

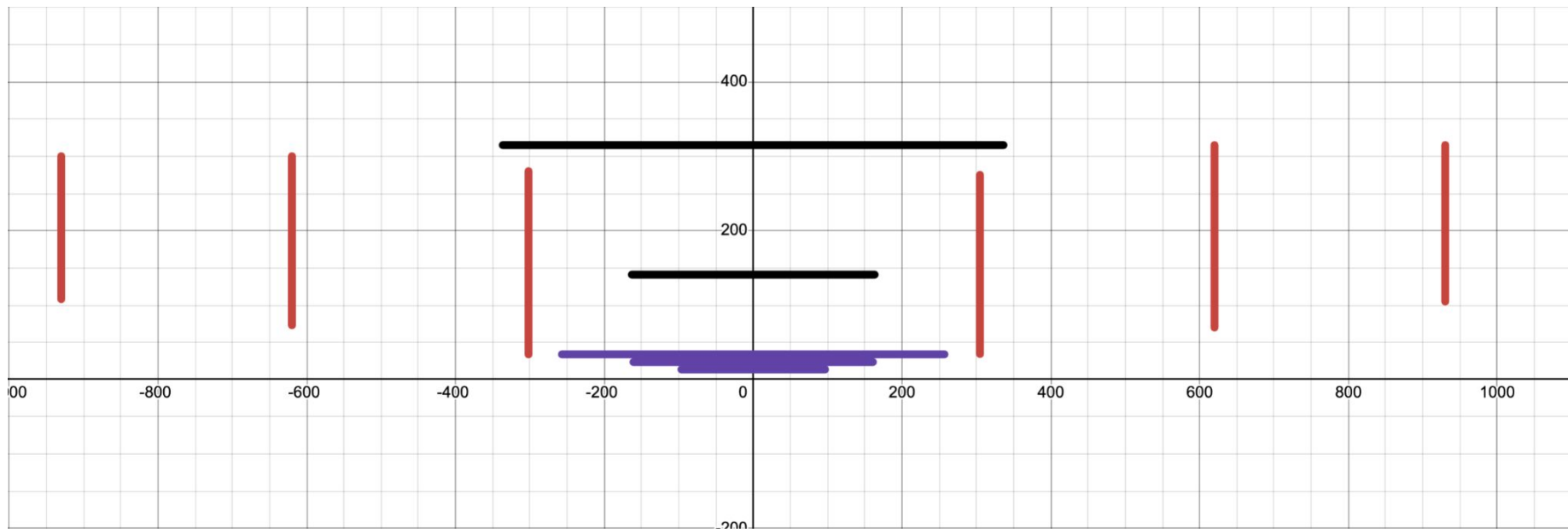
Week of 14/07/25 - 18/07/2025

Estrella Cayuelas Solano

IDEA_base25_v03_filler

Baseline as of 17/07/2025

IDEA_base25_v03_filler: configuration

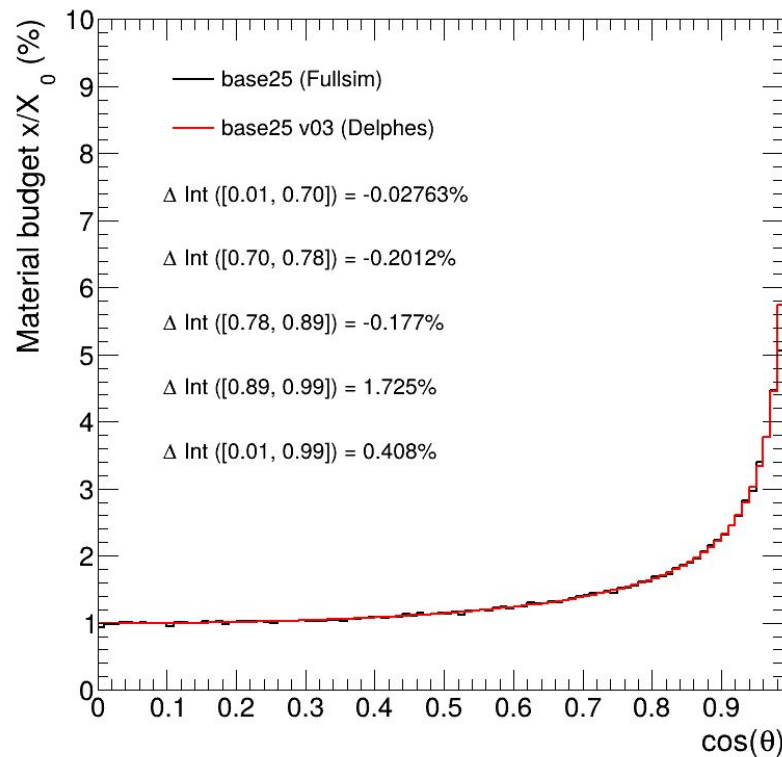
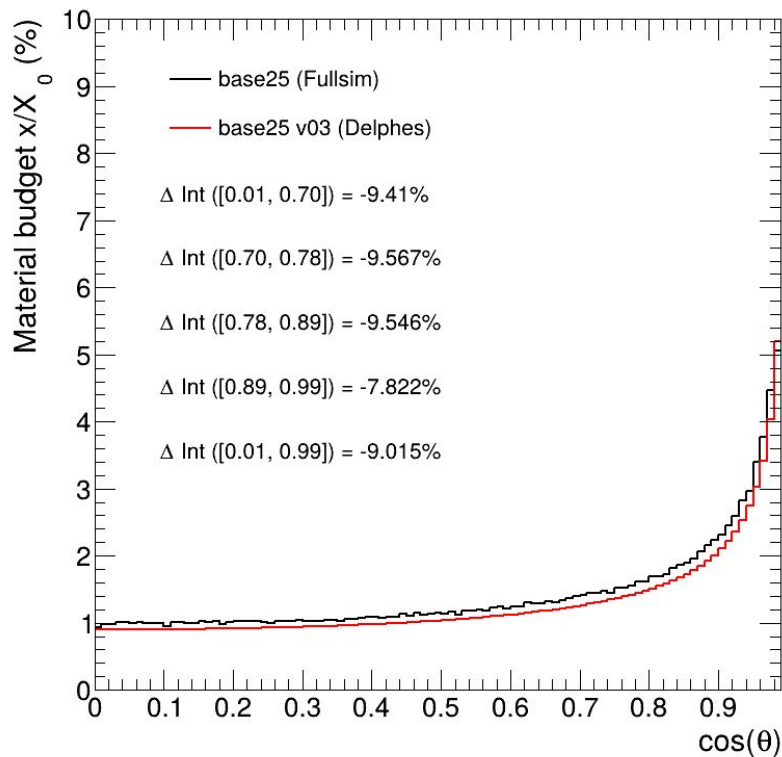


VTXLOW: width from 280 to 309

```
1 VTXLOW -0.0965 0.0965 0.0137 0.000309 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXLOW -0.1609 0.1609 0.0237 0.000309 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXLOW -0.257 0.257 0.0340 0.000309 0.0937 2 0 1.5708 3e-06 3e-06 1
```

Inner barrel	
Parameter	Value (mm)
VTXIB_z1	96.5
VTXIB_z2	160.9
VTXIB_z3	241.4 → 257
VTXIB_r1	13.7
VTXIB_r2	23.7
VTXIB_r3	34.0

VTXLOW: width from 280 to 309



VTXHIGH: width from 470 to 415

```
1 VTXHIGH -0.1631 0.1631 0.141 0.000415 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXHIGH -0.3364 0.3364 0.315 0.000415 0.0937 2 0 1.5708 7e-06 7e-06 1
```

```
2 VTXFILLER 0.674756 0.747726 -0.932 0.000245 0.02 0 0 1.5708 0 0 0
2 VTXFILLER 0.795301 0.870693 -0.931 0.00017 0.02 0 0 1.5708 0 0 0
```

```
2 VTXFILLER 0.795301 0.870693 0.931 0.00017 0.02 0 0 1.5708 0 0 0
2 VTXFILLER 0.674756 0.747726 0.932 0.000245 0.02 0 0 1.5708 0 0 0
```

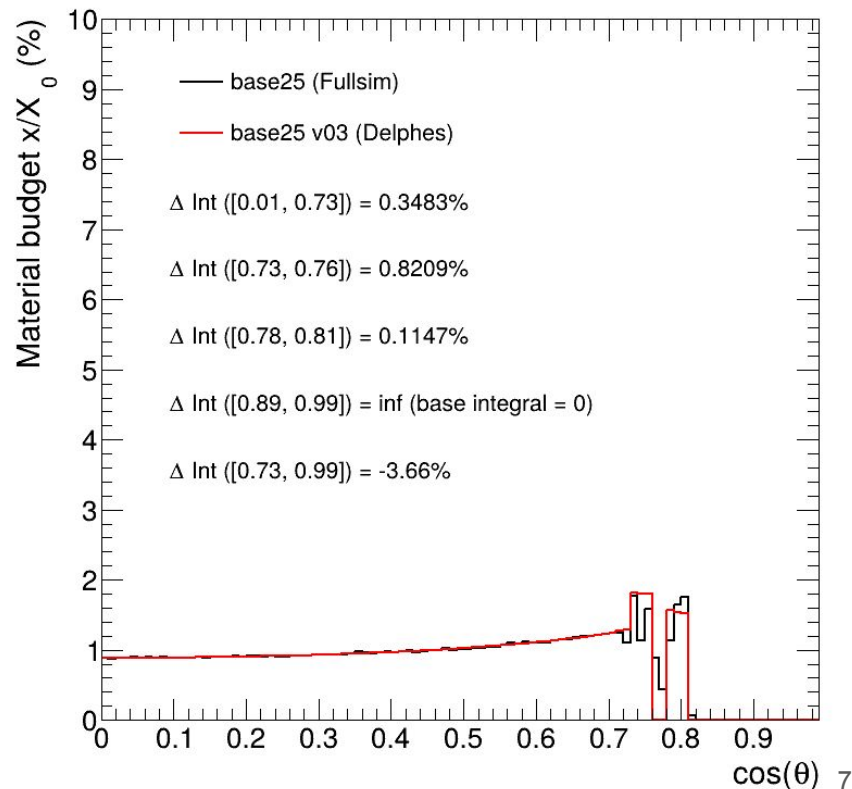
Outer barrel	
Parameter	Value (mm)
VTXOB_z1	163.1
VTXOB_z2	326.3 → 336.4
VTXOB_r1	130.0 → 141
VTXOB_r2	315.0

VTXHIGH: width from 470 to 415 + change in z + filler

- Added fillers to adjust Material Budget
 - Filler 1: 0.73-0.76
 - Filler 2: 0.78-0.81
- Fillers are **NON-ACTIVE**

```
2 VTXFILLER 0.674756 0.747726 -0.932 0.000245 0.02 0 0 1.5708 0 0 0
2 VTXFILLER 0.795301 0.870693 -0.931 0.00017 0.02 0 0 1.5708 0 0 0
```

```
2 VTXFILLER 0.795301 0.870693 0.931 0.00017 0.02 0 0 1.5708 0 0 0
2 VTXFILLER 0.674756 0.747726 0.932 0.000245 0.02 0 0 1.5708 0 0 0
```

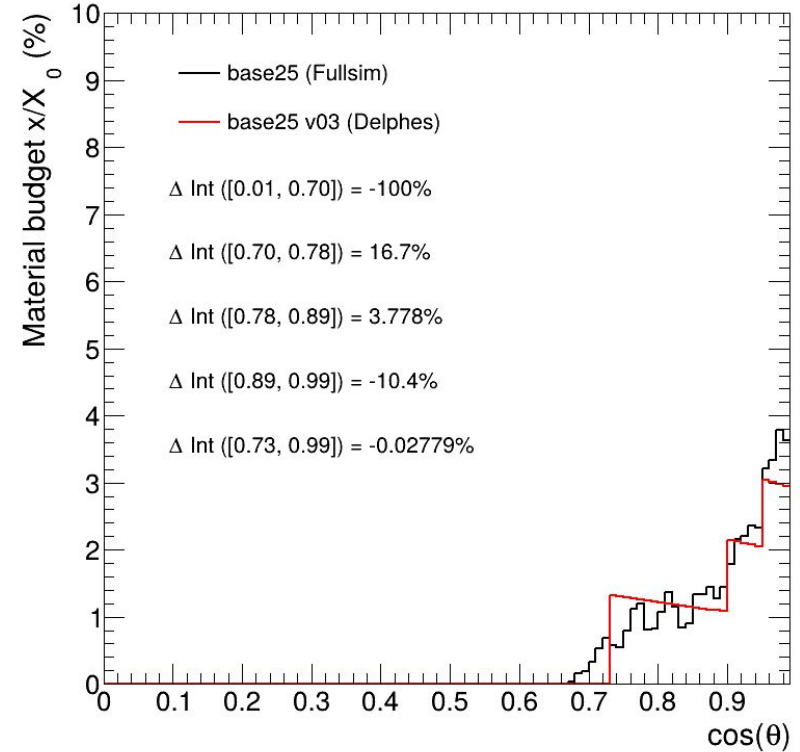
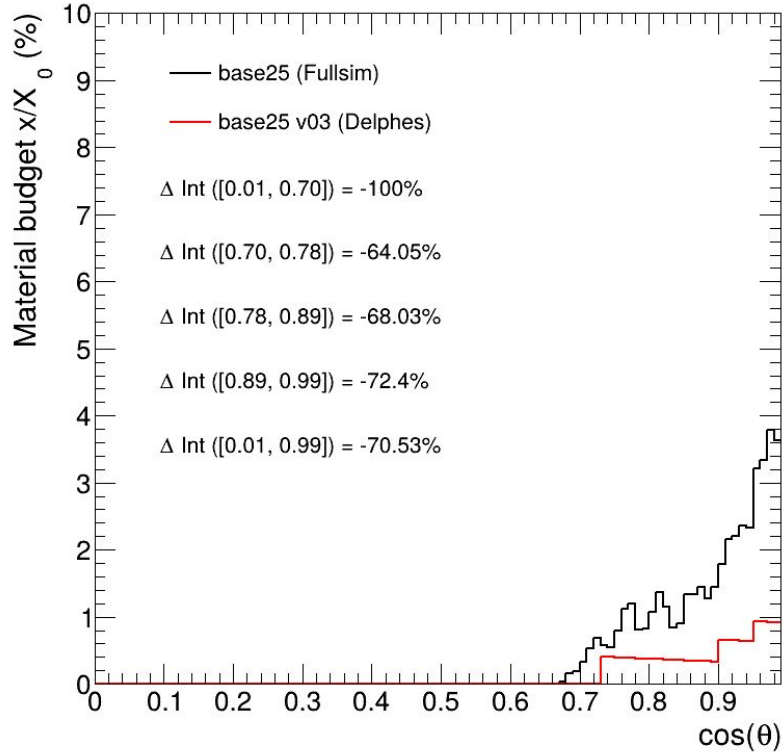


VTXDSK: width from 280 to 909

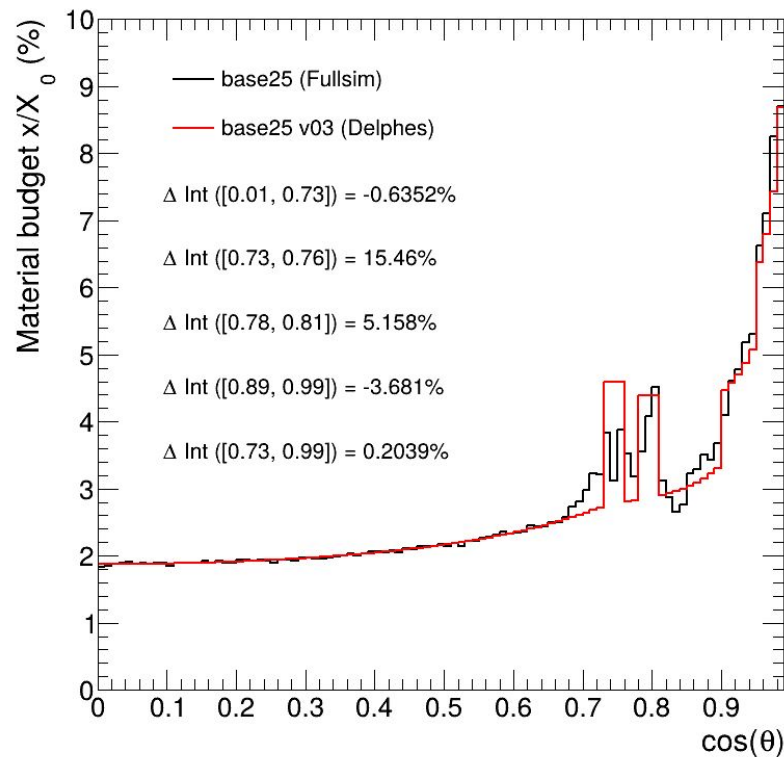
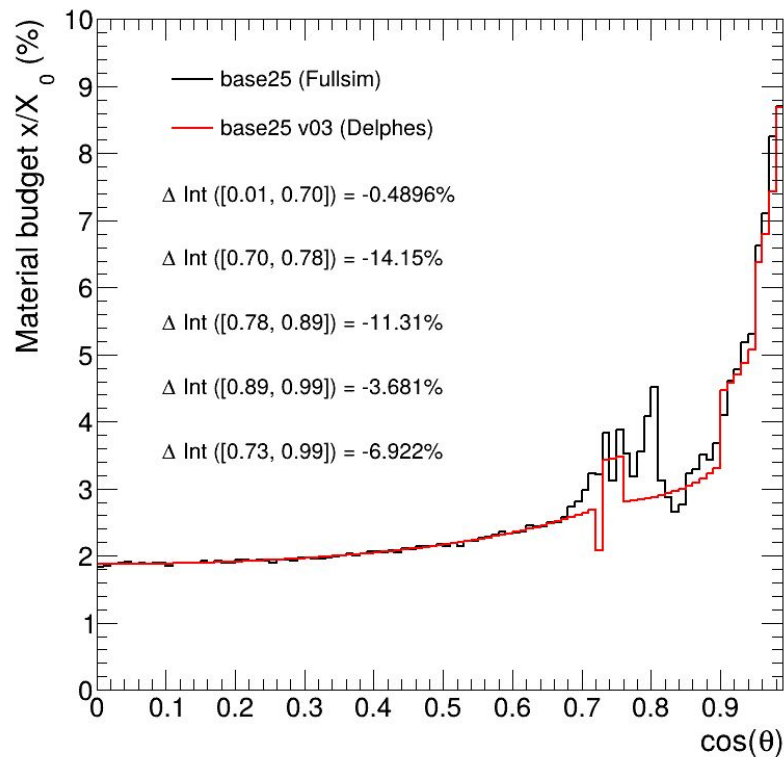
```
2 VTXDSK 0.108 0.3 -0.93 0.000909 0.0937 2 0 1.5708 7e-06 7e-06 1
2 VTXDSK 0.073 0.3 -0.62 0.000909 0.0937 2 0 1.5708 7e-06 7e-06 1
2 VTXDSK 0.034 0.28 -0.302 0.000909 0.0937 2 0 1.5708 7e-06 7e-06 1
2 VTXDSK 0.034 0.28 0.302 0.000909 0.0937 2 0 1.5708 7e-06 7e-06 1
2 VTXDSK 0.073 0.3 0.62 0.000909 0.0937 2 0 1.5708 7e-06 7e-06 1
2 VTXDSK 0.108 0.3 0.93 0.000909 0.0937 2 0 1.5708 7e-06 7e-06 1
```

Disks	
Parameter	Value (mm)
VTXD_z1	279.06 → 302
VTXD_z2	609.086 → 620
VTXD_z3	918.641 → 930
VTXD_rmax1	275.0 → 280
VTXD_rmax2	315.0 → 300
VTXD_rmax3	315.0 → 300
VTXD_rmin1	34.5 → 34
VTXD_rmin2	70.0 → 73
VTXD_rmin3	105.0 → 108

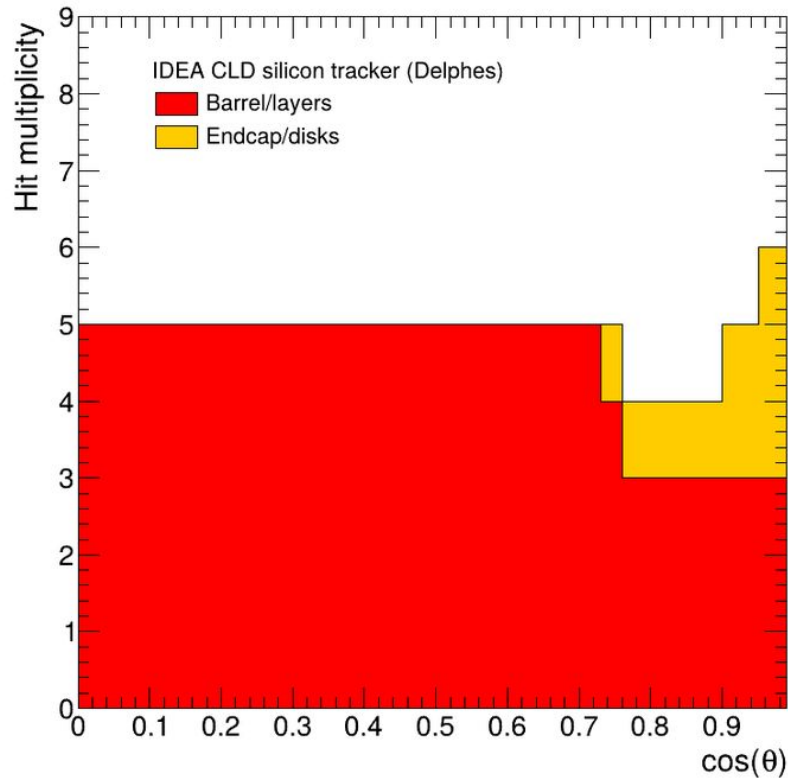
VTXDSK: width from 280 to 909



Final result: no filler (left) vs. filler (right)



IDEA_base25_v03_filler: hit multiplicity



LONG BARREL

Long barrel v03: configuration - NO FILLERS

```
# barrel  name      zmin  zmax   r      w (m)    X0      n_meas

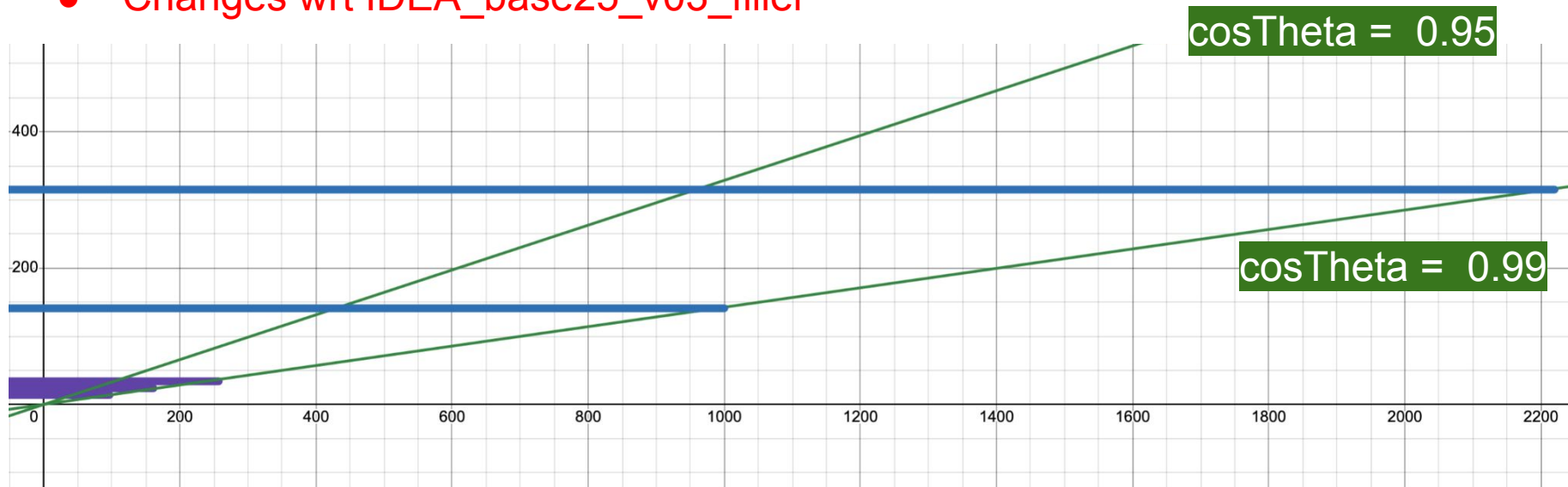
1 PIPE -100 100 0.01 0.00235 0.35276 0 0 0 0 0 0
1 VTXL0W -0.0965 0.0965 0.0137 0.0003076 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXL0W -0.1609 0.1609 0.0237 0.0003076 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXL0W -0.257 0.257 0.0340 0.0003076 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXHIGH -1.0 1.0 0.141 0.000415 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXHIGH -2.220 2.220 0.315 0.000415 0.0937 2 0 1.5708 7e-06 7e-06 1
```

Inner barrel	
Parameter	Value (mm)
VTXIB_z1	96.5
VTXIB_z2	160.9
VTXIB_z3	257
VTXIB_r1	13.7
VTXIB_r2	23.7
VTXIB_r3	34.0

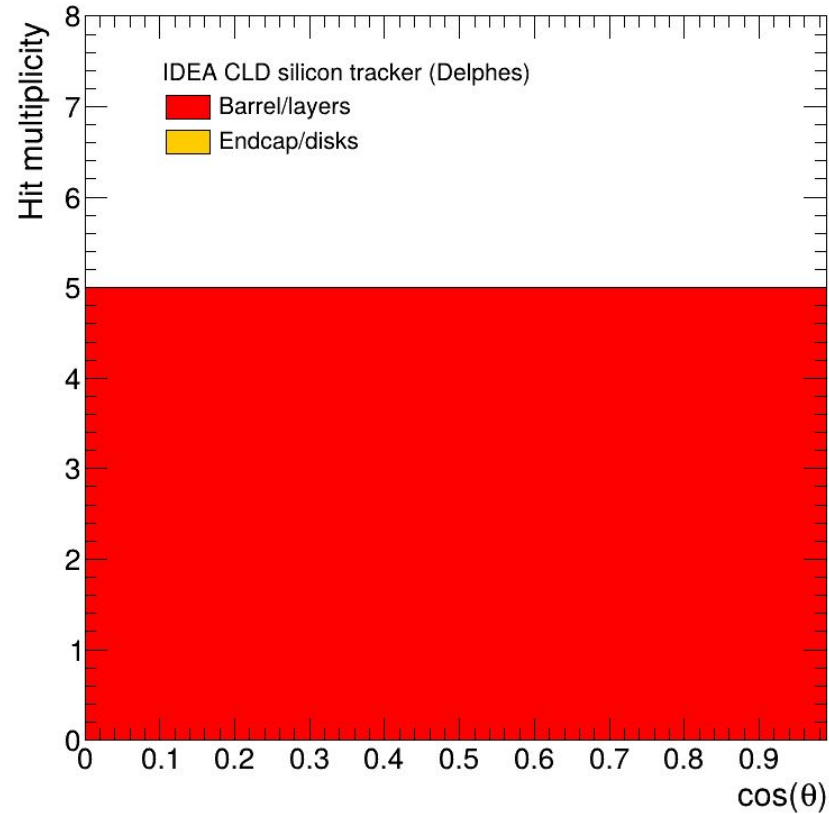
Outer barrel	
Parameter	Value (mm)
VTXOB_z1	1000
VTXOB_z2	2220
VTXOB_r1	141
VTXOB_r2	315.0

Long barrel v03: configuration - NO FILLERS

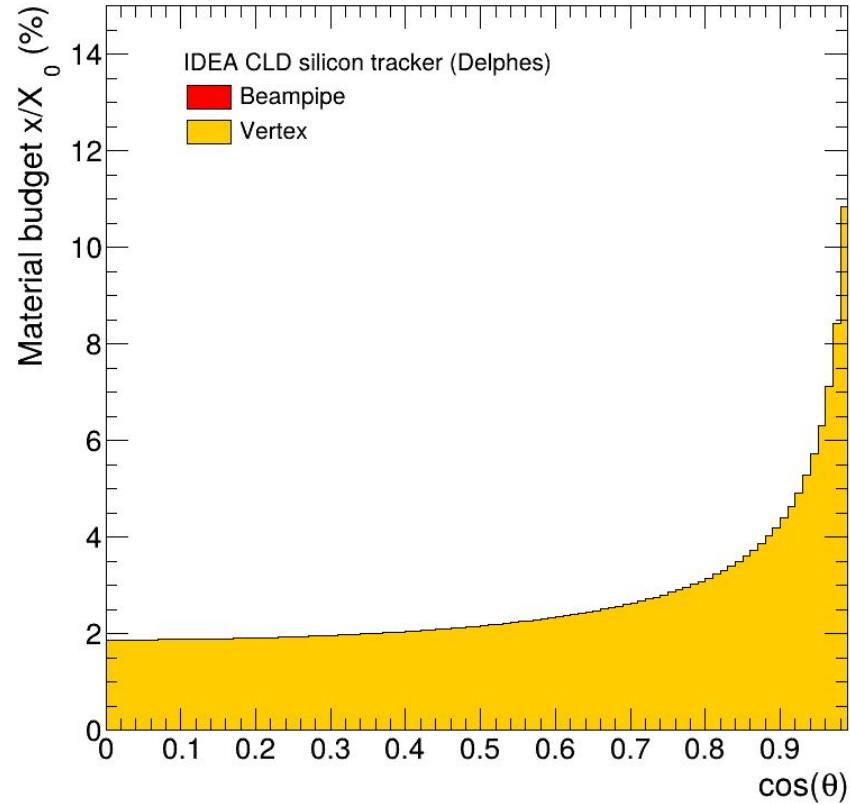
- Extended Middle barrel zmax, radius constant
- Extended Outer barrel zmax (double), radius constant
- Removed disks and fillers
- Changes wrt IDEA_base25_v03_filler



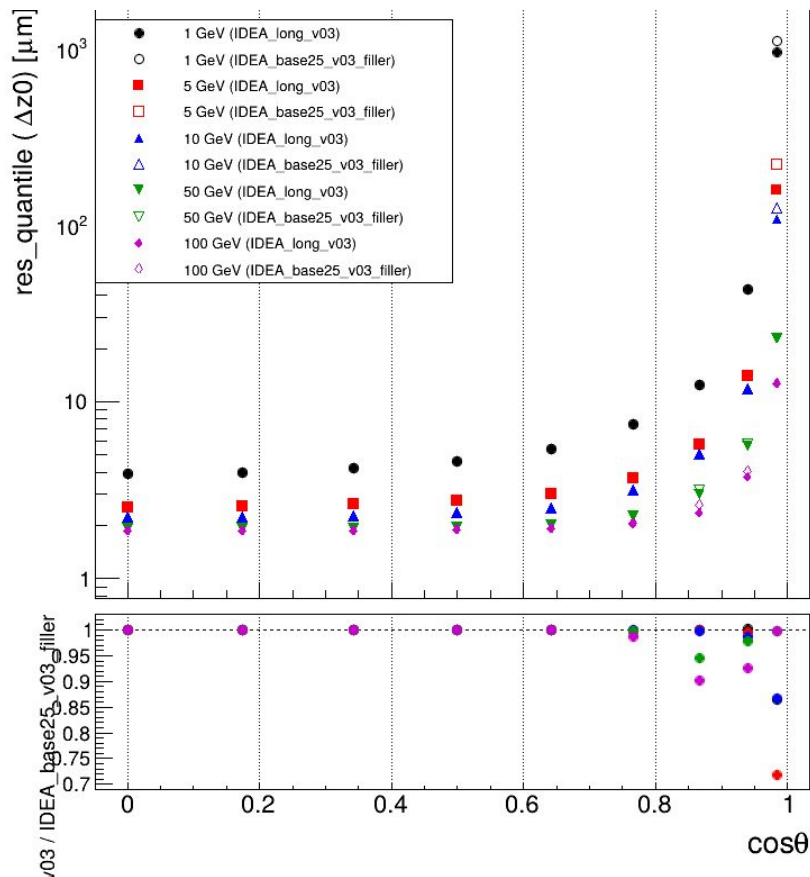
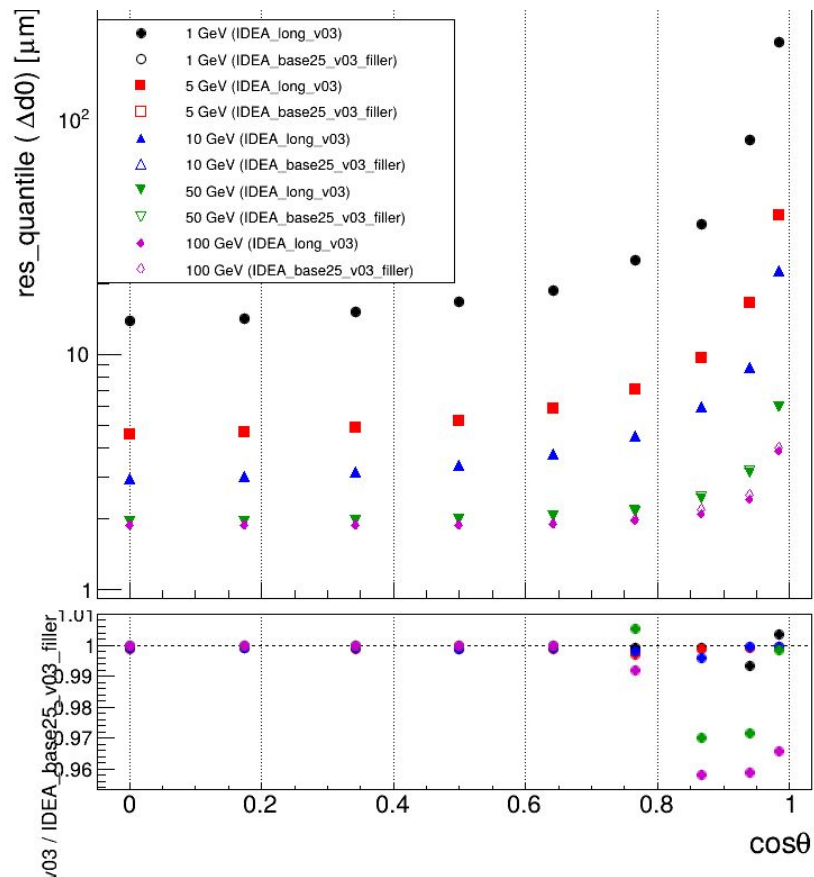
Long barrel v03: hit multiplicity



Long barrel v03: Material budget



Long barrel v03: d0, z0resolution vs IDEA_base25_v03_filler



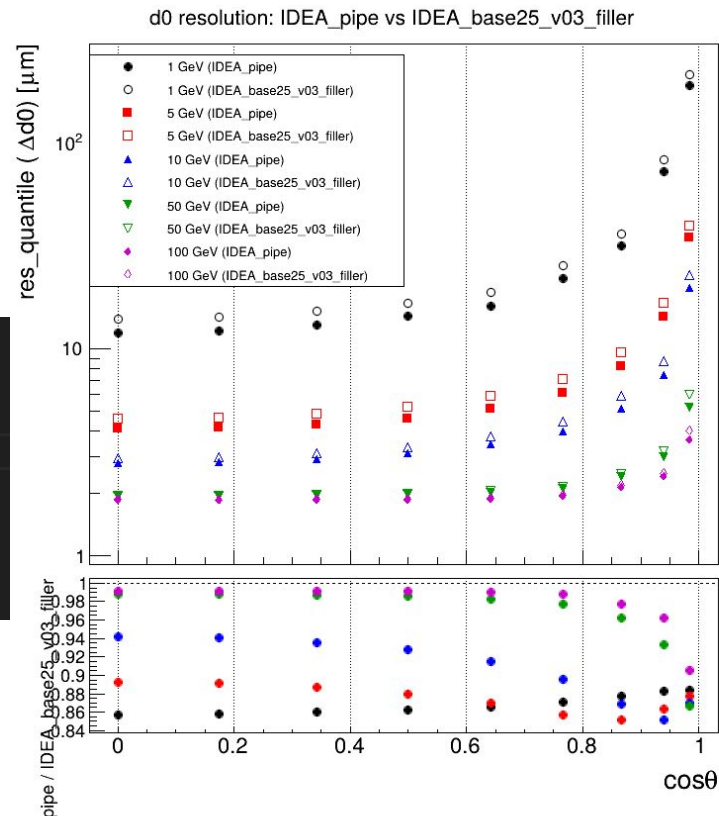
LAYER 1 INSIDE BEAMPIPE

Same geometry as IDEA_base25_v03_filler except for inner barrel layer 1, which is moved inside the beampipe

Layer 1 at 10 mm: d0 resolution

- Up to 15% improvement at low momentum

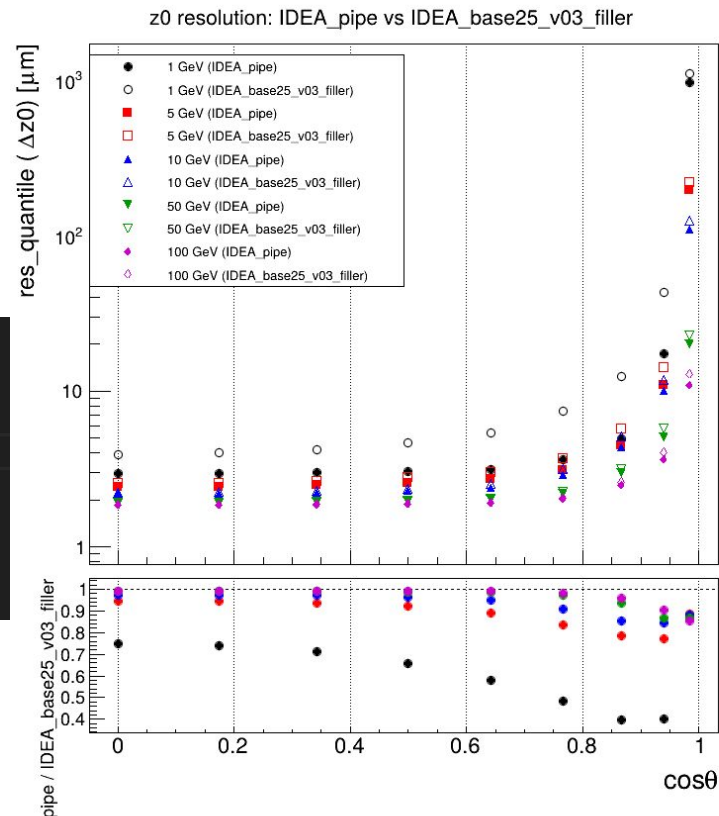
```
# barrel name      zmin  zmax   r      w (m)   X0      n_meas
1 PIPE -100 100 0.01 0.00235 0.35276 0 0 0 0 0 0
1 VTXPIPE -0.0965 0.0965 0.01 0.000309 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXLOW -0.1609 0.1609 0.0237 0.000309 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXLOW -0.257 0.257 0.0340 0.000309 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXHIGH -0.1631 0.1631 0.141 0.000415 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXHIGH -0.3364 0.3364 0.315 0.000415 0.0937 2 0 1.5708 7e-06 7e-06 1
```



Layer 1 at 10 mm: z0 resolution

- Up to 60% improvement at low momentum

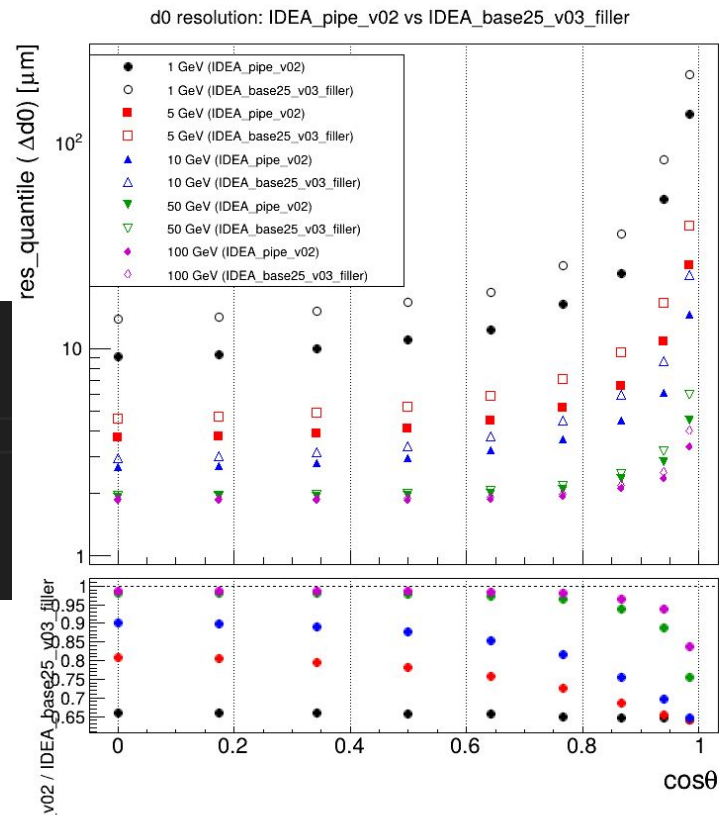
#	barrel	name	zmin	zmax	r	w (m)	X0	n_meas
1	PIPE	-100 100	0.01	0.00235	0.35276	0 0 0 0 0 0		
1	VTXPIPE	-0.0965 0.0965	0.01	0.000309	0.0937	2 0 1.5708	3e-06 3e-06 1	
1	VTXLOW	-0.1609 0.1609	0.0237	0.000309	0.0937	2 0 1.5708	3e-06 3e-06 1	
1	VTXLOW	-0.257 0.257	0.0340	0.000309	0.0937	2 0 1.5708	3e-06 3e-06 1	
1	VTXHIGH	-0.1631 0.1631	0.141	0.000415	0.0937	2 0 1.5708	3e-06 3e-06 1	
1	VTXHIGH	-0.3364 0.3364	0.315	0.000415	0.0937	2 0 1.5708	7e-06 7e-06 1	



Layer 1 at 8 mm: d0 resolution

- Up to 35% improvement at low momentum

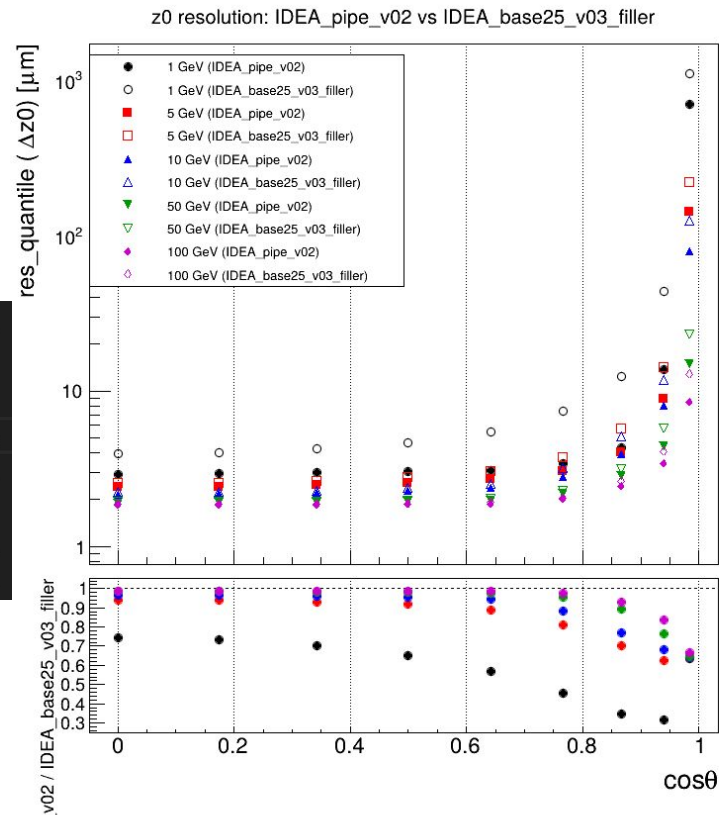
#	barrel	name	zmin	zmax	r	w (m)	X0	n_meas
1	PIPE	-100 100	0.01	0.00235	0.35276	0 0 0 0 0 0		
1	VTXPIPE	-0.0965 0.0965	0.008	0.000309	0.0937	2 0 1.5708	3e-06 3e-06	
1	VTXLOW	-0.1609 0.1609	0.0237	0.000309	0.0937	2 0 1.5708	3e-06 3e-06	1
1	VTXLOW	-0.257 0.257	0.0340	0.000309	0.0937	2 0 1.5708	3e-06 3e-06	1
1	VTXHIGH	-0.1631 0.1631	0.141	0.000415	0.0937	2 0 1.5708	3e-06 3e-06	1
1	VTXHIGH	-0.3364 0.3364	0.315	0.000415	0.0937	2 0 1.5708	7e-06 7e-06	1



Layer 1 at 8 mm: d0 resolution

- Up to 70% improvement at low momentum

#	barrel	name	zmin	zmax	r	w (m)	X0	n_meas
1	PIPE	-100 100	0.01	0.00235	0.35276	0 0 0 0 0 0		
1	VTXPIPE	-0.0965 0.0965	0.008	0.000309	0.0937	2 0 1.5708	3e-06 3e-06	
1	VTXLLOW	-0.1609 0.1609	0.0237	0.000309	0.0937	2 0 1.5708	3e-06 3e-06 1	
1	VTXLLOW	-0.257 0.257	0.0340	0.000309	0.0937	2 0 1.5708	3e-06 3e-06 1	
1	VTXHIGH	-0.1631 0.1631	0.141	0.000415	0.0937	2 0 1.5708	3e-06 3e-06 1	
1	VTXHIGH	-0.3364 0.3364	0.315	0.000415	0.0937	2 0 1.5708	7e-06 7e-06 1	



Next steps

- Continue optimizing geometries
- Construct material budget for layer inside beampipe
- Begin studying tilted geometry

Back-up

Long barrel v01: configuration

```
# barrel  name      zmin  zmax   r      w (m)    X0      n_meas

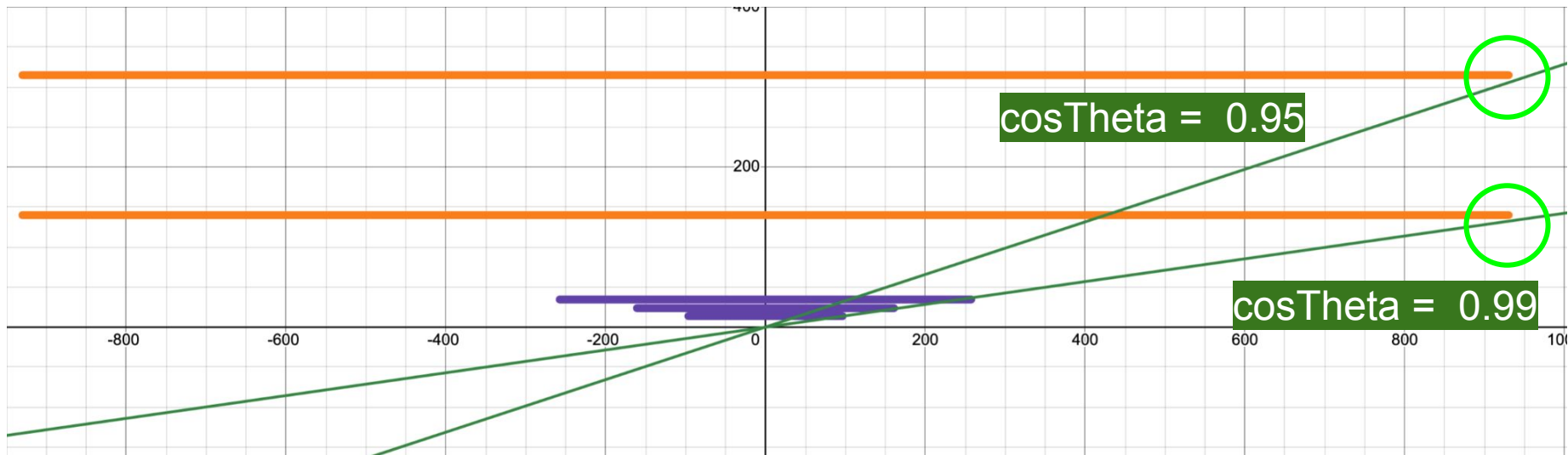
1 PIPE  -100 100 0.01 0.00235 0.35276 0 0 0 0 0 0
1 VTXLOW -0.0965 0.0965 0.0137 0.0003076 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXLOW -0.1609 0.1609 0.0237 0.0003076 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXLOW -0.257 0.257 0.0340 0.0003076 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXHIGH -0.930 0.930 0.141 0.000415 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXHIGH -0.930 0.930 0.315 0.000415 0.0937 2 0 1.5708 7e-06 7e-06 1
```

Inner barrel	
Parameter	Value (mm)
VTXIB_z1	96.5
VTXIB_z2	160.9
VTXIB_z3	257
VTXIB_r1	13.7
VTXIB_r2	23.7
VTXIB_r3	34.0

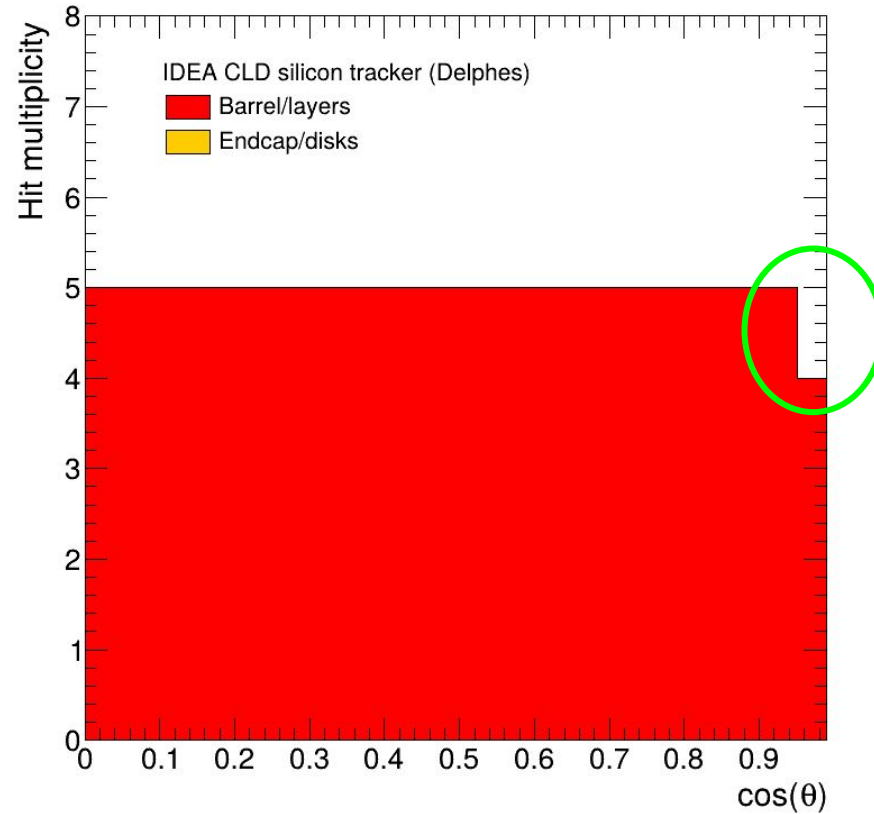
Outer barrel	
Parameter	Value (mm)
VTXOB_z1	930
VTXOB_z2	930
VTXOB_r1	141
VTXOB_r2	315.0

Long barrel v01: configuration

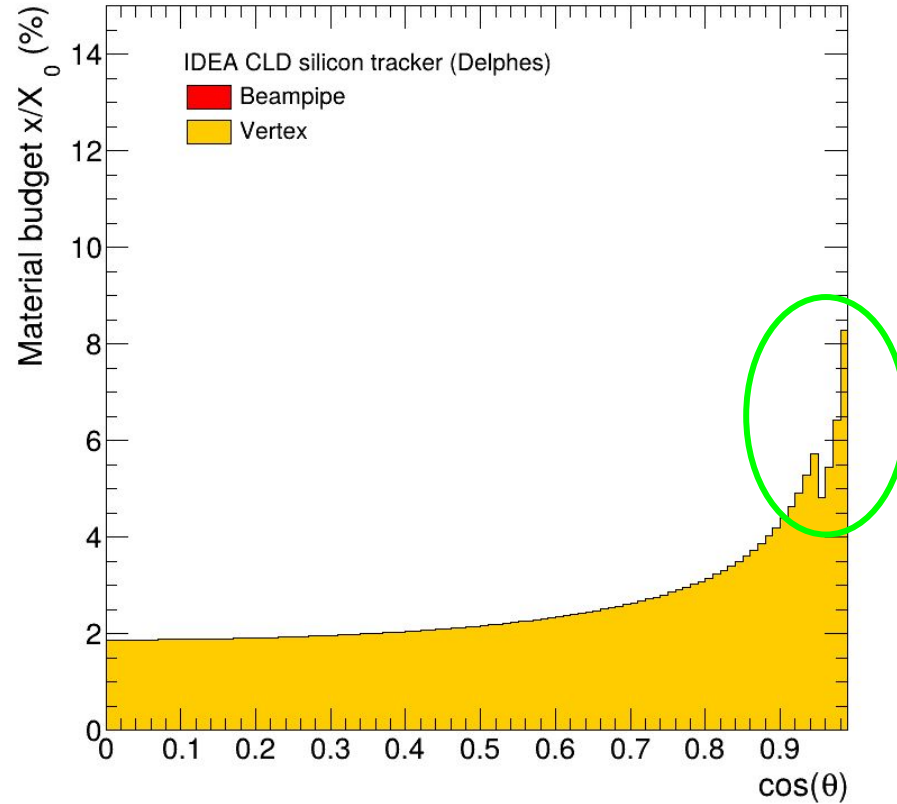
- Based on IDEA_base25_v03 geometry, deleting disks and extending barrels
- Not enough coverage in regions 0.95-0.99



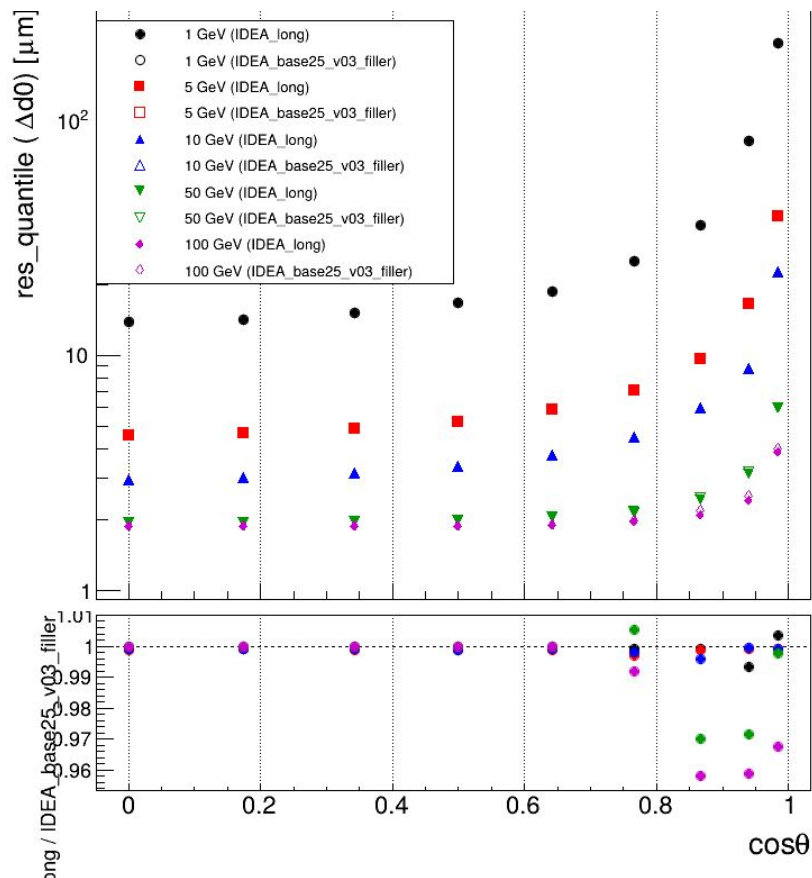
Long barrel v01: hit multiplicity



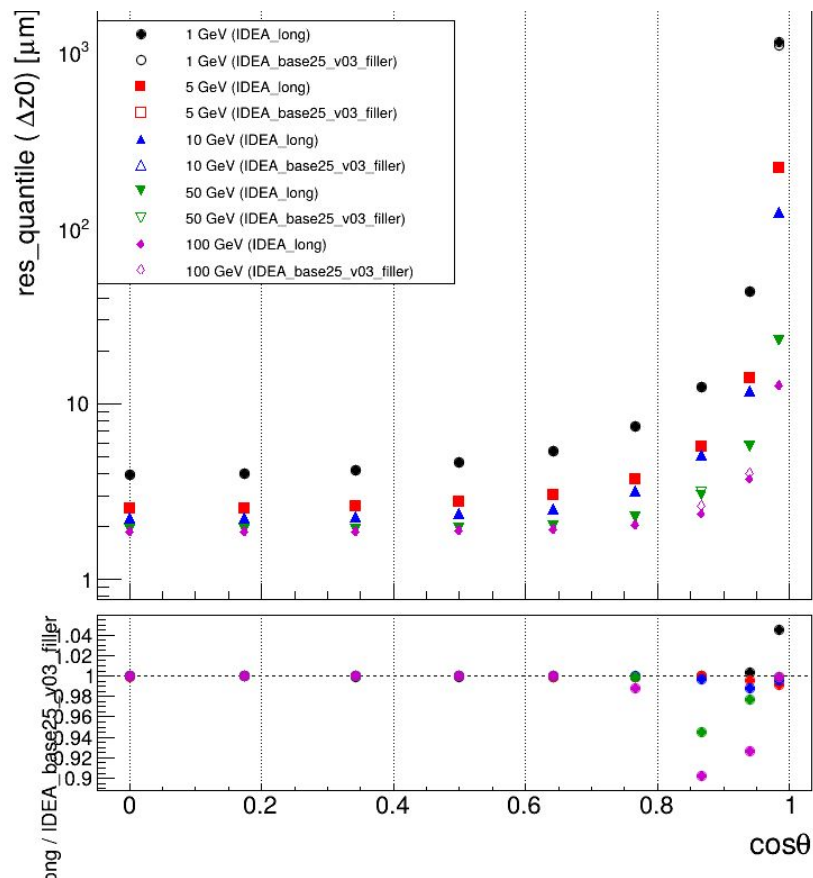
Long barrel v01: Material budget



Long barrel v01: d0 resolution vs IDEA_base25_v03_filler



Long barrel v01: z0 resolution vs IDEA_base25_v03_filler



Long barrel v02: configuration

```
# barrel  name      zmin  zmax   r      w (m)    X0      n_meas

1 PIPE  -100 100 0.01 0.00235 0.35276 0 0 0 0 0 0
1 VTXL0W -0.0965 0.0965 0.0137 0.0003076 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXL0W -0.1609 0.1609 0.0237 0.0003076 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXL0W -0.257 0.257 0.0340 0.0003076 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXHIGH -1.0 1.0 0.141 0.000415 0.0937 2 0 1.5708 3e-06 3e-06 1
1 VTXHIGH -1.4 1.4 0.2 0.000415 0.0937 2 0 1.5708 7e-06 7e-06 1
```

Inner barrel	
Parameter	Value (mm)
VTXIB_z1	96.5
VTXIB_z2	160.9
VTXIB_z3	257
VTXIB_r1	13.7
VTXIB_r2	23.7
VTXIB_r3	34.0

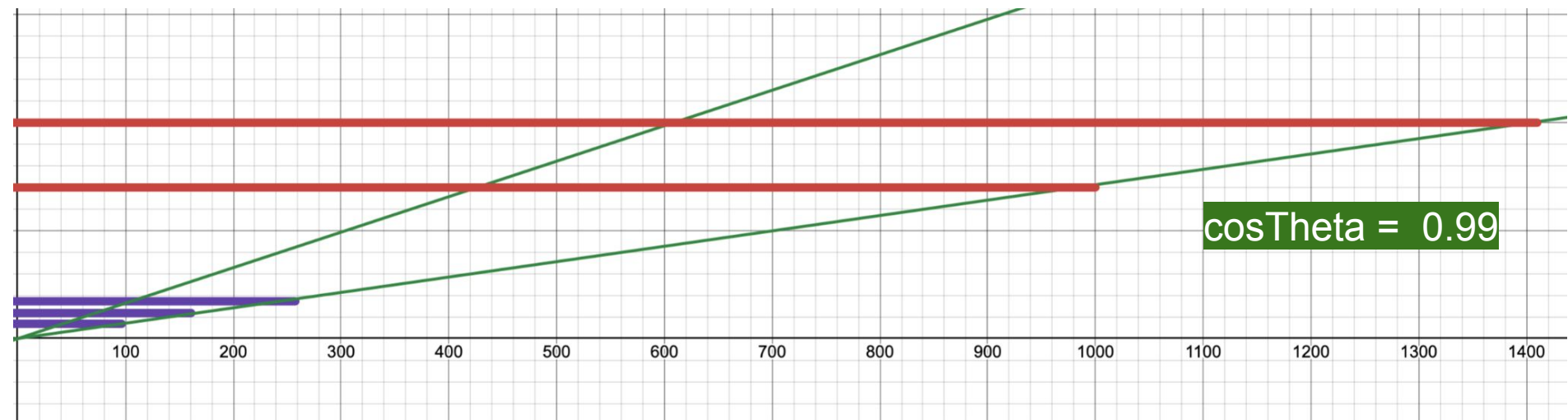
Outer barrel	
Parameter	Value (mm)
VTXOB_z1	1000
VTXOB_z2	1400
VTXOB_r1	141
VTXOB_r2	200

Long barrel v02: configuration

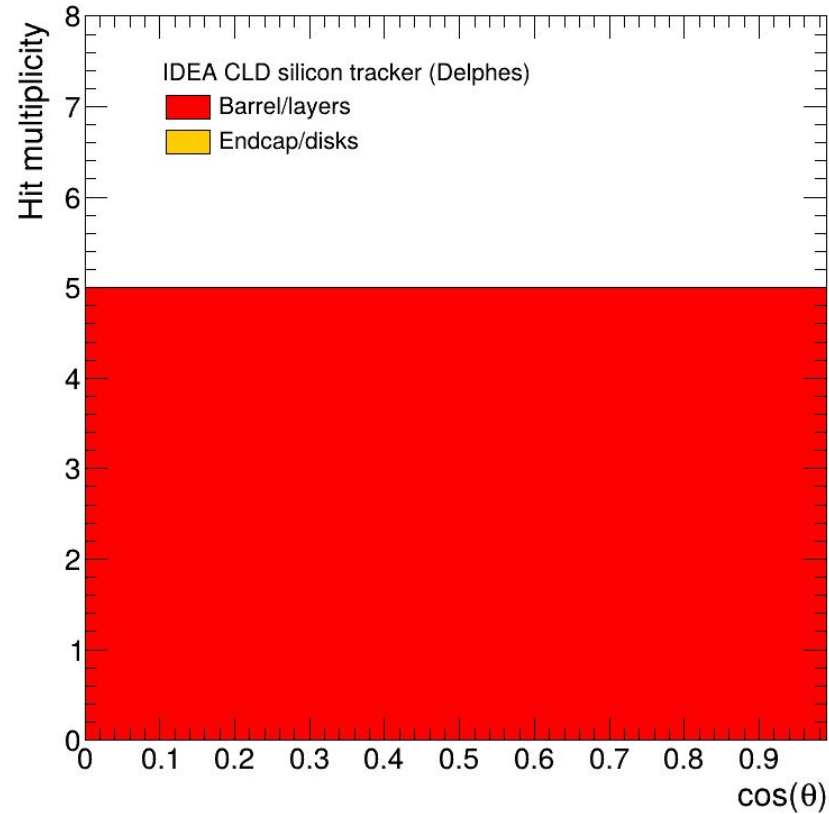
- Extended Middle barrel zmax, radius constant
- Lowered Outer barrel radius, extended zmax
- Changes wrt long barrel v01

$\cos\Theta = 0.95$

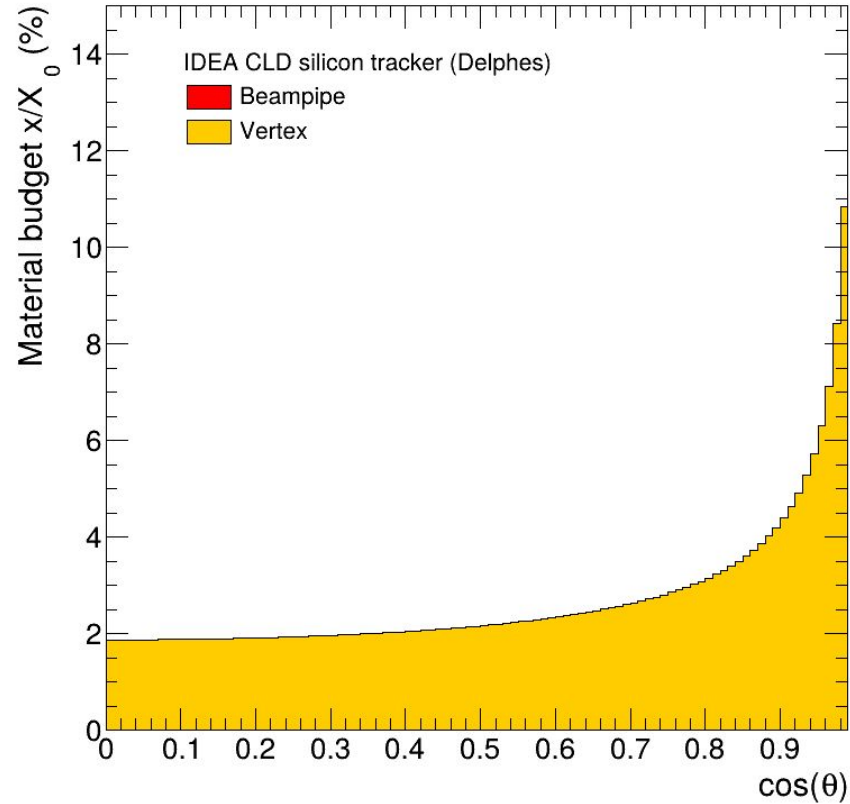
$\cos\Theta = 0.99$



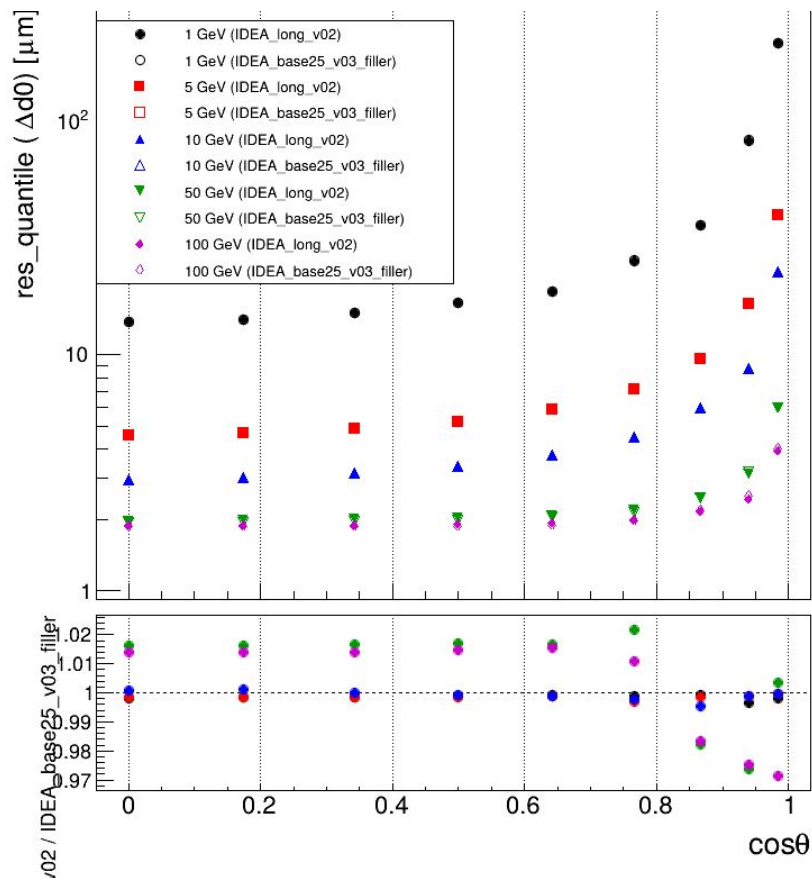
Long barrel v02: hit multiplicity



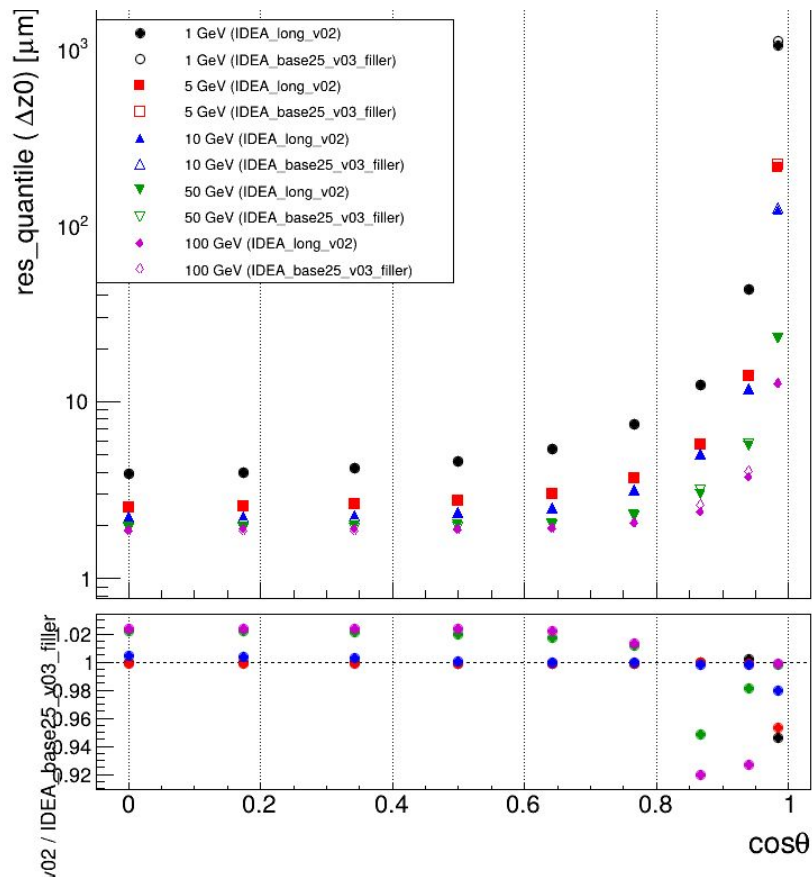
Long barrel v02: Material budget



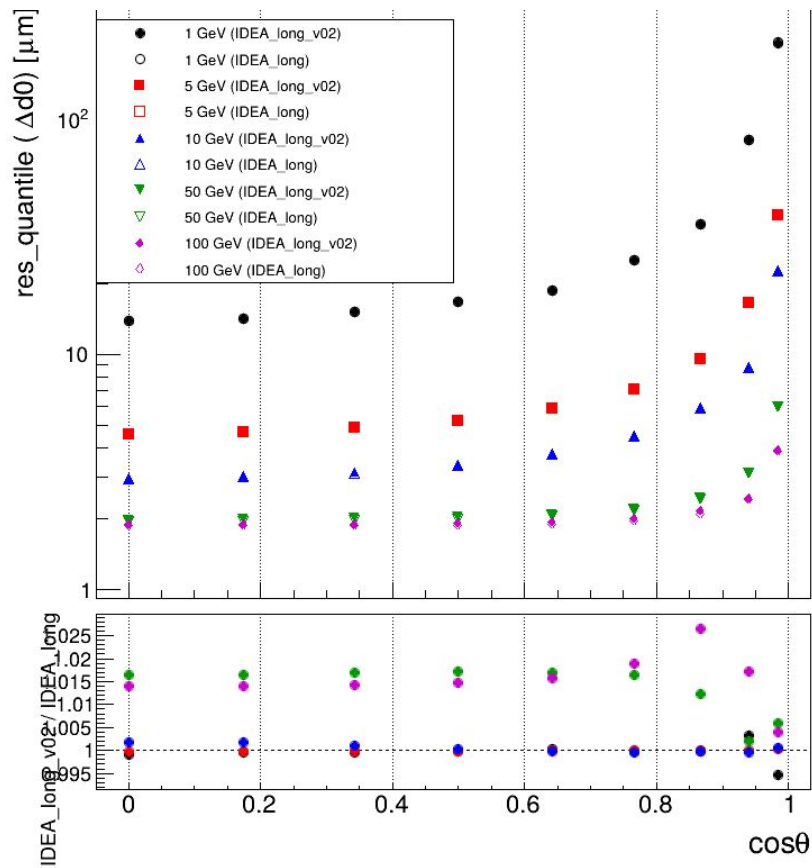
Long barrel v02: d0 resolution vs IDEA_base25_v03_filler



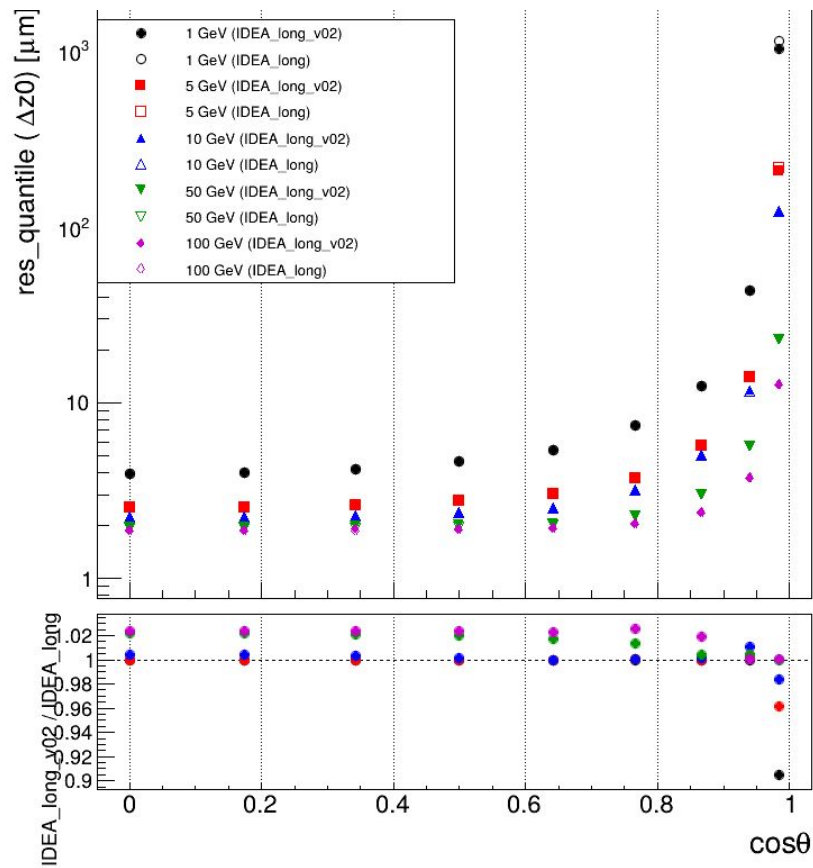
Long barrel v02: z0 resolution vs IDEA_base25_v03_filler



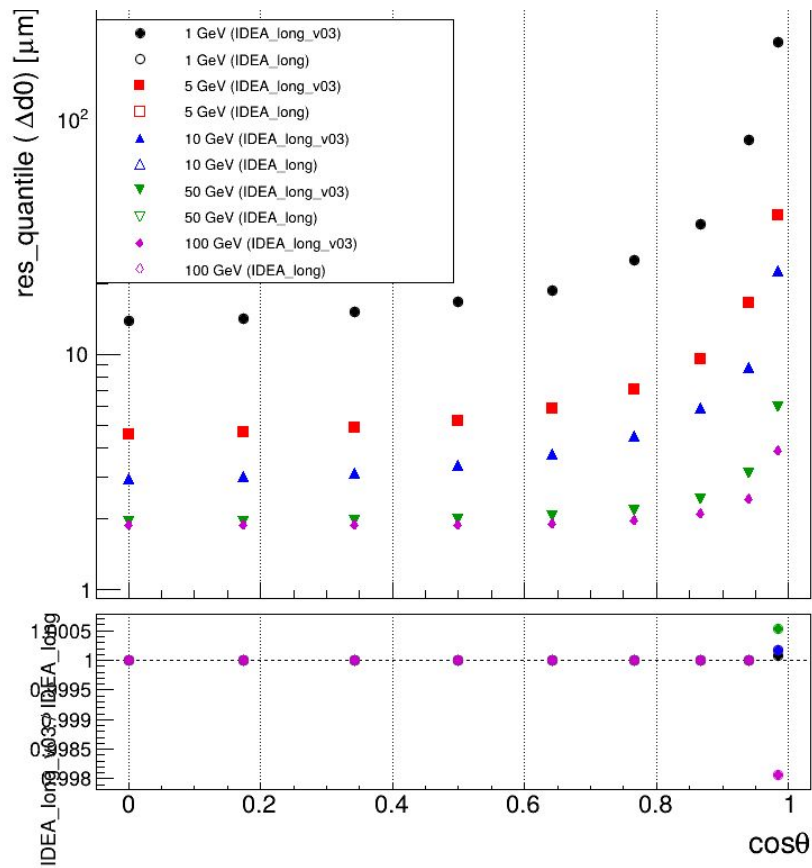
Long barrel comparisons: d0 resolution v02 over v01



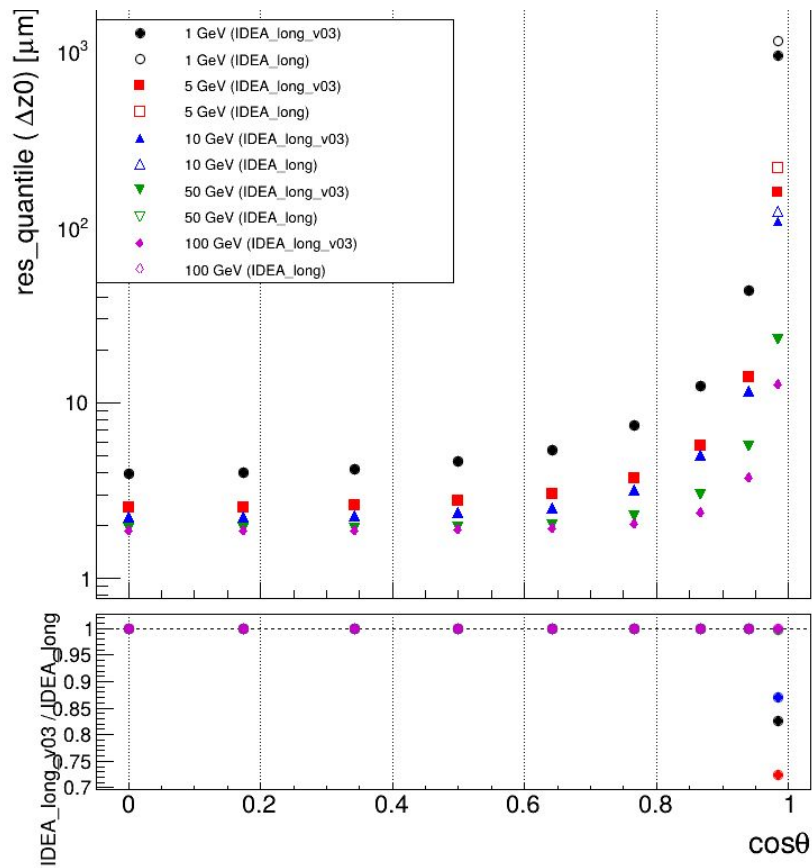
Long barrel comparisons: z0 resolution v02 over v01



Long barrel comparisons: d0 resolution v03 over v01

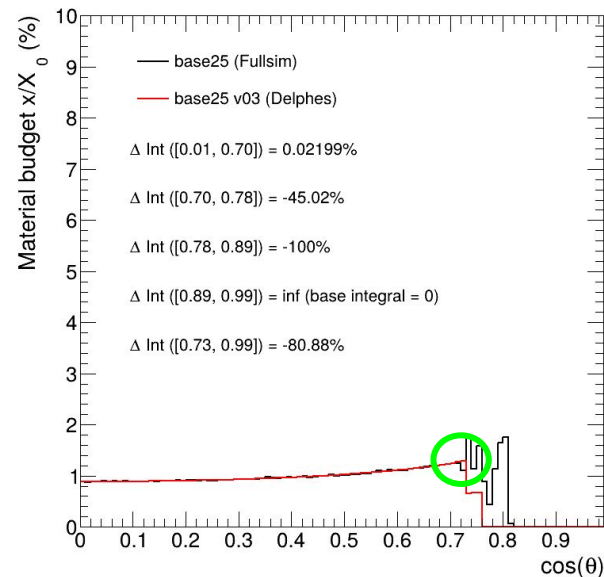
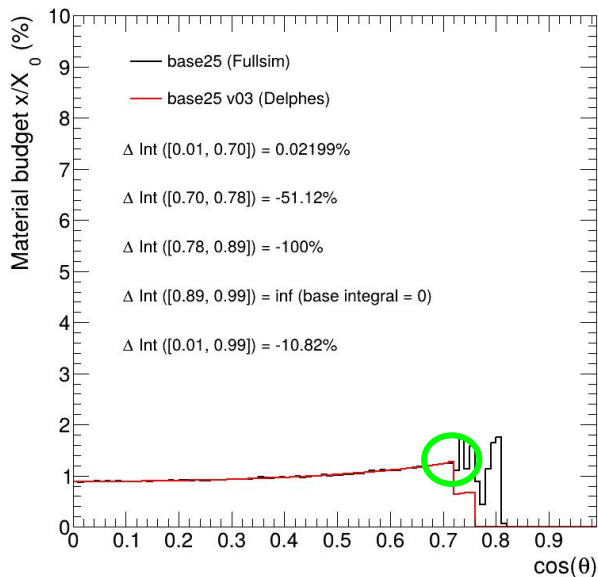


Long barrel comparisons: z0 resolution v03 over v01



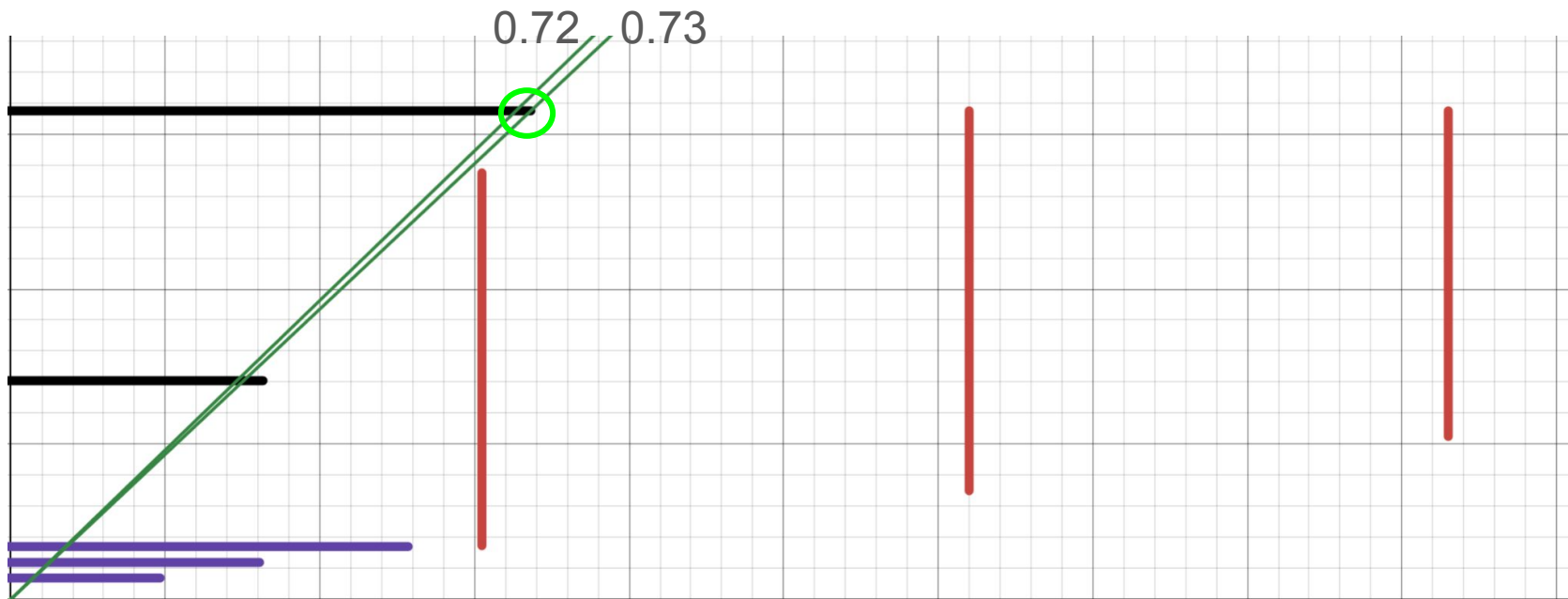
VTXHIGH: width from 470 to 415 + change in z

- Changed outer barrel zmax from 326.3 to 336.4 to fix region in 0.72-0.73 without including it in the filler, which would have been an overkill



VTXHIGH: width from 470 to 415 + change in z

- What I was hoping to accomplish: extend outer barrel layer to cover 0.72-0.73 region



VTXHIGH: width from 470 to 415 + change in z

- Hit multiplicity result from change in radius 326.3 (left) to 336.4 (right)

