Progress report on EicRoot tracking

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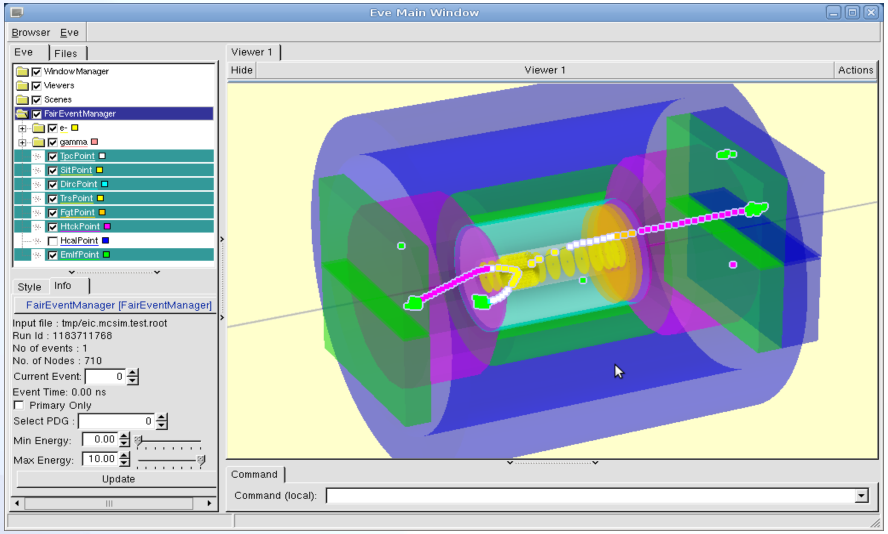
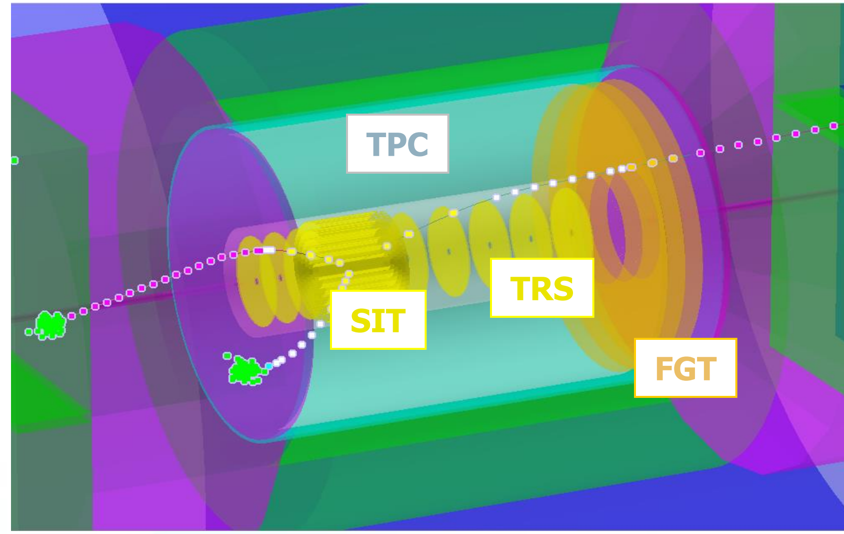
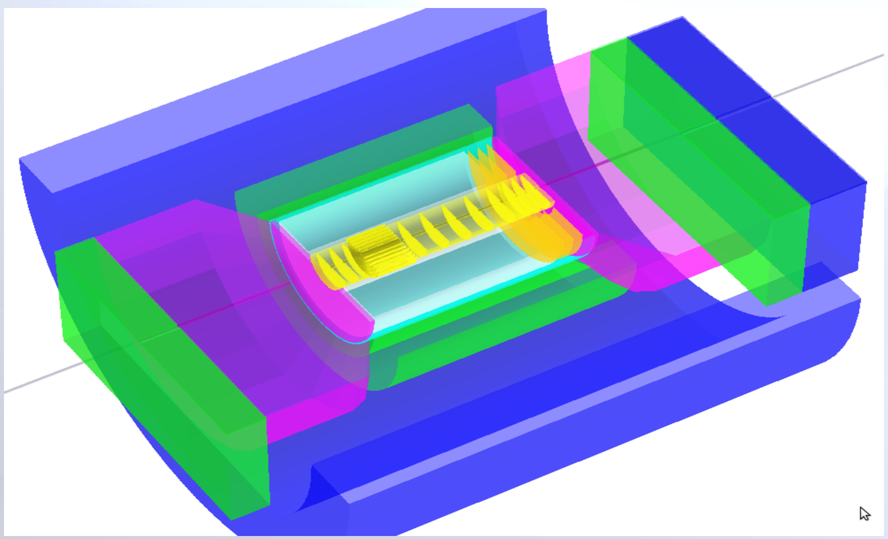
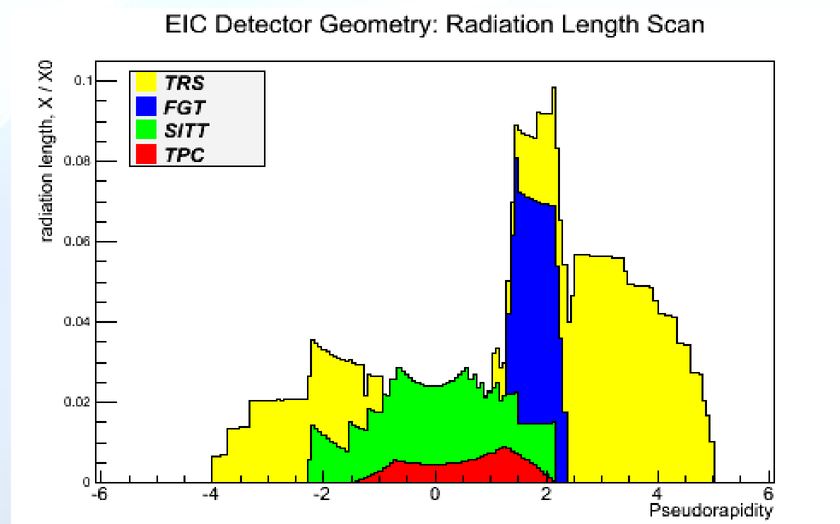
October'2012 presentation









-> look nice, but: just MC points & tracks

EIC in FairRoot framework

- Simulation, reconstruction, visualization …

FairRoot external package bundle → **FairBase C++ classes** →

- **CbmRoot**
- **R3BRoot**
- **PandaRoot**
  - → **EicRoot**
- **MpdRoot**

- GEANT3, GEANT4, etc
- ROOT
- VGM
- … and several other things

-> Make best use of PandaRoot code development

-> Have no need to manually back port bug fixes

End user view

- Use either private (from SVN) or official installation
- No executable (steering through ROOT macro scripts)

simulation → **digitization** → **reconstruction** → **"PID" Pass**

simulation	digitization	reconstruction	"PID" Pass
-> MC points	-> Hits	-> "Short" tracks	-> "Combined" tracks
		-> Clusters	-> Vertices @ IP

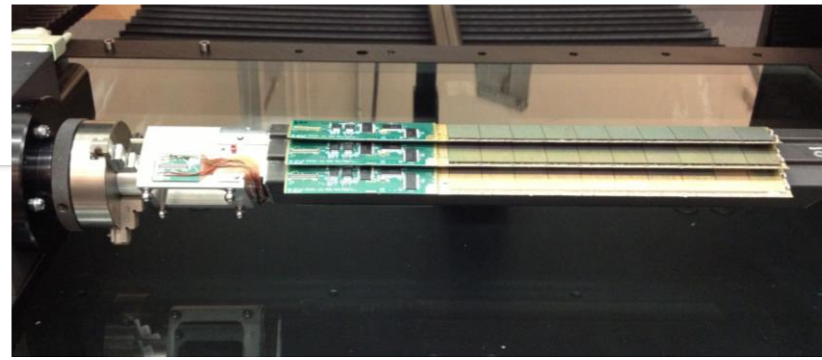
- ROOT files for analysis available at every stage
- C++ class structure is well defined at each I/O stage

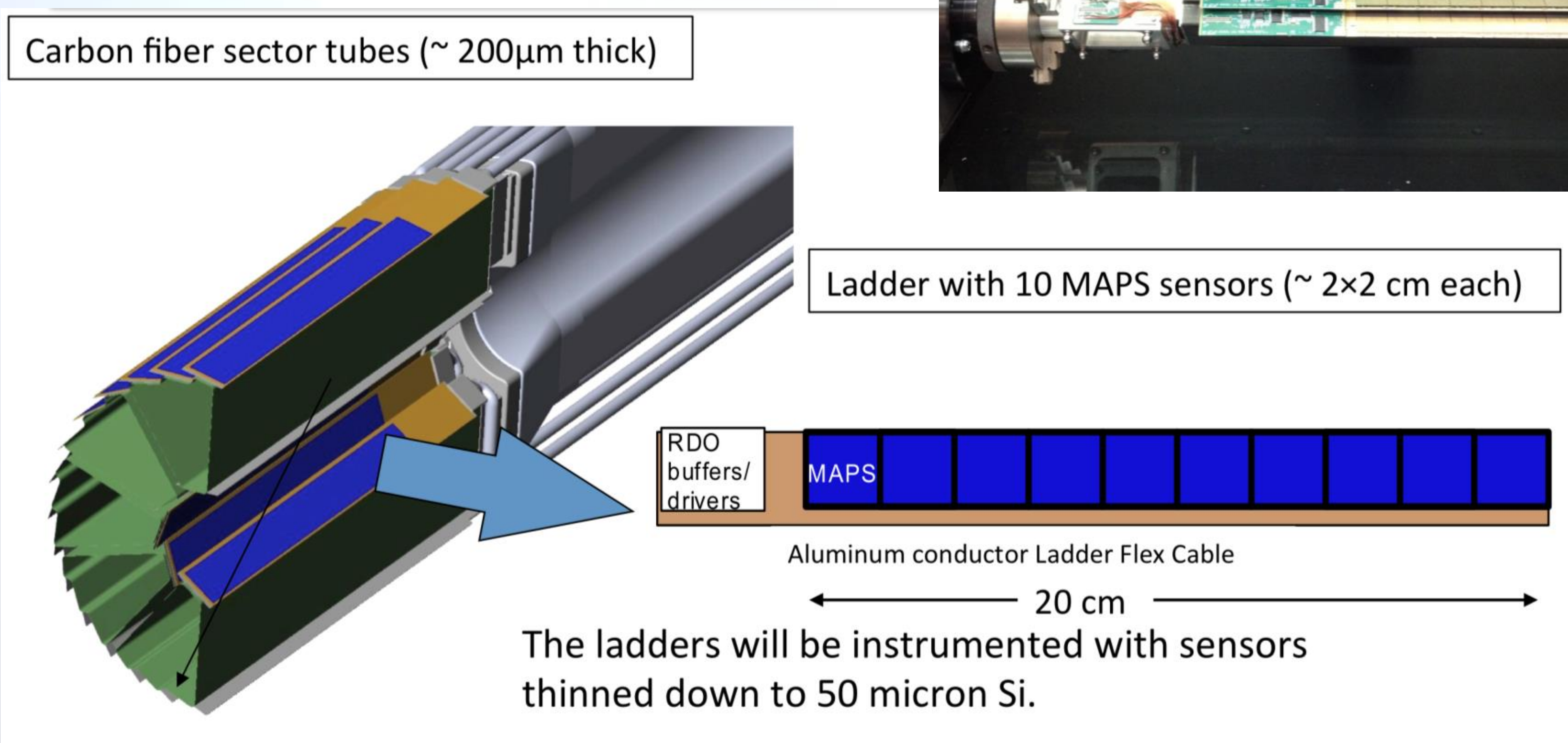
EicRoot tracking

- Magnetic field interface exists
- Detector geometry is described in 0-th approximation:
  - Silicon vertex tracker
  - Silicon forward/backward tracker
  - TPC
  - GEM forward tracker
- Digitization exists (simple yet useable)
- Ideal track reconstruction inherited from PandaRoot codes

Vertex silicon tracker

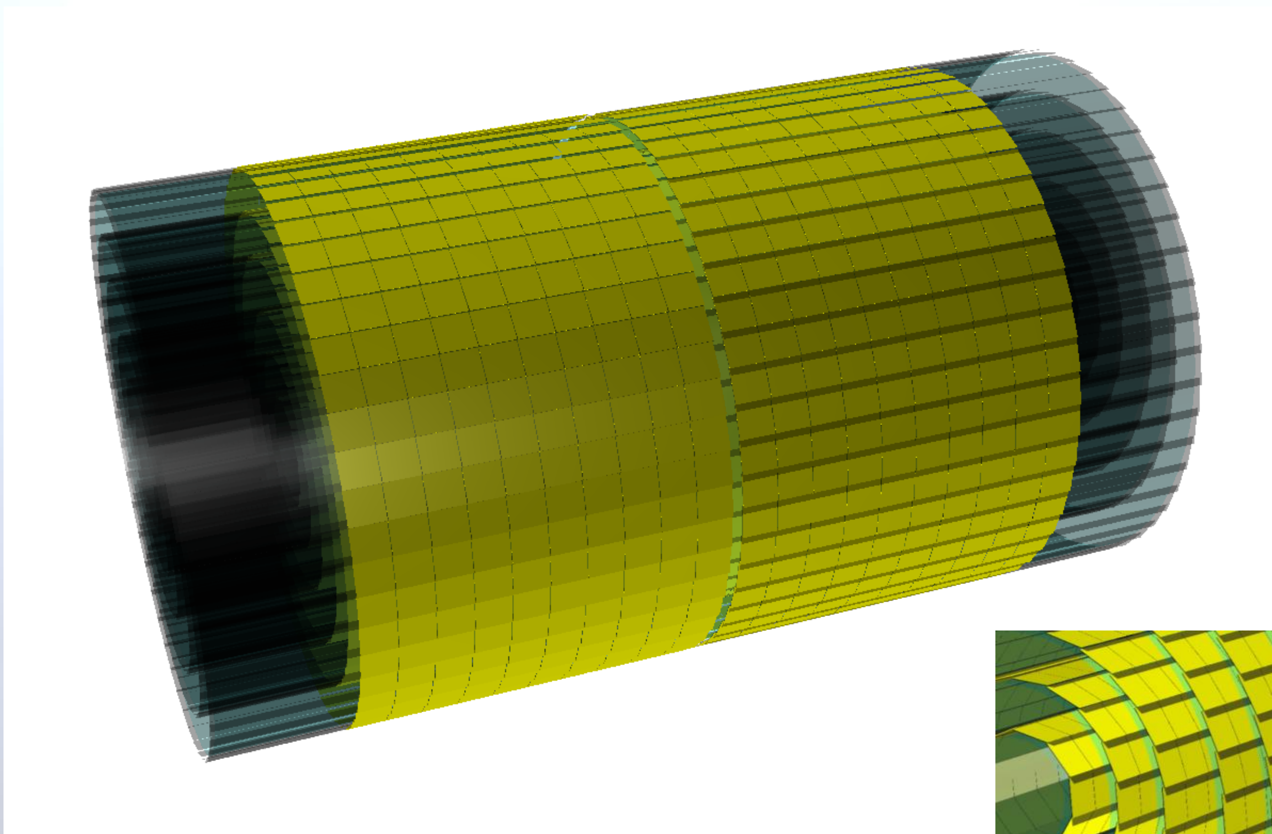
- MAPS technology; ~20x20mm^2 chips, ~20 μm 2D pixels
- STAR upgrade “building blocks” (cable assemblies)

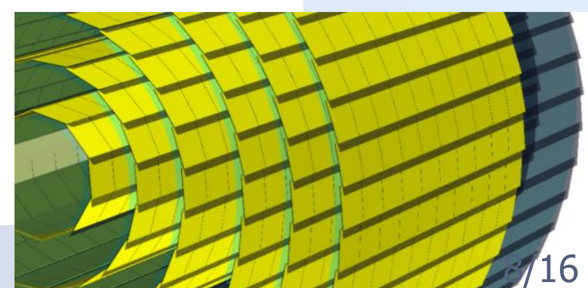




Vertex silicon tracker

- 6 layers at [30..160] mm radius
- 0.37% X_0 in acceptance per layer simulated precisely;
- digitization: single discrete pixels, one-to-one from MC points

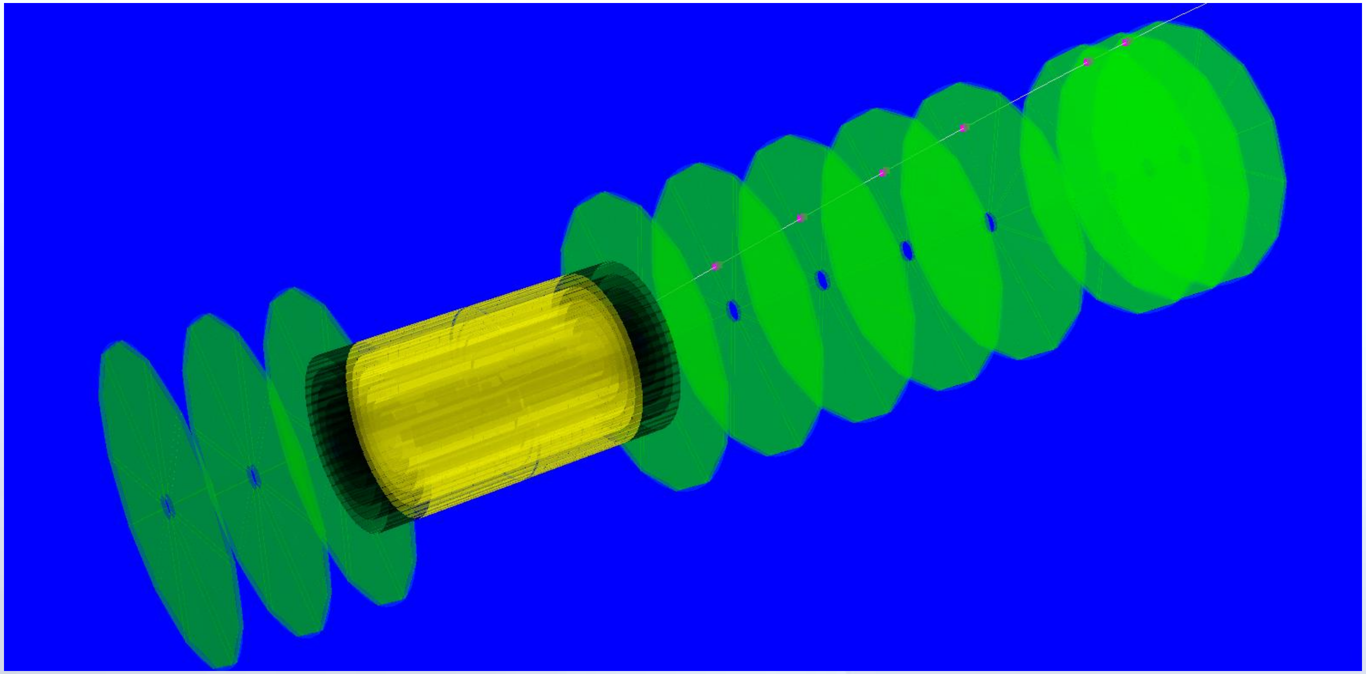




Forward/backward silicon tracker

-> desired configuration:

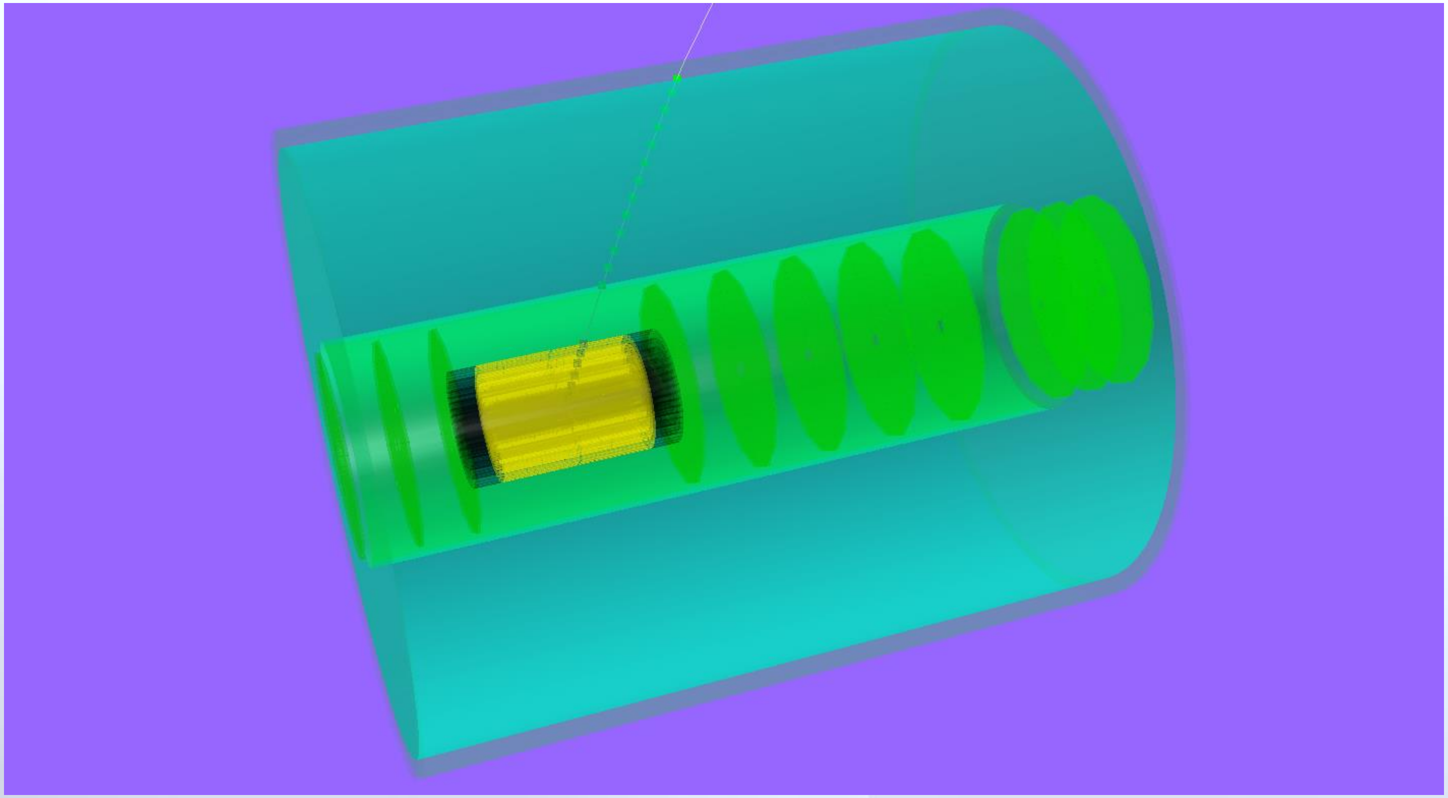
- 3+5+3 silicon disks with up to 280 mm radius
- N sectors per disk; 200 μm silicon-equivalent thickness



- digitization: discrete ~20x20 μm^2 pixels

TPC

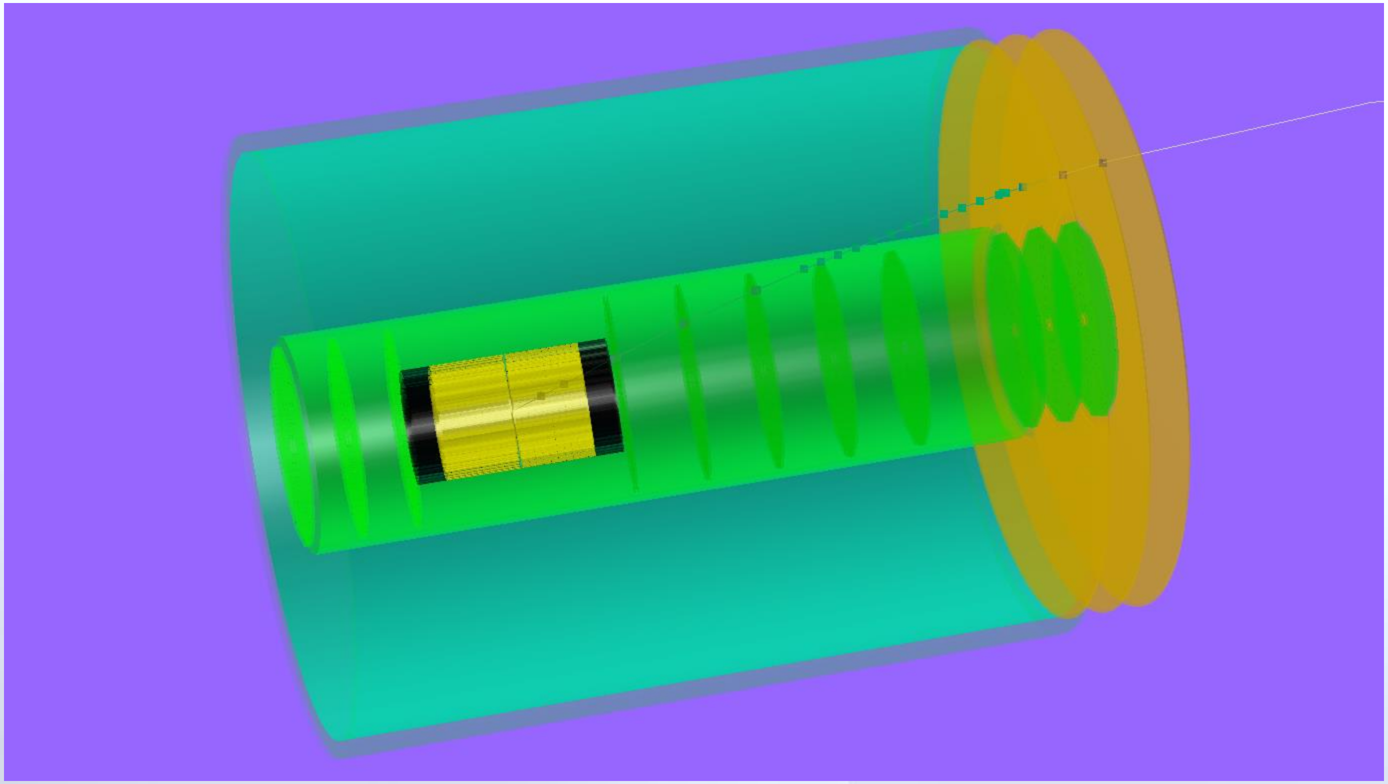
- ~2m long; gas volume radius [300..800] mm
- 1.2% X_0 IFC, 4.0% X_0 OFC; 15.0% X_0 aluminum endcaps



- digitization: assume known diffusion coefficients in "XY and "Z" and 1x5 mm GEM pads (so up to 100 points per track)

Endcap GEM

- 3 disks behind the TPC endcap
- STAR FGT design



- digitization: 100 μm resolution in X&Y; gaussian smearing

Tracking scheme

- So-called ideal PandaRoot track "finding":
  - Monte-Carlo hits are digitized on a per-track basis
  - Effectively NO track finder used

- PandaRoot track fitting code:
  - Kalman filter
  - Steering in magnetic field
  - Precise on-the-fly accounting of material effects

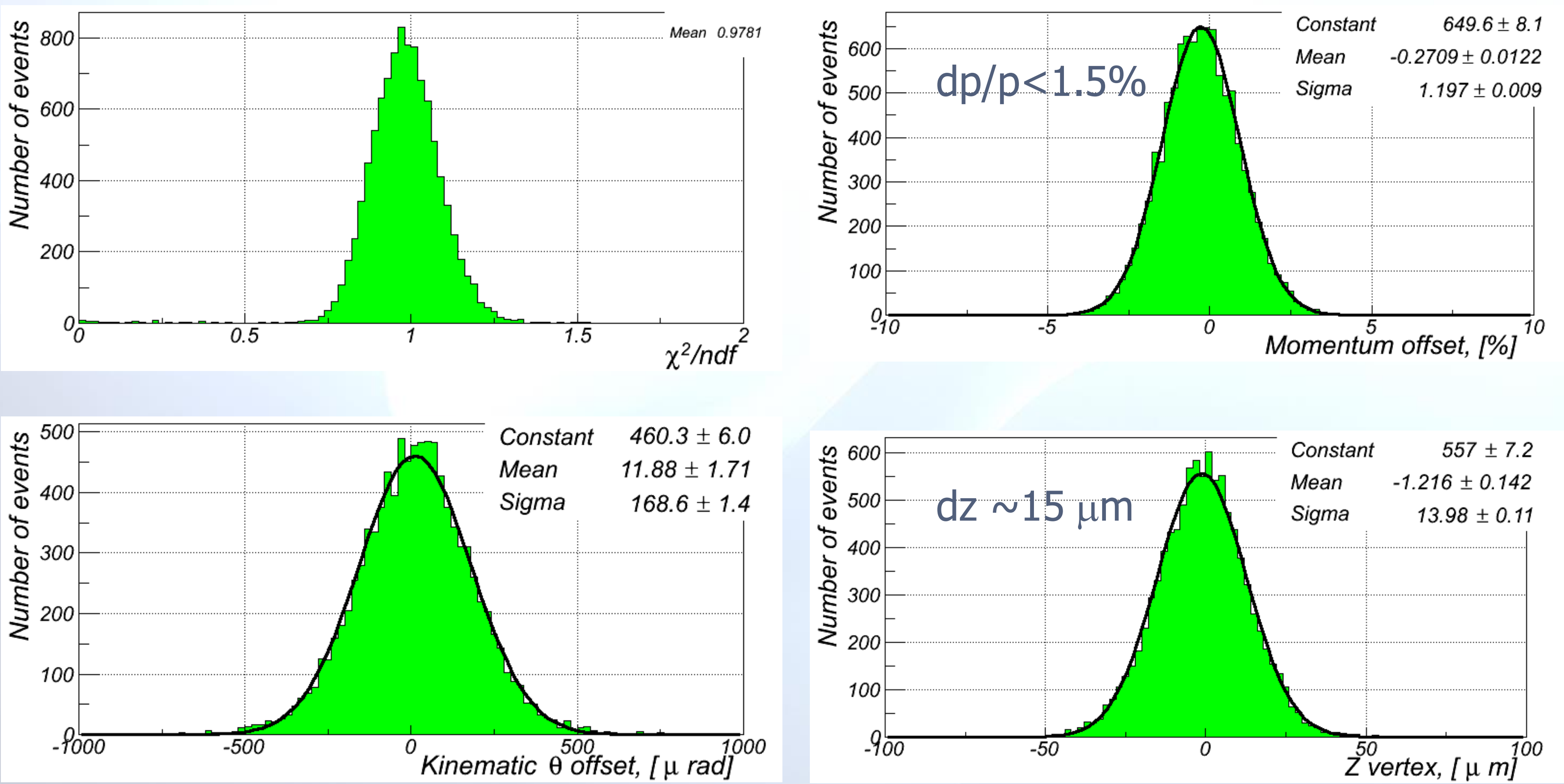
-> pretty much useable for acceptance and single-track resolution studies;

-> less suitable for radiation length scans;

-> hardly useful for efficiency and occupancy estimates;

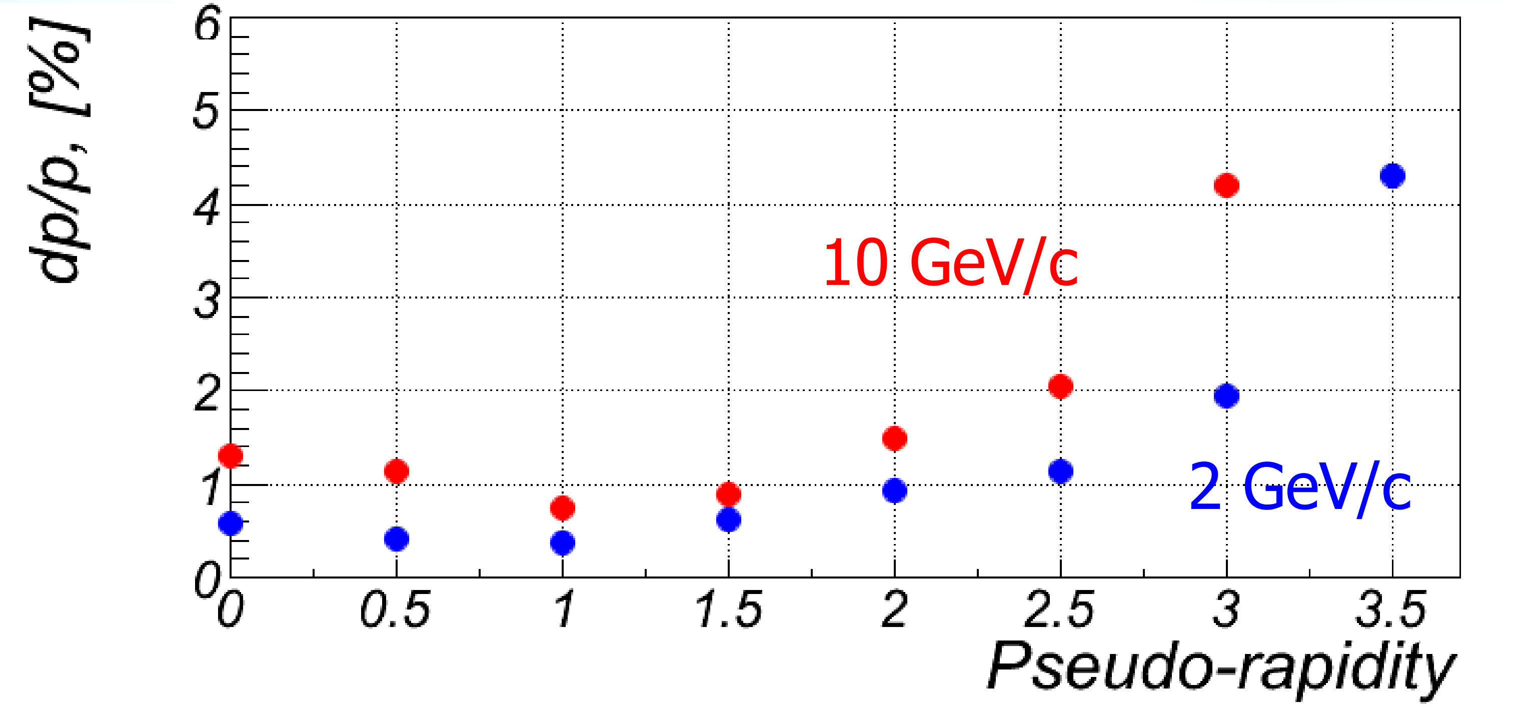
Example plots (1)

Simulate and reconstruct 10k 10 GeV/c π^+ tracks at $\eta=0.5$:



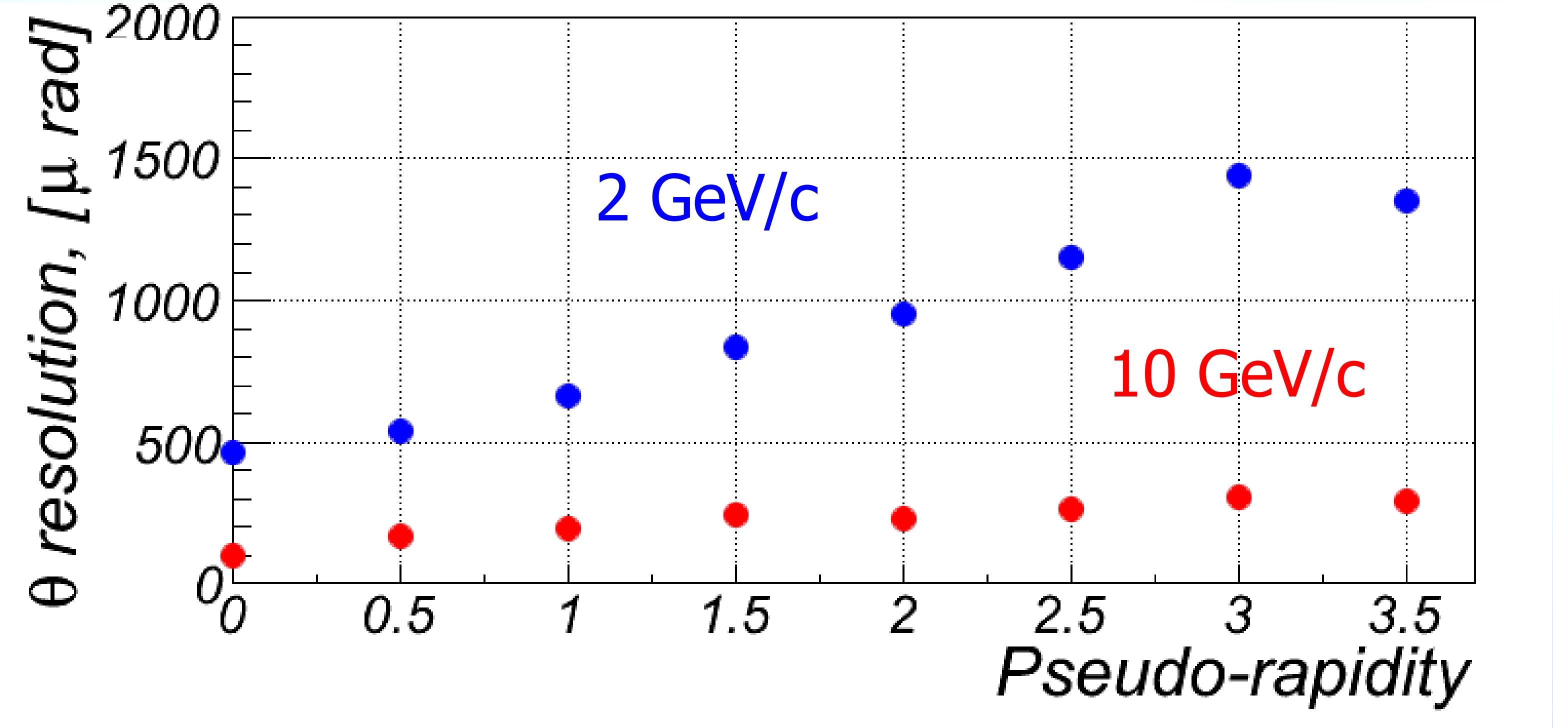
Example plots (2)

π^+ track momentum resolution vs. pseudo-rapidity



Example plots (3)

π^+ track angular resolution vs. pseudo-rapidity



-> watch dead material effects!;

Outlook & TODO list

- Finalize initial geometry
- Take care about official release & installation

- Perform geometry optimization
- Implement more realistic digitization schemes

- Think about track finder algorithms

- Start PID detector implementation