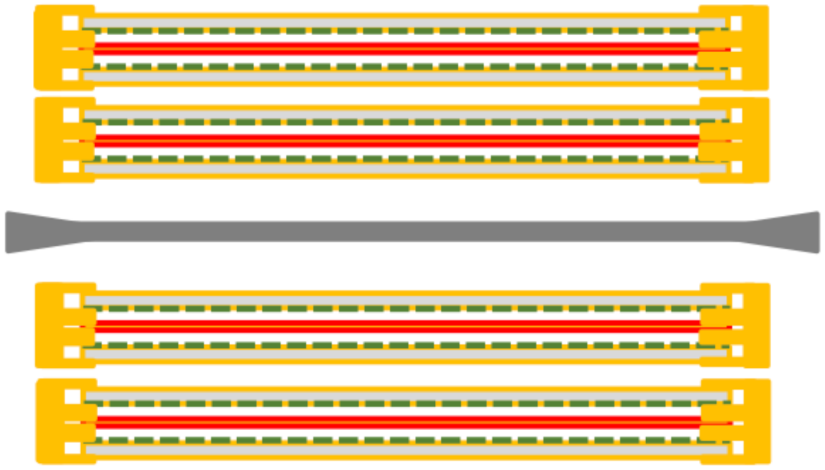
MATERIAL REVISION

E. DE LUCIA

FIRST GEOMETRY TO SIMULATE: 2 SMALL GAP B2B

	Schema 1 small gap B2B C+ layer	1 cm gas gap			
	from outside to inside or viceversa				
		Thikcness (um)		X0 (cm)	% X0
Cyl. Support Anode	Cu Ground FEE	3		1,43	0,021
	kapton	50		28,6	0,017
	glue	25		33,5	0,007
	FR4	100		19,3	0,052
	glue	25		33,5	0,007
	MILLIFOAM/honeycomb	3000		1312,5	0,023
	glue	25		33,5	0,007
	FR4	100		19,3	0,052
					0,187
Amplif.	Cu	3		1,43	0,021
	kapton	50		28,6	0,017
	DLC	0,1		12,1	0,000
	Pre-preg (106)	50		19,3	0,026
					0,064
Anode 2D	Cu	3		1,43	0,021
	kapton	50		28,6	0,017
	glue	25		33,5	0,007
	Cu	3		1,43	0,021
	kapton	25		28,6	0,009
					0,076
Tile BaseLine	Glue (KREMPEL)	25		33,5	0,007
	kapton	50		28,6	0,017
	Glue	25		33,5	0,007
	Honeycom	2000		1312,5	0,015
	Glue	25		33,5	0,007
	Kapton	50		28,6	0,017
					0,073
			Tot. Anode x2		0,800

- N.2 small gap B2B C+layers → 1.5÷1.9% X0
- 2 × 1 cm gas gap/B2B device
- 4 cm global sampling gas

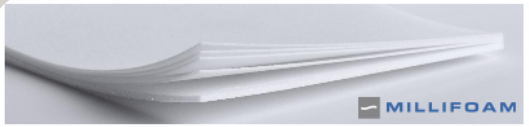


Gas Gap	10000

Cyl Support + 2 Cathode	Cu	3		1,43	0,021
	kapton	50		28,6	0,017
	glue	25		33,5	0,007
	FR4	100		19,3	0,052
	glue	25		33,5	0,007
	MILLIFOAM/honeycomb	3000		1312,5	0,023
	glue	25		33,5	0,007
	FR4	100		19,3	0,052
	glue	25		33,5	0,007
	kapton	50		28,6	0,017
	Cu	3		1,43	0,021
					0,233

C+RWELL MATERIAL REVISION

- Pre-preg (106): G10 con 70% di colla e 30% di fibra di vetro
- CF: fibra di vetro con 70% di colla e 30 di fibra di vetro



4a MANUFACTURING

Technical Datasheet - MILLIFOAM® RHC71IGF

MILLIFOAM® RHC71IGF is a closed-cell rigid foam based on polymethacrylimide (PMI) chemistry and contains no CFC's. It is the structural foam of choice for a broad range of automotive, electronics, medical and other industrial applications. In the medical market, it is a commonly used core material for x- ray and CT tabletops.

Polymer	PMI	Sheet Size	2500 x 625 mm
Thickness range	0.5-2.5 mm	Supplier	Evonik GmbH

Less resin uptake during part processing means lower final part weight and reduced overall cost. MILLIFOAM® RHC71IGF is suitable for prepreg processing, resin infusion and RTM process up to temperatures of 130°C (266°F) and pressures of 0.3 MPa (44 psi). Its thermoformability provides tremendous manufacturing advantages and makes it easy to shape by machining.

MILLIFOAM® RHC71IGF Properties	
Density	75 kg/m³
Compressive Strength	1.5 MPa
Compressive Modulus	73 MPa
Tensile Strength	2.8 MPa
Tensile Modulus	92 MPa
Shear Strength	1.3 MPa
Shear Modulus	29 MPa
Coefficient of Thermal Expansion	3.81 1/K*10E-5
Thermoforming Temperature	195°C (383°F)
Drying Conditions	4 hrs @ 130°C ± 5°C (266°F ± 9°F)

Da simulazioni precedenti fatte da Lia abbiamo le seguenti informazioni
per i materiali della PCB, vetronite, DLC e la composizione finale:

```
// FR4 vetronite: fibra di vetro 60%  + resina epossidica 40%
// CHECK simulato come il permaglas ma con la densita' del FR4
// Epoxy, dal codice del CGEM IT
// C_18 H_31 =_3
//
// fiberglas, a mean value from tab. 1 in https://www.asminternational.org/documents/10192/1849770/06781G_p27-34.pdf
// mass fraction %:
// SiO2  60 wt%
// B2O3   5 wt%
// Al2O3 13 wt%
// CaO   22 wt%
// vetronite
double vetronite_density = 1.85*g/cm3;
// fiberglass 60% epoxy 40%

// DLC diamond like carbon
double dlc_density = 2.*g/cm3;
G4Material* dlc =  new G4Material("DLC", dlc_density, 1);
dlc->AddElement(C, 1);

// PCB
5     micron rame   --> considering holes in density calculation
50    micron kapton --> considering holes in density calculation
100.1 micron dlc    --> full (no holes)
35    micron rame   --> full (no holes)
1.6   mm vetronite  --> full (no holes)
```

```
// Honeycom = C_14 H_22 O_2 N_2
// lvs_name    = "Nomex";
// lvd_density  = 3.2e-2*g/cm3;
// lvi_element  = 4;
// G4Element *C = G4Element::GetElement("Carbon");
// G4Element *H = G4Element::GetElement("Hydrogen");
// G4Element *O = G4Element::GetElement("Oxygen");
// G4Element *N = G4Element::GetElement("Nitrogen");
// m_M_Honeycomb =  new G4Material(lvs_name, lvd_density, lvi_element)
// m_M_Honeycomb -> AddElement(C, lvi_natoms=14);
// m_M_Honeycomb -> AddElement(H, lvi_natoms=22);
// m_M_Honeycomb -> AddElement(O, lvi_natoms=2 );
// m_M_Honeycomb -> AddElement(N, lvi_natoms=2 );
```

```
<material name="Air">
    <D type="density" unit="g/cm3" value="0.0012"/>
    <fraction n="0.000124" ref="C"/>
    <fraction n="0.755268" ref="N"/>
    <fraction n="0.231781" ref="O"/>
    <fraction n="0.012827" ref="Ar"/>
  </material>

  <material name="Epoxy">
    <D type="density" value="1.3" unit="g/cm3"/>
    <composite n="44" ref="H"/>
    <composite n="15" ref="C"/>
    <composite n="7" ref="O"/>
  </material>

  <material name="G10">
    <D type="density" value="1.7" unit="g/cm3"/>
    <fraction n="0.08" ref="Cl"/>
    <fraction n="0.773" ref="Quartz"/>
    <fraction n="0.147" ref="Epoxy"/>
  </material>

  <material name="Kapton">
    <D type="density" value="1.43" unit="g/cm3" />
    <composite n="22" ref="C"/>
    <composite n="10" ref="H" />
    <composite n="2" ref="N" />
    <composite n="5" ref="O" />
  </material>

  <material name="ArCO2">
    <D type="density" value="0.00184" unit="g/cm3"/>
     <fraction n="0.7" ref="Ar"/>
     <fraction n="0.3" ref="CO2"/>
  </material>

<material formula="Cu" name="Copper" state="solid" >
      <RL type="X0" unit="cm" value="1.43558" />
      <NIL type="lambda" unit="cm" value="15.5141" />
      <D type="density" unit="g/cm3" value="8.96" />
      <composite n="1" ref="Cu" />
  </material>
```