

A proposal to reduce the FDC support
material thickness
– GlueX-doc-800-v2

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Due to concerns about the amount of material in the FDC, we propose replacing most of the FR-4 (G10) in the original HDGeant model with a Rohacell/carbon-fiber/E-glass laminate. We also plan to make the anode-cathode spacer rings out of polyethylene. The wire frame will remain FR-4 for now. There is one laminate for each cathode plane. A sketch of the arrangement for each chamber layer is shown in figure 1. The density of the Rohacell layer is 0.075 g/cm^3 (not low-density Rohacell). The E-glass layer is a composite of epoxy resin (fraction = 0.327) and E-glass fibers (fraction=0.673), which is an insulating layer. The density of E-glass fiber is about 2.61 g/cm^3 and the chemical composition is 54% SiO_2 , 14% Al_2O_3 , 22% $\text{CaO}+\text{MgO}$, and 10% B_2O_3 by weight. A list of the material thicknesses in radiation lengths is presented in table 1.

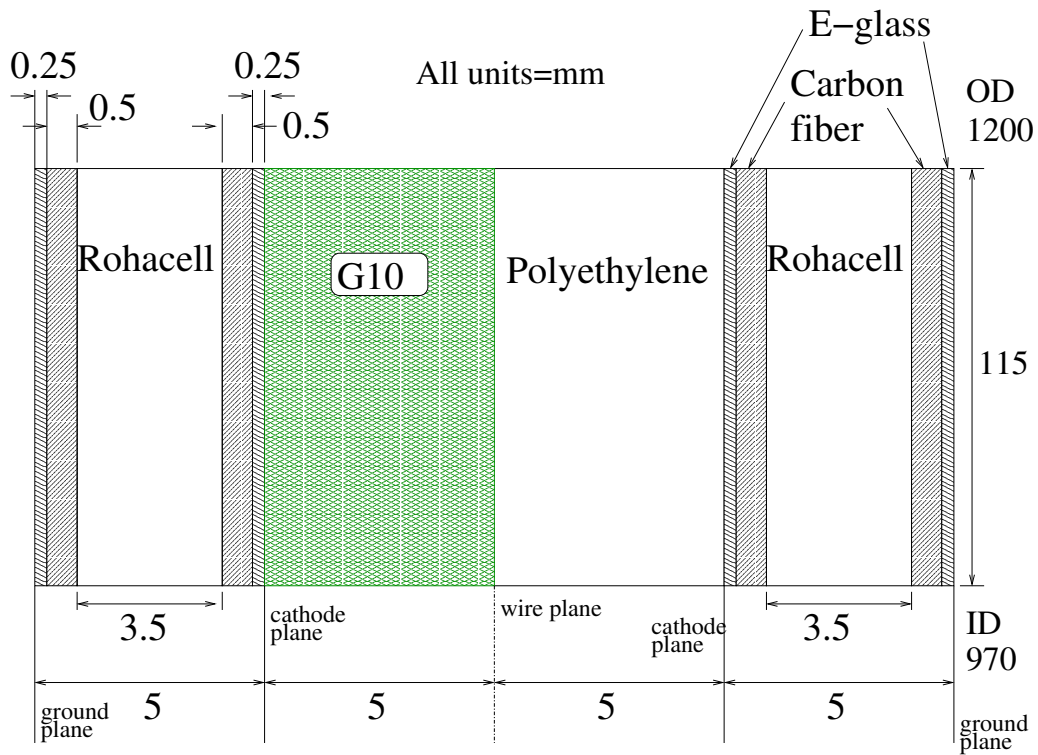


Figure 1: Cartoon of the support frame for each wire/cathode chamber unit (not to scale).

Material	Thickness (g/cm ²)	Radiation Length (g/cm ²)	X/X ₀
E-glass/epoxy	0.2182	29.24	0.00746
Carbon fiber/epoxy	0.4090	42.70	0.00958
Rohacell	0.0526	41.04	0.00128
FR-4(G10)	0.9550	30.17	0.03165
Polyethylene	0.4750	44.64	0.01064
Total (each drift layer)			0.06511
Total (each package)			0.39
Total (12 cm of FR-4)	22.91	30.17	0.76

Table 1: Thicknesses of the various layers in the sandwich. A comparison to the old FR-4-only support ring is also presented – the sandwich is about a factor of 2 less thick in radiation lengths.