



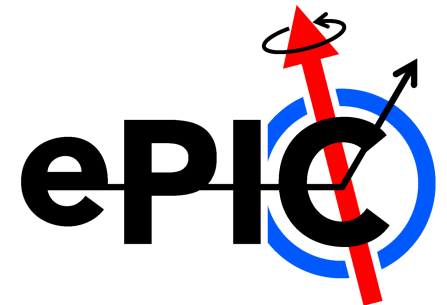
BERKELEY LAB

Bringing Science Solutions to the World

Track angular resolution and magnetic field dependence

Wenqing Fan

ePIC collaboration meeting, 01/10/2023



- ▶ New magnet (MARCO) will be used for the ePIC experiment
 - ◆ Decreasing field strength at larger z

Scaled BaBar
field map

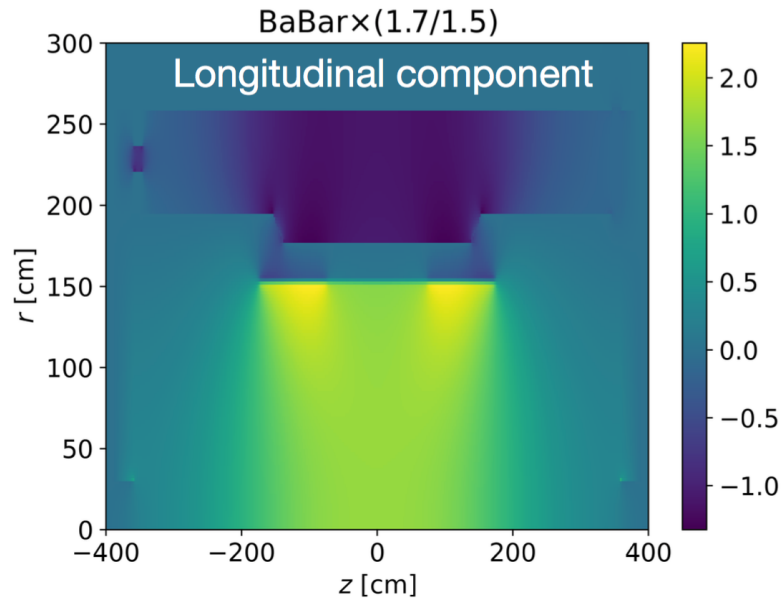
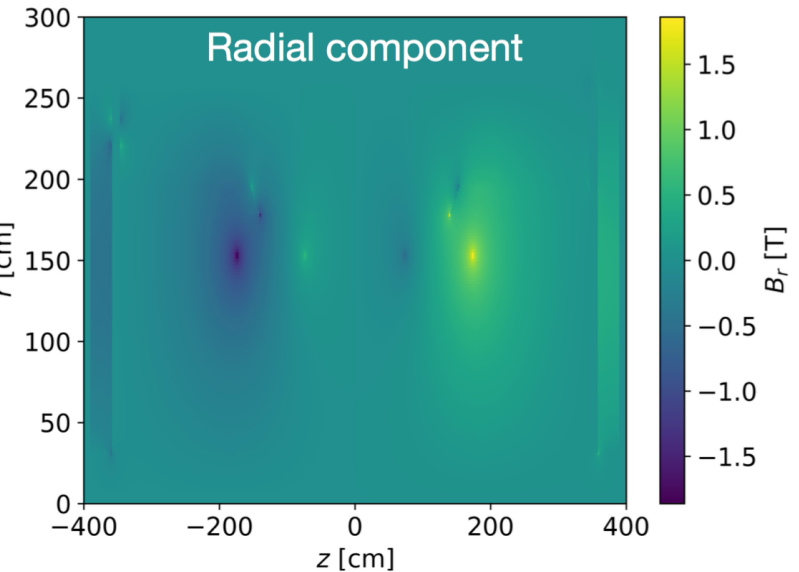


Figure credit: Rey Cruz-Torres



Marco field map

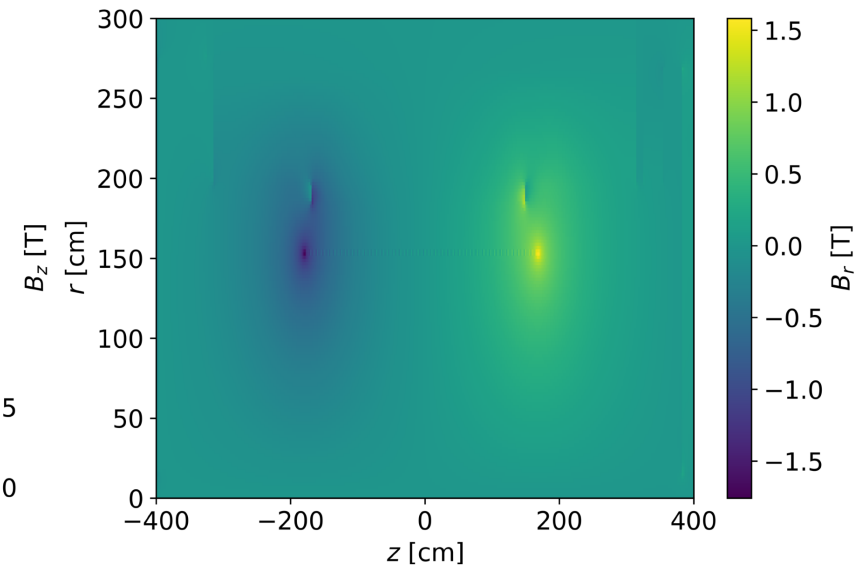
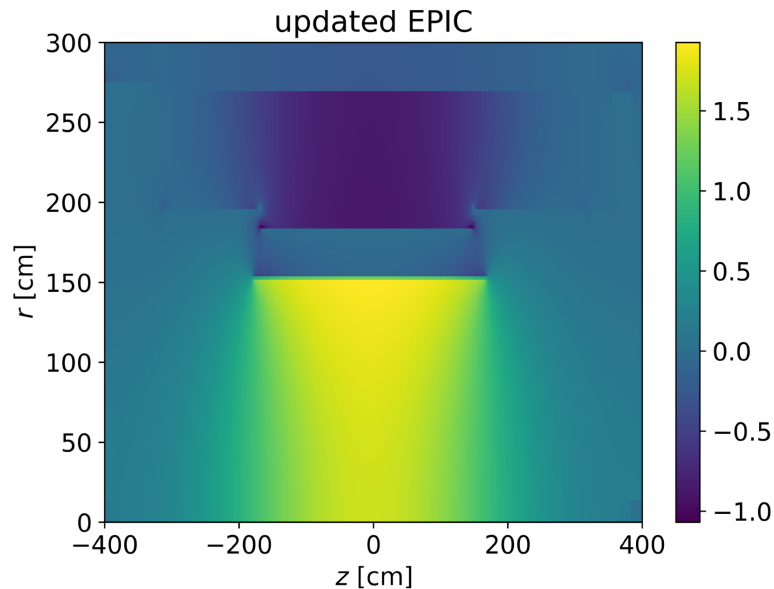
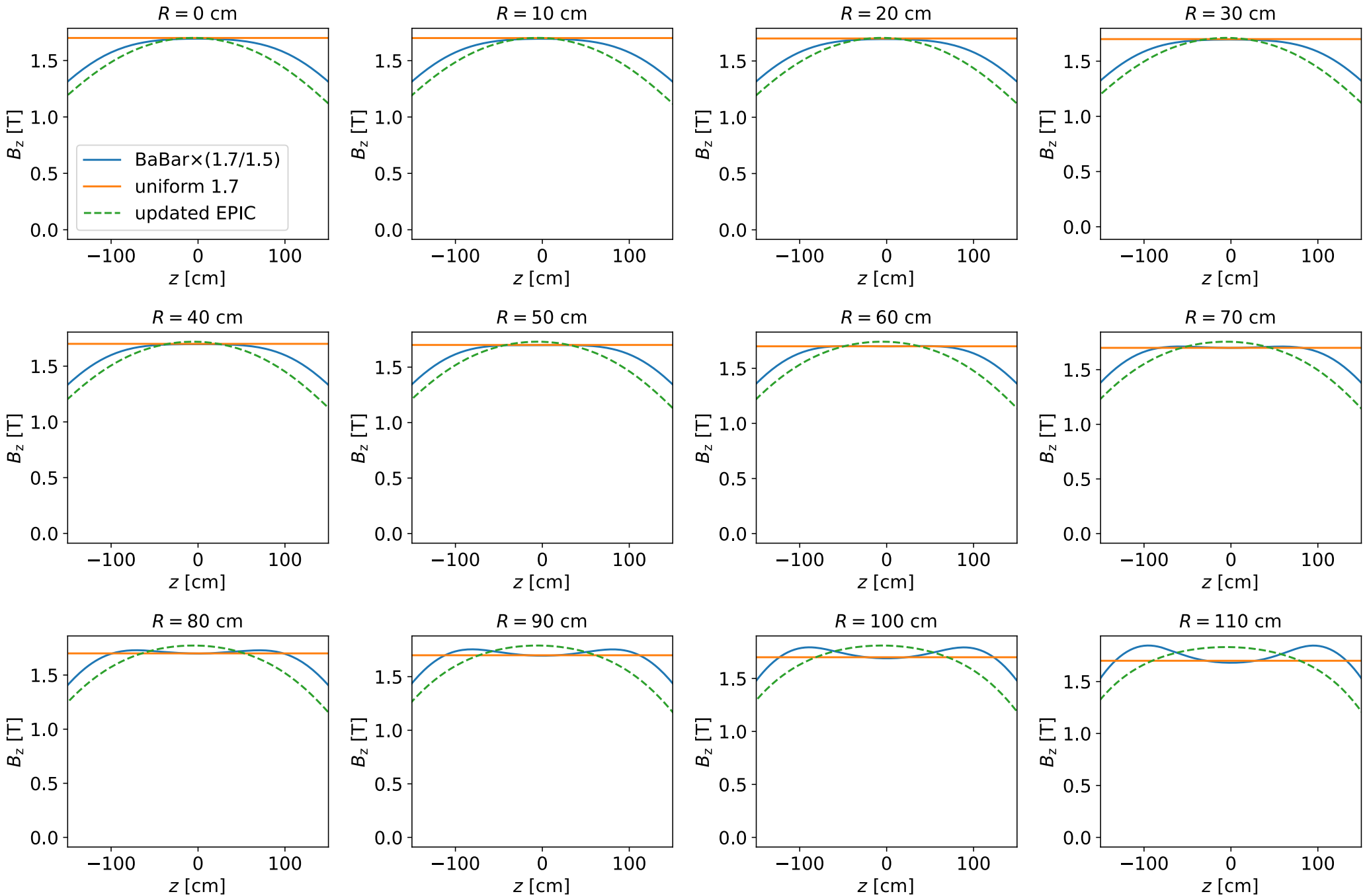
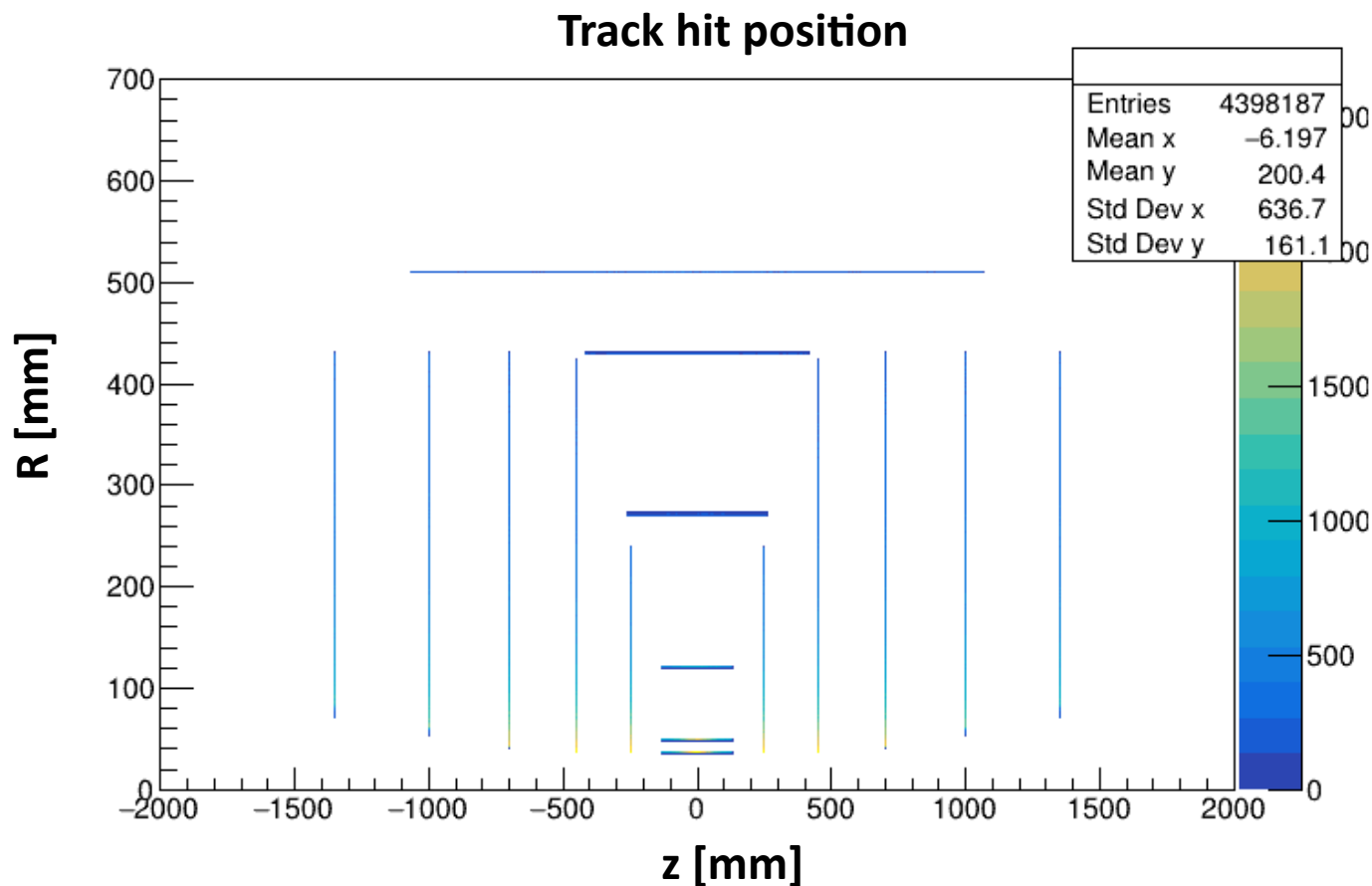


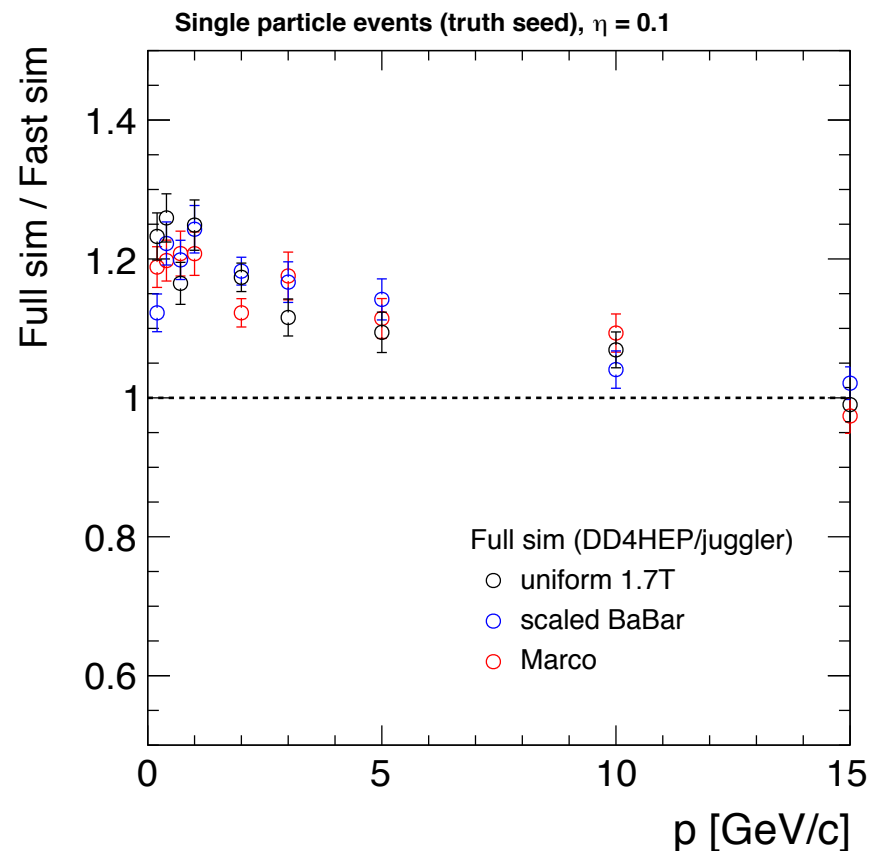
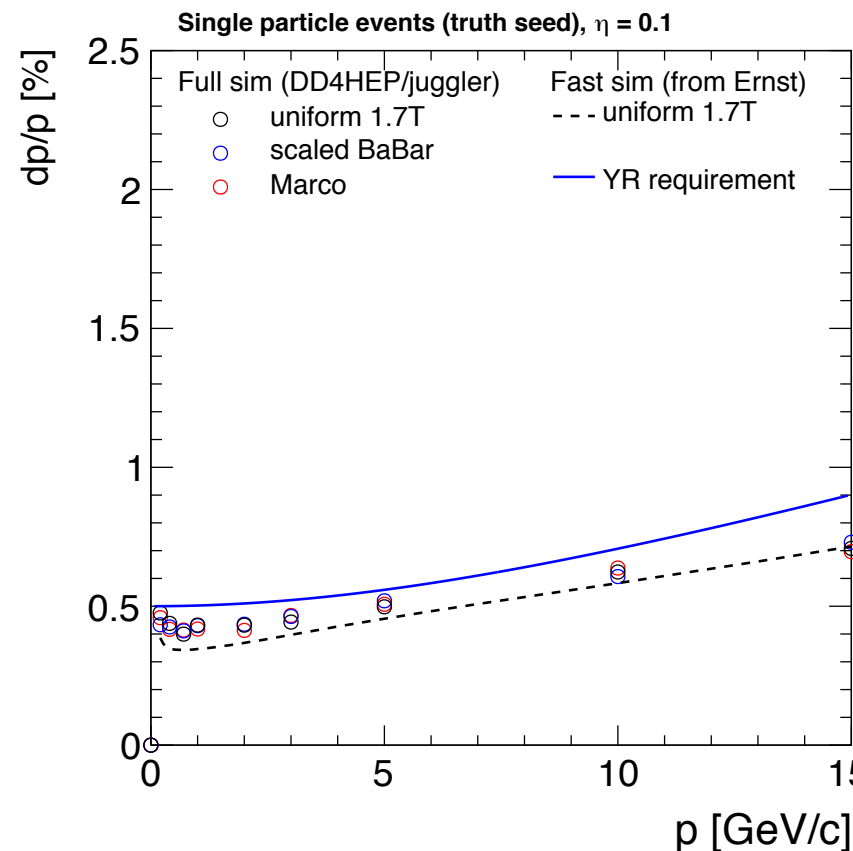
Figure credit: Rey Cruz-Torres



- ▶ Symmetric geometry (not tagged geometry) with different B field settings
 - ◆ Barrel MPGD: spatial resolution $150\mu\text{m}$, $r = 51\text{cm}$
 - ◆ Barrel silicon: spatial resolution $10\mu\text{m}/\sqrt{12}$, $r = 3.6, 4.8, 12, 27, 42\text{cm}$
 - ◆ Endcap silicon: spatial resolution $10\mu\text{m}/\sqrt{12}$, $z = 25, 45, 70, 100, 135\text{cm}$

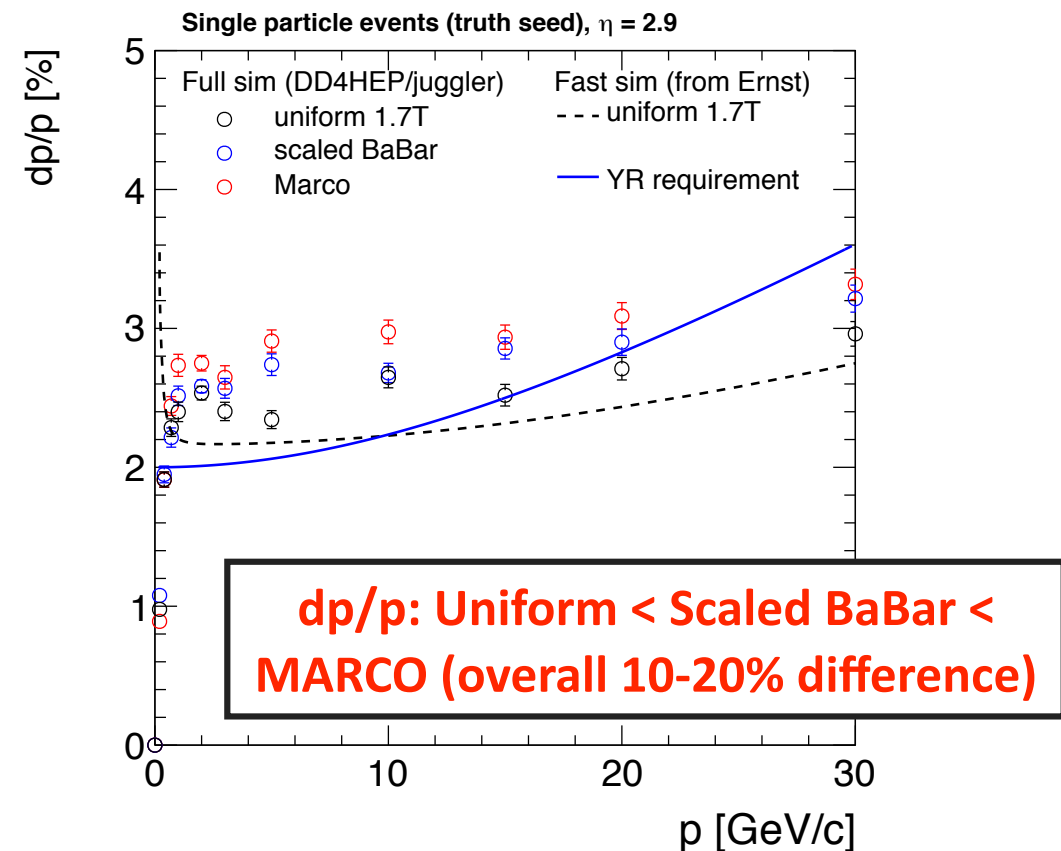
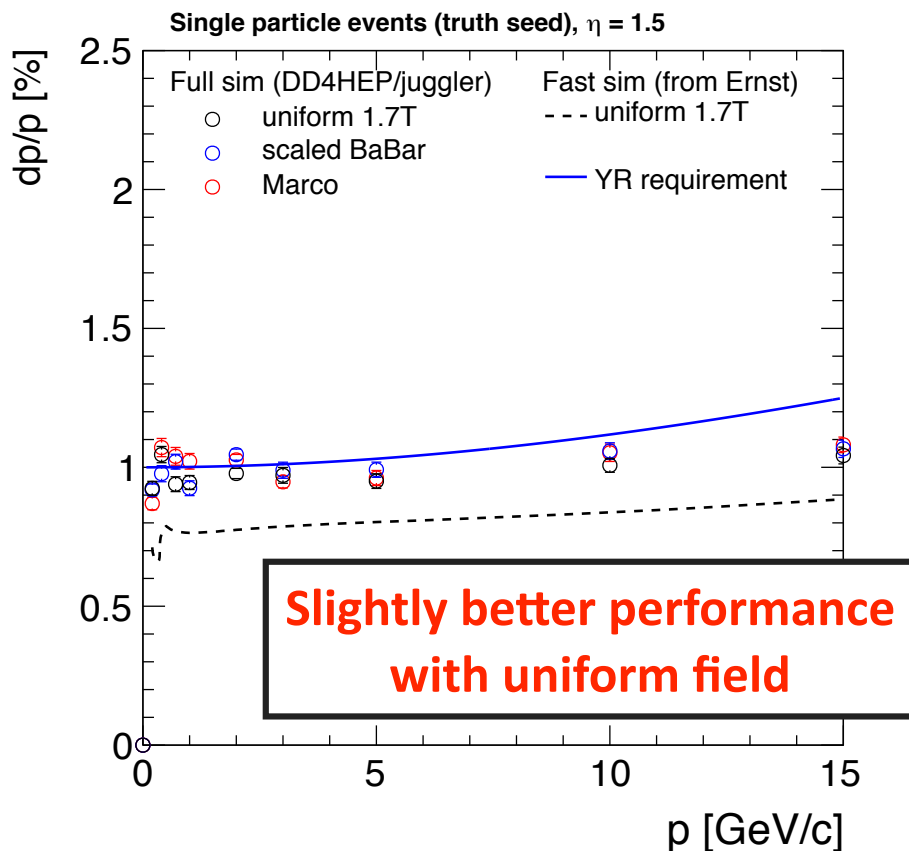


- ▶ Same geometry with different B field settings
 - ◆ **New MARCO field map (1.7T), Scaled BaBar field map (by 1.7T/1.5T), Uniform 1.7T field**
- ▶ Difference between full and fast simulation due to material difference
 - ◆ No support cylinder in the fast simulation + more material per disk (including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



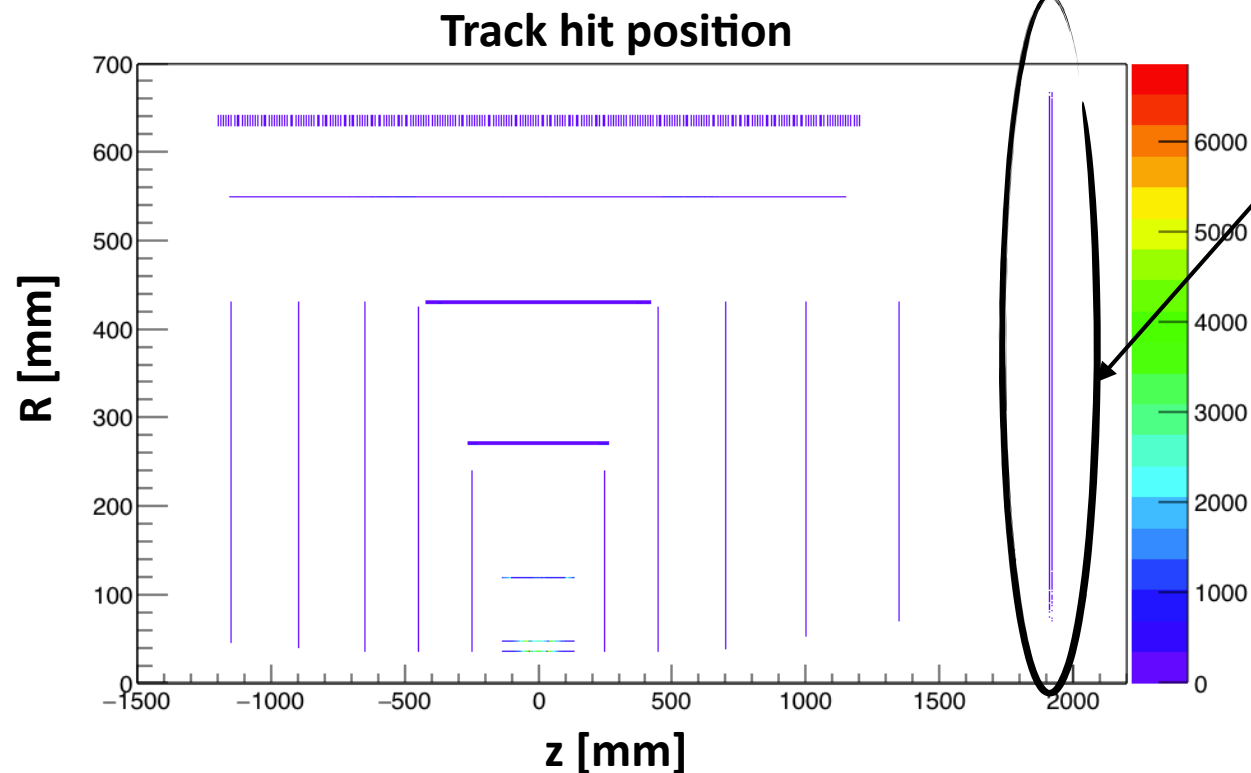
**Similar
performance
from
different B
field settings**

- ▶ 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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► Geometry tag: Brycecanyon

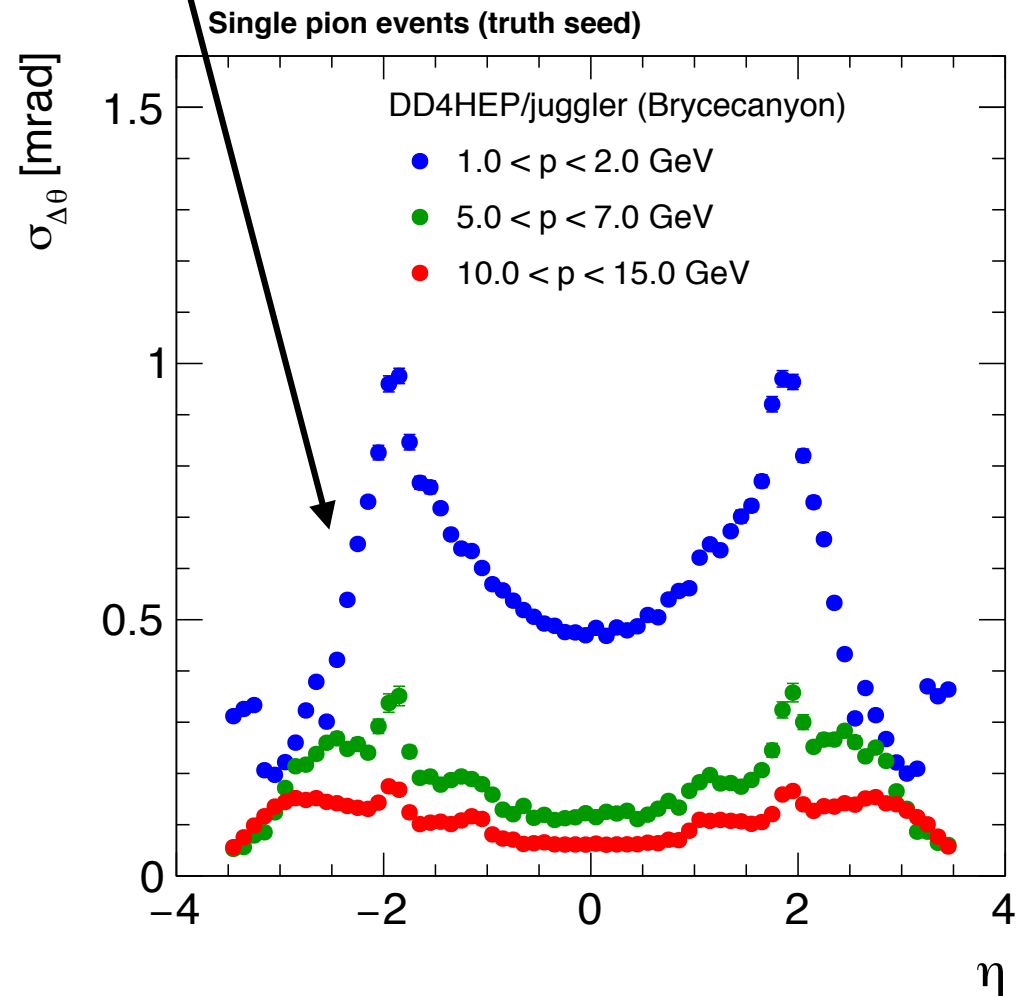
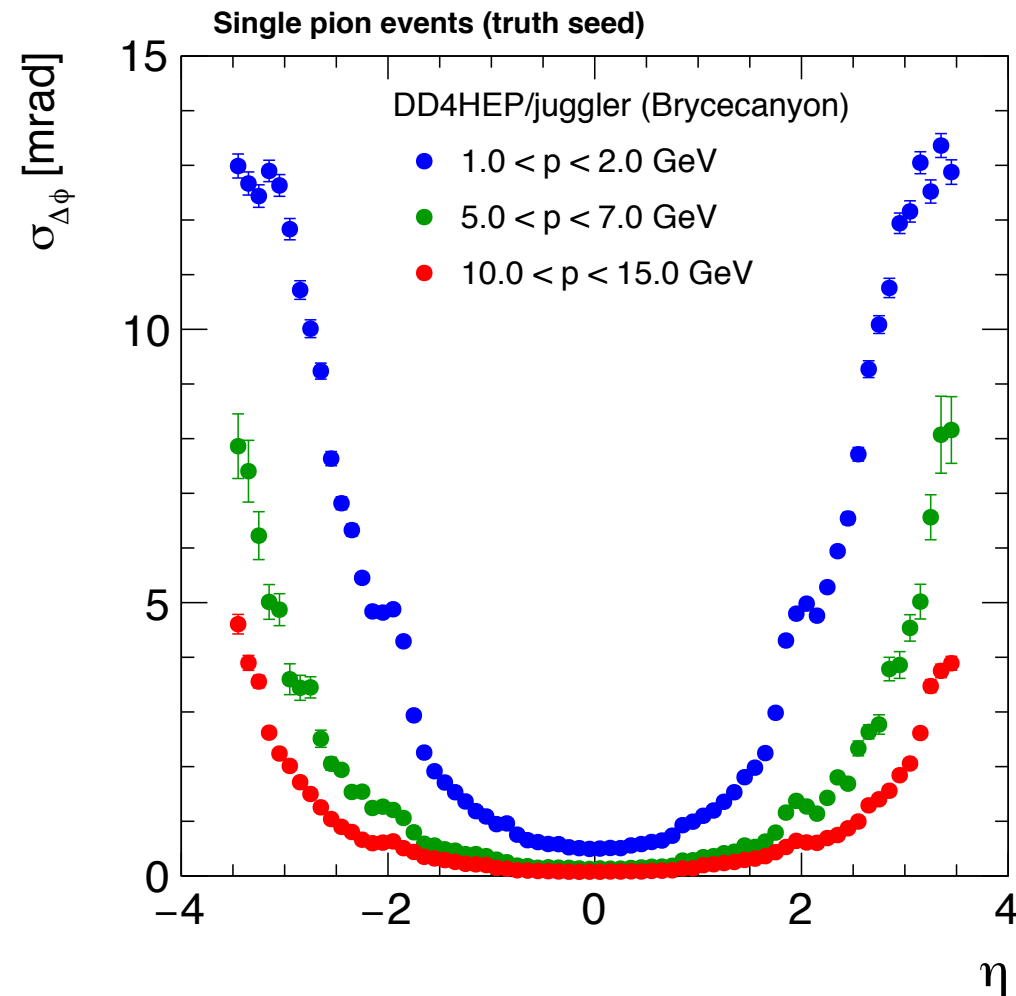
- ◆ 5 barrel silicon: spatial resolution $10\mu\text{m}/\sqrt{12}$, $r = 3.6, 4.8, 12, 27, 42\text{cm}$
- ◆ 1 barrel MPGD: spatial resolution $150\mu\text{m}$, $r = 55\text{cm}$
- ◆ 1 barrel TOF: spatial resolution $30 \times 3000\mu\text{m}$, $r = 64.6\text{cm}$
- ◆ 10 endcap silicon: spatial resolution $10\mu\text{m}/\sqrt{12}$, $z = -115, -90, -65, -45, 25, 25, 45, 70, 100, 135\text{cm}$
- ◆ 1 endcap TOF: spatial resolution $30\mu\text{m}$, $z = 192\text{cm}$



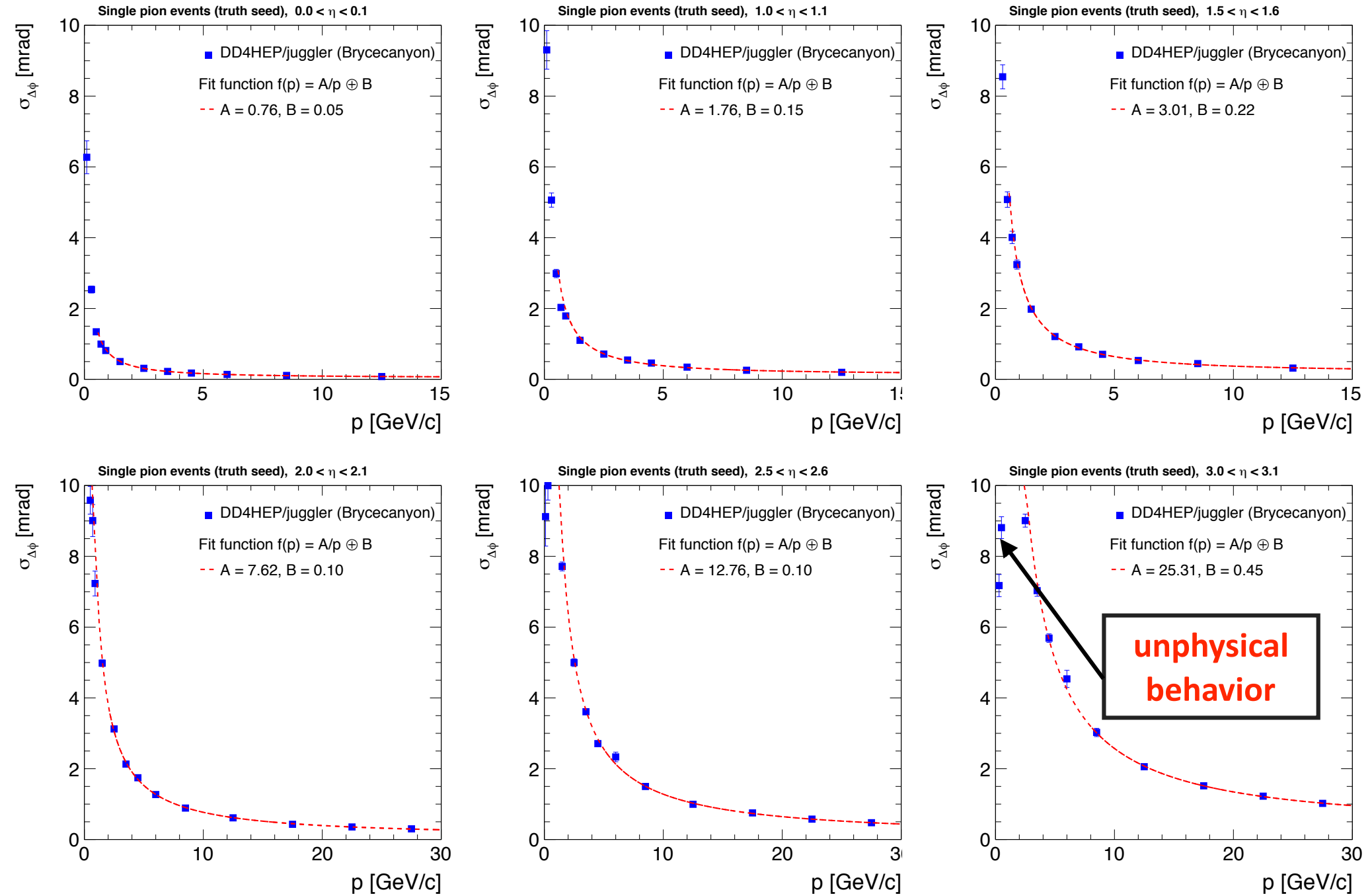
NOT in track reconstruction with juggler/EICrecon

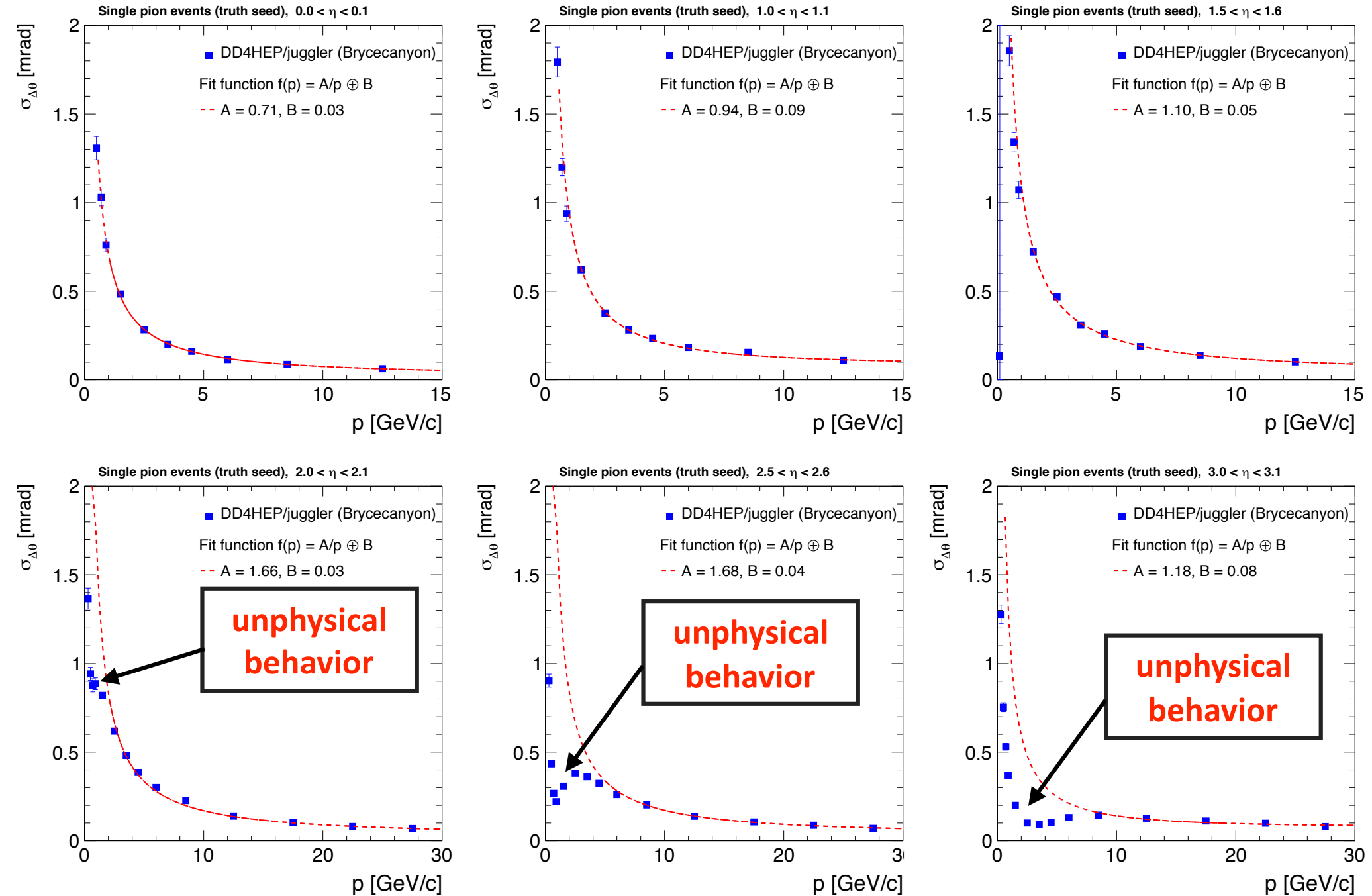
- ▶ Caveat: endcap TOF hits at $z = 192\text{cm}$ not included in the track reconstruction

$\Delta\theta$ resolution not reliable for the lowest momentum range or back/forward rapidity (see slide 11)

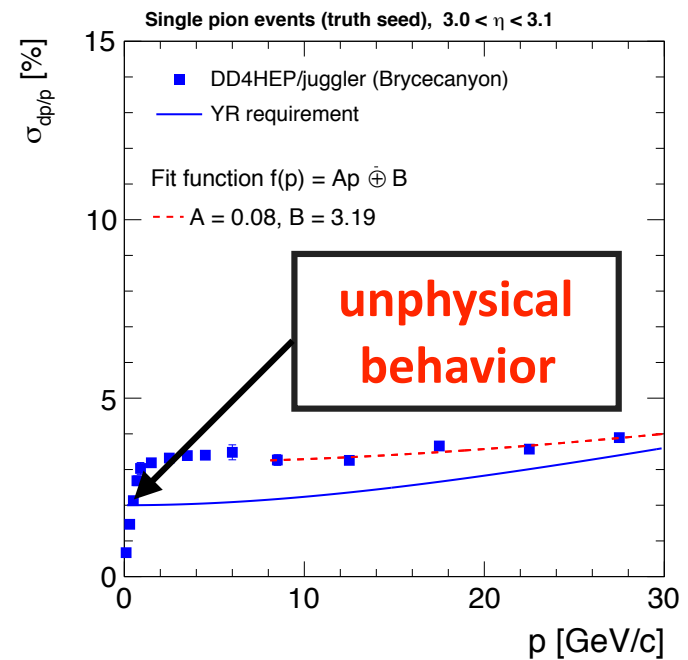
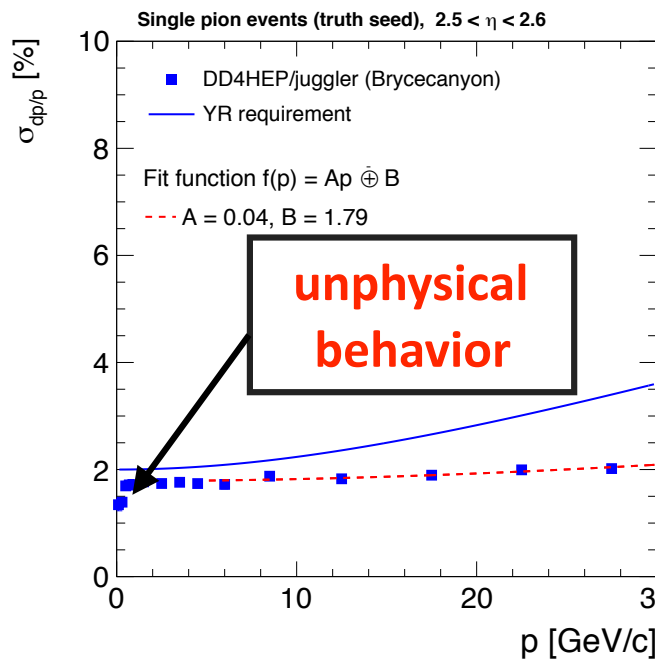
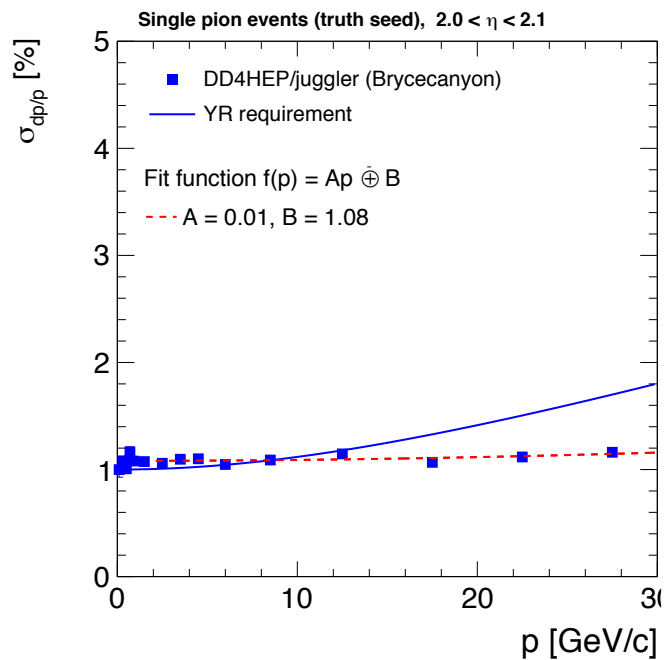
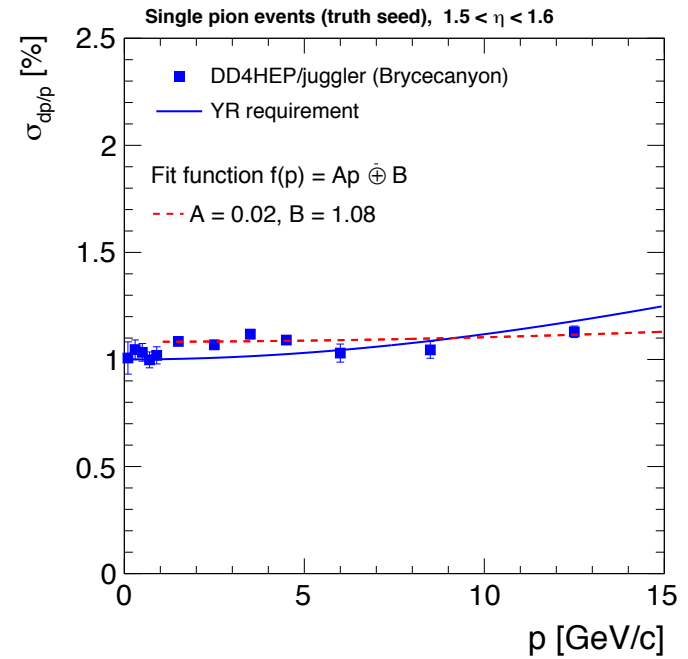
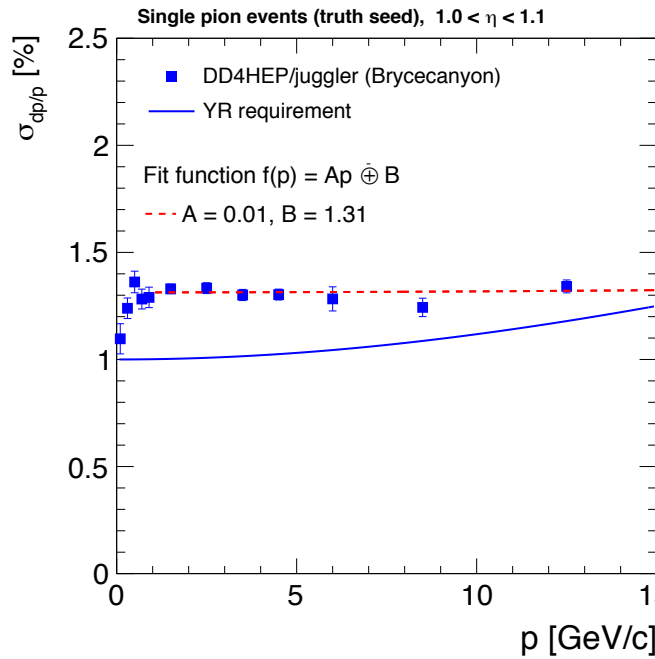
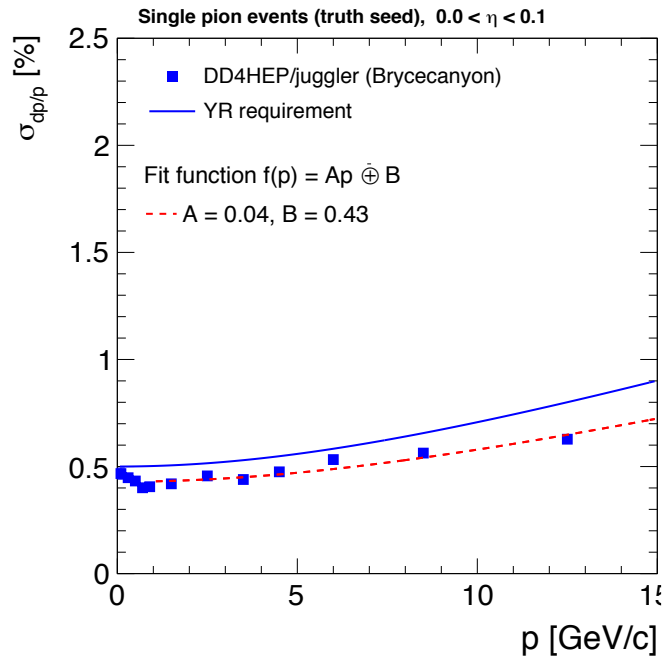


Azimuthal angular resolution ($\Delta\phi$ resolution)





Momentum resolution ($\Delta p/p$ resolution)



- ▶ 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 very forward rapidity

- ▶ Looked at the angular resolution with the tagged geometry (Brycecanyon) + new MARCO field map
 - ◆ Good resolution for $\Delta\phi$ and $\Delta\theta$
 - ◆ Further investigation needed: unphysical behavior at low p range at forward/backward rapidity for $\Delta\theta$ – better resolution toward lower p (also seen for momentum resolution)