The Optimization of SITOuter & DCInner Layers' Position

XiaoJie Jiang
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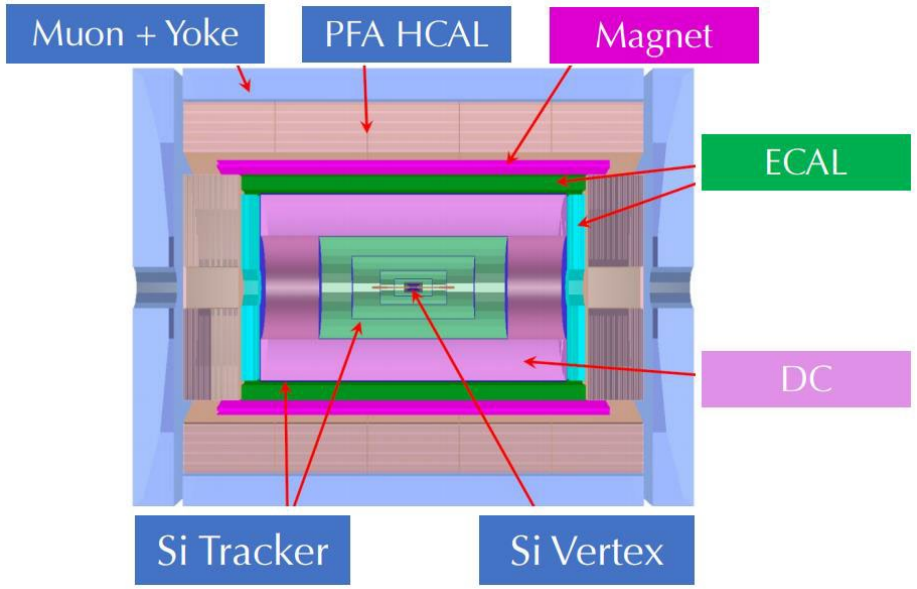
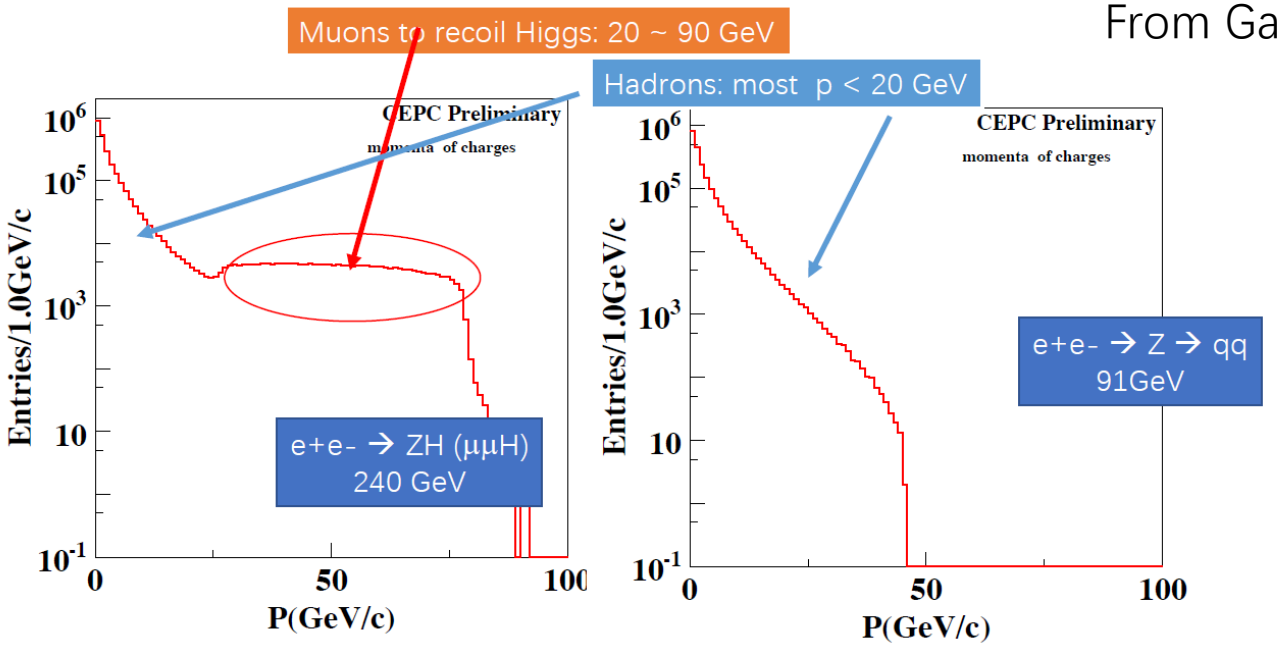
1. Introduction

The 4th CEPC conceptual Tracker



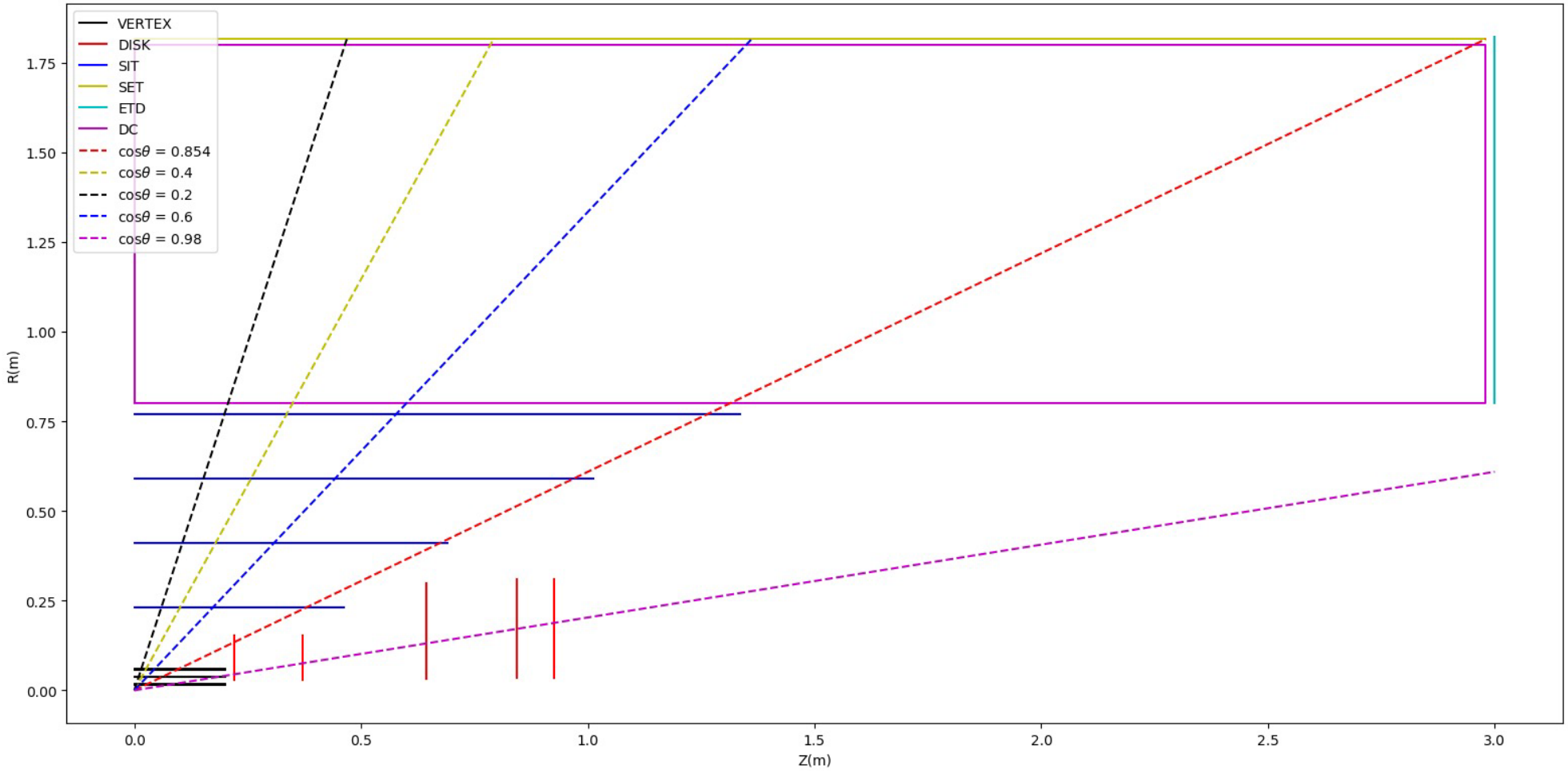
Momenta of tracks @ 240 & 91 GeV

From GangLi



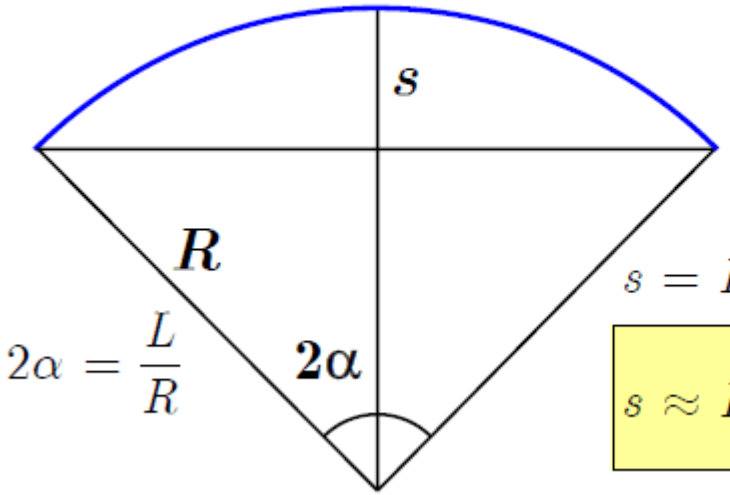
- Particle ID with a drift chamber is a key feature for the 4th conceptual detector
- Most hadrons from Higgs/Z pole data are below 20 GeV/c
- The tracker should have sufficient momentum resolution for particles < 20 GeV/c

1.2 Introduction-CEPC Detector's geometry



1.3 Introduction-Sagitta

the sagitta s



$$2\alpha = \frac{L}{R}$$

$$s = R(1 - \cos\alpha)$$

$$s \approx R\frac{\alpha^2}{2} = \frac{L^2}{8R}$$

- In order to get a better sagitta value, we thought it's necessary to place a sensitive enough detector at the middle of a whole Trcker

1.4 Tracker parameters （-1800）

Components	Radius(mm)	$\sigma_{R\phi}$(μm)	σ_Z(μm)	Thickness(X_0 %)
Beam Pipe	10.35	-	-	0.172
VTX	12.3/14.4/35.5/37.5/58.3/60.3	2.8/6/4/4/4/4	2.8/6/4/4/4/4	0.156/0.156/0.154/0.154/0.153/0.153#
VTX-shell	65.245	-	-	0.139
SITs	81.5/332.2/582.7; 81.5/430.9/780.6; 81.5/520.8/920.5;	7.2/7.2/7.2	86.6/86.6/86.6	0.661/0.651/0.650#
DC inner wall	611.9;809.9;989.9	-	-	0.110
DC cell (66;55;45 x18x18mm)	612;810;990-1800	100	2828	0.00127×layernum##
DC outer wall	1801.93	-	-	1.349
SET	1811.3	7.2	86.6	**0.182***
TotalAir				0.262**

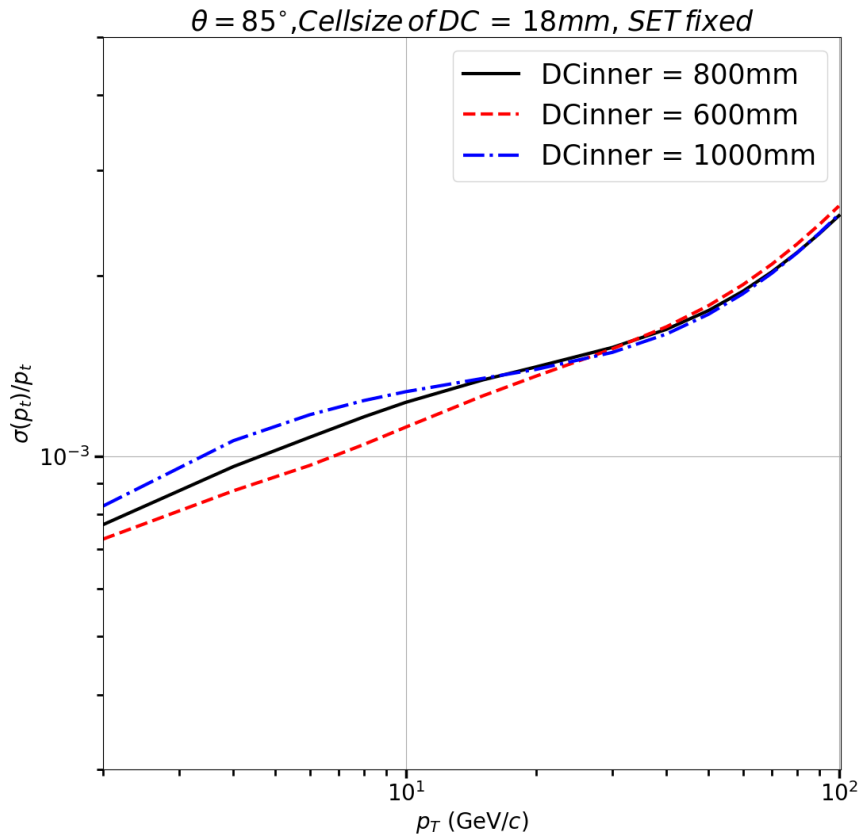
#average for ϕ(0,2π)

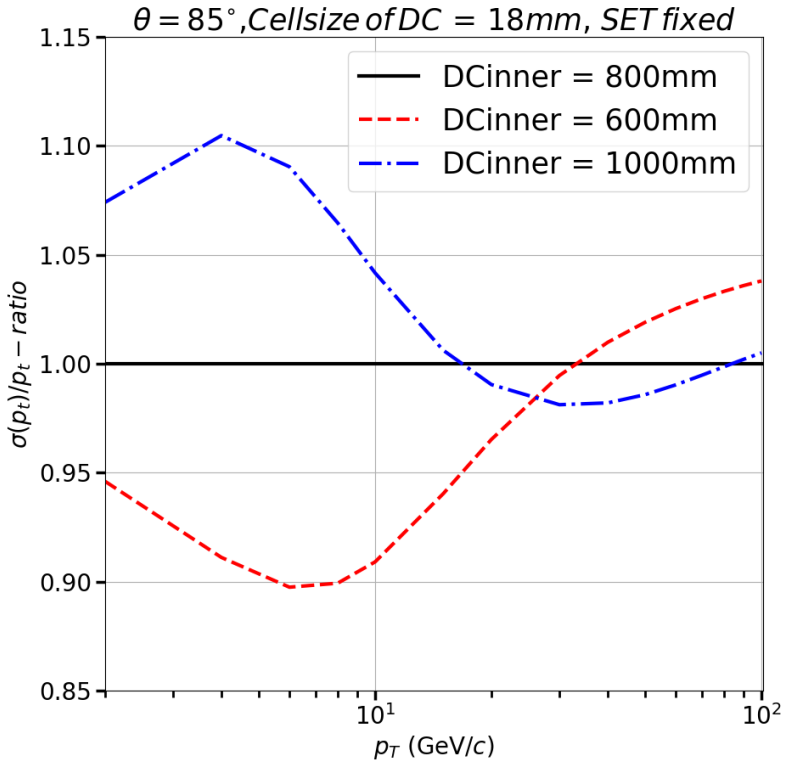
##GasHe_90Isob_10 without wire, if Air, 0.00592% per cell

* Sensor face to IP, 0.468% lie after sensor

** Dominant lie between SITs

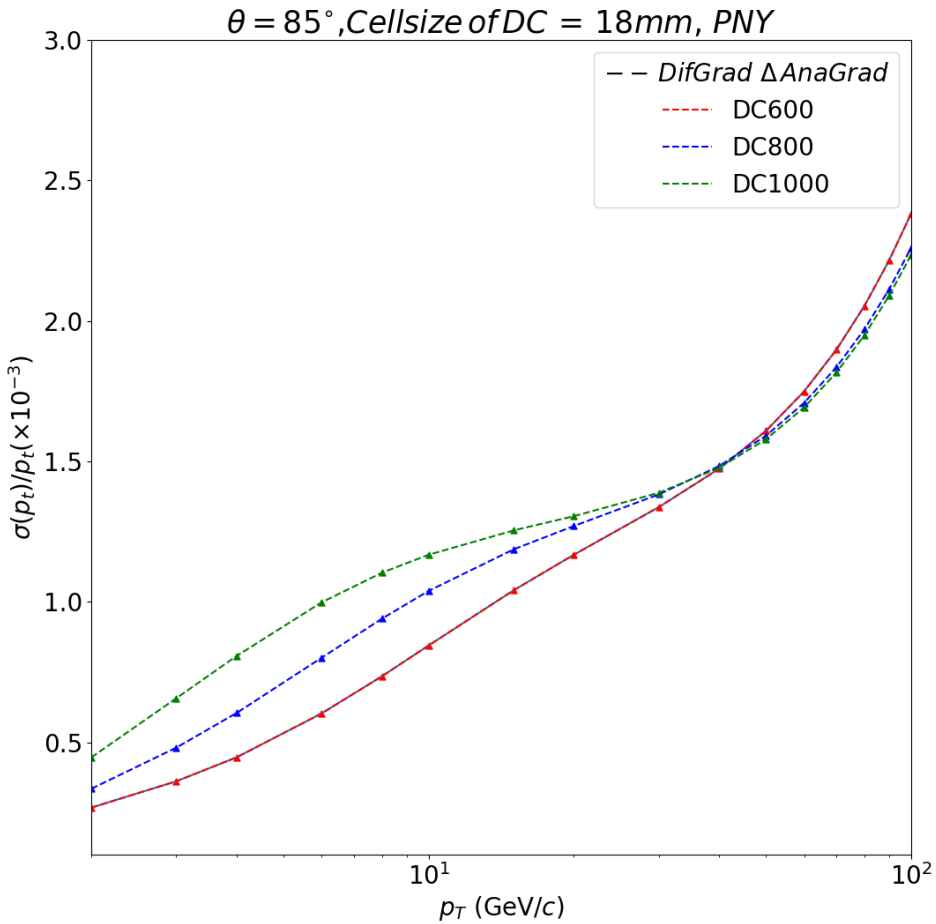
2.Fast Calculation's result





- The Dcinner = 600mm is better.

2.Fast Calculation's result(Use differential or analysis method to get the Grad)



- Almost the same.

The last week, we have known:

- There is no doubt that place DCinner at 600mm is better.
- When we use DCHits, GenFit's result is worse than Marlin's.
- These two full simulation tools' difference comes from DCHits.

Then,

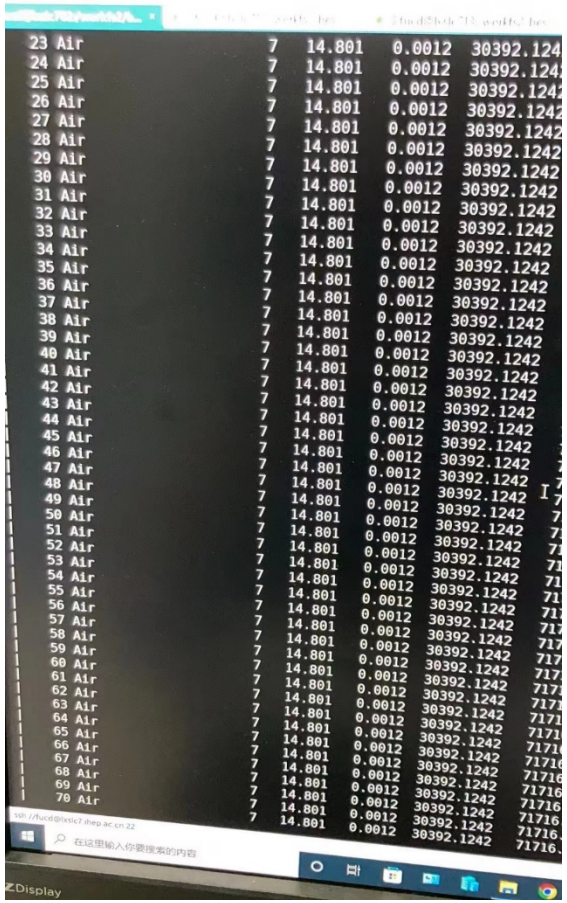
- We checked the codes later and found the chamber's materials of these two tools is different.

  ->changed the Chamber_mat

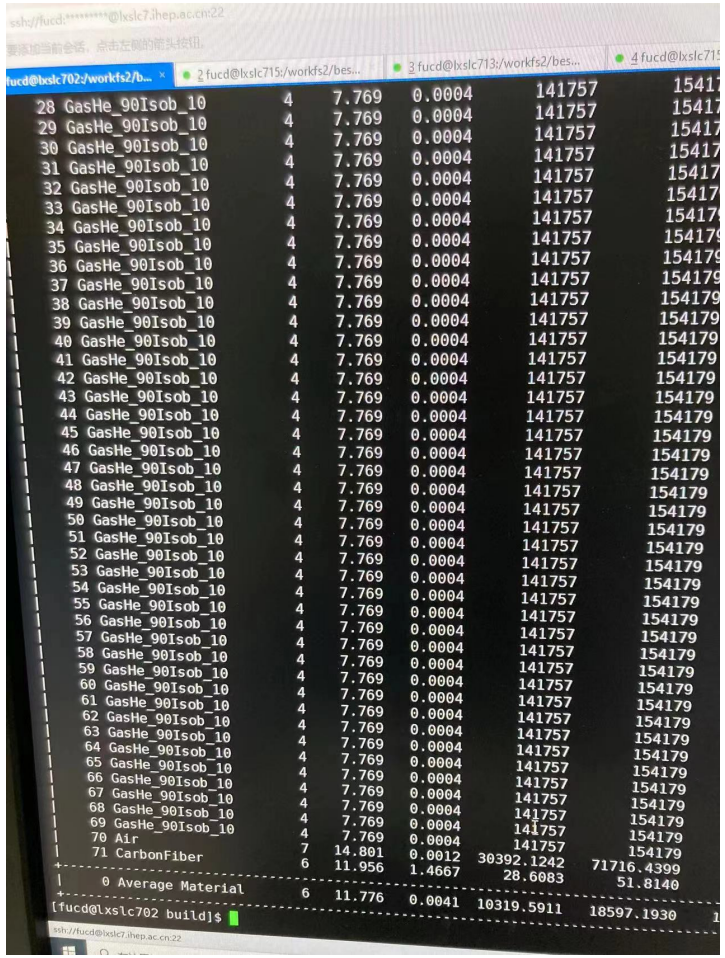
- The curves are have the big ups and downs. I thought we should use larger statistics.

  ->entrancies: 0.3w→2.7w

3. det-mat -> chamber mat

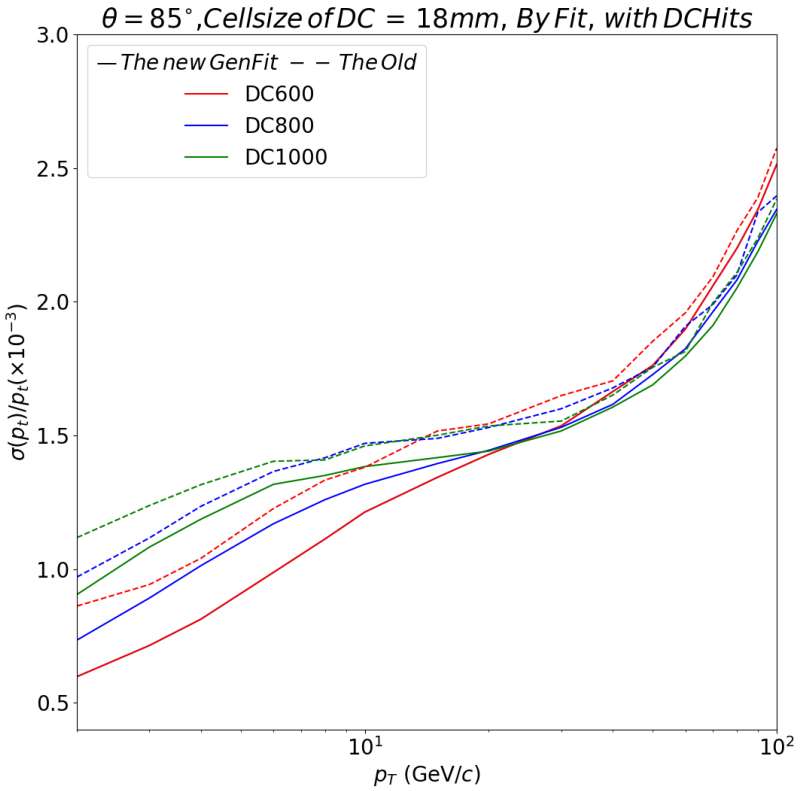


Before



After

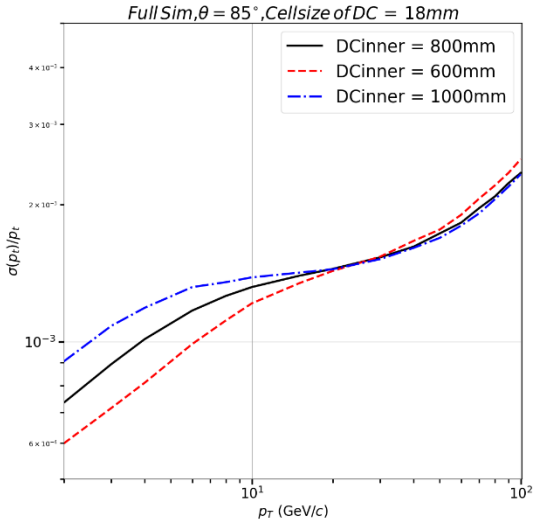
3. Compare the old GenFit with the new

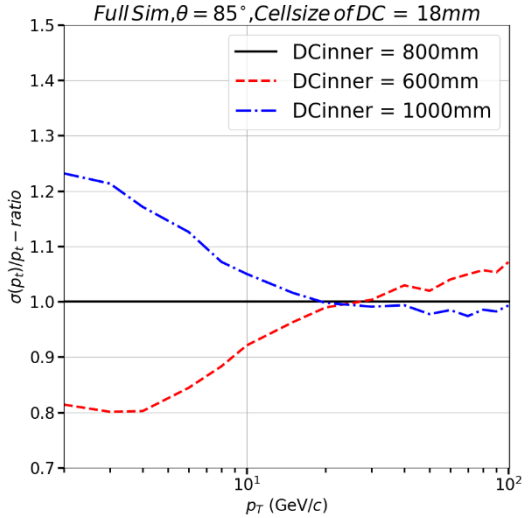


- The trend of the curves is similar. And the sigamPt comes from the new version is smaller.
- The curve is more smooth.

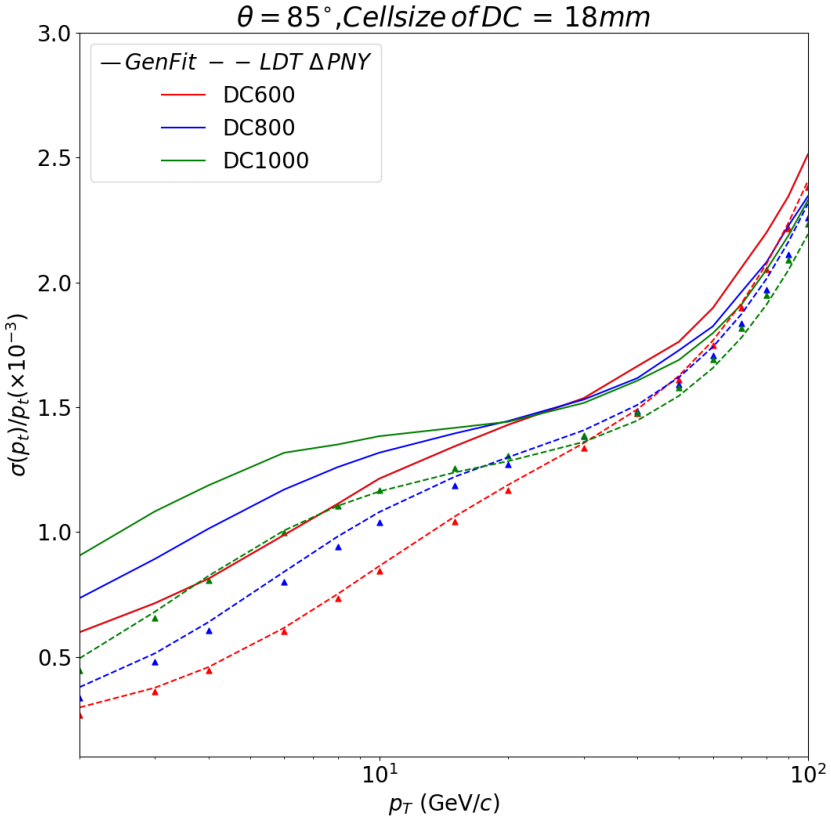
3. The verification by other tools

GenFit's result





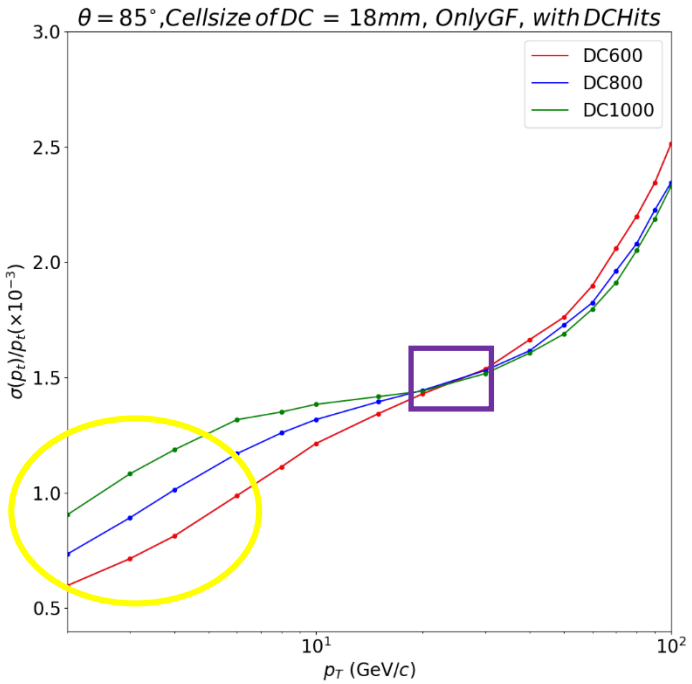
Compare the Full sim, LDT, Fast cal



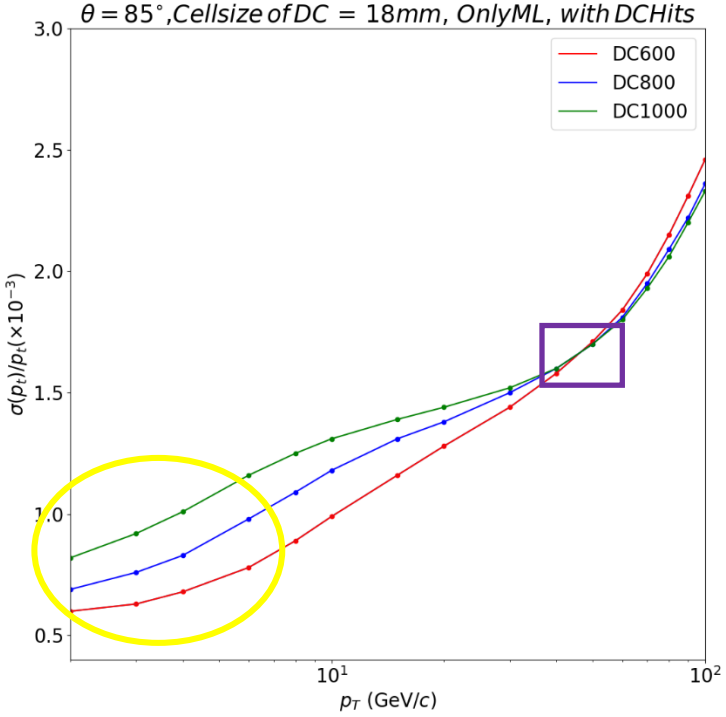
- The result is similar.

3. The difference between Marlin & GenFit (Marlin's datas from GangLi)

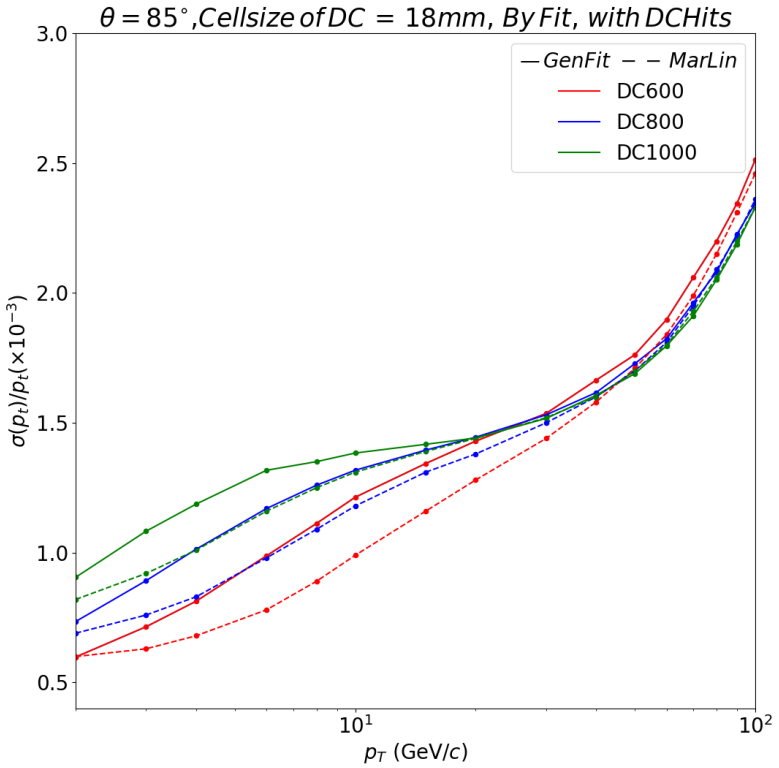
By GenFit:



By Marlin:



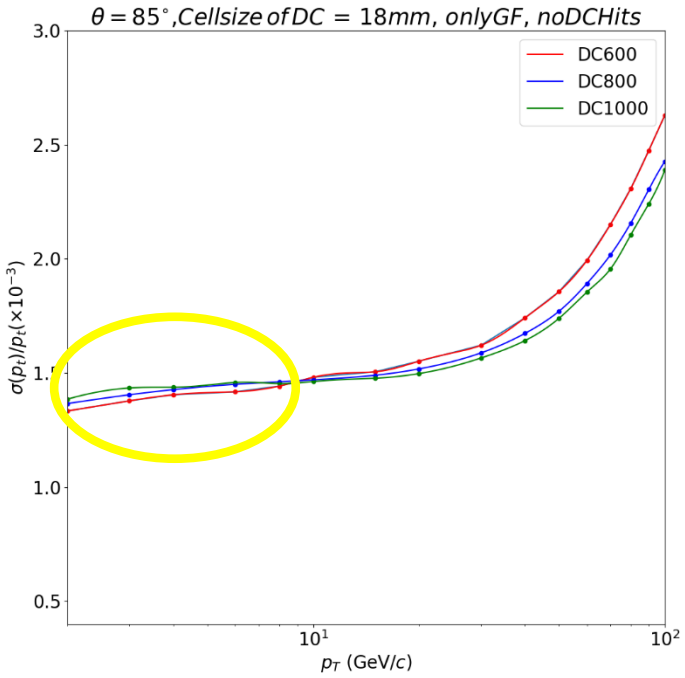
Compare:



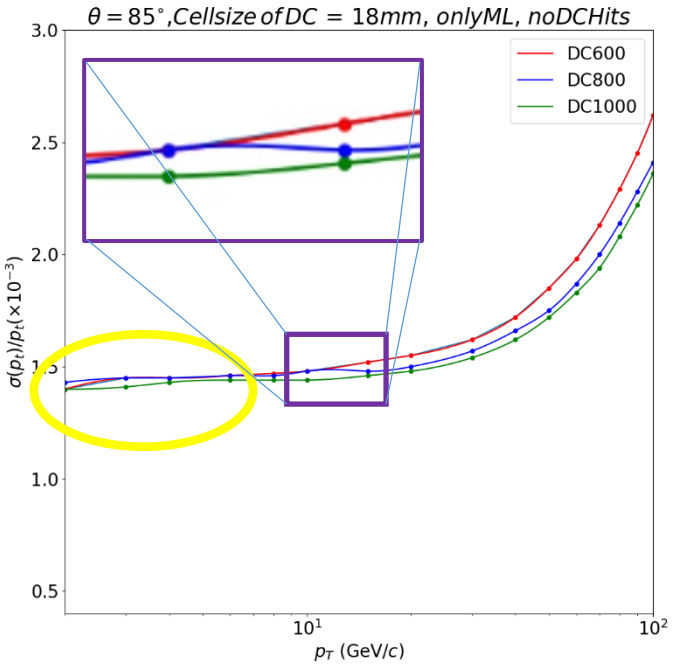
- The trend of the curves is similar. But GenFit's curve is still higher at low momentum.
- At low momentum, the slope of GenFit is bigger bigger than Marlin's.
- I thought multiple-scattering has a greater impact on GenFit.

3. Not Use the DC Hits(but there are still DC's materials)

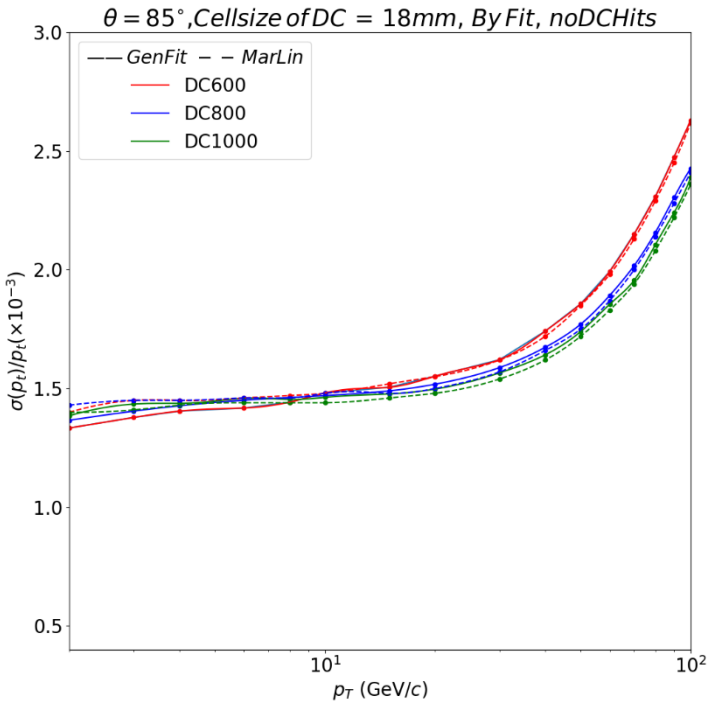
By GenFit:



By Marlin:

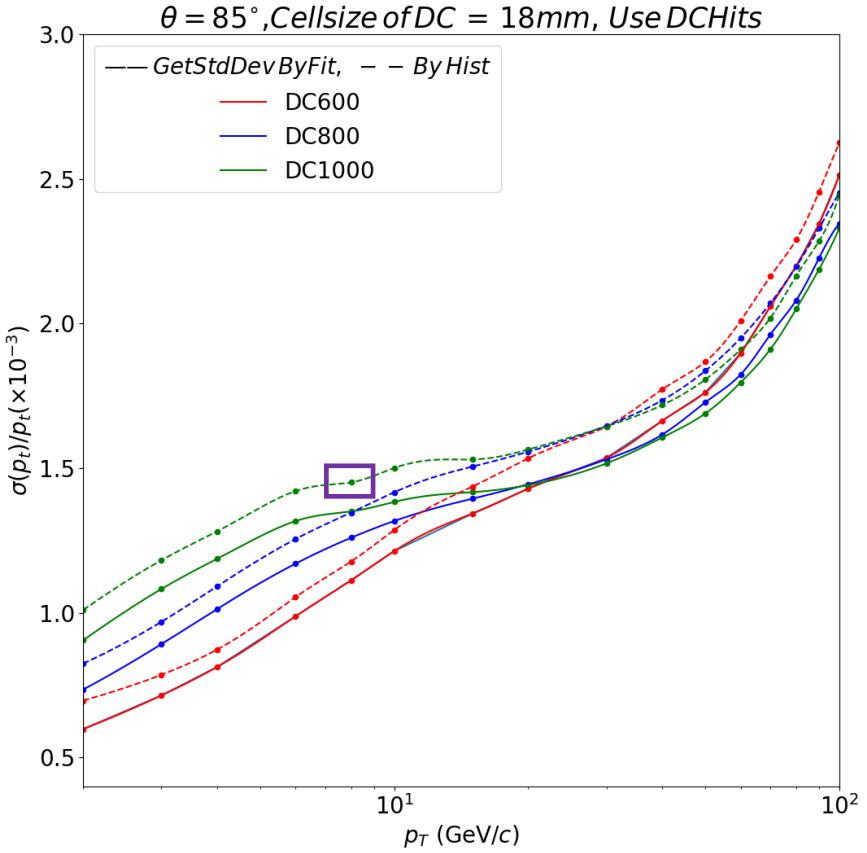


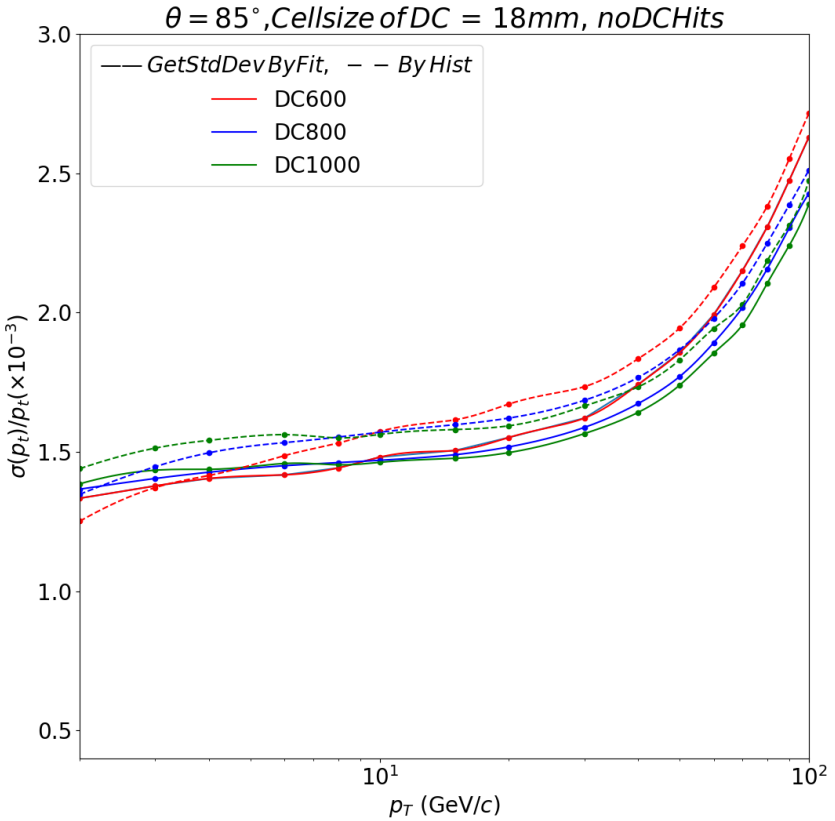
Compare:



- When we don't use the DCHits, the result is very similar of these two full simulation tools.
- There are still a little difference. You can see it in the yellow circle.
- We can say the difference still comes from DC.

3. The StdDev values come from Histogram directly





- By Hist: used x-range (-5σ, 5σ); By Fit: (-2.5σ, 2.5σ)

Summary

- There is no doubt that place DCinner at 600mm is better.
- The unnormal higher of GenFit's result comes from chamber's material.
- When we use DCHits, the curve's trend of GenFit is still different with Marlin's.
- These two full simulation tools' difference comes from DCHits.
- More statistics render the curve more smooth.