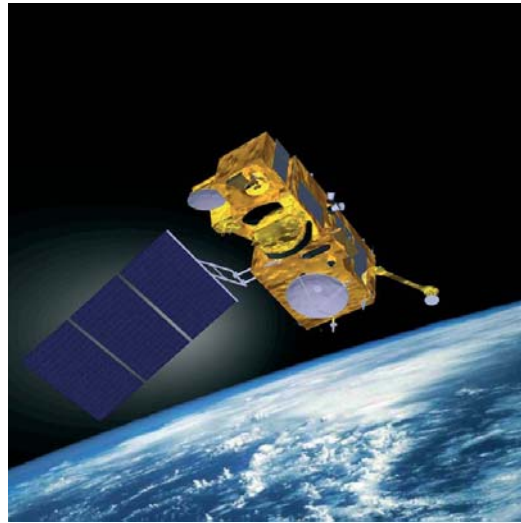




# Sentinel-3

## Surface Topography Mission

### System Performance Simulator and Ground Prototype Processor and Topography Expertise



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# Payload

Sentinel-3 is an ESA Earth Observation Mission in the frame of **GMES**. The launch of the first satellite S3-A is expected to take place in **2013**. The second satellite S3-B launch is expected in 2014.

Sentinel 3 Mission is dedicated to Ocean and global land monitoring : Wide-swath ocean color, vegetation, sea/land surface temperature, and **TOPOGRAPHY** :

## SAR Radar Altimeter

- Dual band Ku+C altimeter : Ku Band for Observation and C band for Ionospheric Correction
- 2 Operational Modes
  - ✓ LRM (Low Resolution Mode) for Open Ocean and Ice Interiors
  - ✓ SAR (High Resolution Mode) for Coastal, In-Land and Ice Margins
- 2 tracking Modes
  - ✓ Conventional Closed-Loop mode for flat surfaces
  - ✓ Open-loop mode with support of GPS Navigation Solution for non smooth surfaces

## MicroWave Radiometer

- Dual Frequency radiometer (similar to EnvisAT one) for wet tropospheric correction, and atmospheric attenuations

## Precise Orbit Determination including

- GNSS Receiver

# Performance Requirements

- The key driver for the performances of the STM (over open ocean and coastal zone)

Error type	Error
Altimeter random error	1.3 cm
Sea state bias / altimeter bias	2.0 cm
Ionosphere propagation correction error	0.7 cm
Dry Troposphere prop. correction error	0.7 cm
Wet Troposphere prop. correction error	1.4 cm
Total range error (rms)	2.94 cm

- For the radiometer the requirement is to provide a wet tropospheric correction to an accuracy of  $\leq 1.2$  cm as target and  $\leq 2.0$  cm as threshold (over ocean areas)
- The POD performances to be achieved are understood as goal performances, the threshold performances to take into account are defined as:
  - NRT (Near Real Time) : 10 cm
  - STC (Slow Time Critical): 4 cm
  - NTC (Non Time Critical): 3 cm

# CLS activities

Thales Alenia Space - France and its core team members awarded by ESA for Sentinel-3 B2/C/D/E1 program

CLS is member of this core team, responsible for the development and procurement of the end-to-end Surface Topography Mission (STM) Simulators for the two Sentinel-3 satellites (S3-A and S3-B) and the associated expertise :

- Consolidation of the performance requirements
- Support the development and the validation of the operational level 0, level 1b processor
- Support the development of the instruments
- Assessment the end-to-end mission performances
- Support during the In Orbit Commissioning phase

To reach these objectives, two simulators/processors are identified for each instrument:

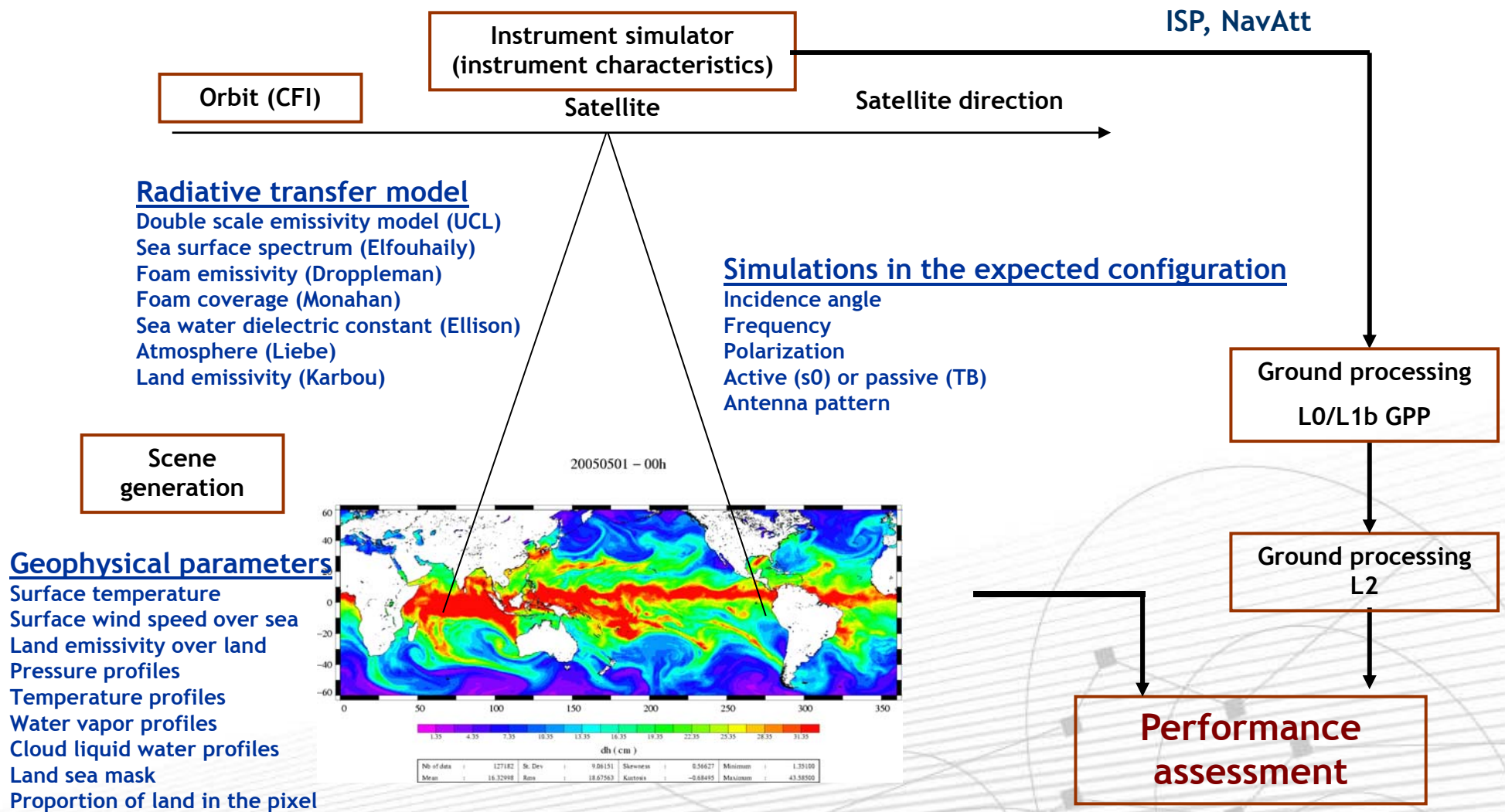
- A **Ground Prototype Processor (GPP)** which will include the definition of the level 0 and level 1b products and processing
- A **System Performance Simulator (SPS)** which include the GPP as well as other modules.



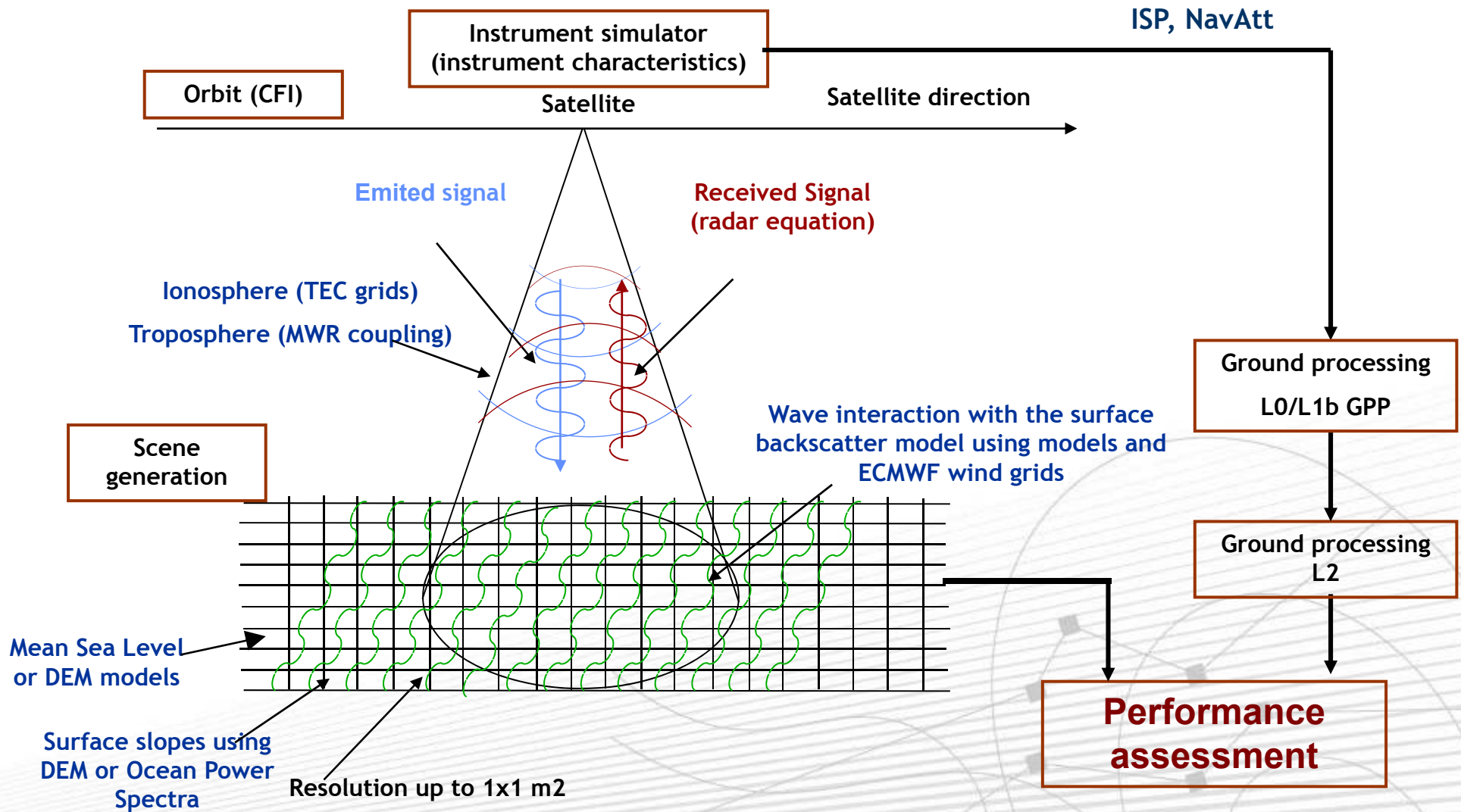
# SPS and GPP processors

- **SPS and GPP for each instrument : SRAL, MWR and GNSS**
- **SPS modules**
  - ✓ Scene generator
    - aims at simulating the scene parameters involved in the signal generation
  - ✓ Instrument Simulator
    - simulates all the acquisition chain from instrument stimuli to formatting of ISP and NavAtt packets
  - ✓ L0, L1B processings
    - Process L0 and L1B from Instrument Source Packet
  - ✓ Simplified Level 2 Process (except for GNSS)
    - Process L2 products with CFI for Sentinel-3 space segment Contract
  - ✓ Support and Analysis Function
    - Manages man machine interface
    - Processes activation sequencer
    - Used for analysis and performance assessment
- **GPP is a subset of SPS**

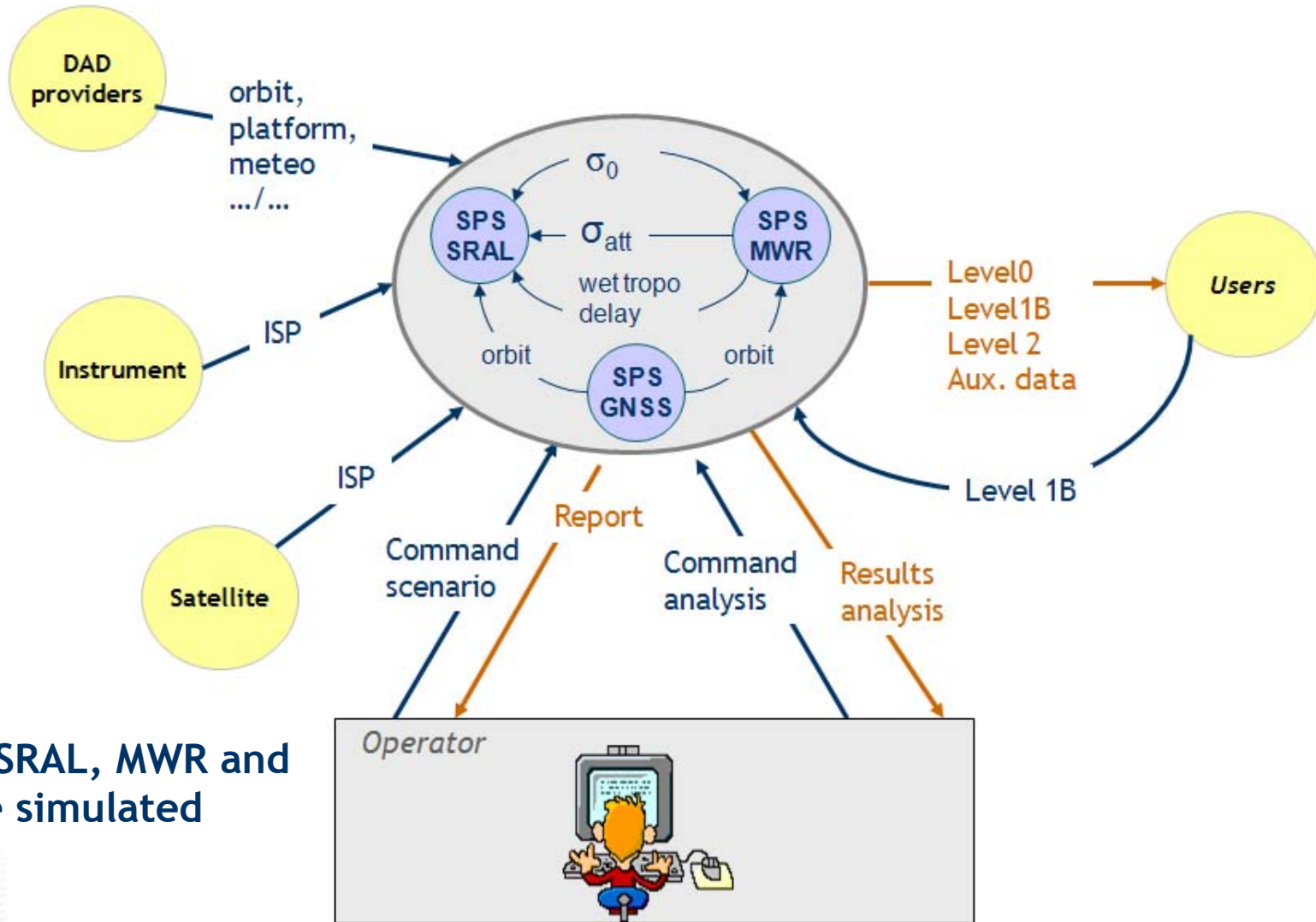
# MWR Simulation and E2E performance principle



# SRAL - E2E performance principle



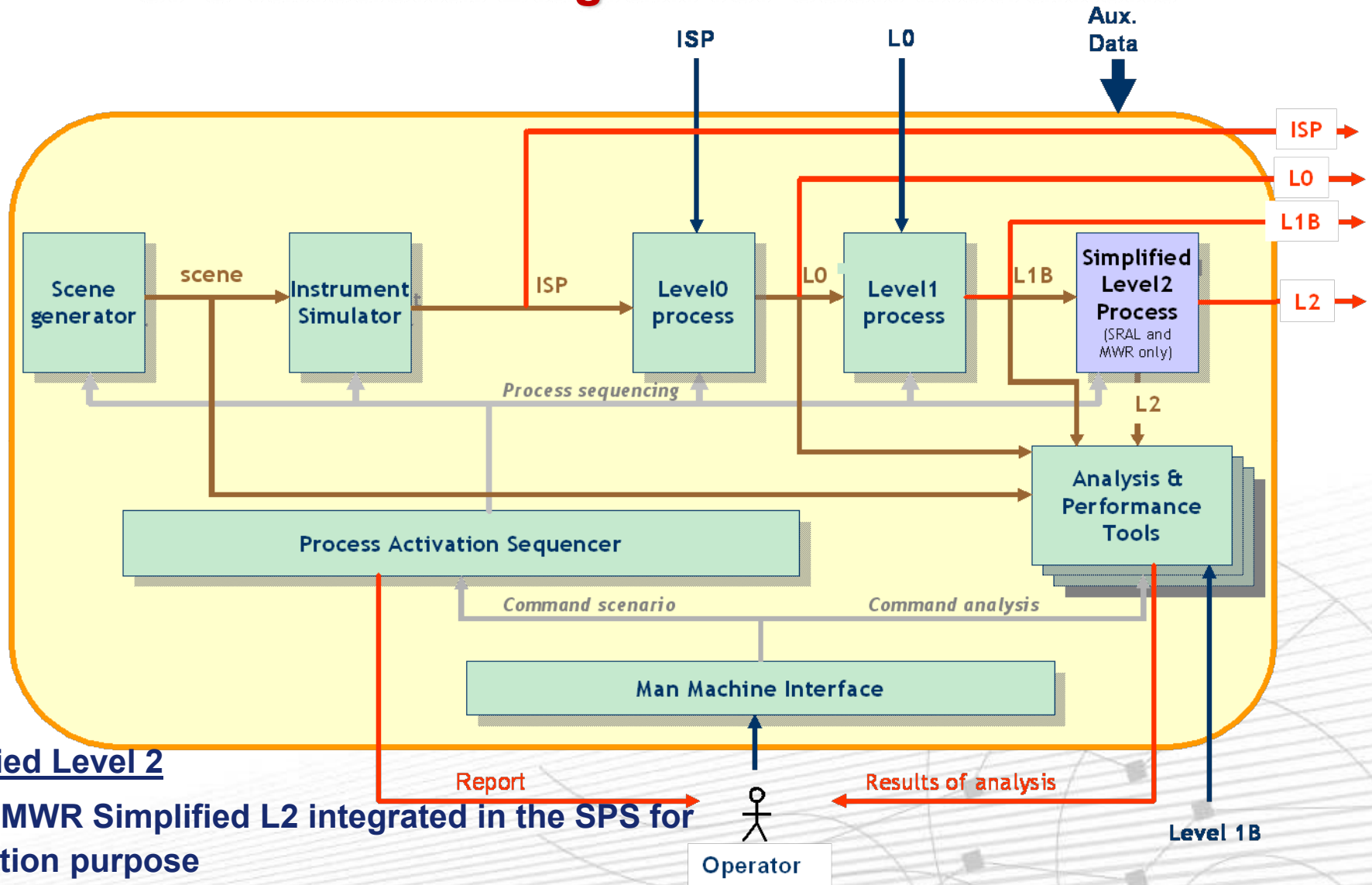
# SPS context diagram



Coupling of SRAL, MWR and GNSS will be simulated



# SPS functional Diagram for each instrument

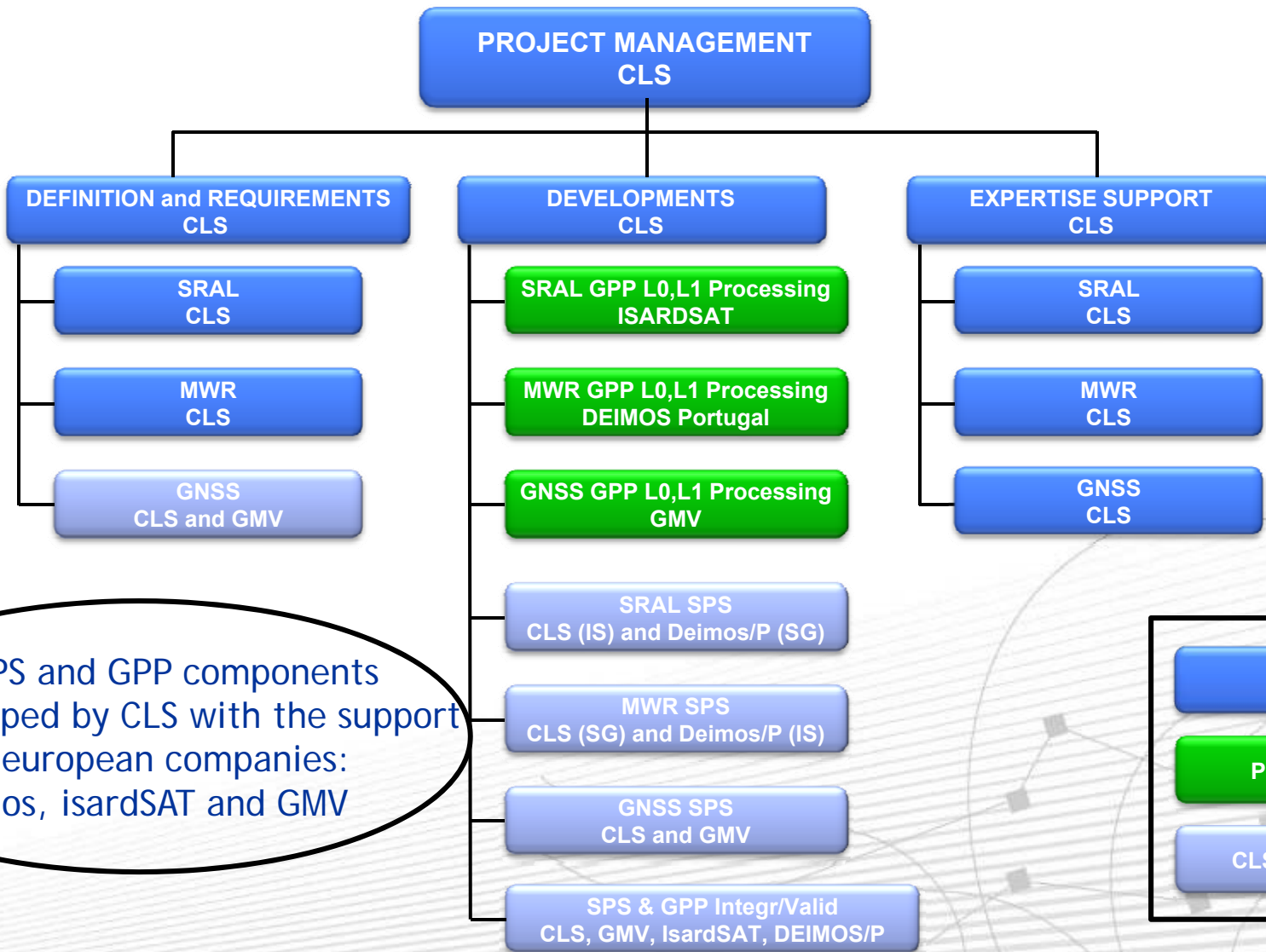


## Simplified Level 2

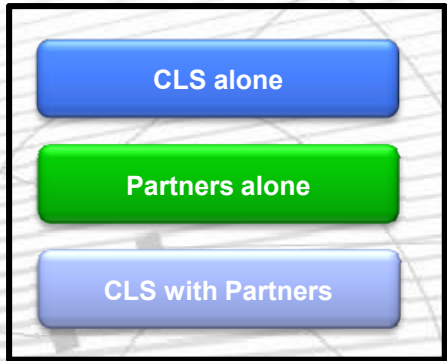
SRAL / MWR Simplified L2 integrated in the SPS for verification purpose

Level 2 CFI for POD out of scope of this activity

# End-to-End simulators Project organization

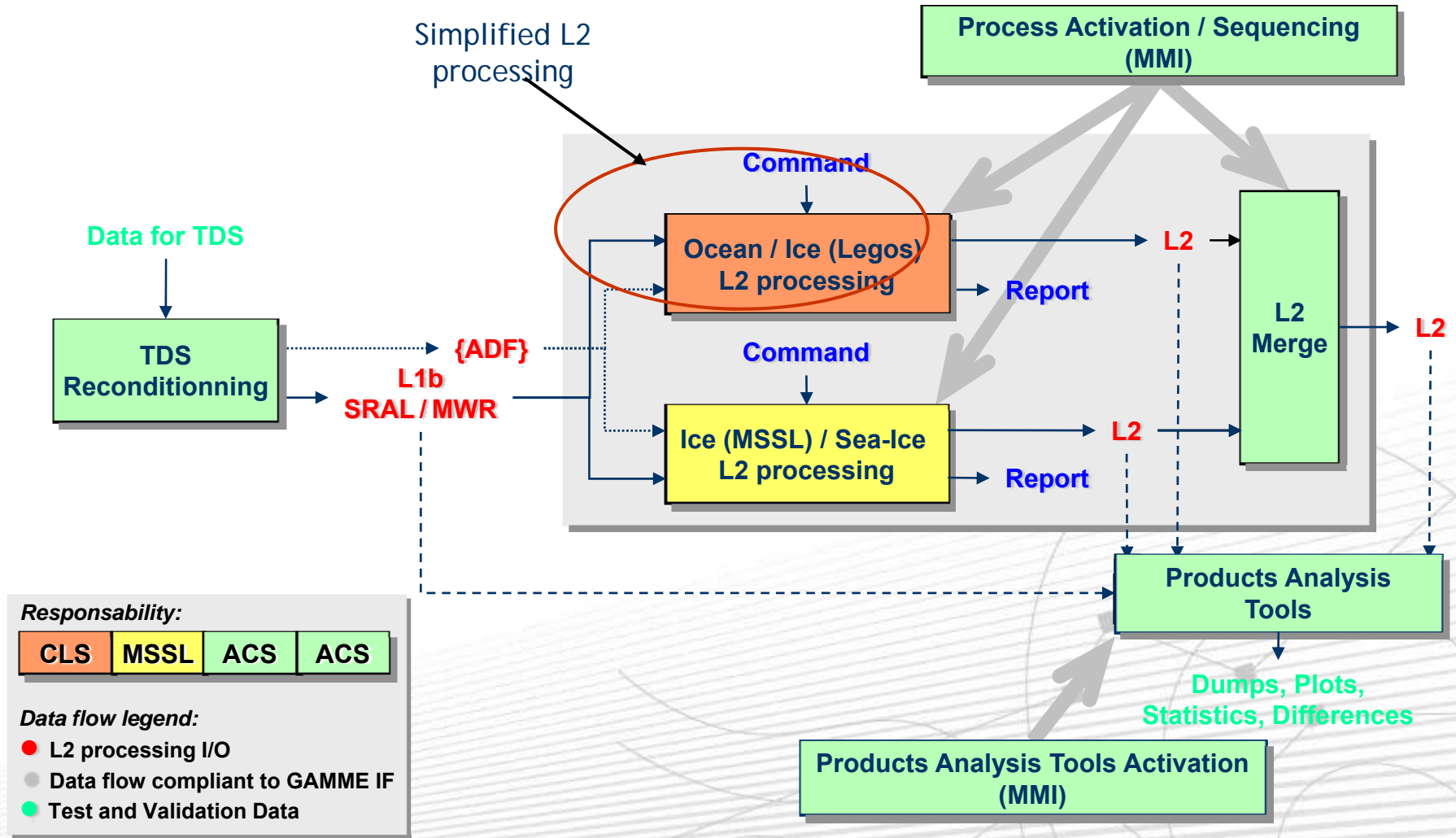


The SPS and GPP components are developed by CLS with the support of 3 european companies: Demos, isardSAT and GMV



# Level 2 Prototype Project organisation

The simplified L2 processor is developed in the frame of an ESRIN project to develop the L2 prototype for S3. The project is performed by MSSL, ACS and CLS and led by CLS.



# End-to-End performance activities

- The final delivery of the SPS and GPP to TAS/ESA is expected for the beginning of 2011
- The expertise activity will be performed until 2013 for S3 A Satellite
- Pre Launch Activities after SPS, GPP deliveries
  - Performance Evaluation is done using the SPS & GPP
    - E2E performance verification with the SPS
      - Generation of Realistic ISP Data at L0 input
      - L0&L1 processing with the GPP
      - Performance verification with the L2 simplified (CFI)
    - Instruments validation using AIT Data with the GPP
- Post launch Activities
  - Performance Evaluation is done using real measured data along with SPS & GPP
    - L0&L1 processing with the GPP of L0 real data
    - L2 simplified processing of L1b data to estimate geophysical parameters
    - Noise level estimates using Fourier Analysis and along track statistics