

Updates on ECCE Tracker AI WG

Cristiano Fanelli and Karthik Suresh
24th September 2021

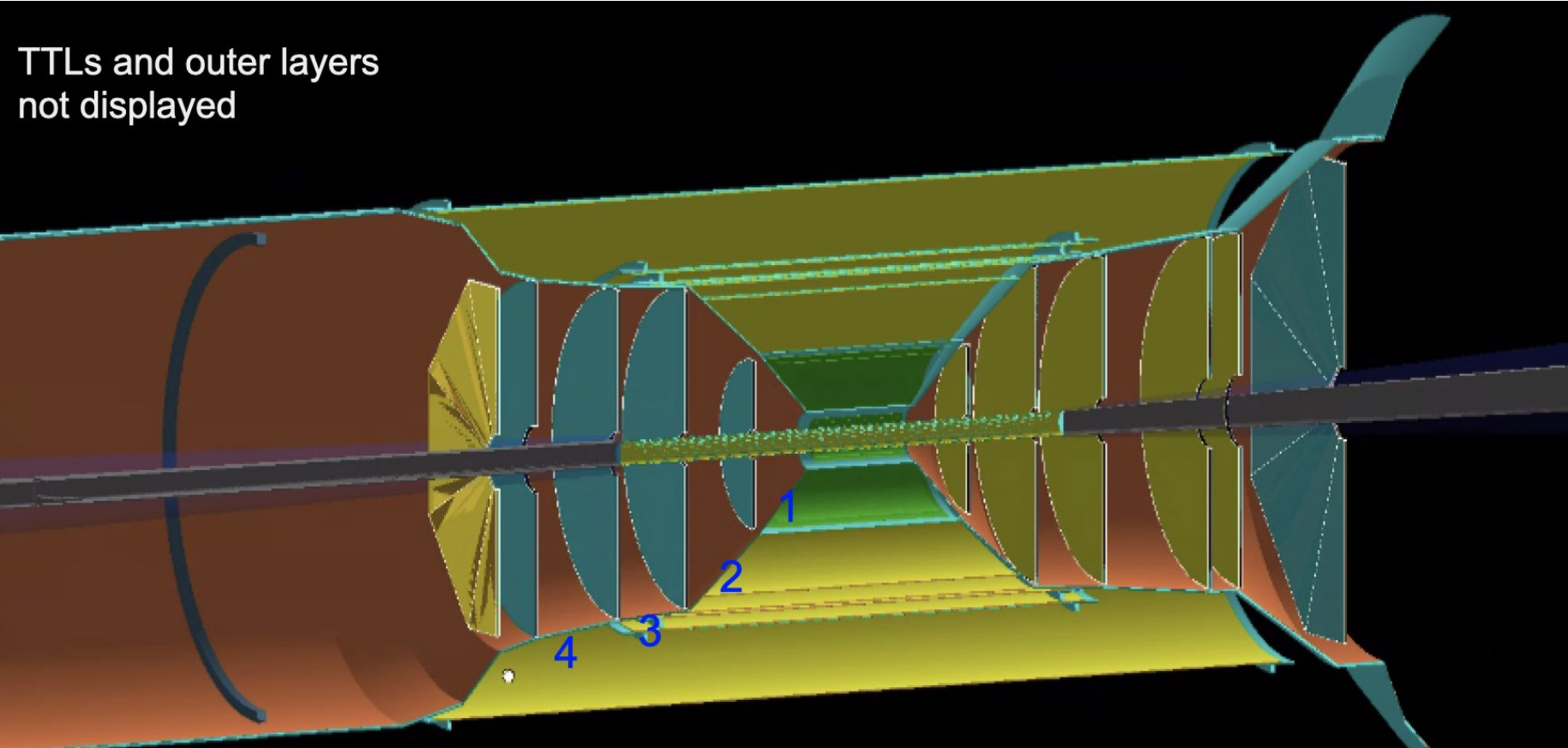
Outline

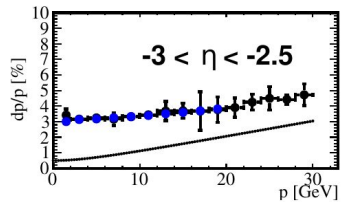
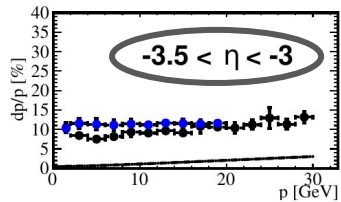
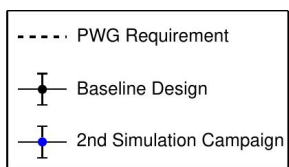
- For the 2nd simulation campaign major updates in the design of the Inner Tracker, particularly with a more realistic support structure etc.
- The design of the support has major impact in the design of the tracking system and reflects in what can be optimized.
- As we pointed out, in the optimization we were also tuning the lengths of the ITS3 sagitta layers and so far we did not receive confirmation of how feasible it could be
- We decided to keep the ITS3 lengths fixed. Since the e-going and h-going endcaps are asymmetric, we slightly shifted the vtx and sagitta systems with respect to the IP to “match” the different acceptance in the two directions.
- We started studying different designs for the support structures. These have been parametrized in G4 and we can run optimization of these structures along with the parameters of the tracking stations supported by this design.

2nd Simulation Campaign

Location : eicS3/eicstest/ECCE/MC/prop.3/prop.3.3/General/particleGun/singlePion/eval_00000/

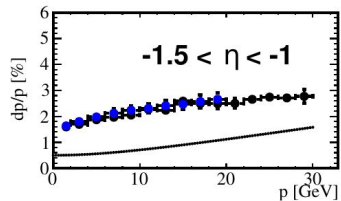
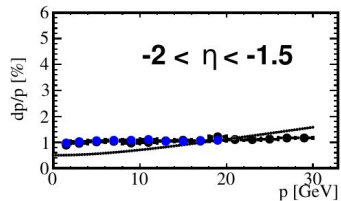
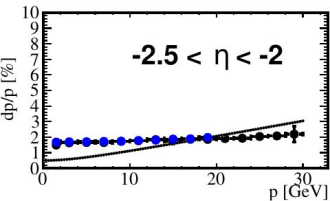
TTLs and outer layers
not displayed





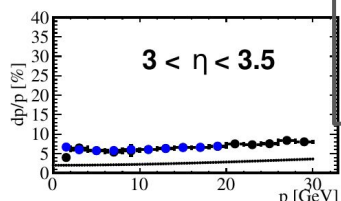
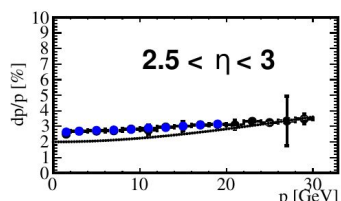
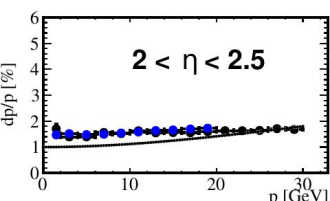
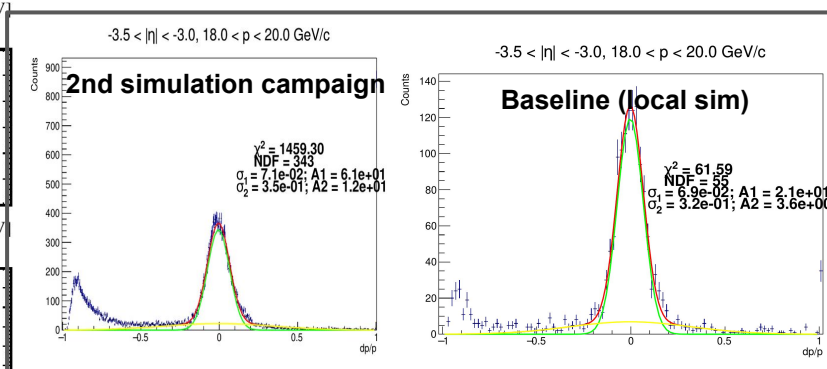
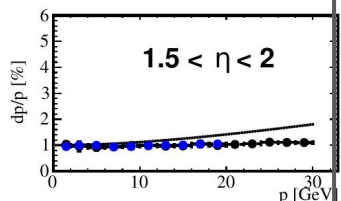
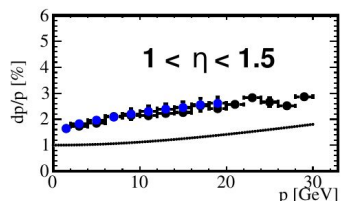
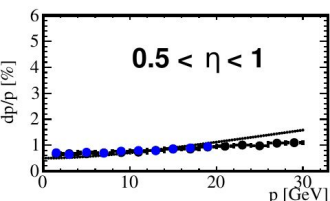
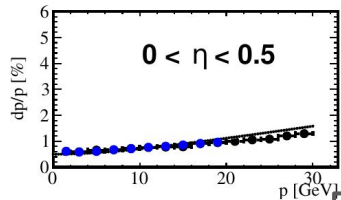
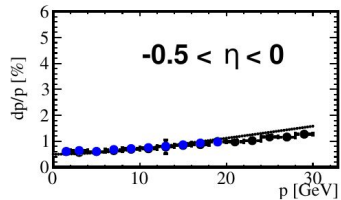
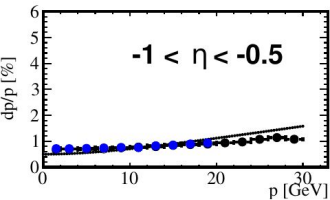
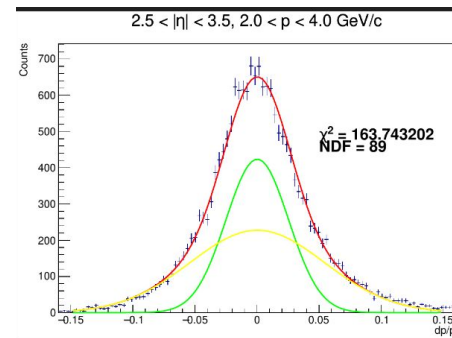
Red:
 From 2nd simulation campaign
 prop.3/prop.3.3/General/particleGun/singlePion/eval_00000

Black: generated up to 30 GeV
 ** Sanity Check. Red and black are consistent within uncertainty



Both Has DISPLACED_VERTEX = true

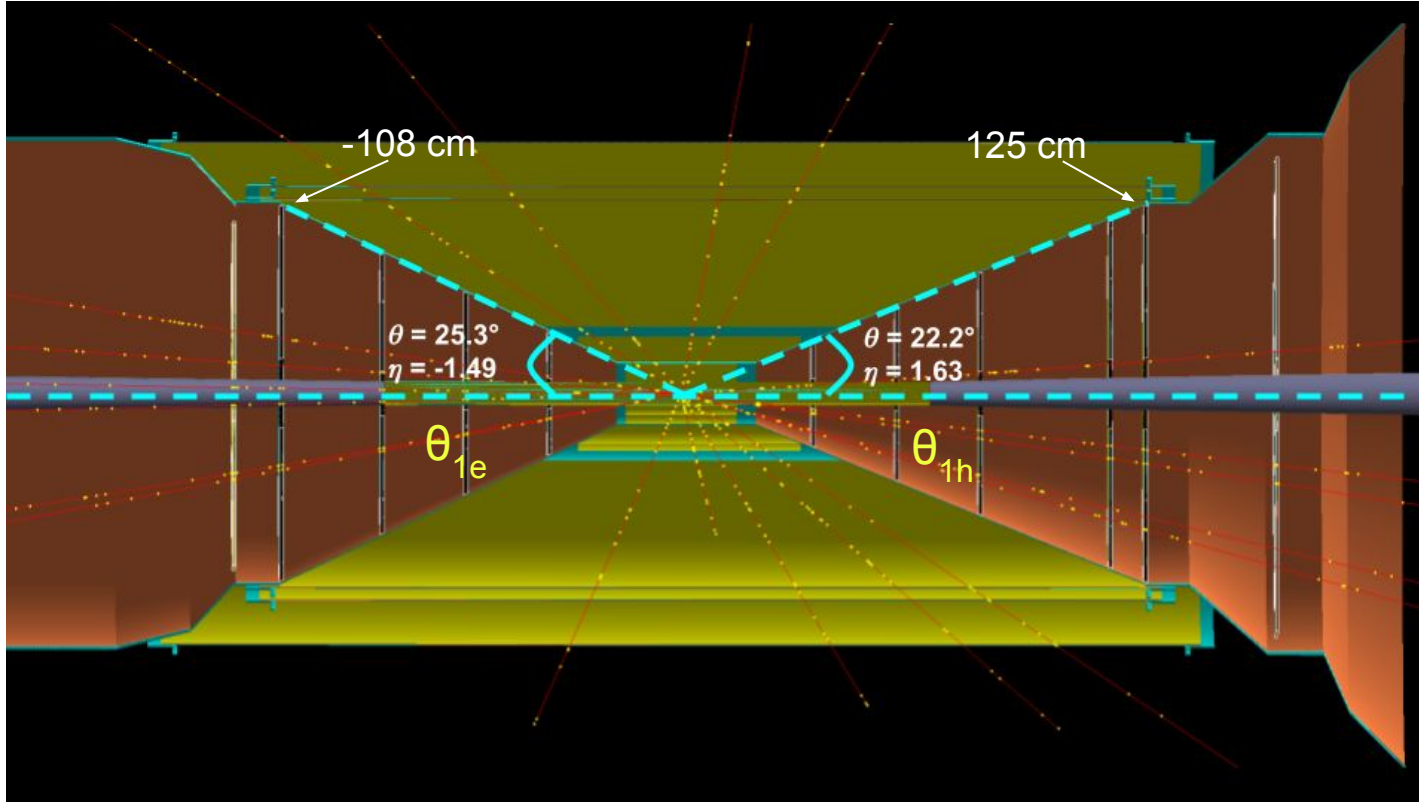
Goodness of fit :
 Double Gaussian Fits



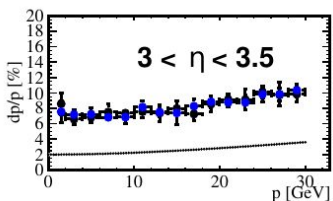
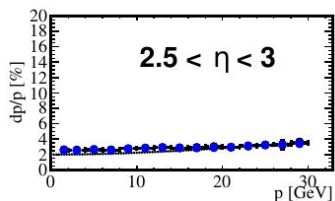
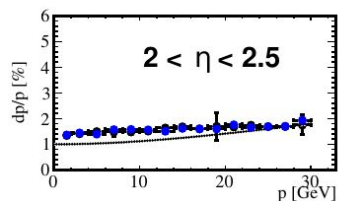
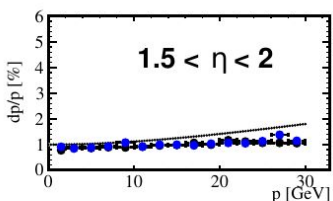
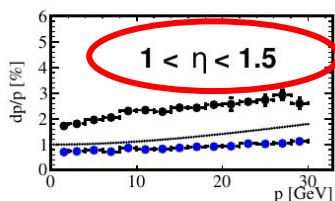
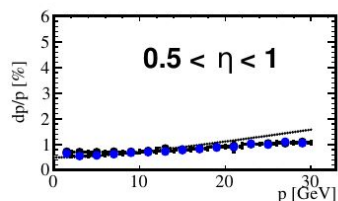
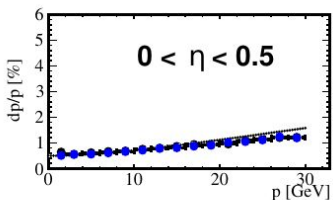
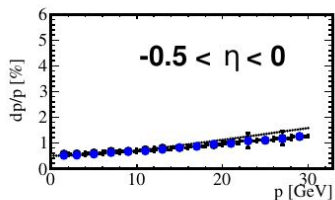
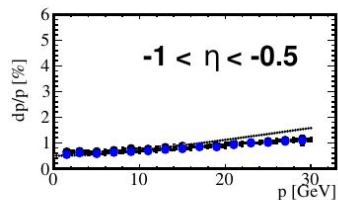
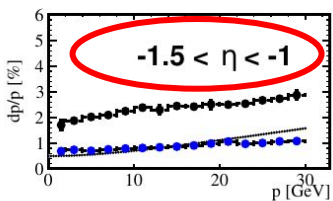
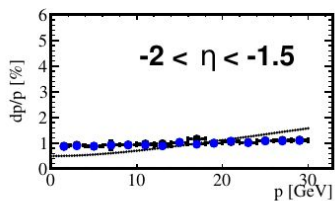
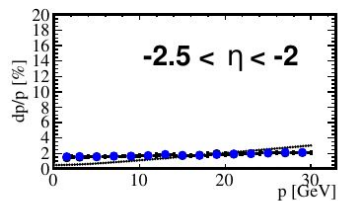
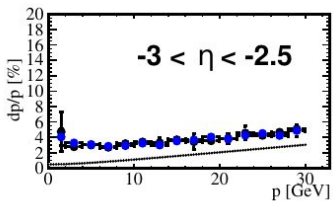
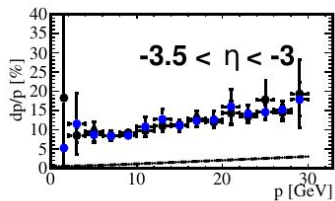
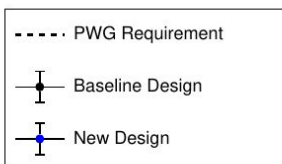
displaced_vertex = true Check Spares....

Starting point: an intentionally “limited” design

Here “material” in the inner tracker is concentrated along the highlighted slopes (pointing to the IP). These slopes need to be tuned. (Shallow angles -> effect on resolutions to be studied. See next slides)

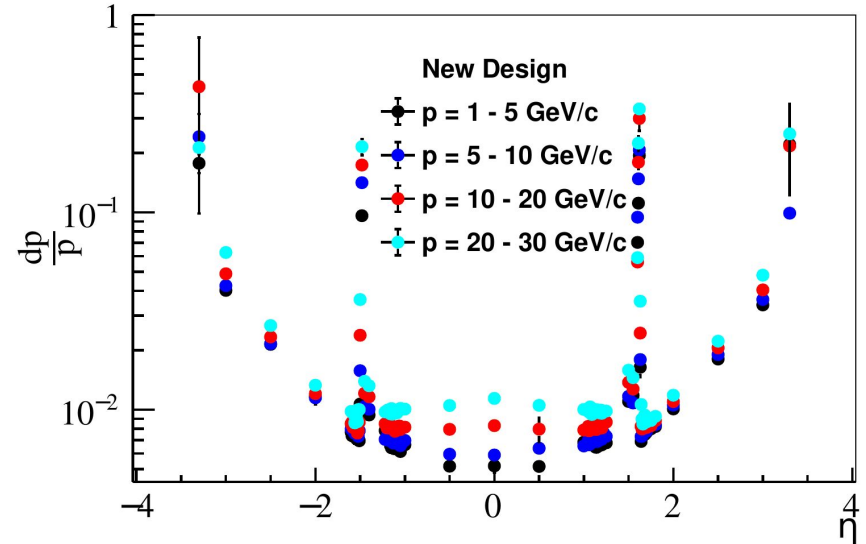
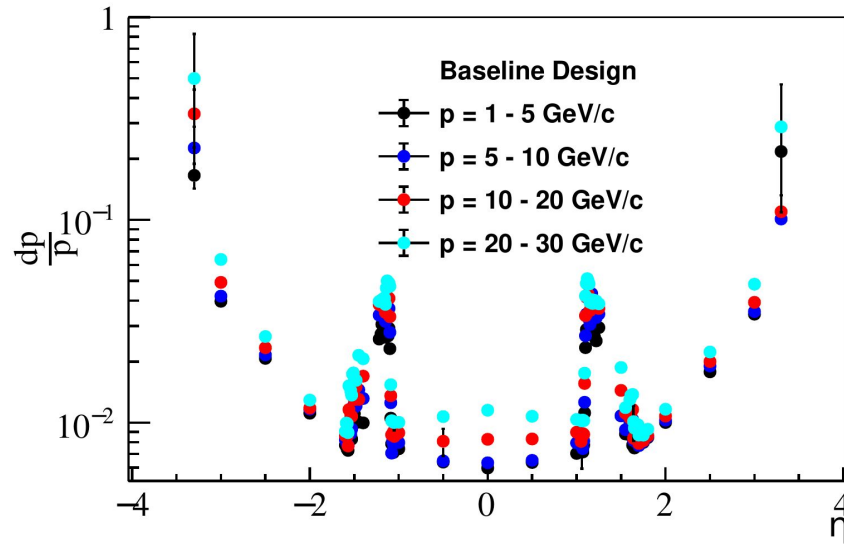


- Support structure parametrized with **two main slopes**.
- Support structure is made of Carbon Shell with 3mm thick wall.
- Vtx and sagitta ITS3 layers been rigidly shifted with respect to the IP
- The length of the uRWell is extended to cover acceptance



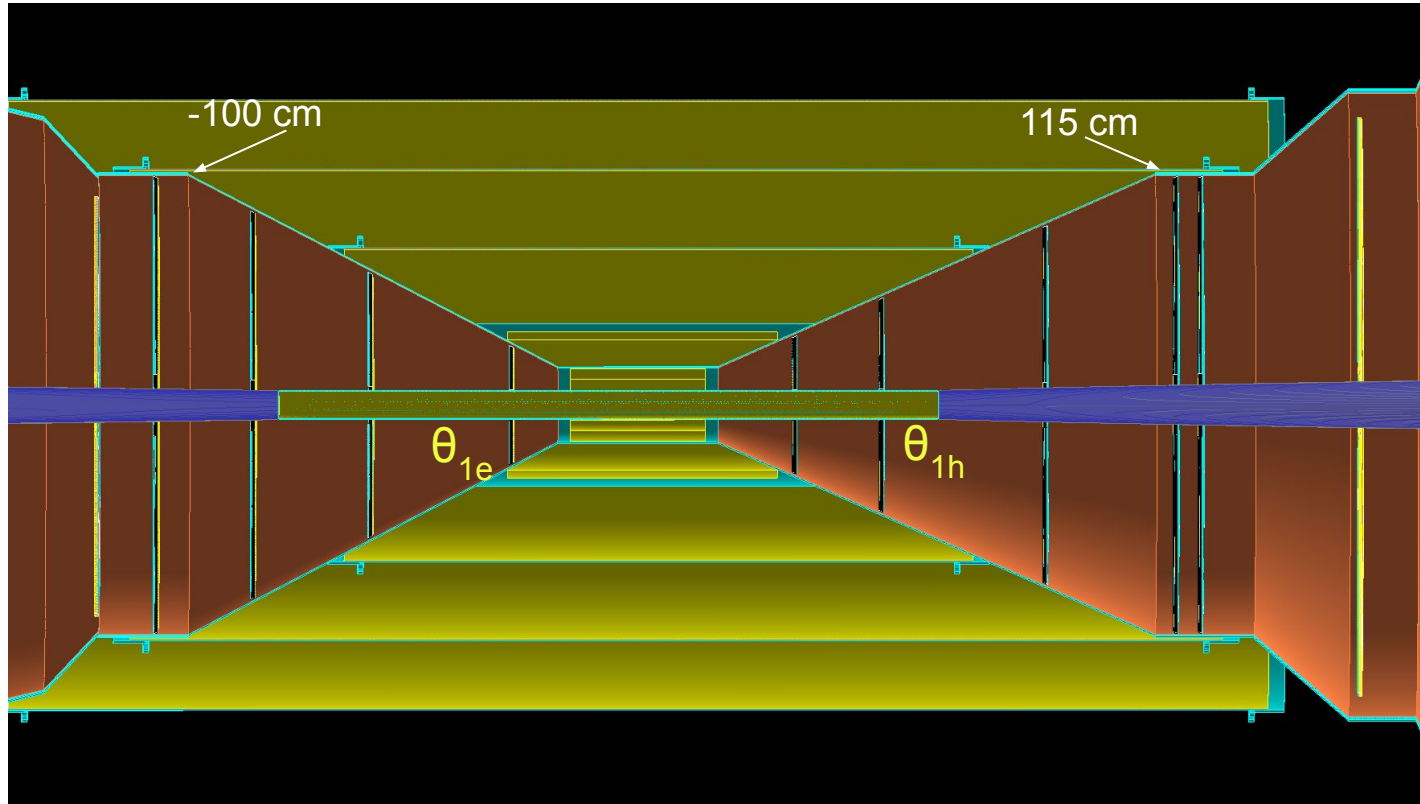
- 500k pi- events (Single track per event)
- P range 1 - 30 GeV/c
- DISPLACED_VERTEX = false

dp/p Vs eta: comparison baseline vs new design

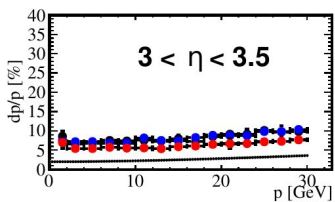
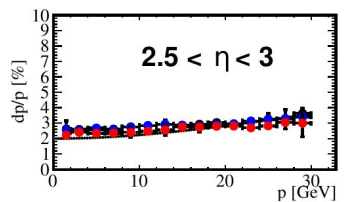
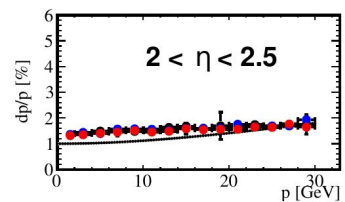
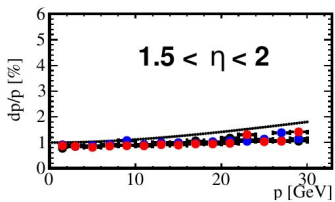
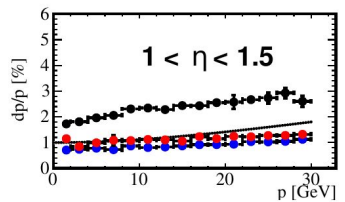
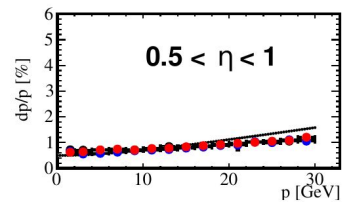
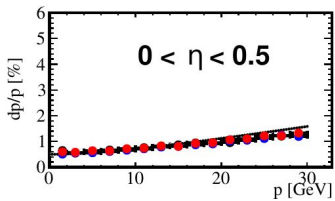
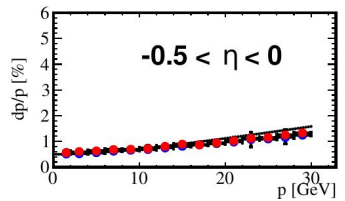
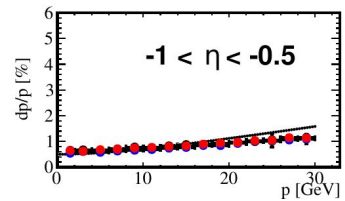
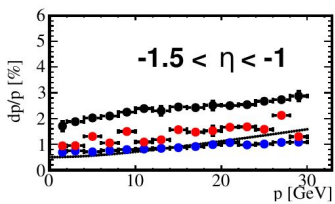
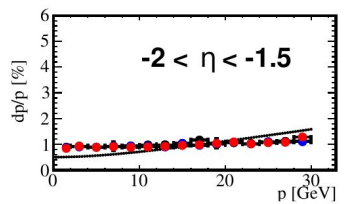
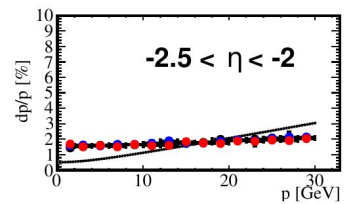
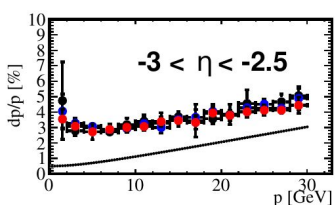
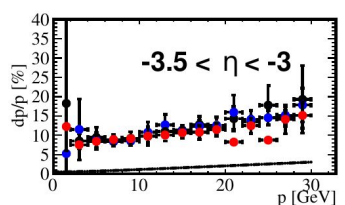
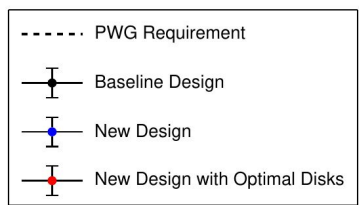


As expected improvement in $\sim 1 < |\eta| < 1.5$
at the expense of the values of eta coinciding with the two
inclinations pointing to the IP

... and changing the slopes (New Design with Optimal Disk and changed slopes)

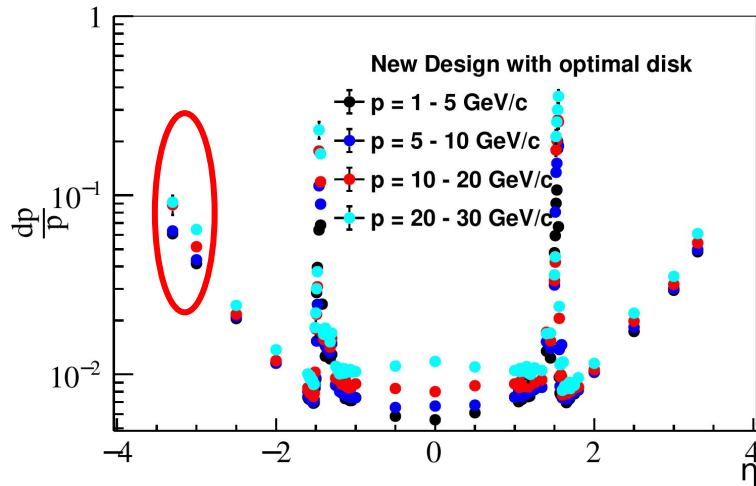
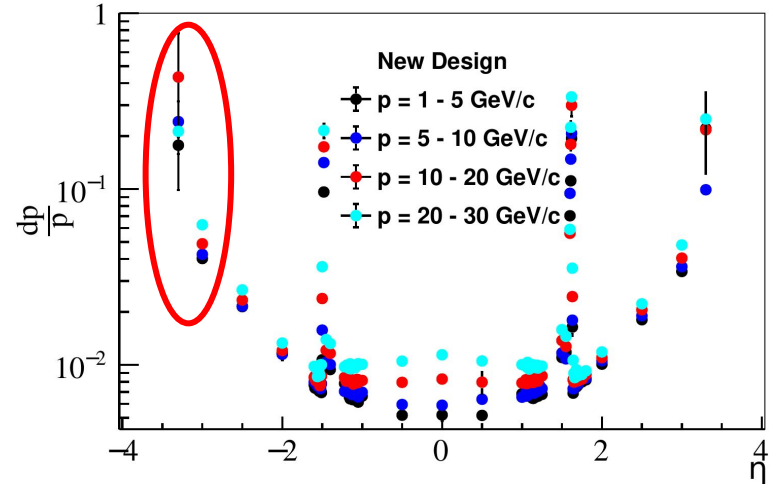
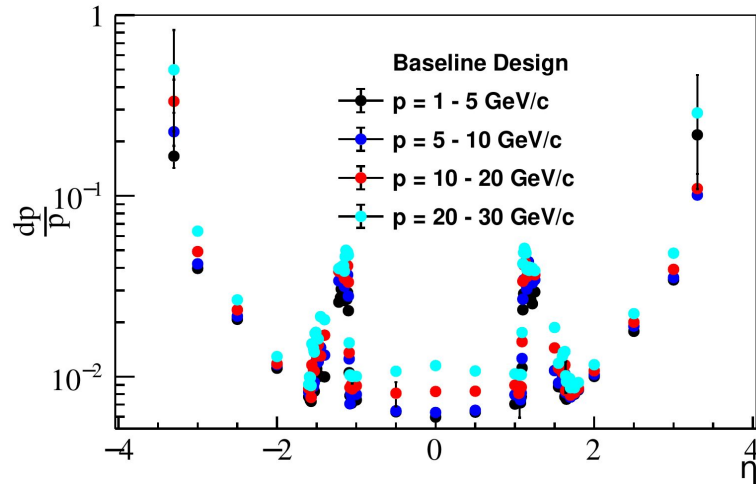


- Changed the angles slightly such that conical structure goes from end of vtx support to -100 cm and 115 cm
- The Z positions of the disks are from AI Optimisation.



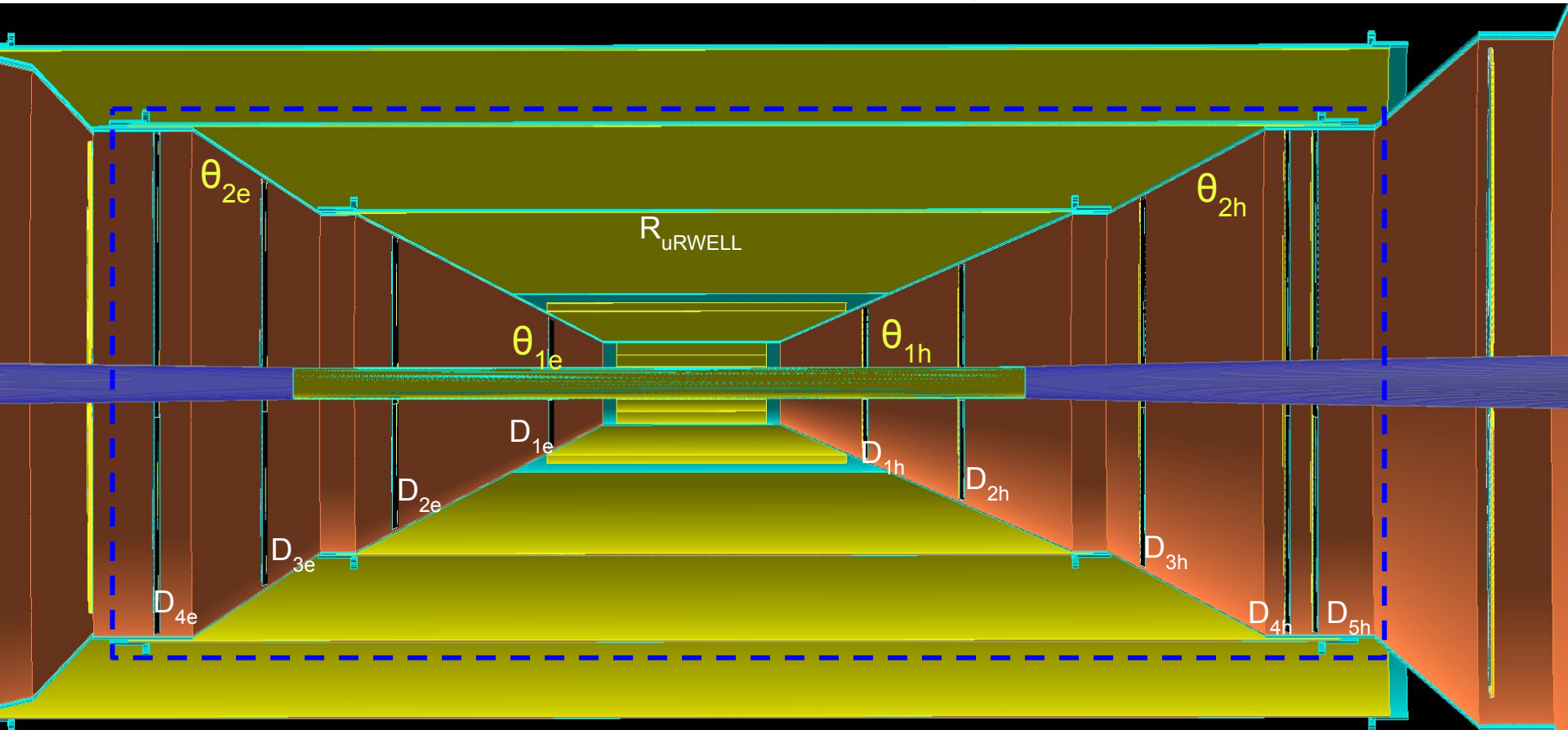
- No optimization whatsoever has been done yet with the new support structure
- Some tuning may be needed, see $-1.5 < \eta < 1$.

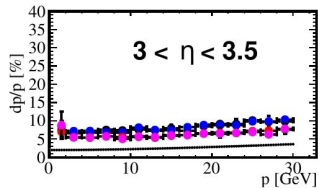
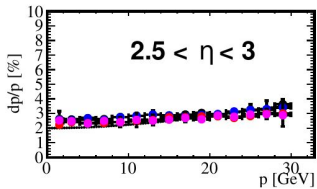
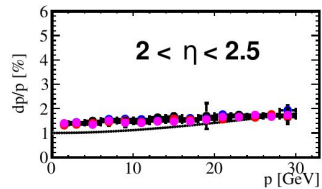
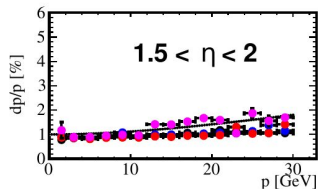
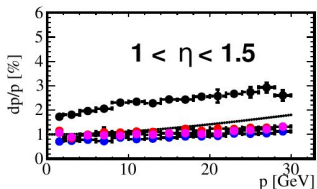
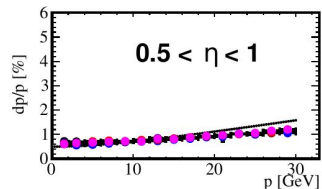
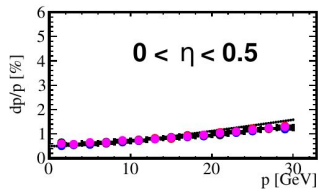
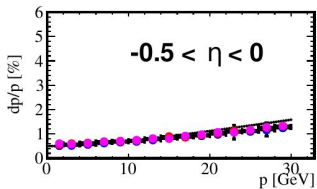
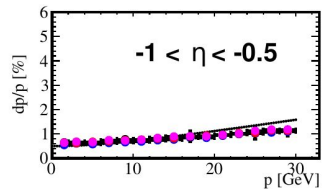
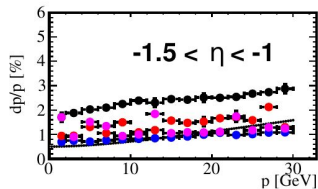
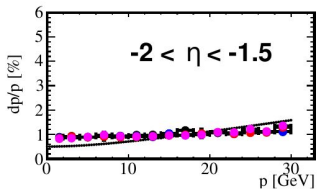
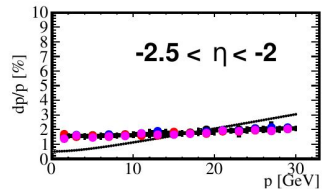
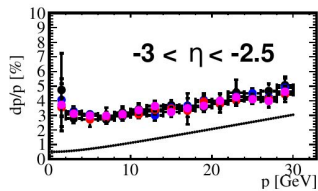
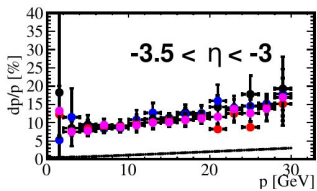
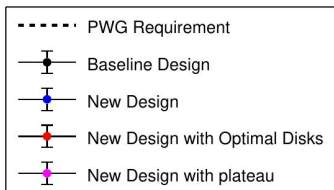
dp/p Vs eta: comparison baseline vs new design



- **Eta edges** are improved due to Optimal disk positions.
- Still the structure angles have to be optimised No AI optimisation of these structural angles done

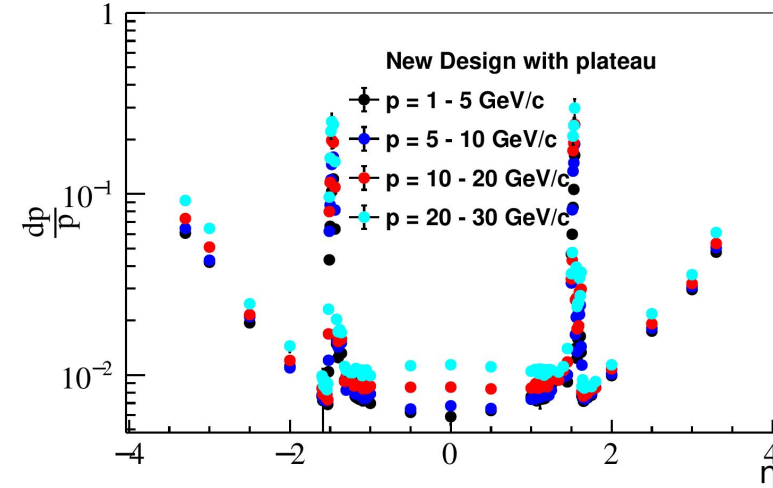
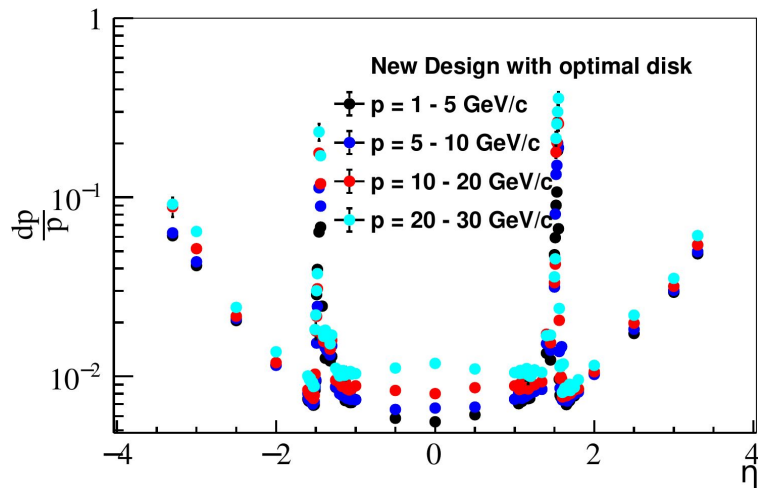
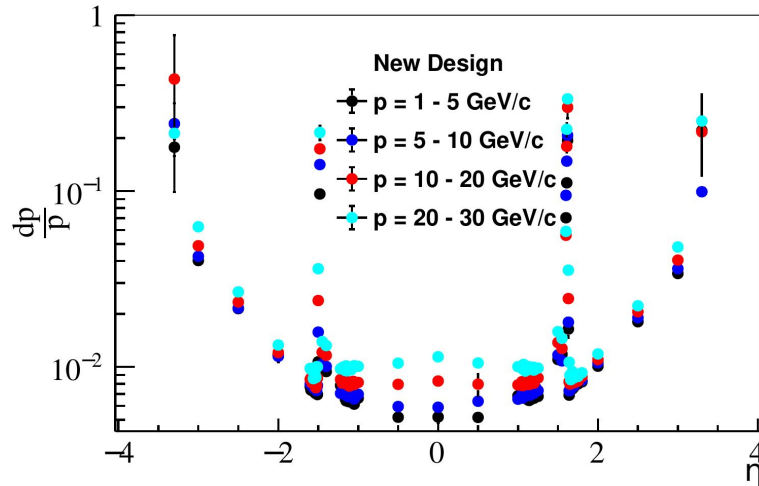
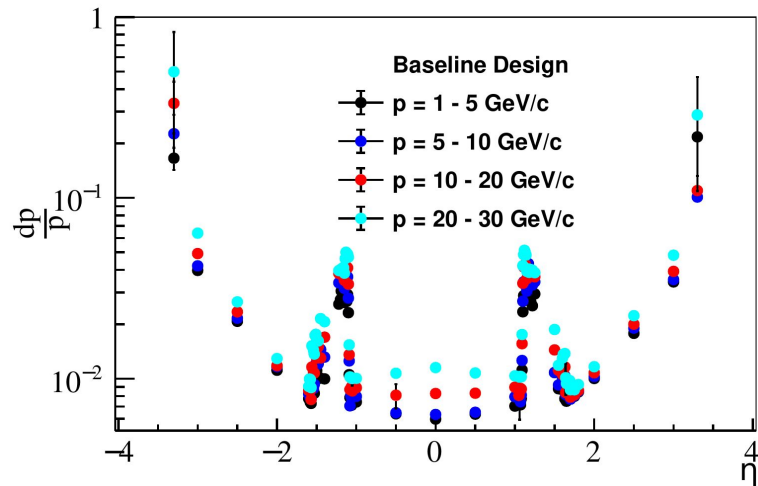
Full parametrization for this new design (New Design with Plateau)





- No optimization whatsoever has been done yet with the new support structure
- Some tuning may be needed, see $-1.5 < \eta < 1$.

dp/p Vs eta: comparison baseline vs new design



Summary

- 2nd simulation campaign used as temporary reference for technology choice.
- We decided to keep the ITS3 lengths fixed. Since e-going and h-going endcaps are asymmetric, we slightly shifted the vtx and sagitta systems with respect to the IP to “match” the different acceptance in the two directions.
- We started studying different designs for the support structures. These have been parameterized in G4 and we can now optimize these structures along with the parameters of the tracking stations supported by such design.
- We ran some sanity checks (see comparison with 2nd simulation campaign).
- We have new optimization pipelines to run (what shown here is one of those), parametrized in terms of geometry of tracking layers and angles of support structure. All this will be explored in the next days.

Spares