

# PLAT



## ***Planets around M-dwarfs***

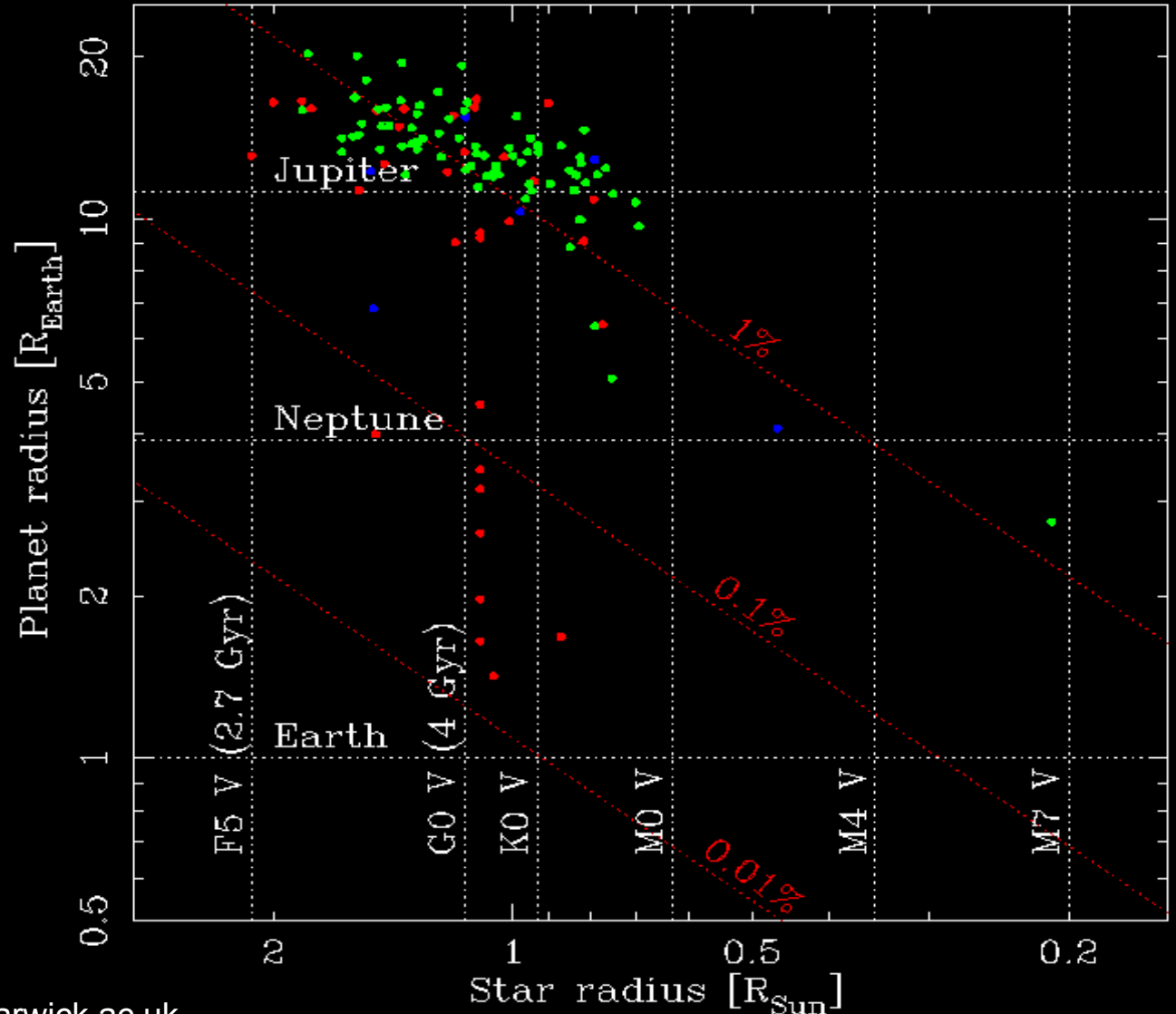
*Peter Wheatley, Warwick, UK*

*WP coordinator: M-dwarfs as planet hosts*

# M-dwarf hosts: advantages I

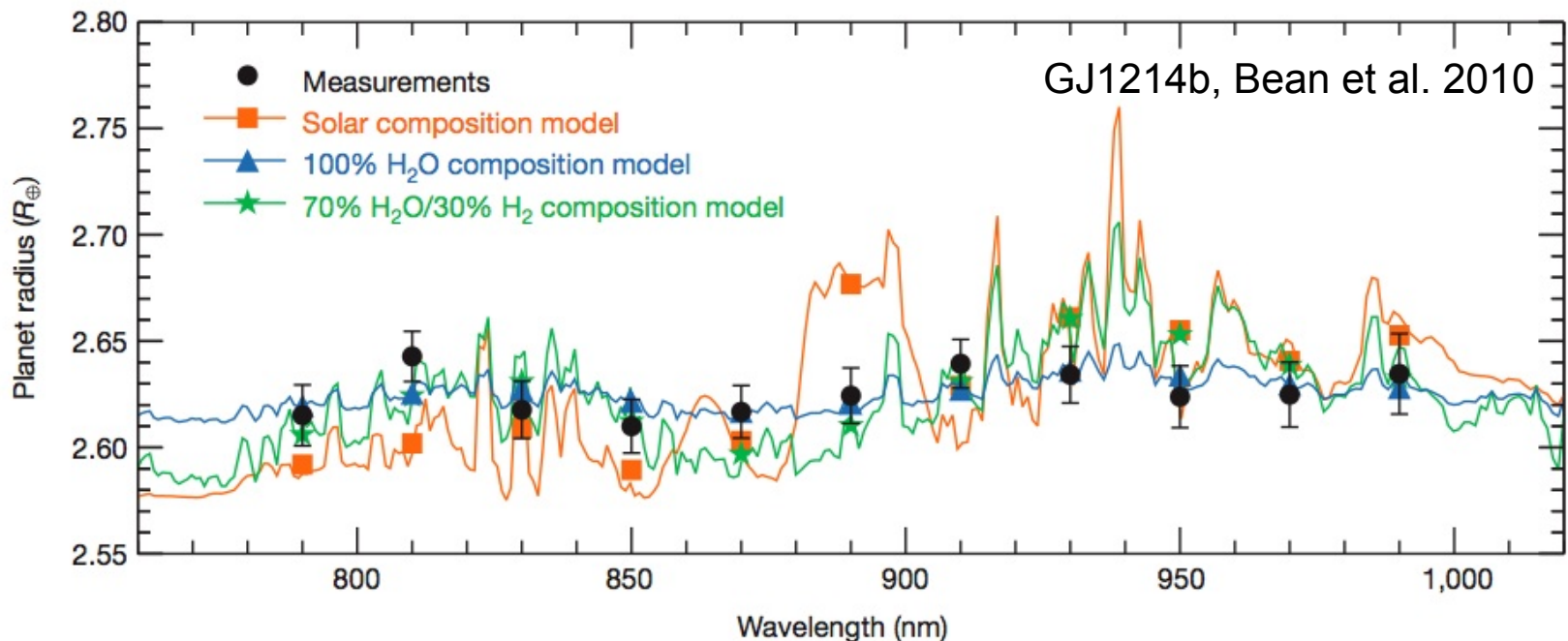
- Transit depth scales with  $R_*^{-2}$ 
  - so can detect Earth-sized planets with  $\sim 1000$ ppm transits

- RV signal scales with  $M_*^{-2/3}$

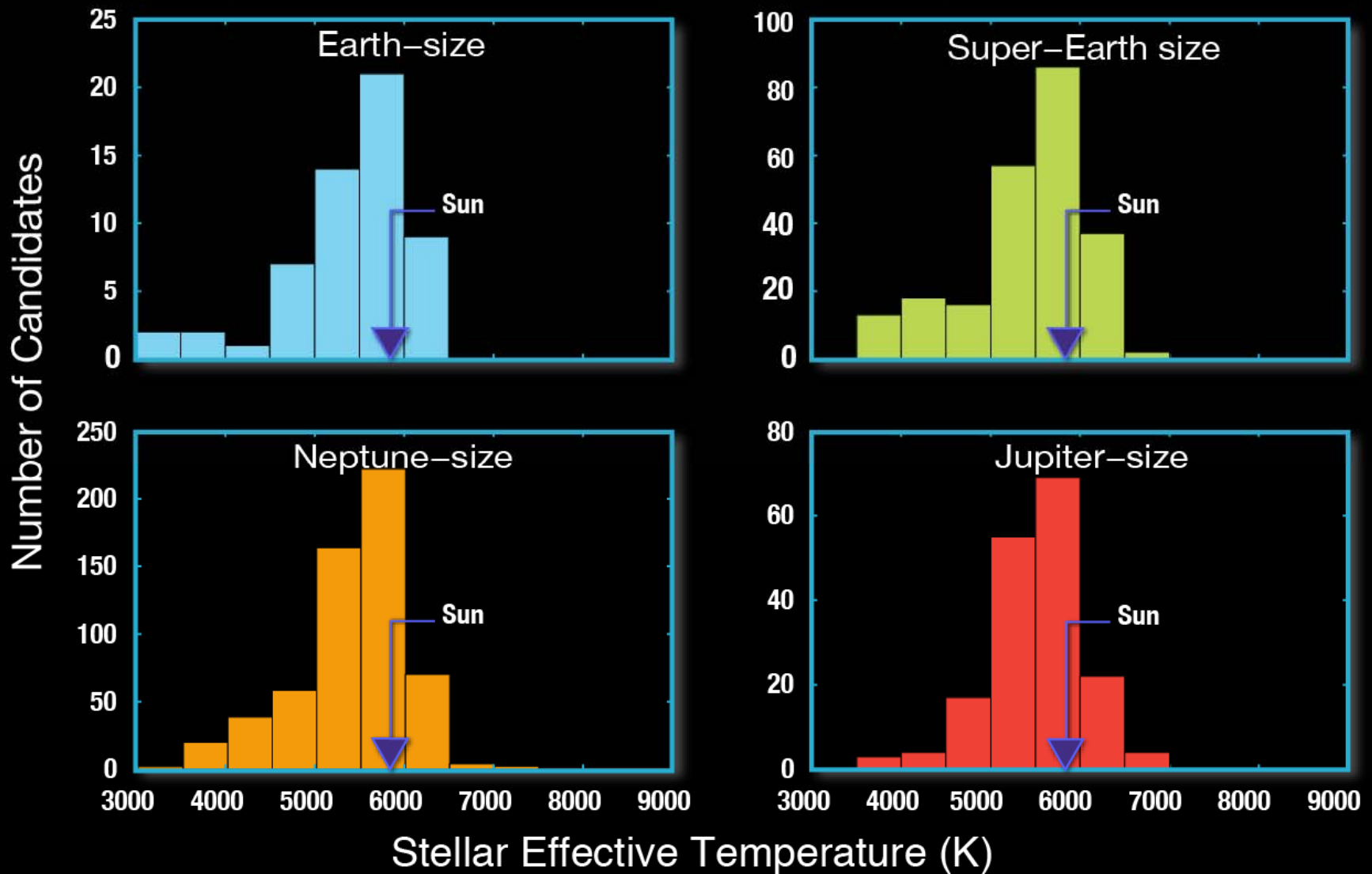


## M-dwarf hosts: advantages II

- Habitable zone separation scales with  $R_* T_*^2$ 
  - so habitable planets can be detected with short orbital periods, e.g. in PLATO step-and-stare phase, and readily followed up
- Planet-star contrast also improves for habitable zone
  - helping characterise atmosphere using secondary eclipse observations
- Strength of features in transmission spectra scale with transit depth
  - so can characterise atmosphere using ground-based observations



# Encouraging news from Kepler

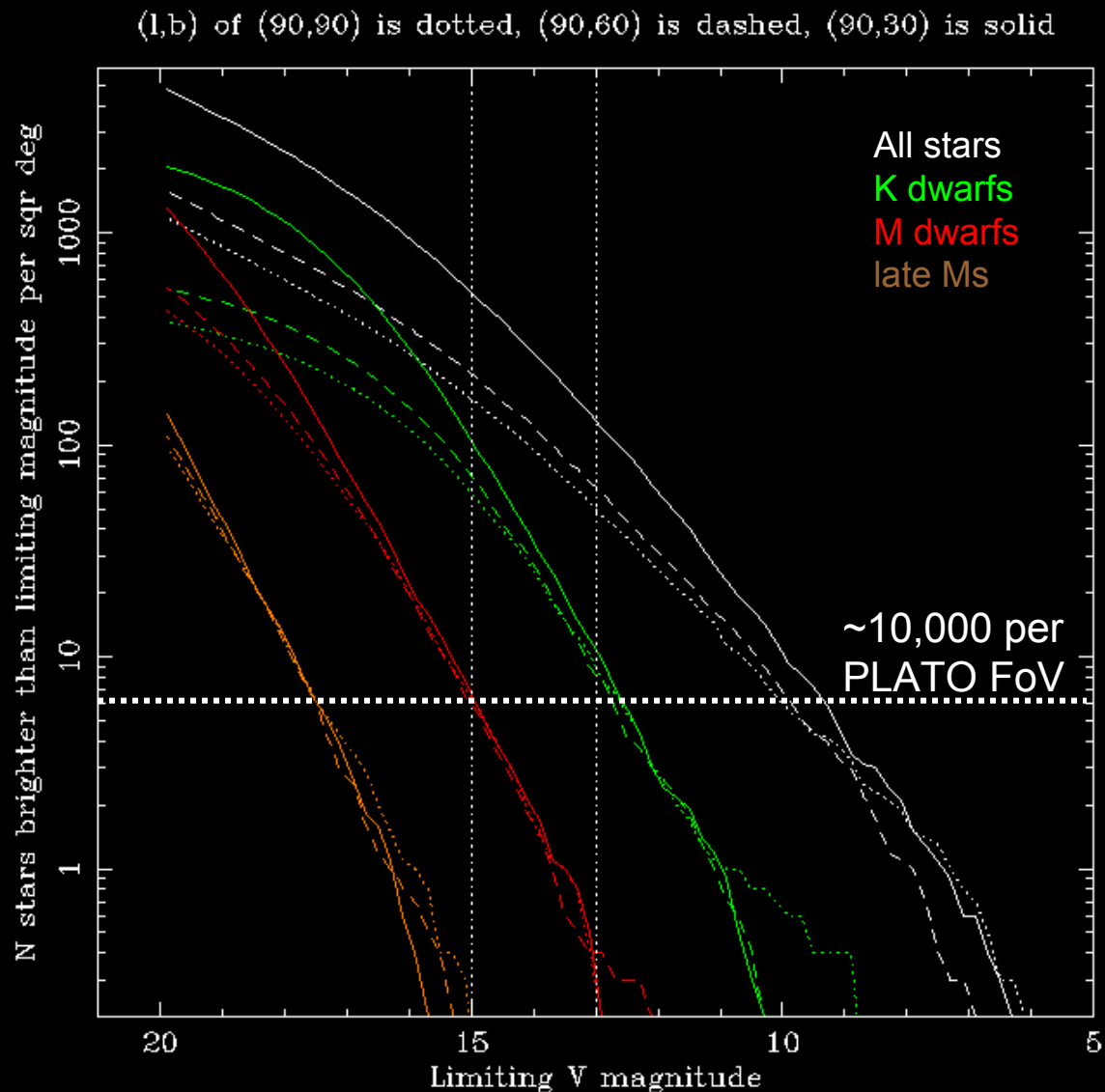


# M-dwarf hosts: disadvantages

- Inherently less habitable?
  - e.g. tidal locking, stellar activity
- Intrinsically low luminosity
  - so bright examples are rare

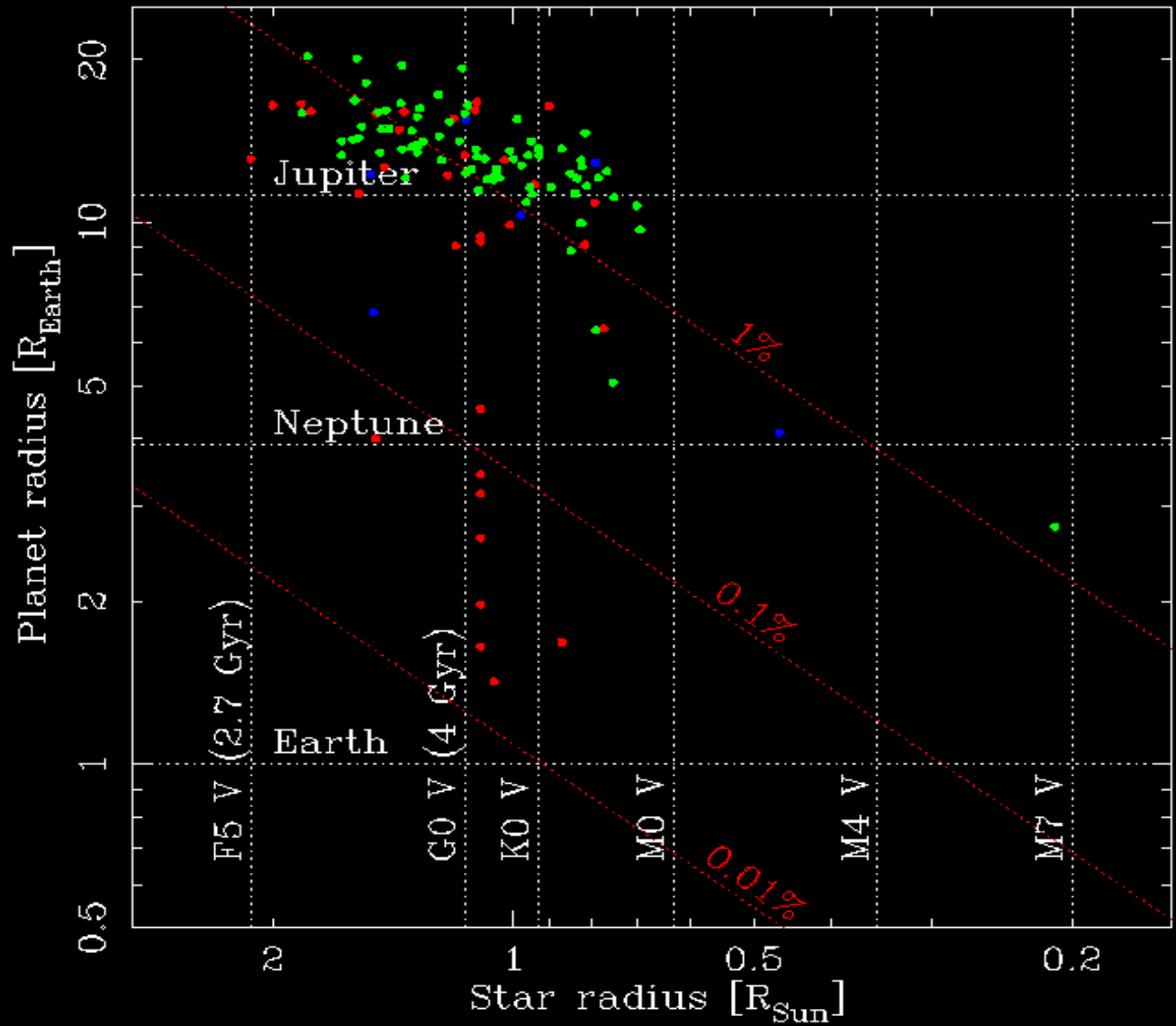
## PLATO P4 sample:

- >10,000 M stars
- <800ppm noise in 1 hr
- $m_V < 15$
- >5000 observed for yrs
- >5000 for months



Based on Besancon model

# M-dwarfs include a wide range of radii

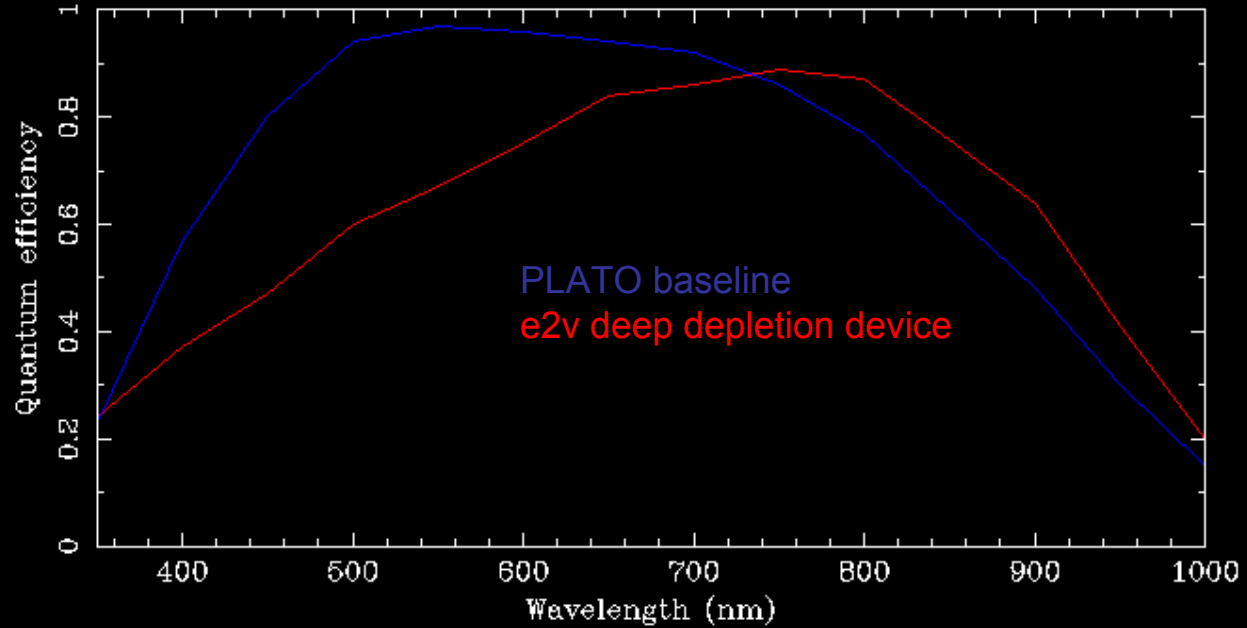
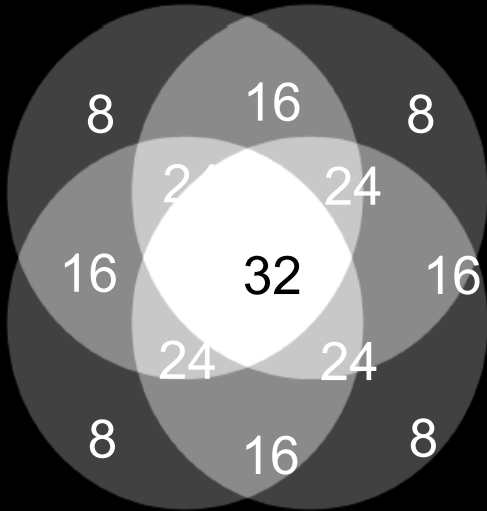




# Simulation recipe

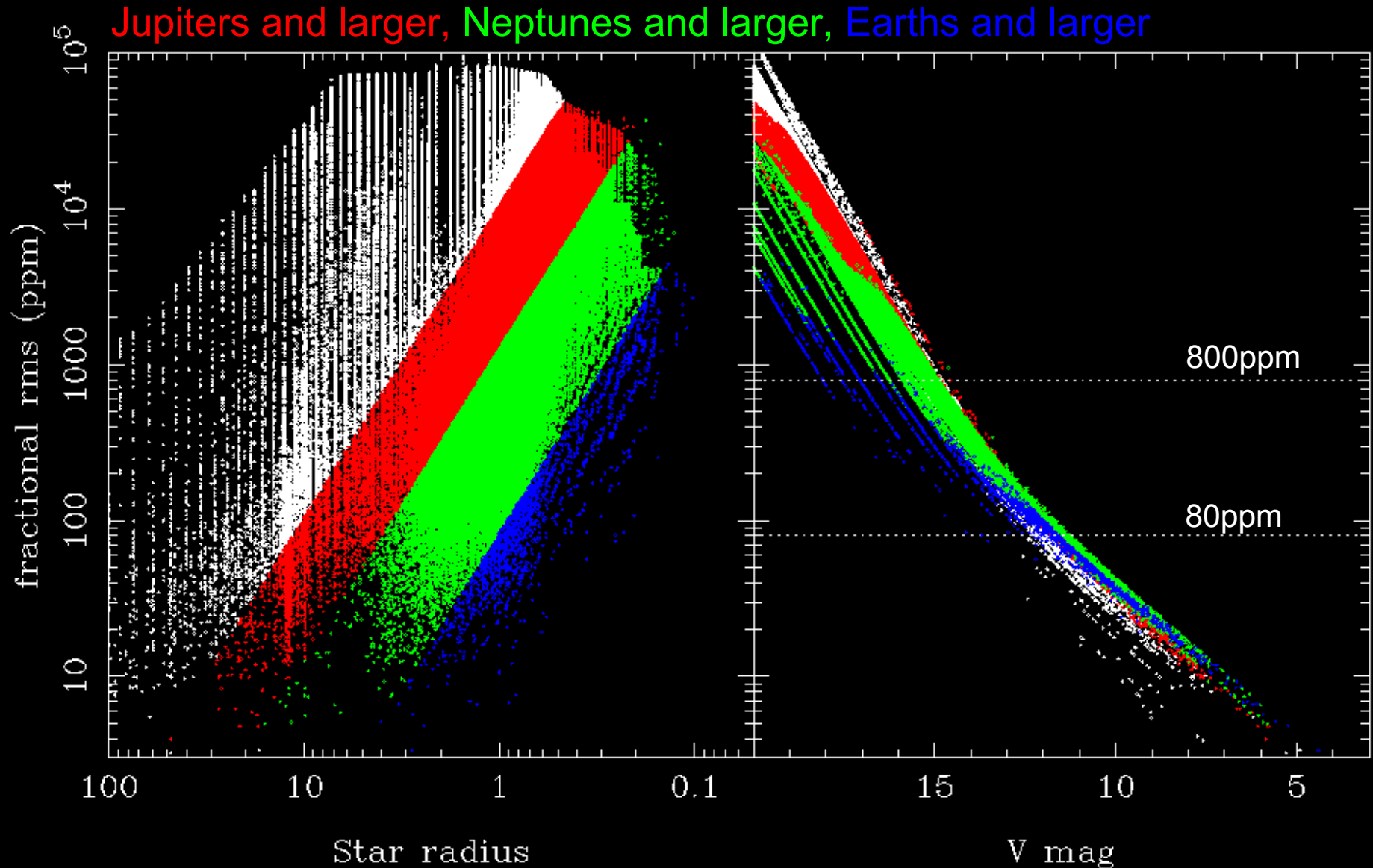
- Assume payload configuration

- CCD QE,  
pixel size,  
optics throughput,  
effective area,  
field of view



- Stellar population from Besancon model (for  $l=277$ ,  $b=-30$ )
- Use spectral atlas to estimate shot noise for each star

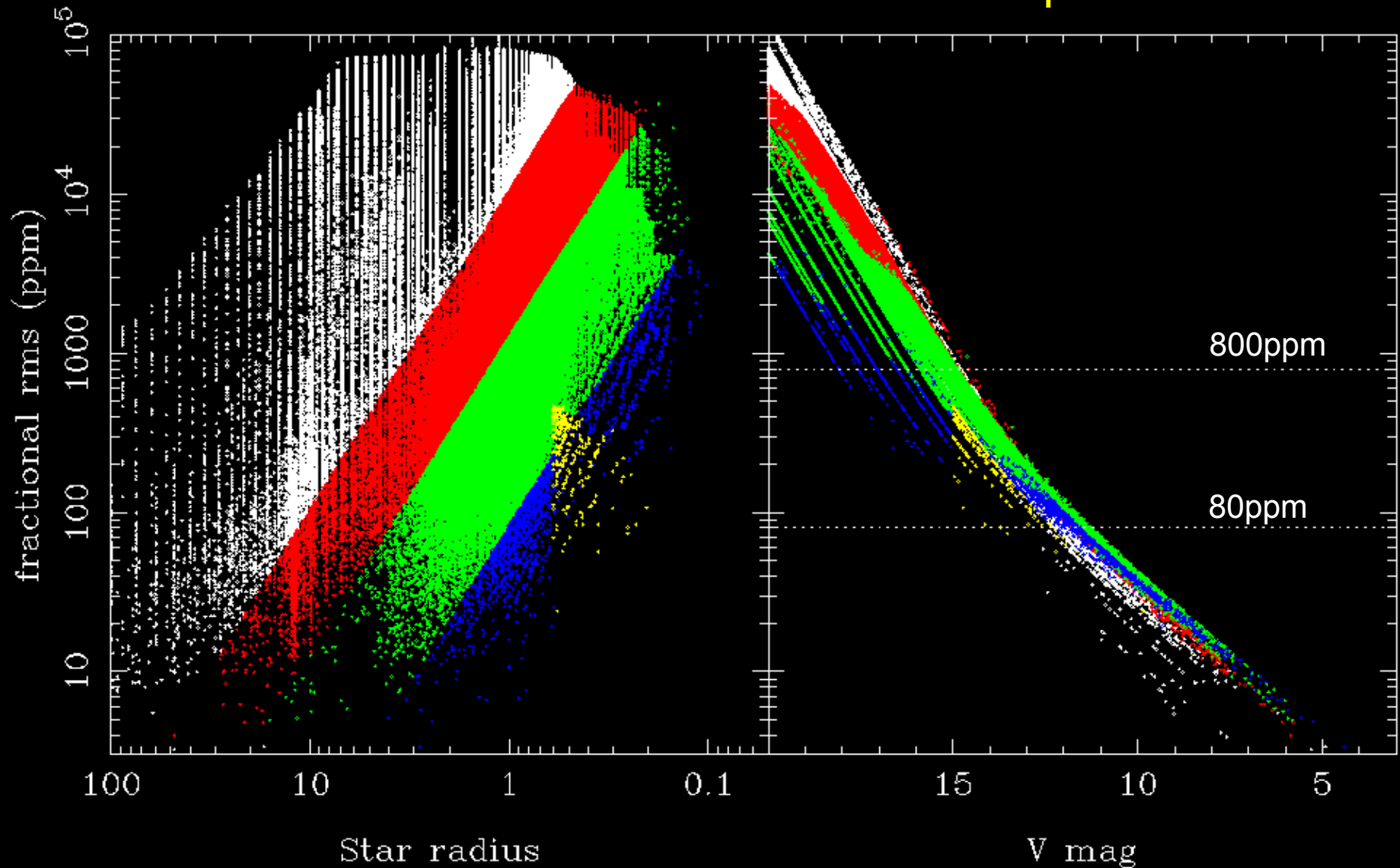
# Simulated PLATO target population





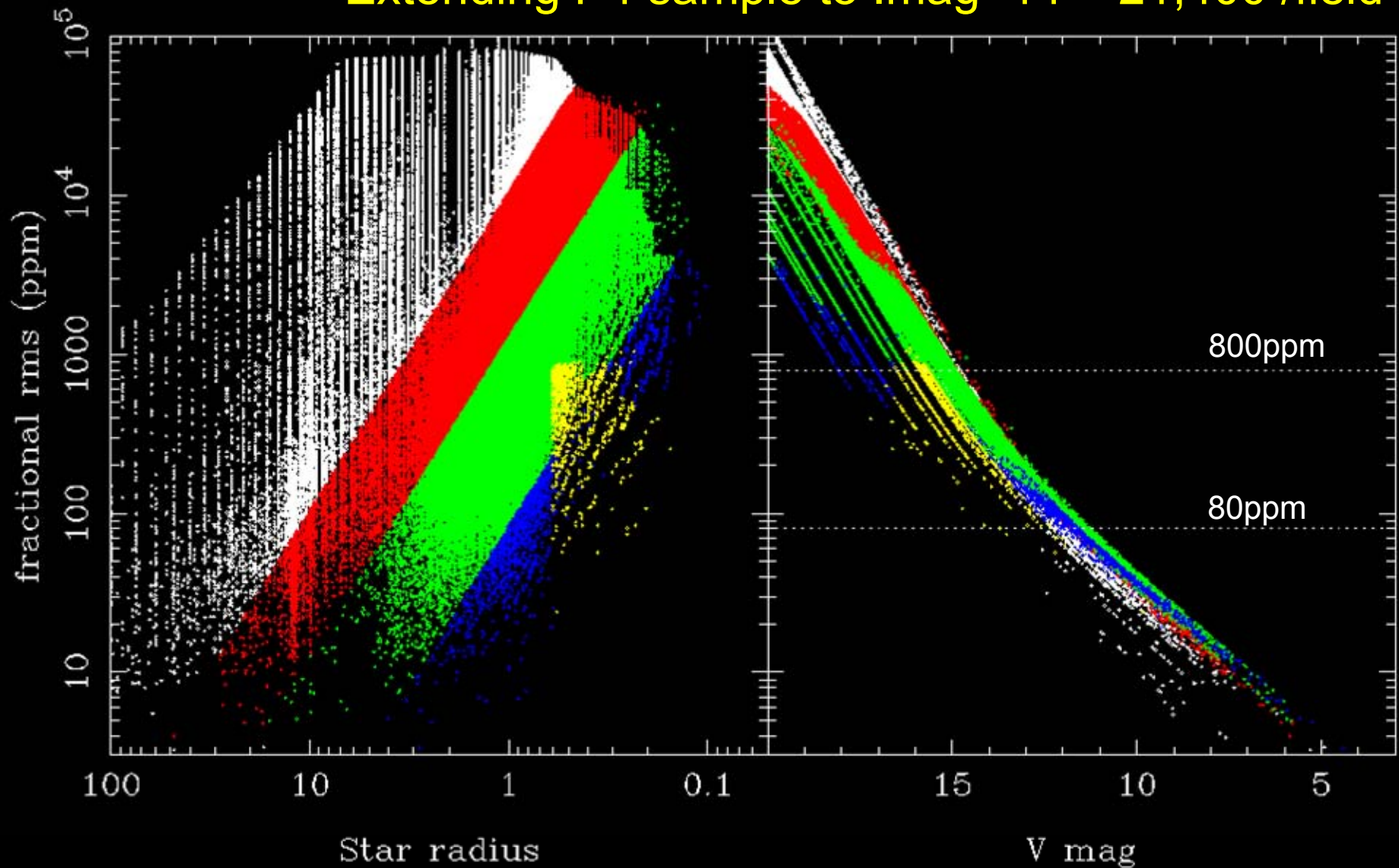
# Simulated PLATO target population

P4 sample = 6200 /field

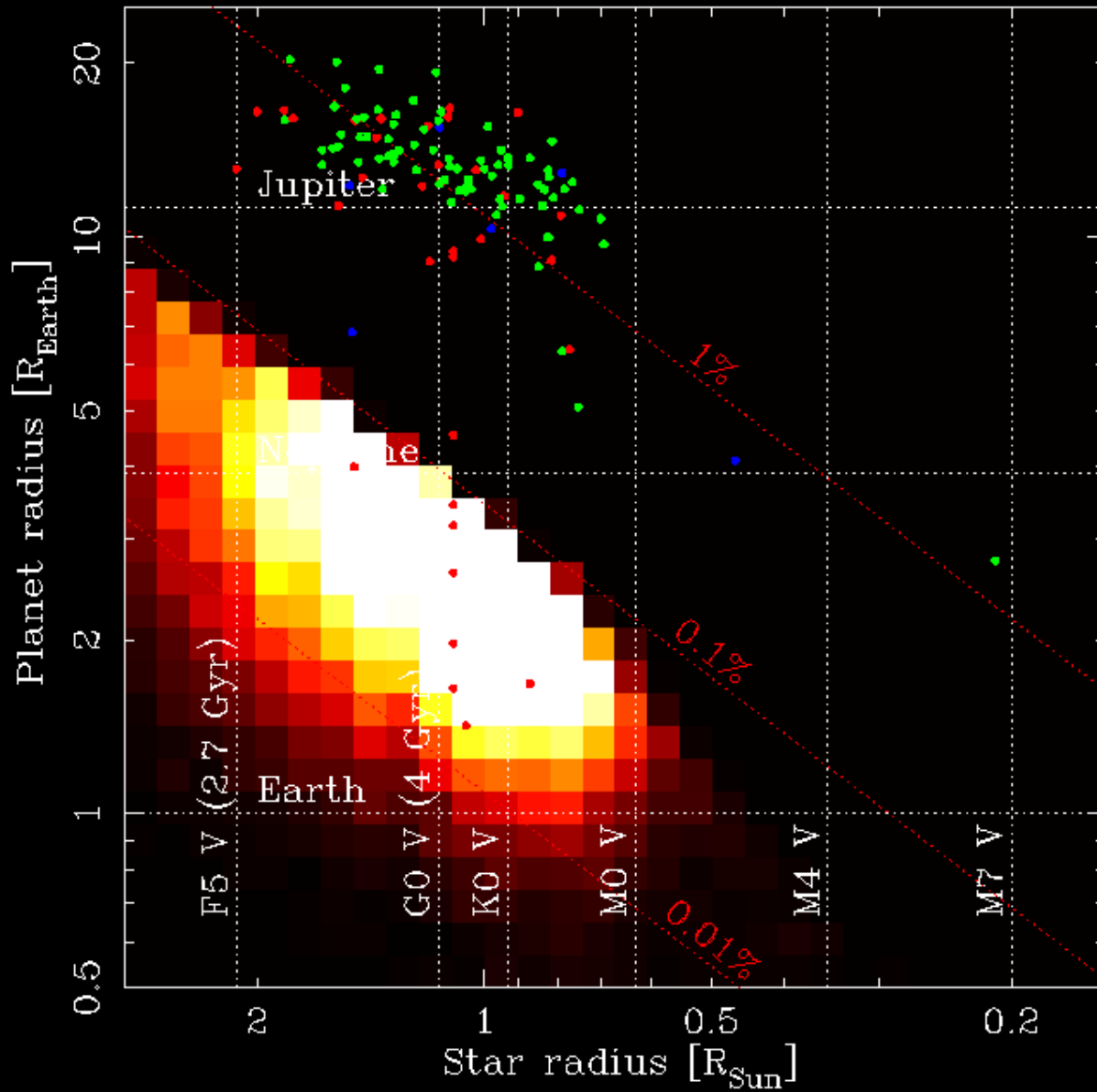


# Simulated PLATO target population

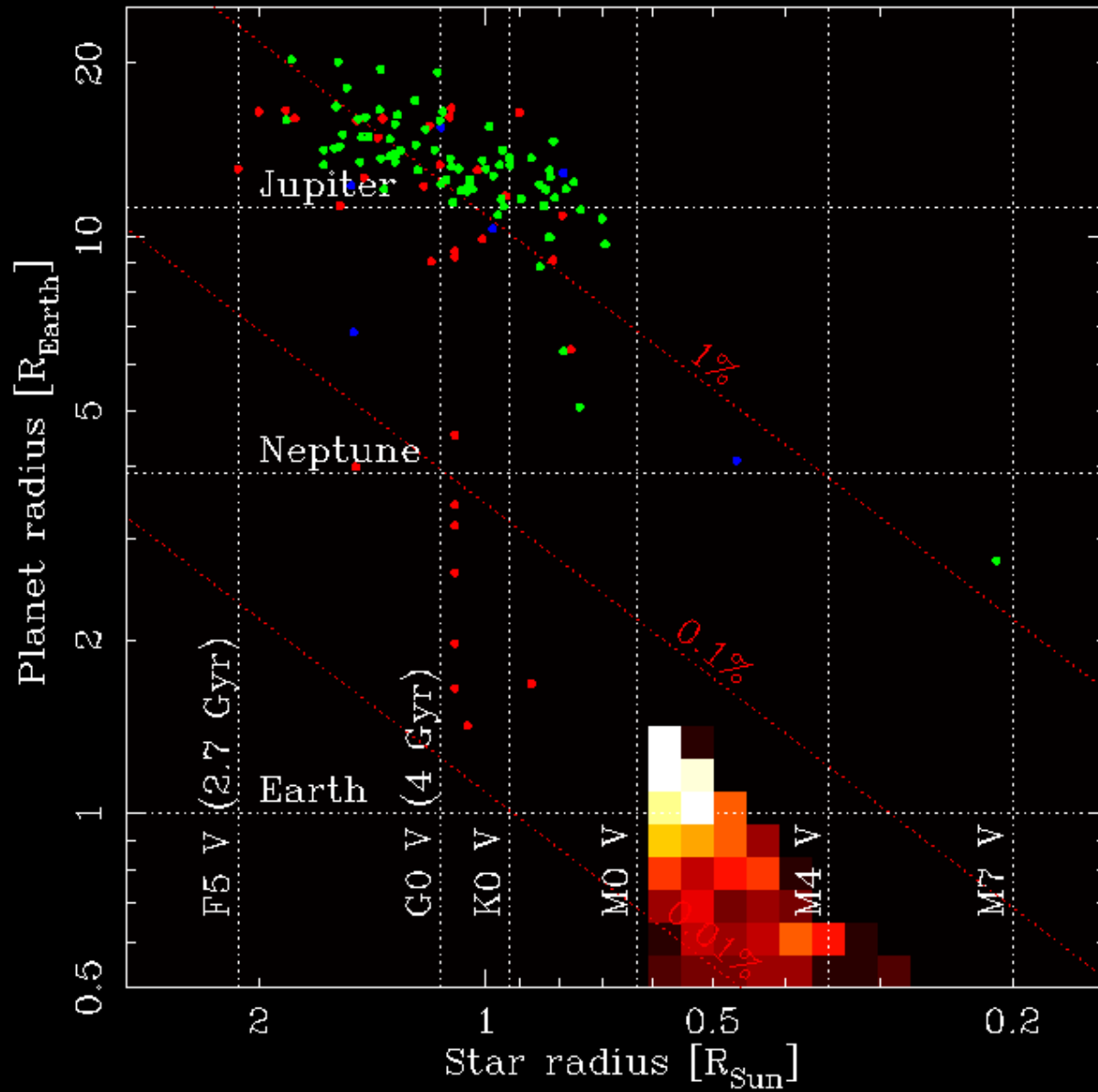
Extending P4 sample to  $I_{\text{mag}} < 14 = 21,400$  /field



# PLATO discovery space



# PLATO P4 sample discovery space





# Summary

- PLATO key science objectives include discovery of exoplanets around nearby M-dwarfs, including in habitable zone
- Simulations suggest
  - 6,000 targets/field in P4 sample
  - 12,000 M-dwarfs observed for years
  - ~50,000 observed for months
  - exceeding requirements by factors 2 and 10
- Relaxing constraint of  $V < 15$  to  $I < 14$ 
  - 40,000 M-dwarfs observed for years
  - 160,000 for months
- Excellent prospects for detection of habitable Earths