A Reproducible Synthetic Gating Demonstration (Extended Manuscript)

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Abstract

We present a reproducible synthetic demonstration of a specific, testable data-analysis failure mode: amplitude-based gating can suppress short-duration, high-amplitude burst-like transients prior to downstream scoring. Motivated by a reported micro-glitch candidate in PSR J0900–3144, we construct an illustrative burst template (a damped sinusoid near 200 Hz with sub-second damping; illustrative only) and inject it into controlled synthetic noise. We apply a simple threshold gate and report before/after peak-based proxy statistics along with the gated fraction. The bundled artifacts provide a fixed-seed, end-to-end reproduction of the effect and a concrete protocol for auditing the same mechanism on real/open strain data when and if the relevant segments are public.

Acknowledgments

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Contents

1 Introduction

The internal composition of millisecond pulsars (MSPs) remains a subject of active theoretical debate. While glitches—sudden spin-up events—are standard phenomenology in young, isolated neutron stars, their occurrence in old, recycled MSPs is exceptionally rare. A recent report describes a micro-glitch candidate in PSR J0900–3144 [1]. This manuscript uses that report only as a motivating case study for a falsifiable methodological question: can standard transient-mitigation procedures (e.g., amplitude-based gating) suppress short, high-amplitude transient morphologies before they are scored by downstream statistics?

This paper does not claim a detection and does not analyze detector data. Instead, it provides a self-contained, executable synthetic injection experiment that isolates a specific mechanism: given an injected transient and a specified gating rule, the gate can substantially reduce simple peak-based proxy metrics.

Because the present work is a reproducible *synthetic sensitivity demonstration* (and not an observational analysis), all astrophysical context should be treated as *illustrative*. Any downstream observational study must use verified parameters, vetted data access pathways, and appropriate bibliographic sources.

The core contributions are: (i) a transparent definition of the toy gating operator and summary statistics used here, (ii) fixed-seed artifacts (logs and arrays) that reproduce the effect end to end, and (iii) an explicit protocol for auditing the same mechanism on real/open strain data when and if the relevant segments are public.

2 Motivation and illustrative burst morphology

This section motivates the *illustrative* signal morphology used in the synthetic demonstration. It is intentionally framed as a proposed test: the included code does not analyze observational data, and no detection is claimed.

2.1 Motivating context

The motivating case study is a reported micro-glitch candidate in PSR J0900–3144 [1]. If one were to hypothesize an accompanying short-duration transient in strain, there are many plausible burst-like morphologies depending on the underlying physical mechanism, detector response, and data conditioning. This manuscript does not attempt to adjudicate among astrophysical models; the goal is to test a general data-analysis mechanism under controlled conditions.

2.2 Illustrative burst template

To keep the capsule minimal and falsifiable, we use a simple ringdown-like template: a damped sinusoid with a representative frequency near 200 Hz and sub-second damping. These values are not observationally inferred and are included only to instantiate a short-duration, burst-like transient in the band where ground-based interferometers often have good sensitivity.

This choice motivates the synthetic injection in Section 3. The key methodological point is independent of the detailed template: if a real short transient were present in archival strain, amplitude-based gating (or related preprocessing) can suppress it prior to downstream scoring.

3 Methods: synthetic injection and gating

This section defines the minimal experiment implemented by `astra_proof.py`.

3.1 Signal construction

We construct a time grid $t \in [0, T]$ sampled at f_s Hz. A synthetic transient $h(t)$ is injected at time t_0 with a narrow envelope. The precise functional form is specified by the code and is part of the reproducibility contract.

The observed series is

$$x(t) = h(t) + n(t), \tag{1}$$

where $n(t)$ is additive, zero-mean Gaussian noise with standard deviation σ.

3.2 Gating operator

We apply a simple amplitude threshold gate. In the abstract, a gating operator takes an input series $x(t)$ and produces an altered series $g(x)(t)$ by applying a rule such as

$$g(x)(t) = \begin{cases} 0, & |x(t)| > \tau \\ x(t), & \text{otherwise,} \end{cases} \tag{2}$$

where τ is a threshold. For convenience we report the *gated fraction*

Formally, the gate is just an elementwise nonlinear operator; it is used here as a transparent toy model of amplitude-based transient mitigation.

$$f_g = \frac{1}{N} \sum_{k=1}^{N} \mathbb{I}(|x_k| > \tau), \tag{3}$$

where x_k denotes the discrete samples.

3.3 Summary statistics

We compute simple before/after summary statistics that are easy to verify:

- Peak SNR proxy before gating: $\max_t |x(t)|/\sigma$.
- Peak SNR proxy after gating: $\max_t |g(x)(t)|/\sigma$.
- Gated fraction f_g.

These are not meant to replicate matched filtering or Bayesian inference; they are chosen for transparency.

3.4 Determinism and artifacts

For a fixed seed, the script writes:

- `verification_log.txt`: a human-readable report of the parameters and measured statistics.
- `astra_injection.npz`: arrays t, x, and $g(x)$.

Optionally, with `--mc N`, the script runs N trials (seed sweep) and writes:

- `mc_summary.csv`: per-trial statistics.
- `mc_table.tex`: a compact LaTeX table with quantiles.

Table 1: Monte Carlo summary of synthetic gating impact (200 trials).

Metric	Median	[10%, 90%]
Peak SNR before gating	69.14	[68.27, 70.28]
Peak SNR after gating	8.00	[7.99, 8.00]
Gated samples fraction	0.0077	[0.0077, 0.0078]

3.5 Proposed test on real/open strain (falsifiable protocol)

The synthetic experiment above establishes a mechanism: gating can suppress a burst-shaped transient prior to scoring. To make the hypothesis falsifiable on real data *when and if the relevant segment is public*, the bundle includes `astra_real_verify.py`, which implements an explicit protocol with a real/open-data attempt (via `gwpy`) and a documented synthetic fallback.

The proposed test can be stated as a checklist:

1. Select a target GPS time t_{gps} and detector(s) (e.g., H1/L1) and fetch a window of strain around $t_{\mathrm{gps}} \pm 32\,\mathrm{s}$ if open data are available.

2. Define an injected or hypothesized burst template (frequency, damping time, and amplitude scale used for the protocol comparison).

3. Compute a proxy recovery score on the *ungated* stream and on a *gated* stream produced by a clearly specified rule.

4. Report the ratio of ungated-to-gated scores, and archive the full code, parameters, and logs.

Pass/fail criterion (for the gating-suppression prediction): the prediction is supported if, under the specified rule, the ungated stream yields a meaningfully larger proxy recovery score than the gated stream (e.g., a multi-$\times$ ratio), and this behavior is stable under small perturbations of the gating parameters. The prediction is falsified if no such suppression is observed under reasonable gating rules.

4 Results

4.1 Single-run reproducibility

A single run of the script produces a specific set of reported values and artifacts. The log file is intended to be the primary "paper trail" for reviewers who want to check numerical values without opening binary arrays.

4.2 Monte Carlo stability (optional)

If the Monte Carlo mode is executed, the script emits a small summary table capturing the distribution of outcome metrics across seeds.

4.3 Interpretation (bounded)

In this toy setting, gating tends to reduce extrema, which in turn reduces peak-based summary statistics. The magnitude of this effect depends on the chosen threshold τ and the injected transient's amplitude relative to the noise scale σ.

This manuscript does not claim that the demonstrated magnitude transfers to real instruments; rather, it demonstrates the *mechanism* clearly and reproducibly.

5 Discussion

5.1 What this does and does not show

This submission shows that a deterministic gating operator can strongly alter peak-based summary metrics in a constructed injection-and-noise experiment. It does *not* show:

- that any particular astrophysical model is correct,
- that any particular detector observed a signal,
- that gating is universally beneficial or harmful,
- or that peak-SNR proxies are sufficient for inference.

The motivating context discussed in Section 2 is included only to motivate an illustrative burst morphology for the synthetic capsule and should not be read as an observational or model-selection claim.

The strongest claim supported by the included artifacts is a *mechanism claim*: given an injected transient and a specified gating rule, the gate can reduce a peak-based proxy score by an order of magnitude. This motivates an empirical check on real data conditioning, but it is not itself a detection.

5.2 Why include a paper at all?

The manuscript exists to make the artifact self-describing:

- It states assumptions explicitly.
- It defines the operator and metrics.
- It describes the outputs and how to regenerate them.

5.3 Potential extensions (not implemented here)

A reader could extend this capsule in several directions without changing the core idea:

1. Replace peak-based metrics with a matched-filter statistic against a known template.
2. Replace Gaussian noise with colored noise and include whitening.
3. Explore threshold schedules (time-varying $\tau(t)$).
4. Replace hard gating with soft clipping (e.g., tanh) and compare.

We intentionally do not include these extensions to keep the core script small and reviewable.

5.4 Proposed real-data test (protocol)

To make the prediction falsifiable, the bundle includes `astra_real_verify.py`. When open data are available, it attempts to fetch public strain for a user-specified GPS time and detector using standard tooling (`gwpy`). If open data are not accessible, it runs an equivalent synthetic protocol and writes a log file that documents parameters and proxy outcomes.

This design provides reviewers with an immediate, concrete path to test the hypothesis on public data when/if the relevant segment becomes available, without implying unauthorized access to restricted archives.

6 Reproducibility

6.1 Minimal commands

From the repository root (with the Python environment activated):

```
python -m harmonic_matter_engine_v6.astra --out astra_output --seed 123

del /q astra_submission_bundle\verification_log.txt
copy astra_output\verification_log.txt ^
 astra_submission_bundle\verification_log.txt
copy astra_output\astra_injection.npz astra_submission_bundle\astra_injection.npz

del /q astra_submission_bundle\mc_table.tex
python -m harmonic_matter_engine_v6.astra ^
 --out astra_submission_bundle --seed 123 --mc 200

cd astra_submission_bundle
pdflatex -interaction=nonstopmode -halt-on-error paper.tex
pdflatex -interaction=nonstopmode -halt-on-error paper.tex
```

6.2 Expected outputs

A successful run should produce:

- `astra_output/verification_log.txt`
- `astra_output/astra_injection.npz`
- (optional) `astra_output/mc_summary.csv` and `astra_output/mc_table.tex`

6.3 Determinism notes

The synthetic noise is generated with a fixed seed, so numerical results are deterministic up to floating-point variation. Across machines and Python versions, small differences in floating-point computations may slightly change the last few digits, but the qualitative outcomes should match.

PDF builds are not guaranteed to be byte-for-byte identical across runs (e.g., due to embedded timestamps or PDF object identifiers). For verification, prefer comparing the reported numerical values in `verification_log.txt` and the arrays in `astra_injection.npz`.

7 References

References

[1] Bhavnesh Bhat et al. A glitch in the millisecond pulsar J0900-3144. *Monthly Notices of the Royal Astronomical Society*, 2025. Accepted for publication.

A Appendix A: operator viewpoint

This appendix expands on the operator viewpoint used in the main text.

Let $x \in \mathbb{R}^N$ be a discrete time series. Define the hard-gating operator g_τ elementwise by

$$(g_\tau(x))_k = x_k \, \mathbb{I}(|x_k| \le \tau). \tag{4}$$

A.1 Nonlinearity

g_τ is nonlinear. In particular, for general x, y and scalar α,

$$g_\tau(x+y) \ne g_\tau(x) + g_\tau(y), \qquad g_\tau(\alpha x) \ne \alpha g_\tau(x). \tag{5}$$

This is why it is useful to make the operator explicit before discussing any downstream statistic.

A.2 Effect on extrema

Define $M(x) = \max_k |x_k|$. For any x,

$$M(g_\tau(x)) \le \tau. \tag{6}$$

Thus, if a downstream score depends directly on $M(x)$ (or is strongly correlated with it), then gating can bound that score.

A.3 A simple bound for peak-based proxies

If a noise scale estimate $\sigma > 0$ is fixed, then the peak proxy $S(x) = M(x)/\sigma$ obeys

$$S(g_\tau(x)) \le \tau/\sigma. \tag{7}$$

The toy experiment in this submission simply instantiates these relationships with explicit arrays and logs.

B Appendix B: algorithm listing (pseudocode)

For ease of review, the core procedure can be expressed as:

```
Inputs:
  fs, T, t0                 # sample rate, duration, injection time
  sigma                     # noise std
  tau                       # gating threshold
  seed                      # RNG seed

Procedure:
```

```
  t <- linspace(0, T, N)
  h <- synthetic_injection(t; t0, <template parameters>)
  n <- Normal(0, sigma) sampled with seed
  x <- h + n
  x_gated <- x
  for each k:
    if abs(x[k]) > tau:
      x_gated[k] <- 0

  snr_before <- max(abs(x)) / sigma
  snr_after  <- max(abs(x_gated)) / sigma
  gated_fraction <- count(abs(x) > tau) / N

Outputs:
  verification_log.txt
  astra_injection.npz (t, x, x_gated)
  optional MC summary table
```

The implementation used for the results is the Python code provided in the bundle.

C Appendix C: reviewer checklist

C.1 Checklist

1. Run the proof script once with a fixed seed.
2. Confirm that `verification_log.txt` is produced.
3. Confirm that `astra_injection.npz` contains arrays `t`, `data`, `gated_data`.
4. (Optional) Run `--mc 200` and confirm `mc_table.tex` and `mc_summary.csv` are produced.
5. Rebuild the PDF and confirm the table appears.

C.2 Common failure modes

- If the PDF build fails, ensure a LaTeX distribution (e.g., MiKTEX) is installed and `pdflatex` is on `PATH`.
- If Python cannot import the module entrypoint, run from the repository root and ensure the environment is activated.

D Appendix D: full source listing

The following listings are included to make the submission self-contained and reviewer-friendly.

D.1 Proof script (as shipped in this bundle)

```
"""Project ASTRA: Reproducibility Kernel entrypoint.

This file exists to match the 'save as astra_proof.py' instruction in the submission bundle,
while the implementation lives inside the engine package.
"""

from harmonic_matter_engine_v6.astra.astra_proof import main


if __name__ == "__main__":
    main()
```

D.2 Real/open-data verification protocol script

```
"""Project ASTRA: Archival/Open-Data Verification Protocol

Goal
----
Provide a reproducible *protocol* for testing the gating-suppression hypothesis on
real gravitational-wave strain, when/if open data is available.

Important scope note
--------------------
- This script does NOT claim access to proprietary data.
- If open data cannot be fetched, it runs in synthetic mode and produces artifacts
  that demonstrate the analysis procedure (not a detection claim).

Usage (examples)
----------------
# Try open data (will only work for public segments)
python astra_real_verify.py --gps 1448668818 --detector H1 --try-open-data

# Synthetic-only protocol (always available)
python astra_real_verify.py --gps 1448668818 --detector H1

Outputs
-------
Writes a log file next to the script by default:
- astra_submission_bundle/real_verify_log.txt

Optionally writes a plot if matplotlib is available.

"""

from __future__ import annotations

import argparse
from dataclasses import dataclass
from pathlib import Path
from typing import Optional, Tuple

import numpy as np
```

```python
@dataclass(frozen=True)
class TemplateParams:
    h0: float = 3.46e-21
    f_hz: float = 200.0
    tau_s: float = 0.3
    duration_s: float = 1.0


def tukey_window(n: int, alpha: float = 0.25) -> np.ndarray:
    """Minimal Tukey window implementation (no SciPy dependency)."""
    if n <= 1:
        return np.ones((n,), dtype=np.float64)
    if alpha <= 0.0:
        return np.ones((n,), dtype=np.float64)
    if alpha >= 1.0:
        # Hann
        x = np.linspace(0.0, 1.0, n, dtype=np.float64)
        return 0.5 * (1.0 - np.cos(2.0 * np.pi * x))

    x = np.linspace(0.0, 1.0, n, dtype=np.float64)
    w = np.ones((n,), dtype=np.float64)
    edge = alpha / 2.0

    left = x < edge
    w[left] = 0.5 * (1.0 + np.cos(np.pi * (2.0 * x[left] / alpha - 1.0)))

    right = x >= (1.0 - edge)
    w[right] = 0.5 * (
        1.0 + np.cos(np.pi * (2.0 * x[right] / alpha - 2.0 / alpha + 1.0))
    )

    return w


def make_template(dt: float, p: TemplateParams) -> np.ndarray:
    n = max(1, int(round(p.duration_s / dt)))
    t = np.arange(n, dtype=np.float64) * dt
    return p.h0 * np.exp(-t / p.tau_s) * np.sin(2.0 * np.pi * p.f_hz * t)


def normalized_xcorr_max(x: np.ndarray, y: np.ndarray, eps: float = 1e-30) -> float:
    """Return max absolute correlation normalized by std(x)*||y||.

    This is a *proxy* score suitable for protocol comparisons (gated vs ungated).
    It is not a substitute for a calibrated matched-filter SNR.
    """
    x = np.asarray(x, dtype=np.float64)
    y = np.asarray(y, dtype=np.float64)

    x_std = float(np.std(x))
    y_norm = float(np.linalg.norm(y))
```

```
    # Full correlation; for 64s @ 4096 Hz this is large but still manageable.
    c = np.correlate(x, y, mode="valid")
    score = float(np.max(np.abs(c)) / ((x_std + eps) * (y_norm + eps)))
    return score


def apply_energy_gate(
    strain: np.ndarray,
    gate_k: float,
    tukey_alpha: float,
) -> Tuple[np.ndarray, float]:
    """Simple amplitude/energy gating (illustrative).

    Uses threshold = gate_k * median(strain^2).
    Zeros samples beyond threshold; optionally applies a short Tukey taper to
    soften edges.
    """
    energy = strain * strain
    thr = float(gate_k) * float(np.median(energy))

    gated = strain.copy()
    mask = energy > thr
    if np.any(mask):
        gated[mask] = 0.0

        if tukey_alpha > 0.0:
            # Apply a short taper around each masked region (very simple).
            # This is NOT a replica of any specific production pipeline.
            pad = 128
            w = tukey_window(2 * pad + 1, alpha=tukey_alpha)
            idx = np.where(mask)[0]
            for i in idx:
                a = max(0, i - pad)
                b = min(len(gated) - 1, i + pad)
                ww = w[(a - (i - pad)) : (2 * pad + 1 - ((i + pad) - b))]
                gated[a : b + 1] *= ww

    return gated, thr


def fetch_open_data(
    gps: int,
    detector: str,
    duration_s: int,
    prefer_fs_hz: int,
) -> Tuple[Optional[np.ndarray], Optional[float], str]:
    """Try to fetch public GWOSC open data via gwpy.

    Returns (strain, dt, note).
    """
    try:
        from gwpy.timeseries import TimeSeries  # type: ignore

        start = gps - duration_s // 2
```

```
        end = gps + duration_s // 2
        ts = TimeSeries.fetch_open_data(detector, start, end, verbose=True)
        # Resample for stable dt (optional); if already at prefer_fs, this is cheap.
        if prefer_fs_hz and int(round(1.0 / ts.dt.value)) != int(prefer_fs_hz):
            ts = ts.resample(prefer_fs_hz)
        return ts.value.astype(np.float64), float(ts.dt.value), "open_data"
    except Exception as e:
        return None, None, f"open_data_unavailable: {e}"


def synthetic_strain(
    fs_hz: int, duration_s: int, noise_std: float, seed: int
) -> Tuple[np.ndarray, float]:
    rng = np.random.default_rng(seed)
    n = fs_hz * duration_s
    return rng.normal(0.0, noise_std, size=(n,)).astype(np.float64), 1.0 / float(fs_hz)


def write_log(path: Path, lines: list[str]) -> None:
    path.write_text("\n".join(lines) + "\n", encoding="utf-8")


def main(argv: list[str] | None = None) -> None:
    ap = argparse.ArgumentParser()
    ap.add_argument("--gps", type=int, default=1448668818)
    ap.add_argument("--detector", type=str, default="H1")
    ap.add_argument("--duration", type=int, default=64)
    ap.add_argument("--fs", type=int, default=4096)
    ap.add_argument("--try-open-data", action="store_true")
    ap.add_argument("--seed", type=int, default=123)
    ap.add_argument("--noise-std", type=float, default=1e-23)
    ap.add_argument("--gate-k", type=float, default=25.0)
    ap.add_argument("--tukey-alpha", type=float, default=0.25)
    ap.add_argument(
        "--out", type=str, default="astra_submission_bundle/real_verify_log.txt"
    )
    args = ap.parse_args(argv)

    # 1) Data acquisition
    mode = "synthetic"
    note = ""
    strain: np.ndarray
    dt: float

    if args.try_open_data:
        real, real_dt, note = fetch_open_data(
            args.gps, args.detector, args.duration, args.fs
        )
        if real is not None and real_dt is not None:
            strain, dt = real, real_dt
            mode = "open_data"
        else:
            strain, dt = synthetic_strain(
                args.fs, args.duration, args.noise_std, args.seed
```

```
        )
        mode = "synthetic_fallback"
else:
    strain, dt = synthetic_strain(args.fs, args.duration, args.noise_std, args.seed)

# 2) Template
template = make_template(dt, TemplateParams())

# 3) Gating (illustrative)
gated, thr = apply_energy_gate(
    strain, gate_k=args.gate_k, tukey_alpha=args.tukey_alpha
)

# 4) Scores (proxy)
score_ungated = normalized_xcorr_max(strain, template)
score_gated = normalized_xcorr_max(gated, template)

# 5) Report
out_path = Path(args.out)
out_path.parent.mkdir(parents=True, exist_ok=True)

lines: list[str] = []
lines.append("PROJECT ASTRA | REAL/OPEN DATA VERIFICATION PROTOCOL")
lines.append(f"gps: {args.gps}")
lines.append(f"detector: {args.detector}")
lines.append(f"duration_s: {args.duration}")
lines.append(f"fs_hz_target: {args.fs}")
lines.append(f"mode: {mode}")
if note:
    lines.append(f"note: {note}")
lines.append(f"dt_s: {dt}")
lines.append(f"gate_k: {args.gate_k}")
lines.append(f"gate_threshold_energy: {thr}")
lines.append(f"tukey_alpha: {args.tukey_alpha}")
lines.append(f"template_h0: {TemplateParams.h0}")
lines.append(f"template_f_hz: {TemplateParams.f_hz}")
lines.append(f"template_tau_s: {TemplateParams.tau_s}")
lines.append(f"score_ungated_proxy: {score_ungated}")
lines.append(f"score_gated_proxy: {score_gated}")
lines.append(
    f"score_ratio_ungated_over_gated: {score_ungated / (score_gated + 1e-30)}"
)

write_log(out_path, lines)
print(f"[ASTRA] Wrote: {out_path.resolve()}")

# Optional plot
try:
    import matplotlib.pyplot as plt  # type: ignore

    t = np.arange(len(strain), dtype=np.float64) * dt
    fig = plt.figure(figsize=(10, 4))
    ax = fig.add_subplot(1, 1, 1)
    ax.plot(t, strain, lw=0.5, label="ungated")
```

```
        ax.plot(t, gated, lw=0.5, label="gated")
        ax.set_xlabel("t (s)")
        ax.set_ylabel("strain (arb)")
        ax.legend(loc="upper right")
        ax.set_title(
            f"ASTRA protocol: mode={mode}, gps={args.gps}, det={args.detector}"
        )
        png = out_path.with_suffix(".png")
        fig.tight_layout()
        fig.savefig(png, dpi=150)
        print(f"[ASTRA] Wrote: {png.resolve()}")
    except Exception:
        pass


if __name__ == "__main__":
    main()
```

D.3 Verification log (single-run)

```
duration_s: 60
f_gw_hz: 200.0
fs_hz: 4096
gated_fraction: 0.0076904296875
h0: 3.46e-21
mjd: 59942
noise_std: 5e-23
seed: 123
snr_after: 7.992639590548629
snr_before: 70.00645697734741
t0_s: 30.0
tau_s: 0.3
threshold: 3.998009872088356e-22
threshold_sigma: 8.0
```

D.4 Monte Carlo CSV (optional)

```
mjd,seed,fs_hz,duration_s,noise_std,threshold_sigma,threshold,h0,f_gw_hz,tau_s,t0_s,snr_before,snr_after,gated_fraction
59942,123,4096,60,5e-23,8.0,3.998009872088356e-22,3.46e-21,200.0,0.3,30.0,70.00645697734741,7.992639590548629,0.0076904296875
59942,124,4096,60,5e-23,8.0,3.9936729304295683e-22,3.46e-21,200.0,0.3,30.0,70.6517720618278,7.999146351147175,0.0077311197916666
59942,125,4096,60,5e-23,8.0,4.009101573894585e-22,3.46e-21,200.0,0.3,30.0,68.59871286894344,7.994579806736735,0.0077962239583333
59942,126,4096,60,5e-23,8.0,4.001899771807856e-22,3.46e-21,200.0,0.3,30.0,70.32367206584885,7.9949715715663645,0.0078125
59942,127,4096,60,5e-23,8.0,4.000620629732537e-22,3.46e-21,200.0,0.3,30.0,71.80596479317603,7.997916243946748,0.0078002929 6875
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D.5 Real/open-data protocol log (optional)

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PROJECT ASTRA | REAL/OPEN DATA VERIFICATION PROTOCOL
gps: 1448668818
detector: H1
duration_s: 64
fs_hz_target: 4096
mode: synthetic
dt_s: 0.000244140625
gate_k: 25.0
gate_threshold_energy: 1.1348950647828591e-45
tukey_alpha: 0.25
template_h0: 3.46e-21
template_f_hz: 200.0
template_tau_s: 0.3
score_ungated_proxy: 3.81788544312562
score_gated_proxy: 3.7882835837867694
score_ratio_ungated_over_gated: 1.0078140558076332
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