

# Investigating the occurrence of hot Jupiters with stellar age

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## Summary:

- **Hot Jupiters (HJs)** - class of gas giants physically similar to Jupiter with orbital periods < 10 days
- If rapid orbital decay occurs hot Jupiters will be engulfed, and we may expect to see a trend with stellar age if this happens on Gyr timescales
- Project aims to test this relation using a sample of TESS hot Jupiter candidates, fitting isochrone ages to each system
- **From the age distributions: a strong peak is seen at ~3 Gyr for both HJ samples, whereas this peak is less pronounced for the control group, with a broader overall distribution**
- **A BLS search will be carried out on a sample of ~280k stars observed by TESS at 2-minute cadence so occurrence rates can be calculated**

## Sample selection: TESS planet candidates

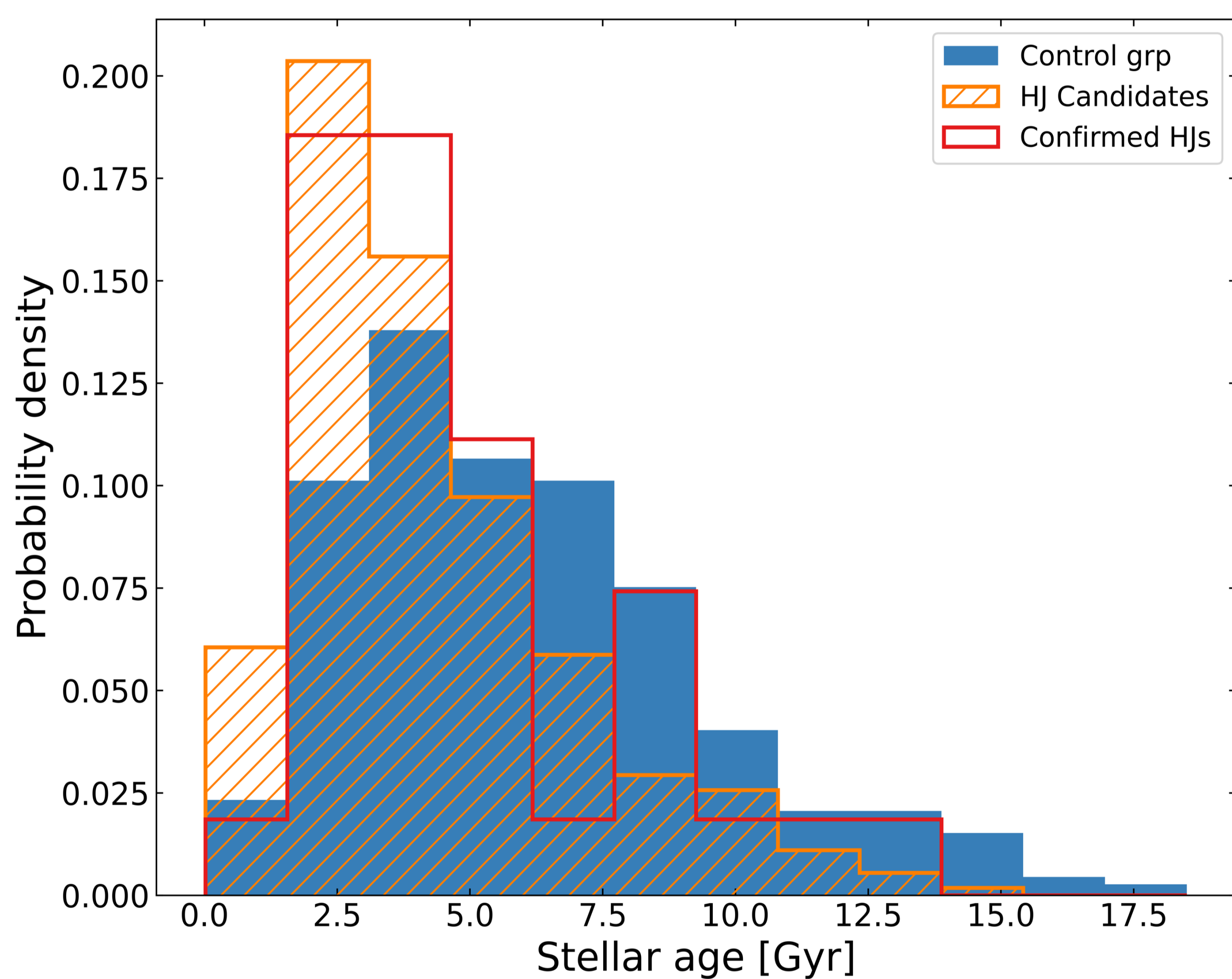
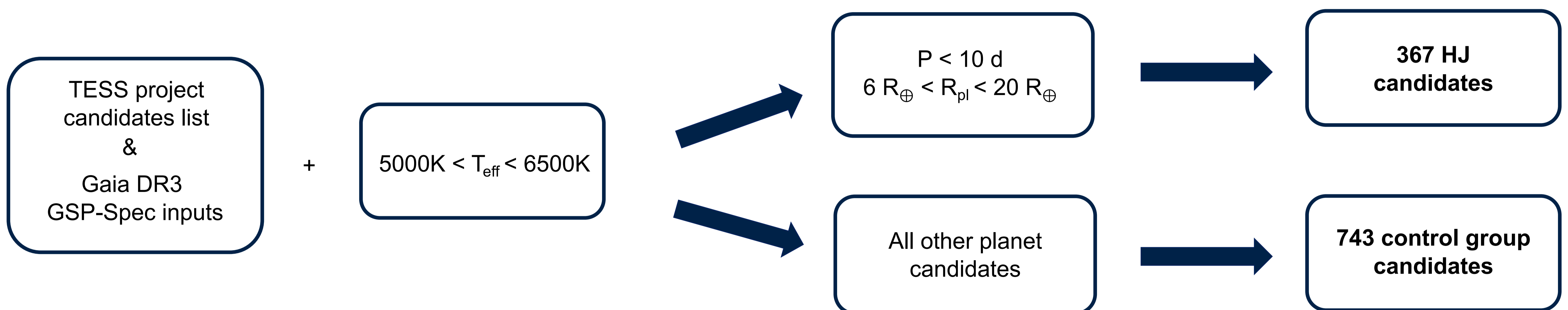
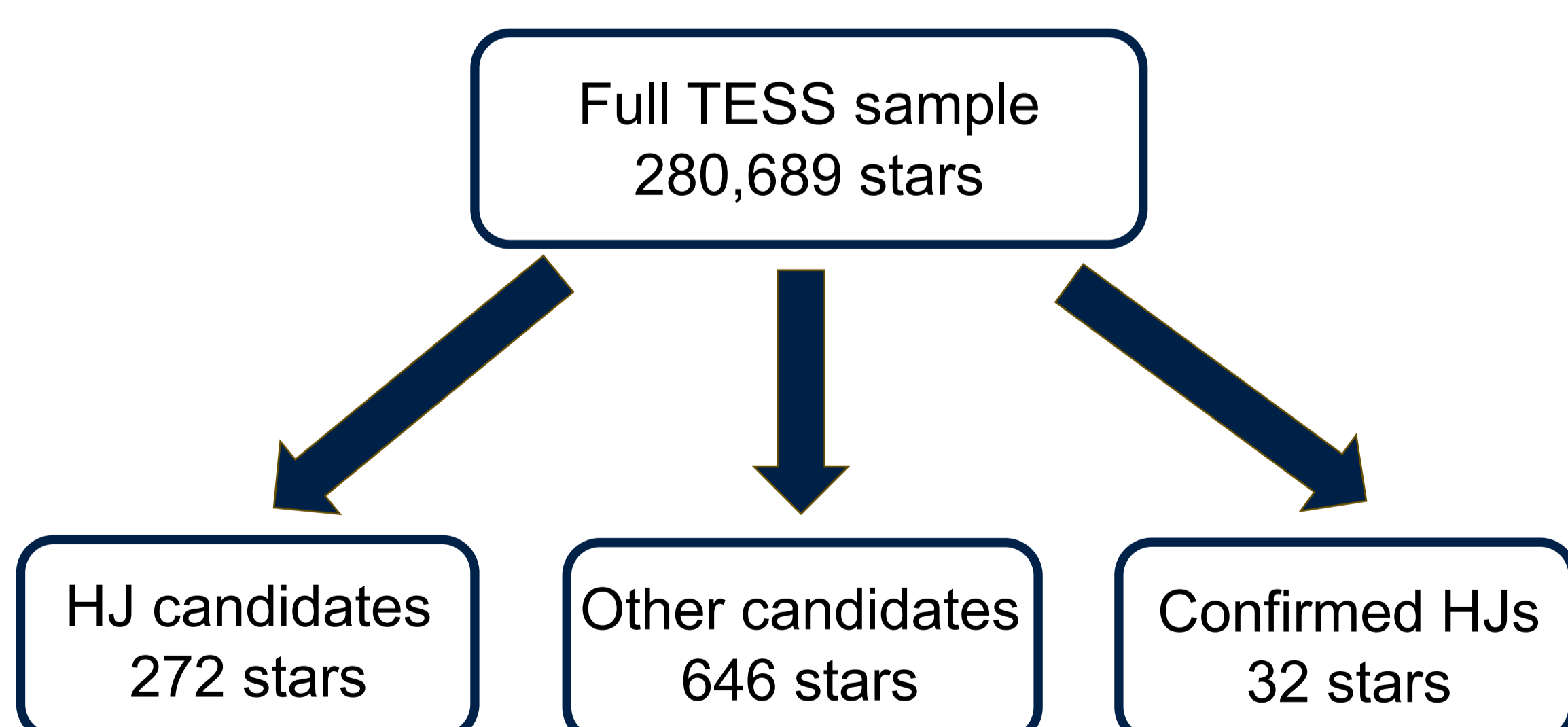


Figure 1: Histogram showing the distribution of stellar age fitted using BASTA for the control group (blue), HJ candidates (orange hatch) and confirmed HJ (red) samples. A strong peak at ~3 Gyr is present for both HJ samples.



## Future work

- Run BLS search pipeline on the full TESS sample (~280k stars)
- Implement further vetting checks e.g. odd/even transit depth, secondary eclipse events
- Transit injection and recovery tests to determine efficiency of pipeline → **occurrence rates determined as function of stellar age**

## Isochrone age fitting

- BASTA used to characterize stellar properties → priors on initial mass function, Gaia G/BP/RP magnitudes, temperature, metallicity and parallax
- Sample of 37 brightest confirmed TESS HJ hosts used to validate fitting process
- Changes made to inputs: **+60 to  $T_{\text{eff}}$  errors, floor of 0.1 for  $[M/H]$  errors**
- $M_* < 1.1M_{\odot}$  → convective overshooting, mass loss and diffusion
- $M_* > 1.1M_{\odot}$  → convective overshooting and mass loss

## BLS transit search

- Sample selection: **stars observed within TESS sectors 1-77 at 2-min cadence + gaia GSP-Spec inputs available → 280,689 stars**
- BLS search for signals with periods between 0.5-10d, durations between 0.03-0.3d
- Significant periodic signal: if signal detection efficiency  $\geq 8$  and SNR  $> 8$

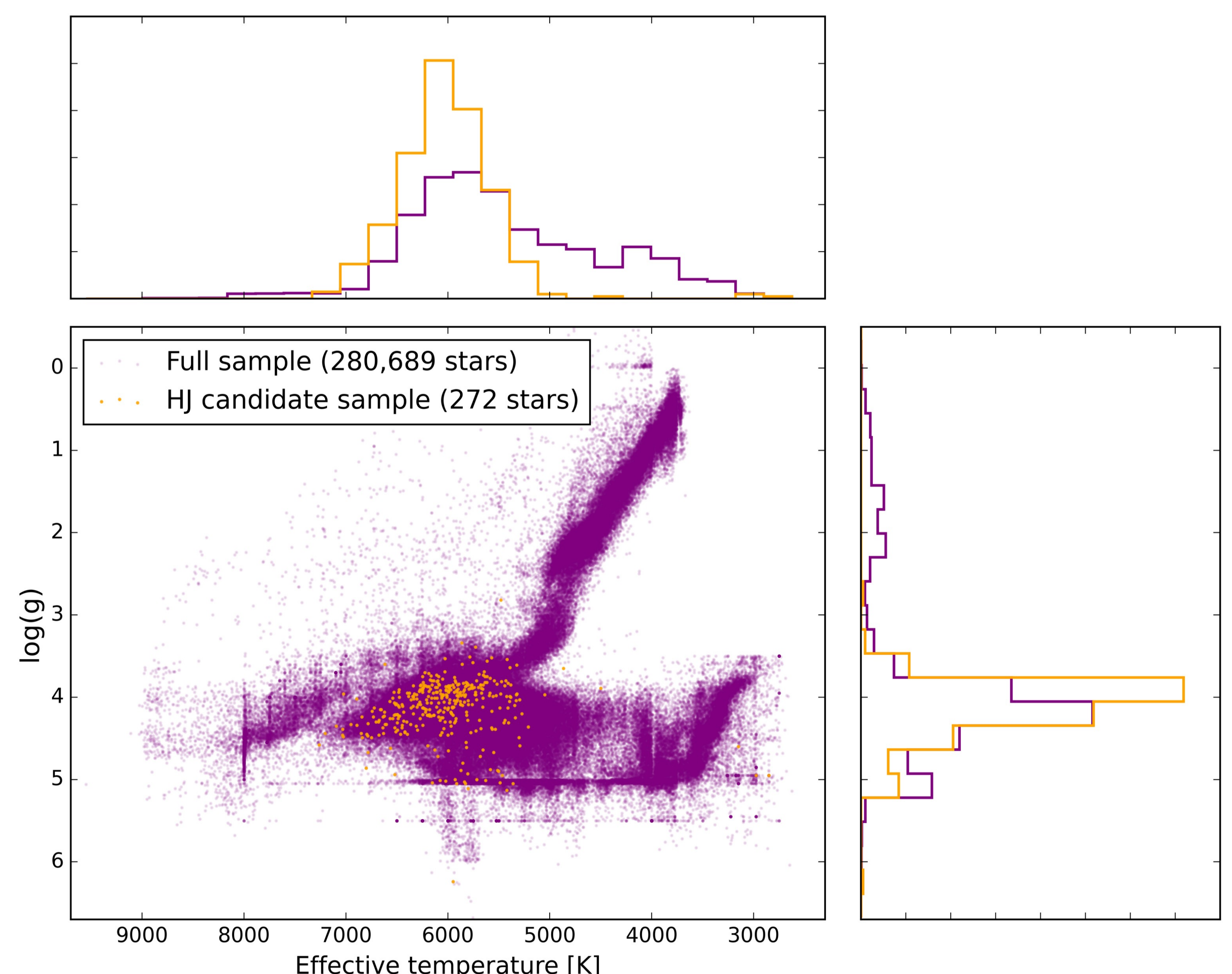


Figure 2: Plot of  $\log(g)$  vs stellar effective temperature for the full TESS sample (purple) and TESS HJ candidate sample that are within this (orange). Note that histograms are in terms of probability density.