

Progress in BIC sim: 'Add single-clad material to geometry'

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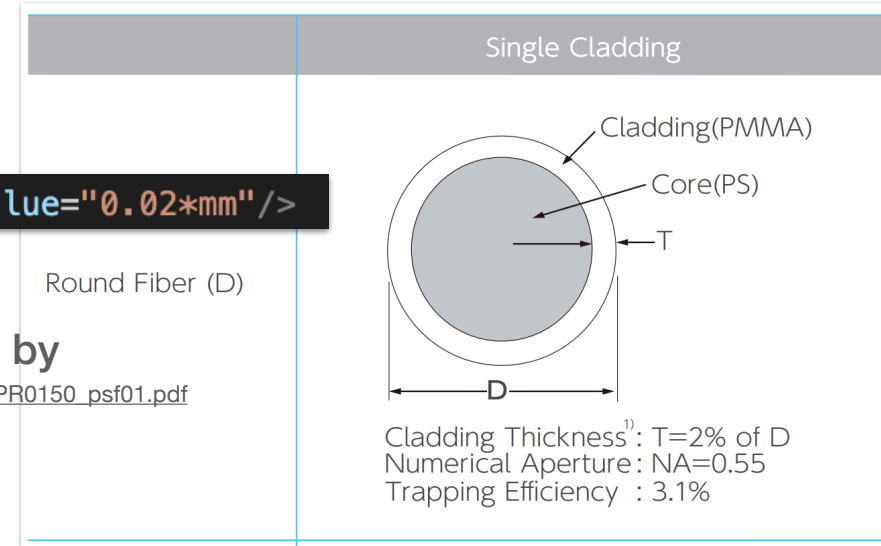
Single-clad thickness: Modification

- Epic/compact/ecal/barrel_interlayers.xml

```
68 // <constant name="EcalBarrel_CladdingThickness" value="0.02*mm"/>
```

- 0.04 to 0.02 mm referenced by

https://www.kuraray.com/uploads/5a717515df6f5/PR0150_psf01.pdf



- Epic/src/BarrelCalorimeterSciFi_geo.cpp

```
62 static Ref_t create_detector(Detector& desc, xml_h e, SensitiveDetector sens)
```

```
63 {
```

```
100   for (xml_coll_t li(x_det, _U(layer)); li; ++li) {
```

```
107     for (int j = 0; j < repeat; j++) {
```

```
199     void buildFibers(Detector& desc, SensitiveDetector& sens, Volume& s_vol, int layer_number, xml_comp_t x_fiber,
```

```
200     const std::tuple<double, double, double, double>& dimensions)
```

```
201     {
```

```
204     double f_cladding_thickness = getAttrOrDefault(x_fiber, _Unicode(cladding_thickness), 0.0 * cm);
```

Single-clad thickness: Implementation

```
$ cd ~/eic/epic  
$ cmake -B build -S . -DCMAKE_INSTALL_PREFIX=install  
$ cmake --build build -- install  
$ dd_web_display --export $DETECTOR_PATH/$DETECTOR_CONFIG.xml
```

- Where is 'fiber_vol' with clad info?

```
detector_geometry.root/Default;1/world_volume/EcalBarrelScFi_20/sector_0/layer1_0/slice3_2/fiber_grid_0_0_0/fiber_vol_0 fiber_core_vol_0  
TGeoTubeSeg  
DX=0.04800000 DY=0.04800000 DZ=218.2500  
Phi1=0 Phi2=360  
Rmin=0 Rmax=0.04800000 Looks working well!
```

Single-clad material: Code structure (1)

- Epic/src/BarrelCalorimeterSciFi_geo.cpp

```
219 // fiber and its cladding
220 double f_radius_core = f_radius - f_cladding_thickness;
221 Tube f_tube_clad(0, f_radius, s_length);
222 Volume f_vol_clad("fiber_vol", f_tube_clad, desc.material(x_fiber.materialStr()));
223 Tube f_tube_core(0, f_radius_core, s_length);
224 Volume f_vol_core("fiber_core_vol", f_tube_core, desc.material(x_fiber.materialStr()));
```

- Epic/compact/ecal/barrel_interlayers.xml

```
246 <layer repeat="EcalBarrelImagingLayers_num-1" vis="EcalBarrelLayerVis"
247     space_between="EcalBarrel_ImagingLayerThickness + EcalBarrel_SpaceBetween"
248     space_before="EcalBarrel_FrontSupportThickness + EcalBarrel_ImagingLayerThickness + EcalBarrel_SpaceBetween/2.">
249     <slice material="Aluminum" thickness="EcalBarrel_AluminumPlateThickness" vis="EcalBarrelSliceVis"/>
250     <slice material="SciFiPb_PbGlue_Edge" thickness="EcalBarrel_RadiatorEdgeThickness" vis="EcalBarrelSliceVis"/>
251     <slice material="SciFiPb_PbGlue" thickness="EcalBarrel_RadiatorThickness" vis="EcalBarrelFiberLayerVis">
252         <fiber material="SciFiPb_Scintillator"
253             sensitive="yes"
254             grid_n_phi="5"
255             grid_dr="2*cm"
256             radius="EcalBarrel_FiberRadius"
257             cladding_thickness="EcalBarrel_CladdingThickness"
258             spacing_x="EcalBarrel_FiberXSpacing"
259             spacing_z="EcalBarrel_FiberZSpacing"
260             vis="EcalBarrelFiberLayerVis">
261         </fiber>
262     </slice>
263     <slice material="SciFiPb_PbGlue_Edge" thickness="EcalBarrel_RadiatorEdgeThickness" vis="EcalBarrelSliceVis"/>
264     <slice material="Aluminum" thickness="EcalBarrel_AluminumPlateThickness" vis="EcalBarrelSliceVis"/>
265 </layer>
266
```

Single-clad material: Code structure (2)

- Epic/compact/materials.xml

```
468 <material name="SciFiPb_Scintillator">
469   <D type="density" value="1.049" unit="g / cm3"/>
470   <fraction n="0.077" ref="H"/> 1.008 u
471   <fraction n="0.921" ref="C"/> 12.011 u
472   <fraction n="0.001" ref="N"/>
473   <fraction n="0.001" ref="O"/>
474   <constant name="BirksConstant" value="0.126*mm/MeV"/>
475 </material>
```

- Reference (https://www.kuraray.com/uploads/5a717515df6f5/PR0150_psf01.pdf)

Materials

	Materials	Refractive index	Density (g/cm ³)	No. of atom per cm ³
Core	Polystyrene(PS)	n _D =1.59	1.05	C: 4.9x10 ²² H: 4.9x10 ²²
Cladding	for single cladding inner for multi-cladding Polymethylmethacrylate (PMMA)	n _D =1.49	1.19	C: 3.6x10 ²² H: 5.7x10 ²² O: 1.4x10 ²²

Single-clad material: Code structure (2)

- Epic/compact/materials.xml

```

468 <material name="SciFiPb_Scintillator">
469   <D type="density" value="1.049" unit="g / cm3"/>
470   <fraction n="0.077" ref="H"/>
471   <fraction n="0.921" ref="C"/>
472   <fraction n="0.001" ref="N"/>
473   <fraction n="0.001" ref="O"/>
474   <constant name="BirksConst" value="0.126*mm/MeV"/>
475 </material>
+
475 </material> <material name="SciFiPb_Clad">
476   <D type="density" value="1.19" unit="g / cm3"/>
477   <fraction n="0.080" ref="H"/> 1.008 u
478   <fraction n="0.606" ref="C"/> 12.011 u
479   <fraction n="0.000" ref="N"/>
480   <fraction n="0.314" ref="O"/> 15.999 u
481   <constant name="BirksConstant" value="0.126*mm/MeV"/>
482 </material>
  
```

- Reference (<https://www.kuraray.com/uplo>)

Materials

	Materials	Refractive index	Density (g/cm ³)	No. of atom per cm ³
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To-do

- Pull Request pending on Git
- Single-clad material implementation?
- Move to 'sampling fraction'