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Impact of magnetic field maps on the tracking performance

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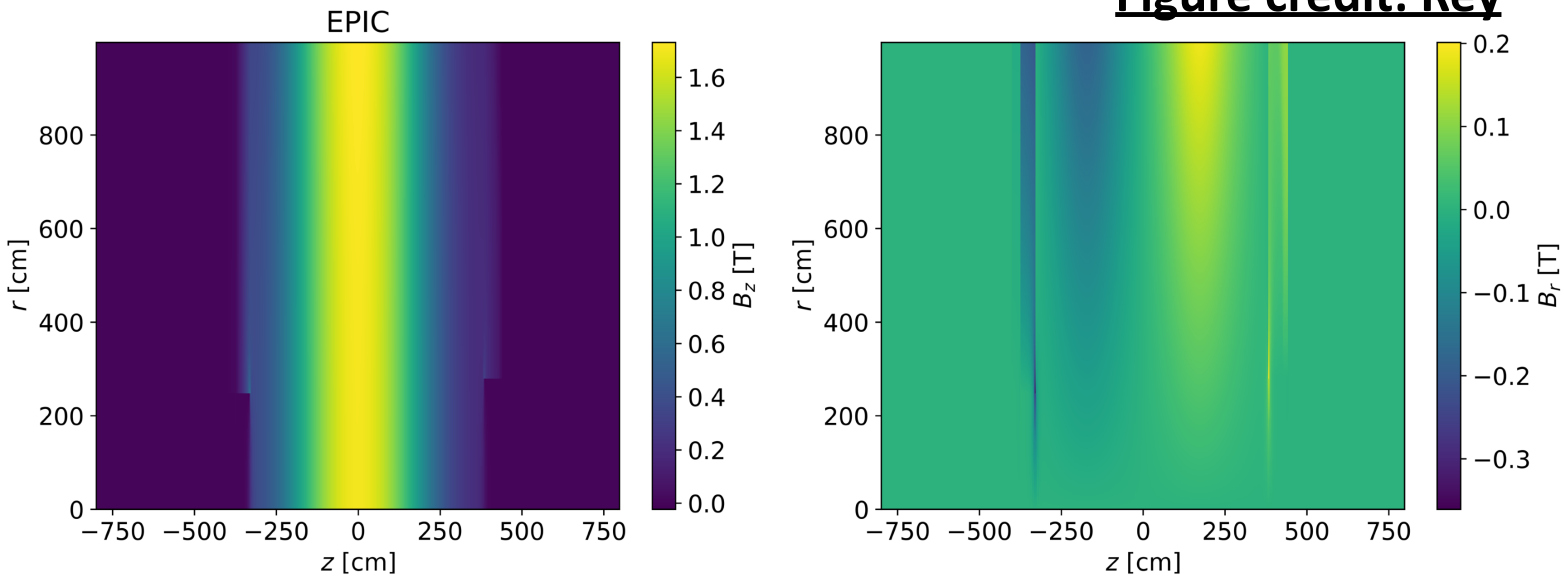
ePIC tracking WG meeting, 11/17/2022

Corrected field map for the new magnet MARCO

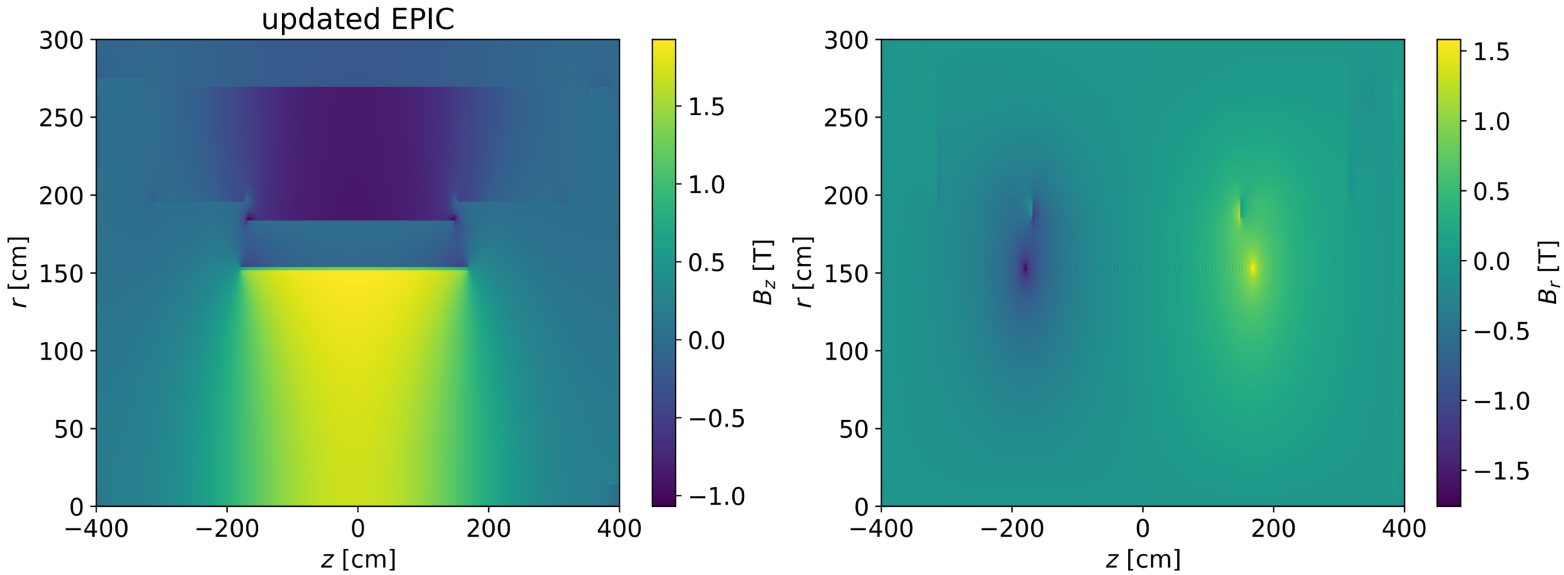
- Corrected magnetic field map available (link)
  - More details in Rey's talk: https://indico.bnl.gov/event/17349/

Figure credit: Rey

Old map
v.6.4.1.1.2,
2022/10/05

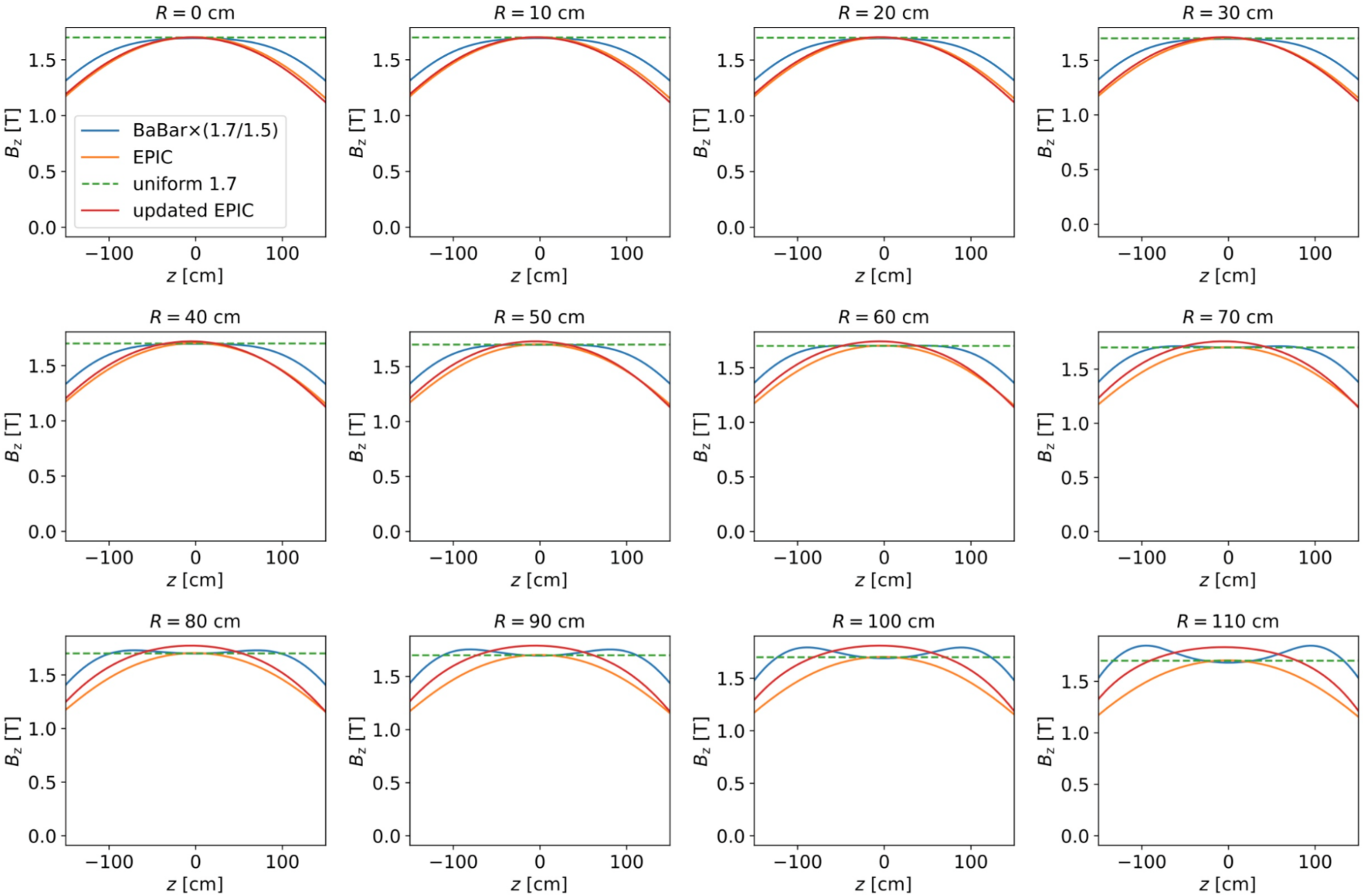


Corrected map
v.6.4.1.1.3,
2022/11/14



Field map comparison

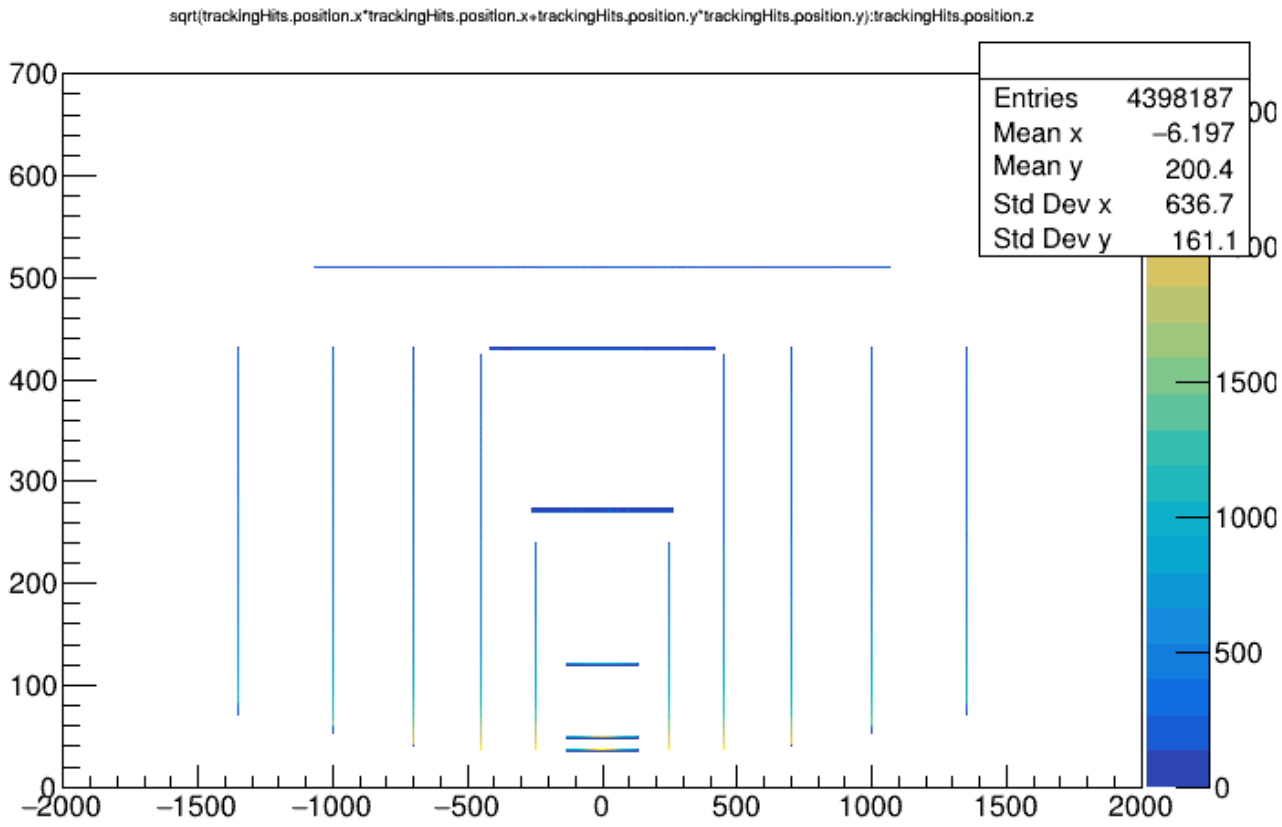
Figure credit: Rey



Effect of the different B field settings

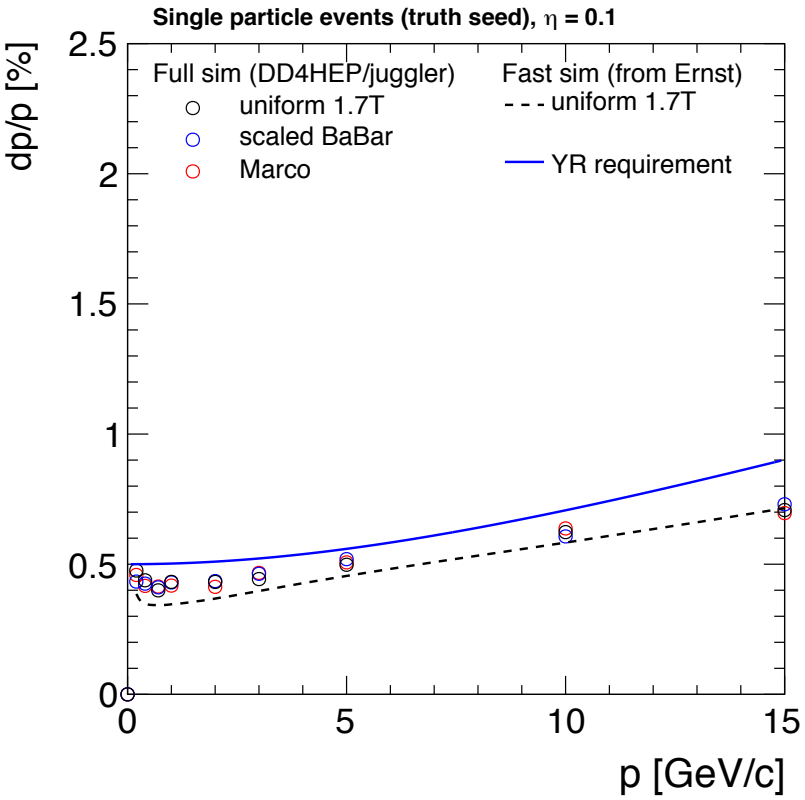
- Same (symmetric) geometry with different B field settings
  - Barrel MPGD: spatial resolution 150um, r= 51cm
  - Barrel silicon: spatial resolution 10um/sqrt(12), r= 3.6, 4.8, 12, 27, 42cm
  - Endcap silicon: spatial resolution 10um/sqrt(12), z = 25, 45, 70, 100, 135cm

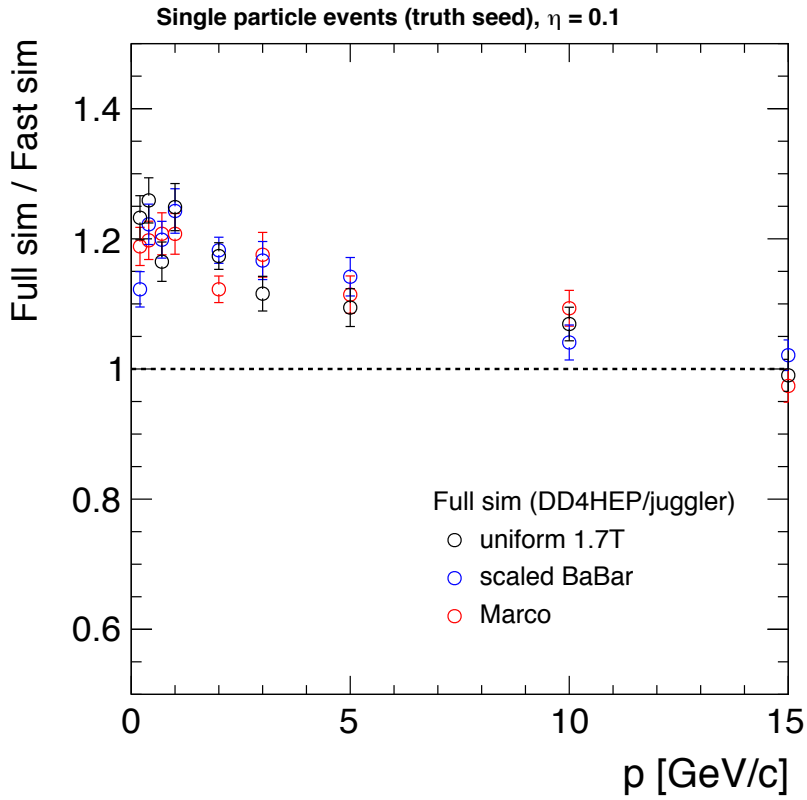
Symmetric geometry



Effect of the different B field settings

- Same geometry with different B field settings
  - New MARCO field map (1.7T), Scaled BaBar field map (by 1.7T/1.5T), Uniform 1.7T field
- Difference between full and fast simulation due to material difference
  - No support cylinder in the fast simulation + more material per disk (including air) in the full simulation





Similar performance from different B field settings

Effect of the different B field settings

- Same geometry with different B field settings
  - New MARCO field map (1.7T), Scaled BaBar field map (by 1.7T/1.5T), Uniform 1.7T field
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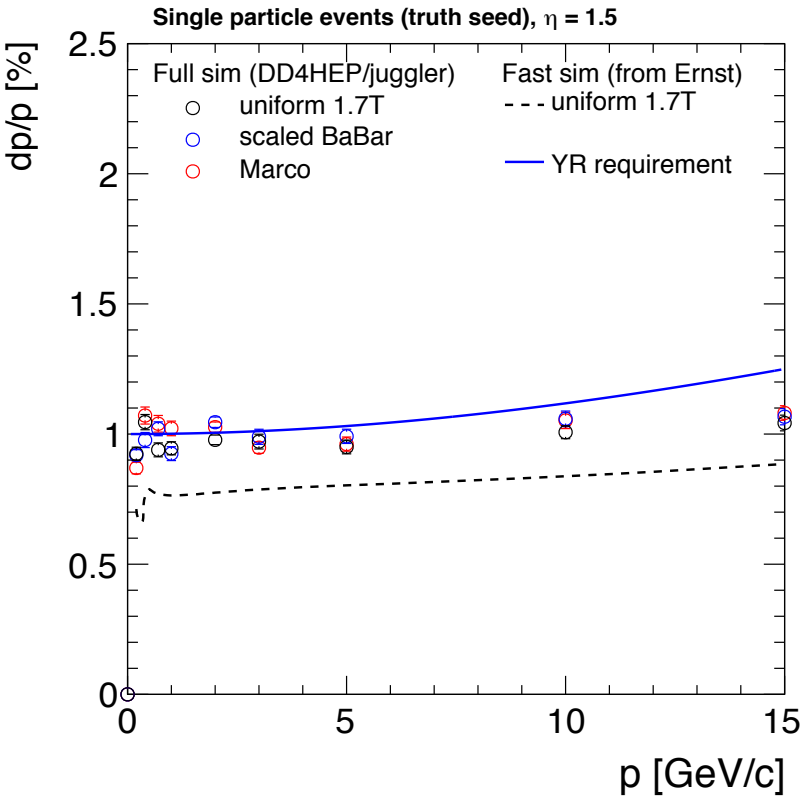
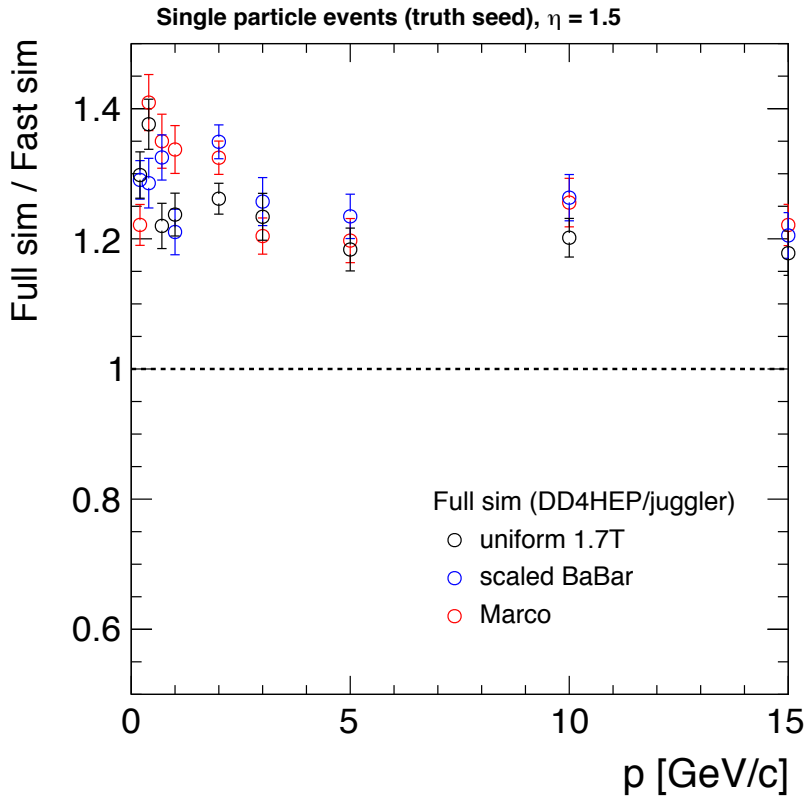
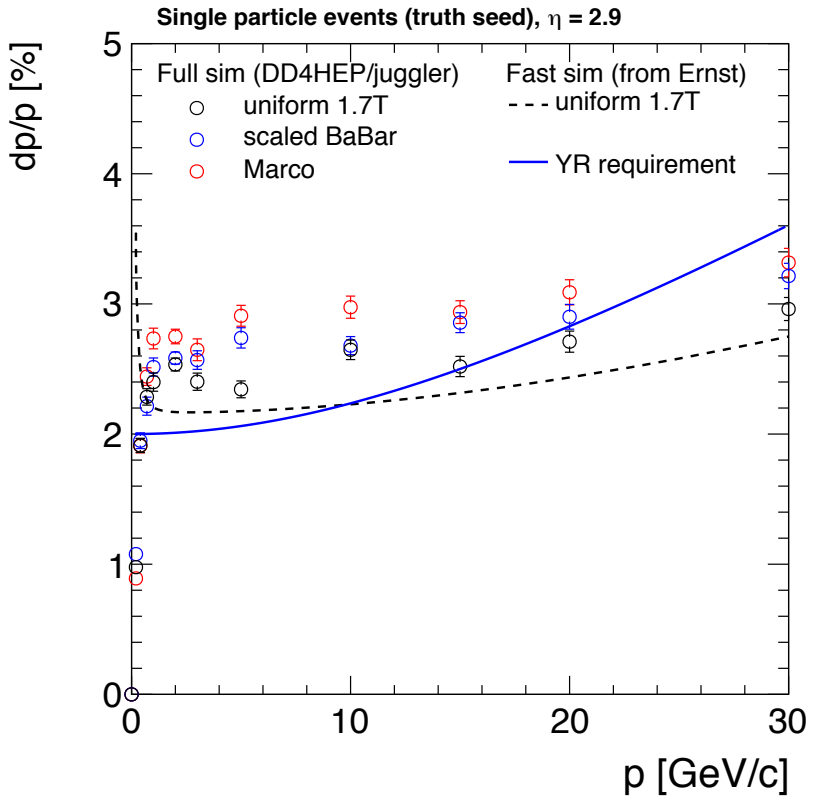


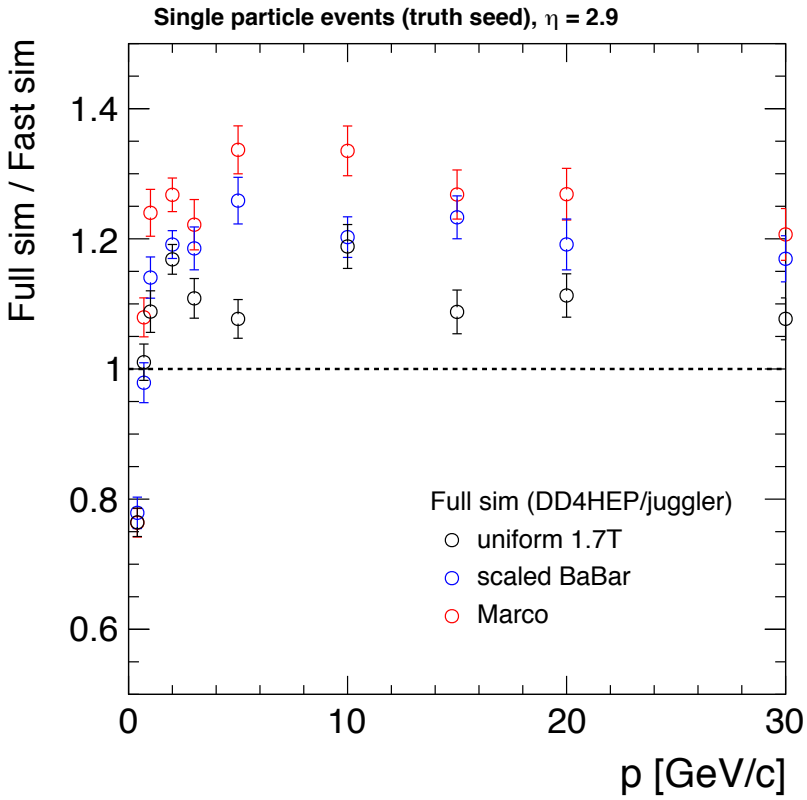


Slightly better performance with uniform field

Effect of the different B field settings

- Same geometry with different B field settings
  - New MARCO field map (1.7T), Scaled BaBar field map (by 1.7T/1.5T), Uniform 1.7T field
- Difference between full and fast simulation due to material difference
  - No support cylinder in the fast simulation + more material per disk (including air) in the full simulation





dp/p: Uniform < Scaled BaBar < Marco

Overall 10-20% difference

Summary

- Looked at the effect of different magnetic field maps on momentum resolution
  - Small effect on the performance around mid-rapidity
  - 10-20% worse performance from the new MARCO field map comparing to the uniform field map at forward rapidity
- Difference between full and fast simulation due to material difference
  - Better agreement at higher momentum range
- Switch to tagged geometry (+ more statistics)
- We will revisit use of available space in z with the aim to restore YR performance over a wider range at forward η