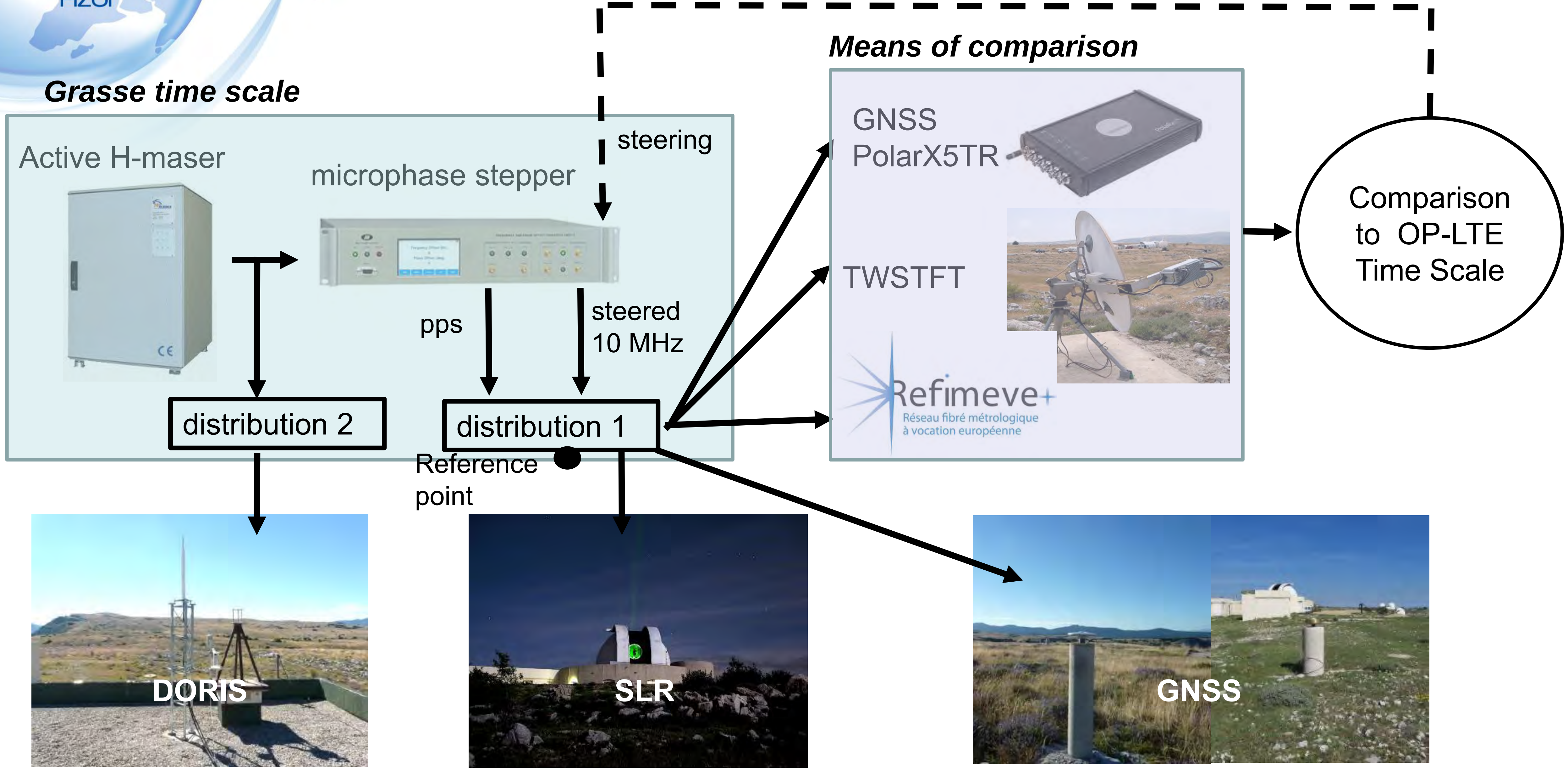


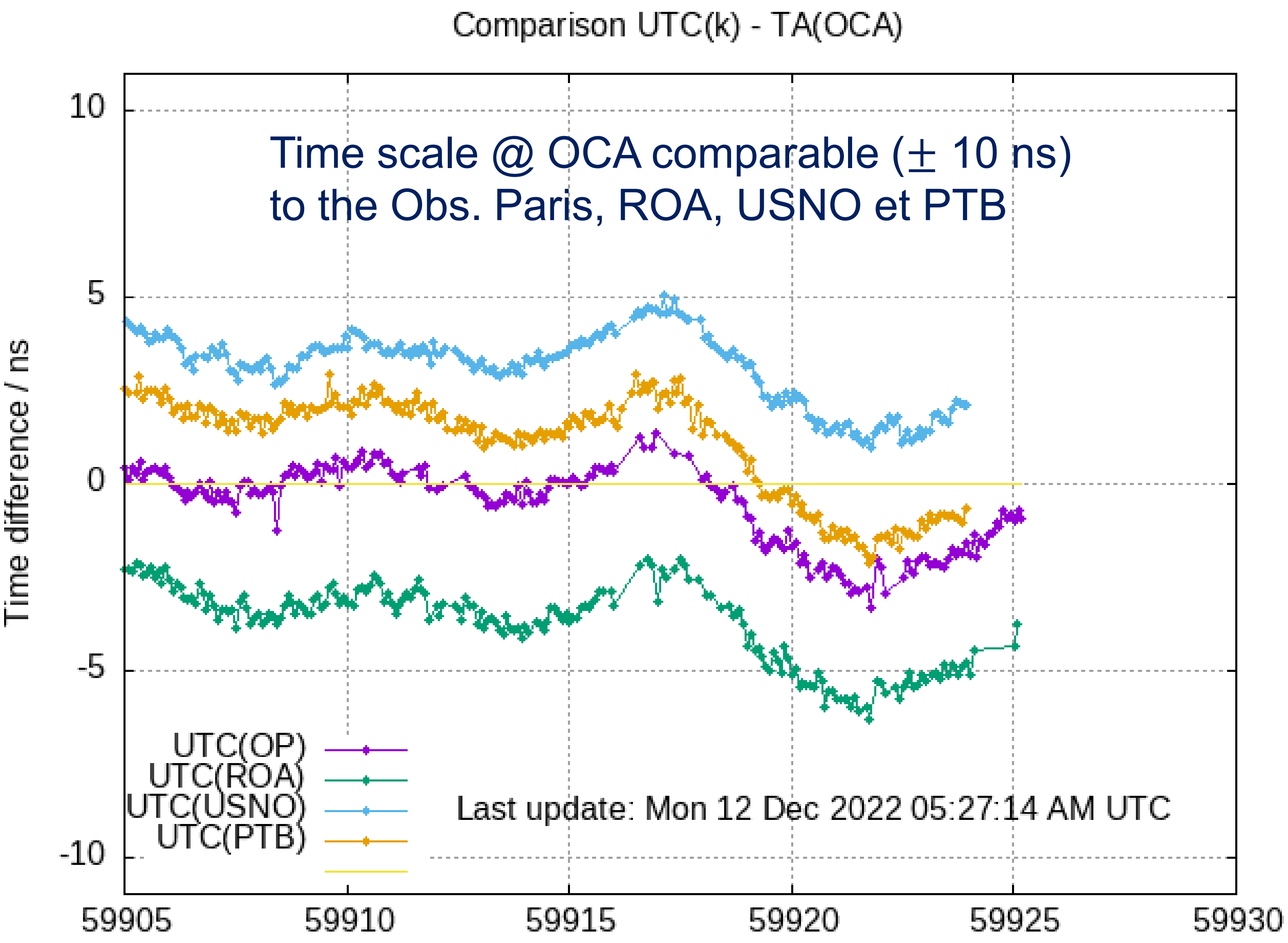
Fig.8 *Computed SLR reference point coordinates provided in a local coordinate system during different measurement sessions.*

Barneoud et al., REFAG 22

Grasse Time scale comparison & distribution

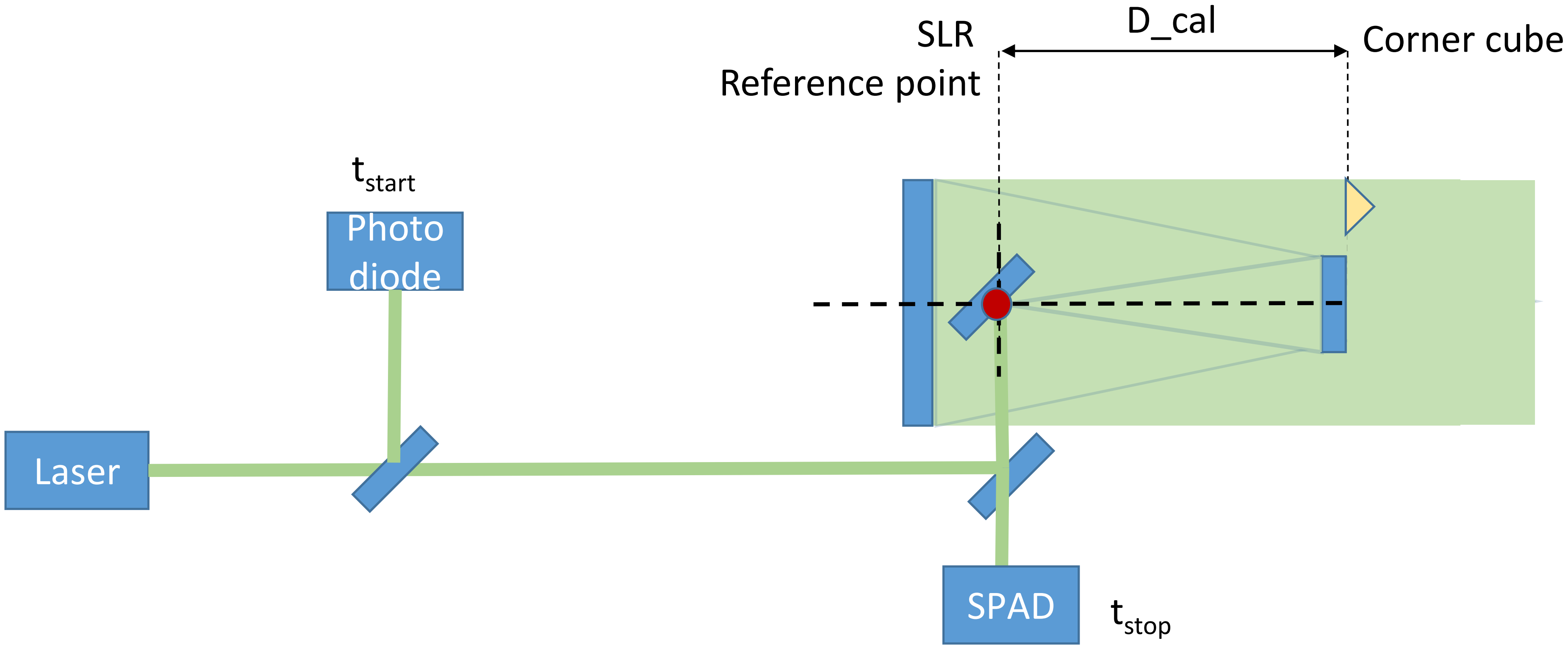


Grasse Time scale comparison with National Metrologic Institute



How to link reference point of the geodetic technic to the local time scale reference point ?

- Example in SLR: classical calibration vs time calibration



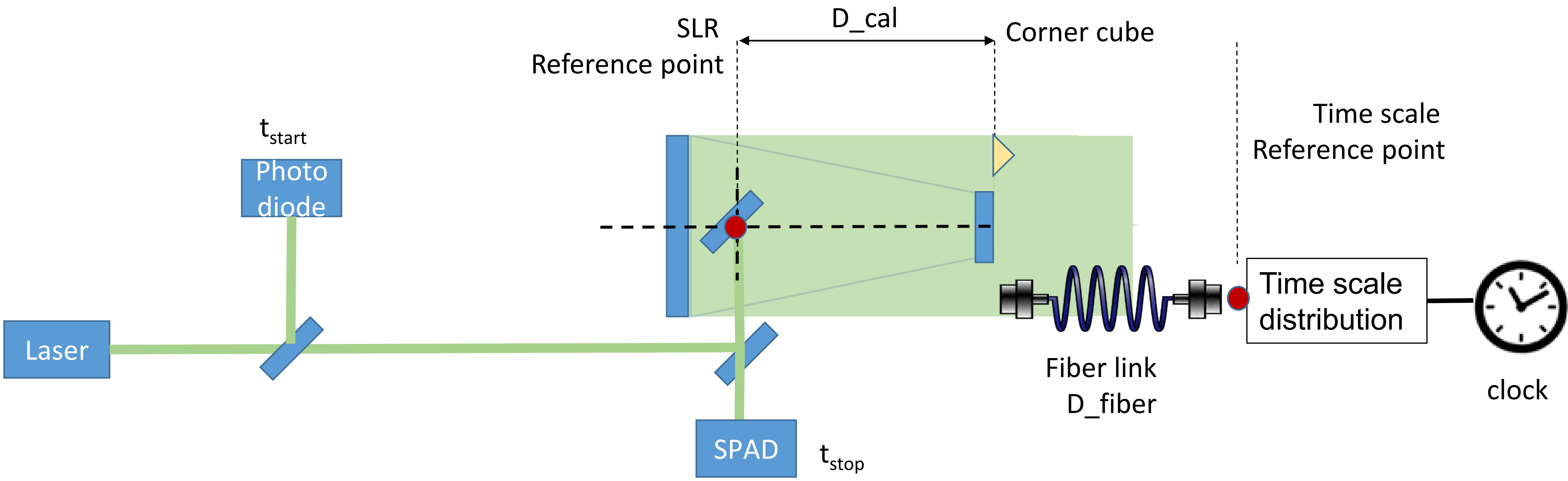
2 x D_cal = ToF(t_{stop}-t_{start}) – delays

⇒ Time of Flight measurement = relative measurement

Done & shared by all the SLR stations

How to link reference point of the geodetic technic to the local time scale reference point ?

- Example in SLR: classical calibration vs <u>time calibration</u>

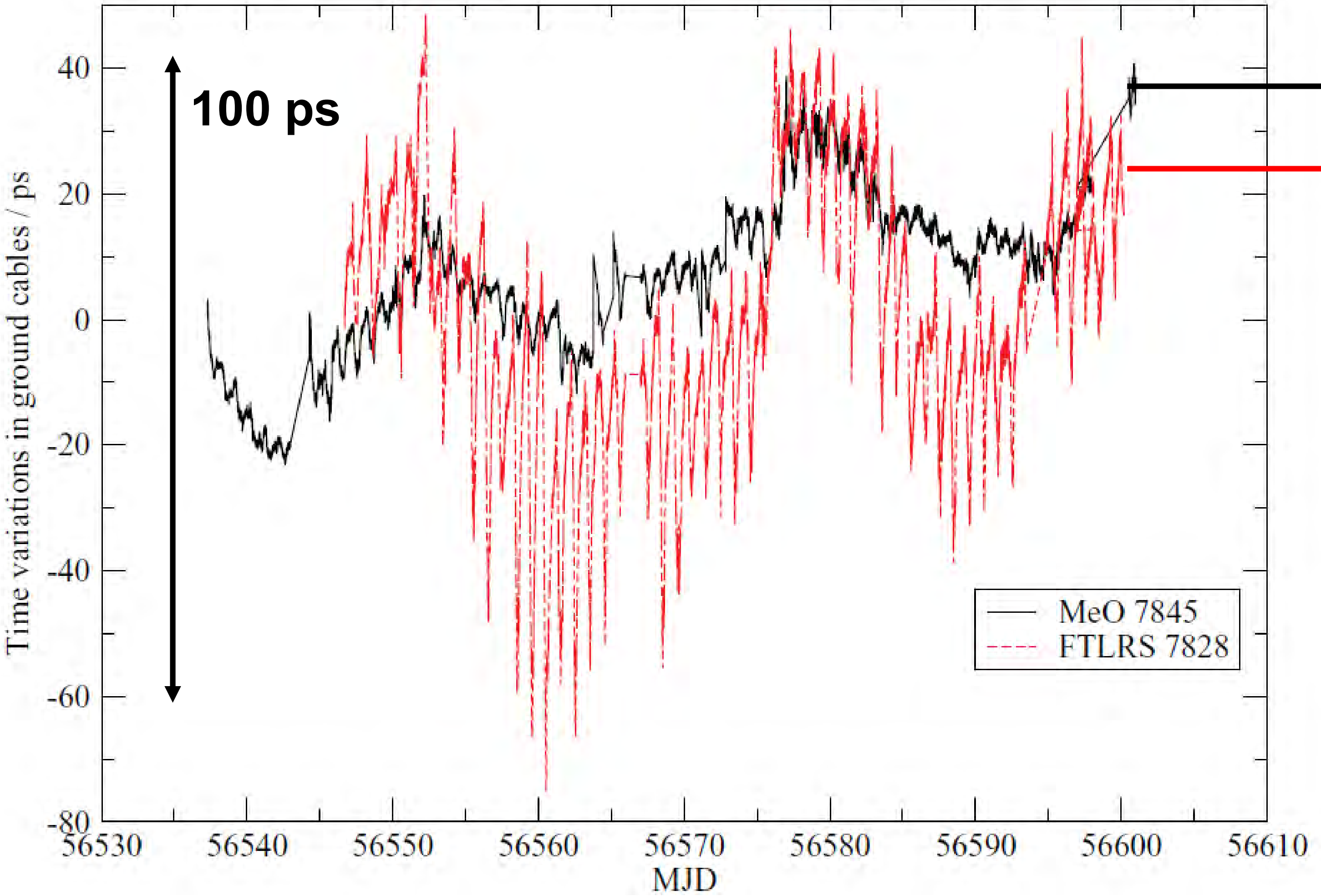


Time calibration

⇒ Determination of the absolute delays between the SLR reference point and the time scale reference point

Not done and not shared by all the SLR stations

Time scale distribution
=> output from the T2L2 experiment



inside building

outside building

=> The time scale distribution should have to be monitored

Exertier et al., metrologia, 2017

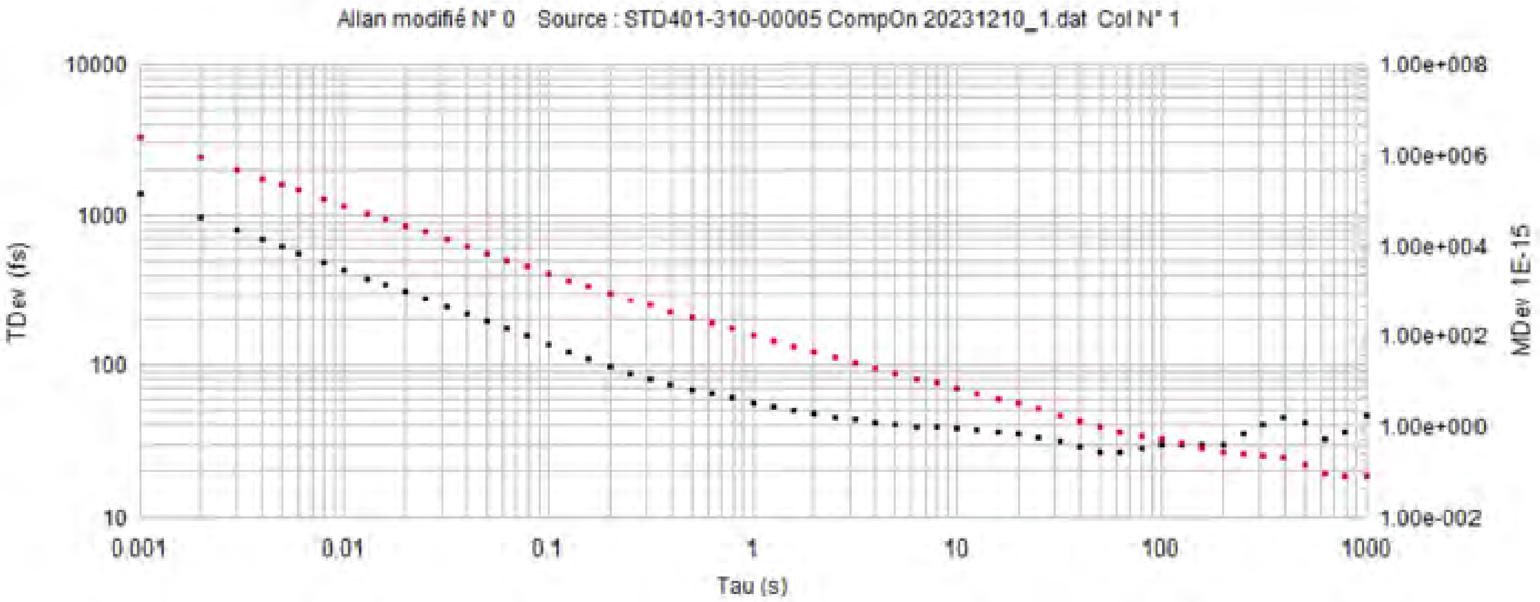
Time scale distribution at Grasse

STD-401-310
Synchronous fibered distribution unit

2.2 Caractéristiques générales

Les caractéristiques attendues sur l'ensemble du système avec des conditions thermiques stabilisées à 1 degré sont les suivantes :

- Cadence des signaux min : 0
- Cadence des signaux max : 50 MHz
- Incertitude : < 2 ps RMS
- Stabilité : < 1 ps @ 1000 s
- Dérive : < 2 ps sur 1000 s
- Déclenchement sur front de monté ou front de descente
- Durée des pulses min : > 200 ps
- Nombre de canaux : 1
- Distance min : 1 m
- Distance max : < 20 km
- Seuil de détection réglable indépendant pour chaque cana
- Impédance d'entrée : 50 Ω



Ground topographic survey and time scale distribution

OPEN QUESTIONS :

- What periodicity of the topographic survey is required on ground during the GENESIS operation ?
- Are the daily relative topographic survey relevant data to share ?
- Which time/frequency architecture should be preferred on ground ?
- Synthonisation or synchronisation ?
- Is it necessary to calibrate group delays between techniques?
- Is it necessary to survey the frequency/time distribution ?

Thanks for your attention