First POD Results on Sentinel-6A
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INTRODUCTION

1. STC/NTC Configuration
2. First Comparisons to Orbits from ESOC
3. Clocks Analysis
4. SLR Calibration & Validation
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1. STC/NTC CONFIGURATION

- **Operational processing**
  - *POE-F dynamic and measurements standards* (e.g., same as Sentinel-3A/B and Jason-3).
    - Nominal attitude (negligible impact of measured quaternions).
    - Updated Solar Radiation Pressure macromodel (IDS box-wing) with respect to ESA/ESTEC Sentinel-6 POD Context.

**FIGURE**: Daily CR estimates from ESOC.
1. STC/NTC CONFIGURATION

- **Operational processing**
  - STC/NTC DORIS+GPS reduced-dynamic orbits (Galileo not used in the operational orbits).
  - No fixing of GPS ambiguities (not yet possible with the operational RINEX files).
  - Adjusted GPS PCO in all three directions (no PCV map).
  - Updated DORIS PCO: +10 mm in Y and +32 mm in Z directions (w/o solving for station heights).
  - Similar SRP mismodeling signature observed in Y (common X and Z signals to be explained).

**FIGURE**: Daily estimated Galileo (left) and 10-day estimates of DORIS (right) PCO.
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2. **First Comparisons to Orbits from ESOC**

- Comparisons to independent GPS+Galileo solutions from ESOC (Cycle 001)

**Figure:** CY001 CNES POE-F DORIS+GPS - ESOC GPS+Galileo.

![Graphs showing comparisons between CY001 CNES POE-F DORIS+GPS and ESOC GPS+Galileo](image-url)

- Radial component (RMS = 0.84)
- Along-track component (RMS = 2.31)
- Cross-track component (RMS = 0.79)
2. First Comparisons to Orbits from ESOC

- Comparisons to independent GPS+Galileo solutions from ESOC (Cycle 002)

**Figure:** CY002 CNES POE-F DORIS+GPS - ESOC GPS+Galileo.
2. First Comparisons to Orbits from ESOC

- **SLR validations (Cycles 001-002)**
  - *8-station Core-Network (CN): Yarragadee, Graz, Greenbelt, Matera, Maui, Herstmonceux, Hartebeesthoek, Zimmerwald.
  - **RMS of SLR CN residuals above 70 degree elevation.

<table>
<thead>
<tr>
<th>Orbit solutions</th>
<th>SLR CN* residuals (RMS)</th>
<th>High-elevation** SLR residuals (RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CY001</td>
<td>CY002</td>
</tr>
<tr>
<td>ESOC Galileo</td>
<td>1.26 cm</td>
<td>1.39 cm</td>
</tr>
<tr>
<td>ESOC GPS+Galileo</td>
<td>1.04 cm</td>
<td>1.32 cm</td>
</tr>
<tr>
<td>ESOC GPS</td>
<td>0.90 cm</td>
<td>1.24 cm</td>
</tr>
<tr>
<td>CNES POE-F DORIS+GPS</td>
<td>0.77 cm</td>
<td>1.25 cm</td>
</tr>
</tbody>
</table>

**Figure**: SLR residuals RMS for CNES POE-F DORIS+GPS and ESOC GPS/Galileo.
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3. **CLOCKS ANALYSIS**

- **Context**
  - Analysis of the Sentinel-3A, Sentinel-3B and Sentinel-6A clock behavior:
    - for the *SAA effect* (clock and/or frequency),
    - for the altimeter processing (Sentinel-6A case, comparison with DORIS frequency estimations).
3. **CLOCKS ANALYSIS**

- **Sentinel-3A**

**Figure:** Sentinel-3A's clock as seen by GPS.
3. Clocks Analysis

- Sentinel-3B

**Figure**: Sentinel-3B's clock as seen by GPS.
3. CLOCKS ANALYSIS

 Sentinel-6A

**FIGURE**: Sentinel-6A’s clock as seen by GPS.
3. Clocks Analysis

 Sentinel-6A

**Figure**: Sentinel-6A’s USO frequency as seen by DORIS and GPS.
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4. SLR CALIBRATION & VALIDATION

- **ILRS SLR mission support**
  - 15 SLR stations *interleaved* since the beginning of the Sentinel-6a/Jason-3 tandem phase.
  - Frank Lemoine (NASA/GSFC) sent a message to the ILRS stations on March 02, 2021 reminding them of the need to interleave tracks and to otherwise alternate whole tracks, pass-by-pass.

**Figure:** Yarragadee SLR station interleaving between Jason-3 and Sentinel-6a.
Hemispherical orbit/altimeter bias between Sentinel-6a and Jason-3? High-elevation interleaving SLR residuals could help identifying the origin of this bias.

**Figure**: Residual difference of SSH between Jason-3 and Sentinel-6a.
4. SLR CALIBRATION & VALIDATION

- SLR (at orbit level) versus tide gauges (at sea level)
  - Only 7 stations interleave at high elevations.
  - Yarragadee only has enough passes above 70° elevation angle \(\Rightarrow\) no clear systematic differences between Jason-3 and Sentinel-6a CNES POE-F orbits.

**Figure:** Yarragadee SLR station interleaving passes above 70° elevation angle.