Why do R&D on ECAL, HCAL

Scintillator Based Calorimetry

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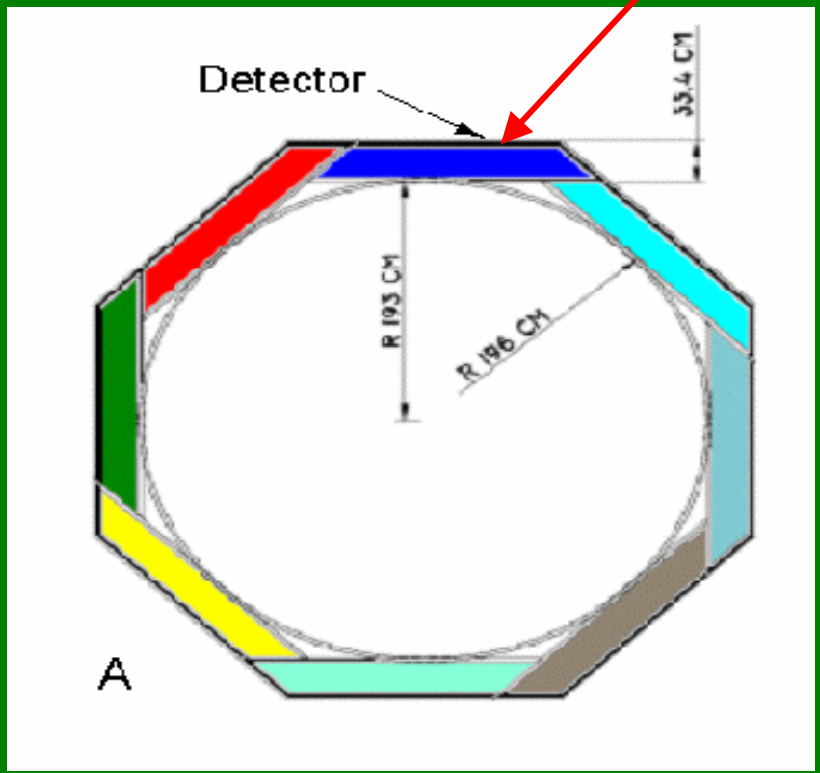
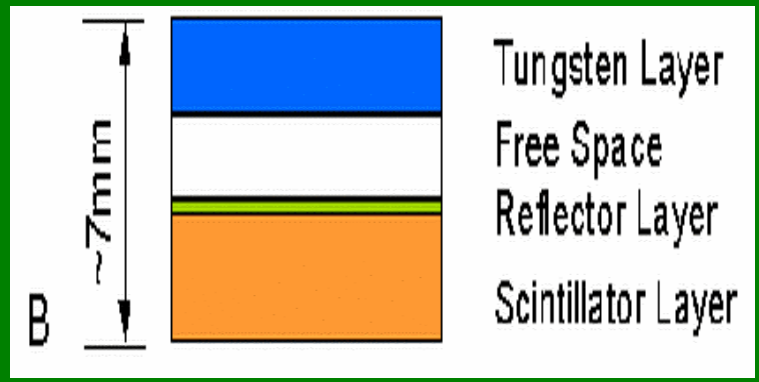
At this point in the R&D process we should be investigating as many variations of calorimetry as possible. It is wrong to concentrate on any one geometry until we understand the resolution versus cost of any well thought out geometry.

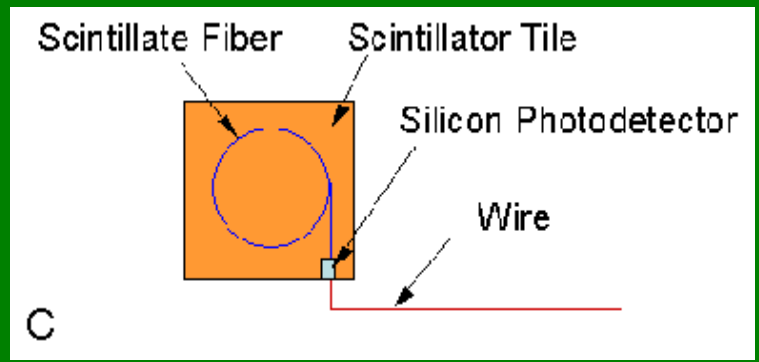
Our Colorado group proposes to collaborate in the comparison of the various proposals with signals to understand what we can get away with.

Modules

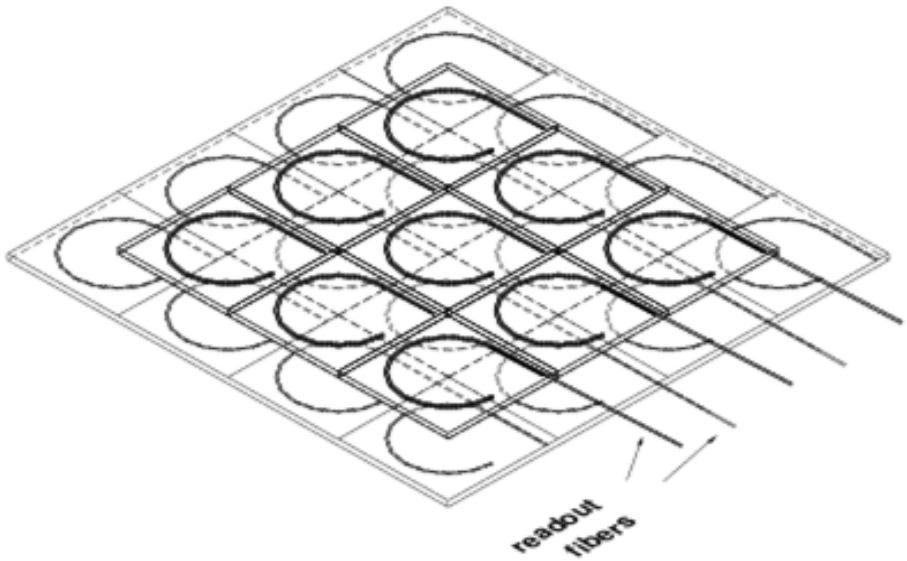
Each module = ~12 tons







Basic Geometry



5x5 cm² →

2.5x2.5 cm²

Comparable

to

Moliere Radius

Reduces # of channels by 4

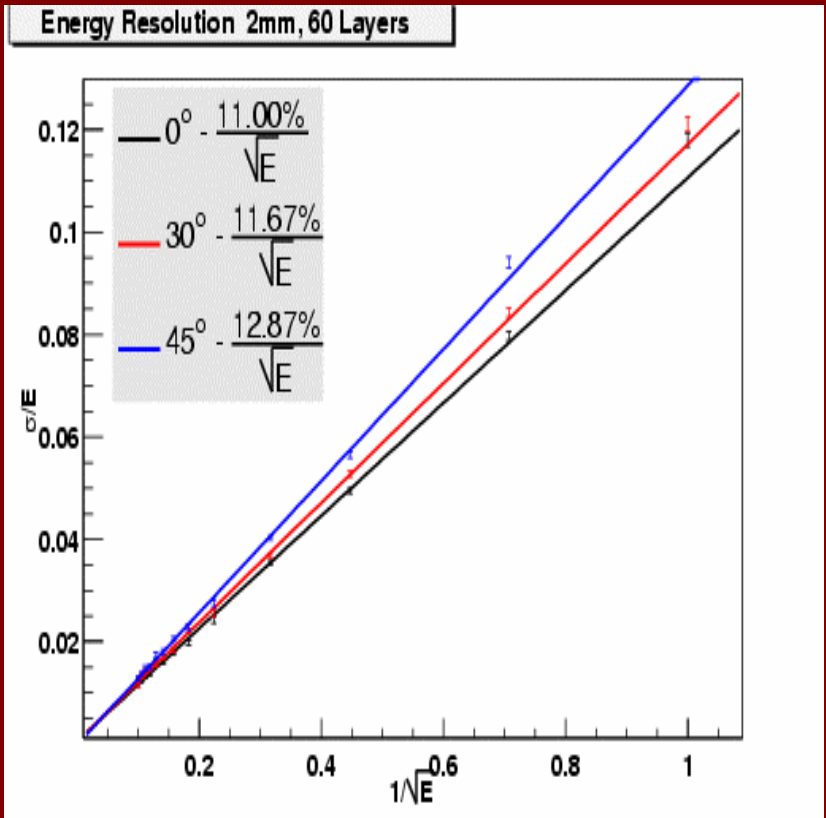
FOR EXAMPLE

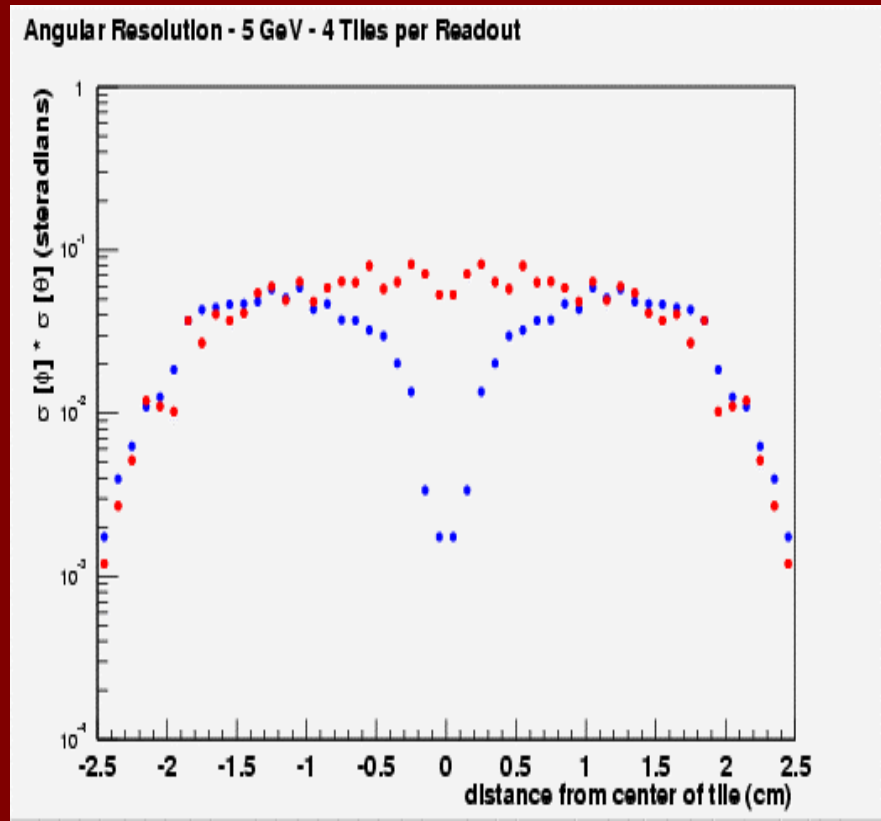
- *Energy resolution of scintillator tungsten is better than silicon tungsten. Spatial resolution is worse.*
- *I argue that energy resolution is more important than spatial resolution in getting good W and Z mass in jets.*

- *Good accurate simulation should tell who is correct.*
- *Cost of Silicon Tungsten Calorimeter being proposed costs ~$ 80 M . The preliminary cost of Scintillator Tunsgten we propose is ~$ 50 M (25% contingency). Need to make sure we used same costing procedure. Is $30 M worth it.*

Simulation

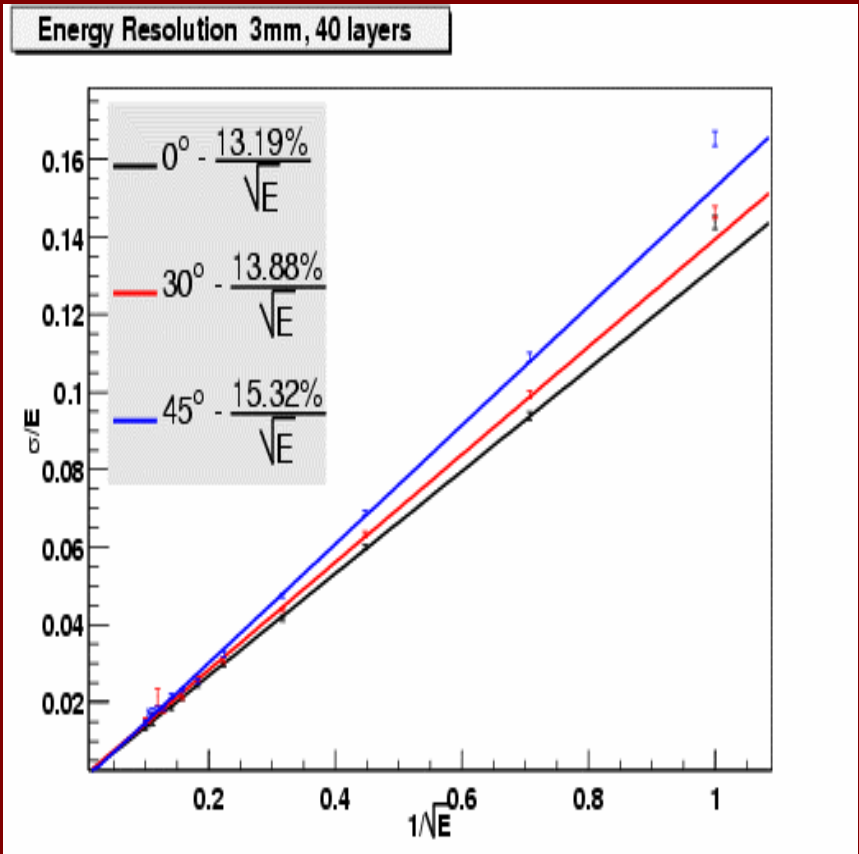
1/2 Xo

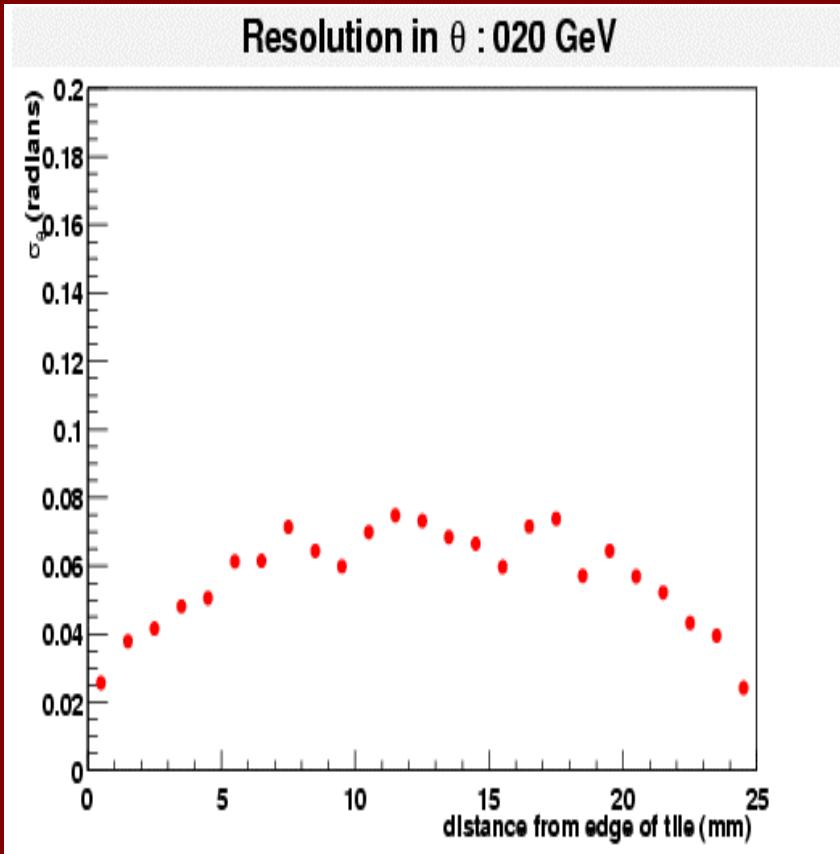




Simulation

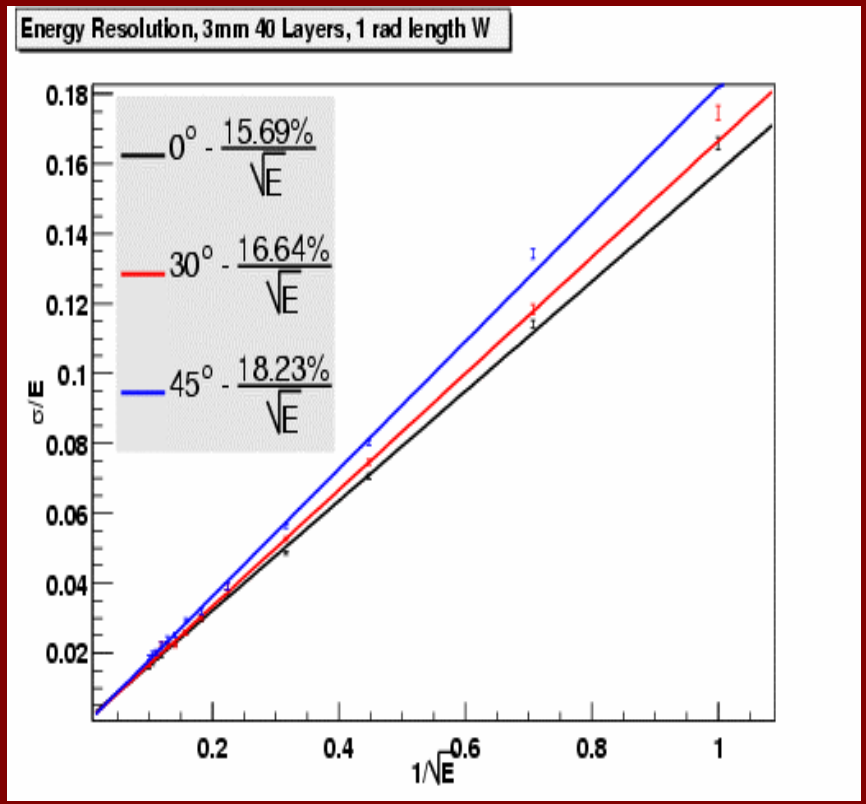
3/4 Xo

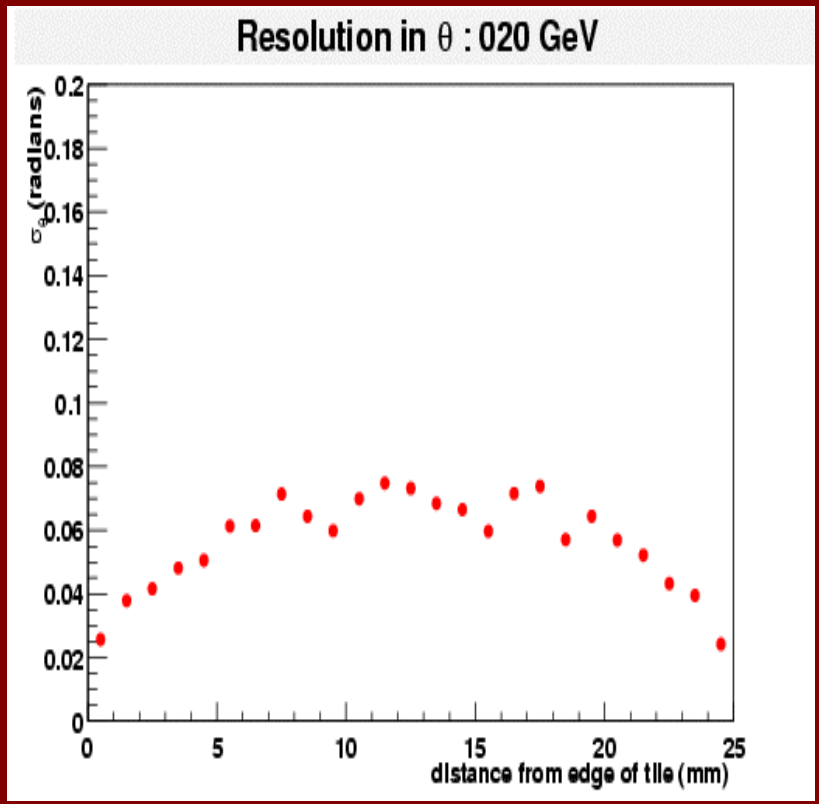




Simulation

1 Xo





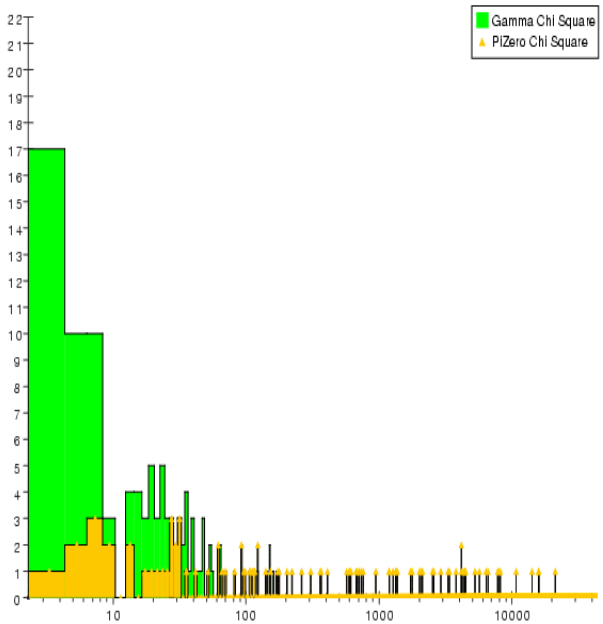
$$C_{ij} = 1/N \sum_k (x_i^k - \mu_i^k)(x_j^k - \mu_j^k)$$

$$H = C^{-1}$$

$$\chi^2 = \Sigma (x_i^k - \mu_i^k) H_{ij} (x_j^k - \mu_j^k)$$

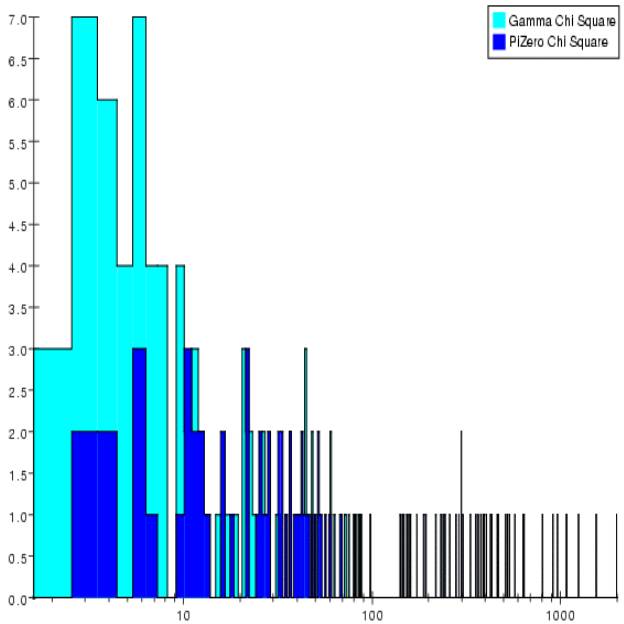
χ^2 Separation

10 GeV



χ^2

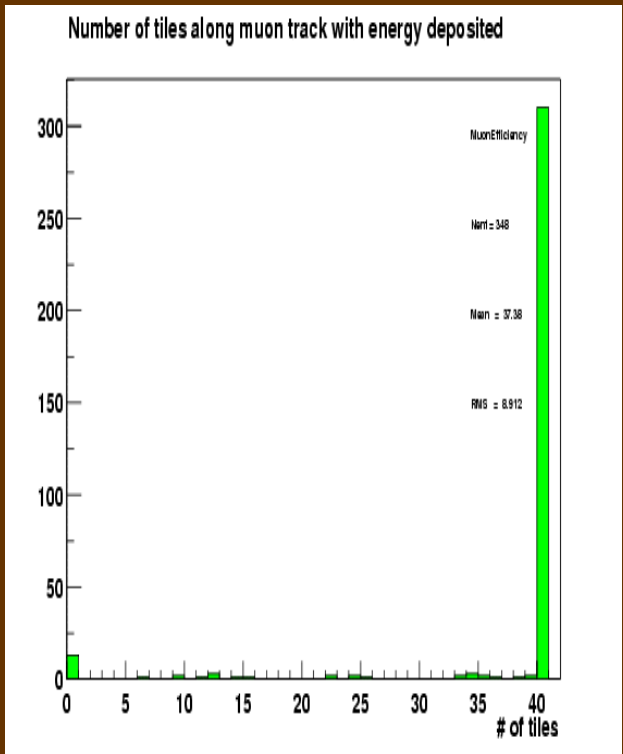
20 GeV

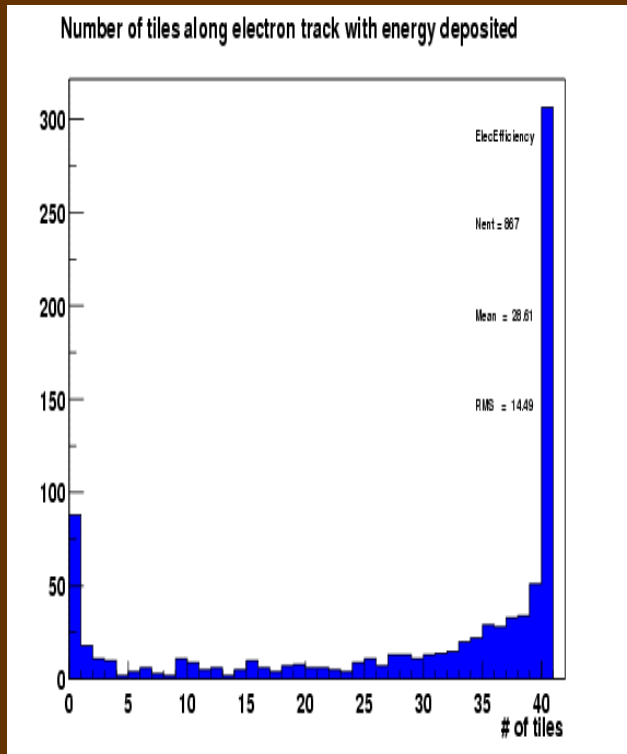


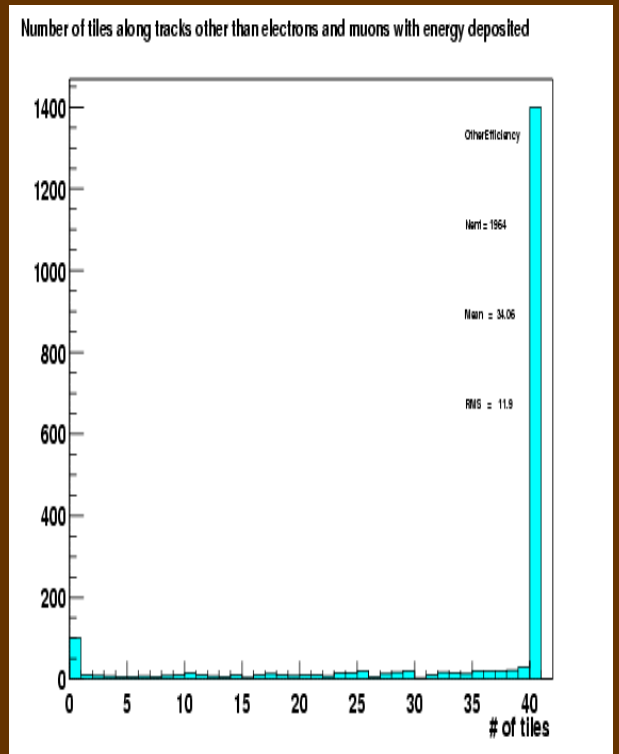
χ^2

Computer Simulation

Propagation of charged tracks from the tracker into the calorimeter



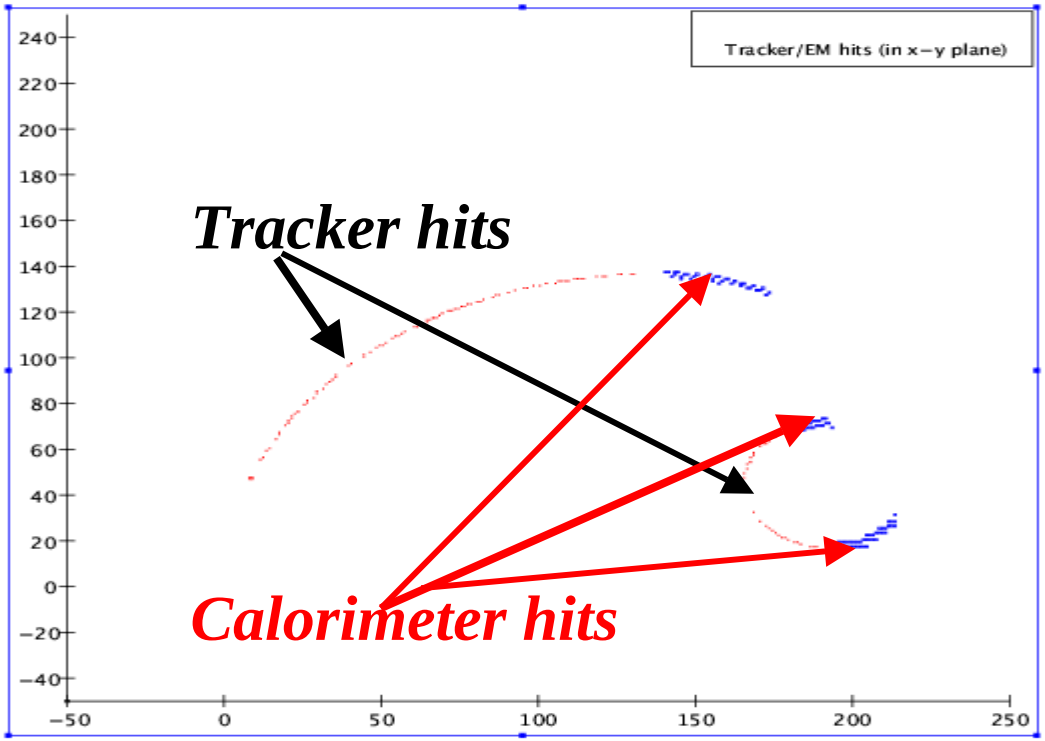




Low Energy Charged Tracks in the Detector

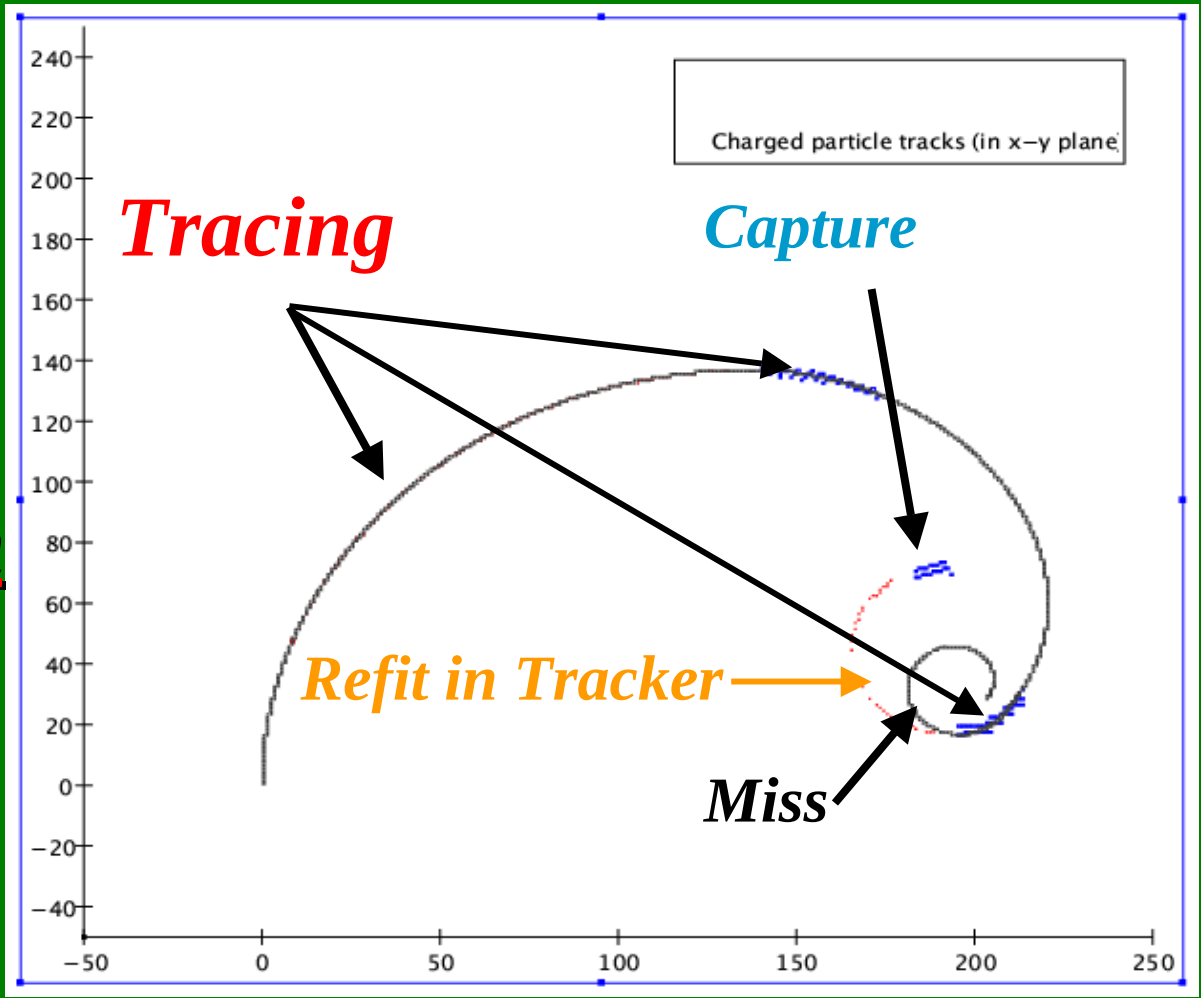
About 30% of

Z decay tracks

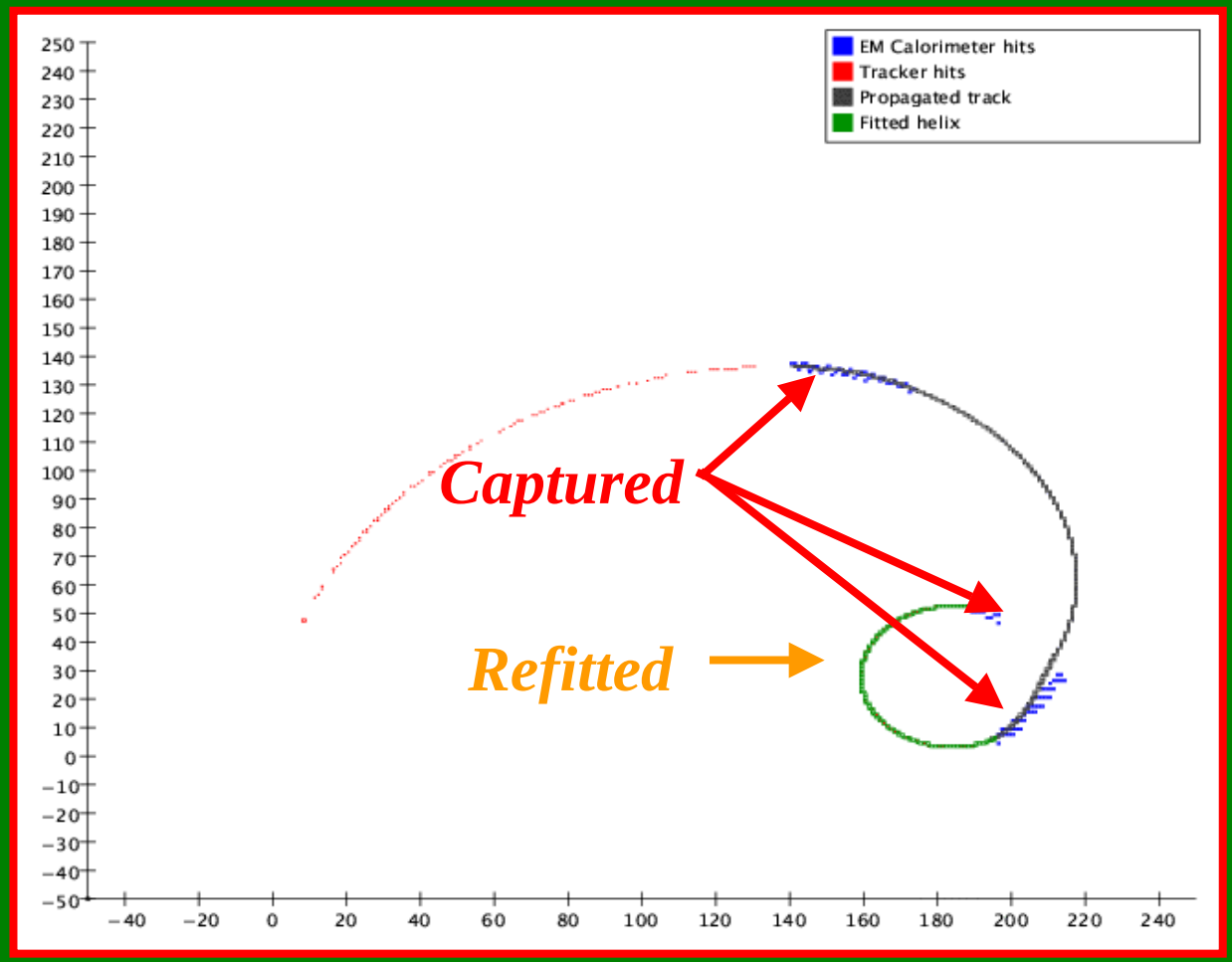


74% success

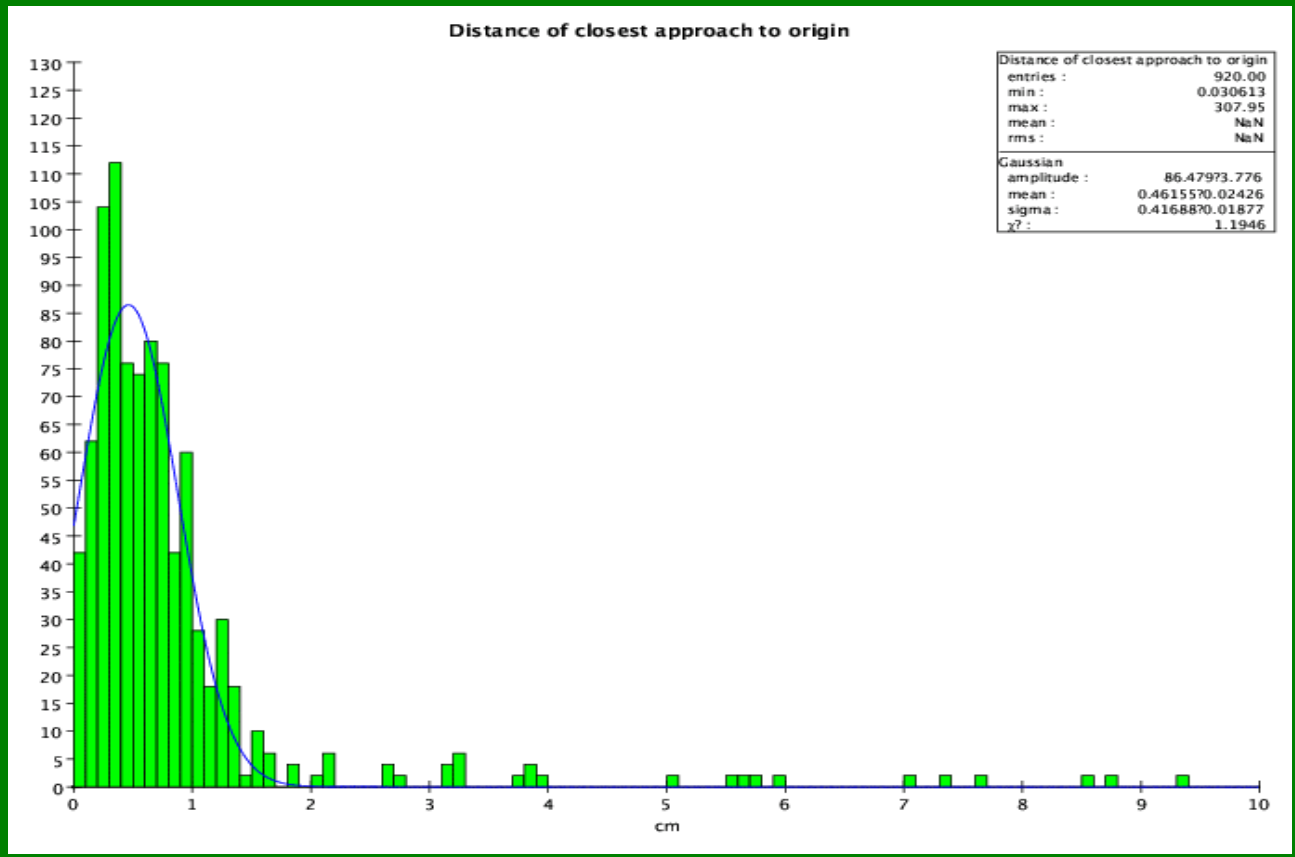
Necessary for good particle flow algorithm



- *Final Trace and removal of hits*
- *74% success*



Distance of Closest Approach to Interaction Point.



CONCLUSION

- *Scintillator based ECAL and HCAL calorimetry may be a viable alternative.*
- *The alternate offset geometry offers good separation between single and double γ and reduces the number of channels by 4 !!!*
- *It is too early to determine what technology is most adequate.*
- *So far we have not found a show stopper.*