ePIC Tracking Simulation Updates

Shujie Li April 22 29, 2025 RNC-EIC meeting

1. Tracking study workflow on Perlmutter - Amir

- check tracking performance when
 - One SVT layer is disabled
 - The material thickness doubled
- Workflow to handle configuration change, material map, and batch submission
 - 4 cores x 128 threads per study
 - Parsl-enabled status monitoring
 - Discussed with Iraklii on ideas to improve
- Example results with single pion event \rightarrow
- Next:
 - Repeat this study for DIS+background
 - Similar study for MPGD and TOF



2. New background merged sample

	DIS	minBias (SIDIS)	electron beam gas (GeV)	SR (GeV)	proton beam gas (GeV)
Energy	10x275 (minQ2=1)	10x275	10x275	18	10x275
Frequency (kHz)	1.14 (for 18x275)	500	3177.25 (10000Ahr)	14000	350.3kHz (100Ahr)

Generated with Pythia6. Not recommended to mix this with other samples from Pythia8

In one merged event (2us):

# of events	0.002	0.9	6.4	28	0.7
# of particles	0.037	14.9	12.8	28	12.4

- Two scenarios:
 - 1. Realistic: mix DIS+electron/proton beam gas+SR according to their rate
 - DD4hep: 4sec/event, EICrecon: 2Hz
 - 2. Forced signal: only record events with DIS signals.
 - DD4hep: 10sec/event, ElCrecon: 0.7Hz
- To identify the signal and background events in the merged sample, use the same seed in HEPMCmerger but modified generator status code, then extract a separate list of particle indice from DIS signals.

3. Recent software changes

- Updated beampipe geometry <u>https://github.com/eic/epic/pull/842</u>
 - Need to check ACTS surface, and update material map, then validate tracking
 - New SR sample



- MPGD digitization algorithm
 - 2D digitization implemented in 25.02 but hits are not correctly handled
 - <u>Reverted</u> for 25.04







← Barak will add this hits plot to benchmark

Plan for SVT preTDR

- Geometry:
 - Use updated beam pipe
 - Curved IB, and default OB
 - Disk placement tbd
- Reconstruction algorithm:
 - Known inefficiencies at <0.5GeV from seeding
 - Use old digi algorithm for MPGD
- Event sample:
 - New DIS+background event sample
- Performance study:
 - Efficiency, purity, resolution (dp/p, theta, phi, DCAr)
 - (2nd) vertexing tbd