The TESS Input Catalog and Selection of Targets for the TESS Transit Search

TESS Target Selection Working Group (TSWG), including Joshua Pepper, Martin Paegert, Ryan Oelkers, Nathan De Lee, Willie Torres, and Science Office Head David Latham

Creating the TIC

Source Catalogs

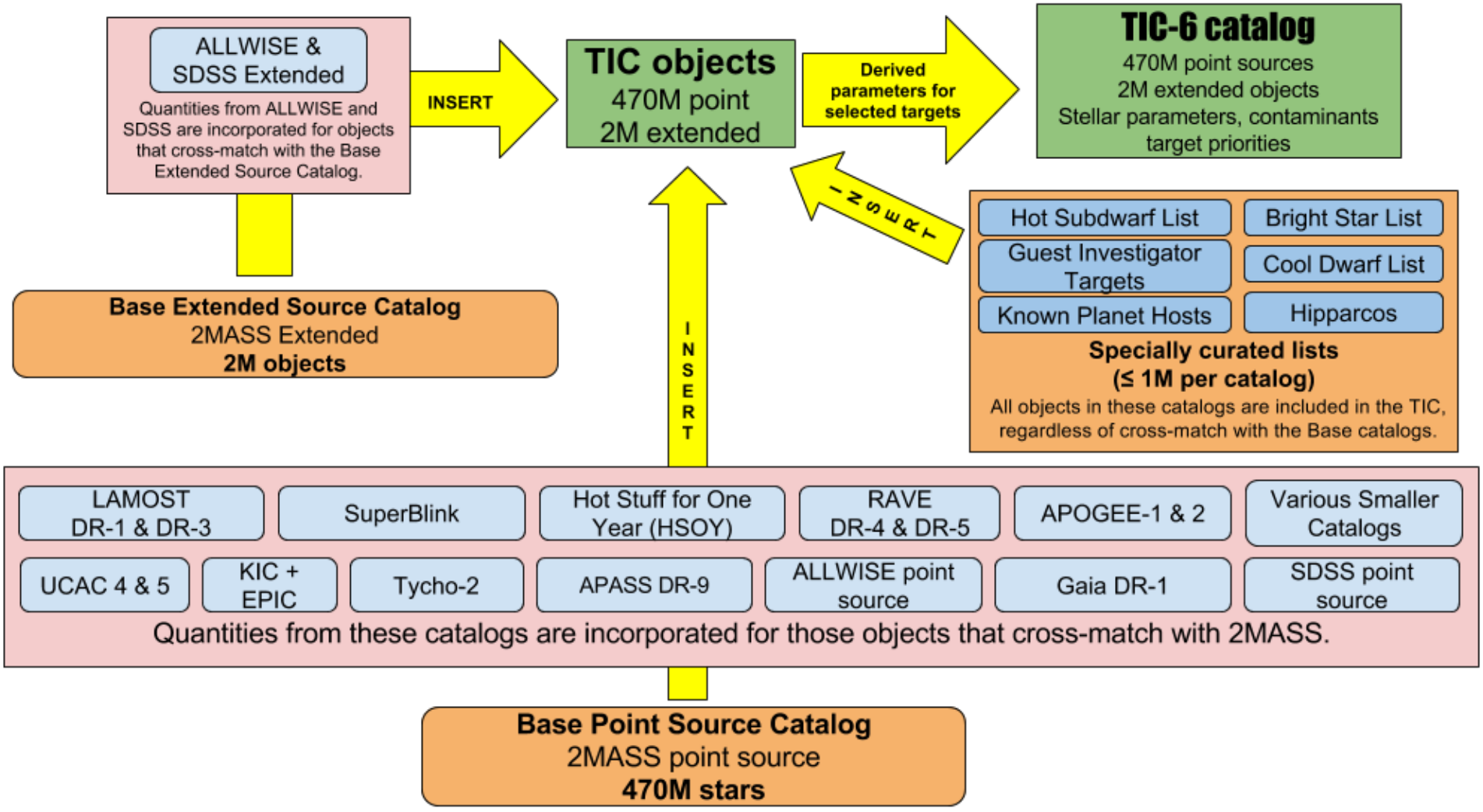
TESS Input Catalog (TIC) 750 million stars and galaxies

Candidate Target List (CTL) 4 million stars

Construction of the TIC

- *What is the TIC?*
  - A systematic and comprehensive catalog of all persistent optically luminous objects in the sky
  - Does not include solar system or transient objects
- *How is it created?*
  - Compilation and combination of large photometric surveys (some spectroscopy)

Compilation of the TIC



Observed and Calculated Stellar Parameters

- From Catalogs
  - Coordinates, proper motion, colors (spectroscopic log *g* and T_{eff} for 0.5 million stars)
- TIC Calculations
  - Use colors to calculate T-mag
  - Use colors and proper motion to screen out giants (parallax is available for 1.2 million out of 4 million CTL stars)
  - (For CTL) Use de-reddened colors to calculate T_{eff}
  - (For CTL) Use colors and distance relations to calculate stellar radius, mass, log, luminosity, etc.

Is the star in a specially curated list?

No

Is (T< 12) or (T<13 & T_{EFF}< 5500 K)?

No

Do not include in the CTL

Yes

Does the star have a parallax?

Yes

Do the effective temperature and calculated surface gravity (from the parallactic radius) suggest the star is a dwarf?

No

Do not include in the CTL

Yes

Include in the CTL

Yes

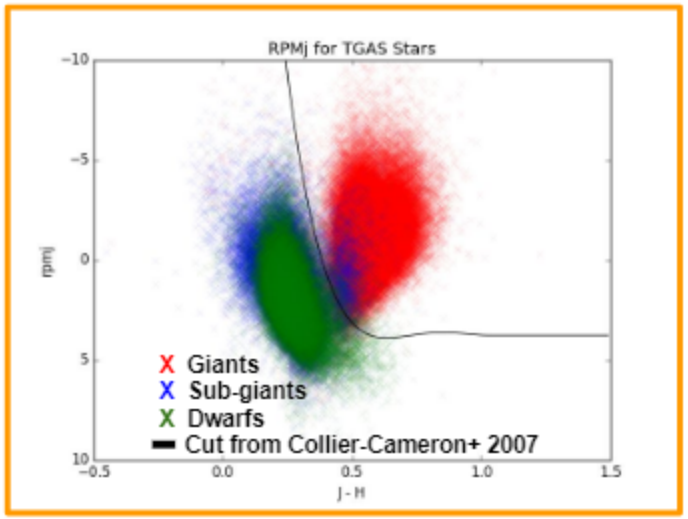
Include in the CTL

No

Does the star have a proper motion?

Yes

Calculate reduced proper motion with 2MASS J (RPM_J) and compare to the cut defined by Collier Cameron + 2007



No

Do not include in the CTL

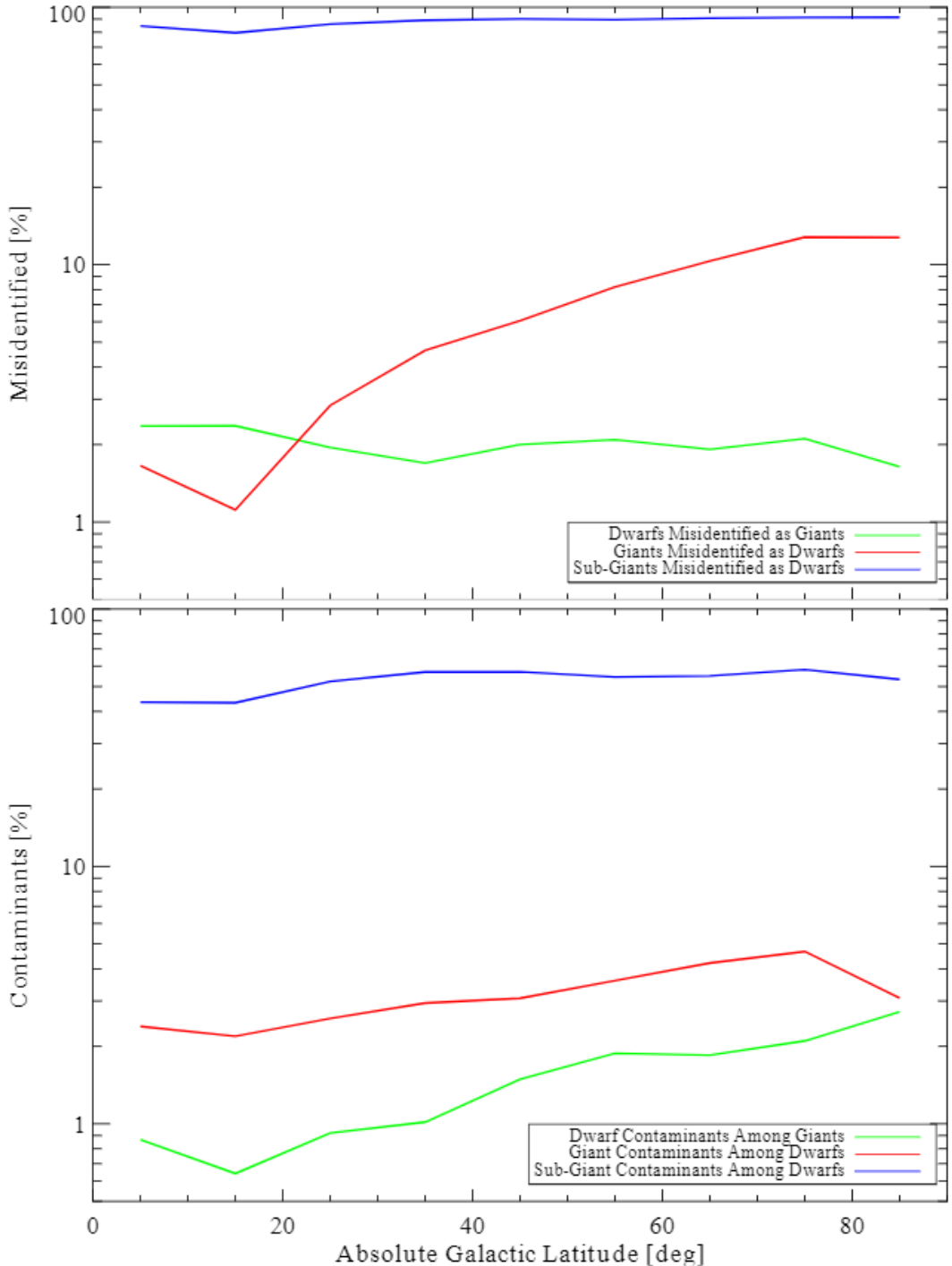
Is RPM_J at least 2σ below the cut?

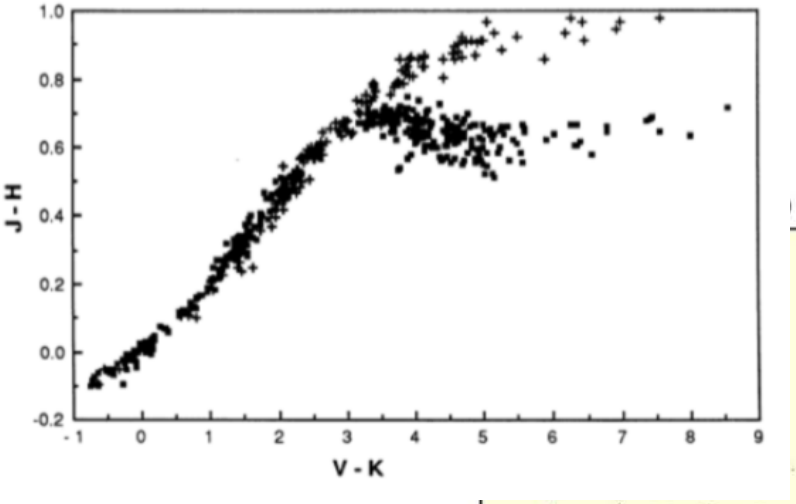
No

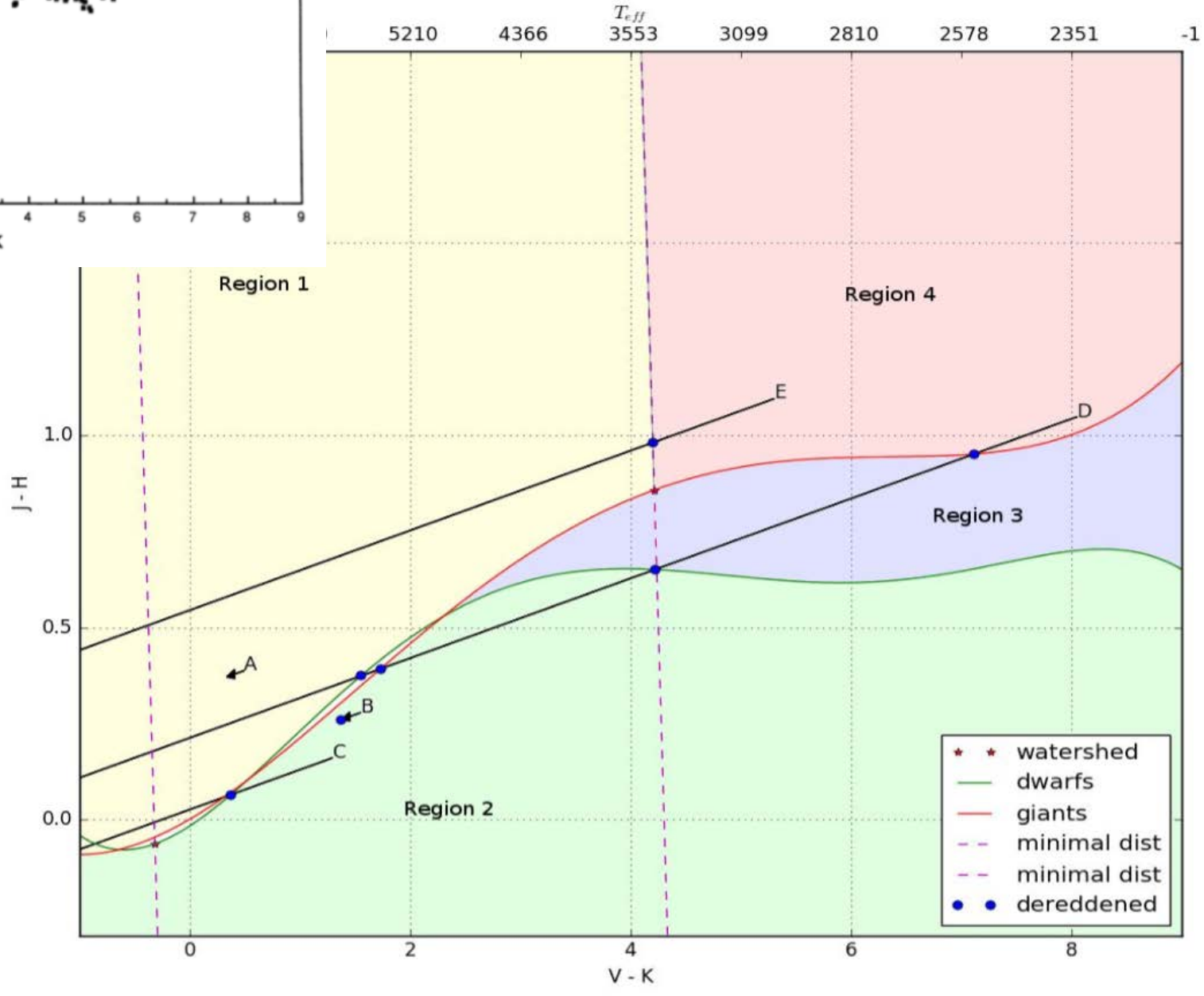
Do not include in the CTL

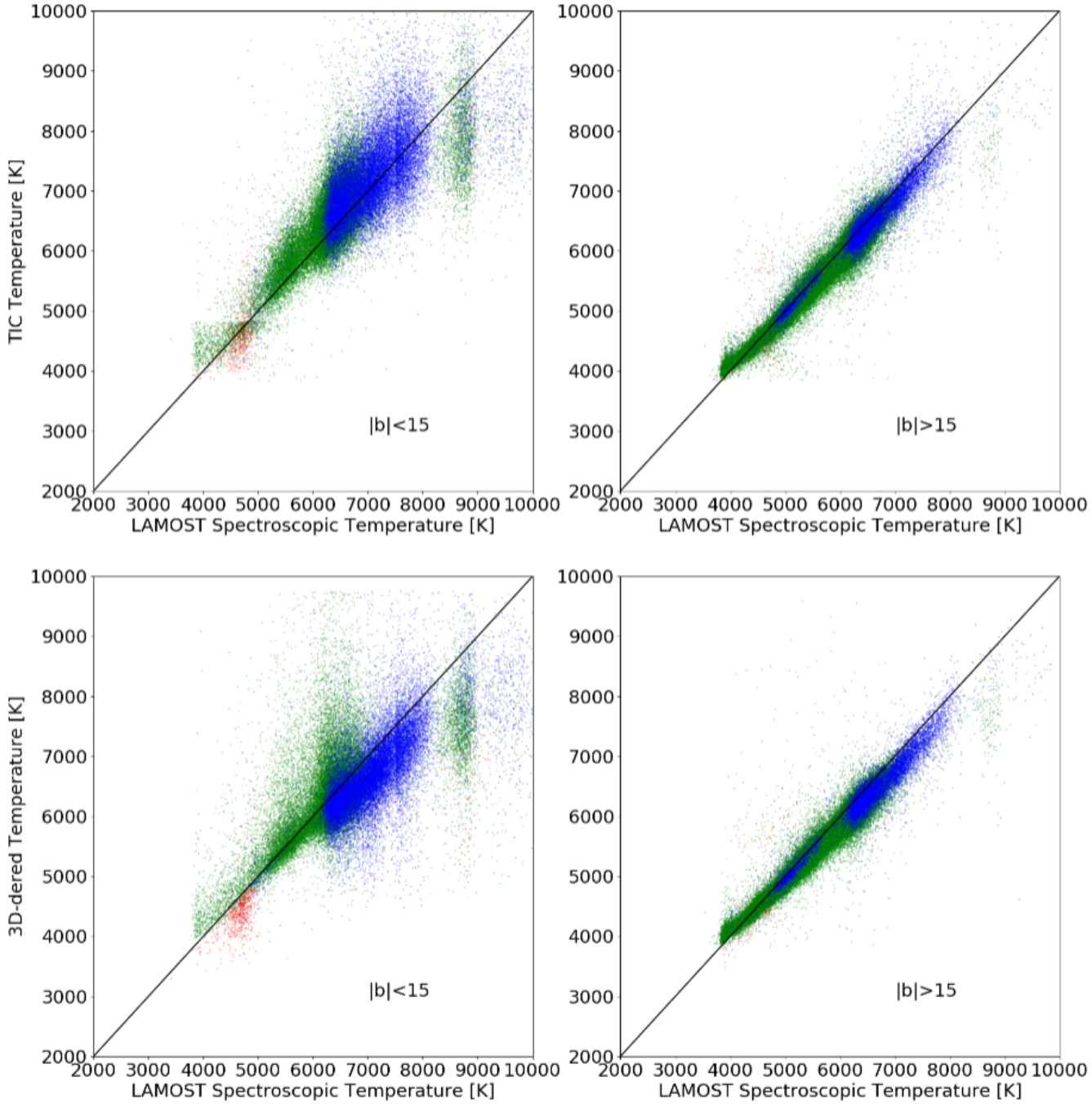
Yes

Include in the CTL

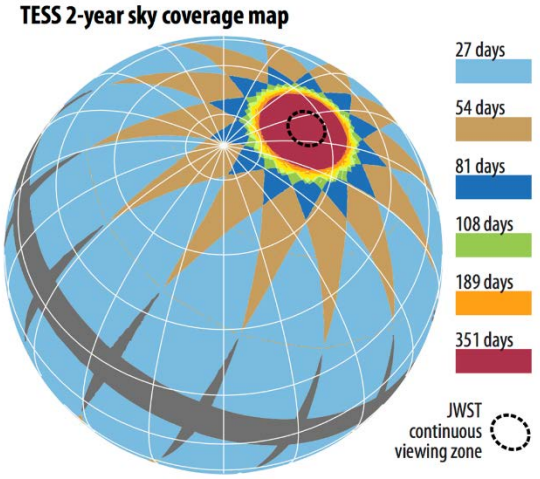

Misidentified [%]
100
10
1
Dwarfs Misidentified as Giants
Giants Misidentifed as Dwarfs
Sub-Giants Misidentified as Dwarfs
Contaminants [%]
100
10
1
Dwarf Contaminants Among Giants
Giant Contaminants Among Dwarfs
Sub-Giant Contaminants Among Dwarfs
0
20
40
60
80
Absolute Galactic Latitude [deg]


J - H
V - K


T_{eff}
5210
4366
3553
3099
2810
2578
2351
Region 1
Region 2
Region 3
Region 4
A
B
C
D
E
watershed
dwarfs
giants
minimal dist
minimal dist
dereddened
J - H
V - K


TIC Temperature [K]
3D-dered Temperature [K]
LAMOST Spectroscopic Temperature [K]
|b|<15
|b|>15
2000
3000
4000
5000
6000
7000
8000
9000
10000

Full TESS 2-min Target List



Combination of multiple lists

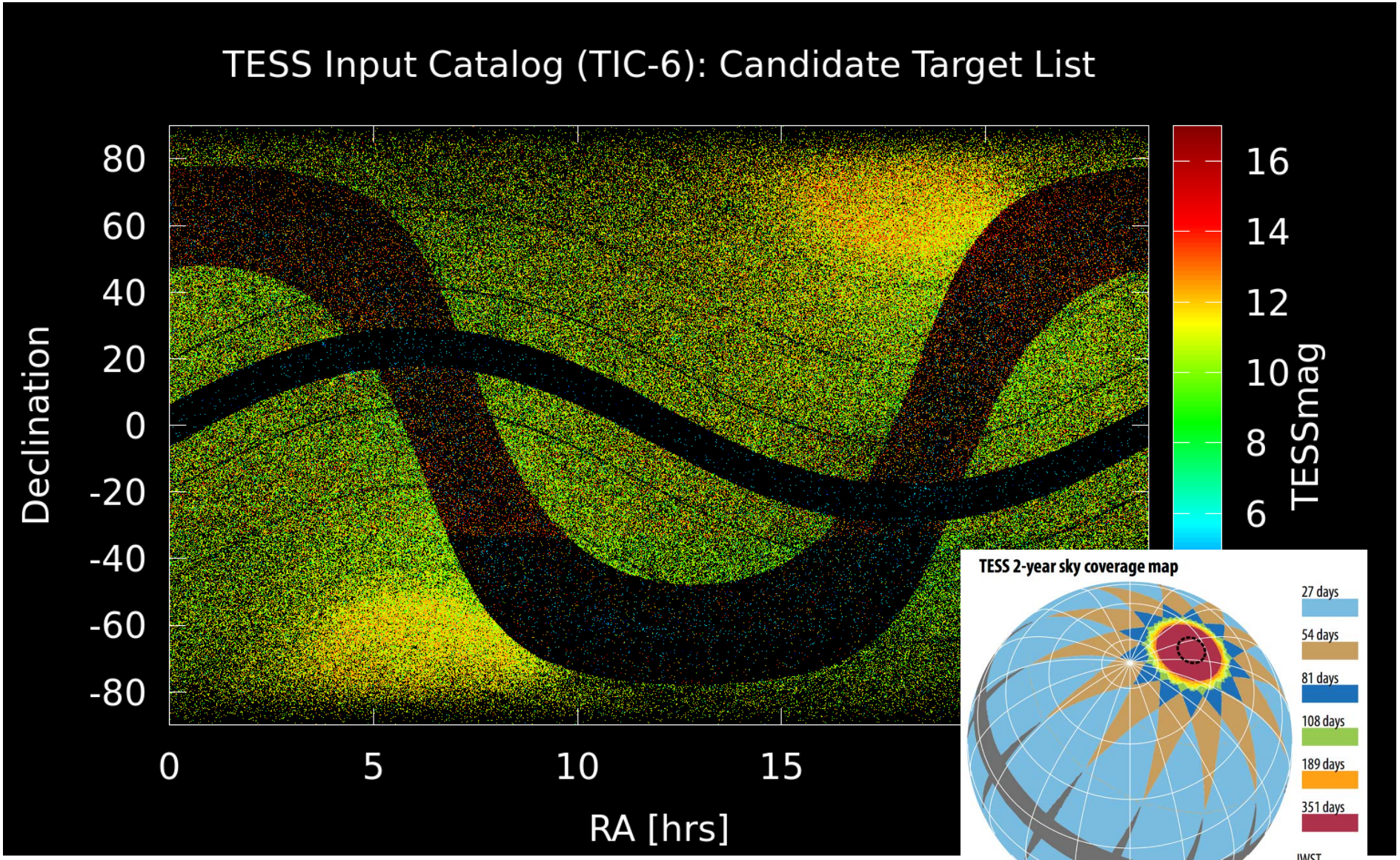
Target Source/Type	Year 1 + 2	# per sector
Engineering	N/A	1,600
Bright Stars (T<6) (CTL)	10,000	400
Exoplanets (CTL)	170,000	~14,200
Asteroseismology	20,000	750
GI	40,000	1,500
DDT	40,000	1,500
Total	280,000	16,200 - 17,800

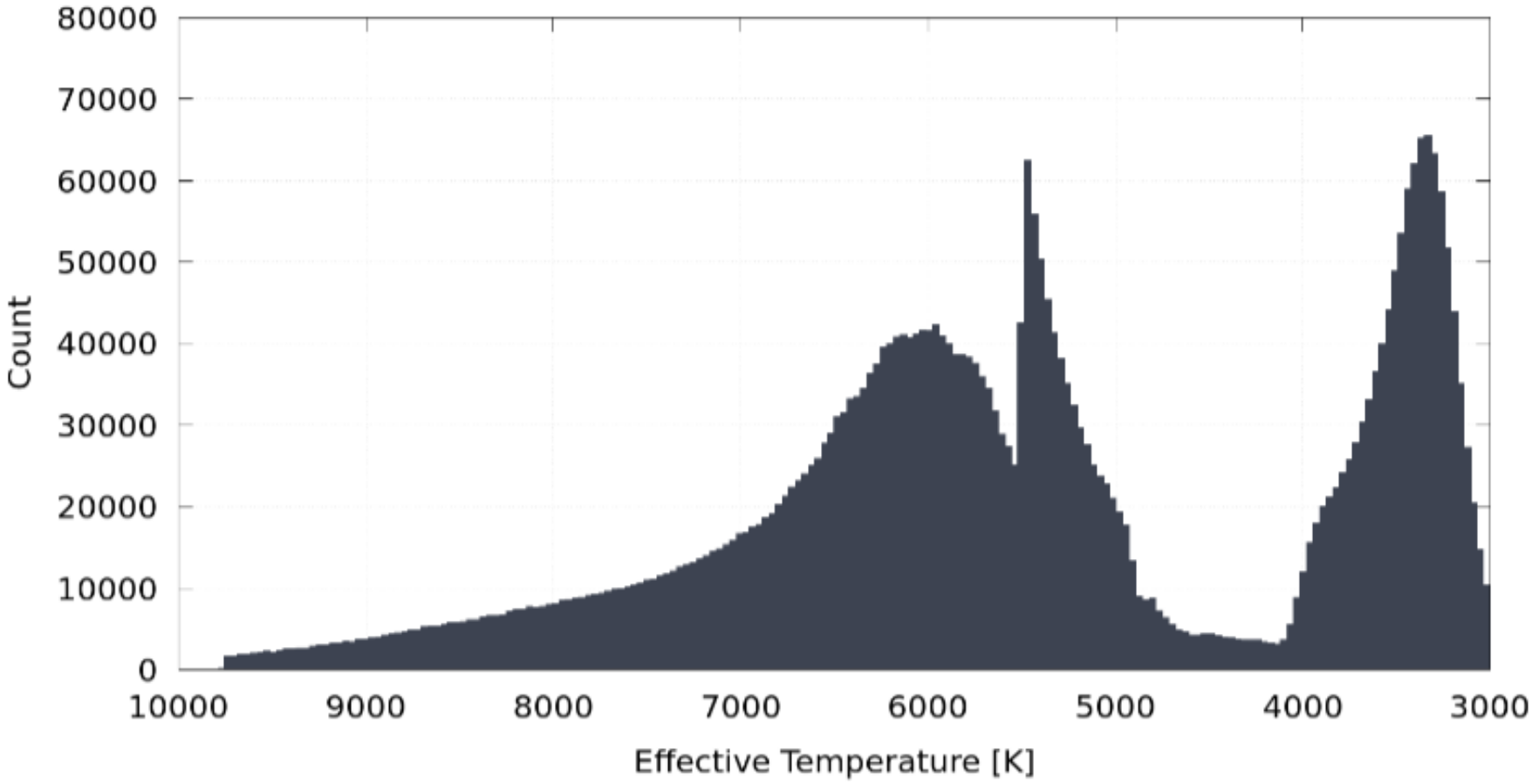
The CTL: 4 million stars of which ~300,000 will be selected for 2-min cadence

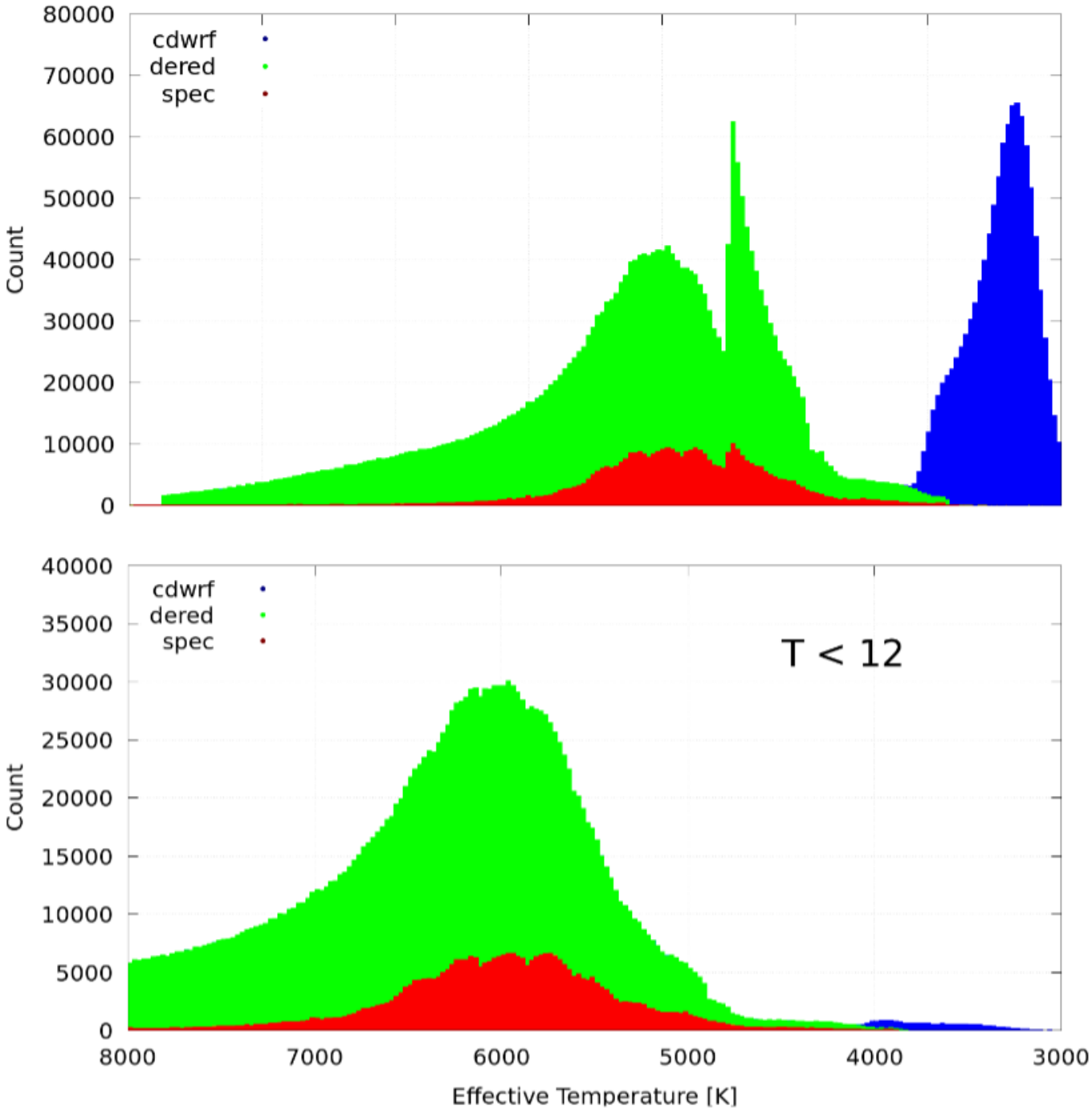
- Observing priority is calculated for all CTL stars: bright and small are the important features
  - Priority scales as $\frac{\sqrt{N_{sectors}}}{\sigma(T)R^{3/2}}$
- There are only so many bright stars in the sky, and even fewer bright dwarfs, and even fewer cool bright dwarfs
  - All cool bright dwarfs should be in the CTL. For these stars, we are not target limited.
- Priorities are probabilistic. Do not assume that any individual star can or will be observed at 2-min cadence
  - The CTL is constantly evolving
  - Large space available for DDT targets (PI office)
  - CCD gaps, bad pixels, sector wedges, etc.

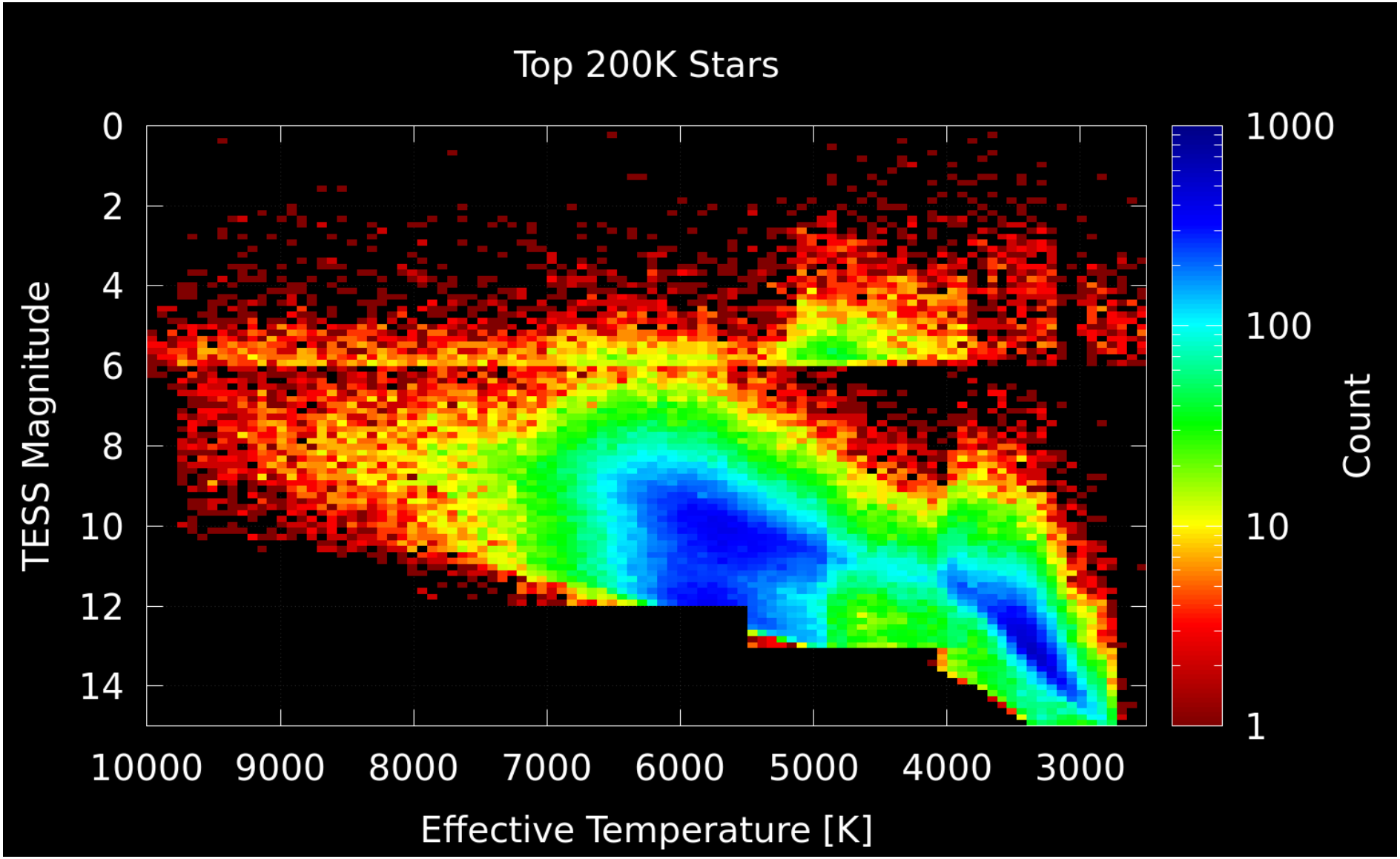
The TESS Mission Science Priorities Dictate Target Selection

1. To search >200,000 stars for planets with orbital periods less than 10 days and radii smaller than $2.5R_{\oplus}$.
2. To search for transiting planets with radii smaller than $2.5R_{\oplus}$ and with orbital periods up to 120 days among 10,000 stars in the ecliptic pole regions.
3. To determine masses for at least 50 planets with radii smaller than $4R_{\oplus}$.


TESS Input Catalog (TIC-6): Candidate Target List
Declination
80
60
40
20
0
-20
-40
-60
-80
0
5
10
15
RA [hrs]
16
14
12
10
8
6
TESSmag
TESS 2-year sky coverage map
27 days
54 days
81 days
108 days
189 days
351 days
JWST
continuous
viewing zone

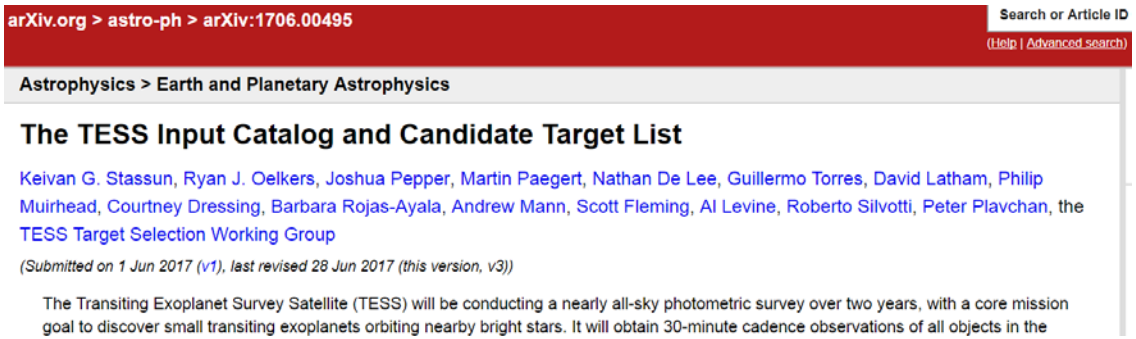

80000
70000
60000
50000
40000
30000
20000
10000
0
Count
10000
9000
8000
7000
6000
5000
4000
3000
Effective Temperature [K]


cdwrf
dered
spec
Count
80000
70000
60000
50000
40000
30000
20000
10000
0
cdwrf
dered
spec
T < 12
Count
40000
35000
30000
25000
20000
15000
10000
5000
0
8000
7000
6000
5000
4000
3000
Effective Temperature [K]


Top 200K Stars
TESS Magnitude
0
2
4
6
8
10
12
14
10000
9000
8000
7000
6000
5000
4000
3000
Effective Temperature [K]
1000
100
10
1
Count

Versions and Schedule

- TIC-6 and CTL-6 released January 2018
- Access TIC through MAST
- Access CTL through MAST or Filtergraph `filtergraph.com/tess_ctl`
- Documentation on arxiv:1706.00495
- Expect TIC-7 in late 2018, incorporating Gaia DR2



arXiv.org > astro-ph > arXiv:1706.00495 Search or Article ID

(Help | Advanced search)

Astrophysics > Earth and Planetary Astrophysics

The TESS Input Catalog and Candidate Target List

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The Transiting Exoplanet Survey Satellite (TESS) will be conducting a nearly all-sky photometric survey over two years, with a core mission goal to discover small transiting exoplanets orbiting nearby bright stars. It will obtain 30-minute cadence observations of all objects in the