S6 P4 GPP: The Sentinel-6 Poseidon-4 Ground Processor Prototype

New simulation results

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ABSTRACT

Sentinel 6/Jason-CS Poseidon 4 is an operational oceanography programme of two satellites that will ensure continuity to the Jason series of operational missions. Sentinel-6 builds on heritage from the Jason series of ocean topography satellites and from ESA's CryoSat mission. This new mission is designed to complement ocean information from Sentinel-3.

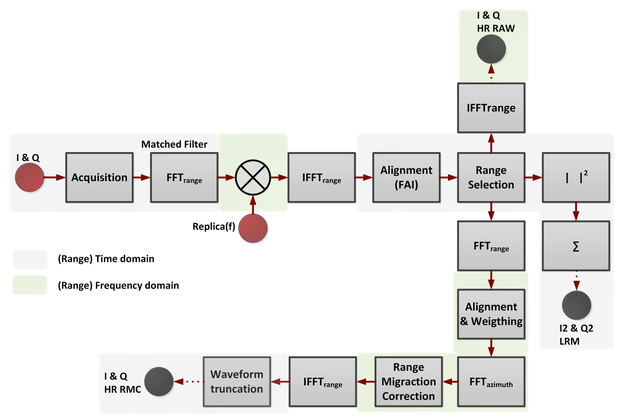
This poster provides a review of the architectural and algorithmical implementation of the Sentinel-6 Poseidon-4 Ground Prototype Processor (GPP), stressing how this processing chain has been adapted to the new characteristics of the Poseidon-4 instrument and the related implications. The operation of the GPP is demonstrated with new simulated data, up to date with the last instrumental configuration.

A preliminary validation of the GPP is included, based on the geophysical retrievals processor implemented by isardSAT in the frame of the Sentinel-6 GPP project. This processor integrates a fully analytical high-resolution (HR) or SAR ocean retracker based on Ray et al. 2015 model and adapted to the new Sentinel-6 Poseidon-4 characteristics.

INSTRUMENT:
CONFIGURATION & CHARACTERISTICS

Dual-frequency radar altimeter: Ku-band (Surface height measurements) and C-band (ionospheric corrections)

Interleaved Ku-band **mode** operation: near continuous transmission of Ku-band pulses. It allows the simultaneous operation of the low resolution mode (LR or LRM) and high resolution (HR or SAR).



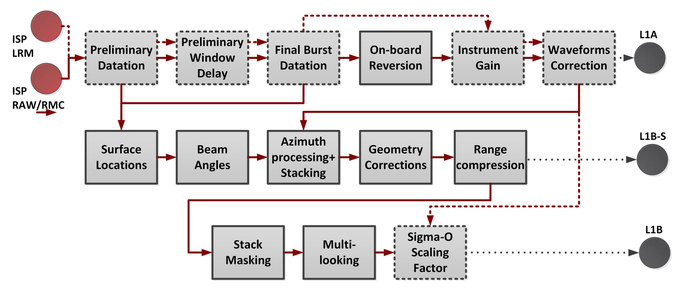
On-board digital processing and architecture:

- Matched filter digital operation instead of analog-based de-ramping
- On-board range migration correction to reduce amount of data to download

GPP PROCESSOR

Integrates different processing chains:

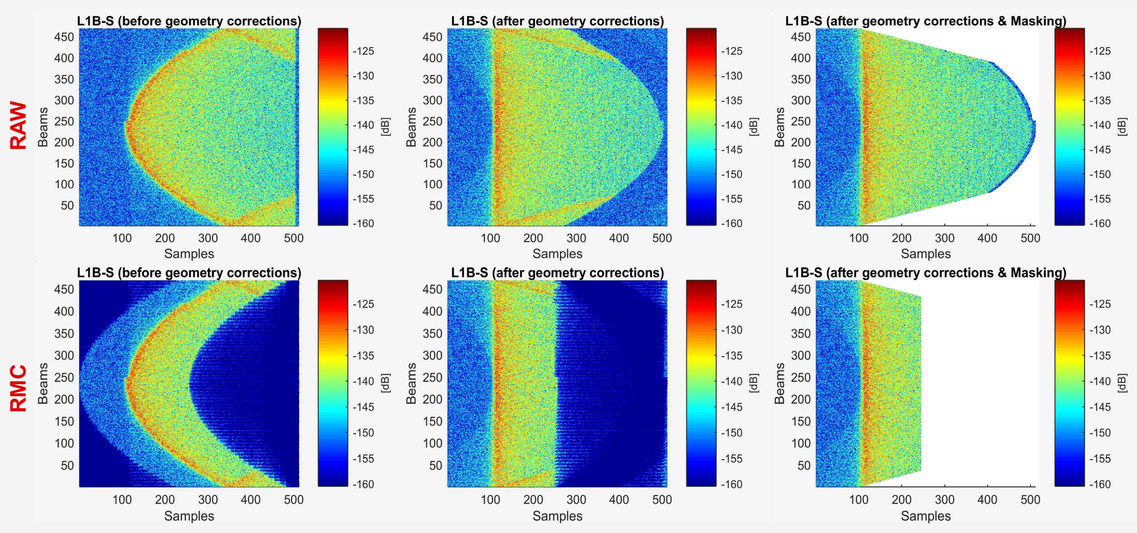
1. **Low-resolution (LR):** L1B product for LRM mode
2. **High-resolution (HR):** L1A, L1B-S and L1B for HR-RAW & HR-RMC modes



Characteristics of the processor:

- Power **waveforms** encoding the range information are in the **time-domain** (processor shall be carefully adapted properly, especially for zero-padding)
- GPP is **easily re-configurable** through specific processing option flags (ZP factor, along- & across-track weighting, exact & approximate azimuth processing, Doppler ambiguities removal, transponder processing/surface focusing,…)

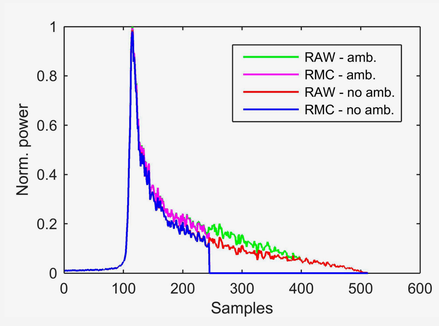
OCEAN-LIKE SCENARIO (HR-RAW & -RMC)



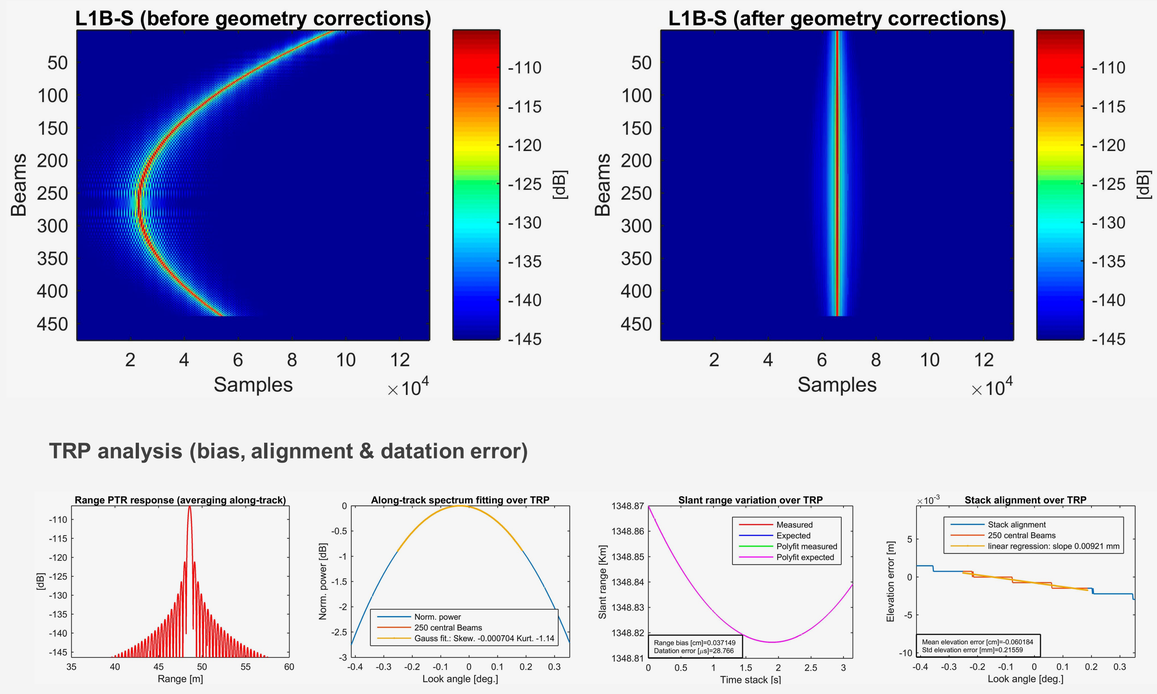
Processing configuration:

- Azimuth approximate method + neither along- nor across-track weighting + ZP of 2
- On-board RMC shall be reverted to get data same format as RAW (and so processed a la RAW on-ground); half of RMC waveform on-board is cut to reduce data download → half of stack shall be masked out once reverted.

Multi-look waveforms



TRANSPONDER (TRP)



GPP requirements:

- Datation bias <=100 μs
- Range bias (mean) <= 1 mm & random error (std) <= 1mm
- Slope of range in stack below 1 mm

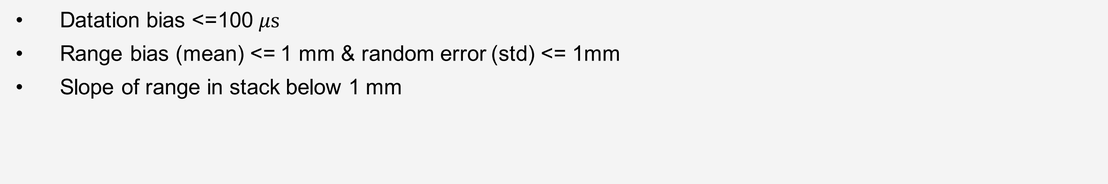
GEOPHYSICAL RETRIEVALS (HR-RAW & -RMC)

Retracking characteristics

- Aligned with L1B processing configuration options (ZP, stack masking,…)
- Adapted to account for differences between sampling frequency & TX bandwidth
- Noise floor estimation based on adaptive window (derivative of waveform)
- Seeds on SWH for subsequent estimation based on sliding window statistics

Track with low radial velocity: ~0 m/s

Track with high radial velocity: -13 m/s



GPP requirements

- Range random error for 2-m SWH <= 3.4 cm (std/RMSE)
- Random error on sigma0 <=0.1 dB (std/RMSE)

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