



BTOF Hit Rate Analysis

Signal vs. Background

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Analysis Overview & Data Source

DATASET

`pythia8NCDIS_10x100_minQ2eq1_WBKG.eicrecon.root`

- NC DIS process
- 10×100 GeV (e $\times$ p)
- $\min Q^2 = 1 \text{ GeV}^2$
- Beam background mixed in (WBKG)
- 1000 simulated events

KEY BRANCHES USED

TOFBarrelHits.eDep

Energy deposit per SimHit (BTOF)

MCParticles.PDG

MCParticles.generatorStatus

Particle identity & signal/background origin

_TOFBarrelHits_particle.index

Links each hit back to its MC particle

Methodology

Hit classification via generatorStatus

Signal status 1 – 1999 **BKG1** status 2000 – 2999

Task 2

Fraction of hits passing an eDep threshold, scanned 0–20 keV, separately for signal and BKG1.

Task 3a

Hit multiplicity per event (all / signal / BKG1 SimHits).

Task 3b

Physical rate in Hz: $\text{rate} = (\text{mean hits / event}) \times (\text{real collision rate, 500 kHz})$.

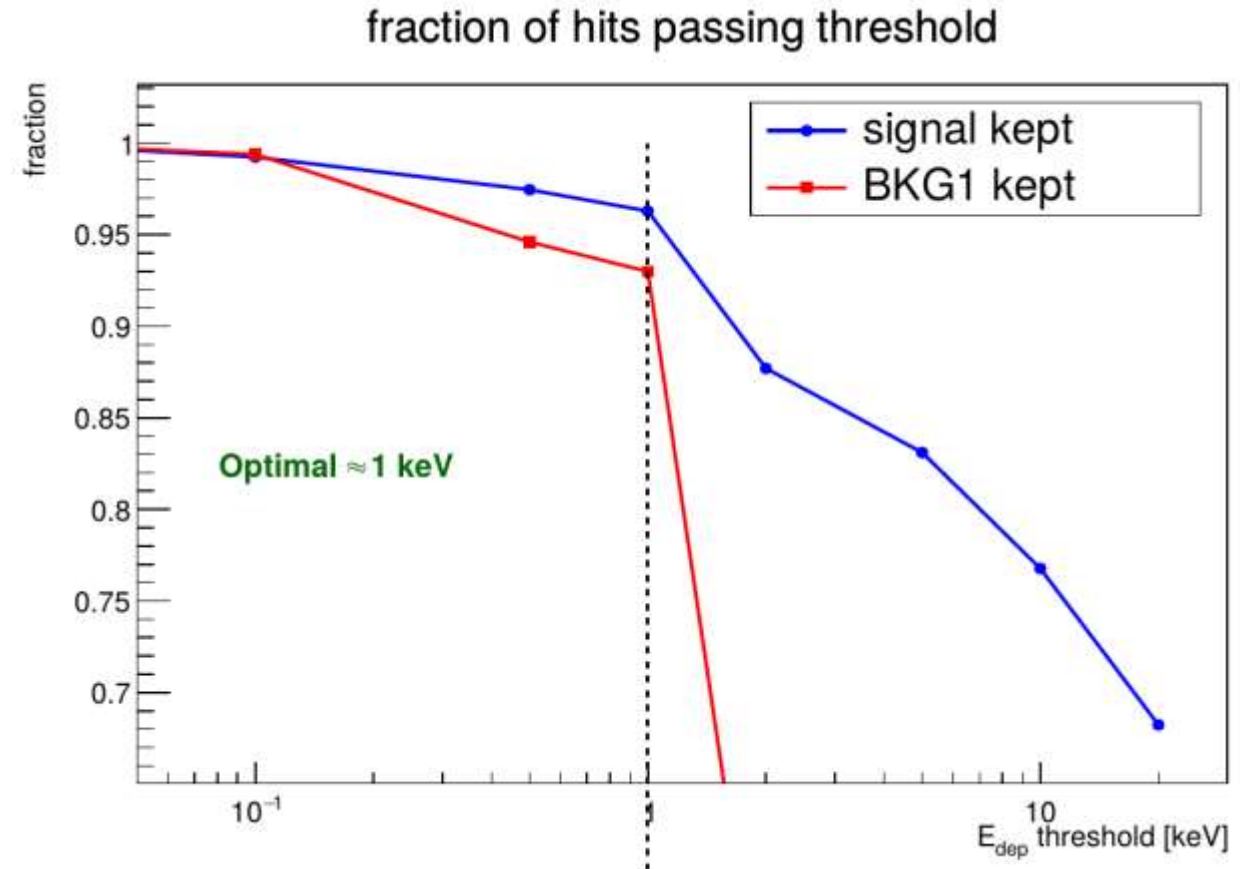
Results — eDep Threshold Scan (Task 2)

BKG1 collapses sharply near 2 keV

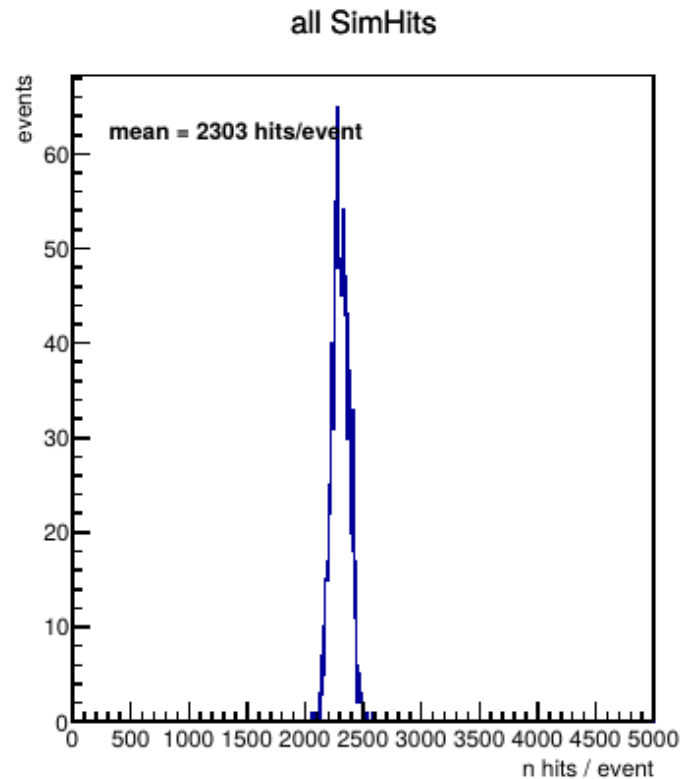
(0.93 $\rightarrow$ ~ 0), while signal declines gradually (0.96 at 1 keV $\rightarrow$ 0.68 at 20 keV).

Optimal threshold $\approx 1\text{--}2$ keV

— removes nearly all background while keeping most of the signal.



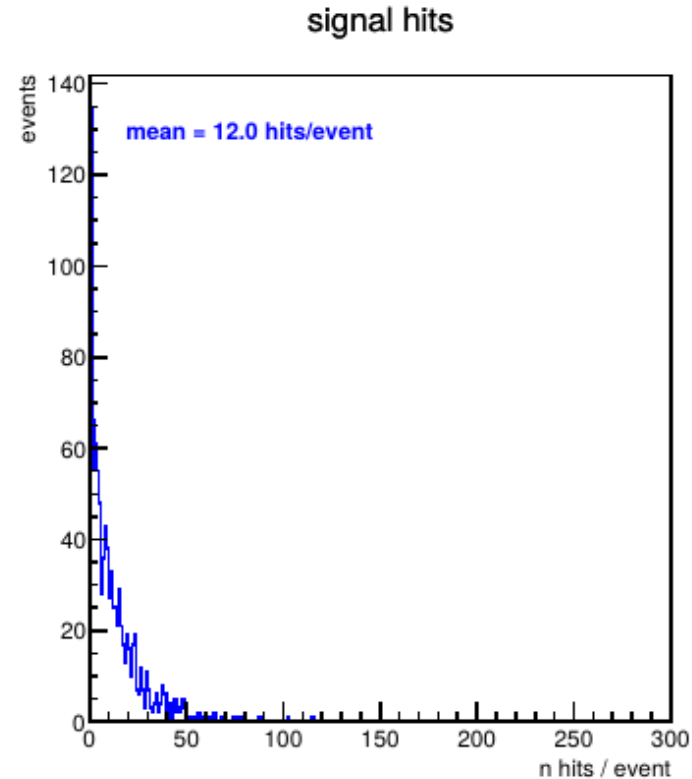
Results — Multiplicity per Event (Task 3a)



2303

hits / event

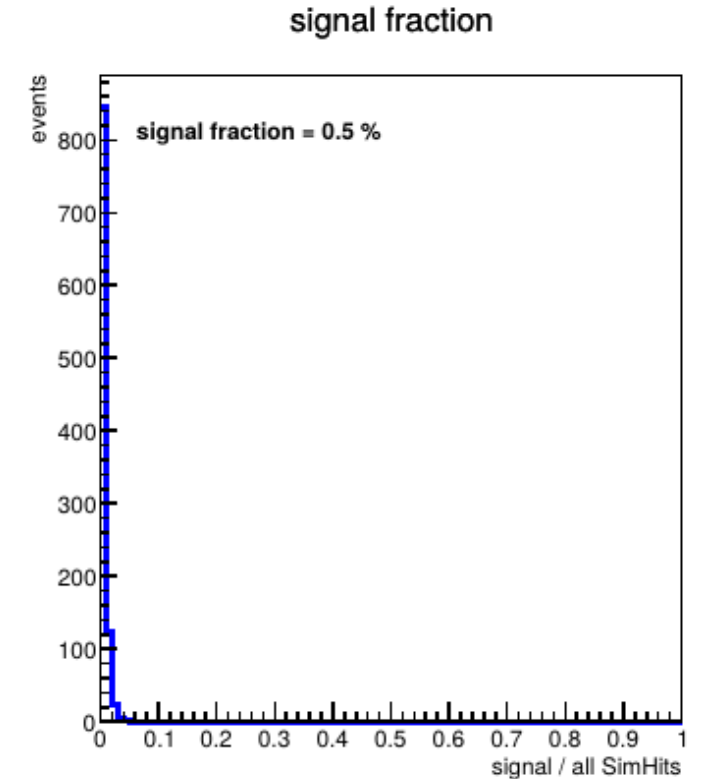
all SimHits



12.0

hits / event

signal

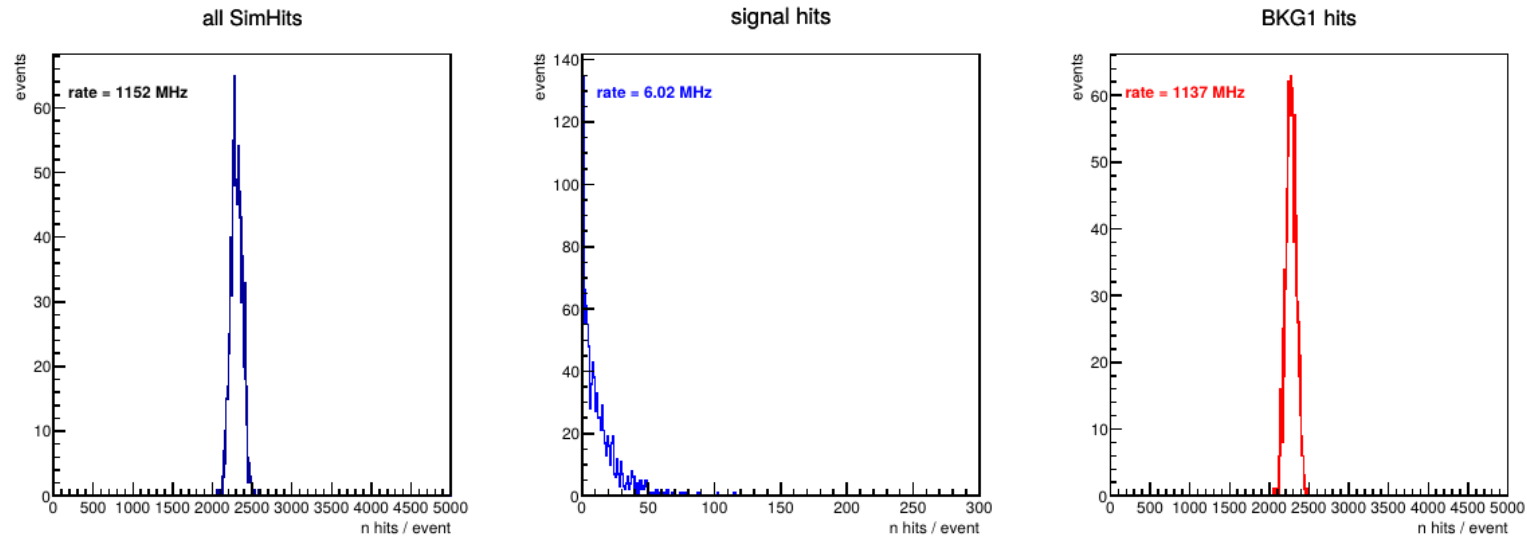


0.5%

signal fraction

of all SimHits

Results — Physical Rate Estimate (Task 3b)



Rate (no threshold)	
All SimHits	1152 MHz
BKG1	1137 MHz
Signal	6.02 MHz

Raw flux before any threshold — far beyond a realistic readout budget.

Combined with the ~ 2 keV threshold from Task 2, background drops sharply while most of the signal is retained.

Thank you.