Calorimeter Simulation Infrastructure

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Outstanding Issues

❖ **Electromagnetic calorimeter energy resolution**

❖ **Hadronic calorimeter simulations**

❖ **Refined detector geometries**

❖ **Far forward detectors**

❖ **Reconstruction infrastructure**

EM energy resolution

❖ **Using default set of range cuts, Geant4 returns a poorer energy resolution than expected for sampling calorimeters with very thin sensitive layers.**

- **For SiD, with ~300micron Si, get ~20%, vs ~16% expected.**

❖ **This can be remedied by running with smaller range cuts in the absorber material, but one must go to very small values, and program slows by factor of 10-20.**

EM energy resolution

❖**Recently released Geant4 v8 has modifications which address this issue.**

- **Essentially reduces range cut as one approaches a volume boundary.**

- **Reduces sensitivity of dependence on range cut.**

- **Adds slight overhead in runtime to handle additional geometry queries.**

- **Beginning systematic studies, but hampered by lack of testbeam data.**

- **See talk by David Ward at Vienna.**

Hadronic Calorimetry

❖ **Still expending a large amount of effort trying to understand the simulation of hadronic showers and how to measure energy with digital readout.**

  - **See talk by Ron Cassell.**

❖ **Need a common approach to specifying how to consistently handle analog vs digital readout.**

  - **Common definitions of density for digital readout?**

Refined detector geometries

❖ **Current simulations employ cylindrical barrels and endcaps. After gross optimizations, would like to also be able to simulate buildable detectors.**

❖ **lcdd format handles arbitrarily complex geometries.**

❖ **Compact geometry format which provides input to GeomConverter currently does not.**

❖ **Refactoring just beginning. Would like requirements input from users.**

Far Forward Geometries

❖**Electron-tagging in far forward region was investigated by T. Maruyama and N. Graf prior to technology decision. TM has continued to work on this at a low level.**

❖**However, whole forward region (beam cal, lumical, …) needs to be systematically investigated.**

- **See talk by Jinlong Zhang.**

❖**Some interest by BNL in this region.**

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Reconstruction Infrastructure

❖ **Would like to automate process by which sampling fractions are determined for analog.**

- **Could build into package such as slicDiagnostics or develop standalone.**

- **Currently also only have one single value for EM calorimeter. Would like to develop and implement layer-by-layer. Theta-dependence?**

❖ **Can we agree on digital "sampling fractions"?**

- **Or is this hopelessly entangled in the clustering definitions?**

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Reconstruction Infrastructure

❖ **Have CellID $\rightarrow$ position, still need position $\rightarrow$ CellID**

❖ **Neighbor ID code needed for different calorimeters, e.g. EM/HAD, or Barrel/Endcap**

Event overlays

❖**Need to be able to overlay events at the hit level in order to study pileup.**

- **Fairly straighforward to do, but needs someone to work on it.**