Azimuthal momentum-resolution asymmetry in hadron direction

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EIC YR Tracking Meeting

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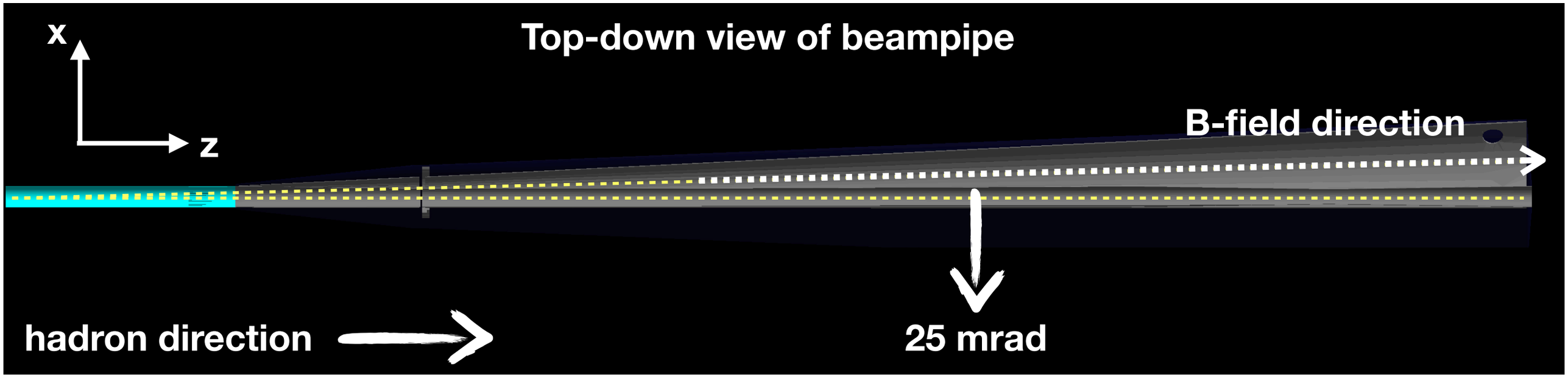
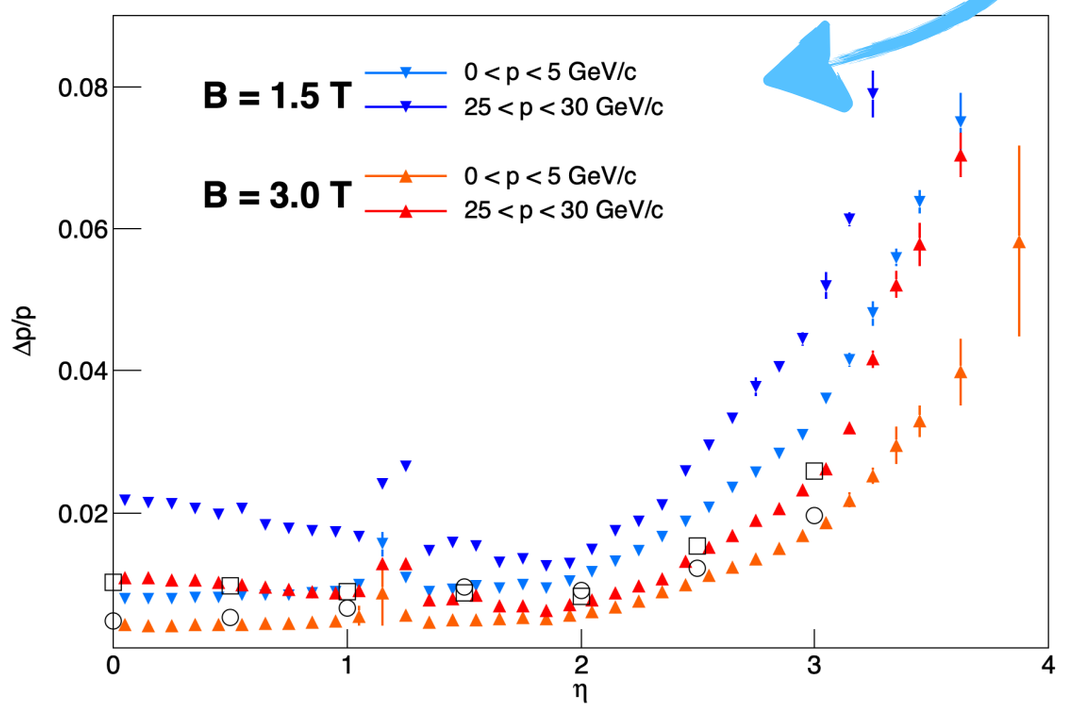
Introduction



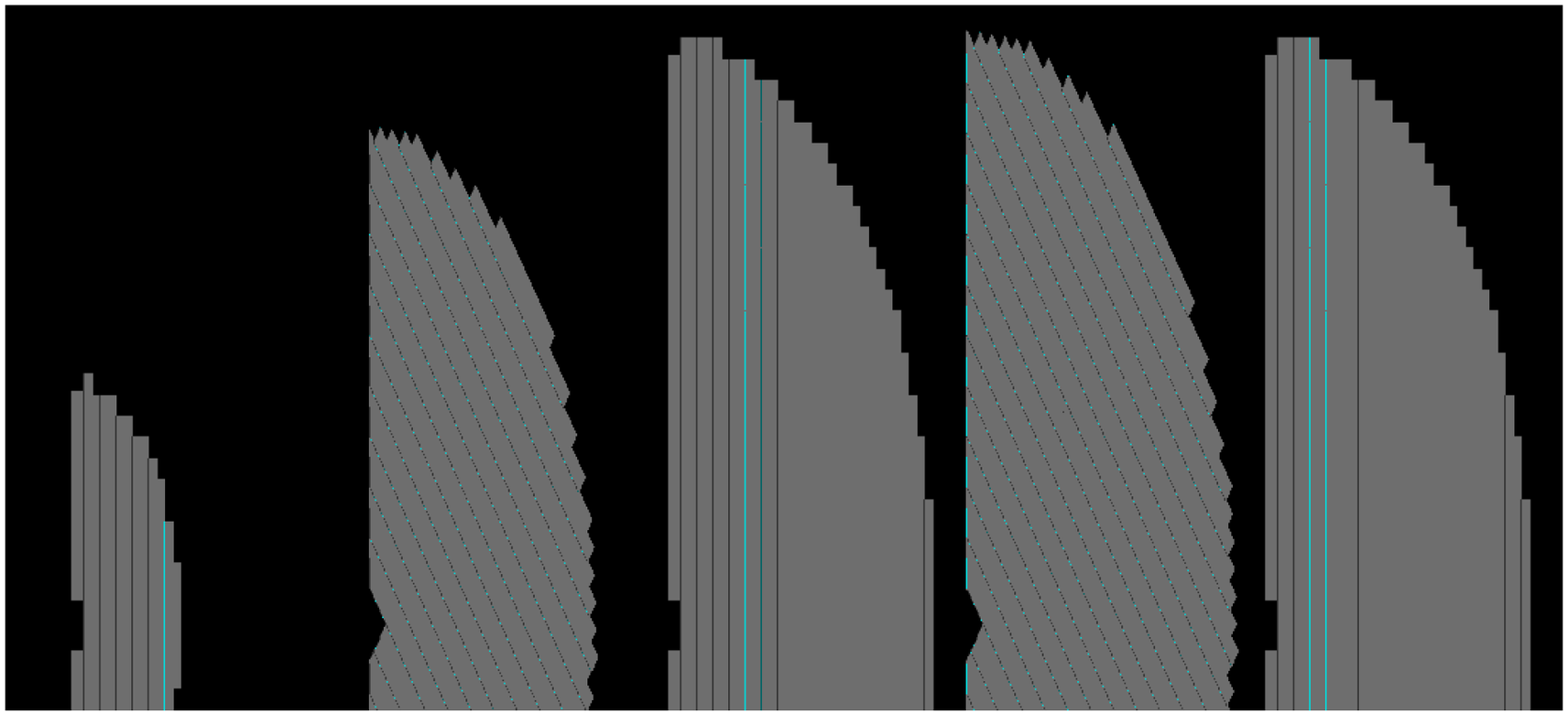
- Results shown so far assuming ϕ independence

- B field rotated by 25 mrad in hadron-going direction
- $\int B \cdot dl$ depends on ϕ
- Need to take into account asymmetry impact on momentum resolution



Simplifying the geometry

The realistic Berkeley All-Si tracker is not azimuthally symmetric:



B field: uniform 3.0 T

Silicon disks

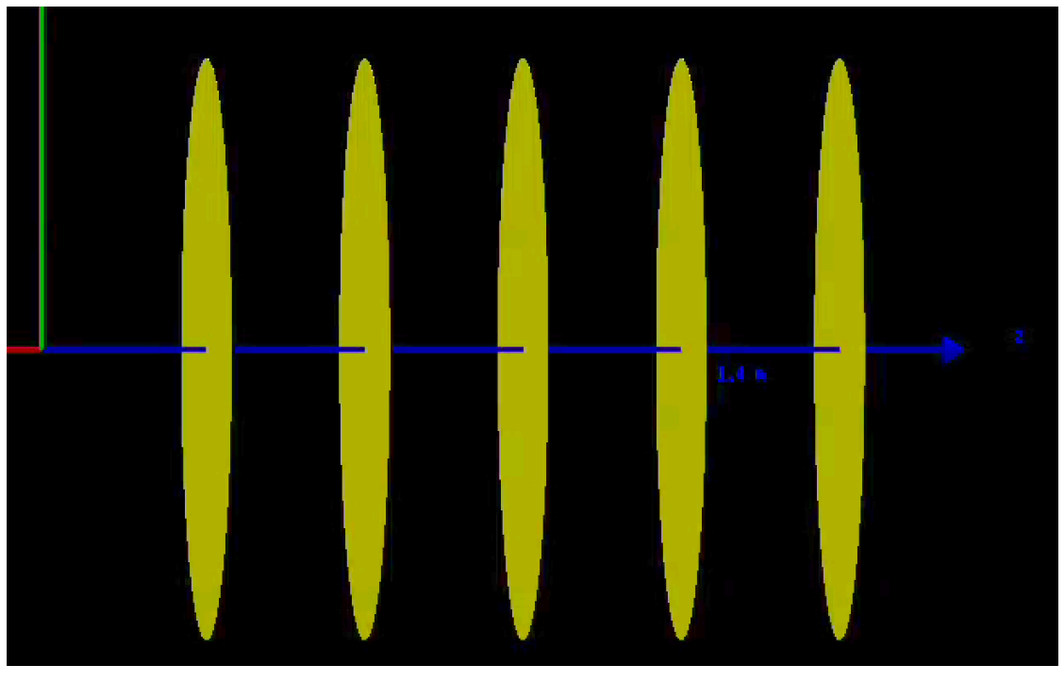
z = 25, 49, 73, 97, 121 cm

r_{min} = 0

r_{max} = 44 cm

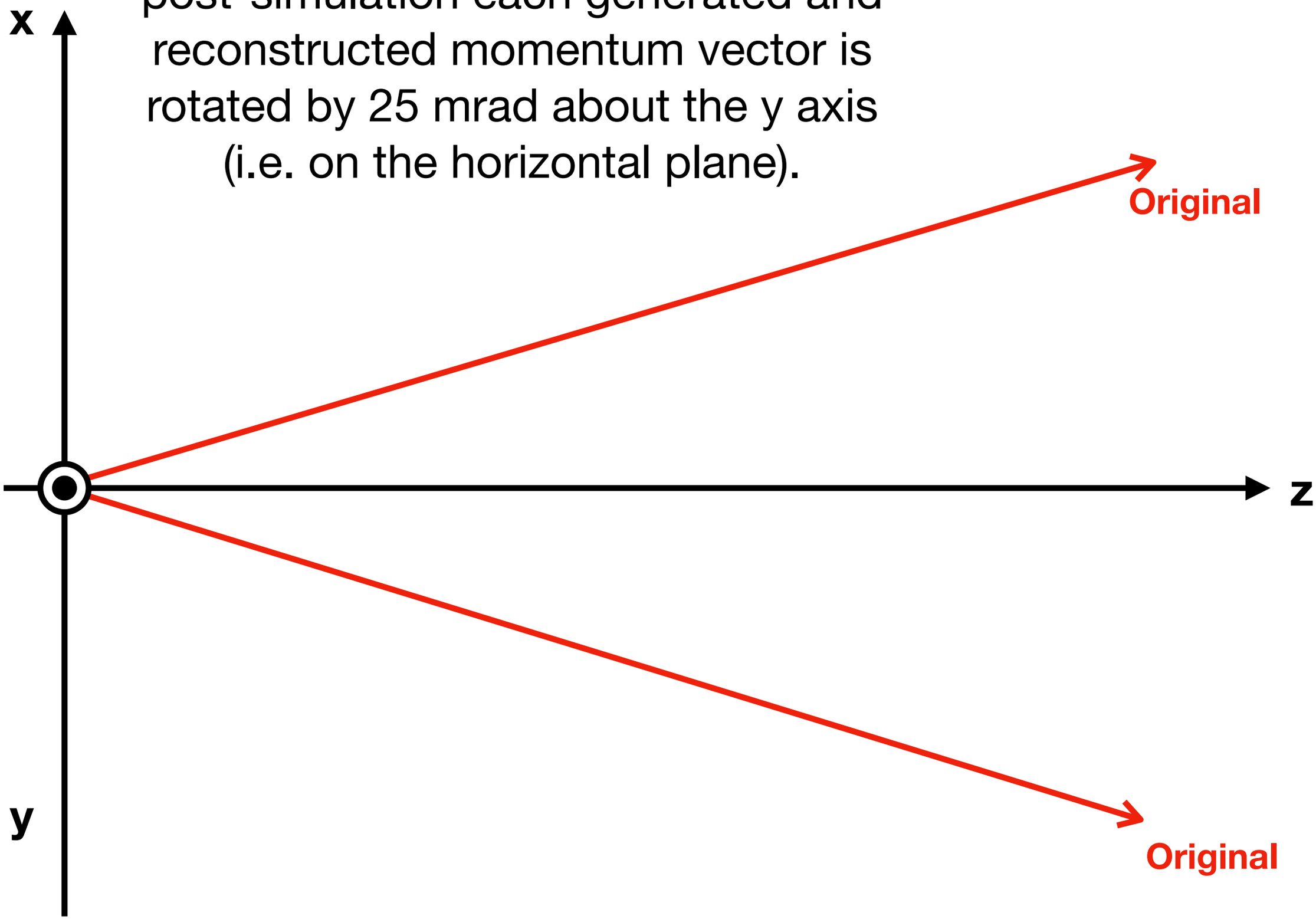
pixel size = 20 μm

material = 0.3% X/X_0 each



Rotation

post-simulation each generated and reconstructed momentum vector is rotated by 25 mrad about the y axis (i.e. on the horizontal plane).



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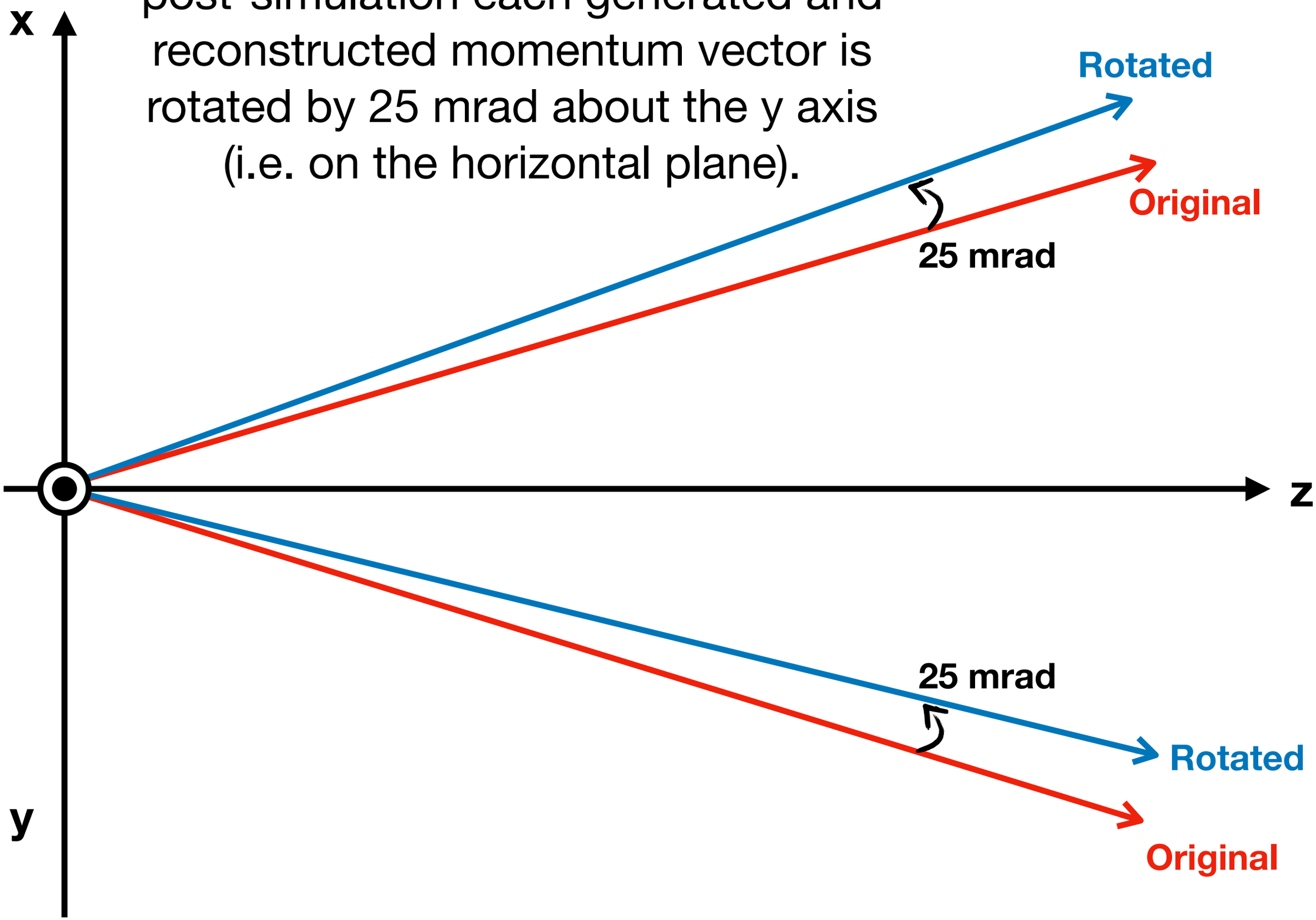
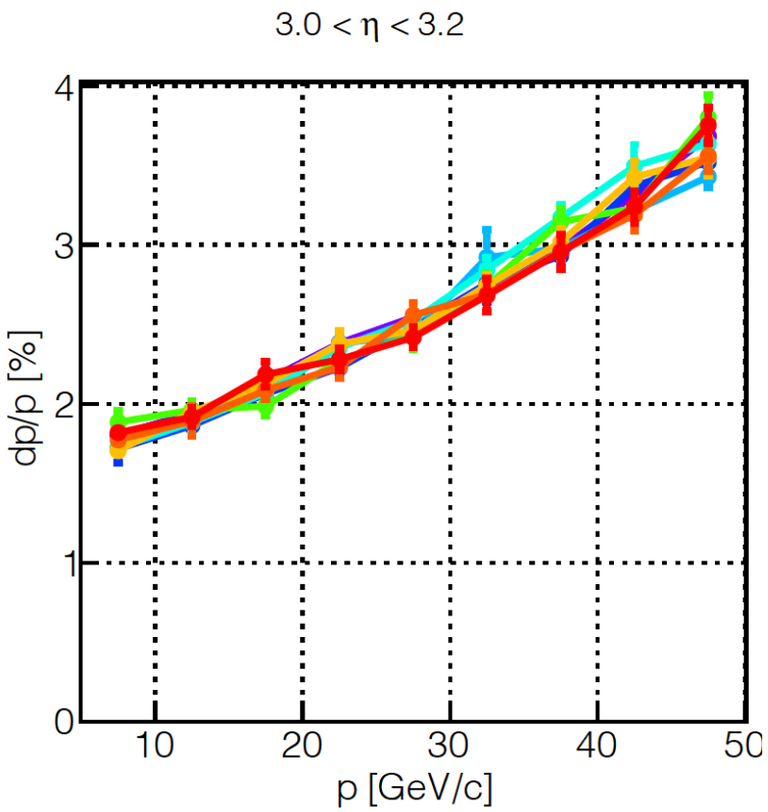
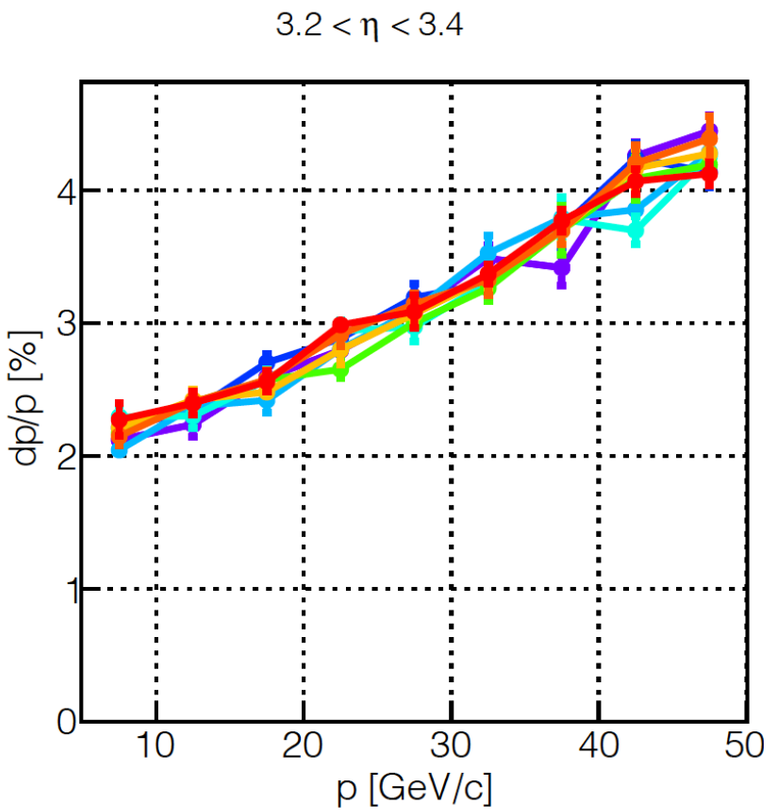
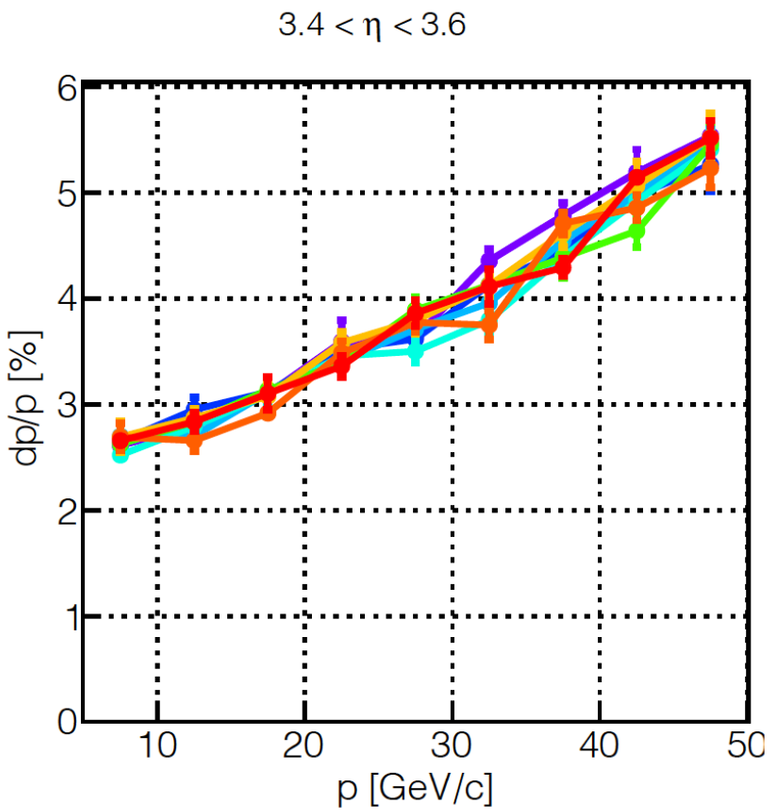
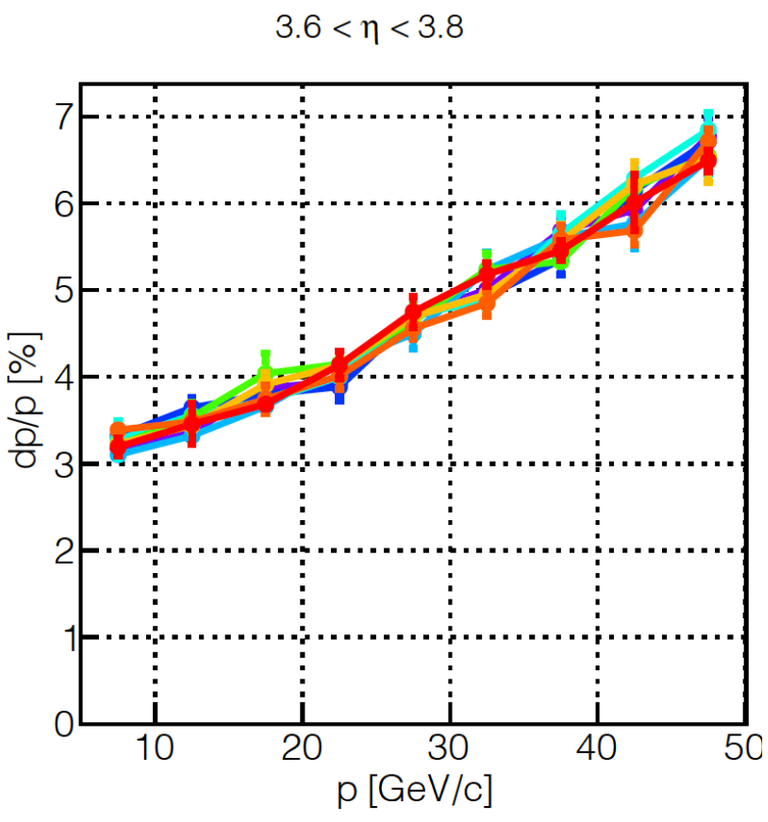


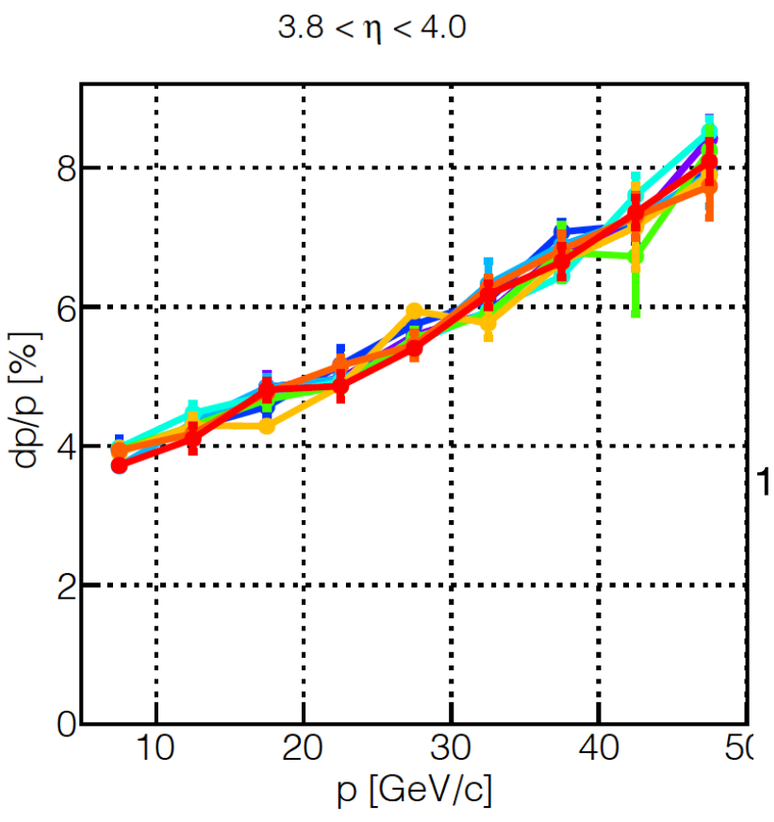
Momentum resolutions before rotation



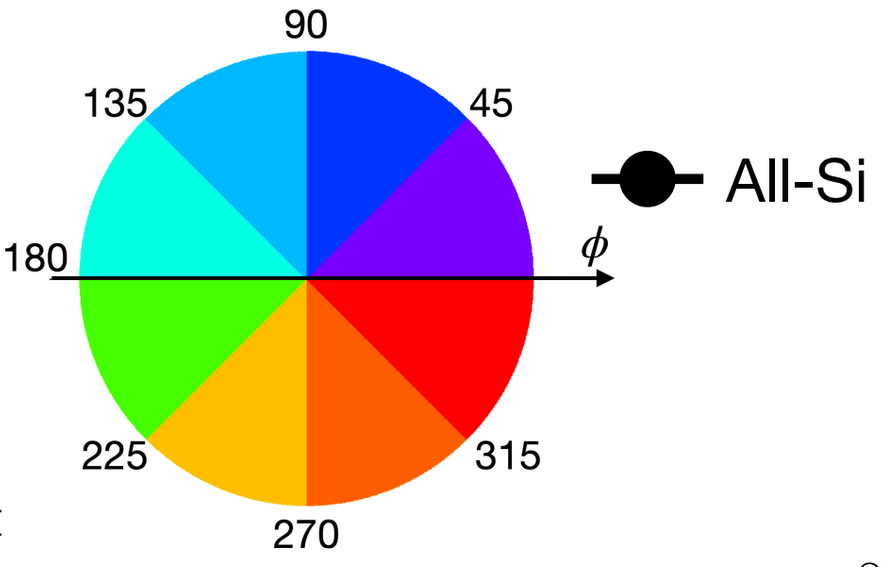




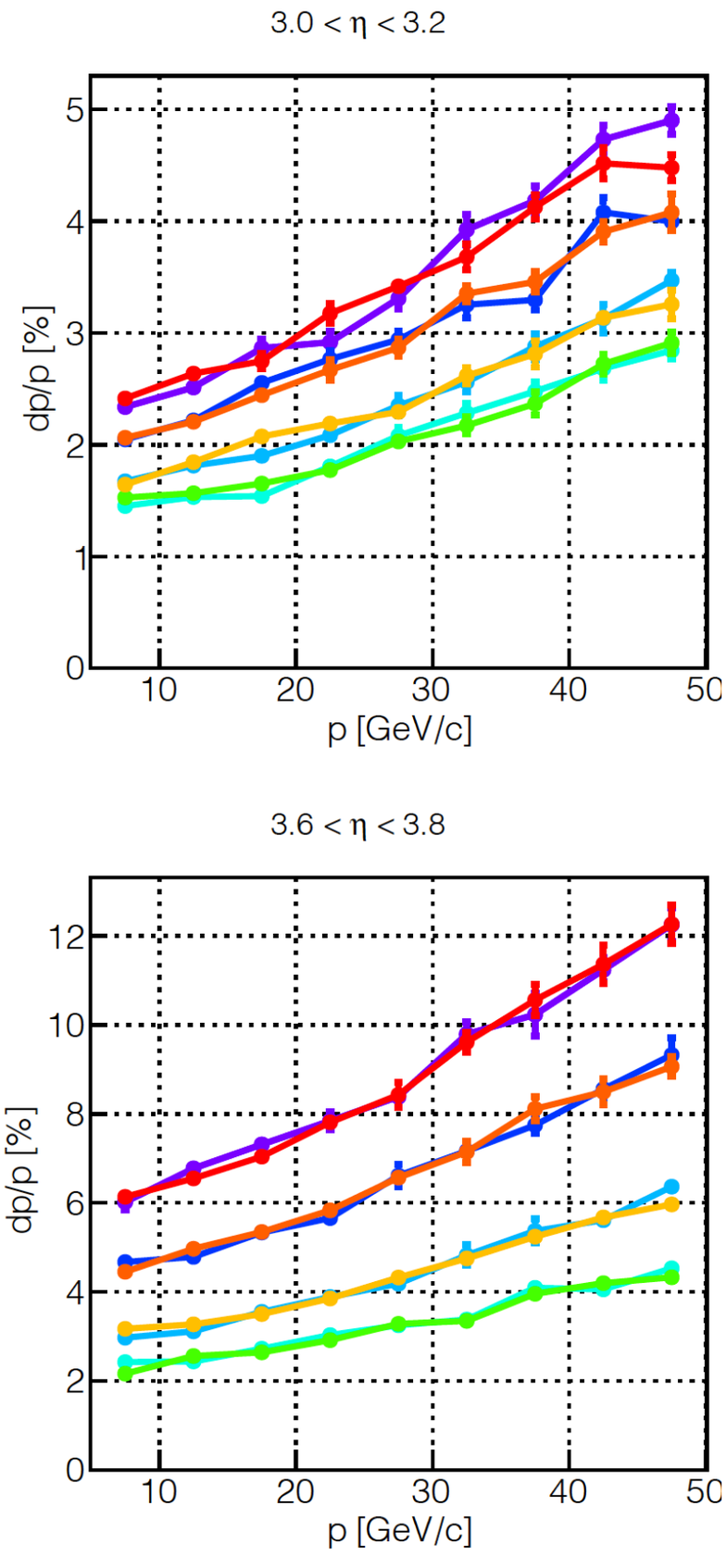


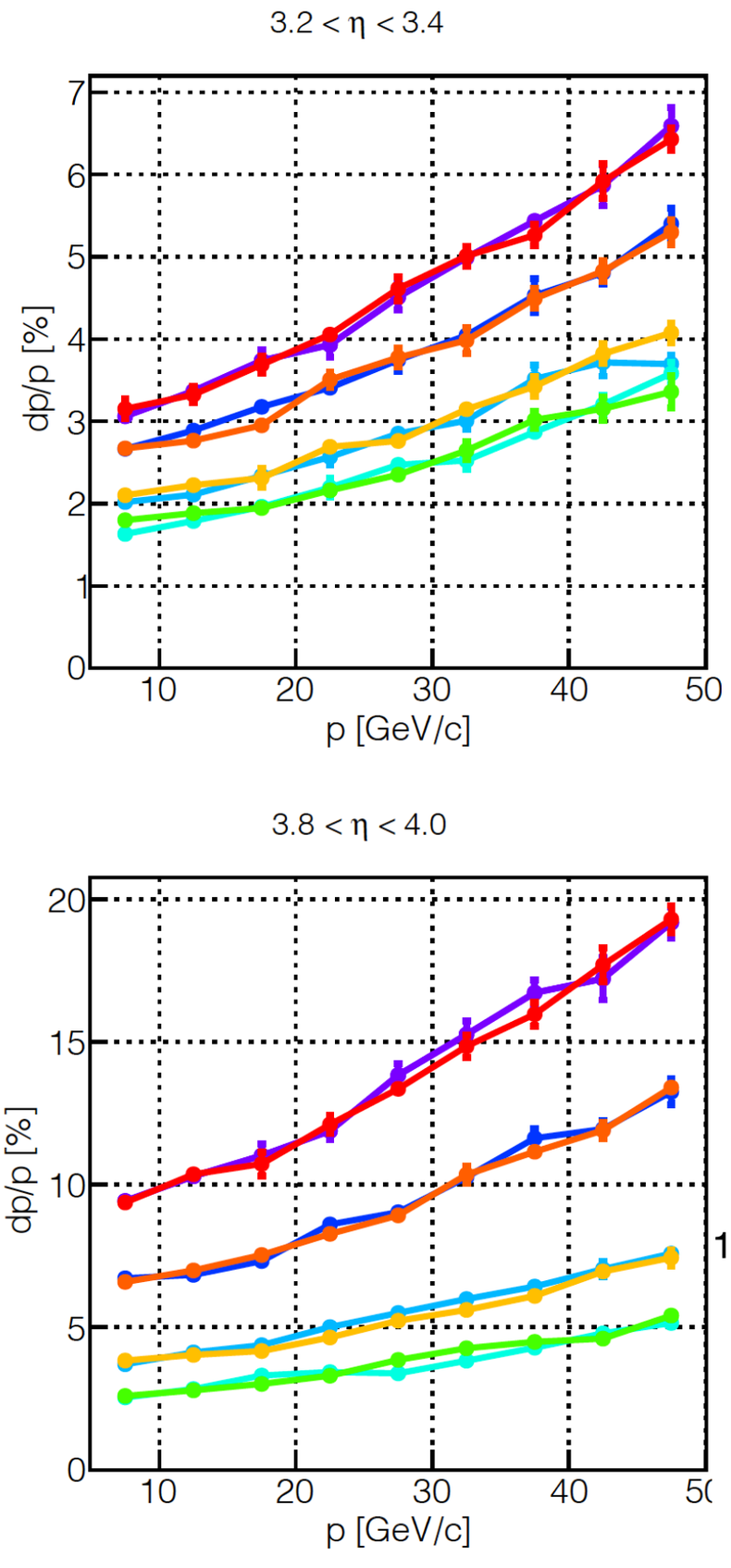


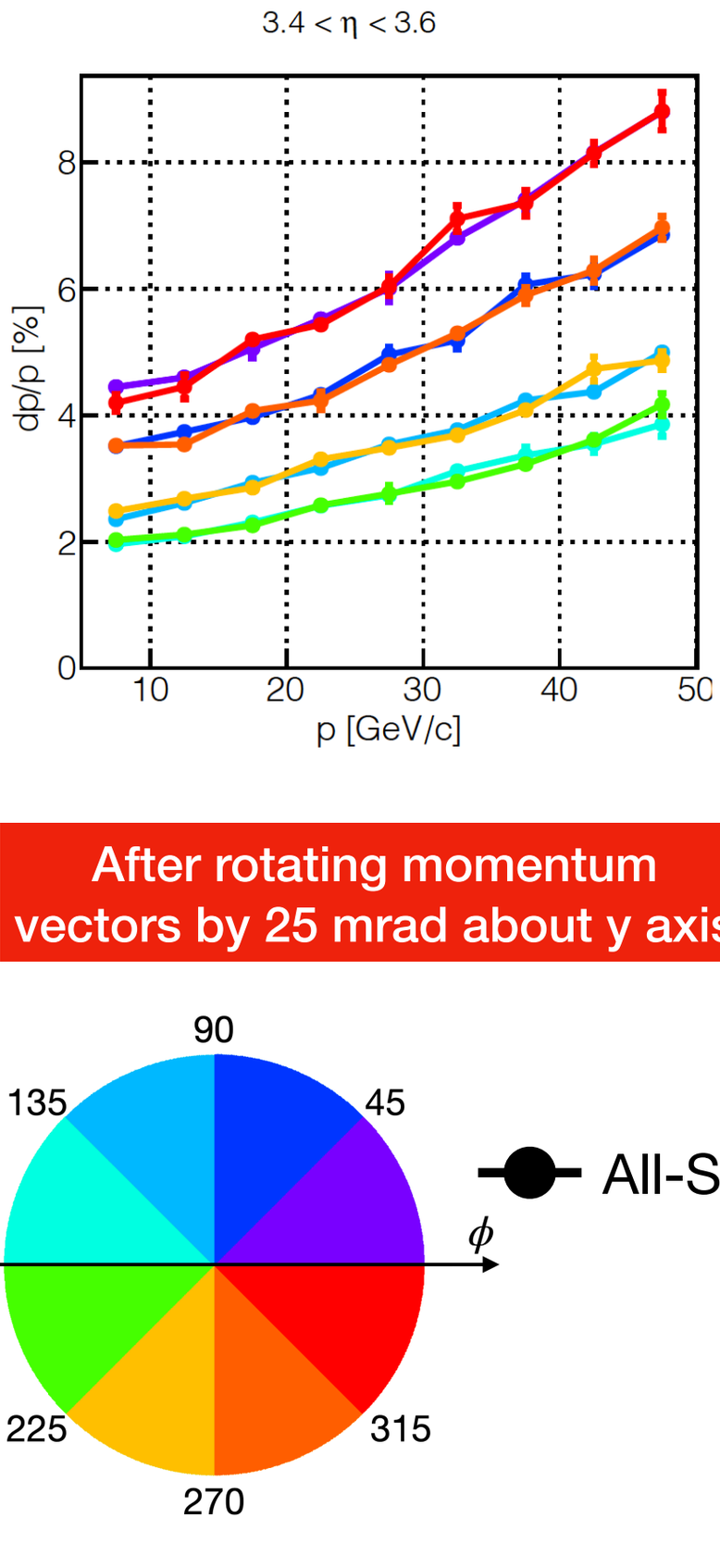
Before rotating (perfect azimuthal symmetry)



Momentum resolutions after rotation

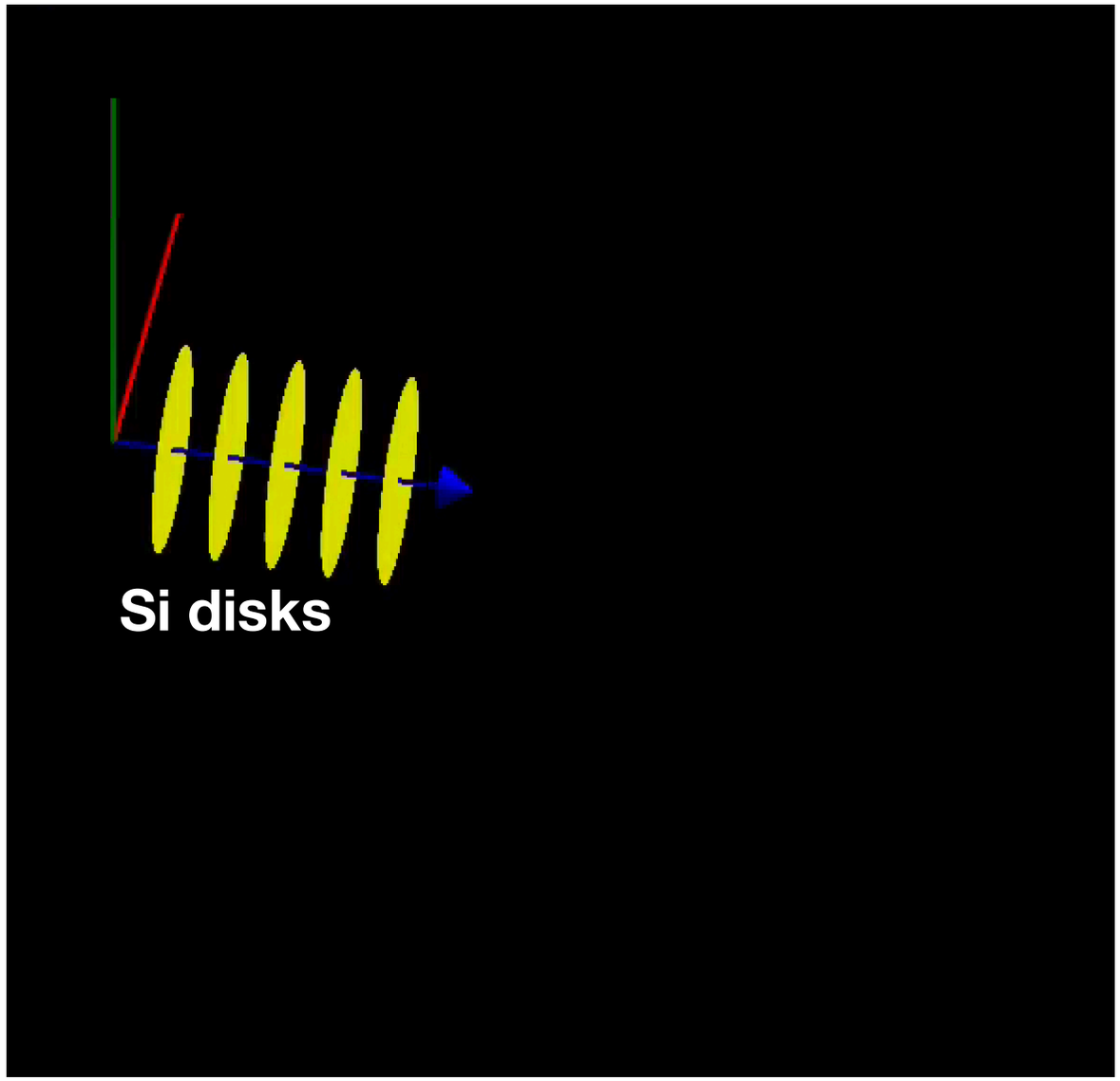






After rotating momentum vectors by 25 mrad about y axis

Detector layout (Si disks)



B field: uniform 3.0 T

Silicon disks

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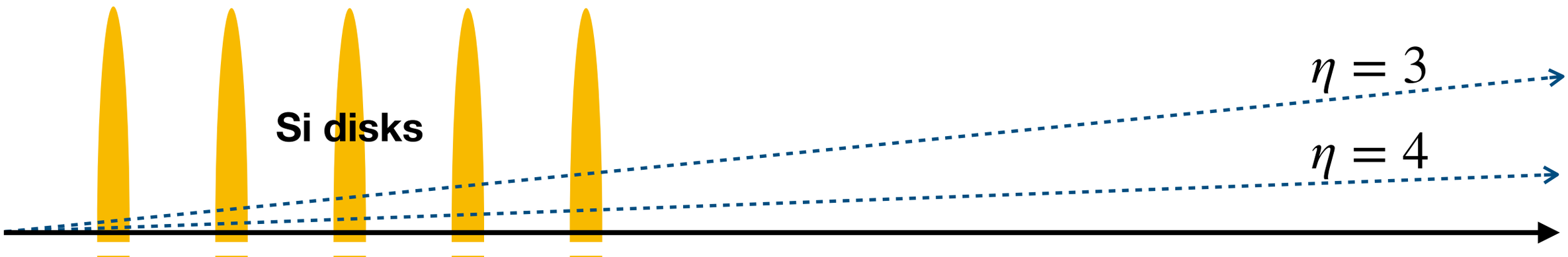
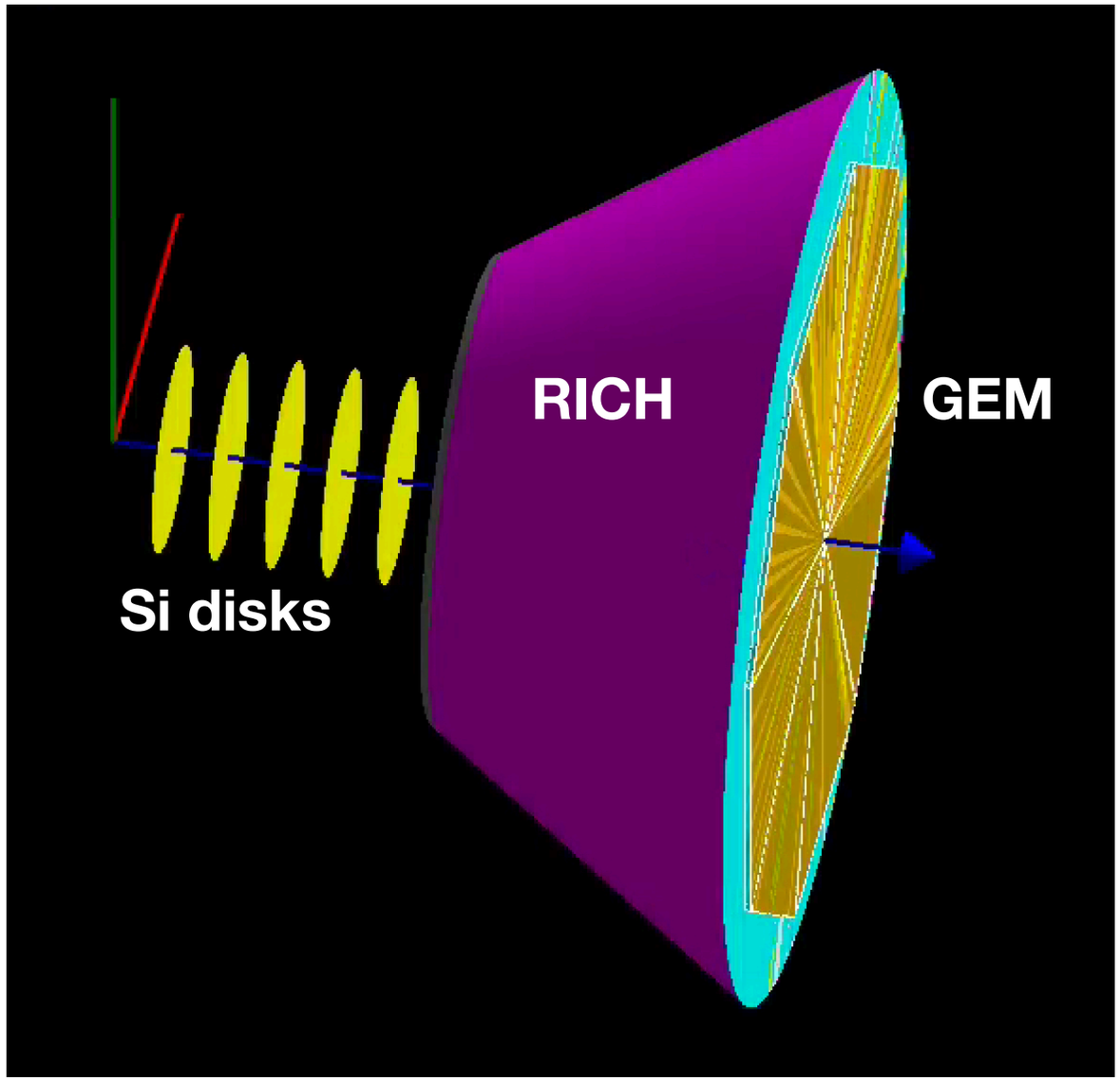
r_{max} = 44 cm

pixel size = 20 μm

material = 0.3% X/X_0 each



Detector layout (Si disks + GEM)



B field: uniform 3.0 T

Silicon disks

z = 25, 49, 73, 97, 121 cm

r_{min} = 0

r_{max} = 44 cm

pixel size = 20 μm

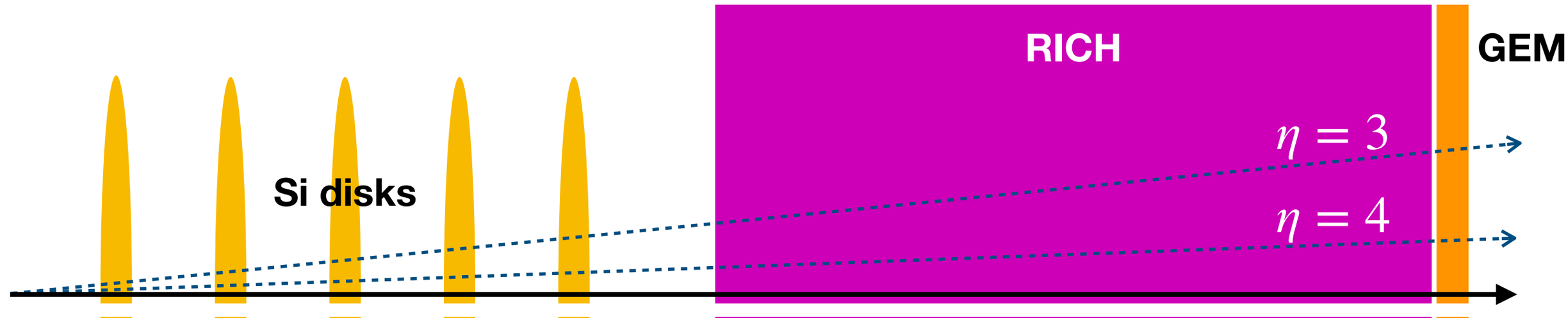
material = 0.3% X/X_0 each

GEM

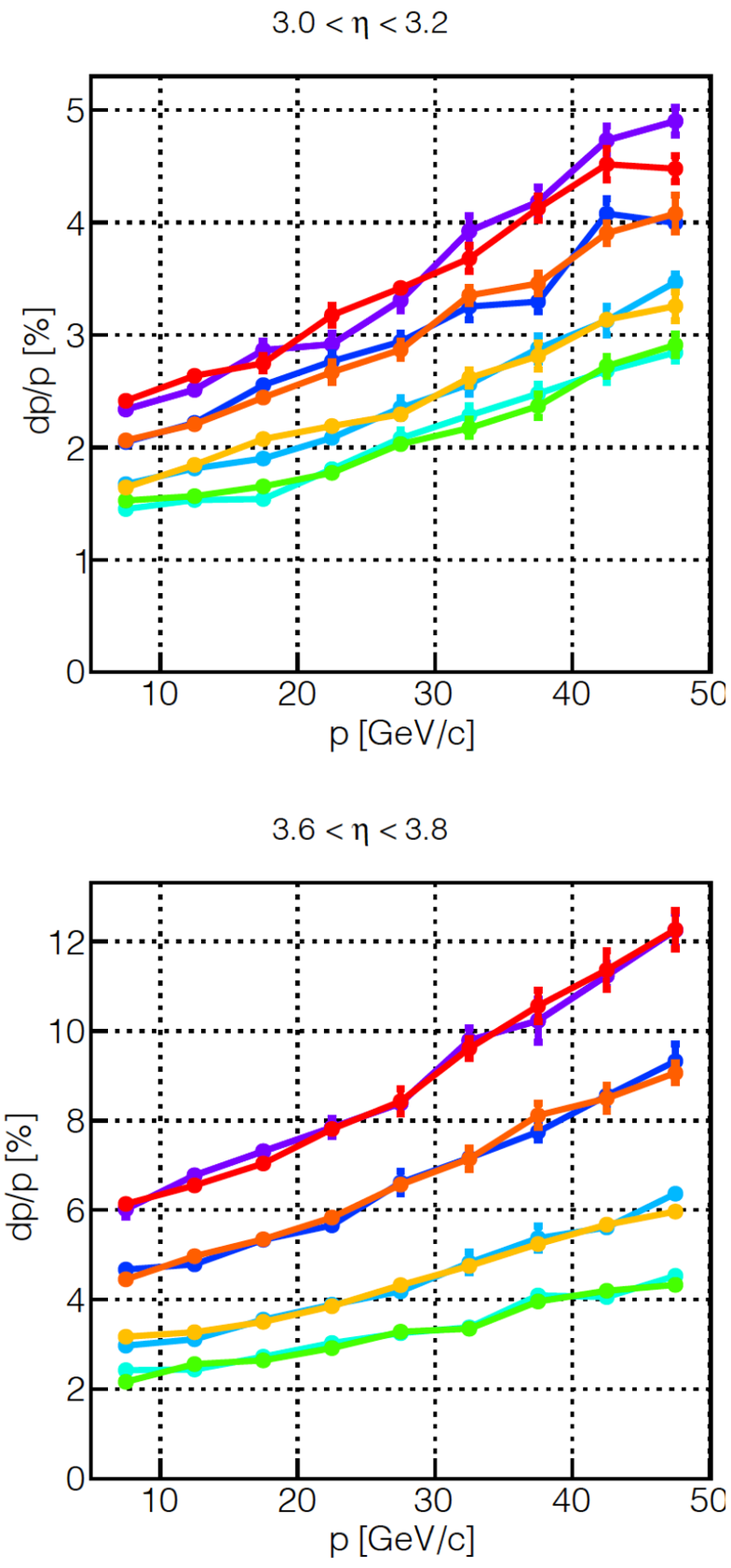
z position = 300 cm

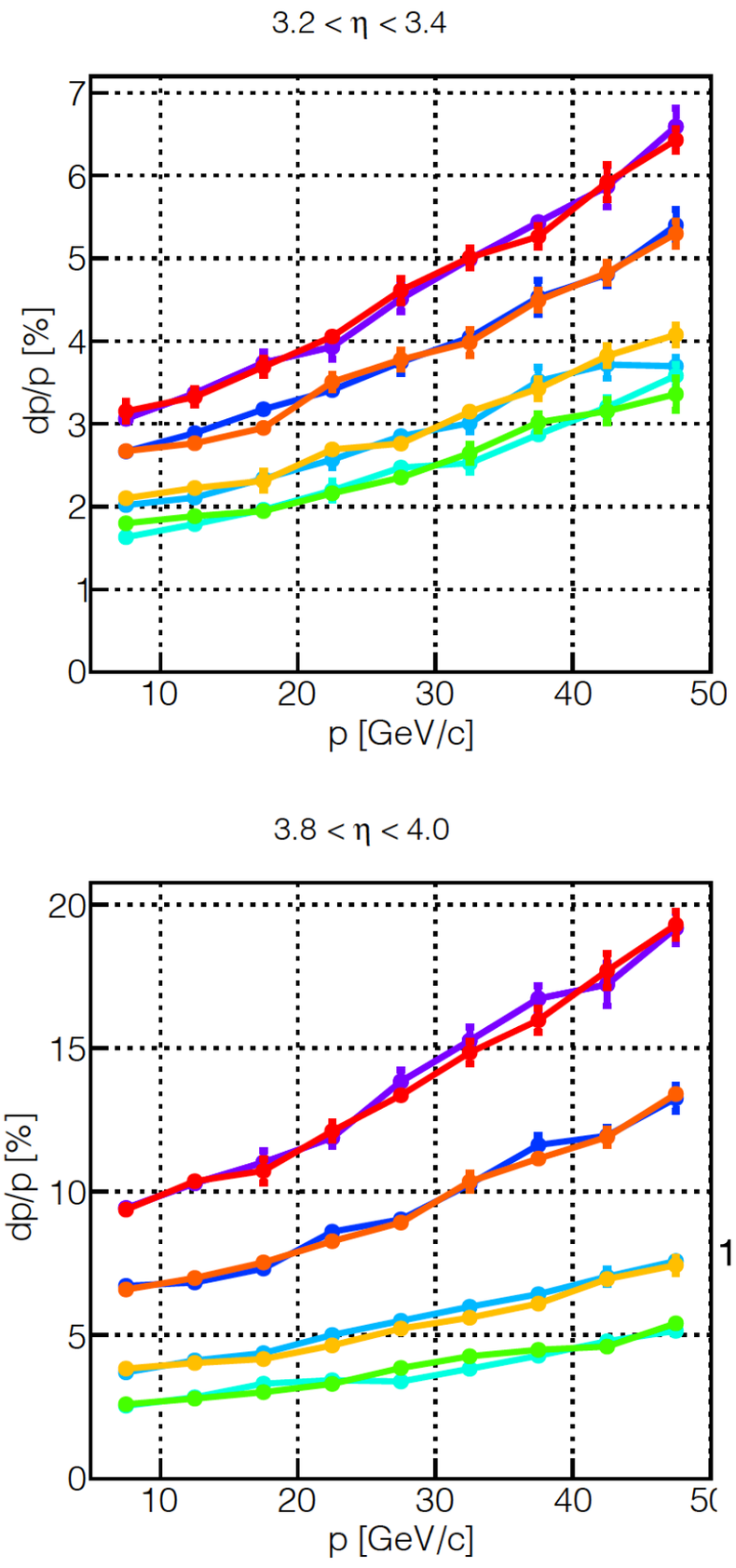
$\sigma(\hat{r}) = 50\ \mu\mathrm{m}$

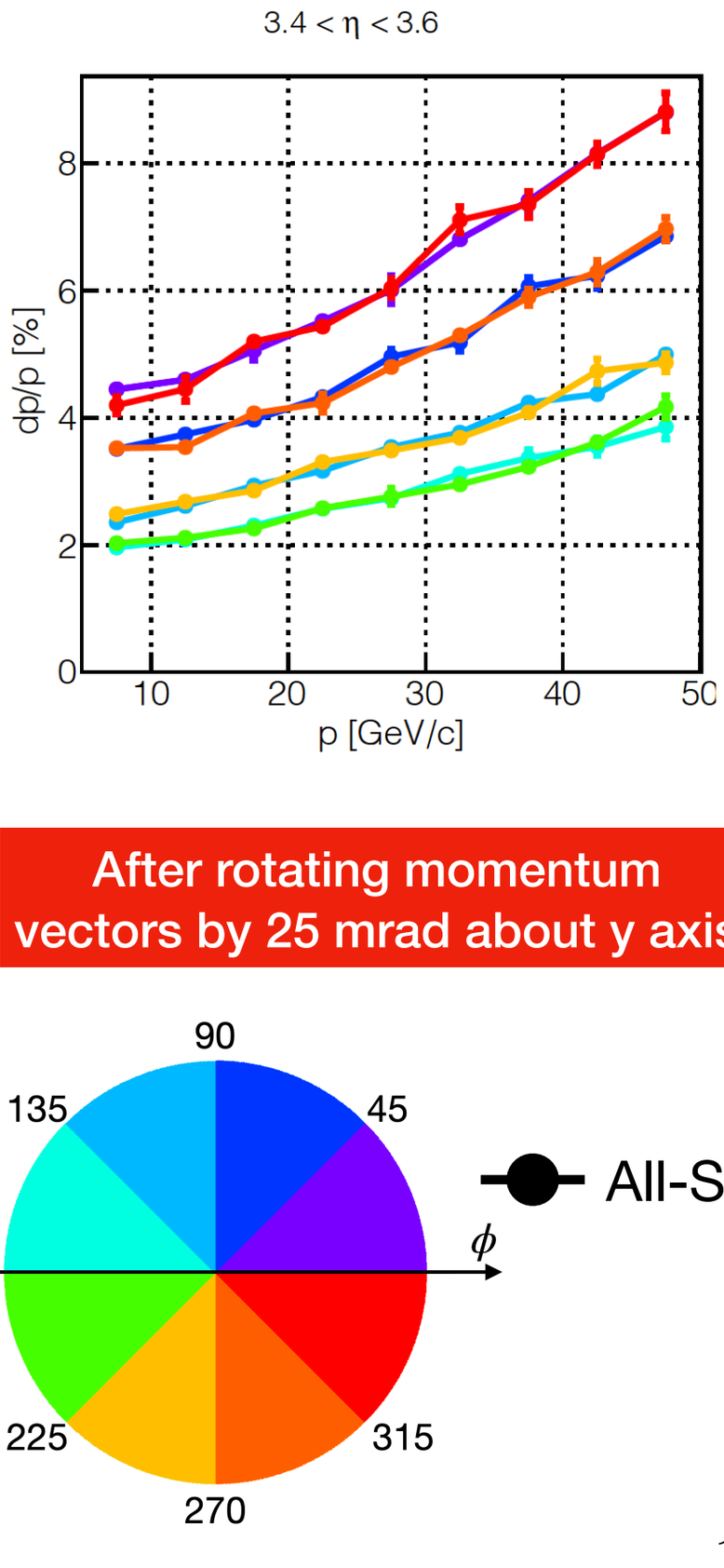
$\sigma(\hat{\phi}) = 50\ \mu\mathrm{m}$



Momentum resolutions after rotation

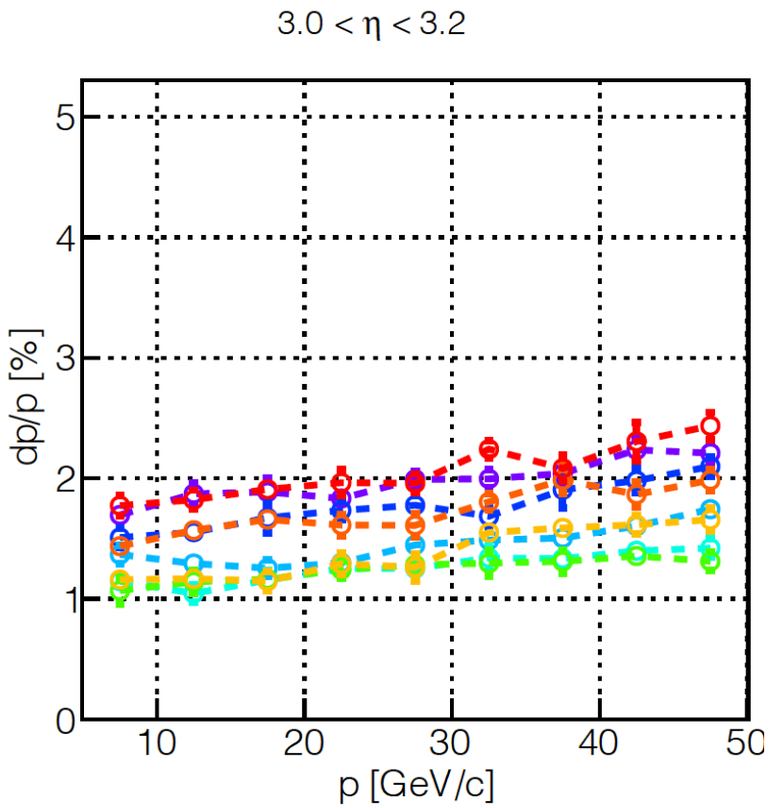


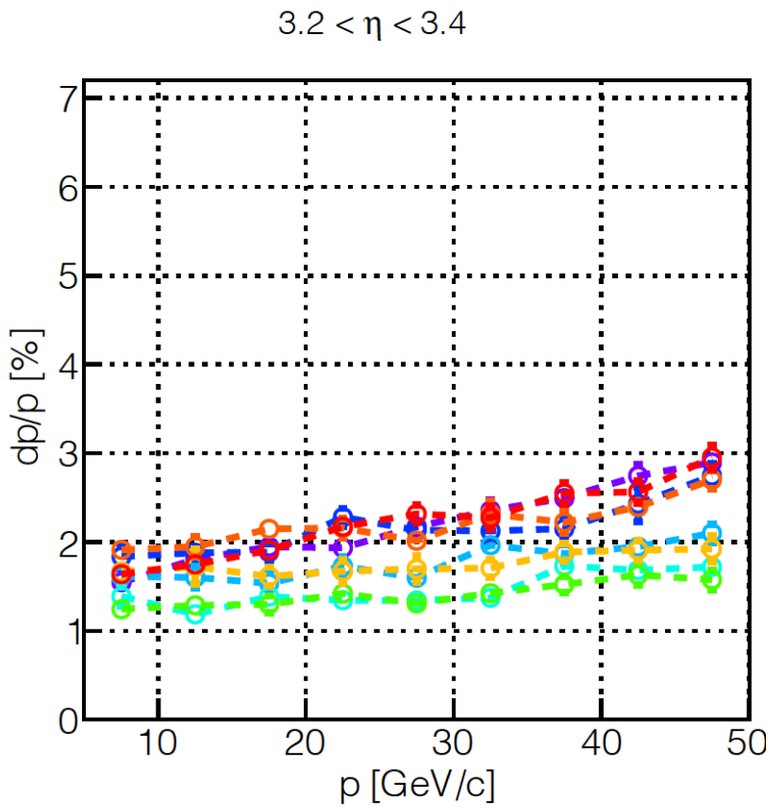


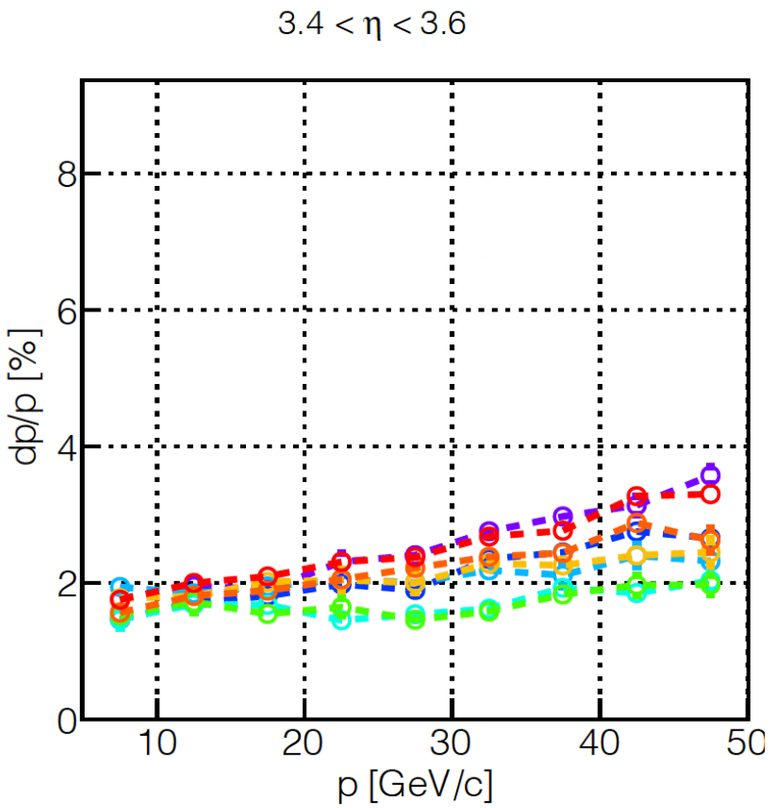


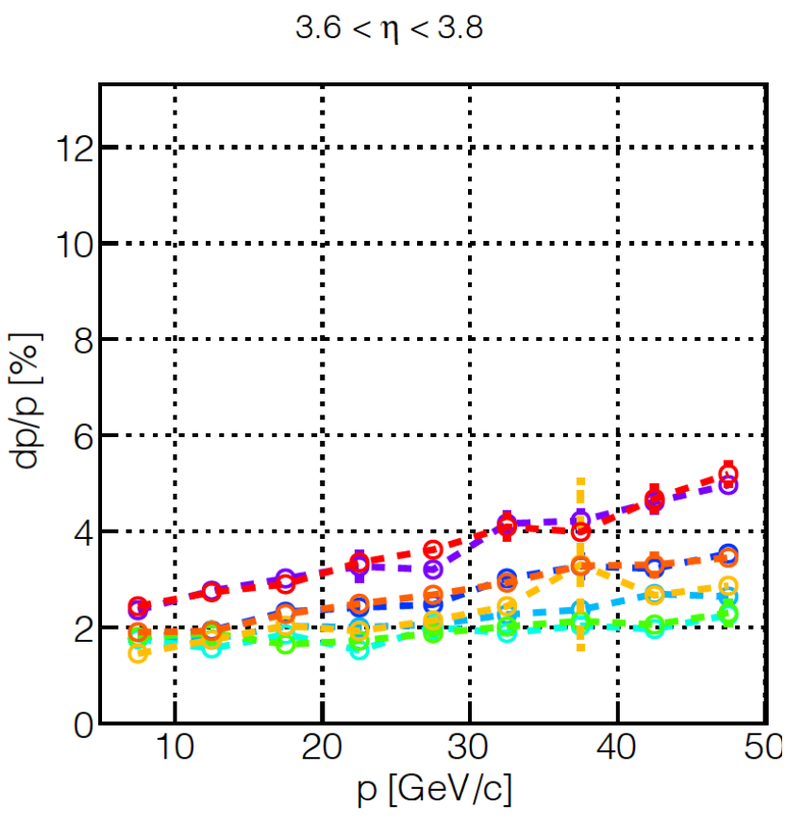
After rotating momentum vectors by 25 mrad about y axis

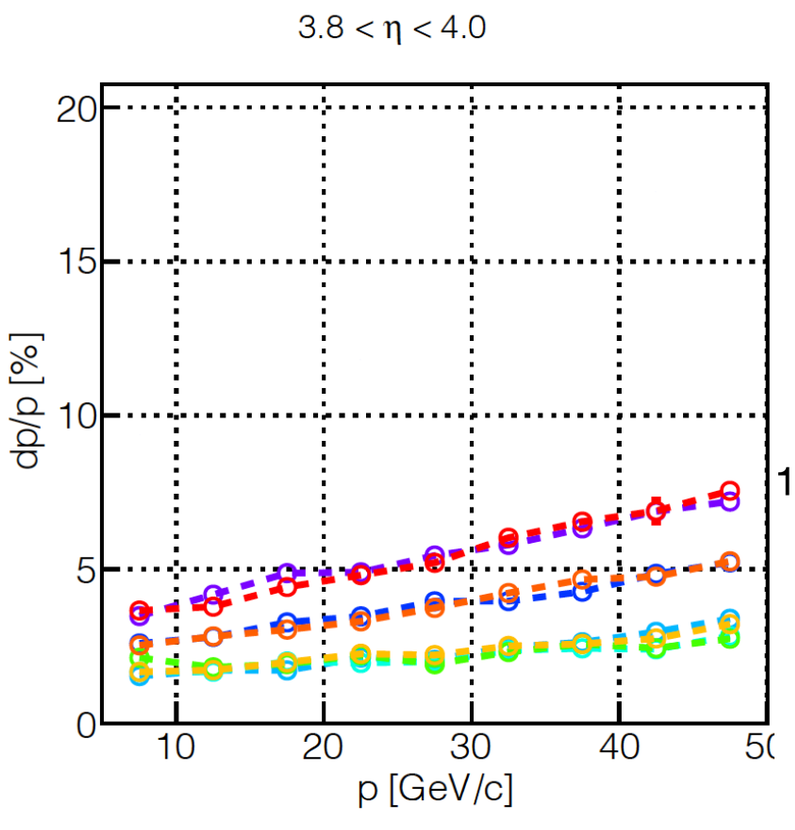
Momentum resolutions after rotation



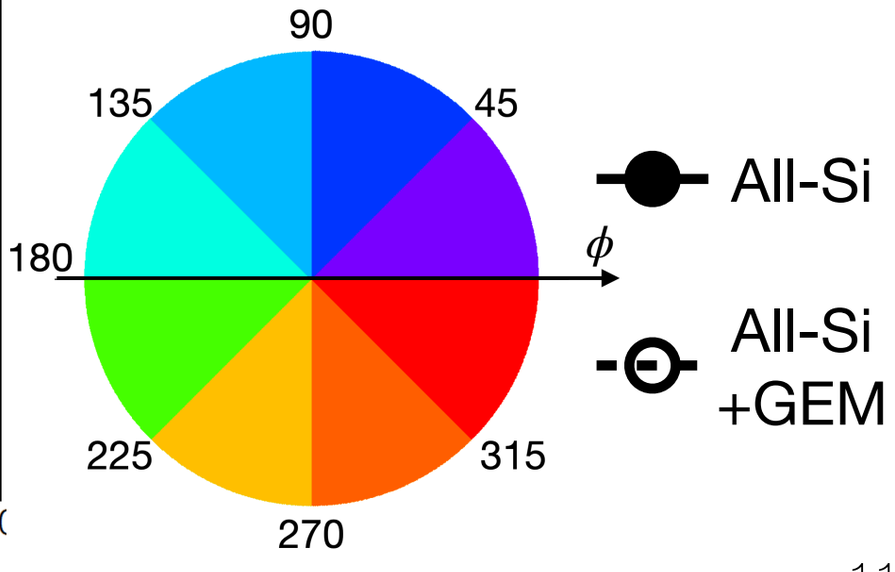








After rotating momentum vectors by 25 mrad about y axis



Summary and Conclusions

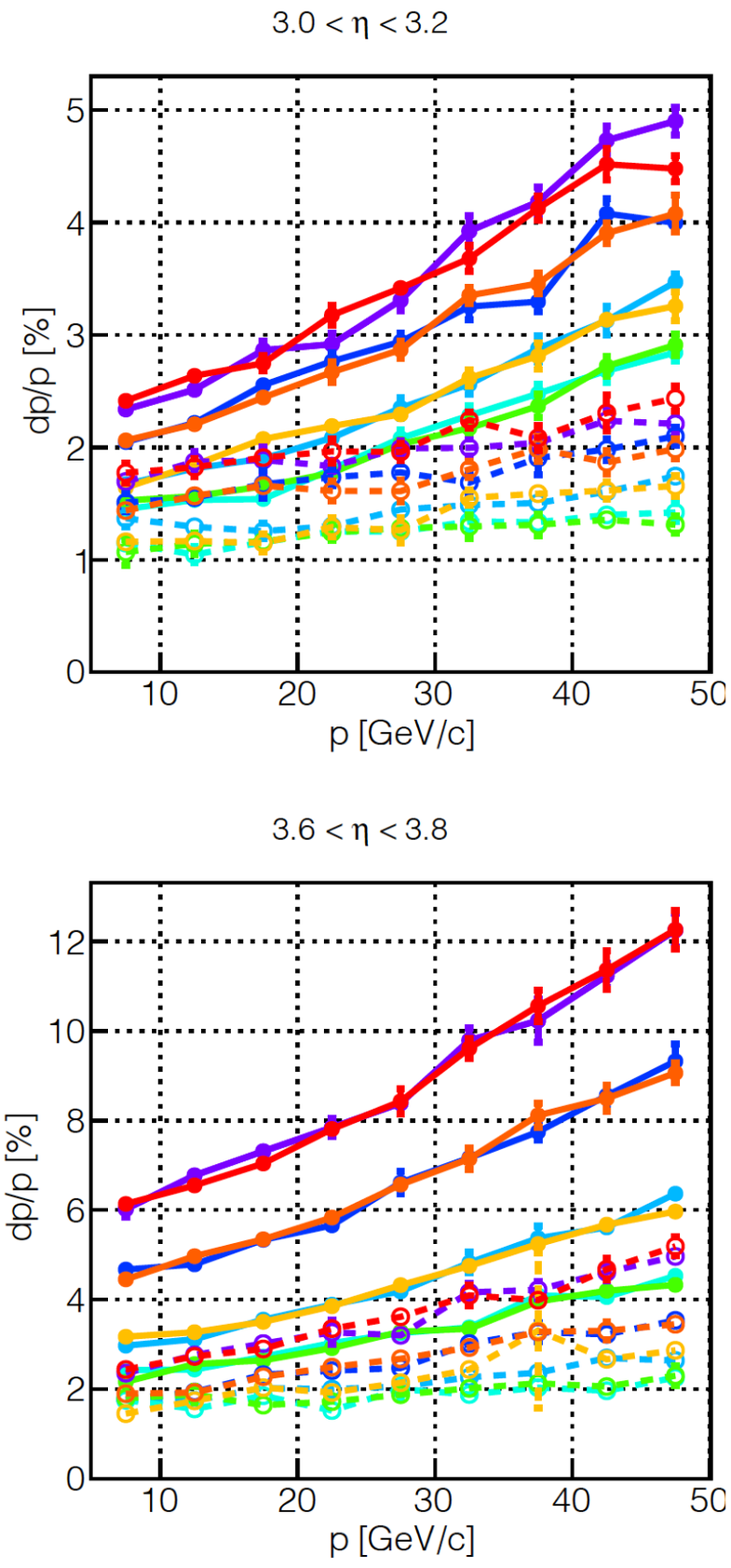
- Azimuthal momentum-resolution asymmetry needs to be taken into account in the hadron direction

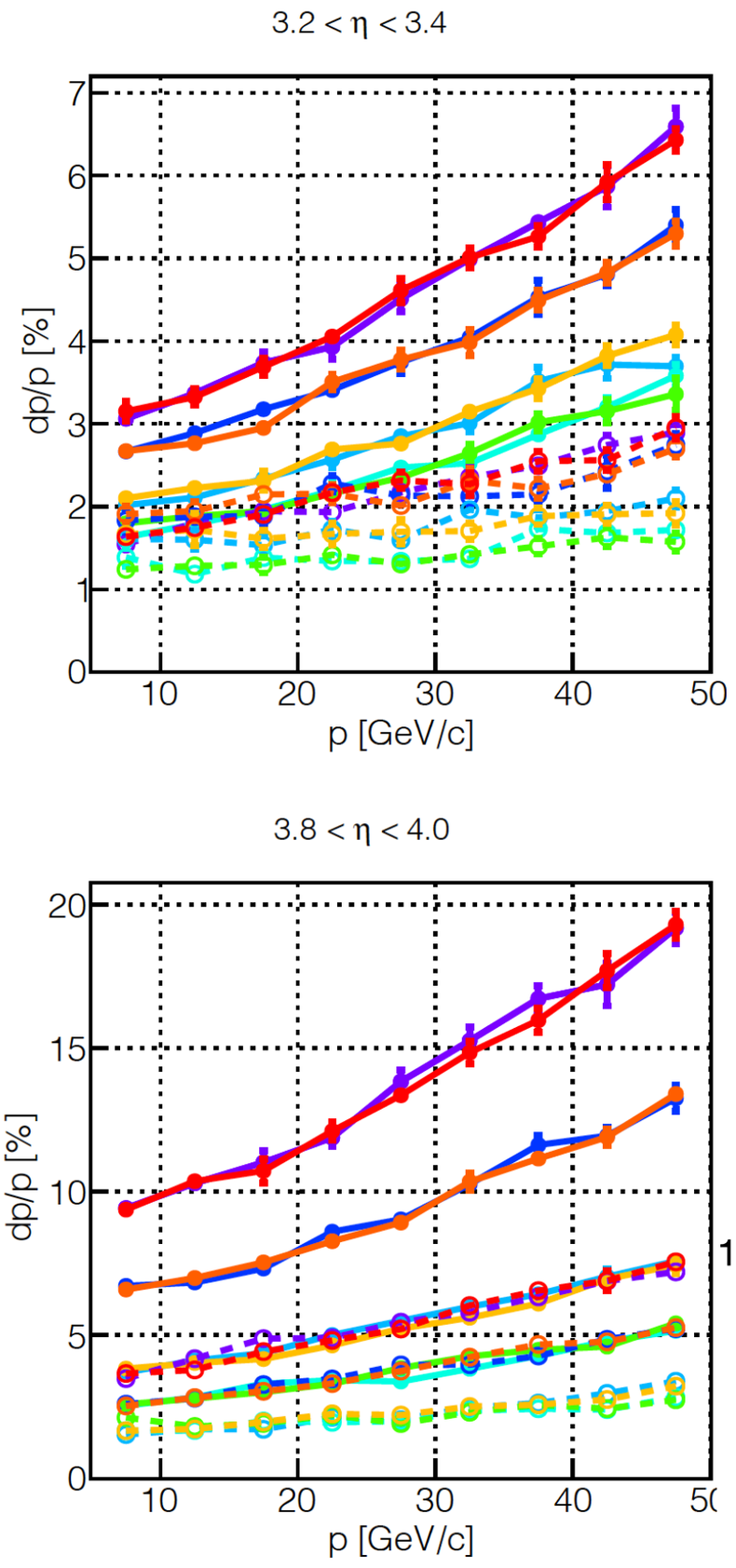
- Significant momentum-resolution deterioration at higher momenta for $\phi \sim 0$

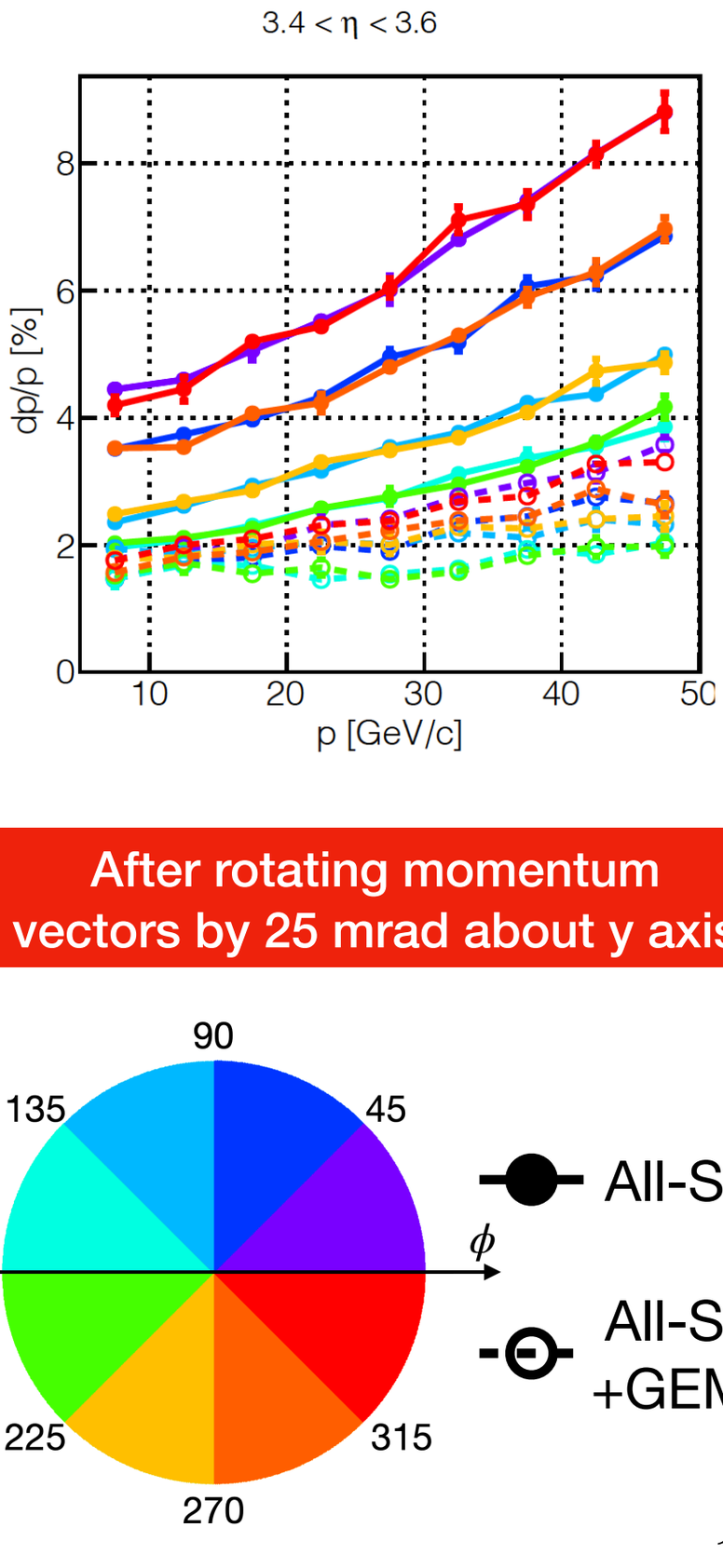
- Momentum resolution loss is recoverable with auxiliary tracking

Backup slides

Momentum resolutions after rotation







After rotating momentum vectors by 25 mrad about y axis

All-Si

All-Si +GEM