Left Behind (for now): Targets Missed in Year-1 TESS Observations

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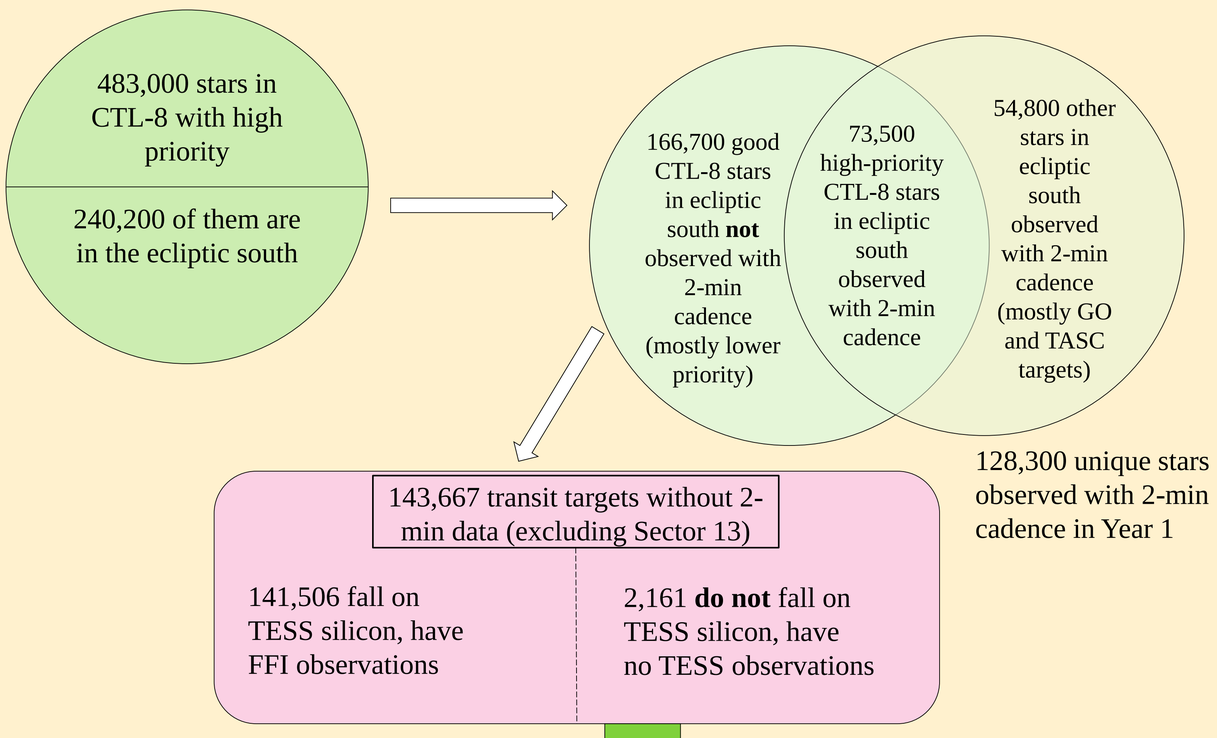
Even though TESS approaches full sky coverage, about 15% of the sky is missed in the prime mission, mostly because the ecliptic is not observed, but partly because of gaps between sectors, cameras, and CCDs. To support planning for the extended mission, I have identified the stars that represent good transit targets, along with very bright stars, along with known planet hosts, that were missed in the ecliptic south. Their properties are described here.

* This analysis excludes stars in the field of Sector 13, for which the coverage information for 30-min cadence was not yet available.

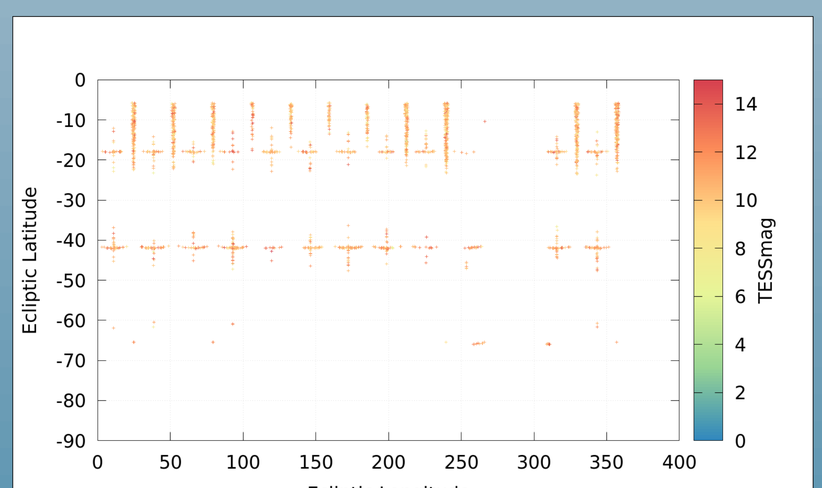
Transit Targets

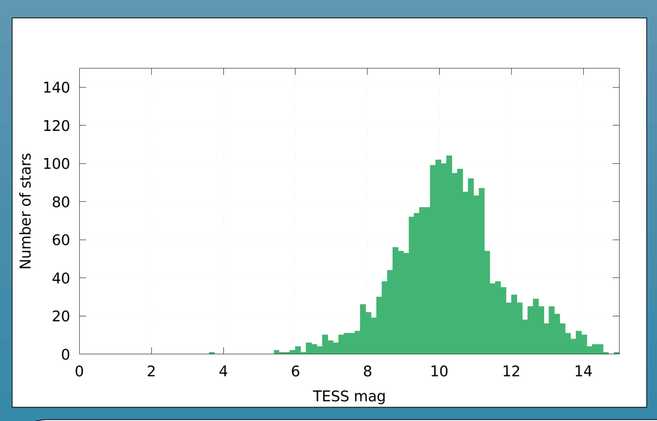
Stars are selected for the TESS transit search by prioritizing stars from the TIC and compiling them in the Candidate Target List (CTL). There are two versions of the CTL of relevance for actual TESS target selection. CTL-7 was used to select targets for Year 1 observations in the ecliptic south. CTL-8 was released in 2019 toward the end of Year 1. It includes a more comprehensive incorporation of Gaia DR2, and will be used to select targets for Year 2 observations.

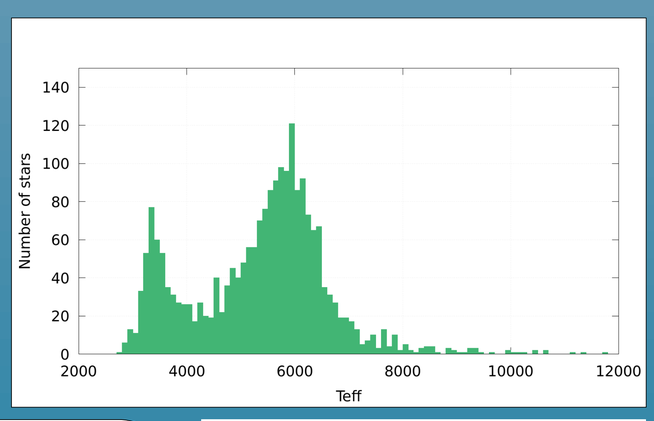


2,161 missed transit targets

- 394 are very high priority (priority greater than 0.00255 in CTL-8; would be included in a restricted TESS mission of 100K targets)
- ❑ 902 have T < 10
- ❑ 129 have T < 8
- ○ 12 are OB stars
- ○ 84 are A stars
- ○ 549 are F stars
- ○ 727 are G stars
- ○ 404 are K stars
- ○ 386 are M stars

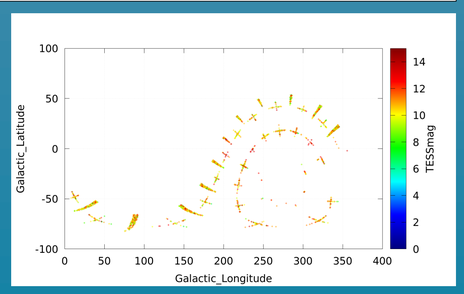






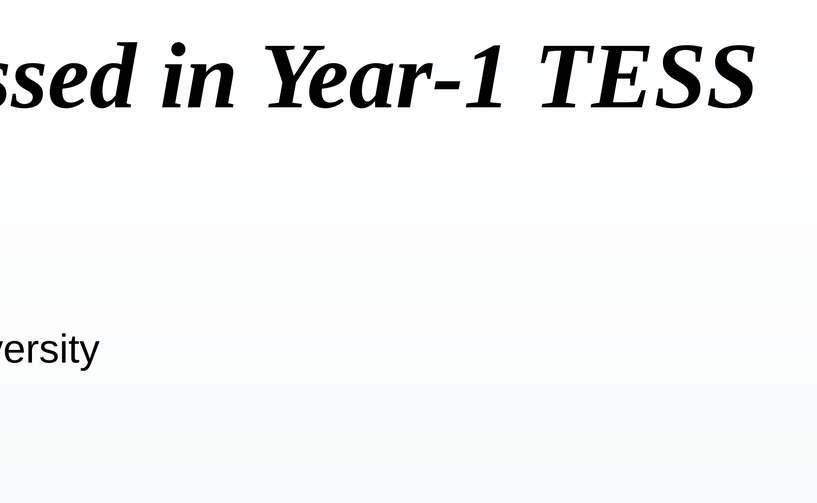
Summary

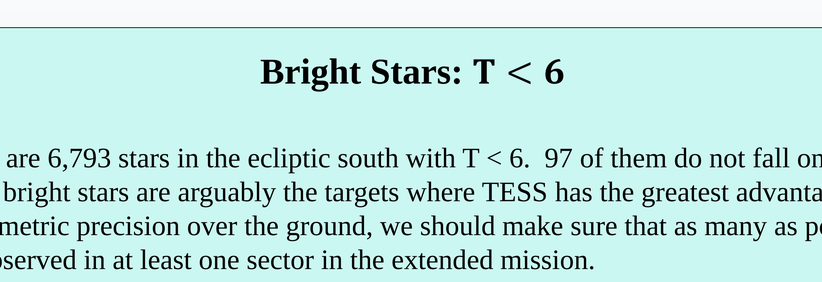
Small numbers of otherwise good transit targets fall in sector and pixel gaps, along with a few bright stars and other potentially valuable scientific targets. These misses do not impact the mission success, but in the interest of delivering a complete portrait of photometric variability of the sky, the extended mission should aim to position sectors to cover at least the wedges between sectors, which will catch most of the missed stars.



Bright Stars: T < 6

There are 6,793 stars in the ecliptic south with T < 6. 97 of them do not fall on silicon. Since bright stars are arguably the targets where TESS has the greatest advantage in photometric precision over the ground, we should make sure that as many as possible are observed in at least one sector in the extended mission.





Sample Stars

Star	T mag	Distance [pc]	Notes
Beta Corvi	0.8	44.7	Giant, G2II; High proper motion
Beta Trianguli Australis	1.4	12.3	Dwarf, F1V; High proper motion
YY Piscium	2.2	127	Giant, M3III; likely Long-Period Variable
Upsilon Librae	2.35	59.7	Giant, K3.5III; Double star
AR Ceti	2.7	129	Giant, M3II; likely Long-Period Variable

What about known planet hosts?

There are 579 exoplanet host stars in the ecliptic south, identified from the NASA Exoplanet Archive (NEA). Of those, 539 are of interest for TESS observations, with 256 transit hosts, 260 radial velocity hosts, 18 direct imaging hosts, and 3 eclipse timing detections. The remaining 40 are microlensing discoveries, for which TESS observations are not particularly relevant.

Of the 539 targets, 14 exoplanet hosts were nominally missed by TESS in Year 1.

However, almost all of these targets are just at the northern edge of the TESS sectors, and could be mostly considered as being in the ecliptic region rather than missed. HD 34445, an RV planet host in a pixel gap, is the one exception.

Star	T mag	Discovery Type	Ecliptic Latitude
EPIC 212297394	13.6	Transit	-5.982859
K2-267	10.8	Transit	-6.749710
EPIC 246865365	14.4	Transit	-6.570684
GJ 1265	10.8	Radial Velocity	-6.269607
HD 10442	7.0	Radial Velocity	-7.330278
HD 34445	6.7	Radial Velocity	-15.686473
K2-117	12.7	Transit	-6.623544
K2-132	11.0	Transit	-7.161352
K2-252	12.0	Transit	-6.681130
K2-266	10.6	Transit	-7.723503
K2-55	12.3	Transit	-5.973910
WASP-136	9.45	Transit	-8.313803
WASP-65	11.3	Transit	-8.638664
WASP-76	9.0	Transit	-7.752005