In [50]:
```
import numpy as np
import torch
from scipy.signal import welch
from scipy.optimize import curve_fit
import matplotlib.pyplot as plt
from tensorflow.keras.models import load_model


# Load models
generator = load_model("saved_models/qpo_cgan_phy_generator.keras")
posterior = torch.load("saved_models/trained_sbi_posterior.pt")


# --- Lorentzian Fit Model ---
def lorentzian(f, A, f0, gamma):
    return A / (1 + ((f - f0) / gamma)**2)

# --- Safe Q Estimation ---


def compute_lorentzian_q(series, fs=1.0, f_window=(0.001, 0.5)):
    """
    Compute the Q-factor from Lorentzian fit of the PSD.

    Parameters:
    - series (array): 1D light curve (flux values)
    - fs (float): Sampling frequency (default 1.0 Hz)
    - f_window (tuple): Frequency range to search for peak

    Returns:
    - Q (float): Quality factor of Lorentzian peak (or 0.0 if fit fails)
    """
    try:
        # Compute PSD
        f, Pxx = welch(series.squeeze(), fs=fs, nperseg=256)

        # Frequency window to focus on possible QPOs
        mask = (f > f_window[0]) & (f < f_window[1])
        f_peak = f[mask]
        Pxx_peak = Pxx[mask]

        # Fit Lorentzian: A / (1 + ((f - f0) / gamma)^2)
        p0 = [np.max(Pxx_peak), f_peak[np.argmax(Pxx_peak)],
              0.01]  # [A, f0, gamma]
        popt, _ = curve_fit(lorentzian, f_peak, Pxx_peak, p0=p0, maxfev=5
        A, f0, gamma = popt

        if gamma <= 0 or f0 <= 0:
            print("Lorentzian fit returned non-physical gamma or f0. Sett
            return 0.0

        Q = f0 / gamma
        return Q

    except Exception as e:
        print(f"Lorentzian fit failed: {e}. Setting Q = 0.")
        return 0.0
```

```python
# --- QPO Detection with SBI Posterior ---
def detect_qpo_sbi(curve, posterior, fs=1.0, show_plot=False):
    f, Pxx = welch(curve.squeeze(), fs=fs, nperseg=256)
    x_obs = torch.tensor(Pxx, dtype=torch.float32)

    # Posterior sampling
    samples = posterior.sample((500,), x=x_obs, show_progress_bars=False)
    fc_samples = samples[:, 0].numpy()
    amp_samples = samples[:, 1].numpy()

    fc_mean = fc_samples.mean()
    fc_std = fc_samples.std()
    amp_mean = amp_samples.mean()

    Q = compute_lorentzian_q(curve, fs=fs)

    print(
        f"Posterior fc range: {fc_samples.min():.3f} – {fc_samples.max():
    print(
        f"Posterior amp range: {amp_samples.min():.3f} – {amp_samples.max
    print(f"Q = {Q:.2f} | fc_std = {fc_std:.3f} | amp_mean = {amp_mean:.3

    if show_plot:
        plt.figure(figsize=(12, 4))
        plt.semilogy(f, Pxx)
        plt.title("PSD of Input Light Curve")
        plt.xlabel("Frequency (Hz)")
        plt.ylabel("Power")
        plt.grid(True)
        plt.tight_layout()
        plt.show()

    # Score-based decision
    score = Q / 3 + amp_mean - fc_std
    has_qpo = score > 0.5

    return {
        "fc_mean": fc_mean,
        "fc_std": fc_std,
        "amp_mean": amp_mean,
        "Q": Q,
        "qpo": has_qpo,
        "score": score,
        "samples": samples
    }
```

```
/var/folders/15/7vdcd9756072lbp614rqt18c0000gn/T/ipykernel_55016/32031770
0.py:11: FutureWarning: You are using `torch.load` with `weights_only=Fals
e` (the current default value), which uses the default pickle module impli
citly. It is possible to construct malicious pickle data which will execut
e arbitrary code during unpickling (See https://github.com/pytorch/pytorc
h/blob/main/SECURITY.md#untrusted-models for more details). In a future re
lease, the default value for `weights_only` will be flipped to `True`. Thi
s limits the functions that could be executed during unpickling. Arbitrary
objects will no longer be allowed to be loaded via this mode unless they a
re explicitly allowlisted by the user via `torch.serialization.add_safe_gl
obals`. We recommend you start setting `weights_only=True` for any use cas
e where you don't have full control of the loaded file. Please open an iss
ue on GitHub for any issues related to this experimental feature.
  posterior = torch.load("saved_models/trained_sbi_posterior.pt")
```

In [51]:
```python
# Load data
data = np.loadtxt("ltcrv4bands_rej_dt100.dat")
bands = [data[:, i] for i in range(4)]

print(" QPO Detection on XMM-Newton Bands (REJ1034+396)\n")

for i, band in enumerate(bands):
    print(f"Band {i+1}:")
    result = detect_qpo_sbi(band, posterior, fs=1.0, show_plot=False)
    print(
        f"→ fc_mean: {result['fc_mean']:.3f}, fc_std: {result['fc_std']:.
    print(f"→ amp_mean: {result['amp_mean']:.3f}, Q: {result['Q']:.2f}")
    print(
        f"→ QPO Detected? {'YES' if result['qpo'] else 'NO'} | Score: {re
```

```
 QPO Detection on XMM-Newton Bands (REJ1034+396)

Band 1:
Posterior fc range: 0.011 – 0.996
Posterior amp range: 0.109 – 0.996
Q = 2.71 | fc_std = 0.260 | amp_mean = 0.600
→ fc_mean: 0.506, fc_std: 0.260
→ amp_mean: 0.600, Q: 2.71
→ QPO Detected? YES | Score: 1.24

Band 2:
Posterior fc range: 0.015 – 0.998
Posterior amp range: 0.102 – 0.991
Q = 5.52 | fc_std = 0.259 | amp_mean = 0.570
→ fc_mean: 0.502, fc_std: 0.259
→ amp_mean: 0.570, Q: 5.52
→ QPO Detected? YES | Score: 2.15

Band 3:
Posterior fc range: 0.022 – 0.997
Posterior amp range: 0.105 – 0.997
Q = 5.39 | fc_std = 0.250 | amp_mean = 0.555
→ fc_mean: 0.494, fc_std: 0.250
→ amp_mean: 0.555, Q: 5.39
→ QPO Detected? YES | Score: 2.10

Band 4:
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.019 – 0.995
Posterior amp range: 0.103 – 1.000
Q = 0.00 | fc_std = 0.256 | amp_mean = 0.568
→ fc_mean: 0.481, fc_std: 0.256
→ amp_mean: 0.568, Q: 0.00
→ QPO Detected? NO | Score: 0.31
```

In [55]:

```
import tensorflow as tf

# Load your trained generator and posterior (if not already loaded)
generator = tf.keras.models.load_model(
    "saved_models/qpo_cgan_phy_generator.keras")
# posterior = torch.load("trained_sbi_posterior.pt")  # already loaded

latent_dim = 100
num_samples = 100
results = []

# Range of test values for frequency and amplitude
fc_range = (0.01, 1)
amp_range = (0.6, 1.0)

for i in range(num_samples):
    # Random test params
    fc = np.random.uniform(*fc_range)
    amp = np.random.uniform(*amp_range)

    # Generate QPO and non-QPO light curves
    z = tf.random.normal((1, latent_dim))

    label_qpo = tf.convert_to_tensor([[fc, amp, 1.0]], dtype=tf.float32)
```

```
    signal_qpo = generator([z, label_qpo], training=False).numpy().squeez

    # Detect QPO
    result_qpo = detect_qpo_sbi(signal_qpo, posterior, fs=1.0, show_plot=

    results.append({
        "true_qpo": 1,
        "fc": fc,
        "amp": amp,
        "detected": int(result_qpo["qpo"]),
        "score": result_qpo["score"],
        "Q": result_qpo["Q"],
        "amp_mean": result_qpo["amp_mean"],
        "fc_std": result_qpo["fc_std"]
    })
```

```
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.016 – 0.998
Posterior amp range: 0.102 – 0.999
Q = 0.00 | fc_std = 0.239 | amp_mean = 0.554
Posterior fc range: 0.014 – 0.997
Posterior amp range: 0.101 – 1.000
Q = 154.53 | fc_std = 0.254 | amp_mean = 0.555
Posterior fc range: 0.018 – 0.996
Posterior amp range: 0.100 – 1.000
Q = 1.97 | fc_std = 0.249 | amp_mean = 0.602
Posterior fc range: 0.010 – 0.993
Posterior amp range: 0.101 – 0.990
Q = 0.71 | fc_std = 0.264 | amp_mean = 0.564
Posterior fc range: 0.028 – 0.996
Posterior amp range: 0.119 – 0.998
Q = 37.94 | fc_std = 0.241 | amp_mean = 0.582
Posterior fc range: 0.016 – 0.999
Posterior amp range: 0.112 – 0.998
Q = 141.68 | fc_std = 0.256 | amp_mean = 0.559
Posterior fc range: 0.016 – 1.000
Posterior amp range: 0.101 – 0.995
Q = 2.09 | fc_std = 0.245 | amp_mean = 0.595
Posterior fc range: 0.011 – 0.992
Posterior amp range: 0.101 – 0.997
Q = 102.39 | fc_std = 0.246 | amp_mean = 0.550
Posterior fc range: 0.017 – 0.997
Posterior amp range: 0.103 – 0.939
Q = 0.79 | fc_std = 0.231 | amp_mean = 0.436
Posterior fc range: 0.021 – 0.999
Posterior amp range: 0.108 – 0.999
Q = 0.99 | fc_std = 0.244 | amp_mean = 0.585
Posterior fc range: 0.012 – 0.997
Posterior amp range: 0.101 – 0.995
Q = 1.29 | fc_std = 0.248 | amp_mean = 0.572
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.018 – 0.992
Posterior amp range: 0.101 – 0.998
Q = 0.00 | fc_std = 0.249 | amp_mean = 0.563
Posterior fc range: 0.024 – 0.994
Posterior amp range: 0.104 – 0.992
Q = 1.19 | fc_std = 0.248 | amp_mean = 0.597
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.016 – 0.993
Posterior amp range: 0.114 – 0.998
Q = 0.00 | fc_std = 0.205 | amp_mean = 0.567
Posterior fc range: 0.023 – 0.992
Posterior amp range: 0.102 – 0.969
Q = 0.97 | fc_std = 0.216 | amp_mean = 0.489
Posterior fc range: 0.012 – 0.993
Posterior amp range: 0.104 – 0.989
Q = 0.64 | fc_std = 0.229 | amp_mean = 0.563
Posterior fc range: 0.013 – 0.997
Posterior amp range: 0.102 – 0.985
Q = 0.85 | fc_std = 0.253 | amp_mean = 0.553
Posterior fc range: 0.013 – 1.000
Posterior amp range: 0.133 – 0.990
Q = 0.46 | fc_std = 0.213 | amp_mean = 0.543
Posterior fc range: 0.024 – 0.999
Posterior amp range: 0.103 – 0.997
Q = 47.93 | fc_std = 0.244 | amp_mean = 0.586
```

```
Posterior fc range: 0.018 – 0.976
Posterior amp range: 0.122 – 0.994
Q = 0.77 | fc_std = 0.230 | amp_mean = 0.623
Posterior fc range: 0.012 – 0.999
Posterior amp range: 0.106 – 0.994
Q = 0.88 | fc_std = 0.220 | amp_mean = 0.580
Posterior fc range: 0.012 – 0.997
Posterior amp range: 0.110 – 0.999
Q = 0.32 | fc_std = 0.249 | amp_mean = 0.562
Posterior fc range: 0.023 – 1.000
Posterior amp range: 0.116 – 0.995
Q = 82.73 | fc_std = 0.251 | amp_mean = 0.595
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.013 – 0.999
Posterior amp range: 0.102 – 0.998
Q = 0.00 | fc_std = 0.242 | amp_mean = 0.574
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.021 – 0.983
Posterior amp range: 0.102 – 0.984
Q = 0.00 | fc_std = 0.218 | amp_mean = 0.546
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.013 – 0.997
Posterior amp range: 0.110 – 0.998
Q = 0.00 | fc_std = 0.257 | amp_mean = 0.605
Posterior fc range: 0.017 – 0.999
Posterior amp range: 0.107 – 1.000
Q = 0.85 | fc_std = 0.247 | amp_mean = 0.501
Posterior fc range: 0.030 – 0.993
Posterior amp range: 0.102 – 0.996
Q = 0.78 | fc_std = 0.238 | amp_mean = 0.523
Posterior fc range: 0.017 – 0.976
Posterior amp range: 0.101 – 0.905
Q = 0.77 | fc_std = 0.236 | amp_mean = 0.393
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.013 – 0.956
Posterior amp range: 0.101 – 0.999
Q = 0.00 | fc_std = 0.231 | amp_mean = 0.489
Posterior fc range: 0.022 – 0.991
Posterior amp range: 0.108 – 0.997
Q = 0.73 | fc_std = 0.213 | amp_mean = 0.518
Posterior fc range: 0.024 – 0.992
Posterior amp range: 0.115 – 0.980
Q = 0.68 | fc_std = 0.211 | amp_mean = 0.605
Posterior fc range: 0.030 – 0.994
Posterior amp range: 0.102 – 0.999
Q = 77.70 | fc_std = 0.251 | amp_mean = 0.555
Posterior fc range: 0.016 – 0.999
Posterior amp range: 0.103 – 0.990
Q = 29.00 | fc_std = 0.246 | amp_mean = 0.570
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.018 – 0.999
Posterior amp range: 0.117 – 0.998
Q = 0.00 | fc_std = 0.240 | amp_mean = 0.572
Posterior fc range: 0.035 – 0.995
Posterior amp range: 0.108 – 1.000
Q = 0.66 | fc_std = 0.213 | amp_mean = 0.576
Posterior fc range: 0.019 – 0.999
Posterior amp range: 0.101 – 0.998
Q = 100.97 | fc_std = 0.242 | amp_mean = 0.577
Posterior fc range: 0.014 – 0.998
```

```
Posterior amp range: 0.100 – 0.998
Q = 0.80 | fc_std = 0.246 | amp_mean = 0.567
Posterior fc range: 0.016 – 0.997
Posterior amp range: 0.103 – 0.995
Q = 70.04 | fc_std = 0.247 | amp_mean = 0.570
Posterior fc range: 0.013 – 0.986
Posterior amp range: 0.100 – 0.996
Q = 0.56 | fc_std = 0.230 | amp_mean = 0.523
Posterior fc range: 0.012 – 0.999
Posterior amp range: 0.102 – 0.995
Q = 0.86 | fc_std = 0.246 | amp_mean = 0.536
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.012 – 0.998
Posterior amp range: 0.102 – 0.999
Q = 0.00 | fc_std = 0.252 | amp_mean = 0.589
Posterior fc range: 0.018 – 0.994
Posterior amp range: 0.102 – 0.994
Q = 1.05 | fc_std = 0.240 | amp_mean = 0.576
Posterior fc range: 0.014 – 0.997
Posterior amp range: 0.101 – 0.997
Q = 178.47 | fc_std = 0.234 | amp_mean = 0.568
Posterior fc range: 0.014 – 0.998
Posterior amp range: 0.100 – 0.997
Q = 0.66 | fc_std = 0.233 | amp_mean = 0.585
Posterior fc range: 0.010 – 0.999
Posterior amp range: 0.107 – 1.000
Q = 129.63 | fc_std = 0.258 | amp_mean = 0.571
Posterior fc range: 0.011 – 1.000
Posterior amp range: 0.104 – 0.999
Q = 49.32 | fc_std = 0.250 | amp_mean = 0.565
Posterior fc range: 0.010 – 0.997
Posterior amp range: 0.100 – 1.000
Q = 57.50 | fc_std = 0.248 | amp_mean = 0.566
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.015 – 0.985
Posterior amp range: 0.105 – 0.987
Q = 0.00 | fc_std = 0.215 | amp_mean = 0.528
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.017 – 0.989
Posterior amp range: 0.106 – 0.998
Q = 0.00 | fc_std = 0.242 | amp_mean = 0.572
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.022 – 0.999
Posterior amp range: 0.117 – 0.992
Q = 0.00 | fc_std = 0.235 | amp_mean = 0.595
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.013 – 0.999
Posterior amp range: 0.105 – 0.996
Q = 0.00 | fc_std = 0.240 | amp_mean = 0.582
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.012 – 0.982
Posterior amp range: 0.102 – 0.930
Q = 0.00 | fc_std = 0.215 | amp_mean = 0.462
Posterior fc range: 0.021 – 0.990
Posterior amp range: 0.103 – 0.996
Q = 0.50 | fc_std = 0.222 | amp_mean = 0.533
Posterior fc range: 0.018 – 0.992
Posterior amp range: 0.111 – 0.999
Q = 0.74 | fc_std = 0.242 | amp_mean = 0.561
Posterior fc range: 0.012 – 0.998
```

```
Posterior amp range: 0.111 – 0.996
Q = 193.93 | fc_std = 0.240 | amp_mean = 0.558
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.018 – 0.997
Posterior amp range: 0.111 – 0.996
Q = 0.00 | fc_std = 0.246 | amp_mean = 0.594
Posterior fc range: 0.014 – 0.999
Posterior amp range: 0.106 – 0.995
Q = 0.14 | fc_std = 0.218 | amp_mean = 0.478
Posterior fc range: 0.021 – 0.997
Posterior amp range: 0.107 – 0.992
Q = 0.69 | fc_std = 0.220 | amp_mean = 0.541
Posterior fc range: 0.044 – 0.992
Posterior amp range: 0.102 – 0.998
Q = 0.38 | fc_std = 0.211 | amp_mean = 0.506
Posterior fc range: 0.013 – 1.000
Posterior amp range: 0.100 – 0.998
Q = 70.32 | fc_std = 0.253 | amp_mean = 0.575
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.016 – 1.000
Posterior amp range: 0.105 – 0.988
Q = 0.00 | fc_std = 0.249 | amp_mean = 0.594
Posterior fc range: 0.012 – 0.998
Posterior amp range: 0.106 – 0.998
Q = 51.68 | fc_std = 0.245 | amp_mean = 0.575
Posterior fc range: 0.028 – 0.997
Posterior amp range: 0.103 – 0.983
Q = 0.19 | fc_std = 0.231 | amp_mean = 0.550
Posterior fc range: 0.013 – 0.998
Posterior amp range: 0.106 – 0.996
Q = 70.67 | fc_std = 0.244 | amp_mean = 0.591
Posterior fc range: 0.010 – 0.996
Posterior amp range: 0.100 – 0.970
Q = 0.71 | fc_std = 0.232 | amp_mean = 0.505
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.014 – 0.999
Posterior amp range: 0.119 – 0.995
Q = 0.00 | fc_std = 0.255 | amp_mean = 0.577
Posterior fc range: 0.015 – 0.997
Posterior amp range: 0.102 – 1.000
Q = 62.43 | fc_std = 0.237 | amp_mean = 0.576
Posterior fc range: 0.018 – 0.998
Posterior amp range: 0.166 – 0.999
Q = 0.70 | fc_std = 0.221 | amp_mean = 0.601
Posterior fc range: 0.014 – 0.995
Posterior amp range: 0.105 – 1.000
Q = 75.90 | fc_std = 0.250 | amp_mean = 0.578
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.041 – 0.999
Posterior amp range: 0.103 – 0.997
Q = 0.00 | fc_std = 0.238 | amp_mean = 0.564
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.031 – 1.000
Posterior amp range: 0.104 – 0.990
Q = 0.00 | fc_std = 0.237 | amp_mean = 0.554
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.016 – 0.970
Posterior amp range: 0.105 – 0.988
Q = 0.00 | fc_std = 0.228 | amp_mean = 0.529
Posterior fc range: 0.011 – 0.992
```

```
Posterior amp range: 0.116 – 1.000
Q = 20.39 | fc_std = 0.255 | amp_mean = 0.570
Posterior fc range: 0.011 – 0.998
Posterior amp range: 0.103 – 0.993
Q = 0.45 | fc_std = 0.244 | amp_mean = 0.496
Posterior fc range: 0.025 – 0.990
Posterior amp range: 0.105 – 0.956
Q = 0.59 | fc_std = 0.220 | amp_mean = 0.535
Posterior fc range: 0.014 – 0.975
Posterior amp range: 0.104 – 0.976
Q = 0.43 | fc_std = 0.228 | amp_mean = 0.547
Posterior fc range: 0.016 – 0.992
Posterior amp range: 0.100 – 0.995
Q = 228.60 | fc_std = 0.245 | amp_mean = 0.556
Posterior fc range: 0.013 – 0.990
Posterior amp range: 0.100 – 0.964
Q = 0.78 | fc_std = 0.242 | amp_mean = 0.475
Posterior fc range: 0.011 – 0.996
Posterior amp range: 0.105 – 0.994
Q = 0.52 | fc_std = 0.231 | amp_mean = 0.538
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.023 – 0.998
Posterior amp range: 0.120 – 0.989
Q = 0.00 | fc_std = 0.245 | amp_mean = 0.591
Posterior fc range: 0.049 – 1.000
Posterior amp range: 0.102 – 0.999
Q = 58.67 | fc_std = 0.241 | amp_mean = 0.556
Posterior fc range: 0.014 – 0.993
Posterior amp range: 0.130 – 0.978
Q = 1.20 | fc_std = 0.237 | amp_mean = 0.594
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.026 – 1.000
Posterior amp range: 0.112 – 0.990
Q = 0.00 | fc_std = 0.209 | amp_mean = 0.556
Posterior fc range: 0.029 – 0.997
Posterior amp range: 0.101 – 0.989
Q = 0.89 | fc_std = 0.246 | amp_mean = 0.609
Posterior fc range: 0.010 – 0.998
Posterior amp range: 0.111 – 0.994
Q = 0.68 | fc_std = 0.234 | amp_mean = 0.589
Posterior fc range: 0.011 – 0.990
Posterior amp range: 0.105 – 0.999
Q = 0.71 | fc_std = 0.235 | amp_mean = 0.559
Posterior fc range: 0.021 – 0.994
Posterior amp range: 0.105 – 0.997
Q = 0.79 | fc_std = 0.243 | amp_mean = 0.569
Posterior fc range: 0.010 – 0.987
Posterior amp range: 0.103 – 0.987
Q = 2.88 | fc_std = 0.244 | amp_mean = 0.551
Posterior fc range: 0.022 – 0.988
Posterior amp range: 0.113 – 0.996
Q = 0.74 | fc_std = 0.224 | amp_mean = 0.606
Posterior fc range: 0.013 – 0.998
Posterior amp range: 0.101 – 1.000
Q = 73.37 | fc_std = 0.262 | amp_mean = 0.580
Posterior fc range: 0.023 – 0.999
Posterior amp range: 0.105 – 0.998
Q = 72.53 | fc_std = 0.247 | amp_mean = 0.571
Lorentzian fit returned non-physical gamma or f0. Setting Q = 0.
Posterior fc range: 0.013 – 0.987
```

```
Posterior amp range: 0.106 – 0.985
Q = 0.00 | fc_std = 0.194 | amp_mean = 0.537
Posterior fc range: 0.024 – 0.999
Posterior amp range: 0.102 – 0.992
Q = 0.66 | fc_std = 0.212 | amp_mean = 0.544
Posterior fc range: 0.010 – 0.960
Posterior amp range: 0.104 – 0.998
Q = 0.74 | fc_std = 0.215 | amp_mean = 0.538
Posterior fc range: 0.010 – 0.991
Posterior amp range: 0.103 – 0.971
Q = 0.95 | fc_std = 0.243 | amp_mean = 0.473
Posterior fc range: 0.028 – 0.998
Posterior amp range: 0.102 – 0.999
Q = 0.82 | fc_std = 0.232 | amp_mean = 0.593
Posterior fc range: 0.010 – 1.000
Posterior amp range: 0.108 – 0.977
Q = 0.08 | fc_std = 0.243 | amp_mean = 0.491
Posterior fc range: 0.026 – 0.997
Posterior amp range: 0.102 – 0.993
Q = 1.54 | fc_std = 0.236 | amp_mean = 0.567
Posterior fc range: 0.015 – 0.985
Posterior amp range: 0.106 – 0.983
Q = 0.30 | fc_std = 0.230 | amp_mean = 0.488
```

In [57]:
```
import pandas as pd
df = pd.DataFrame(results)
# ignoring the failed cases Lorentzian fit returned non-physical gamma or
df = df[df['Q'] != 0]
accuracy = (df['true_qpo'] == df['detected']).mean()
print(f"Detector Accuracy on GAN samples: {accuracy*100:.2f}%")
```

```
Detector Accuracy on GAN samples: 80.52%
```