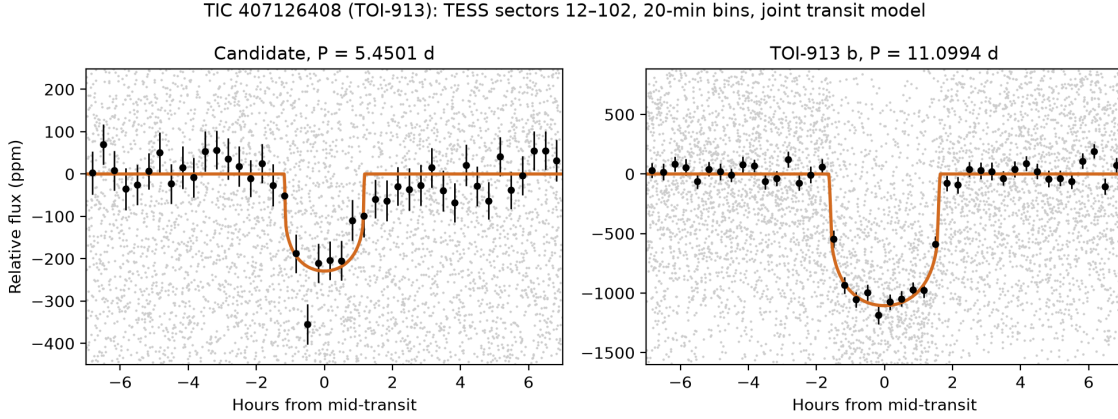


TOI-913 (TIC 407126408): a 5.45-day, $1.1 R_{\oplus}$ transit candidate

Josh Gold, independent researcher, Acton, MA. One-page summary, 16 October 2026. Not peer reviewed. Preprint (version 2): doi:10.5281/zenodo.23415929. Code: github.com/killercatfish/tess-hunt.

The signal. $P = 5.450138 \pm 0.000016$ d, depth 196^{+24}_{-21} ppm, duration 2.4 h, $R_p = 1.12 \pm 0.09 R_{\oplus}$ if on the target (K dwarf, $V = 10.5$, 65 pc, Dec -80.8°). 34 transits in SPOC 2-min data, Sectors 12–102. Inside TOI-913 b ($P_b/P = 2.037$). **Not first:** the open-source *eumemic/exoplanets* search detected it on 2026 Oct 8 (MES 8.0, below its candidate cut of 10). Ours is an independent detection plus vetting.



What it survives

- Nine of ten automated tests (odd/even 0.7σ ; no secondary; size; harmonic; per-sector; injection); shape test inconclusive.
- Season holdout: 3 of 4 hidden seasons show the transit at $> 2\sigma$ (the fourth 1.8σ).
- Recovered as the strongest periodic signal in QLP FFI photometry.
- Empirical FAP $< 1.5\%$ (200 block-shuffled light curves). Inverted light curve: strongest unrelated peak SDE 14.5 vs 21.7.
- Free-density fit $2.43^{+0.97}_{-1.01} \rho_{\odot}$ vs catalogue 2.09 ± 0.45 .
- Not a 5:1 harmonic of a 27.3 d systematic (drifts 0.59 of a period).
- TRICERATOPS with Zorro speckle, a galaxy removed: FPP 0.036, NFPP 0.023. **Neither validated nor “likely planet”** (both need NFPP < 0.001).

What is weak or not done

- **9.5'' background giant** (TIC 407126405, needs a 1.1% eclipse): excluded only by transit duration from its TIC radius. Centroids cannot separate it (ours $p = 0.44$; *eumemic*’s 0.62).
- **26.5'' star** (TIC 407126406, $T = 17.0$, needs a 23% eclipse): carries most of the NFPP. Our injection-calibrated per-sector centroids only weakly disfavour it ($p = 0.02$; 0.21 at 150 ppm), as of 16 Oct, after version 2. The 58'' star is rejected ($p < 5 \times 10^{-6}$).
- Single-transit depths scatter somewhat more than their errors ($\chi^2/\text{dof} = 1.51$; 21% of off-transit phases as large).
- Pipeline recall: it missed 7 of 17 of *eumemic*’s signals in a blind re-vet (stops at the first sub-threshold peak). Validation: 23 of 26 known planets at the right period, 8 of 9 EBs rejected, tuned on the same set.
- Built with substantial AI assistance (Claude), directed by me. I checked the key numbers by hand and every number in the preprint against its result file. No professional astronomer has checked it.

Next tests. (1) Seeing-limited photometry of TIC 407126406 (and the giant) during a predicted transit; the star is at Dec -81° , so this needs a southern telescope; ephemeris good to ± 15 min in late 2026. (2) TESS Sector 114 (Feb–Mar 2027): transit times pre-registered before the data exist (doi:10.5281/zenodo.23290795); result published within 30 days whatever it shows.

Inspired by P. Rabinovich’s single-star TESS method (doi:10.5281/zenodo.22967456).