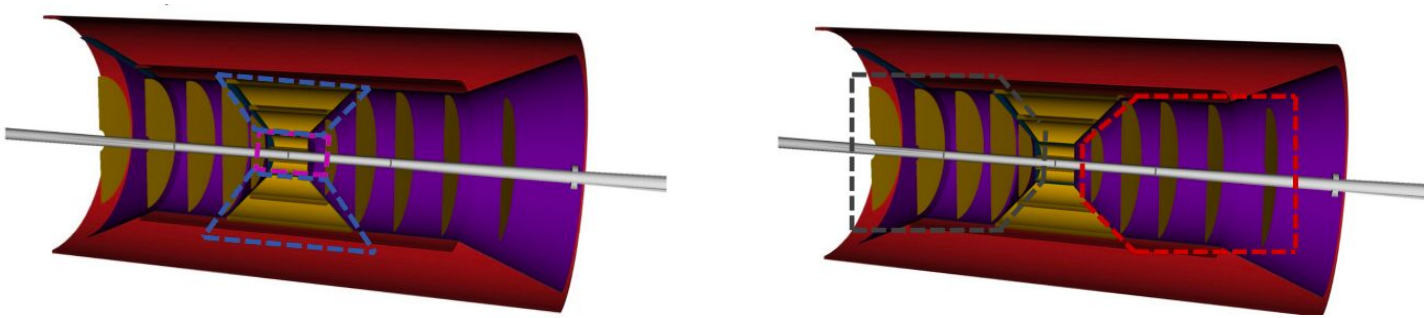
Progress on Noise Effects Study on ePIC Tracking

Current Estimation of Noise Hit Count

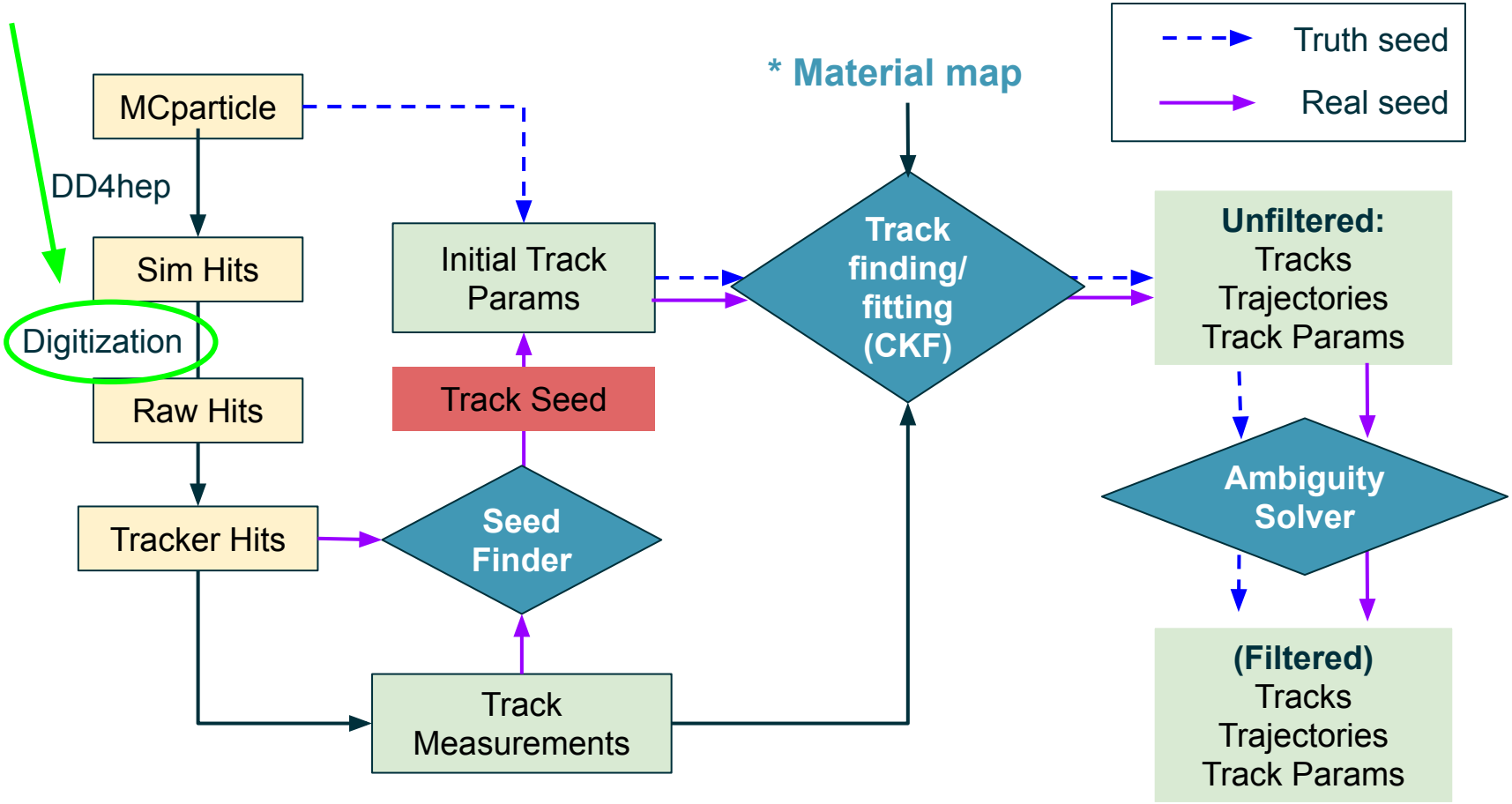
Sampled fake-hit rate: **FHR < 5 x 10^{-7} per event per pixel.**
Fake hits/event/collection: **FHR x total pixels**

Pixels sizes: **20x20µm²**

	Inner Barrel	Outer Barrel	Endcaps
Total pixels	8.65E+08	7.83E+09	1.18E+10
Fake hits/event	4.33E+02	3.92E+03	5.91E+03

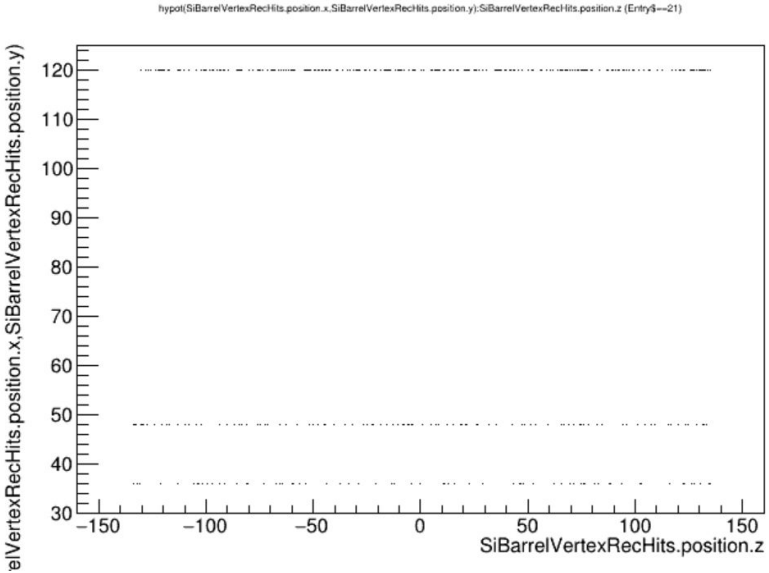


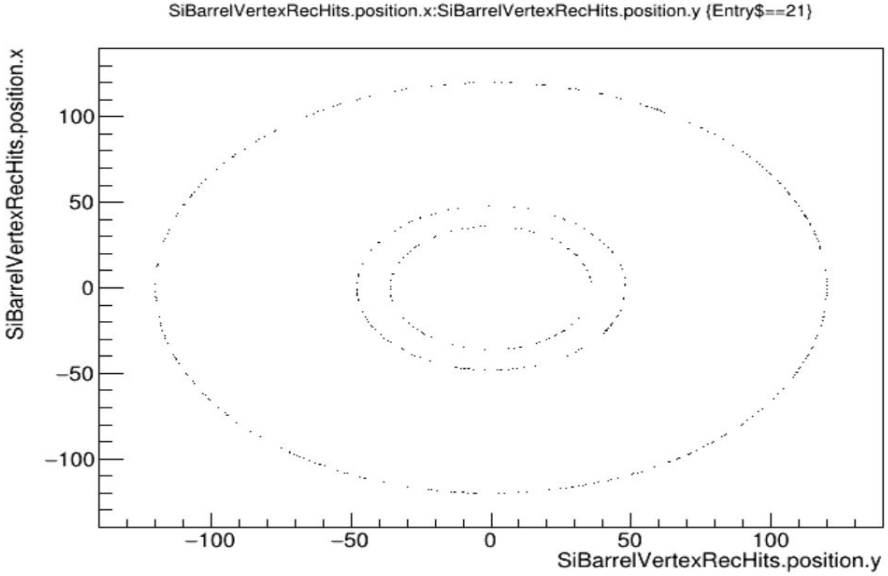
Noise Implementation



Inner Barrel Layers (L012) Hit Distribution for Single Event

These are hits from a single event, with 3 of the hits from the generated particle, and the remainder 433 hits being noise hits.

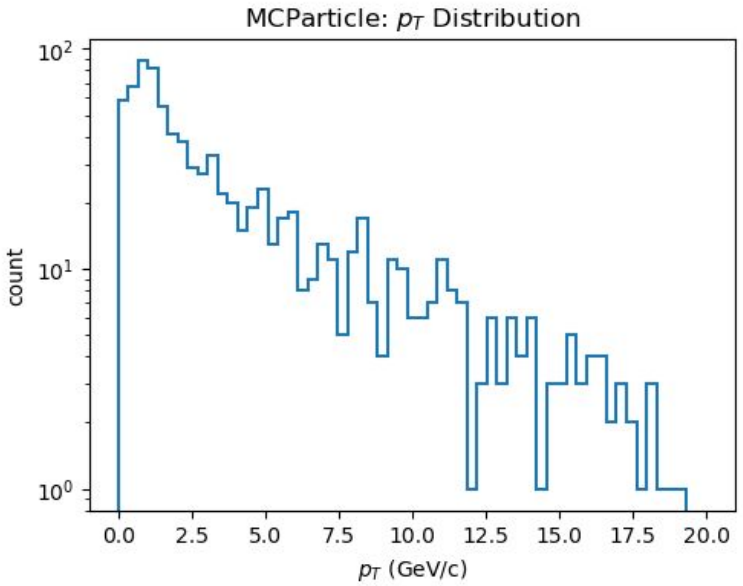


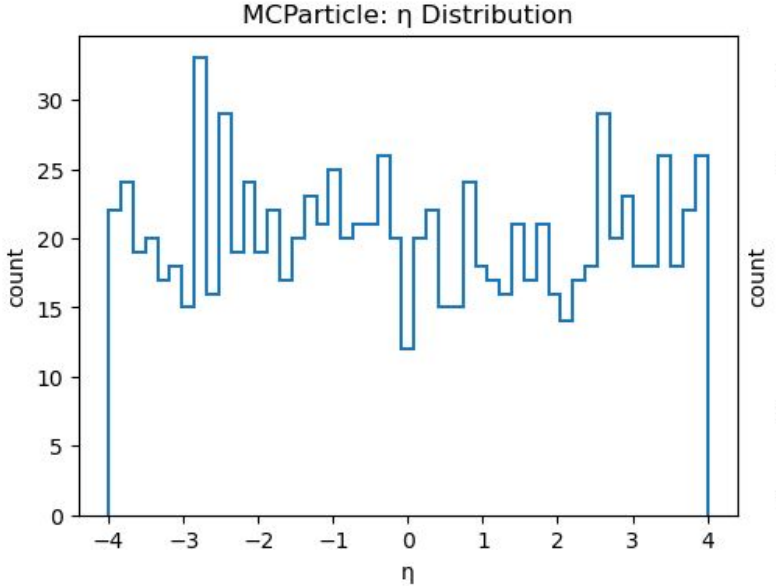


Credit: Barak Schmookler

Sampled Events

1. 1,000 single-muons events
2. Craterlake geometry
3. 0.5<p<20 GeV/c
4. -4 ≤ η ≤ 4





Efficiency Definition

Analyzed with/without noise as a function of η and p_T

Efficiency

Efficiency is the ratio:

$$\frac{\textbf{\# of MCParticles with reconstructed tracks}}{\textbf{\# of MCParticles}}$$

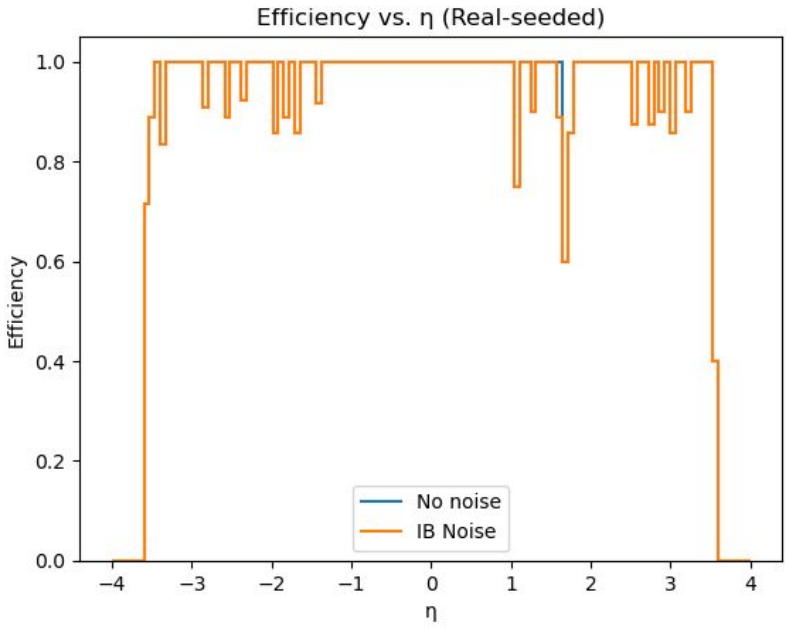
We also define **purity conditions: checks if the reconstructed tracks match with an MCParticle within:

- **ΔΘ (theta) : 0.005 rad**
- **ΔΦ (phi) : 0.03 rad**

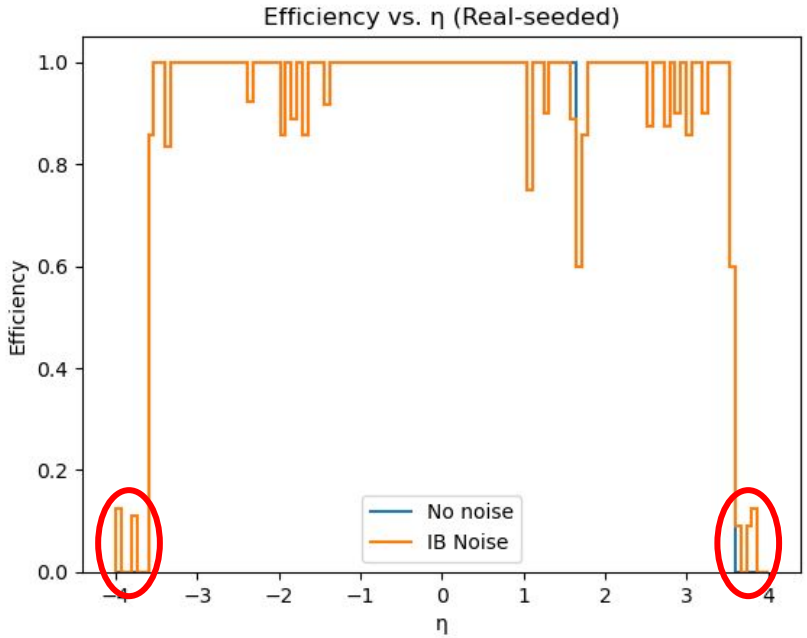
$$\text{Efficiency} = \frac{\text{\# of MCParticles with reconstructed tracks}}{\text{\# of muon MCParticles}}$$

For this particular event that happened at this pseudorapidity, there was a “random” reconstructed track, not necessarily at this angle, but for this event.

Real-Seeded Efficiency Against Pseudorapidity (η)



With purity cut

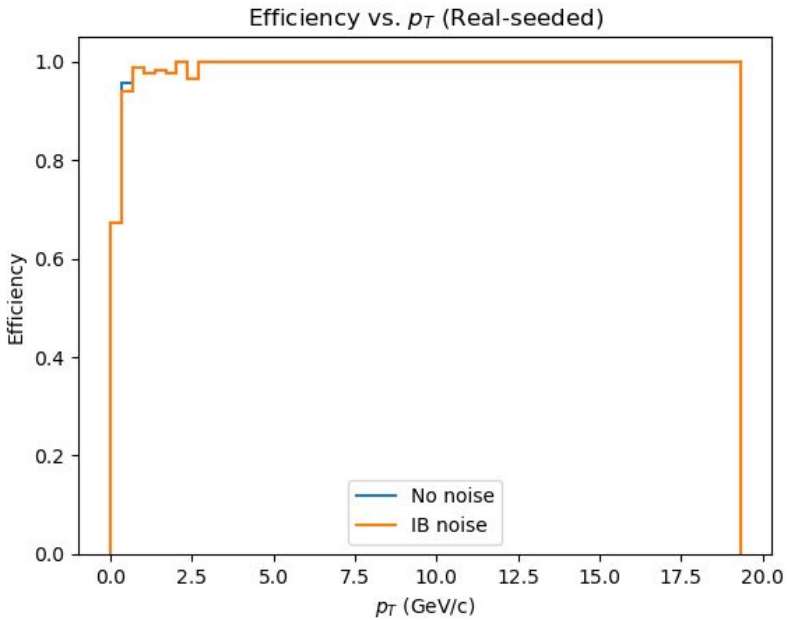


Without purity cut

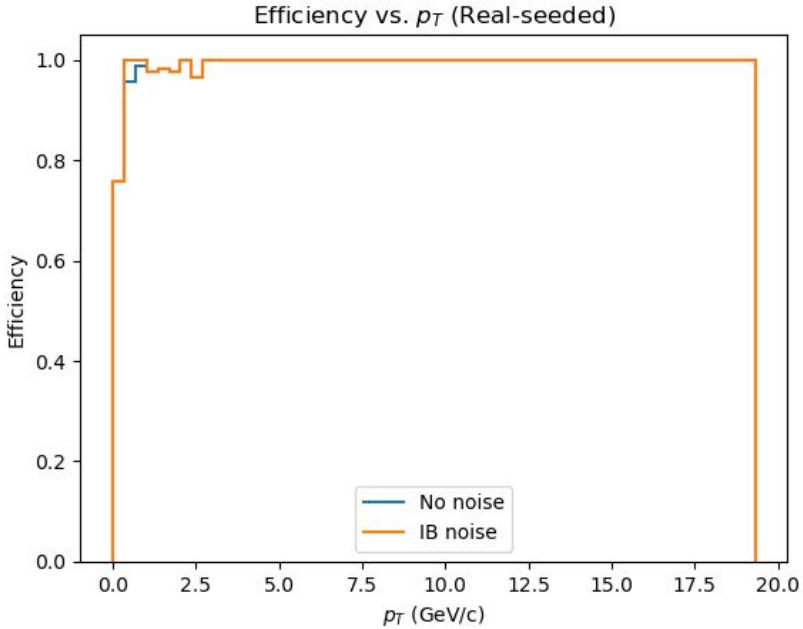
$$\text{Efficiency} = \frac{\text{\# of MCParticles with reconstructed tracks}}{\text{\# of muon MCParticles}}$$

Real-Seeded Efficiency Against Transverse Momentum (p_T)

Specified Eta Range: $-3.6 \leq \eta \leq 3.6$



With purity cut



Without purity cut

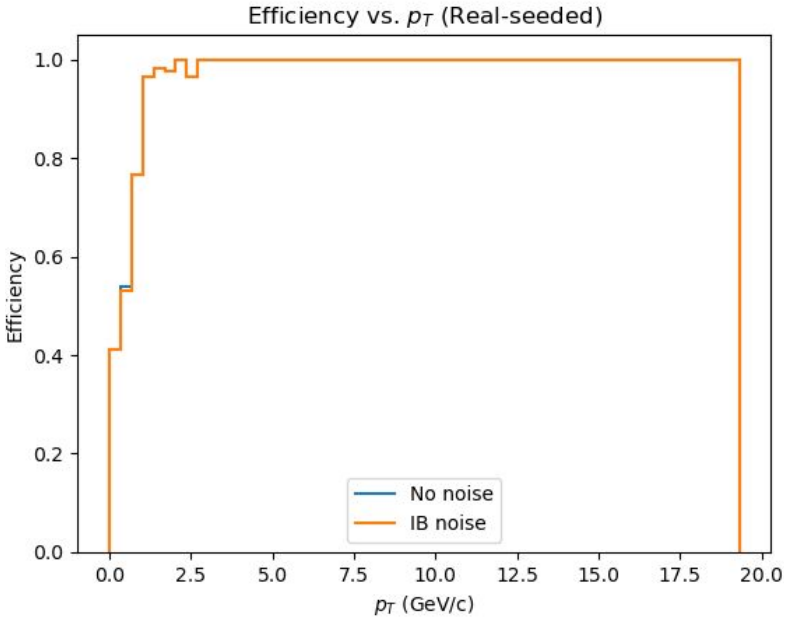
Next Steps

1. Efficiency analysis with noise in outer barrels
2. Use hit based matching for more concrete purity condition
3. Momentum resolution plots

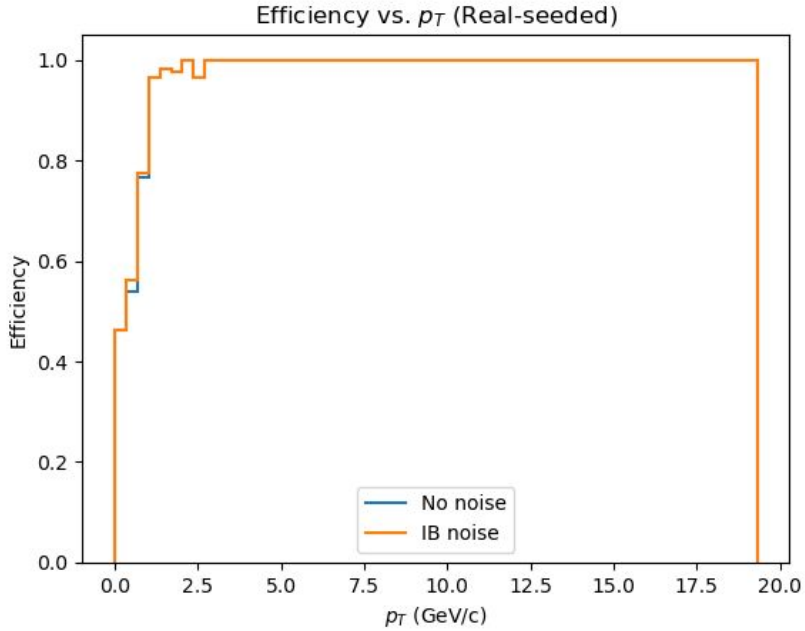
Backup

$$\text{Efficiency} = \frac{\text{\# of MCParticles with reconstructed tracks}}{\text{\# of muon MCParticles}}$$

Real-Seeded Efficiency Against Transverse Momentum (p_T) Without Eta Cut



With purity cut



Without purity cut