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PV-CC PDGS status & Cal/Val plan

Iskander Benhadj

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Outline

- PV-CC objectives
- PDGS development status
- PV-CC Cal/Val plan

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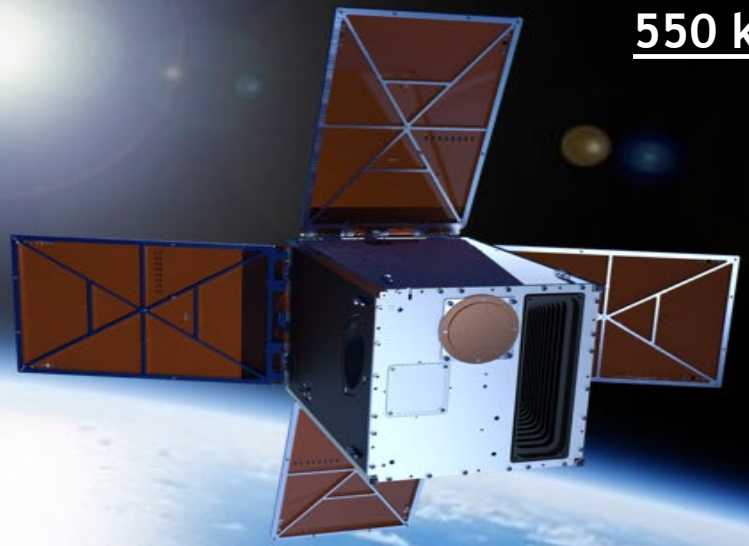
PROBA-V Companion Cubesat (PV-CC)

AerospaceLab

Belgian Nanosat platform flying the **spare PROBA-V** Instrument

Sun-synchronous orbit **500-550 km** altitude range

Global coverage **12 days**



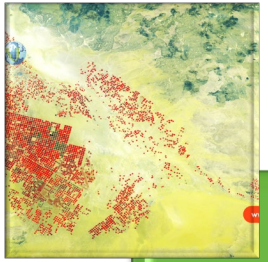
Cubesat **mass 18kg**

Re-use of PROBA-V ground segment for the IOD data

PV-CC objectives

Technology Objectives

- Demonstrate TRL level of the platform
- Verification of the ground station (control & command as well as downlink capacity)
- Cross calibration of PROBA-V with the companion Cubesat



Application Objectives

- Studies on BRDF effects (allowing better modeling) thanks to different observation geometry (viewing and sun angles)
- Harmonization of datasets captured by different platforms, in a different orbit, but with the same sensor
- Improve Calibration / Validation for Cubesat and Small satellites

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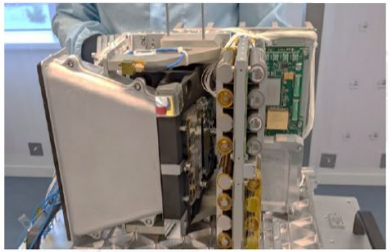
PROBA-V vs PV-CC

	Proba-V	PVCC
Altitude (km)	820	564
GSD at Nadir	VNIR : 97 m SWIR : 186 m	VNIR : 67 m SWIR : 128 m
Ground Speed (km/s)	6,6	7,0
Native sampling time (ms)	VNIR: 14,7 SWIR: 28,3	VNIR: 9,6 SWIR: 18,4
Integration Time Range (ms)	VNIR: 1,2 – 11,3 SWIR: 0,4 – 22,3	VNIR: 1,2 – 6,2 SWIR: 0,4 – 12,4
Satellite Mass (kg)	158	18



SOURCE: AerospaceLab

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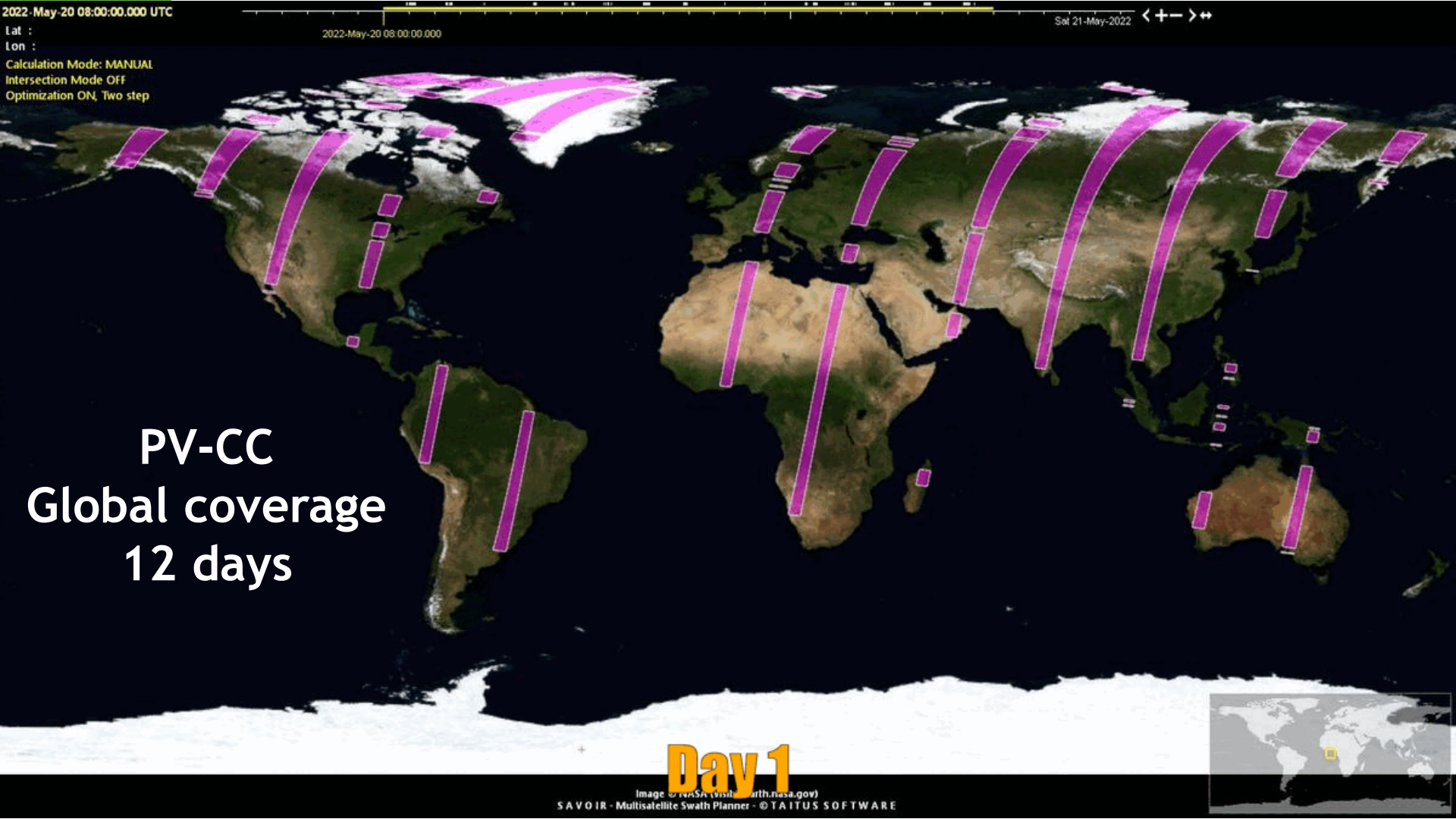
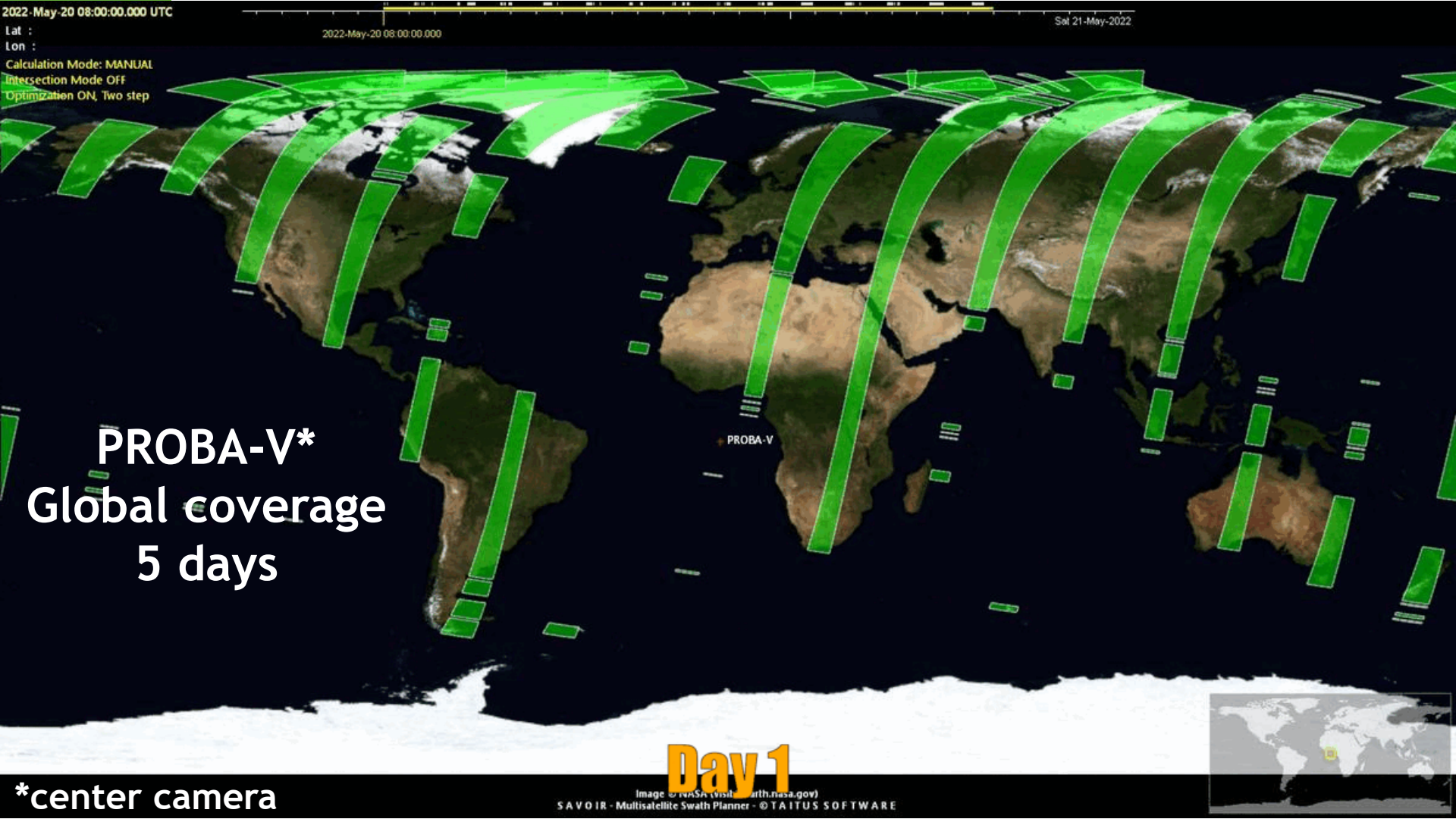

2022-May-20 08:00:00.000 UTC
Lat :
Lon :
Calculation Mode: MANUAL
Intersection Mode OFF
Optimization ON, Two step
2022-May-20 08:00:00.000
Sat 21-May-2022
PV-CC
Global coverage
12 days
Day 1
SAVOIR - Multisatellite Swath Planner - ©TAITUS SOFTWARE



*center camera

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PDGS DEVELOPMENT STATUS

PV-CC PDGS phases/contracts

PDGS: Payload Data Ground Segment
SVT: Software Validation and Testing

2020

Today

2023

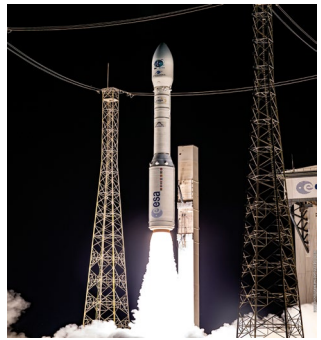
PV-CC operation study — 2020-2021

PV-CC PDGS modification and SVT — 2021-2022

PV-CC commissioning and data product validation — 2023

PV-CC operation — 2023

End 2022
Start 2023



Launch

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PDGS overview and updates

- Analysis of PV-CC high-level mission requirements and impact assessment on PDGS

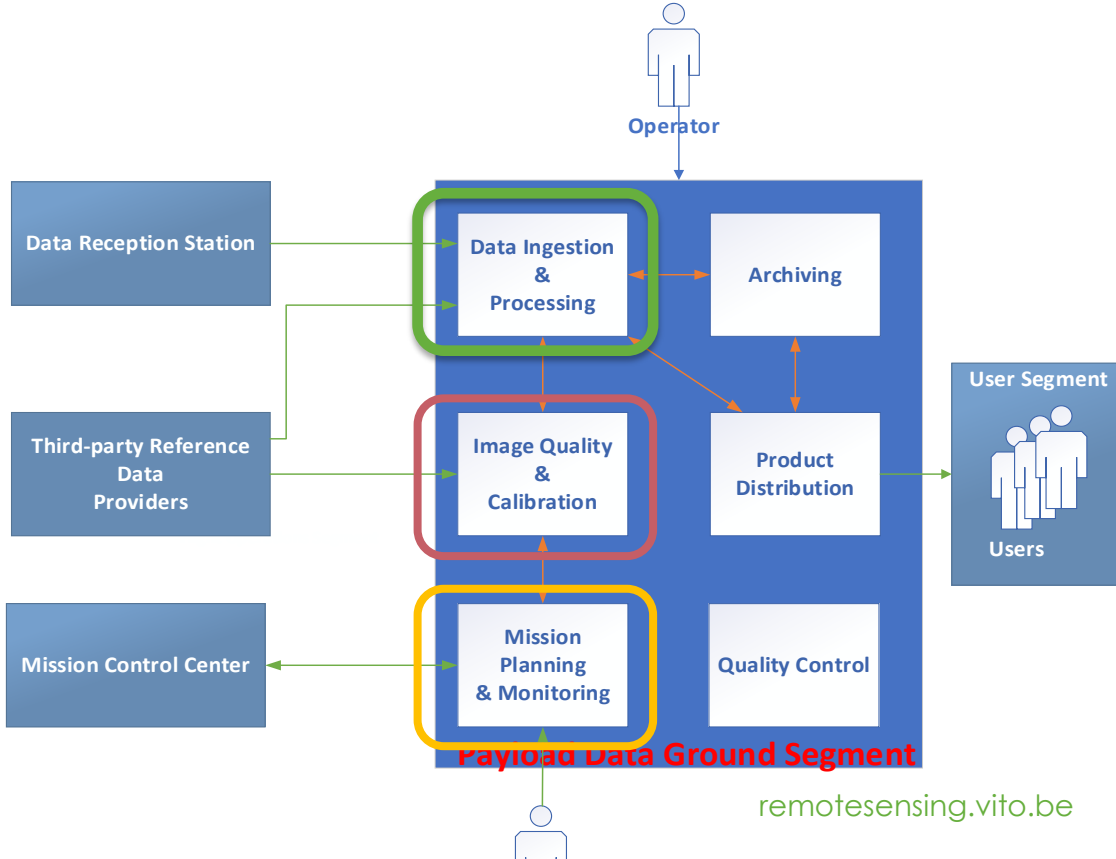
✓ The definition of RAW data products

✓ The MCC – User Segment interface

✓ MCC tasking and commanding vs. land-sea mask imaging

✓ Update of calibration to accommodate for Cubesat low performance

Re-use of PROBA-V ground segment



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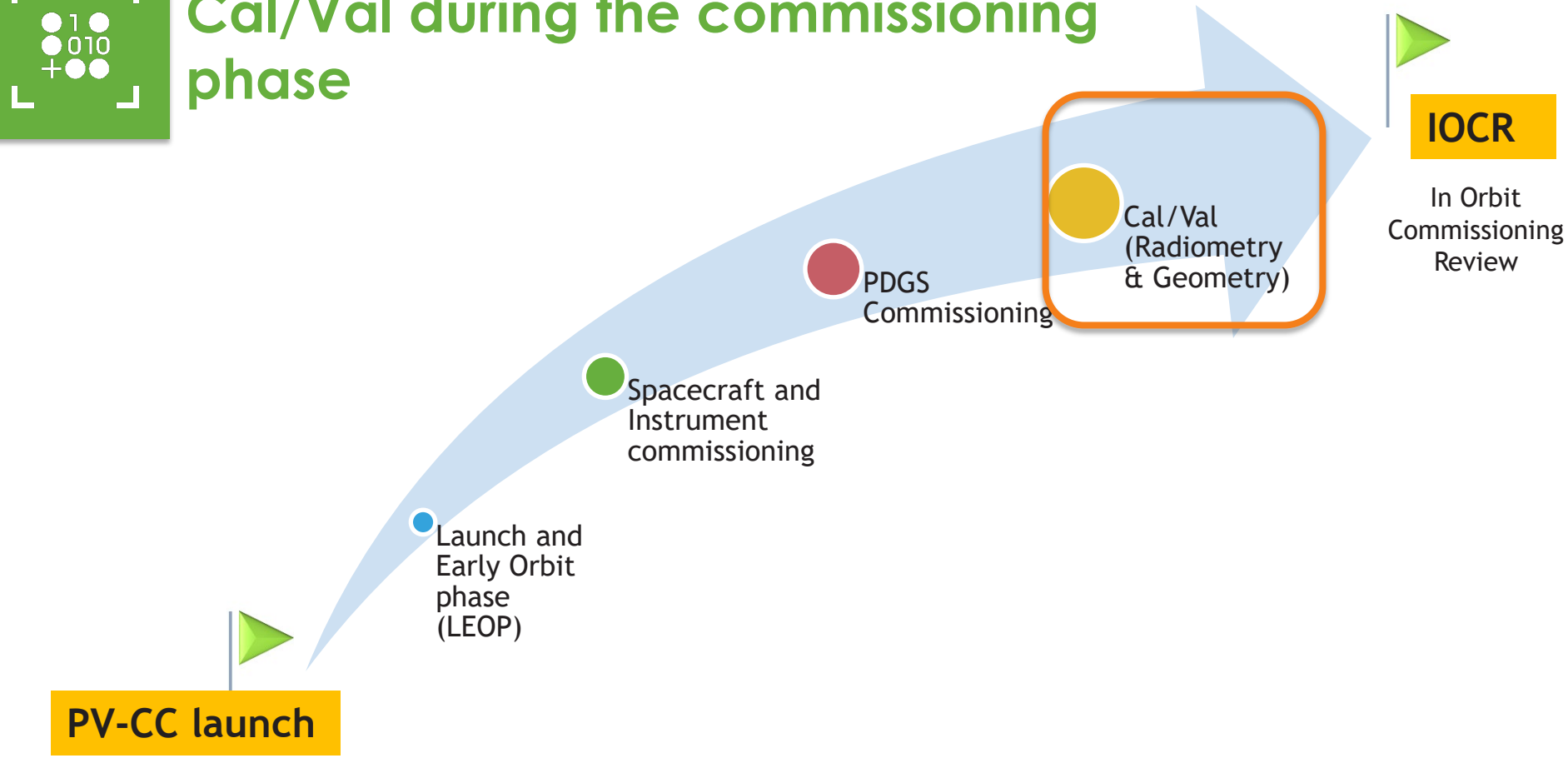
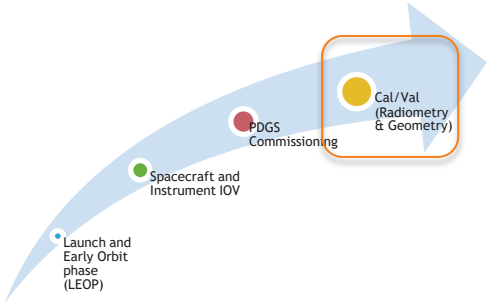
PV-CC CAL/VAL PLAN

Cal/Val during the commissioning phase



Cal/Val plan (geometry)



Commissioning start

End of commissioning

Commissioning period

Boresight refinement	Collect data	Refine boresight			
Calibration parameters finetuning		fine tune parameter	generate ICP file	test/check	validate/update
		Fine-tuning		Test/Validation	
Monitoring					Monitor/update
					Geo deployment
Nominal Operation					Start nominal operation

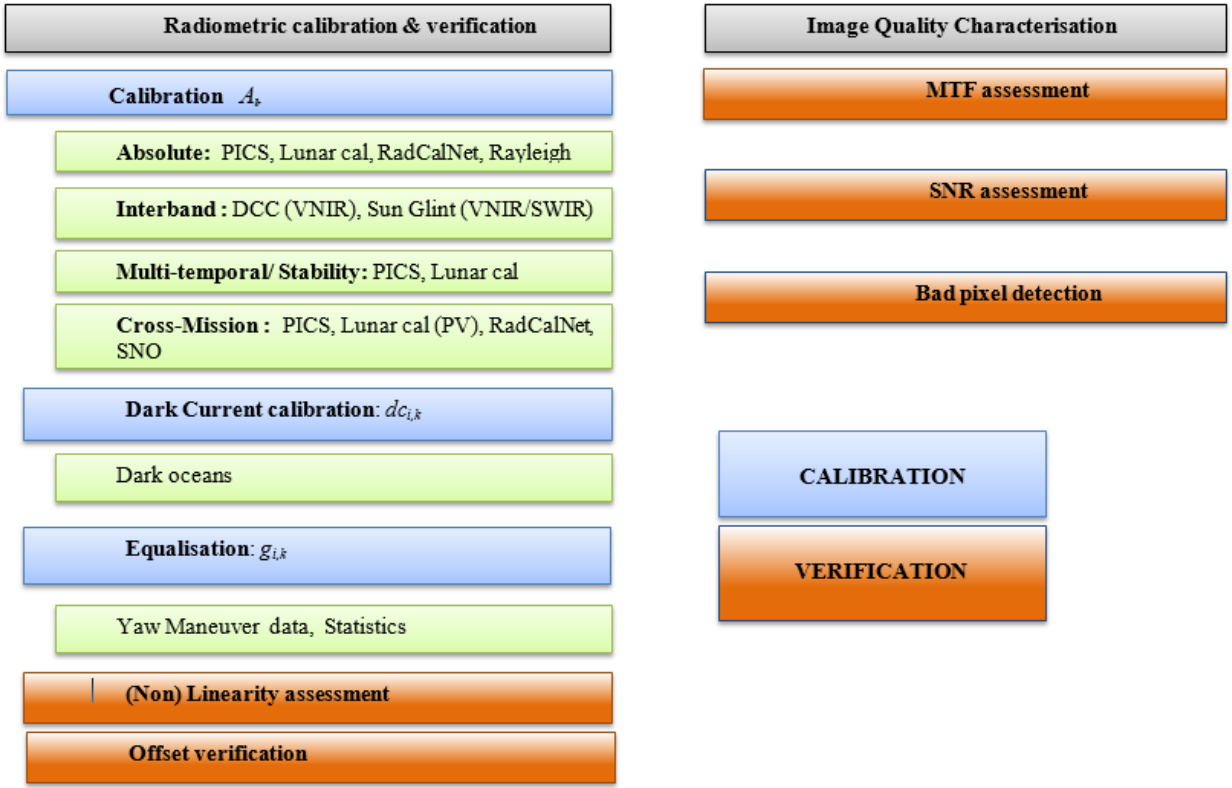
Cal/Val plan (geometry)

- GCP database from Landsat/Sentinel2 is prerequisite
- GCP distortion calculation (chip matching + cross correlation)
- Parameter inversion based on robust Least square fitting and outliers removal
  - **Interior orientation** (focal length, CCD polynomial distortions)
  - **Exterior orientation** (boresight angles)
- Band to band co-registration
- Co-registration with other sensors (Landsat/Sentinel2, etc..)
- Generation of geometric ICP file

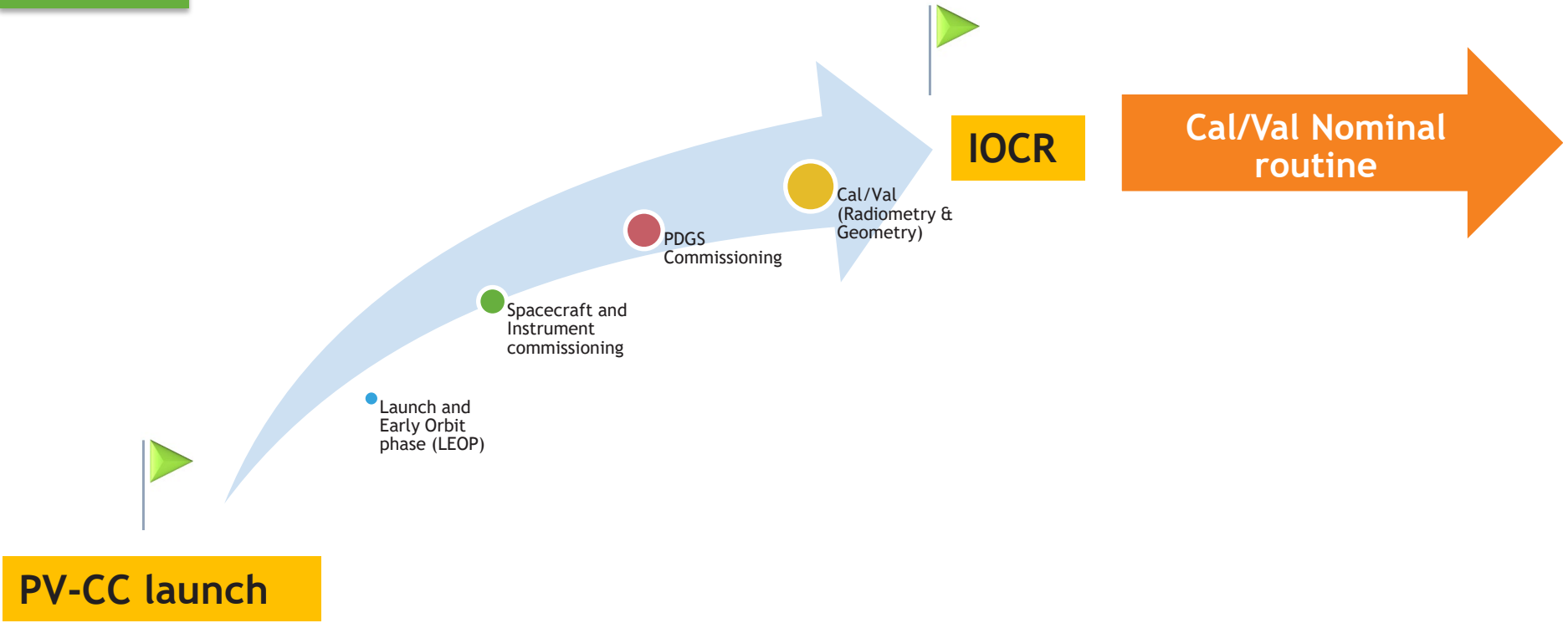
Cal/Val plan (radiometry)

- PROBA-V heritage
- Differences wrt PROBA-V commissioning
  - Availability of Landsat8, Sentinel-2, Sentinel-3
  - Availability of RadCalNet sites
  - LIME lunar model (very good absolute accuracies)
  - Yaw maneuvers
- Complexities
  - the longer revisit time at nadir (approximately 12 days, TBC)
  - possible larger sensitivity to thermal environment changes

Cal/Val plan (radiometry)



Cal/Val during the nominal operation

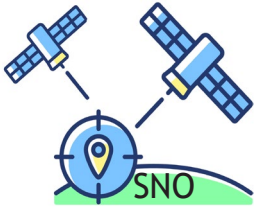


Cal/Val activities (geometry)

- **Daily operations**
  - From nominal data, selected ROI's are automatically processed
- **Weekly operations**
  - Verification of the L1C geometric accuracy
  - Verification of the L2 geometric accuracy
- **Monthly update (if needed) of the ICP-GC**
  - Update frequency can by reduced if stability is further confirmed
  - Update frequency can be increased (e.g. once a week) in the very unlikely event of rapid degradation

Cal/Val activities (radiometry)

- **Use of tasking** interface to acquire :



- Priority will be given to calibration over PICS and RadCalNet sites, Lunar calibration, and dark current acquisitions.
- Automatic radiometric processing will be performed:
  - to continuously **monitor the instrument** calibration parameters
  - to **compensate for drifts** caused by systematic changes such as ageing of the instruments
  - to **update the ICP file** as needed to maintain the accuracy of the calibration and continuity of product quality

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THANK YOU

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Sentinel-2 image Copernicus Sentinel data (2016)