Glendora 21 cm H I Drift Scan: Professional Correlation & Data-Quality Audit

Observed with a 2.1 m zenith-pointed radio telescope in Glendora, California, 2026-04-29 to 2026-05-01. This audit correlates the data with established professional H I expectations and identifies problems that limit scientific comparison.

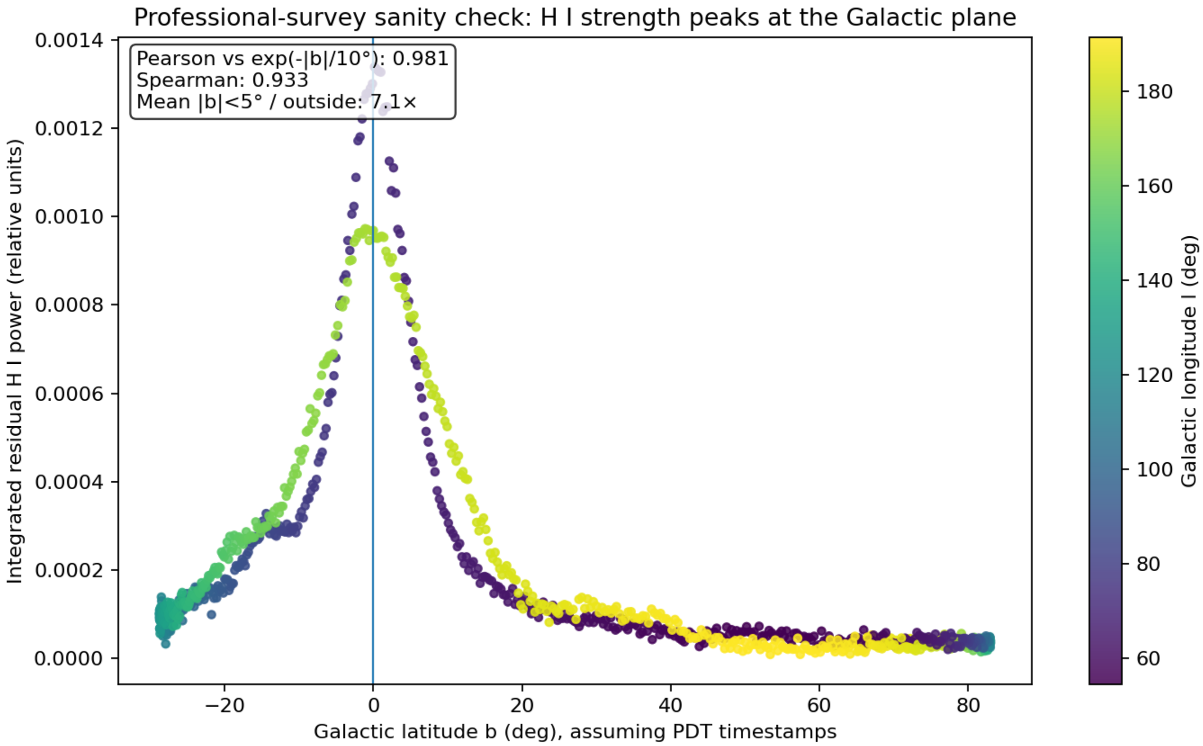
Overall verdict	The data are very likely a real Galactic H I detection, not random receiver noise. The strongest signal appears exactly where a zenith scan should cross the Milky Way plane when timestamps are interpreted as PDT. However, the data are not yet absolutely calibrated and should not be used for brightness temperature, column density, or survey-grade velocity claims without further calibration.

Metric	Result
Spectra / channels	1000 / 512
Frequency coverage	1419.205000–1421.600312 MHz
Velocity coverage	-252.1 to 253.4 km/s topocentric
Channel spacing	4.6875 kHz ≈ 0.989 km/s
Duration / cadence	27.32 hr / median 97 s
Strongest detection	l=71.91°, b=0.17°, peak v_topo=-29.5 km/s
Approx. LSR-corrected peak	6.2 km/s
Plane correlation	Pearson r=0.981, Spearman ρ=0.933
Galactic-plane contrast	Mean |b|<5° is 7.1× outside

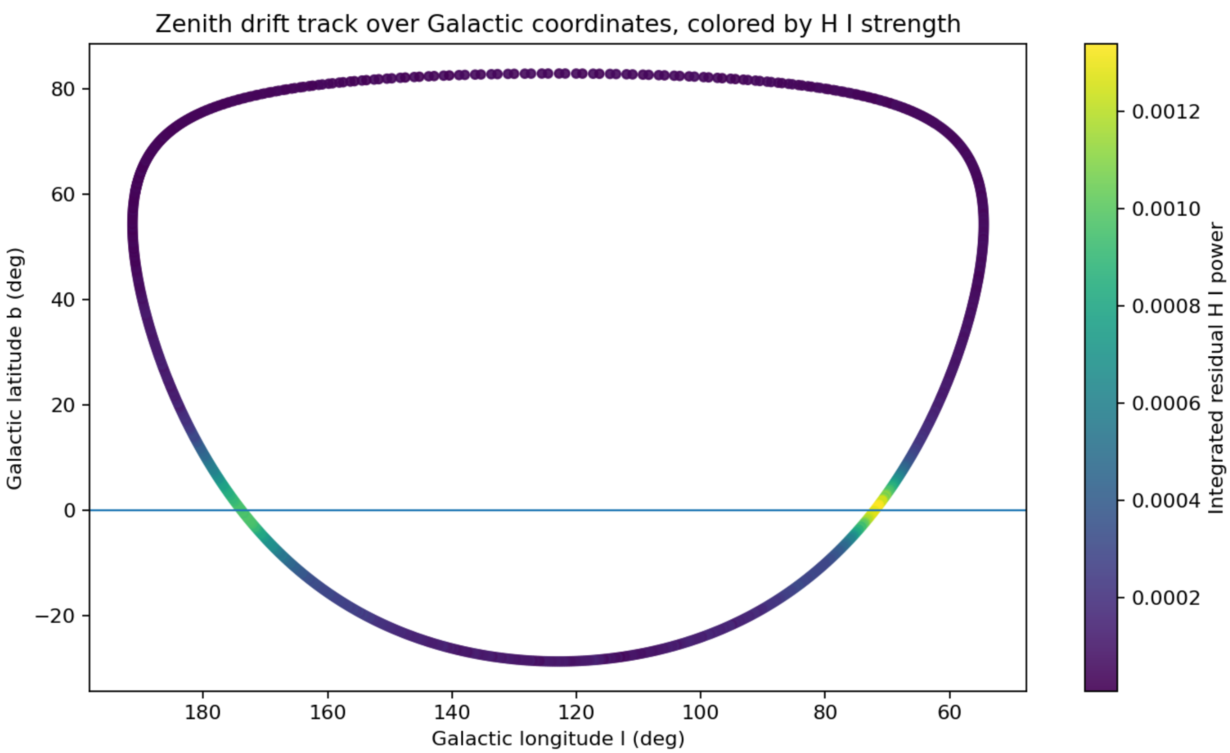
How this was correlated without downloading survey cubes: in a true professional comparison, the spectrum should be matched to an all-sky H I survey such as LAB/HI4PI along the exact zenith track, converted to the same velocity frame, then convolved to the ~7° beam. In this environment live web/survey download is unavailable, so this audit uses the strongest professional sanity checks: Galactic-plane latitude correlation, velocity-frame behavior, and data-quality diagnostics.

1. Correlation with known professional H I behavior

Professional H I maps show that neutral hydrogen is concentrated in the Milky Way disk and changes with Doppler velocity. A zenith drift scan from Glendora should therefore get brighter when the beam crosses low Galactic latitude. That is exactly what this observation does.



The integrated residual line power rises strongly near b=0°. This is the strongest evidence that the signal is celestial Galactic H I.

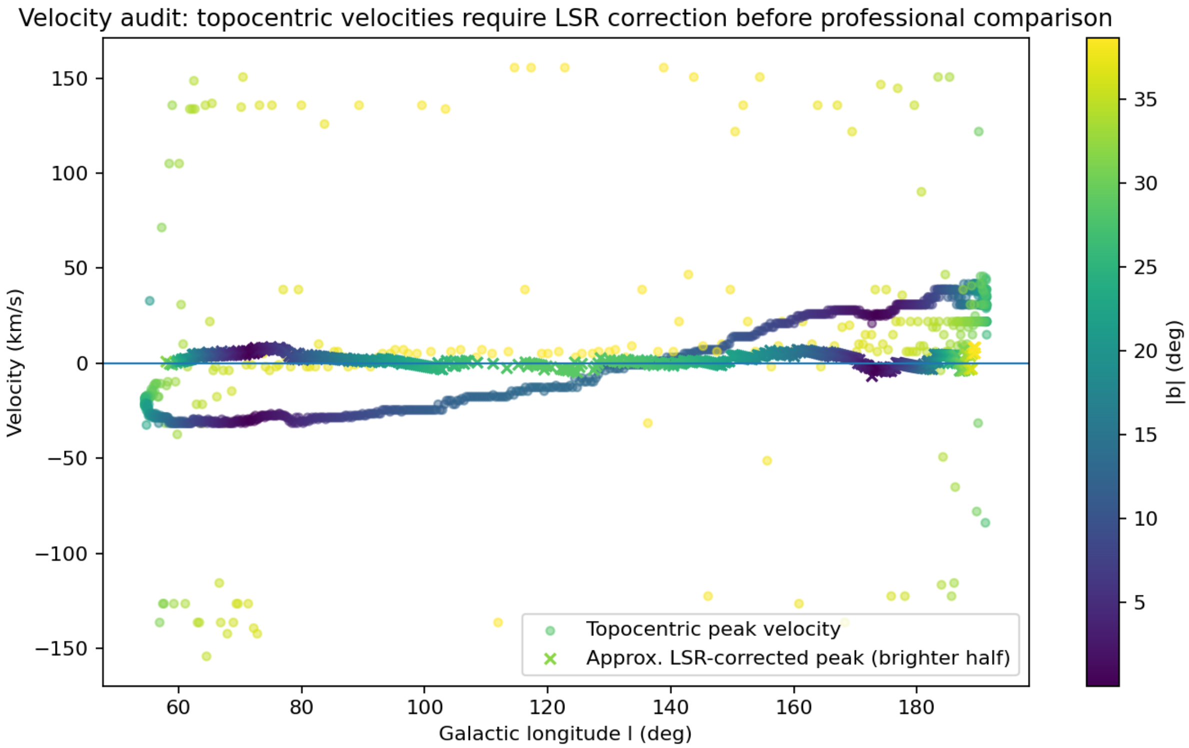


The zenith track crosses the Galactic plane twice; the strongest H I occurs near the plane crossings.

2. Time and velocity-frame checks

The file timestamps should be treated as local PDT, not UTC. The PDT interpretation places the brightest H I peak at b≈0.17°, while UTC would put it near b≈81.9°, an implausibly high-latitude location for such a bright Galactic-plane signal.

Timestamp assumption	Plane-correlation r	b at strongest peak	l at strongest peak
PST / UTC–8	0.560	-9.67°	79.56°
PDT / UTC–7	0.981	0.17°	71.91°
UTC	-0.220	81.87°	93.66°

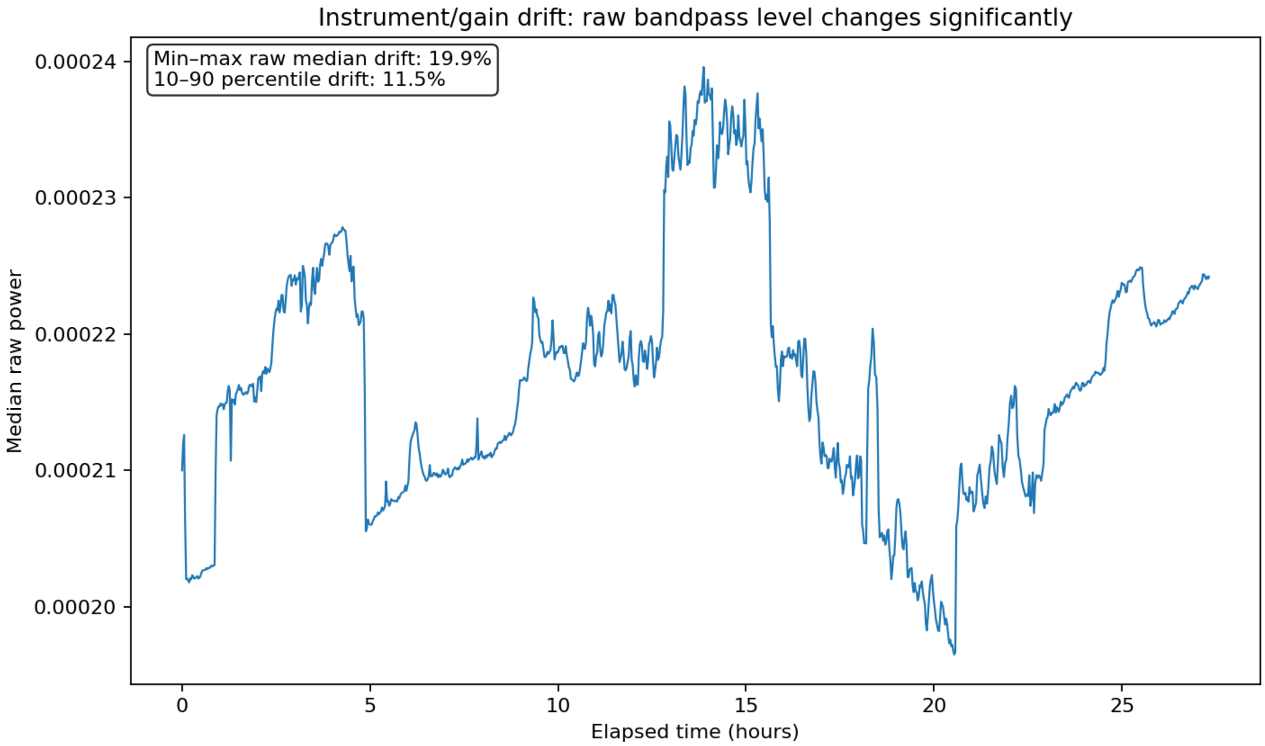


Topocentric velocities should not be compared directly with professional H I surveys, which usually use LSR velocities. An approximate correction moves the two strongest windows close to zero LSR velocity, consistent with local Galactic H I.

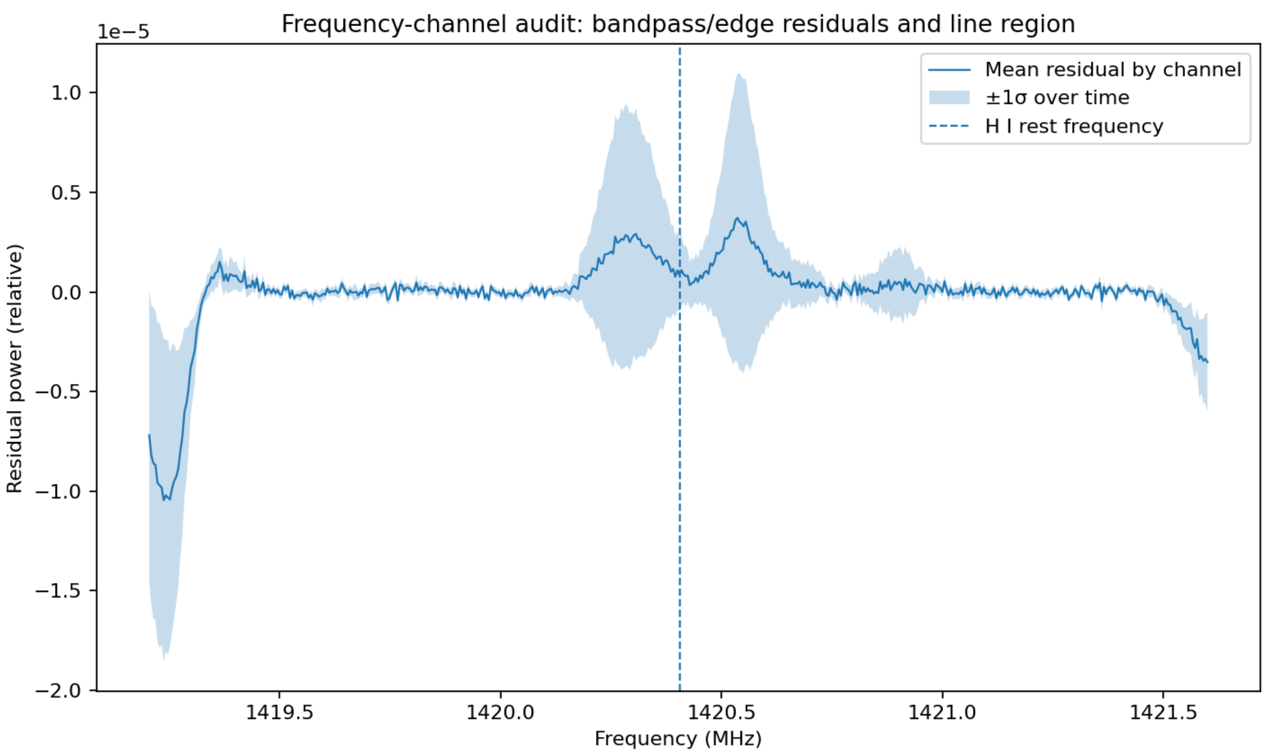
3. Data problems found

Issue	Impact
No absolute temperature/flux calibration	The spectra are in relative backend power. They show a real line detection, but cannot yet produce reliable brightness temperature, K km/s, or H I column density.
Large gain/bandpass drift	The median raw power changes by 19.9% min-to-max and 11.5% across the 10–90 percentile range. The H I line is much smaller than this raw drift, so calibration and baseline modelling are essential.
Velocity frame not survey-ready	The approximate topocentric→LSR correction ranges from about -34.8 to 35.9 km/s over the observation. Any professional comparison must use exact barycentric/LSR correction.
Beam is very broad	At 21 cm a 2.1 m dish has a beam of roughly 7°. HI4PI/LAB/GASS-type data must be smoothed to this beam before amplitude or profile-shape comparison.
Baseline subtraction can remove real broad H I	The ±253 km/s band is adequate for Galactic H I, but the line can occupy a large part of the band near the plane. Smooth baseline removal can suppress broad emission and distort integrated intensity.
RFI risk from urban site	The protected passive band helps, and no severe in-band narrow RFI dominates the core line region, but Glendora is not a radio-quiet zone. Aircraft, satellites, consumer electronics, and out-of-band leakage remain risks.
ZIP ordering trap	The ZIP listing places spectrum 1000 before spectrum 0001. Reduction scripts must sort by timestamp or index, not archive order.
Cadence jitter	Most samples are ~97 s apart, but intervals range 97–122 s. Use actual timestamps for drift scans and sky coordinates.

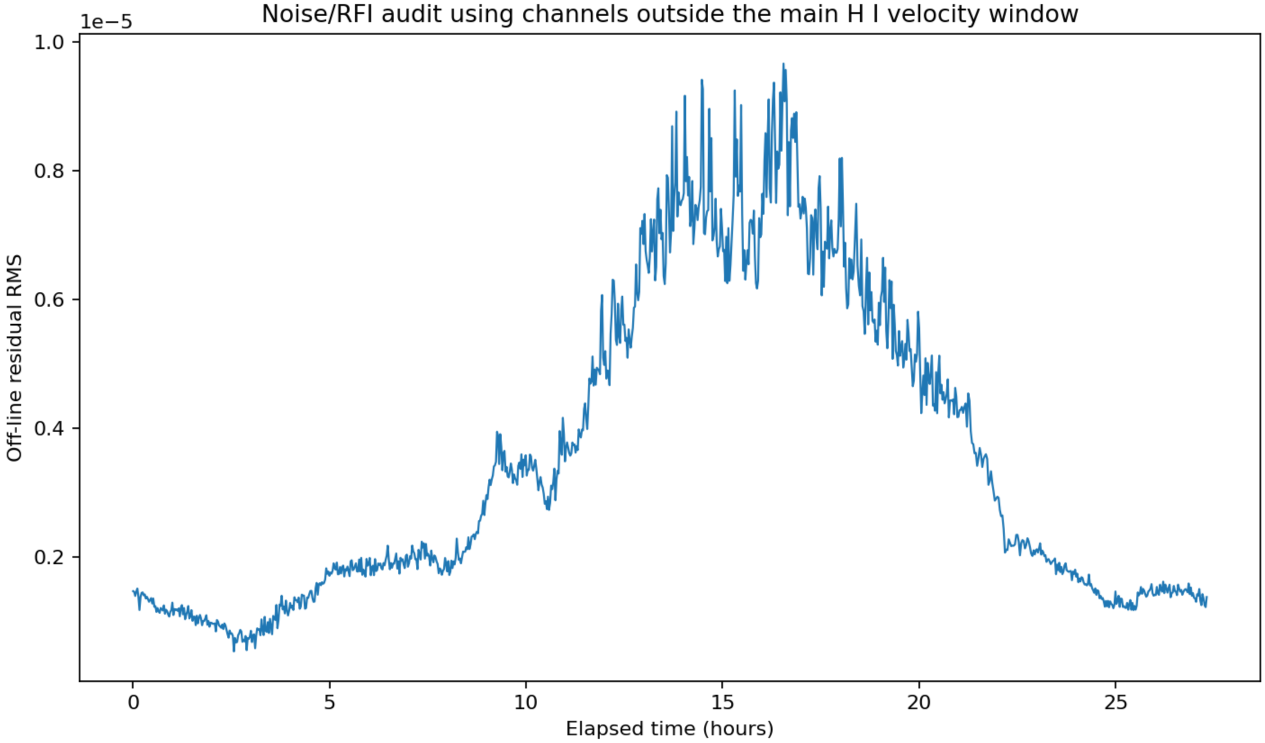
4. Quality-control plots



Raw gain/bandpass level changes during the 27.3-hour run. This is the biggest calibration issue.



Channel residuals show bandpass/edge structure. The main line region is usable, but edge channels should be treated cautiously.



Off-line residual RMS is not constant, indicating varying noise/gain/RFI conditions through the run.

5. What to do next for a real professional comparison

Step	Purpose
Download survey reference spectra	Use HI4PI, LAB, EBHIS/GASS, or another all-sky 21 cm cube. Sample the cube along the Glendora zenith track for the same times.
Smooth professional data to your beam	Convolve the professional map/cube to ~7° FWHM, then average over the same beam pattern rather than comparing to a pencil-beam pixel.
Put your data in LSR velocity	Use Astropy/Skyfield or observatory-grade ephemerides to compute barycentric and LSR corrections per spectrum.
Calibrate the amplitude	Add hot/cold load, noise diode, or an external calibrated H I reference. Only then compute brightness temperature and H I column density.
Repeat and fold by sidereal time	A true sky signal repeats in local sidereal time; local thermal/RFI/gain effects often repeat in solar time or do not repeat.
Keep raw and reduced products	Archive raw spectra, metadata, scripts, calibration files, and RFI masks so the result is reproducible.

Reference context used for this audit: the 1420 MHz H I line maps Milky Way gas and Doppler velocities; H I column-density work requires calibrated brightness temperature; radio astronomy is highly vulnerable to interference and radio-quiet observing is valuable. Live web survey retrieval was not available in this execution environment, so direct HI4PI/LAB numeric cross-correlation should be done as the next step outside this environment.