# Some inner cylinder considerations

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# Issues for the inner cylinder

- Material thickness ($X_0$)
- RF shielding
- Load bearing (or not)
- Mechanical

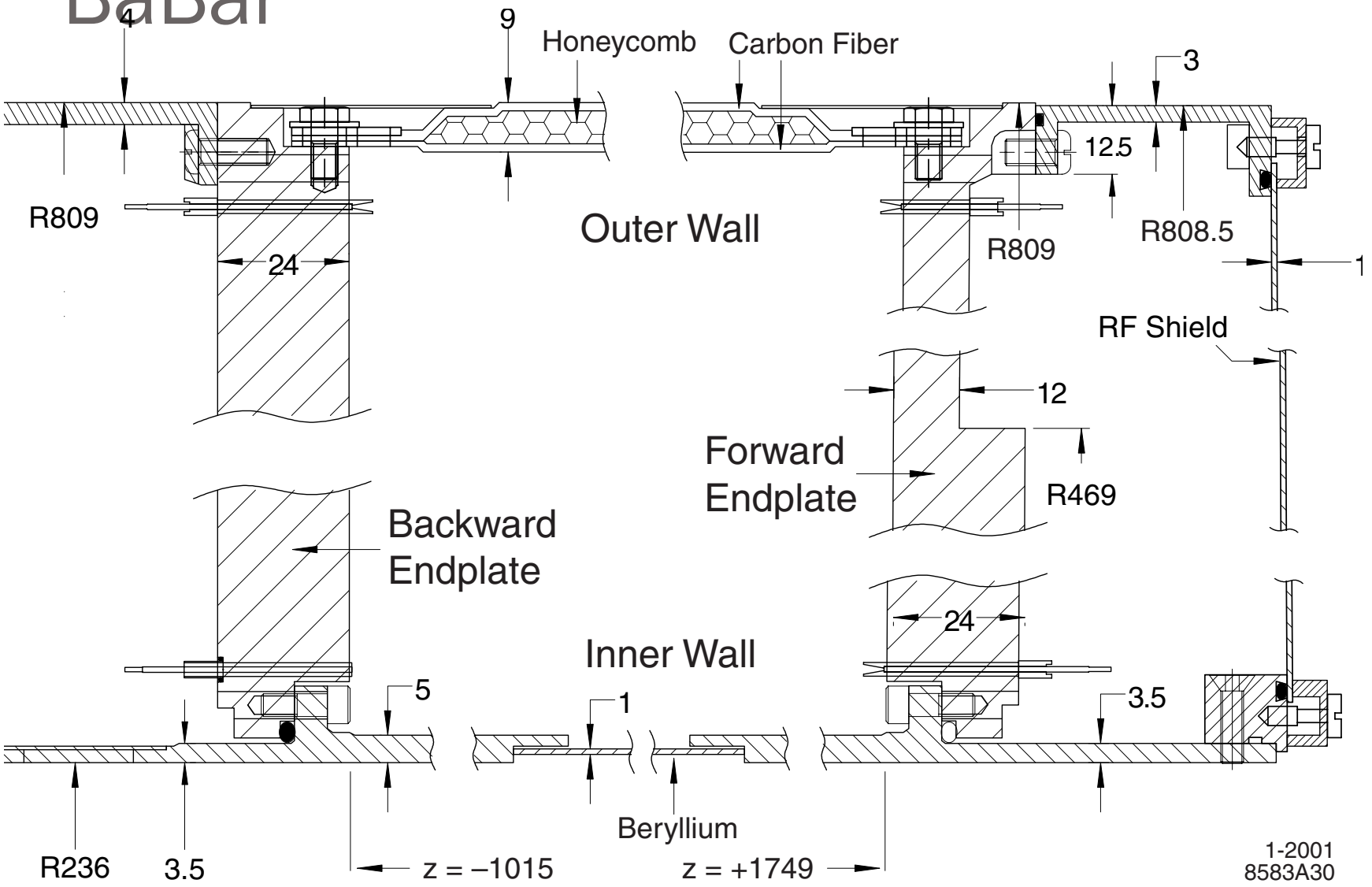
# Some previous experiments

| Experiment | Inner cylinder material | | Thickness ($X_0$) | Load bearing |
|---|---|---|---|---|
| BaBar | 1 mm Be | 2 × epoxy | 0.0028 + epoxy | Y |
| KLOE | 1.1 mm CF | 2 × 100 um Al | 0.0041 | N |
| CLEO-3 | 2 mm rohacell | 2 × 20 um Al | 0.0012 | N |
| CDF | 2.51 mm CF | 25.4um Al | 0.0099 | N |
| Belle | 0.3 mm CF | ??? | 0.0011 + ? | N |
| Belle-2 | 0.5 mm CF | ??? | 0.0013 + ? | N |

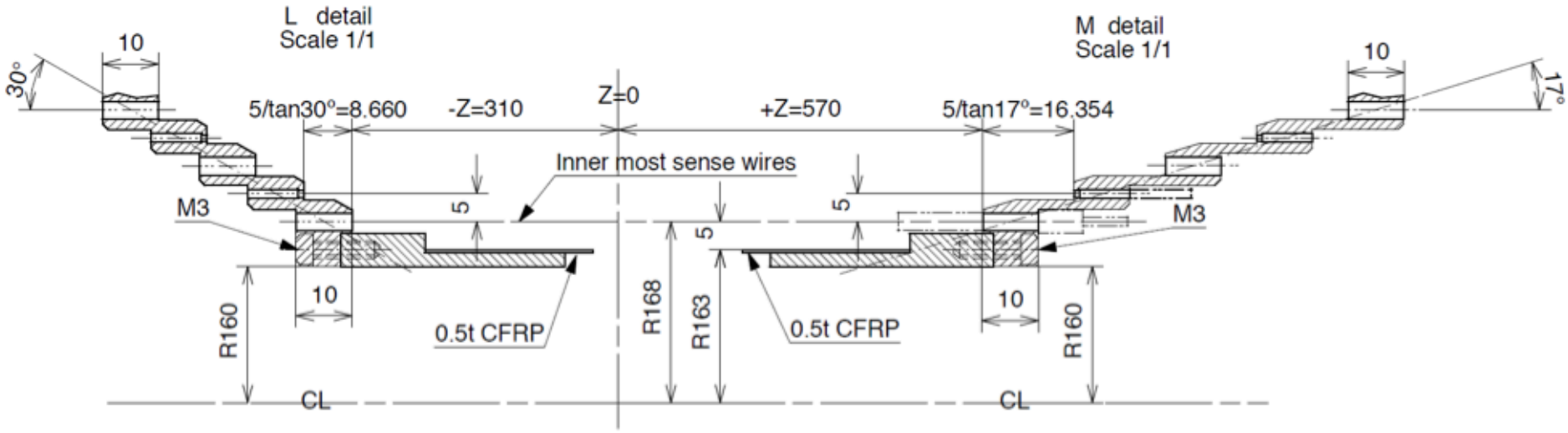
# Material radiation lengths

- Beryllium 353 mm
- Carbon Fiber 267 mm
- Rohacell 2664 mm (CLEO; can vary by 2×)
- Aluminum 89 mm
- Epoxy 387 mm

# BaBar


4
9
Honeycomb
Carbon Fiber
3
12.5
R809
24
Outer Wall
R809
R808.5
1
RF Shield
12
Forward
Endplate
R469
Backward
Endplate
24
Inner Wall
5
1
3.5
Beryllium
R236
3.5
z = –1015
z = +1749
1-2001
8583A30

# Belle-2


L detail
Scale 1/1
M detail
Scale 1/1
10
30°
5/tan30°=8.660
-Z=310
Z=0
+Z=570
5/tan17°=16.354
10
17°
Inner most sense wires
M3
5
5
5
M3
R160
10
0.5t CFRP
R168
R163
0.5t CFRP
10
R160
CL
CL

# Material

- Dan Peterson DR3 talk at Vienna 2001 instrumentation conference: "Scattering material < 0.15% RL required to allow use of the outer silicon layer in momentum measurement at all momenta."
- However, we have a silicon tracker capable of stand-alone tracking at low momentum, so perhaps this is not as much of an issue for us.
- I have asked Philip to look at the physics impact of inner cylinder thickness.
  - this is also a way of getting him (and me) started using FastSim.

# Mechanical issues

- CLEO was aiming for a very thin inner cylinder. They felt that they were unable to achieve the required radial distortion tolerance of 250 μm with Beryllium, and so went for 2 mm rohacell with 20 μm aluminum skins.
- Very light, but strain limit was 0.8 mm. Need to worry about aluminum wire creep loading the inner cylinder. (Extension, not compression).

# RF shielding

- Dave Britton, "Some comments on RF shielding and carbon composites", TNDC-96-28, Nov. 1995.
- David Nelson, "Drift Chamber Electronics System Shielding and Grounding Requirements", TNDC-97-74, Dec. 1997.
- CDF used a single 25.4 μm aluminum skin on the inner cylinder: "The electrical shielding has proved adequate, since there has been no evidence of pick-up from either the accelerator or silicon detector when taking collision data."
- Bill Wisniewski noted out that the BaBar calorimeter used a double shield separated by 1–2 mm, but that the capacitive coupling was so large that it functioned as a single shield.
- Seems complicated to me.