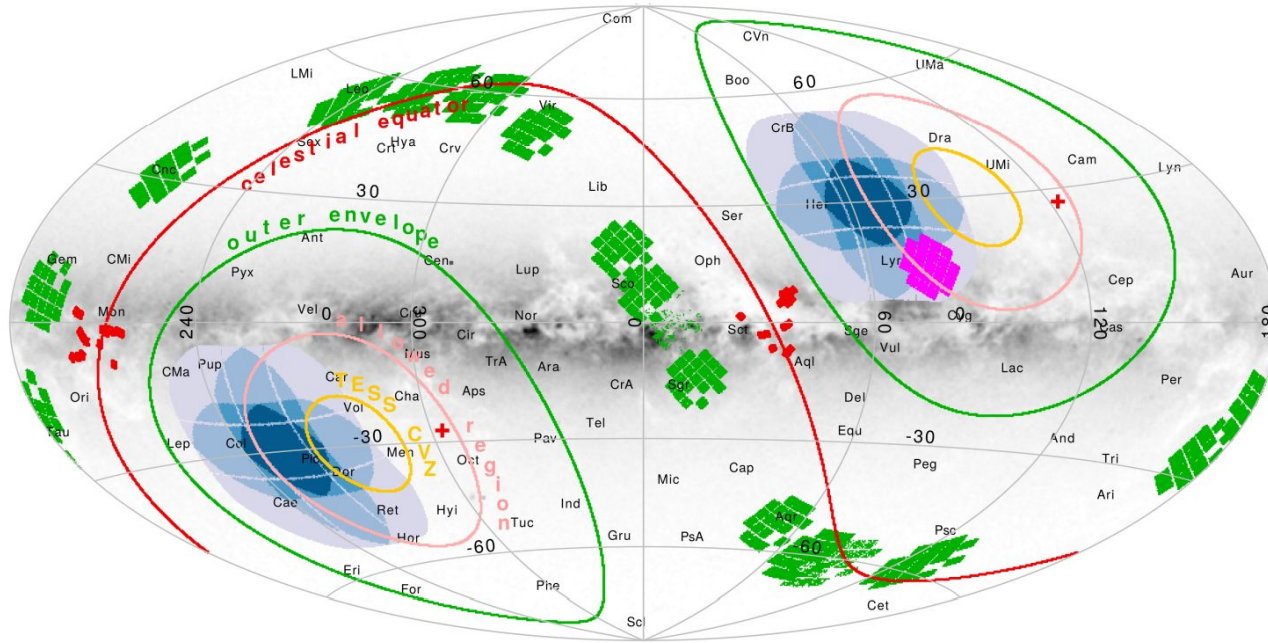


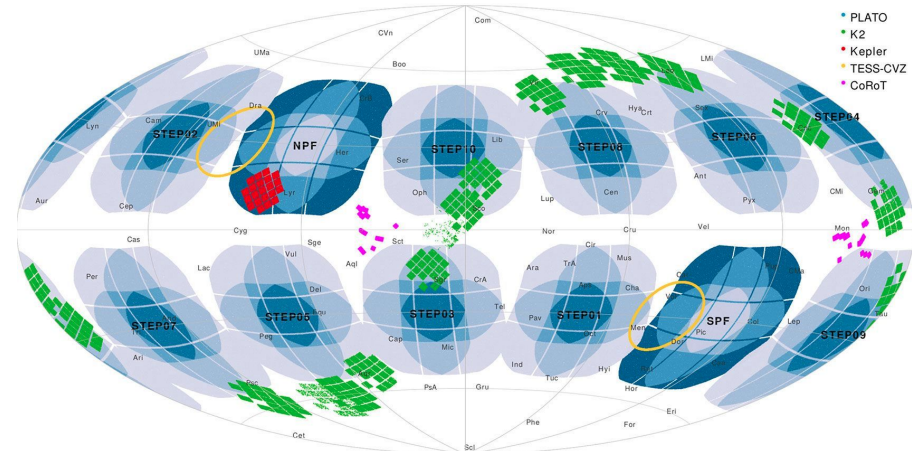
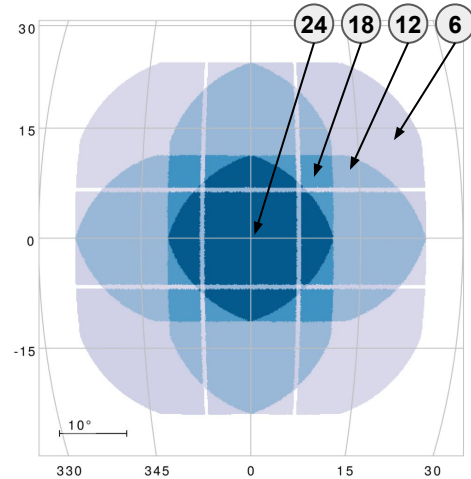
The PLATO Field(s) and the PLATO Prime Sample



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The PLATO Field(s): requirements

- PLATO will observe with **24 NCAMs** arranged in groups of six with an offset of 9.2° : flower-like pattern with different areas covered by 6, 12, 18, 24 NCAMs. Overall FOV: **$\sim 2150 \text{ deg}^2$ ($\sim 49^\circ \times 49^\circ$), 5% of the whole sky**
- Also: **2 FCAMs** with color information (blue/red wide-band filter) and faster cadence (but smaller FOV)
- During its nominal 4-yr mission, PLATO will continuously monitor one or two pre-selected fields for at least two years each during the so-called Long-duration Observation Phase (**LOP**). The mission has been designed to have the capability to observe additional fields for shorter intervals, at least two months each (Step-and-stare Observation Phase; **SOP**)
- Several requirements for the LOP fields from SciRD: for instance, the center should be at $\beta > 63^\circ$ (R-SCI-50), i.e. **close to the ecliptic poles!** But there are also requirements on the number of specific targets (next slide ↻)



Sky fields for ESA's planet-hunter satellite PLATO
(Marchiori, V., et al., 2019, A&A, 627, A71)

The PLATO Stellar Samples

The stellar samples are subsets of the tPIC (Montalto+ 2021; currently 218,820 stars in tPIC v2.1) defined in terms of spectral type, noise and magnitude (Table 1).

From the SciRD, PLATO shall observe during its LOP phase:

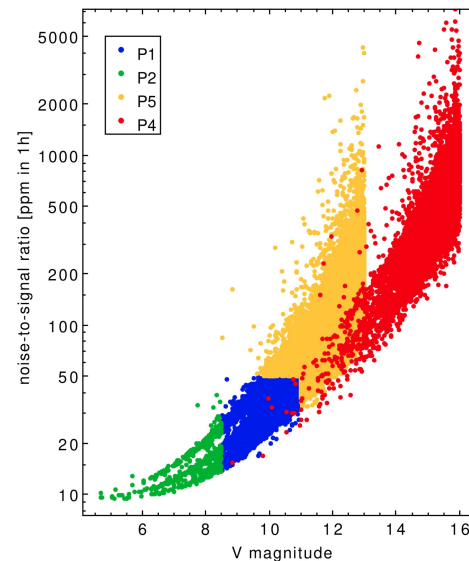
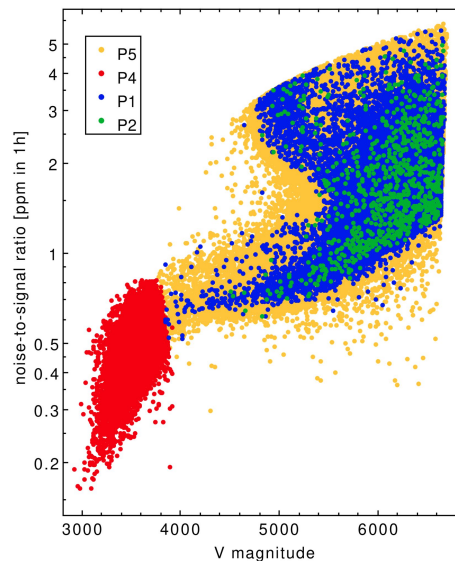
- $\geq 15,000$ P1 (goal: 20,000)
- $\geq 1,000$ P2
- $\geq 5,000$ P4
- $\geq 245,000$ P5

The **Prime Sample** ($< 20,000$) and the **Proprietary Sample** ($< 2,000$) are also subsets of the tPIC).

Moreover, 8% of the PLATO science data rate will be allocated to **Guest Observer (GO)** programs selected by ESA through open calls!

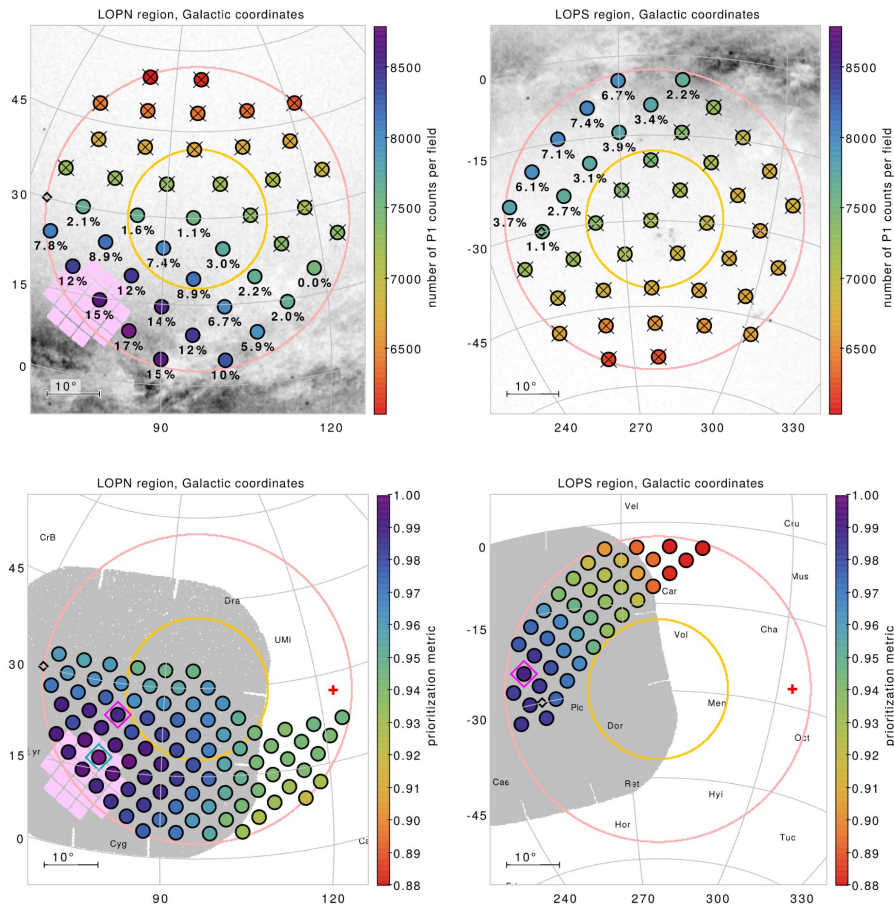
Table 1. Definitions of the main PLATO stellar samples.

Sample	SpT	lum. class	mag. limit	Noise
P1	F5-K7	dwarfs and subgiants	$V < 11$	< 50 ppm
P2	F5-K7	dwarfs and subgiants	$V < 8.5$	< 50 ppm
P4	M	dwarfs	$V < 16$	—
P5	F5-K7	dwarfs and subgiants	$V < 13$	—



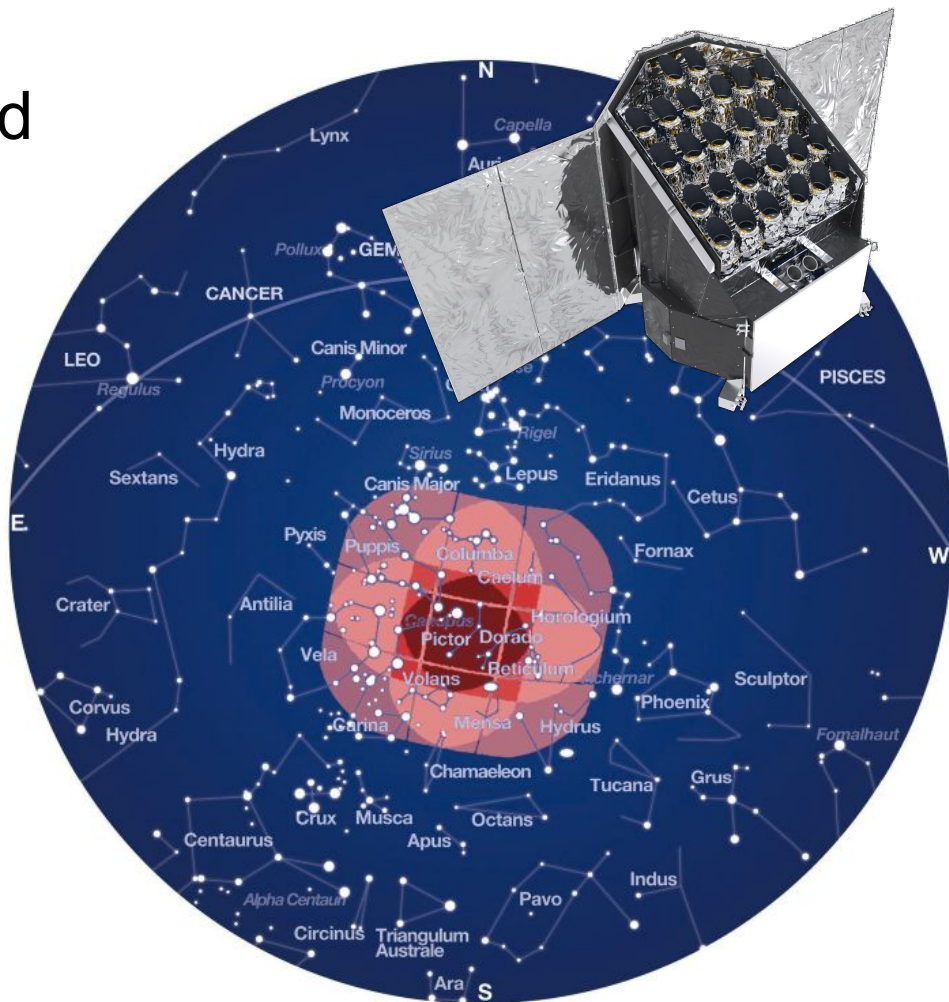
The optimization process

- Described in detail in Nascimbeni+ 2022, Nascimbeni+ 2025
- Grid-based approach:** we first identified a number of grid points within the *allowed zone* ($|\beta| > 63^\circ$ cap) to select the ones compliant with the requirements on the number of targets
- We then applied a *metric* which also takes into account R^* , expected S/N and stellar contamination to identify the two most favorable fields: **LOPS1** and **LOPN1** (Nascimbeni+ 2022). The southern field has been later moved to **LOPS2**, to ensure that the selected field is independent of the initial spacecraft rotation angle after launch (Nascimbeni+ 2025).
- July 2023: after carefully considering the synergies with the ground-based facilities, the SWT selected as the first field...



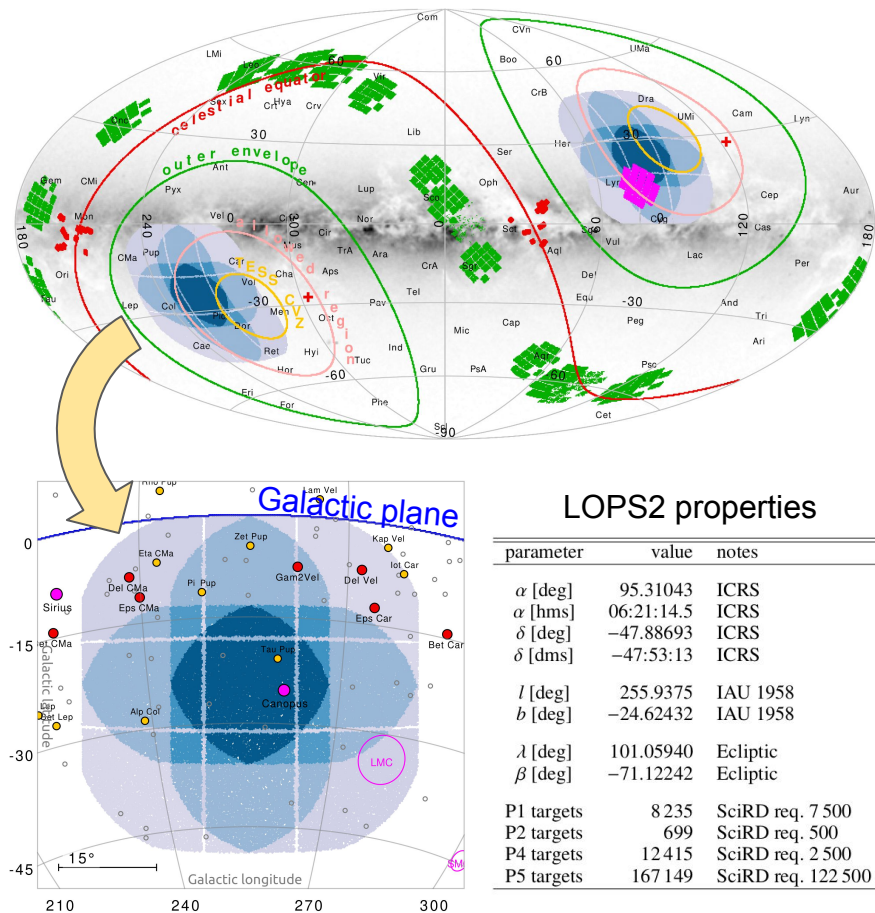
LOPS2: the first PLATO field

parameter	value	notes
α [deg]	95.31043	ICRS
α [hms]	06:21:14.5	ICRS
δ [deg]	-47.88693	ICRS
δ [dms]	-47:53:13	ICRS
l [deg]	255.9375	IAU 1958
b [deg]	-24.62432	IAU 1958
λ [deg]	101.05940	Ecliptic
β [deg]	-71.12242	Ecliptic
P1 targets	8 235	SciRD req. 7 500
P2 targets	699	SciRD req. 500
P4 targets	12 415	SciRD req. 2 500
P5 targets	167 149	SciRD req. 122 500



LOPS2: the first PLATO field

- PLATO will start its operation with a long-duration observing phase (LOP), i.e., with a field to be observed continuously for at least two years;
- *The first PLATO field will be “LOPS2”, centered at $\alpha \sim 6^h 21^m$, $\delta \sim -48^\circ$ in the southern hemisphere* (Nascimbeni et al. 2025, A&A). Constellation-wise, it will cover Pic, Col, Dor, Cae, Ret, Pup entirely, plus smaller parts of CMa, Car, Vol, Men, Hor, Eri, Lep, Vel, Hyi for a total of $\sim 2150 \text{ deg}^2$;
- *LOPS2 spans $-73.8^\circ < \delta < -20^\circ$ in declination*. It will be fully visible only from southern facilities, but a non-negligible fraction of its 6 and 12 NCAM regions will also be accessible from low-latitude northern observatories;
- *LOPS2 spans $-49^\circ < b < 0^\circ$ in Galactic latitude*, one of its sides being tangent to the disk. Wide range of stellar populations represented;
- Fully compliant with the PLATO Scientific Requirements in terms of P1-P2-P4-P5 counts



LOPS2: the first PLATO field

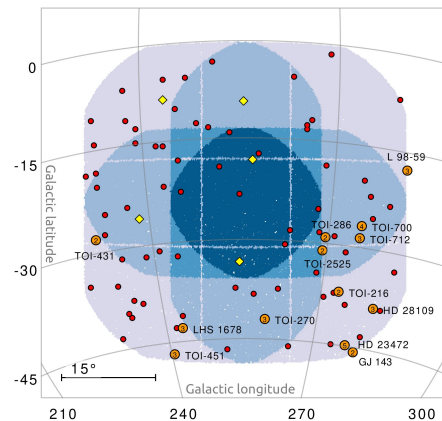
Synergies: most of the TESS continuous viewing zone (CVZ; $\beta < -78^\circ$) and the JWST CVZ are fully within LOPS2, as are 544 TESS planetary candidates and 108 already confirmed transiting planets

The LOPS2 footprint also includes:

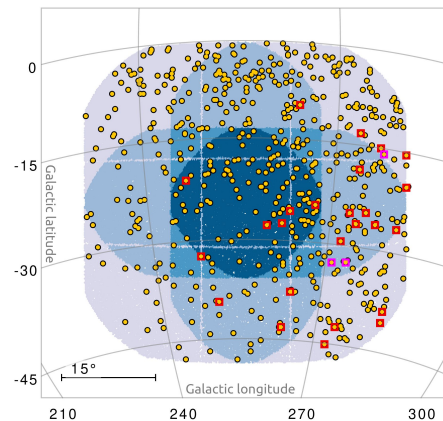
- the Large Magellanic Cloud (LMC);
- 367 open clusters, of which seven have a significant number of bright ($V < 15$) solar-type stars;
- ~300k cataloged variable stars of almost all the known types, including EBs, LPV, γ Cas, CP, CV, δ Scu, γ Dor, Cepheids, RR Lyrae, SPB, β Cep, etc.;
- 77 non-transiting exoplanets, mostly discovered with the radial velocity technique;
- some benchmark objects such as γ Dor, γ Vel, AB Dor and the Kapteyn's star;

...and much more. Huge community involvement!

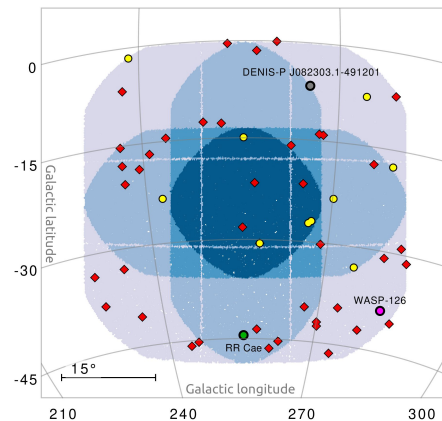
Known transiting planets



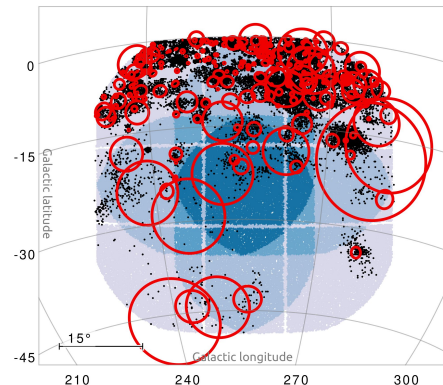
TESS candidates



Non-transiting planets

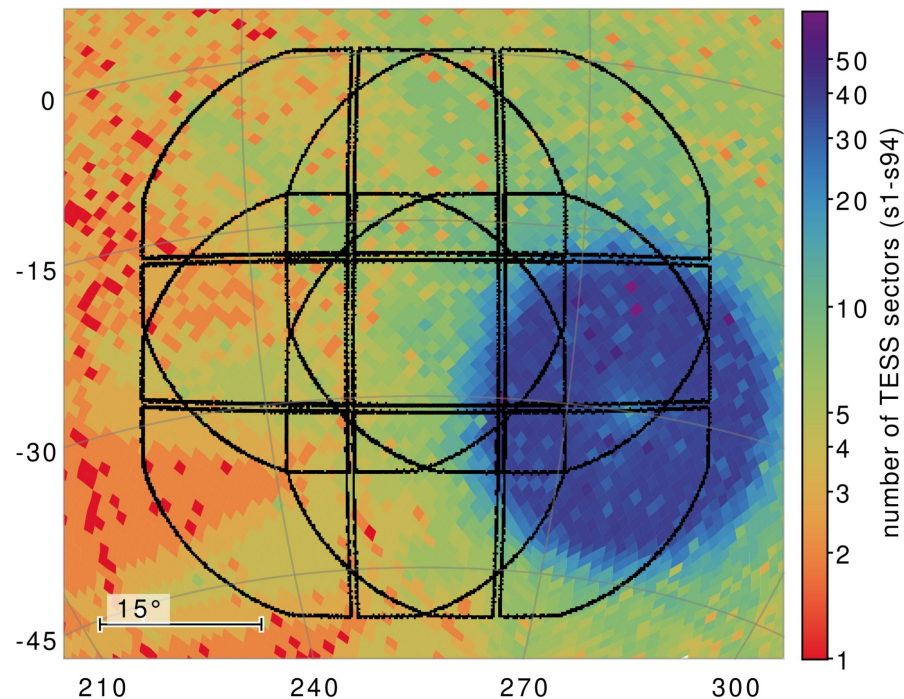


Open clusters



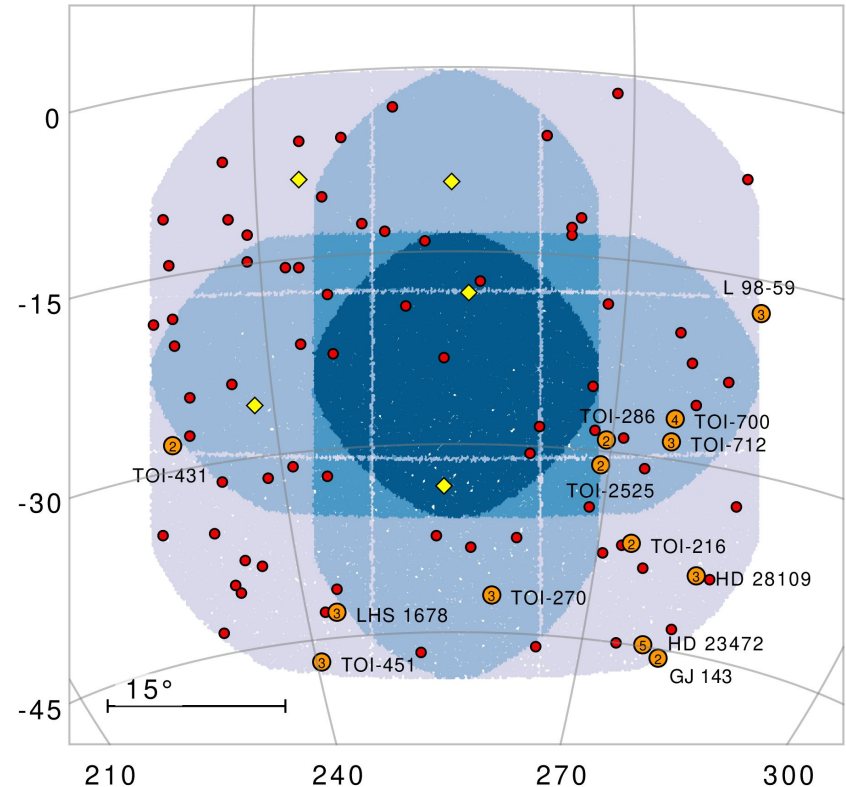
Synergy with TESS

- Among the 519 704 unique TESS targets observed at the regular 2-min cadence up to Sector 94 included, 37 910 lie within the approximate footprint of LOPS2
- Among these, 55% were observed for at least three TESS sectors (not always contiguous) and 15% for at least 13 sectors, or one year cumulated (mostly within the $\beta \lesssim -78^\circ$ cap).
- In term of FFIs 25% of the LOPS2 sky area has been already surveyed through at least 12 TESS sectors, 55% through at least five sectors, and 88% by three.



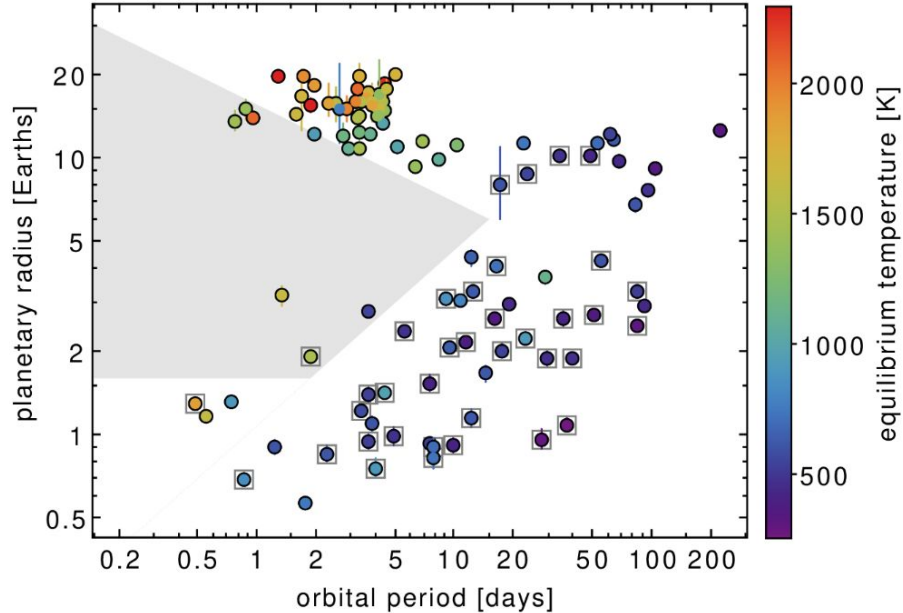
LOPS2: known exoplanets

- Overall, **108 confirmed transiting planets** are located in LOPS2 ; they belong to 84 distinct planetary systems. They cover a vast area of the parameter space: 47 HJ, 14 WJ/CJ, 24 (mini-)Neptunes, 23 rocky planets.
- 13 systems with **multiple transiting planets**: five doublets, six triplets and two high multiplicity systems (TOI-700, HD 23472)
- ...but also 544 “active” **TOIs** (TESS candidates) and 53 **non-transiting planetary systems** mostly discovered by RVs and imaging: they will be ALL included in the PIC, regardless of their magnitude or S/N (within feasibility)
- In the case of non-transiting planets, PLATO could not only better characterize the host star, but also discover additional planets (e.g., inner companions to long-period planets discovered by RVs or astrometry)

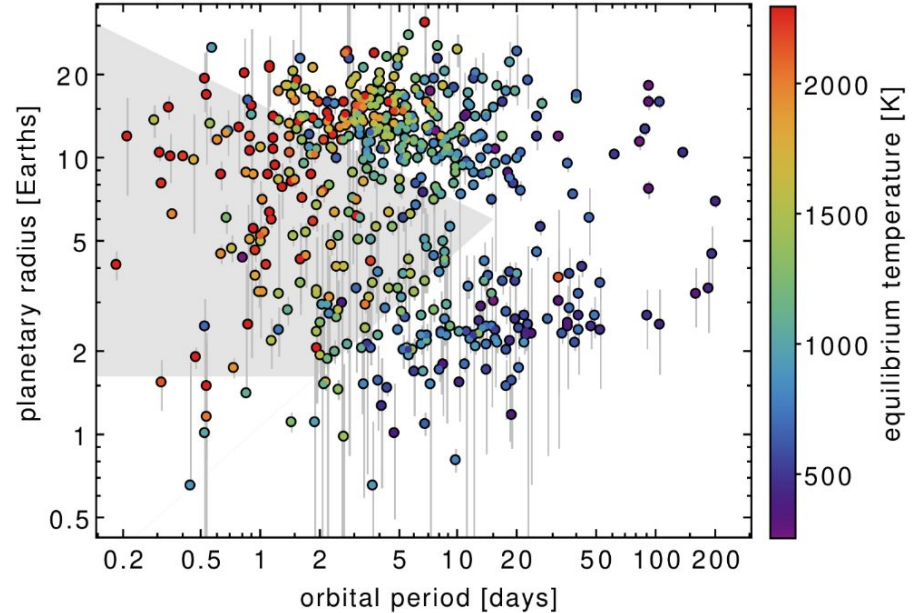


LOPS2: known exoplanets

CONFIRMED PLANETS



TESS candidates



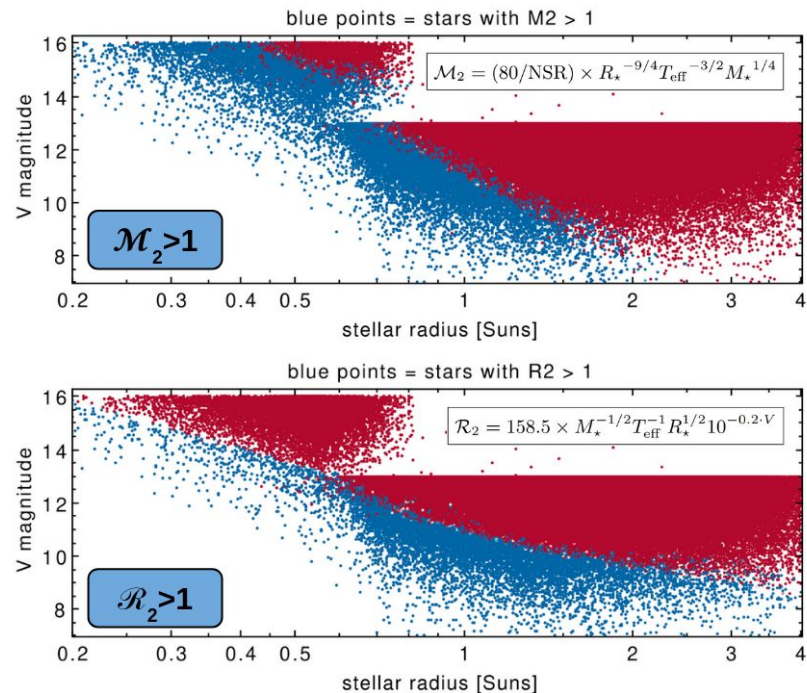
The PLATO Prime Sample

The **Prime Sample** (PS) is a subset of the tPIC on which the PLATO Consortium has committed to follow up the detected candidate planets (see the PLATO Science Management Plan). As such, the PS focuses on exoplanetary science.

Two **metrics** have been developed to guide the PS selection:

- $\mathcal{M}_2$ is about the **photometric detection by PLATO**; it is proportional to the SNR of an HZ planet. $\mathcal{M}_2$ is an *absolute* metric: $\mathcal{M}_2 > 1$ means that an habitable $1 R_{\oplus}$ planet would be detectable* in the ≥ 2 years of a nominal LOP phase.
- $\mathcal{R}_2$ is about the **RV follow-up**; it is proportional to the SNR of an HZ planet. $\mathcal{R}_2$ is a *relative* metric: $\mathcal{R}_2 > 1$ means that confirming an habitable, $1 M_{\oplus}$ planet would be as easy* as it is for an Earth twin around a G2V star at $V=11$. It can be rescaled according to the amount of observing effort we can invest on the PS.

Both of them assign higher priority to bright, small, and nearby stars, as expected.



* both metrics of course assume white noise scaling ($N^{0.5}$) and no stellar activity, rotation, pulsations/granulations, binarity etc. since they cannot be captured as a simple function of the tPIC astrophysical parameters (T_{eff} , M_* , R_*).

The PLATO Prime Sample

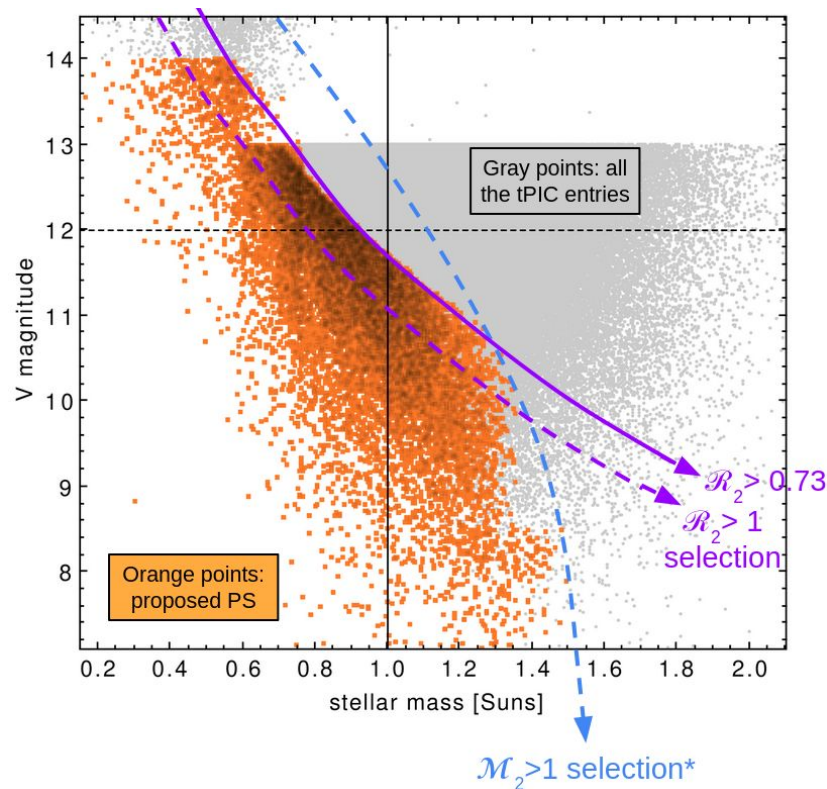
The SWT has agreed:

- to select a PS made of 15,000 stars
- to force the whole P2 sample into the PS;
- to exclude large ($>1.5 R_{\odot}$) and faint ($V>14$) stars;
- to adopt $\mathcal{M}_2$ as the base metric and to tune $\mathcal{R}_2$ so that 15k targets are reached.

The **current PS selection** is very effective in selecting the most suited stars for the follow-up. It includes:

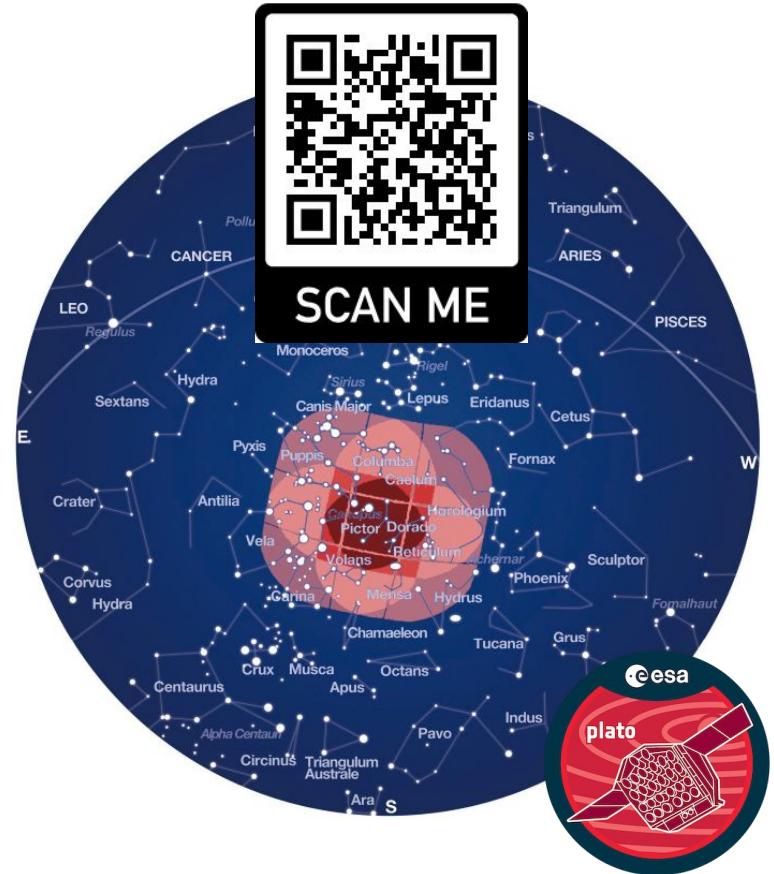
- ~1000 bright ($V<11$) K dwarfs (~6% of the PS), almost 100% of those available in the tPIC;
- ~2500 bright ($V<11$) G dwarfs (~17% of the PS), almost 100% of those available in the tPIC;
- ~750 M dwarfs ($V<14$) from the P4 sample

The astrophysical parameters (T_{eff} , $R_{\star}$, $M_{\star}$) of the PS are on average centered on the Solar values.

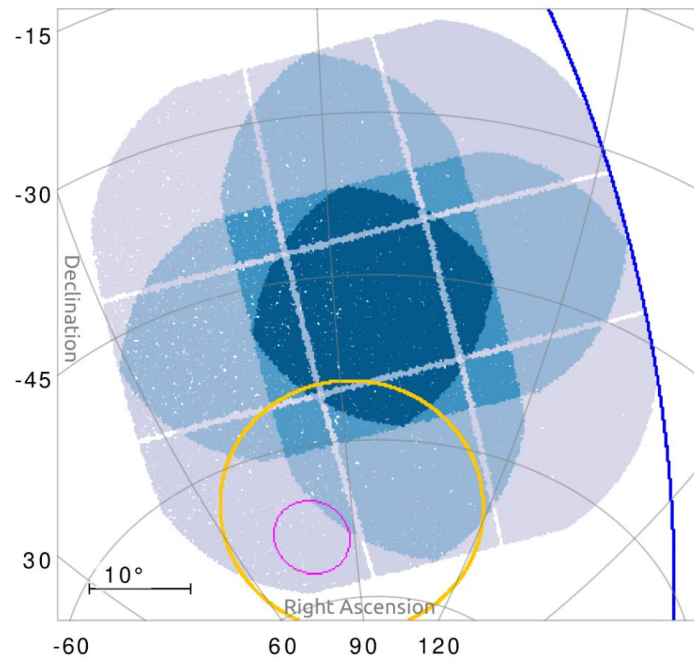
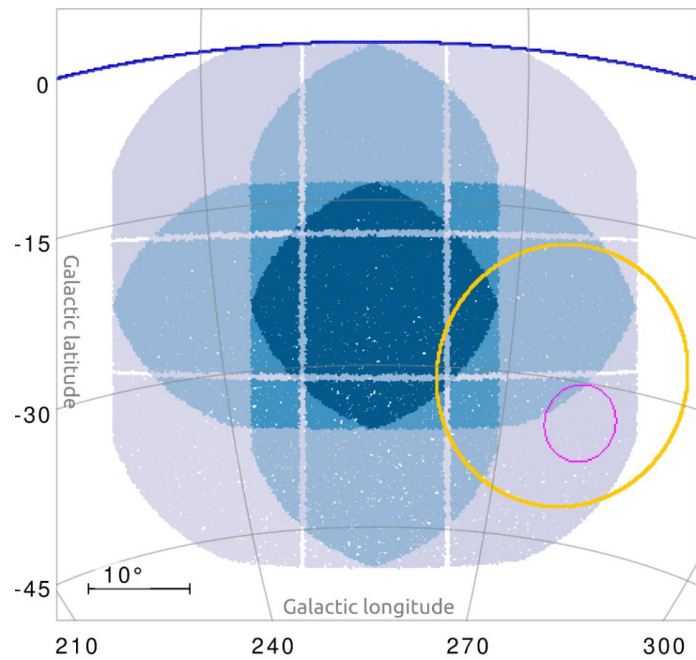


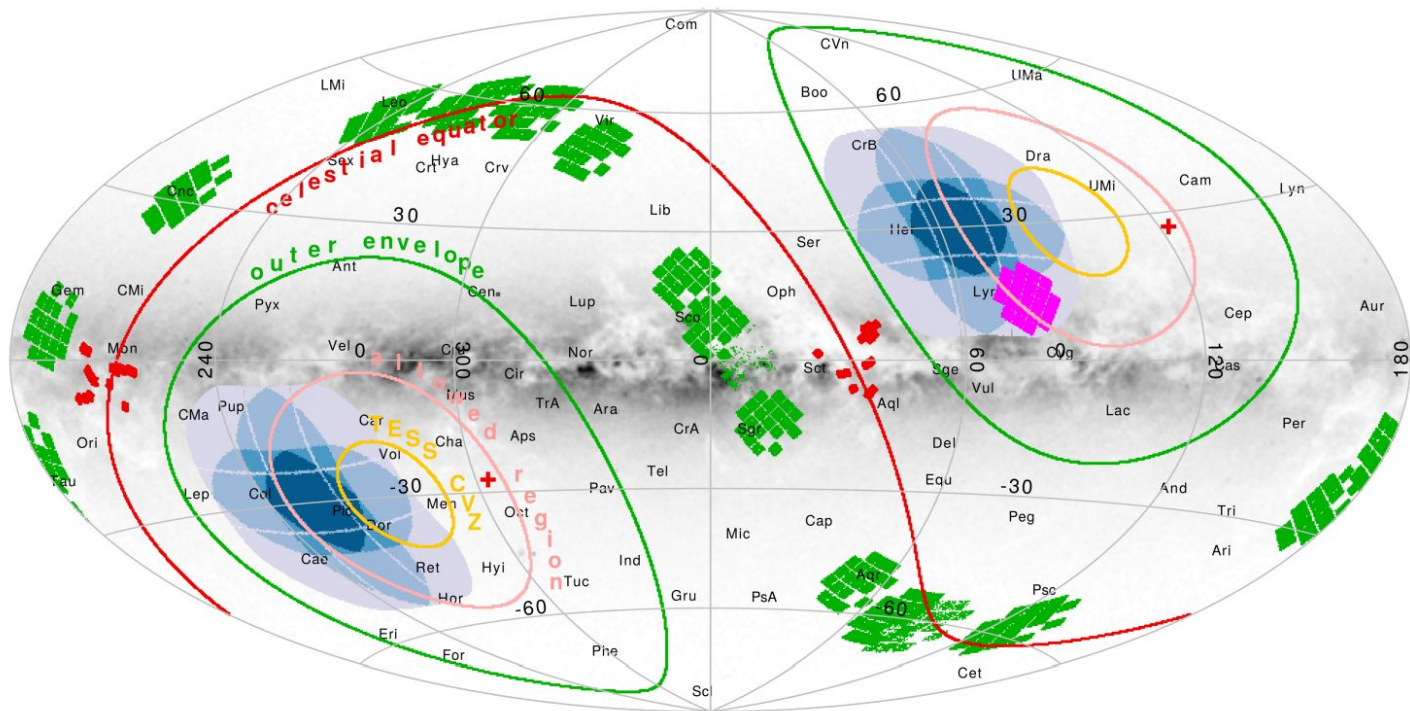
Conclusions

- LOPS2 will be the first PLATO field to be pointed, and it will be continuously monitored for *at least* 2 years
- Next field is still TBD, and it will be probably selected after examining real data from LOPS2
- The call for GO proposals will be released six-months before launch (i.e., in 2026): be prepared!
- The LOPS2 footprint can be downloaded from Zenodo <https://zenodo.org/records/14720127> (⇒ QR code)
- Many details on LOPS2 and the selection process in Nascimbeni+ 2025 (A&A 694, 313) and Nascimbeni+ 2022 (A&A 658, 31). A third (specifically on the P4 sample) and a fourth one (on the selection of the PS) are currently *in prep.*



BACKUP SLIDES





LOPS2 visibility from the North

- Assuming $\varphi=+28.5^\circ$ (~La Palma) and LOPS2
- No stars observable at airmass $X<1.5$** (i.e. $\delta>-31.5^\circ$; green parallel); this is true up to $\varphi=-21.5^\circ$
- Only **10% of P1** and **19% of P5** are barely observable at airmass $X<2$ ($\delta>-19.7^\circ$; red parallel); most of them are imaged by six and twelve PLATO cameras
- Short answer: **the observability of LOPS2 from the northern facilities is marginal**. Moving to Mauna Kea ($\varphi=+19.8^\circ$) would raise the fraction to 30% P1 and 39% P5 (mostly six and twelve cameras).
- In this regard, LOPS2 is one of the most favorable fields in the South; alternative pointings have zero overlap even with Mauna Kea

