Missing tracks in BO

31 October 2024

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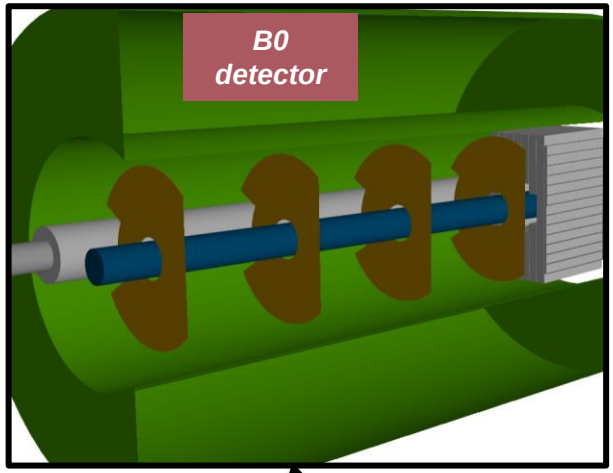
EPIC far-forward detectors



Detector	Acceptance
Zero-Degree Calorimeter (ZDC)	θ < 5.5 mrad (η > 6)
Roman Pots (2 stations)	0.0* < θ < 5.0 mrad (η > 6)
Off-Momentum Detectors (2 stations)	0.0 < θ < 5.0 mrad (η > 6)
B0 Detector	5.5 < θ < 20 mrad (4.6 < η < 5.9)

EPIC far-forward detectors

Joint acceptance in ePIC detectors

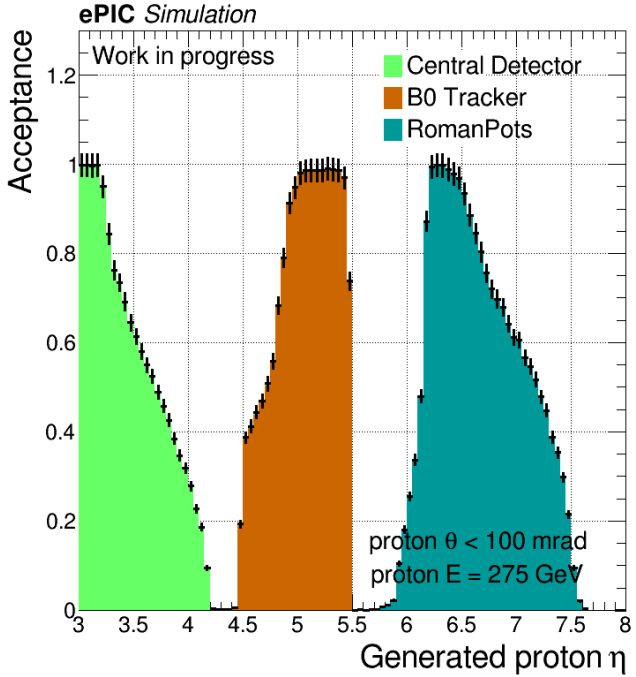
- Particle gun with protons of E=275 GeV and θ<100mrad using 18x275 beam settings.
- Photon acceptance defined as:

  $N(N_{TRK}>0)/N$

Observations

- Gaps between sub-detectors

NOTE: Some recent updates in the simulation has been made which changed the acceptances



Simulation update - geometry

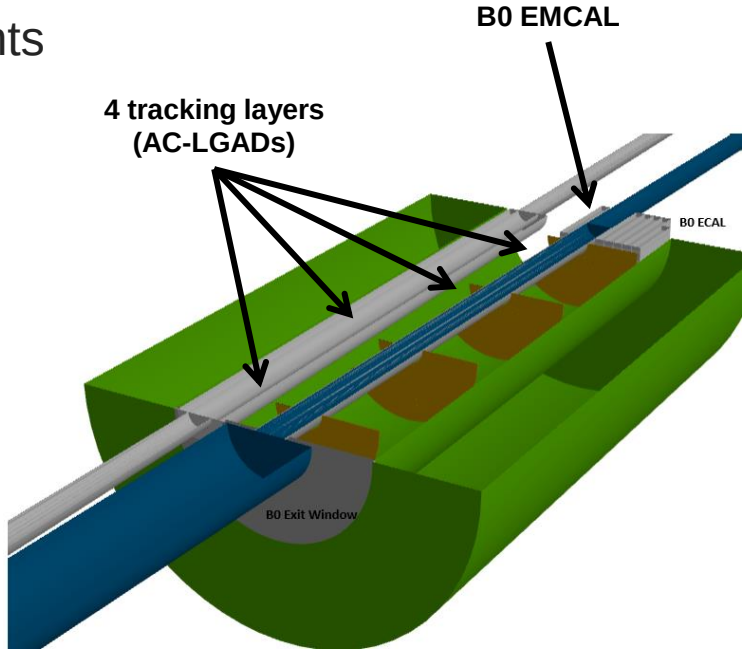
Simulation status – B0 geometry (https://github.com/eic/epic/pull/788)

- The B0 detector team is developing detector configuration according to the physics requirements

Recent update (distances from the IP)

Start off the coil:	580 cm
Tracker 1	590 cm
Tracker 2	622 cm
Tracker 3	655 cm
Tracker 4	688 cm
CAL front	692 cm
CAL end	712 cm
end coil:	700 cm

B0 exit window: 4mm of *StainlessSteel*



Simulation update - geometry

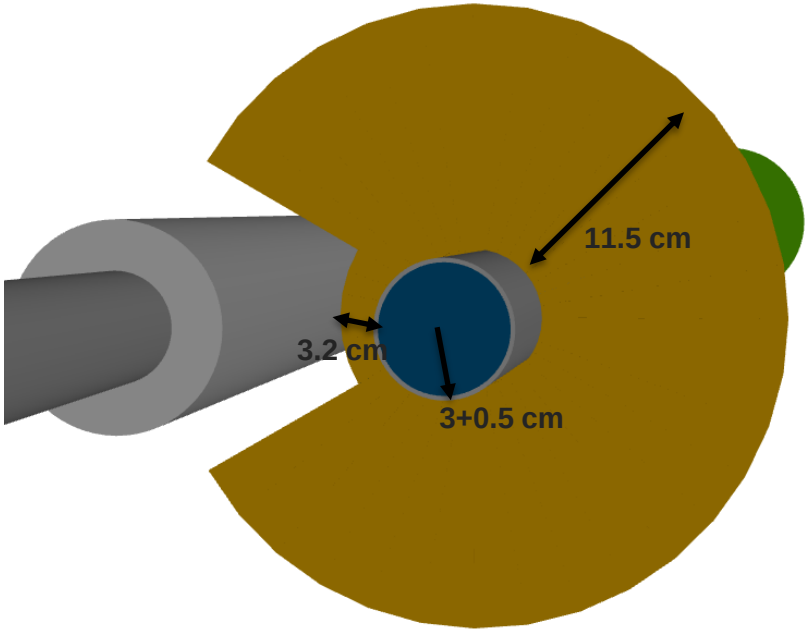
B0 Tracker

- Adjust the geometry to fit better engineering constrains

Electron beam: 1.9*2.5 = 4.75 cm

Tracker (disks):

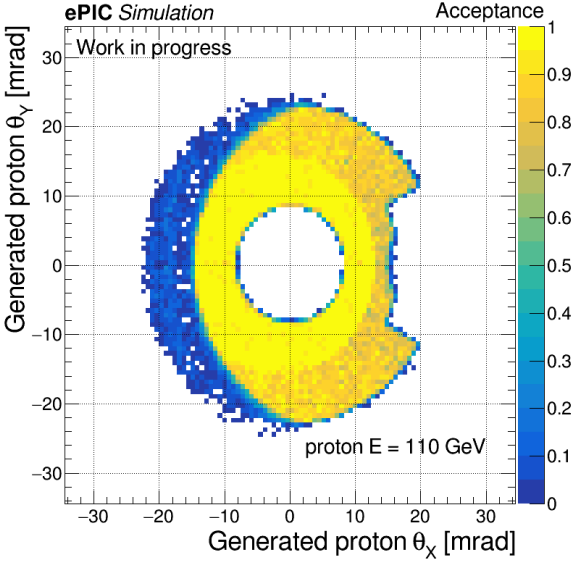
- Inner radius: 3.5 cm (5mm clearance)
- Small radius
  - Layer 1: 3.5+2*1.6 = 6.7 cm
  - Layer 2: 3.5+2*1.6 = 6.7 cm
  - Layer 3: 3.5+3*1.6 = 8.3 cm
  - Layer 4: 3.5+4*1.6 = 9.9 cm
- Outer radius: 15 cm

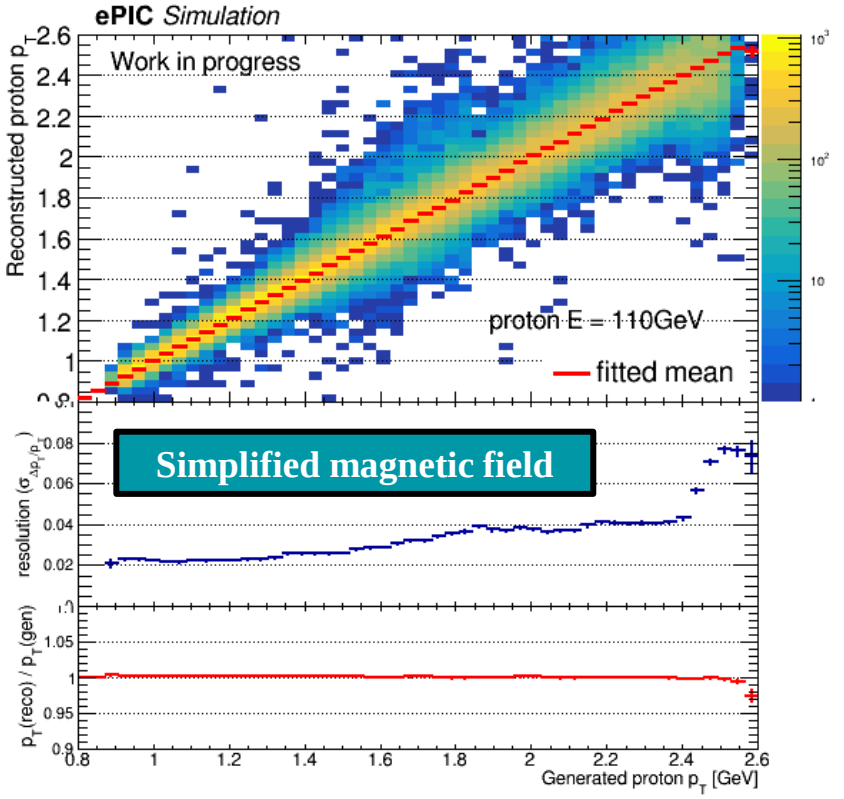


B0Tracker performance - protons

Track reconstruction

- 110 GeV protons generated with 5 < θ/mrad < 25.
- Overlap with central beampipe causes large losses (acceptance starts at about θ = 8.5 mrad





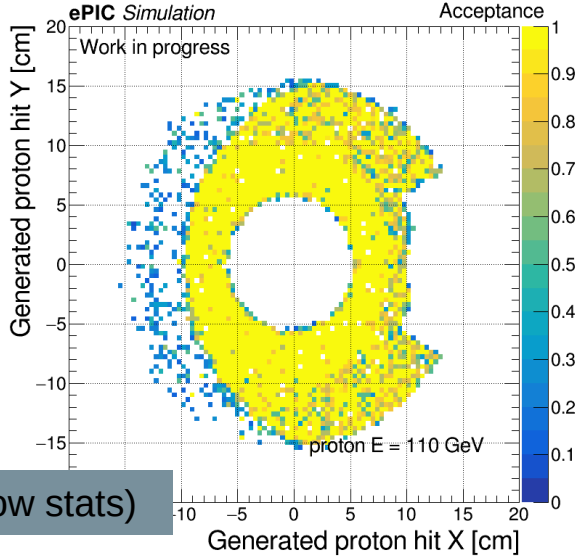
With realistic field: **Resolution pT ~ 4-6%**

B0Tracker performance - protons

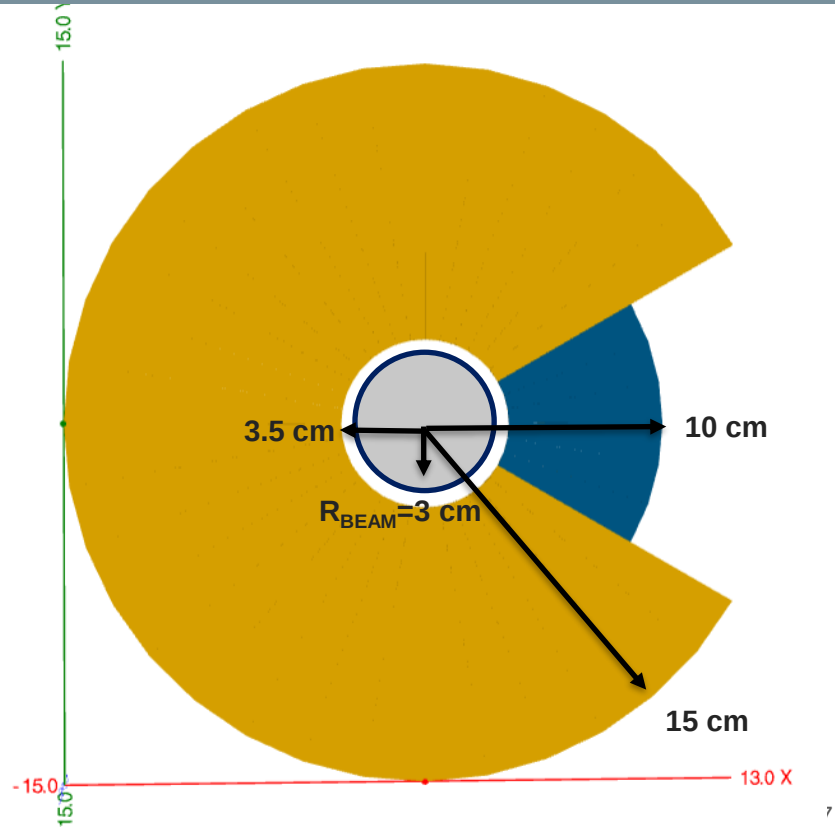
<constant name="B0TrackerCenter_zpos" value="6.3*m"/>

Track reconstruction

- 110 GeV protons generated with 5 < θ/mrad < 25.
- Look at the hit position, X,Y = Z * tan(theta), we expect the inner circle of the acceptance to start at 3.5 (not at >5 cm)



Debug (low stats)

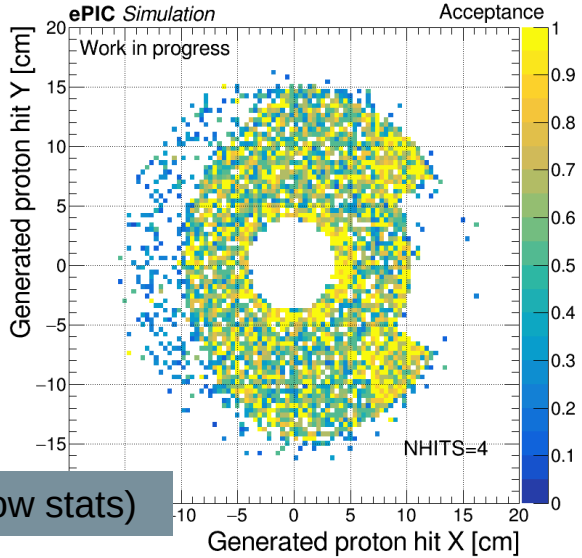


B0Tracker performance - protons

<constant name="B0TrackerCenter_zpos" value="6.3*m"/>

Track reconstruction

- 110 GeV protons generated with 5 < θ/mrad < 25.
- Count hits (instead of reconstructed tracks) in the tracking layers – acceptance looks different (as expected)



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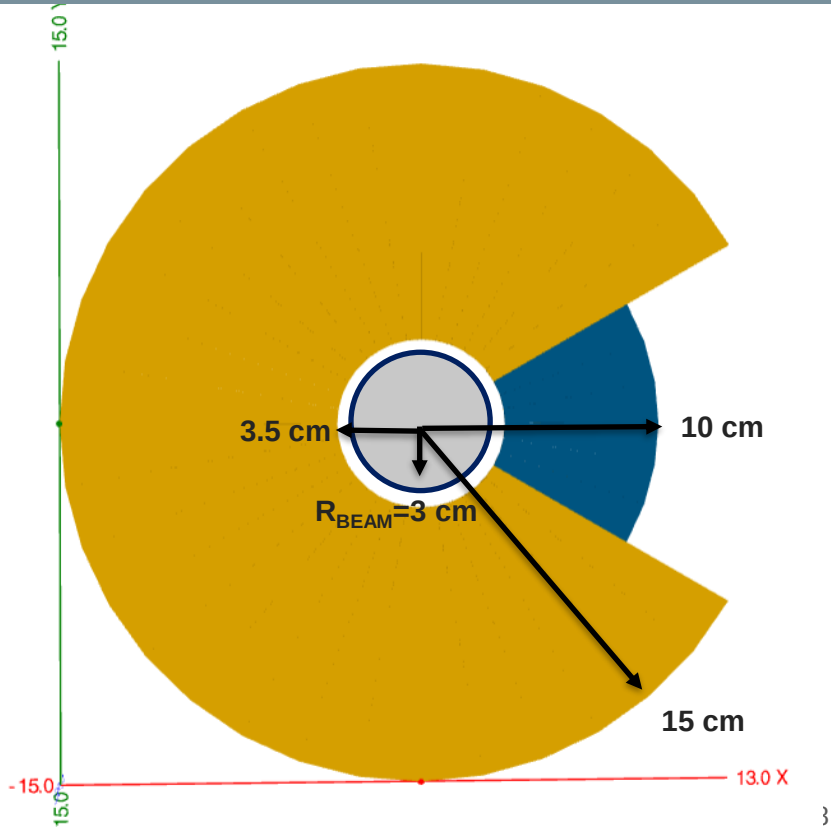
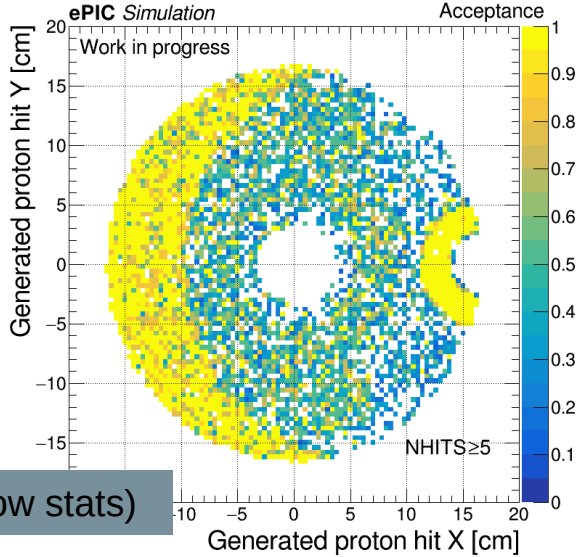


B0Tracker performance - protons

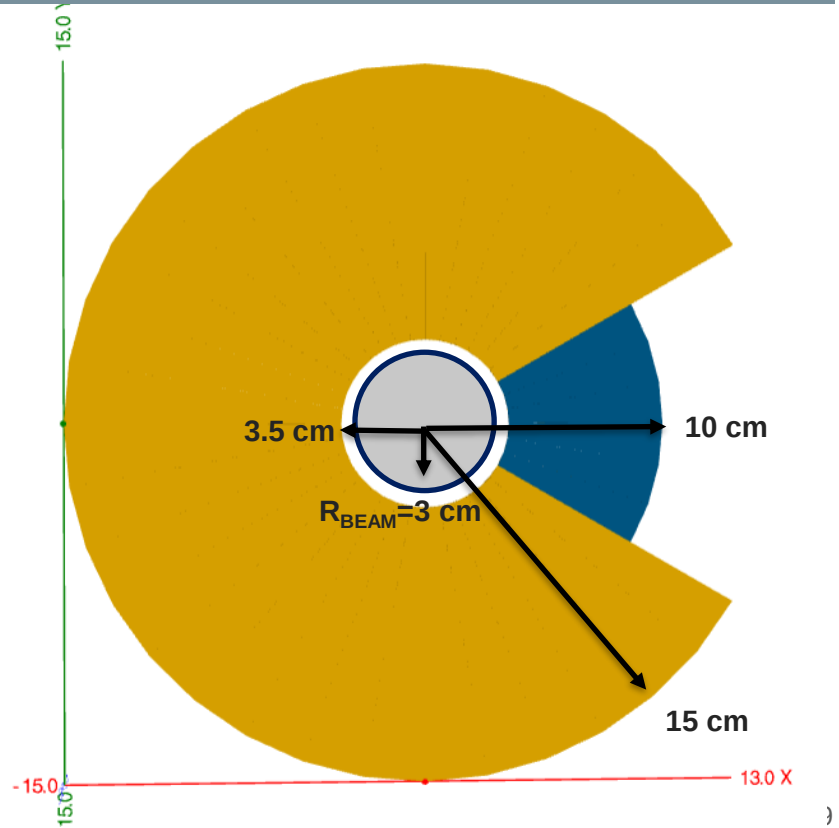
<constant name="B0TrackerCenter_zpos" value="6.3*m"/>

Track reconstruction

- 110 GeV protons generated with 5 < θ/mrad < 25.
- Large number of hits due to early scattering of protons – no reconstructed tracks



Debug (low stats)

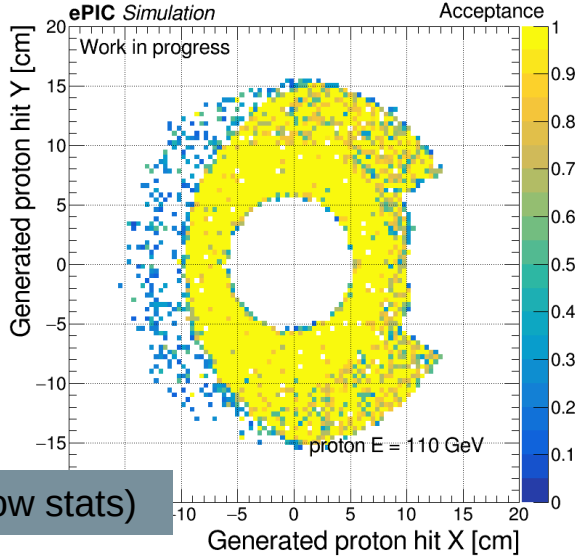


B0Tracker performance - protons

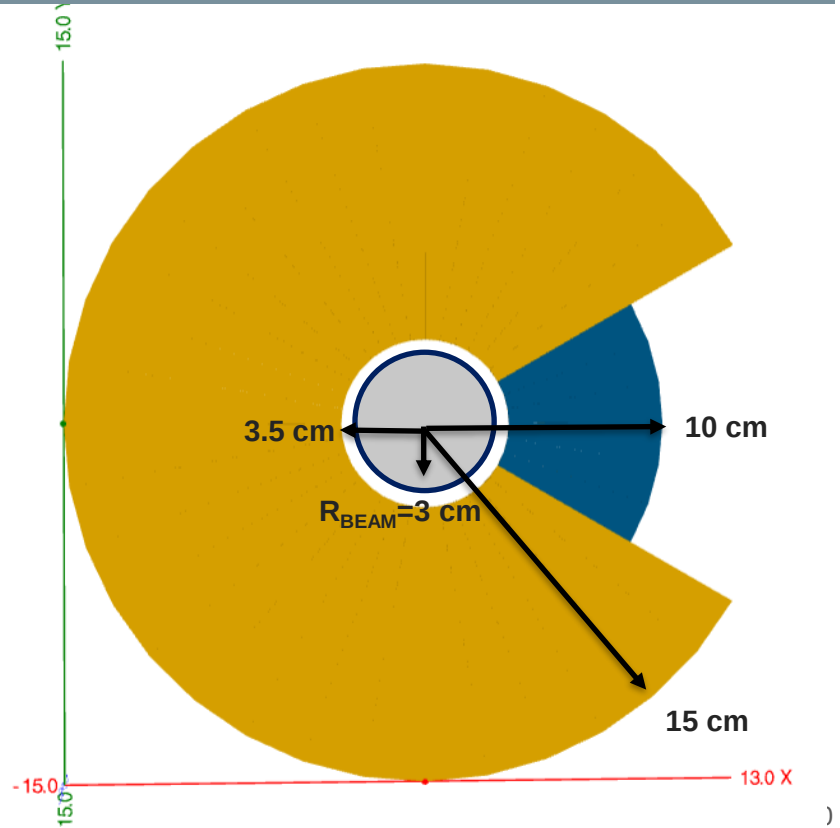
<constant name="B0TrackerCenter_zpos" value="6.3*m"/>

Track reconstruction

- 110 GeV protons generated with 5 < θ/mrad < 25.
- Show again slide 7 (track reconstruction – default), the 10 cm radius is too large (overlaps with electron beampipe)



Debug (low stats)

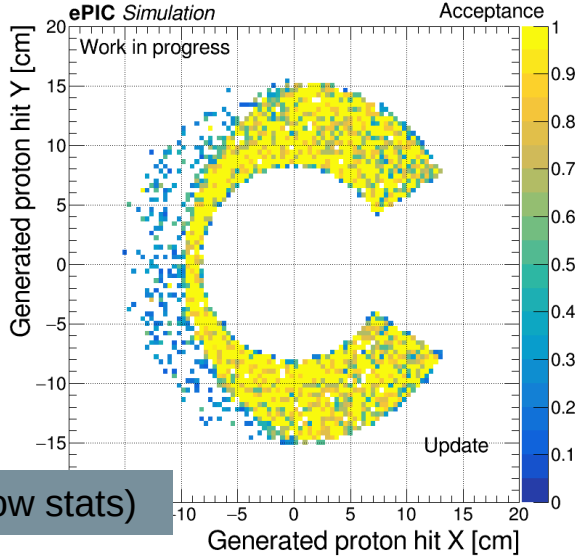


B0Tracker performance - protons

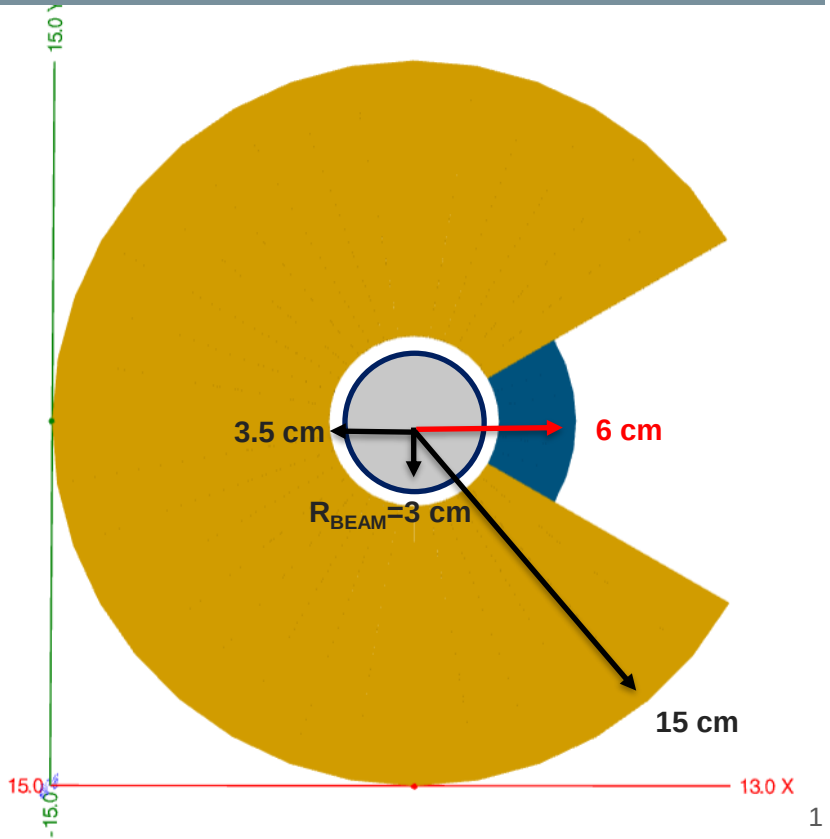
<constant name="B0TrackerCenter_zpos" value="6.3*m"/>

Track reconstruction

- 110 GeV protons generated with 5 < θ/mrad < 25.
- Update tracker – make middle radius smaller – an unexpected results achieved (???)



Debug (low stats)

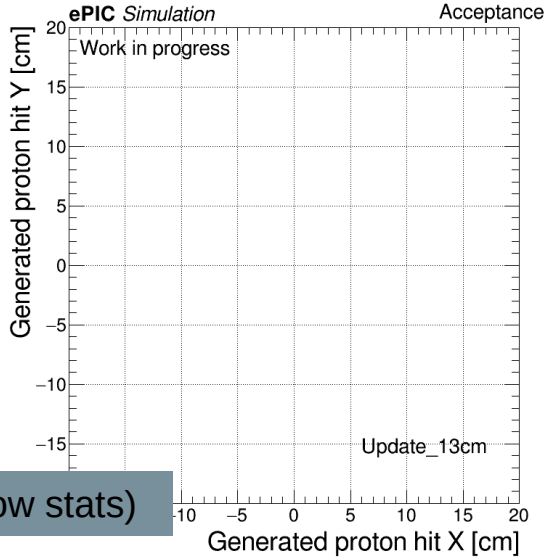


B0Tracker performance - protons

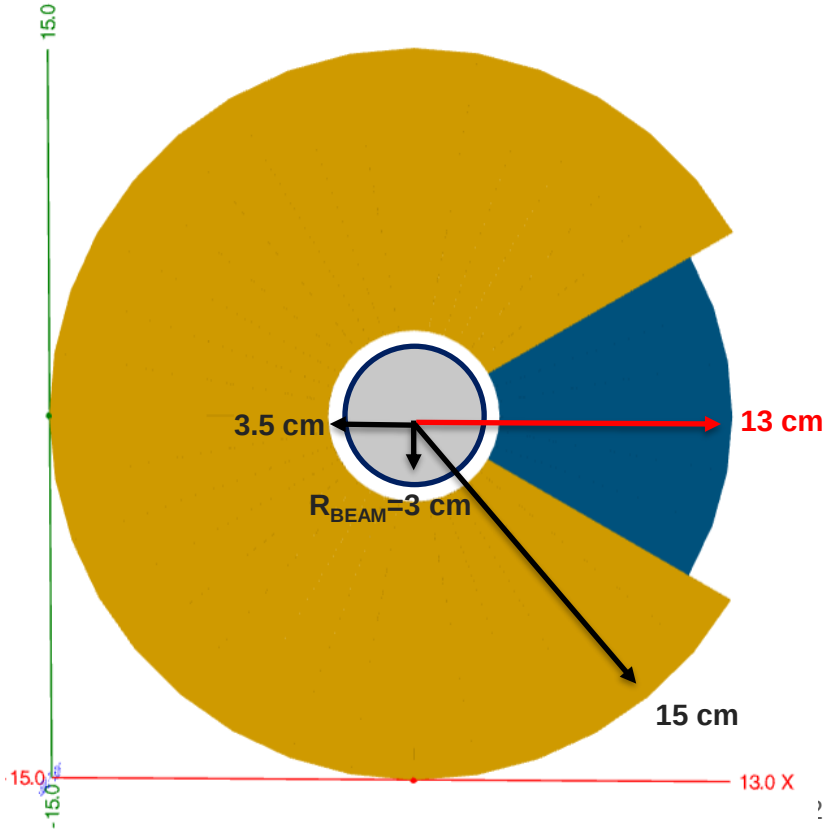
<constant name="B0TrackerCenter_zpos" value="6.3*m"/>

Track reconstruction

- 110 GeV protons generated with 5 < θ/mrad < 25.
- Update tracker – make middle radius larger???



Debug (low stats)



Discussion

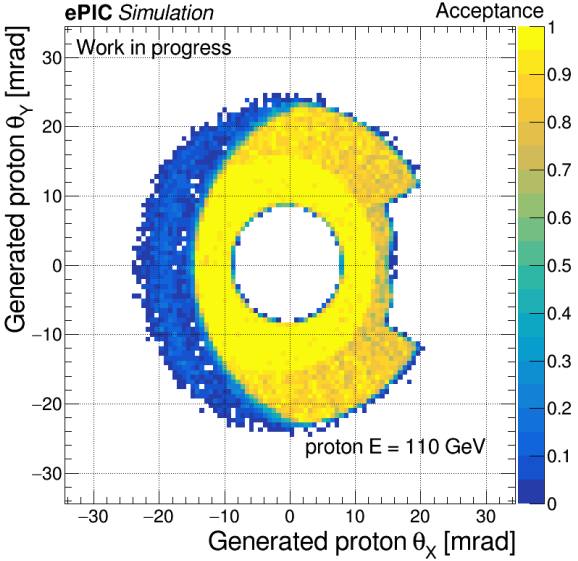
- Changing the B0 tracking geometry shows an unexpected behaviour.
- It seems that even when we have a hit in each B0 layer, the tracking is not performing as expected → maybe geometry is not propagated properly?
- Issue has been opened: https://github.com/eic/EICrecon/issues/1644

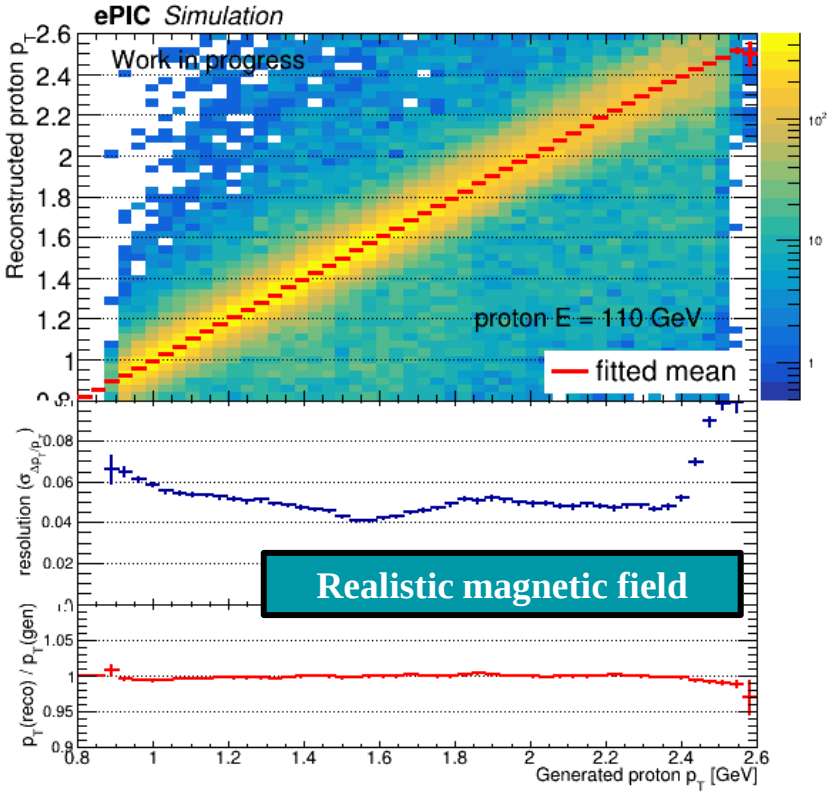
Backup

B0Tracker performance - protons

Track reconstruction

- A realistic B0 field was copied from [b0-field-map-testing].
- Is not in the master branch (the impact on the RP reconstruction need to be integrated)





NEW: Realistic resolution of 5%