DORIS missions and system status

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DORIS MISSIONS

Today 6 satellites contribute to IDS / 13 missions have contributed since 1990

- **SENTINEL 3A (GMES)** : 814km, 98.6° **February 16th 201**6 ➔2023
- **JASON3** **(Eumetsat/NOAA/NASA/CNES) : 1336 km, 66° January 17th 2016 ➔ 2021**(DGXXS+LRA+GPS)
- SARAL (CNES/ISRO): 800km, 98.5° February 2013 → 2018 (DGXX+LR)
  ➔ Since July 4th, "SARAL-DP" mission on an orbit increased by + 1km
- HY2-A (CNSA, NSOAS): 960km, 99° August 2011 → (DGXX+LRA+GPS)
- CRYOSAT-2 (ESA): 717 km, 92° April 2010 → end 2017 (DGXX + LRA)
- JASON2 (**Eumetsat/NOAA/NASA/CNES**): 1336 km, 66° June 2008 → 2017 (DGXX+LRA+GPS)
  ➔on interleaved orbit since October 12th

Many future missions

- Sentinel 3B**,** AIT on going — end of 2017 (7 years)
- Sentinel 3C, 3D — 2020, 2025 (7 years)

DORIS instrument development on going

- HY2-C : DORIS contract signed between TSA and NSOAS — 2019
- HY2-D : DORIS contract will be signed in June 2017 — 2020 (3 years)
- HY2E-F-G-H : to be confirmed — 2024

- JASON-CS1/ SENTINEL 6A (Eumetsat/NOAA) — end 2020 (7 years)
  JASON-CS2/SENTINEL 6B — 2025 (7 years)

DORIS instrument development on going

- SWOT (NASA/CNES) : 970km, 78° — 2021 (3 years)

DORIS instrument development on going

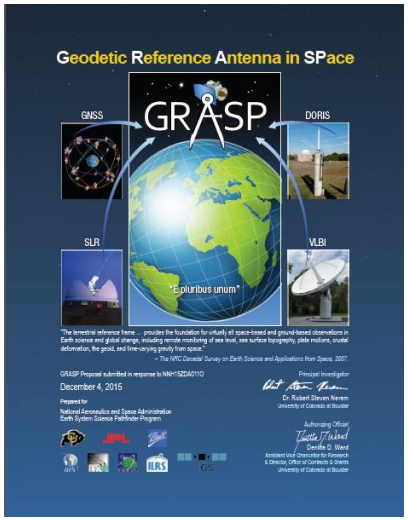
- GRASP **(**NASA Earth Venture Mission-2) — 2020
  - TriG/SLR/VLBI
  - Orbit: 925 – 1400 km, 100.2 deg., sun-synchronous

- E-GRASP/Eratosthenes (ESA Earth Explorer-9 mission) : Phase 0 — **2024**
  - Payload: GNSS/DORIS/SLR/VT/µSTAR/T2L2
  - Orbit: 6450 – 7800 km, 6.4 deg.
  - Or 933 – 7200 km, 116 deg., sun-synchronous

Satellite-VLBI mission projects

aiming at improving TRF to a precision of 1 mm and a stability of .1 mm/yr and homogenizing TRF/CRF/EOP

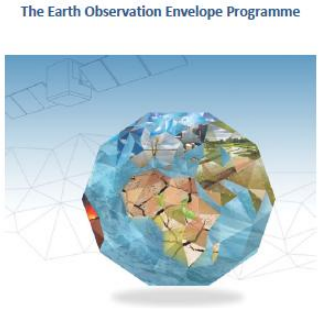
- **GRASP**
  - NASA Earth Venture Mission-2 (2020)
  - Payload: GNSS/SLR/VT (+ DORIS in TriG?)
  - Orbit: 925 – 1400 km, sun-synchronous
  - Submitted on December 4, 2015

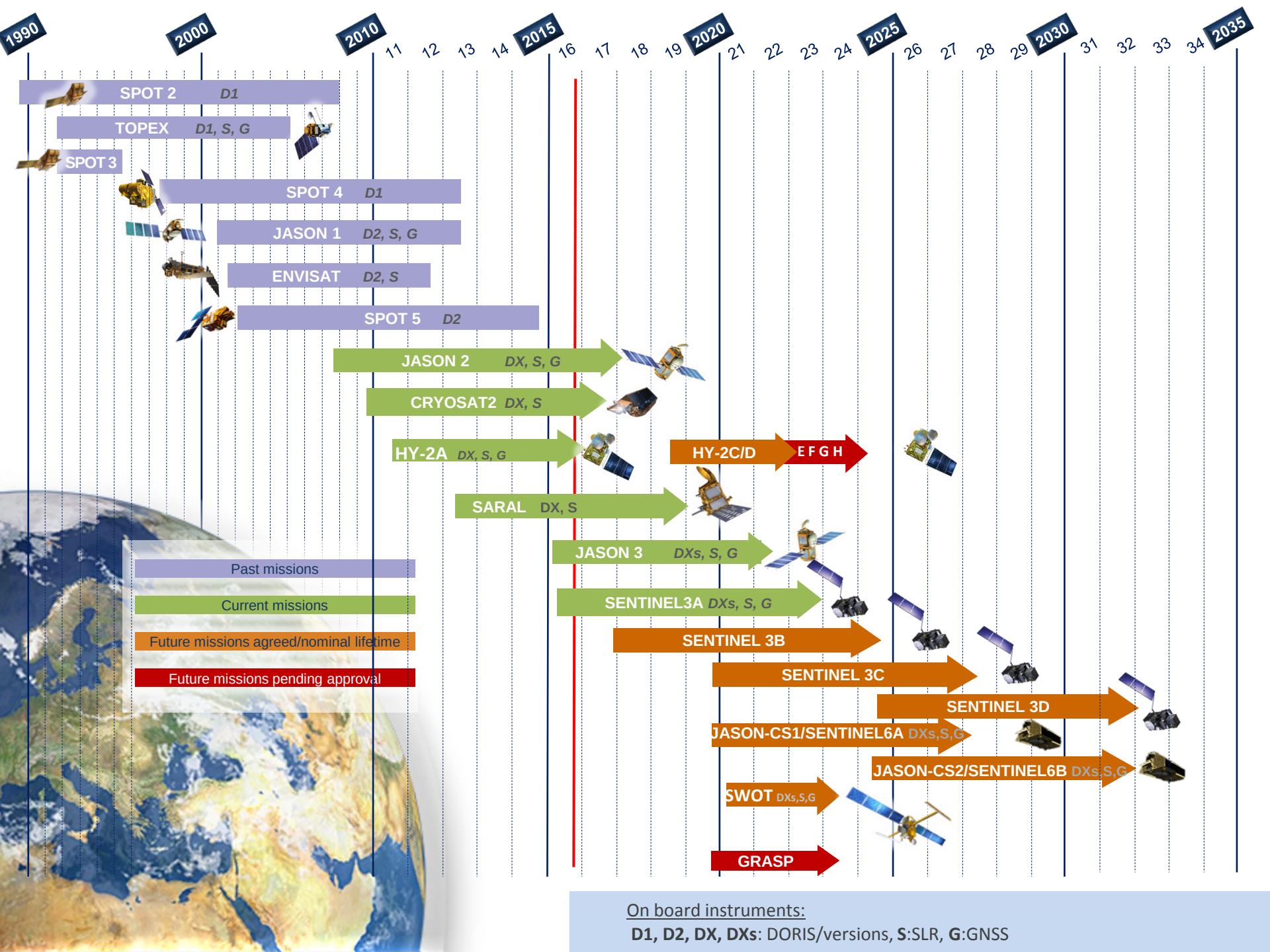


- **E-GRASP/Eratosthenes**
  - ESA Earth Explorer-9 mission (2024)
  - Payload: GNSS/DORIS/SLR/VT/T2L2 (+ µSTAR?)
  - Orbit: 762 – 7472 km, 63.4 deg.
  - Submitted on June 24, 2016

esa

ESA/EXPLORER/EE-9
November 2015





On board instruments:

D1, D2, DX, DXs: DORIS/versions, **S**:SLR, **G**:GNSS

DORIS / Jason-3

- DORIS initialization and in-orbit assessment : 0 DORIS anomaly, DORIS used as GPS Laben back-up
- SALP Hand-over successful (August 2016)

- USO and Radiations : sensitivity is stronger than Jason-2, much weaker than Jason-1 (10x less).
  - No impact on altimeter measurement,
  - Almost no impact on orbits (bypass exists, A. Couhert),
  - Impact on SAA stations localization (IDS). Correction by a model TBD should minimize.
  - Redundant USO probably as sensitive.

DORIS / Sentinel-3A

- Station acquisition : 0 DORIS anomaly
- In-orbit assessment OK
- SALP Hand-over planned soon (December 2016)
- USO sensitivity to Radiations :
  - probably present as the quartz comes from the same batch as Jason-3,
  - but not detected yet, as SAA is less active than for Jason (the orbit is lower)
  - Orbits accuracy OK at centimeter level, station localization OK

Latest news on DORIS DATA

- **Jason3:** reached its final orbit on February 12th, the DORIS DATA have been available since February 17th (cycle1) :
  - DORIS-RINEX only (NO DORIS2.2)

- **Sentinel3A**: reached its final orbit on March 2, 2016 and all DORIS data have been available since then.
  - DORIS-RINEX only (NO DORIS2.2)
  - 24µs time bias in RINEX-DATA data recently corrected➔ reprocessing of all data soon available at IDS.

- **Jason2**: manoeuvers between October 2 and October 12 to reach the interleaved orbit wrt Jason3 ➔ No DORIS orbit and no DORIS2.2 data delivered during this period (only DORIS-RINEX)

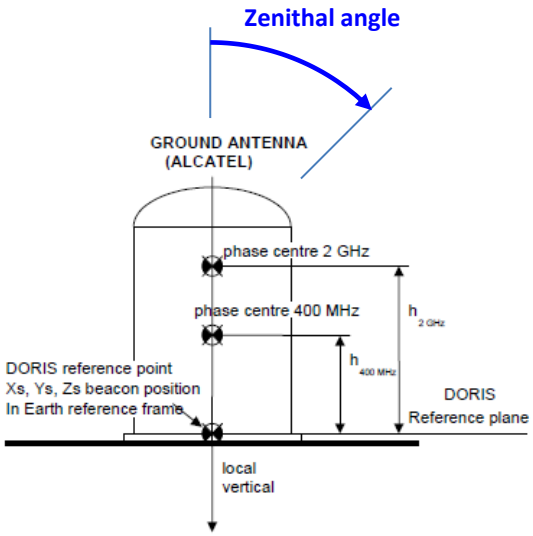
Fourth generation Beacon B4G

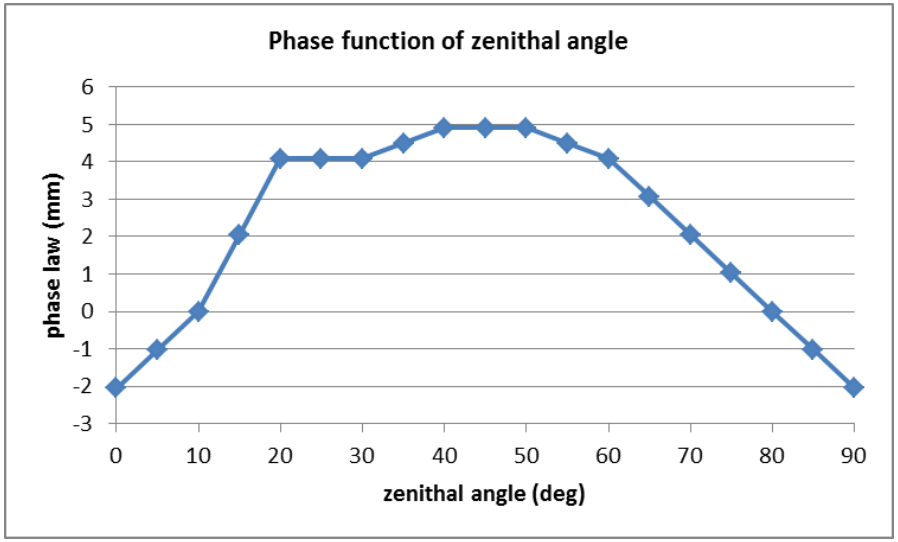
- **Designed to be operational up to 2030**
  - New electronic (with up to-date components)
  - Better masks clearance expected thanks to longer distance between beacon and antenna (up to 50 m)
  - Already integrated in existing system

- **Schedule :**
  - Kick off of developement in March 2016
  - PDR successful in July 2016
  - CDR planned for the beginning of 2017
  - Production of prototype unit October 2017
  - Pre-production unit May 2018
  - First production units April 2019

Radio frequency characterization of ALCATEL DORIS ground antenna

- **Objective :**
  - Define the phase center and the dispersion of ALCATEL Antennas,
  - Measure the phase evolution and if needed determine the phase law.
- **Available data on IDS website (antex file)**
  - 2GHz phase center : $h_{2\ GHz}$ = 510 mm (± 5 mm)
  - 2Ghz phase law : magnitude = 7 mm

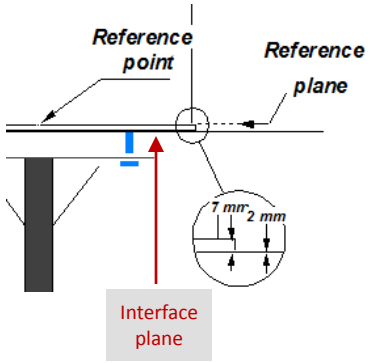


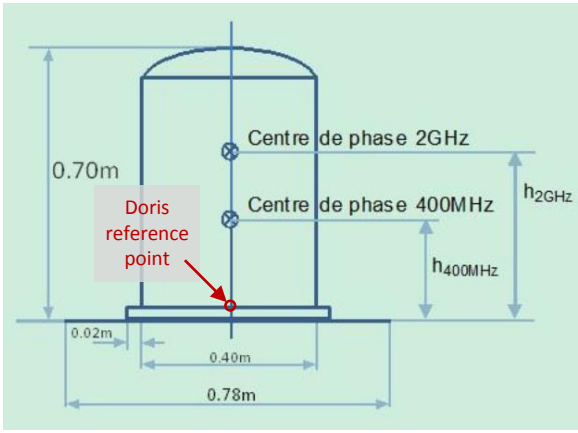


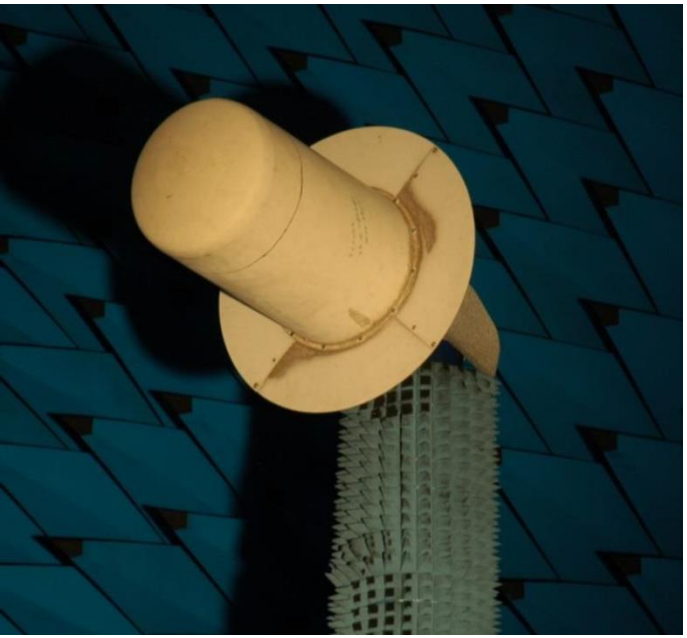
Alcatel Antenna

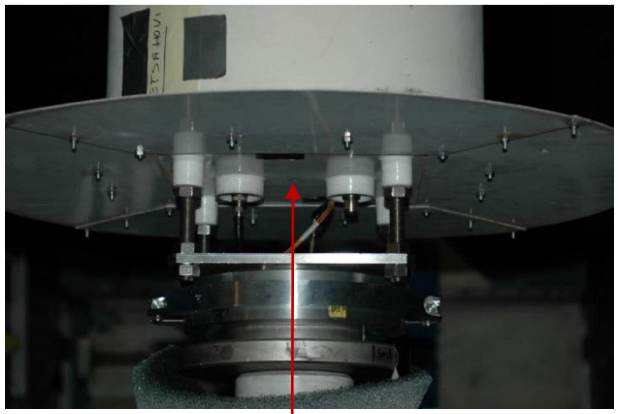
Radio frequency characterization of ALCATEL DORIS ground antenna

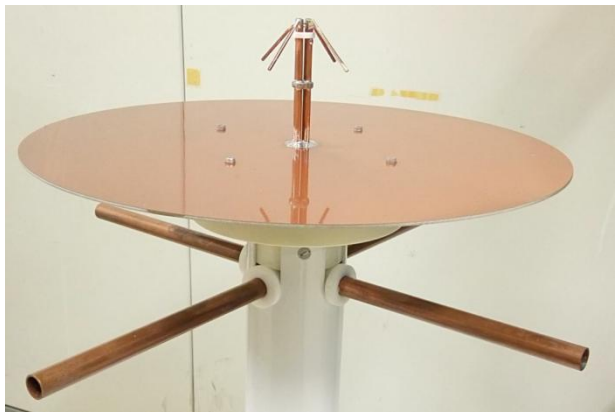
- **Five Alcatel ground antenna have been characterized at CNES compact antenna test range (CATR) with cooperation of antennas measurements team** (D.Belot, L.Feat (CNES), A.Durand (Intespace)
  - Serial number : 17, 47, 53, 58 et 66
  - The reference point used during test correspond to the interface plane 5 mm below, and not the DORIS reference plane.





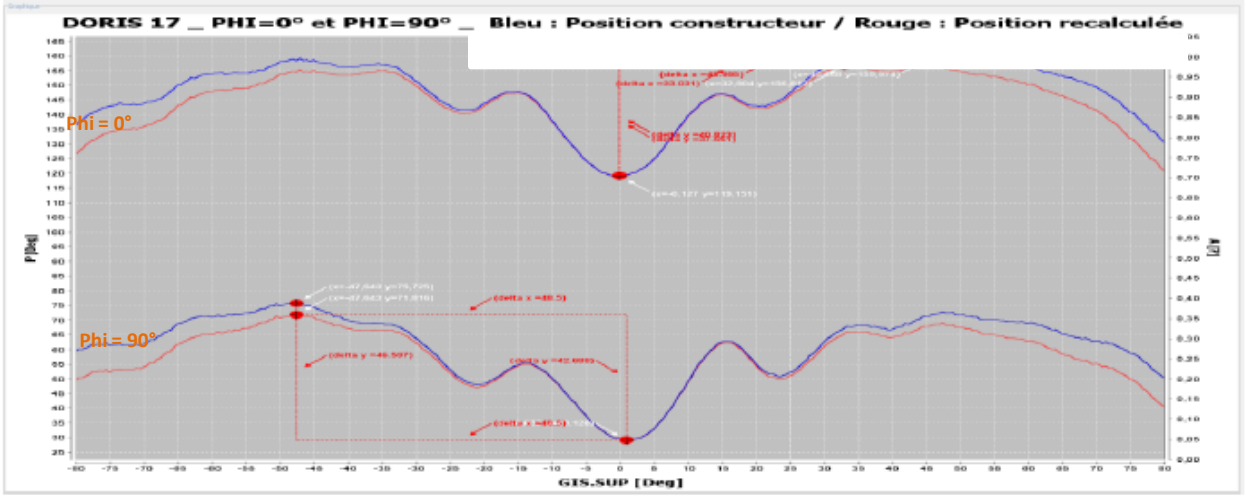


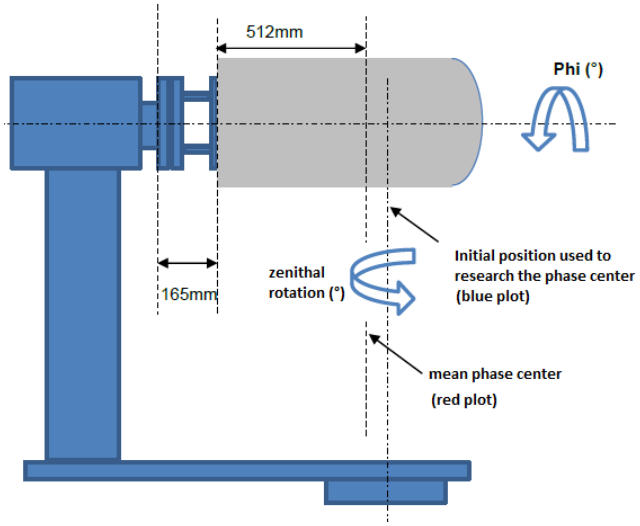


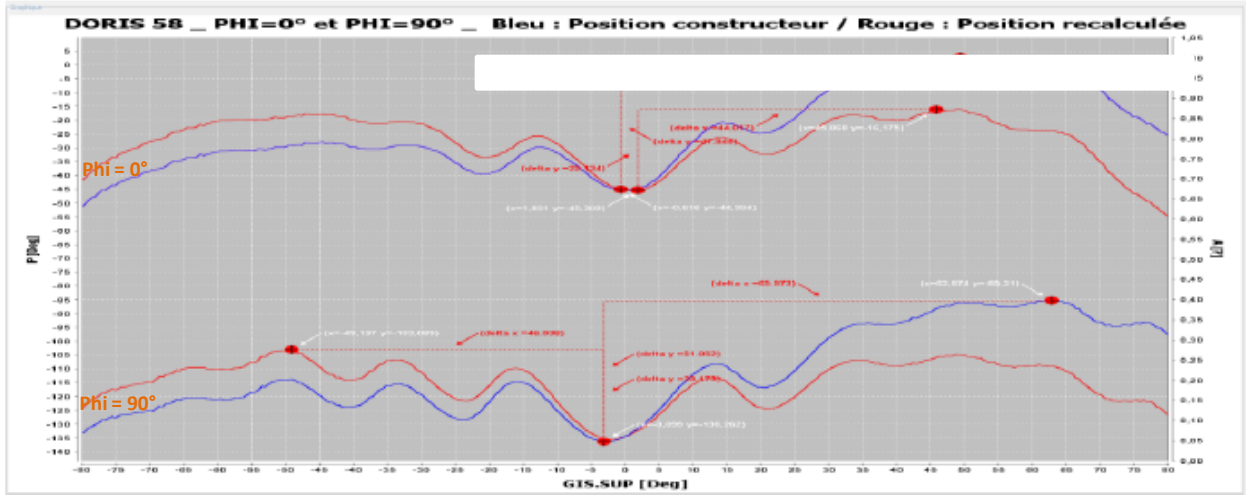


Radio frequency characterization of ALCATEL DORIS ground antenna

- **Measures of phase evolution, function of the zenithal angle for ±80° range (phi = 0° and phi = 90°)**







The original position is 517mm from the interface plane (blue curves) ➔ 512 mm from the reference plane
The modified position is 512mm from the interface plane (red curves) ➔ 507 mm from the reference plane

Radio frequency characterization of ALCATEL DORIS ground antenna

Synthesis

	Antenna				
	N°17	N°47	N°53	N°58	N°66
Phase center position, phi =0° (mm)	512	514	514	517	513
Phase center position, phi =90° (mm)	512	508	509	514	508
Average (mm)	512	511	511.5	515.5	510.5
maximale variation of the phase, phi = 0° (deg)	37.6	30.6	30.1	29.1	32.4
maximale variation of the phase, phi = 90° (deg)	42	34.3	33.9	33.1	36.1
maximale variation of the phase (mm)	17.2	14.0	13.9	13.5	14.8

➔

Average	
512.1 mm	± 4 mm

➔ **Position from the interface plane :** 5 mm have to be deduced to get the positon from the reference plane.

- The mean position (507.1 mm ± 4 mm) from the reference plane is closed to the antenna specifications (510 mm± 5 mm).
- The phase variation is bigger than expected. (up to 17.2 mm compared to 7 mm).
- The phase law curve is significantly different from the phase law defined in the IDS documentation.
- The IDS phase law could be replaced by the mean of the measures. The dispersion, function of the zenithal angle, could be evaluated. This decision implies to apply the measures of 5 antennas for all ALCATEL antennas.

THANK YOU

FOR YOUR ATTENTION