WHAT YOU GET AND WHEN:
PLATO DATA PRODUCTS AND DELIVERY TIME SCALES

ESP 2025

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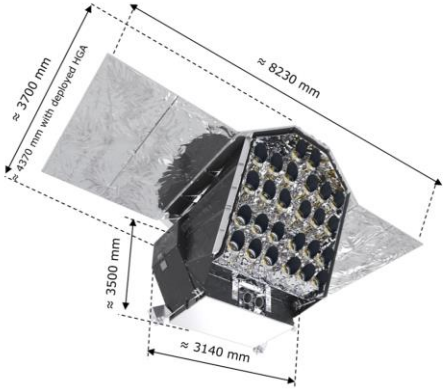
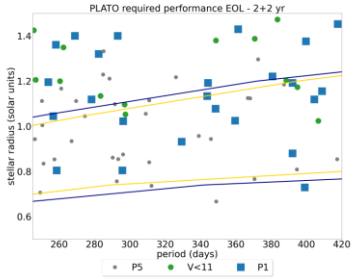
H. Rauer (DLR, FU Berlin), Larry O´Rourke (ESA)

Content

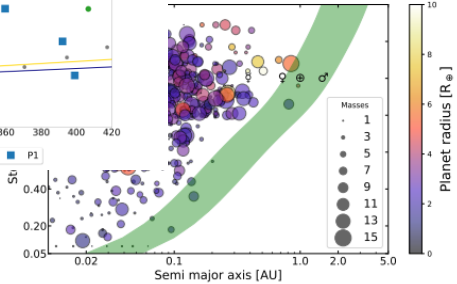
- Intro: A bit about PLATO…
- What do you get: Data products
- Who gives it to you: The ground segment
- When do you get it: Data releases
- What if you like your own targets: Guest Observer program

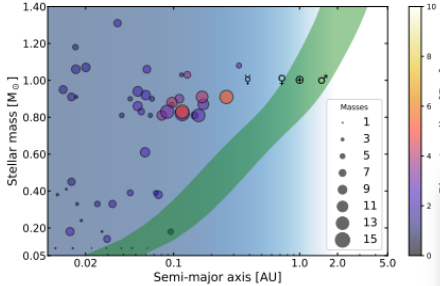


What is it about…

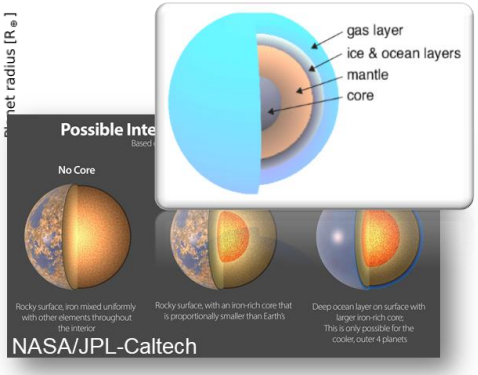


Planet Detection





Planet Interiors



Phase Curves

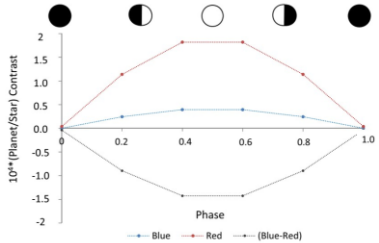
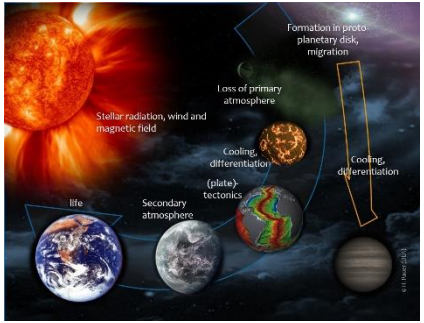
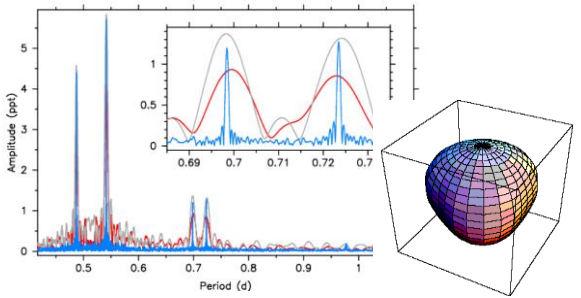


Fig. 8 The phase curve of the contrast (Planet/Star) enhanced by a factor 10^4 as would be observed by the PLATO fast cameras with their "red" and "blue" filters for a hypothetical, nearby (10 pc) Ultra-Hot-Jupiter, assuming the planetary properties of WASP-103b. Data begins at the nightside during conjunction and shows 6 equidistant points. Figure adapted from Grenfell et al (2020).

Understanding Formation and Evolution

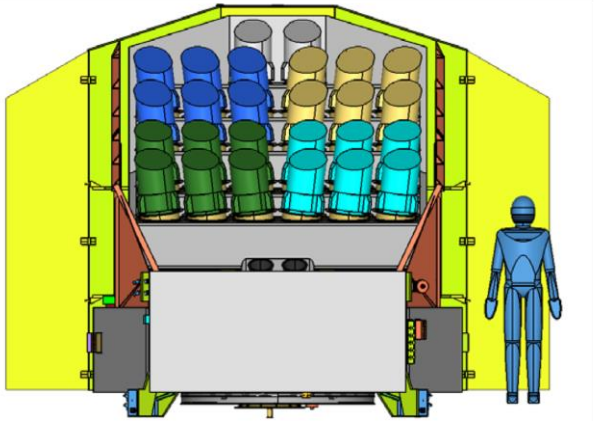


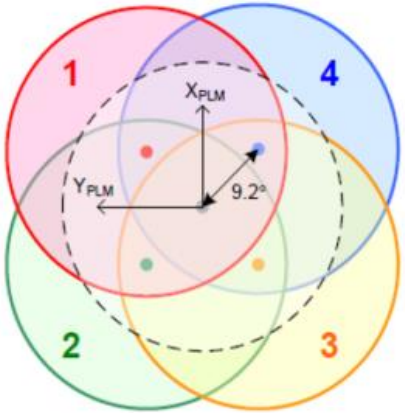
Stellar Oscillations

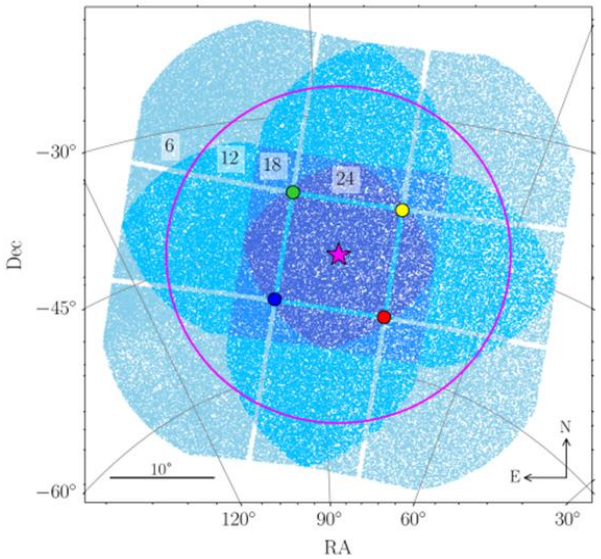


Data Products

The Field-of-View





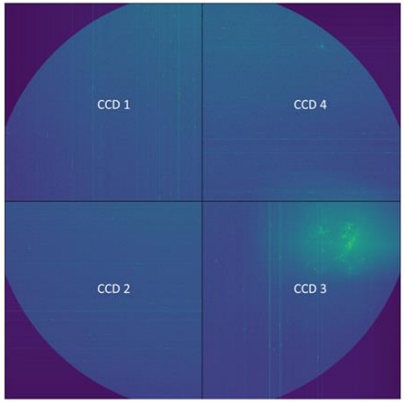


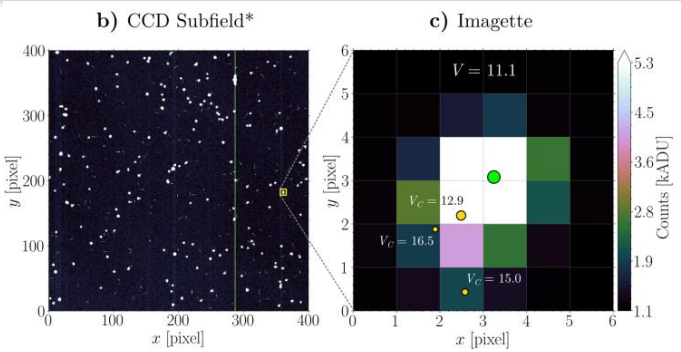
The field-of-view is covered by different numbers of cameras.

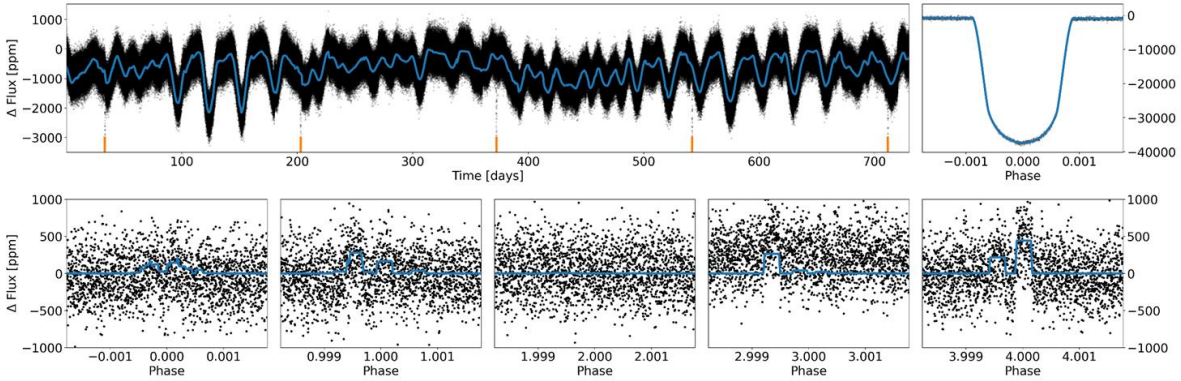
Field of View simulation with PLATOSim
Janssen et al. (2014) A&A, 681, A18
Credit: Juan Cabrera

Payload Data

- 26 cameras full frame data would provide >100Tbit/day
  → compression needed
- The PLATO payload provides
  - **imagettes**
  - **lightcurves**







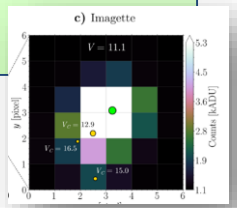
Simulations done with PLATOSim, Janssen et al. (2014) A&A, 681, A18, credit: J. Cabrera

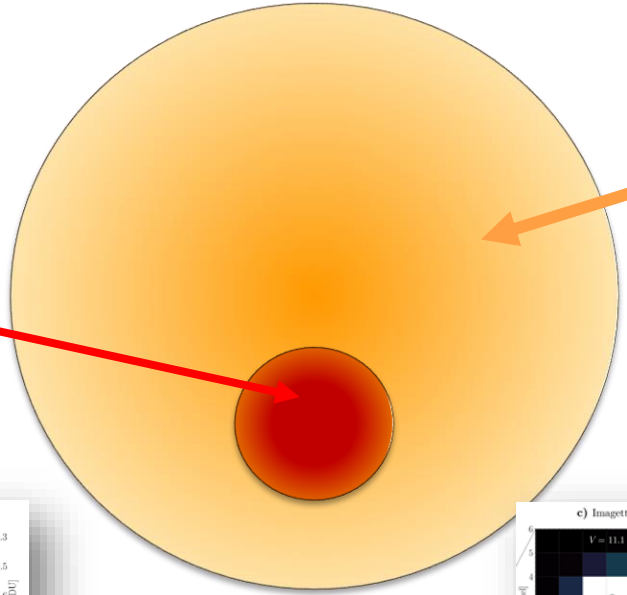
PLATO Stellar Samples

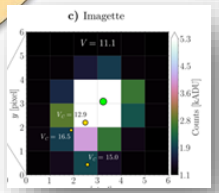
Assuming 2 long pointings:

P1/P2 samples:

- ~15 000 dwarf and subgiant stars (F5 to K7)
- V < 11 mag
- NSR (random) < 50 ppm in one hour

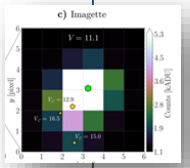


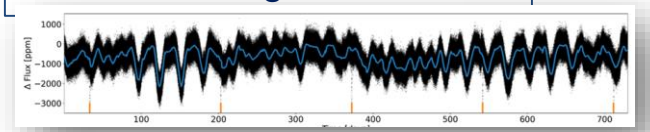




P4/P5 Statistical sample

- > 245 000 dwarf and subgiant stars
- V < 13 mag
- V < 16 mag for M stars



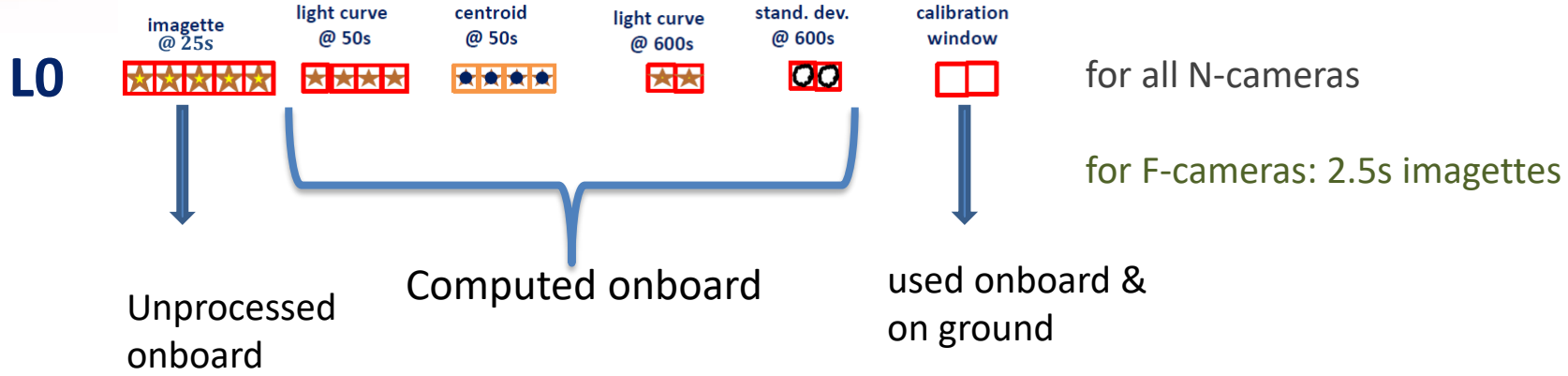


Sub-samples from these are:

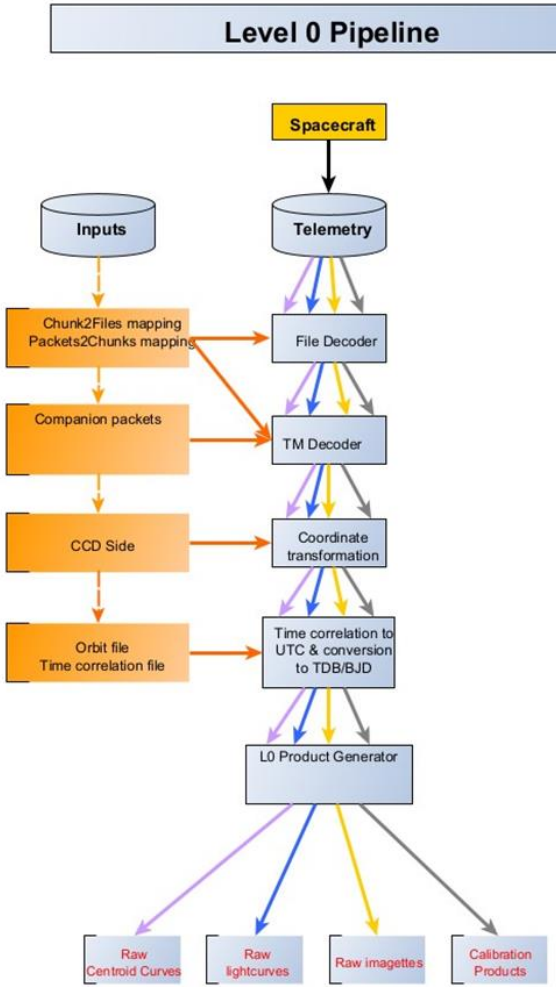
- Prime sample (priority targets)
- Propriety sample (PMC)

In addition: guest observer targets

Data Production Steps



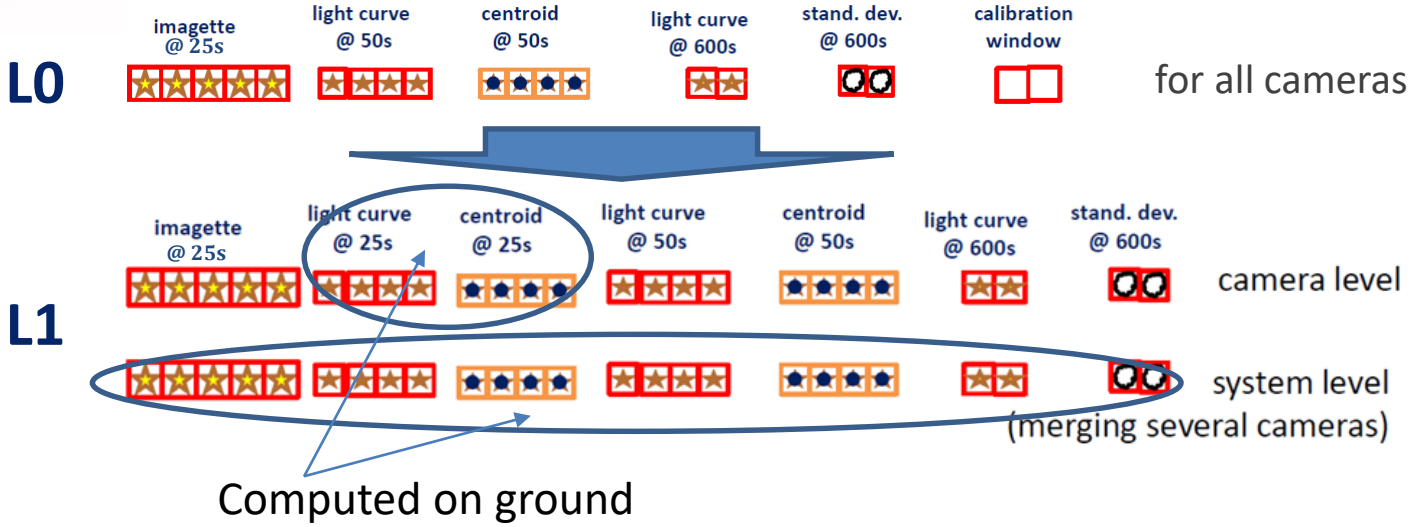
L0 Pipeline



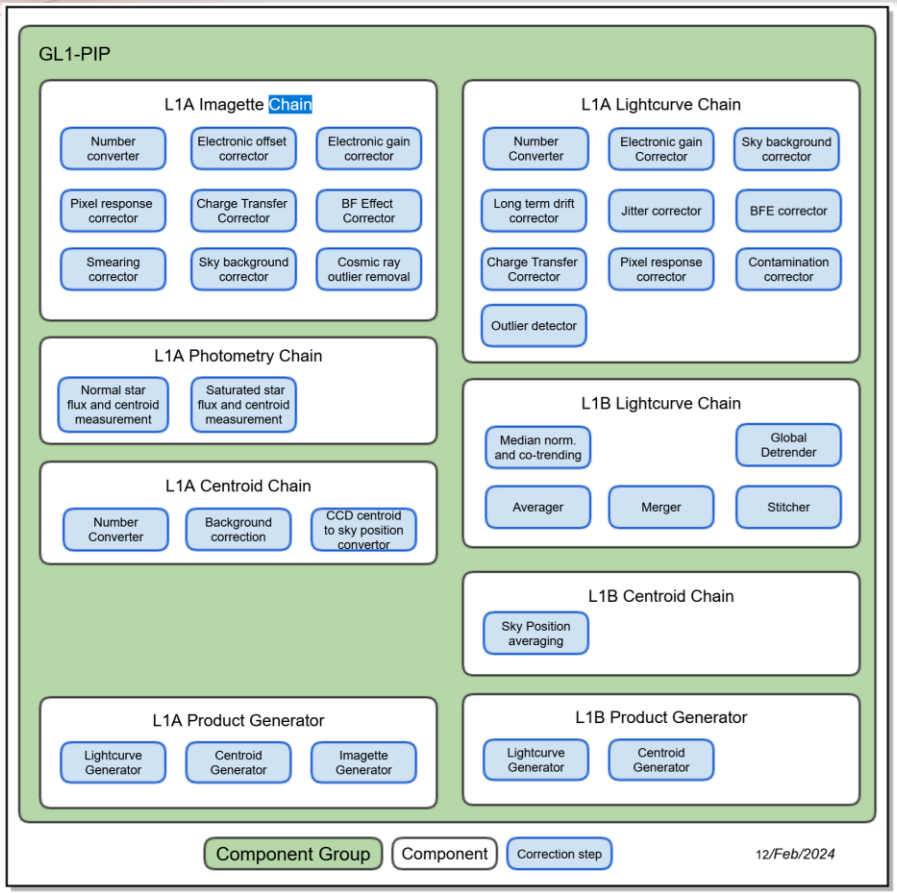
The **Level 0 pipeline** “reconstructs” the data back to its original on-board generated form.

The output of the Level 0 will be **raw imagettes, light curves & centroids** corrected in timing (and coordinate transformation)

Data Production Steps



The PLATO Level 1 pipeline



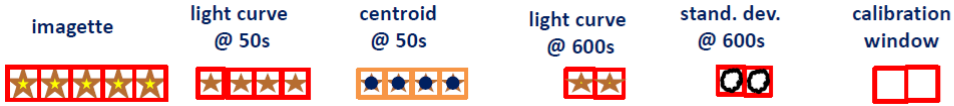
The **Level 1A** pipeline produces individual imagettes, lightcurves and centroid curves from the Level 0 data.

The **Level 1B** pipeline de-trends and combines the individual light and sky position curves produced by L1A to obtain the lightcurves or sky positions per target, telescope and/ or camera groups.

Within each chain, the steps applied are identical, irrespective of whether produced from imagettes, or from on-board processing.

Data Production Steps

L0



for all cameras

L1

camera level

system level
(merging several cameras)

L2 Results of SAS and EAS data processing pipelines

L3 L2 + Ground-based follow-up data → Full PLATO data set

PLATO Data Products

- ✓ Imagettes
- ✓ Light curves and centroids
- ✓ Housekeeping
- ✓ Quality data

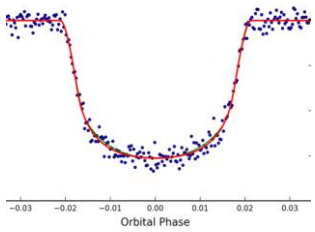
- ✓ Planetary transit candidates and their parameters
- ✓ Asteroseismological analysis
- ✓ Stellar rotation periods and stellar activity properties
- ✓ Seismically-determined stellar masses, radii and ages of stars
- ✓ TTV planetary systems

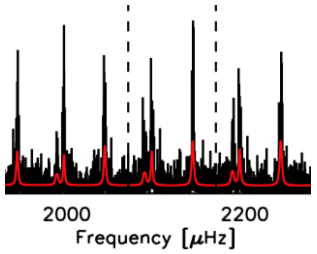
- ✓ List of confirmed planetary systems, which will be fully characterised by combining information from the planetary transits, the seismology of the planet-hosting stars, and the results of ground-based observations.

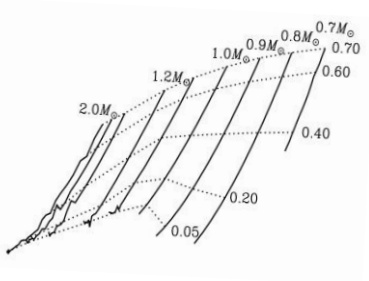
L0 → L1 → L2 → Lg → L3

- ✓ Calibrated Light curves
- ✓ Processed imagettes
- ✓ Ancillary data
- ✓ Quality data

- ❖ Ground-based observations for filtering false planet transits:
  - ✓ Low-precision spectroscopy (1-2 m telescopes);
  - ✓ High-resolution imaging (2 m telescopes);
  - ✓ On and off transit photometry (1-2 m telescopes);
  - ✓ High-resolution spectroscopy (4-8 m telescopes);
  - ✓ Rossiter-McLaughlin (RM) observations (8 m telescopes).
- ❖ Ground-based observations for the characterisation of planets:
  - ✓ High-resolution spectroscopy (1-2 m, 4 m and 8 m telescopes);
  - ✓ Rossiter-McLaughlin (RM) observations (8 m telescopes).







L2 and L3 products

Level-2 (L2):

- The planetary transit candidates and their parameters, as a minimum target identifier, planetary ephemeris of the system, depth and duration of the transit, estimated radius, and their corresponding uncertainties.
- The results of the asteroseismological analysis, and their corresponding uncertainties.
- When possible, the stellar rotation periods and stellar activity properties inferred from activity-related periodicities in the light curves.
- The seismically-determined stellar masses, radii and ages of stars, (and their formal uncertainties), obtained from stellar model fits to the frequencies of oscillation.
- The list of planetary systems confirmed through the detection of Transit Time Variations (TTVs), which will be characterised by combining information from the planetary transits and the seismology of the planet-hosting stars.

Level-3 (L3):

- The list of confirmed planetary systems, which will be fully characterised by combining information from the planetary transits, the seismology of the planet-hosting stars, and the results of ground-based observations.

L2 and L3 products

Level-2 (L2):

- The planetary transit candidates and their parameters, as a minimum target identifier, planetary ephemeris of the system, depth and duration of the transit, estimated radius, and their corresponding uncertainties.
- The results of the asteroseismological analysis, and their corresponding uncertainties.
- When possible, the stellar rotation periods and stellar activity properties inferred from activity-related periodicities in the light curves.
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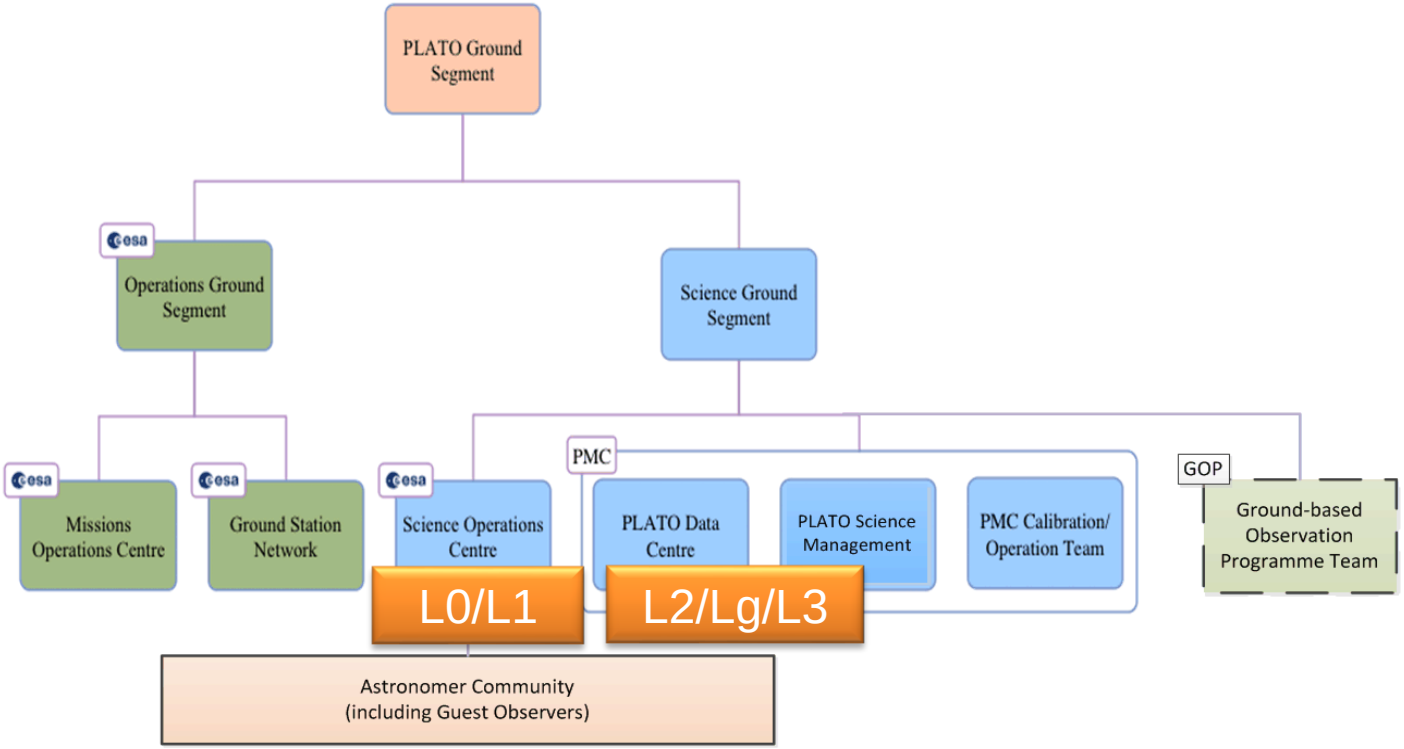
Level-3 (L3):

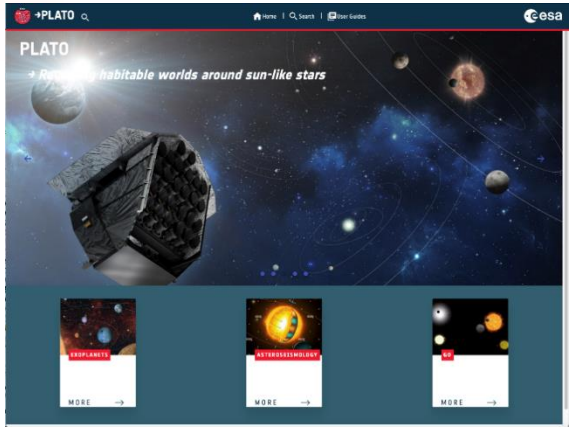
- The list of confirmed planetary systems, which will be fully characterised by combining information from the planetary transits, the seismology of the planet-hosting stars, and the results of ground-based observations.

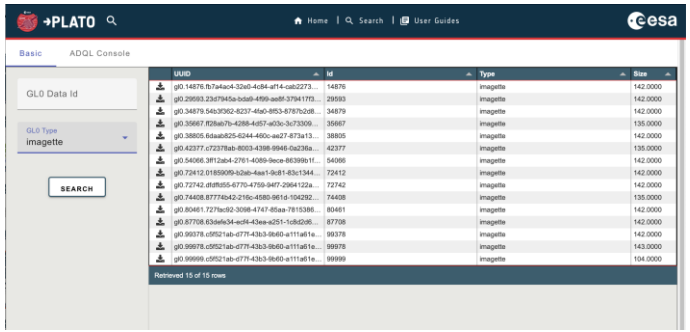
The Ground Segment

Science Ground Segment

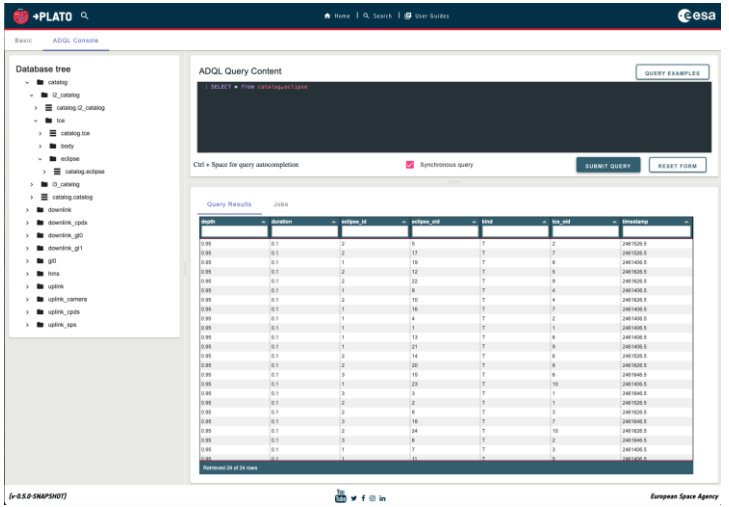


The ESA PLATO Mission Archive



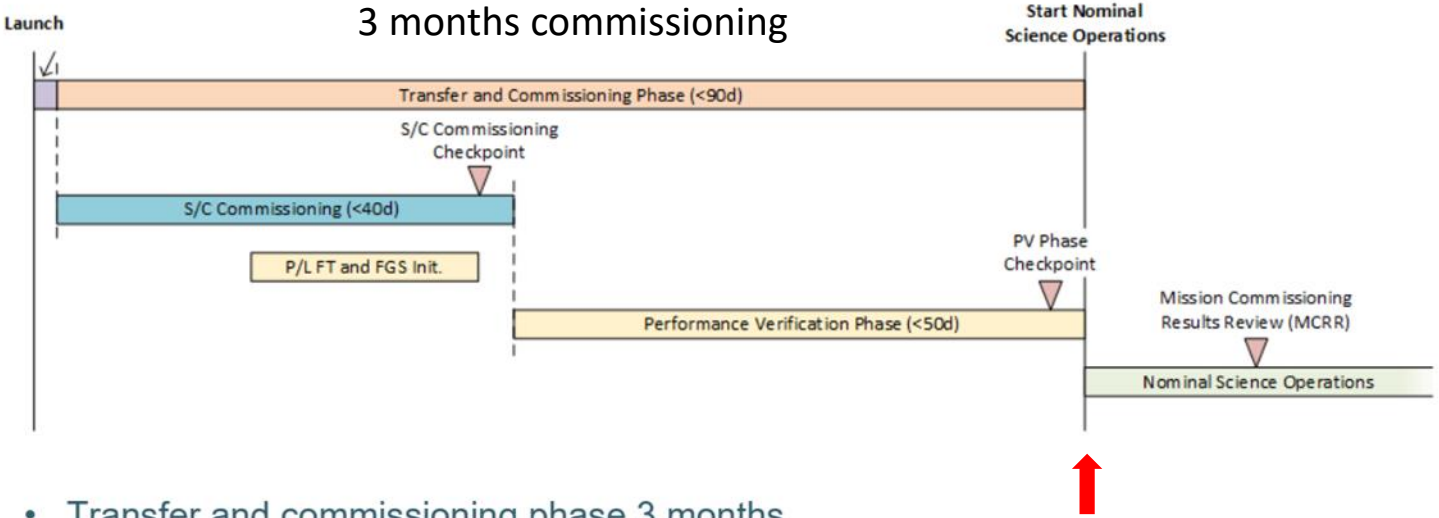


- Interface to the PMC for daily product delivery
- Availability of L0, L1, L2, L3 & Lg products to the community



Data Releases

Time Line after Launch

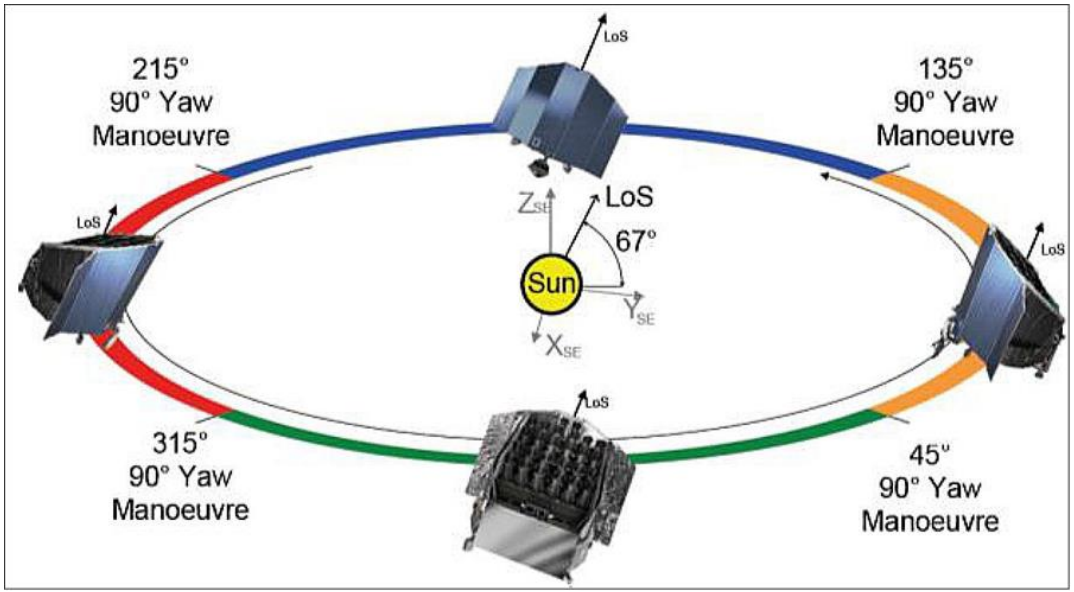


- Transfer and commissioning phase 3 months
- Nominal lifetime 4.25 years
- System sized for 6.5 years with consumables for 8 years

Science obs. starts

Mission operation

Rotation every 3 months by 90º to keep the solar panels looking to the Sun and avoid Sun intrusion.



step	PMC		ESA		Community	Processing durations	Data releases after end of observations of quarter Qn	# targets released 2 fields
	GOP	PDC/PSM	SOC	PAX				
0	End of 3 months observation period of quarter Qn							
1		L0/L1 generation and/or validation				**All targets:** For Q1: 6 months For Qn: <3 months		
2		Generate L2			validated L0, L1, L2 public	**Non-prime sample:** Qn: <3 month **Prime sample:** Qn: ≤1 year	**Non-prime sample:** Q1: 9 months Qn + 6 months → *releases of quarter Q(n>1) occur every 3 months* **Prime sample:** at the latest Q1: 1.5 years Qn + 1.25 years	~220 000 <20 000
3	Lg for prime & propriety samples					Target dependent		
4		L3 for prime & propriety samples			validated L0, L1, L2, L3 public		**Prime&propriety samples:** With publication of parameters or <6 months after completion of ground-based observations. At the latest by end of post-operations.	Prime planet sample: <<10 000 Propriety sample: <2 000

Data Products Releases

Level-0, Level-1 and Level-2 released per yearly quarters

Statistical sample

- Q1: end Q1 + 9 months
- Qn: end Qn + 6 months
- Qn releases occuring every 3 months after delivery of Q2

Prime sample

- Q1: end Q1 + 1.5 years
- Qn: end Qn + 1.25 years

Level-3

Prime sample

- 6 months after ground-based observations are complete

+ information on targets as provided by the community to the ESA archive on a best effort basis (ancillary data base).

The Guest Observer Program

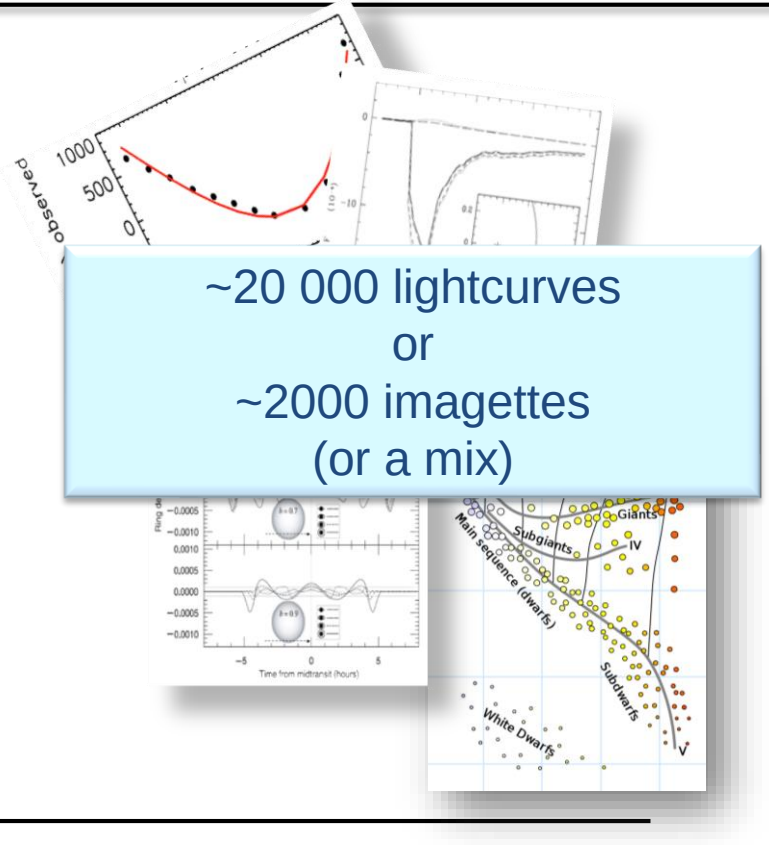
Complementary Science

- **Other science topics:**
  - Reflected light from close-in giant planets
  - Circumbinary planets, Exo-moons, rings, ..
  - Planets around young and evolved stars
  - Galactic Archeology, Clusters, Associations, AGN?
  - Asteroseismology across HRD, for large range in Z
  - Binaries & tidal evolution across HRD
  - Accretion, debris disks & magnetism in YSO
  - …

→ **Guest Observer program:**

➢ 8% of the science data rate for the Guest Observer Program.

➢ Participation is selected through ESA calls



Guest Observer Program

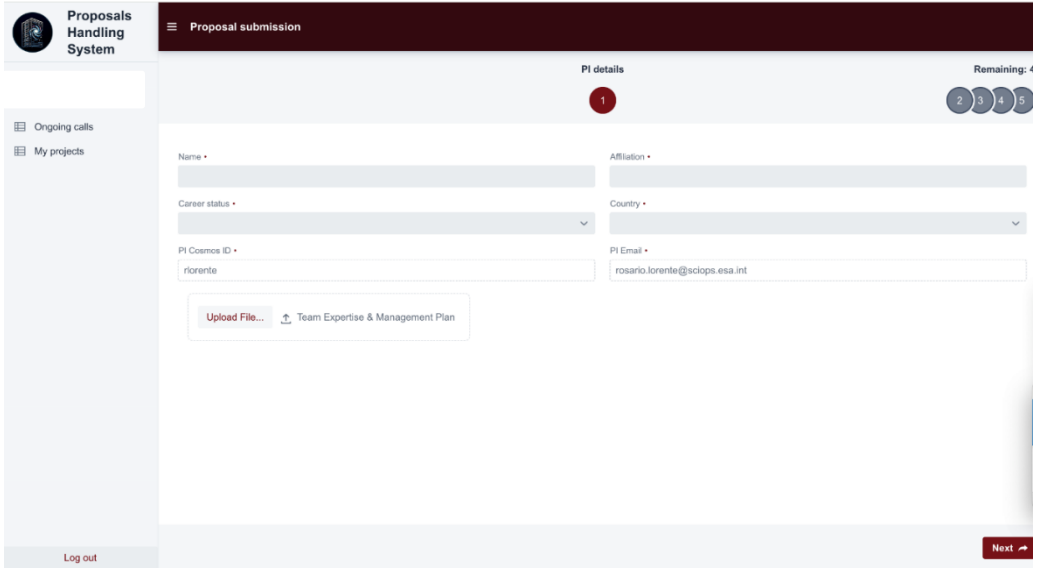
GUEST OBSERVER PROGRAMME

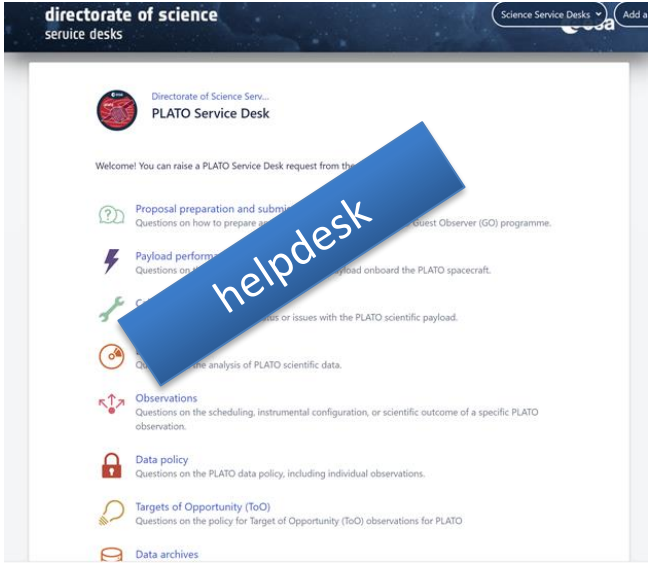
- ESA will issue calls for proposals for complementary science programmes, focused on topics not covered by the PLATO core science objectives (as described in the Science Management Plan)
- The first call will be issued nine months before launch -> March/April 2026
  More open calls will be issued during the mission (once per year, TBC)
- Proposals can include PIC targets but not Prime Sample targets
- Allocated time: Over the mission lifetime, an average of 8% of the science data rate (excluding calibration data)
- Proposals on targets of opportunity possible, but they will be executed on a best effort basis
- Proprietary period: One year, starting at the time of the delivery to the observer of the last portion of the relative Level-1 data

The first PLATO Call for Proposals

- 1st Call will **open in mid-March 2026** (9 months before launch) with a duration of approx. 6 weeks.

- The Proposal Submission system in use will be similar to the ESA Cheops interface but adapted for PLATO. A PMC provided toolkit to check e.g. visibility of your targets on the PLATO camera FOV, is to be used also.

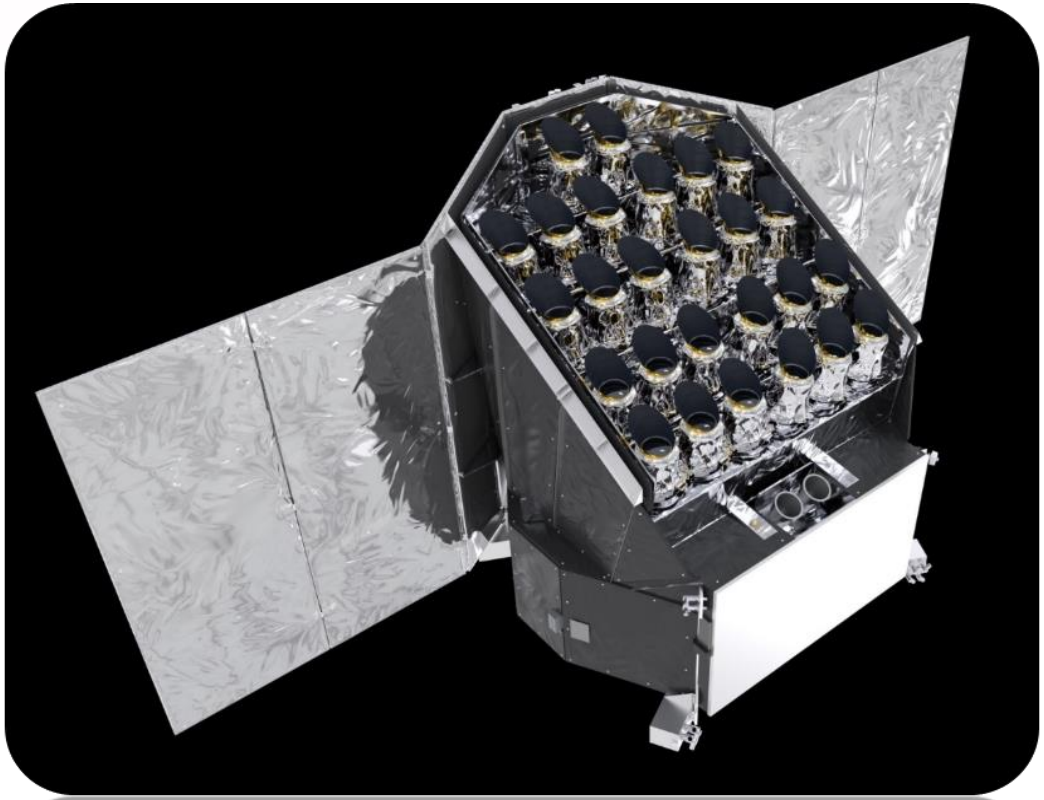




The first PLATO Call for Proposals

- ESA will appoint a Time Allocation Committee (TAC) for the evaluation and selection of the proposals.

- It would be expected that the announcement of the confirmed guest observers will be in September 2026.

- Observations from the GO targets will begin on the 4th month after launch. During the execution of the observations, the SOC will deliver Level-0 and Level-1 products to the observer every three months.

- Workshops are being organized with the community e.g. MPA workshop to prepare the community to apply for GO in Garching on 20-21 October