

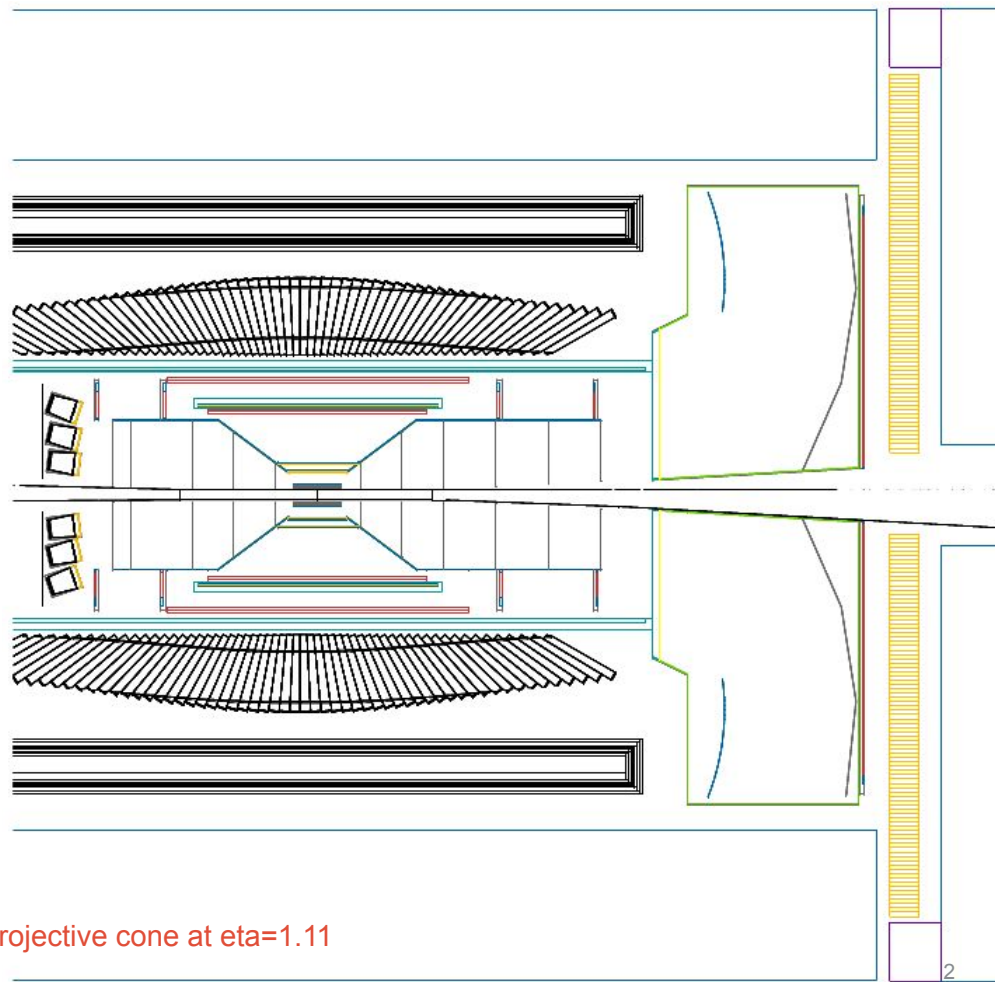
ePIC in DD4hep

Shujie Li
08.16.2022

Barrel Geometry

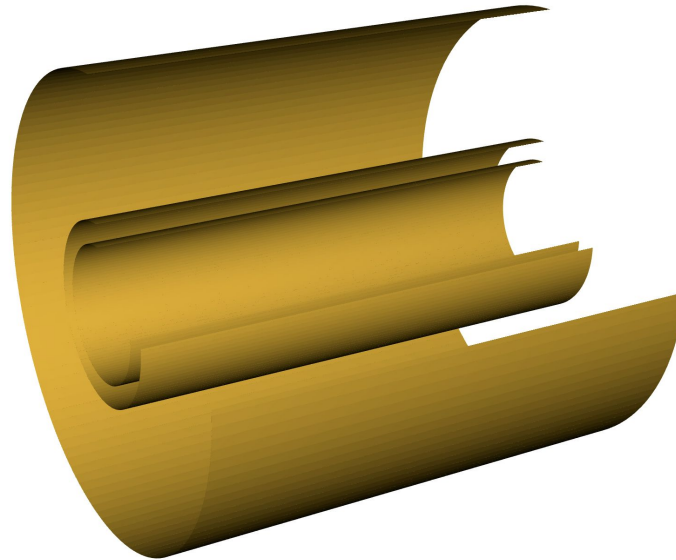
- Barrel setup from Ernst:
 - 270 mm vertex layer with $X/X_0 \sim 0.05\%$ at $r = 36\text{mm}$
 - 270 mm vertex layer with $X/X_0 \sim 0.05\%$ at $r = 48\text{mm}$
 - 270 mm vertex layer with $X/X_0 \sim 0.05\%$ at $r = 120\text{mm}$
 - 540 mm sagitta layer with $X/X_0 \sim 0.25\%$ at $r = 270\text{mm}$
 - 840 mm barrel layer with $X/X_0 \sim 0.55\%$ at $r = 420\text{mm}$
- Currently in DD4hep (implemented by Sylvester):
 - 270 mm vertex layer with $X/X_0 \sim 0.05\%$ at $r = 36\text{mm}$
 - 270 mm vertex layer with $X/X_0 \sim 0.05\%$ at $r = 48\text{mm}$
 - with carbon support ($<100\mu\text{m}$)
 - 270 mm vertex layer with $X/X_0 \sim 0.05\%$ at $r = 123\text{mm}$
 - with carbon support ($<100\mu\text{m}$)
 - sagitta layer with $X/X_0 \sim 0.35\%$ at $r = 270\text{mm}$
 - staves
 - barrel layer with $X/X_0 \sim 0.65\%$ at $r = 420\text{mm}$
 - staves

length determined by the projective cone at $\eta=1.11$



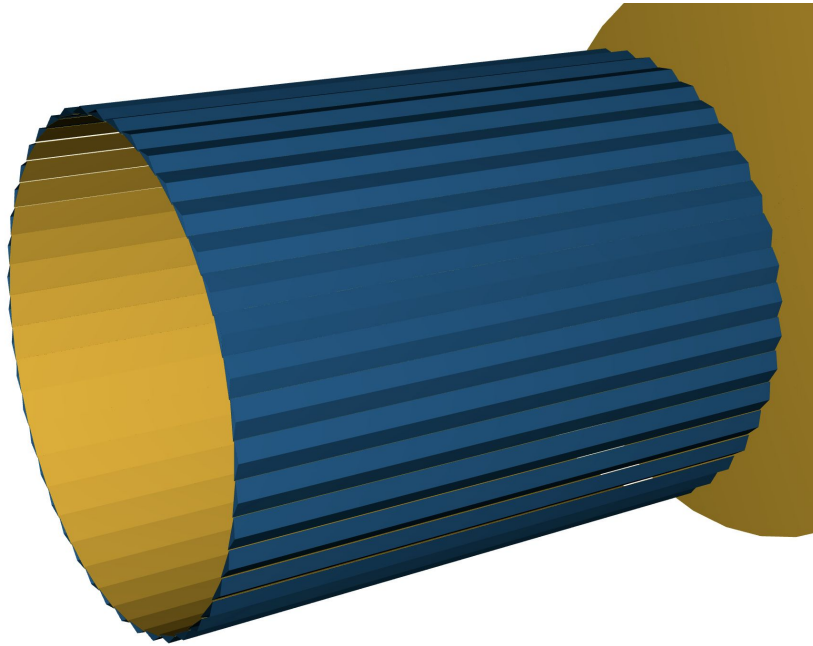
Vertex Layers

3 ITS3 silicon layers (0.04mm each) approximated with 128 staves



Sagitta Layer (temporary)

44 triangle staves (silicon + Al + carbon fiber)

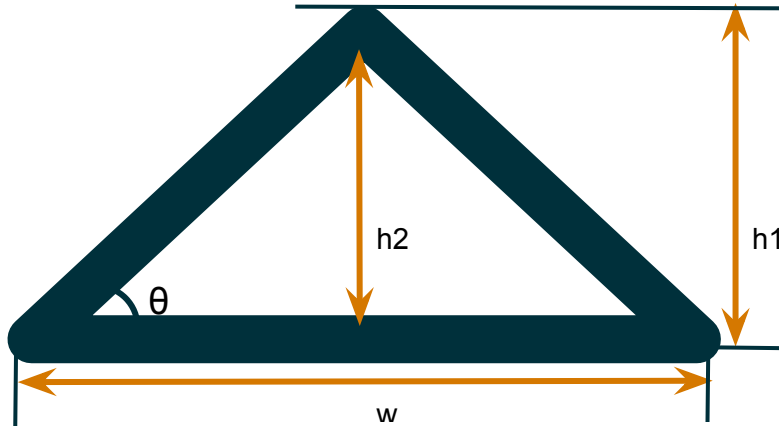


Material Scan

along vector (0,1,0)

\ Material	Atomic			Radiation		Path		endpoint
Num. \ Name	Number/Z	Mass/A	Density	Length	Thickness	Length	X0	y
Layer \	[g/mole]		[g/cm3]	[cm]	[cm]	[cm]	[cm]	cm,
3 Vacuum	7	14.784		0	3.66E+11	0.25	3.1	0 3.10,
4 Gold	79	196.967		19.32	0.3344	0.001	3.1	0.001495 3.10,
5 Beryllium	4	9.012		1.848	35.276	0.076	3.18	0.002146 3.18,
6 Air	7	14.784		0.0012	30528.8407	0.324	3.5	0.000011 3.50,
7 Air	7	14.784		0.0012	30528.8407	0.098	3.6	0.000003 3.60,
8 Silicon	14	28.085		2.33	9.3661	0.004	3.6	0.000427 3.60,
9 Air	7	14.784		0.0012	30528.8407	0.098	3.7	0.000003 3.70,
10 Air	7	14.784		0.0012	30528.8407	1	4.7	0.000033 4.70,
11 Air	7	14.784		0.0012	30528.8407	0.098	4.8	0.000003 4.80,
12 Silicon	14	28.085		2.33	9.3661	0.004	4.8	0.000427 4.80,
13 Air	7	14.784		0.0012	30528.8407	0.098	4.9	0.000003 4.90,
14 Air	7	14.784		0.0012	30528.8407	0.8	5.7	0.000027 5.70,
15 CarbonFiber	6	11.968		1.5	28.0746	0.03	5.73	0.001068 5.73,
16 Air	7	14.784		0.0012	30528.8407	6.47	12.2	0.000212 12.20,
17 Air	7	14.784		0.0012	30528.8407	0.098	12.3	0.000003 12.30,
18 Silicon	14	28.085		2.33	9.3661	0.004	12.3	0.000427 12.30,
19 Air	7	14.784		0.0012	30528.8407	0.098	12.4	0.000004 12.40,
20 Air	7	14.784		0.0012	30528.8407	0.2	12.6	0.000006 12.60,
21 CarbonFiber	6	11.968		1.5	28.0746	0.03	12.63	0.001069 12.63,
22 Air	7	14.784		0.0012	30528.8407	13.37	26	0.000438 26.00,
23 Air	7	14.784		0.0012	30528.8407	0.988	26.99	0.000032 26.99,
24 Silicon	14	28.085		2.33	9.3661	0.004	26.99	0.000428 26.99,
25 Aluminum	13	26.982		2.699	8.8963	0.02	27.01	0.002251 27.01,
26 CarbonFiber	6	11.968		1.5	28.0746	0.011	27.02	0.000374 27.02,
27 Air	7	14.784		0.0012	30528.8407	0.764	27.79	0.000025 27.79,
28 CarbonFiber	6	11.968		1.5	28.0746	0.01	27.8	0.000367 27.80,
29 Air	7	14.784		0.0012	30528.8407	0.204	28	0.000007 28.00,

Bug fixed: stave triangle frame material thickness



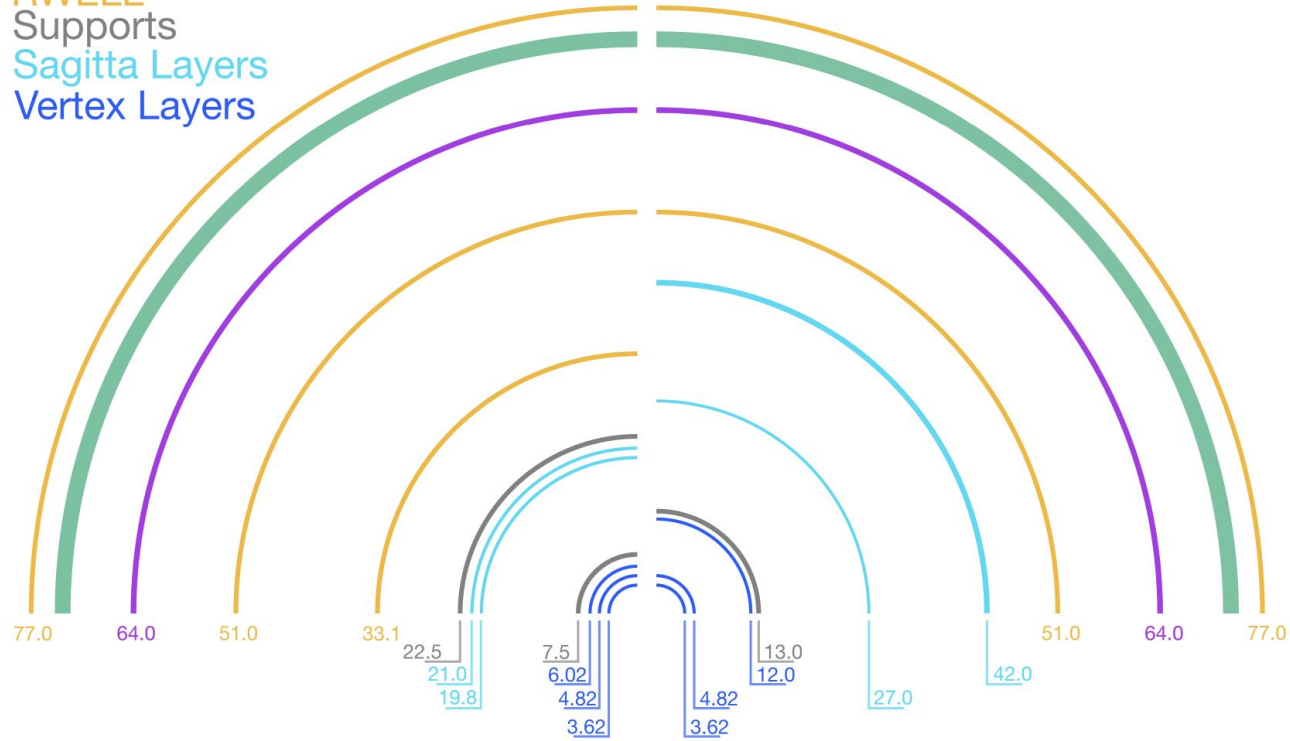
✓ Fix a bug in CarbonFiber frame thickness

ShujieL committed 4 days ago Verified

src/BarrelTrackerWithFrame_geo.cpp

```
@@ -153,7 +153,8 @@ static Ref_t create_BarrelTrackerWithFrame(Detector& description, xml_h e, Sensi
153 153     double frame_width      = m_frame.width();
154 154     double frame_height    = getAttrOrDefault<double>(m_frame, _U(height), 5.0 * mm);
155 155     double tanh            = frame_height / (frame_width / 2.0);
156 -     double frame_height2  = frame_height - frame_thickness - frame_thickness / tanh;
156 +     double costh          = 1./sqrt(1+tanh*tanh);
157 +     double frame_height2  = frame_height - frame_thickness - frame_thickness / costh;
157 158     double frame_width2    = 2.0 * frame_height2 / tanh;
158 159
159 160     Trd1 moduleframe_part1(frame_width / 2, 0.001 * mm, m_frame.length() / 2, frame_height / 2);
```

DIRC
 AC-LGAD
 RWELL
 Supports
 Sagitta Layers
 Vertex Layers

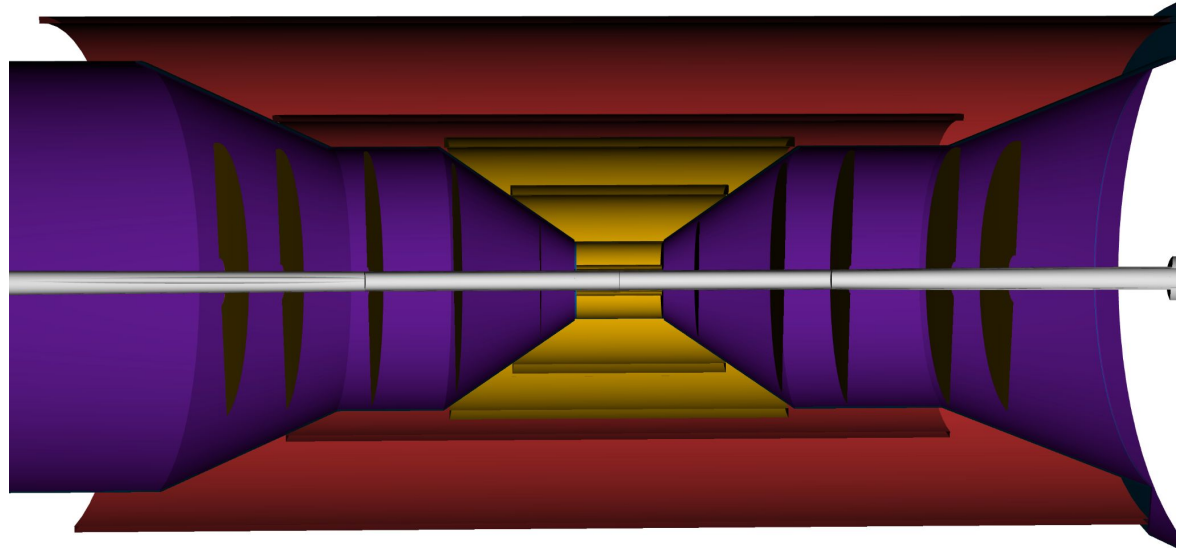


ECCE

EPIC/LBNL

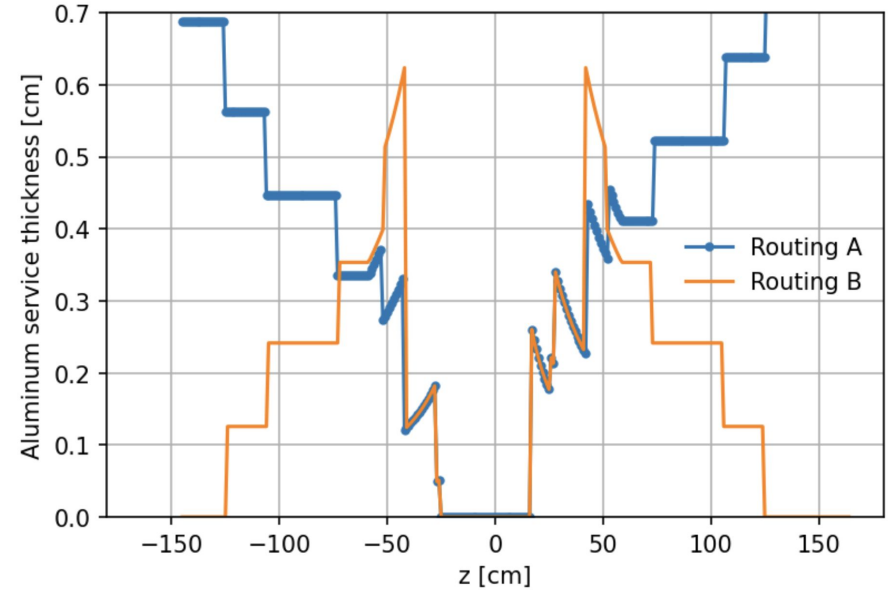
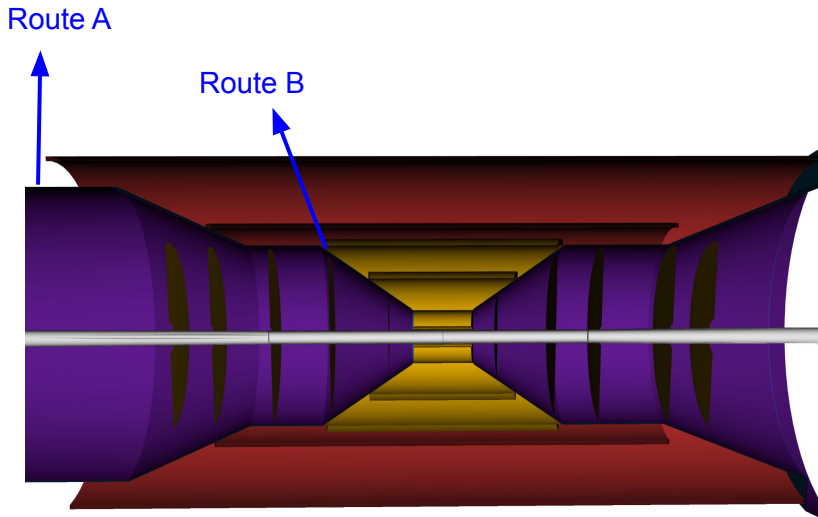
Slightly updated geometry

- Remove carbon cylinder support for the second vertex layer
- Symmetric disks (5 each side)
- Recalculated service thickness
 - Aluminum ☒
 - CarbonFiber ?
- NO uWELL, AC-LGAD

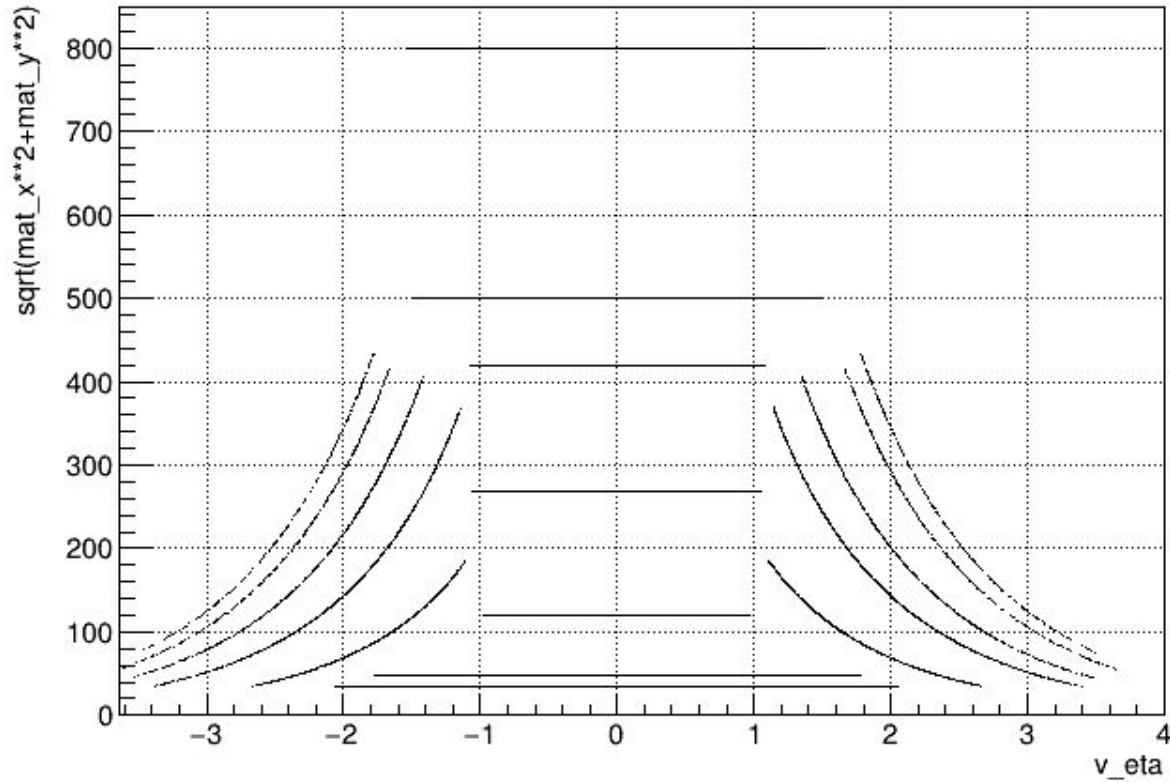


Estimation of service aluminum thickness

- cables from 3 vertex barrel layers go to +z side
- 2 outer barrel layers split evenly to +z
- Route A: cables exist to end of service barrel at large $|z|$ (both sides)
- Route B: cables exist along the cone at $\sim |z|=50\text{cm}$



Sensitive layers for material map



Material map test run:

