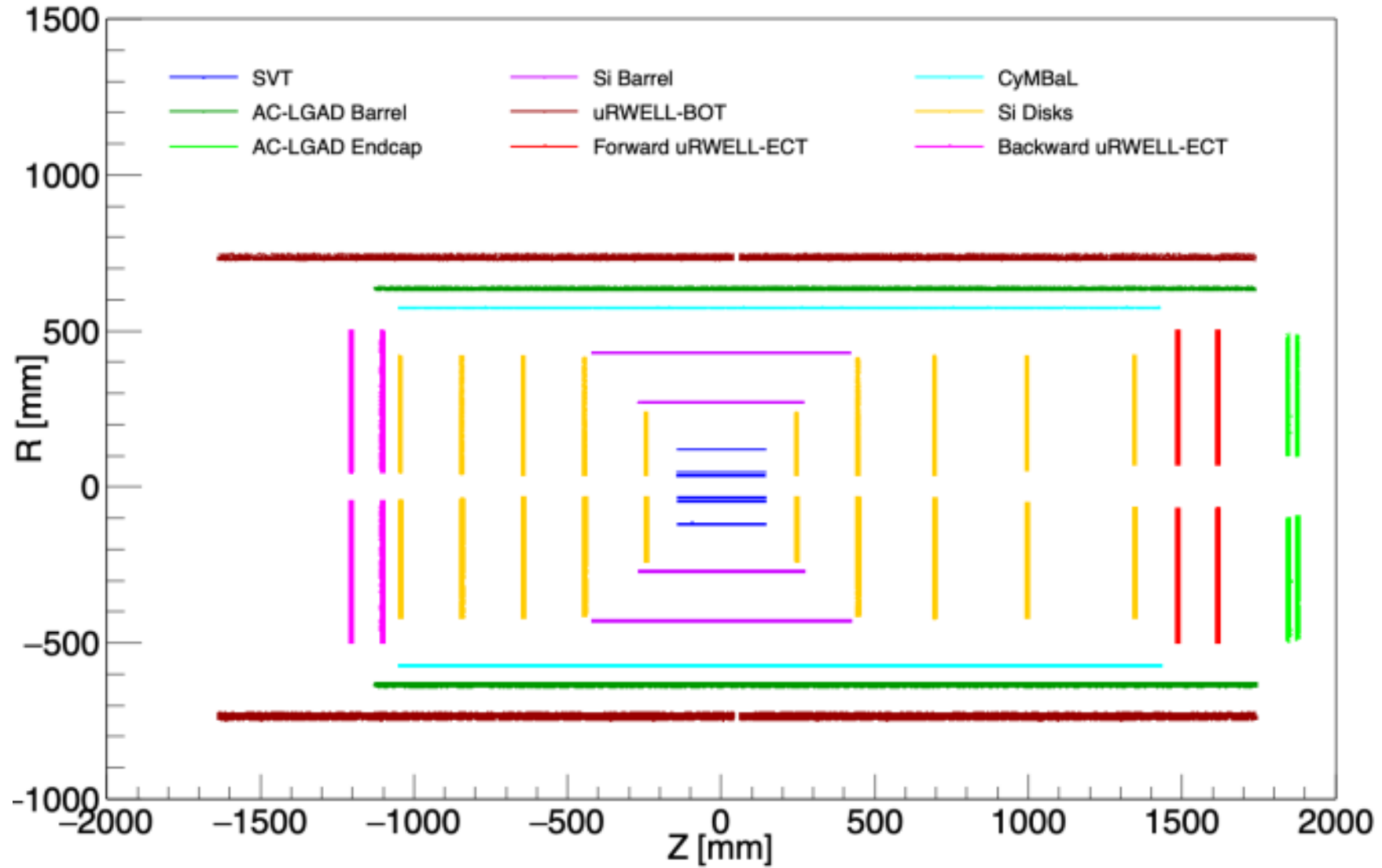# Status of track reconstruction and vertexing in ePIC

Wouter Deconinck, Xin Dong, Shujie Li,

Ernst Sichtermann, Barak Schmookler
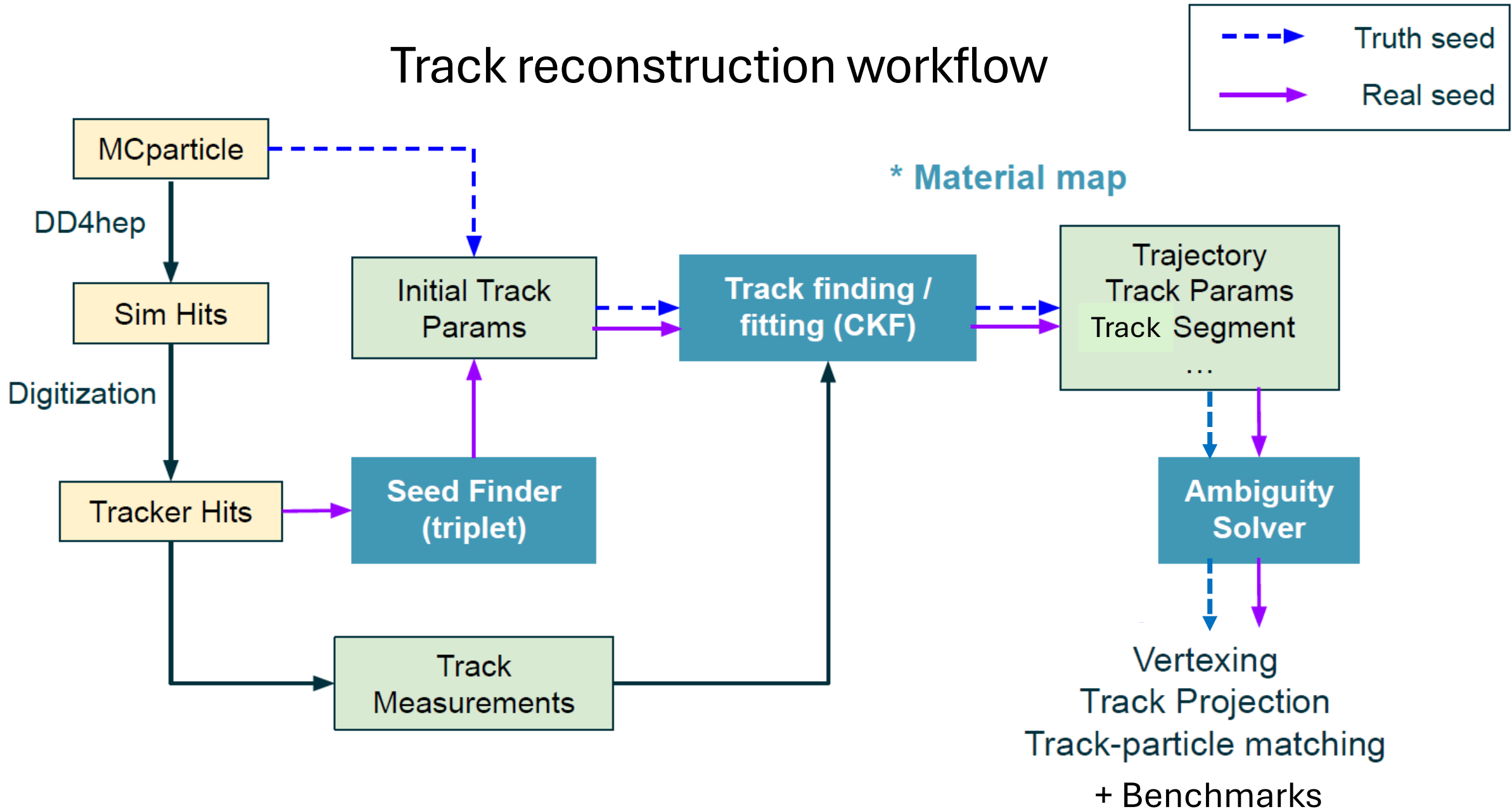
Following up on previous recent presentations on track reconstruction:

1. June 3rd TC meeting
2. Feb 26th TC meeting

ePIC tracking detector layout

Track reconstruction workflow

Acts Greedy Ambiguity Resolution Solver

➢ As of the June campaign (v24.06), the *Acts Greedy Ambiguity Resolution Solver* has been implemented into the standard track reconstruction framework. The solved tracks produced by this algorithm are now the default tracking output for track performance studies and downstream algorithms (e.g. vertexing).

➢ The *Acts Greedy Ambiguity Resolution Solver* takes as input all track candidates (trackTips) from the CKF and filters them to produce a set of solved tracks.

➢ These solved tracks combine input track candidates which contain a minimum number of shared hits. This is important for removing duplicate seeds.

➢ In addition, the input track candidates are required to have a minimum of number of tracker measurement hits to be considered a solved track.

All track candidates – including multiple candidates associated with a single track seed – are passed as input into the *Acts Greedy Ambiguity Resolution Solver*.
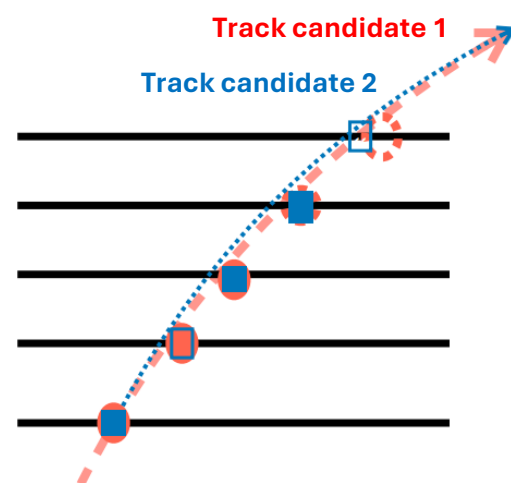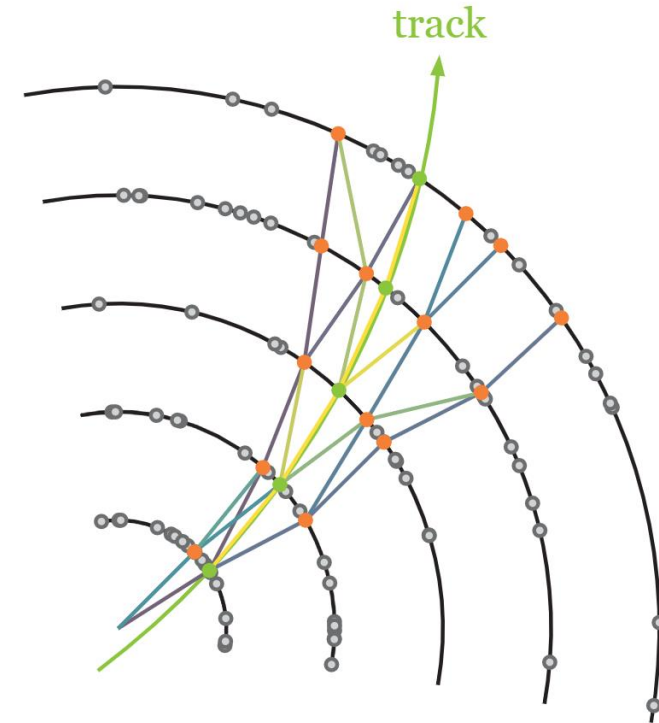
Tracks with shared hits are filtered. This combines track candidates with multiple seed triplets from the same particle (duplicate seeds).

Updated single-particle results – multiplicity and efficiency
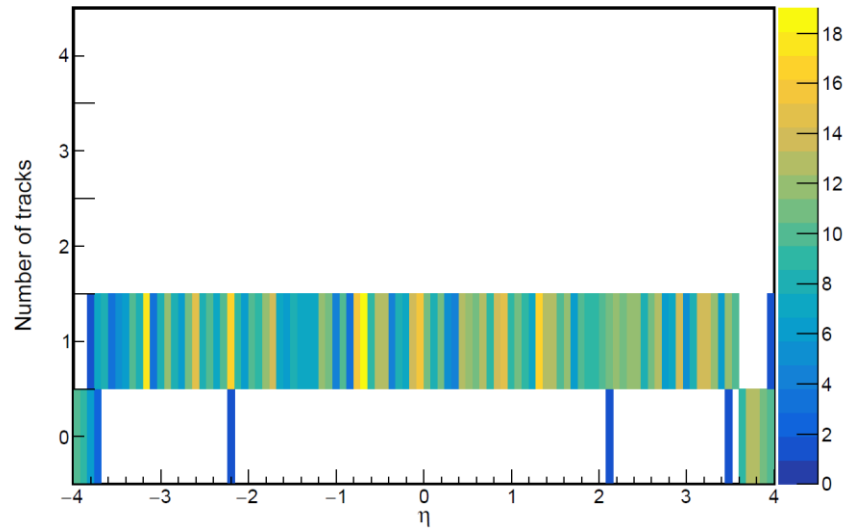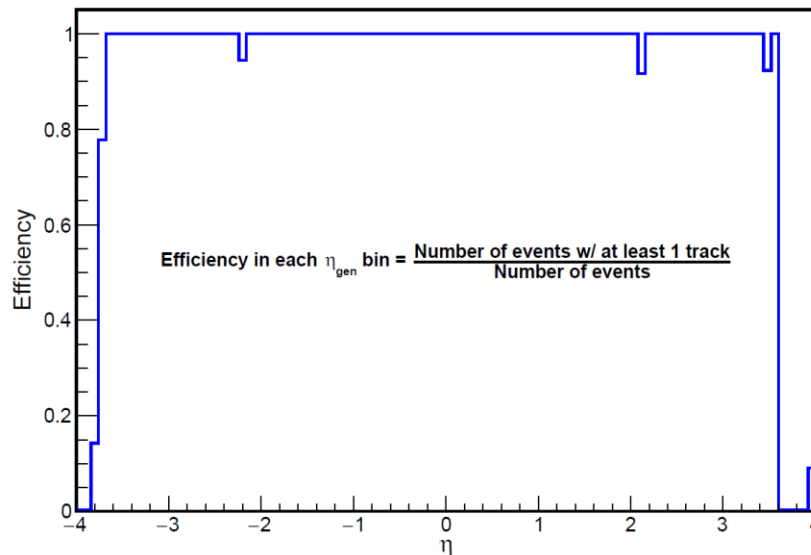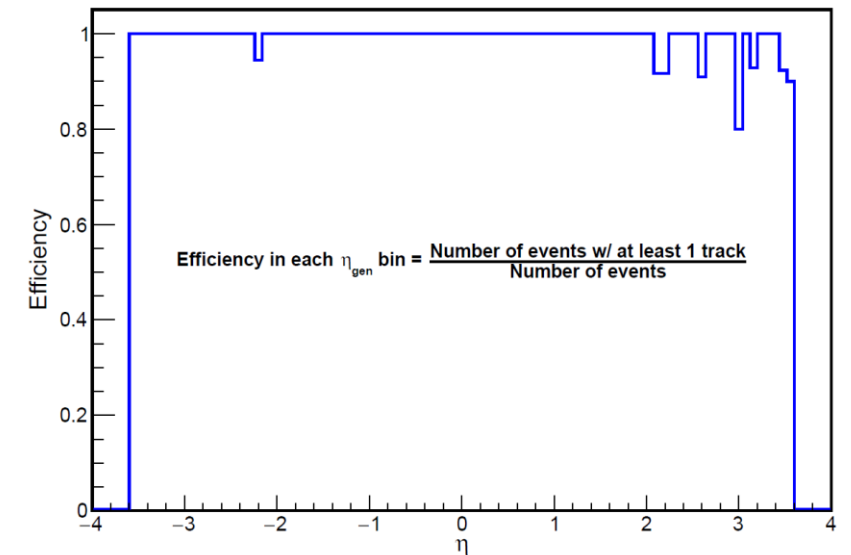
Updated single-particle results – momentum resolution
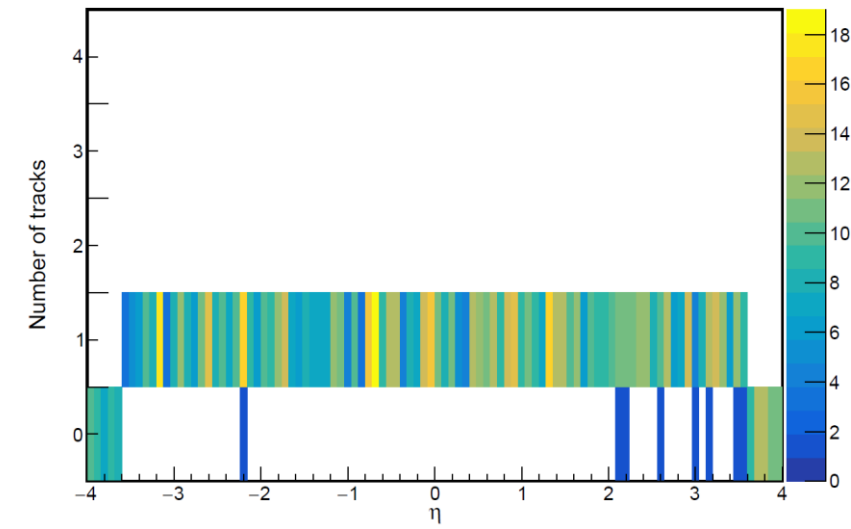
Work by Shyam Kumar
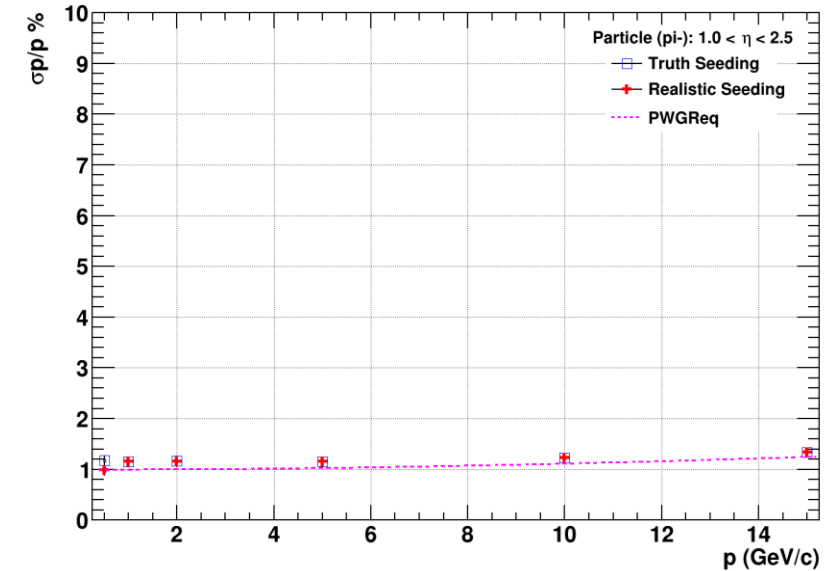
Momentum resolutions from new tracking performance detector benchmark

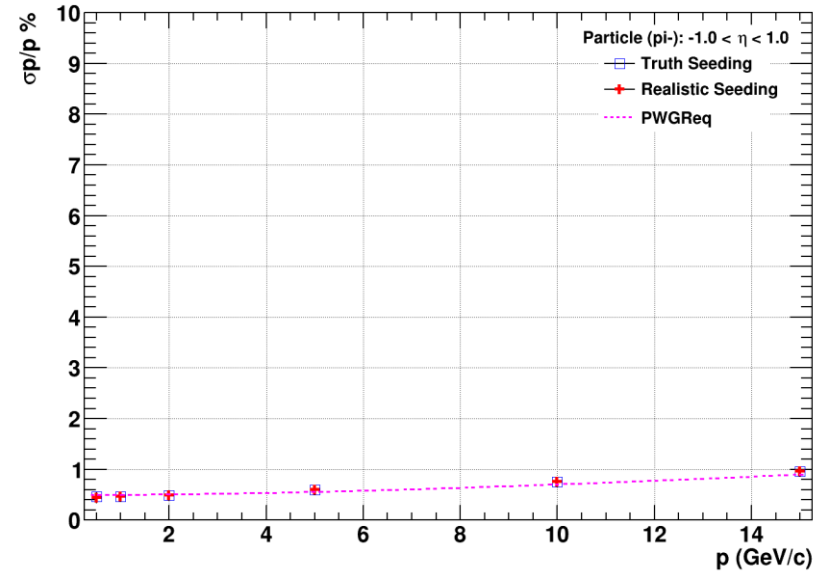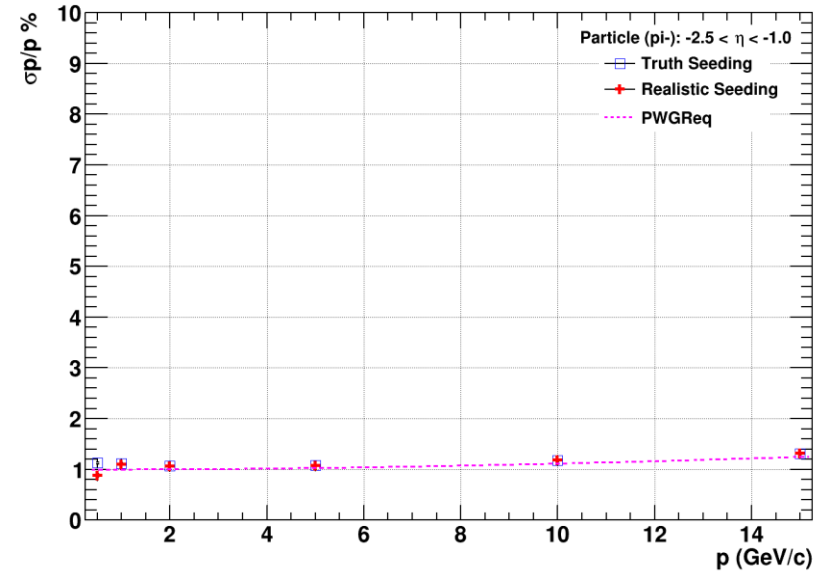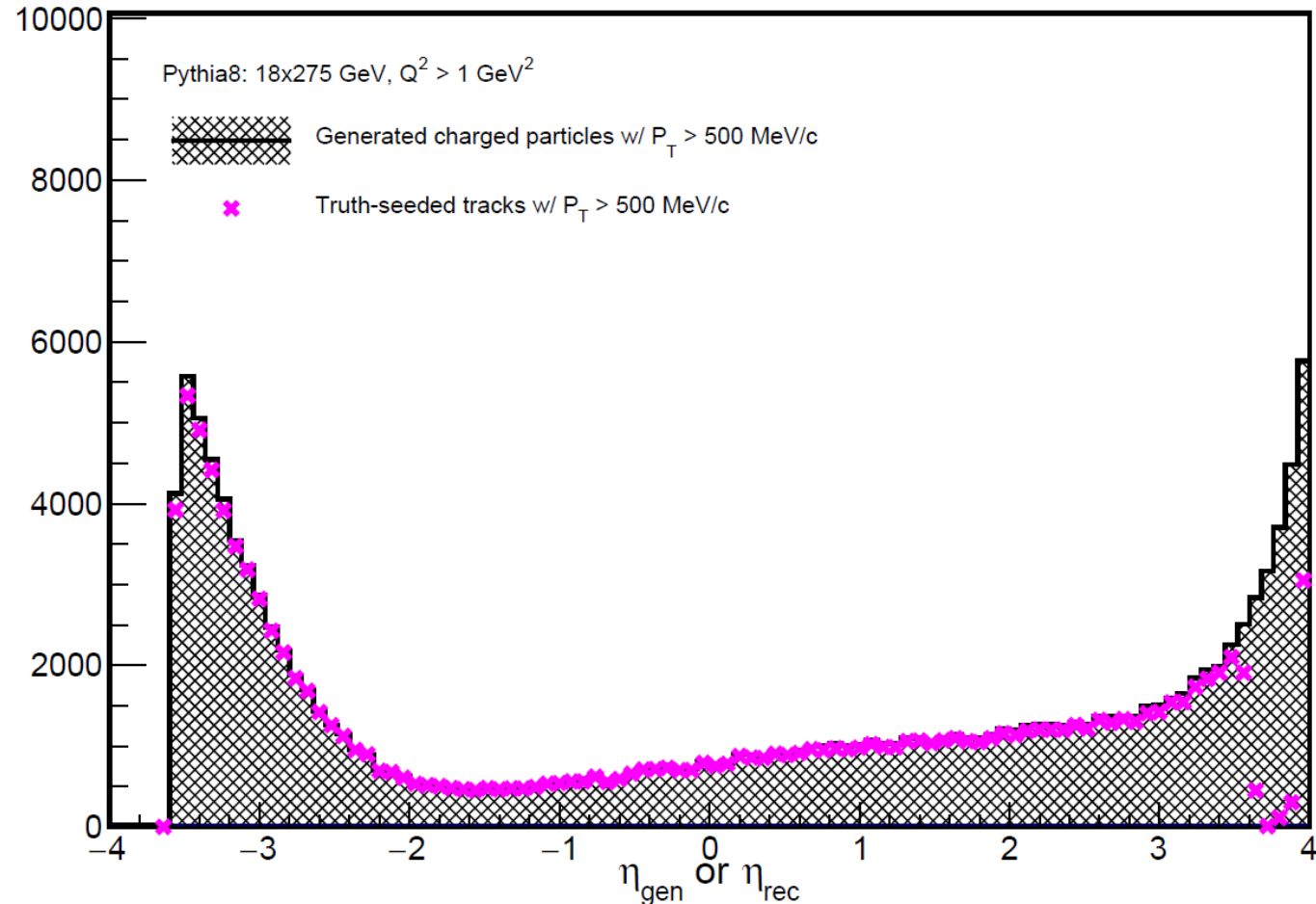Results shown above were produced automatically by recent CI job on EICweb server.

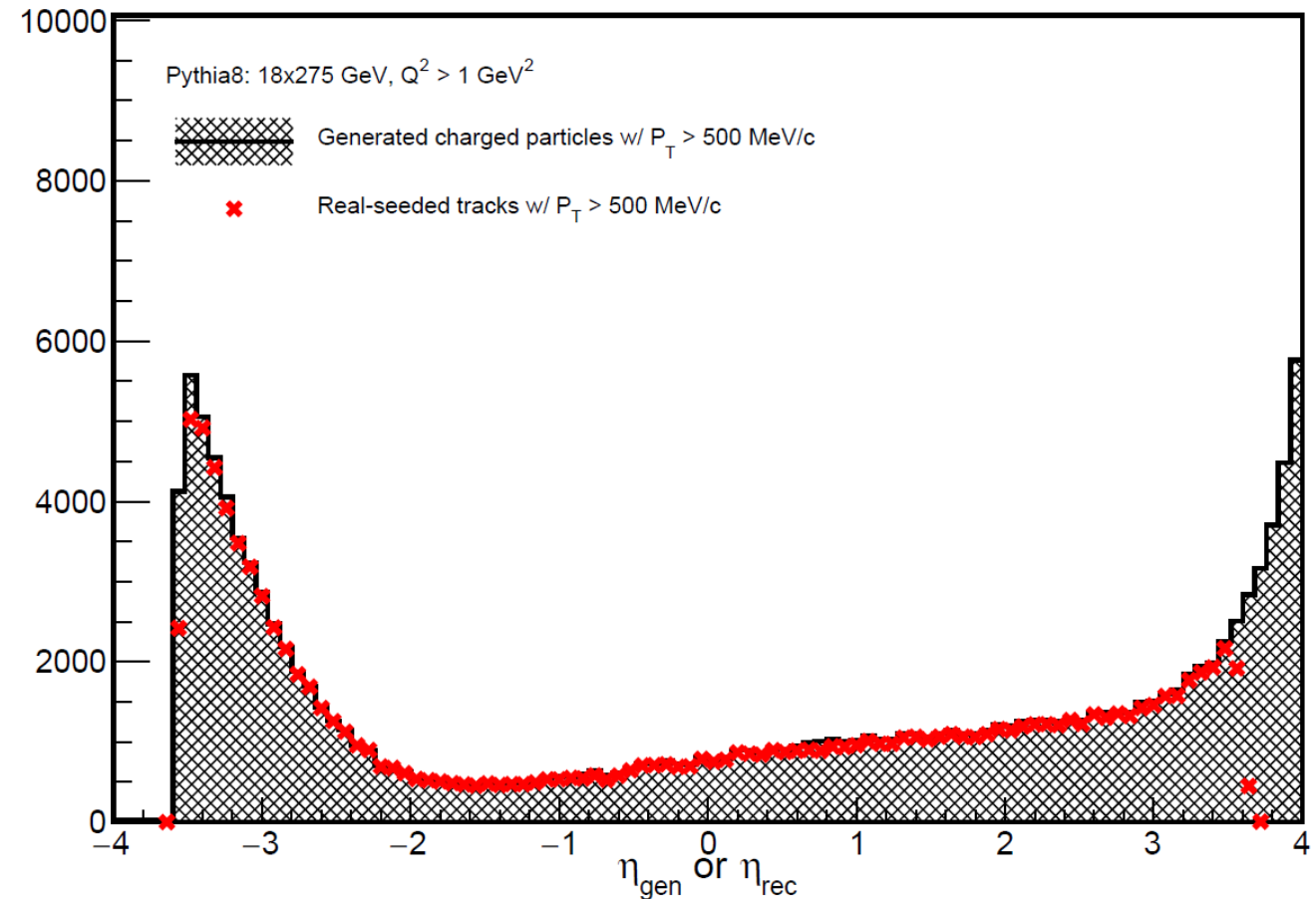Similar analysis/plotting code will be run on monthly simulation campaign output to populate the ePIC image browser.

Updated DIS results – charged particle spectrum

➢Simulation of 50k *Pythia8* events with $Q^2 > 1$ GeV^2 at the 18x275 GeV beam energy setting.

➢ **Black curve**: true pseudo-rapidity distribution of all generated, final-state charged particles with true transverse momentum >500 MeV/c.

➢**Purple points**: reconstructed pseudo-rapidity distribution of all <u>truth-seeded tracks</u> with reconstructed transverse momentum >500 MeV/c.

Pythia8: 18x275 GeV, $Q^2 > 1$ GeV^2

Generated charged particles w/ $P_T > 500$ MeV/c

Truth-seeded tracks w/ $P_T > 500$ MeV/c

η_{gen} or η_{rec}

Updated DIS results – charged particle spectrum

➤ Simulation of 50k *Pythia8* events with $Q^2 > 1$ GeV^2 at the 18x275 GeV beam energy setting.

➤ **Black curve**: true pseudo-rapidity distribution of all generated, final-state charged particles with true transverse momentum >500 MeV/c.

➤ **Red points**: reconstructed pseudo-rapidity distribution of all <u>real-seeded tracks</u> with reconstructed transverse momentum >500 MeV/c.

Pythia8: 18x275 GeV, $Q^2 > 1$ GeV^2

Generated charged particles w/ P_T > 500 MeV/c

Real-seeded tracks w/ P_T > 500 MeV/c
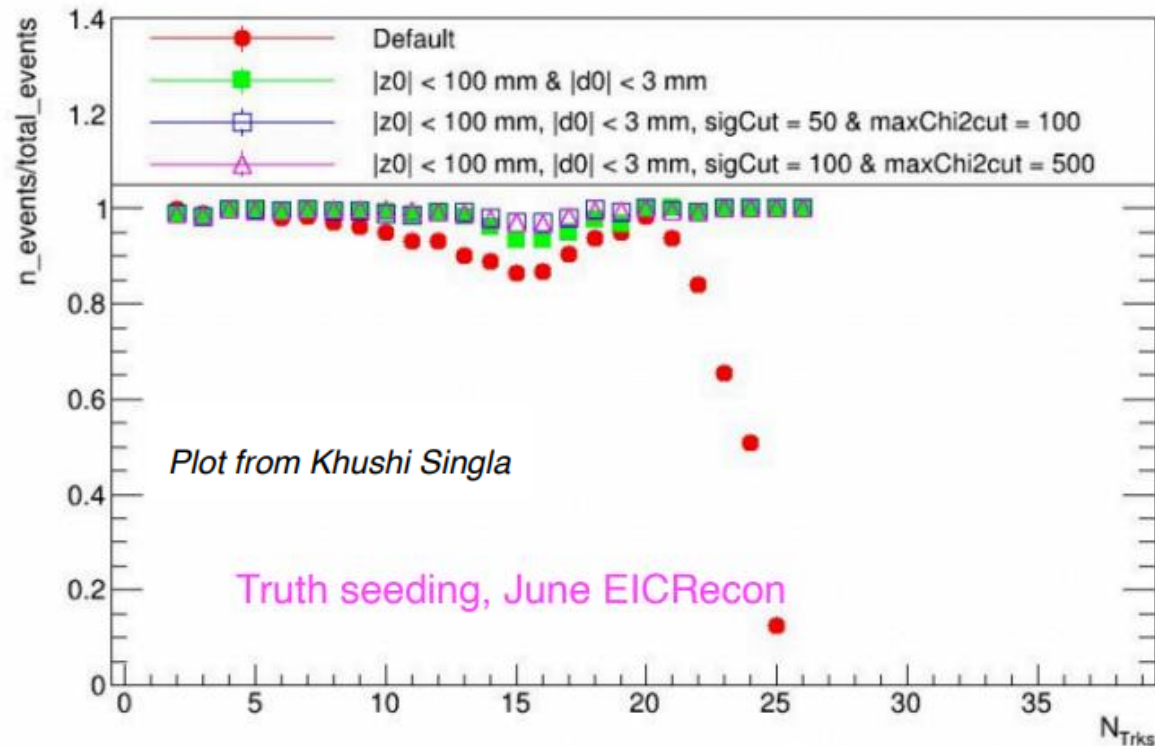
η_{gen} or η_{rec}
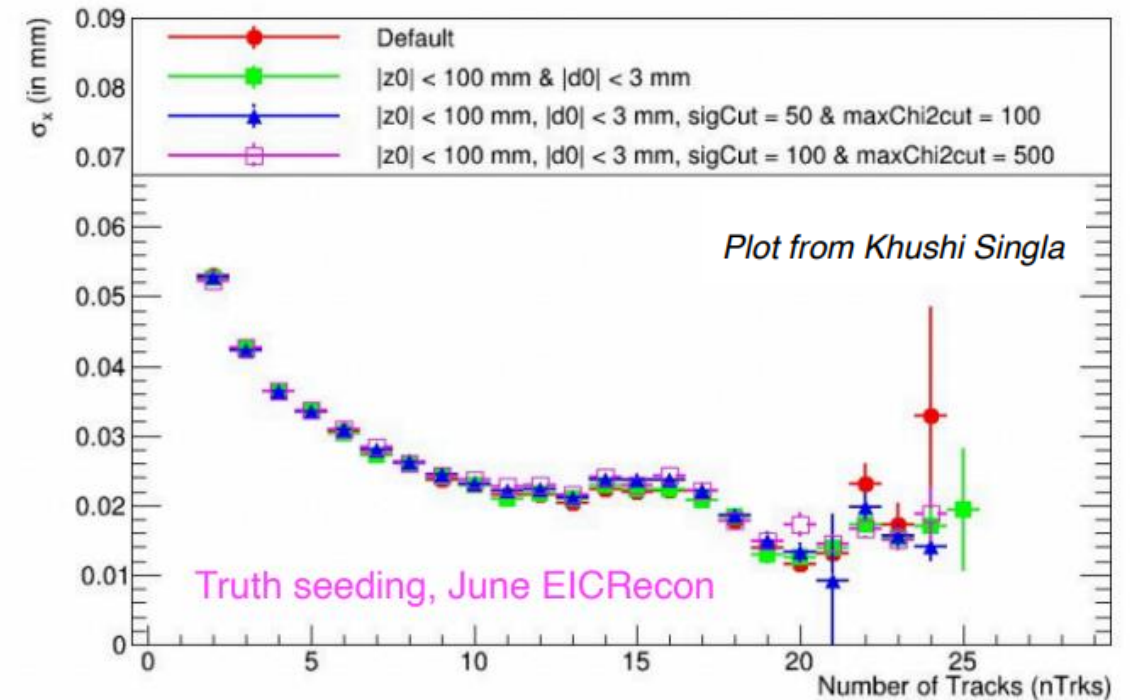
Updates on primary vertex finding / fitting

Improvement in vertexing efficiency with d0 and z0 selections. 94% efficiency for both truth and realistic seeding.

Can achieve vertexing resolution comparable to that in EIC YR

Caveat: DIS events generated at (x,y,z) = (0,0,0) for this study.

Summary / ongoing efforts

➢ We have presented recent developments in the track reconstruction software and resultant tracking and vertexing performance plots.

➢ Ongoing efforts:

1. Additional tuning of the seed finder
2. Tracking for minimum bias events and in the presence of background
3. Studies of angular resolution in the PID detectors
4. Initial work on secondary vertexing
5. Automated material map validation

Backup

Material budgets

Plots from Matt Posik
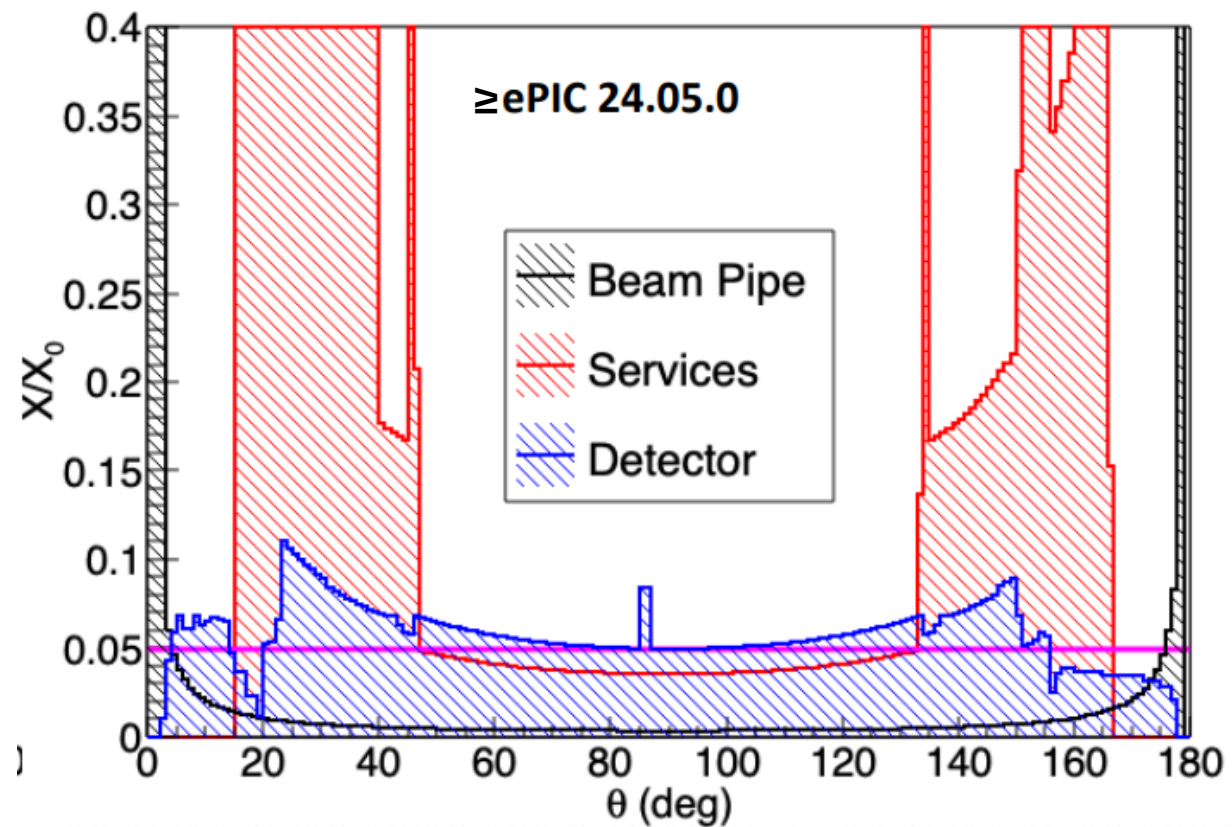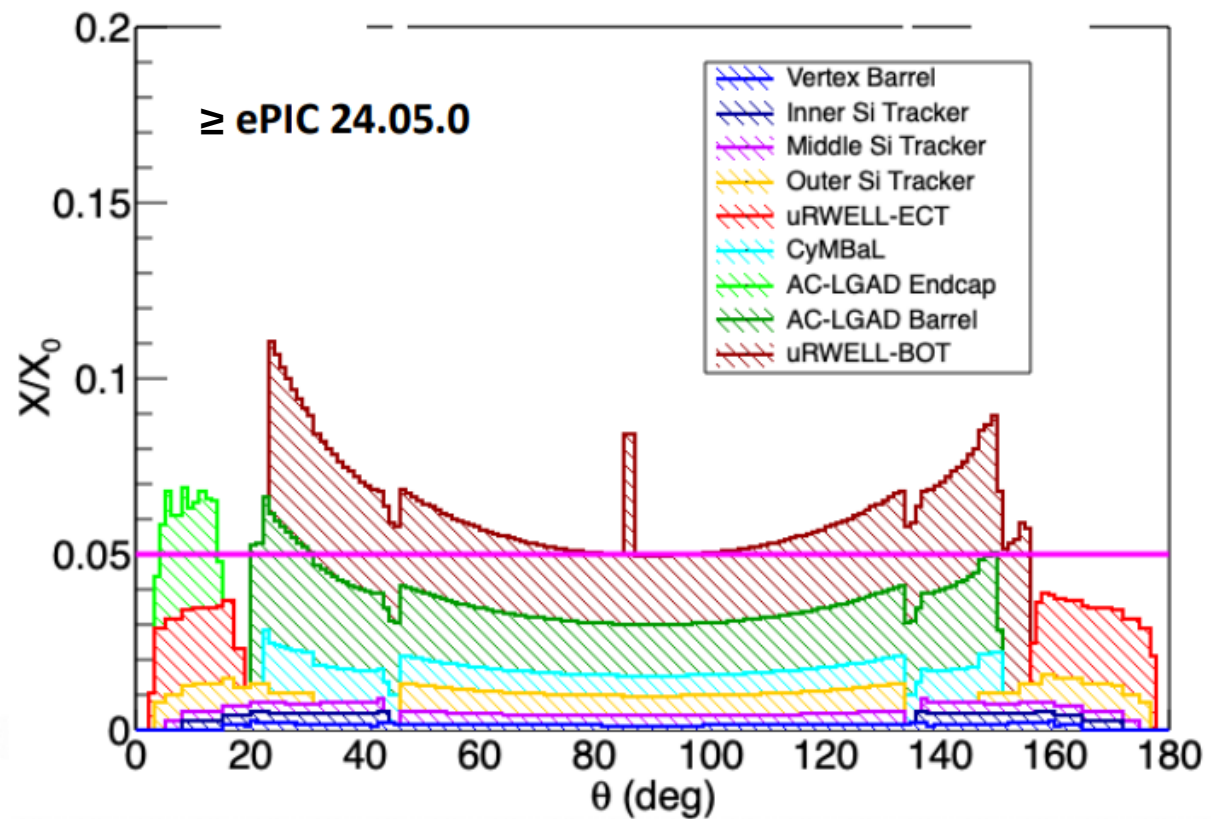
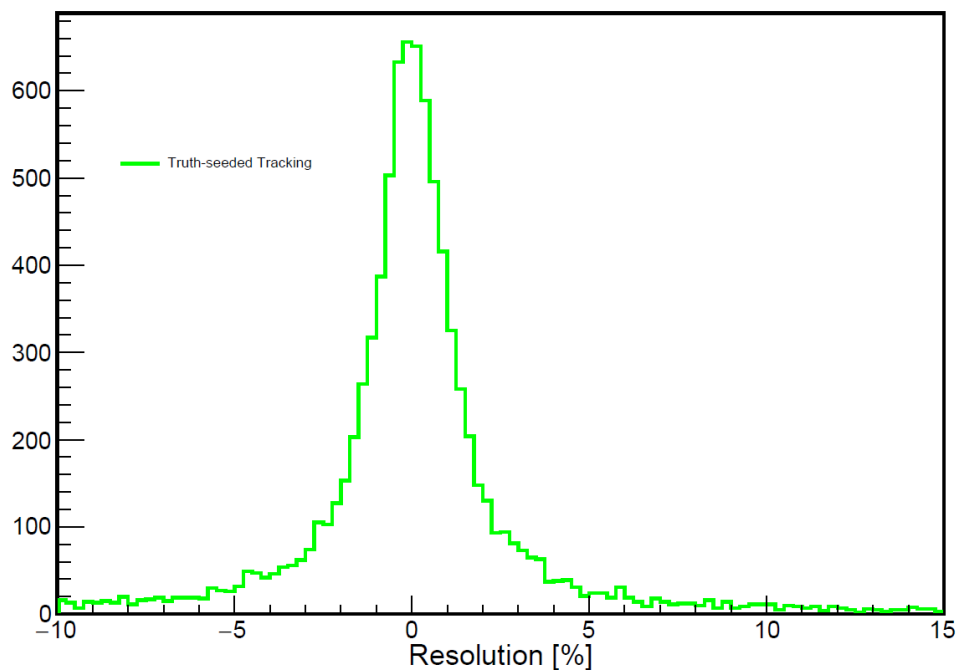# Single-particle momentum resolution integrated over all angles

Single μ^- generated:

0.5 GeV/c < P < 20 GeV/c

-4 < η < 4

Generated vertex: (0,0,0) mm

Momentum Resolution: (rec. - true)/true

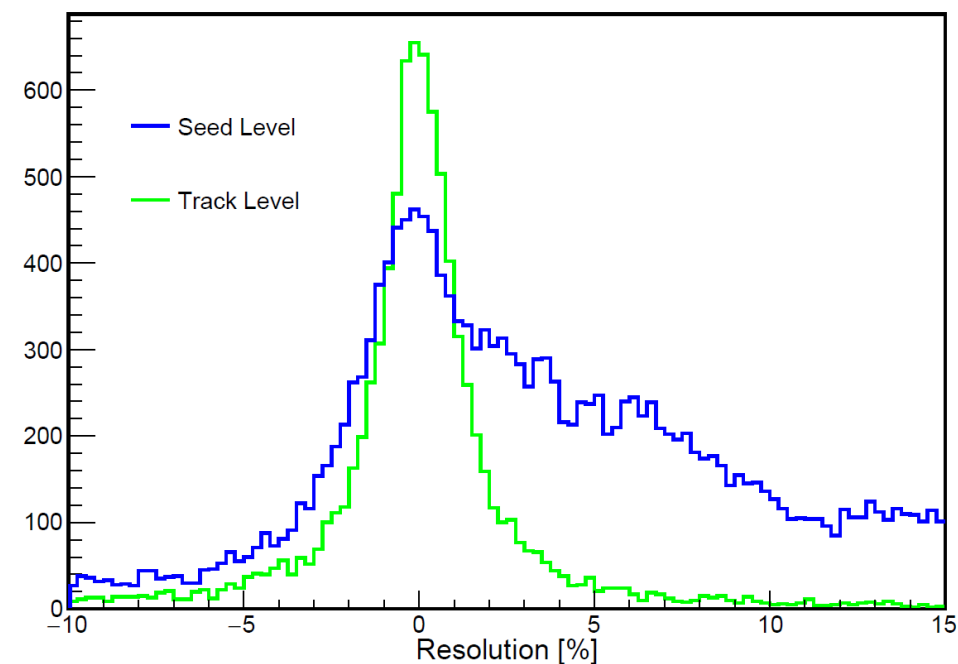**Truth-seeded tracking**

Real-seeded tracking
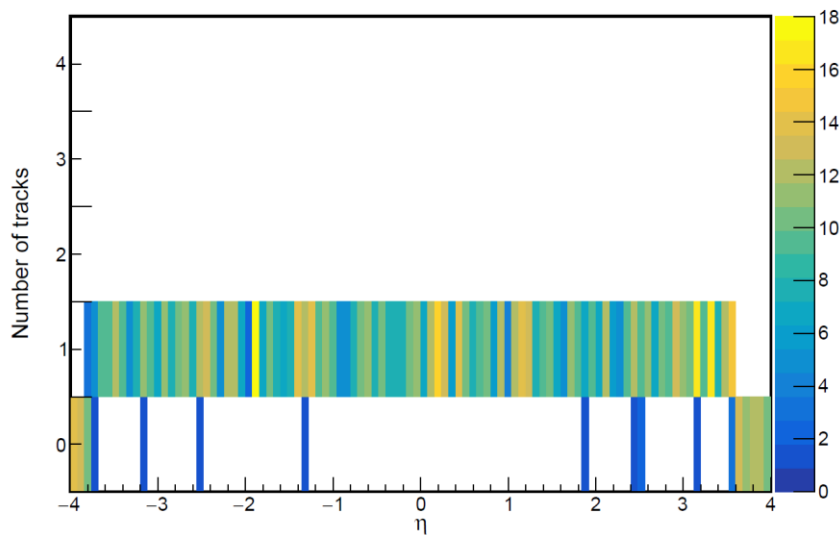
Updated single-particle results – multiplicity and efficiency

Number of tracks vs. generated particle η

Number of tracks vs. generated particle η

Single electron generated:

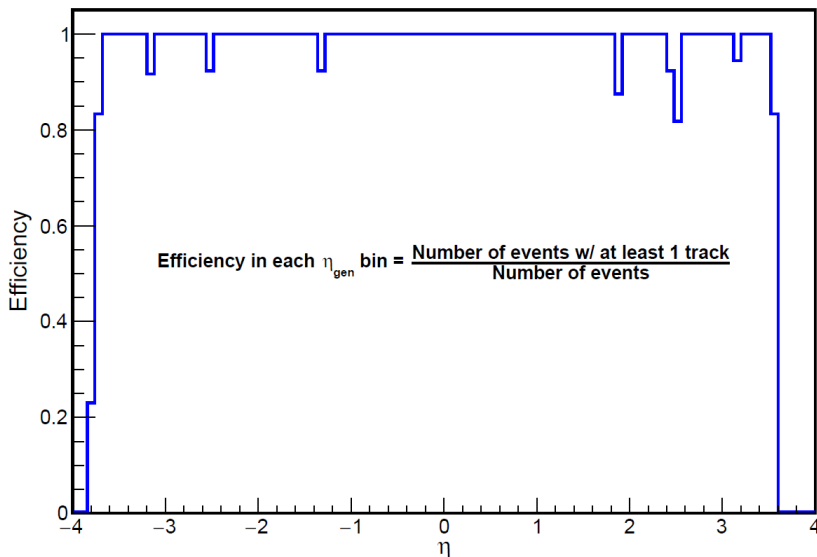0.5 GeV/c < P < 20 GeV/c

-4 < η < 4

Generated vertex: (0,0,0) mm

Truth-seeded tracking
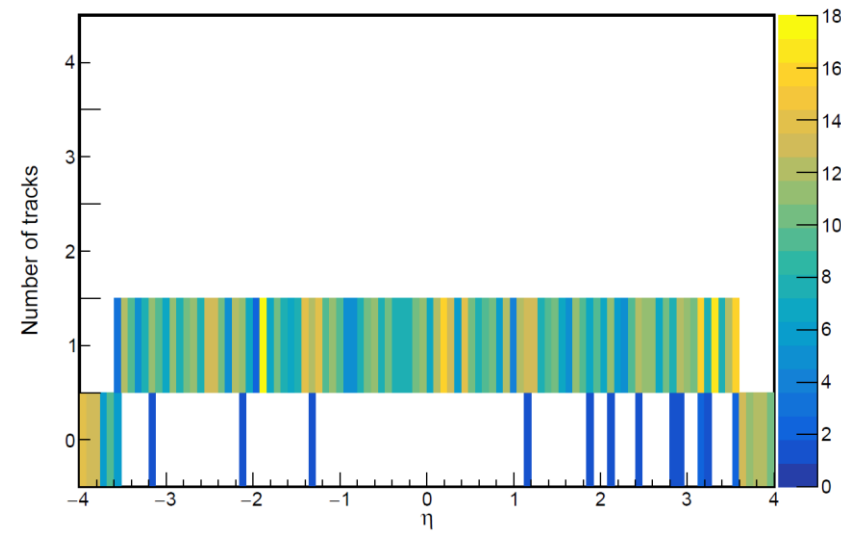
Real-seeded tracking

Tracker Efficiency vs. generated particle η

Efficiency in each η_{gen} bin = $\dfrac{\text{Number of events w/ at least 1 track}}{\text{Number of events}}$

Tracker Efficiency vs. generated particle η

Efficiency in each η_{gen} bin = $\dfrac{\text{Number of events w/ at least 1 track}}{\text{Number of events}}$
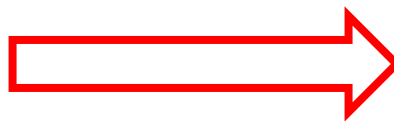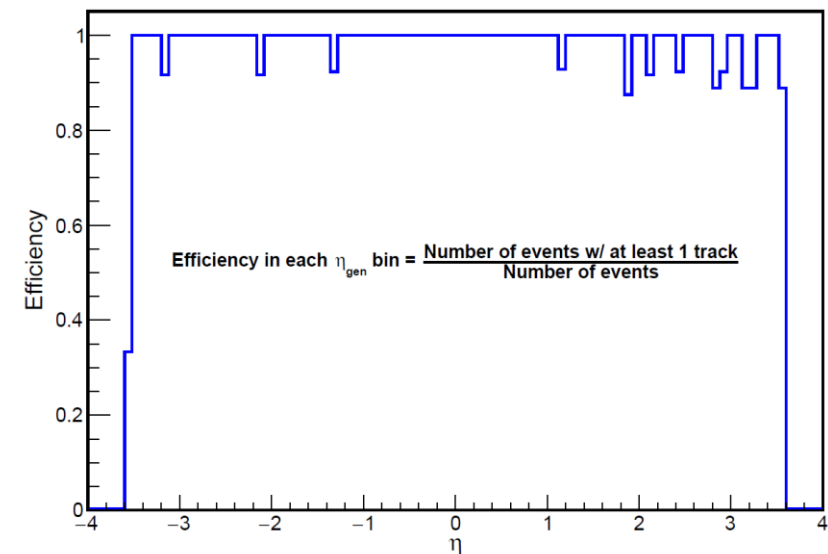
DIS charged particle spectrum with lower minimum P_t

Pythia8: 18x275 GeV, $Q^2 > 1$ GeV^2

— Generated charged particles w/ $P_T > 200$ MeV/c

— Real-seeded tracks w/ $P_T > 200$ MeV/c

— Truth-seeded tracks w/ $P_T > 200$ MeV/c

η_{gen} or η_{rec}