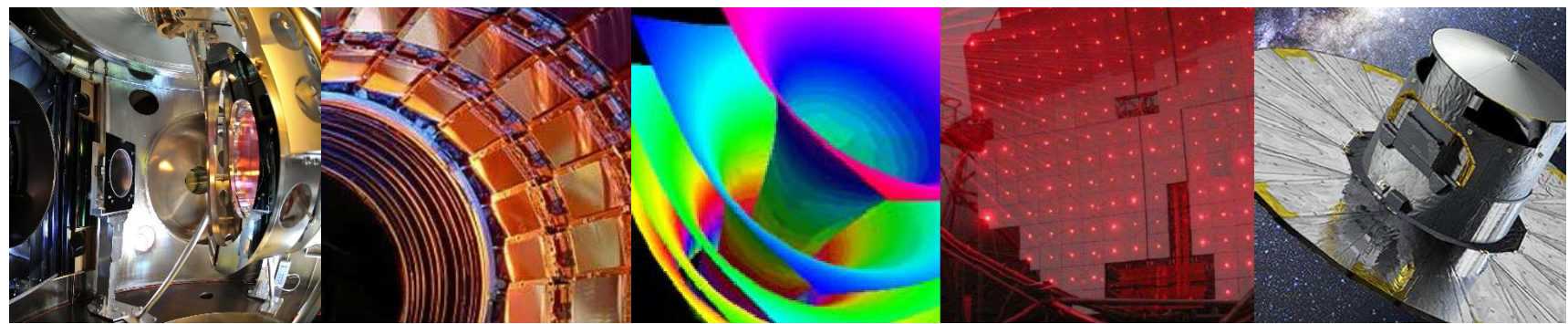




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Development of the Operational Centre for the PLATO ground-based observing program

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Universitat de Barcelona



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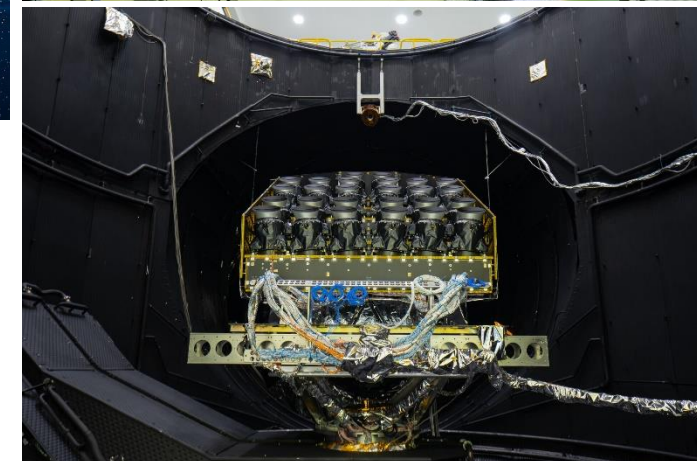
PLATO

ESA mission, **launch expected end 2026**.

- Discover and characterize **hundreds of exoplanets**
- Focus on **rocky planets** in the **habitable zone**
- Radii, masses and ages
- Also, **analysis of host stars**, incl. stellar seismology
- Method: **high-accuracy photometry** of ~200 thousand stars
→ **planetary transits**

Spacecraft:

- 2300kg, wingspan of ~9m, Ariane 6
- Orbit around L2 for 4 years (up to 8.5 years)
- **26 cameras**
 - 24 cameras: 25s integration time
 - 2 cameras: 2.5s
 - 81.4 Mpix/camera. Total: **~2 billion pixels**



PLATO GOP

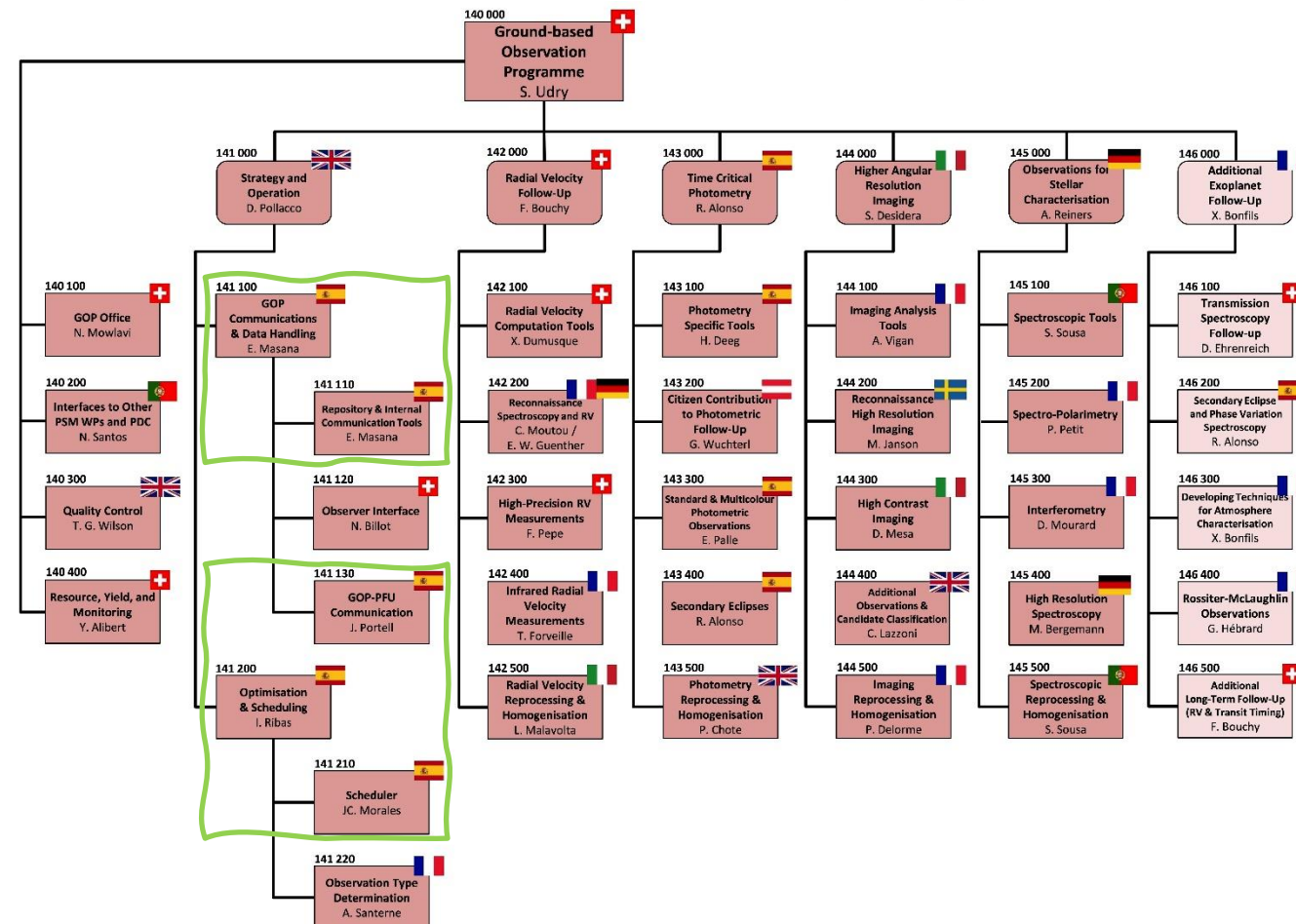
Ground-based follow-up of exoplanet candidates (**GOP, Ground-based Observing Program**):

- **Critical system** for the mission success
- Exoplanet candidates from the spacecraft and the PLATO Data Center (data processing pipelines) must be **confirmed or vetoed** (discarding false positives) and **characterized** (e.g. mass determination) using **ground observatories**

- **High-resolution imaging**: discard contaminants (e.g. nearby stars)
- **Photometry**: transit confirmation
- **Spectroscopy** / radial velocities: mass determination

- Global effort involving **many observatories and instruments** to **follow-up many targets**
 → excellent coordination is mandatory

- GOP WP 141 (**strategy & operation**): essential WPs led by IEEC (ICCUB + ICE/CSIC)



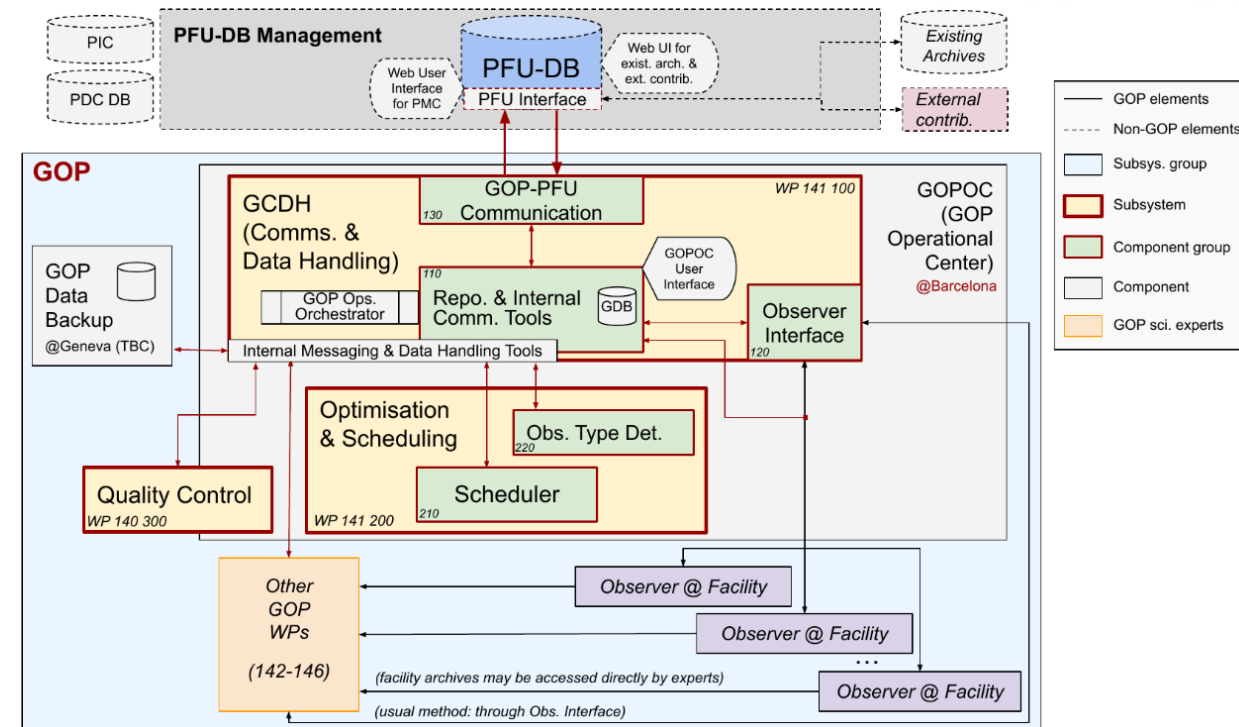
GOP subsystems

Main duties of GOP:

- **Interface** with the PLATO Follow-Up Database (PFU)
- Provide an internal GOP data **repository**
- Determine the adequate **observation type** and strategy
- Determine an **optimum observing schedule**
- Interface with **observers**
- Perform **quality control** on observations data
- Provide **user interfaces**

→ Definition of **subsystems architecture and requirements**

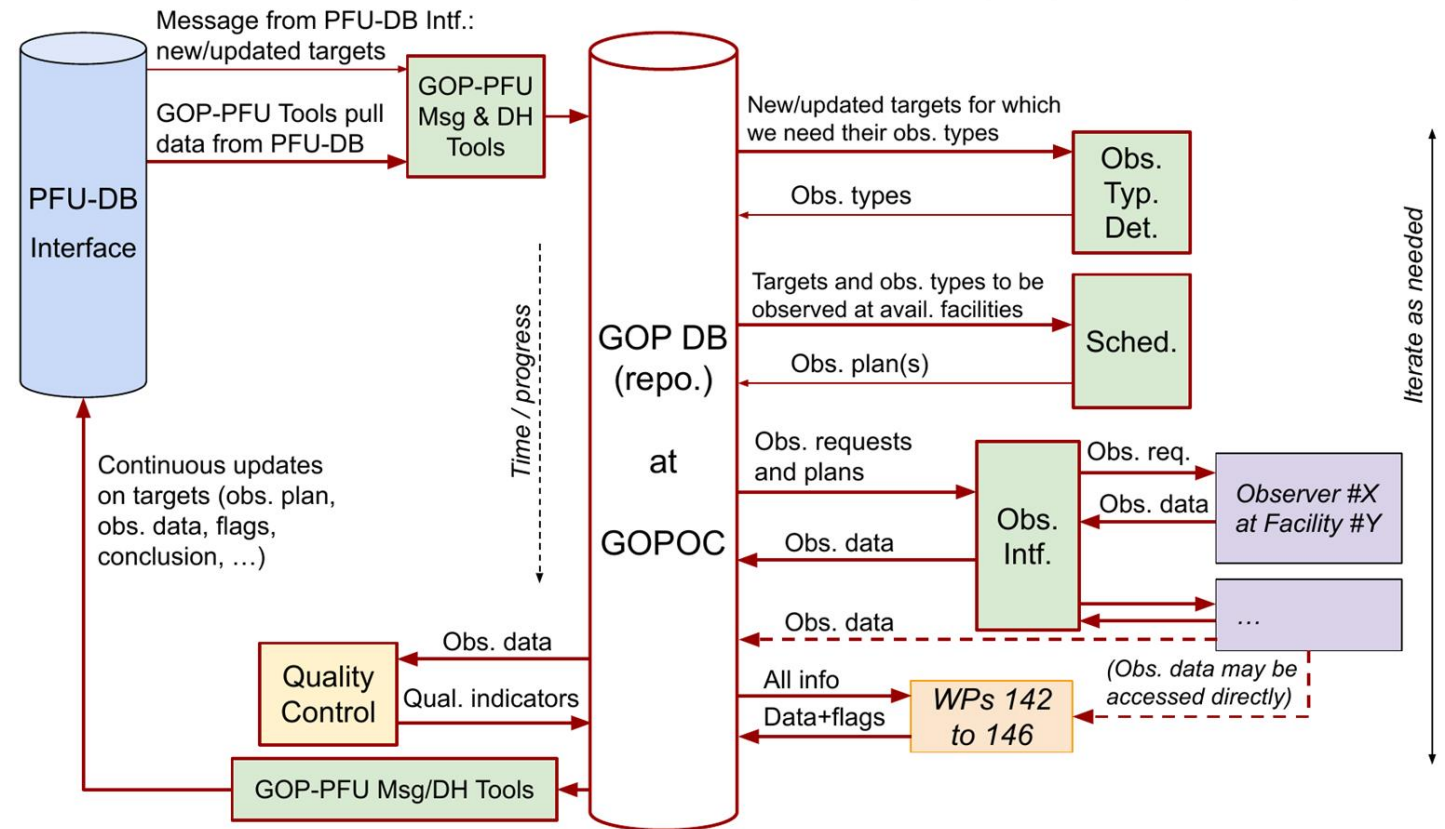
- ICCUB:
 - Central data hub, data interfaces, repository, operational center (GOPOC) and user interface
- ICE:
 - Scheduler and user interface



Overall flowchart of GOP

1. Get targets from the PFU
2. Determine obs. type
3. Determine schedule (obs. plan)
4. Dispatch to facilities
5. Collect observations
6. Evaluate quality
7. Iterate 2-7 as needed
8. Deliver outcome to PFU

Data-driven operations,
message-driven data transfers
→ more robust and efficient
(*Gaia/DPAC lesson learned*)



PLATO-GOP progress at ICCUB

PLATO-GOP activities at ICCUB so far:

- **Hired software engineer** with astrophysics and exoplanets knowledge (Julien Poyatos, March 2023) (PPCC funds)
- Defined **overall GOP operations requirements and architecture**
→ *PLATO GOP Subsystems Requirements and Design Document*
- Defined **internal and external GOP interfaces**
→ Contributions to the *PLATO Master Interface Control Document*
- **Successfully passed ESA Ground Segment Design Review! (GSDR, March-April 2024)**
- Started detailed definition of **software implementation and testing** approach
- First **prototype** of GOP task management **software**, internal **database** and **user interface**
- Initial definition of the **GOP Operational Center (GOPOC)**
→ also started to define personnel needed for **GOP operations** (tech. operators + sci. experts)

At ICE:

- Developments for the STARS framework (optimization of observing plans, i.e. scheduler)
- Graphical User Interface for the scheduler
- PPCC funds: hired software engineer (Pau Ballber)



PLATO-GOP at ICCUB: next steps and plan

Approx. timeline:

- Q2 24:
Detailed **specification** of the GOP data and task management **software**, database and user interfaces
- Q3 24:
Specification of the GOP **Operational Center (GOPOC)**
GOP **test** specification
First complete **prototype** of core GOP **software**
- Q4 24:
Acquisition of the GOPOC hardware (main server + pre-ops test server)
Initial GOP **tests**
- Q1 25:
Initial GOPOC **procedures** handbook
GOP end-to-end **tests**
- Q2 25:
PLATO ground segment **end-to-end tests**
Revision of all GOP software and documentation
- Q3 25:
First complete version of all GOP software and documentation,
ready for **ESA Ground Segment Implementation Review**
- **Launch + 3 months (2027): GOP ready for operations**

Thank you

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on behalf of the ICCUB-ICE-IEEC PLATO Team