

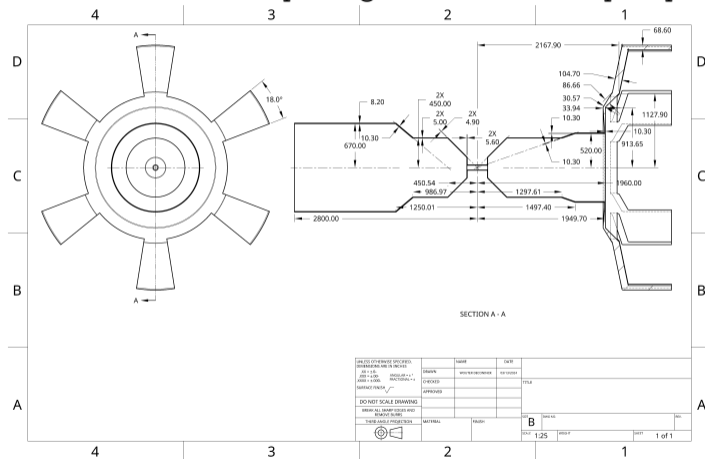
# EEEMCal gap and background studies

Dmitry Kalinkin

~~March 1st, 2024~~ March 15th, 2024

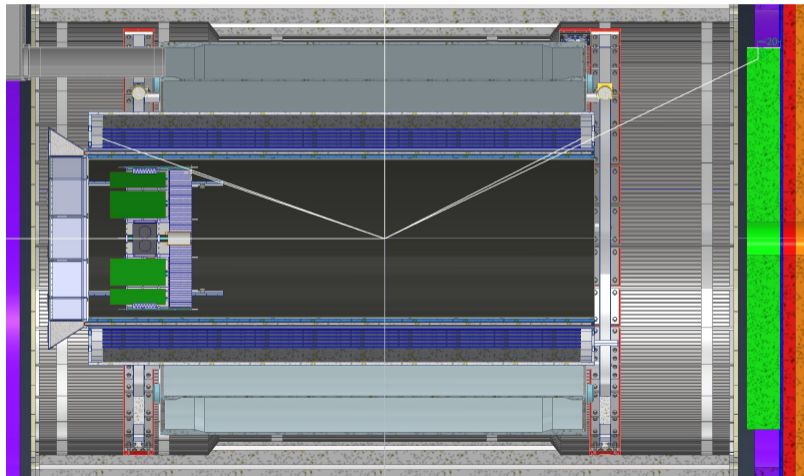


- Work by Wouter on services <https://github.com/eic/epic/pull/661>

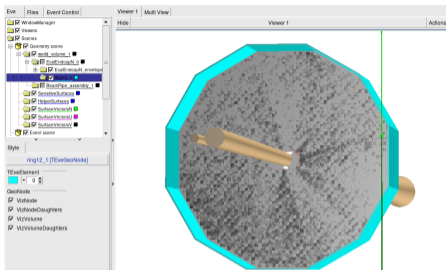


Gap

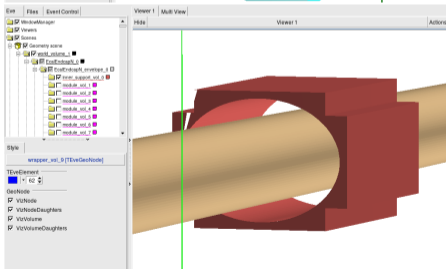
# EMCAL Coverage



# Simulation geometry (as of 24.02)



- ▶ “ring12” (cyan) – 0.9 cm thick StainlessSteel
- ▶ “EcalEndcapN\_envelope” (grey) – StainlessSteel (only applies where children volumes don't override)



- ▶ “Inner\_support\_vol” (rust) – Copper
- ▶ modules (black) – Vacuum (only applies where children volumes don't override)



# Remove aluminum supports

```
src/HomogeneousCalorimeter_geo.cpp

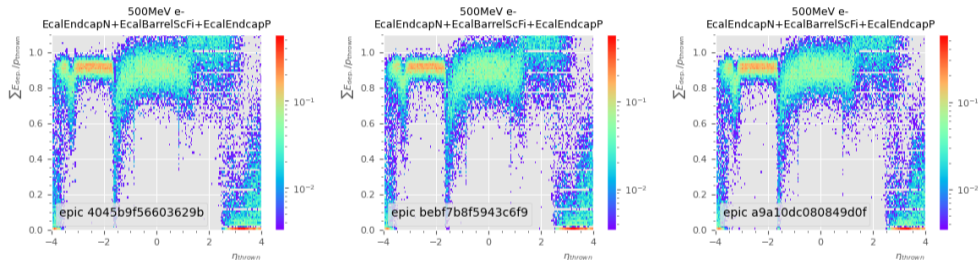
@@ -257,7 +257,7 @@ static std::tuple<int, std::pair<int, int>> add_12surface_disk(Detector& desc, A
//=====
257 257 //=====
258 258
259 259 PolyhedraRegular solid_ring12(12, r12min, r12max, structure_frame_length);
260 - Volume ring12_vol("ring12", solid_ring12, outer_ring_material);
260 + Volume ring12_vol("ring12", solid_ring12, desc.material("Air"));
261 261 Transform3D tr_global_Oring = RotationZYX(Prot, 0., 0.) * Translation3D(0., 0., Oring_shift);
262 262 ring12_vol.setVisAttributes(desc.visAttributes(plm.attr<std::string>(_Unicode(vis_struc))));
263 263

@@ -287,7 +287,7 @@ static std::tuple<int, std::pair<int, int>> add_12surface_disk(Detector& desc, A
287 287 EllipticalTube solid_sub(Innera, Innerb, calo_module_length / 2.);
288 288 Transform3D subtract_pos = RotationZYX(Nrot, 0., 0.) * Translation3D(0., 0., 0.);
289 289 SubtractionSolid calo_subtract(solid_world, solid_sub, subtract_pos);
290 - Volume env_vol(std::string(env.name()) + "_envelope", calo_subtract, outer_ring_material);
290 + Volume env_vol(std::string(env.name()) + "_envelope", calo_subtract, desc.material("Air"));
291 291 Transform3D tr_global = RotationZYX(Prot, 0., 0.) * Translation3D(0., 0., 0.);
292 292 env_vol.setVisAttributes(desc.visAttributes(plm.attr<std::string>(_Unicode(vis_steel_gap))));
293 293
```

(not in the main branch, of course)

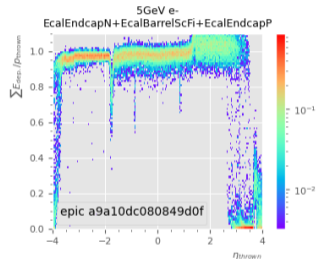
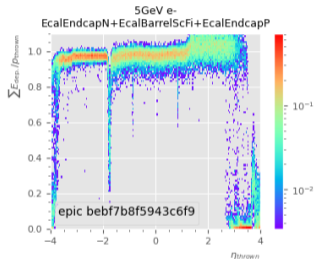
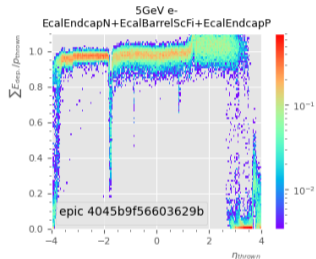


# Total energy deposition vs $\varphi$



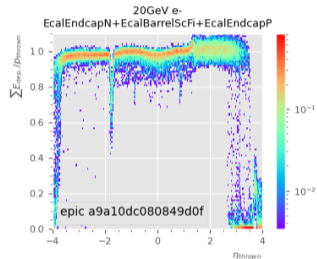
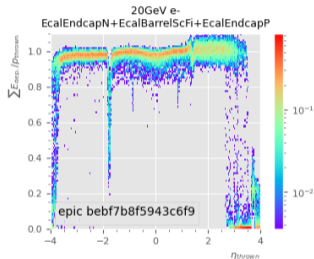
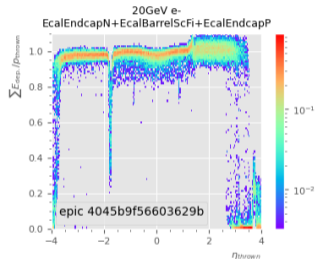
Left: nominal | Center: barrel adjusted PR#648 | Right: remove steel

# Total energy deposition vs $\varphi$



Left: nominal | Center: barrel adjusted PR#648 | Right: remove steel

# Total energy deposition vs $\varphi$



Left: nominal | Center: barrel adjusted PR#648 | Right: remove steel

# Background embedding

## Solution

The issue was that both signal and background vertices are thrown at a random time offset within  $2\mu\text{s}$  “integration window”

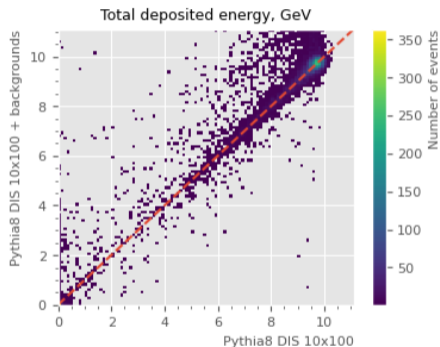
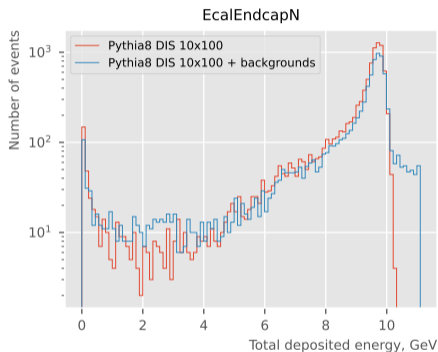
[https://github.com/eic/HEPMC\\_Merger/blob/e58058d9ef1e41f261e0dbcb75ee986aa3392bd0/signal\\_background\\_merger.py#L275](https://github.com/eic/HEPMC_Merger/blob/e58058d9ef1e41f261e0dbcb75ee986aa3392bd0/signal_background_merger.py#L275)

[https://github.com/eic/HEPMC\\_Merger/blob/e58058d9ef1e41f261e0dbcb75ee986aa3392bd0/signal\\_background\\_merger.py#L367](https://github.com/eic/HEPMC_Merger/blob/e58058d9ef1e41f261e0dbcb75ee986aa3392bd0/signal_background_merger.py#L367)

This would not fit within the  $1\mu\text{s}$  cutoff <https://github.com/eic/EICrecon/blob/8924e6abc7eddd3d8f1aff53435cb31655b0fdc6/src/algorithms/calorimetry/CalorimeterHitDigiConfig.h#L21>

The solution is to pass the `--squashTime` option to the `signal_background_merger.py`.

# Look without clustering (Backwards ECal)



# Look without clustering (Barrel ECal)

