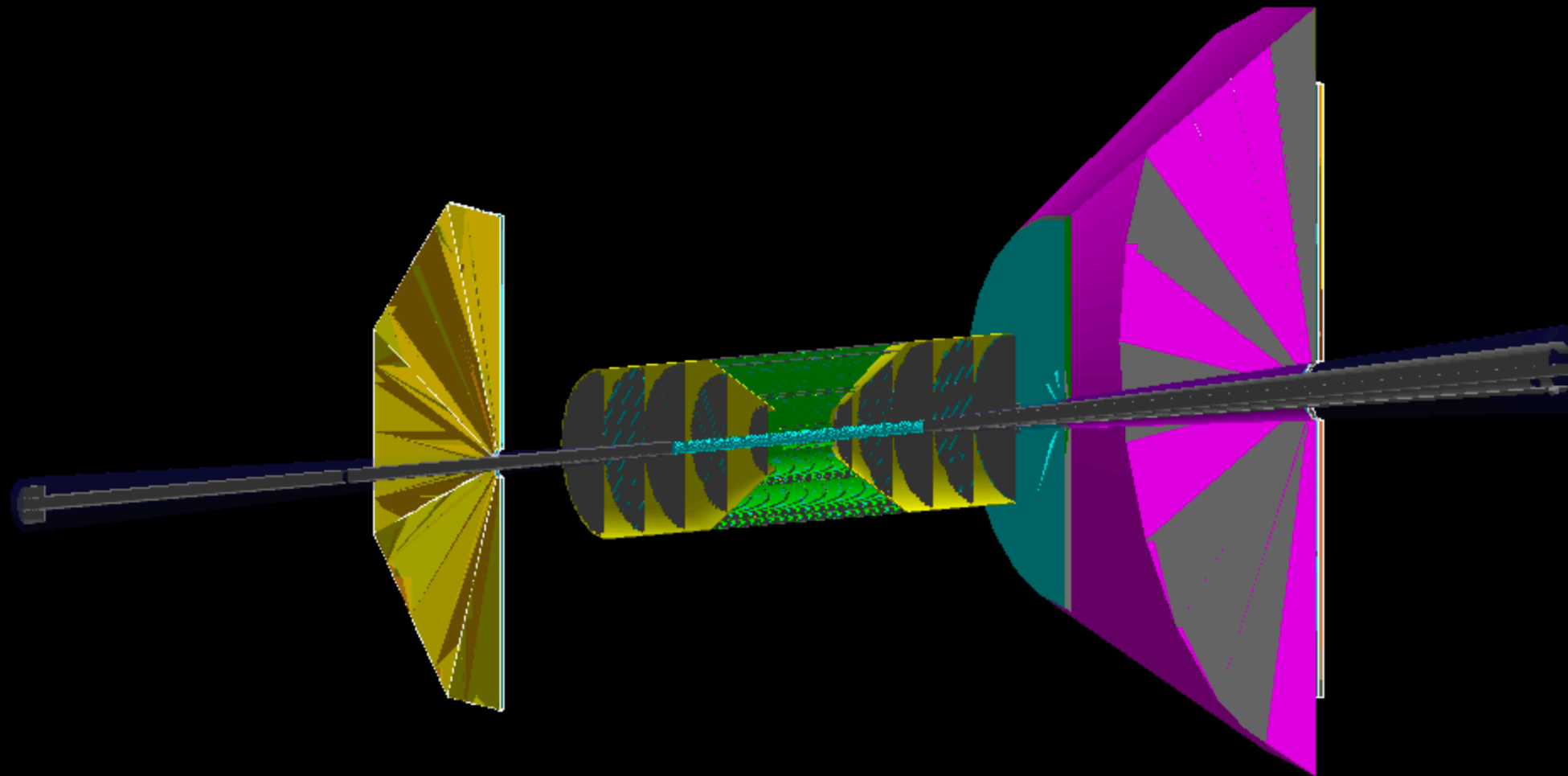


Update on All-Si tracker studies

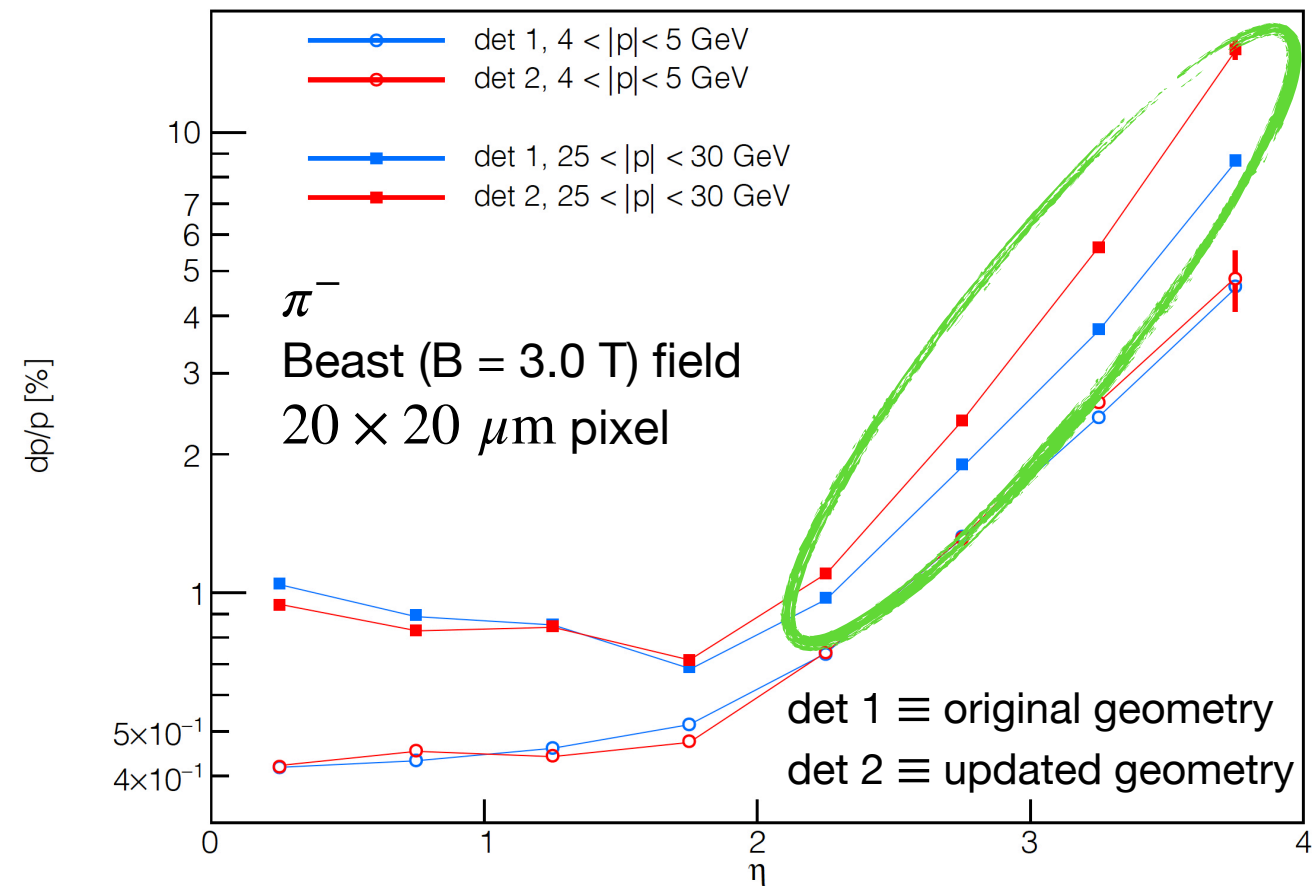
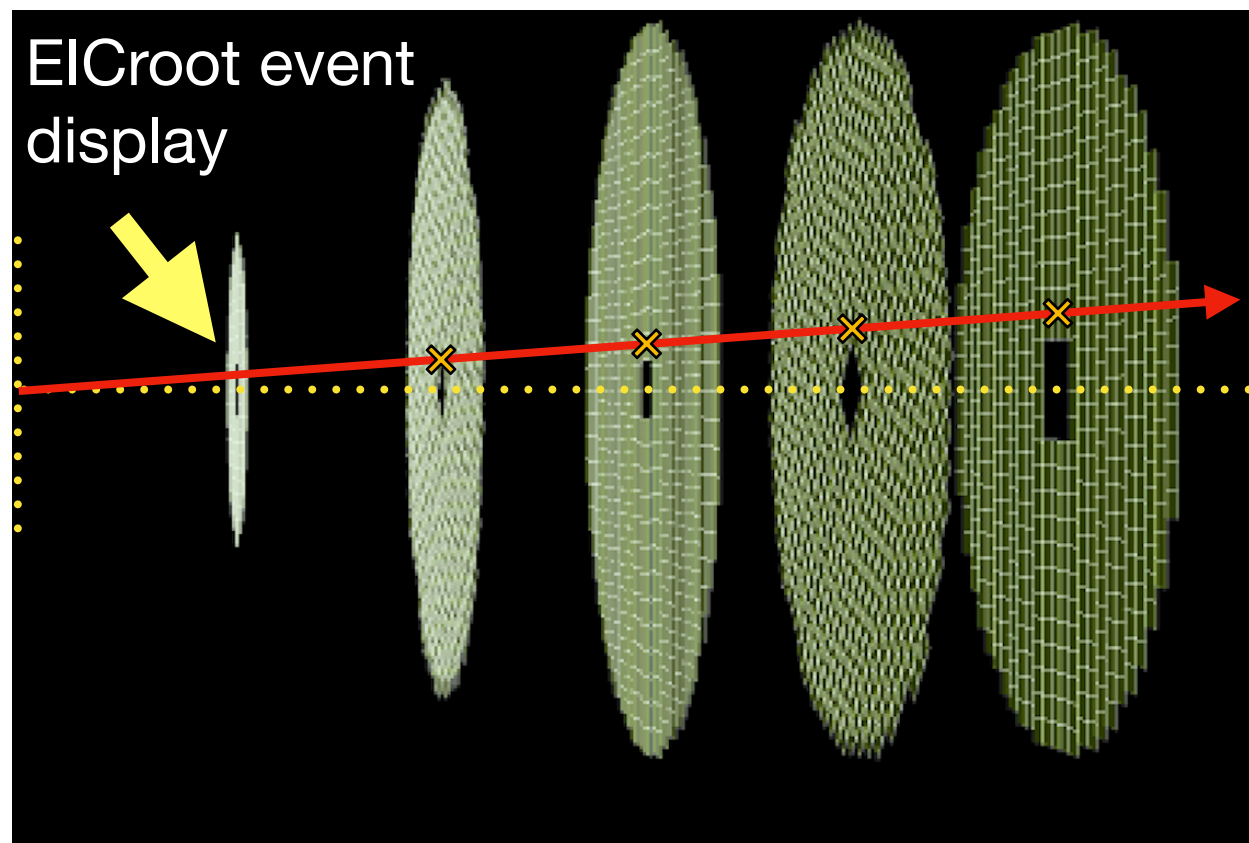


Rey Cruz-Torres

08/27/2020

To Recap:

- Updated All-Si tracker geometry to accommodate new beampipe.
- Larger-radius beampipe limited high-pseudorapidity acceptance.
- A consequence: worse momentum resolution (for higher momenta).



Potential solution: Add GEM at large (available) z to recover momentum resolution.

GEMs in Fun4All

https://github.com/eic/fun4all_macros/blob/master/common/G4_GEM_EIC.C

Lots of help from C. Pinkenburg, J. Huang

Parameters:

$$\eta_{\min} = 1.40$$

$$\eta_{\max} = 3.69$$

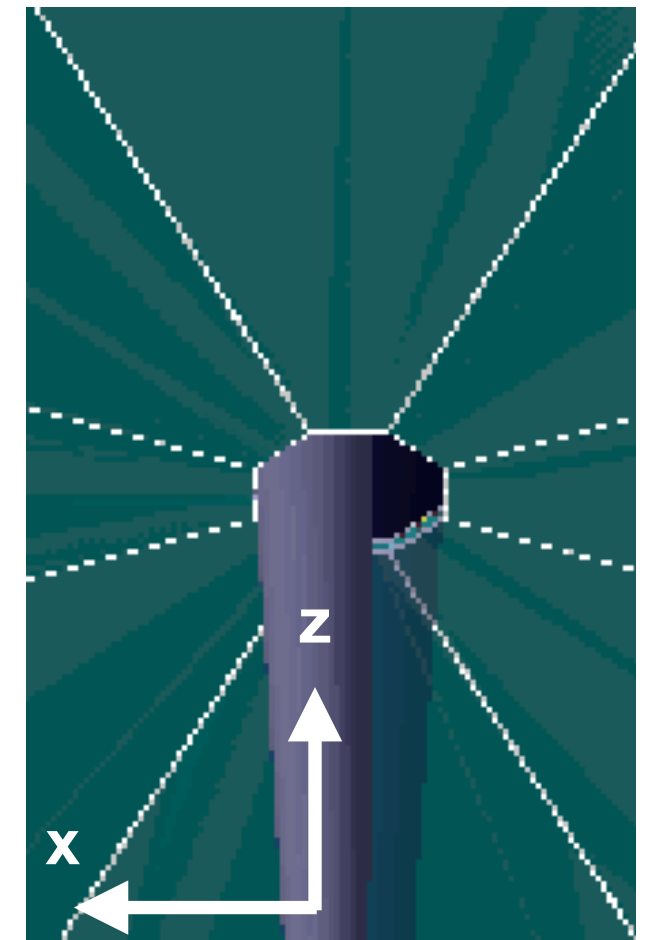
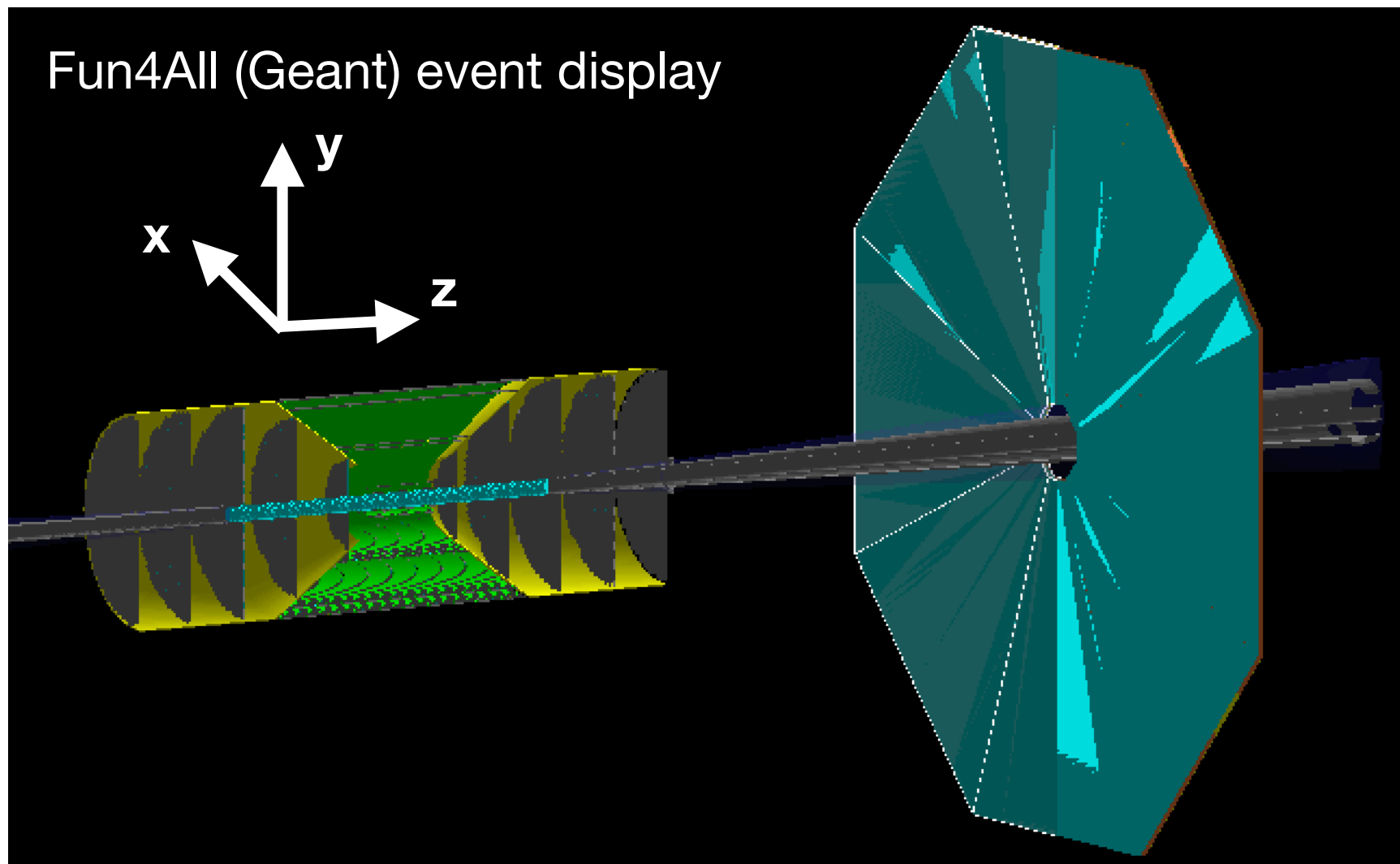
z position = 300 cm

sectors = 8

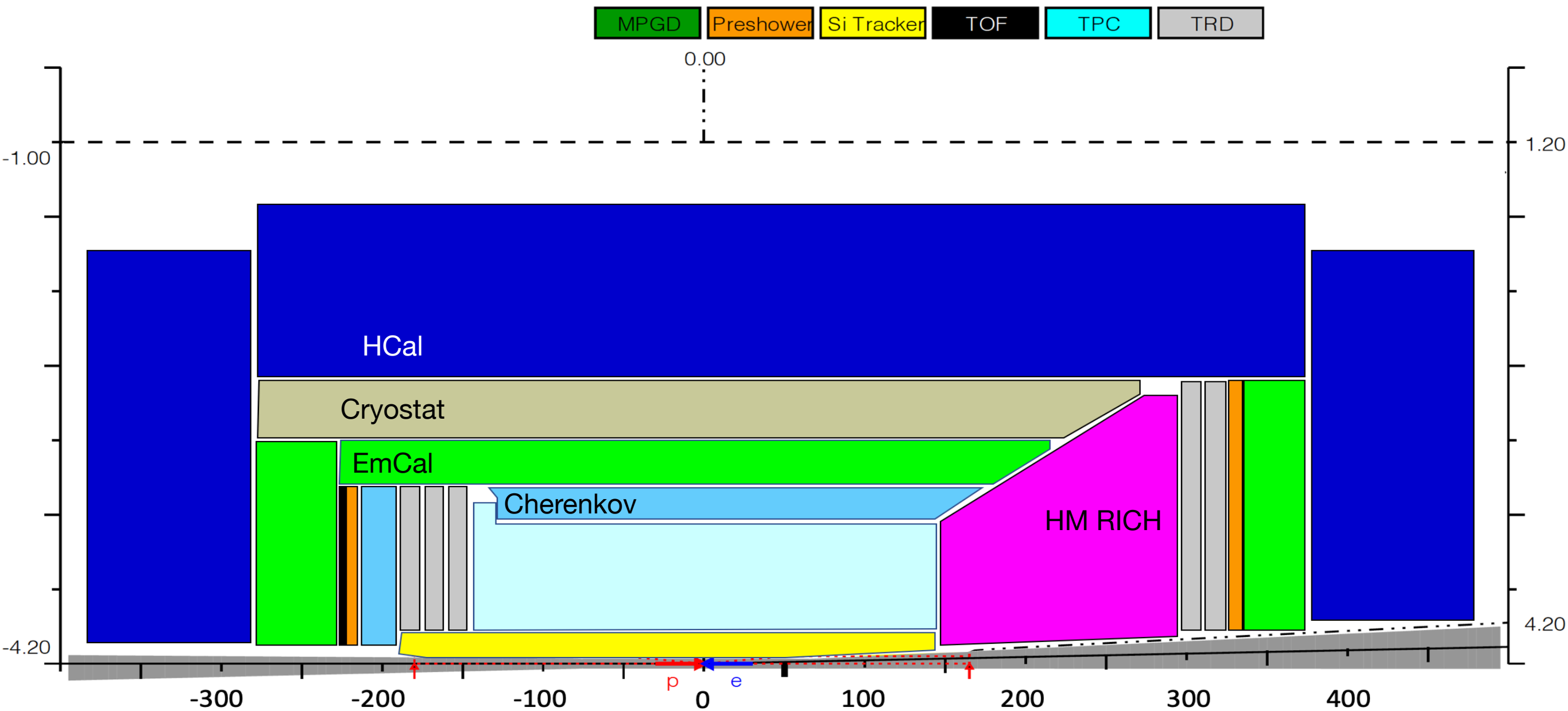
Spatial resolution:

$$\sigma(\hat{r}) = 50 \mu\text{m} \longrightarrow \text{tunable (up)}$$

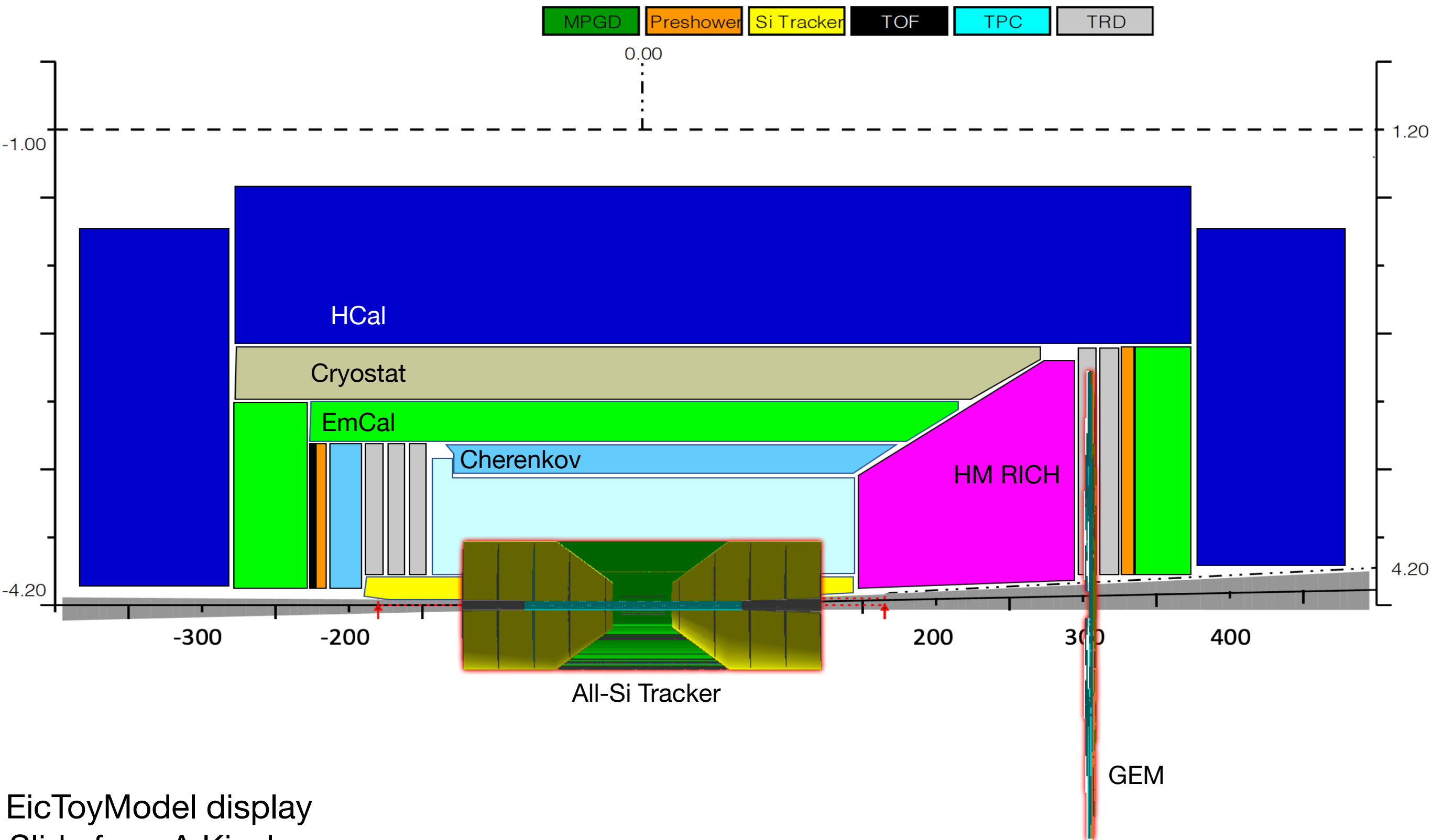
$$\sigma(\hat{\phi}) = 50 \mu\text{m} \longrightarrow \text{best-case scenario}$$



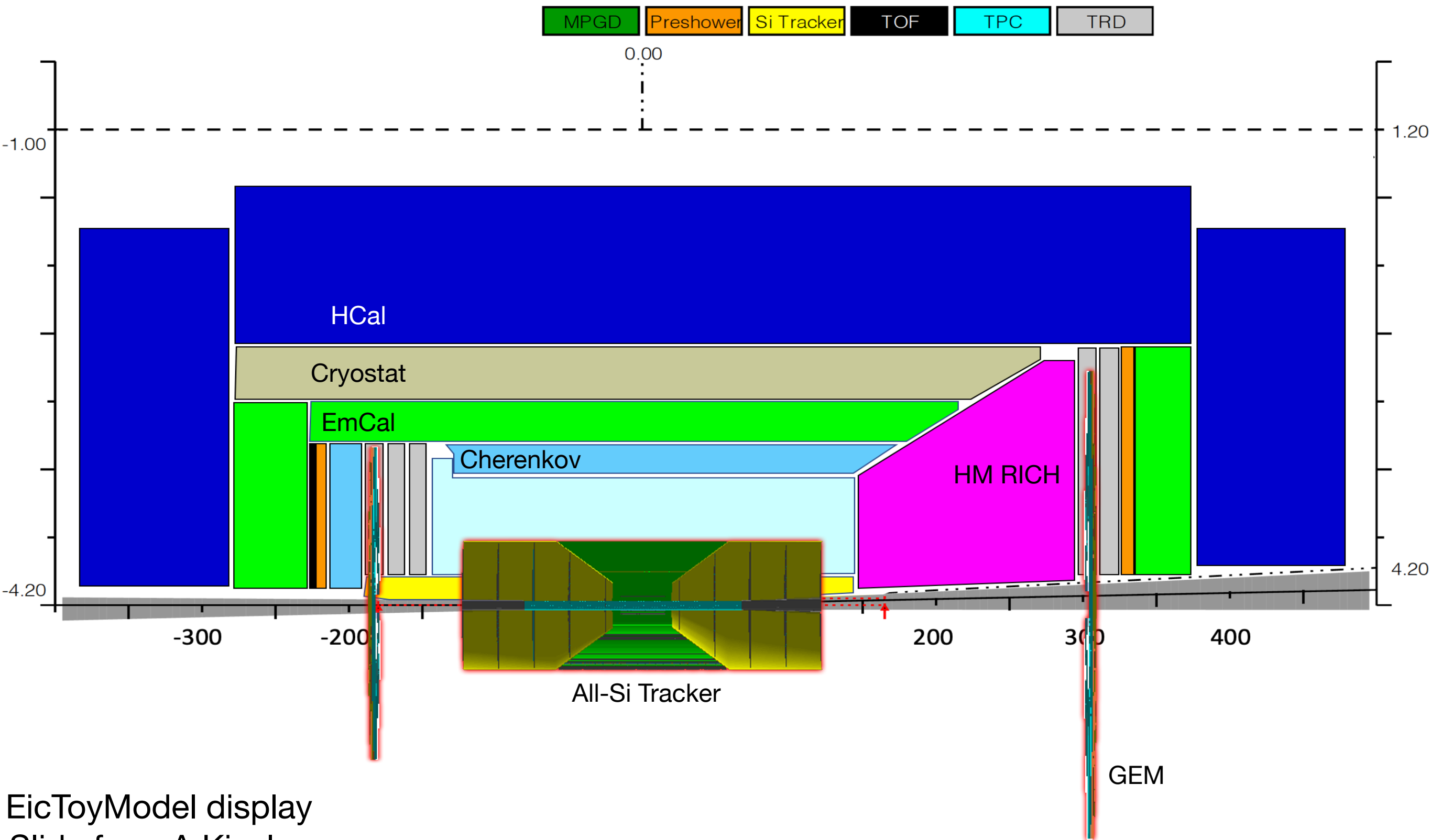
Placement of GEM in forward region



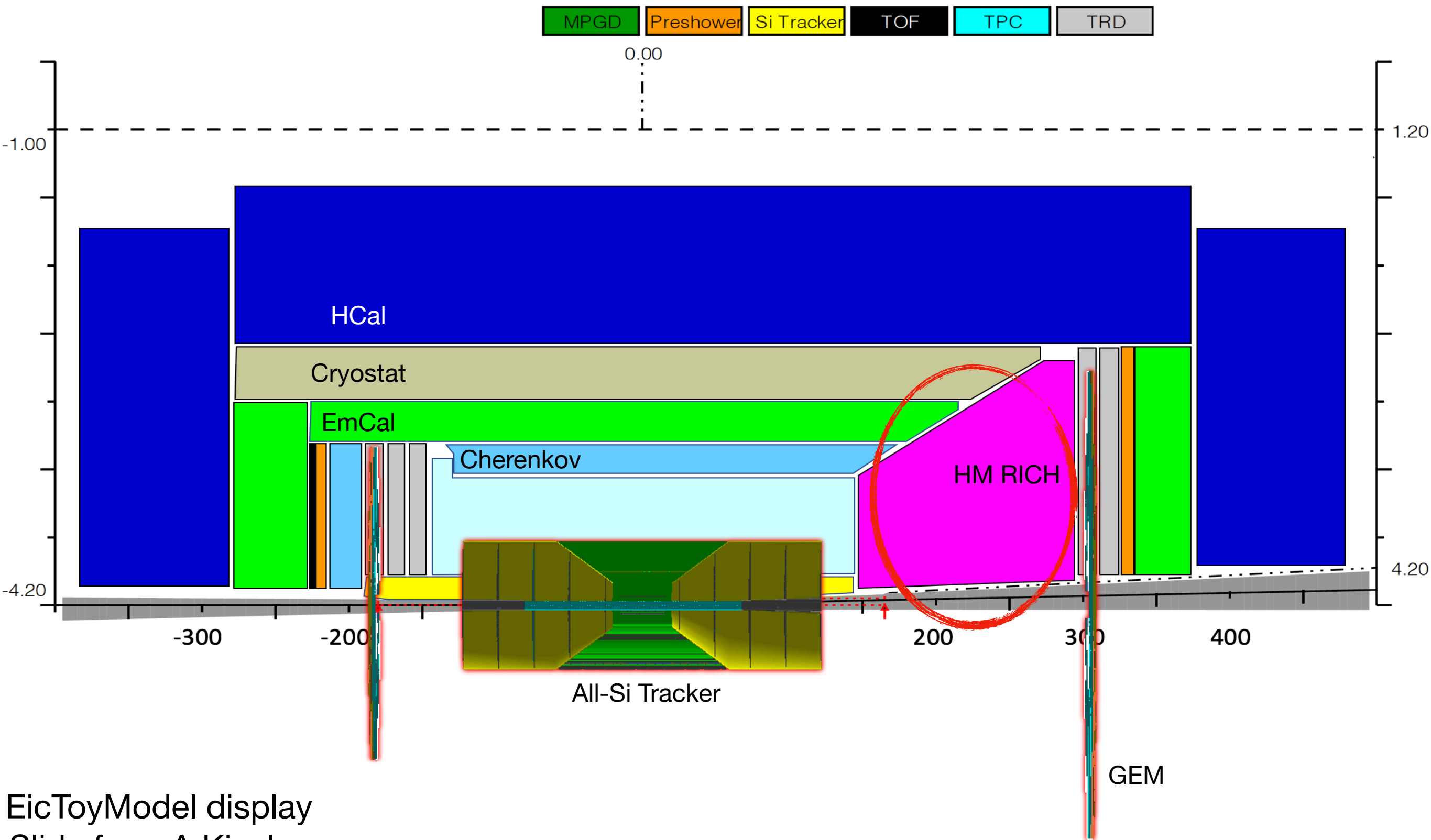
Placement of GEM in forward region



Placement of GEM in forward region

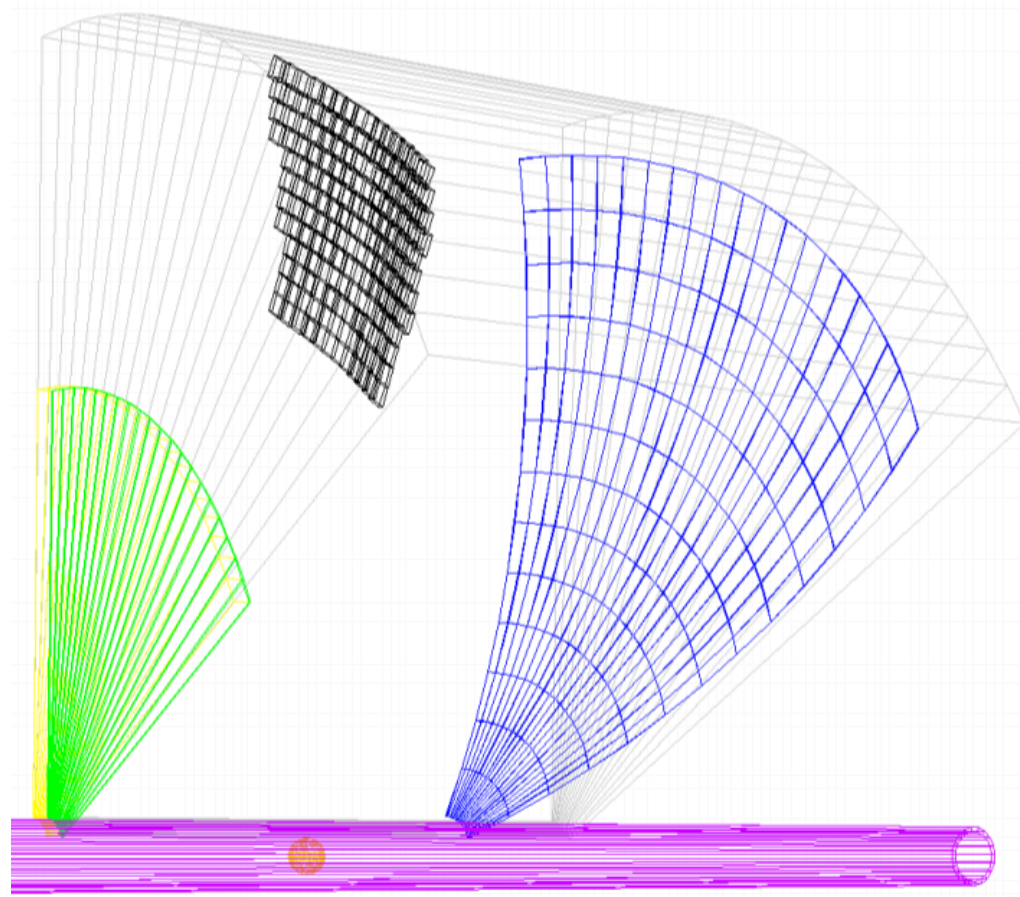


Placement of GEM in forward region



RICH parametrization

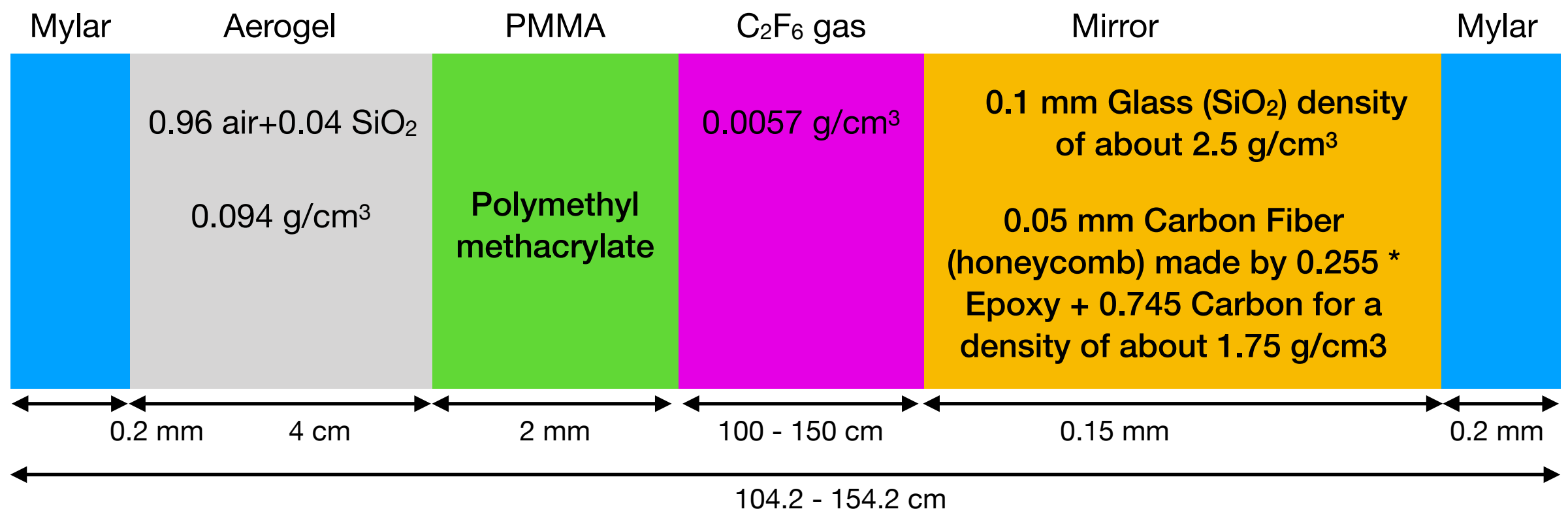
Info from Evaristo Cisbani
(evaristo.cisbani@roma1.infn.it)



Main components and geometry baseline of one (out of 6) dRICH sector:

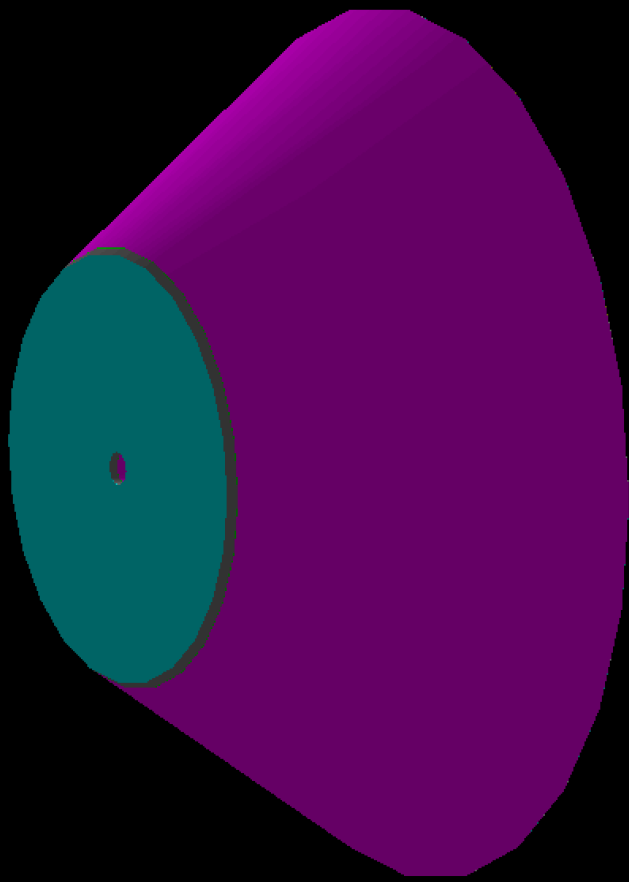
yellow: aerogel

- green: optical filter
- blue: spherical mirror
- black: photosensor array (out of charged particles acceptance)
- pink: beam pipe region.



RICH parametrization in Fun4All

148 cm



Carbon Fiber Epoxy

SiO₂

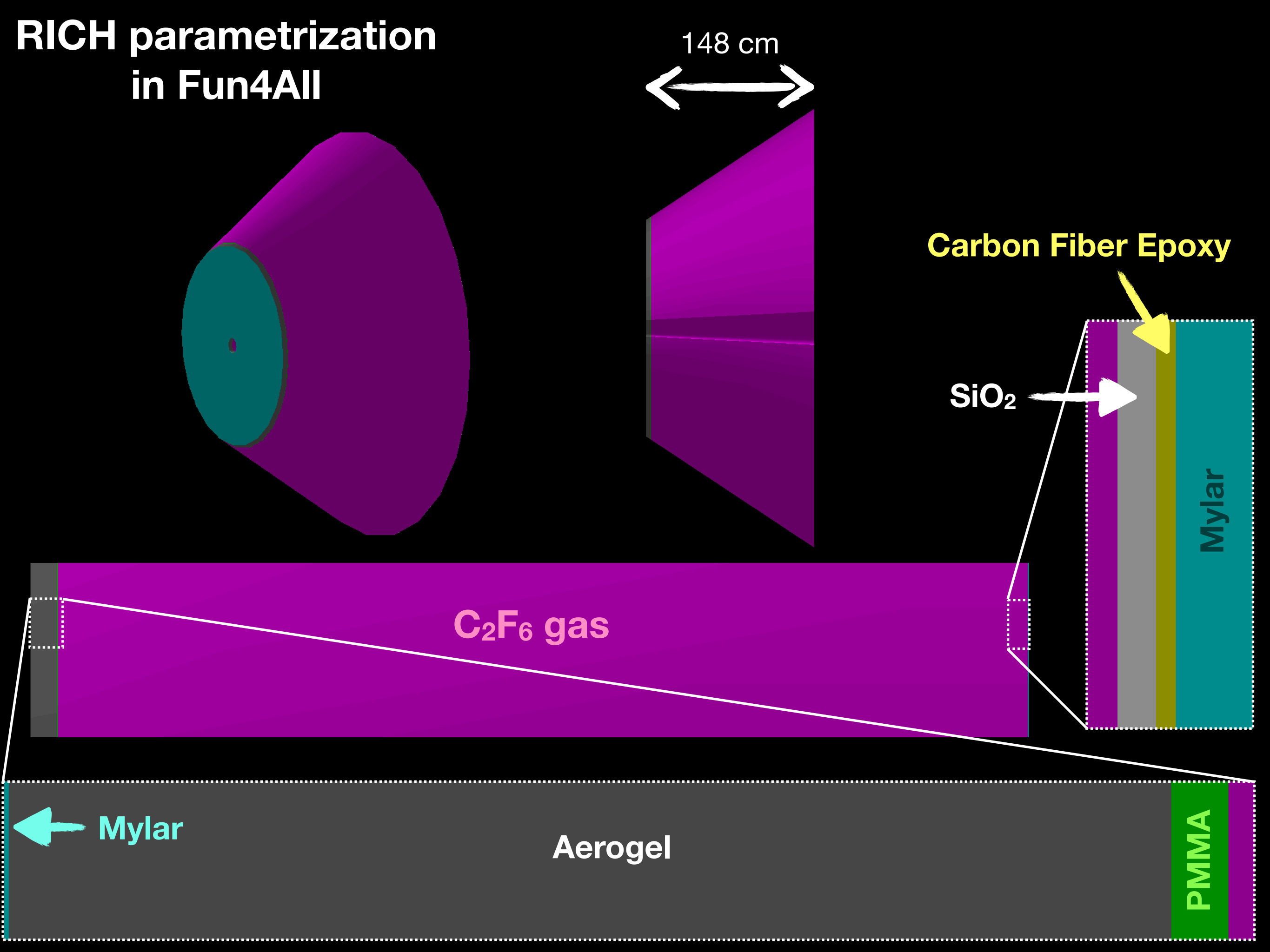
Mylar

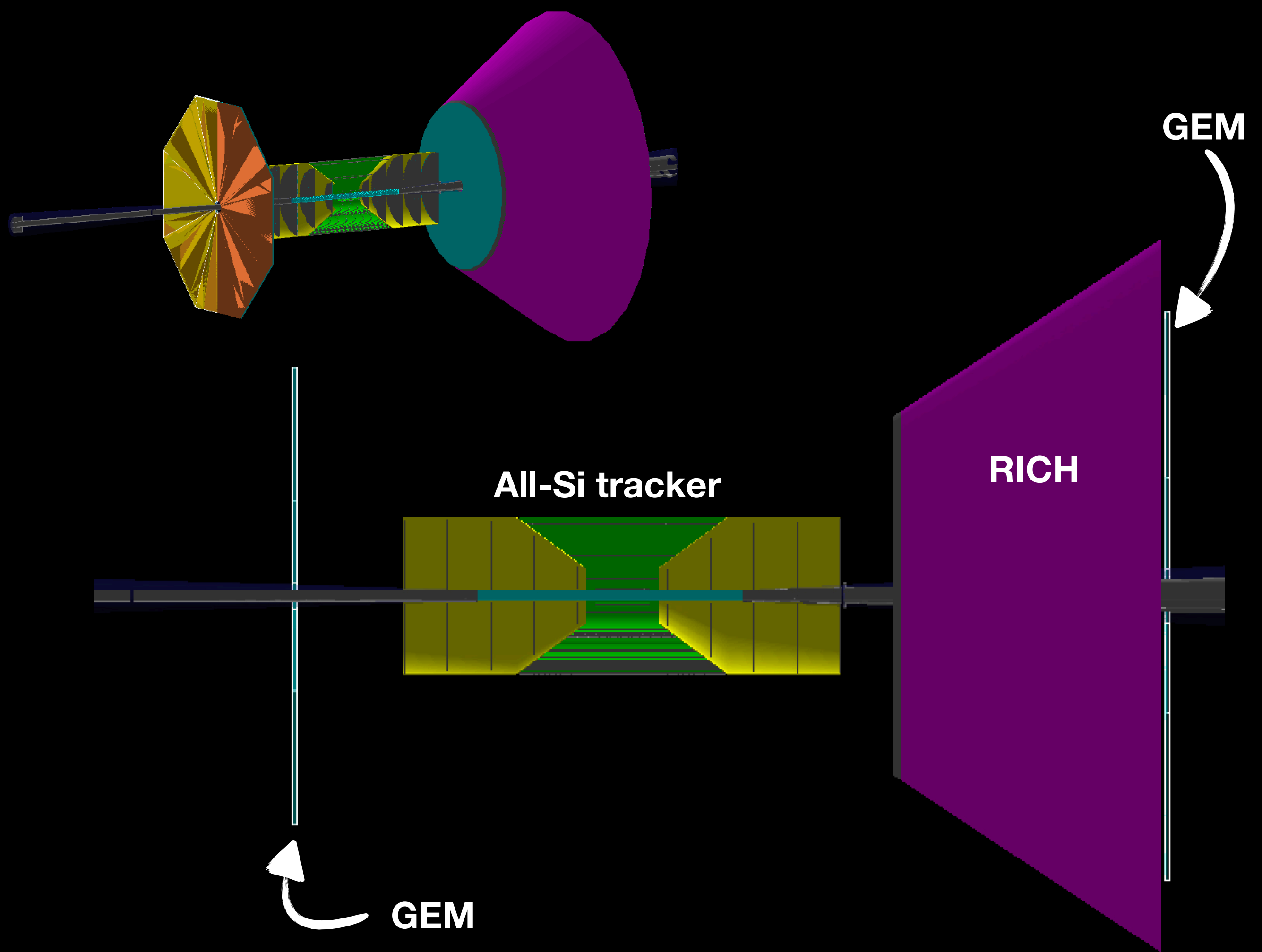
C₂F₆ gas

PMMA

Mylar

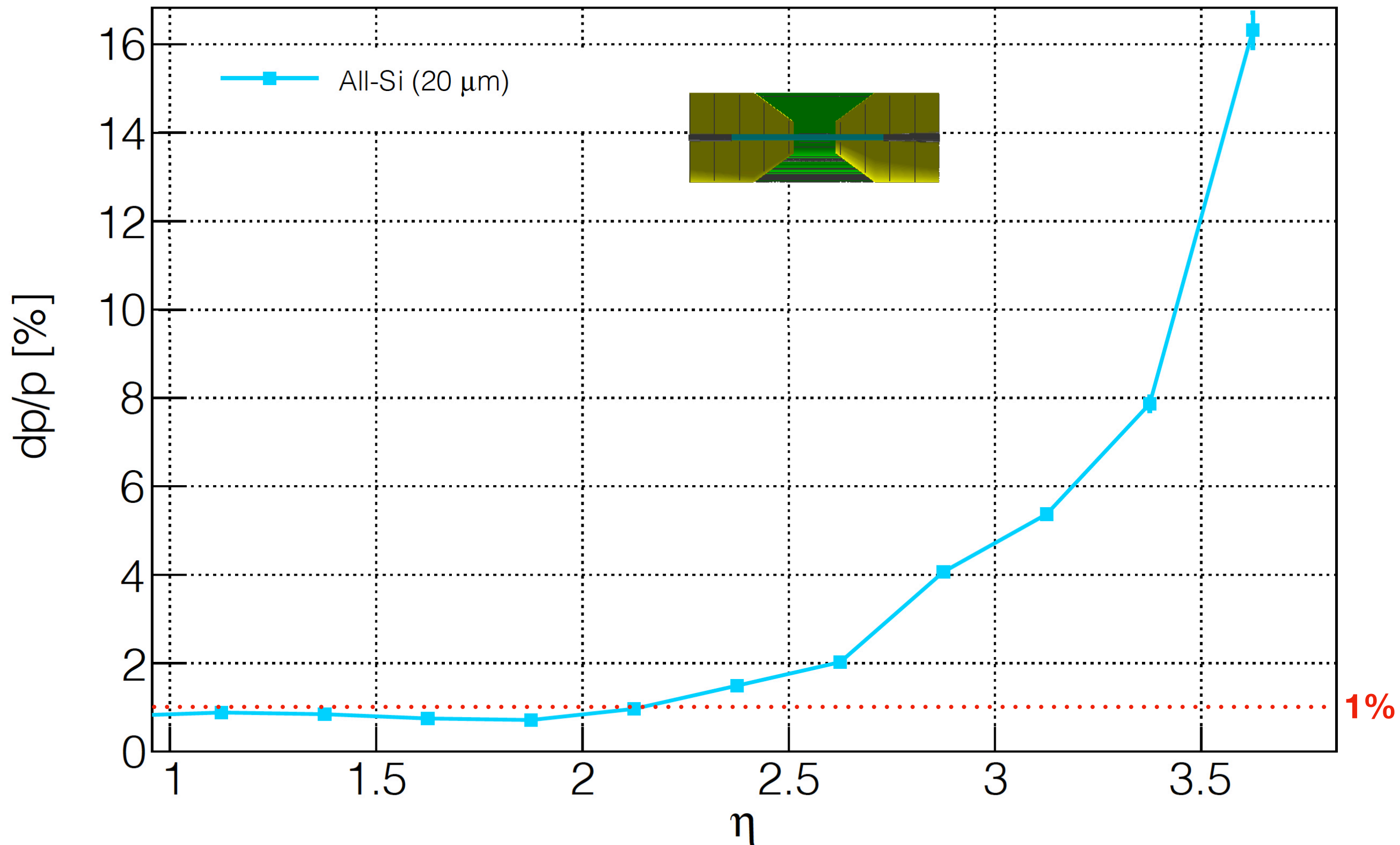
Aerogel





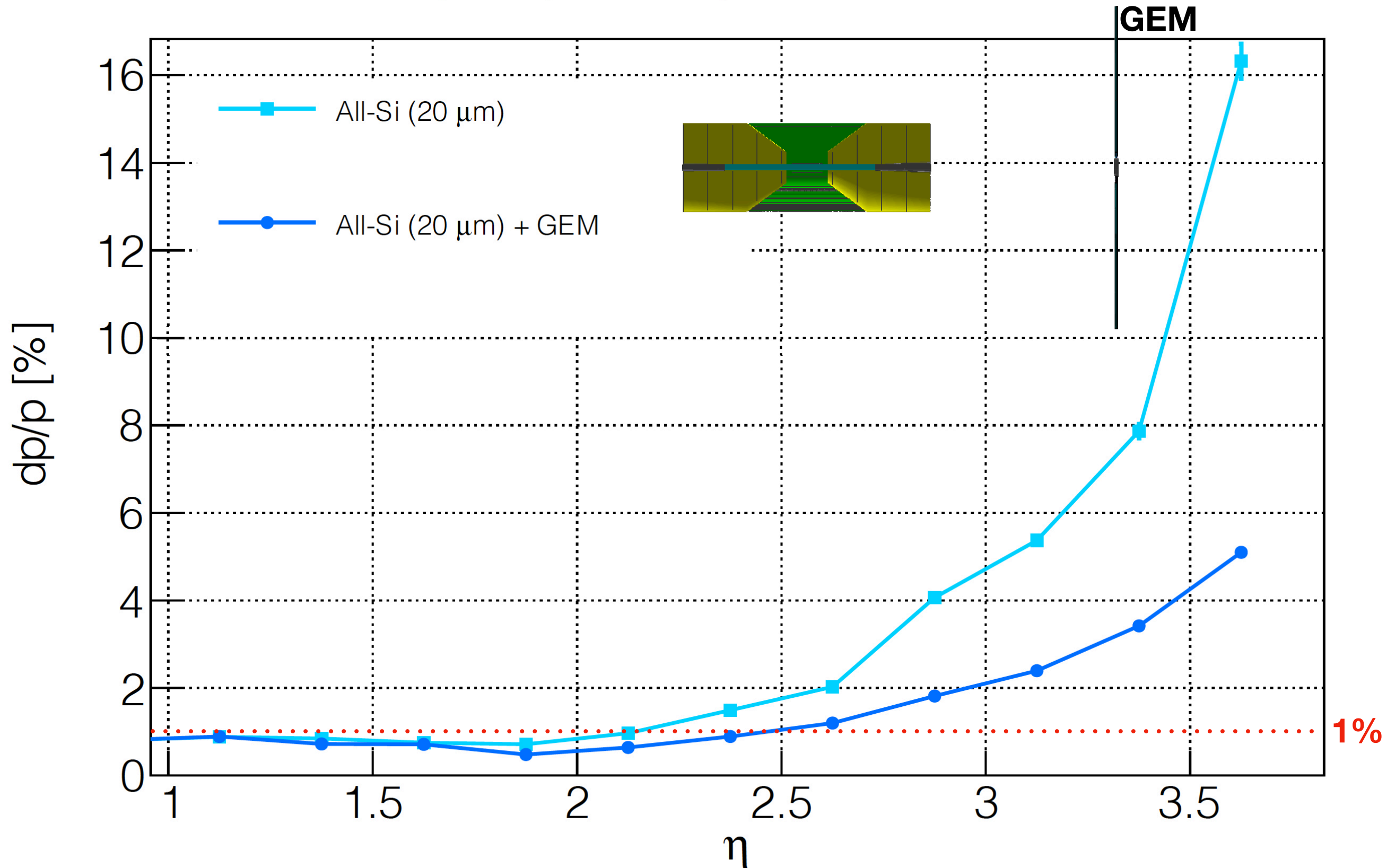
GEM and RICH effect on momentum resolution

Beast (3.0 T), $25.0 < p < 30.0 \text{ GeV}/c$



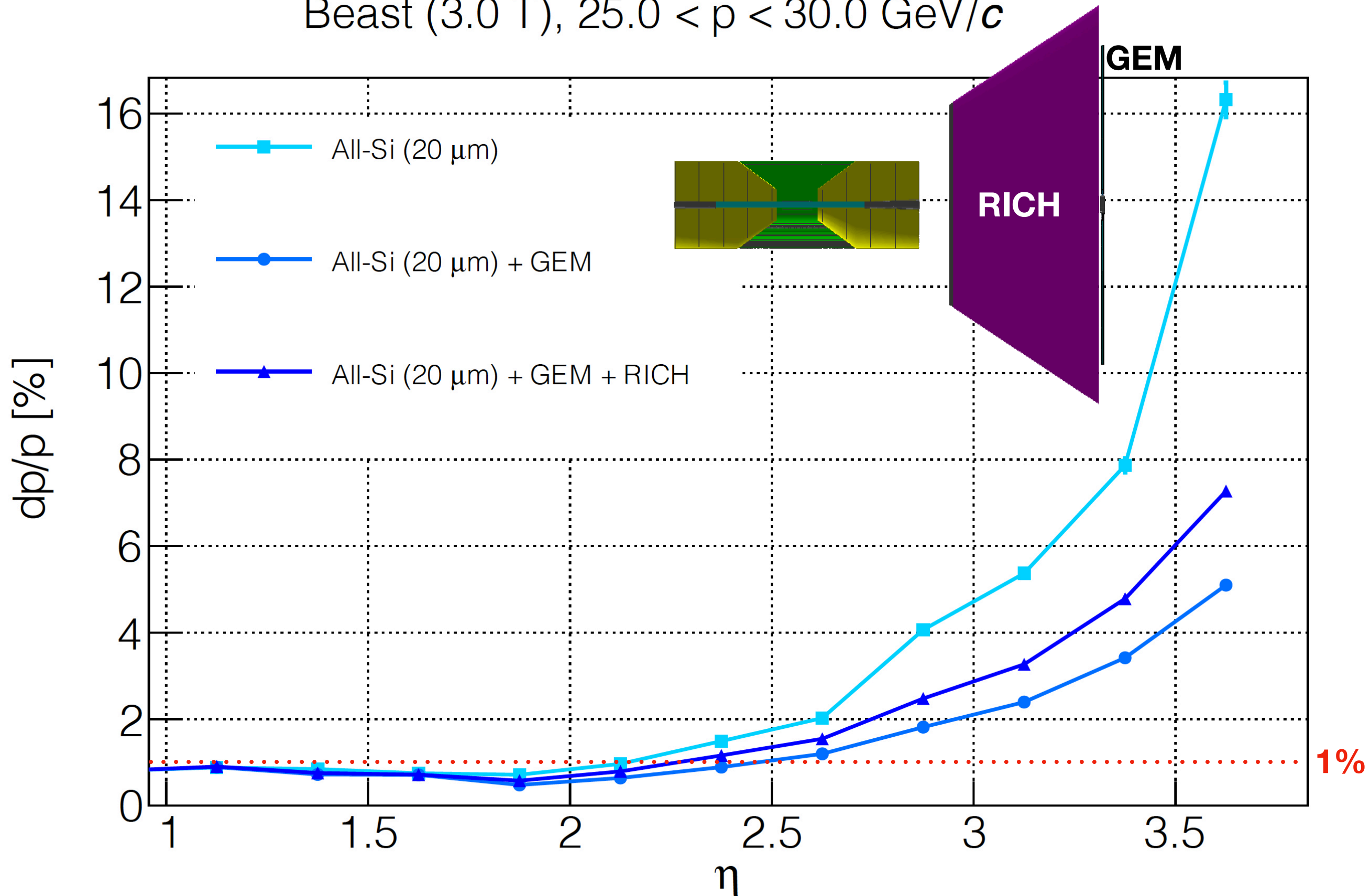
GEM and RICH effect on momentum resolution

Beast (3.0 T), $25.0 < p < 30.0 \text{ GeV}/c$



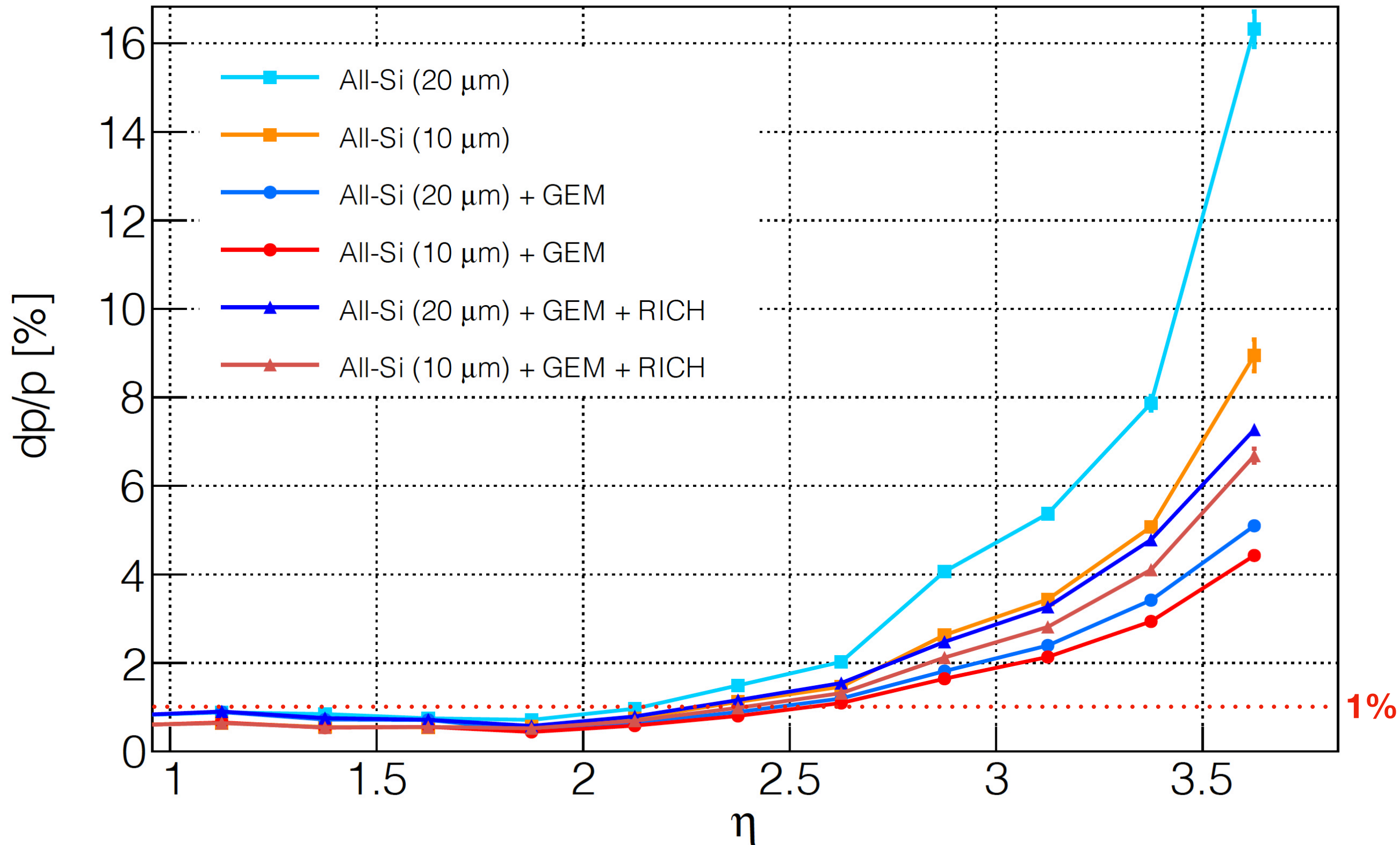
GEM and RICH effect on momentum resolution

Beast (3.0 T), $25.0 < p < 30.0 \text{ GeV}/c$



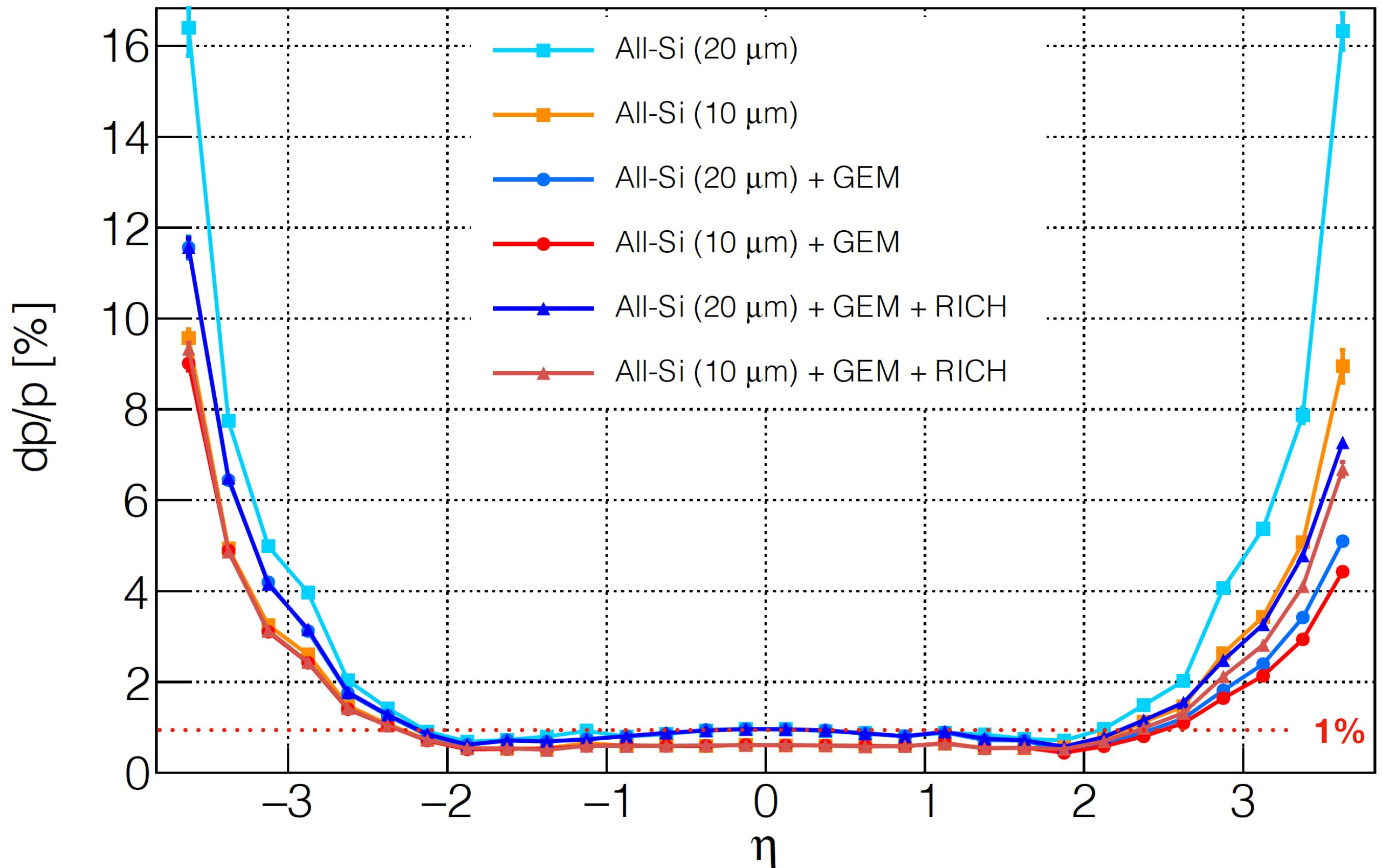
GEM and RICH effect on momentum resolution

Beast (3.0 T), $25.0 < p < 30.0 \text{ GeV}/c$



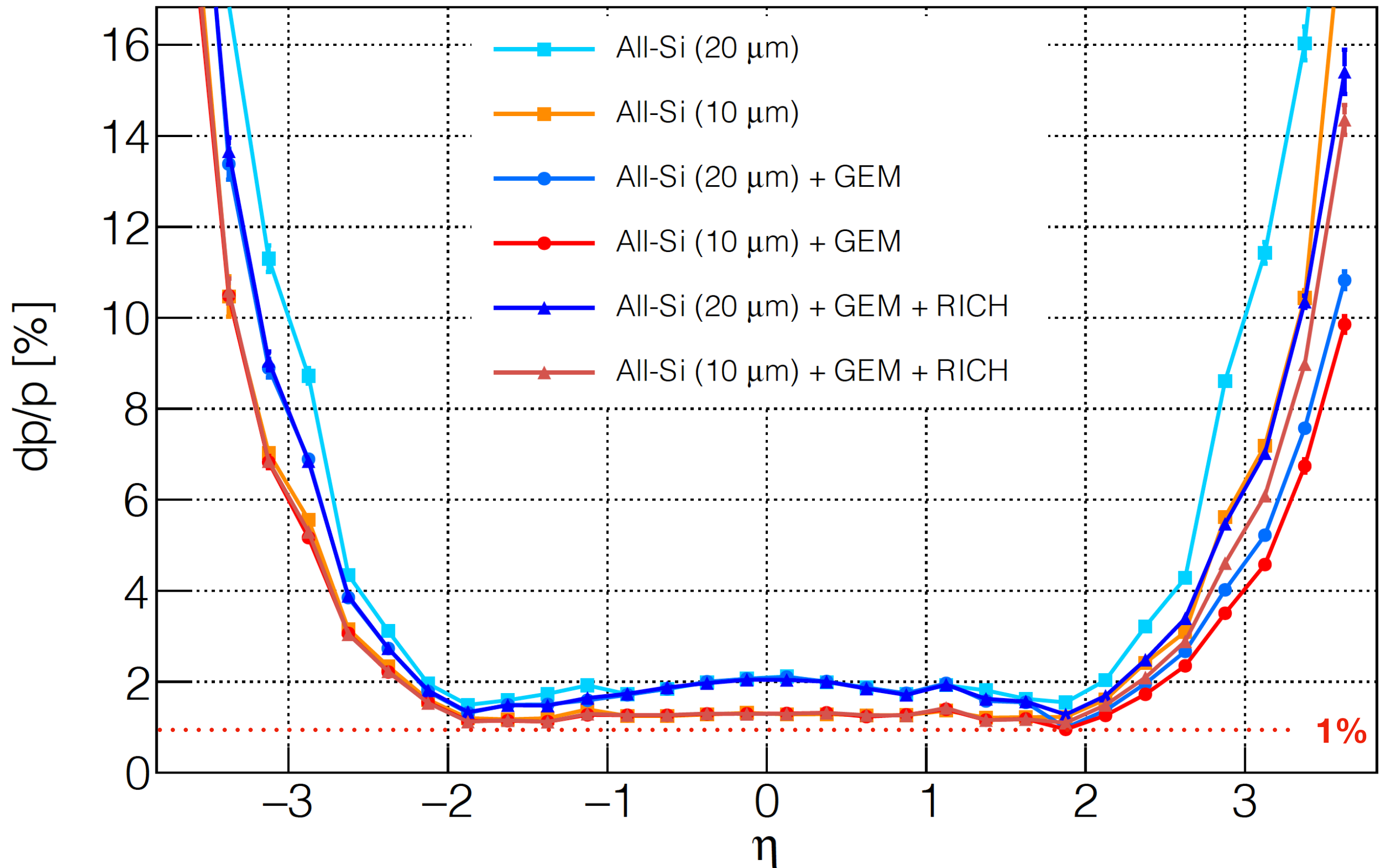
GEM and RICH effect on momentum resolution

Beast (3.0 T), $25.0 < p < 30.0 \text{ GeV}/c$



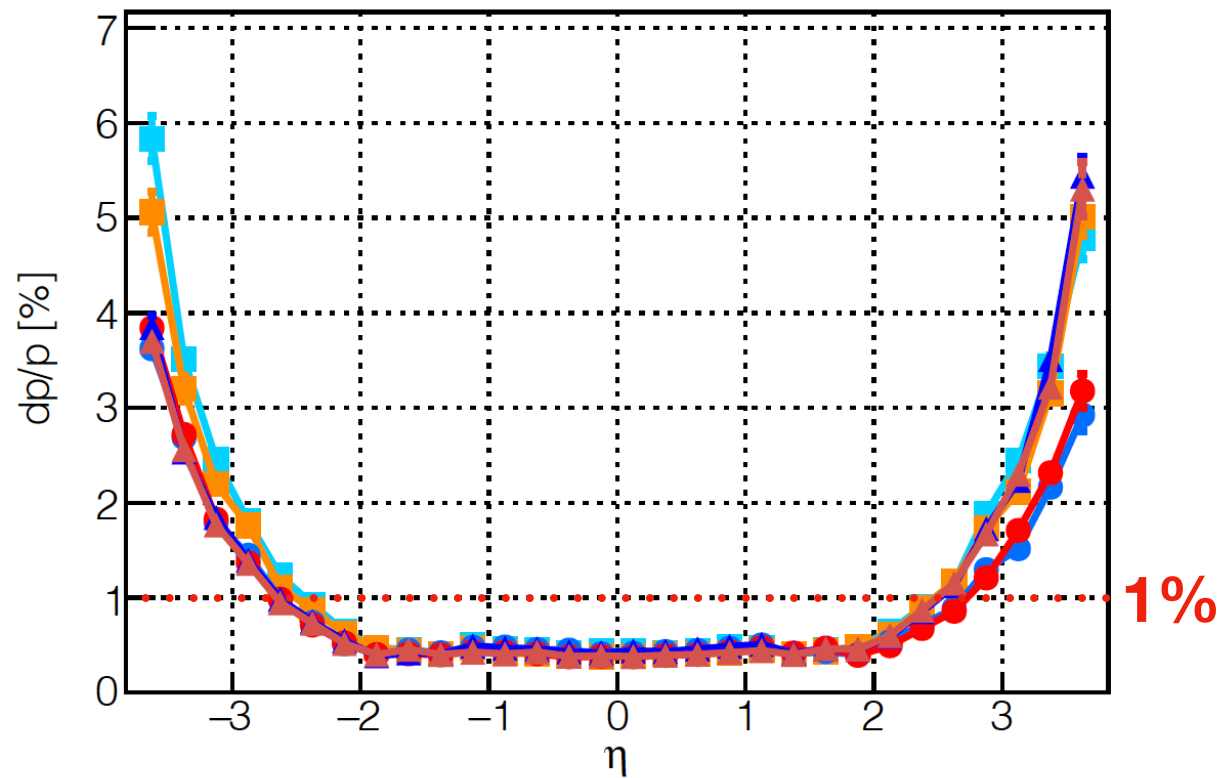
GEM and RICH effect on momentum resolution

BaBar (1.4 T), $25.0 < p < 30.0 \text{ GeV}/c$

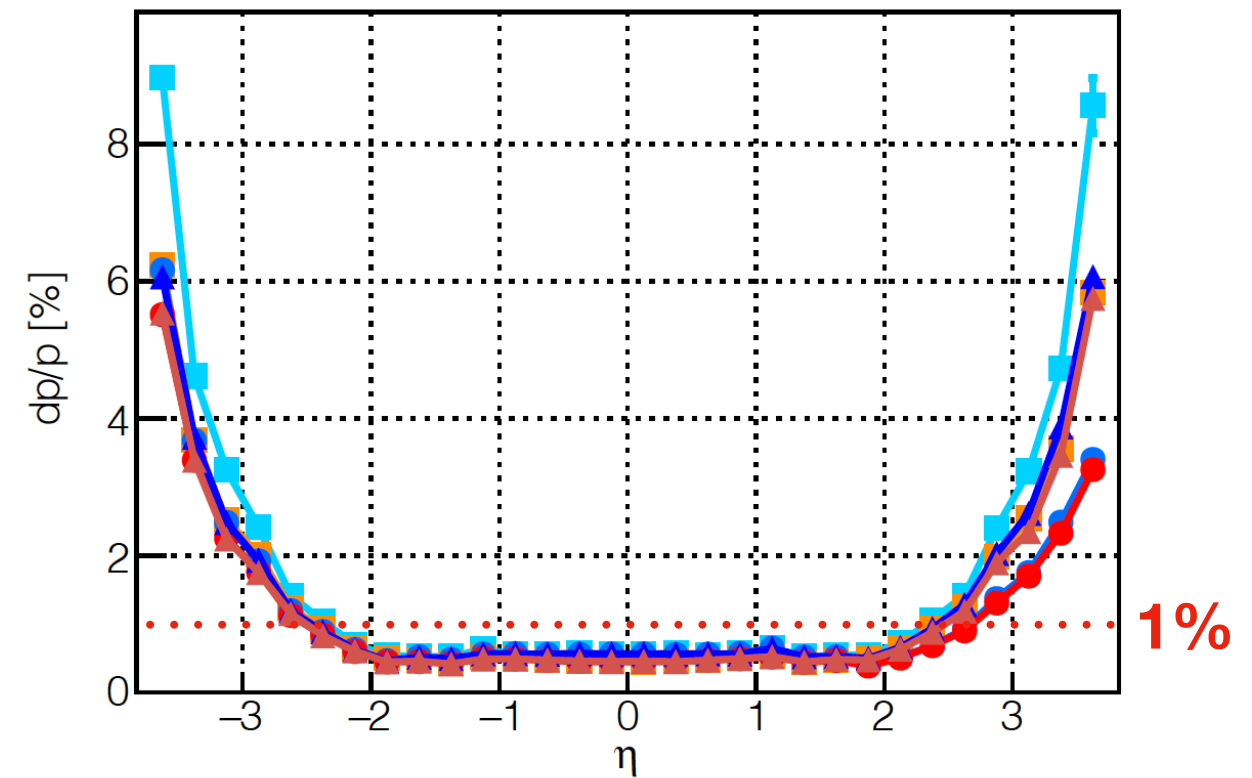


Momentum resolution for 3 momentum bins

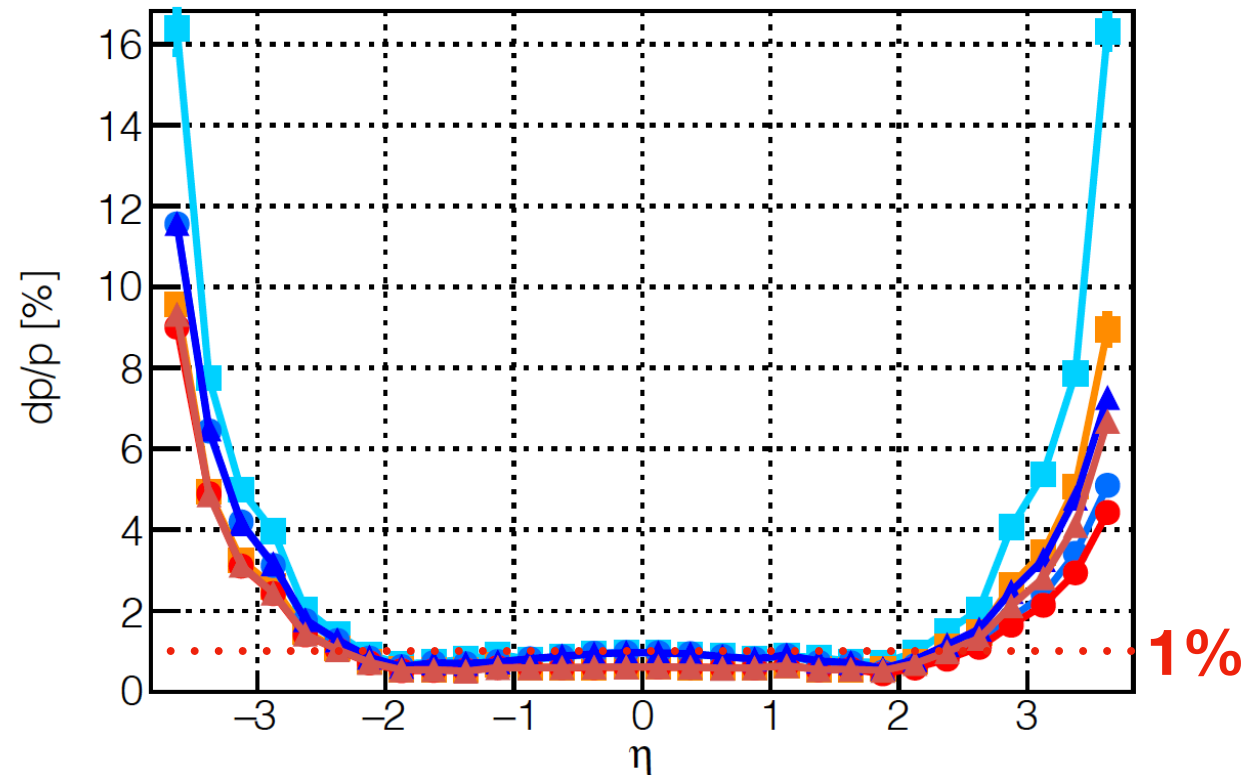
Beast (3.0 T), $4.0 < p < 5.0$ GeV/c



Beast (3.0 T), $10.0 < p < 15.0$ GeV/c



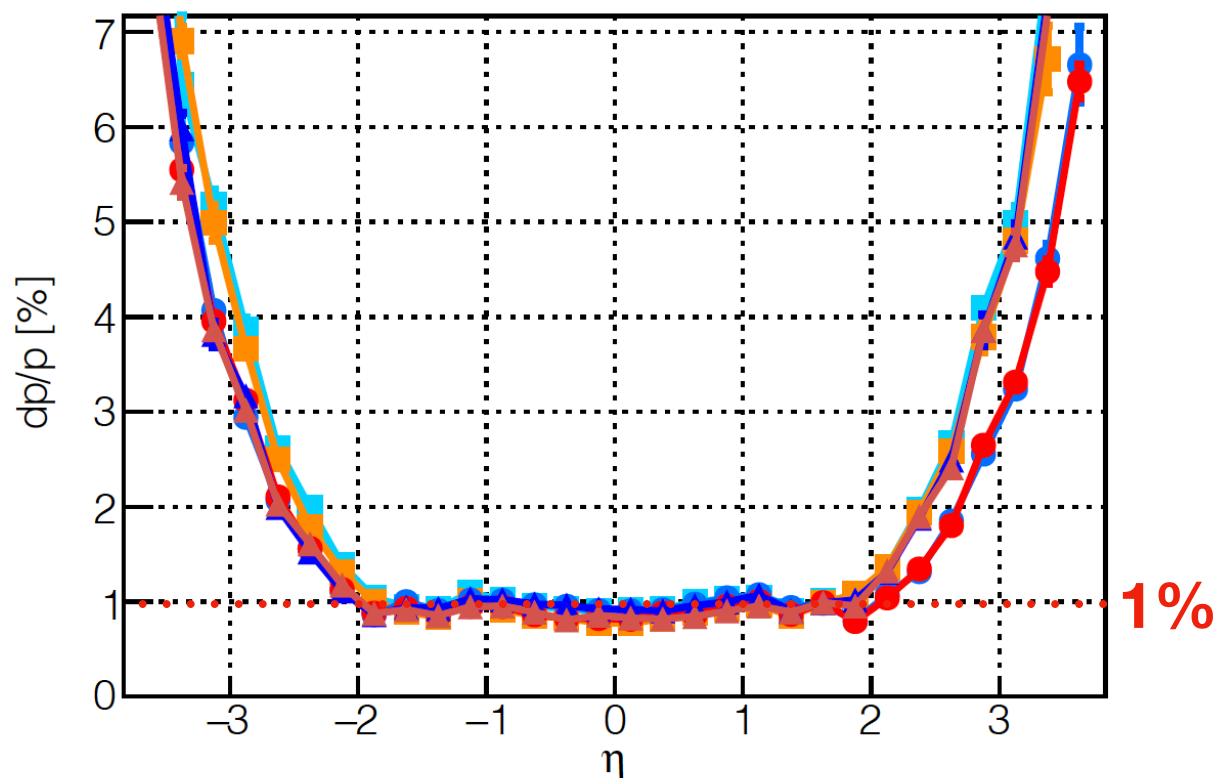
Beast (3.0 T), $25.0 < p < 30.0$ GeV/c



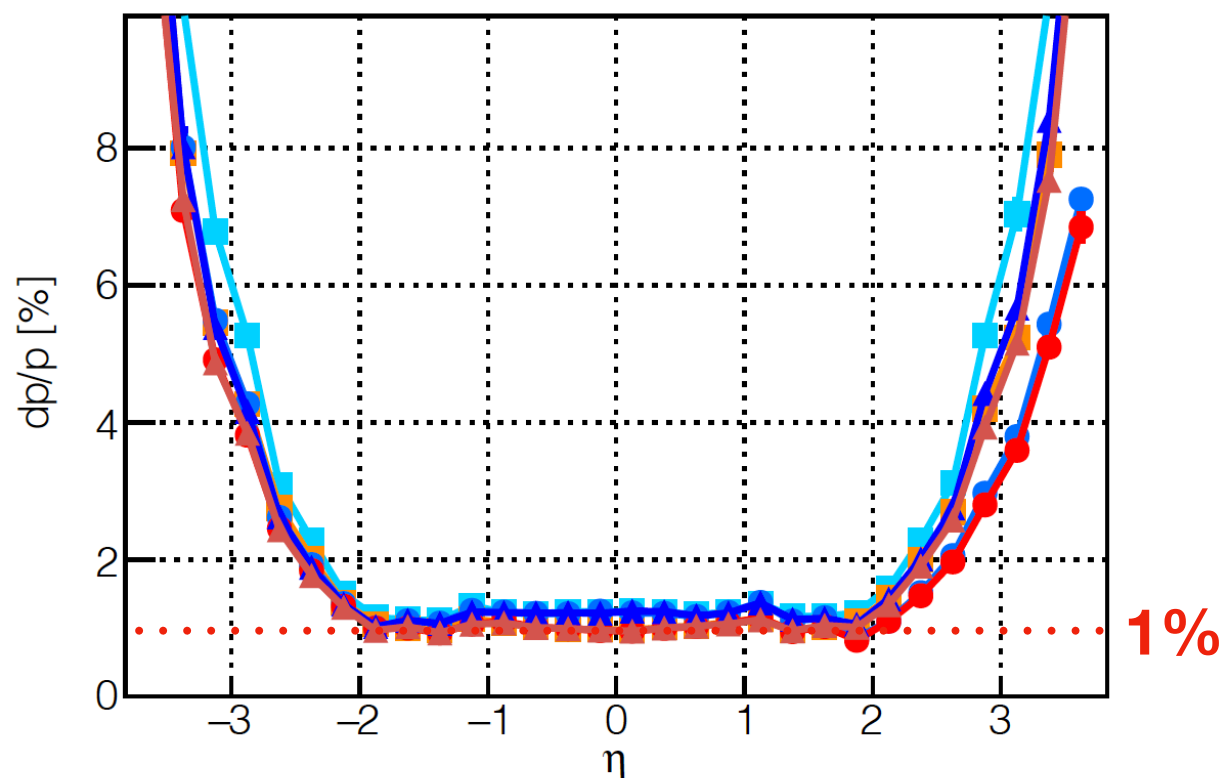
- All-Si (20 μm)
- All-Si (10 μm)
- All-Si (20 μm) + GEM
- All-Si (10 μm) + GEM
- All-Si (20 μm) + GEM + RICH
- All-Si (10 μm) + GEM + RICH

Momentum resolution for 3 momentum bins

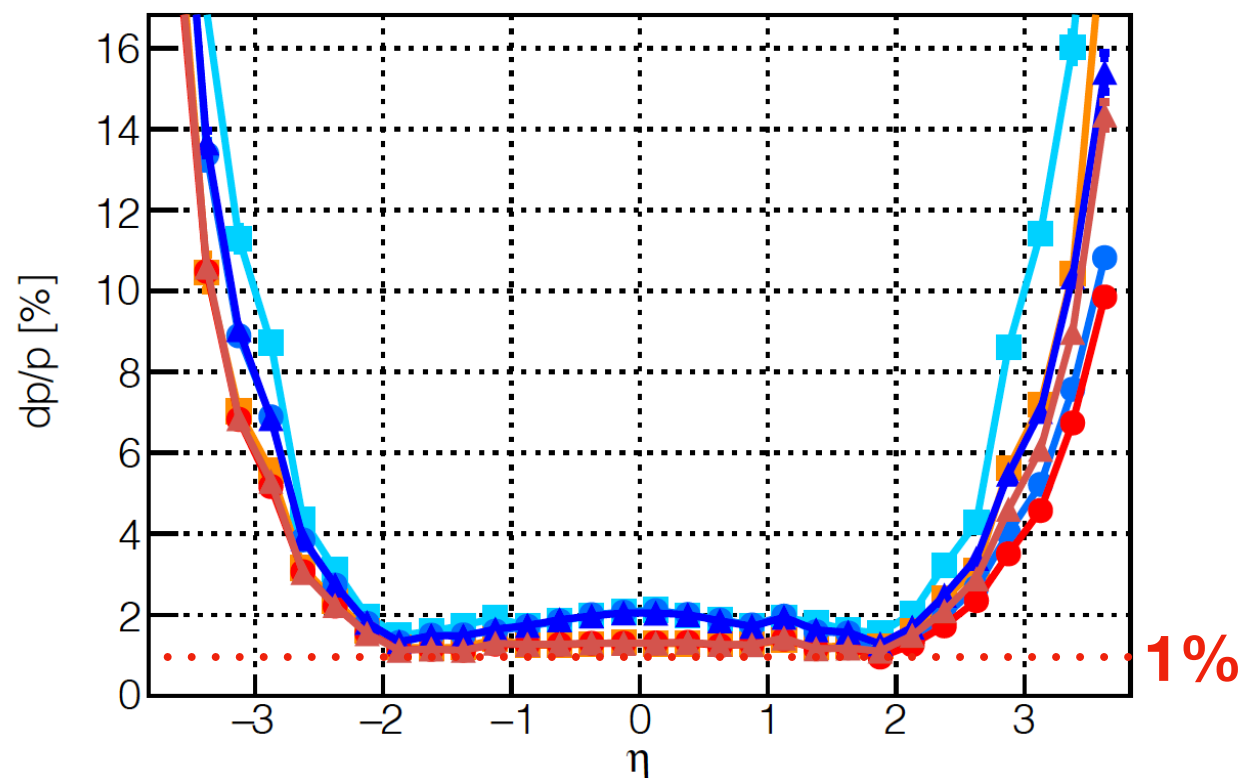
BaBar (1.4 T), $4.0 < p < 5.0 \text{ GeV}/c$



BaBar (1.4 T), $10.0 < p < 15.0 \text{ GeV}/c$



BaBar (1.4 T), $25.0 < p < 30.0 \text{ GeV}/c$



- All-Si (20 μm)
- All-Si (10 μm)
- All-Si (20 μm) + GEM
- All-Si (10 μm) + GEM
- ▲— All-Si (20 μm) + GEM + RICH
- ▲— All-Si (10 μm) + GEM + RICH

Summary and Conclusions

- Added GEMs in the available space at forward and backward pseudorapidities.
- Implemented “effective” RICH geometry between All-Si tracker and forward GEM.
- Started studying GEM (and RICH material) effect on momentum resolutions.
- $50\ \mu\text{m}$ GEM have strong impact on momentum resolution at higher momenta and pseudorapidities.