Recent status from LDT simulation

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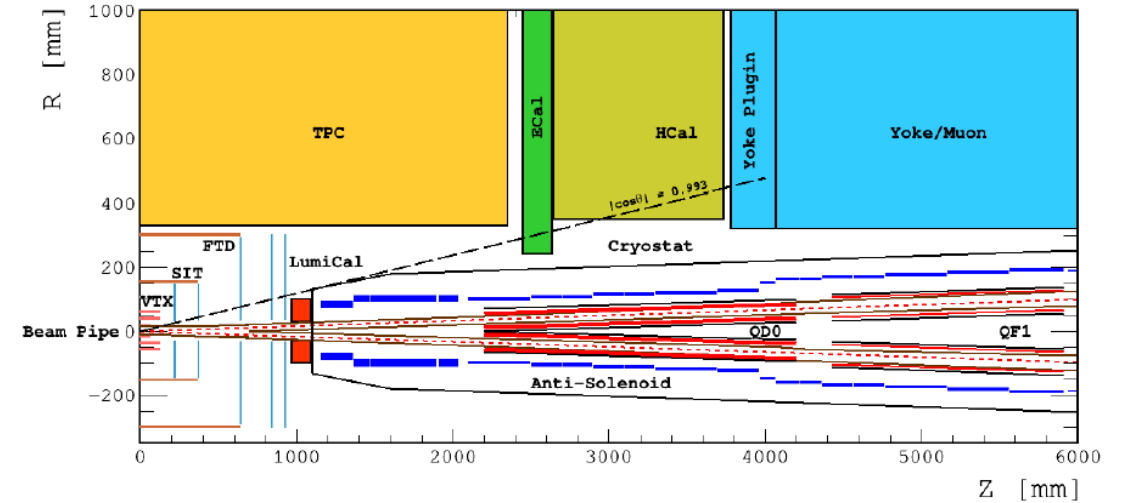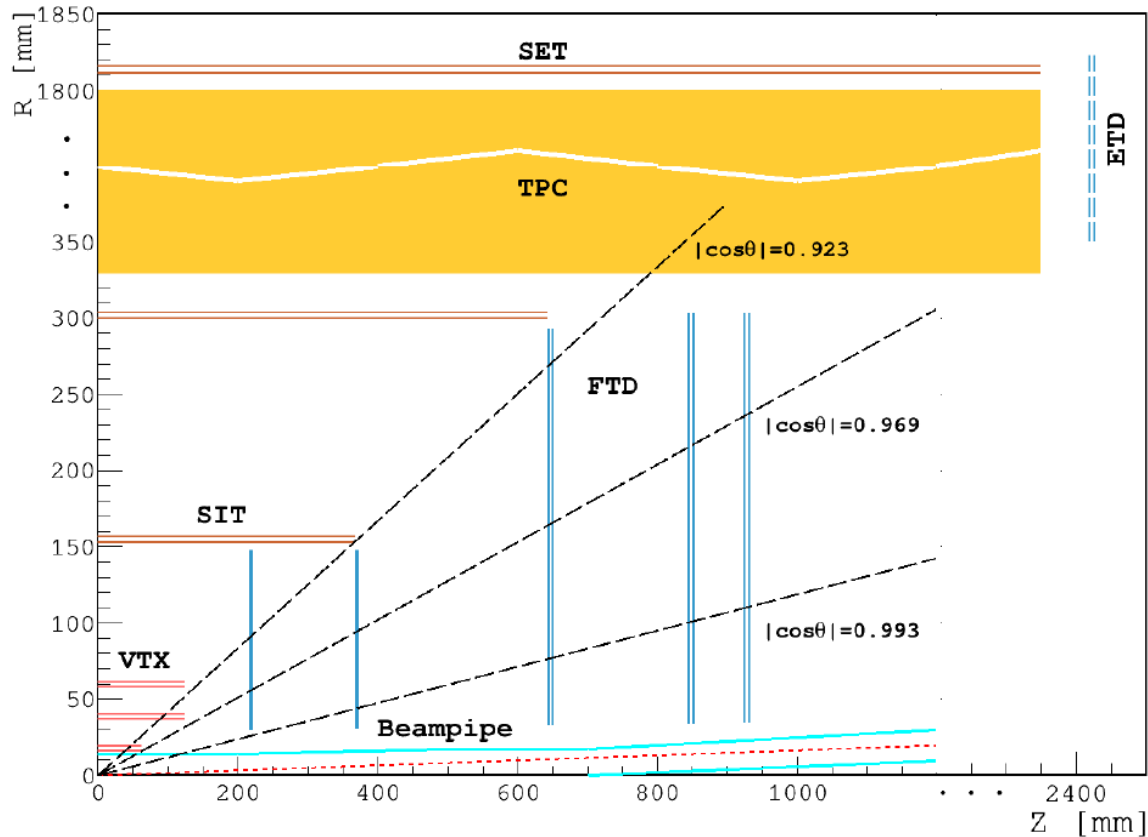-- From CDR, baseline concept geometry

Figure 9.1: Layout of the CEPC interaction region. The two beam pipes merge into one at $|z| = 70$ cm, with the central part between $z = \pm 7$ cm made with Beryllium. The two final focusing magnets (QD0 and QD1) are surrounded with the anti-solenoid magnets ssegmented into 22 sections. The magnets are placed inside the cryostat. The LumiCal (red) sitting in front of the cryostat provides precise luminosity measurement. Silicon tracking detectors, VTX and SIT, are in the barrel region, while FTD disks are covering the forward region.
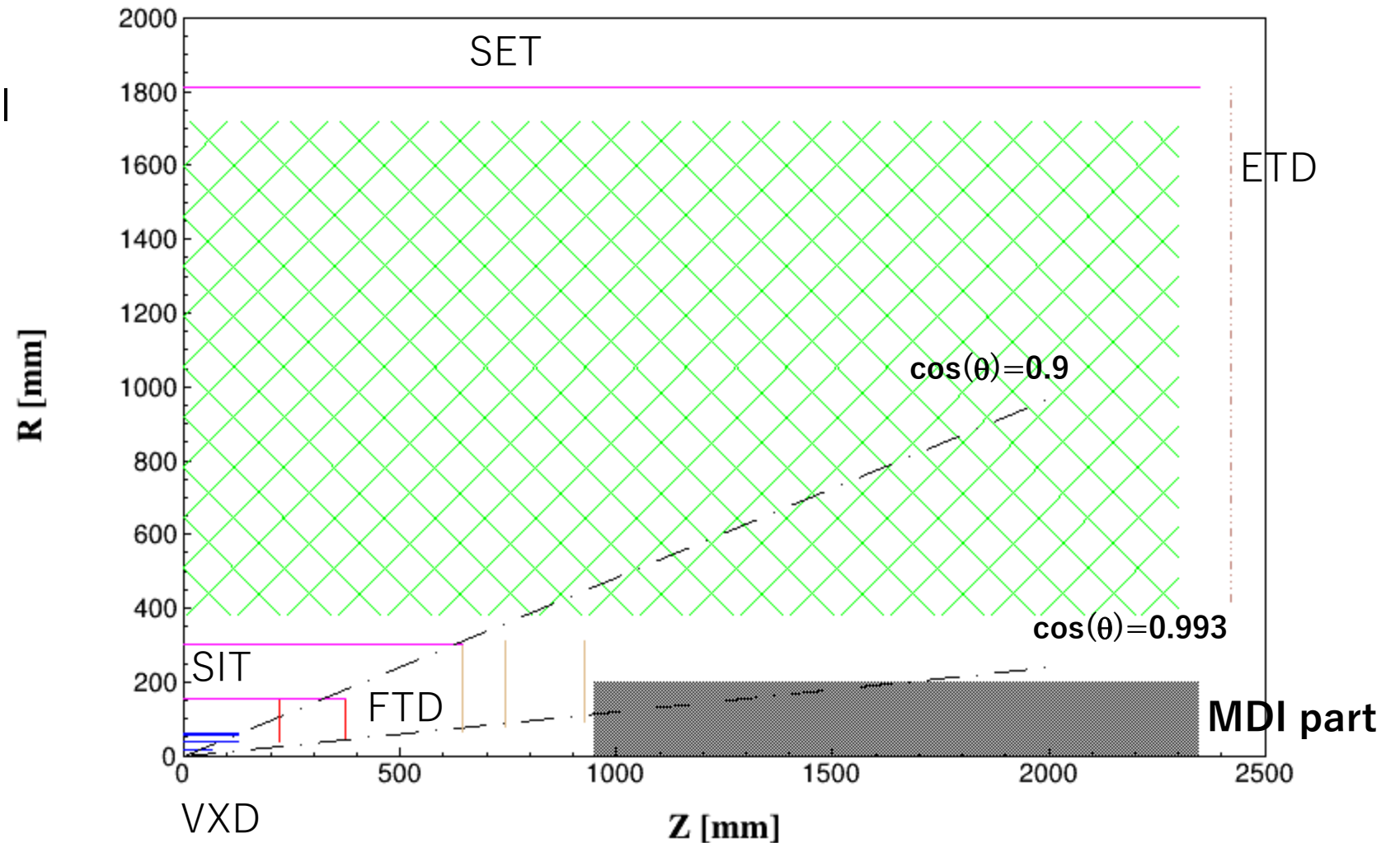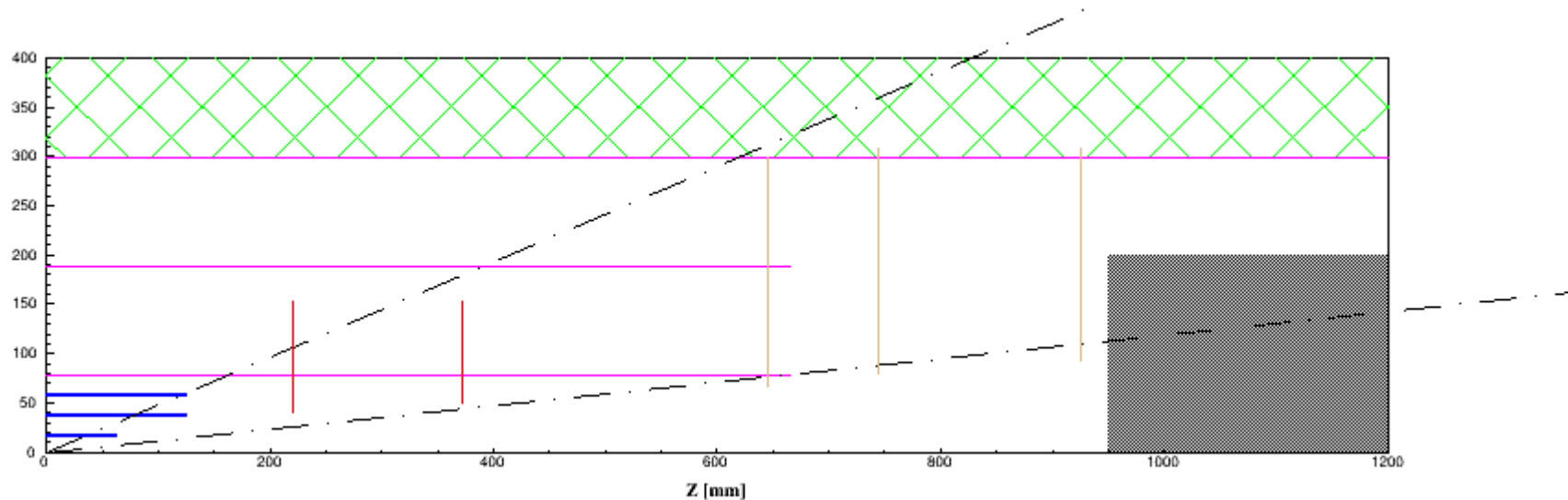
Redrawing :　Baseline Concept Geometry

Tracker :

-- two inner most FTD , pixel

-- other 3 FTD double layer

Coverage concept looks like :

-- barrel part covers $\cos(\theta)<0.9$

-- forward part covers $0.9<\cos(\theta)<0.993$

Barrel part is updated to recent "template" one

Conflict/overwr ap of detectors

SIT/FTD adjustment

length/position are adjusted (temporal)

arrange the position/length of forward detectors

(template)barrel geom.+ (cdr)forward geometry

(template)barrel geom. + (arranged)forward geometry
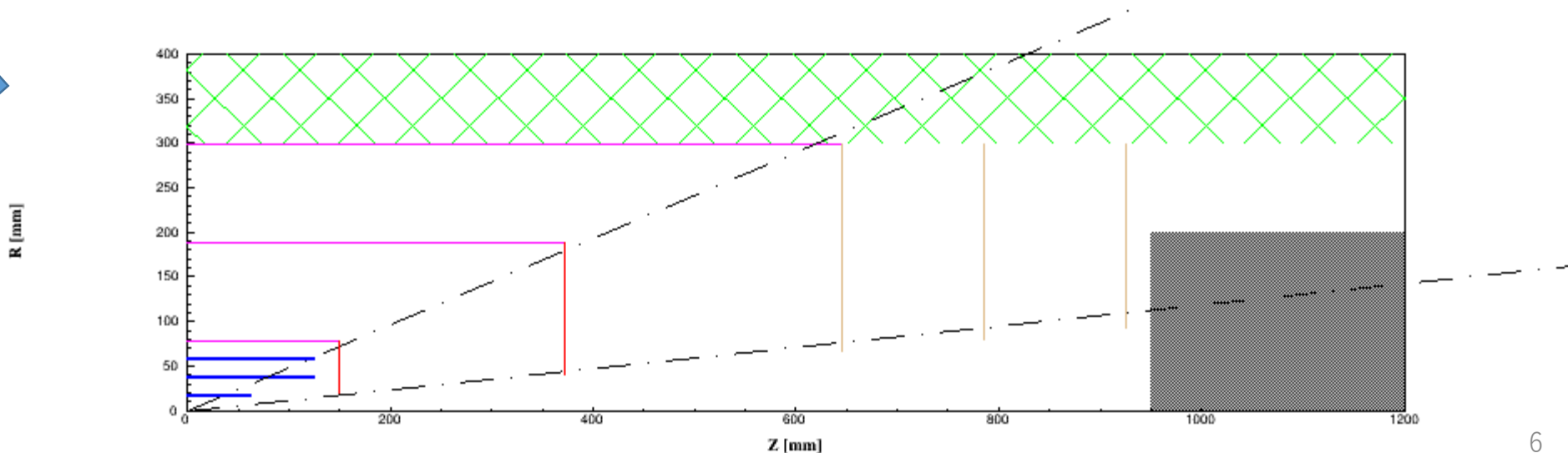
・FTD1,2 : pixel, FTD3-5 : double-layer is assumed in the CDR.

-> like the barrel part, pixel-like structure is assumed.
-> thickness/sigma are borrowed from that of barrel.

・ETD spatial geometry information is taken from the table in the CDR

Sub-detector	layer	+/-z(mm)	R(mm)	sigma_xy(mm)	sigma_z(mm)	X/X0(%)
BeamPipe	0	4225	14.5	---	---	0.15
vertex	1	62.5	16	0.0028	0.0028	0.15
vertex	2	62.5	18	0.006	0.006	0.15
vertex	3	125.	37	0.004	0.004	0.15
vertex	4	125.	39	0.004	0.004	0.15
vertex	5	125.	58	0.004	0.004	0.15
vertex	6	125.	60	0.004	0.004	0.15
VXTShell	7	145.	65	---	---	0.15
Si_pixel	8	371. → 150	78	0.0072	0.0866	0.65
Si_pixel	9	665 → 371	189	0.0072	0.0866	0.65
Si_pixel	10	2350 → 644	298	0.0072	0.0866	0.65
DC	11-160	2350	300-1800	0.1000	2/9999	1.20 (inner wall 0
Si_pixel	161	2350	1811	0.0072	0.0866	0.65

Sub-detector	layer	z(mm)	Rmin(mm)	Rmax(mm)	sigma_u(mm)	sigma_v(mm)	X/X0(%)
FTD	1	150	20	77.9	3	3	0.15
FTD	2	372	40	188.9	3	3	0.15
FTD	3	645	66.49	298.9	0.0072	0.0866	0.65
FTD	4	785	79.25	298.9	0.0072	0.0866	0.65
FTD	5	925	92.67	298.9	0.0072	0.0866	0.65
ETD	(6)	2420	419.3	1822.7	0.0072	0.0866	0.65

Detector		Radius R [mm]	$\pm z$ [mm]	Material budget [X_0]
SIT	Layer 1	153	371.3	0.65%
	Layer 2	300	664.9	0.65%
SET	Layer 3	1811	2350	0.65%
		R_{in}	R_{out}		
FTD	Disk 1	39	151.9	220	0.50%
	Disk 2	49.6	151.9	371.3	0.50%
	Disk 3	70.1	298.9	644.9	0.65%
	Disk 4	79.3	309	846	0.65%
	Disk 5	92.7	309	1057.5	0.65%
ETD	Disk	419.3	1822.7	2420	0.65%

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LDT forward detector input

- u/v – 90 degree. → .. u=ϕ, v=R
- sigma of u (ϕ direction) is set as good (7.2μm)
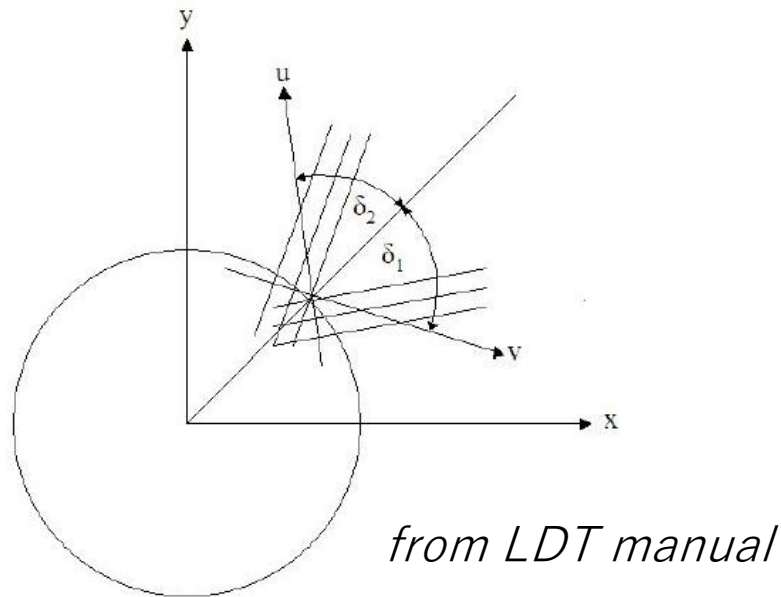- sigma of v (R direction) is worse

Figure 7: Definition of forward coordinates u and v.

from LDT manual

(・ shallow stereo angle (5deg) is also possible)

```
01 LiC Detector-Toy
02 Default Forward Input sheet
03 Version:                     070820
04 Forward module 1
05
06 Number of layers           :  2
07 Description (optional)      :  |------------------------FTD---------------|
08 Names of the layers (opt.):   FTD1,       FTD2
09 z positions [mm]           :   150.0,      372.0
10 Inner radius [mm]          :   20.0,       40.0
11 Outer radius [mm]          :   77.9,       188.9
12 Efficiency u               :   1.00,       1.00
13 Efficiency v               :   1.00,       1.00
14 Angle 1st coord. (u) [Rad]:   0
15 Angle 2nd coord. (v) [Rad]:   pi/2,       pi/2
16 Thickness [rad. lengths]  :   0.0015,     0.0015
17 error distribution         :   0
18 0 normal-sigma(u) [1e-6m] :   3
19        sigma(v) [1e-6m] :   3
20 1 uniform-d(u) [1e-6m]     :
21        d(v) [1e-6m]     :
22
23 Forward module 2
24
25 Number of layers           :  4
26 Description (optional)      :  |------------------------FTD---------------------|
27 Names of the layers (opt.):   FTD3,          FTD4,          FTD5,          ETD,
28 z positions [mm]           :   645.0,         785.0,         925.0,         2420.0,
29 Inner radius [mm]          :   66.49,         79.25,         92.67,         419.3,
30 Outer radius [mm]          :   298.9,         298.9,         298.9,         1822.7,
31 Efficiency u               :   1.00,          1.00,          1.00,          1.00,
32 Efficiency v               :   1.00,          1.00,          1.00,          1.00,
33 Angle 1st coord. (u) [Rad]:   0
34 Angle 2nd coord. (v) [Rad]:   pi/2,          pi/2,          pi/2,          pi/2,
35 Thickness [rad. lengths]  :   0.0065,        0.0065,        0.0065,        0.0065,
36 error distribution         :   0
37 0 normal-sigma(u) [1e-6m] :   7.2
38        sigma(v) [1e-6m] :   86.6
39 1 uniform-d(u) [1e-6m]
40        d(v) [1e-6m]     :
41
42 Rear module 1
43
44 Number of layers           :  -1
45 Description (optional)      :
```
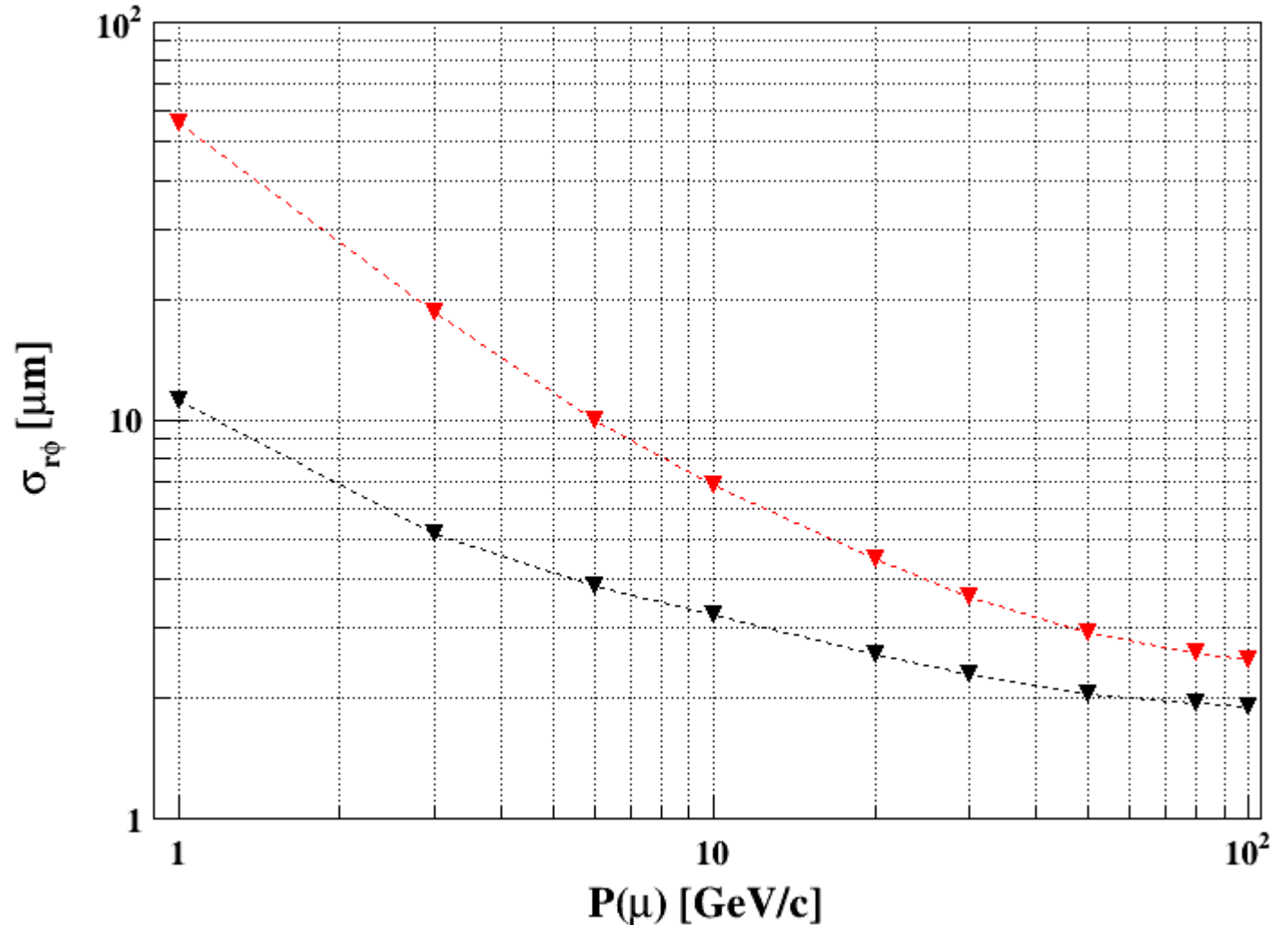
Particle Injection direction for forward region
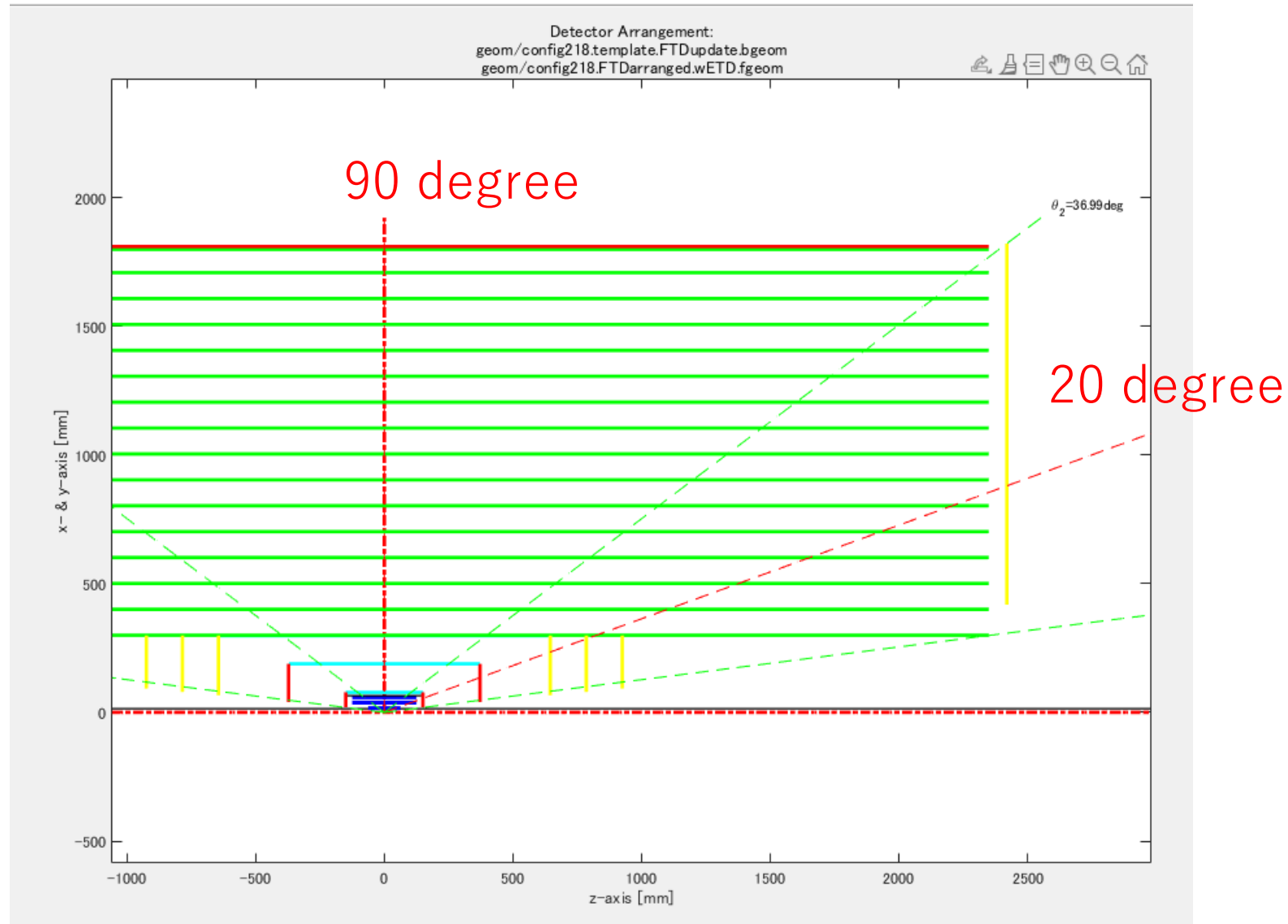
IP resolution with updated geometry

▲ : 20 degree incident
(forward track)

▲ : 90 degree incident
(barrel track : which is from
past results)

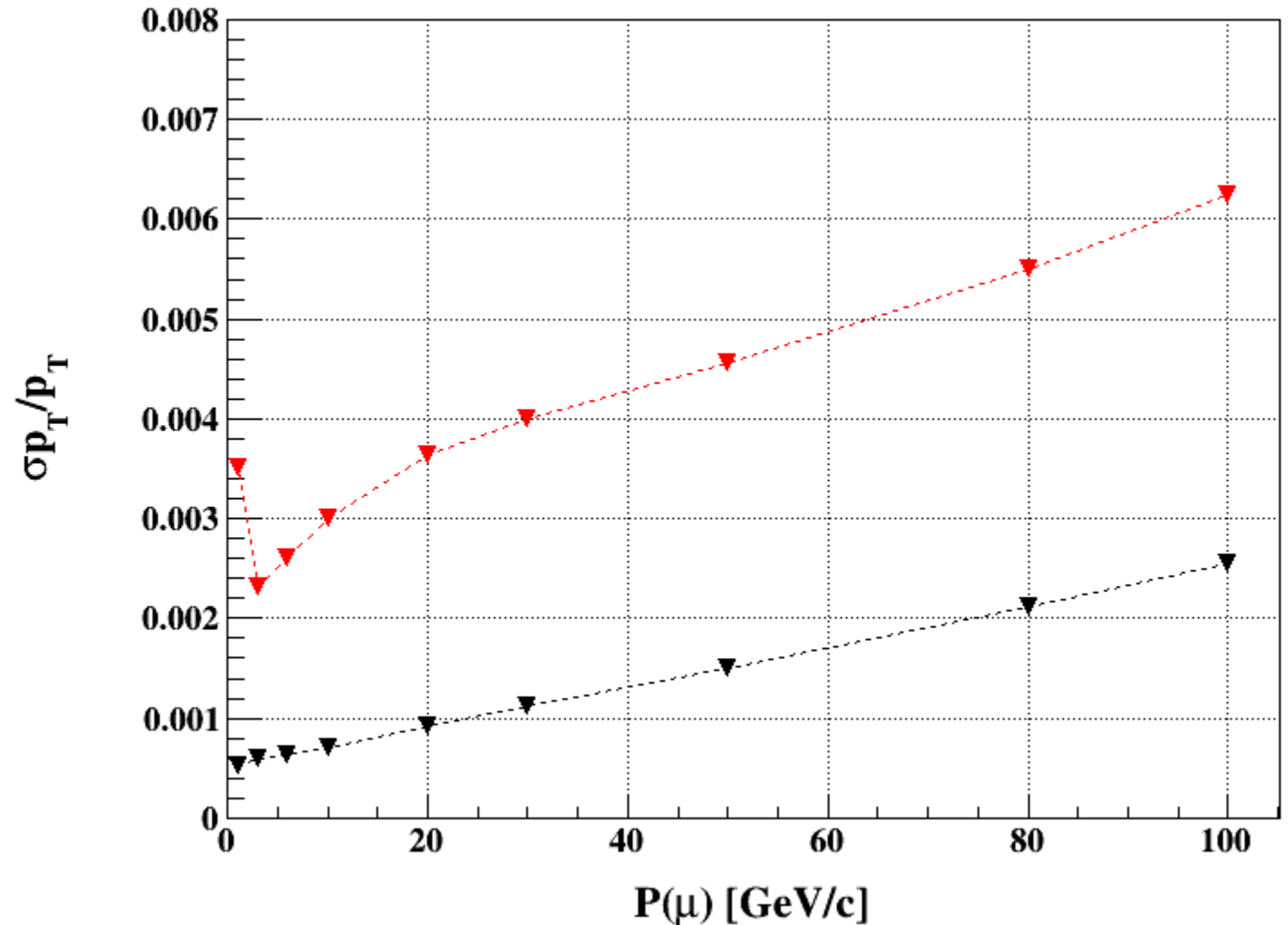IP resolution seems to be
almost the same as that in the
CDR

Momentum resolution with updated geometry

▲ : 20 degree incident

▲ : 90 degree incident

・ At p=1 GeV, a jump can be seen for 20 degree (forward track) incident. Partially it is due to a difference of number of DCH hits. Probably there will be more reasons.

Summary

・ Tracker geometry in the forward region is adjusted to recent updated barrel geometry

Next

・ Changing/Adjusting parameters

・ Angular dependency of i.e. number of hits, thickness, etc.