

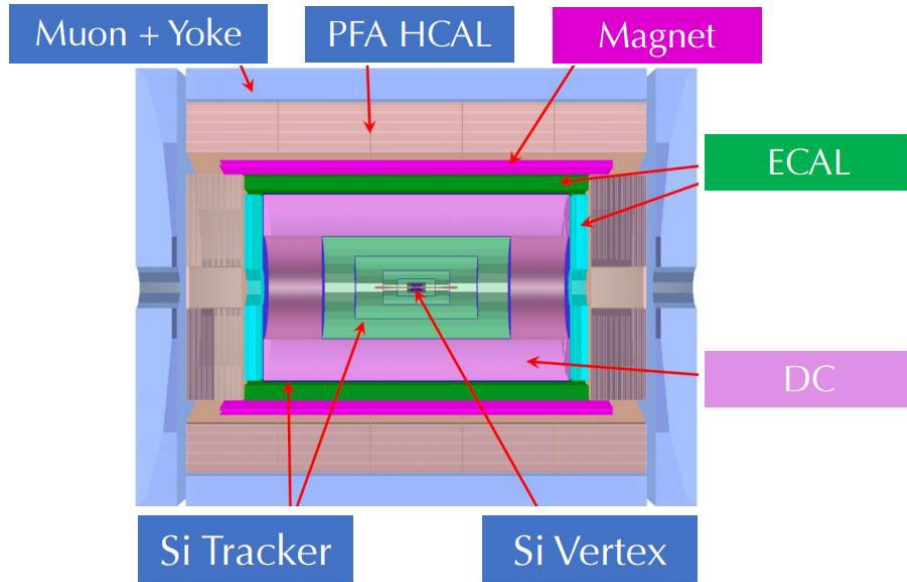
The Optimization of SITOuter & DCInner Layers' Position

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2022/5/27

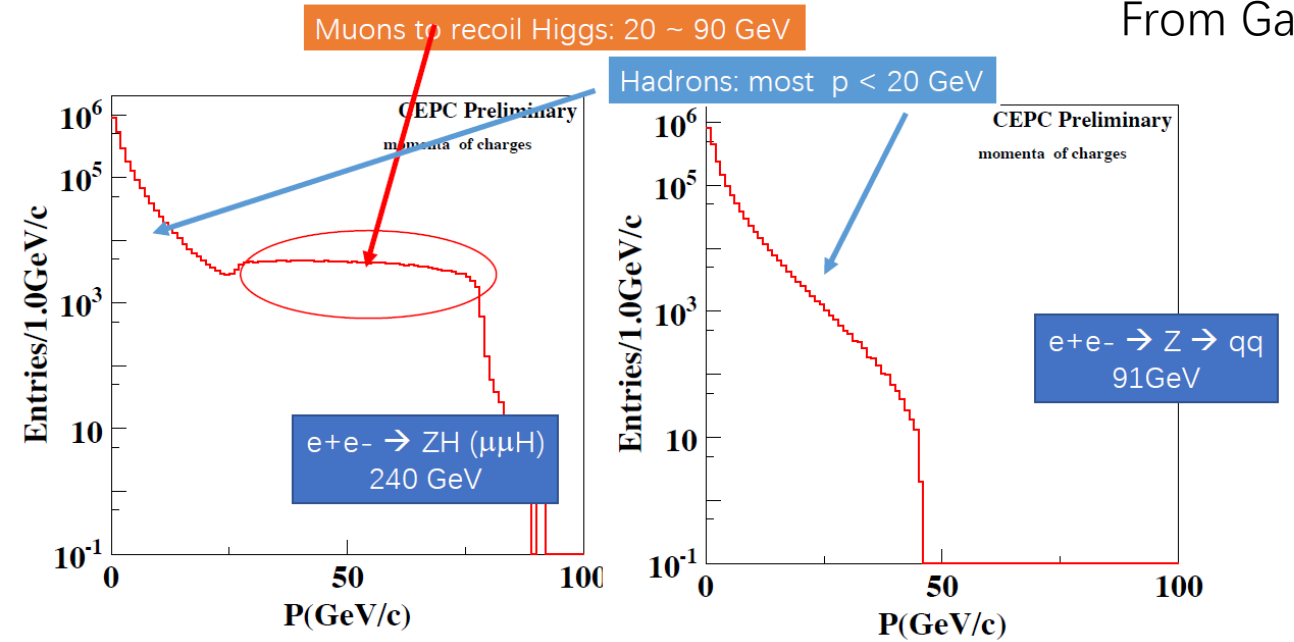
1. Introduction

The 4th CEPC conceptual Tracker



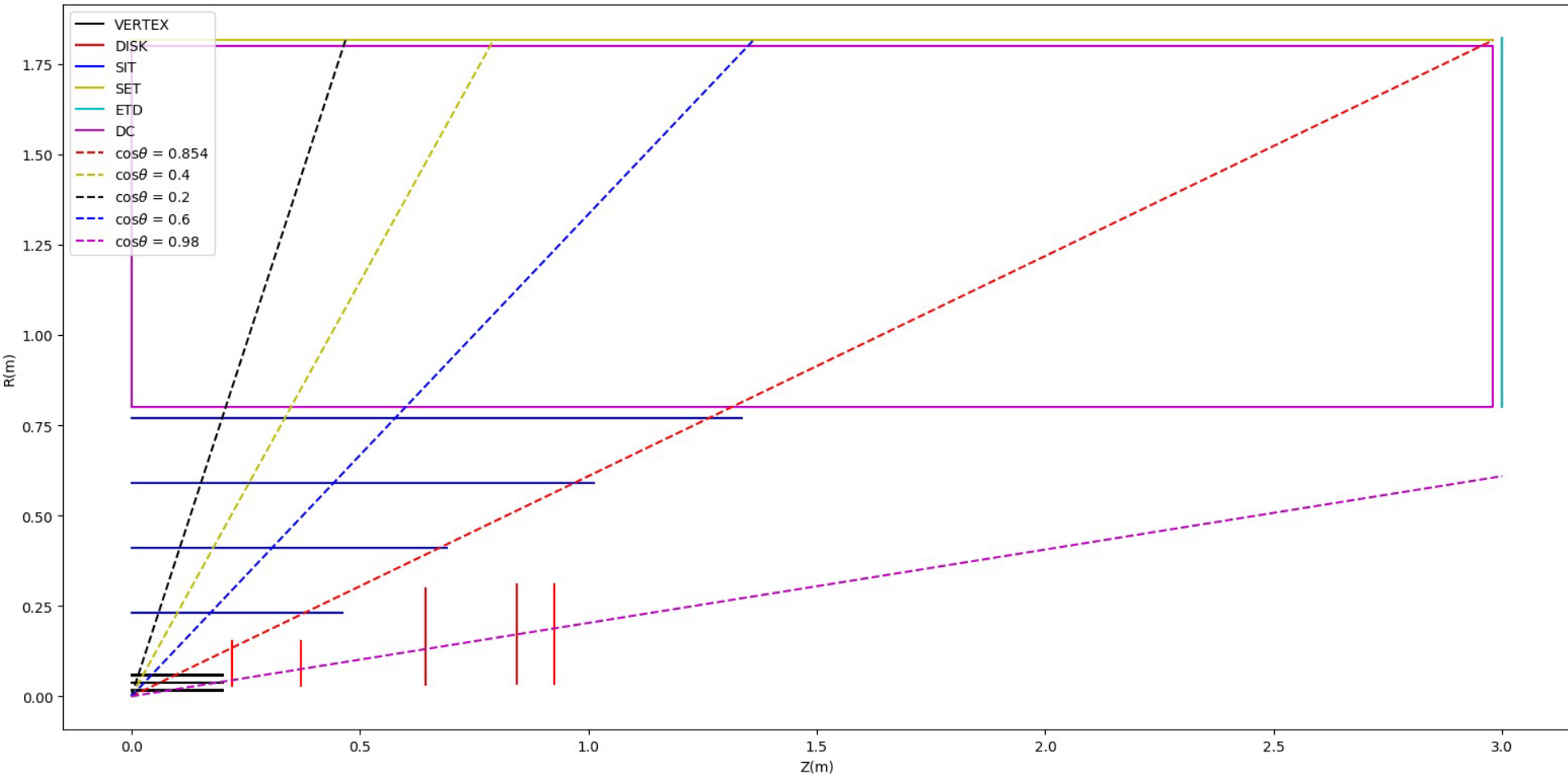
Momenta of tracks @ 240 & 91 GeV

From GangLi



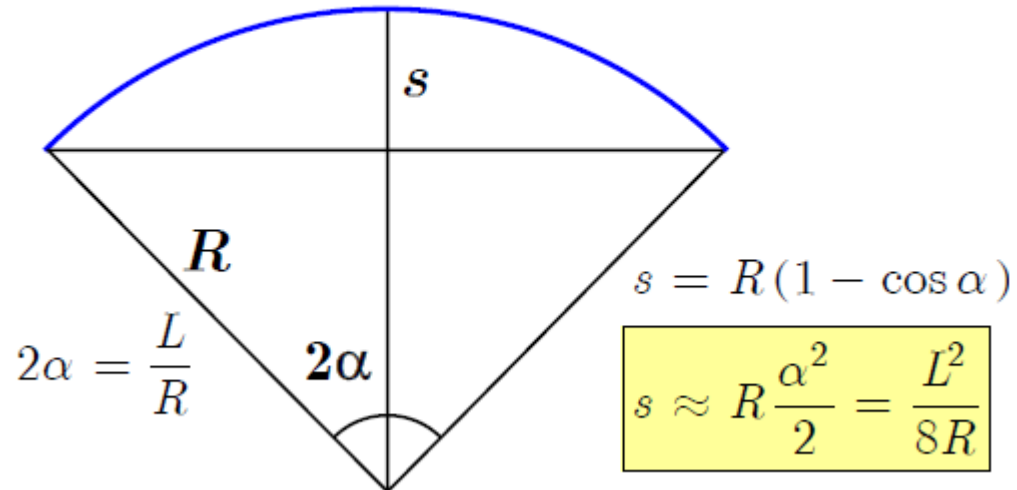
- Particle ID with a drift chamber is a key feature for the 4th conceptual detector
- Most hadrons from Higgs/Z pole data are below 20 GeV/c
- The tracker should have sufficient momentum resolution for particles < 20 GeV/c

1.2 Introduction-CEPC Detector's geometry



1.3 Introduction-Sagitta

the sagitta s



- 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**

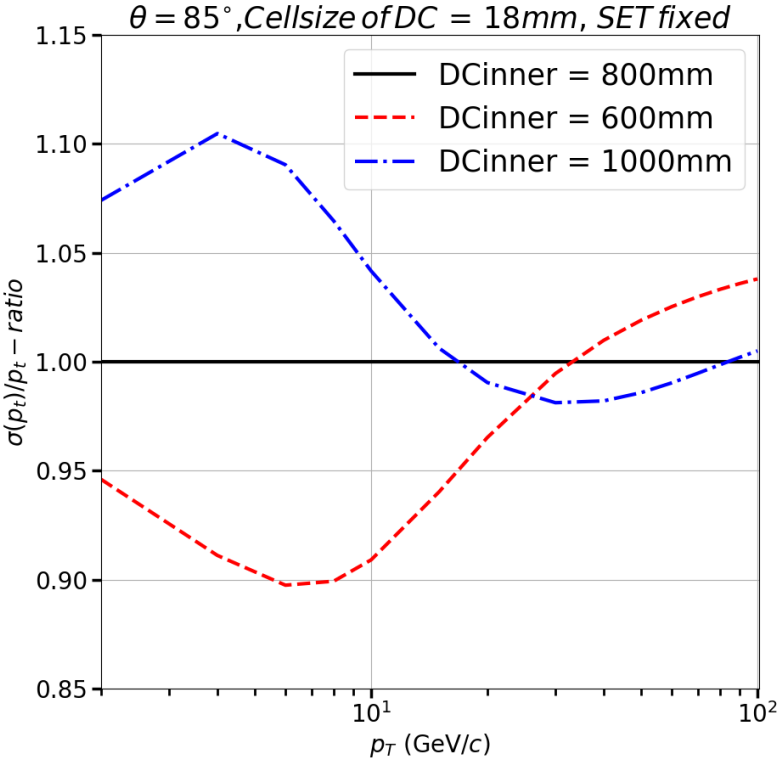
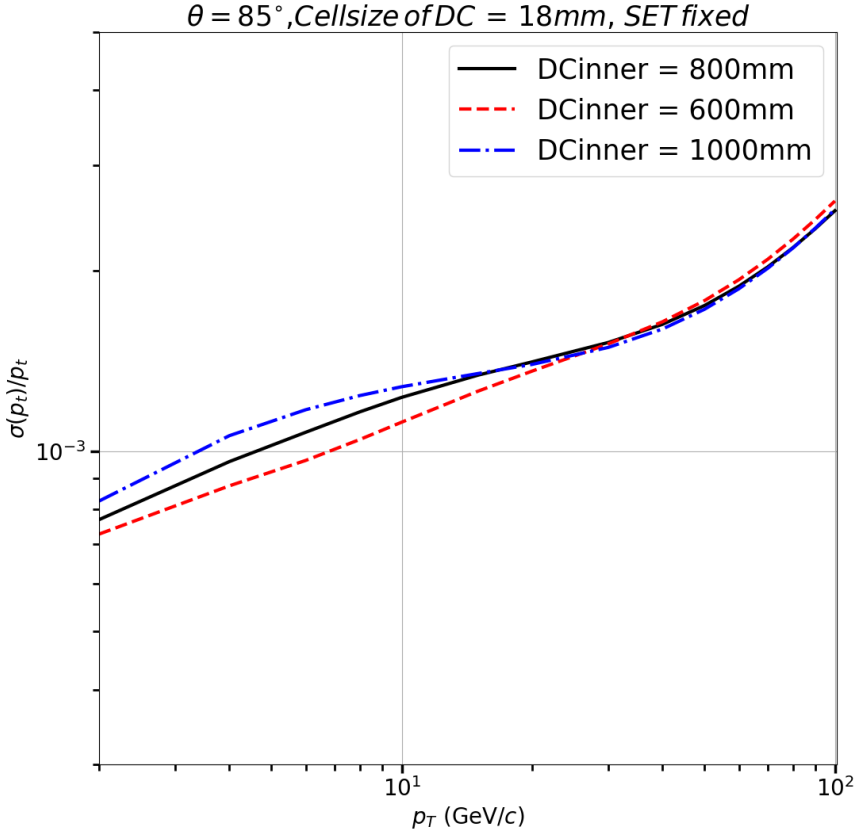
[#]average for $\phi(0,2\pi)$

^{##}GasHe_90Isob_10 without wire, if Air, 0.00592% per cell

* Sensor face to IP, 0.468% lie after sensor

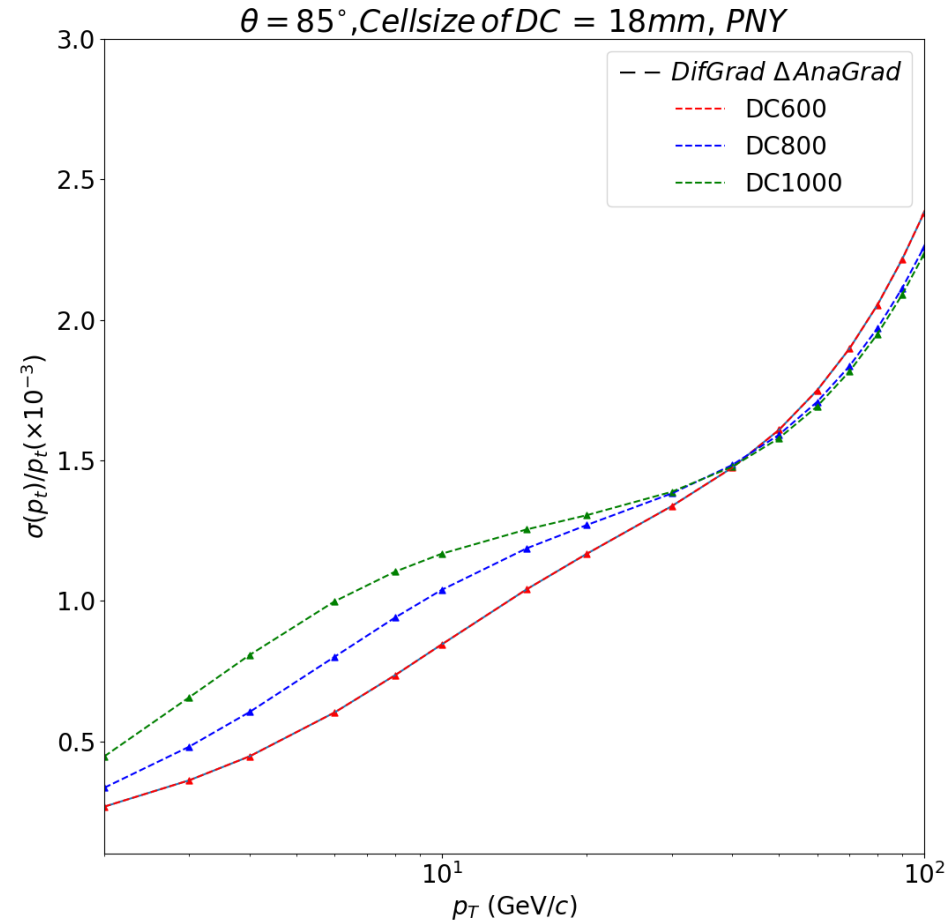
** Dominant lie between SITs

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

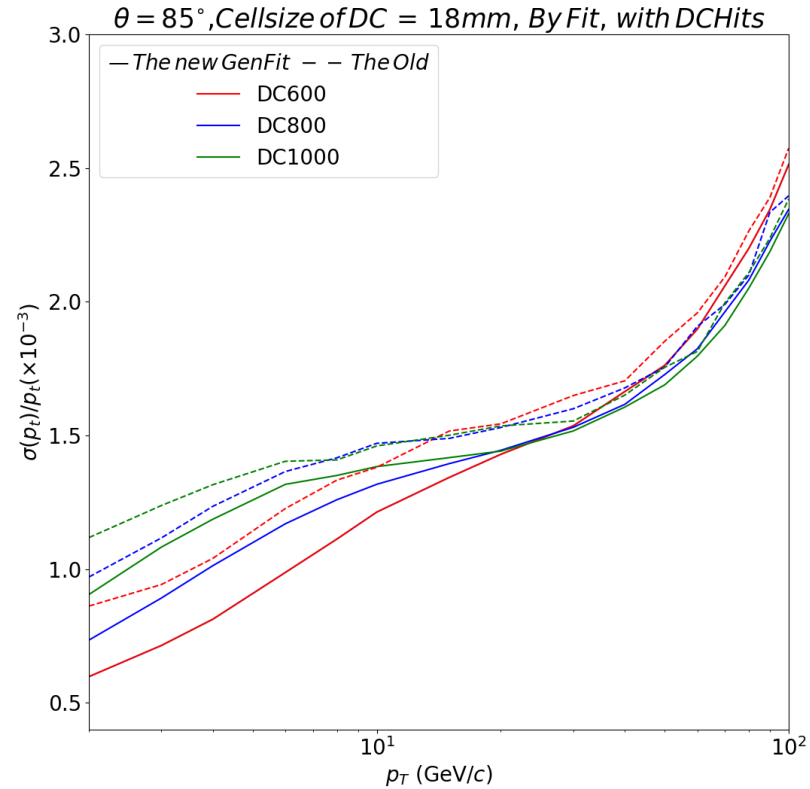
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fucd@lxslc702/works2/bs...  
23 Air 7 14.801 0.0012 30392.124  
24 Air 7 14.801 0.0012 30392.124  
25 Air 7 14.801 0.0012 30392.124  
26 Air 7 14.801 0.0012 30392.124  
27 Air 7 14.801 0.0012 30392.124  
28 Air 7 14.801 0.0012 30392.124  
29 Air 7 14.801 0.0012 30392.124  
30 Air 7 14.801 0.0012 30392.124  
31 Air 7 14.801 0.0012 30392.124  
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34 Air 7 14.801 0.0012 30392.124  
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65 Air 7 14.801 0.0012 30392.124  
66 Air 7 14.801 0.0012 30392.124  
67 Air 7 14.801 0.0012 30392.124  
68 Air 7 14.801 0.0012 30392.124  
69 Air 7 14.801 0.0012 30392.124  
70 Air 7 14.801 0.0012 30392.124  
71 CarbonFiber 6 11.956 1.4667 30392.1242 71716.4399 51.8140
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Before

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fucd@lxslc702/works2/bs...  
28 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
29 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
30 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
31 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
32 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
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47 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
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65 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
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67 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
68 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
69 GasHe_90Isob_10 4 7.769 0.0004 141757 154179  
70 Air 7 14.801 0.0012 30392.1242 71716.4399 51.8140  
71 CarbonFiber 6 11.956 1.4667 30392.1242 71716.4399 51.8140  
0 Average Material 6 11.776 0.0041 10319.5911 18597.1930 1
```

After

3. Compare the old GenFit with the new

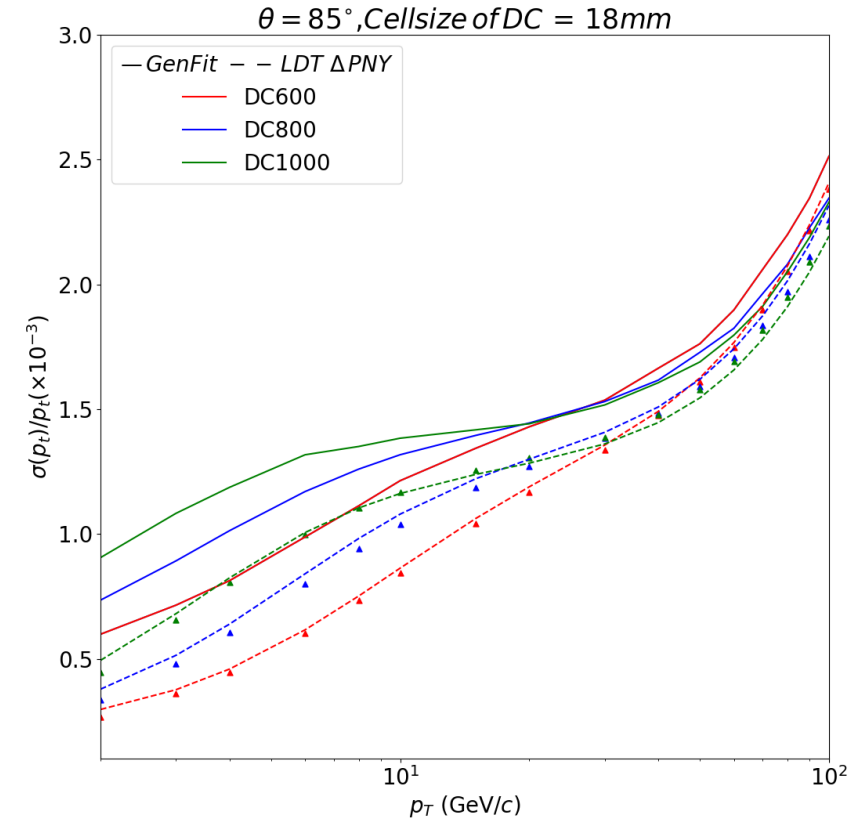
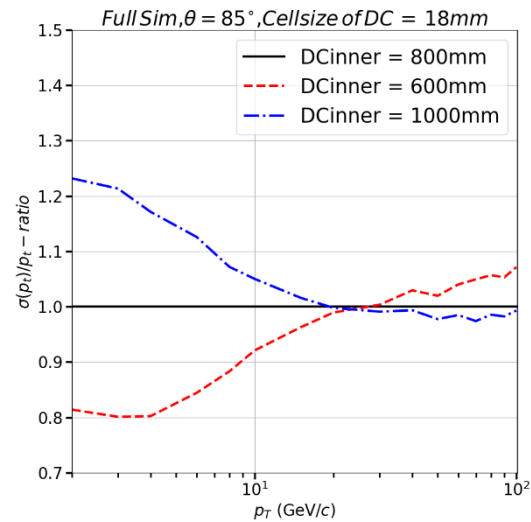
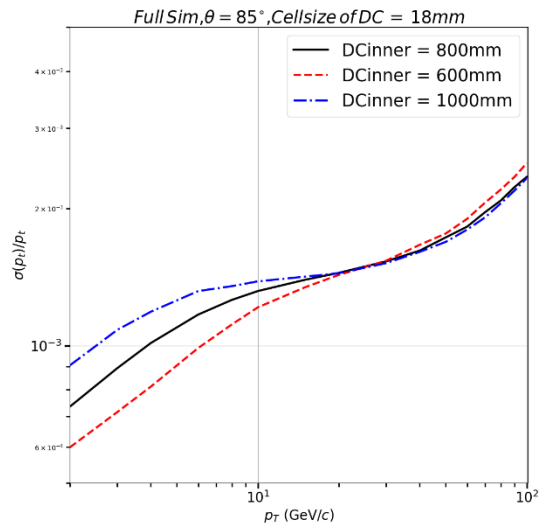


- The trend of the curves is similar. And the sigamPt comes from the new version is smaller.
- The curve is more smooth.

3. The verification by other tools

Compare the Full sim, LDT, Fast cal

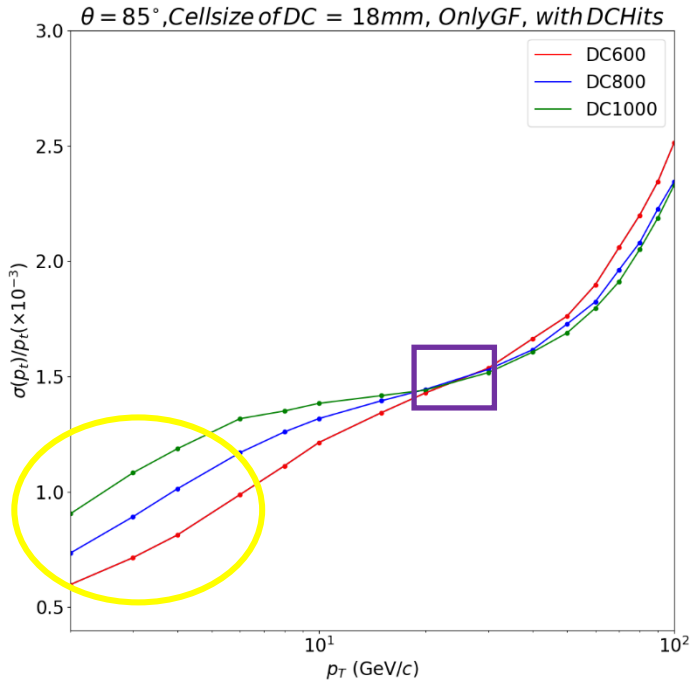
GenFit's result



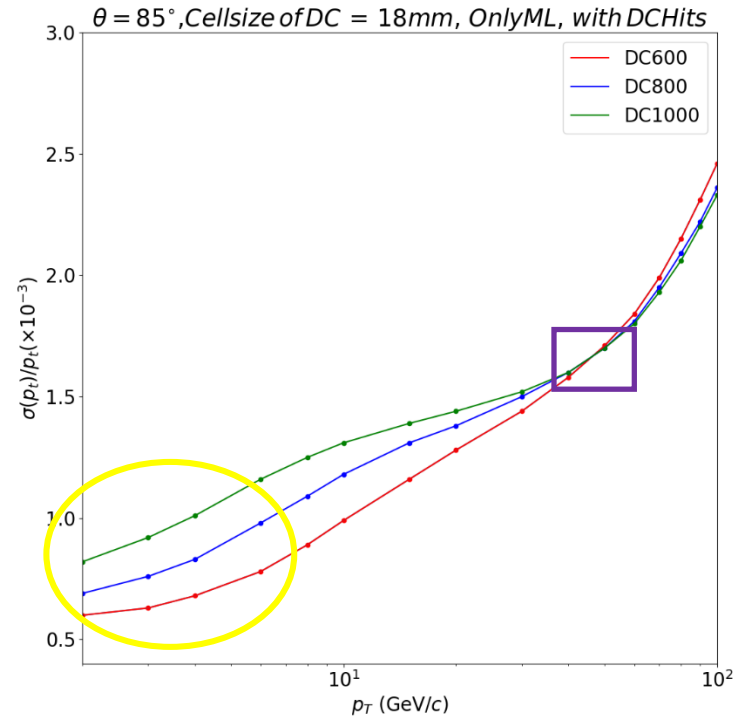
- The result is similar.

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

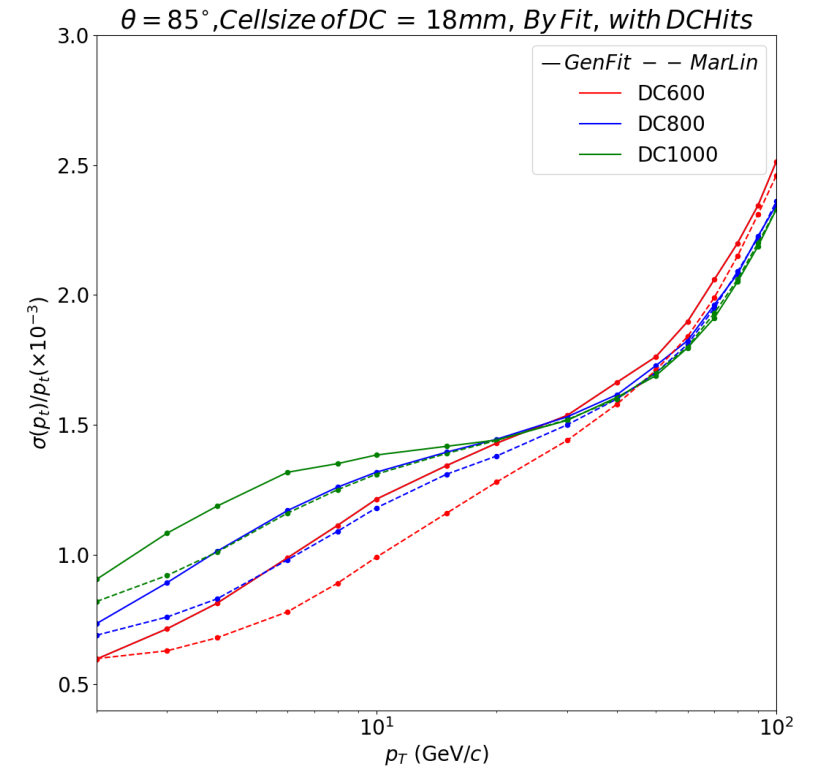
By GenFit:



By Marlin:



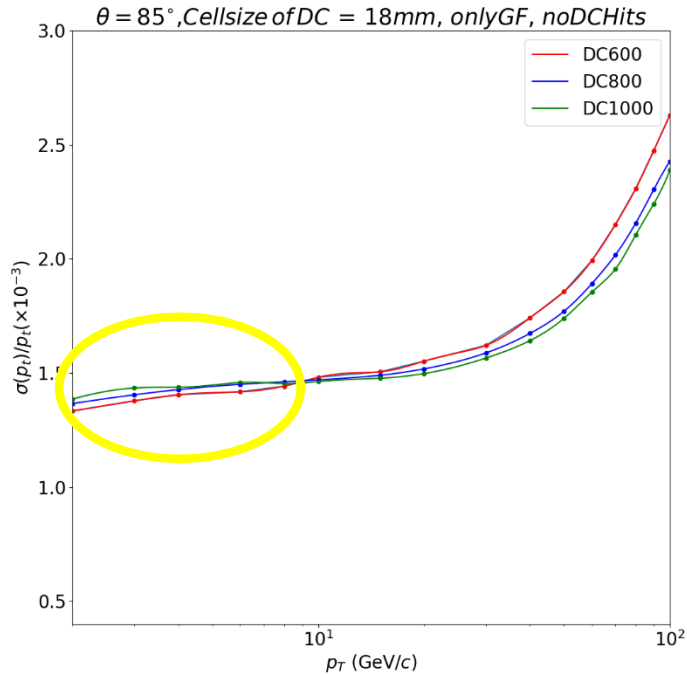
Compare:



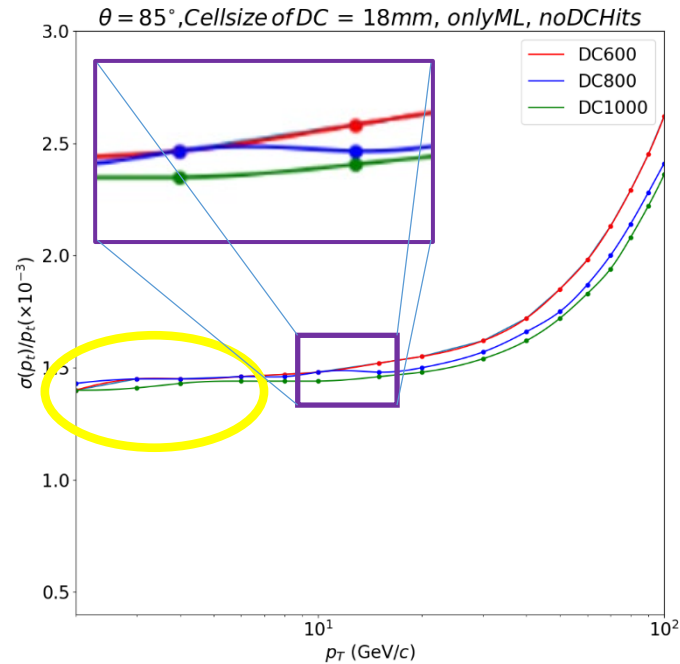
- The trend of the curves is similar. But GenFit's curve is still higher at low momentum.
- At low momentum, the slope of GenFit is bigger bigger than Marlin's.
- I thought multiple-scattering has a greater impact on GenFit.

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

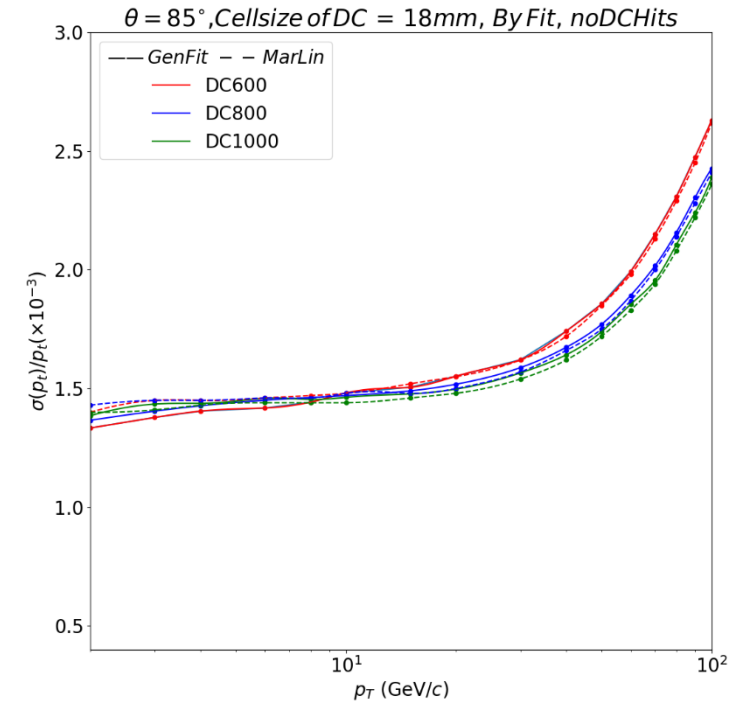
By GenFit:



By Marlin:

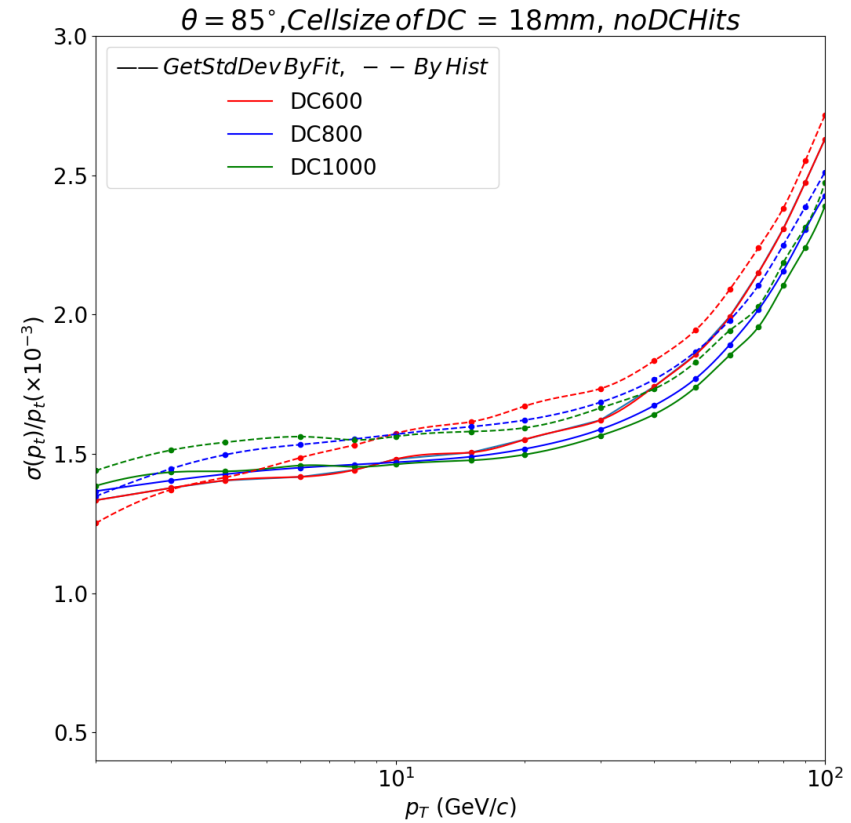
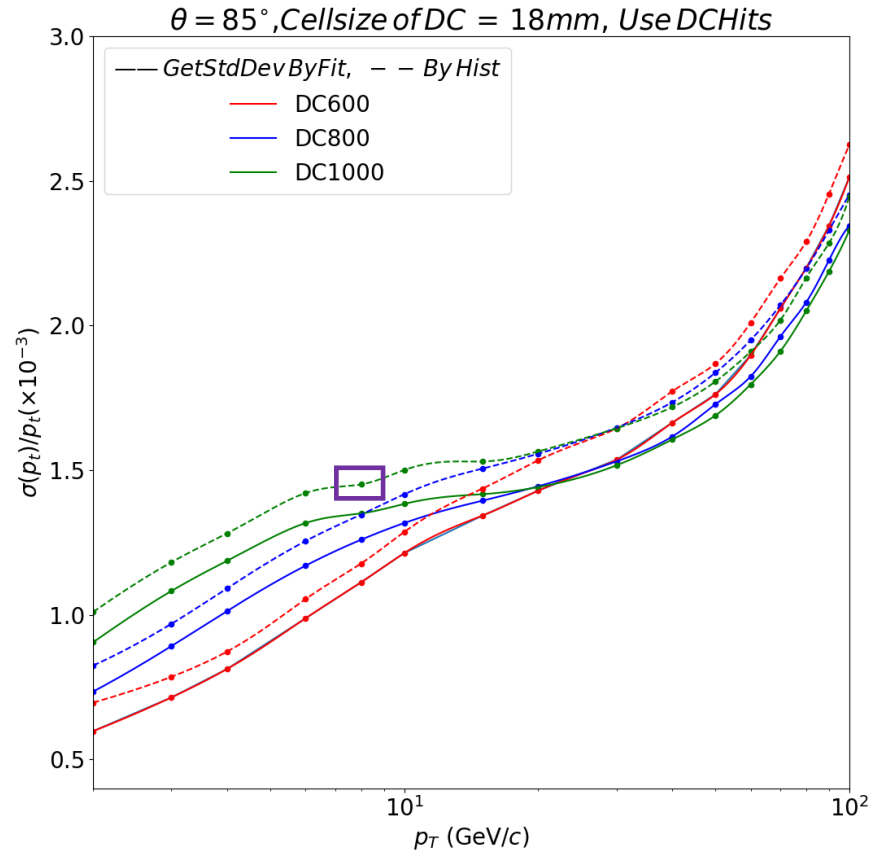


Compare:



- 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 $(-5\sigma, 5\sigma)$; By Fit: $(-2.5\sigma, 2.5\sigma)$

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.