Studying the “confusion term” for different geometries (B and R_{min})

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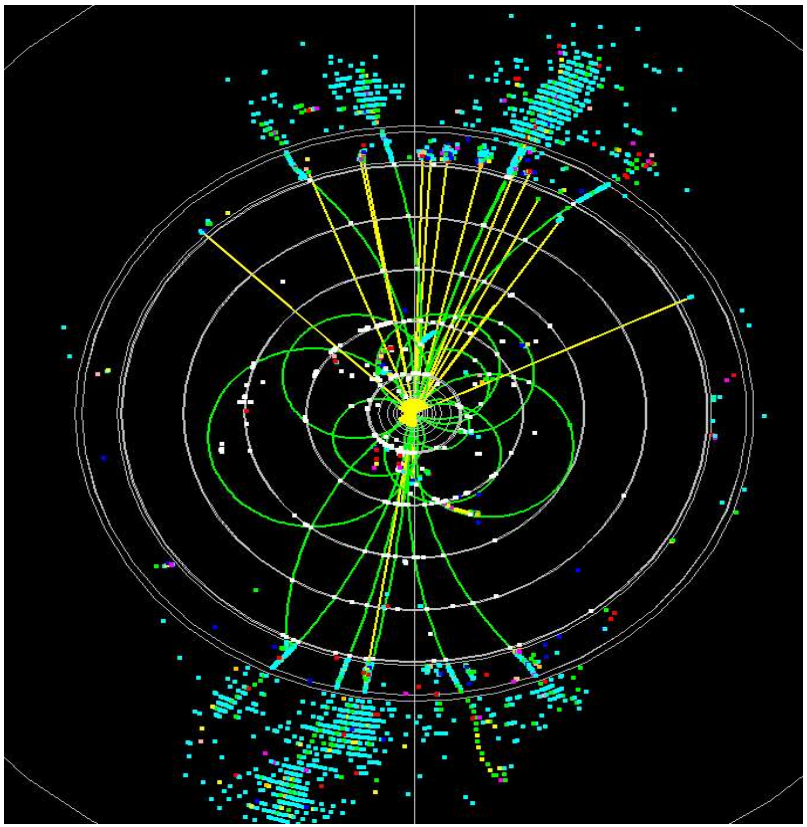
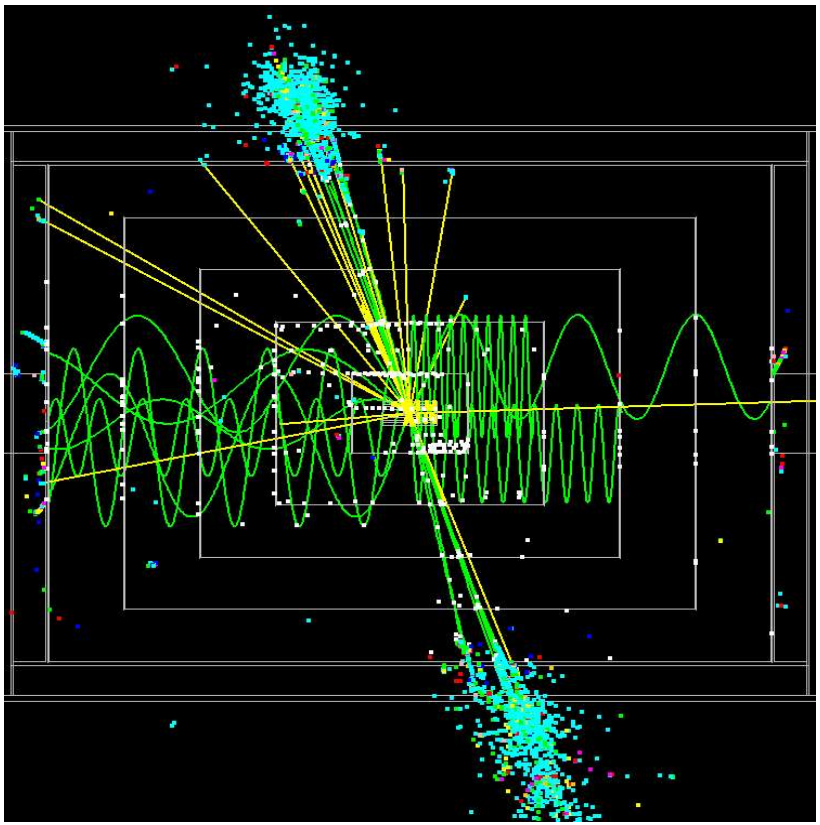
What's the “confusion term”?

- Some hits are due to more than one particle depositing energy in a single calorimeter cell (shower overlaps)

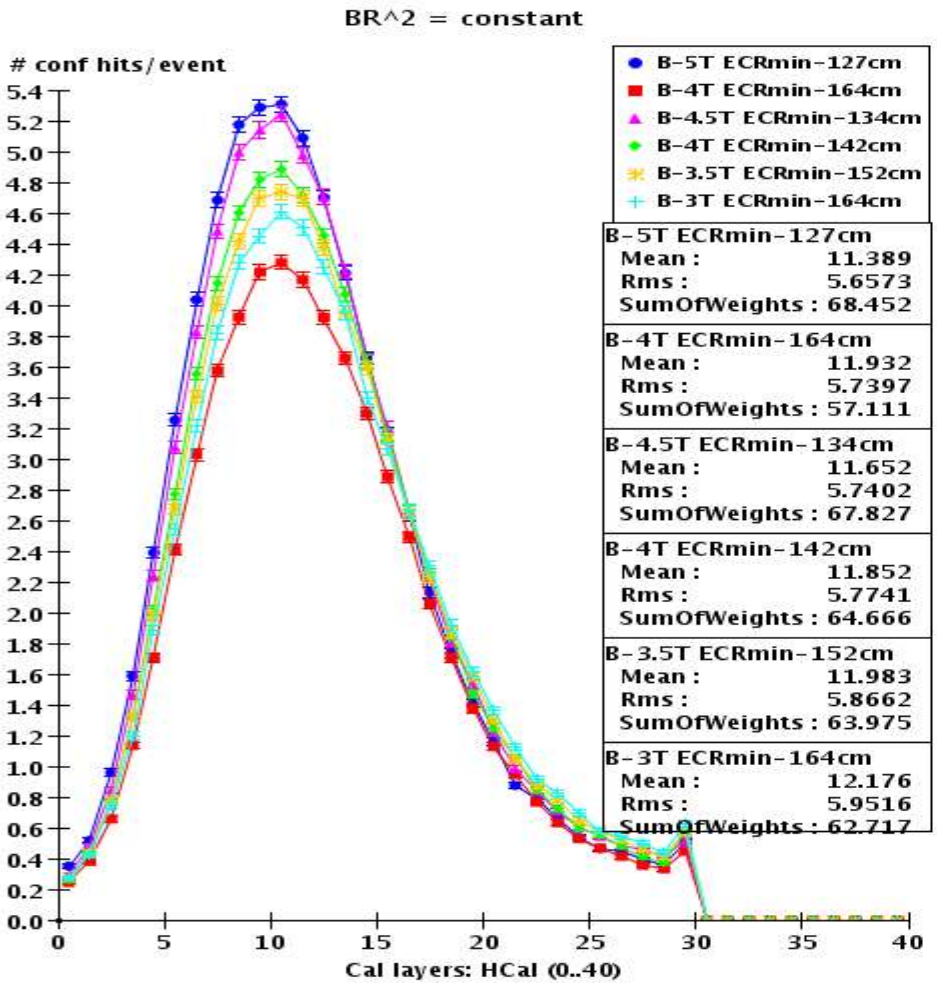


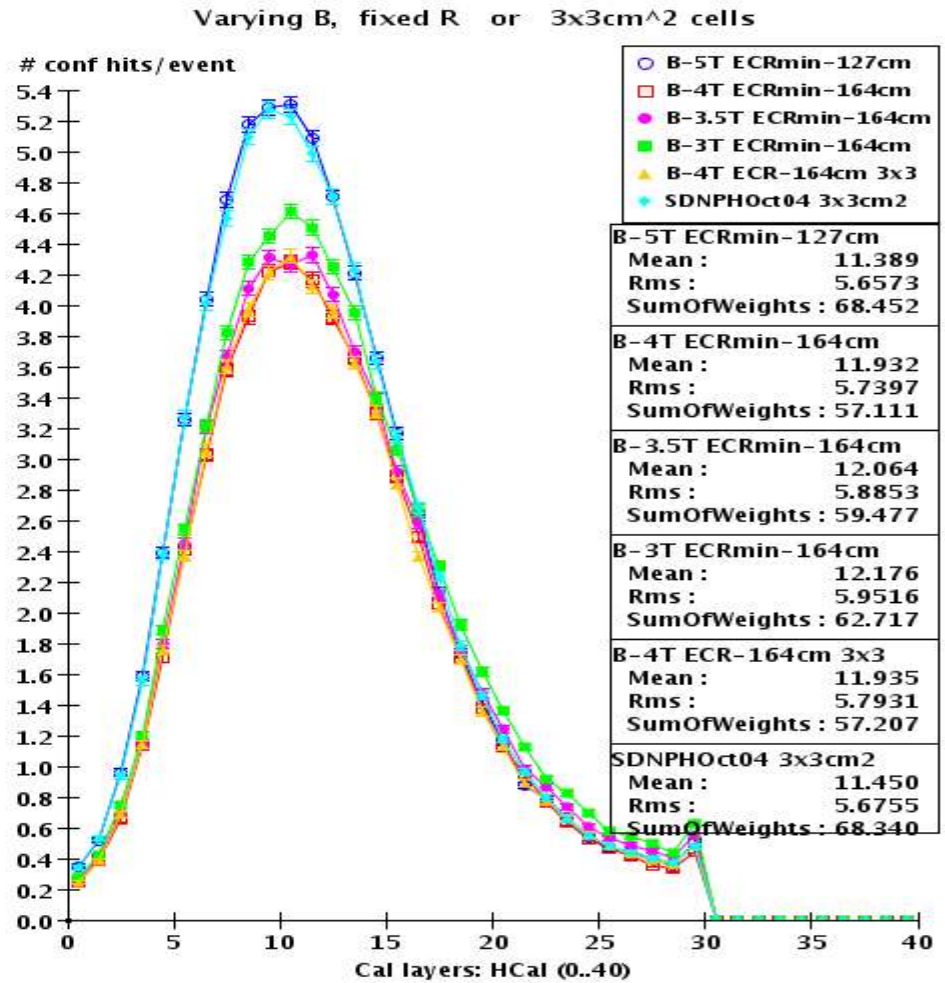


Studying the confusion term

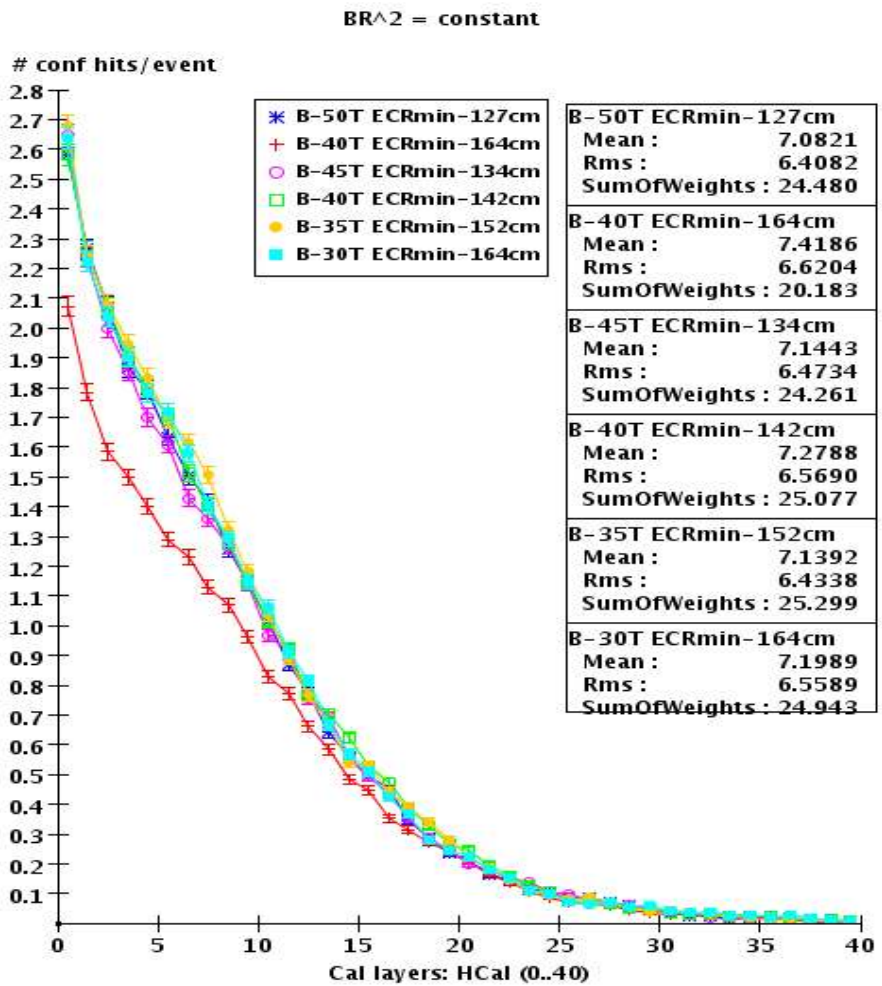
- We have studied the confusion term dependence on:
  - Type (or composition): Em vs. had components, charged vs. neutral components (needs a revisit)
  - Energy evolution (500 and 1000 GeV $e^+e^- \rightarrow ZH \rightarrow$ (qqbar)(bbbar))
  - Projective vs. Non-projective HCal (SDJan03 vs. SDNPHJun04)
- **Today**: How different geometries affect the confusion term (continued from last week)
  - New NP HCal geometry: SDNPHJun04 → SDNPHOct04
    - 34 layers, 2cm-steel + 1cm-scintillator → 41 layers, 2cm-steel + 0.5cm-scintillator
    - Total HCal thickness 102.0cm → 102.5cm
  - B-field between 3T and 5T, keeping $BR^2 =$ *constant* (R is ECal inner radius)
  - B-field between 3T and 4T, keeping R fixed at 164cm
  - Larger cells: 3x3cm^2 cells for standard (5T/127cm) and ~Tesla (4T/164cm) designs
  - Present results based on 2000 500-GeV ee→ZH events above

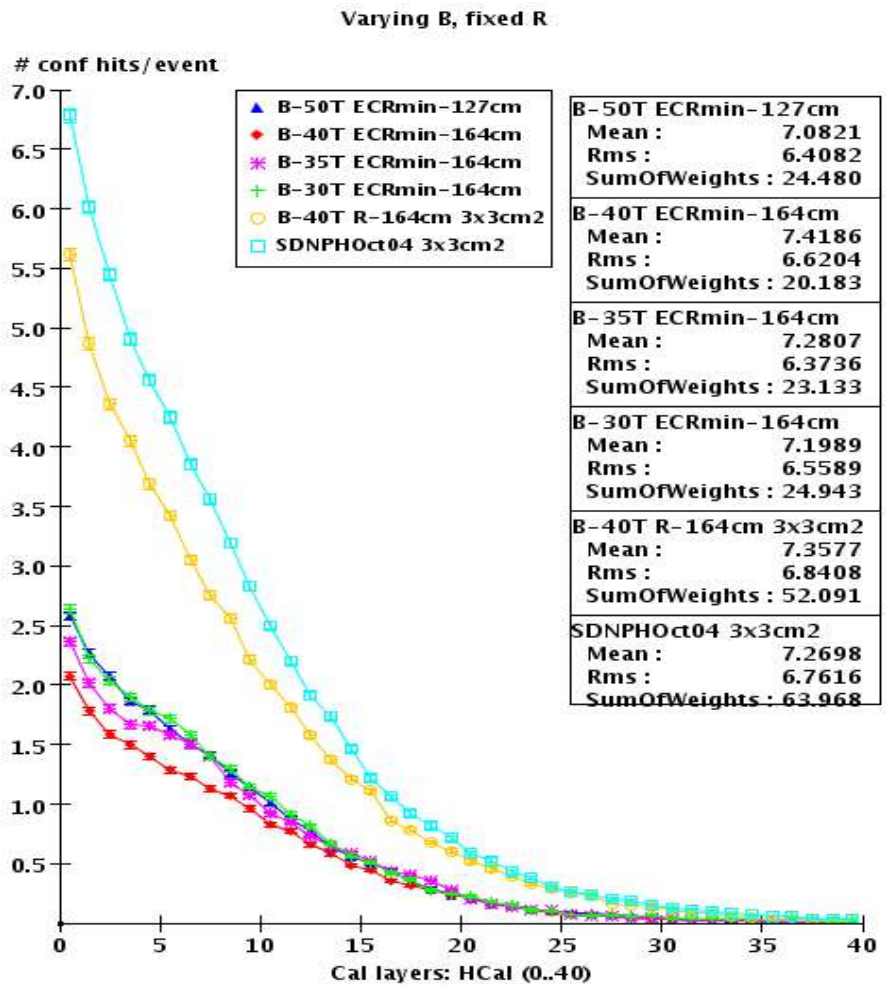
Confusion hits in ECal: longitudinal profile





Confusion hits in HCal: longitudinal profile

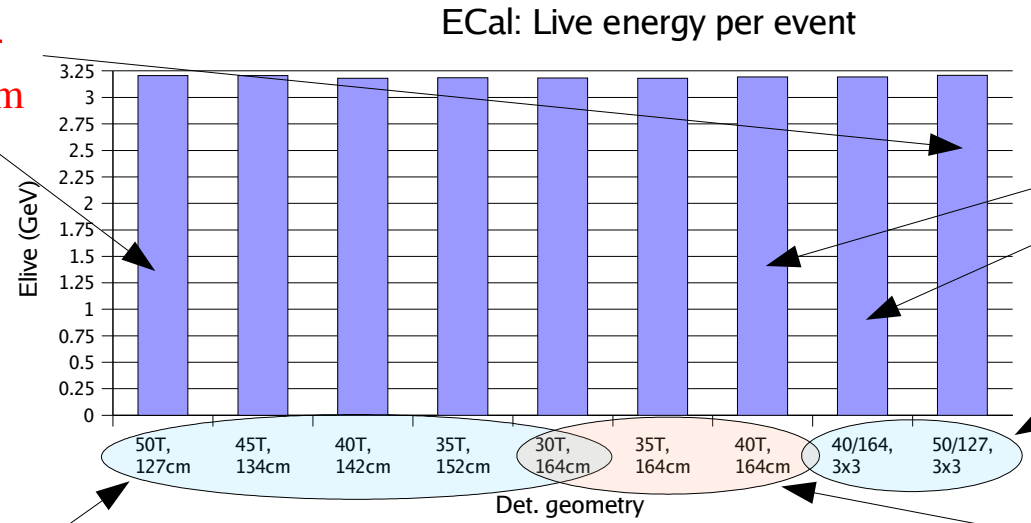




Live energy per event

SDNPHOct04

B=5T, R_{ECal}=127cm



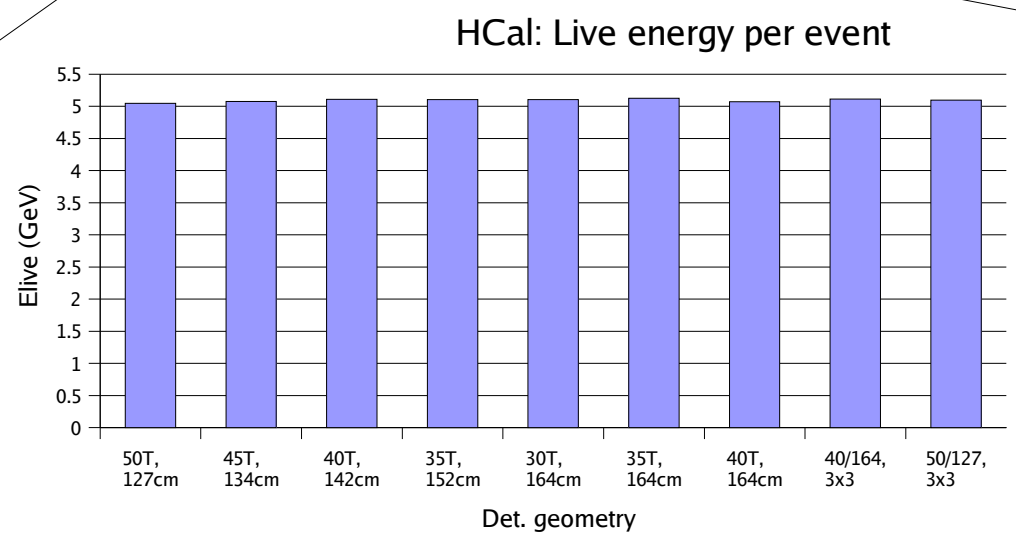
~Tesla

B = 4T, R_{ECal} = 164cm

3x3cm^2 cells

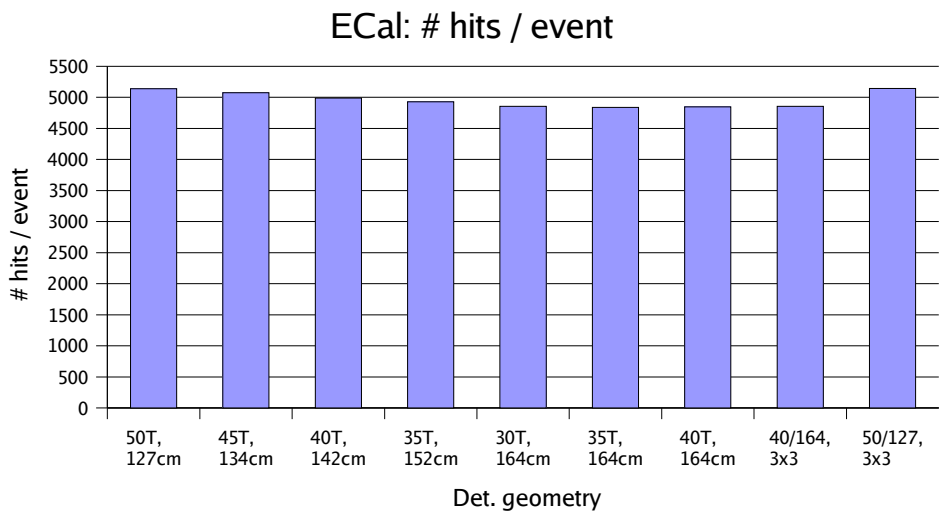
Fixed BR^2

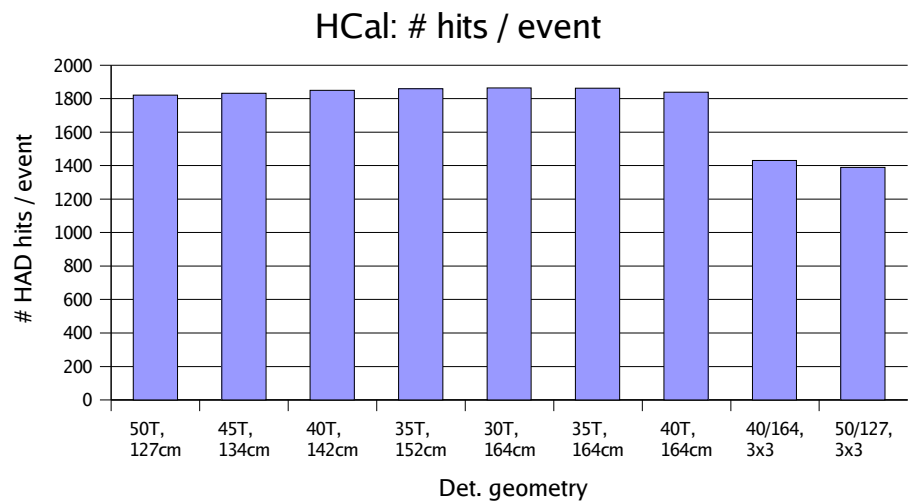
Varying B,
fixed R = 164cm

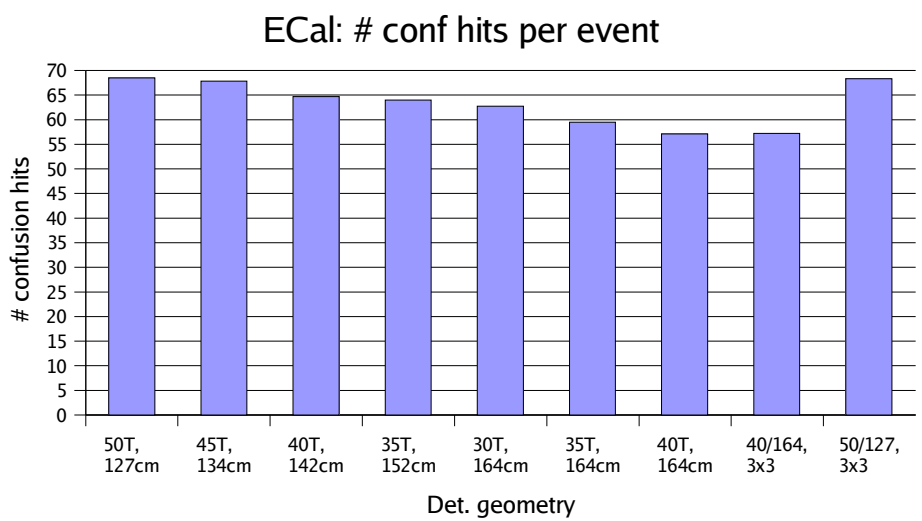


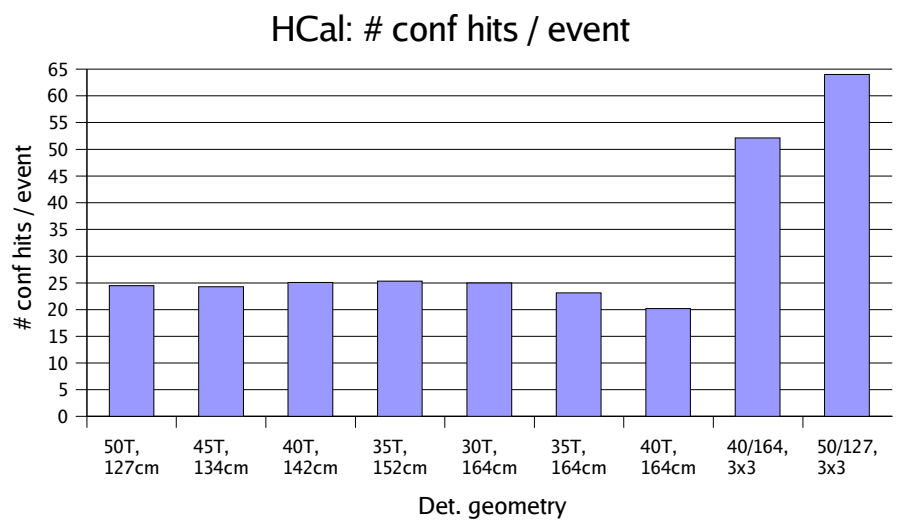
All geometries:
30-layers Si-W Proj Ecal
41-layers Sci-SS NPHCal

Confusion hits

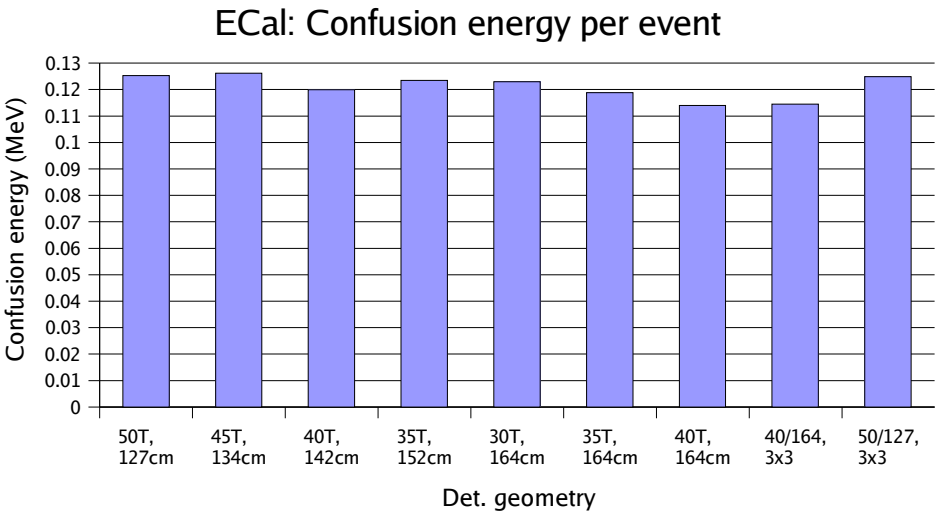


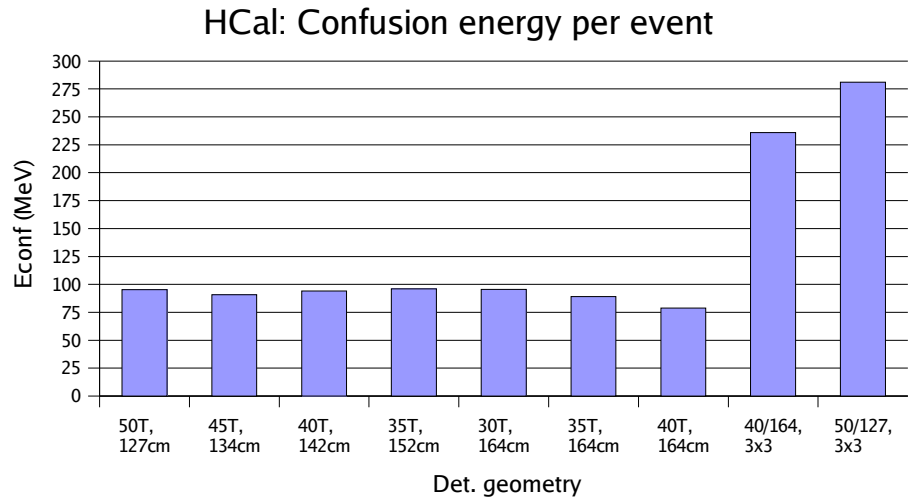


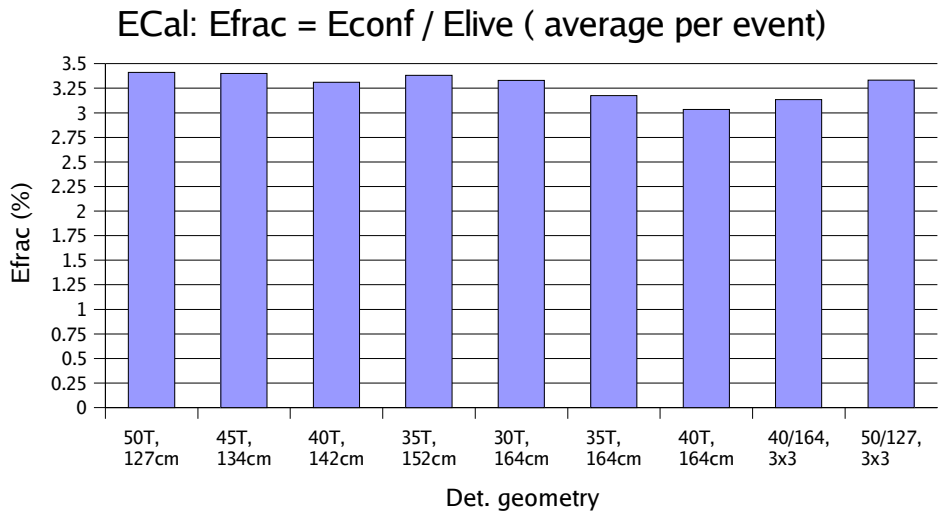


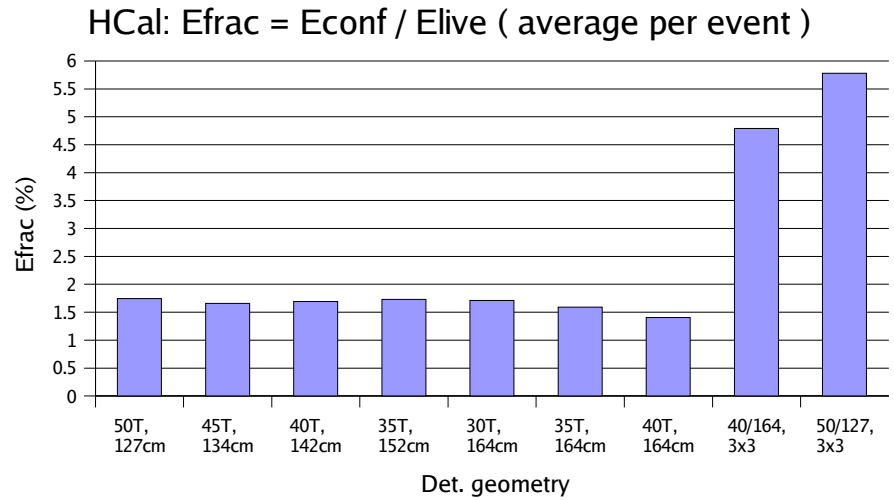


Confusion energy









Preliminary conclusions

- Geometries with constant BR^2 have similar characteristics for confusion (shower overlaps) in Hcal. This is the expected behavior for non-projective geometries with fixed-size cells
- For fixed calorimeter radius, a stronger B-field reduces shower overlaps in both ECal and HCal
- From the geometries tested, the B=4T with R_{min}=164cm combination (~Tesla) minimizes confusion (shower overlaps) in both ECal and HCal
- Some notes worth mentioning:
  - Last presentation's PDGID=0 problem - a bug in the confusion analysis code (fixed), probably affects previous conclusion of gamma-gamma dominance in ECal
  - Observed minor discrepancies (< 1discrep.hit / 10^6 HCal hits) in hit coordinates between LCIO format and cellid+CalorimeterCell. Perfect agreement in ECal hits!

Next steps

- Look at confusion compositions (em-had, charged-neutral)
- Look at 1000 GeV ee→ZH events (more overlaps)
- Look at confusion hits with no valid hits in immediate neighborhood (0/0)
- Attempt to find/fix more problems, e.g. LCIO hit position discrepancy, LCDG4 processing, isolated confusion hits (isol=0/0), etc.