STATUS AND PLANS FOR THE NEW CLICdp SIMULATION MODEL

CLICdp Collaboration Meeting

Marko Petrič

3 June 2015

Status of Detector

- Rough implementation of all detectors done
- Tension: update design vs. stable working version
- Konrad: "layout frozen", but open questions remain
- Walkthrough over detectors and review status and open questions

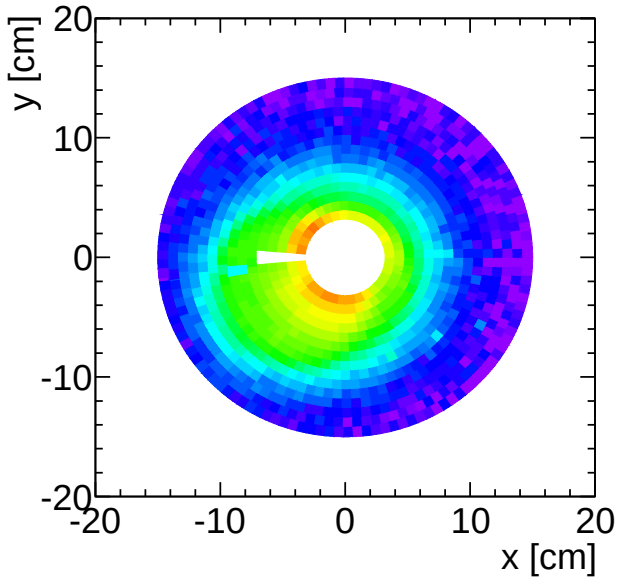
Segmentations

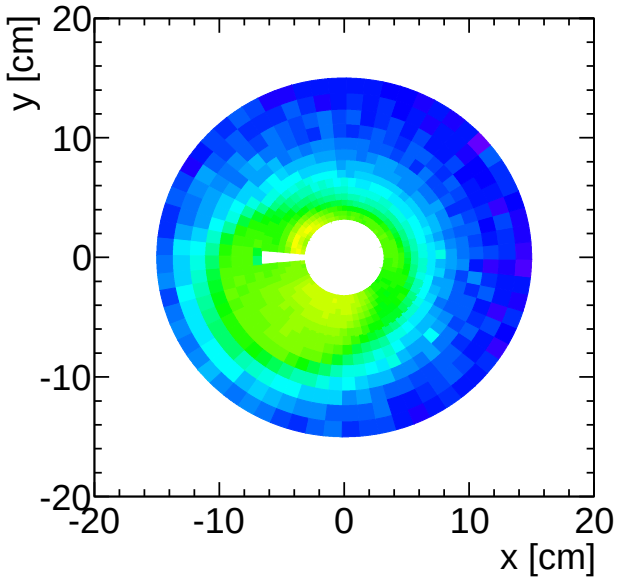
- Segmentations determine the granularity of the calorimeter sensitive detector
- They are paired at run time with the sub-detector and can be easily switched
- The same segmentations classes are used in simulation and reconstruction
  - Transform position local or global to integer cell ID
  - Transform cell ID to local or global position

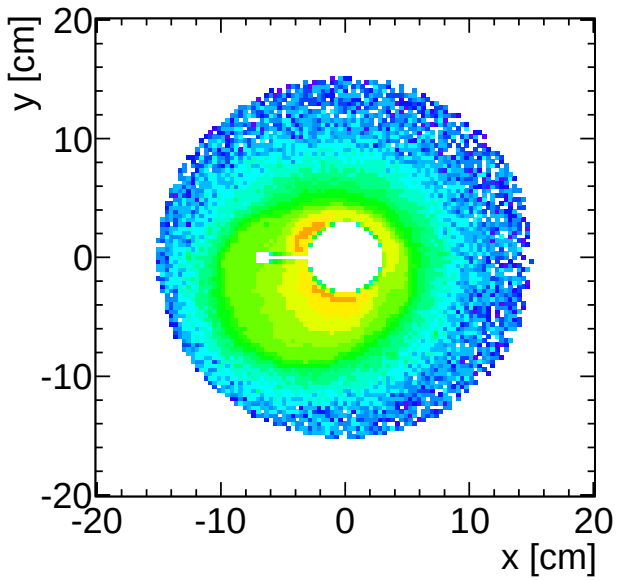
Existing Segmentations: Regular Cartesian Grid, Polar R-(R)Phi Grid, Projective Cylinder, Cylindrical
Missing: Hexagonal Segmentation, Advanced Tiling for the HCal…

Segmentation Example

One Bunch crossing of 3 TeV CLIC background simulated with different BeamCal segmentations








```
<segmentation type="PolarGridRPhi2"
              grid_r_values="3*cm 4*cm 5*cm ... 15*cm"
              grid_phi_values="SpanPhi/(4*8)*deg SpanPhi/(5*8)*deg ... SpanPhi/(15*8)*deg"
              offset_phi="-180*deg+(360*deg-SpanPhi)*0.5" />
```

```
<segmentation type="CartesianGridXY" grid_size_x="0.35*cm" grid_size_y="0.35*cm" />
```

Detector Conventions

Convention: all sub-detectors must reside in an envelope volume described by high-level parameters ('engineering parameters')

- Cross-check between envelope and content, nothing is allowed to stick out of its envelope
- Simplified visualisation of envelope-only detectors

Convention: Sub-Detectors must depend only on envelope parameters

- Avoid hidden dependencies between sub-detectors

Envelopes

Arbitrarily complicated envelopes can be entirely defined in the XML

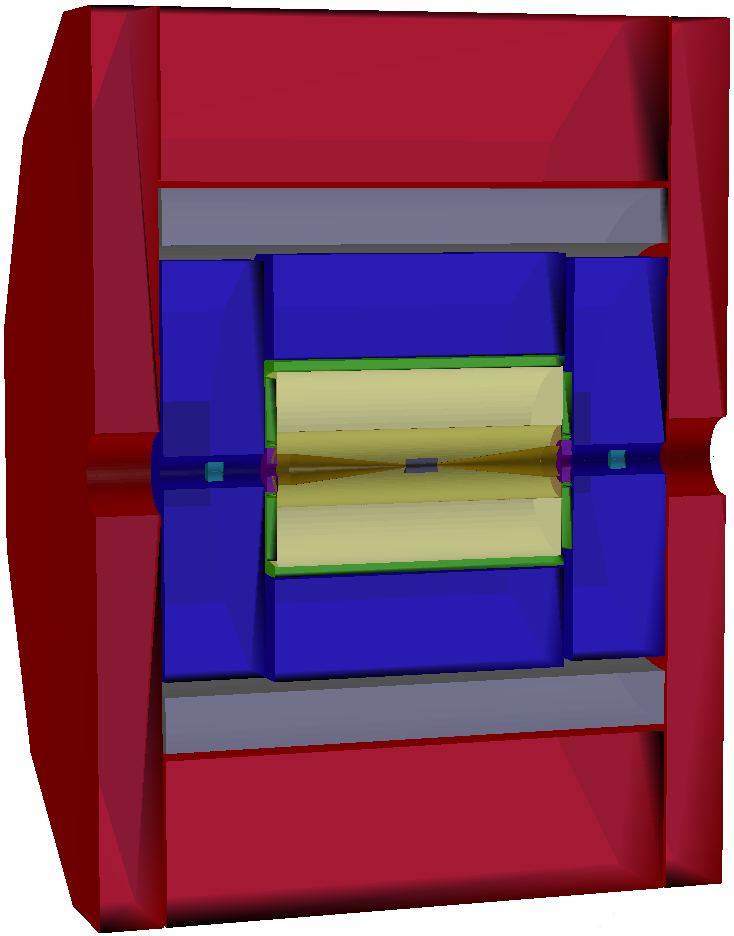
```
<envelope vis="ECALVis">
    <shape type="BooleanShape" operation="Subtraction" material="Air">
        <shape type="BooleanShape" operation="Subtraction">
            <shape type="PolyhedraRegular"  numsides="ECalEndcap_outer_symmetry"
                   rmin="0" rmax="ECalEndcap_outer_radius" dz="2.0*ECalEndcap_max_z"/>
            <shape type="PolyhedraRegular"  numsides="ECalEndcap_outer_symmetry"
                   rmin="0" rmax="ECalEndcap_outer_radius" dz="2.0*ECalEndcap_min_z"/>
        </shape>
        <shape type="Box" dx="ECalEndcap_inner_radius"
               dy="ECalEndcap_inner_radius" dz="ECalEndcap_max_z"/>
        <rotation x="0*deg" y="0*deg" z="180*deg/ECalEndcap_outer_symmetry"/>
    </shape>
    <rotation x="0*deg" y="0*deg" z="90*deg-180*deg/ECalEndcap_outer_symmetry"/>
</envelope>
```

And then make any given driver have an envelope:

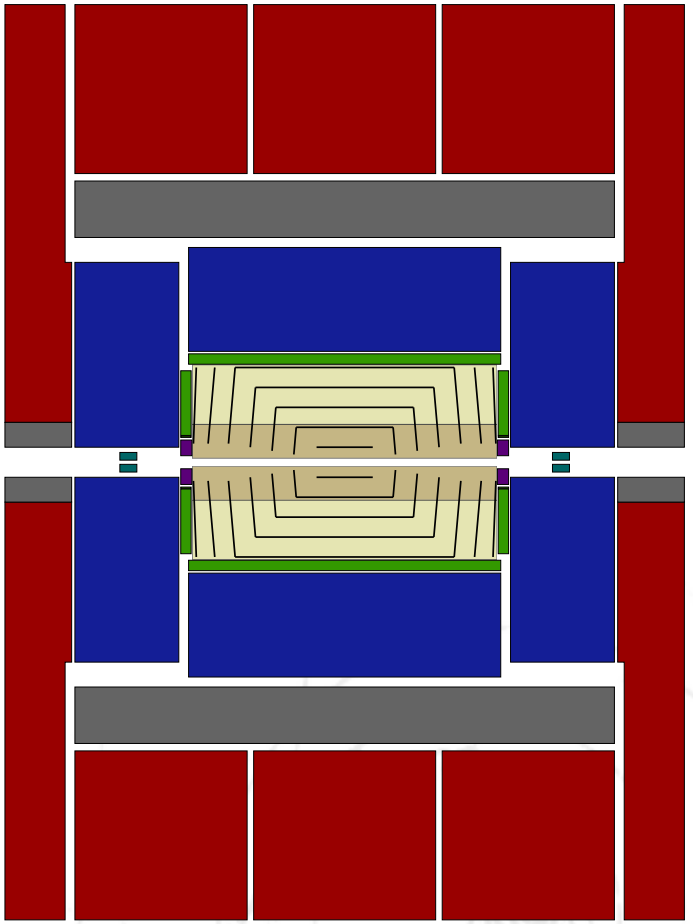
```
Volume envelope = XML::createPlacedEnvelope(lcdd, element, sdet);
if(lcdd.buildType() == BUILD_ENVELOPE) return sdet;
```

Envelopes for Full Detector

Combined envelopes for all sub-detectors



CLICdet_2015 envelopes

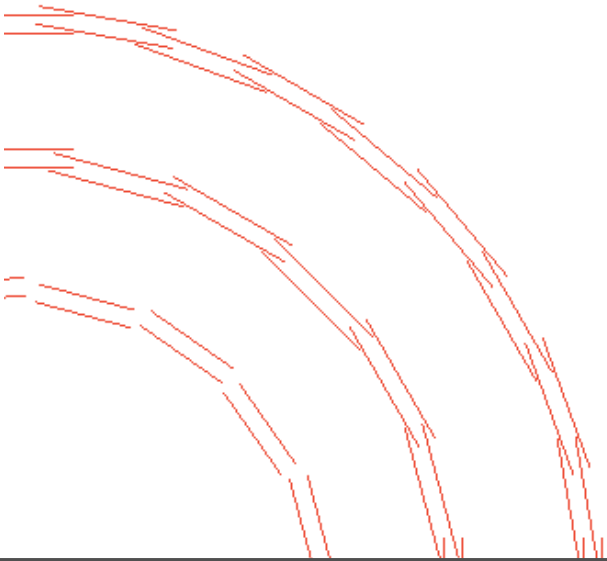


Regions defined by engineers

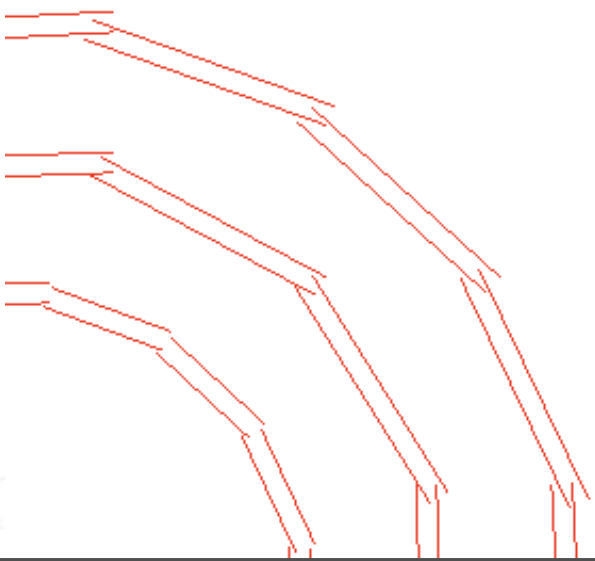
Vertex

- Sensitive geometry fully implemented - missing support
- Open issue: positioning of layers

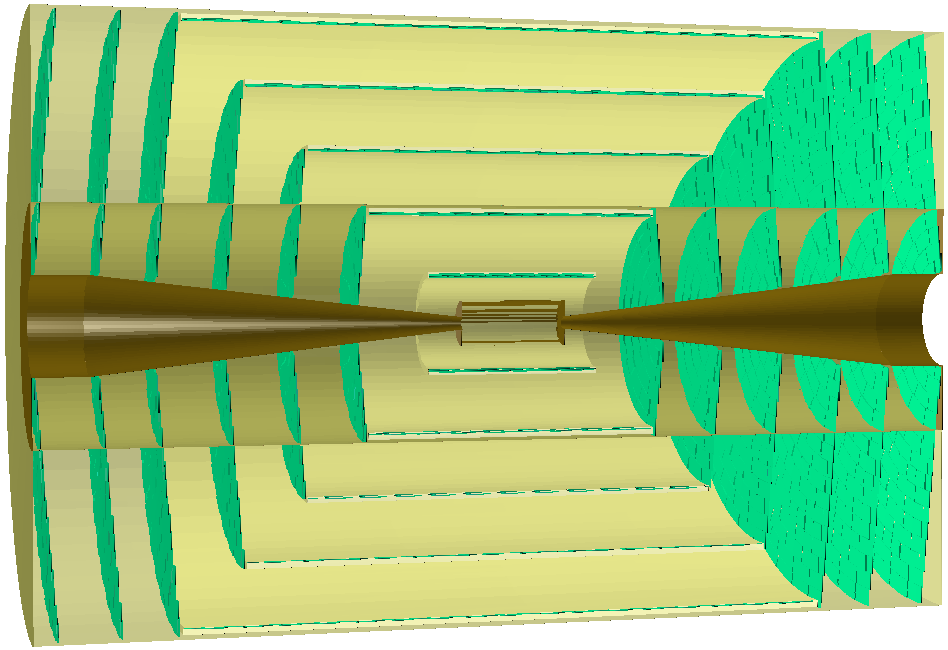
alternating

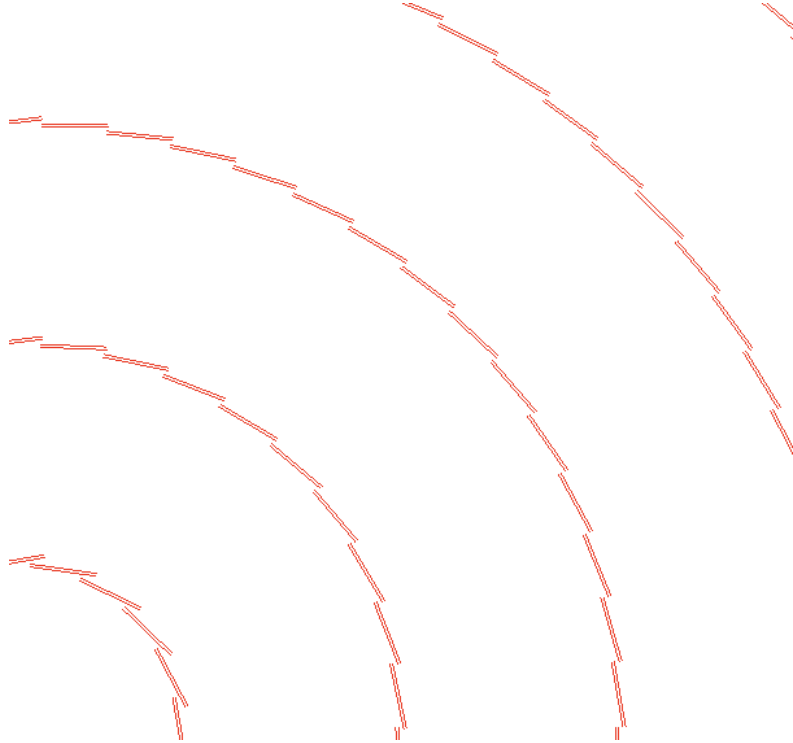


windmill



Inner and Outer Tracker

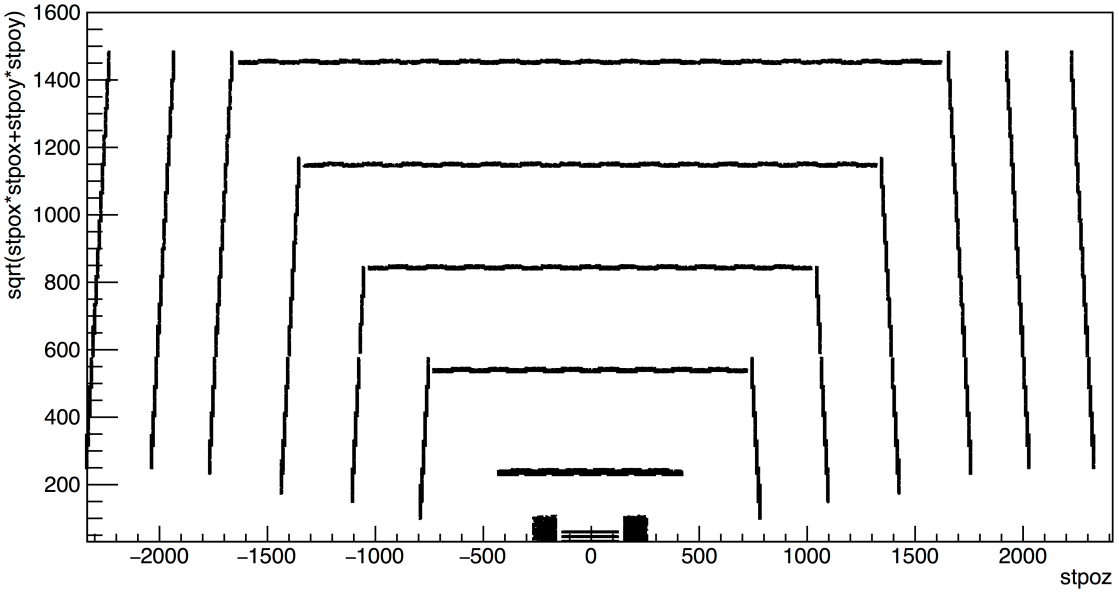


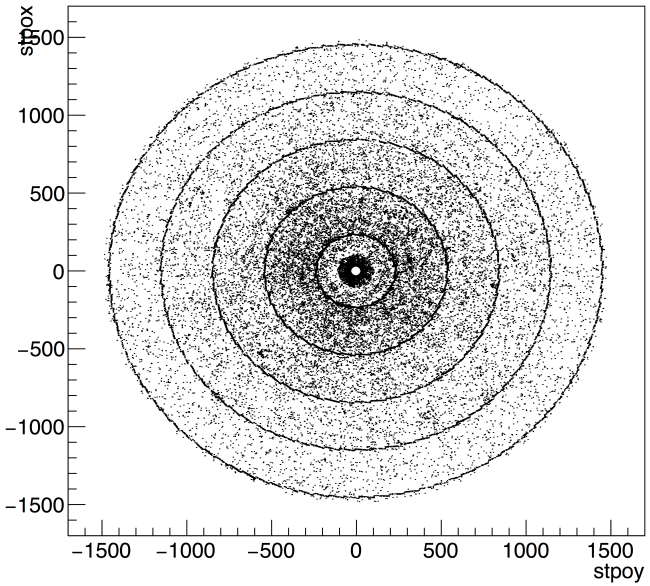


- Sensitive geometry fully implemented - missing support
- Open issue: positioning layers, structure of endcaps, overlap between modules, fitting in available space
- Warning: This driver is very flexible, but change of z position of endcap $\rightarrow$ recalculation of several parameters

Does it work? Yes

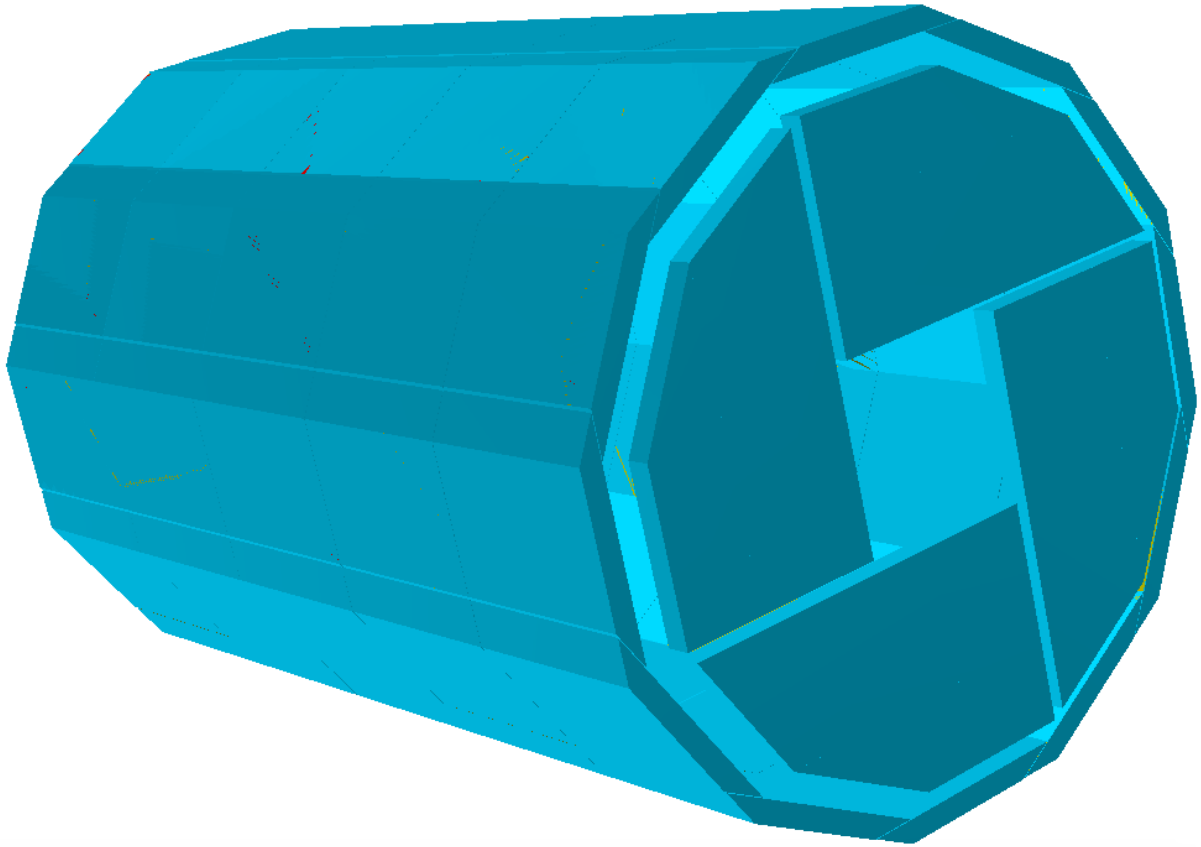
- Hit map from 100 $H\nu\nu$ events





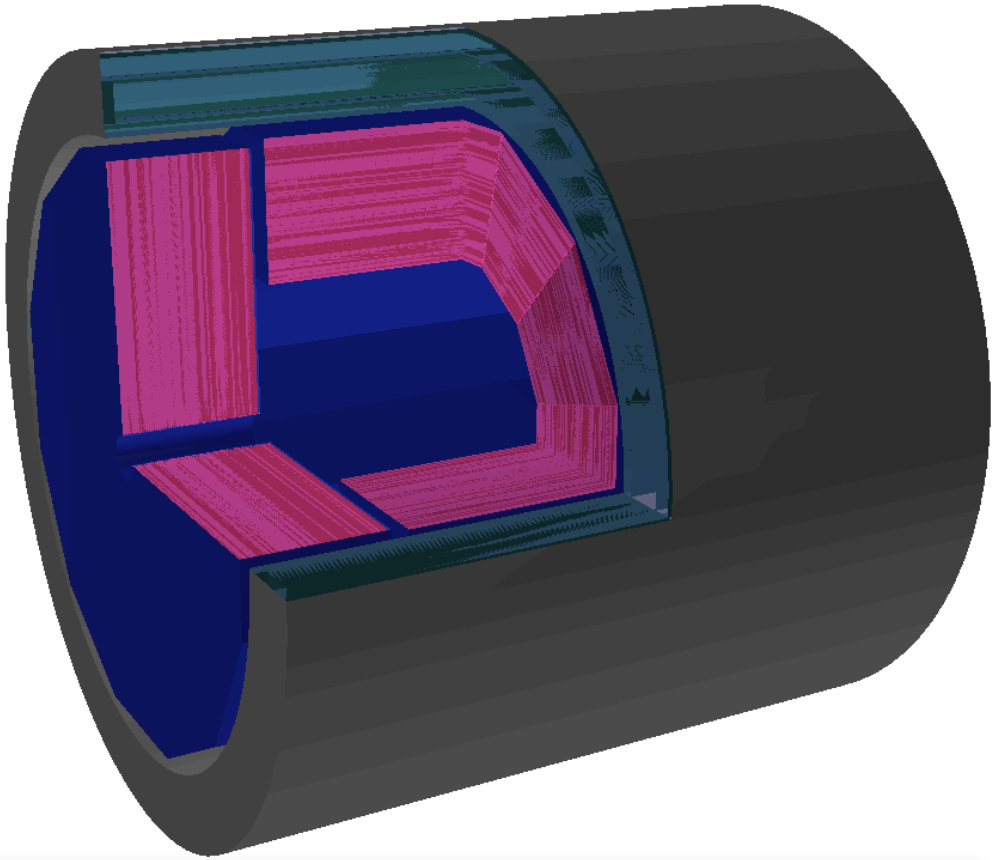
- Visible good coverage of tracker implementation
- Visible spiral vertex endcap
- How reconstruction works on this will be shown in next talk

ECal



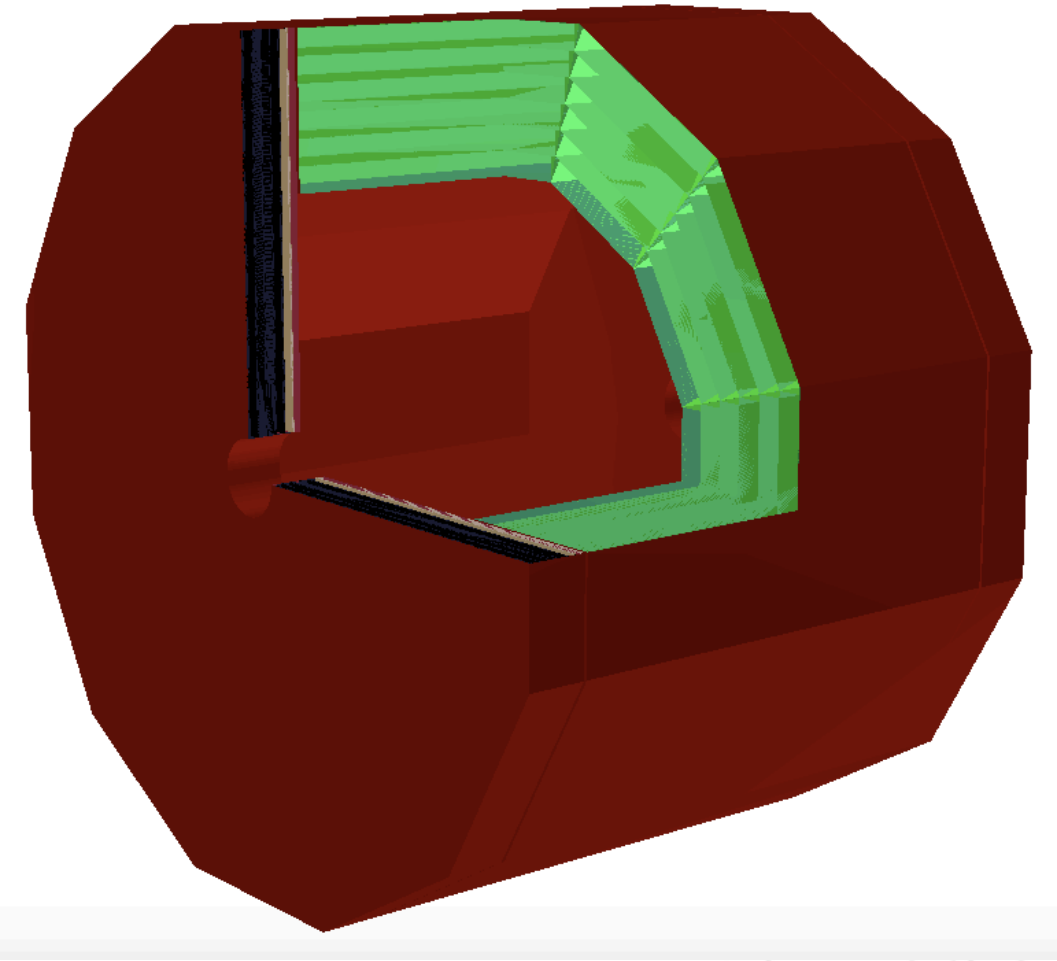
- Barrel in good shape, advanced degree of details
- Endcap: basic implementation with split into sectors
- Plug extended to fit LumiCal closer to IP – no design at present
- LLR has very detailed specifications for ECal
  - Not fully scalable – design based on 8” wafers

Hcal



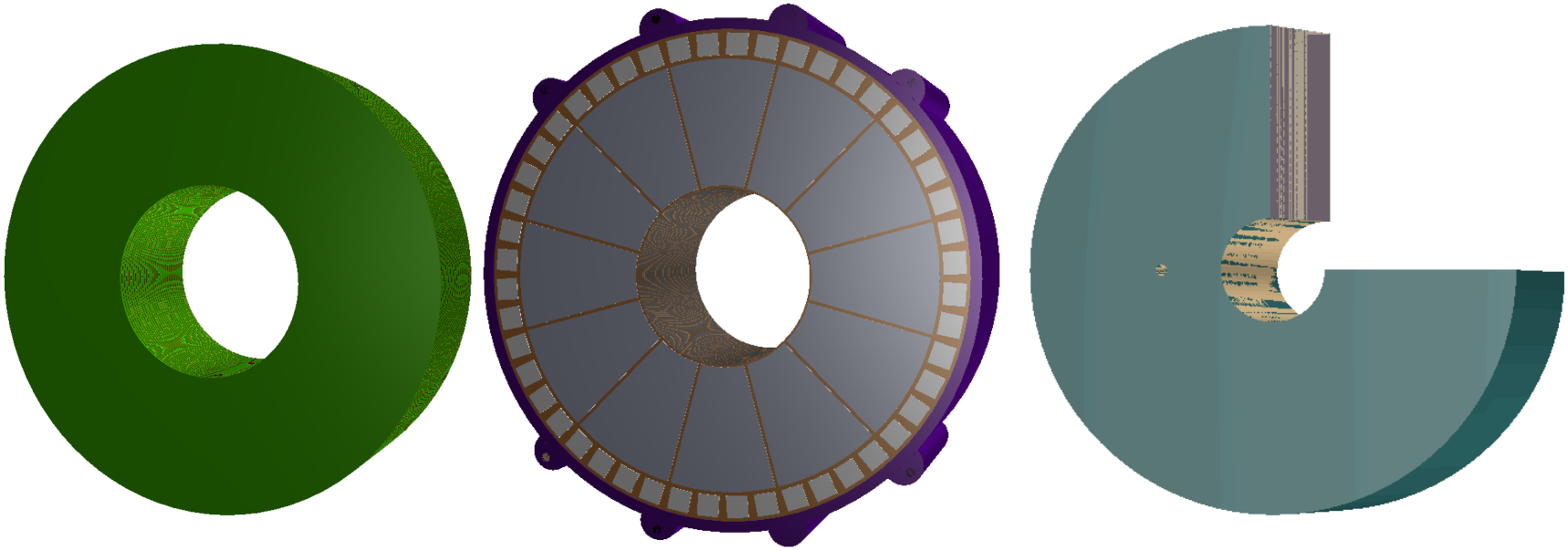
- HCal: Decent level of detail implemented
- HCal: Room for improvement, but not priority
- Solenoid: Layers of steel, vacuum and Al
- Solenoid: Suffices for current simulation

Yoke



- A basic level of detail implemented
- Barrel: 2.5m $\rightarrow$ 6$\times$39 cm Fe, Endcap: 1m $\rightarrow$ 6$\times$12.5 cm Fe
- Need to "drill" cabling spaces $\rightarrow$ acceptance

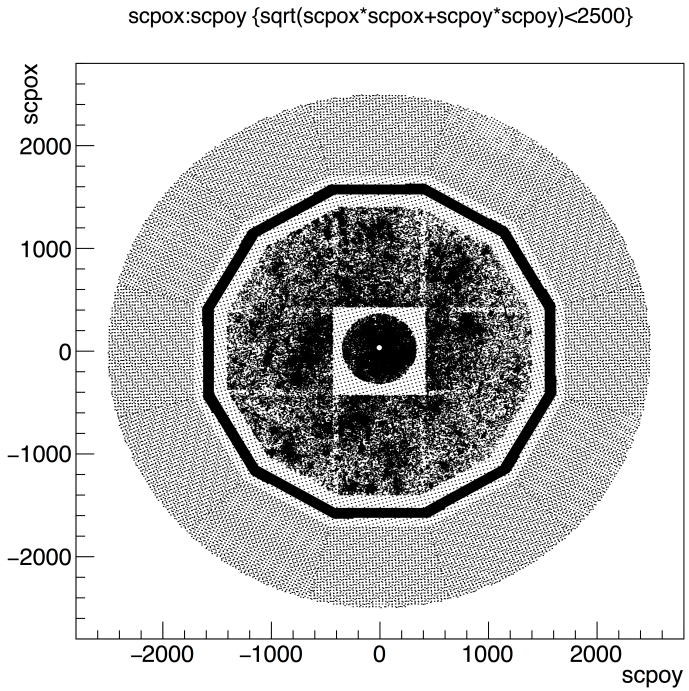
FCal

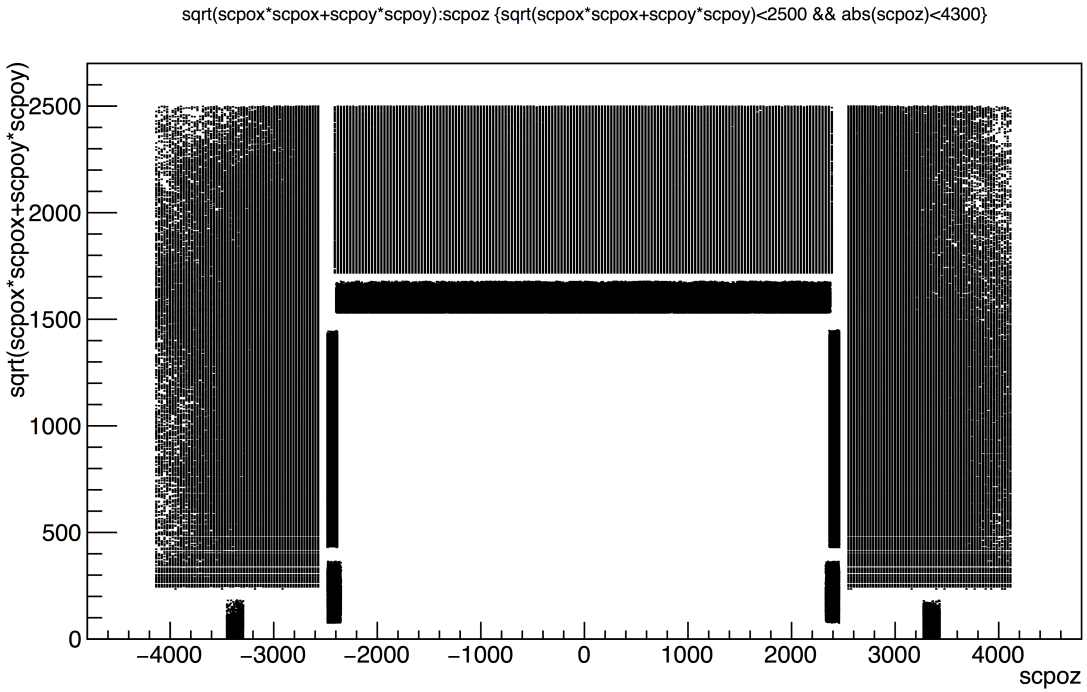


- A basic level of detail implemented for both
- LumiCal has a development version 2, but maybe not suitable for new position

Does it work? Yes

- Hit map from 100 $H\nu\nu$ events





- All components operate normally

Summary

- All detector components working
- There are still some minor hiccups in the geometry which should be ironed out in the next weeks
- First order priority trackers
- Need more constraints $\rightarrow$ positions of layers and overlaps with neighbours
- Do we need another tracker driver for studies?