
MPGD Threshold update

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Status

Threshold Effect on Hits

❑ Shujie presented missing MPGD hits during [Tracking WG meeting \(9/5\)](#)

- Hits lost going from sim hits to digi hits on all MPGD detectors
- [Hits lost mostly due to threshold](#) (current value 0.25 KeV)
- Consensus in MPGD DSC is to revisit the threshold estimate

❑ Sim setting for table below

- $\pi^-, p = 10 \text{ GeV}, |\eta| < 0.21, 0^\circ \leq \phi \leq 360^\circ$
- Epic/EICrecon = 24.08.1/v1.16.1
- Sim Hits = detector.Edep, Raw Hits = detector.charge

missing MPGD hits #774

Open

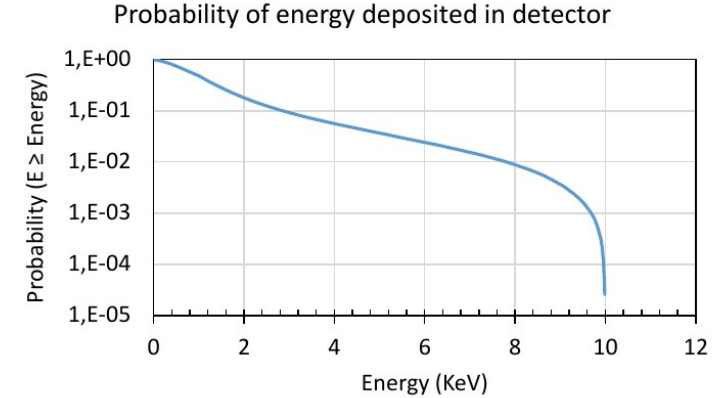
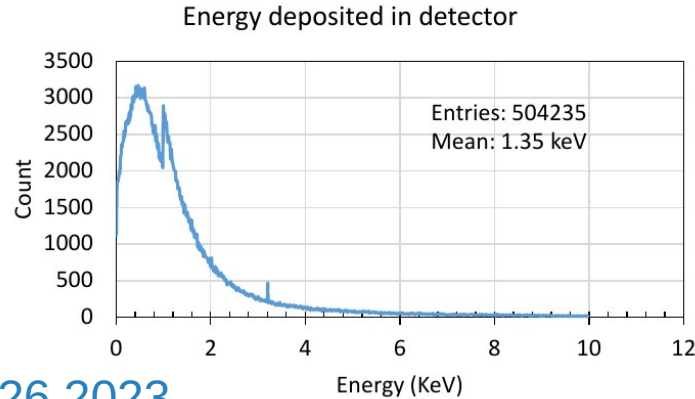
ShujieL opened this issue 2 days ago · 7 comments

Detector	Threshold (keV)	Sim Hits	Raw Hits	Digi/Sim Hits [%]
CyMBal	0.25	13558	11125	82
	0	13558	13120	97
μ RWELL-BOT	0.25	12736	10018	79
	0	12736	12188	96

Matt's presentation

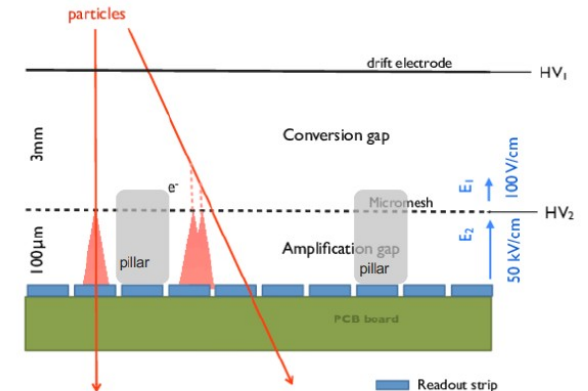


- Energy deposit simulations for physics events
 - Based on https://wiki.bnl.gov/EPIC/index.php?title=Deep_Inelastic_Scattering



Irakli's presentation Oct 26 2023

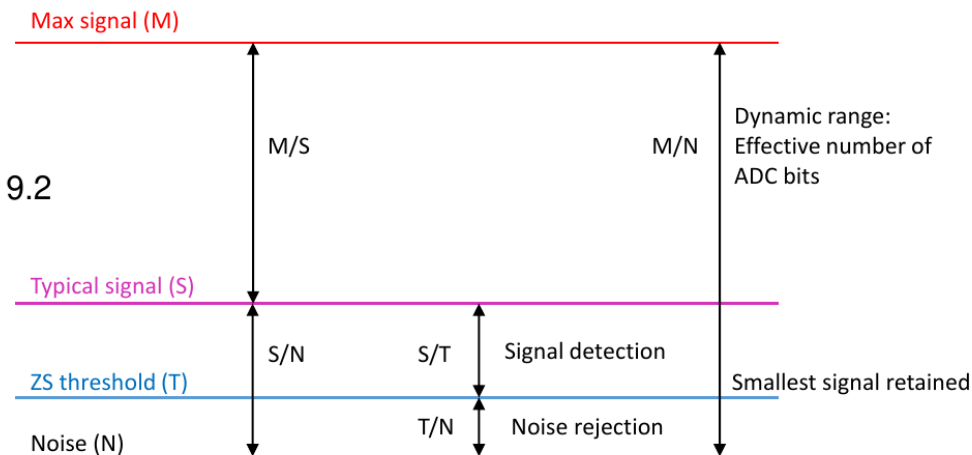
- Typical signal: ~ 1.35 keV
- Detector:
 - Conversion gap: 3 mm
 - Electrons in conversion gap: ~ 50
 - Amplification gain: 8 000 – 10 000
 - 400 – 500 ke^-





- Fix signal to threshold ratio as 10 for high detection efficiency : $S/T = 10$
 - Detect channels with low charges in the cluster
- Efficient noise suppression with $T/N = 6$
 - Streaming readout: no more a narrow trigger window to clean-up not in time noise hits
- Signal / Noise = 60
- Max signal to mean signal ~ 10
 - Low probability of saturated signals
 - Accurate charge and timing measurements
 - NB: These light saturations do not provoke dead time

- Dynamic range : 600
 - Effective number of ADC bits: 9.2
 - 10-11-bit ADC





- Signal : 30 fC

→ Detector gain of ~8 000

- Max / signal : ~10

→ CSA range : 300 fC

- Saturation probability ~1 / 1000
 - @ 10 kHz hit rate : ~ 100 ms

- Signal / threshold : ~10

→ Threshold : 3 fC → ~100 eV

- Assume charges are evenly distributed among all cluster channels but the channel with Max
 - Cluster size of 4
 - 65% of charges going to a single channel : ~19.5 fC
 - Others get ~5.2 fC > 3 fC threshold

- Threshold / noise : 6

→ Noise : 0.5 fC

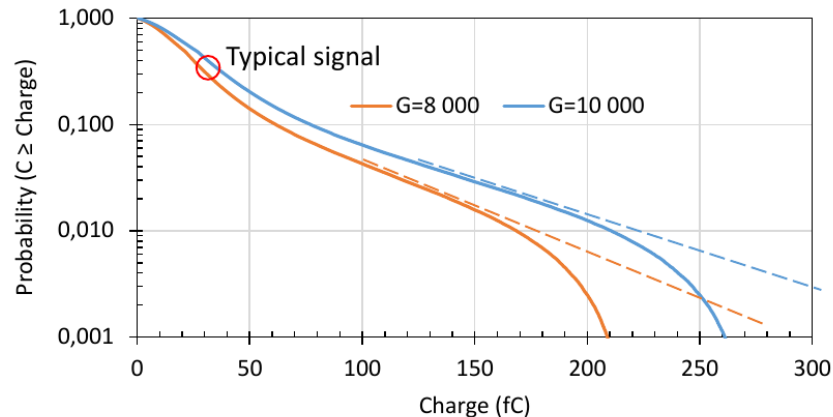
- ENC: 3 100e⁻ – compatible with the envisaged detector capacitances

- Working point will be refined with better knowledge of physics / detector / electronics

→ Configurable flexible very frontend accommodates changes

Threshold: ~100eV

Probability of charge deposit in channel



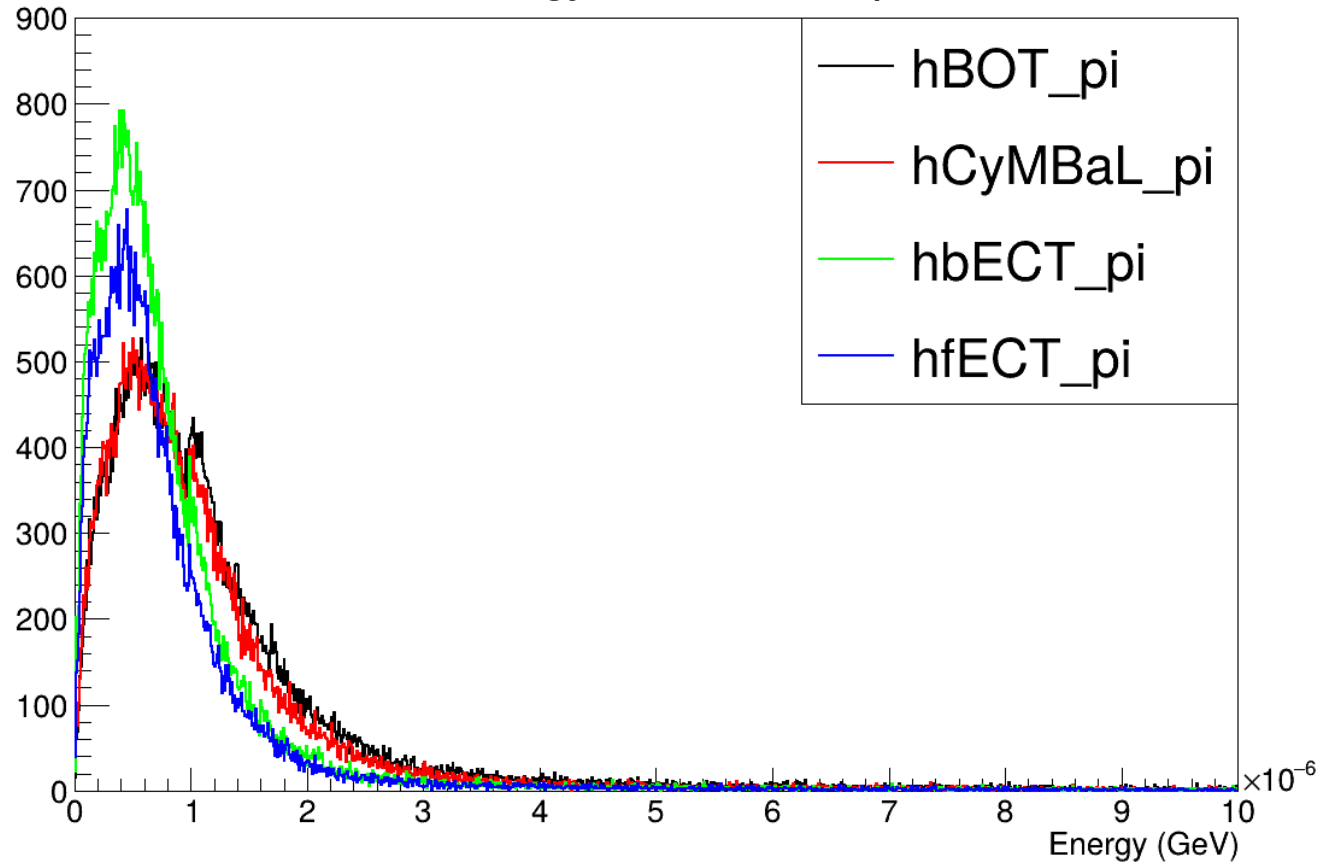
Impact

Matt run a 10GeV pi+ simulation

Efficiency of a 100eV threshold

BOT	0.999
CyMBaL	0.994
bECT	0.97
fECT	0.97

Hit energy from DD4Hep



Summary

- Proposal to move the threshold to 100eV fits the needs and is closer to what the MPGD detectors aim at delivering