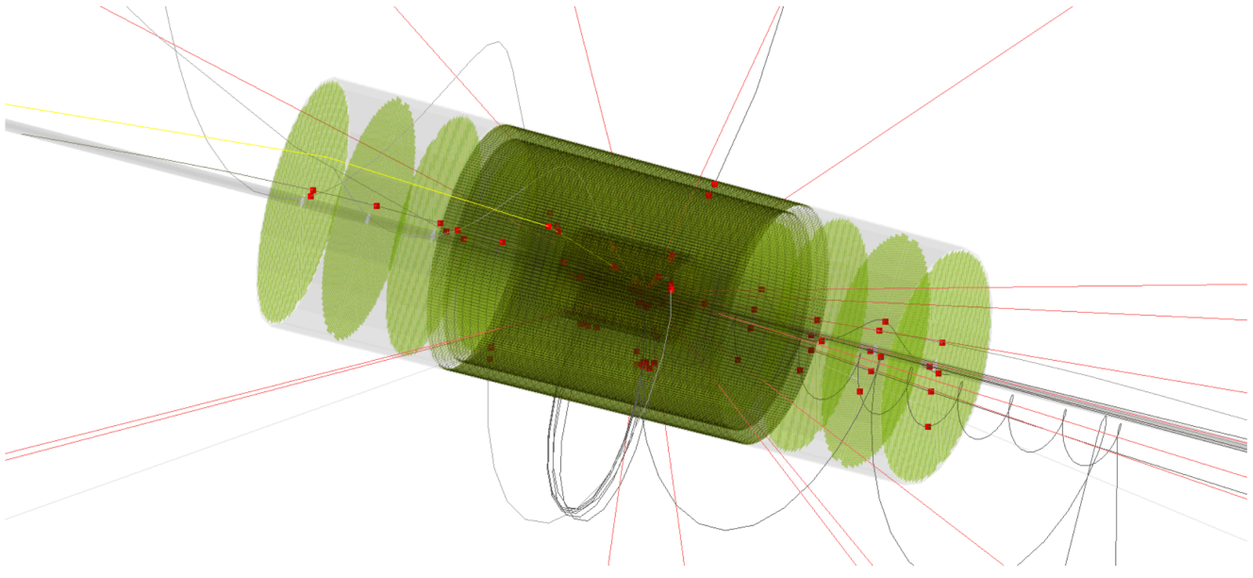
Tapered All-Si Tracker in Fun4All



Rey Cruz-Torres, Winston DeGraw

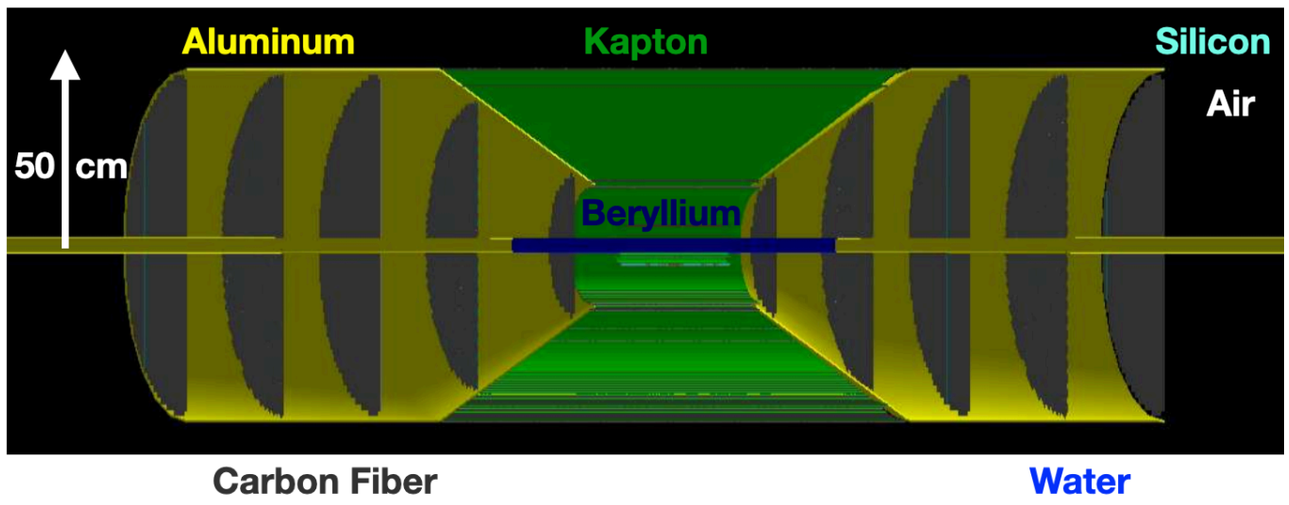
05/14/2020

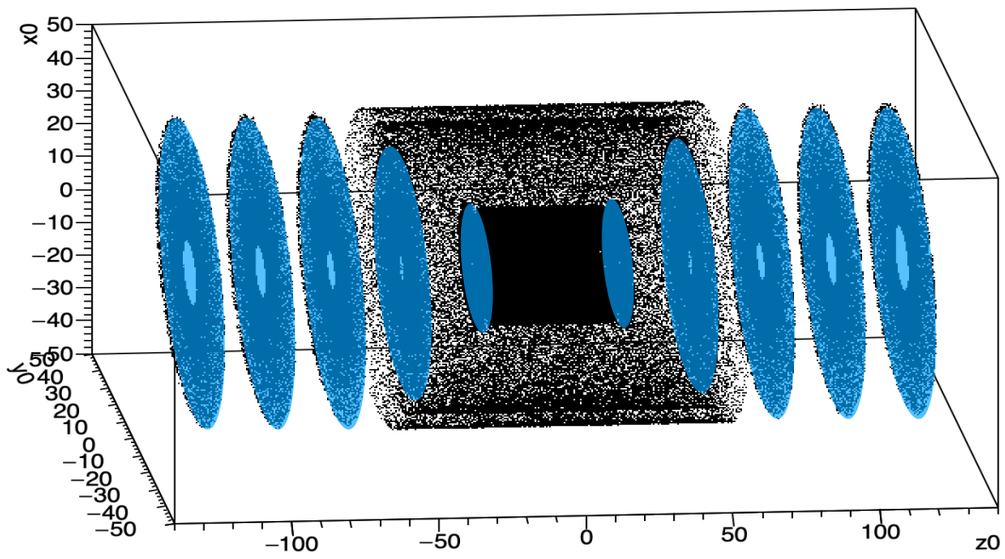
To recap

- Detector design presented by Ernst Sichtermann here.

- Geometry and tracking implementation in Fun4All by Chris Pinkenburg and Jin Huang

- Last week: only tracking in the barrel





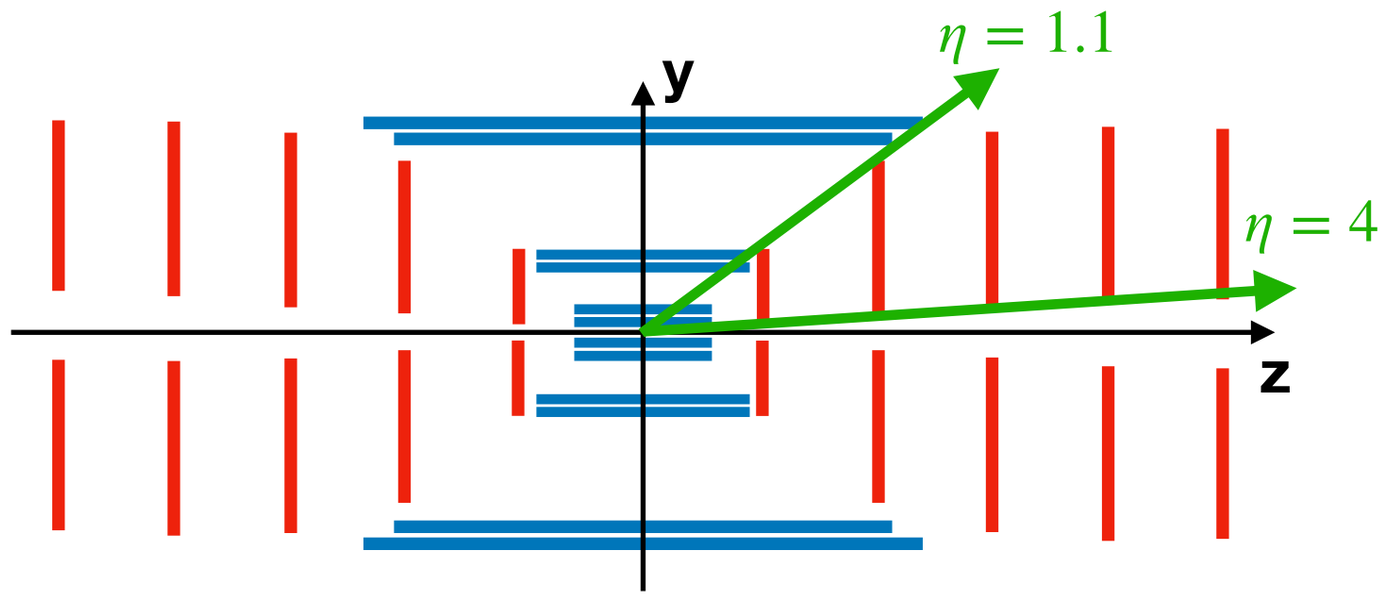
Simulation details

Goals:
Compare sPHENIX and All-Si tracker performance
Compare All-Si tracker performance in 1.5 and 3.0 T B fields
Compare Fun4All with EIC root All-Si implementation

Kalman Filter: PHG4TrackFastSim

$\hat{r}$, $\hat{\phi}$, and $\hat{z}$ resolutions:

$$\frac{1}{\sqrt{12}} 20\ \mu\text{m} \approx 5.8\ \mu\text{m}$$



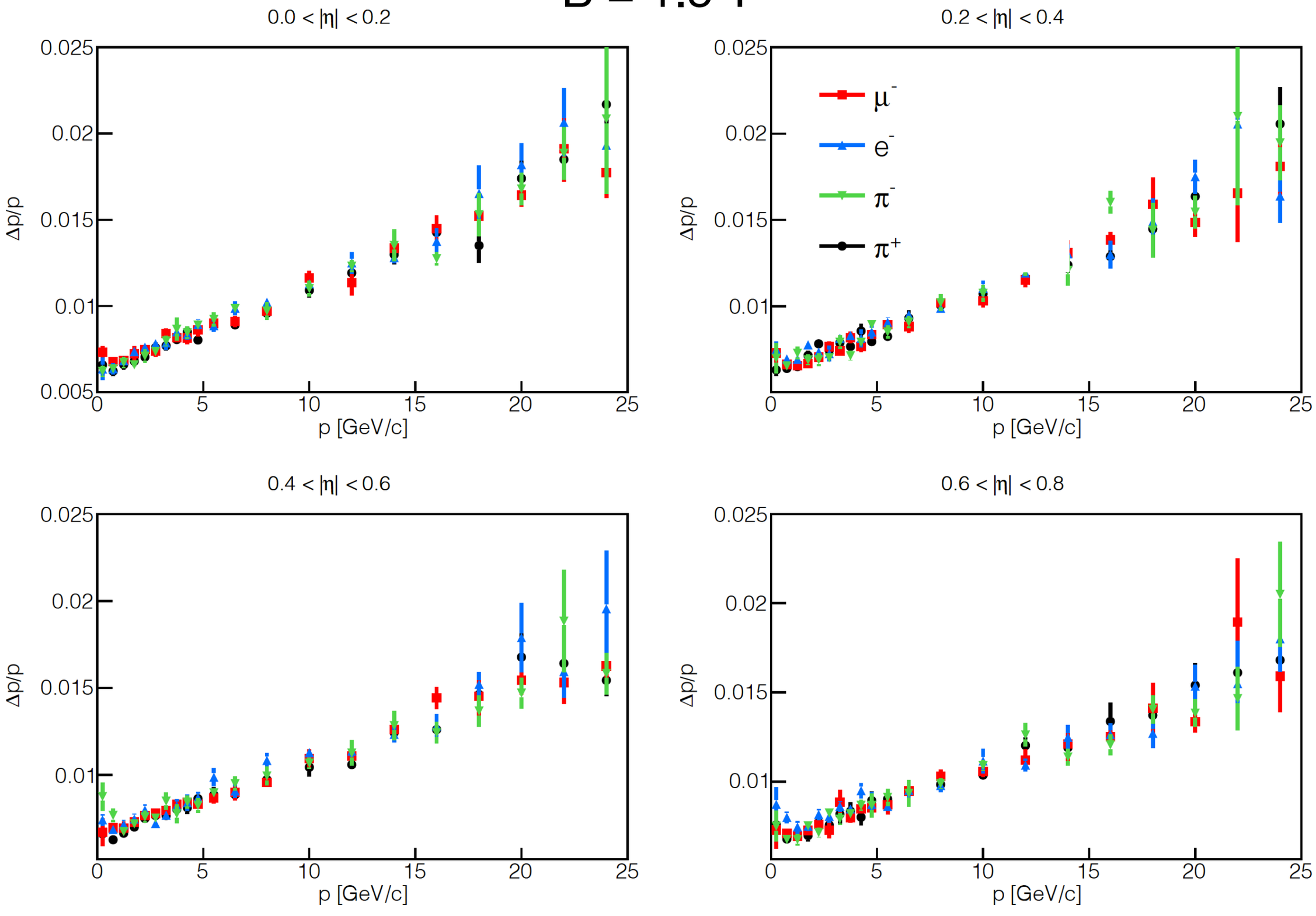
Generation (~5M events):
vertex: (0,0,0)
momentum: (0,50 GeV/c)
$|\eta|$: (0,4)
ϕ: (0,2π)

Additional parameters:
generated particle (π^+,π^-,μ^-,e^-)
B field: 1.5, 3.0 T (solenoidal)

MOMENTUM RESOLUTION

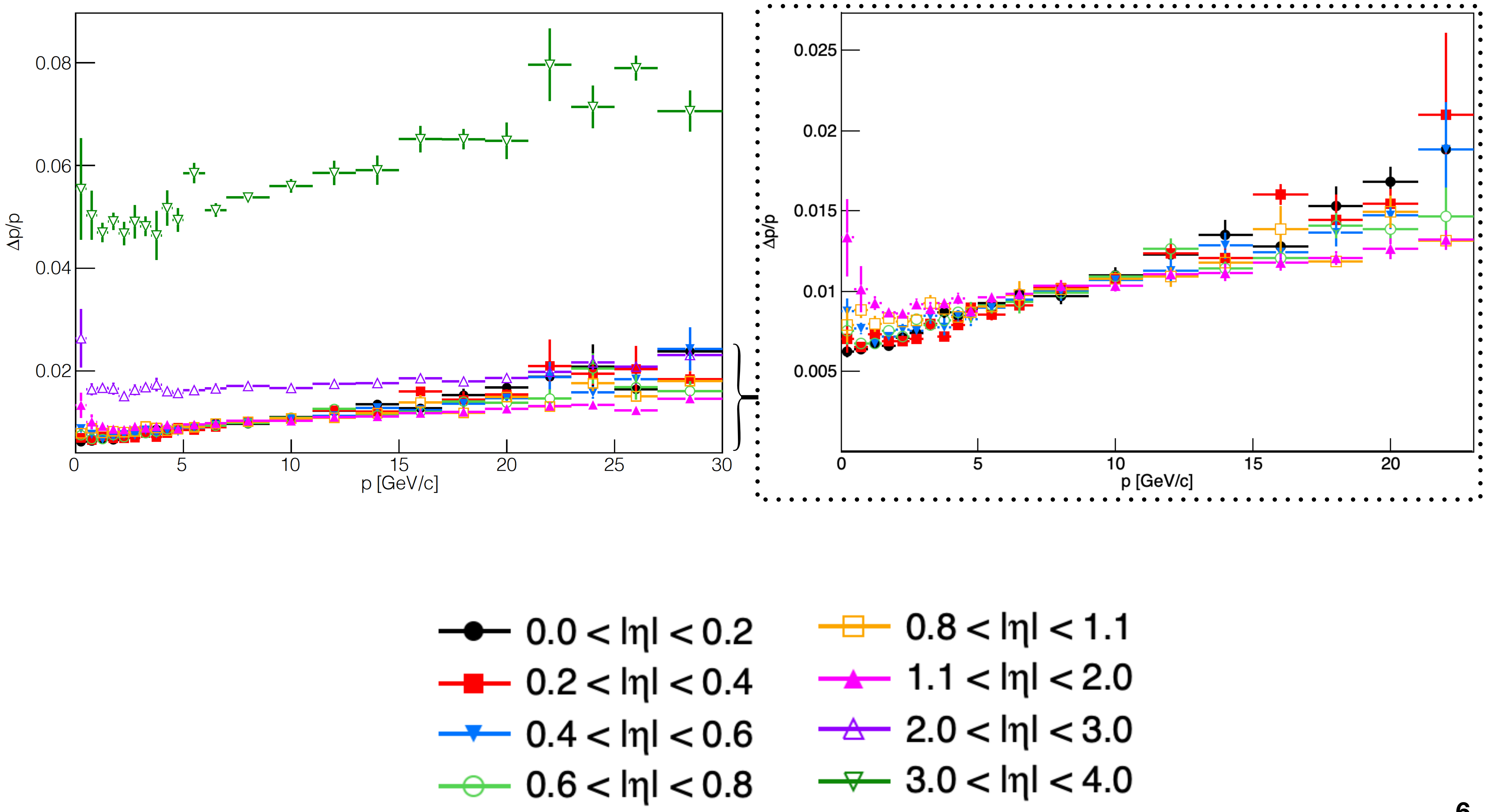
p resolution vs. p

B = 1.5 T

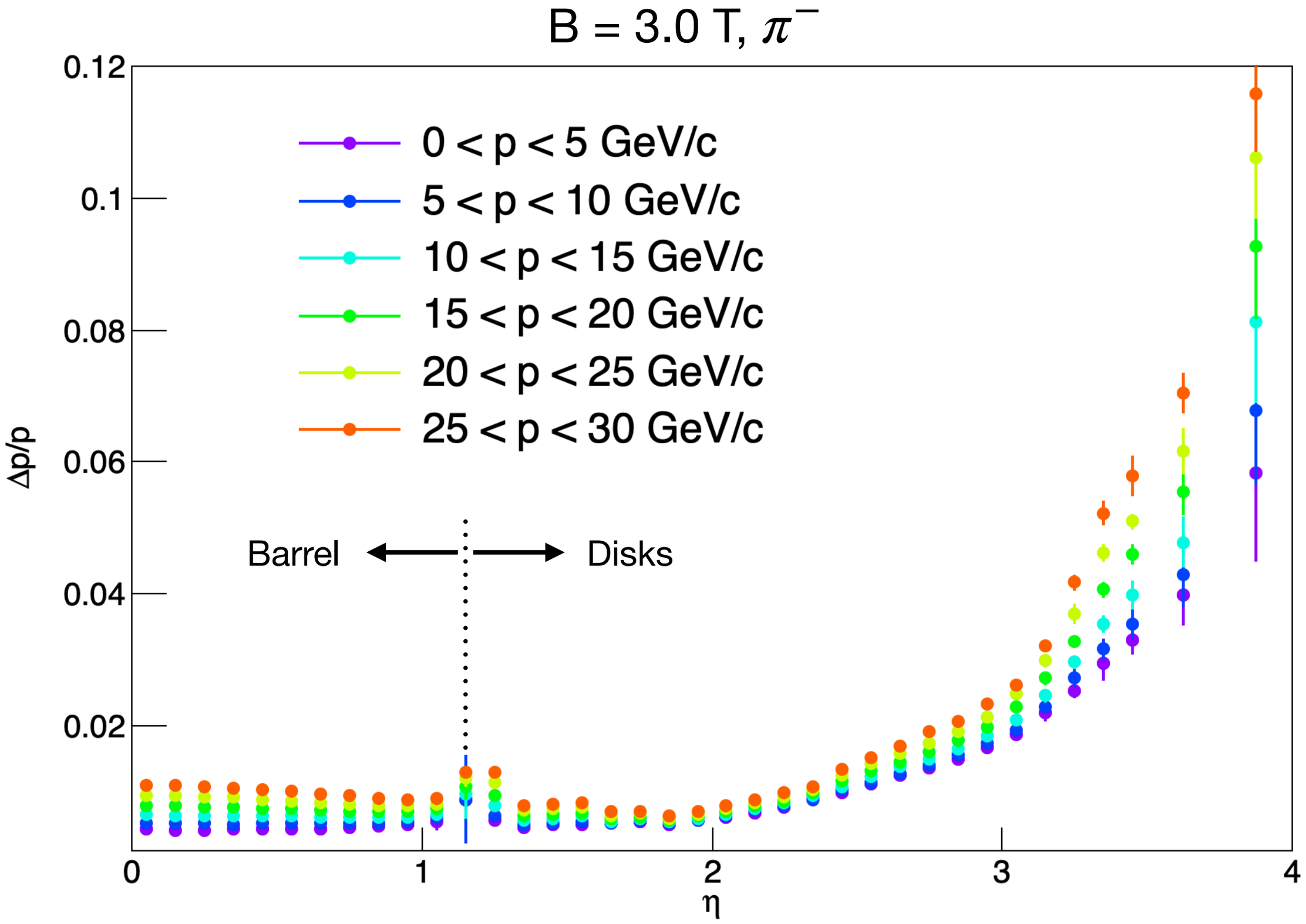


p resolution vs. p

B = 1.5 T, π^-

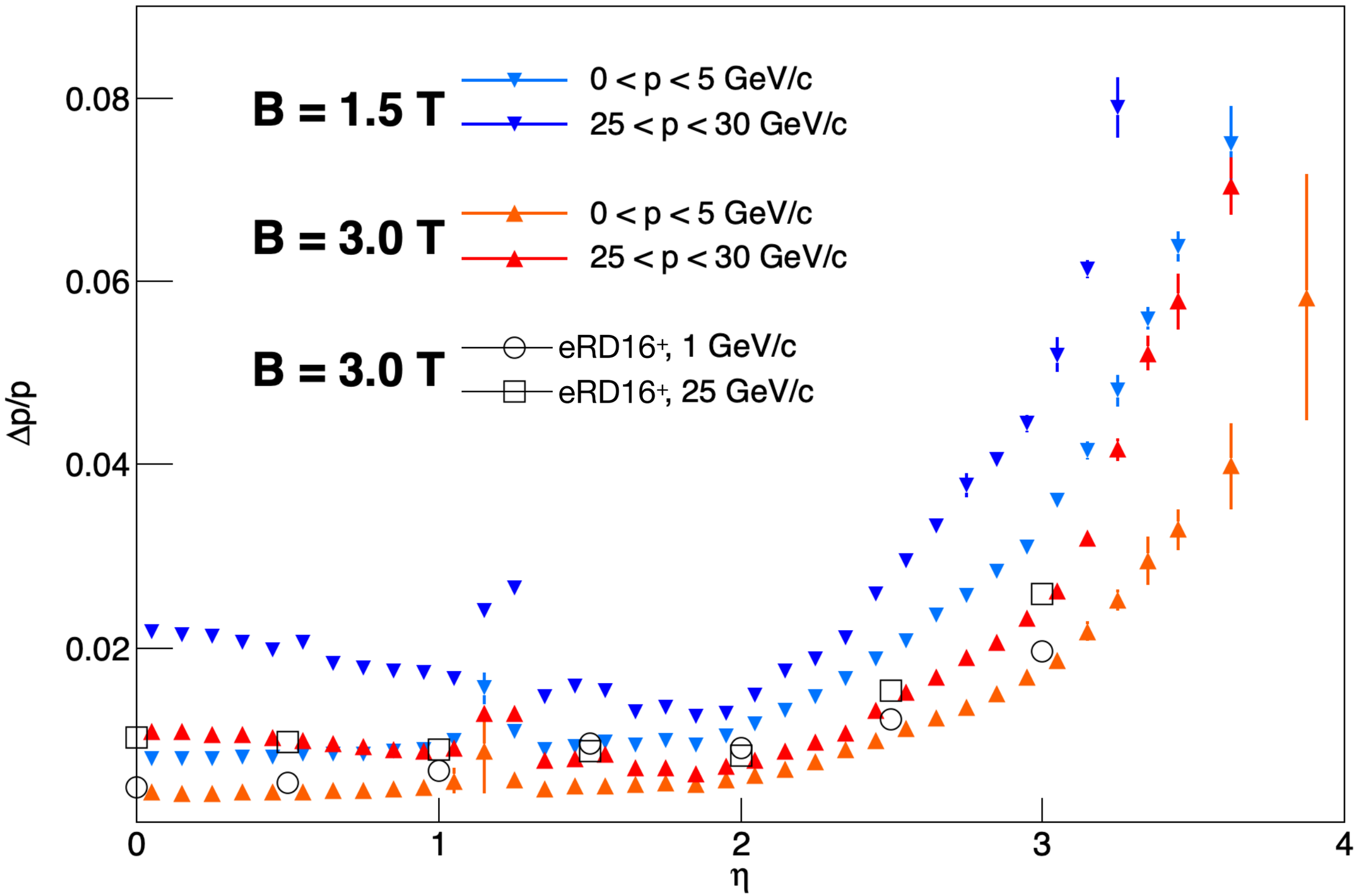


p resolution vs. η



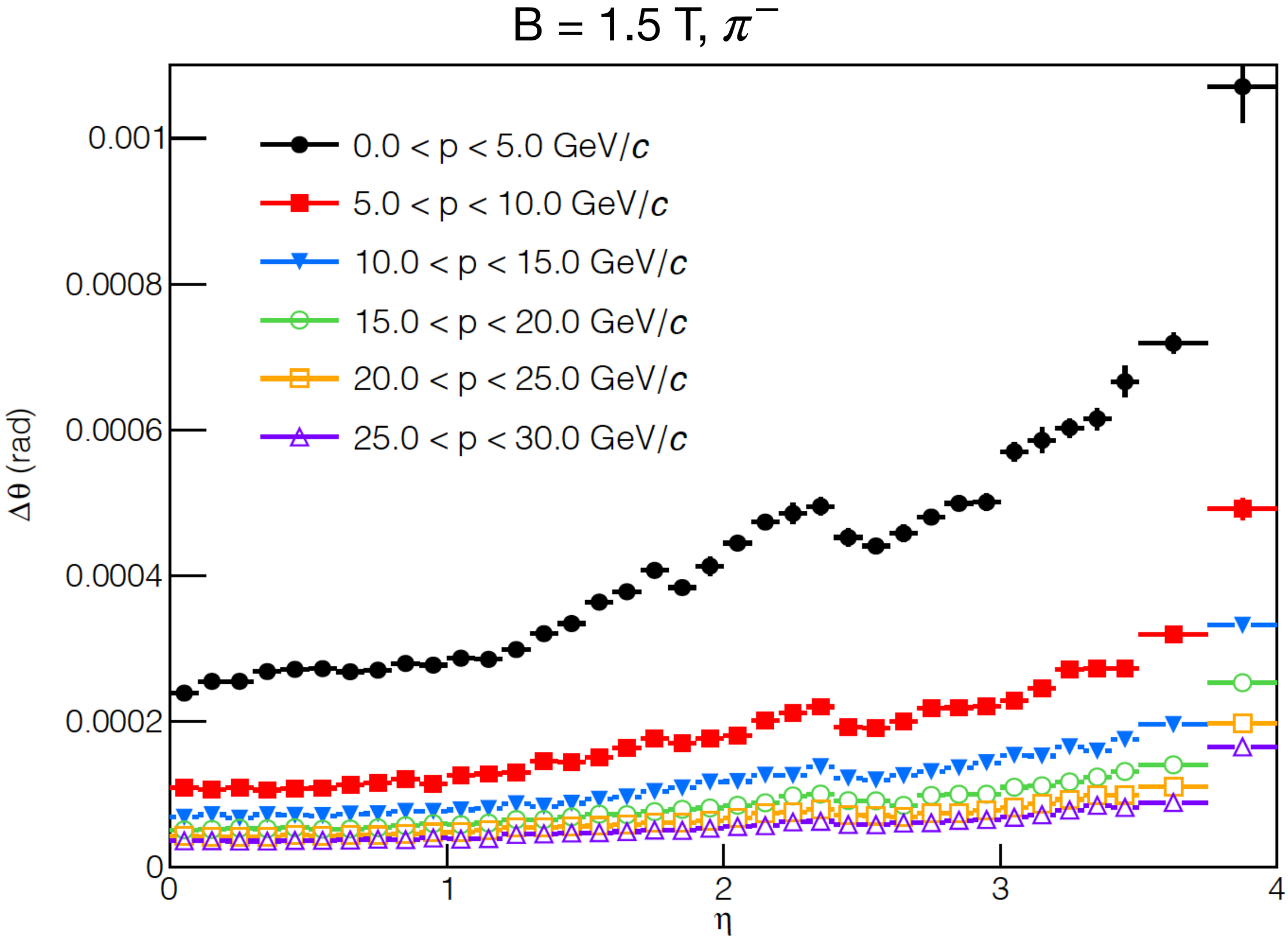
p resolution vs. η

π^-

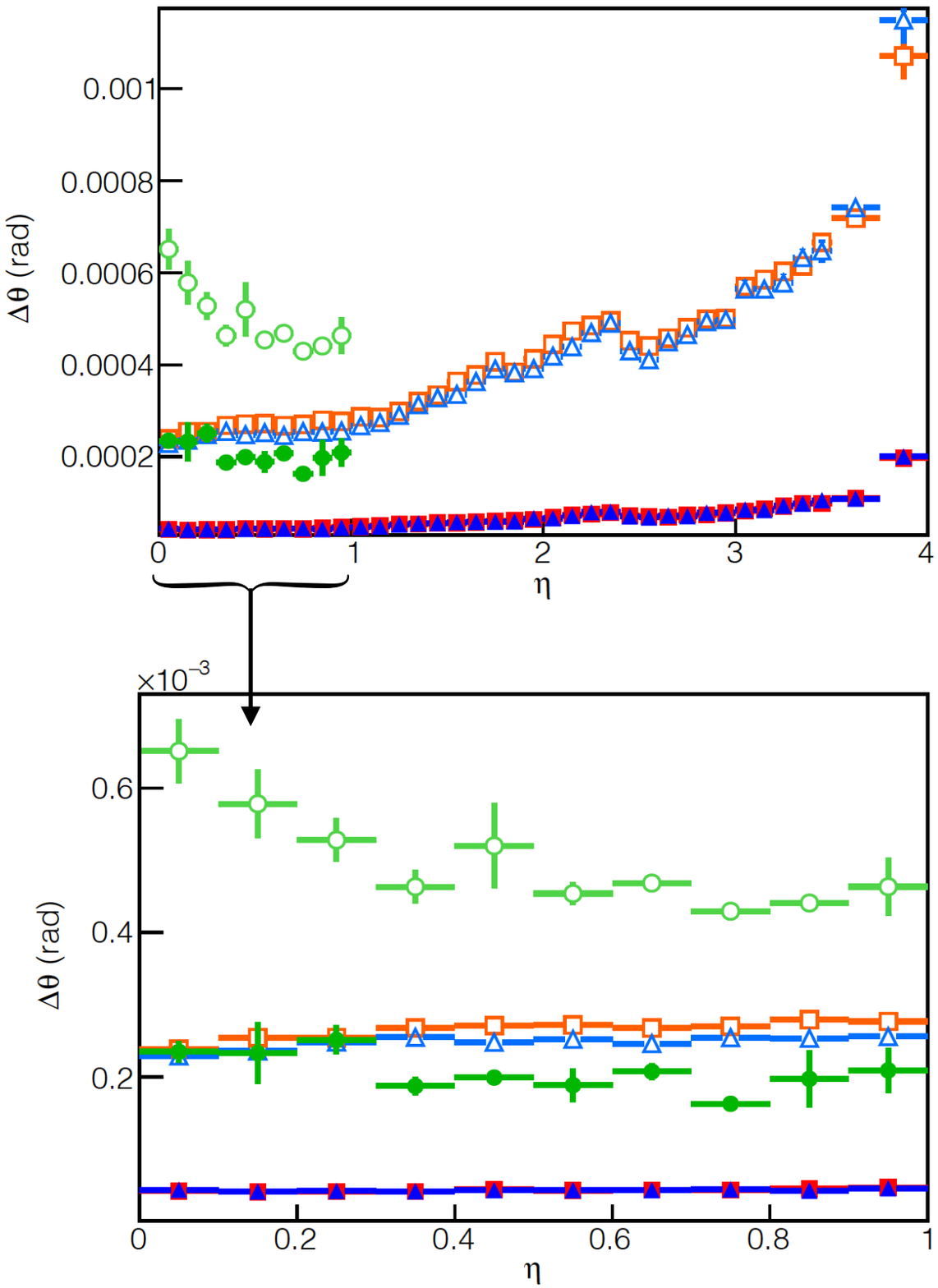


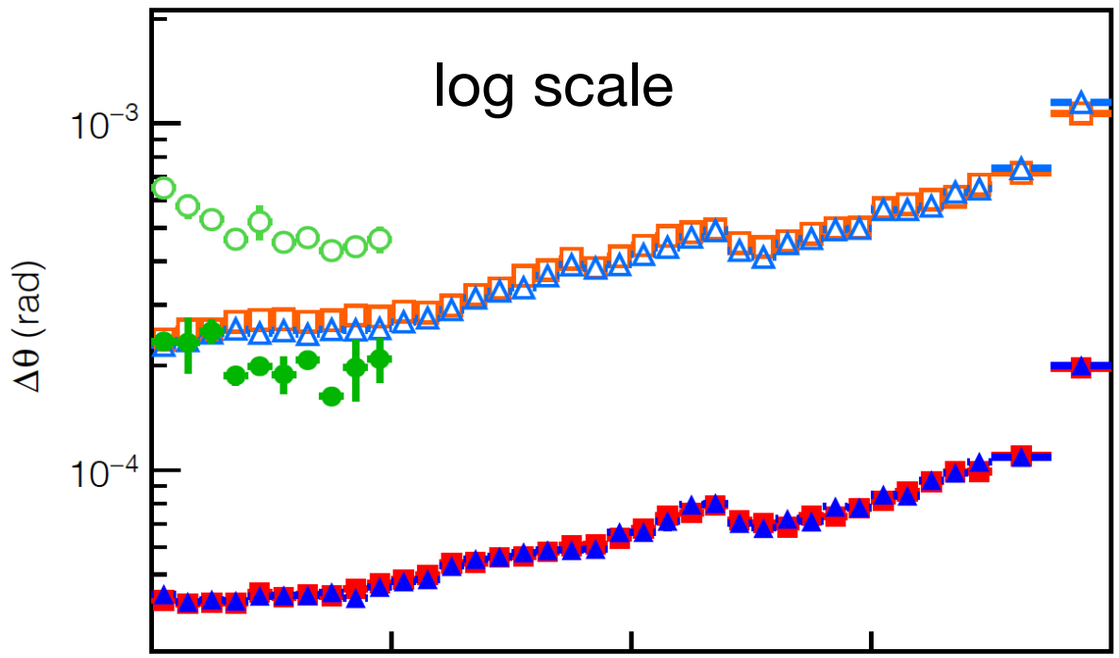
ANGULAR RESOLUTION

θ resolution vs. η



θ resolution vs. η





π^-

0 < p < 5 GeV/c
sPHENIX, B = 1.5 T
All-Si, B = 1.5 T
All-Si, B = 3.0 T

20 < p < 25 GeV/c
sPHENIX, B = 1.5 T
All-Si, B = 1.5 T
All-Si, B = 3.0 T

Summary and Conclusions

- Tapered All-Si tracker implemented in Fun4All framework.

- Compared:
  - B: 1.5, 3.0 T
  - All-Si EICroot results
  - All-Si vs. sPHENIX tracker

- Preliminary momentum resolution comparison shows agreement with implementation in EICroot.

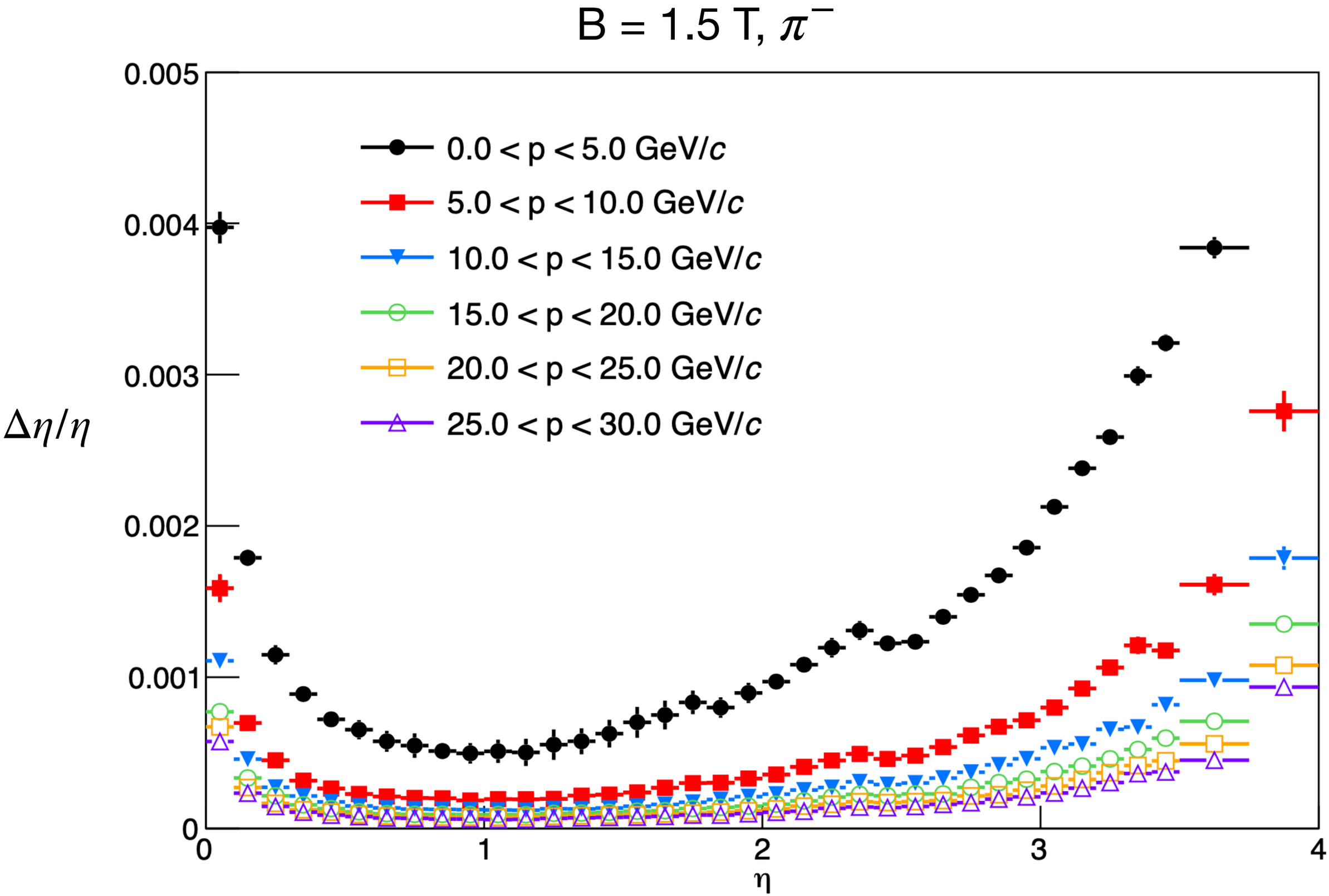
- Angular resolution ~2-4 times better in All-Si tracker than sPHENIX Si+TPC tracker in the momentum range studied.

Next steps:

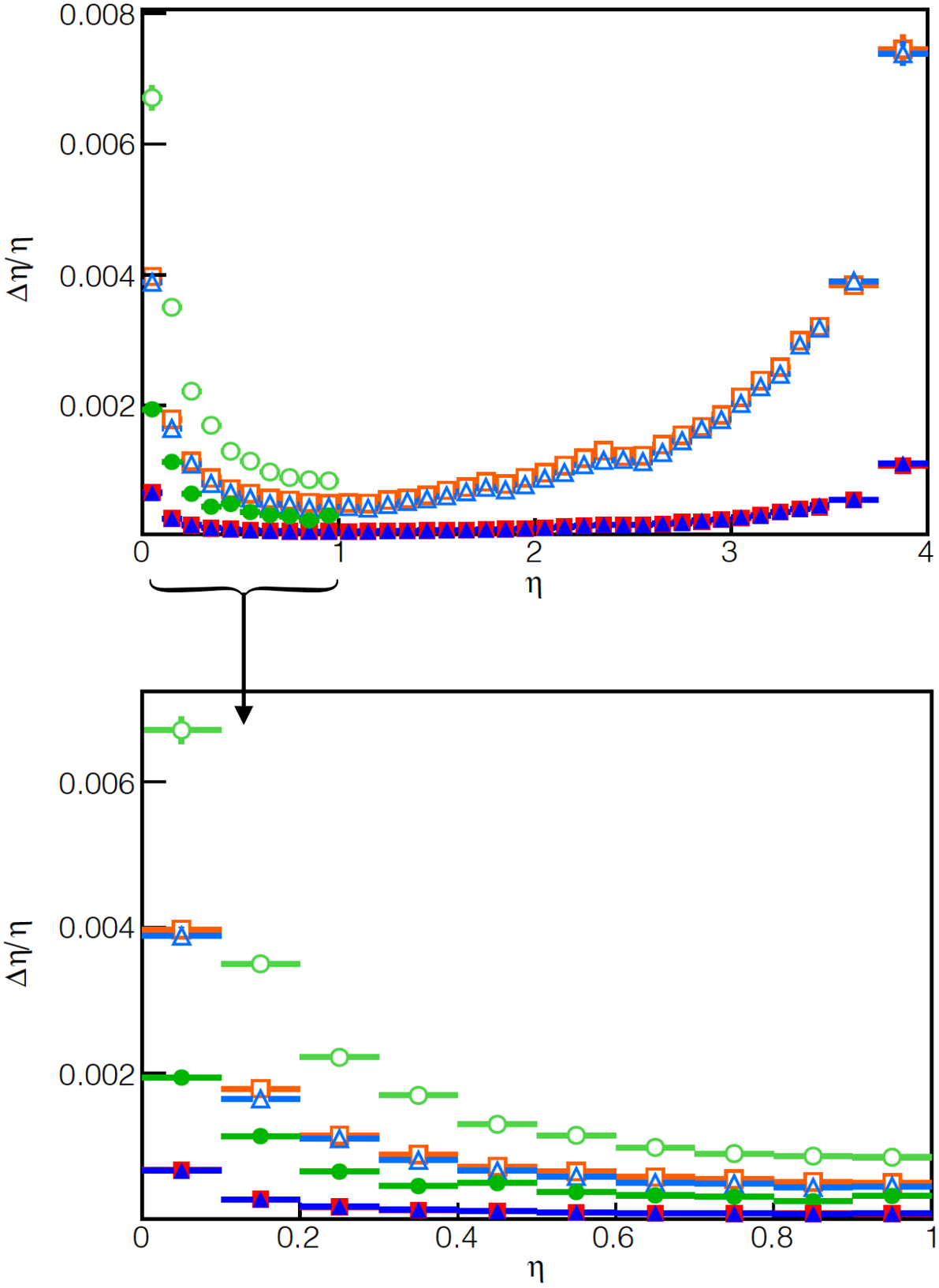
* Repeat studies for jets
* Resolutions at PID

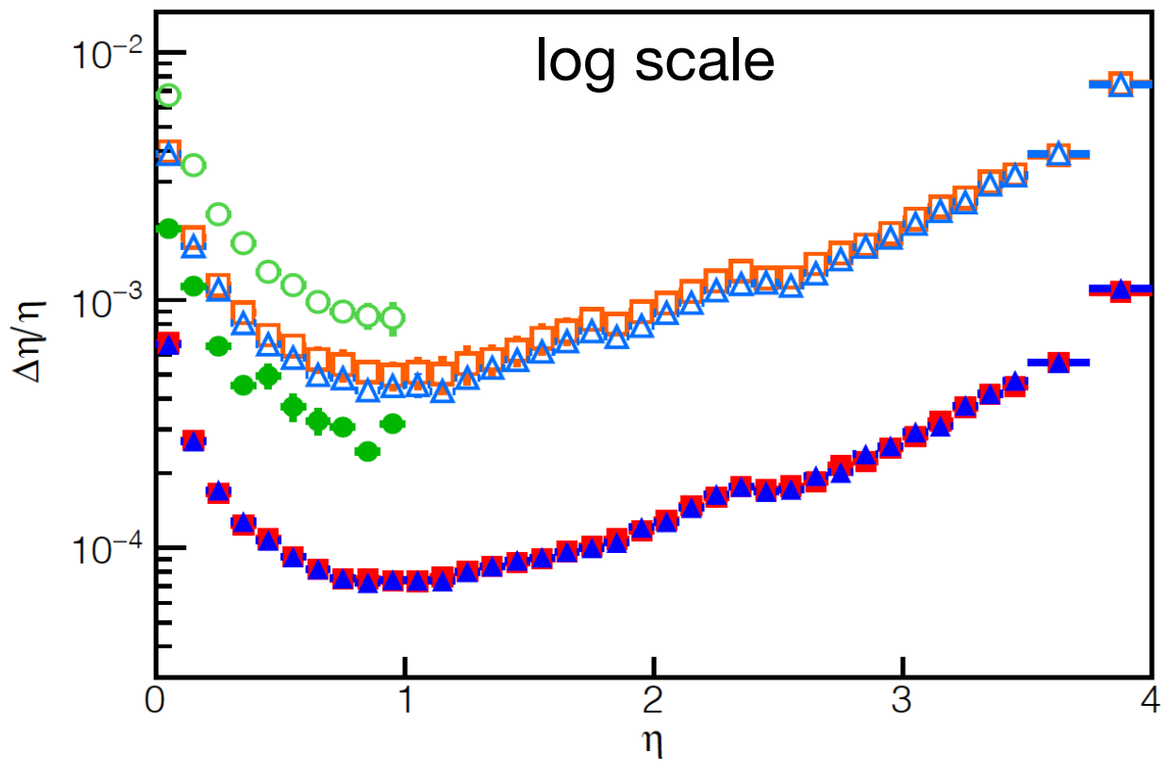
Backup slides

η resolution vs. η



η resolution vs. η





π^-

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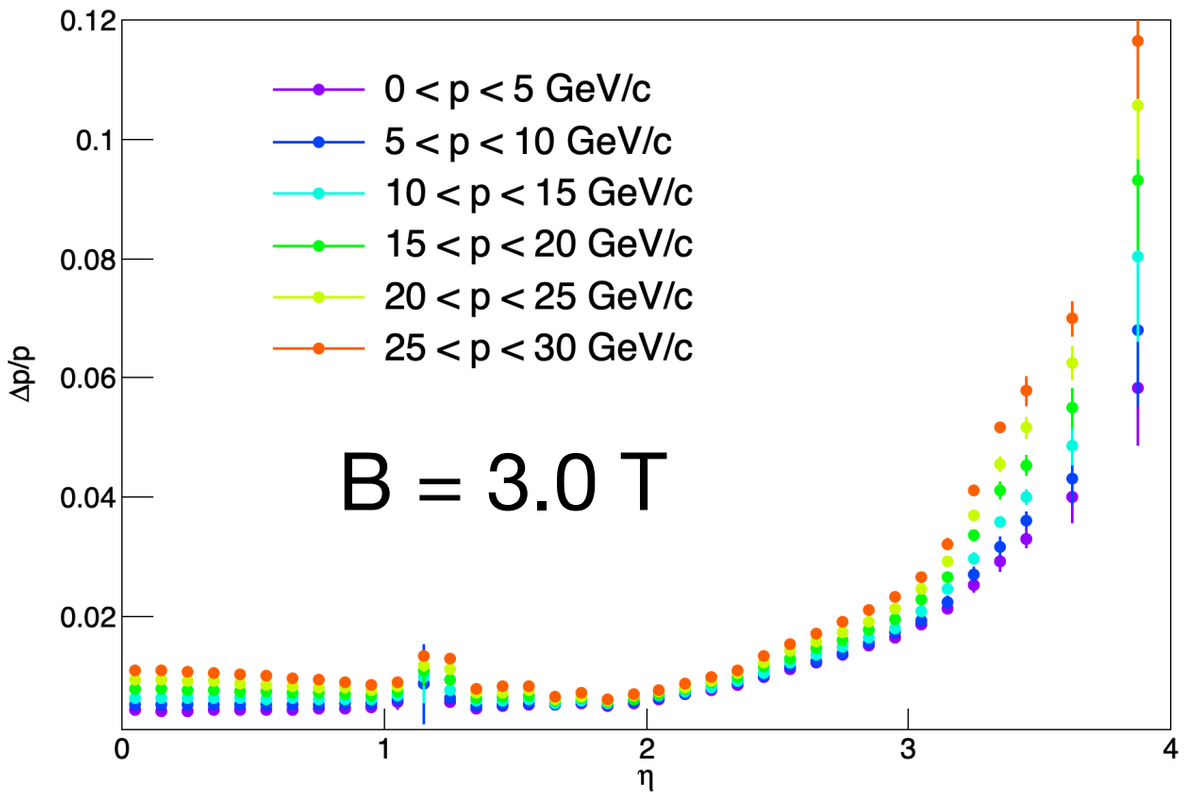
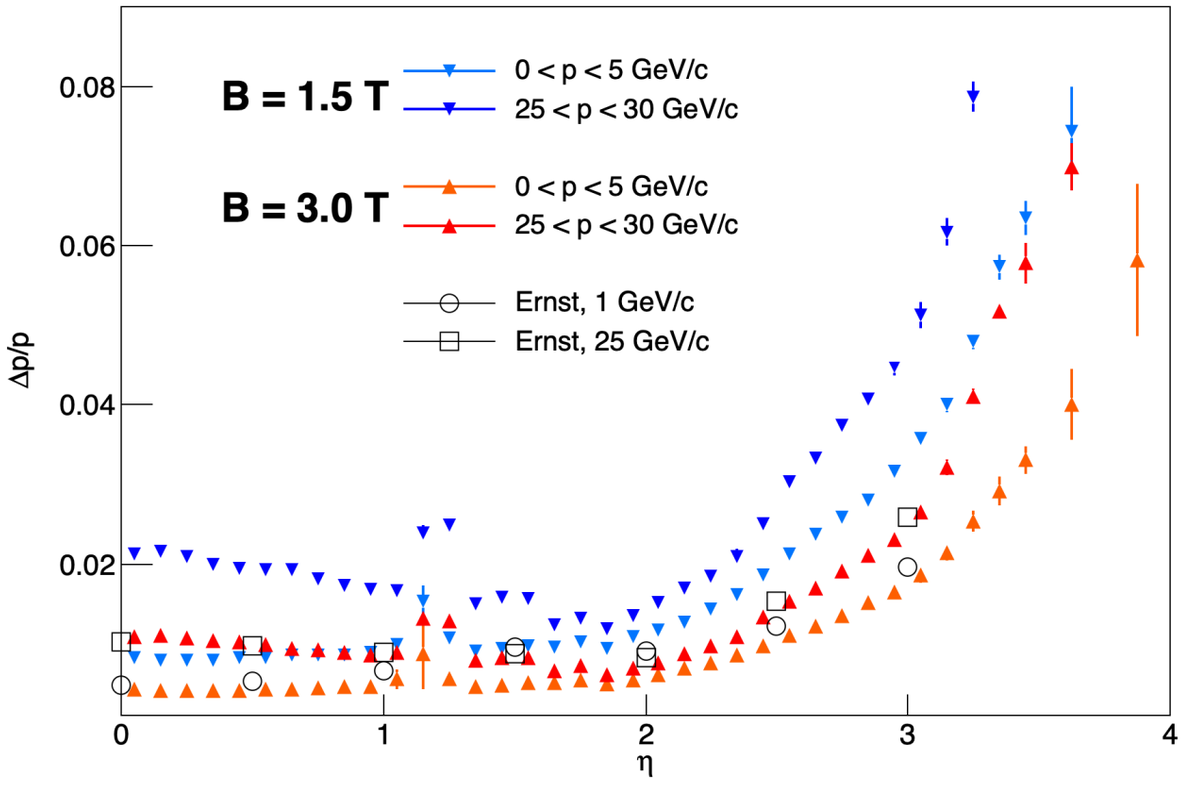
20 < p < 25 GeV/c
sPHENIX, B = 1.5 T
All-Si, B = 1.5 T
All-Si, B = 3.0 T

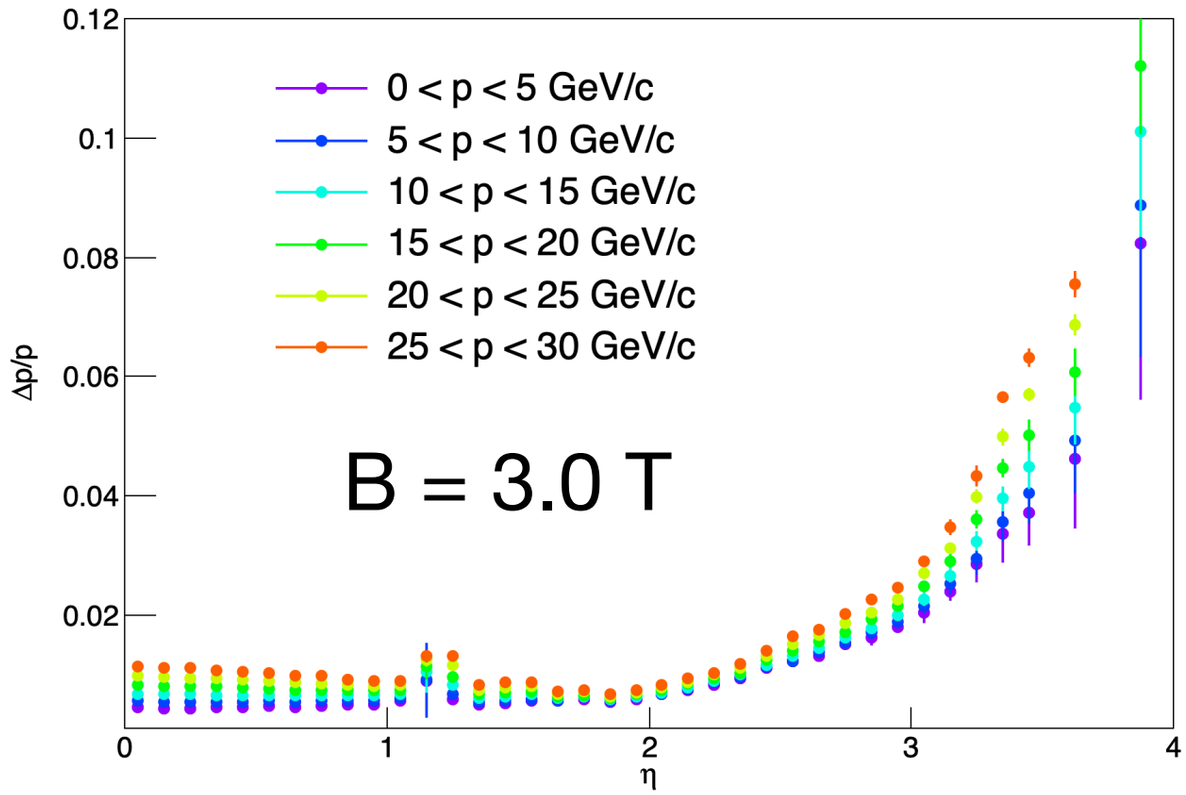
p resolution vs. η for μ^- and e^-

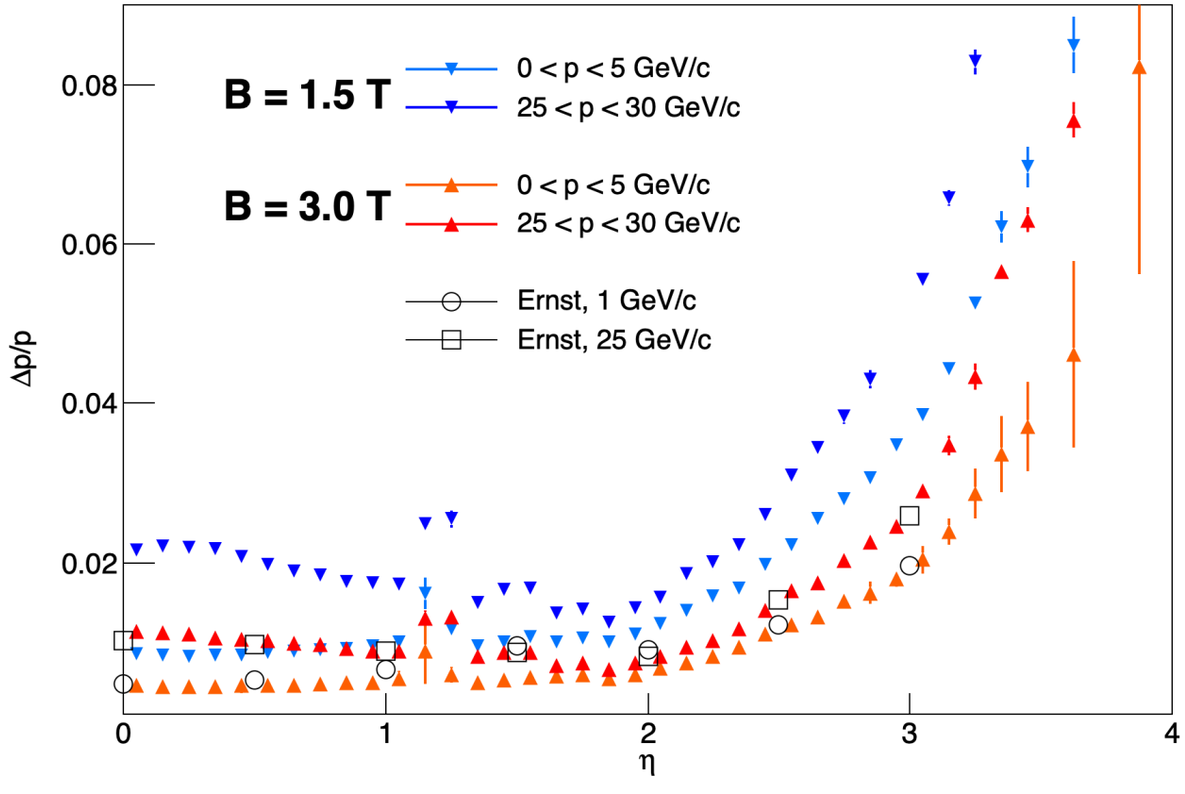
mu-



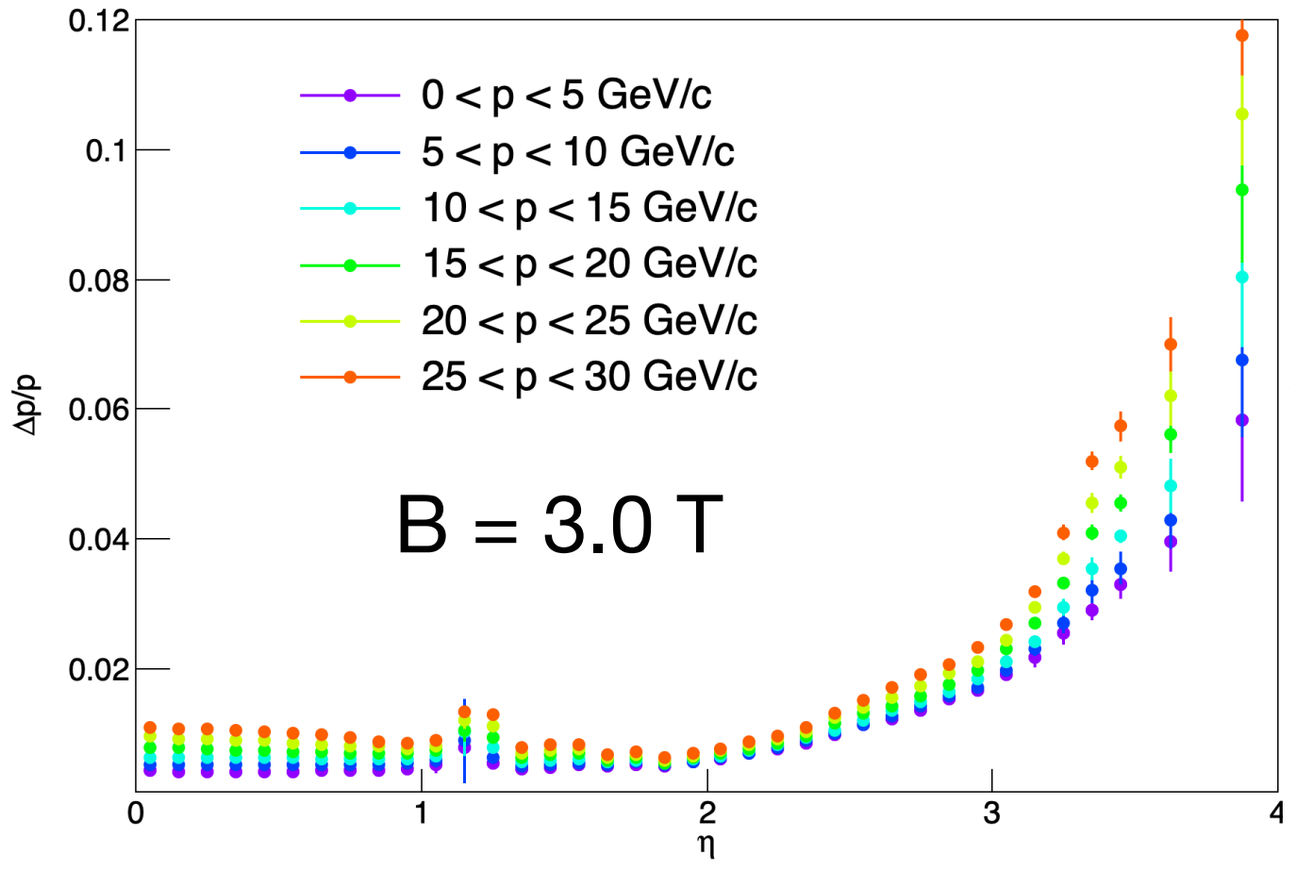


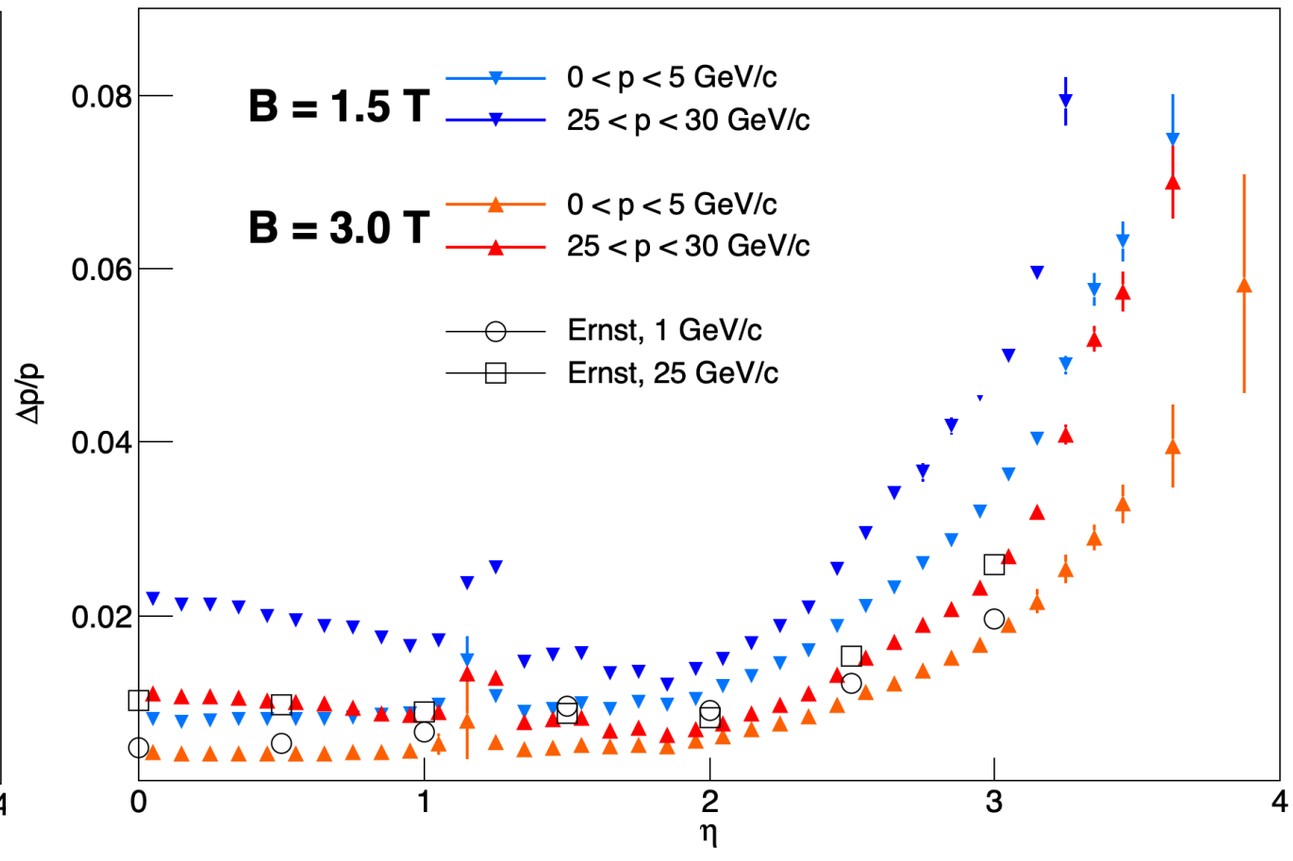
e-



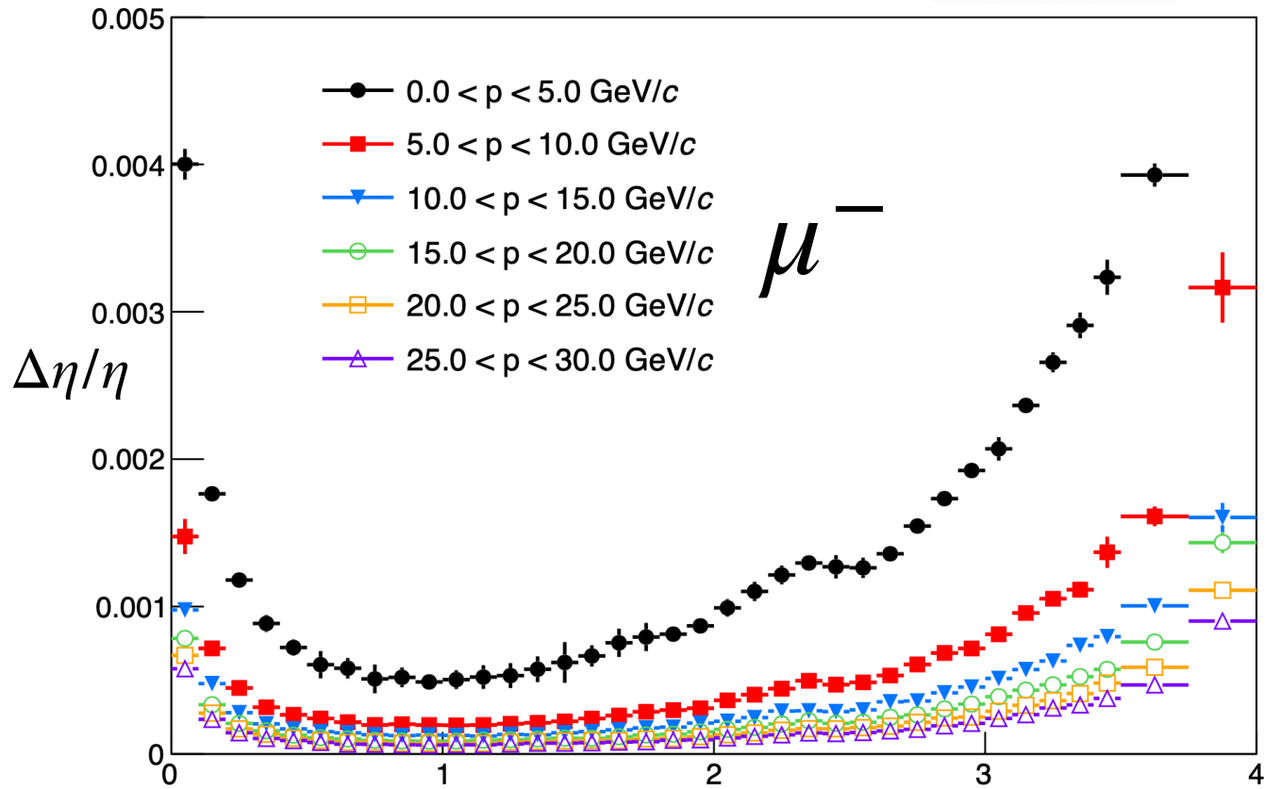


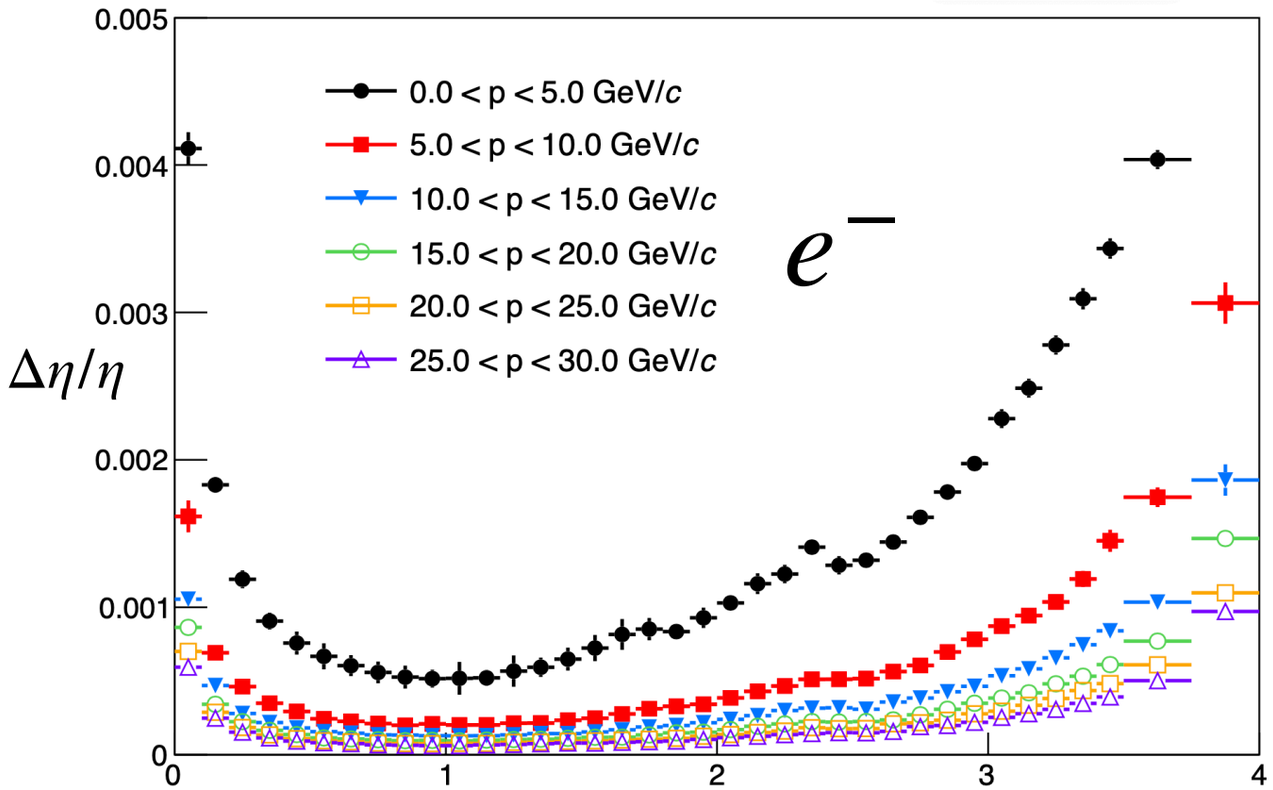
p resolution vs. η for π^+

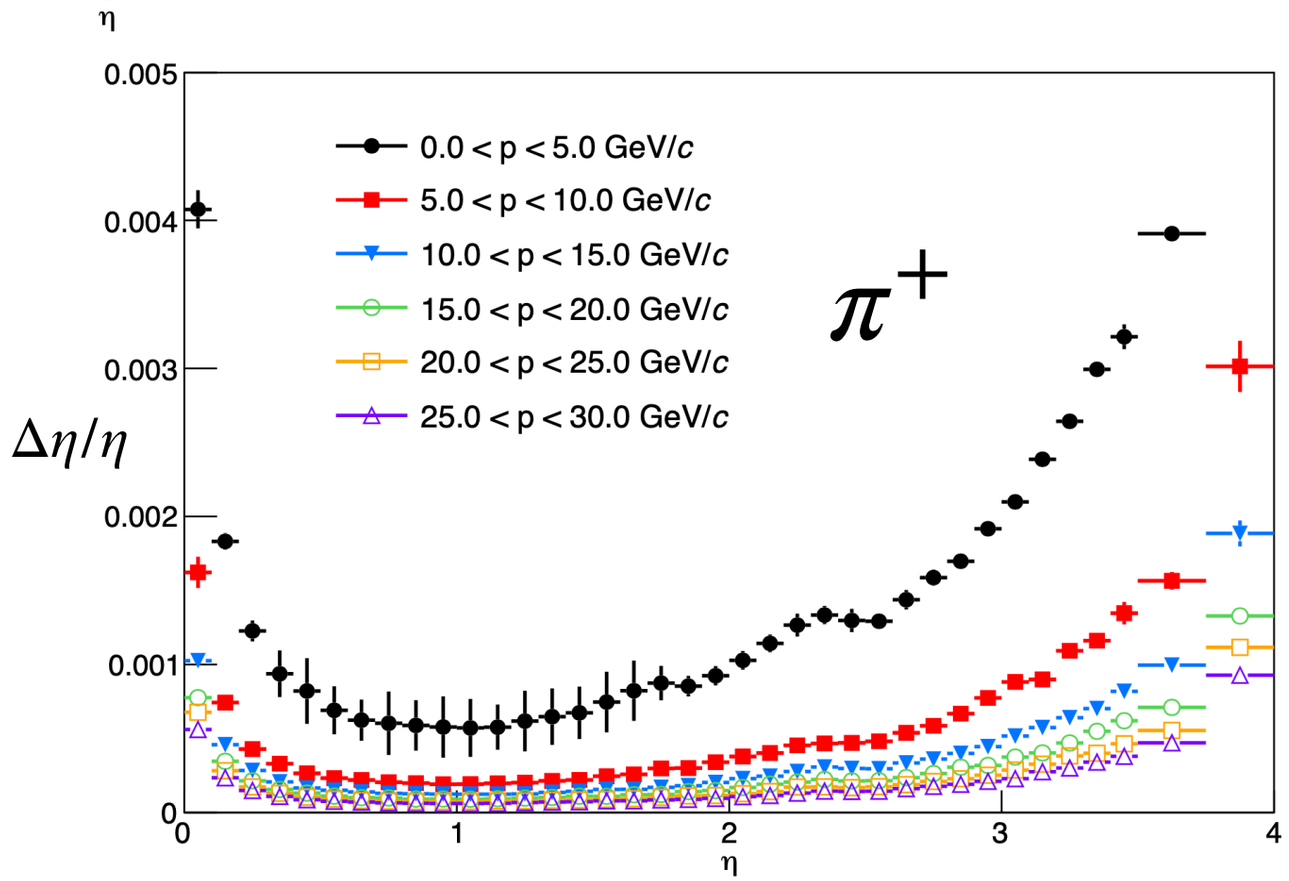




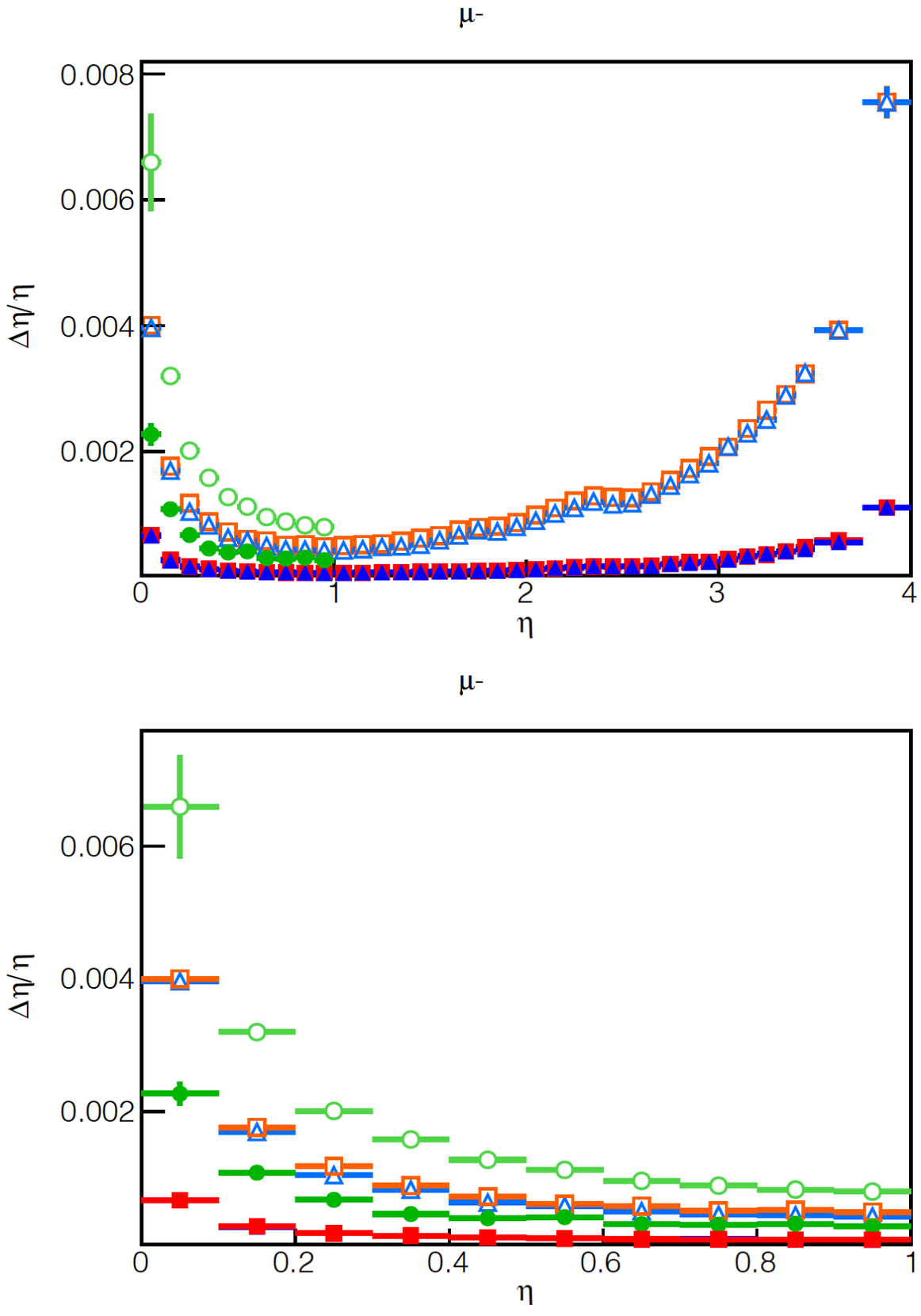
η resolution vs. η

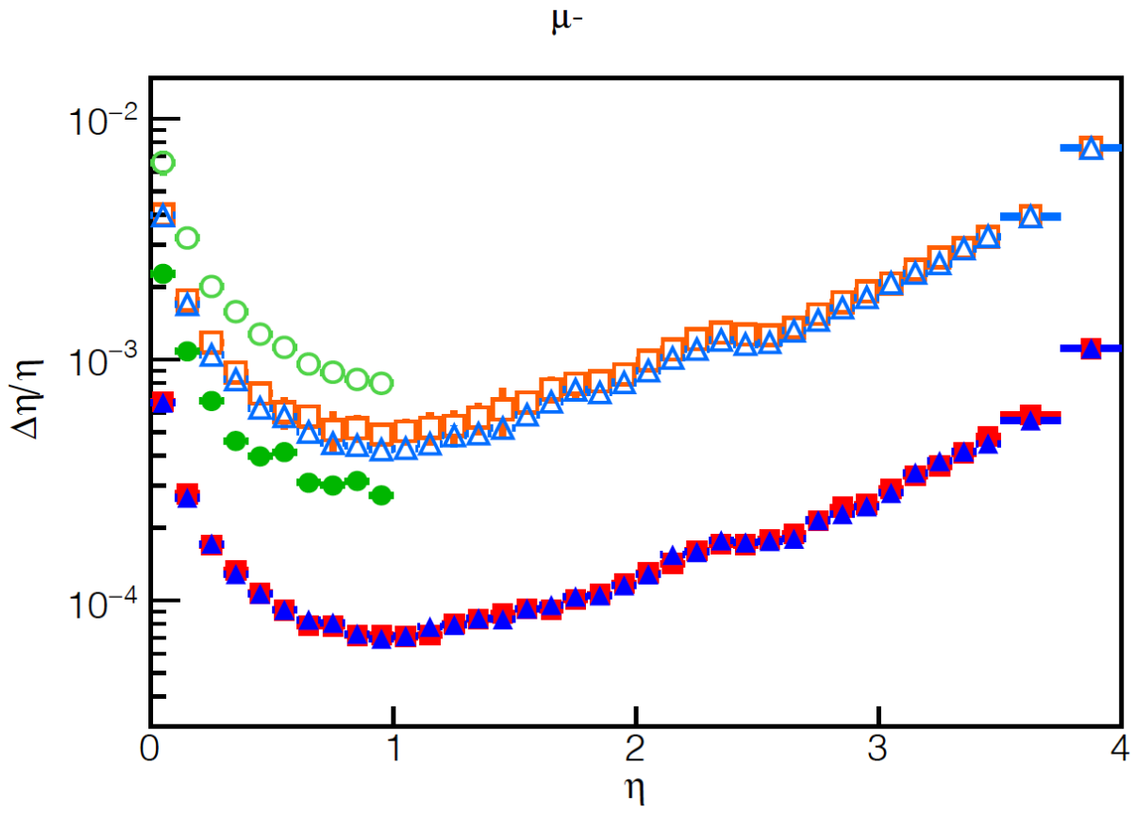


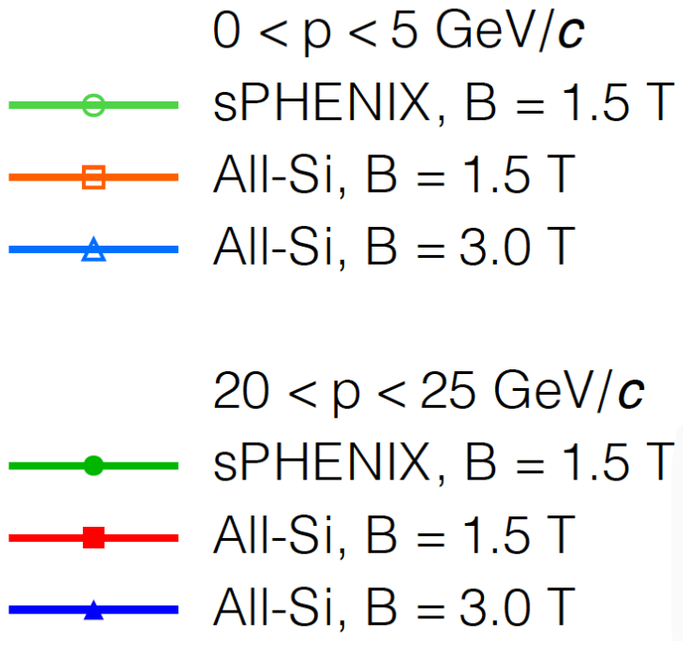




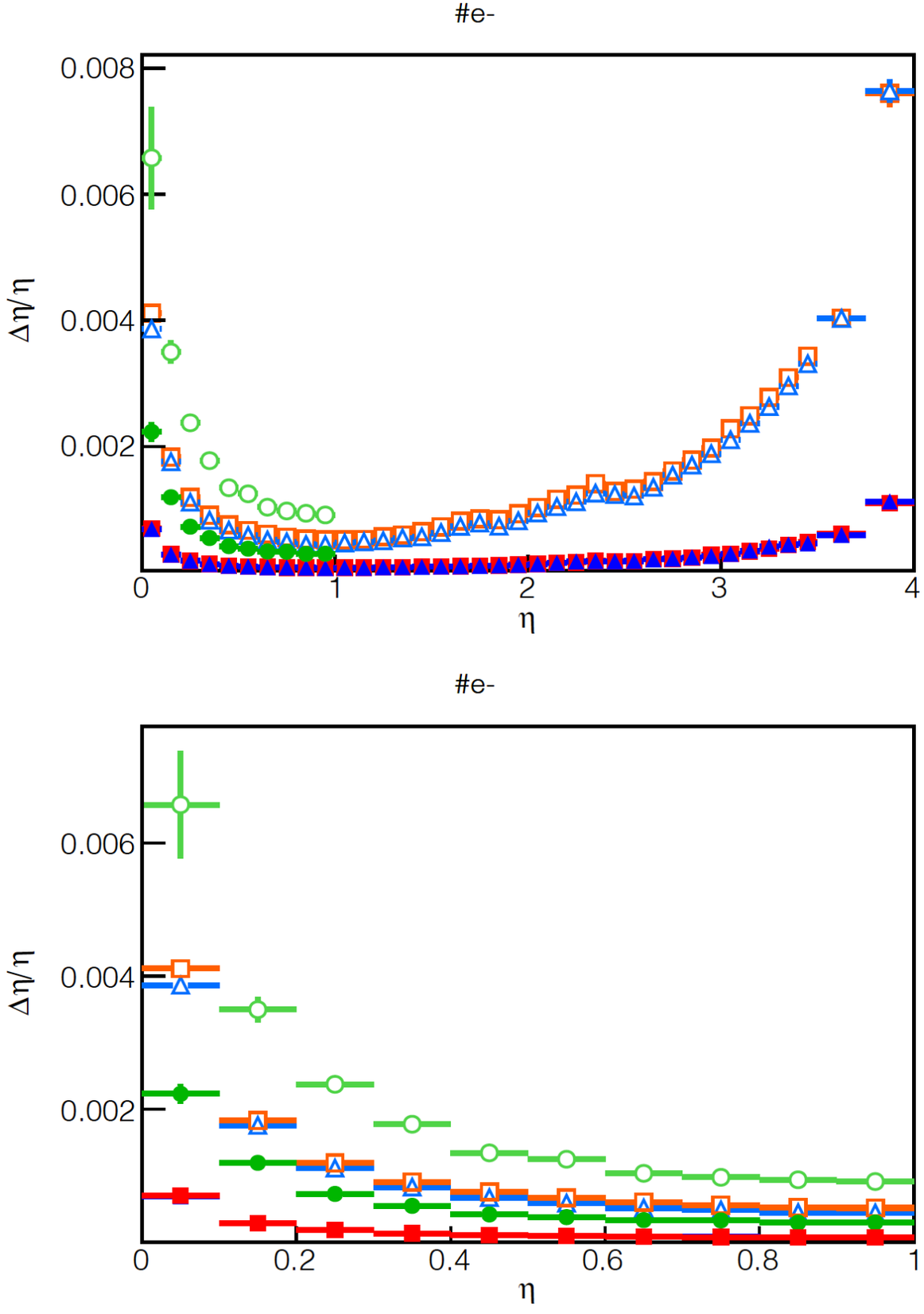
η resolution vs. η

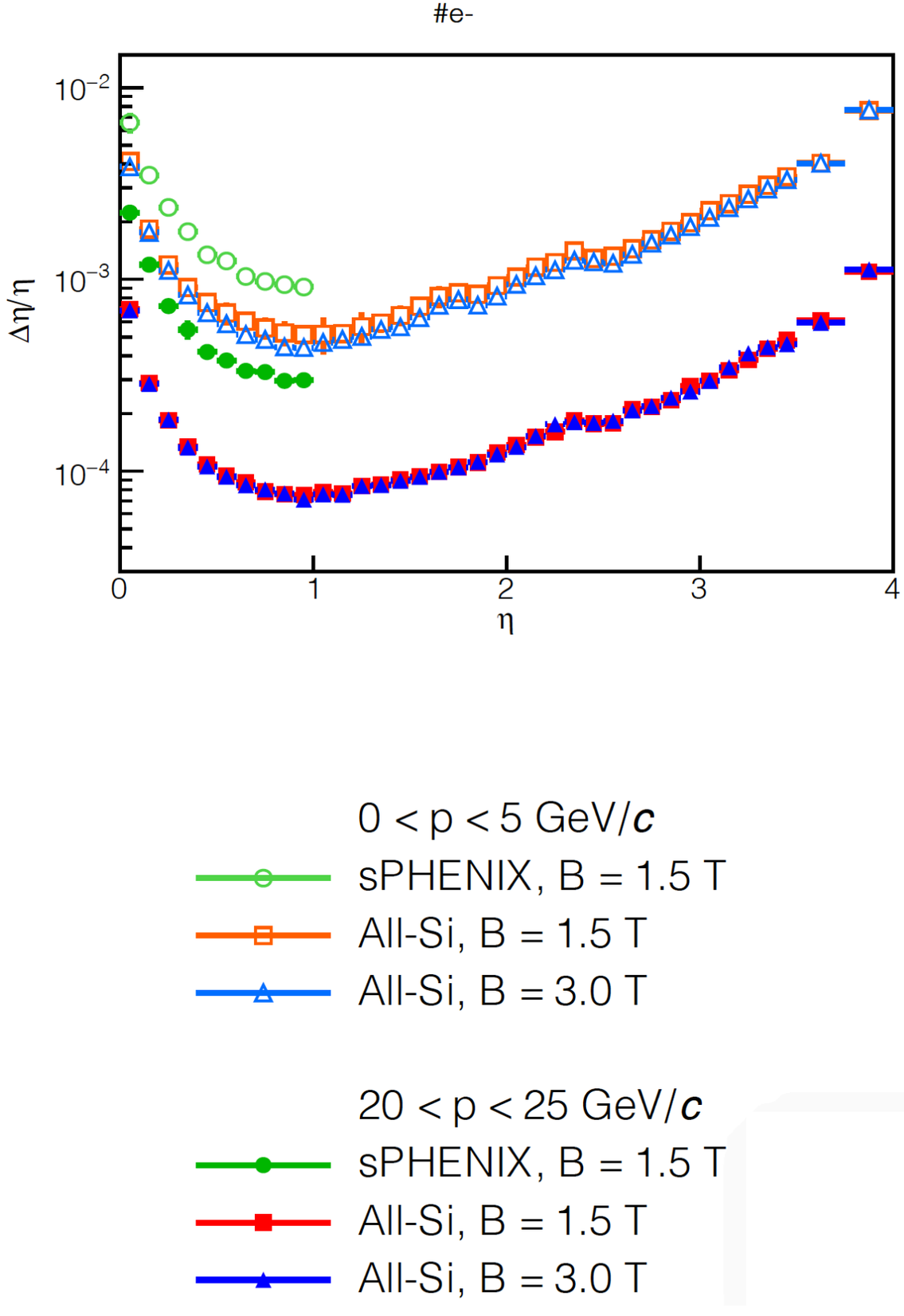




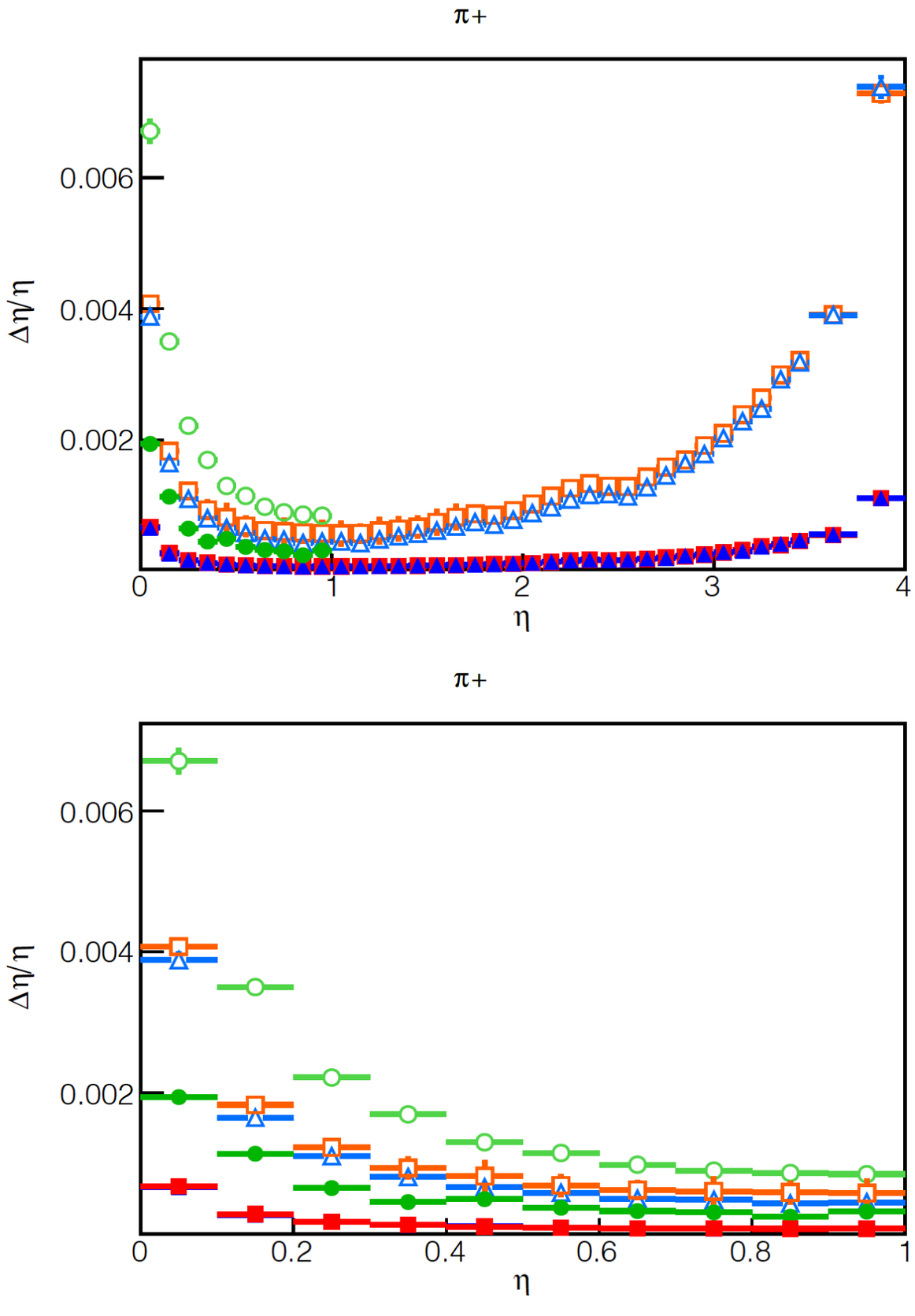


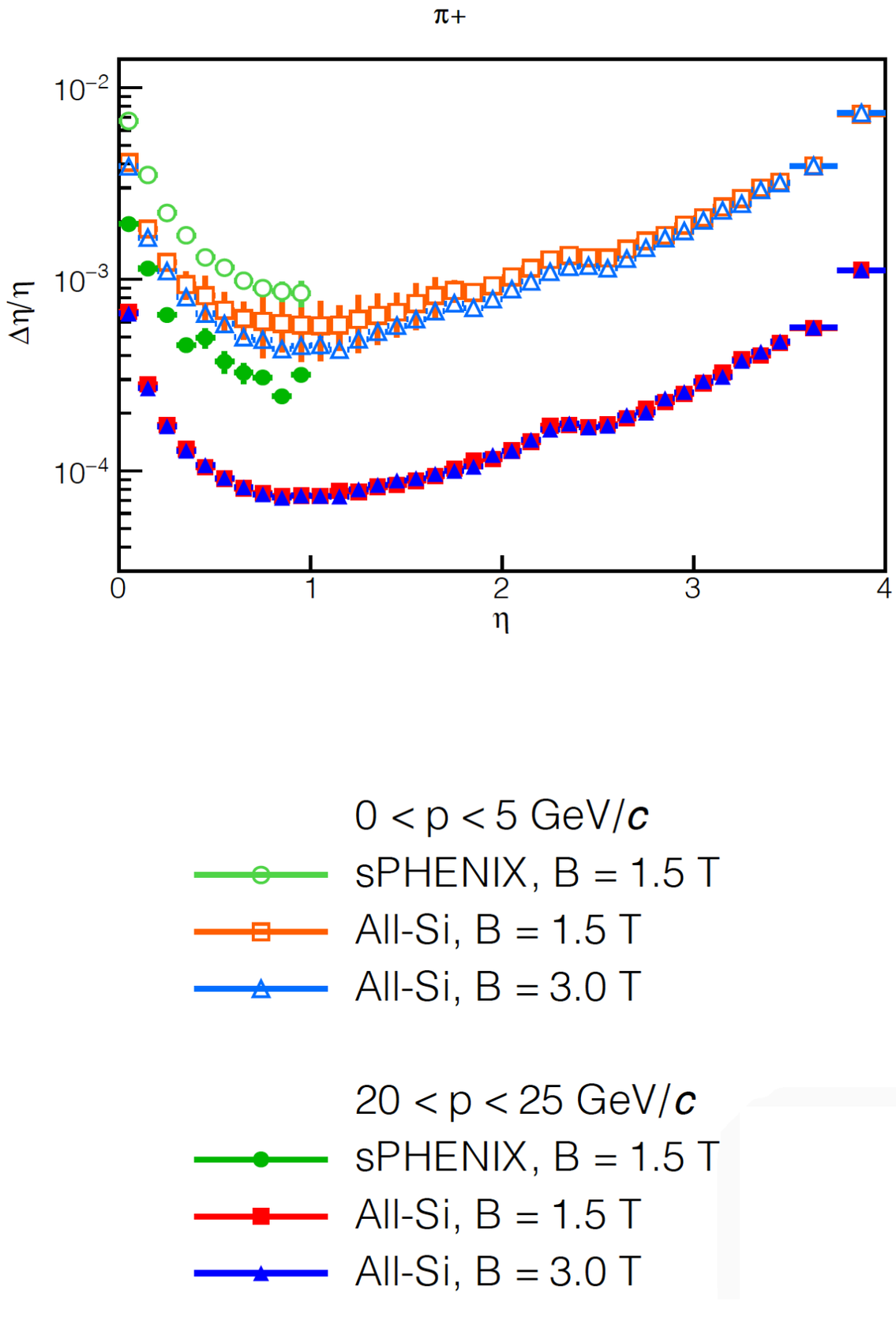
η resolution vs. η





η resolution vs. η

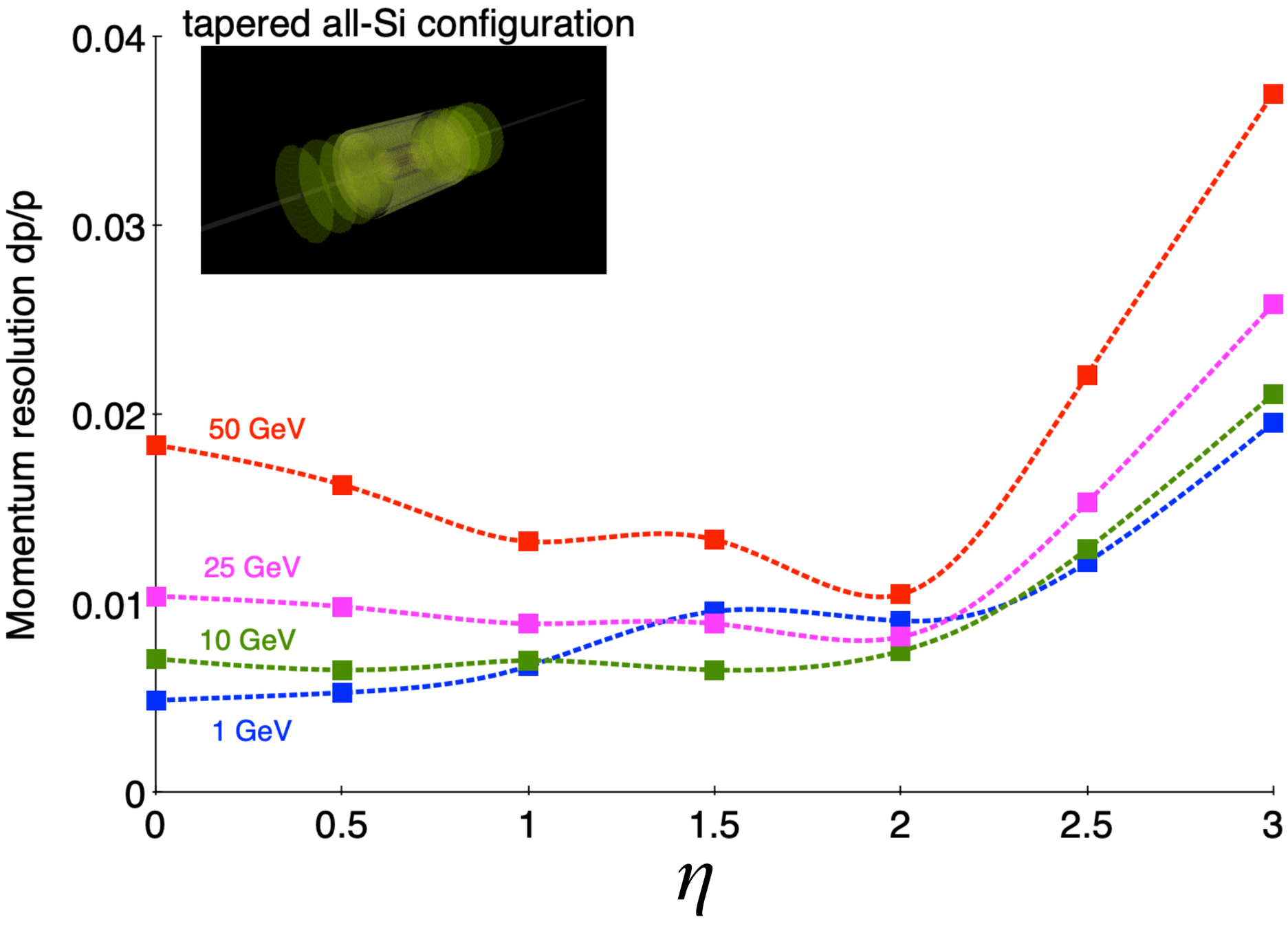




Previous studies

https://indico.bnl.gov/event/7892/contributions/36938/attachments/27856/42740/20200430-EICUG_Tracking_WG_-_eRD16.pdf

eRD16+ - simulations



Detector diagram