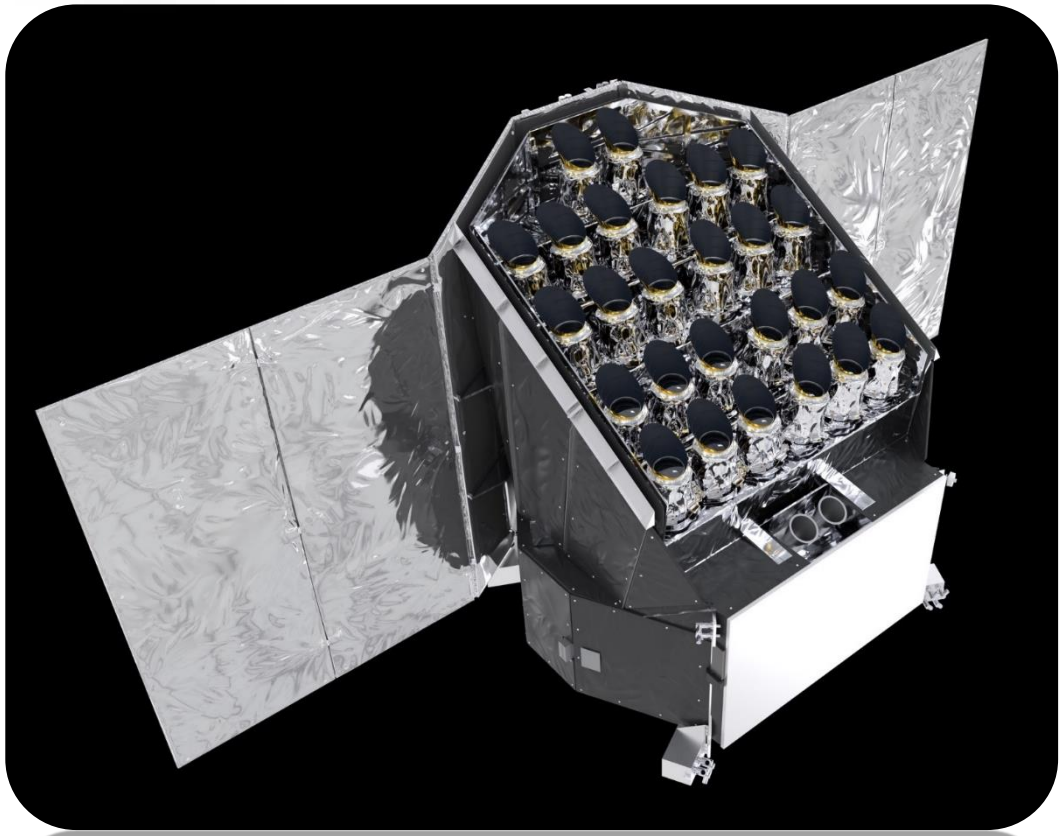


The PLATO Mission

Heike Rauer, DLR, Germany
Isabella Pagano, INAF, Italy
Miguel Mas-Hesse, INTA, Spain

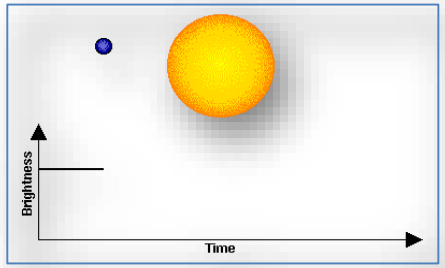
and the whole PLATO Team

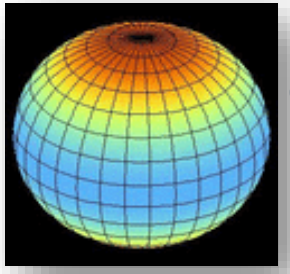
The PLATO Mission

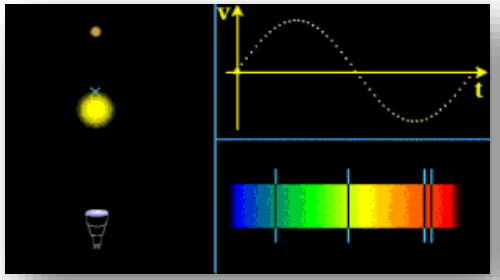
Goals and Methods

Prime mission goals:

- Detect a large number of extrasolar transiting planets, including **Earth-sized planets up to the habitable zone of solar-like stars**
- Determine precise **planetary radii, masses**, hence **mean densities**
- Investigate seismic activity in stars, enabling the precise characterisation of the planet host star, including its **age**







Transit detection

→ Planet/star radius ratio
→ Inclination

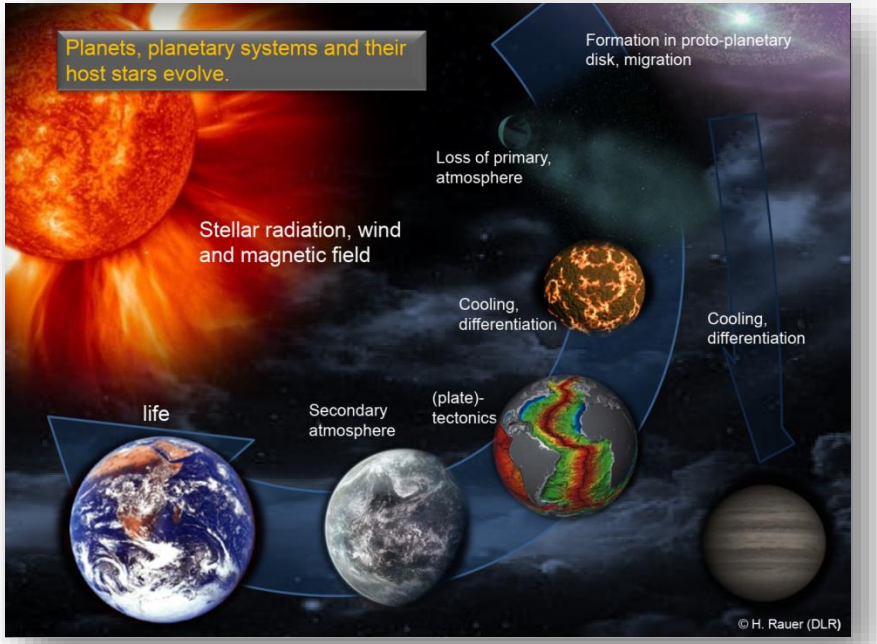
Asteroseismology

→ Stellar radius, mass
→ Stellar age

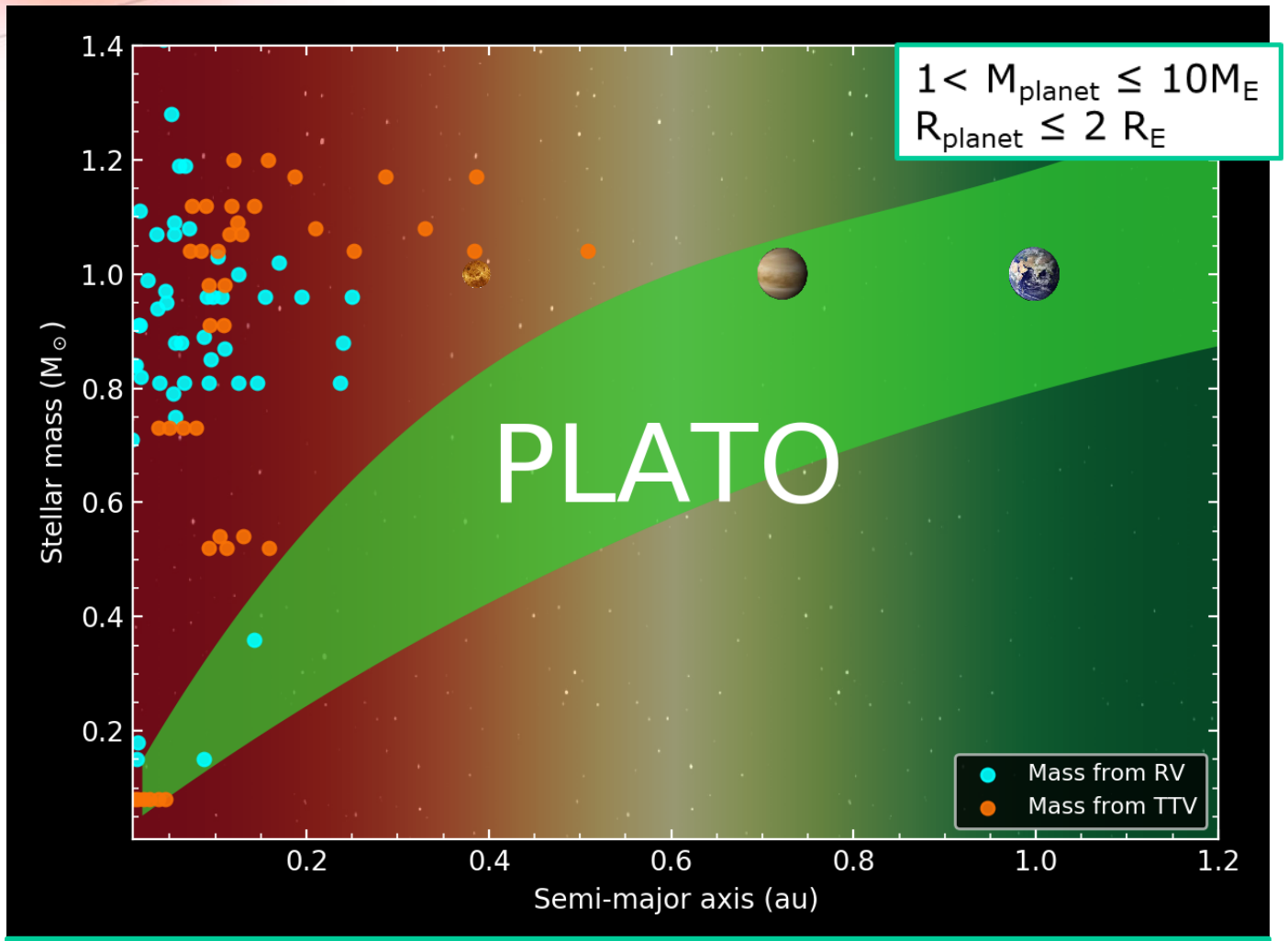
Ground-based observations

→ Planet mass

→ Mean density
→ Age



Characterisation of super-Earths around solar-like stars



Dots: Small planets with measured radius and mass.
(less than twice the Earth and less than 10 Earth masses)

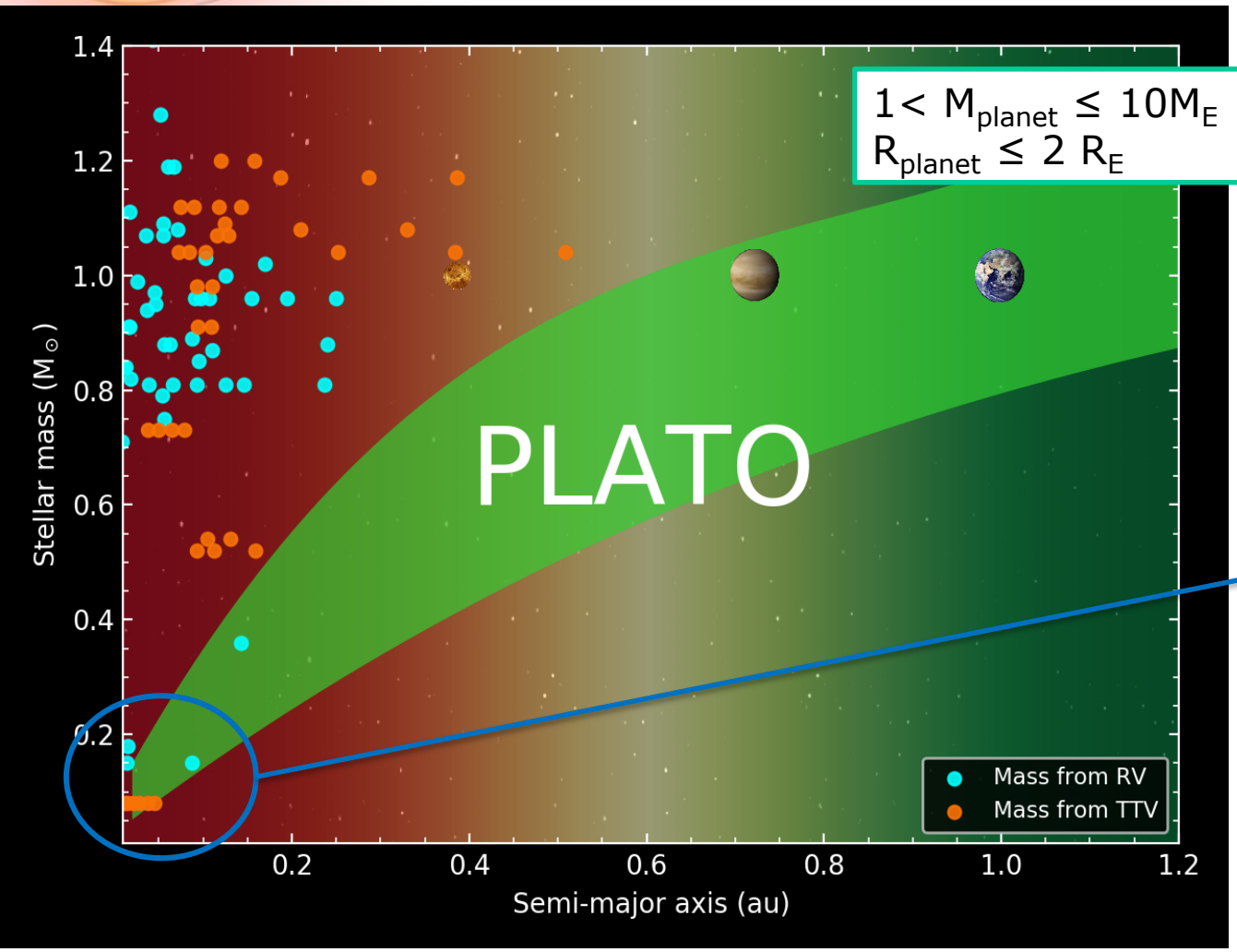
PLATO goals

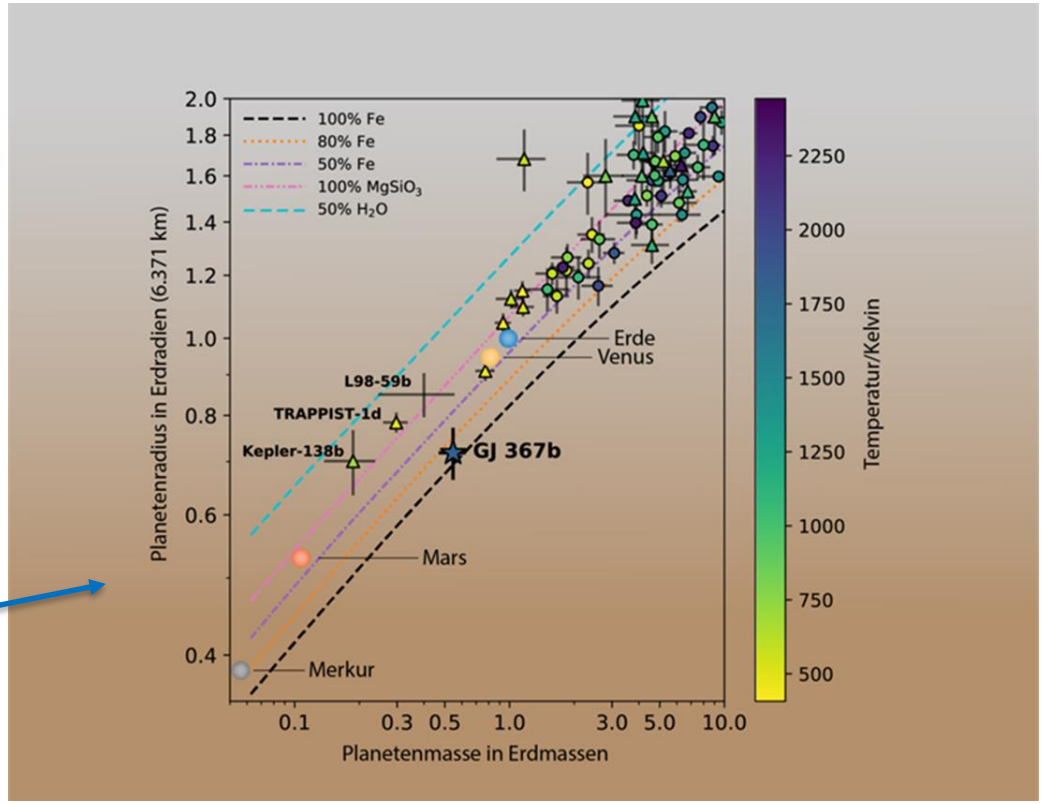
- Search planets in the habitable zone of solar-like stars.
- Determine whether they are rocky planets.
- Determine their age.
- Help us understand how planets form and evolve.
- Tell us whether there other systems like ours.
- Provide targets for further atmosphere studies.

Status today:

- 5202 planets in exoplanet.eu
- 1252 planets with m + r
- 170 with m<10 m_e and r<2 r_e
- 0 characterized in HZ of solar-like stars

PLATO is about Characterisation





Lam et al. 2021

See also HD 23472 system (Barros et al. 2022) for planets <1r_e

PLATO

- 3rd M-class ESA mission
- Launch Q4 2026 into orbit around L2 Earth-Sun Lagrangian point
- High precision photometry : $4 \leq m_v \leq 11$ (13)
- precision of 50 ppm in 1 hour for mv ≤ 11
- Multi-telescopes approach → 26 cameras

ESA/ATG medialab

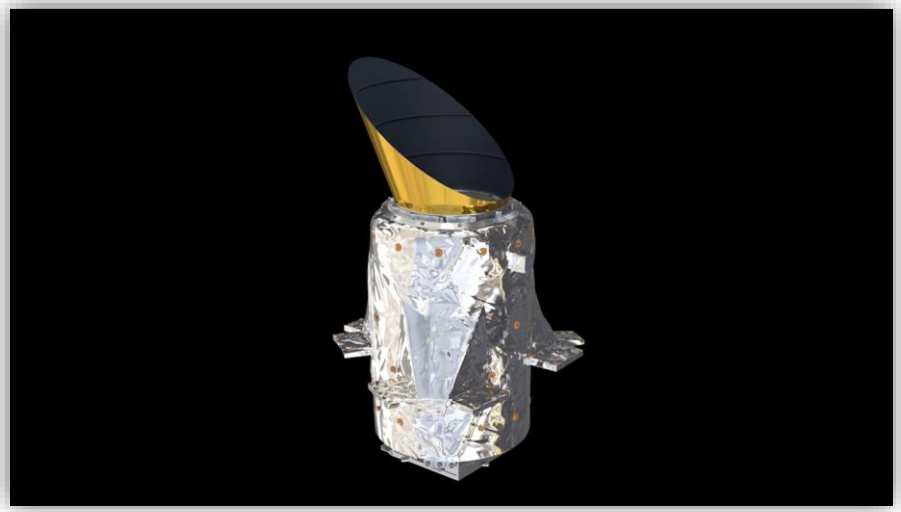
The FoV is spread over:
~2 billion pixels (2 000 Mpx vs 98 Mpx for Kepler)
~6 600 cm^2 of sensitive area (2x Gaia)

Size of about 3.5 m × 3.1 m × 3.8 m (8.2 m solar array)
Launch mass of 2165 kg, including consumables

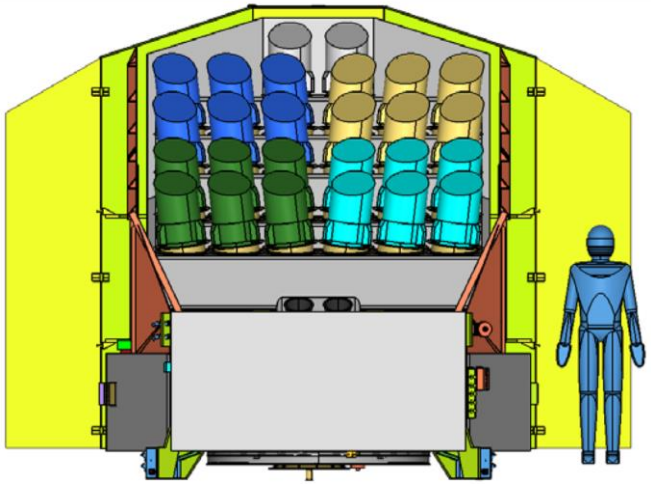
PLATO: instrument

24 Normal cameras:

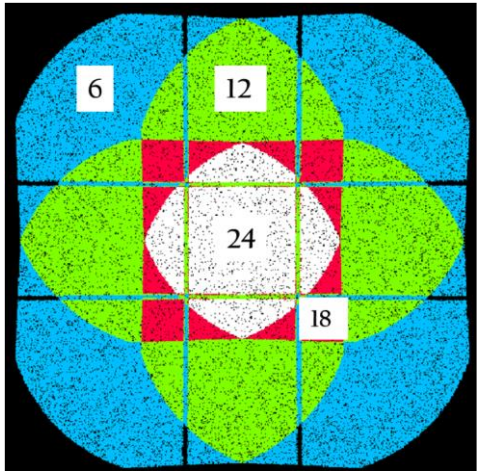
- 12cm aperture telescopes
- range: ~4 ≤ m_V ≤ 16
- Cameras in 4 groups, pointing separation by 9.2 deg
- FOV payload ~49°x 49° (2132 deg^2)
- Each camera has 4 x CCD, each 4510×4510px
- Pixel scale 15 arsec/pixel
- read-out cadence: 25 sec
- operate in “white light” (500 – 1000 nm)



ESA



ESA/OHB



Total FOV ~2132 deg^2

(vs 105 deg^2 Kepler)

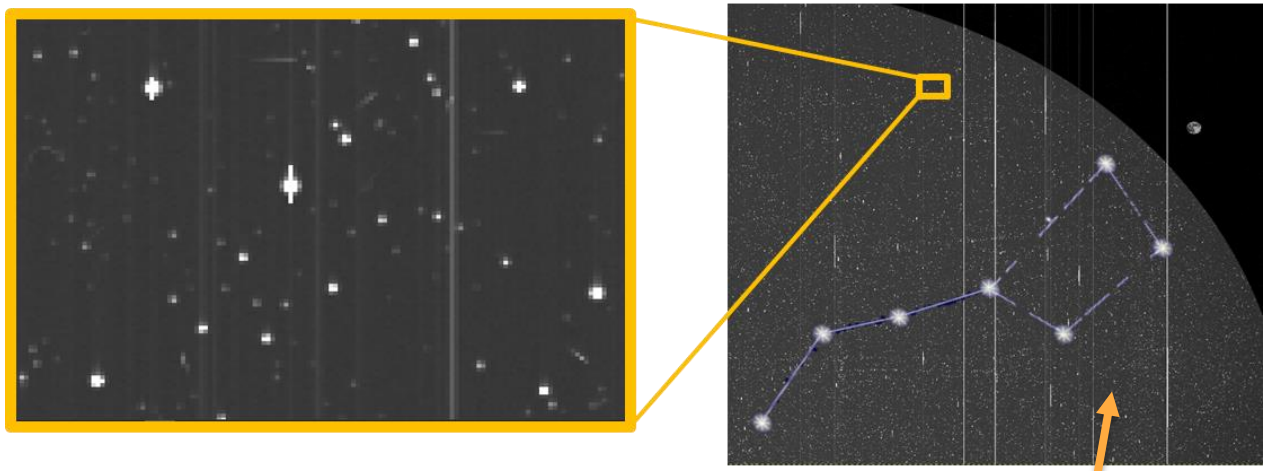
2 Fast cameras:

- range: ~4 ≤ m_V ≤ 8.2
- read-out cadence: 2.5 sec
- one “red“ & one “blue“ camera

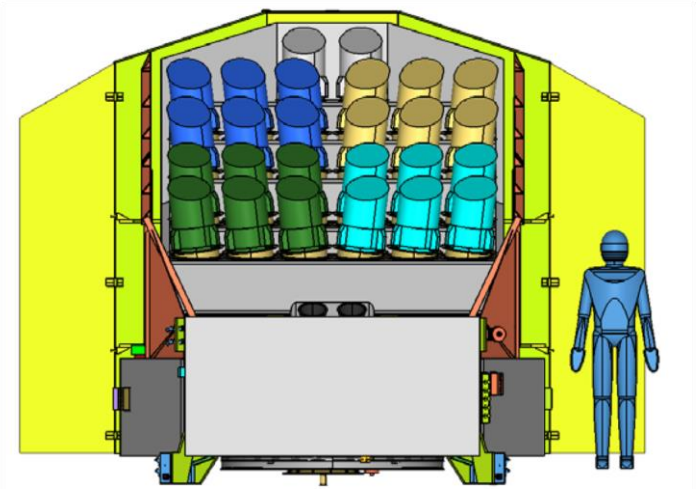
PLATO: instrument

24 Normal cameras:

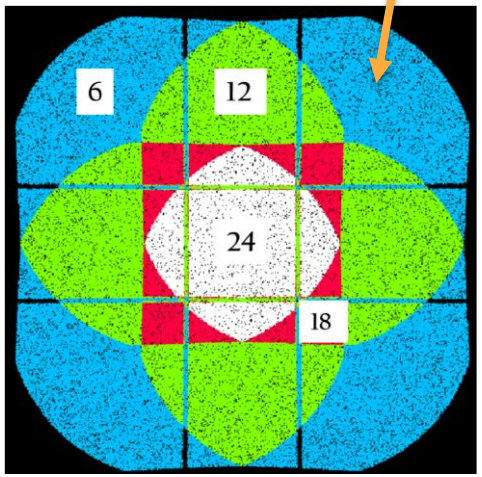
- 12cm aperture telescopes
- range: ~4 ≤ m_V ≤ 16
- Cameras in 4 groups, pointing separation by 9.2 deg
- FOV payload ~49°x 49° (2132 deg^2)
- Each camera has 4 x CCD, each 4510×4510px
- Pixel scale 15 arsec/pixel
- read-out cadence: 25 sec
- operate in “white light” (500 – 1000 nm)



Simulated with PLATOSim (KU Leuven)



ESA/OHB



Total FOV ~2132 deg^2
(vs 105 deg^2 Kepler)

2 Fast cameras:

- range: ~4 ≤ m_V ≤ 8.2
- read-out cadence: 2.5 sec
- one “red“ & one “blue“ camera

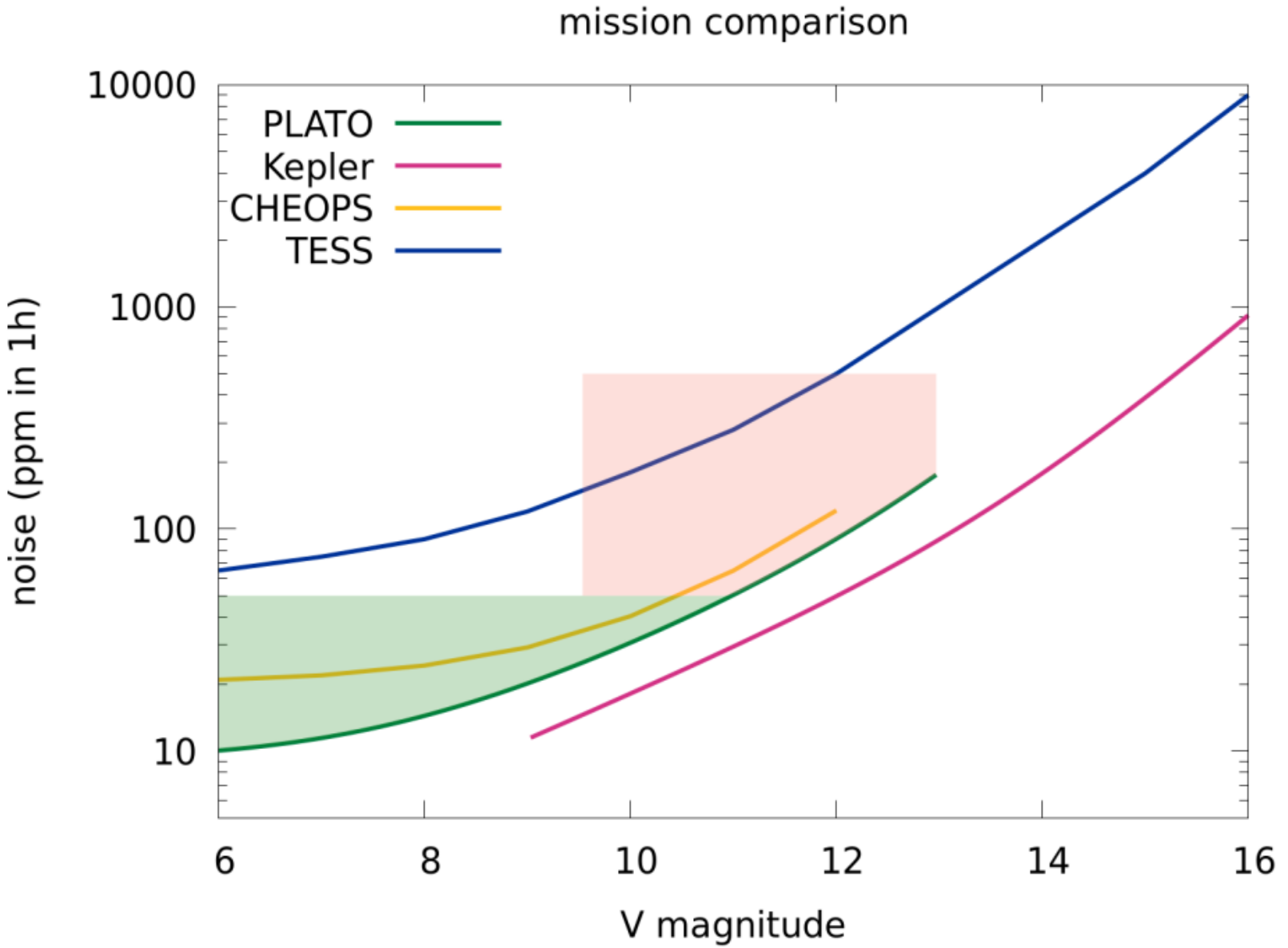


Fig. 12 Comparison of noise levels expected for PLATO with other missions. The approximate parameter space for PLATO samples (green: P1, red: P5) is indicated for illustrative purposes.

Observing Strategie

Nominal Mission:

- 2 „long pointings“ of 2 years each

Alternatives:

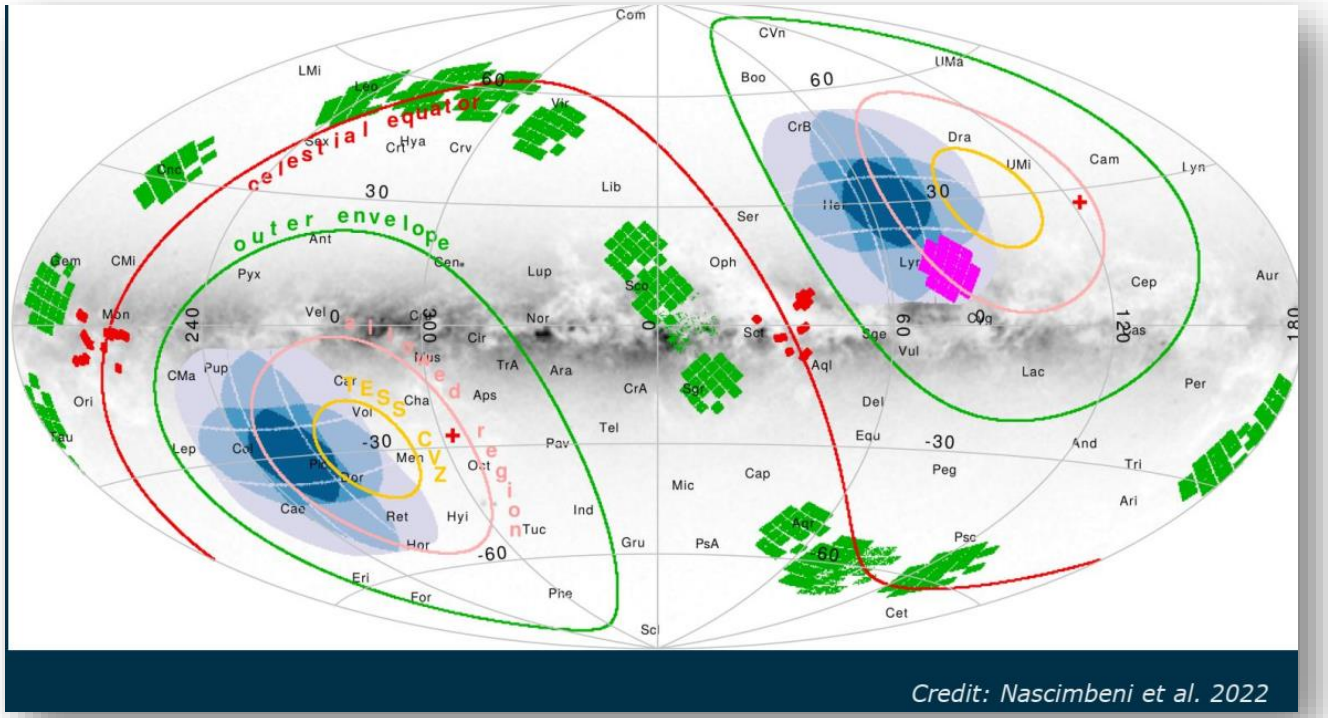
- 1 „long pointing (LP) “ for 3 years
- 1 year „step-and-stare“ of 2 months each

or

- 1 LP for 4 years

possible mission extensions:

- Full performance until 6,5 years
- Consumables for 8 years mission duration



Observing Strategie

Nominal Mission:

- 2 „long pointings“ of 2 years each

Alternatives:

- 1 „long pointing (LP) “ for 3 years
- 1 year „step-and-stare“ of 2 months each

or

- 1 LP for 4 years

possible mission extensions:

- Full performance until 6,5 years
- Consumables for 8 years mission duration

Stellar target samples:

Nominal Mission:

- ~15 000 stars <11mag
  precize planet radii (5%), astroseismology (ages 10%), RV-planet masses (10%)
- >245 000 stars <13 mag:
  planet radii <10%, RV- and TTV-Massen
- >5 000 M dwarfs

Observing Strategie

Nominal Mission:

- 2 „long pointings“ of 2 years each

Alternatives:

- 1 „long pointing (LP) “ for 3 years
- 1 year „step-and-stare“ of 2 months each

or

- 1 LP for 4 years

possible mission extensions:

- Full performance until 6,5 years
- Consumables for 8 years mission duration

Expected transit yields with 4 years mission scenarios:

Targets	Observing Strategy	
	2+2 years	3+1 years
V<11 mag, all planet types	1200 - 1350	2300 - 2700
V<13 mag, all planet types	4600 - 7150	10300 - 10800
V<11 mag, planets <2 r_earth, G0V host star	0 - 120	0 - 140

ESA-SCI(2017)1; Heller et al. 2021, Matuszewski et al. (subm.), Cabrera et al. (in prep.)
see also Rauer et al., in prep.

PLATO Input Catalogue (PIC)
Is build up continuously:

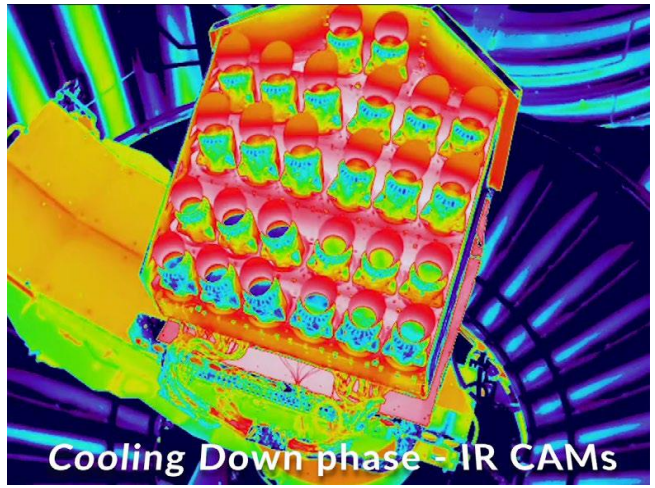
PIC1.1.0 is a catalog of F5->GKM dwarf and sub-giant stars selected accordingly with the criteria defined in the PLATO Science Requirement Document

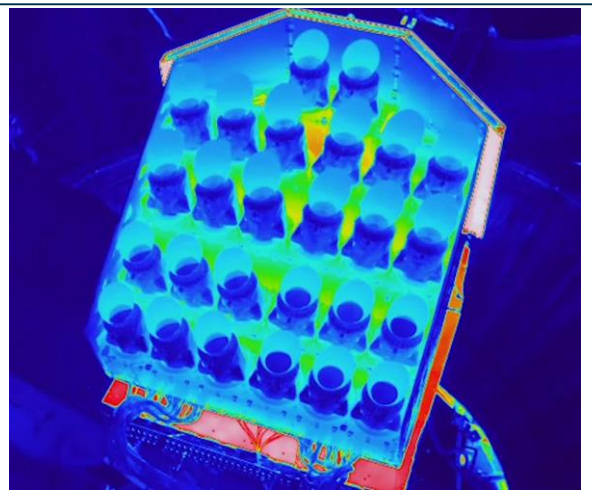
PIC availability (as defined in PLATO SMP):

- A first version of the PIC with the targets in the first LOP sky field will be delivered by the PMC to the ESA Science Working Team **2 years before launch**.
- Updates of the PIC are planned 9 months before launch and 6 months before the start of each LOP.
- Other fine tunings on the PIC are possible at any time during mission operations following the mission planning cycle
- Publication of the PIC (at the latest) 9 months before launch (for guest observer call).

Next: PIC1.1.0 contains 308245 sources

PLM STM: Environmental Campaign completed





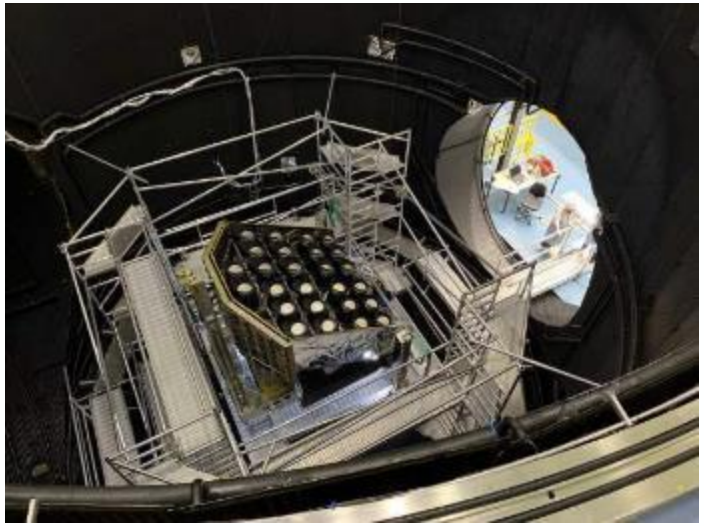


IMAGE Credits: ESA/OHB GmbH

CAM STM Tested

IMAGE Credits: ESA/PMC

CAM EM Tested

IMAGE Credits: SRON/PMC

Payload DPS EM Bench integrated and under testing

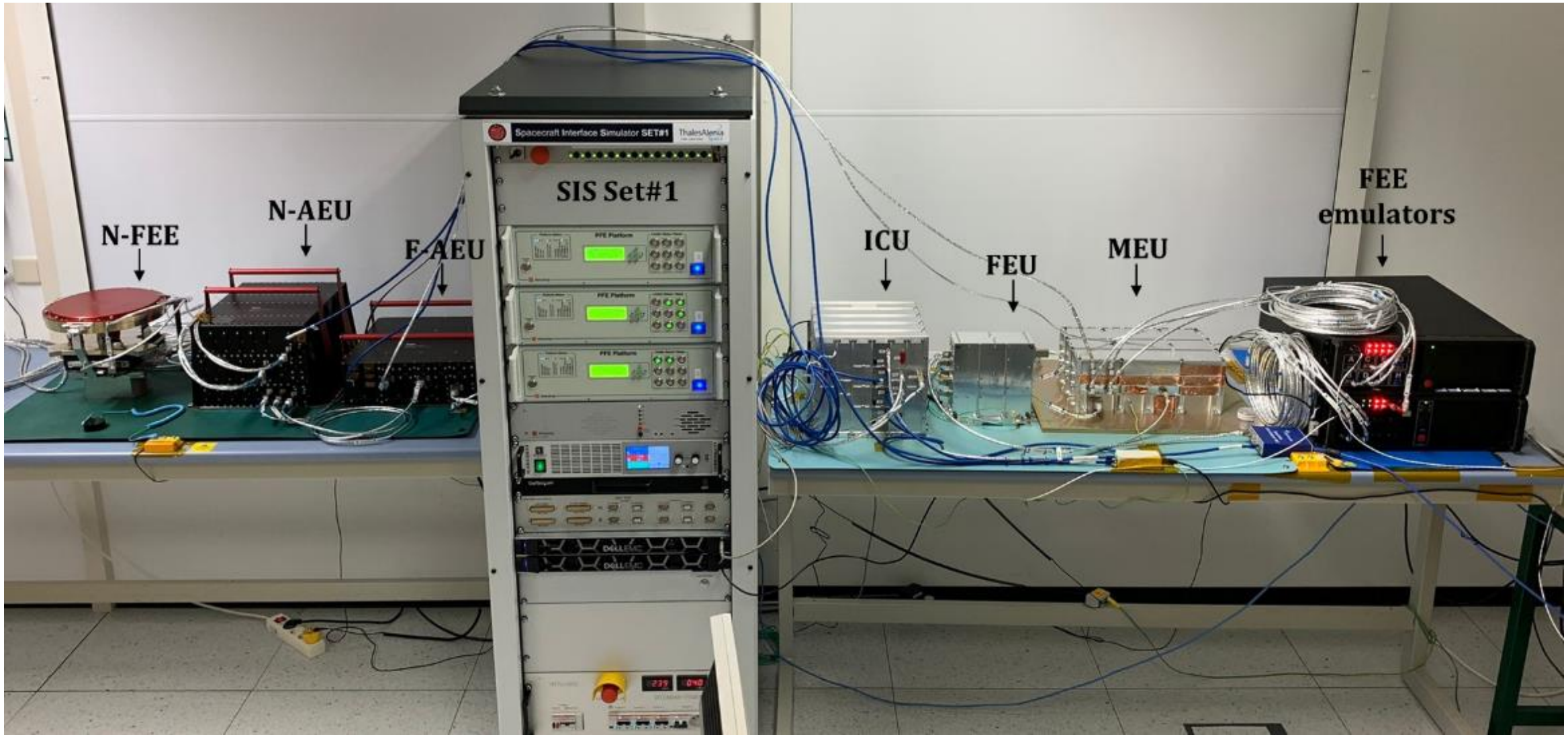
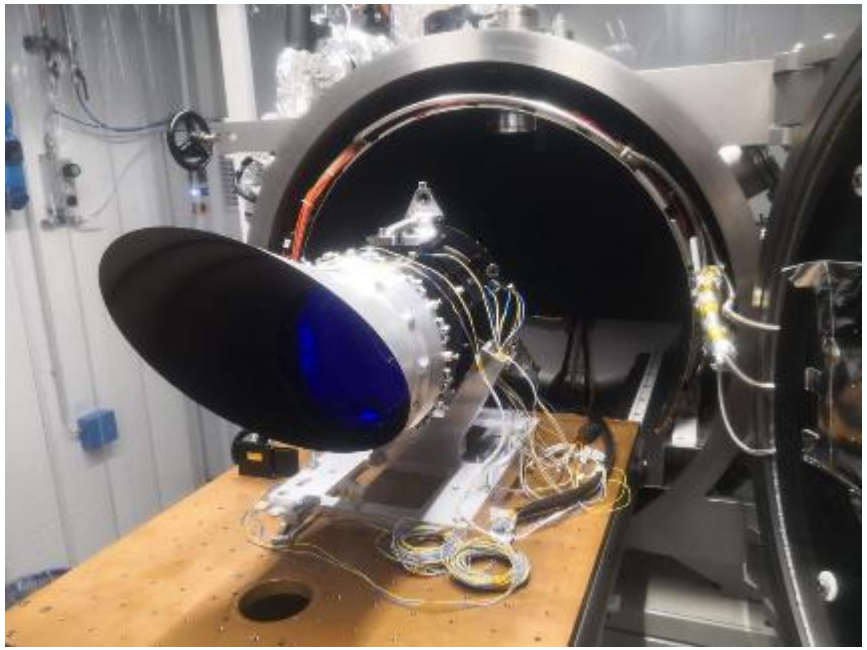
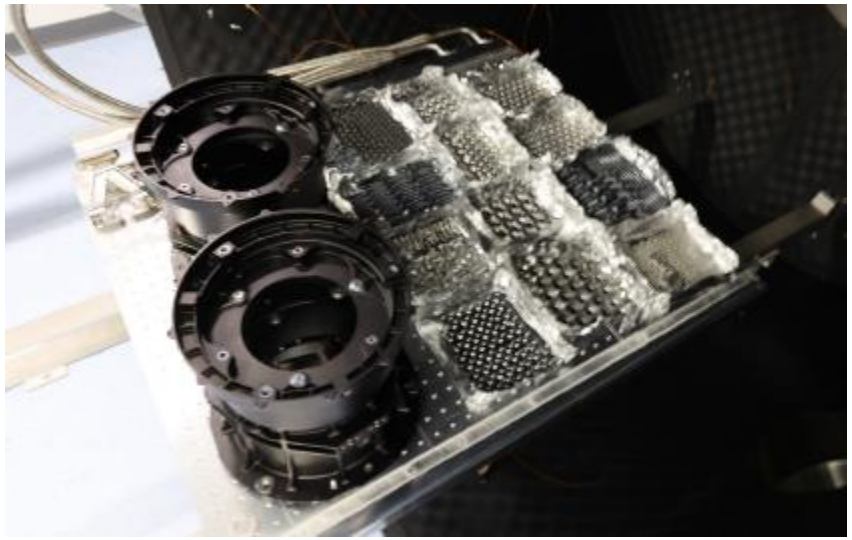
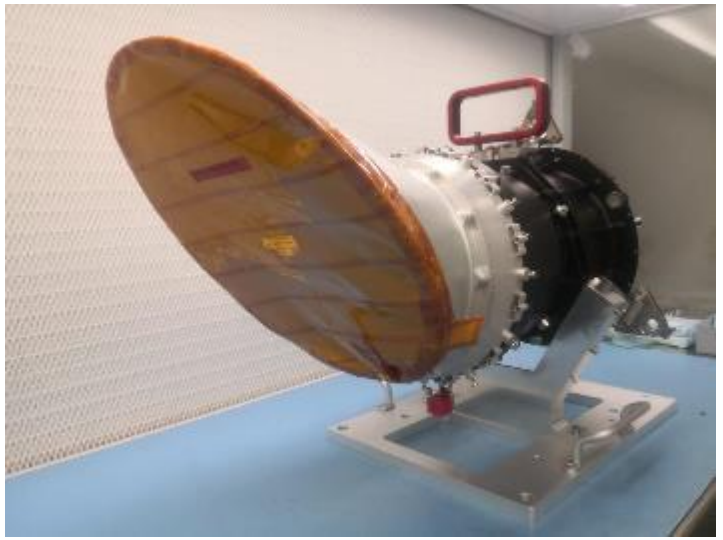


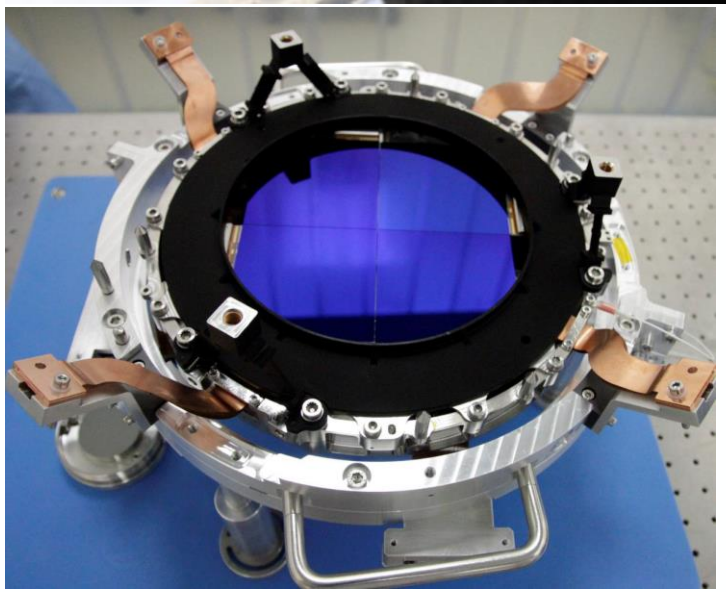
IMAGE Credits: DLR/PMC

Flight CAM production started









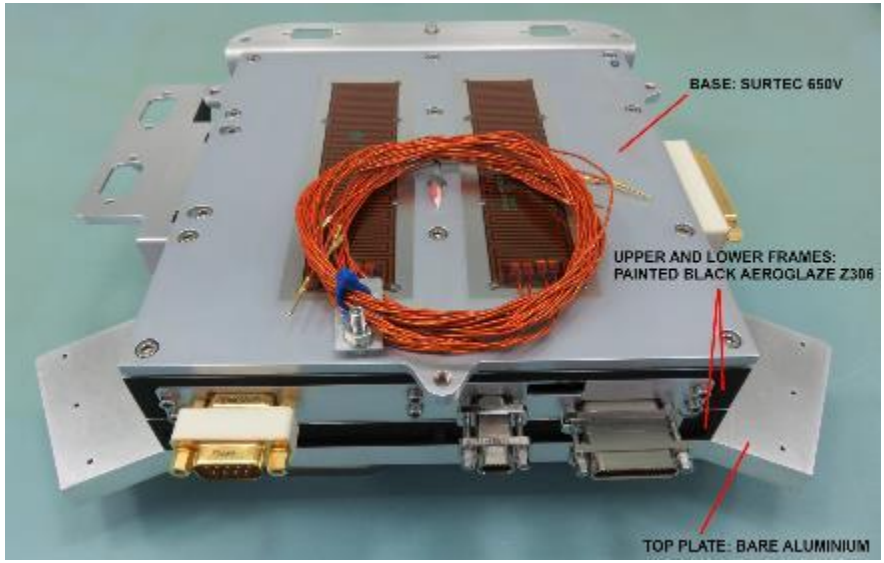
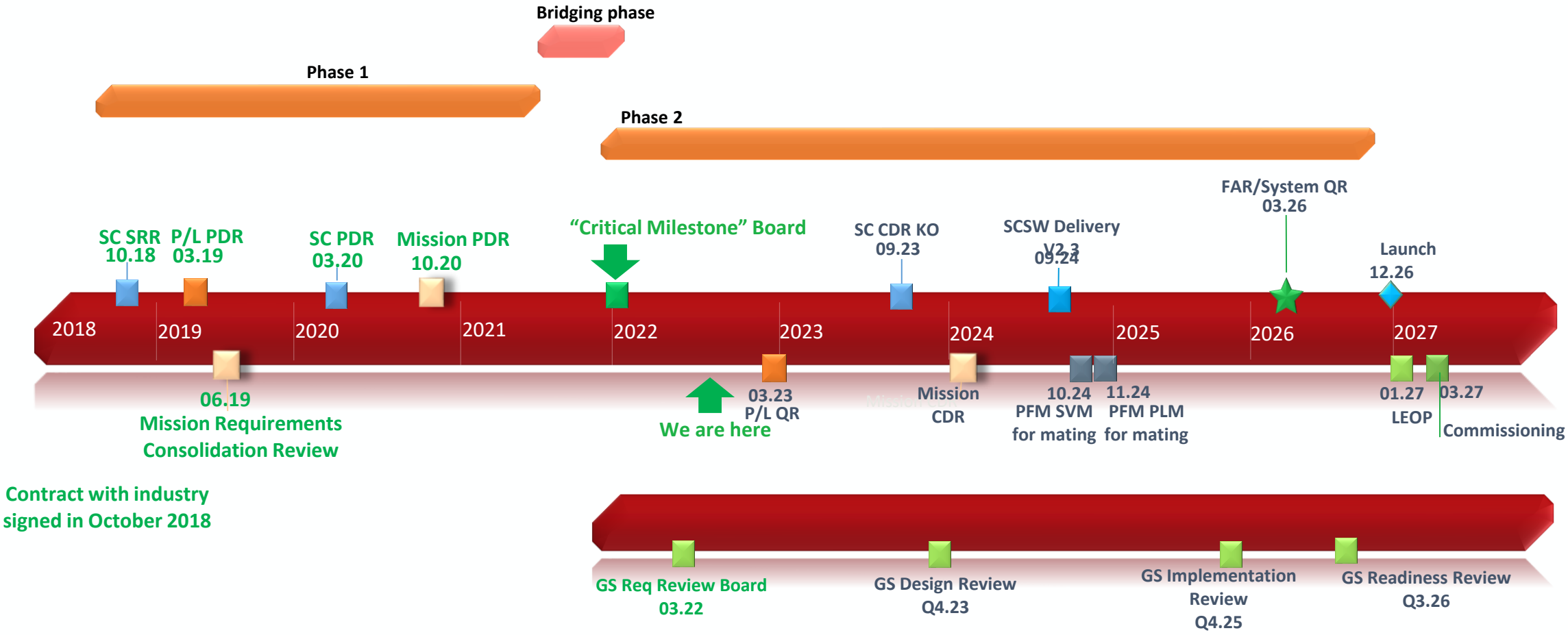


IMAGE Credits: INAF/ASI/LDO/INTA/MSSL/PMC

PLATO Timeline



PLATO is the result of the work of hundreds of people. „Thank You“ to all!

Participants to PLATO Week in Cambridge