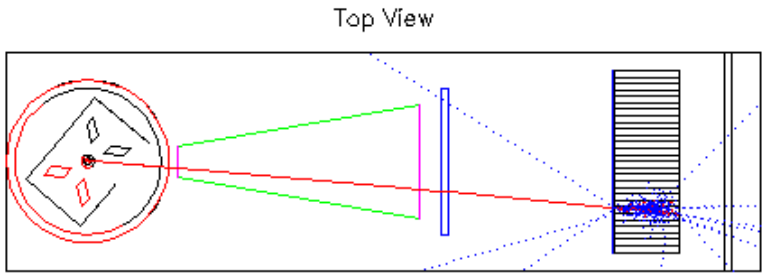
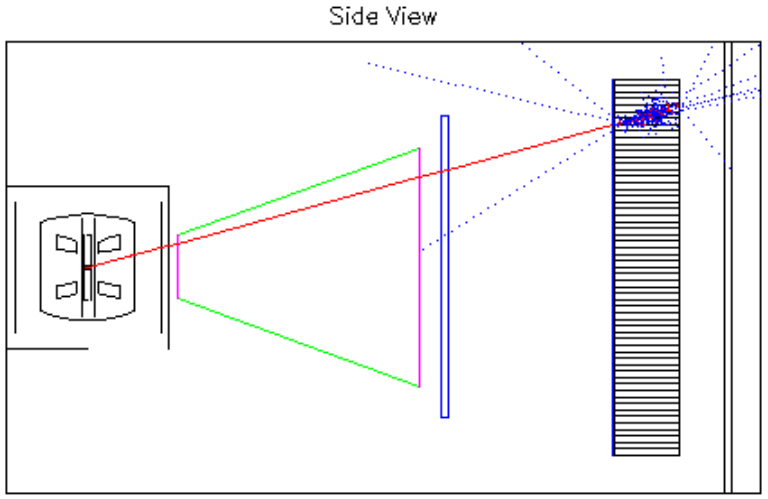
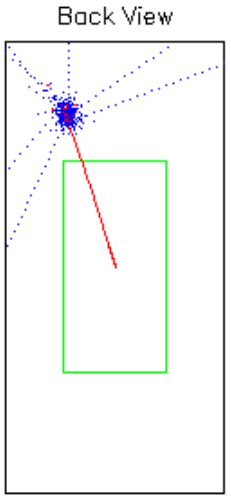
GEANT Simulation of BETA

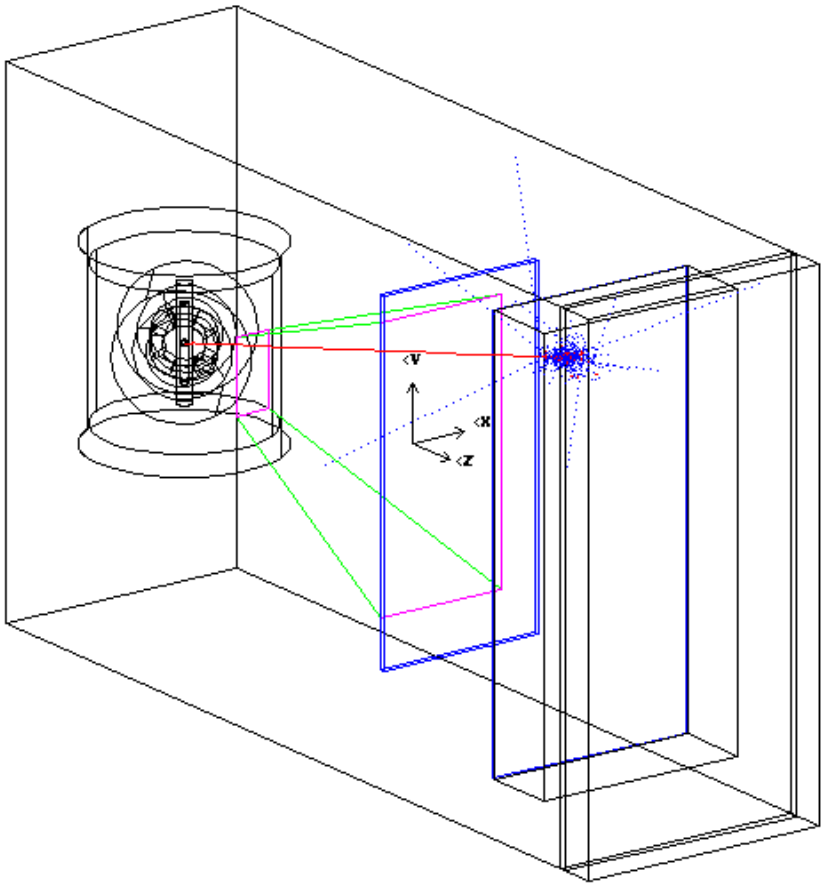
- Geant3 Simulation of BETA originally written by Glen Warren, maintenance passed to James Maxwell
- Consists of both event simulation and reconstruction code
- Task: Revive, Update and Improve code
  - Event simulation package has been focus of work thus far

BETA Simulation





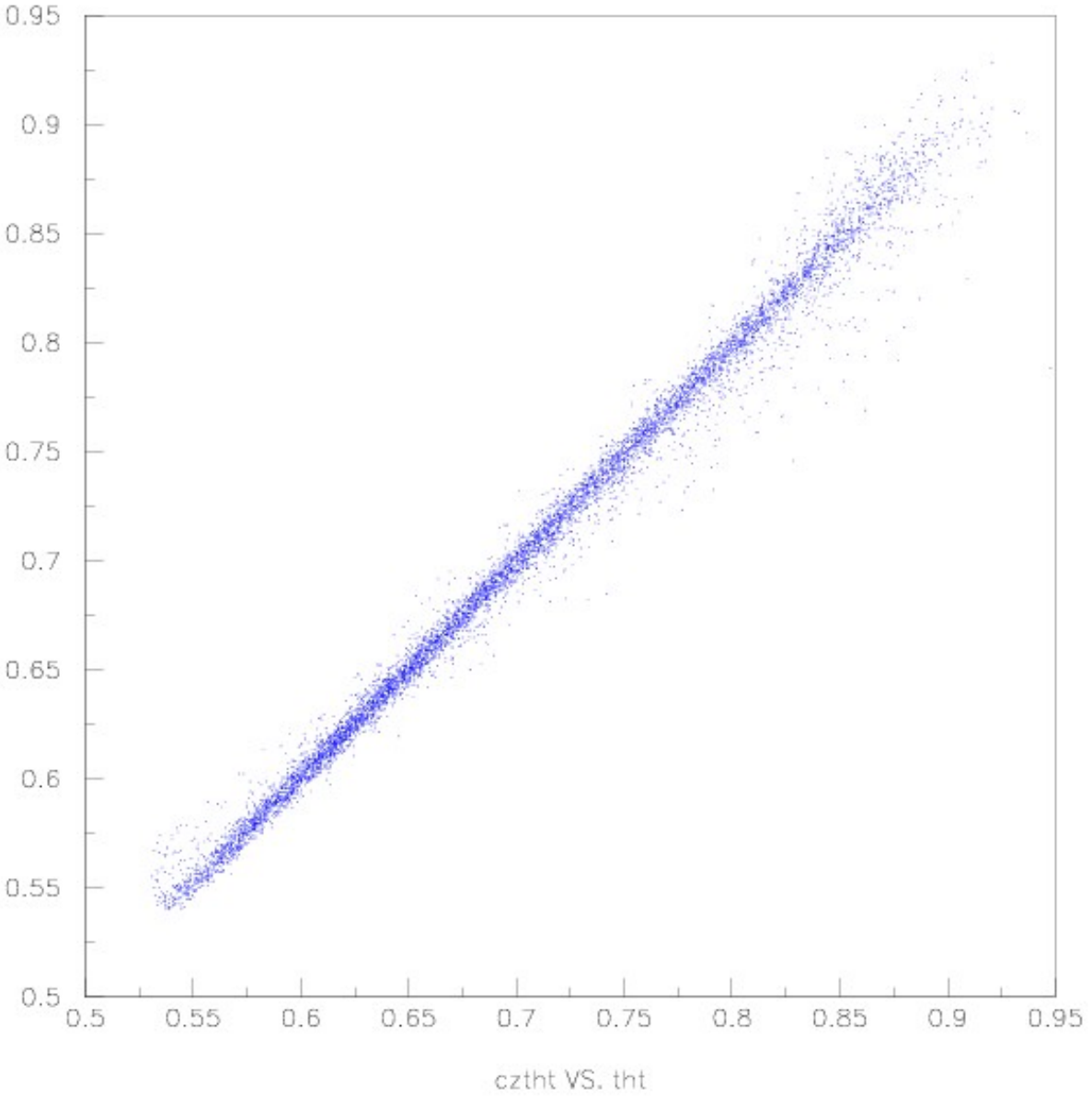




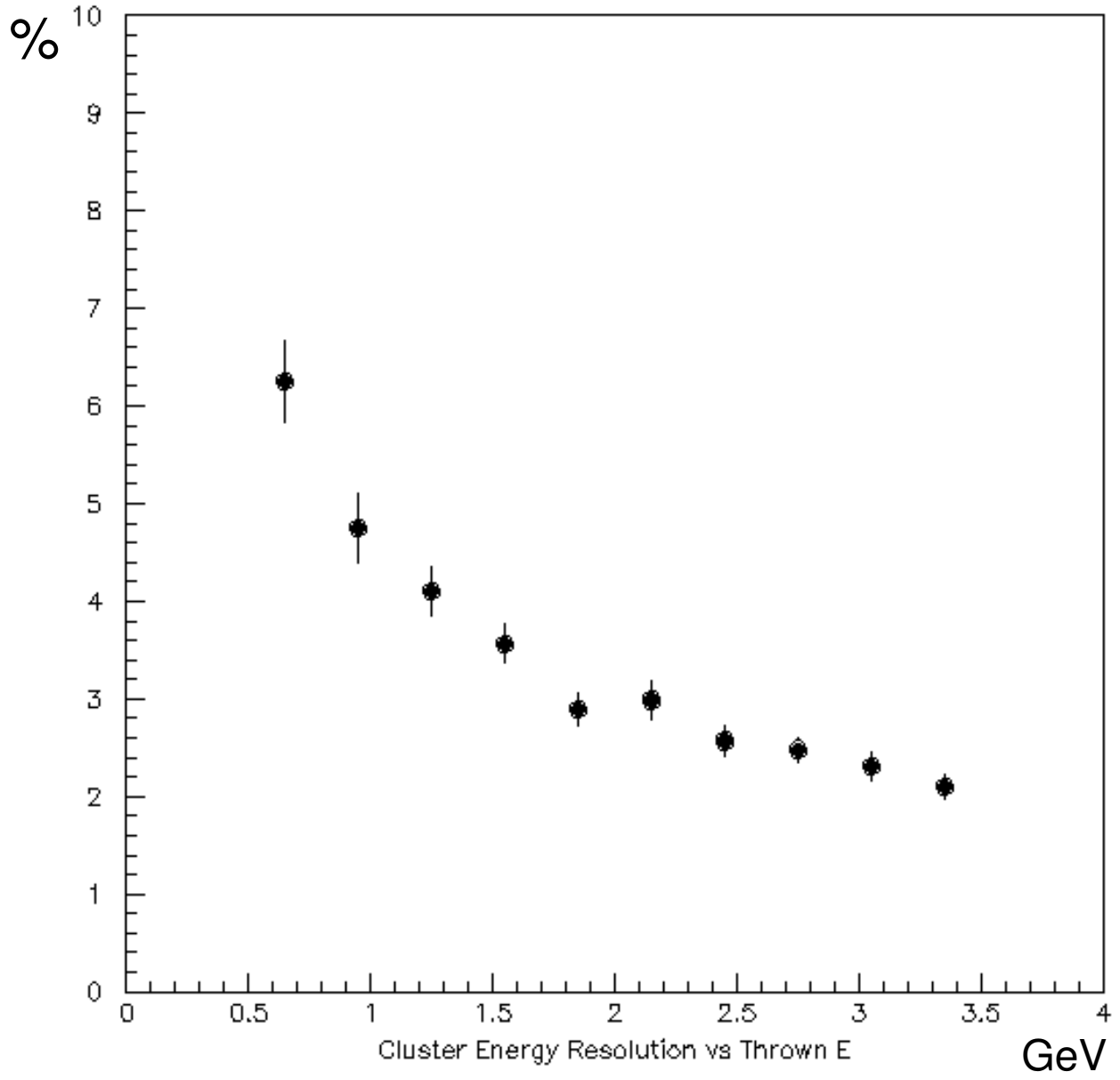
Processing Monte Carlo

- Reconstructs simulated events from ntuples
- In addition to constructing calorimeter cluster info:
  - counts events into kinematic bins
  - finds total rates of various particles in BETA
  - looks for chance of pile-up
  - determines statistical uncertainties
- Reconstruction code is in working order
- Minimal changes have been made thus far; fixes

Reconstructed vs. Thrown Theta



Cluster Energy Resolution v. Thrown E

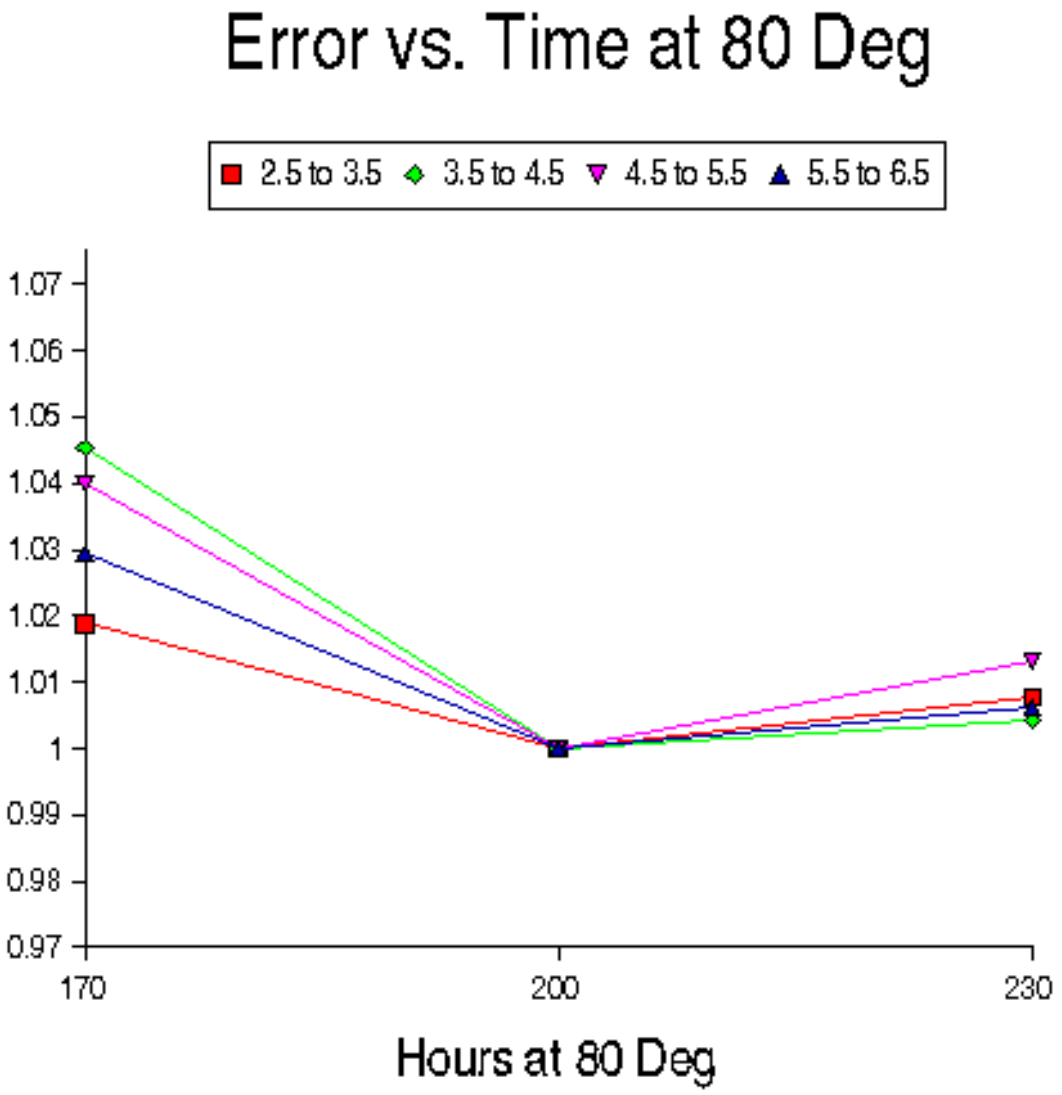


Error Studies: Time Optimizations

- Studying time spent in different energy and angle configurations
- Kept total time constant, and started with planned hours:
  - 5.7 GeV: 200 hrs @ 80°, 100 hrs @ 180°
  - 4.6 GeV: 130 hrs @ 80°, 70 hrs @ 180°

Time at Angle Optimizations

- Comparing hours spent at 180° to hours spent at -80°
- Kept ratio of time at 5.7 & 4.6 GeV constant
- Sets are in Q^2, W>1.1



Time at Energy Optimizations

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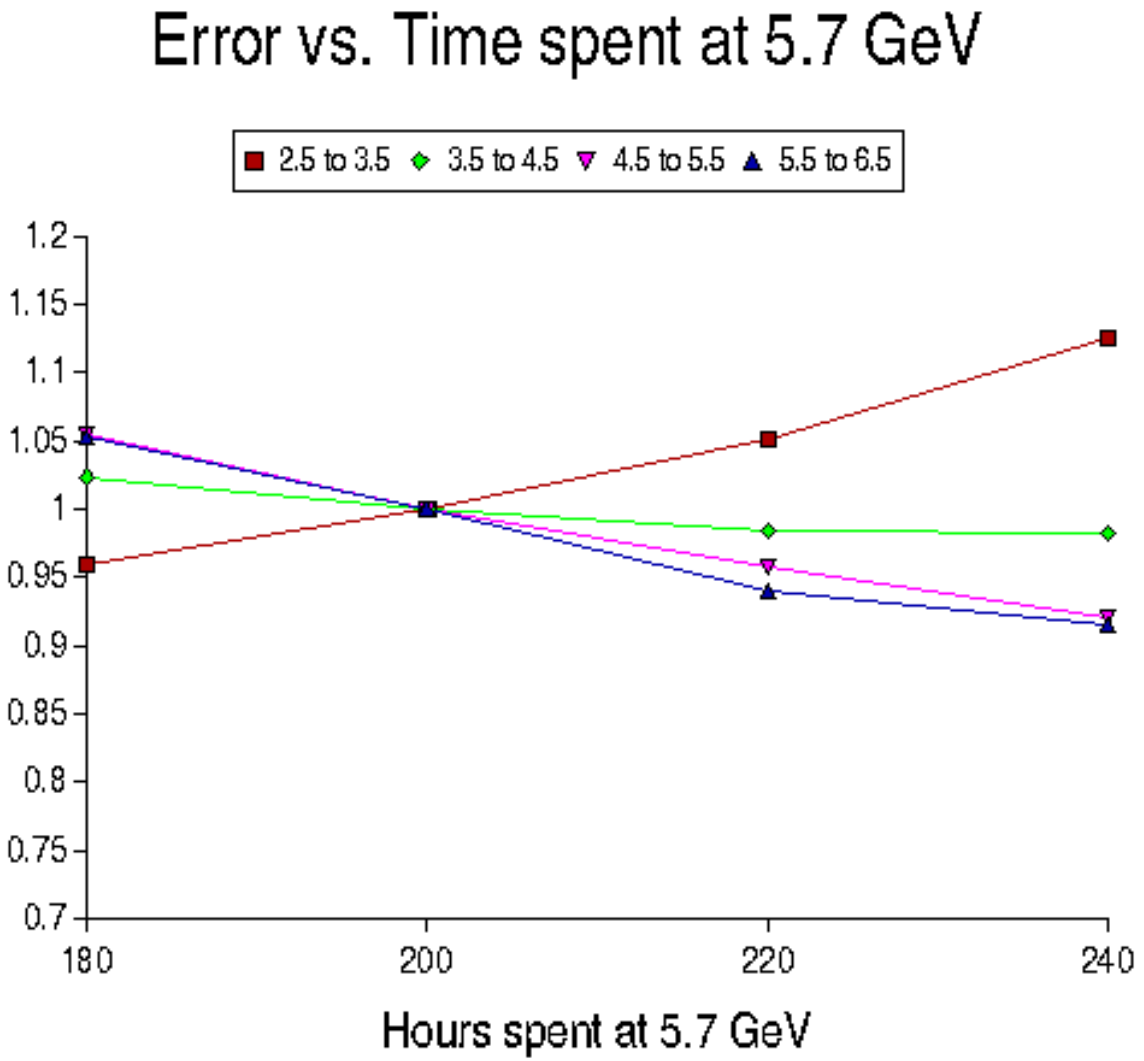
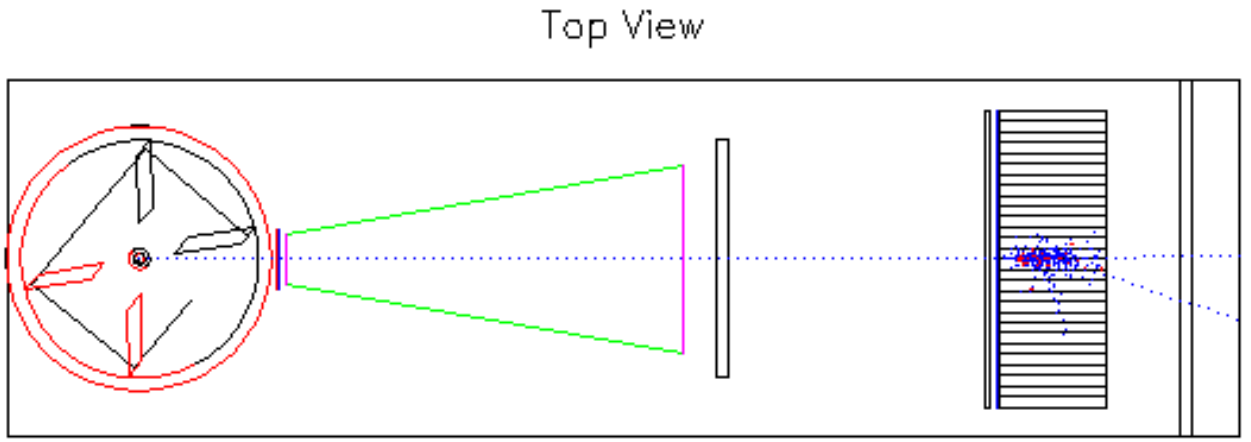
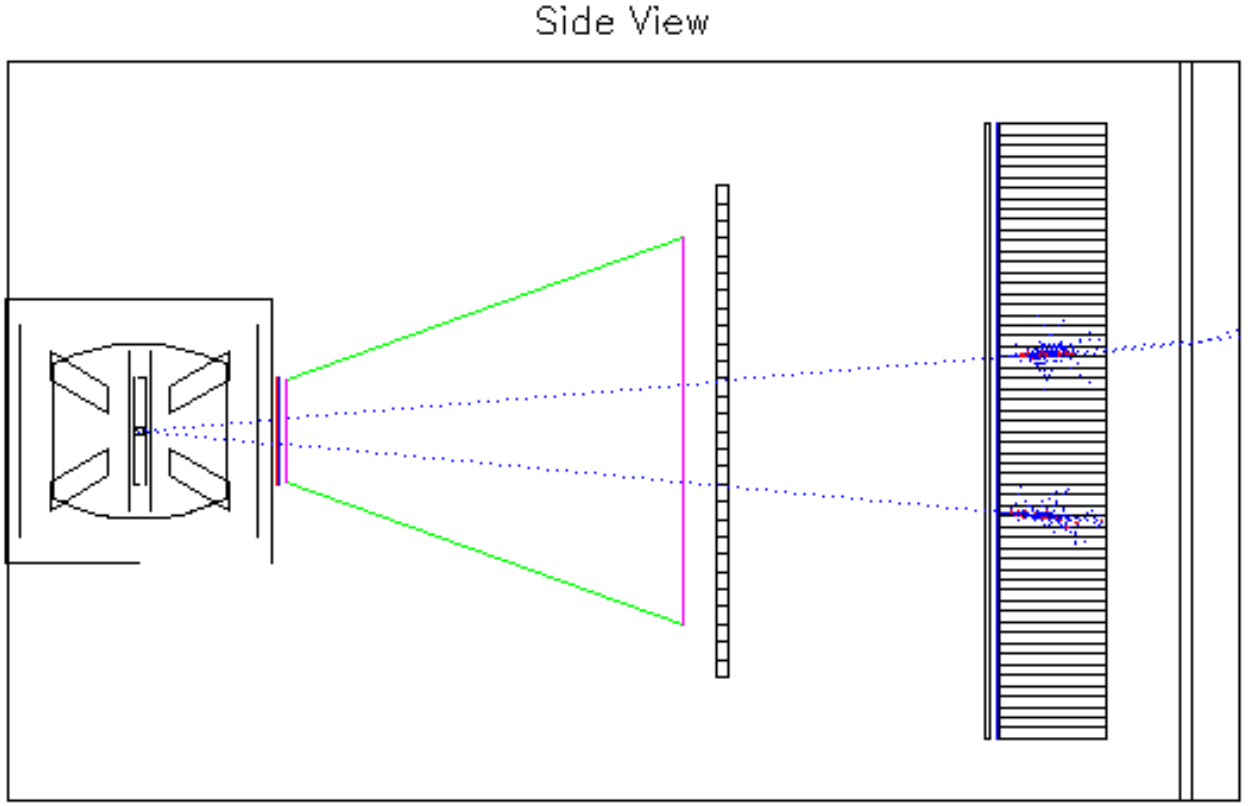


BigCal's PMTs and B Field

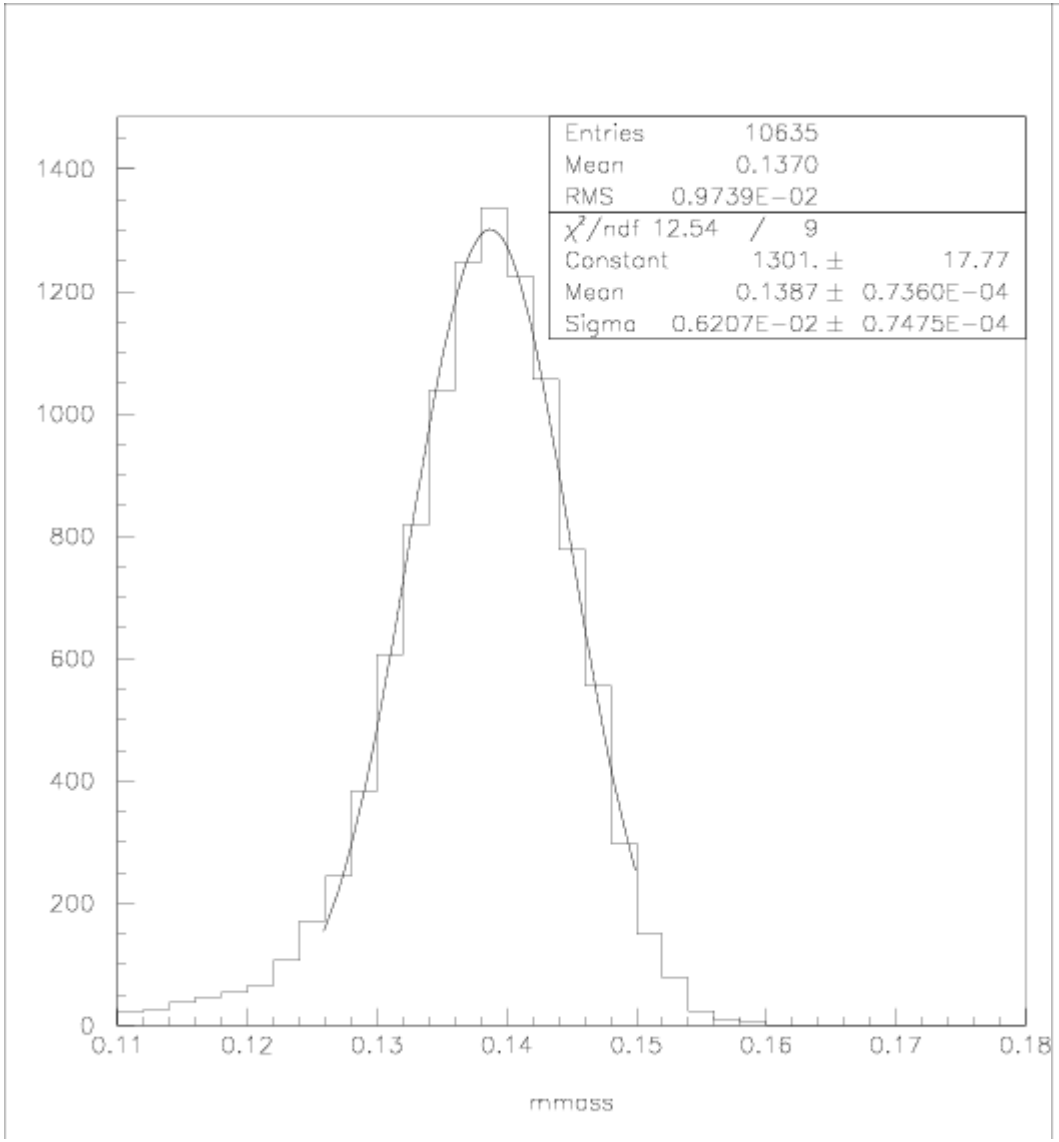
- Iron shielding has been suggested to protect the calorimeter's photomultipliers from the magnetic field
- Studied the effect of an iron shield, 6mm thick in front of the calorimeter on resolution
- Million event runs for 2 configs, with and without

Iron Shielding

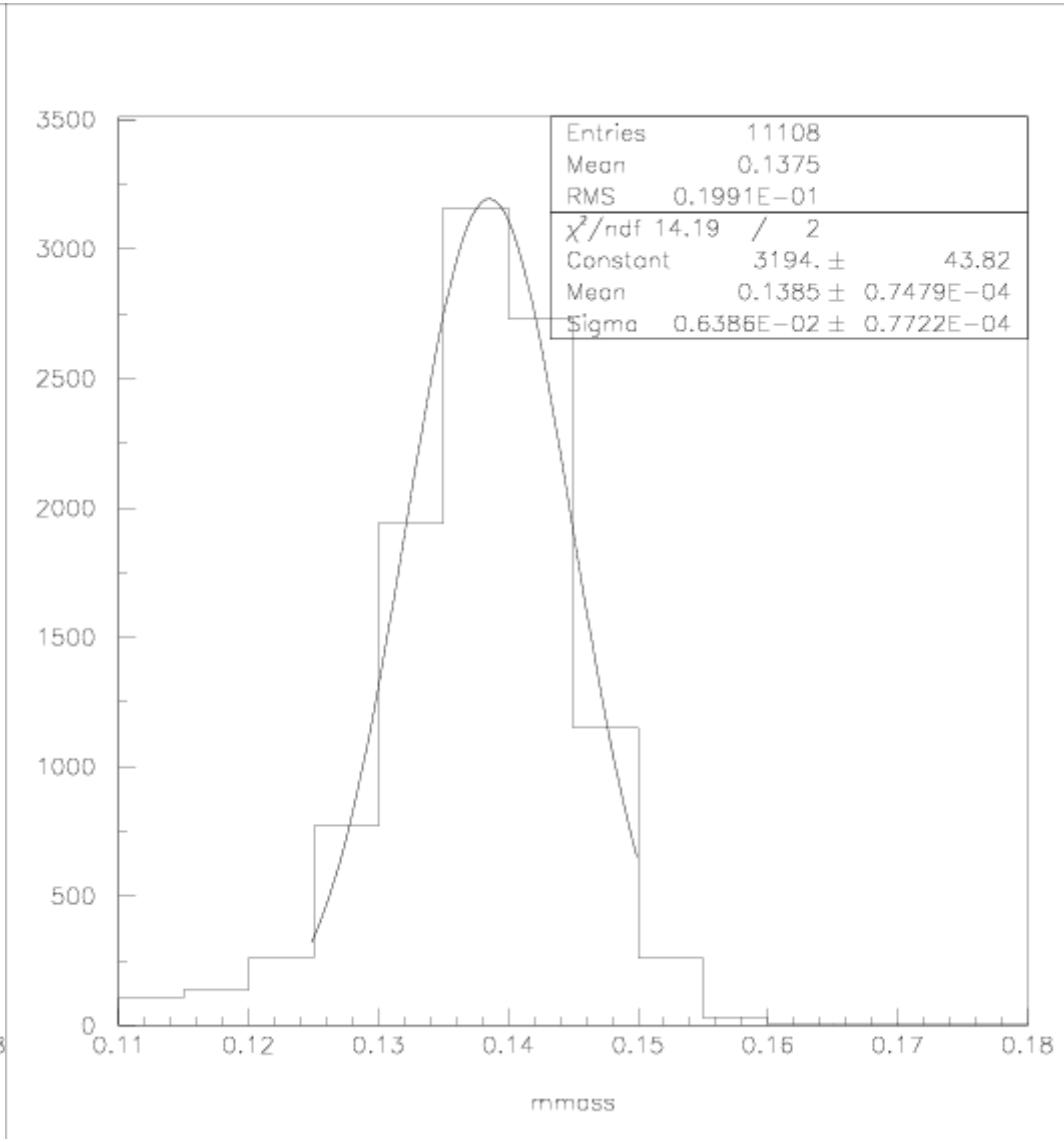




Iron Shielding Results



No Shielding



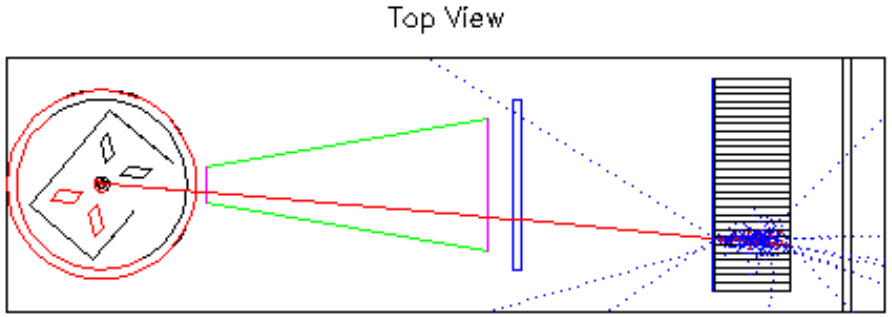
With Shielding

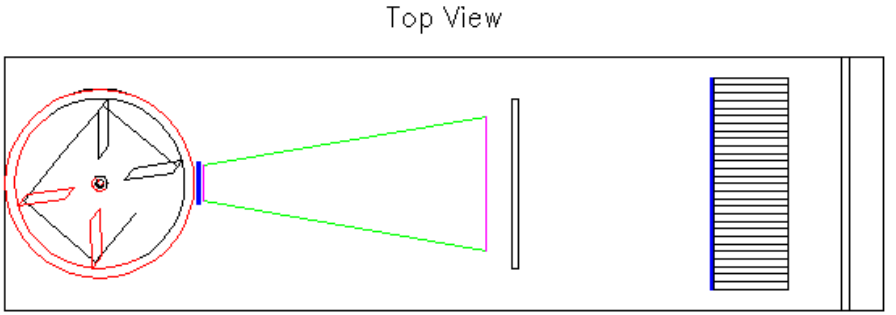
Improving and Updating

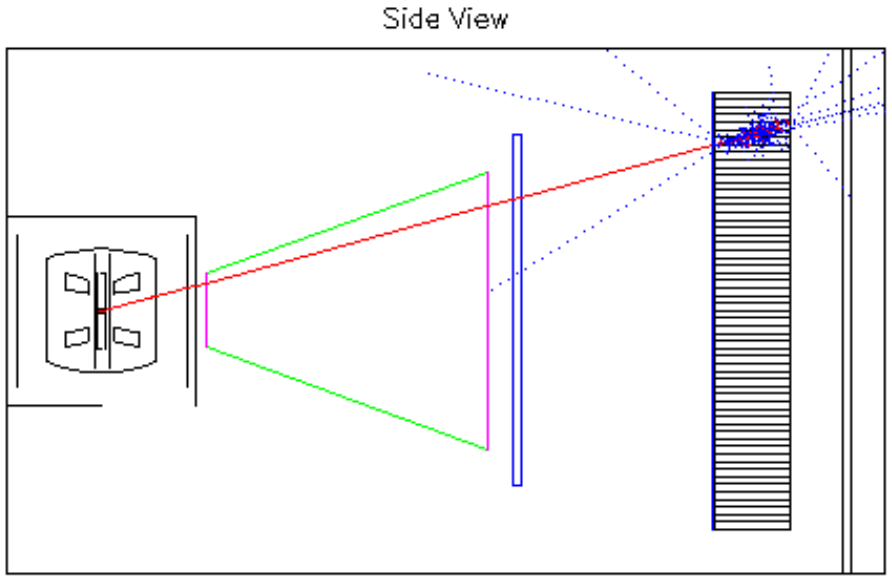
- Geometry changes:
  - Magnet dimension changes
  - Added divisions to Lucite Hodoscope
  - New Front Hodoscope added:
    - 3 planes of bars; two 133 horizontal, 73 vertical
- Code changes:
  - Writing hodoscope hits to ntuple
  - Rationalization for efficiency
- Tracking e^-, e^+

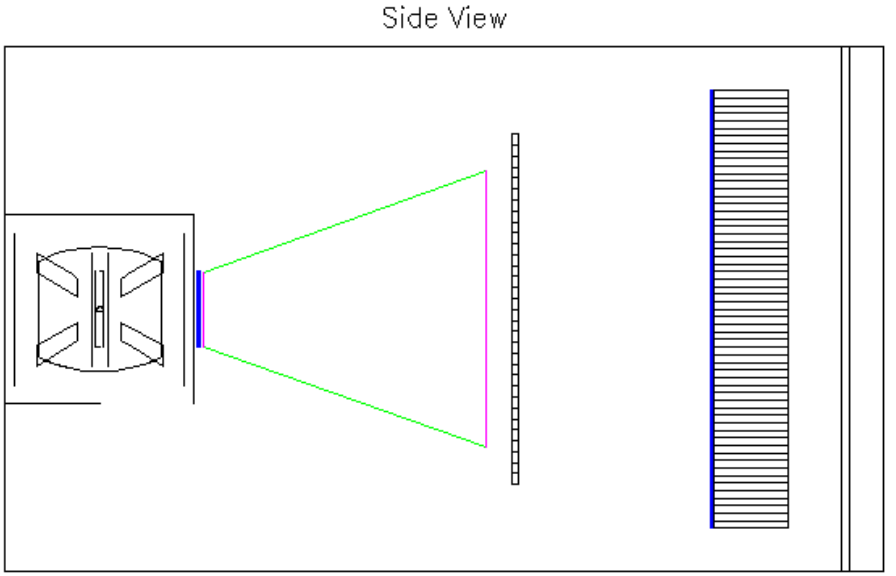
Magnet Coil Dimension Changes

- From 100K random raster, new definition intercepted 4% (of total) more tracks







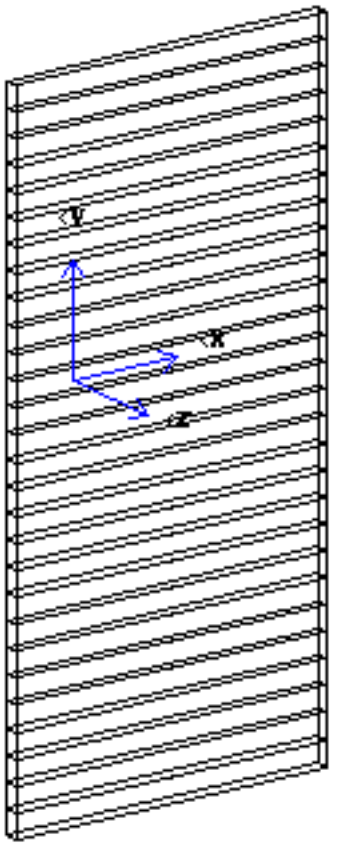


Old

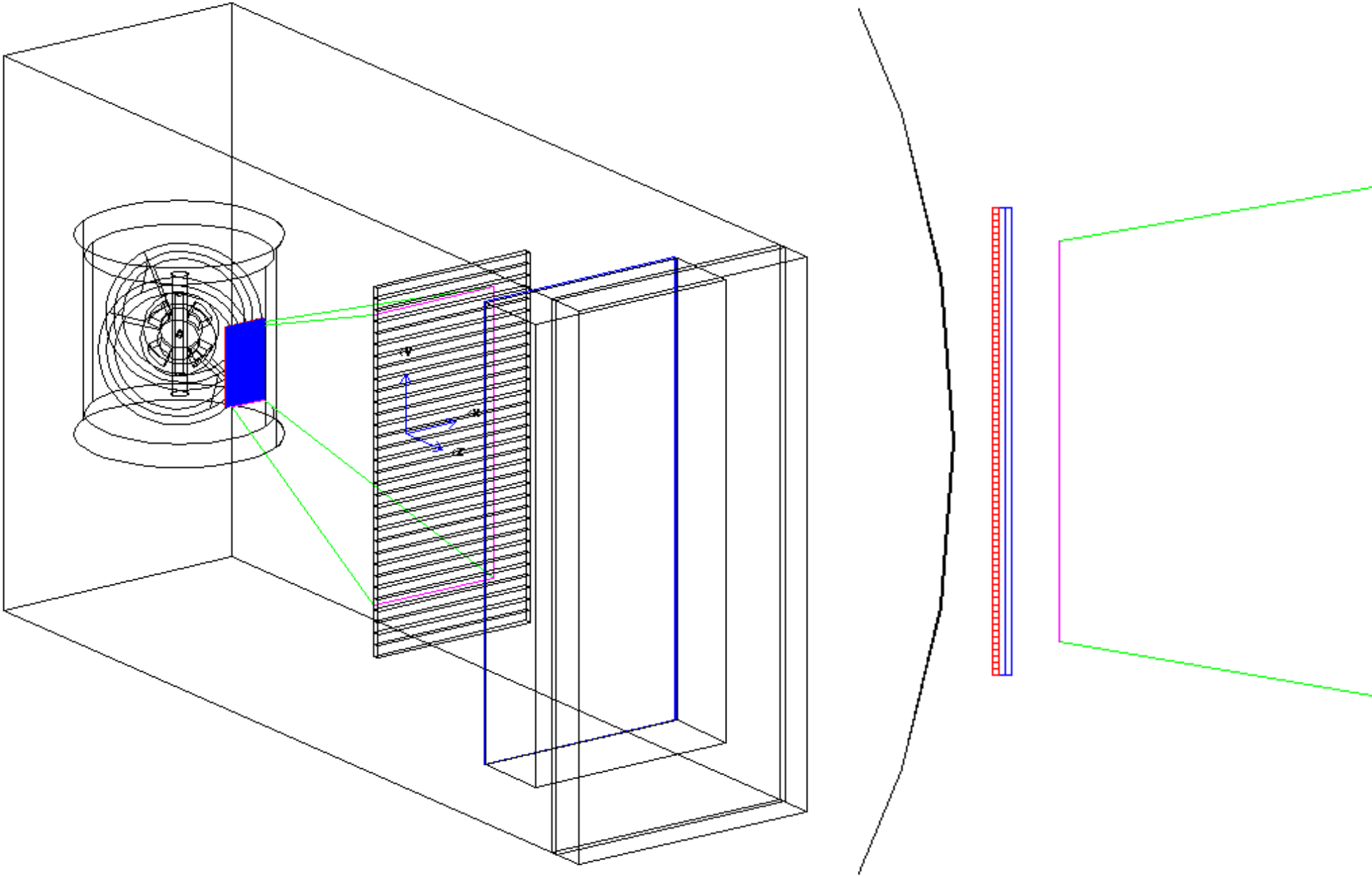
New

Lucite Hodoscope Divisions

- Chopped Hodoscope "plane" into 28 horizontal bars
- Now write particle bars hits to ntuple
- Write x location of hits; will add light propagation in bars

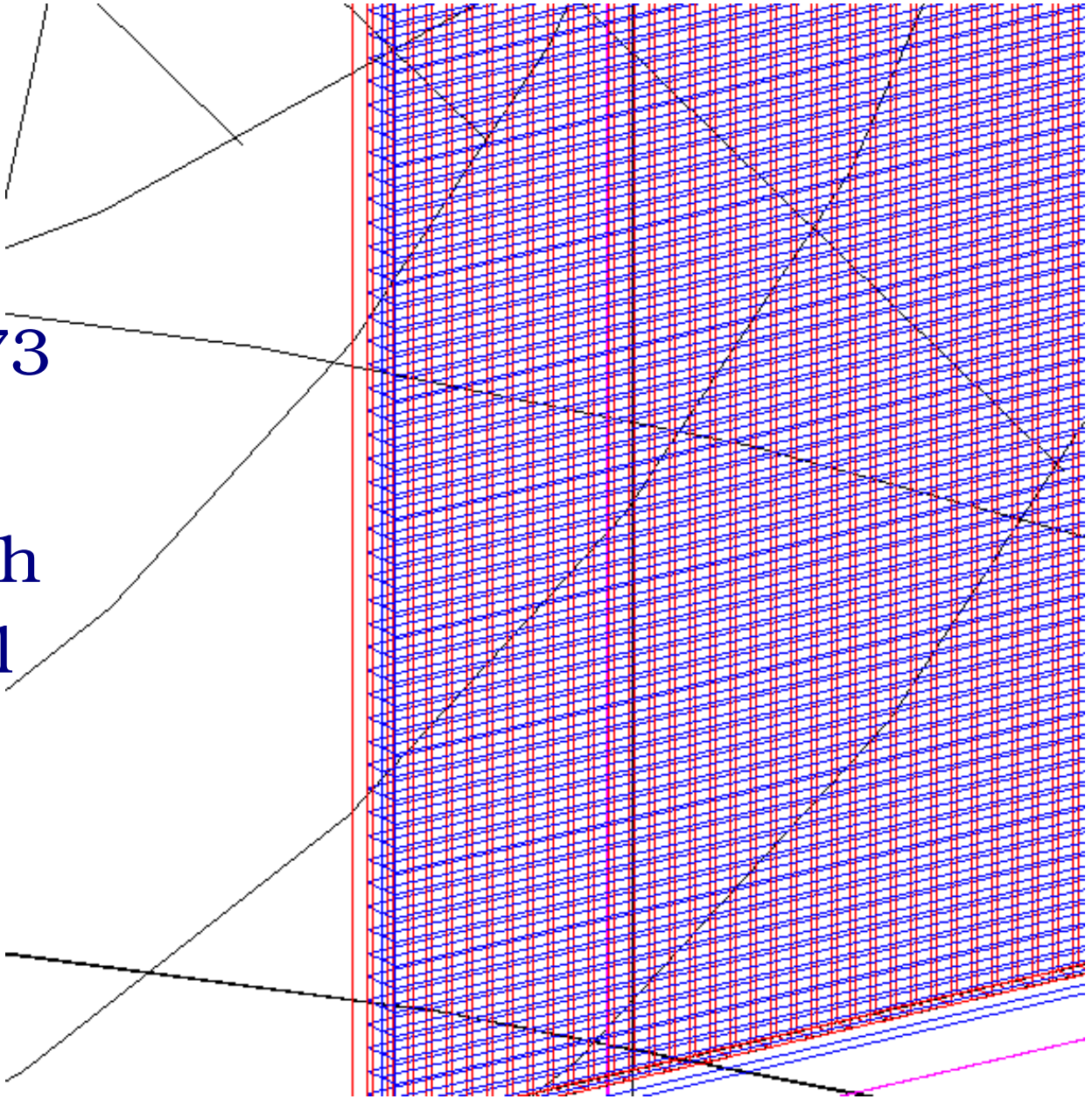


New Front Tracking Hodoscope



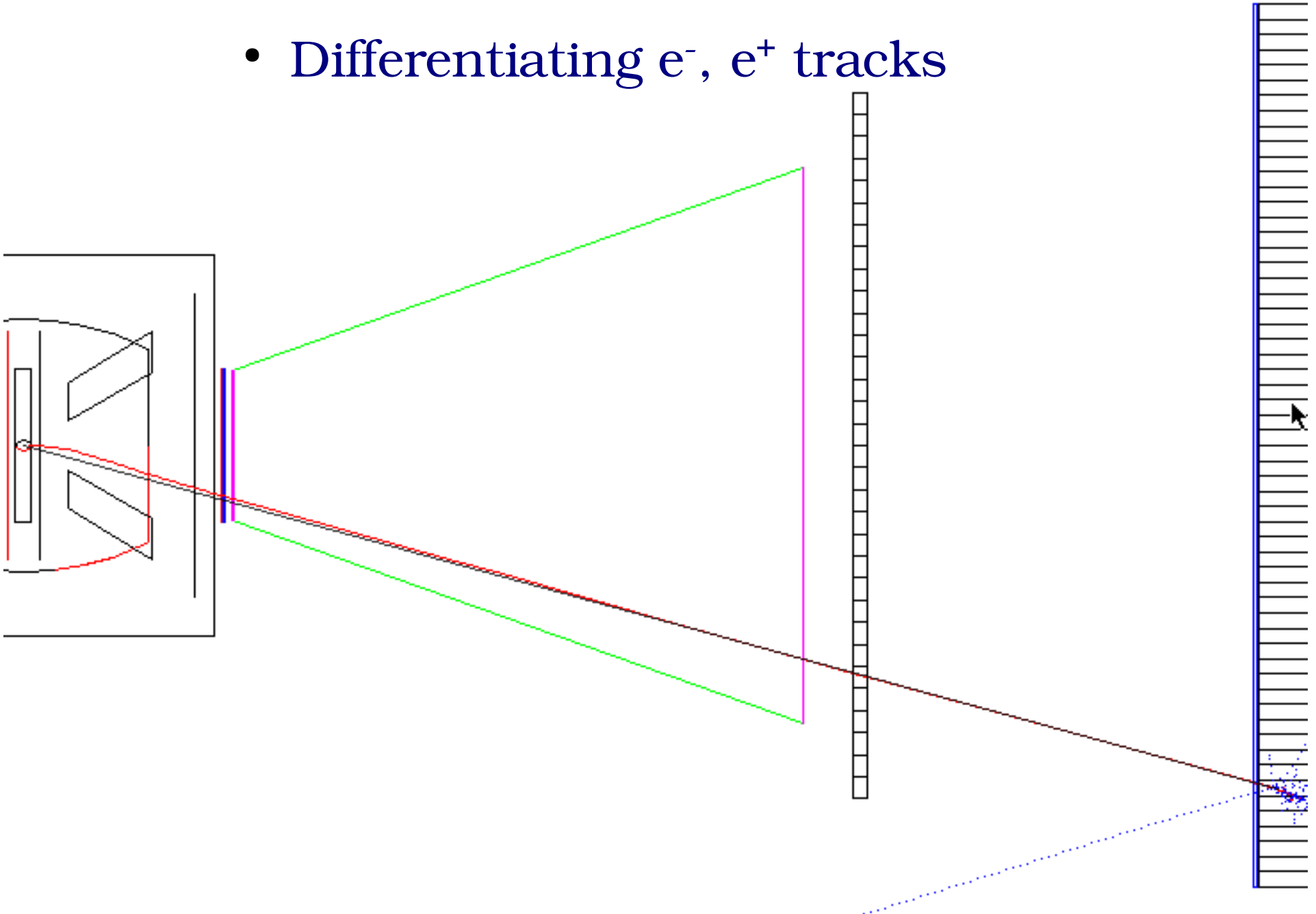
New Front Tracking Hodoscope

- 3 planes:
  - x-plane with 73 vertical bars
  - 2 y-planes with 133 horizontal bars



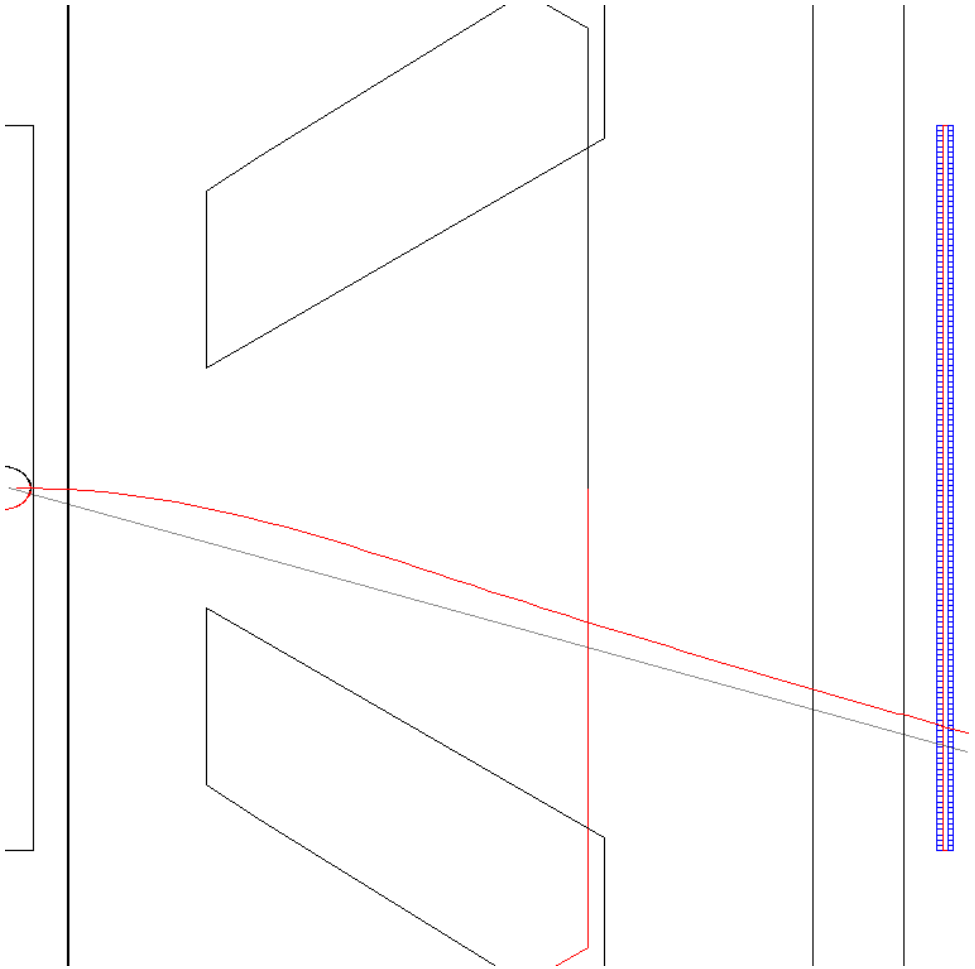
Using the Front Hodoscope

- Differentiating e^-, e^+ tracks

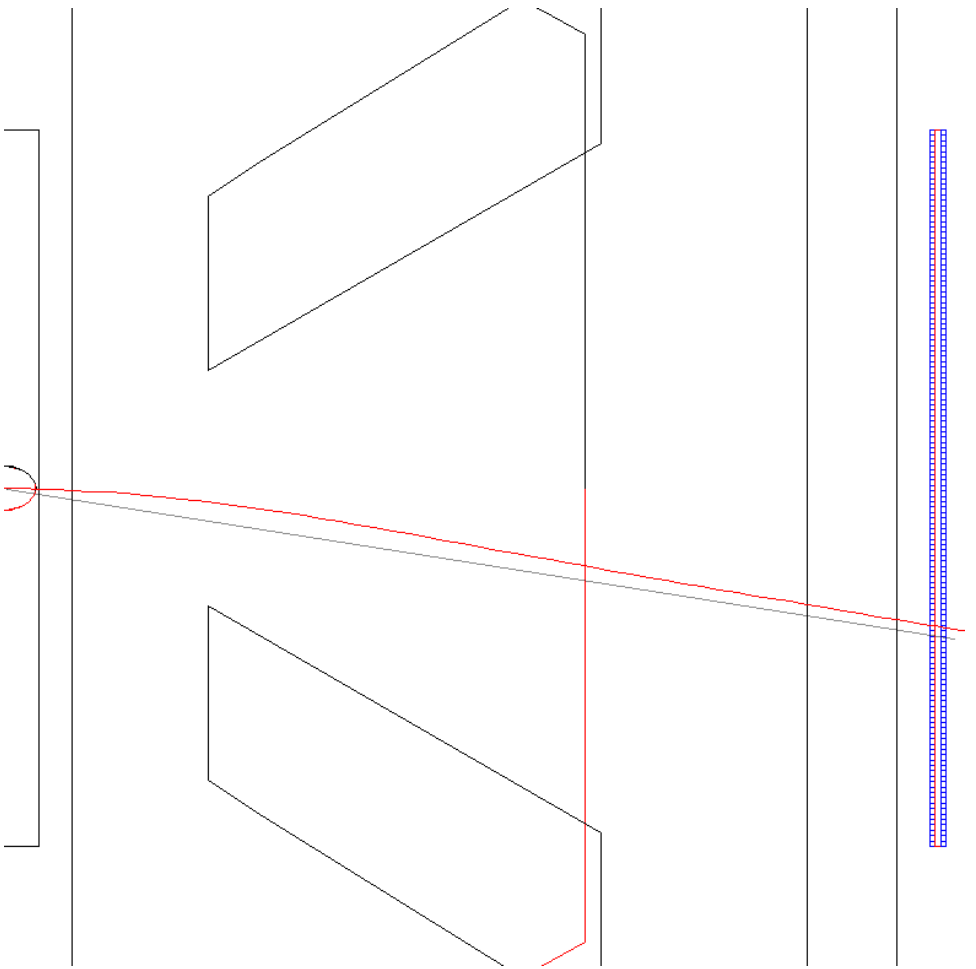


Electron Tracks in Front Hodo

- Compare track to line between target and calorimeter hit point

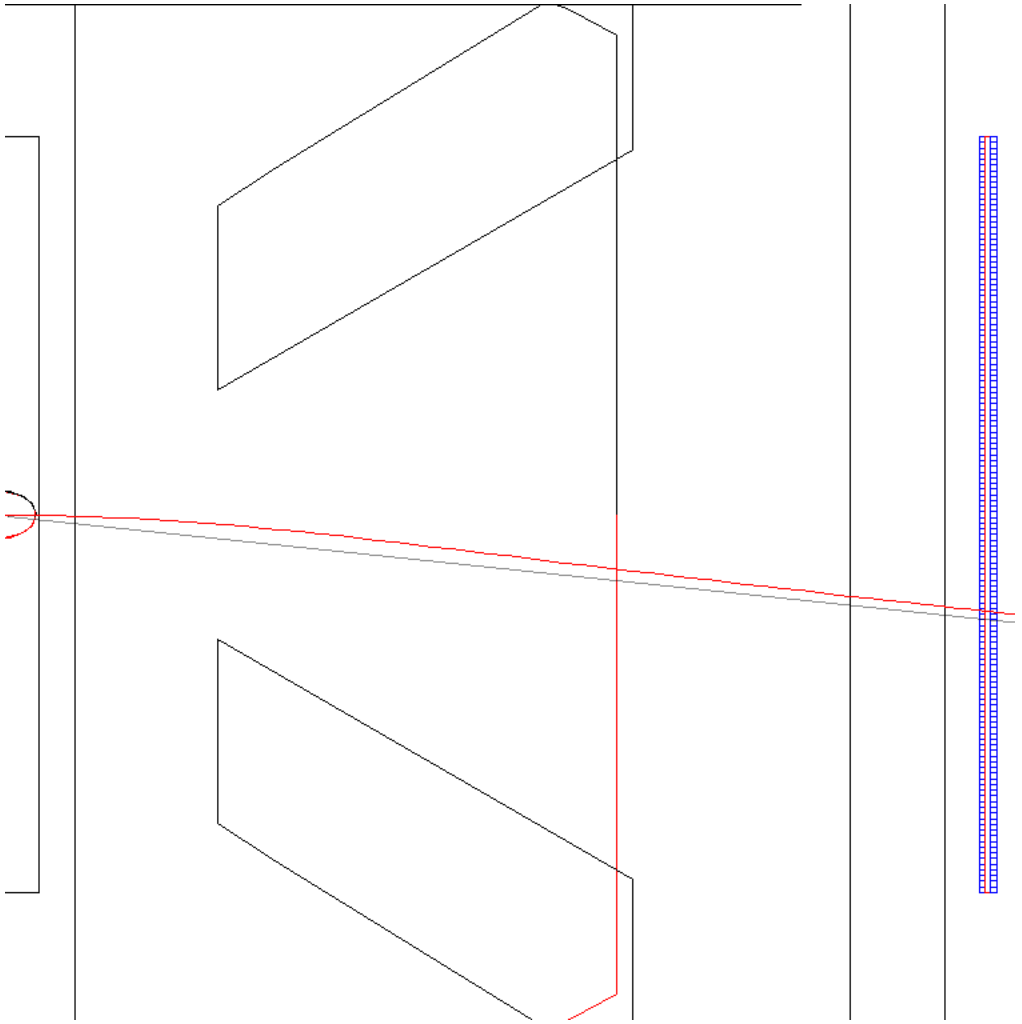


0.5 GeV

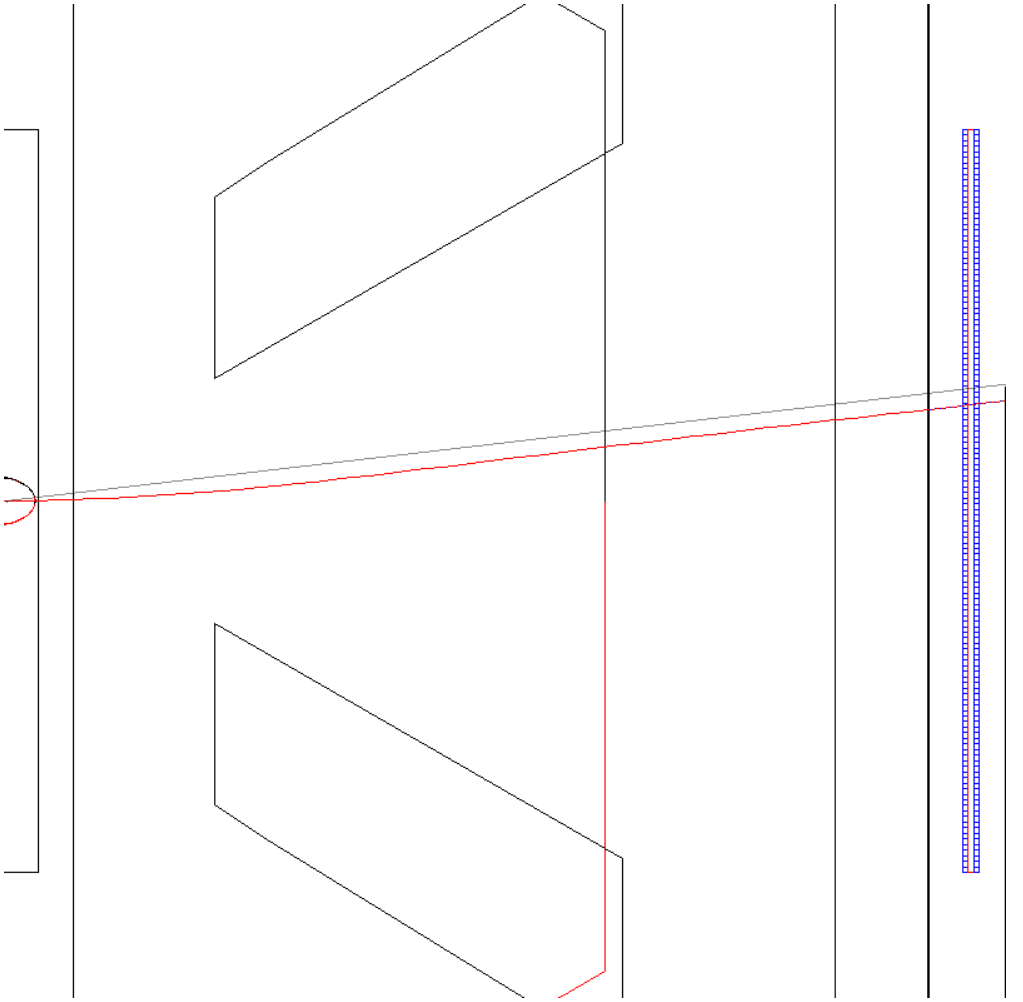


1.0 GeV

Electrons v. Positrons



1.5 GeV electron



1.5 GeV positron

Work to Come

- Magnet improvement, better analysis of effect of this change: error study
- Cerenkov improvement
- Light propagation through the Hodoscope's bars, curved bars
- Track reconstruction code:
  - Writing hit information from all detectors to ntuple