SWOT VALIDATION MEETING

RECONSTRUCTED ATTITUDE VALIDATION

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CONTENT

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RECONSTRUCTED ATTITUDE - STATUS

- Star trackers and Gyro inputs : global assessment
  - STR – Nominal , no STR heads change of configuration in mission mode (required for optimal performance stability)
  - Gyro - Nominal, GYRO2 was turned off during 7 days following the spacecraft DIST4 onboard card anomaly (radiations effect), on Sept. 21st, 2023
  - Gyro calibration management and analysis
    - Principle : 2 rotations per axis (30° around X/Z, 22,5° around Y), 9 hours induced unavailability
    - Latest calibration done on May 4th, 2024
      - Low evolution observed wrt previous Gyro calibration, due to GYRO2 OFF/ON in September
      - To be confirmed with next Gyro calibration at same beta, to be scheduled early in October, no impact on performance
  - Expected frequency : ≈ 1 / year @same beta angle

- ATTD_RECONST : global assessment
  - Nominal behavior for forward processing at D+1
  - Routine processing implemented also at D+7 to manage potential late arrival of telemetry files (Ground Stations or SSR)
  - No performance degradation after a data gap
  - A monthly ATTD summary is exchanged with ADT/CNES team to point out any outfit that could affect final product

RECONSTRUCTED ATTITUDE : OPERATIONAL PRODUCT STATUS AND NEXT

Several updates were made since launch, after iterations with JPL team

Latest operational ATTD_RECONST PGE is Version 4.5 , with the main following updates

- Introduction of a permanent OH2 alignment compensation in order to consider the OH1 as the reference, even when using the OH2 data in the attitude estimation (OH = Optical Head)
- Use of filtered GYRO data instead of the raw GYRO data with an adapted time shift

Next version will contain

- Algorithm refinement : implementation of a ½ gyro sample shift in the attitude reconstruction (as recommended by JPL)
  - PGE deployment expected before September 2024. Will be used for next reprocessing campaign
  - No impact on nominal performance (small improvement is observed during specific SADM rotation)
- Routine operations
  - Monitoring of the quality of the attitude reconstruction and performance of the Multi Head STRs / GYRO measurement
    - Use of ATTD_EXPERT outputs -> dedicated expert product to monitor and quantify the estimation quality
    - Daily statistics estimation and storage (e.g. evolution as a function of beta angle)
    - Automatic report generation and alarm diffusion to the attitude product expert
  - Gyro calibration monitoring

RECONSTRUCTED ATTITUDE : EXAMPLE OF PERFORMANCE

- Routine behavior example : **very weak perturbation along the orbit**

Scale ≈ 30 asec (≈ 8 mdeg)

1 day

ATTD data PSD (Use of filtered GYRO data)
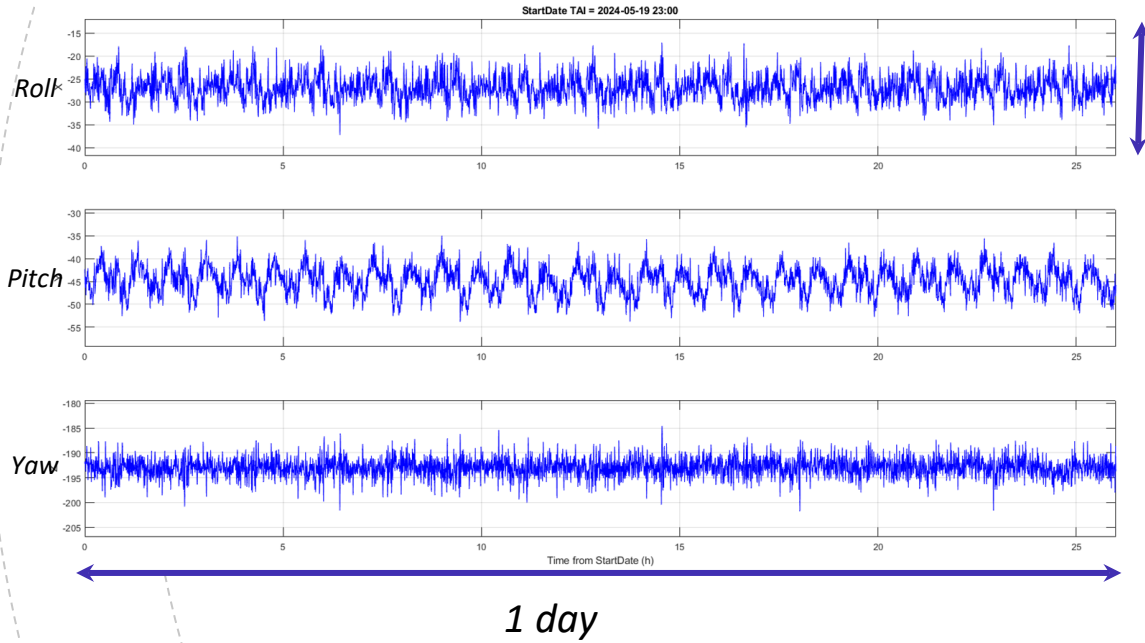
These plots show time series and spectrums of the difference between the estimated attitude of KMSF and the reference target attitude

Nota : the black PSD lines show just for information the ground attitude requirement (as it is applicable to the difference between the estimated attitude and the real attitude, which is unknown in flight)
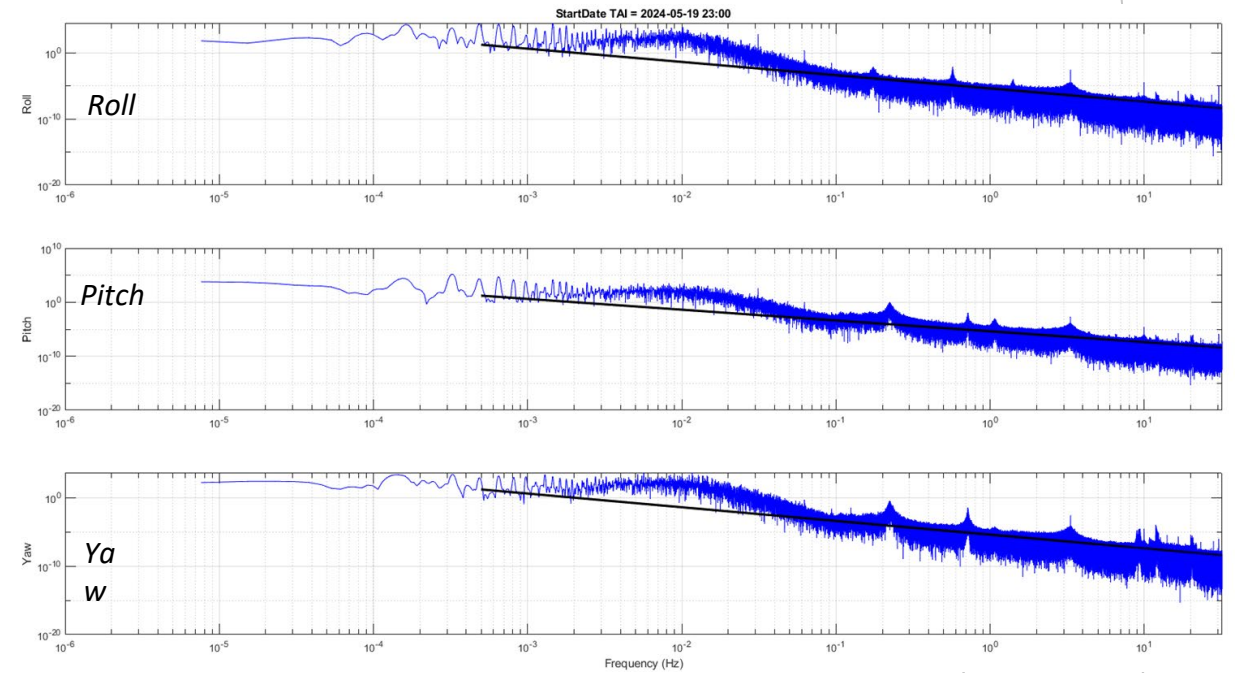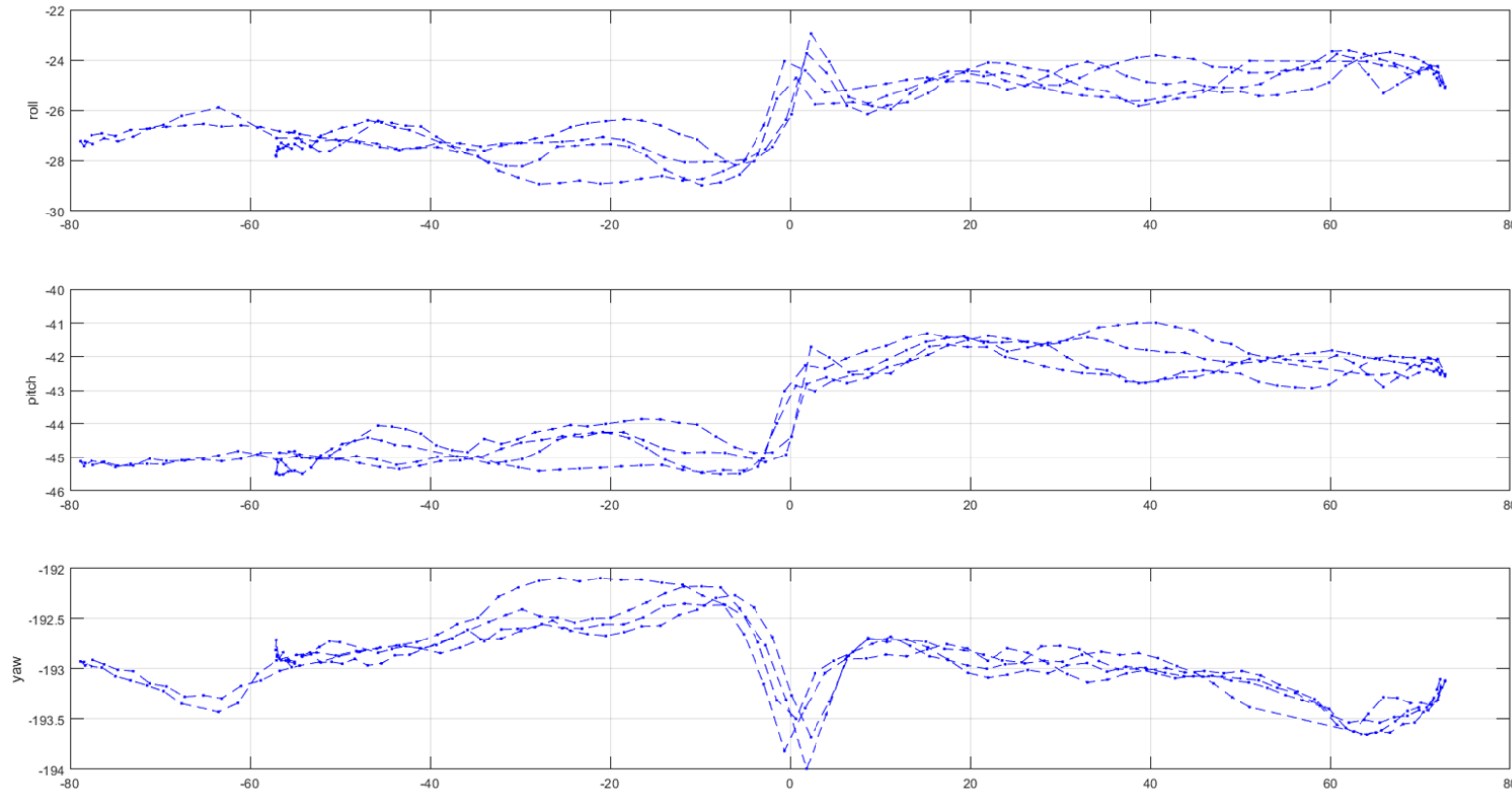
RECONSTRUCTED ATTITUDE : EXAMPLE OF PERFORMANCE

- Routine behavior statistic : **Very good stability for same Beta values**
  - ≈ +/-2 arcsec discrepancy for different Beta due to thermoelastic effects, and corrected for by XOVER_CAL module

Mean estimated mispointing error (KMSF wrt target) in arsec as a function of Beta angle (science orbit)

CONCLUSION

- On board measurements (STR and GYRO) and Ground attitude reconstruction are fully nominal

- Robustness of the ATTD_RECONST algorithm has been consolidated to cope with data gaps or latencies that can occur

- Algorithms updates have been decided and validated jointly with JPL KaRIn team

- Output attitude analysis by expert
  - No significant perturbation in mission mode
  - Perturbations are as expected or lower than anticipated during orbital events
  - Any specific features would be pointed out to CNES ADT team as a warning on Ocean and Hydro data analysis
  - Ground attitude outputs are very stable

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