CPEC Tracking System Optimization

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On behalf of the CEPC Tracker Team

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Motivations

1. Optimization on SITs for full Silicon Tracker
2. Optimization on DC radius for Forth CEPC Tracker
3. Optimization on number of SITs for Forth CEPC Tracker

1. Optimization on SITs for full Silicon Tracker

table shows the main parameters of each geometry layer while the red parts need to be optimized

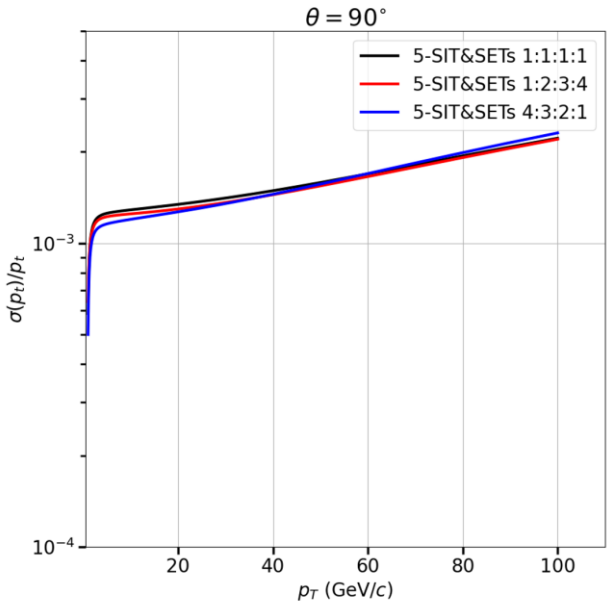
Layers	Radius(mm)	$\sigma_{R\phi}$(mu)	σ_Z(mu)	Thickness($1/X_0$)
Beam Tube	14.5	-	-	0.0015
VTX	16/18/37/39/58/60	2.8/6/4/4/4/4	2.8/6/4/4/4/4	0.001
Support for each VTX layer	-	-	-	0.001
VTX-shell	65.0	-	-	0.0015
SIT&SETs	../../../../..	7.2/…/7.2	86.6/…/86.6	0.0065

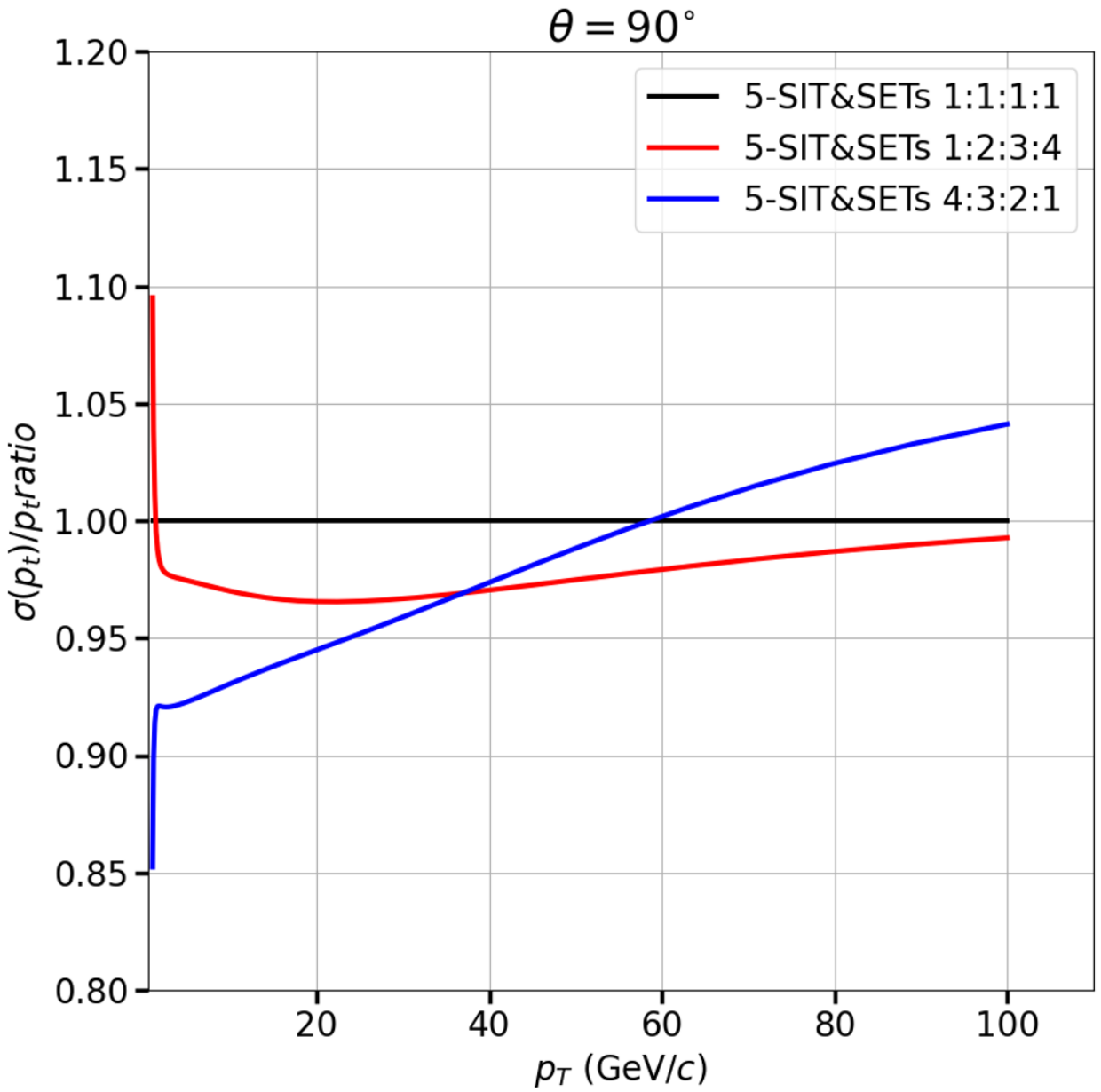
1. Optimization on SITs for full Silicon Tracker

pt: a = 1.7877 ; b = 1.2554

pt: a = 1.8085 ; b = 1.2358

pt: a = 1.9558 ; b = 1.1377

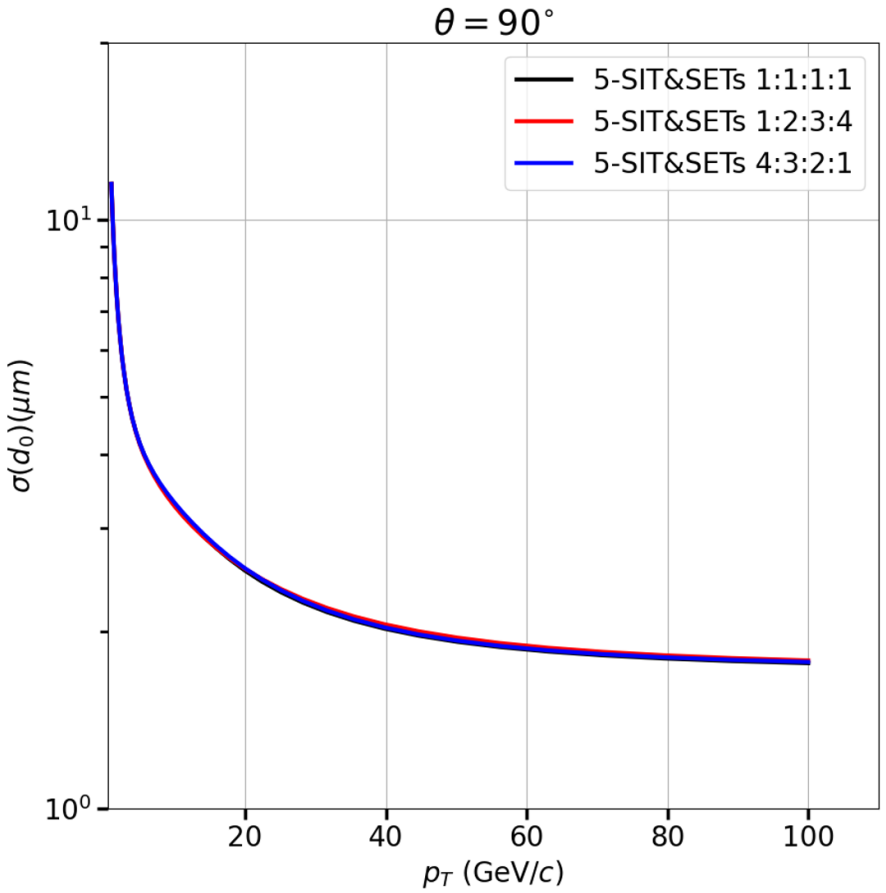


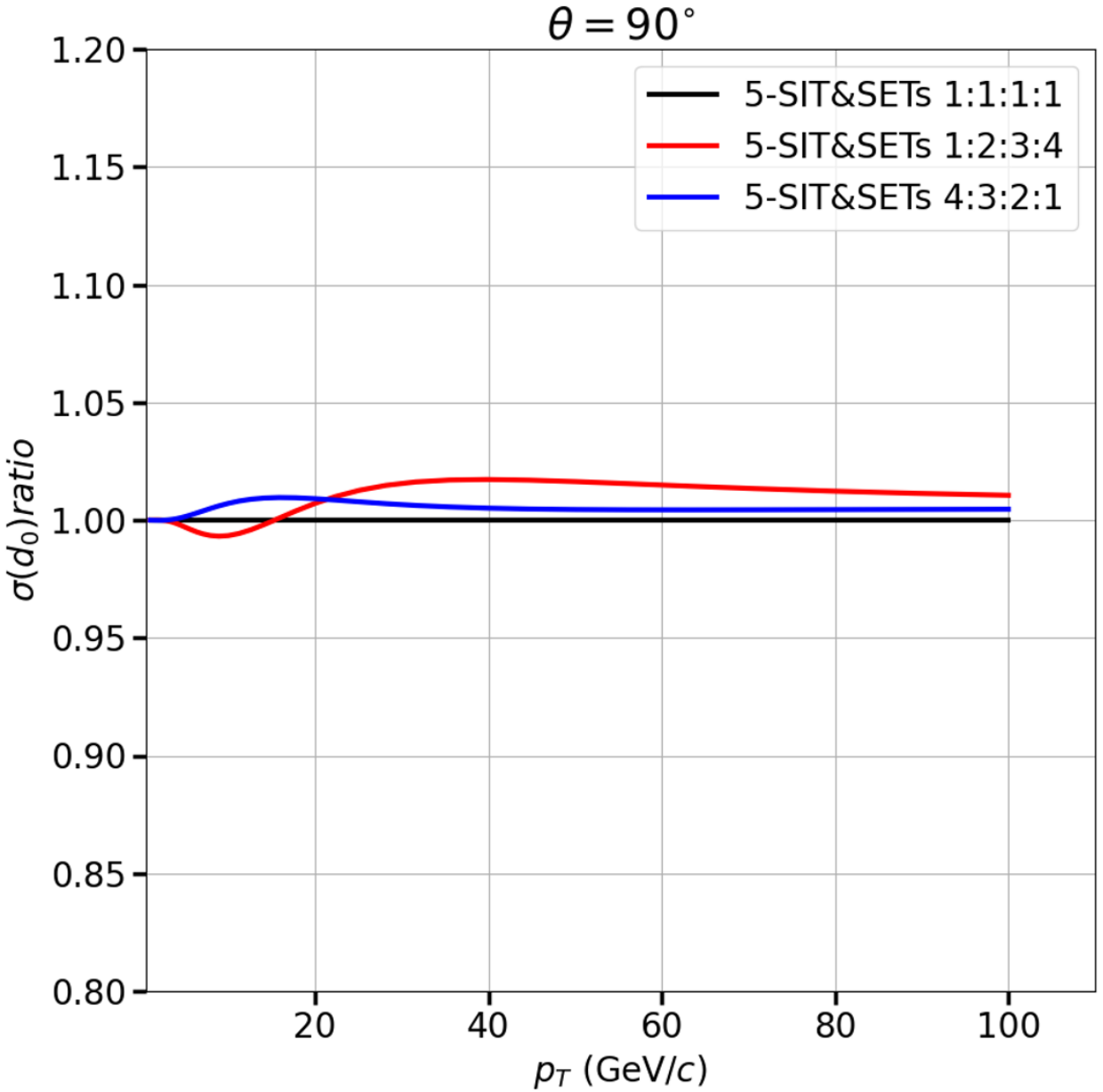


prefer red curve which represents inward design

1. Optimization on SITs for full Silicon Tracker

the difference could be neglect





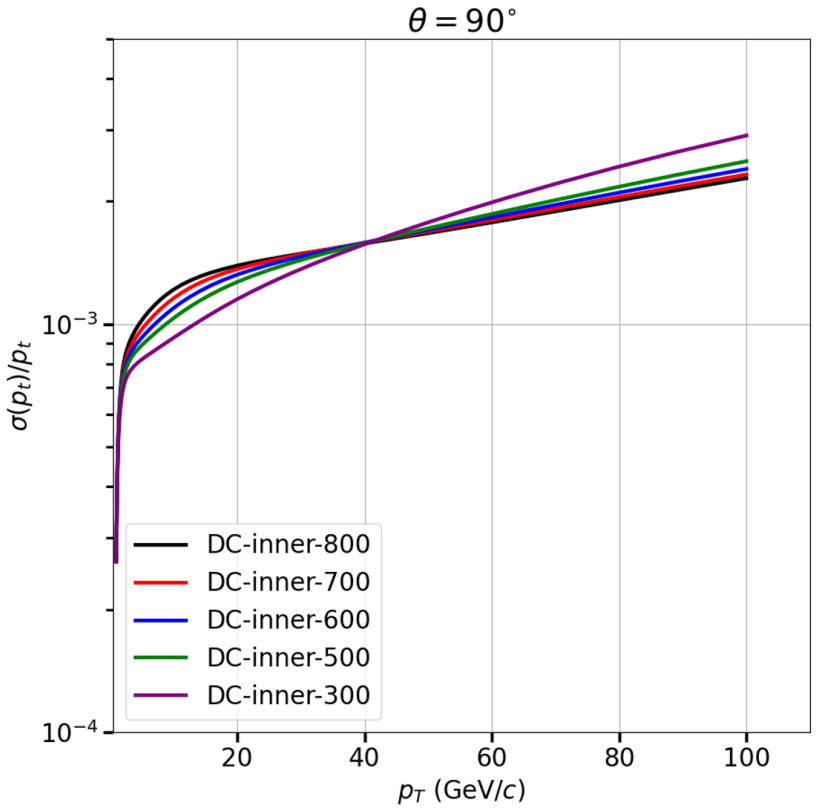
2. Optimization on DC radius for Forth CEPC Tracker

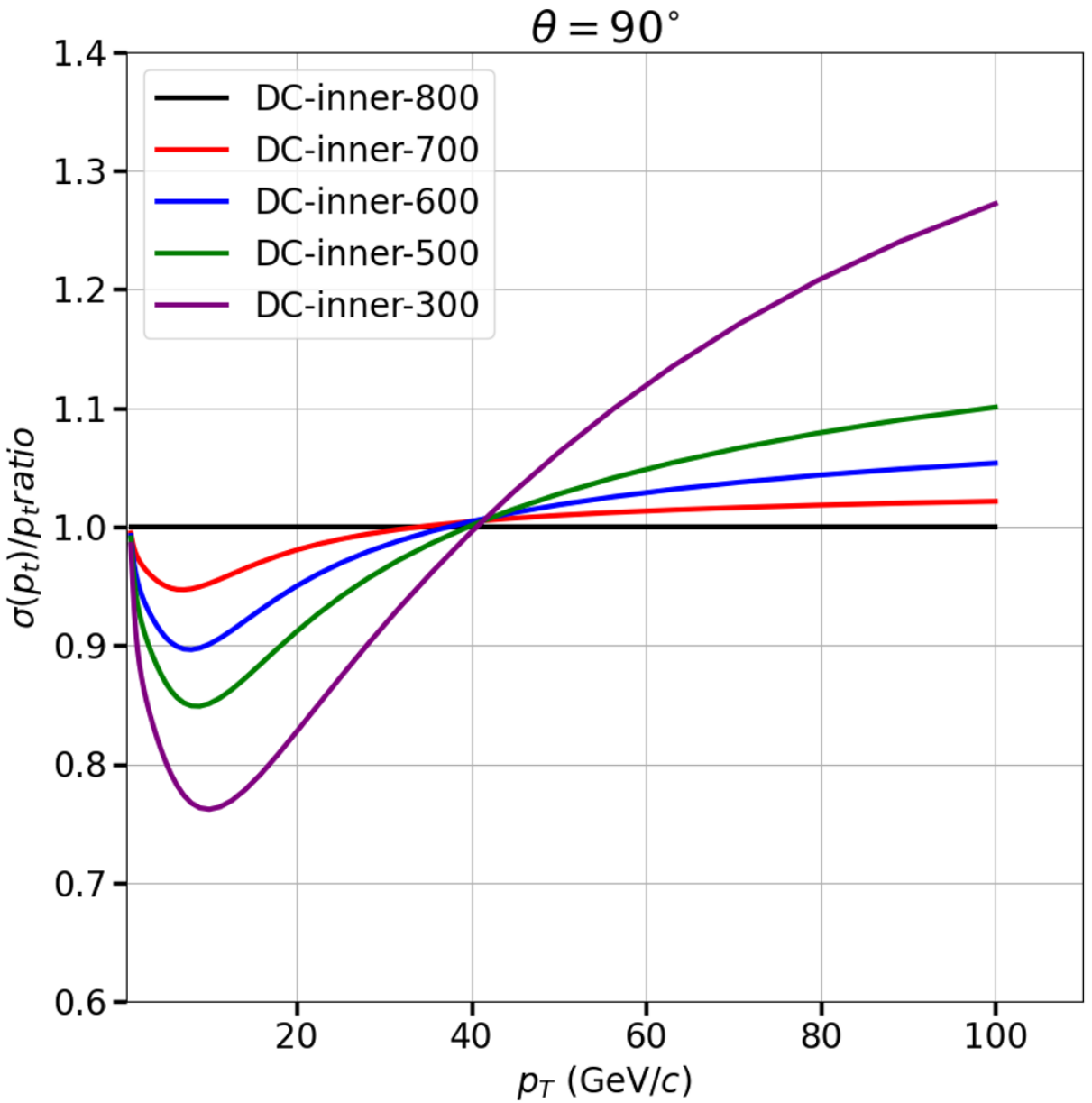
table shows the main parameters of each geometry layer while the red parts need to be optimized

Layers	Radius(mm)	$\sigma_{R\phi}$(mu)	σ_Z(mu)	Thickness($1/X_0$)
Beam Tube	14.5	-	-	0.0015
VTX	16/18/37/39/58/60	2.8/6/4/4/4/4	2.8/6/4/4/4/4	0.001
Support for each VTX layer	-	-	-	0.001
VTX-shell	65.0	-	-	0.0015
SITs	inward design (1:2:3)	7.2/…/7.2	86.6/…/86.6	0.0065
DC inner shell	..	-	-	0.00104
DC wires (15*15mm) and gas	…	100	2828	0.000081+0.0000413
DC outer shell	1803.0	-	-	0.01346
SET	1811.0	7.2	86.6	0.0065

2. Optimization on DC radius for Forth CEPC Tracker

800 : a = 1.7740 ; b = 0.8550
700 : a = 1.8292 ; b = 0.8284
600 : a = 1.9242 ; b = 0.8053
500 : a = 2.0725 ; b = 0.7826
300 : a = 2.6111 ; b = 0.7363

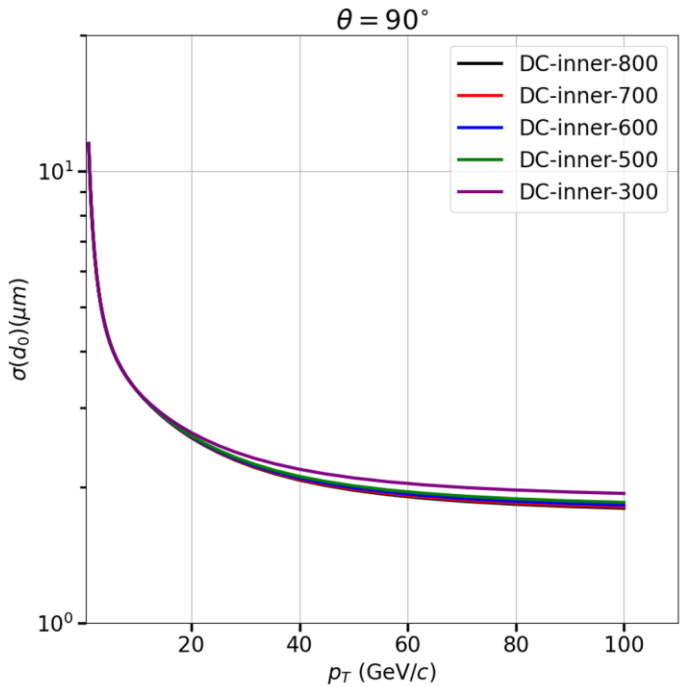


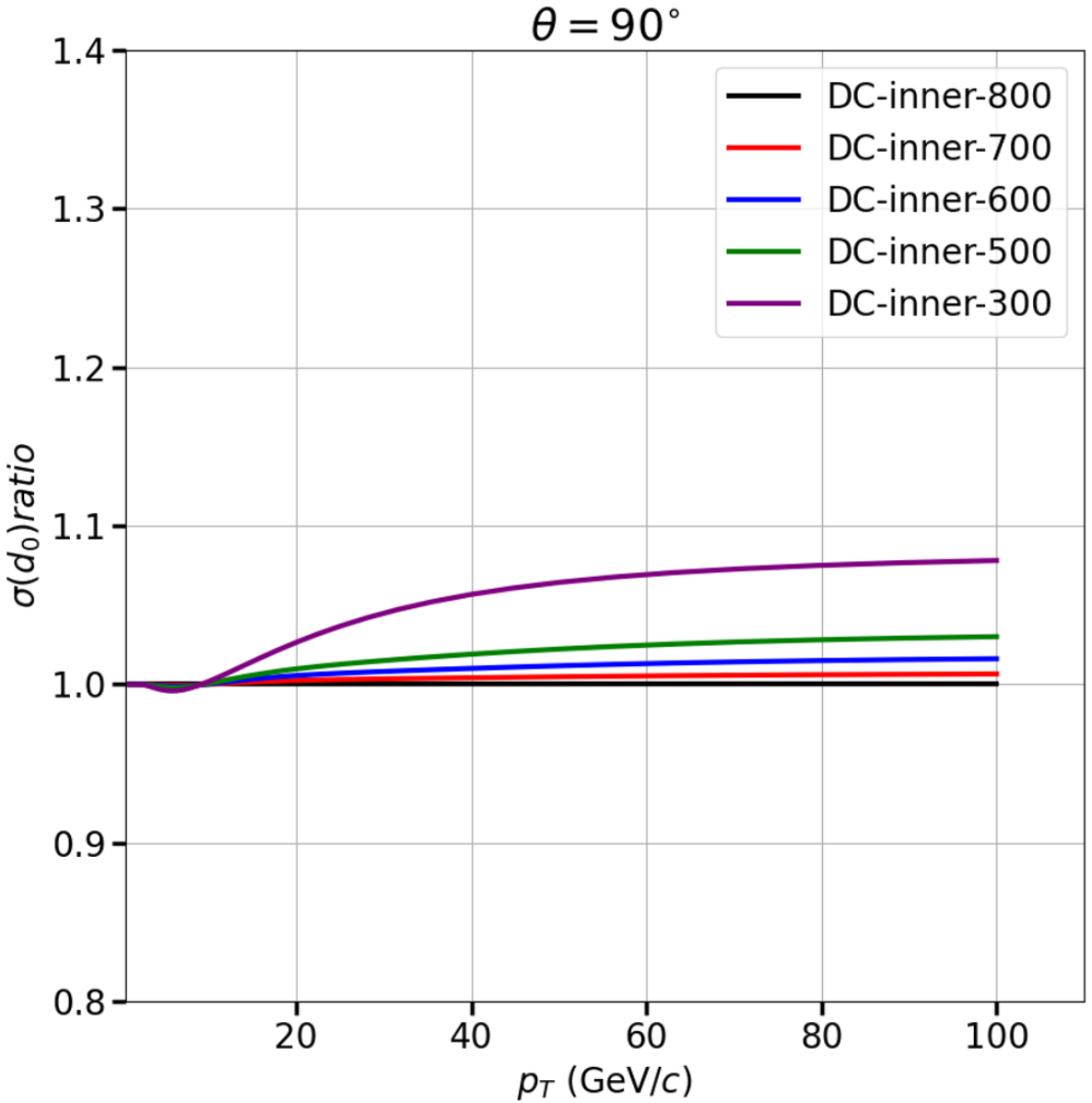


2. Optimization on DC radius for Forth CEPC Tracker

the difference could be neglect except the purple curve

DC-inner-300 gets such worse resolution of d_0 because the silicon detectors are too much close to beam pipe together

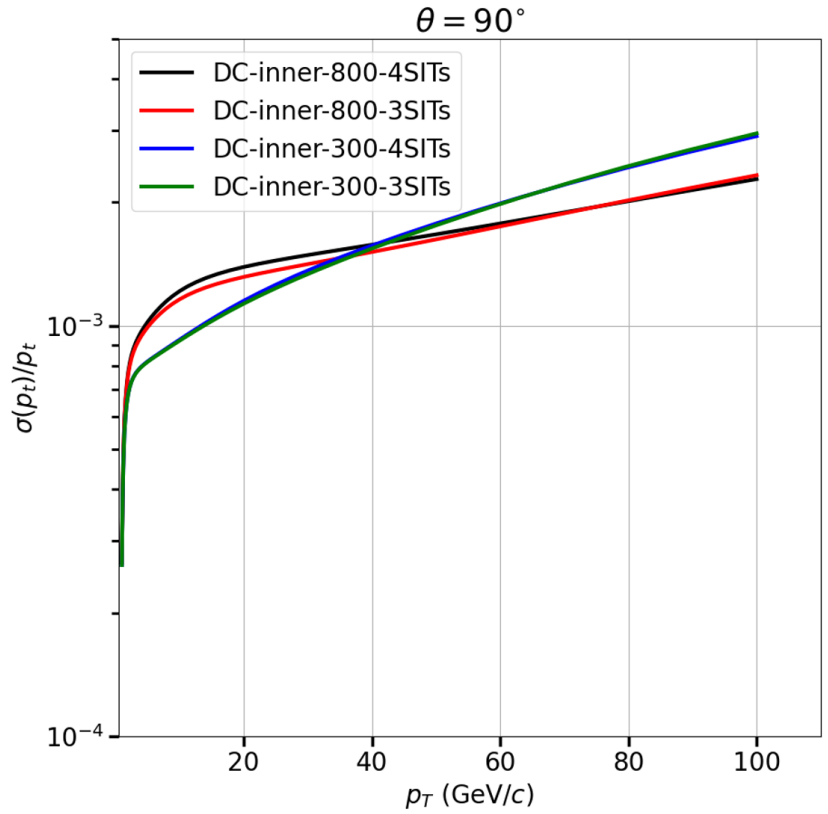


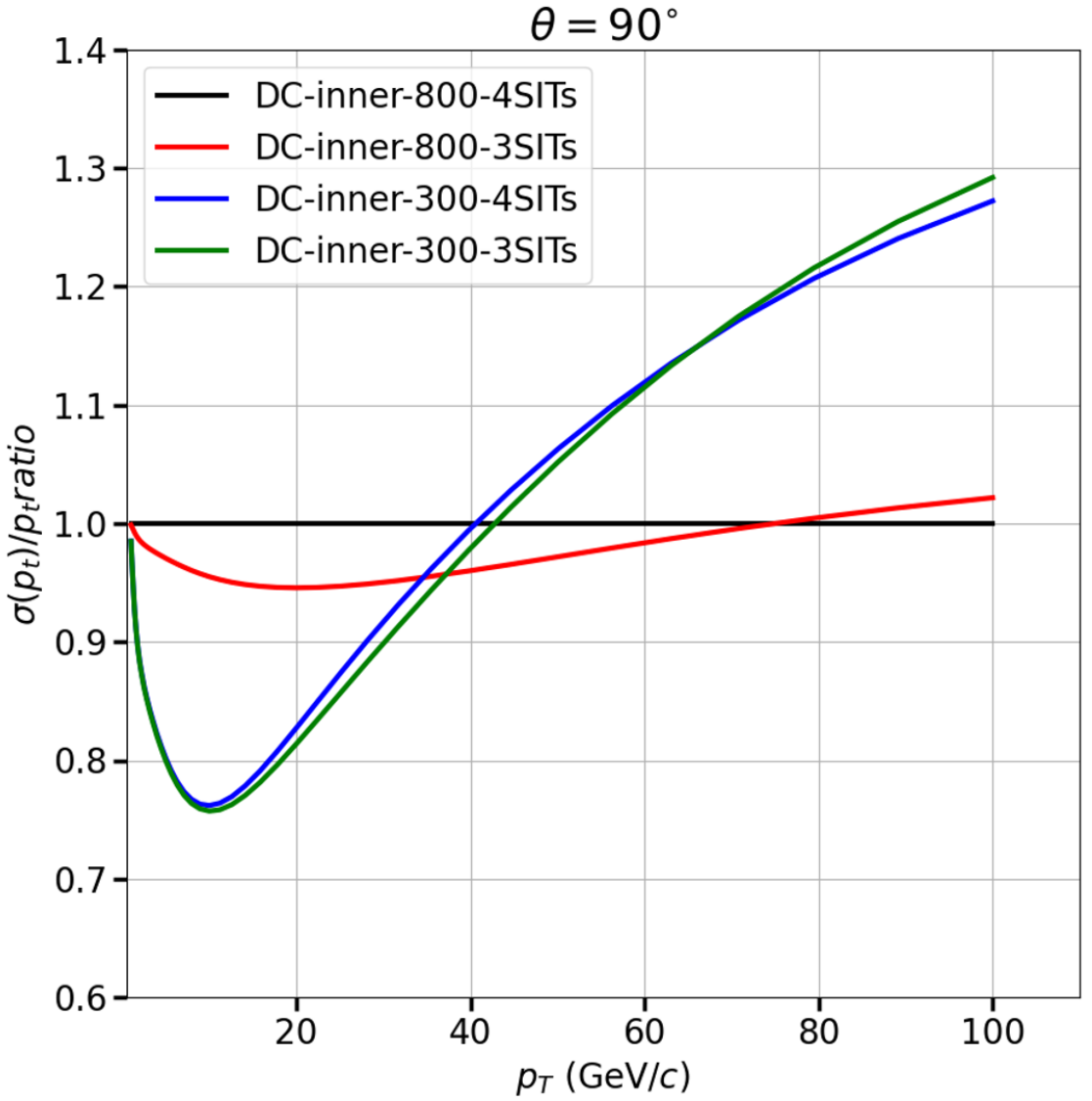


3. Optimization on number of SITs for Forth CEPC Tracker

following the section-2, the number of SITs is decreased from 4 to 3, while the SITs keep inward design

the difference between black & red curves and difference between blue & green curves are both smaller than 5%





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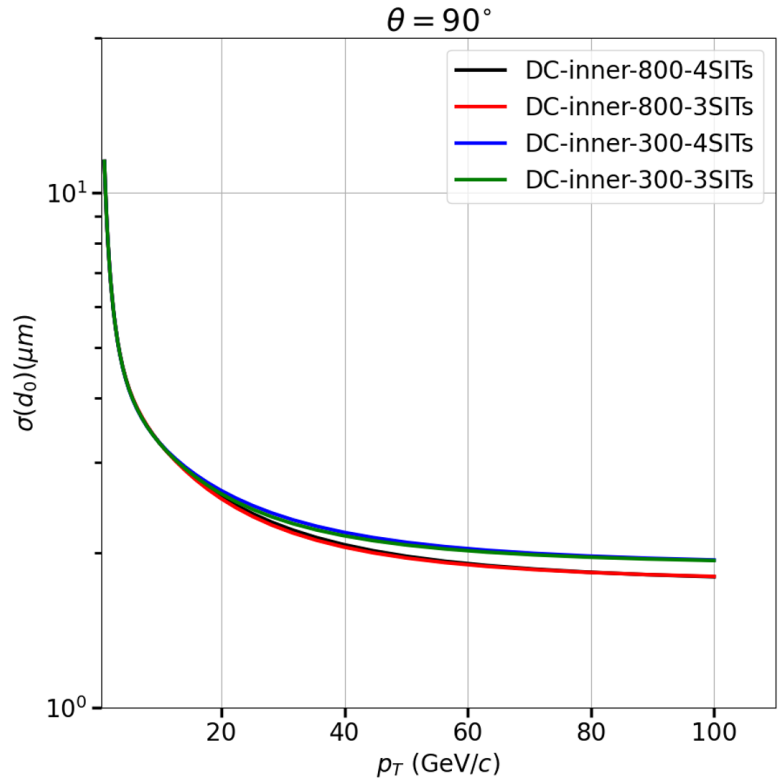

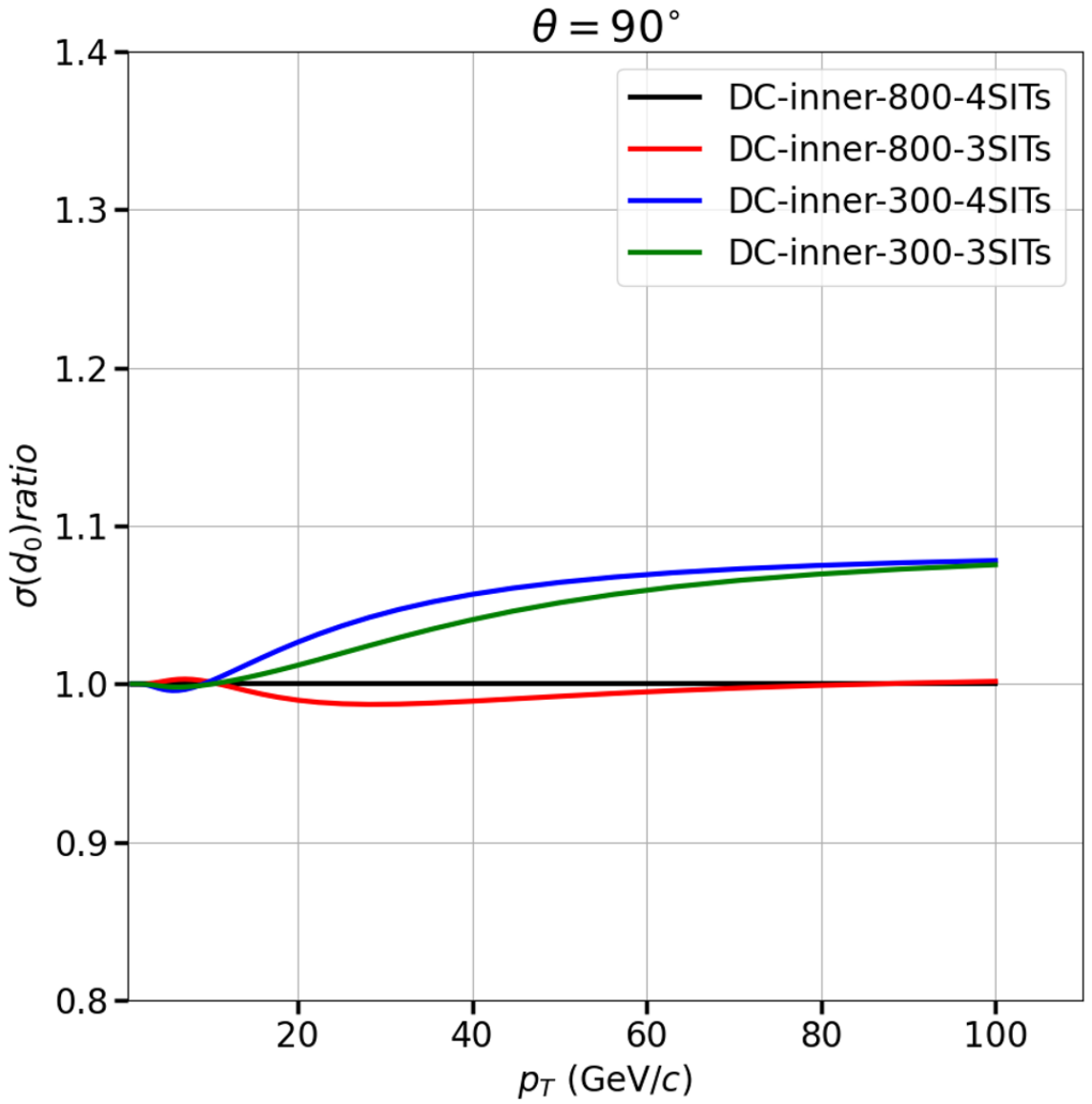

4. Summary

1. Inward design on SITs could take better resolution of momentum because of less multiple scattering influence;
2. The bigger drift chamber, the better resolution of low momentum, but the worse resolution of high momentum and d_0;
3. Since the resolution changes of momentum and d_0 are both smaller than 5%, the number of SITs is going to be decreased from 4 to 3, to save one silicon layer.