SVT Simulations

Shujie Li, ES
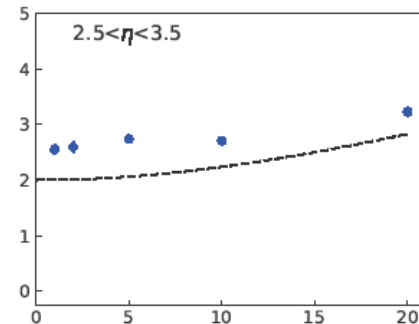
Where are we?
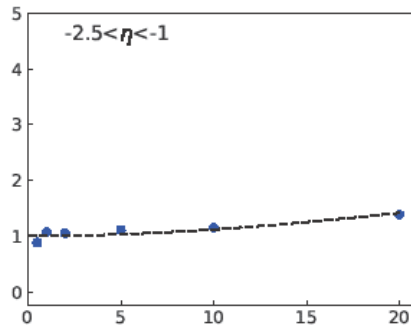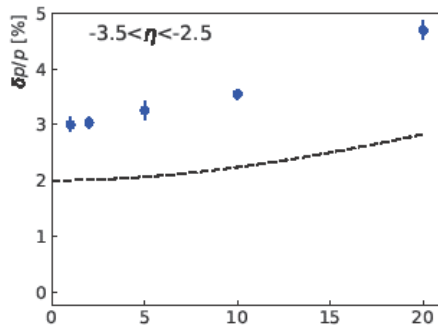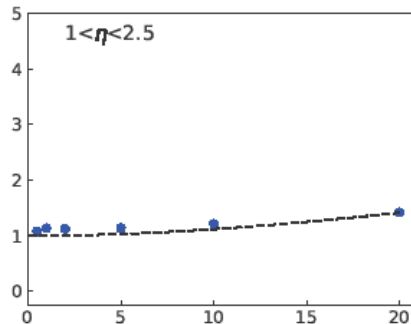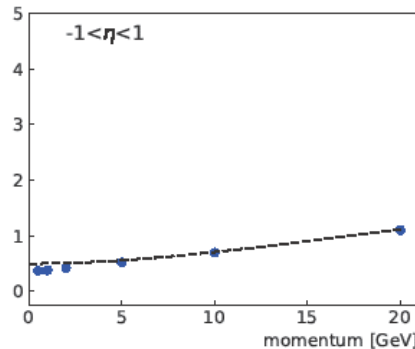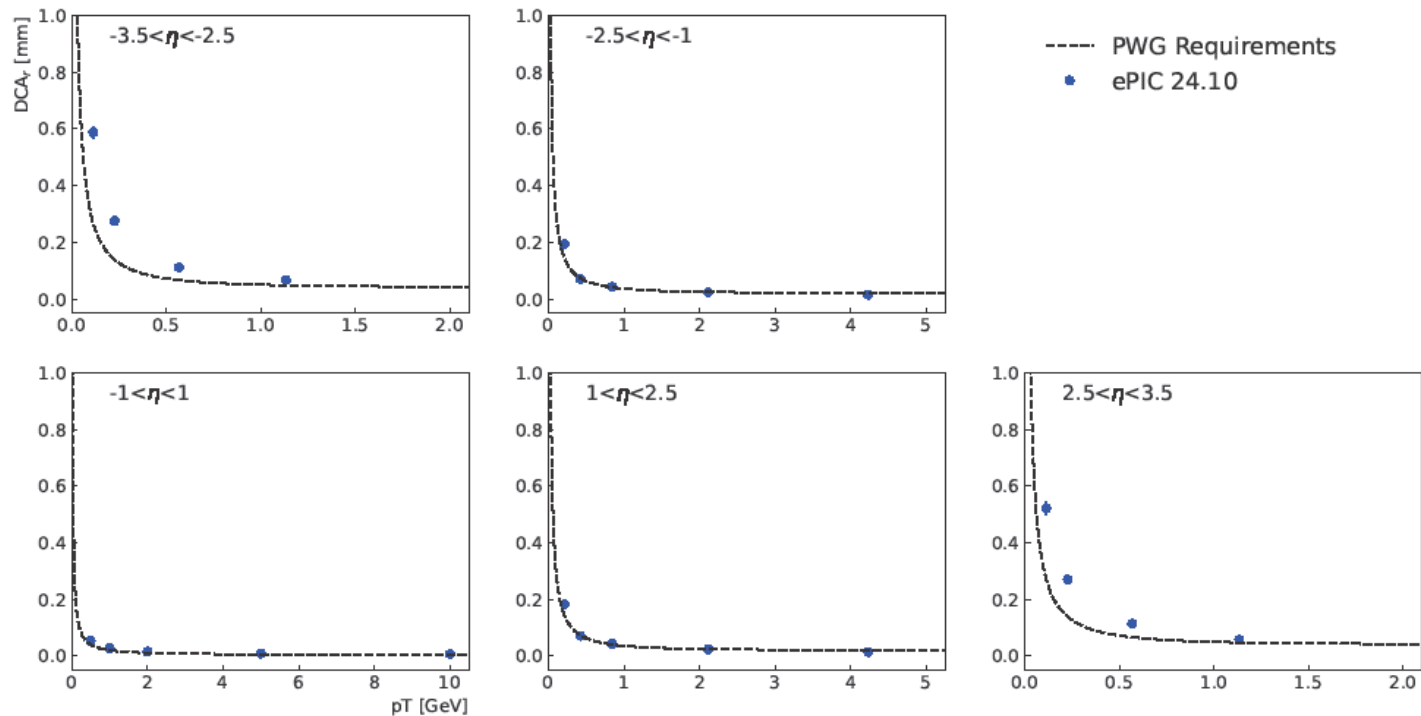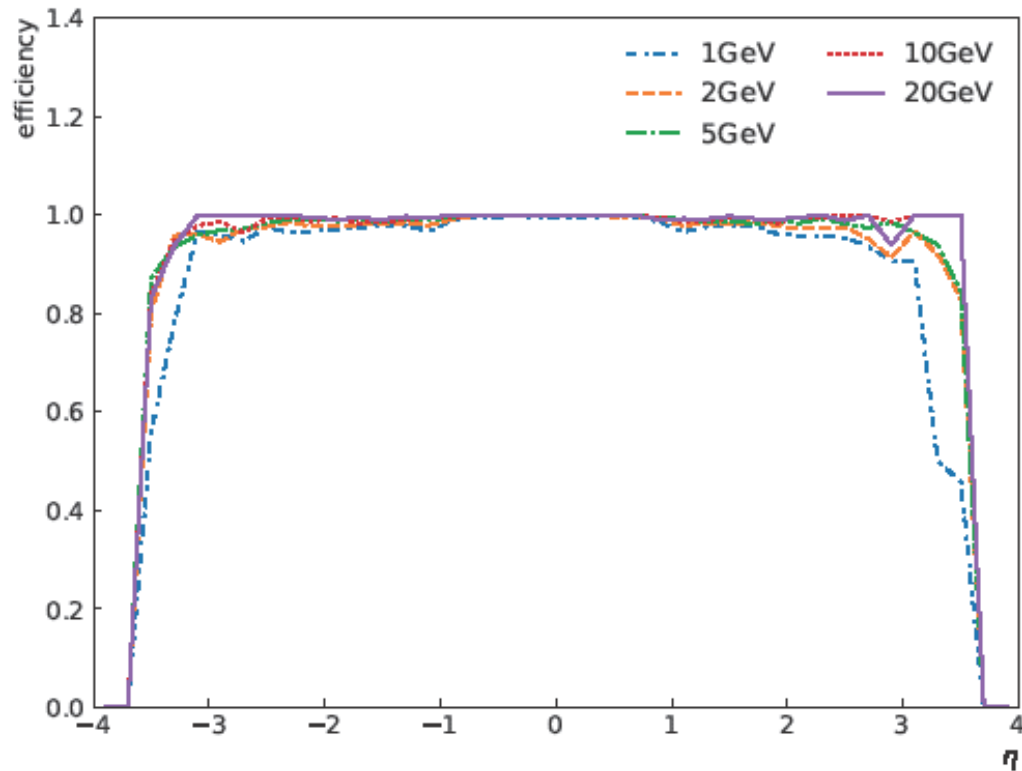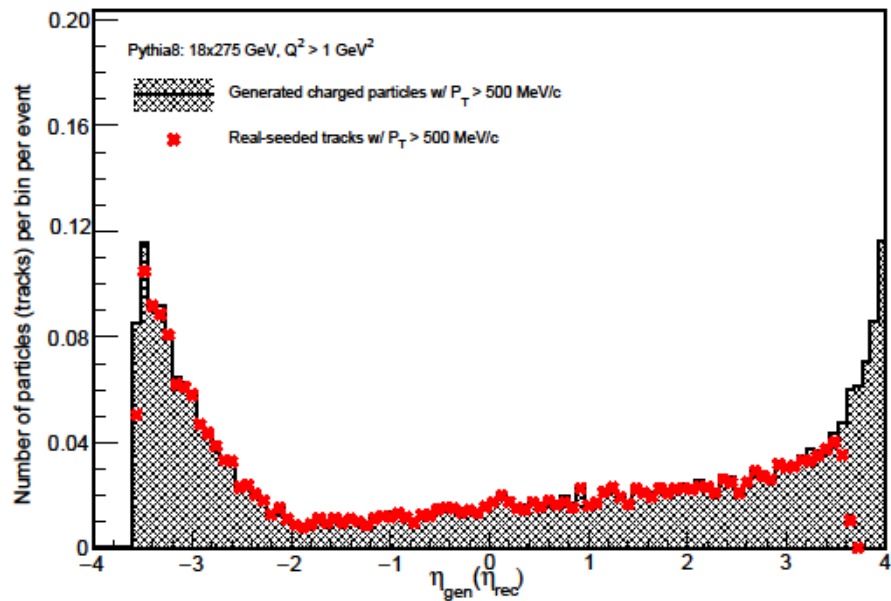
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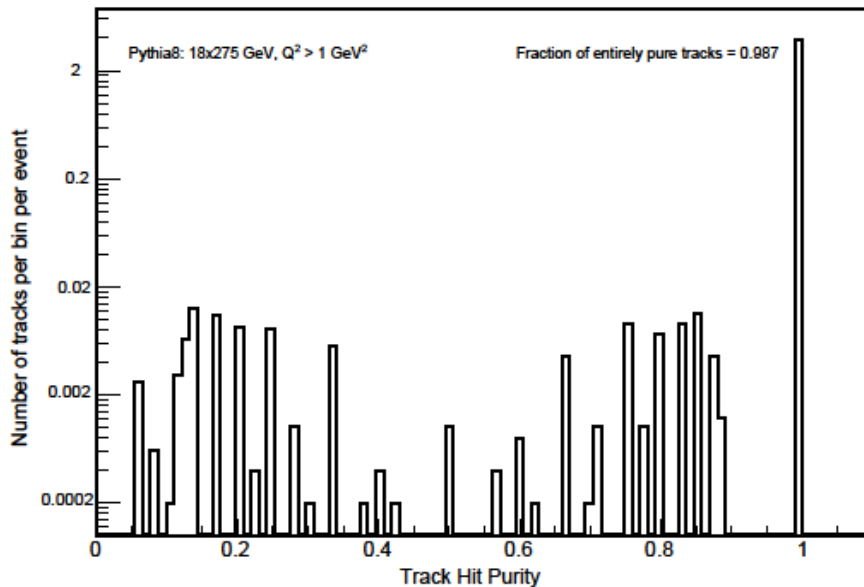
Where are we?

Where are we?

In the ePIC software stack:

- performance metrics from real-seeded tracks (i.e. track finding and reconstruction),

- performance metrics on single-tracks and on DIS-events

Where are we not or not yet?

In the ePIC software stack:

- No demonstration yet of performance with DIS events + backgrounds + detector noise,

- Detector description is still far from complete,

- (No rapid-feedback loop between design and simulation),

Detector description – IB example

- **Official (25.01):**
  - 128 box shape per layer to approximate the cylinder
  - No RSU structure
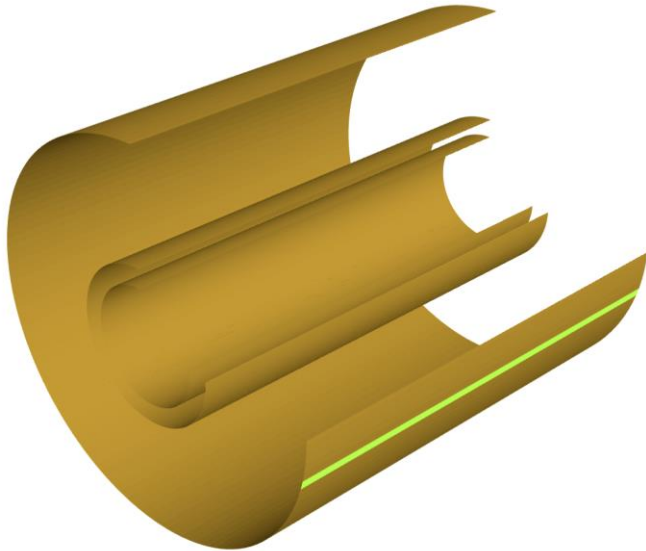
- **Recent developments** (https://github.com/eic/epic/pull/803):
  - With RSU structure:
    - 4 sections / RSU + inactive areas
  - Smooth cylindrical surface
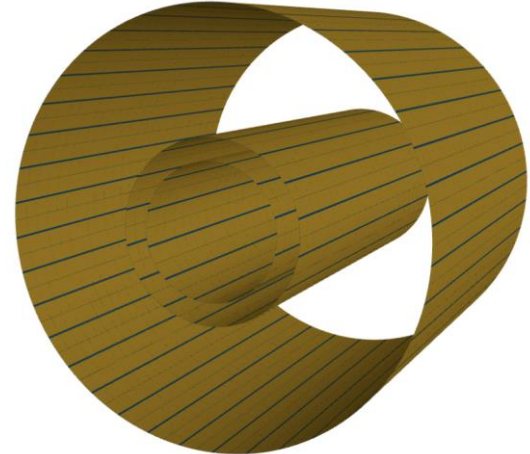
Detector description – IB example

Event sample:
20k 5GeV pi+, -0.5<eta<0.5, 0<phi<30 degrees

Sim hits from L0 and L1:
Sensors are curved with acceptance
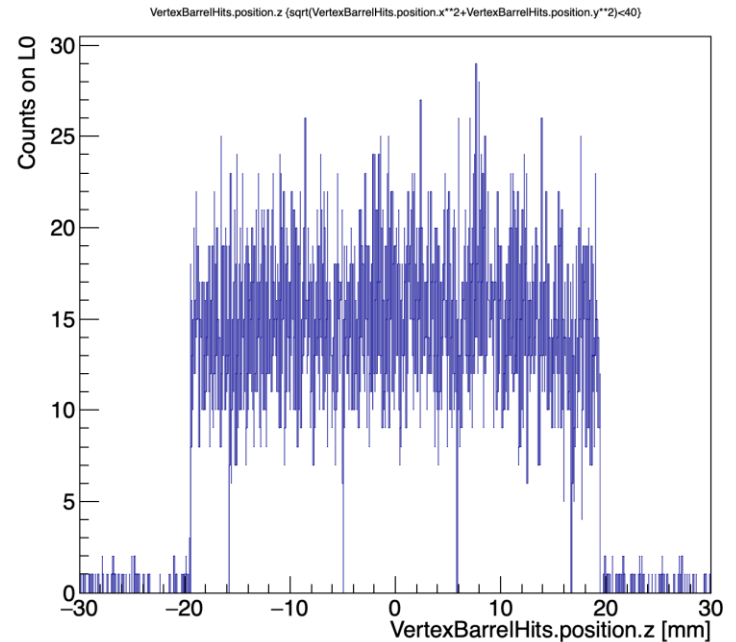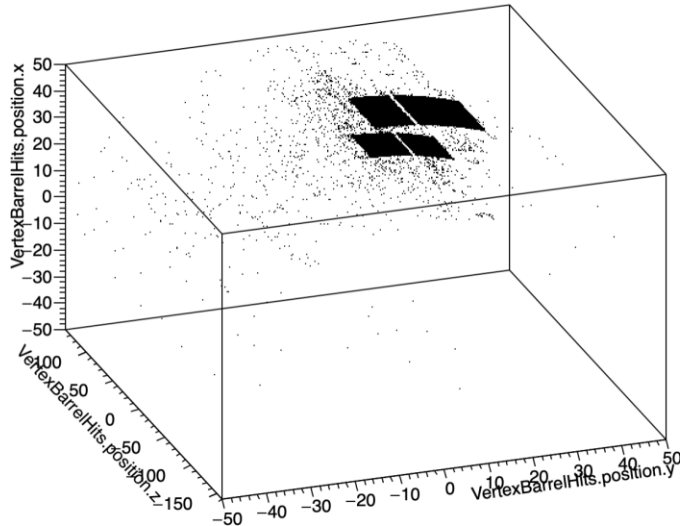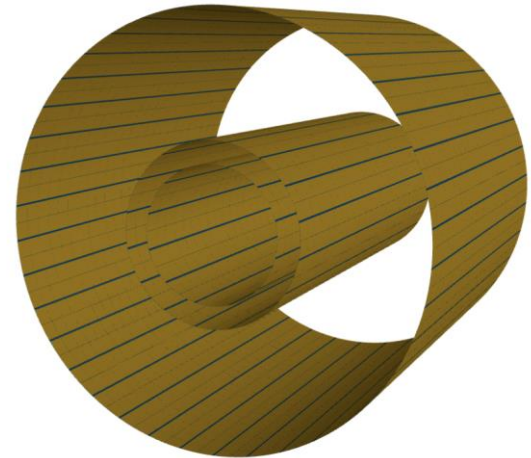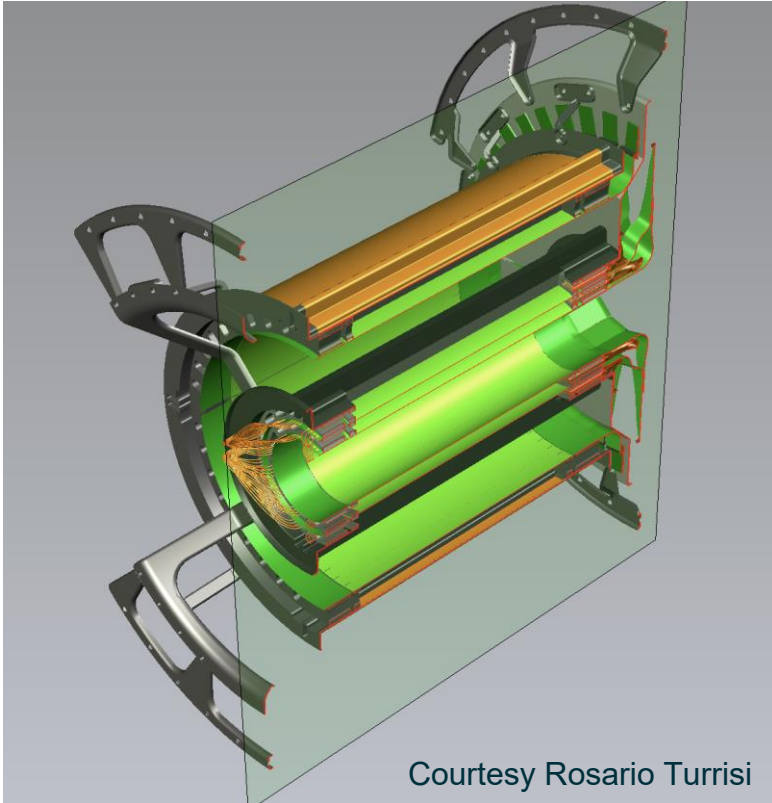gaps from insensitve areas

Curved Sensor

- Git branch: epic/svt_curved
- **New geometry plugin:**
  - SVTBarrelTracker_geo.cpp
  - Use **Tube** instead of Box shape in TGeo.
  - Build each part as described on page 4
    - Tried to use SubtractionSolid for the frame, but it has weird residual volumes (internal precision issue b/w G4 and TGeo?)
  - Passed overlap check
  - **Segmentations:**
    - Multisegmentations to handle 3 layers
    - CylindricalGridPhiZ. phi=0.02mm/radius, z=0.02mm

- **New geometry description:**
  - Vertex_barrel_curved.xml
  - Radius (L0, L1, L2):
    - Was: 36, 48, 120 mm
    - Now: 37.365, 49.820, 124.548mm
      for 12,   16,   40 RSU in phi

VertexBarrel_layer1_0
  L0_0
    UpperLeftTile_0
    UpperLeftTile_biasing_1
    UpperLeftTile_readout_2
    UpperLeftTile_backbone_3
    UpperRightTile_4
    UpperRightTile_biasing_5
    UpperRightTile_readout_6
    UpperRightTile_backbone_7
    LowerLeftTile_8
    LowerLeftTile_biasing_9
    LowerLeftTile_readout_10
    LowerLeftTile_backbone_11
    LowerRightTile_12
    LowerRightTile_biasing_13
    LowerRightTile_readout_14
    LowerRightTile_backbone_15
  L0_1

Detector description – IB example

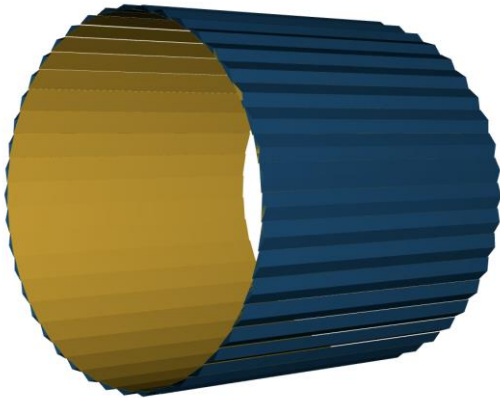Courtesy Rosario Turrisi

Still a ways away from CAD designs…

Two possible paths forward:
Engineer drawings available, options to convert:
1. Resolve all small overlaps, check the mesh grids with the cylinder shape, then convert the drawing to DD4hep,
2. Sort out shape and material of major pieces, and manually implement them in DD4hep,
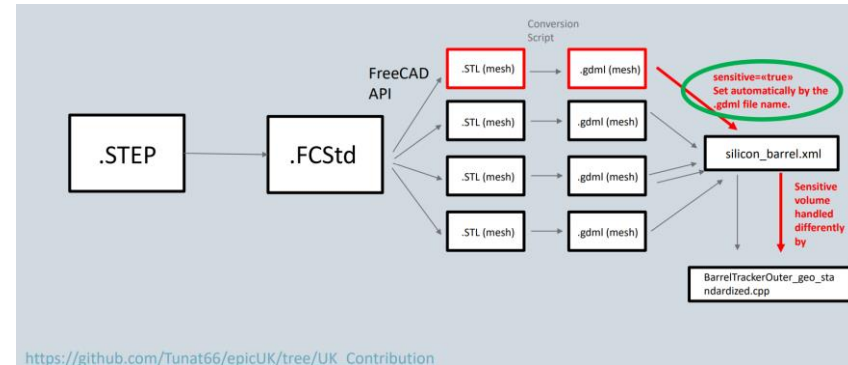
Detector description – OB example

- **Official (25.01):**
  - Stave with truss-like support structure

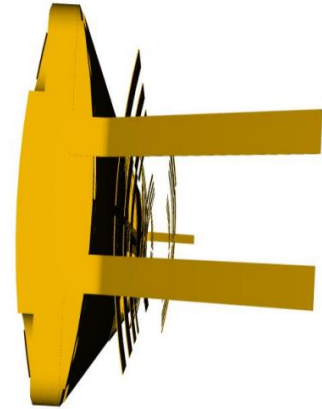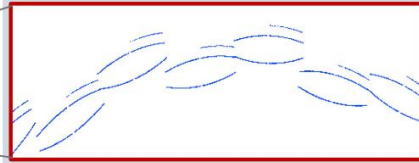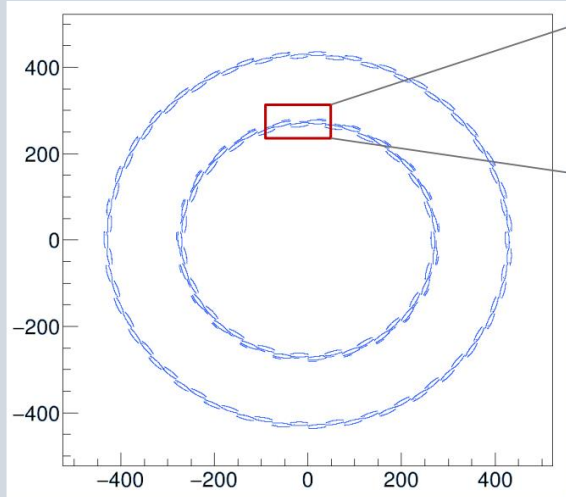- **CAD "import" pioneered by Sam Henry and collagues, c.f.**
  https://indico.bnl.gov/event/25167/contributions/97894/attachments/57990/99584/Tracking%20simulation%20OB.pdf

Detector description – OB example

Geoviewer / hit map reveals something not quite right

Detector description – OB example
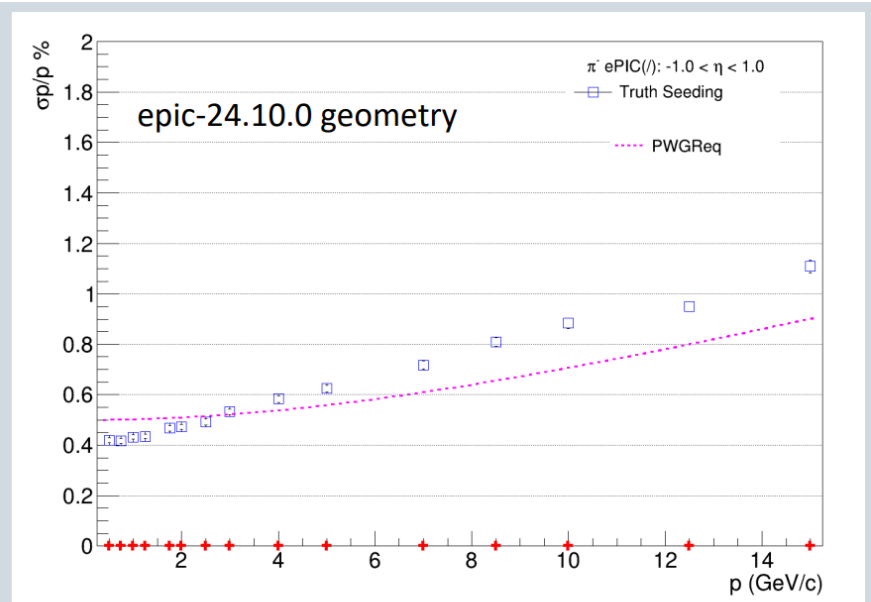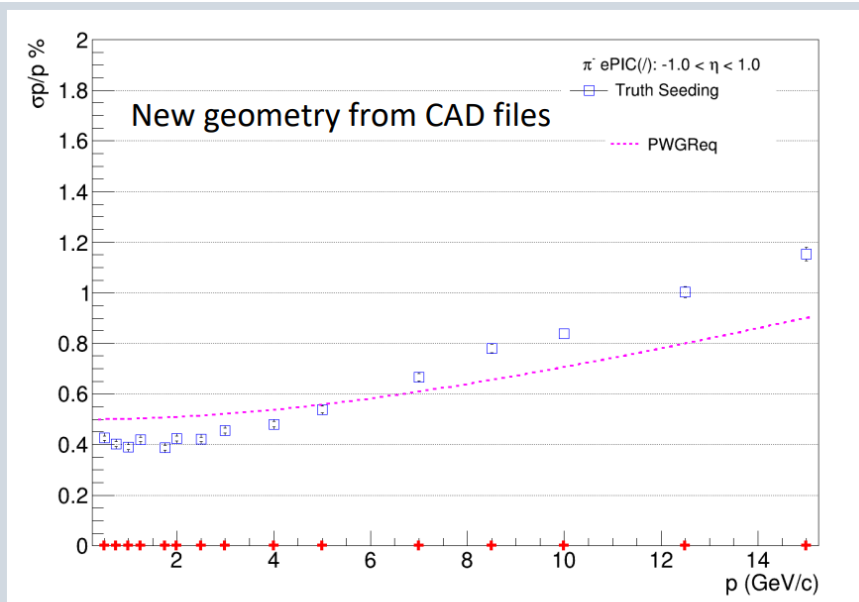
Run time: 92±25 minutes   Run time: 10±3 minutes

Running ddsim and eicrecon on 10,000 events

What do we need?

Demonstration of sufficiency of the ePIC tracking system for DIS + background + noise events

Hit rates at the sensor level are increasingly critical

More advanced detector description, including an updated services model,

…

That is,

Concerted effort, i.e. find additional dedicated effort / person-power,

? – "Hackathon" e.g. adjacent to an upcoming ACTSNP workshop (May 14-16, 2025 in Berkeley)
   -- SVT in-person workshop in June/July 2025 timeframe in the Long Island area