

CPEC Tracking System Optimization

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On behalf of the CEPC Tracker Team

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Contents

1. Main parameters of detectors
2. Brief summary for optimizing VTX
3. Research on optimizing SIT&SETs
 - 3.1 No space left for DC
 - 3.2 Space left for DC
 - 3.3 Brief summary for SIT&SETs

1. Main parameters of detectors



Beam pipe – 14.5mm
First VTX layer – 16.0mm

No drift chamber

6 VTX layers

1 VTX-shell

5 SIT&SETs



Outermost CET – 1811.0mm

1. Main parameters of detectors

Layers	$\sigma_{R\phi}$ (mu)	σ_z (mu)	Thickness($1/X_0$)
Beam Tube	-	-	0.0015
Pixels	2.8/6/4/4/4/4	2.8/6/4/4/4/4	0.001
Support for each pixel	-	-	0.001
VTX-shell	-	-	0.0015
CMOS	7.2	86.6	0.0065

2. Brief summary for optimizing VTX

Mainly caring Δd_0 , Δz_0

1. closer to the beam pipe, smaller the resolution
2. 16.0 – 60.0 mm is small enough for VTX space
3. double layers as a pair could decrease the resolution because of less material budget

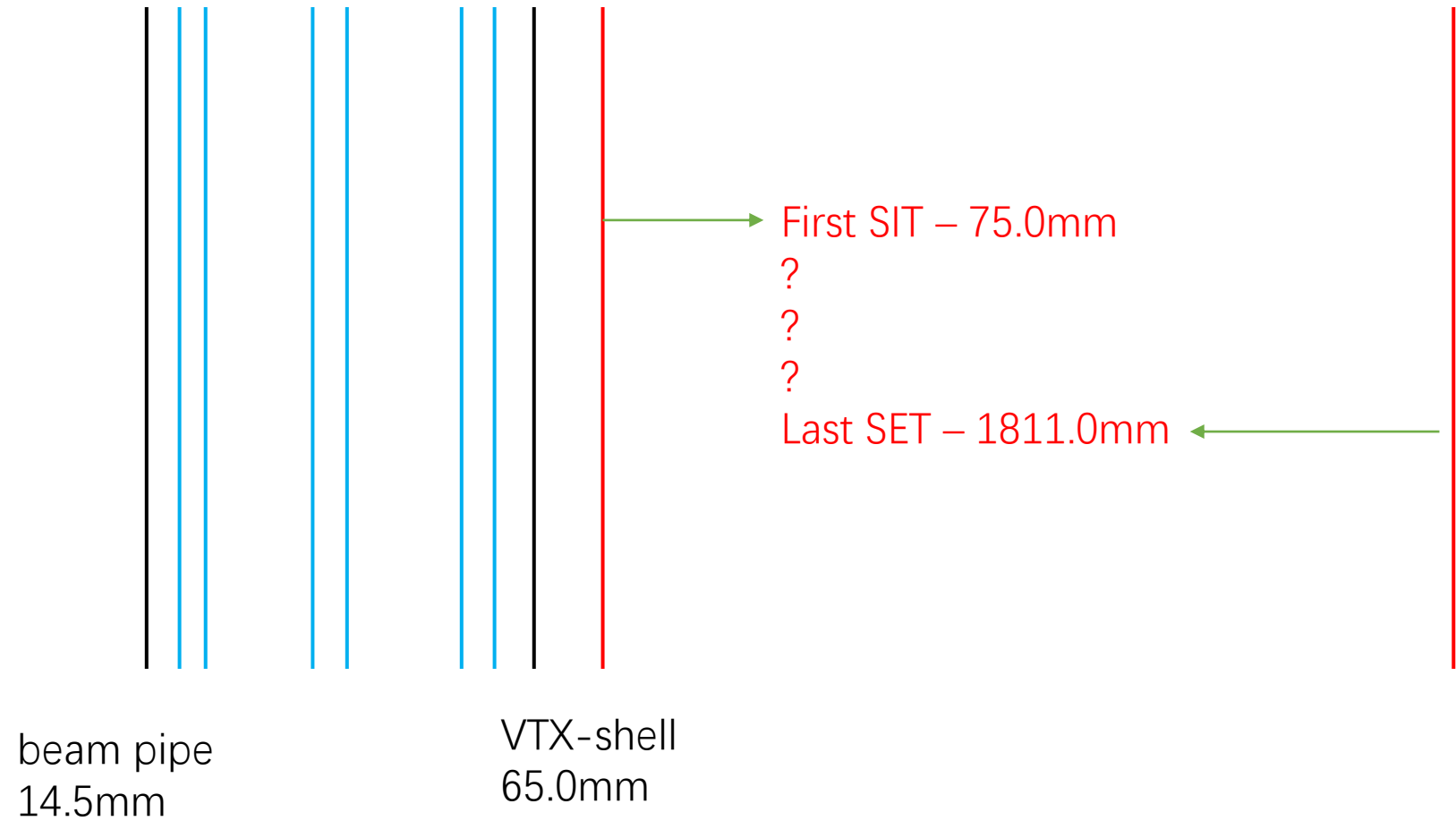
So the suggested structure of VTX is [16.0](#), [18.0](#), [37.0](#), [39.0](#), [58.0](#), [60.0](#)

Details could be found at 'report on 2021.10.29'

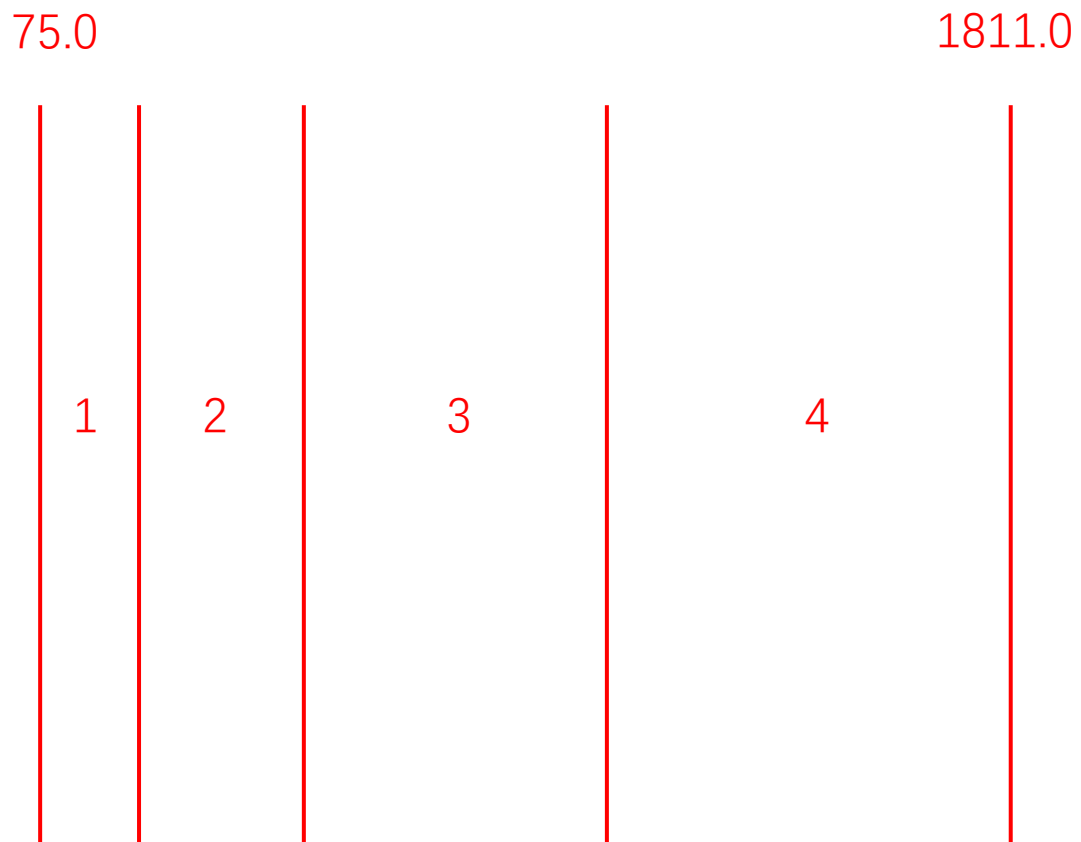
3.1 No space left for DC

VTX

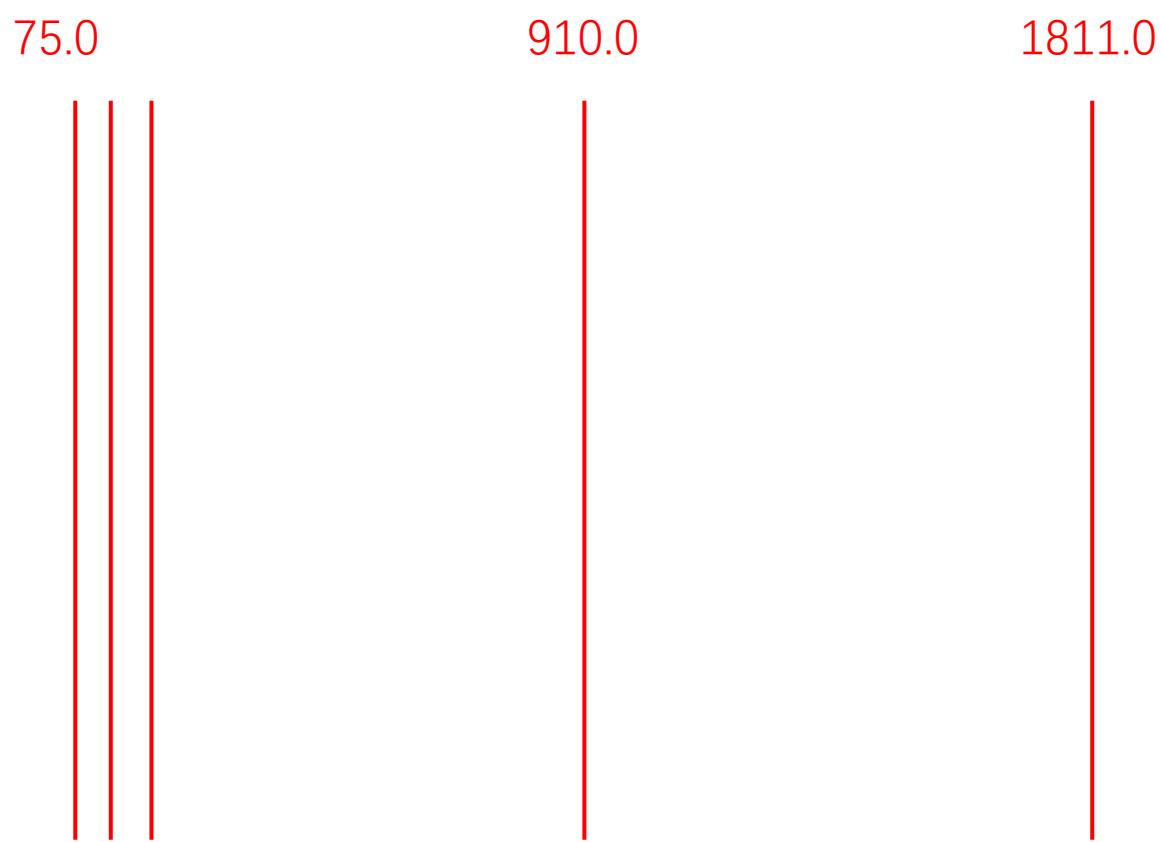
16, 18, 37, 39, 58, 60



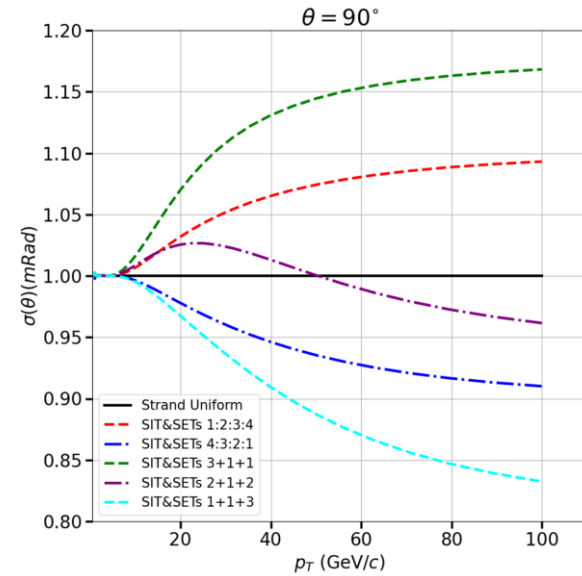
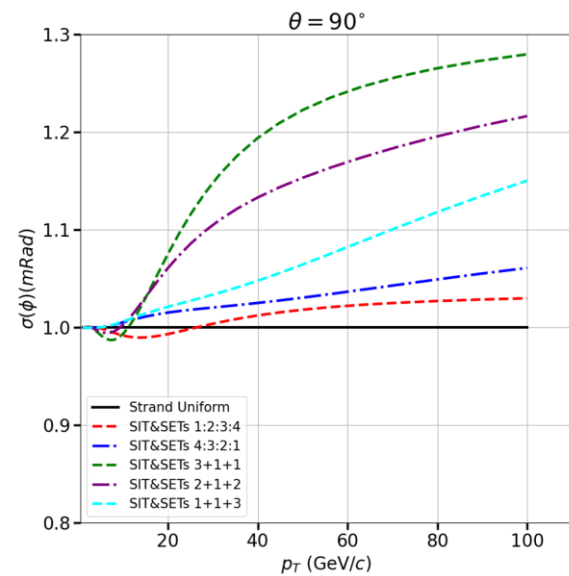
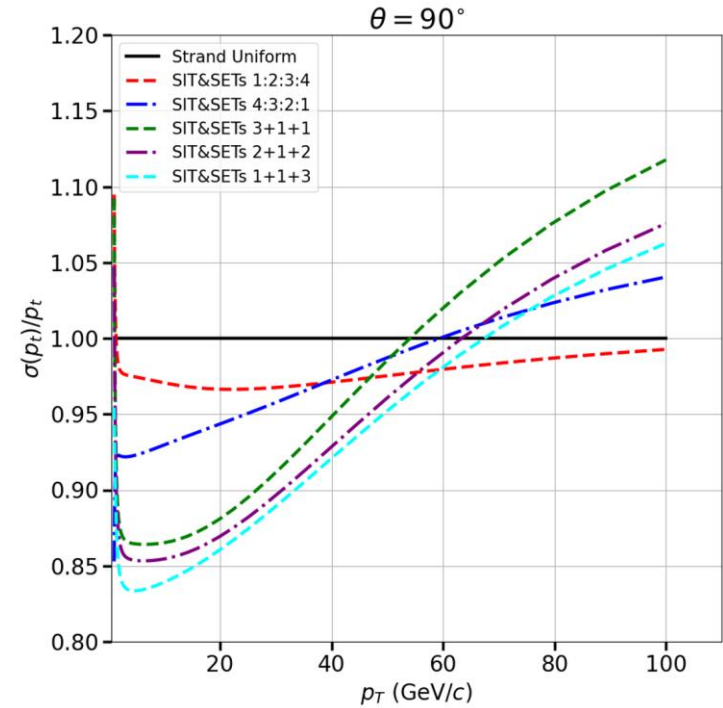
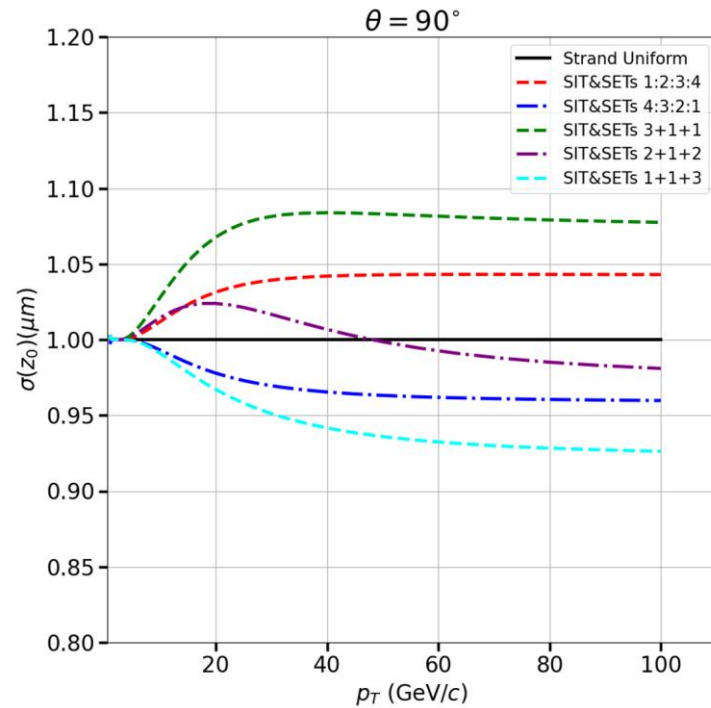
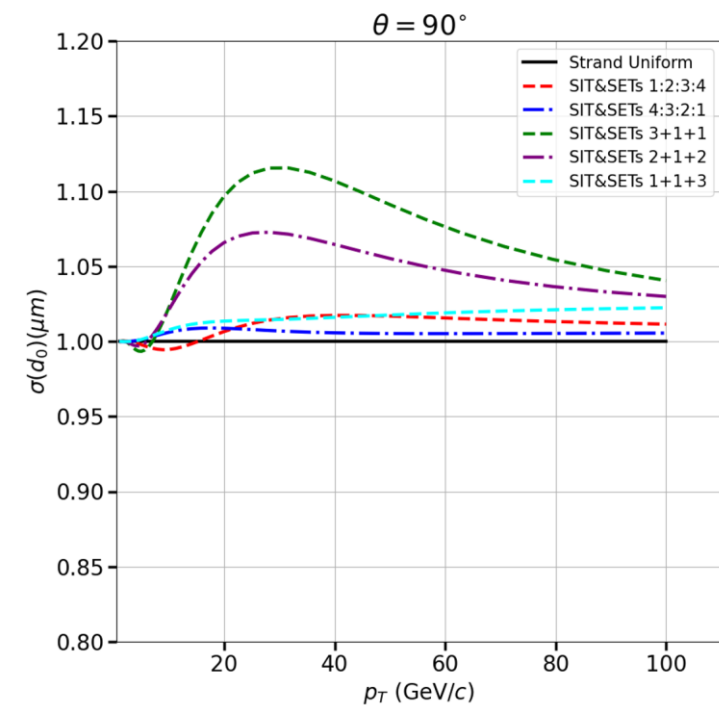
3.1 No space left for DC



here is SIT&SETs 1:2:3:4
while strand uniform means 1:1:1:1



3.1 No space left for DC



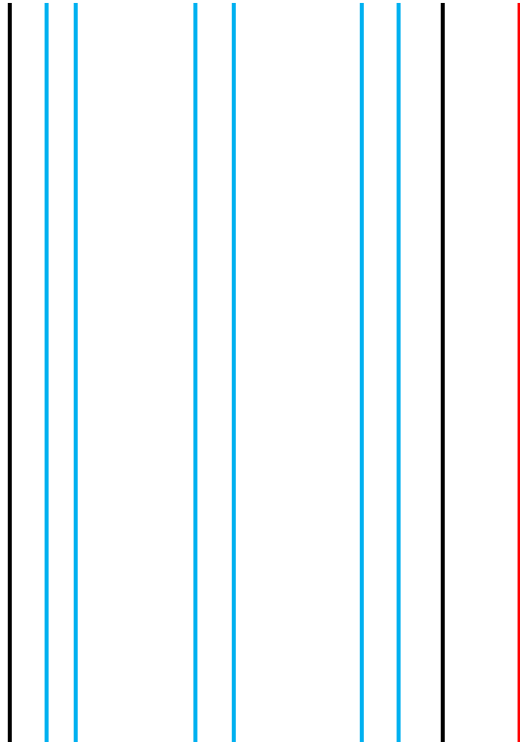
3.1 No space left for DC

Designs	Strand uniform	SIT&SET 1:2:3:4	SIT&SET 4:3:2:1	SIT&SET 3+1+1	SIT&SET 2+1+2	SIT&SET 1+1+3
Total area of detectors in barrel (mm^2)	1.0080e+08	7.8842e+07	1.3089e+08	6.5754e+07	1.1768e+08	1.6950e+08

3.2 Space left for DC

VTX

16, 18, 37, 39, 58, 60



beam pipe
14.5mm

VTX-shell
65.0mm

First SIT – 75.0mm
More 3 SITs
Last SET – 1811.0mm

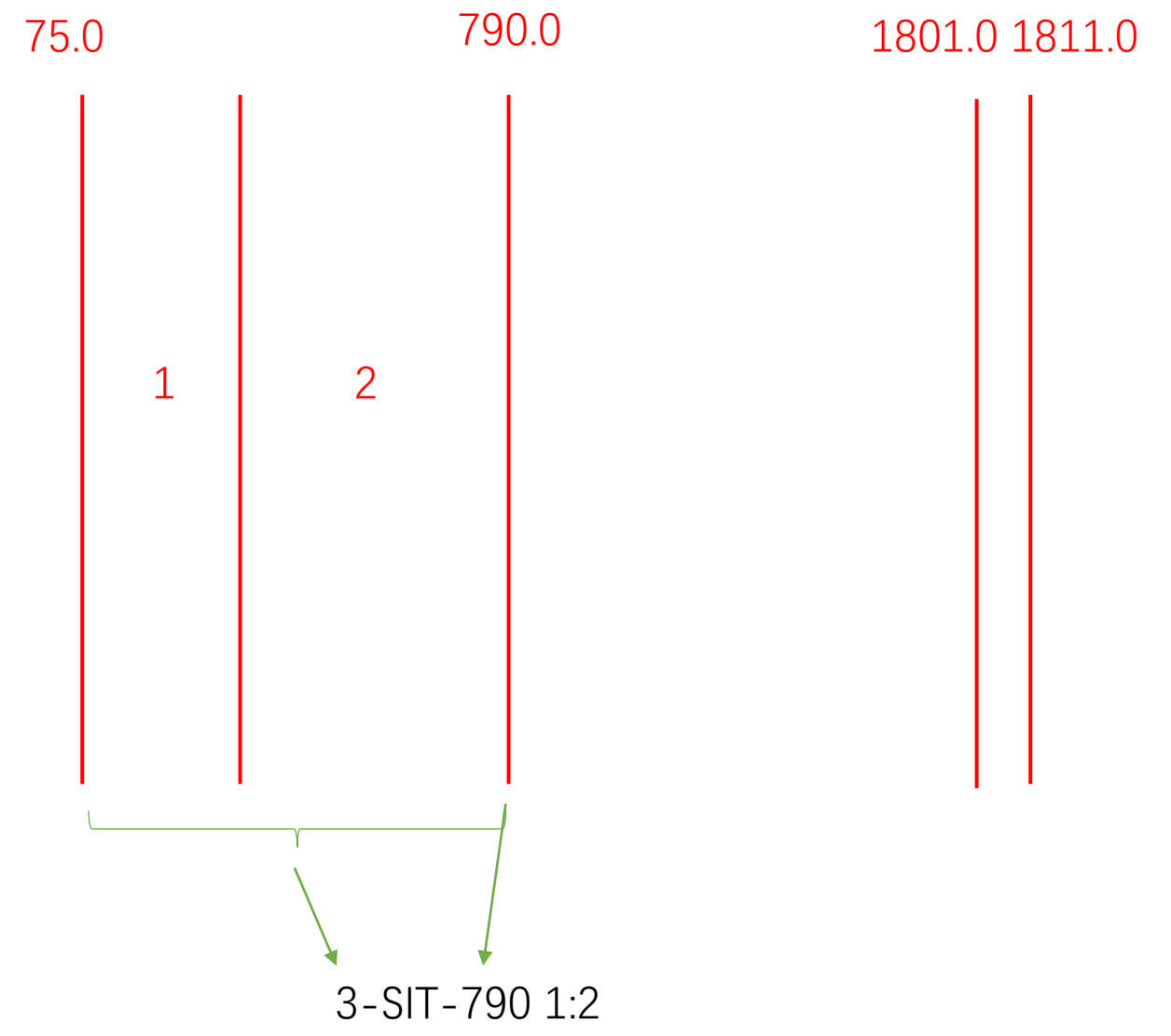
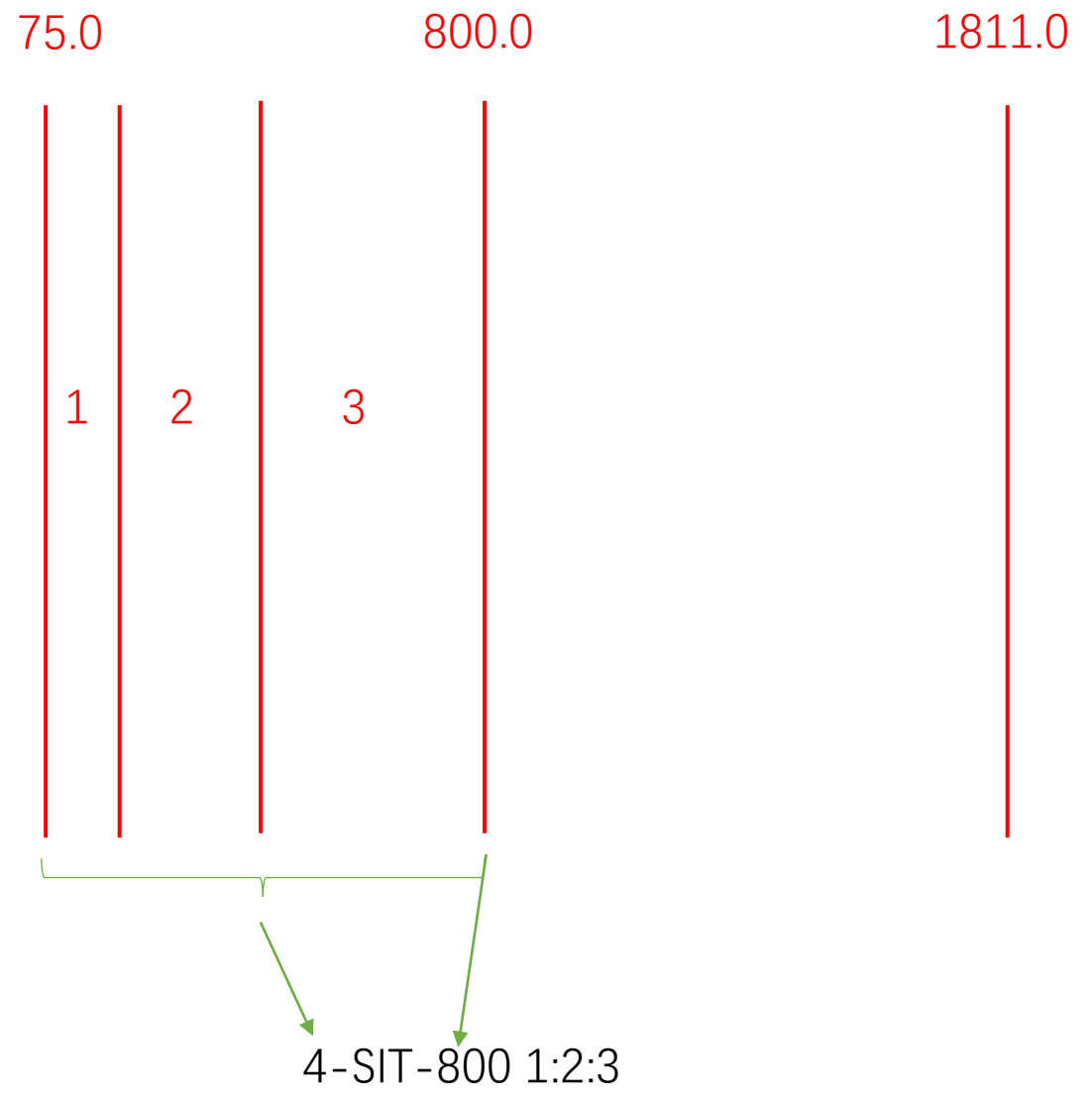
or

*First SIT – 75.0mm
More 2 SITs
More 1 SET – 1801.0mm
Last SET – 1811.0mm*

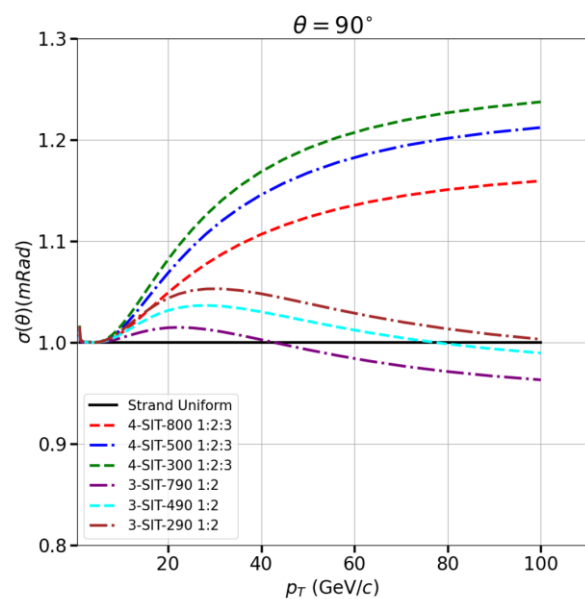
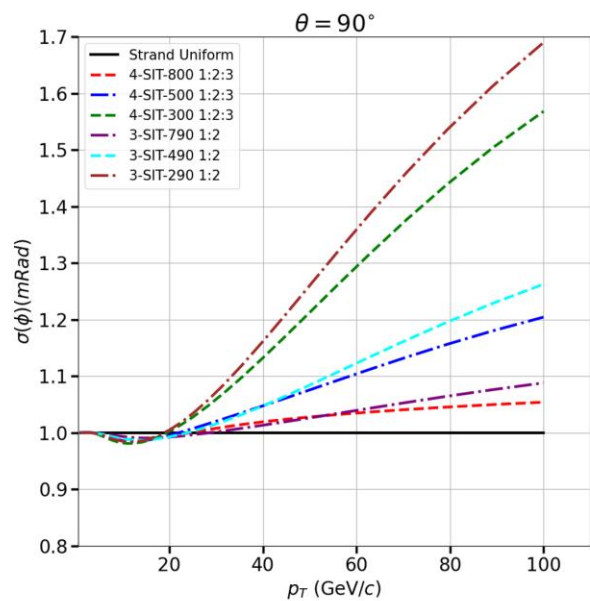
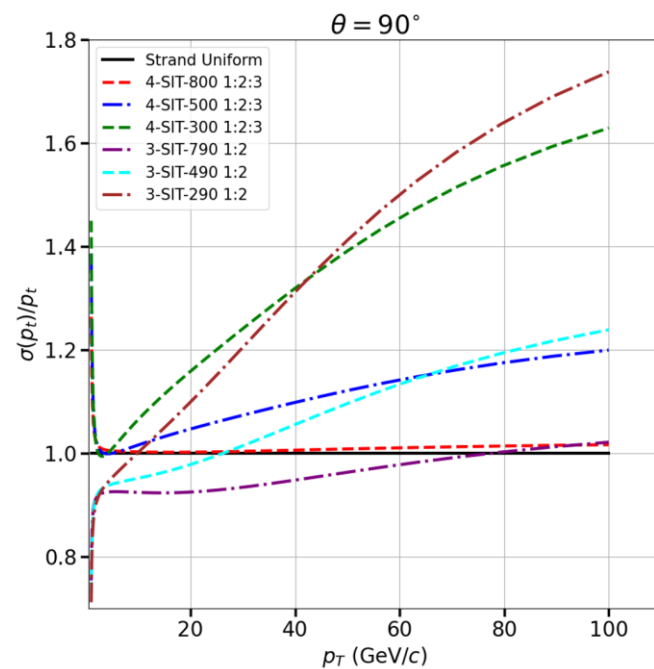
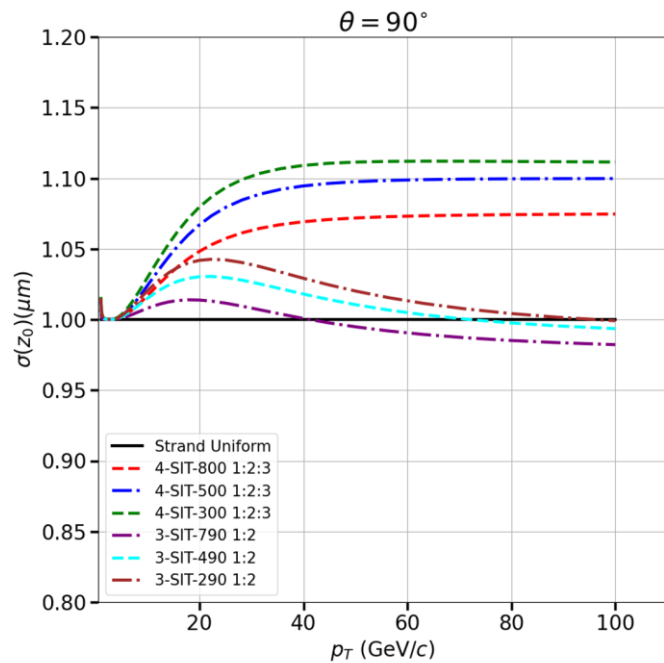
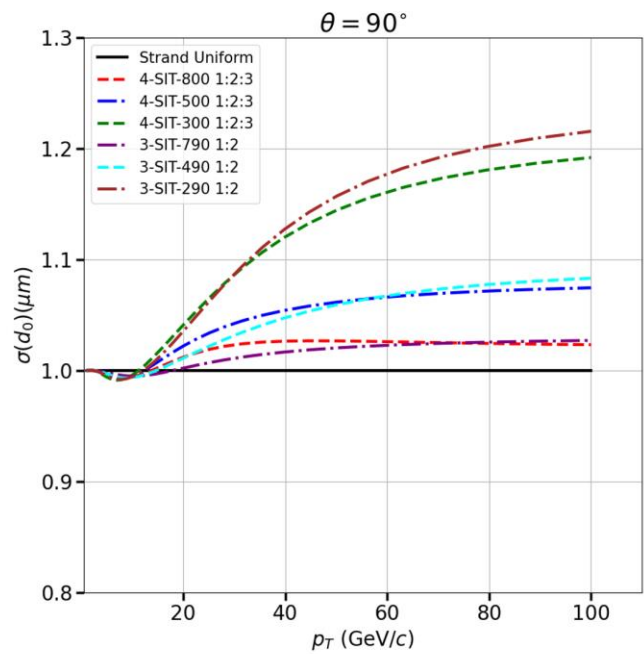
At least 1m
space left
for DC

But no DC
measuring
here
by now

3.2 Space left for DC



3.2 Space left for DC



3.2 Space left for DC

Designs	Strand uniform	4-SIT-800 1:2:3	4-SIT-500 1:2:3	4-SIT-300 1:2:3	3-SIT-790 1:2	3-SIT-490 1:2	3-SIT-290 1:2
Total area of detectors in barrel (mm^2)	1.0080e+08	6.6223e+07	5.8022e+07	5.4586e+07	1.1544e+08	1.0850e+08	1.0564e+08

3.3 Brief summary for SIT&SETs

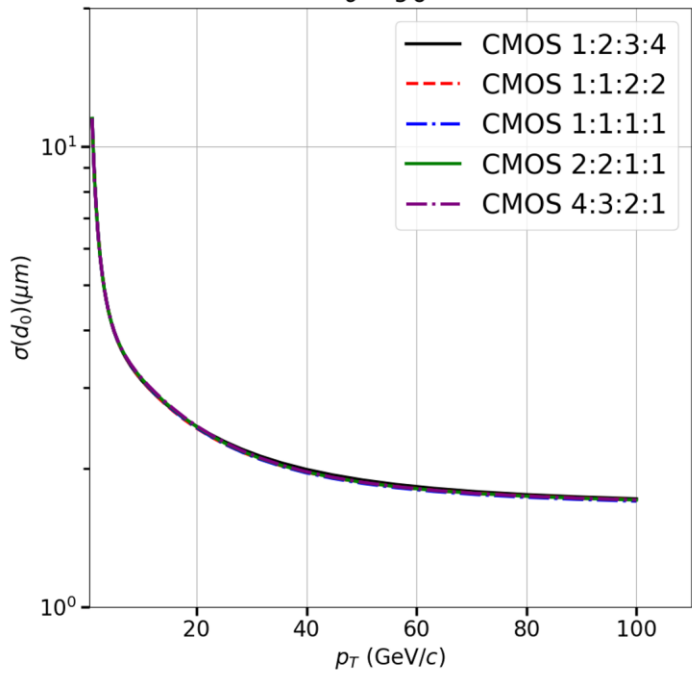
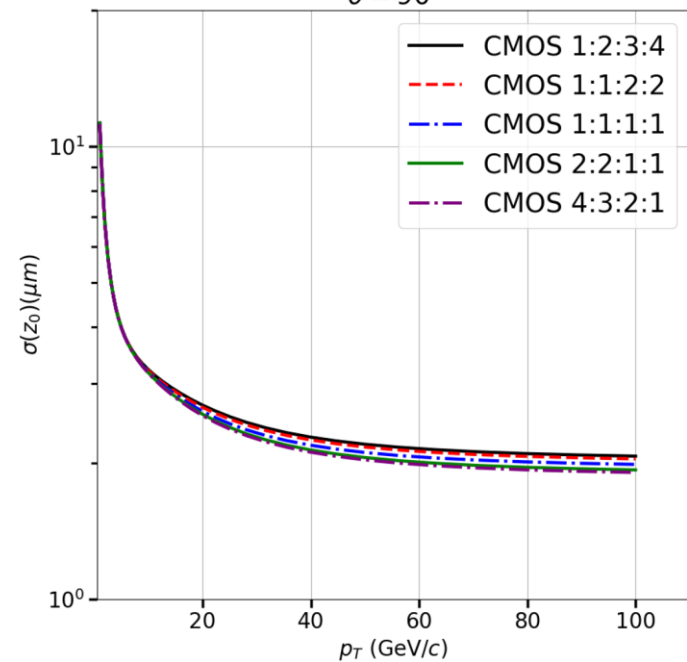
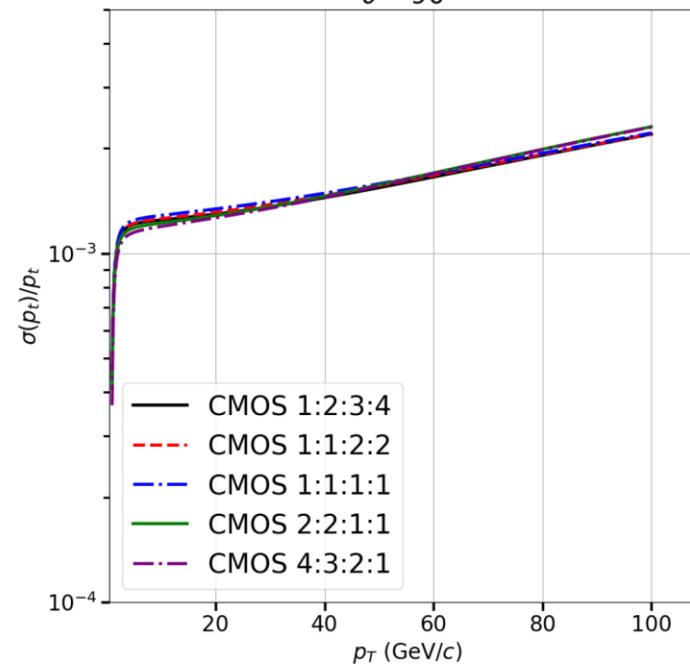
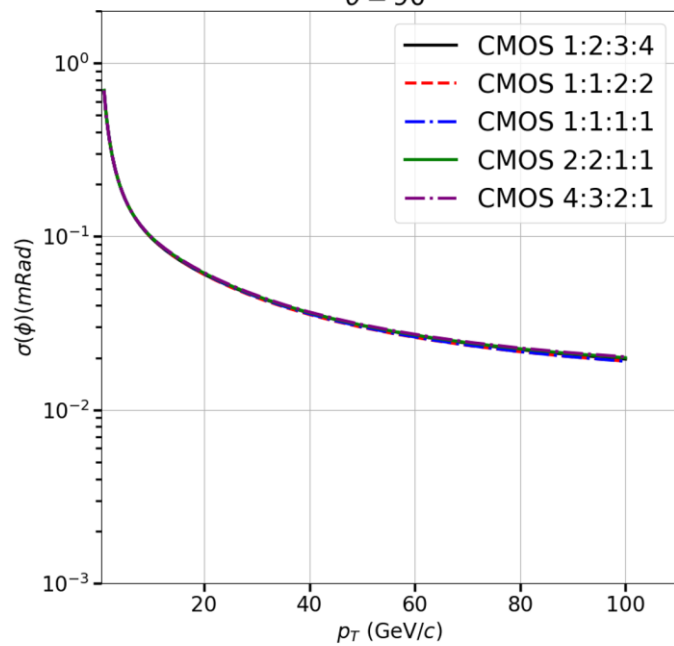
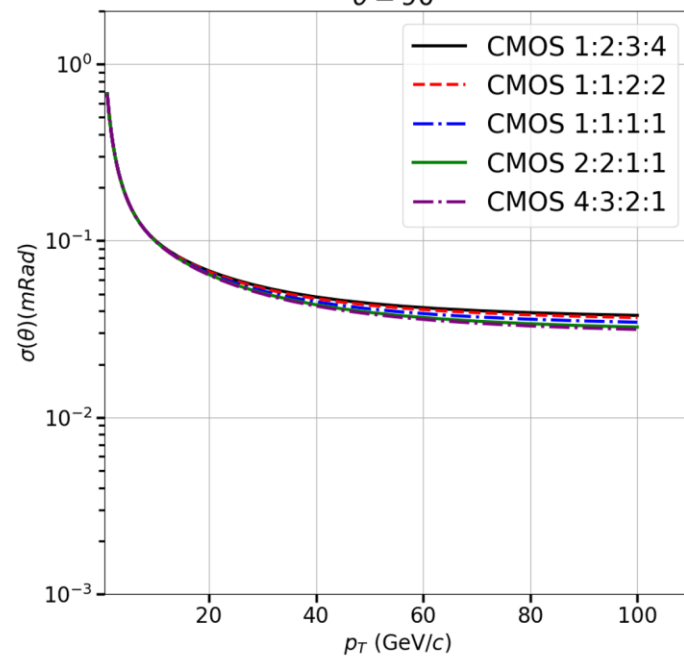
Mainly caring ΔP_t

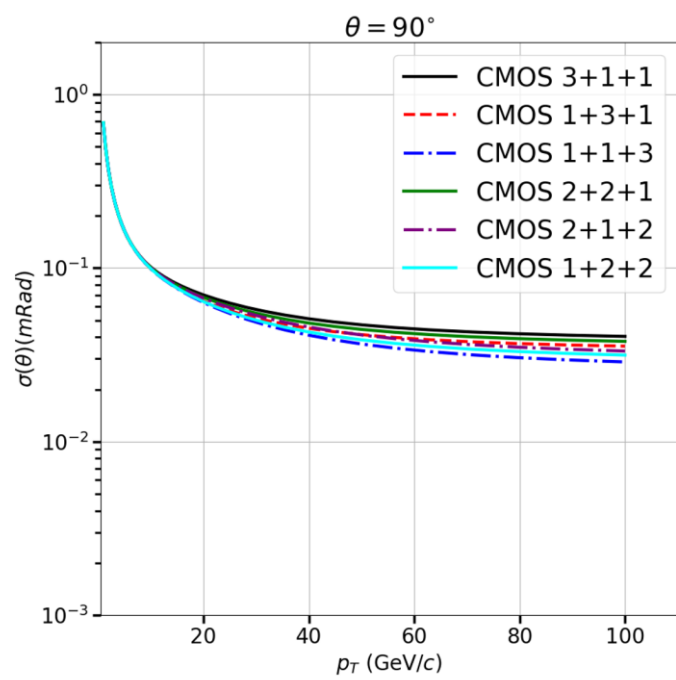
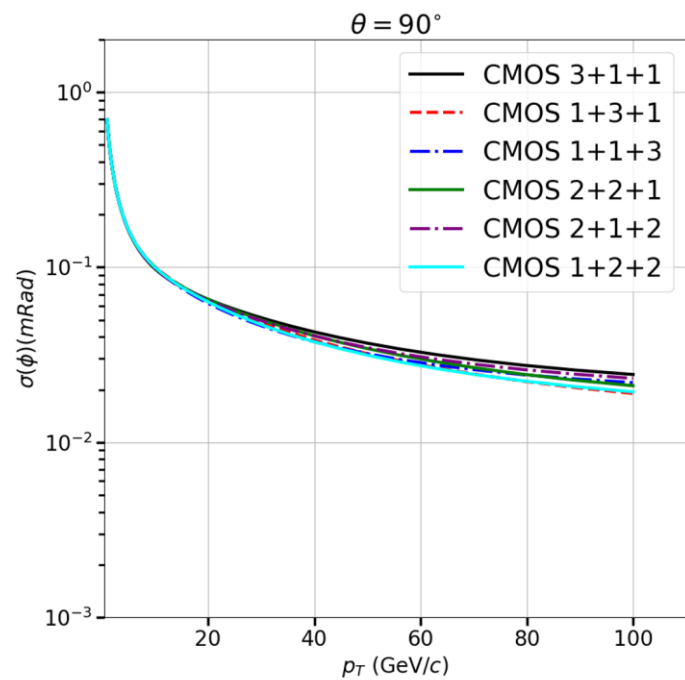
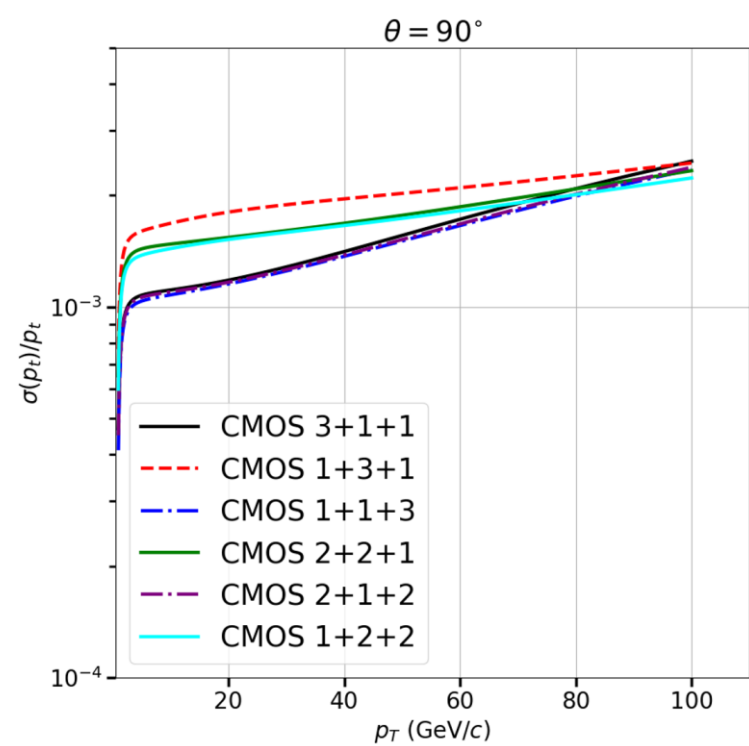
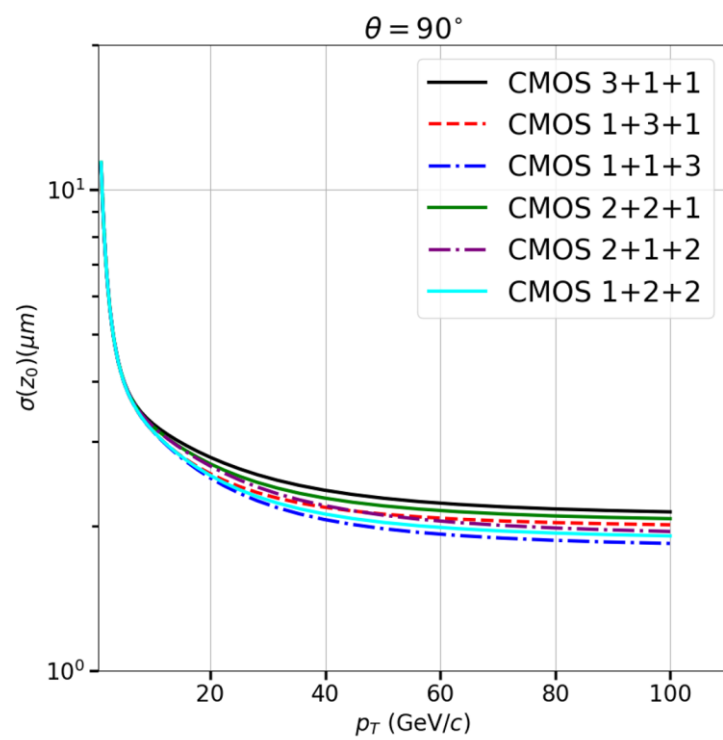
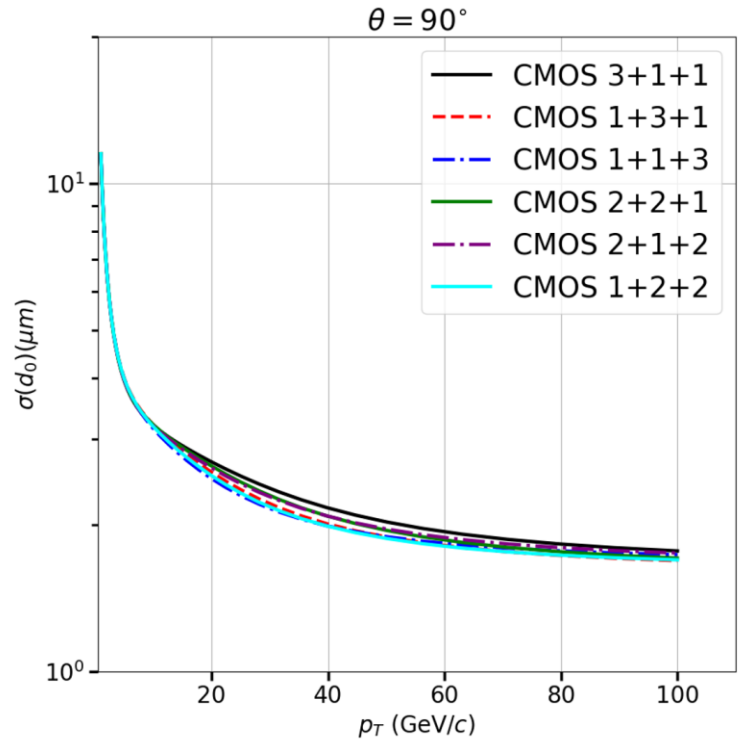
1. Tighter to the VTX of SITs design takes smaller resolution, with no much worse resolution of other parameters
2. Tighter to the VTX of SITs design takes less total area of detectors
3. If it comes to DC position
 - 3.1 Two SETs design could takes better resolution on P_t and z_0 obviously, but cause much more total area of detectors
 - 3.2 With space of SITs becoming smaller, resolution of each helix parameter becomes worse

thanks

Back up

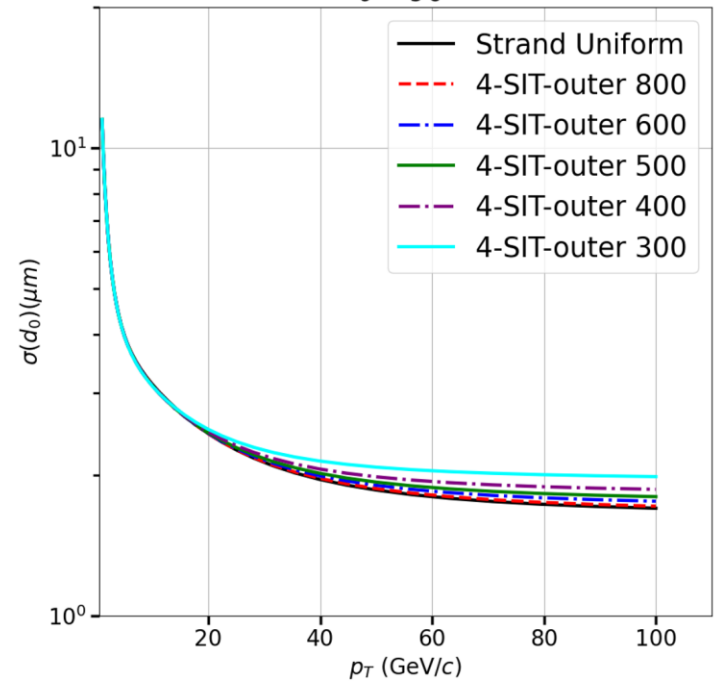
For : 3.1 No space left for DC

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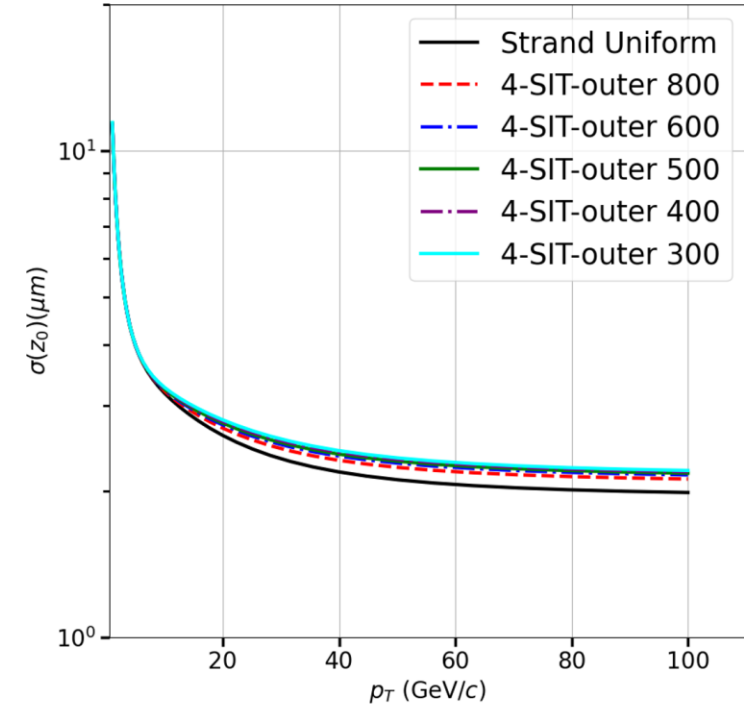


For : 3.2 Space left for DC

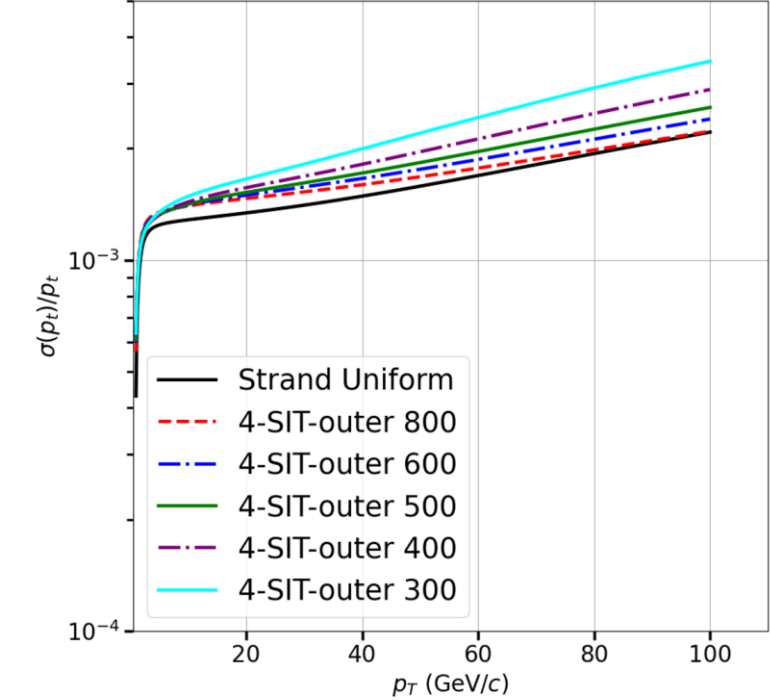
$\theta = 90^\circ$



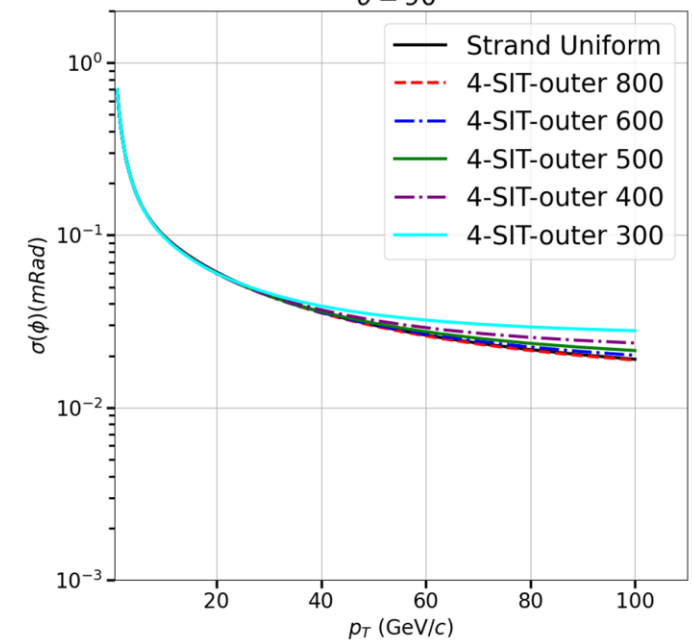
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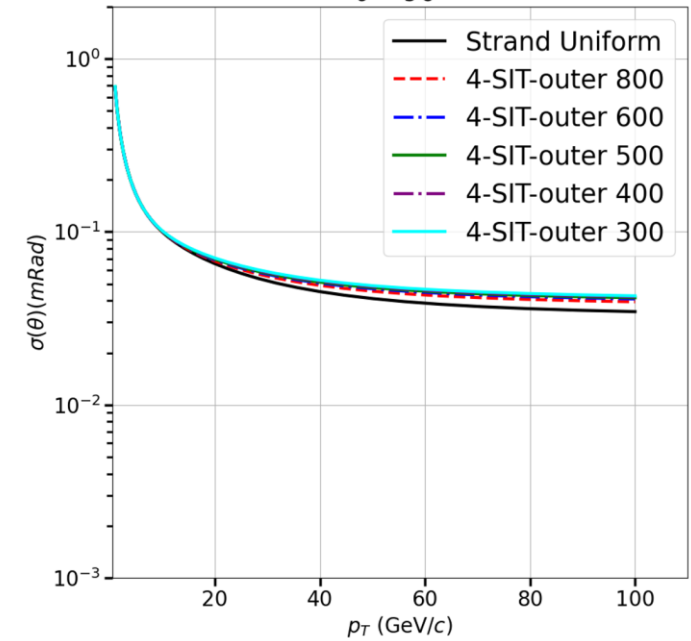
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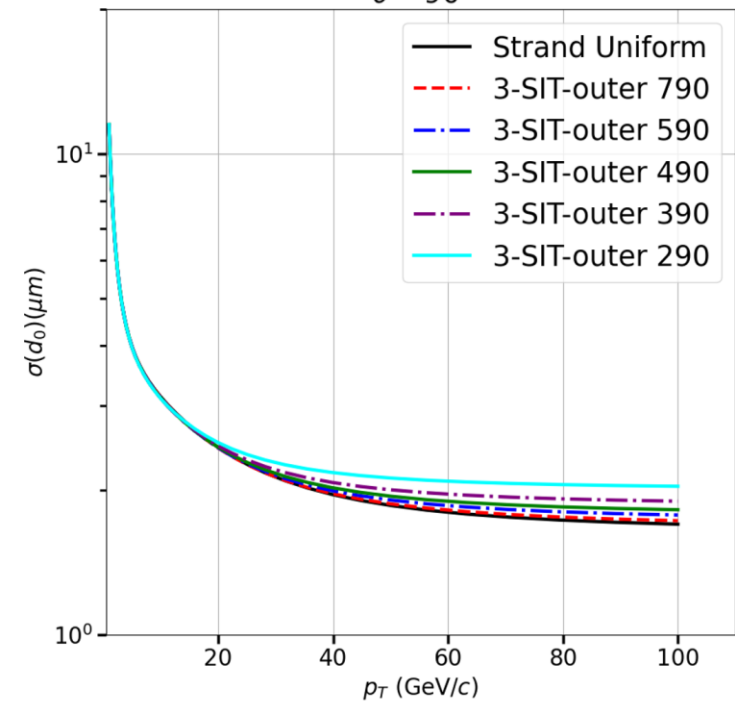
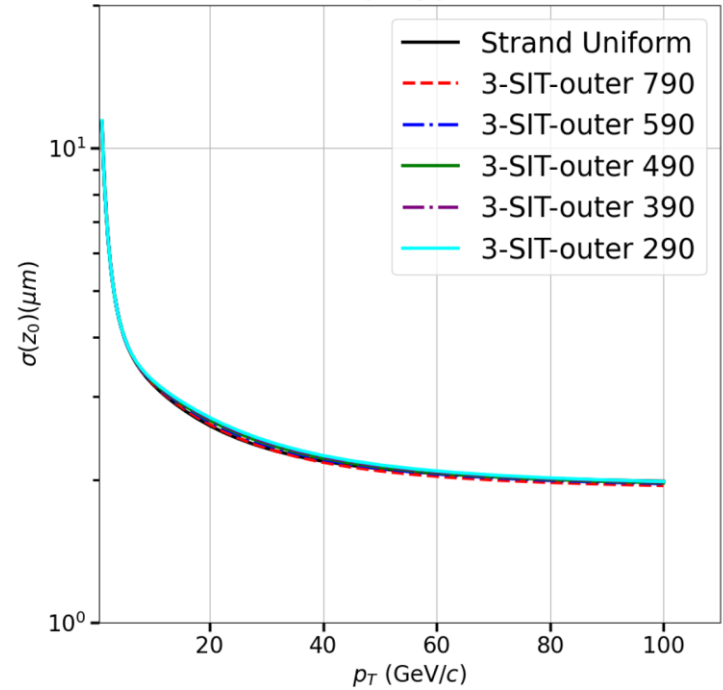
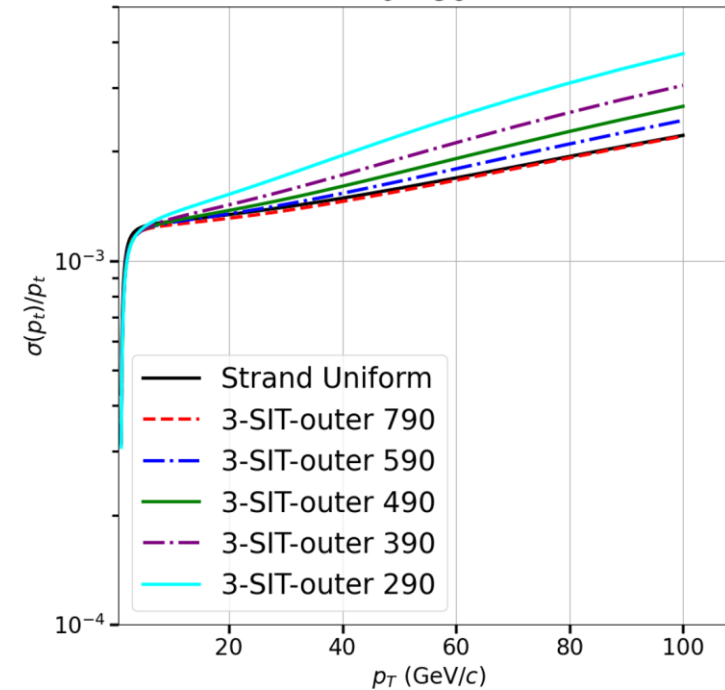
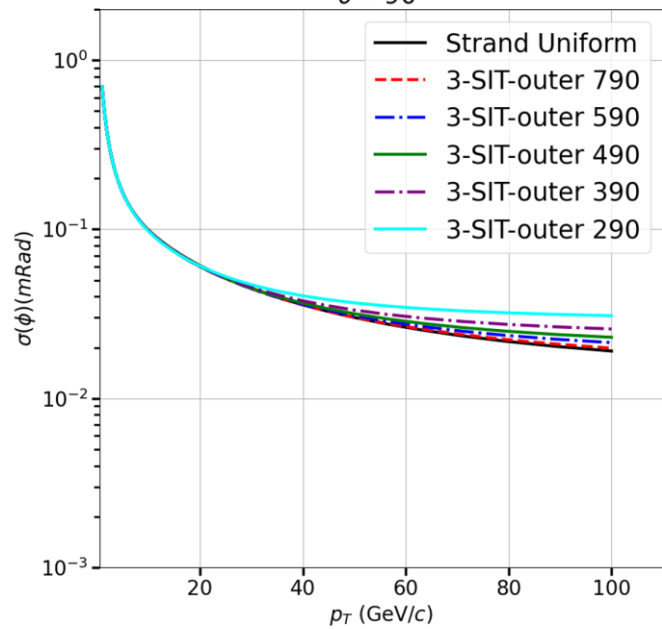
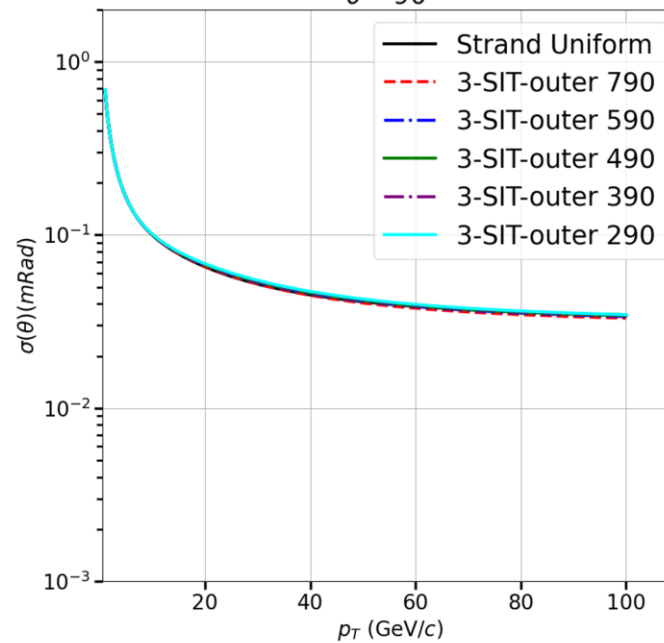


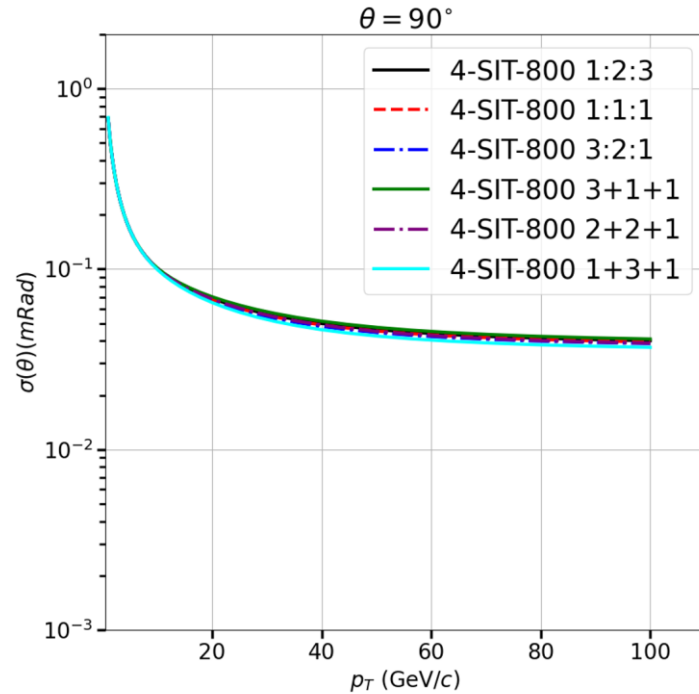
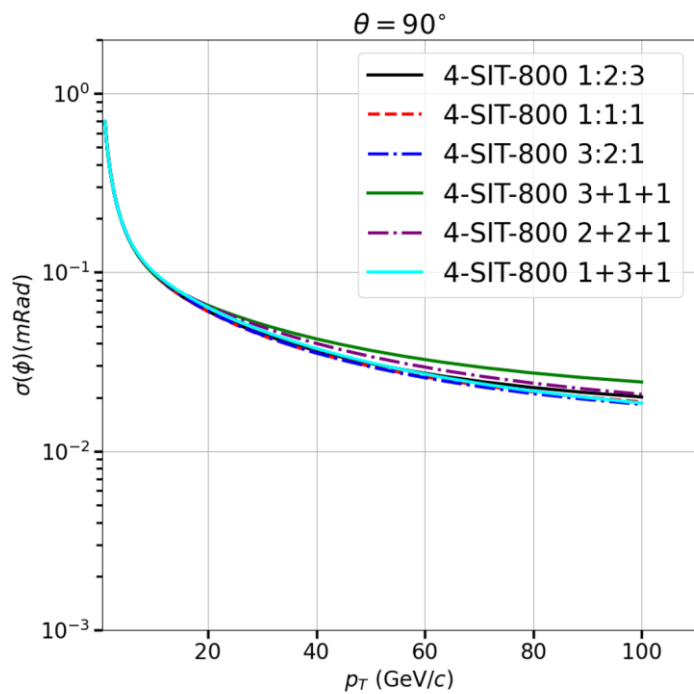
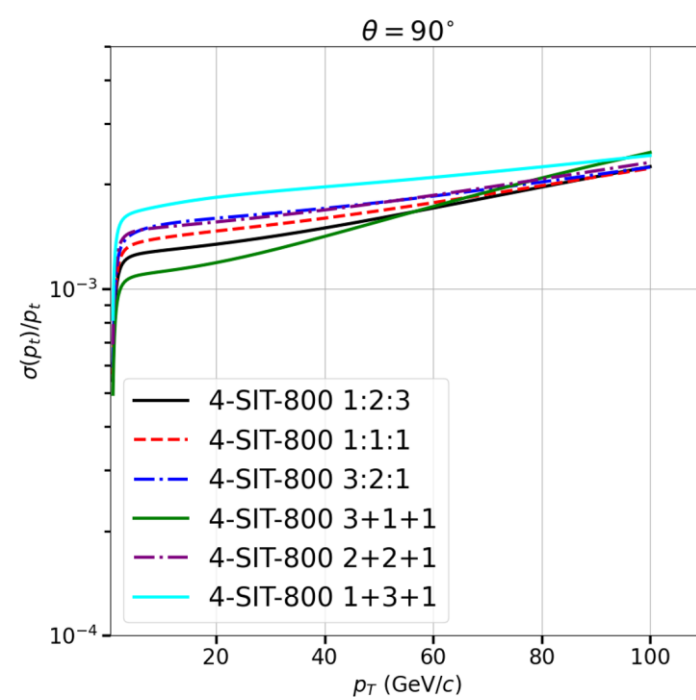
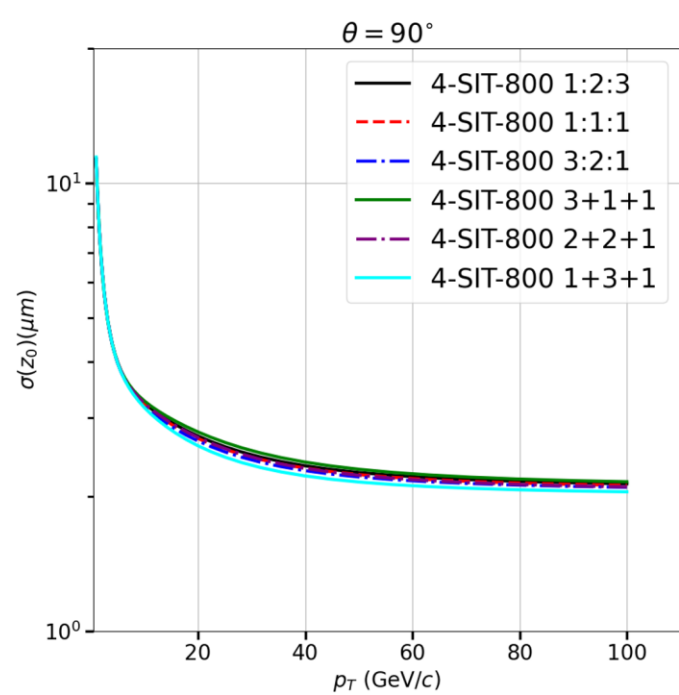
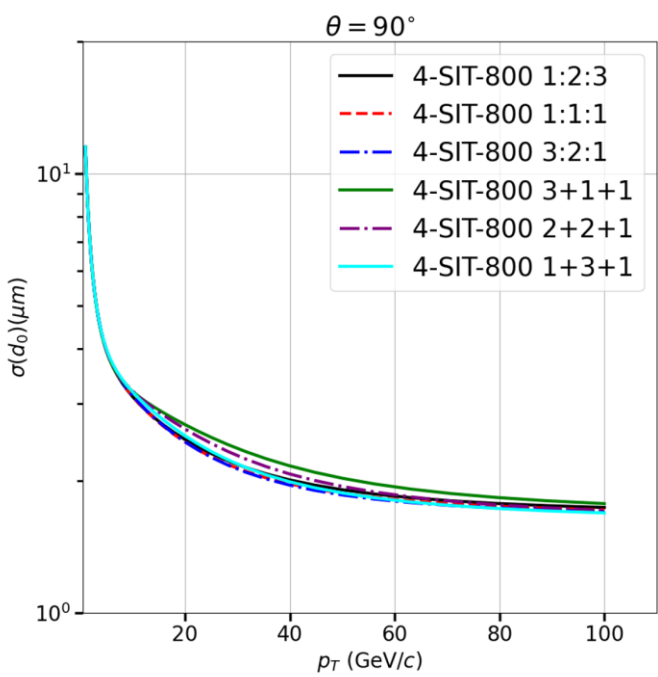
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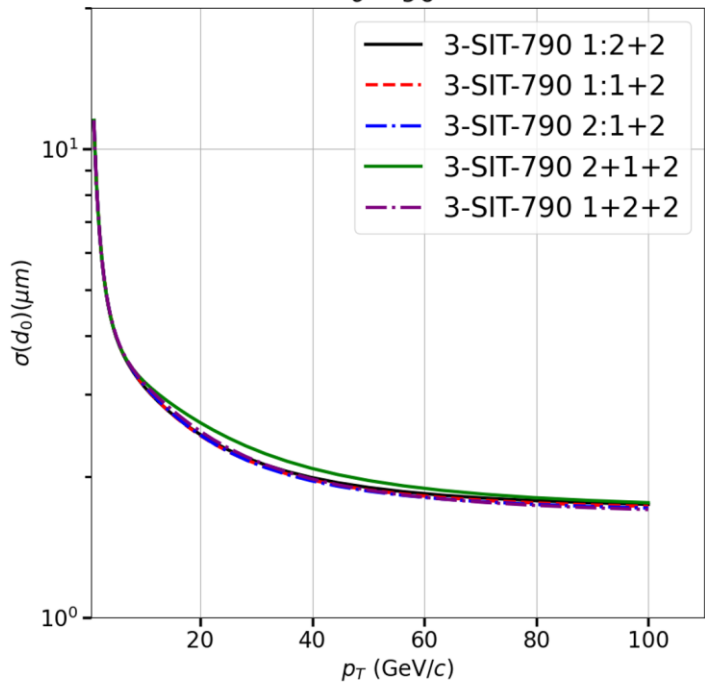
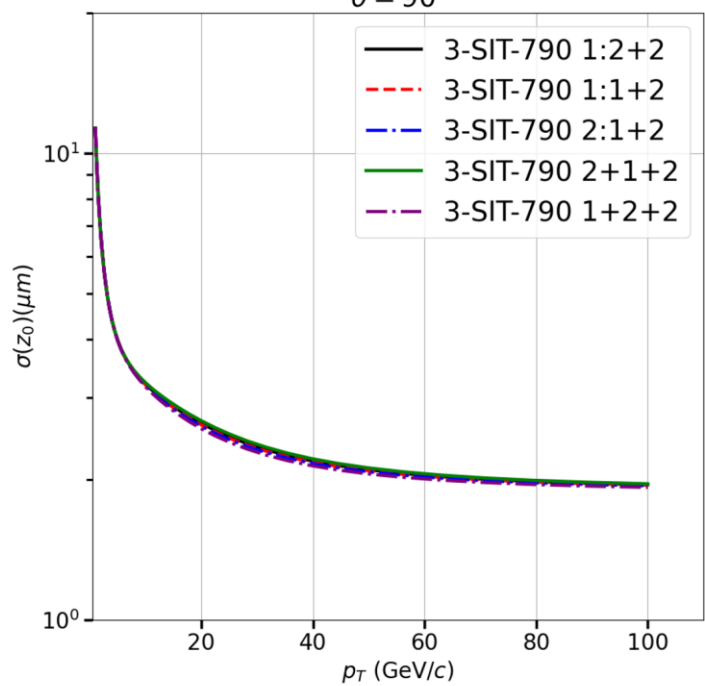
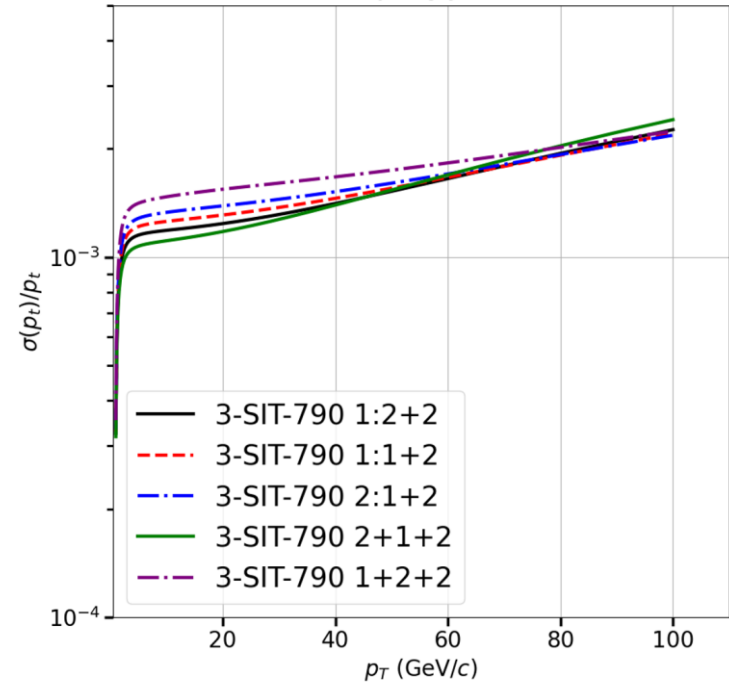
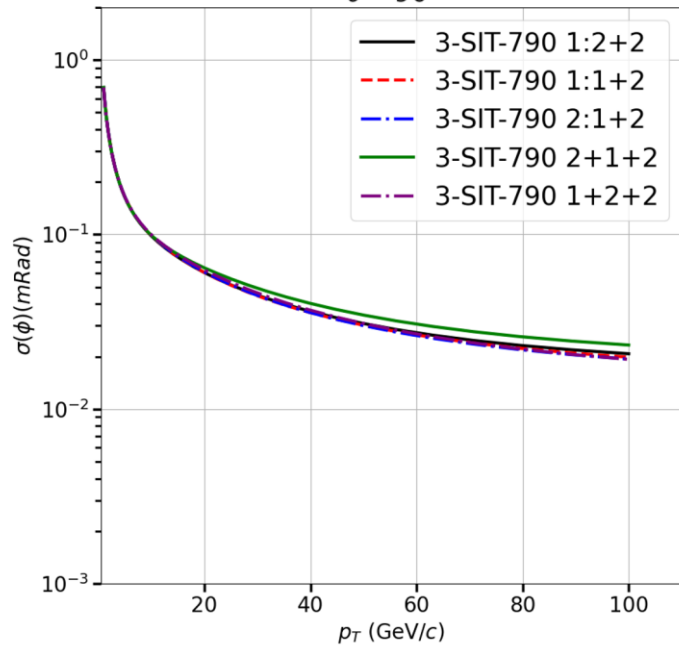


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