NCAL tests at ÚJV Řež

Lecroy Oscilloscope Analysis

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Prague Cyclotron Experiment – Setup Summary

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Objective:
Measure neutron detection efficiency and signal response of a plastic scintillator-based detector (NCAL) using a quasi-monoenergetic neutron beam.

Detector: NCAL (7-module plastic scintillator array with PMTs)

Neutron Source:

Reaction: ^{7}Li(p,n)

Target: Solid lithium (Li) foil

Proton Beam Energy: 32.5 MeV

Beam Structure: Gaussian bunches (FWHM 2–3 ns),
25 MHz → ~40 ns period

Intensity Range: 0.1–5.0 µA (adjustable in seconds)

Detector Positioning:

Detector Face Distance from Target: 3.376 ± 0.02 m

Detector Aperture: 8 × 8 cm²

Shielding Wall Location: Starts at 2.179 m, ends at 3.26 m

Expected Neutron Flux (QM Peak):
At 3.38 m and 5 µA beam current: interpolated between tabulated values (~10^{3}–10^{4} n/cm²/s)

Measurement System:

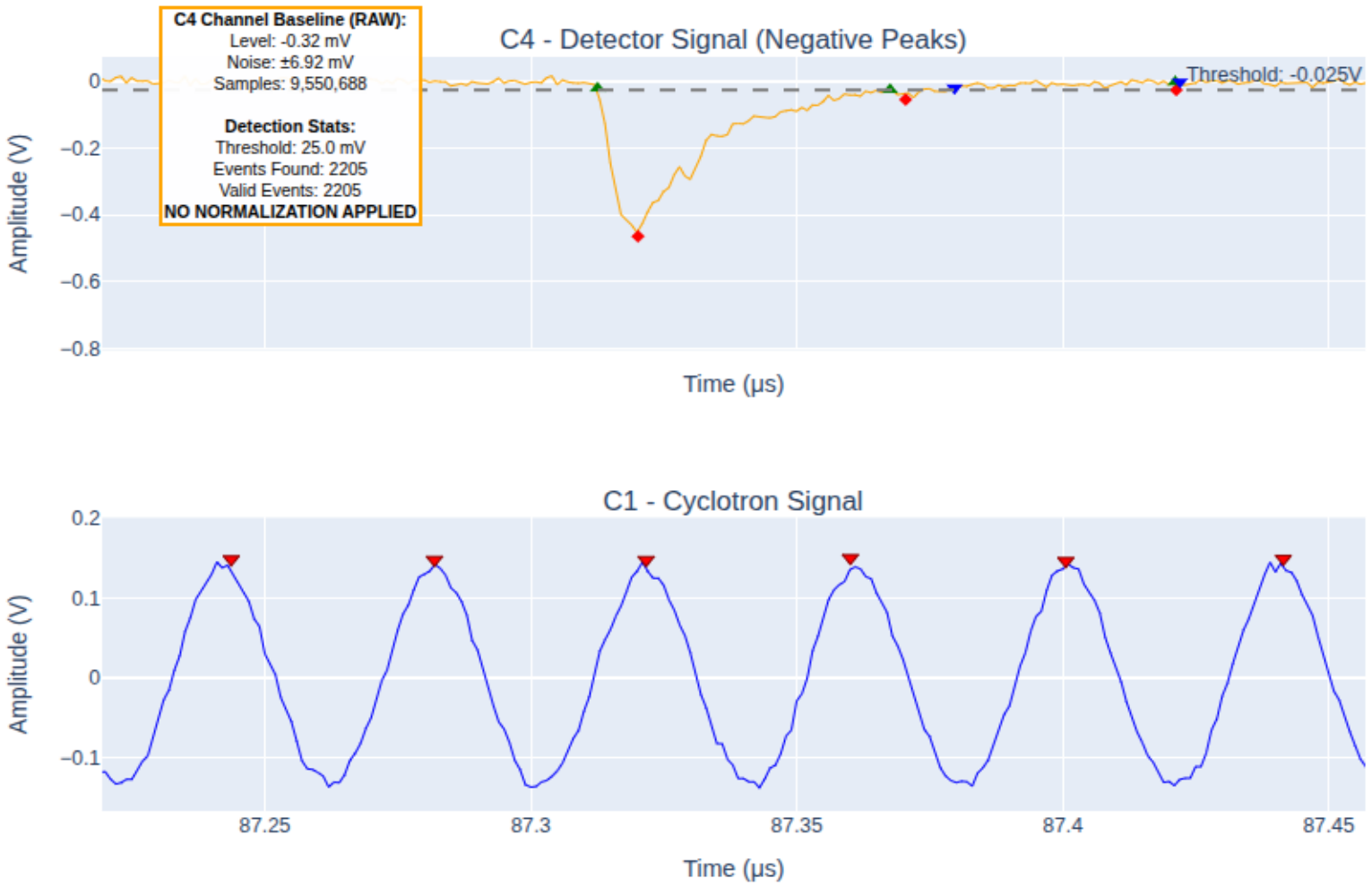
- Oscilloscope
- DiRich
- Digitizer: CAEN 8-channel waveform digitizer (1 kHz sampling)

Triggering: Reference RF signal from cyclotron (25 MHz, ~300 mV)

Polyethylene and lithium-loaded shielding available on site

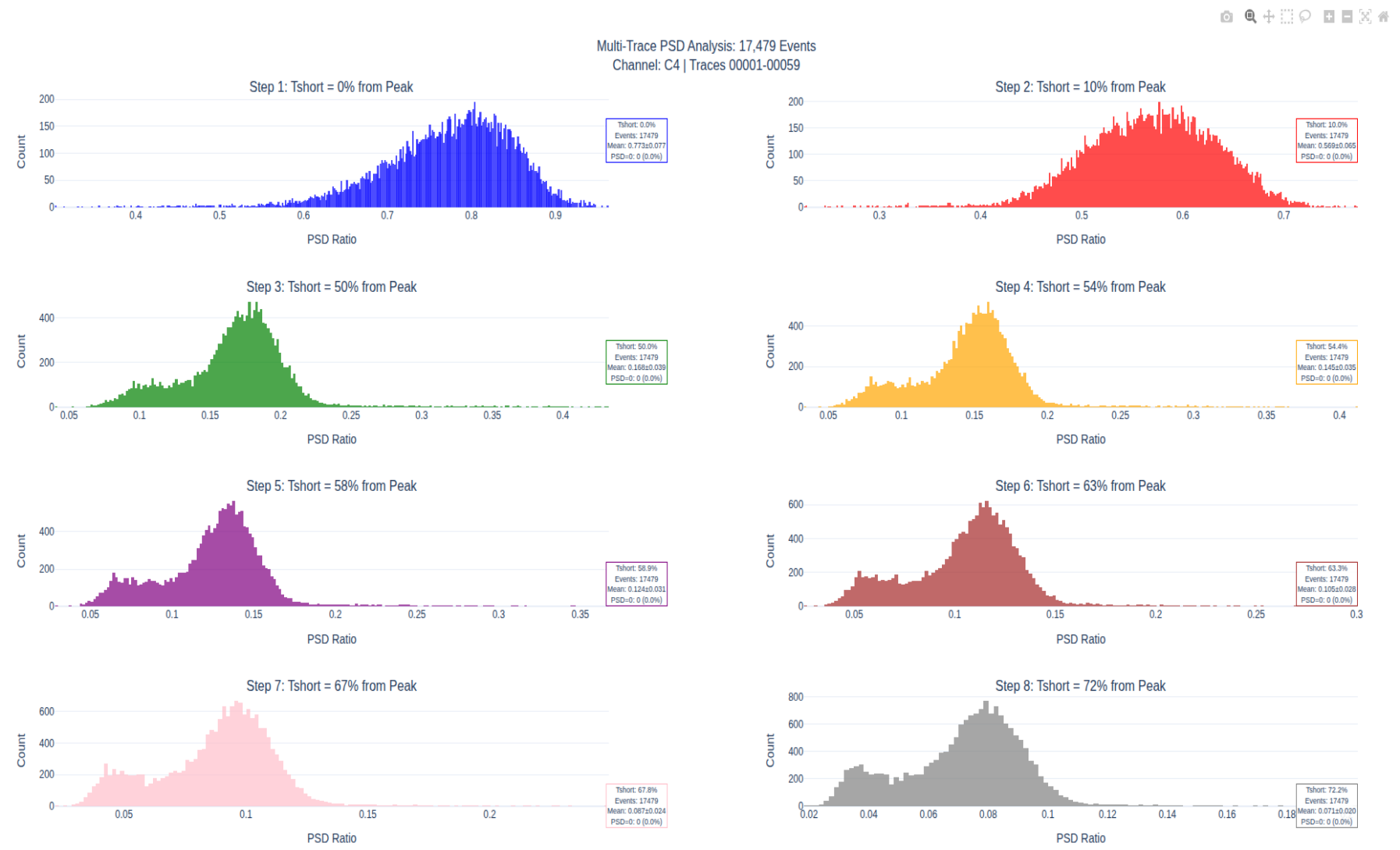
Gamma background present but manageable via pulse shape discrimination

Waveforms

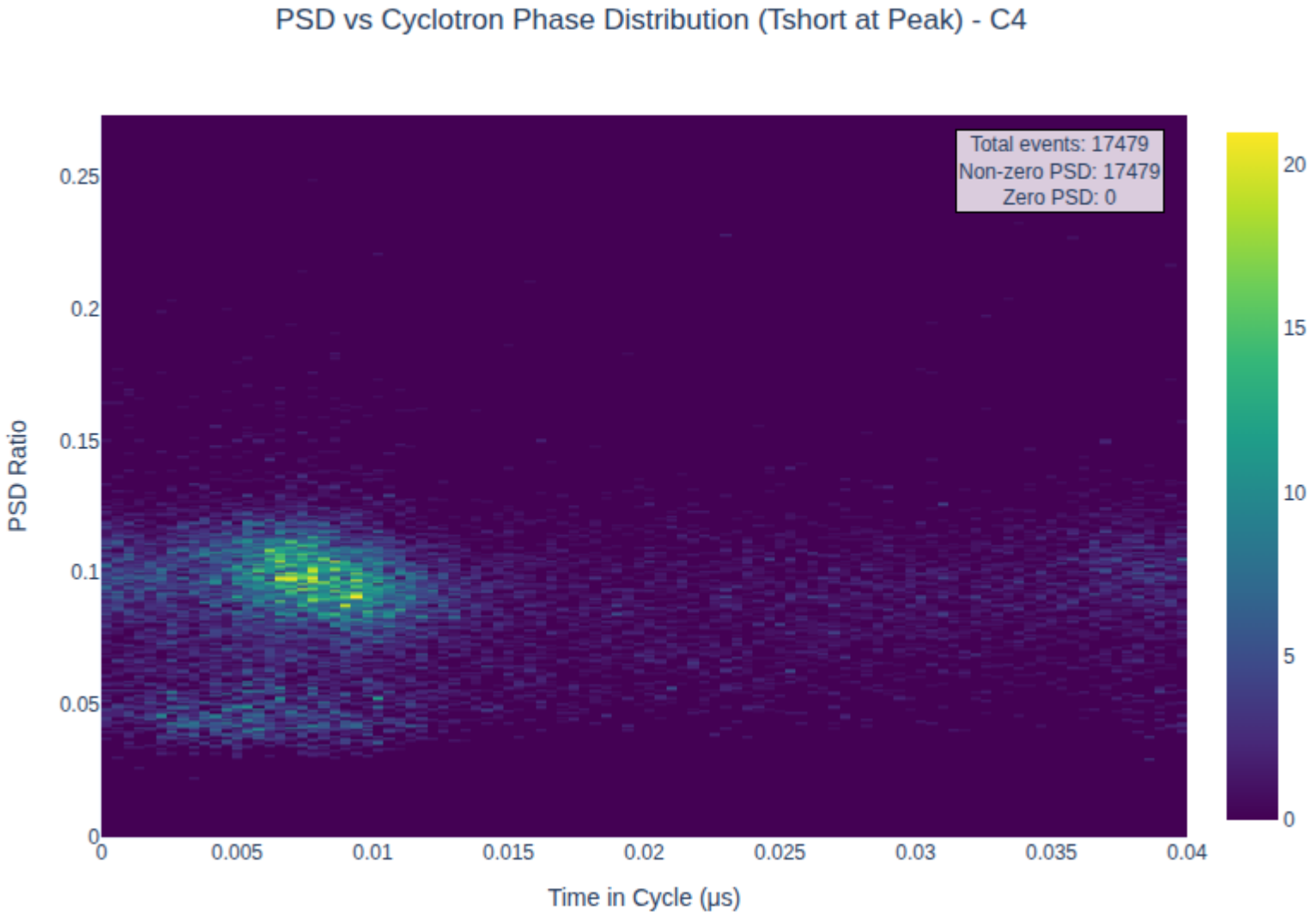

C4 Channel Baseline (RAW):
Level: -0.32 mV
Noise: ±6.92 mV
Samples: 9,550,688
Detection Stats:
Threshold: 25.0 mV
Events Found: 2205
Valid Events: 2205
NO NORMALIZATION APPLIED
C4 - Detector Signal (Negative Peaks)
Threshold: -0.025V
Amplitude (V)
0
−0.2
−0.4
−0.6
−0.8
Time (µs)
C1 - Cyclotron Signal
Amplitude (V)
0.2
0.1
0
−0.1
87.25
87.3
87.35
87.4
87.45
Time (µs)

Rough Pulse Shape Discrimination

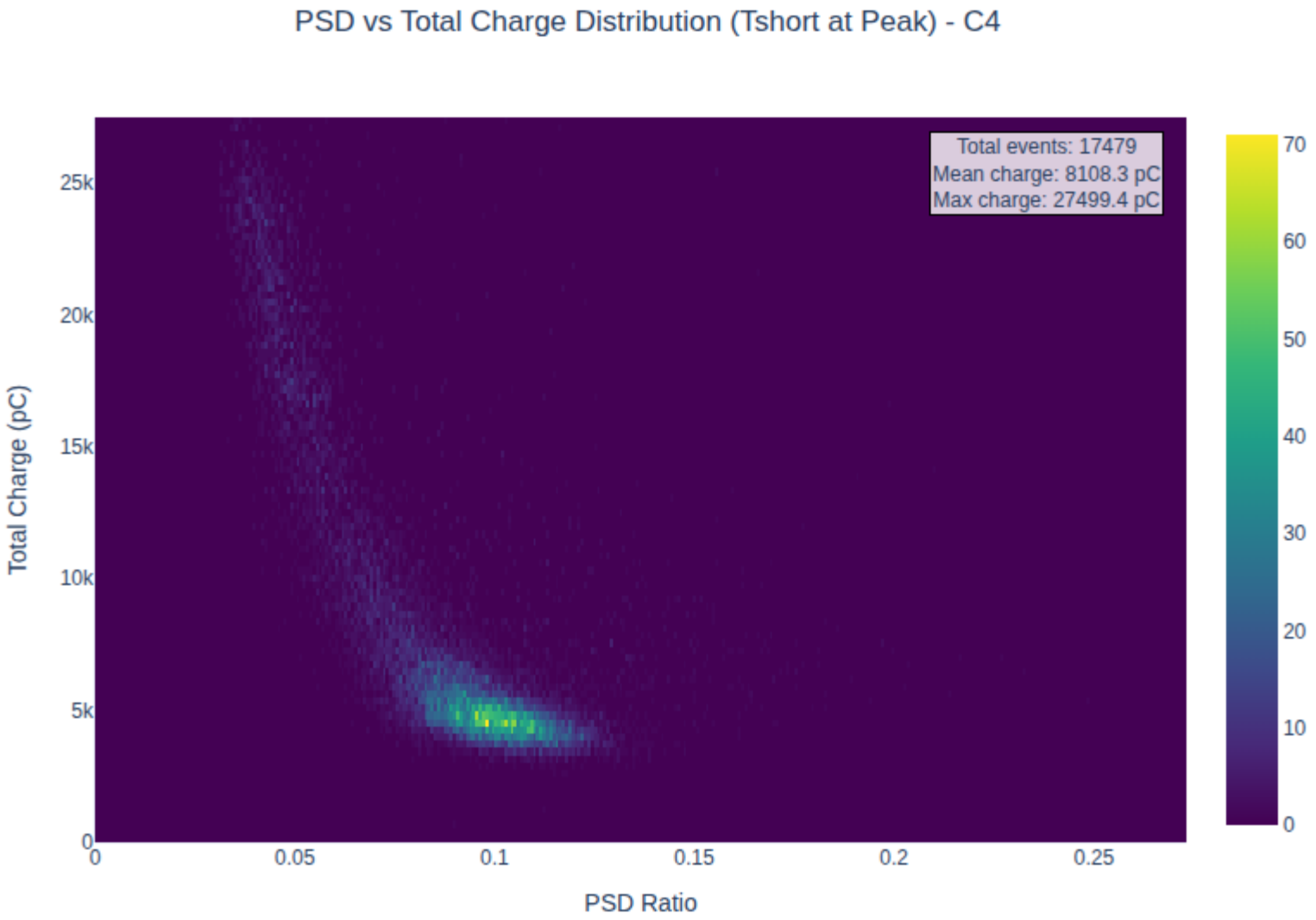
Pulse Shape Discrimination – Tshort by Width



Pulse Shape Discrimination vs Cycle Time



Pulse Shape Discrimination vs Cycle Time



Thank you for your attention!

Questions and discussions