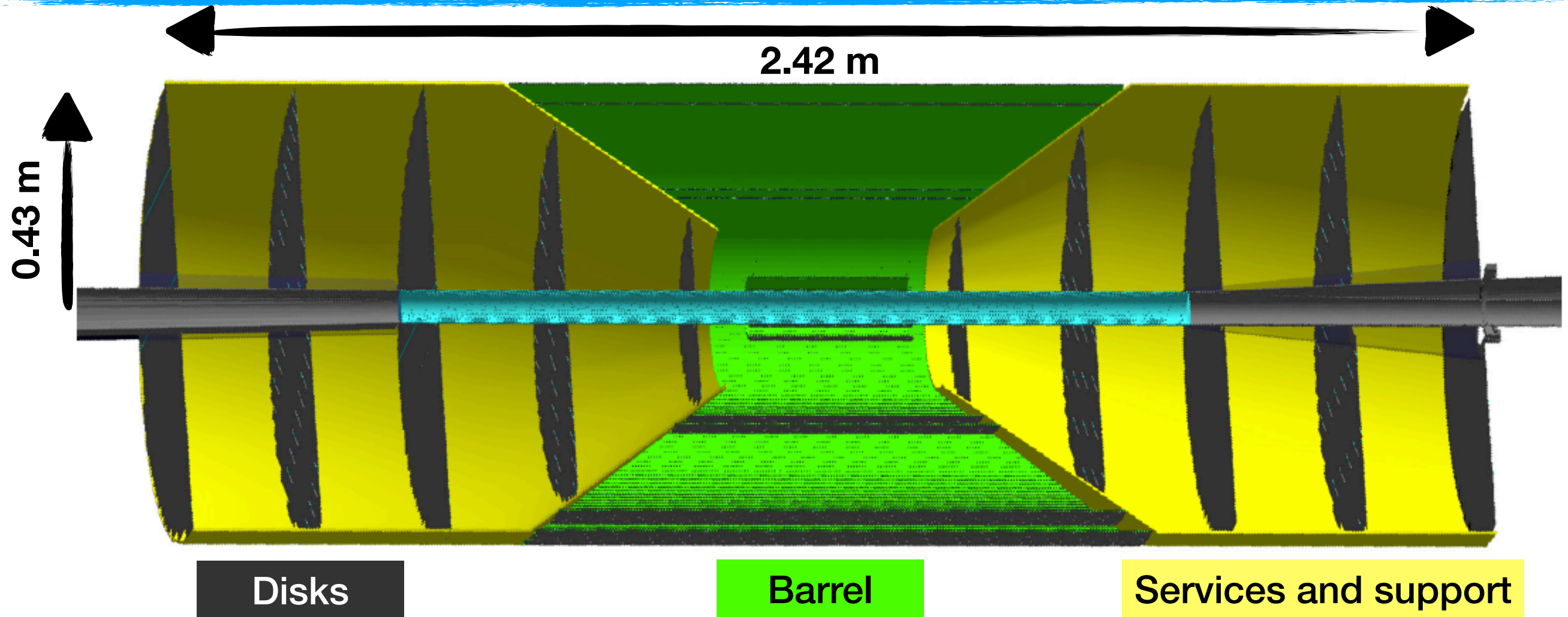


All-Silicon Tracker studies for the Electron-Ion Collider

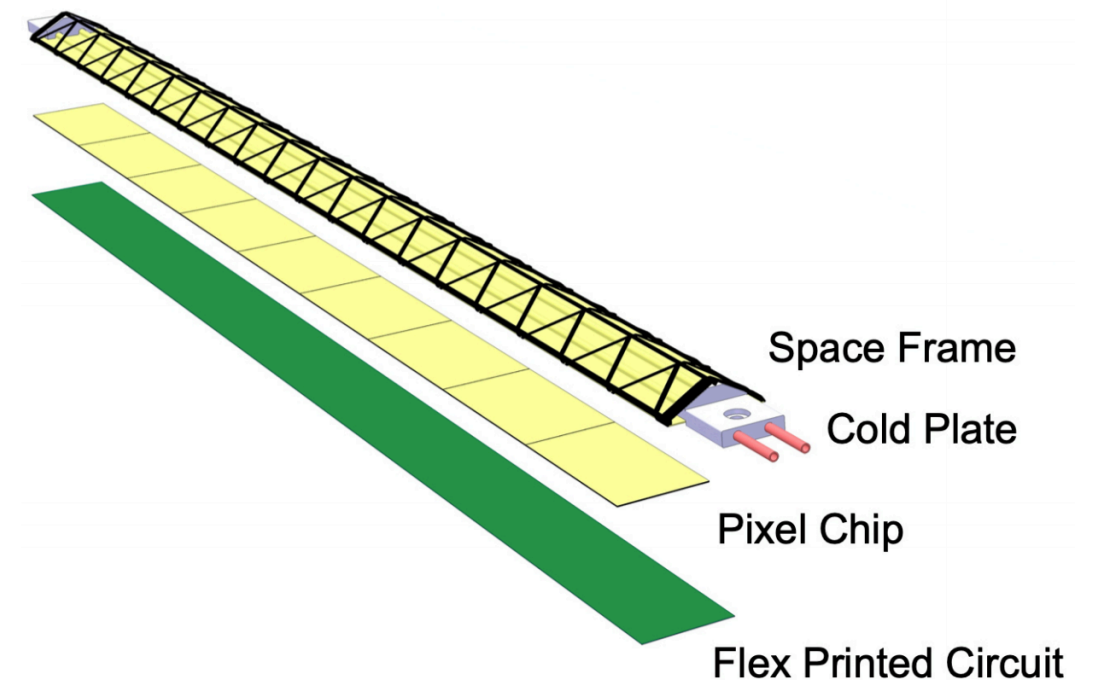


Reynier Cruz-Torres
ECCE Workshop
02/11/2021

Integrated (Barrel+Disks) All-Silicon Tracker Concept



- Geometry made out of Alice ITS2-like staves (material budget $X/X_0 = 0.3\%$)
- silicon pixel of $10\ \mu\text{m}$ pitch based on Monolithic Active Pixel Sensor ([see L. Gonella's presentation](#))
- Simulations carried out in the Fun4All full-simulation framework

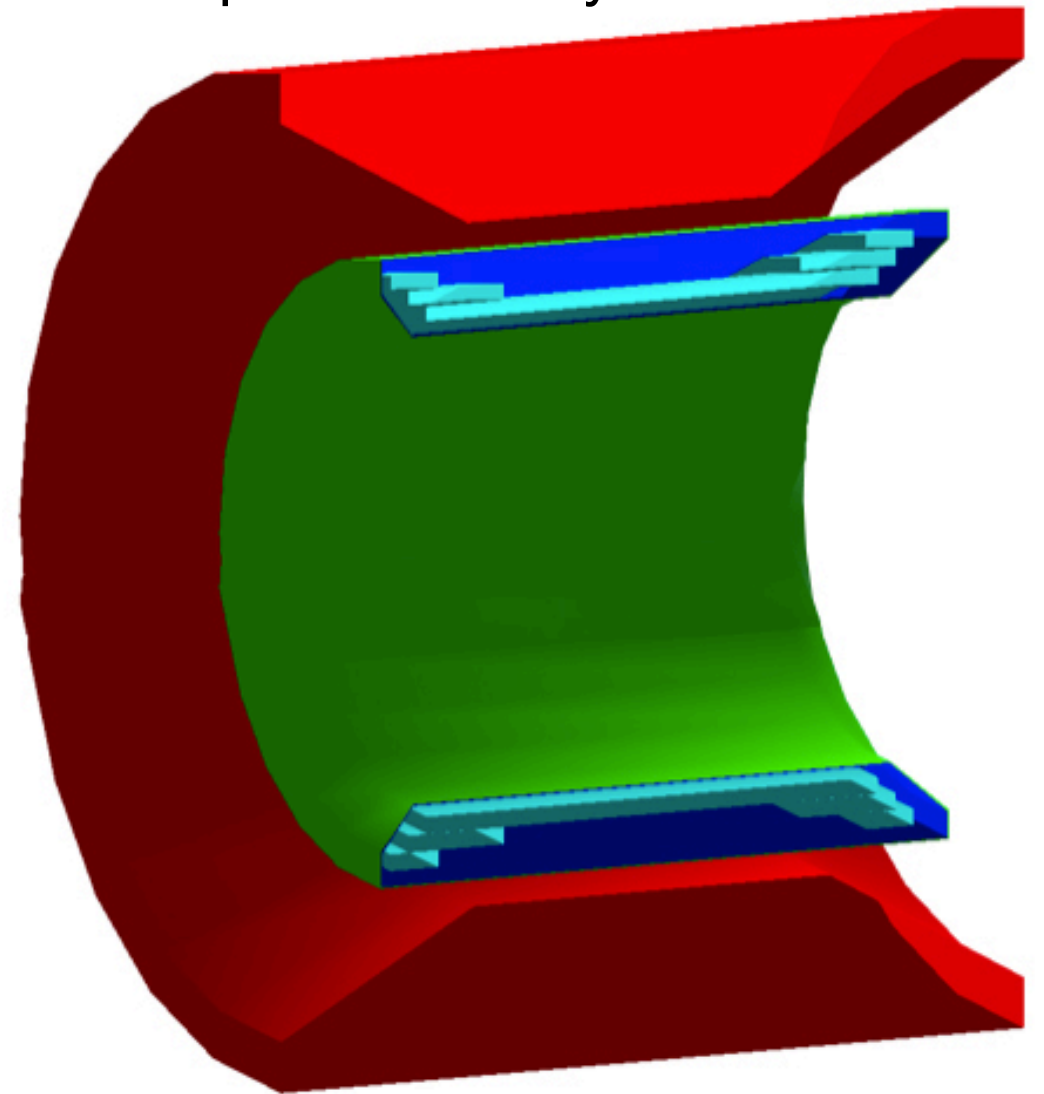


Magnetic Fields

BaBar magnet
peak intensity ~ 1.4 T



Beast magnet
peak intensity ~ 3.0 T

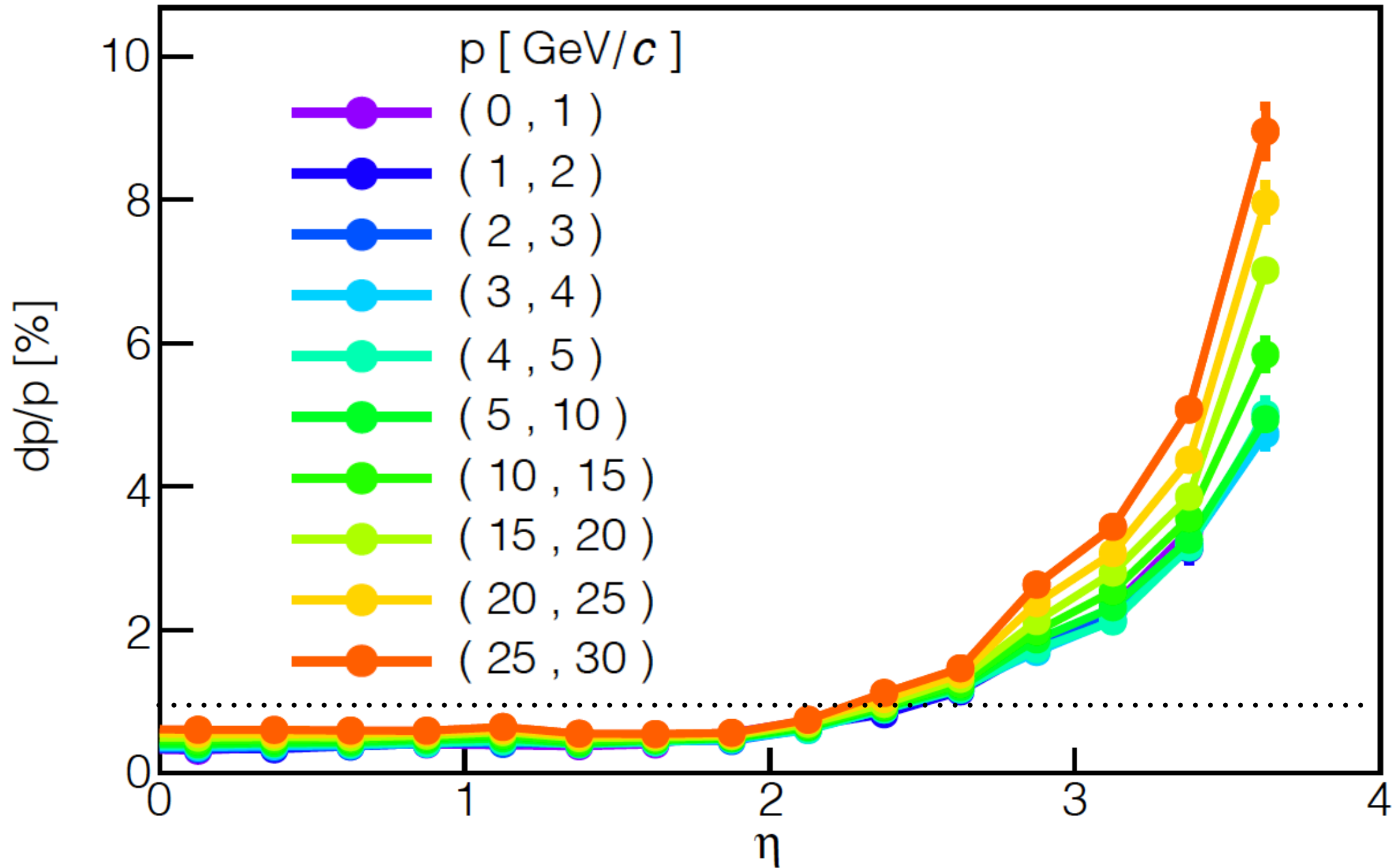


- Solenoid field maps
- Take into account slight fall in B-field intensity away from the interaction point
- Can lead to 10% differences in momentum resolutions compared to uniform fields in the forward / backward directions

Momentum Resolutions

Magnetic field: Beast map (3.0T)
 π^- , 10 μm pixel, $X/X_0 = 0.3\%$

Full (Geant4) simulations

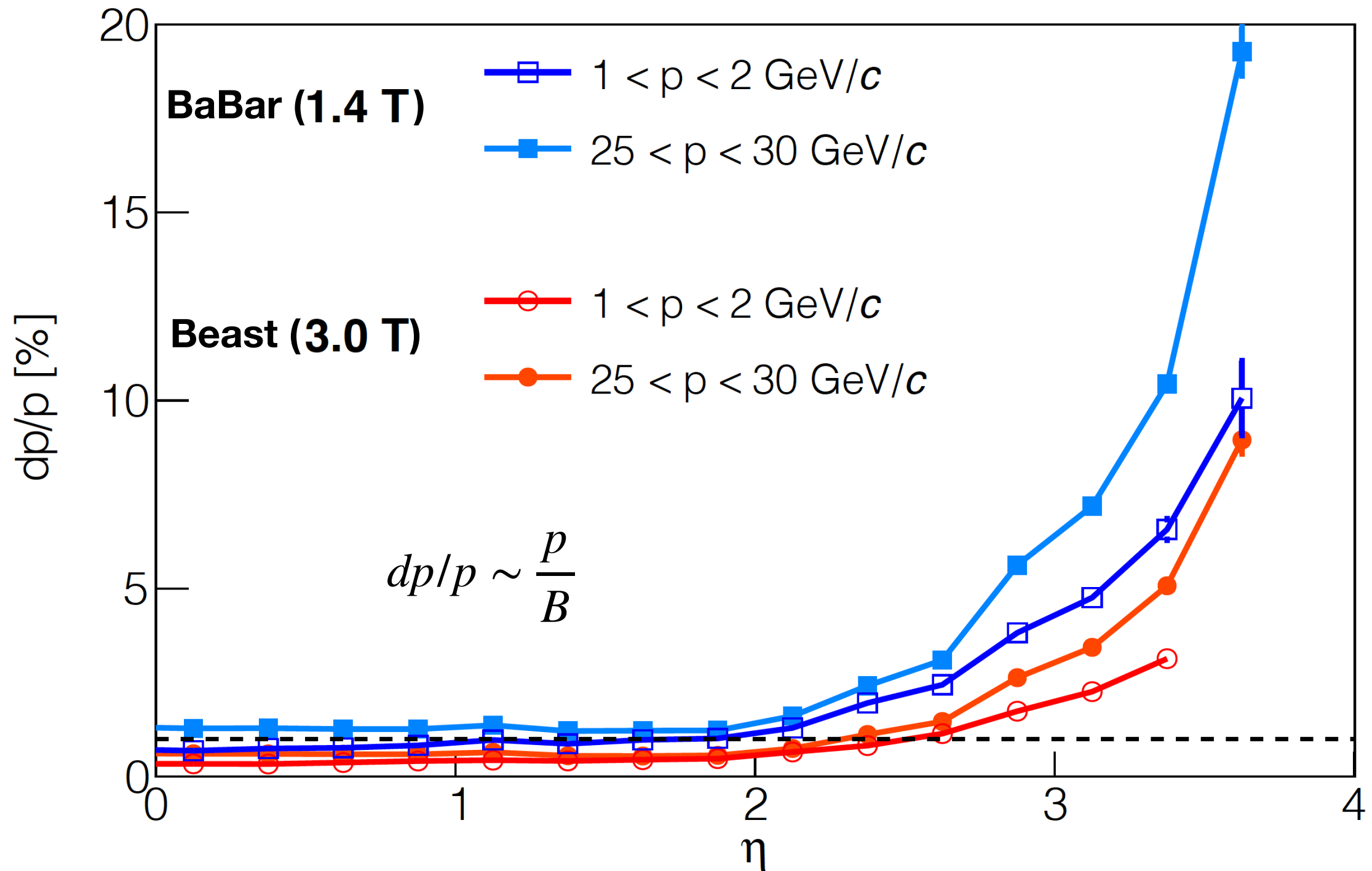


η	0	0.5	1	1.5	2	3	4	5
θ [deg]	90	62	40	25	15	5.7	2.1	0.8

B-field comparison

π^- , 10 μm pixel, $X/X_0 = 0.3\%$

Full (Geant4) simulations



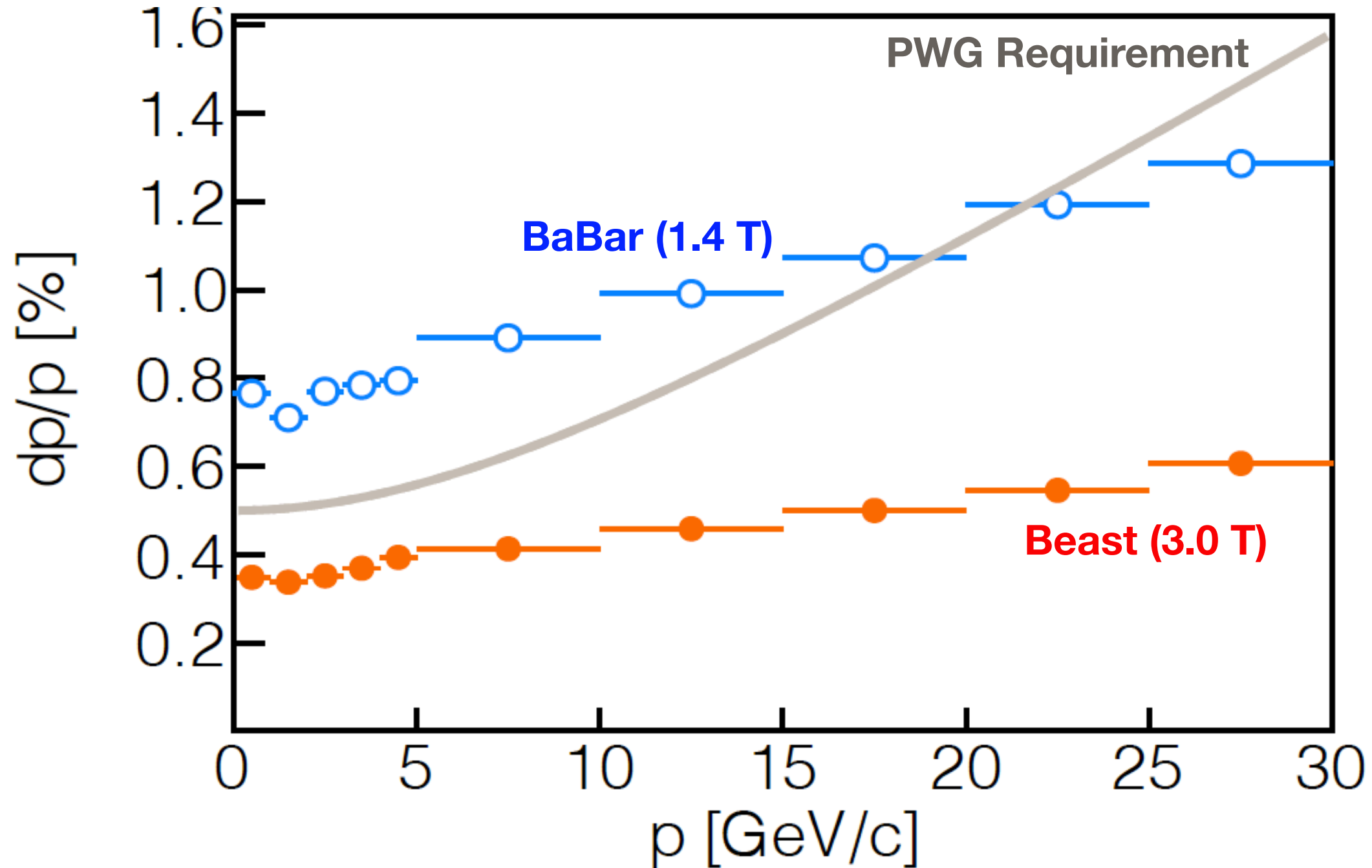
η	0	0.5	1	1.5	2	3	4	5
θ [deg]	90	62	40	25	15	5.7	2.1	0.8

Momentum Resolutions

π^- , 10 μm pixel, $X/X_0 = 0.3\%$

Full (Geant4) simulations

$0 < |\eta| < 0.5$



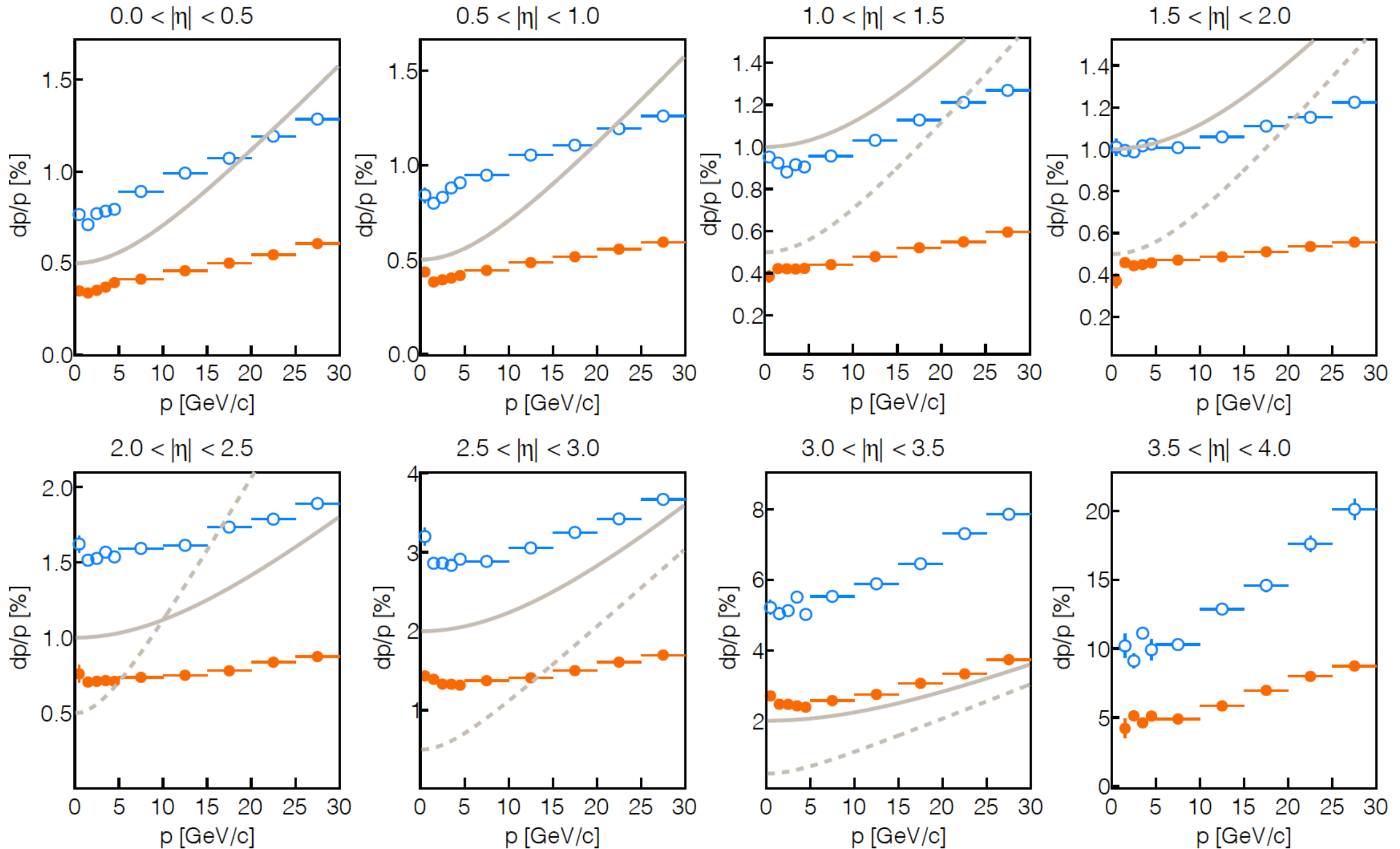
Colored curves parametrized via fits of functional form: $dp/p = Ap \oplus B$ and reported in YR

Momentum Resolutions

Full (Geant4) simulations

π^- , 10 μm pixel, $X/X_0 = 0.3\%$

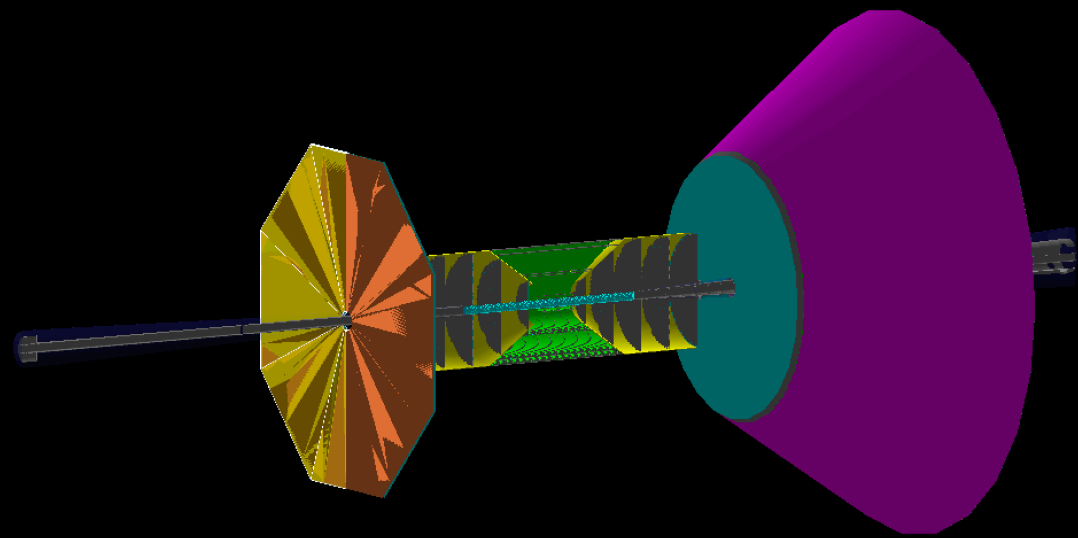
$$dp/p = Ap \oplus B$$



Beast (3.0 T)

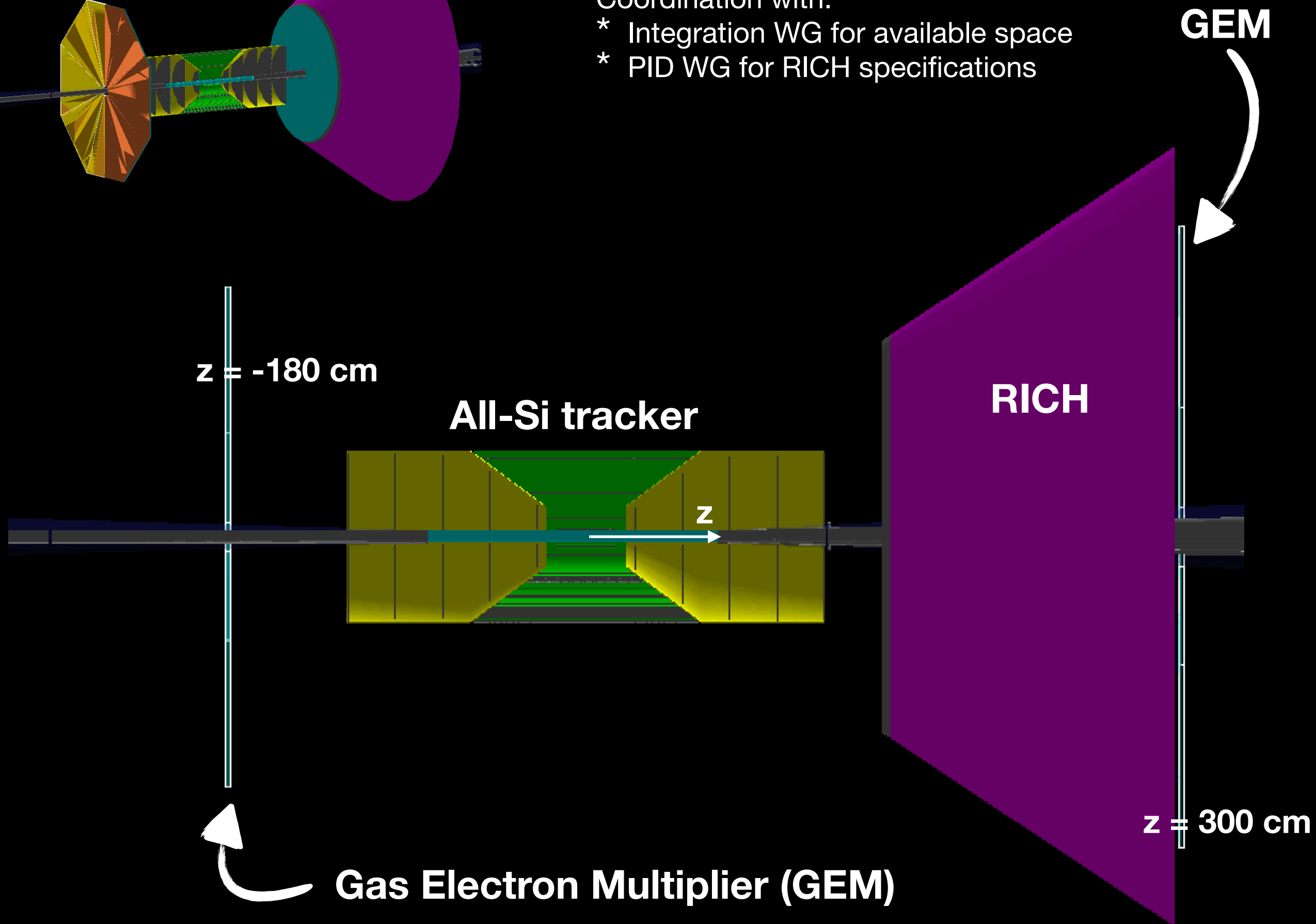
BaBar (1.4 T)

PWG Requirements: — forward backward



Coordination with:

- * Integration WG for available space
- * PID WG for RICH specifications



$z = -180 \text{ cm}$

All-Si tracker

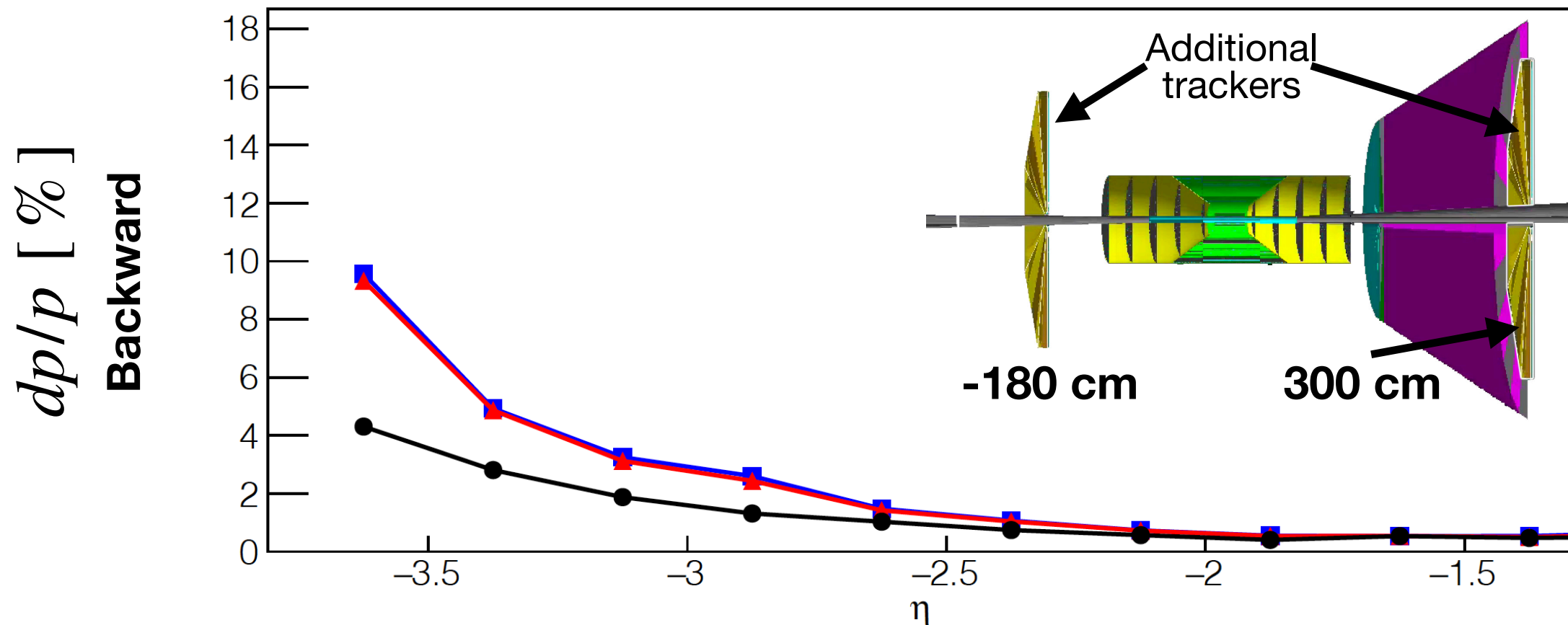
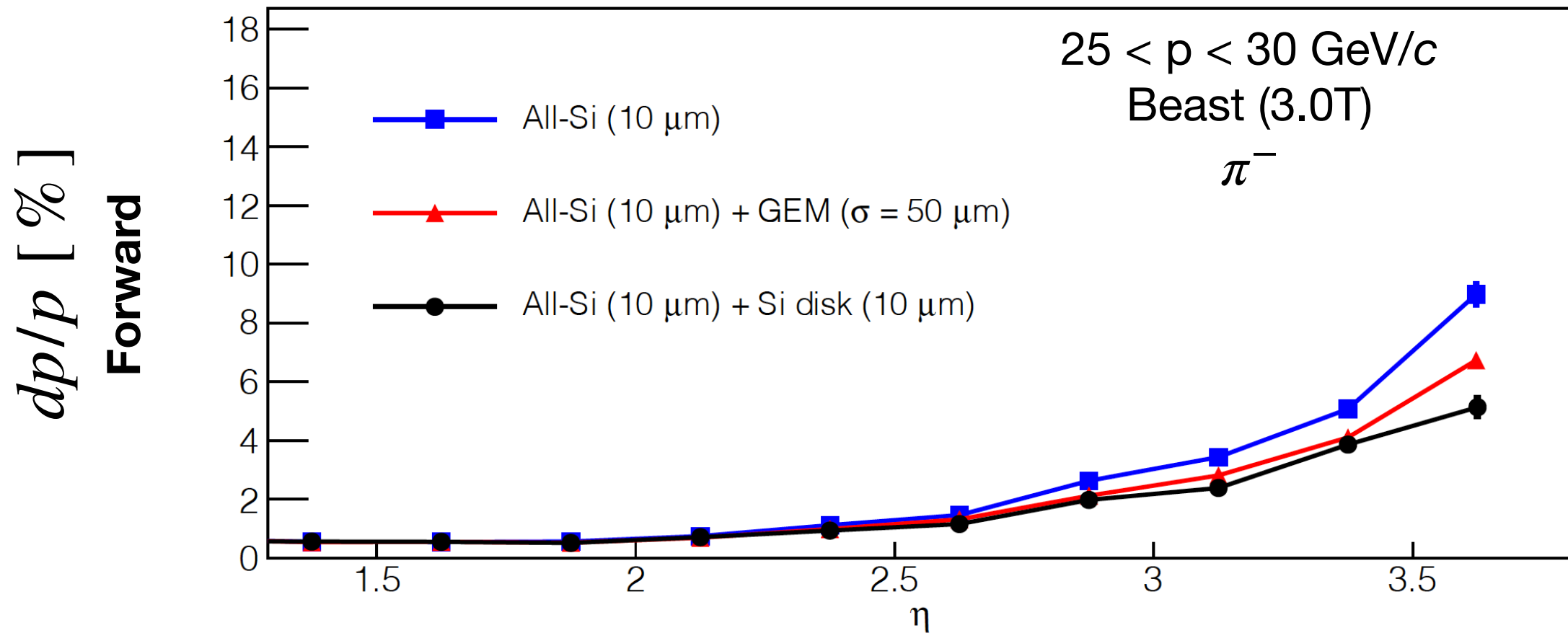
RICH

GEM

$z = 300 \text{ cm}$

Gas Electron Multiplier (GEM)

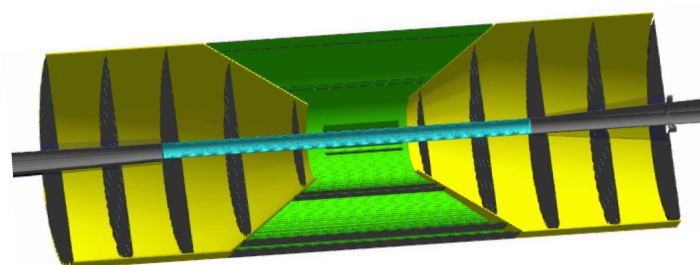
Complementing All-Si tracker with other detectors



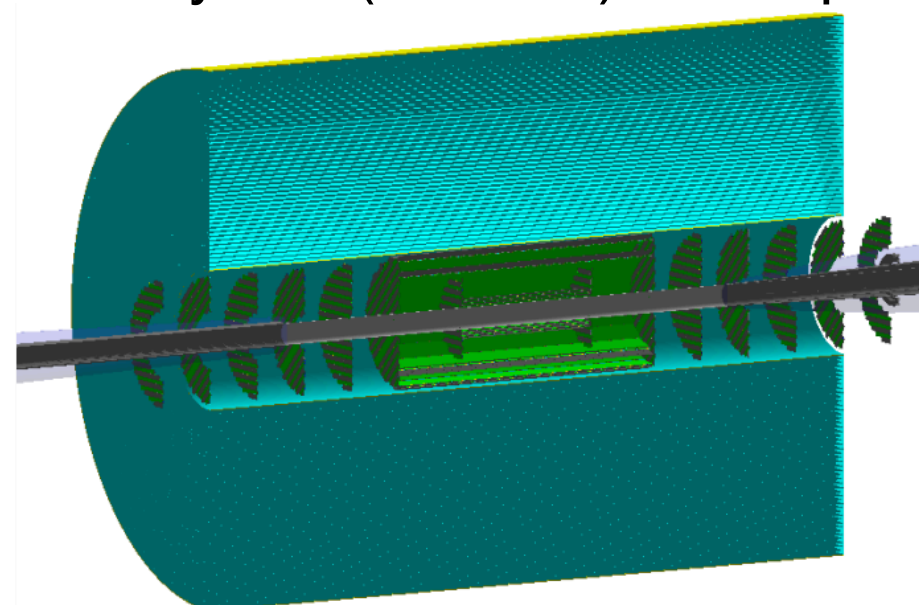
Summary

- Studied All-Silicon tracker prototype for the EIC in full simulations
- Current concept uses Alice ITS2 staves and 10 μm pitch MAPS sensor
- Compared detector performance in two magnetic-field settings (1.4, 3.0 T)
- Momentum resolutions inversely proportional to magnetic field
- Trackers satisfy PWG requirements except for the high- $|\eta|$ region
- Momentum resolutions can be enhanced by complementing detectors with additional tracking stations

All-silicon concept



Hybrid (Si+TPC) concept



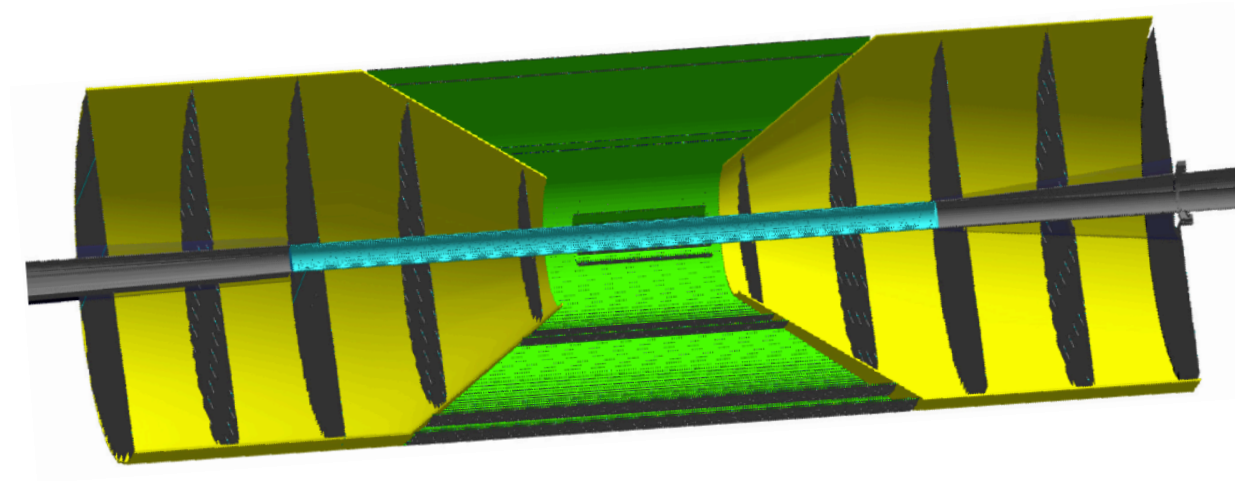
See work by H. Wennl f

- YR tracking WG meetings: <https://indico.bnl.gov/category/276/>

- SVT workshop: <https://www.jlab.org/conference/SVT-EIC>

- Yellow report

Thanks!



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