A 41.23- or 82.45-day eclipsing-binary candidate: TIC 422108893

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Tustin, California. Research note from the 2.4 degree repeating-dip scan around V345 Lac, 18 November 2026.

Status: New candidate, period unsettled. Found 18 Nov 2026. Not filed. Not yet checked from the ground.

Abstract

TESS Quick-Look Pipeline photometry of TIC 422108893 shows four eclipses, one each in sectors 17, 56, 77 and 84. Each is about 23 percent deep, 0.29 mag, and about 0.65 day long. The star is not in the AAVSO Variable Star Index, and no catalogued variable lies within 44 arcsec. It was found by a new 12-harmonic period search with a box least-squares cross-check. The four mid-times fit

Min = BTJD 1771.08453 + 41.22652 E, or every other one, P = 82.45303 d

to within a minute. TESS has no data within 2.2 days of phase 0.5 on the longer clock, so the two periods cannot be told apart from TESS, and the period is not settled. Every shorter period that fits the four eclipses predicts eclipses where TESS saw full light. The next test is 2026-11-23 20:27 UTC, when an eclipse happens only if the period is 41.2265 days. The star is 1.574 degrees from V345 Lac, in the 1.50–1.60 degree ring. Nothing in this note has been submitted to VSX.

1. How the star was found

A repeating-dip scan of TESS stars around V345 Lacertae (TIC 421726141) ran on 18 November 2026. It covered every TESS Input Catalog star within 2.4 degrees of V345 Lac with a TESS magnitude of 13.0 or brighter, 20,840 stars. The light curves are QLP SAP_FLUX, cadences with a quality flag of exactly zero, each sector divided by its own median. The period search uses the multiharmonic χ^2 periodogram approach of Rutkowski & Poleski (2026), run with 12 harmonics: a 12-term Fourier series is fitted at every trial frequency. Rutkowski & Poleski (2026) also introduced the fast Toeplitz-solver technique that accelerates this periodogram (their Toeplitz-LS code). The scan did not run the Toeplitz-LS code. It computed the same 12-harmonic periodogram with the finufft_chi2 backend of nifty-ls (Garrison et al. 2024), a separate package, which matched the Toeplitz-LS results in a test on our own TESS eclipsing binaries on 17 November 2026 and ran about twice as fast. The trial periods run from 0.4 to 30 days, with a frequency step of 1/(10T), where T is the time span of the light curve. The periodogram uses the median-normalized flux with no detrending. A box least-squares (BLS) search (Kovács, Zucker & Mazeh 2002), as implemented in Astropy, is the cross-check. It runs on a copy divided by a one-day running median and binned to 30 minutes, with trial durations of 1.5, 3, 5 and 8 hours. A star is kept as a candidate when at least two separate eclipses fall on the adopted period, the folded eclipse has a signal-to-noise ratio of at least 8, and the depth is at least 0.2 percent.

For TIC 422108893 the scan light curve held sectors 16, 17, 56, 57, 83 and 84. The 12-harmonic periodogram peaked at 20.61 days and BLS at 27.49 days. The scan adopted 20.61 days, saw three eclipses on it, and kept the star as a new candidate with no VSX or Gaia DR3 eclipsing-binary match. Section 4 shows that neither of those periods survives the eclipse timing. The star is bright enough for the earlier 1.50–1.60 degree ring search around V345 Lac, which did not flag it.

The measurements below are made again from the public QLP light curves (Huang et al. 2020; Kunimoto et al. 2021). Sectors 16 and 17 are 30-minute cadence. Sectors 56, 57, 77, 83

and 84 are 200-second cadence. Sector 76 has no QLP file for this TIC. SAP_FLUX is used with the quality flag exactly zero, and each sector is divided by its own median. No detrending is applied. Catalog values are from the TESS Input Catalog (Stassun et al. 2019), Gaia DR3 (Gaia Collaboration 2023) and SIMBAD. No new observations were obtained.

2. The star

TIC 422108893 is GSC 03986-01462 (SIMBAD), Gaia DR3 2006044022708105344, 2MASS J22225316+5608062 and UCAC4 731-084076. The TIC v8.2 position, fetched from MAST on 18 November 2026, is 22h 22m 53.17s, +56° 08′ 06.1″ (J2000), RA 335.72153°, Dec +56.13504°. The TIC lists V = 11.929 ± 0.046 (from UCAC4), T = 11.621, T_{eff} = 8280 K, R = 2.44 $R_{\odot}$, and a contamination ratio of 0.527. Gaia DR3 gives G = 11.83, BP − RP = 0.45, parallax 0.864 ± 0.015 mas, about 1.16 kpc, a renormalized unit-weight error of 0.98, and a GSP-Phot T_{eff} of 9121 K. Those values assume a single star and are copied as published.

From the TIC positions of this star and of V345 Lac, the separation is 1.5742 degrees, 94.5 arcmin, at position angle 22°, to the north-northeast. On the band convention of the V345 Lac pages the star sits in the 1.50–1.60 degree ring.

3. The eclipses

Each eclipse is normalized to a line through the light more than 0.5 day from its middle. The mid-time is the time that makes the two halves of the eclipse mirror each other.

Sector	Mid-eclipse (BTJD)	UTC	Min. flux	Depth	Below 98% (d)	O−C (min)
17	1771.0848	2019-10-14 13:56	0.772	22.8%	0.56	+0.3
56	2842.9734	2022-09-20 11:16	0.763	23.7%	0.58	-0.8
77	3420.1452	2024-04-19 15:32	0.764	23.6%	0.59	+0.0
84	3585.0515	2024-10-01 13:08	0.762	23.8%	0.61	+0.4

Table 1. The four eclipses of TIC 422108893. UTC is at the geocenter, after removing the barycentric light time. O−C is the residual from T_0 = 1771.08453 and P = 41.22652 d. The sector 17 eclipse is 30-minute cadence, so its bottom reads a little shallower.

The eclipse falls to 0.76–0.77 of the light in the 200-second sectors, about 23–24 percent. It lasts about 0.65 day from first to last contact, and 0.56 to 0.61 day below 98 percent of normal light. No secondary eclipse deeper than about 0.15 percent is seen.

4. The period

The gaps between the eclipses are 26, 14 and 4 times 41.2265 days. The fit residuals are +0.3, -0.8, +0.0, +0.4 minutes. On 82.45303 days the same four eclipses are cycles 0, 13, 20 and 22. Every odd cycle of the 41.2265-day clock falls where TESS has no data, and the nearest TESS cadence to phase 0.5 on 82.453 days is 2.16 days away. So TESS allows both 41.2265 and 82.453 days.

Every period that puts all four eclipses on one clock is 82.453/k days for a whole number k. For k = 3, 27.48 days, the predicted times BTJD 1743.60 (sector 16) and 2870.46 (sector 57) are at full light. For k = 4, 20.61 days, the halfway times BTJD 3399.53 (sector 77), 3564.44 (sector 83) and 3605.66 (sector 84) are at 1.003, 0.997 and 1.001 of the sector median. For every k from 5 to 40, down to 2.06 days, at least eight predicted times fall at full light. The scan’s 20.61-day and 27.49-day periods are therefore ruled out, along with every shorter period.

5. The eclipse belongs to this star

TESScut difference images put the centroid of the missing light 0.9 arcsec from the target in sector 56 and 6.9 arcsec in sector 84. That is a simple centroid, not a full pixel model. The

brightest neighbor in the pixel is TIC 422108875 (Gaia DR3 2006044022708105984, G = 13.77), 14 arcsec away at position angle 209°. Its G flux is 0.168 of the target, so a total eclipse of that star would remove at most about 14 percent of the blended light, not 23 percent. The TIC contamination ratio is 0.527. That ratio is not turned into an intrinsic depth here.

6. What the catalogs already say

Checked on 18 November 2026. No catalogued variable lies within 44 arcsec of TIC 422108893. The nearest, Gaia DR3 2006044400657743360, is a G = 19.5 eclipsing binary with a 0.33-day period, 45 arcsec away. The star has not been filed with VSX, and this note is not a VSX submission.

7. Follow-up items and the next minima

The test eclipse. The useful night is a “test” time, halfway between eclipses on the 82.453-day clock. An eclipse at a test time means the period is 41.2265 days. Full light there means 82.453 days. The next test time is 2026-11-23 20:27 UTC. “Either” times are eclipses on both periods.

Observing request. Cover four hours before and four hours after each predicted eclipse time. The eclipse lasts about 15 hours, so that eight-hour run sits inside it, and an eclipse shows as faded light against the comparison stars for the whole run. Keep TIC 422108875, 14 arcsec away, in its own aperture.

Kind	BTJD	UTC middle	Watch from (UTC)	Watch to (UTC)
Test	4368.355	2026-11-23 20:27	2026-11-23 16:27	2026-11-24 00:27
Either	4409.582	2027-01-04 01:56	2027-01-03 21:56	2027-01-04 05:56
Test	4450.808	2027-02-14 07:25	2027-02-14 03:25	2027-02-14 11:25
Either	4492.035	2027-03-27 12:52	2027-03-27 08:52	2027-03-27 16:52
Test	4533.261	2027-05-07 18:18	2027-05-07 14:18	2027-05-07 22:18
Either	4574.488	2027-06-17 23:42	2027-06-17 19:42	2027-06-18 03:42
Test	4615.714	2027-07-29 05:05	2027-07-29 01:05	2027-07-29 09:05
Either	4656.941	2027-09-08 10:29	2027-09-08 06:29	2027-09-08 14:29

Table 2. Predicted middles on the 41.22652-day clock, with the four-hour watch window on each side. UTC at the geocenter. “Test” rows are eclipses only if P = 41.2265 d.

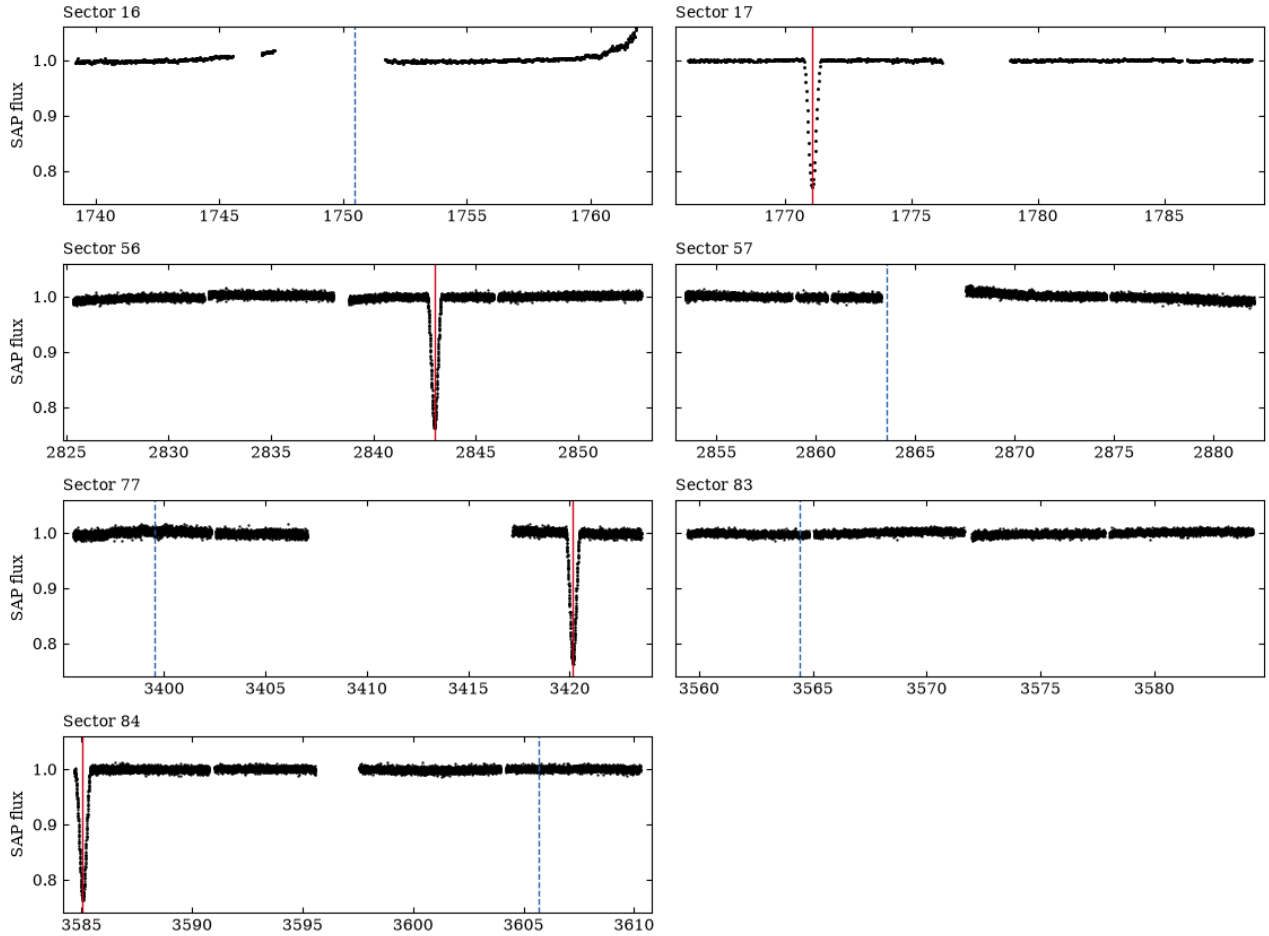


Figure 1. QLP SAP light curves of TIC 422108893, quality flag zero. Red lines are the four eclipses. Dashed blue lines are the halfway times on 41.2265 days. Where TESS has data at those times the light is full.

TIC 422108893. The four eclipses TESS caught. The period is not settled.

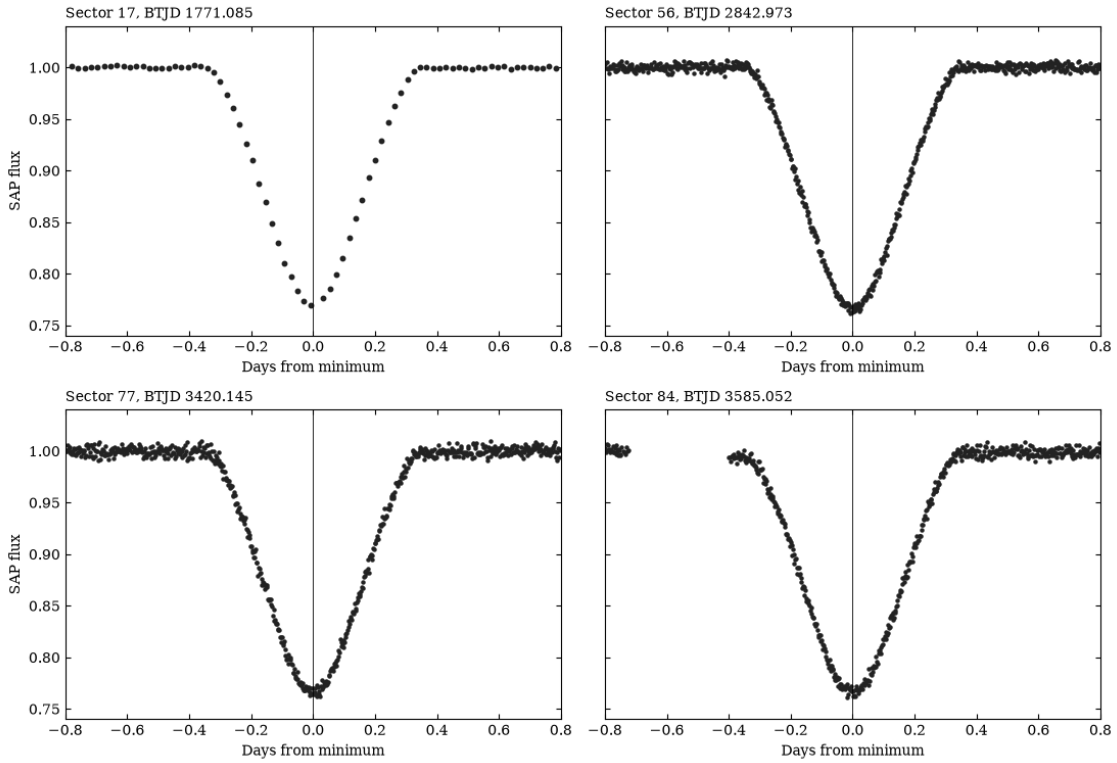


Figure 2. The four eclipses, each normalized to a line through the nearby light.

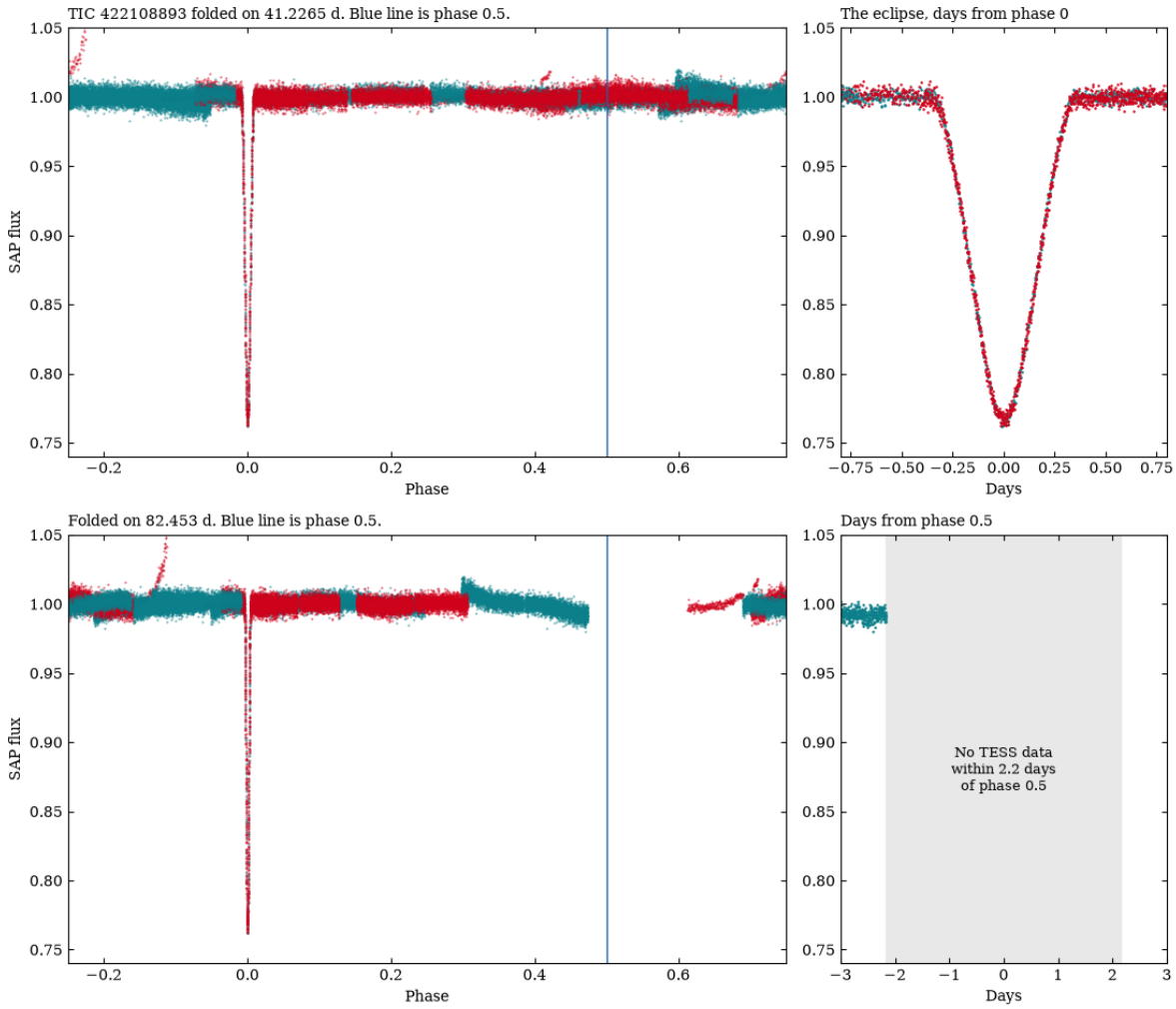
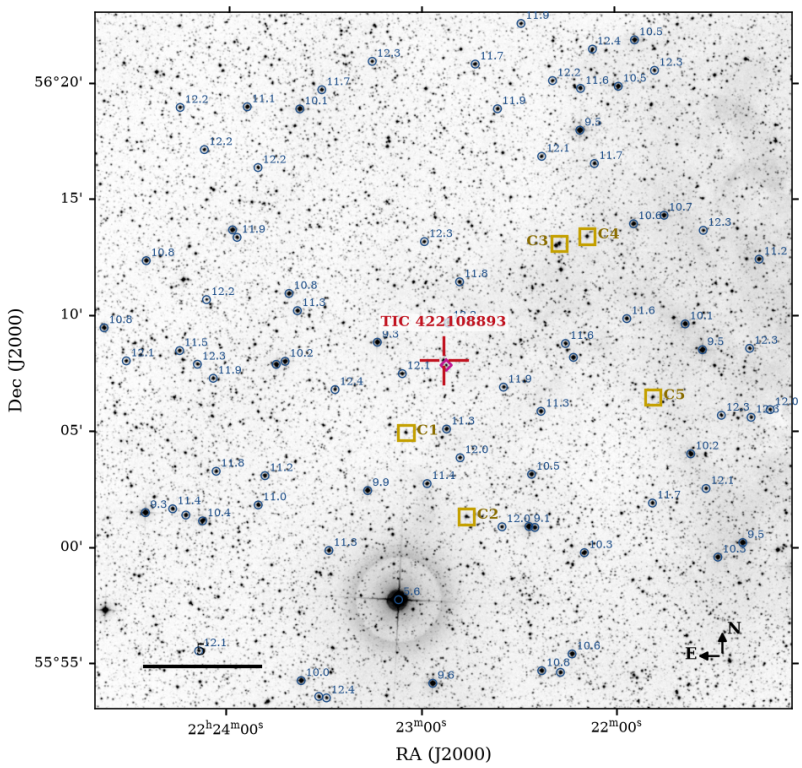


Figure 3. Top: folded on P = 41.2265 d, with the four eclipses overlaid at right. Bottom: folded on 2P = 82.453 d. TESS has no data within 2.2 days of phase 0.5, so the longer period is not ruled out.

TIC 422108893 — wide finder, 30′ × 30′

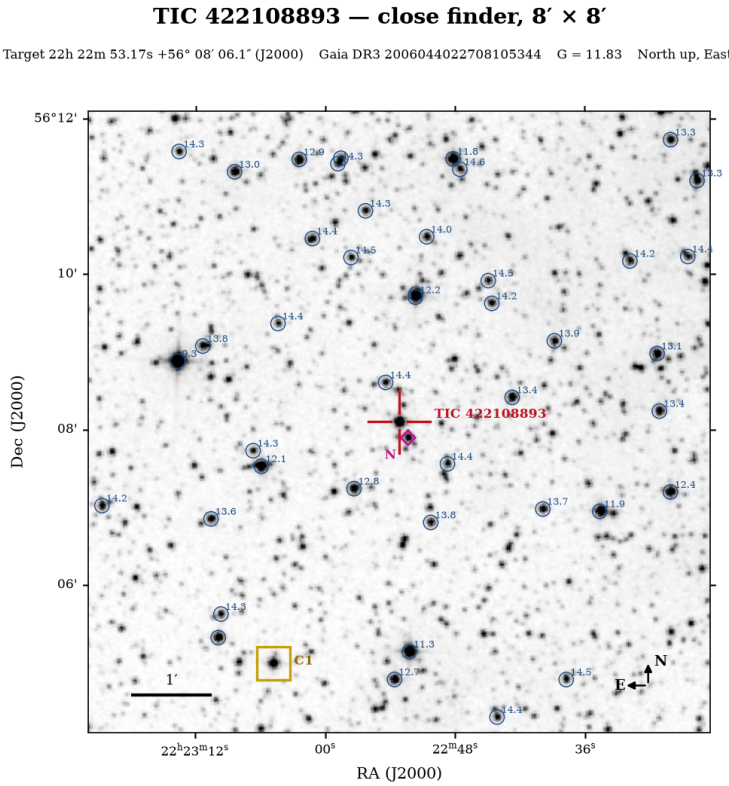
Target 22h 22m 53.17s +56° 08′ 06.1″ (J2000) Gaia DR3 2006044022708105344 G = 11.83 North up, East left



	Gaia DR3	RA, Dec (J2000)	G	BP	RP	BP−RP	dist
T	2006044022708105344	22:22:53.2 +56:08:06.1	11.83	12.00	11.54	0.45	—
C1	2006040895971942912	22:23:04.8 +56:04:59.6	12.41	12.69	11.96	0.72	3.5′
C2	2006040277496659328	22:22:46.2 +56:01:22.3	12.06	12.24	11.74	0.51	6.8′
C3	2006057869682612736	22:22:17.3 +56:13:08.5	11.78	11.92	11.54	0.38	7.1′
C4	2006056456618106624	22:22:08.7 +56:13:26.2	11.86	12.12	11.42	0.69	8.2′
C5	2006054772990937216	22:21:48.5 +56:06:30.3	12.09	12.24	11.82	0.42	9.1′

Red ticks = target (T). Gold squares = comparison stars C1–C5: Gaia G within 1 mag of the target, RUWE < 1.4, no Gaia variability flag, no VSX entry within 10″, not a star on these pages, and no Gaia star within 4″ within 3 mag. 5 of the 5 are within 0.30 of the target in BP−RP. Blue circles: Gaia DR3 stars G < 12.4, labeled with G. Magenta diamond N = TIC 422108875 (Gaia DR3 2006044022708105984, G = 13.77), 14″ from the target. It is in the TESS pixel; see the note. Image: DSS2 red (POSS-II, STScI Digitized Sky Survey) via NASA SkyView. The mosaic header has no plate date. Stars: ESA Gaia DR3 (VizieR I/355), positions shifted from epoch 2016.0 to J2000. Variables: AAVSO VSX (VizieR B/vsx), 18 Nov 2026. Sean's Astronomy Shop, 18 November 2026.

Figure 4. Wide finder, DSS2 red via NASA SkyView. The red marks are TIC 422108893. Gold squares C1 to C5 are comparison stars from Gaia DR3.



	Gaia DR3	RA, Dec (J2000)	G	BP	RP	BP−RP	dist
T	2006044022708105344	22:22:53.2 +56:08:06.1	11.83	12.00	11.54	0.45	—
C1	2006040895971942912	22:23:04.8 +56:04:59.6	12.41	12.69	11.96	0.72	3.5′
C2	2006040277496659328	22:22:46.2 +56:01:22.3	12.06	12.24	11.74	0.51	6.8′
C3	2006057869682612736	22:22:17.3 +56:13:08.5	11.78	11.92	11.54	0.38	7.1′
C4	2006056456618106624	22:22:08.7 +56:13:26.2	11.86	12.12	11.42	0.69	8.2′
C5	2006054772990937216	22:21:48.5 +56:06:30.3	12.09	12.24	11.82	0.42	9.1′

Red ticks = target (T). Gold squares = comparison stars C1–C5: Gaia G within 1 mag of the target, RUWE < 1.4, no Gaia variability flag, no VSX entry within 10″, not a star on these pages, and no Gaia star within 4″ within 3 mag. 5 of the 5 are within 0.30 of the target in BP−RP. Blue circles: Gaia DR3 stars G < 14.6, labeled with G. Magenta diamond N = TIC 422108875 (Gaia DR3 2006044022708105984, G = 13.77), 14″ from the target. It is in the TESS pixel; see the note. Image: DSS2 red (POSS-II, STScI Digitized Sky Survey) via NASA SkyView. The mosaic header has no plate date. Stars: ESA Gaia DR3 (VizieR I/355), positions shifted from epoch 2016.0 to J2000. Variables: AAVSO VSX (VizieR B/vsx), 18 Nov 2026. Sean's Astronomy Shop, 18 November 2026.

Figure 5. Close finder, 8 by 8 arcmin, DSS2 red. TIC 422108875 is the G = 13.8 star 14 arcsec to the south-southwest.

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