Bigbite Geant4 Simulation

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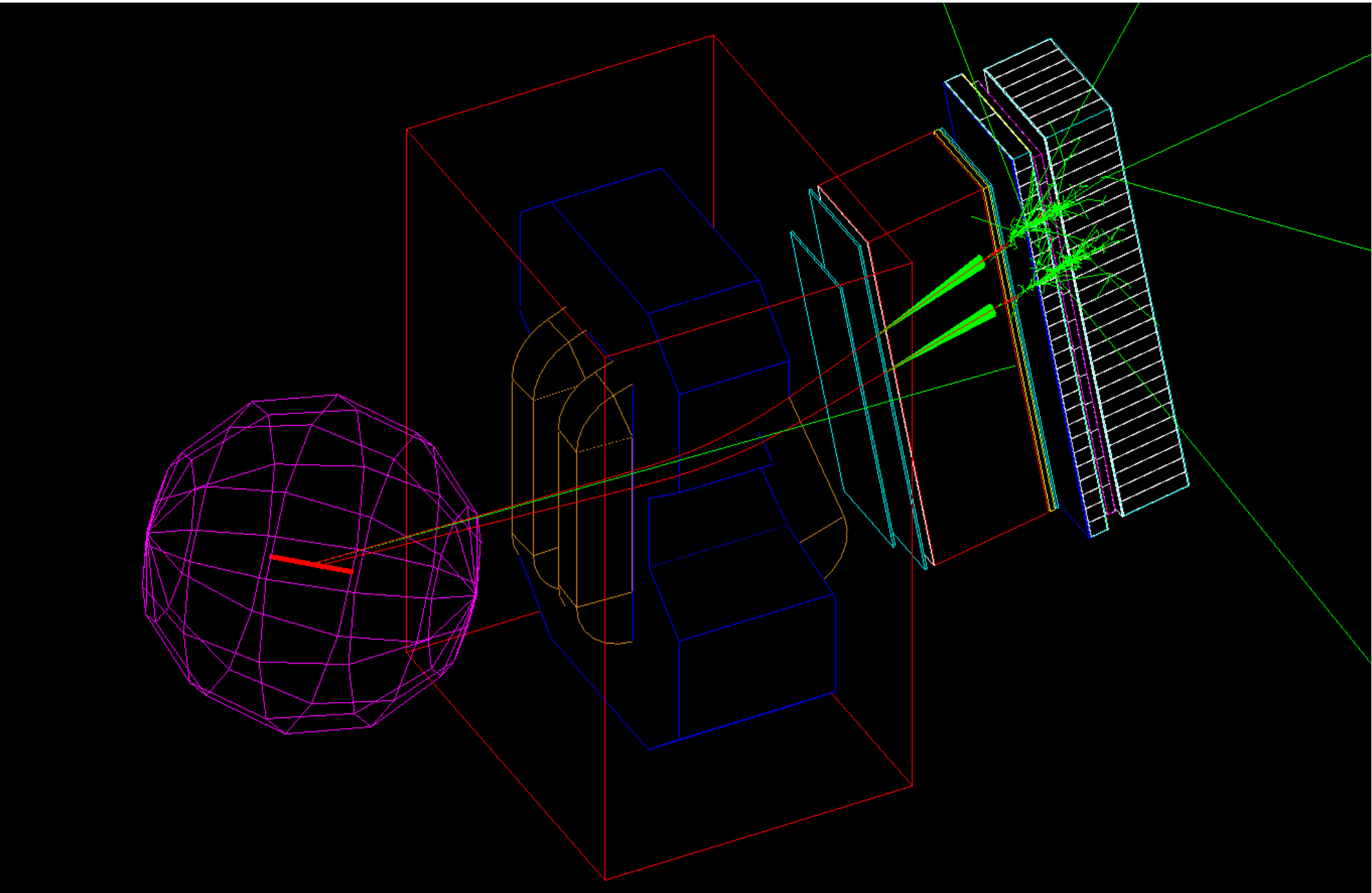
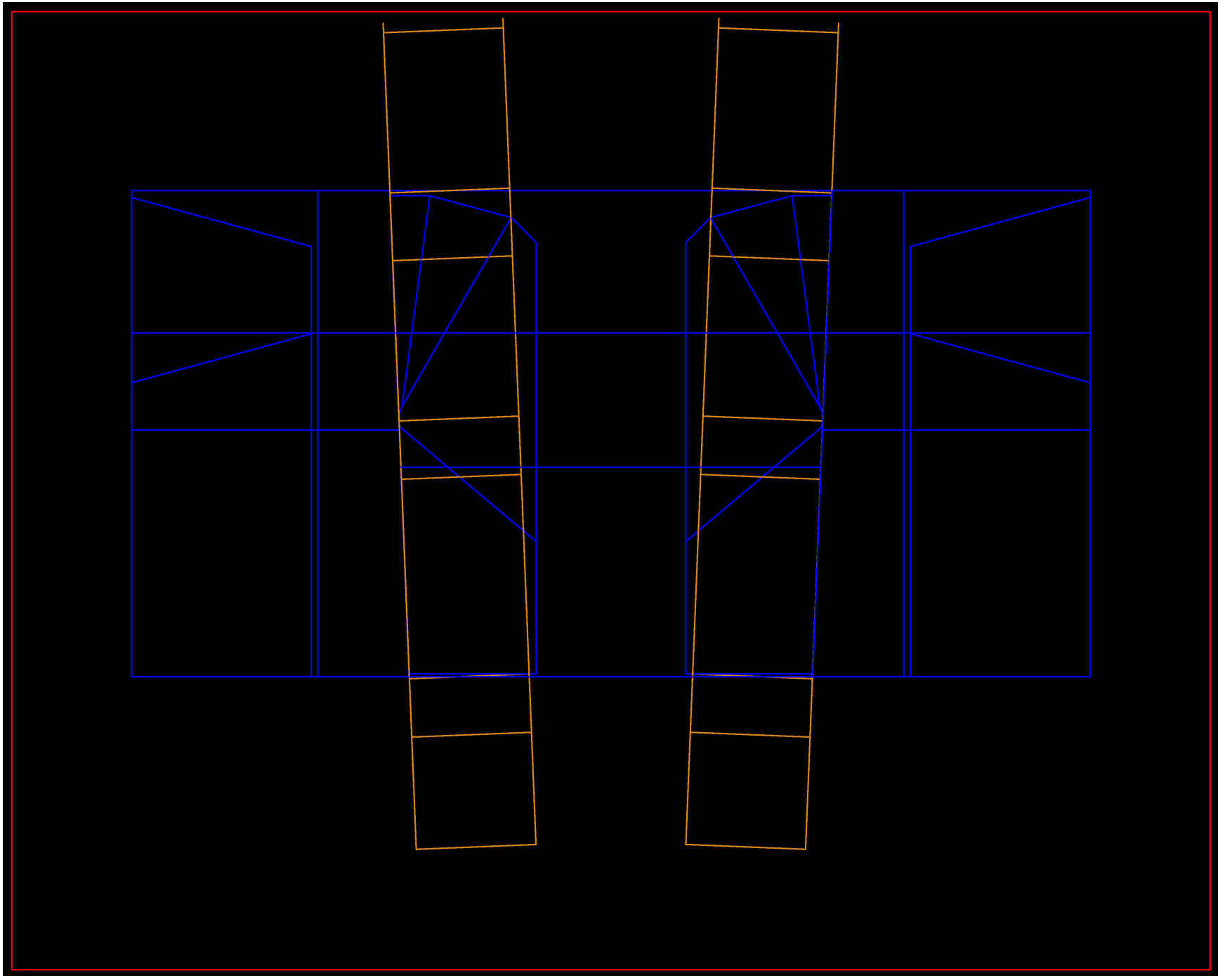
Vahe Mamyan

Geometry



Bigbite Magnet



Magnet Field Map

Magnet field map is calculated using MAFIA (Vladimir Nelubin).

---Ranges for X min = 0.01 meter, max = 0.125 meter ,step = 0.02 meter

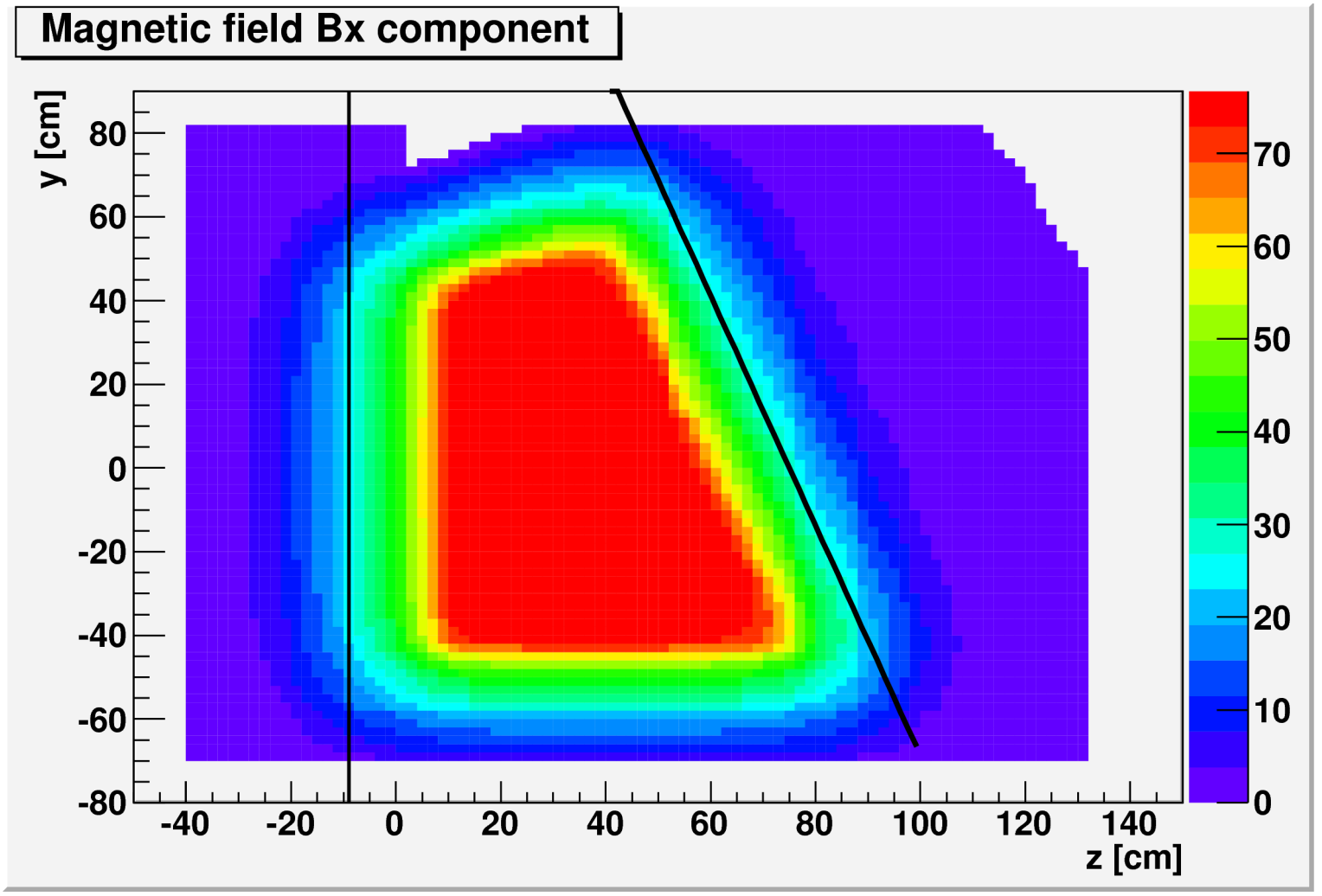
x is directed in horizontal plane (aperture x = +/- 0.125 meter)
x=0 placed in center of BB gap
Mapping is presented for one half of aperture. Second half is symmetrical.

---Ranges for Y min = -0.7 meter , max = 0.8 meter and step = 0.02 meter
y is directed in vertical plane of aperture,
y=0 is located in the center of aperture.

---Ranges for Z min = -0.4 meter, max = 1.3 meter ,step = 0.02 meter
Z=0 at the front edge of yoke of BB.

Magnetic field is linearly interpolated inside a 2x2x2 cm^3 cell.

Magnet Field Effective Boundary



Target and Detectors

Enclosure He-4 gas, GE180 window, He-3 gas. Realistic simulation.

Drift chambers are just volumes filled with the same gas
as the real drift chambers. Not realistic simulation

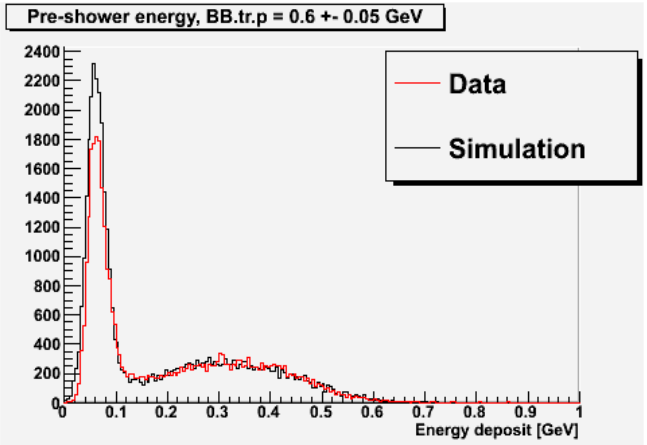
Cerenkov has aluminum window, C4F8O gas. Optical properties of the gas are simulated. The program counts number of photons and keeps in a root tree.

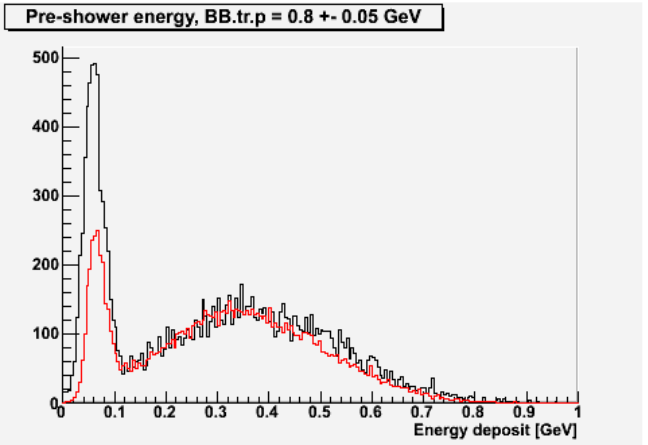
Steel plate before pre-shower, 1 inch.
Pre-shower TF-5 glass, semi-realistic simulation.
Honeycomb plate after pre-shower.
Shower TF-1 glass semi-realistic simulation.

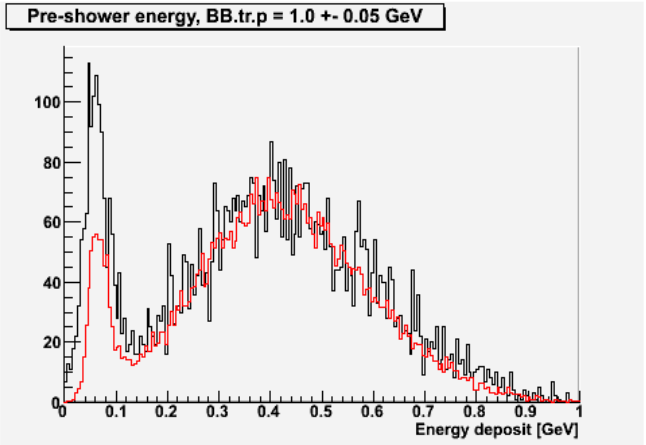
Shower Calibration

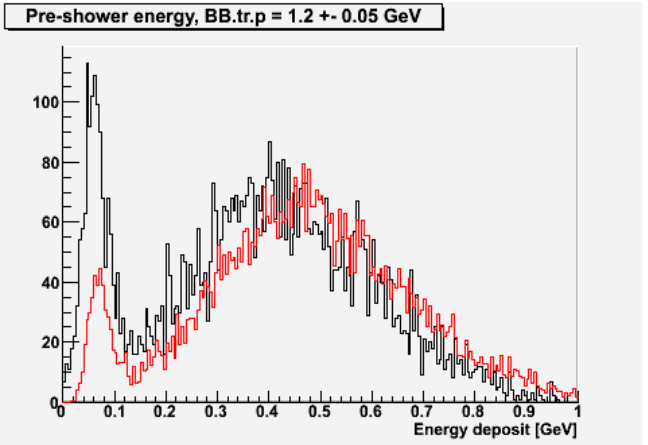
$$\chi^2 = \sum_{i=1}^{N} \left[E_i - \sum_{j}^{N_{ps}} C_{ij} A_{ij} - \sum_{k}^{N_{sh}} C_{ik} A_{ik} \right]^2$$

The black spectrum (simulation) is plotted with cuts similar to electron identification cuts in data analysis.









Track Reconstruction

Record hits in all three DC planes.

Look for tracks that have the same GEANT4 ID number and have a hit in pre-shower and shower around the projected track Position (not intended to study track finding algorithms).

The track is reconstructed using following approximations:

1) All tracks originate from target center.

2) Effective field boundary.

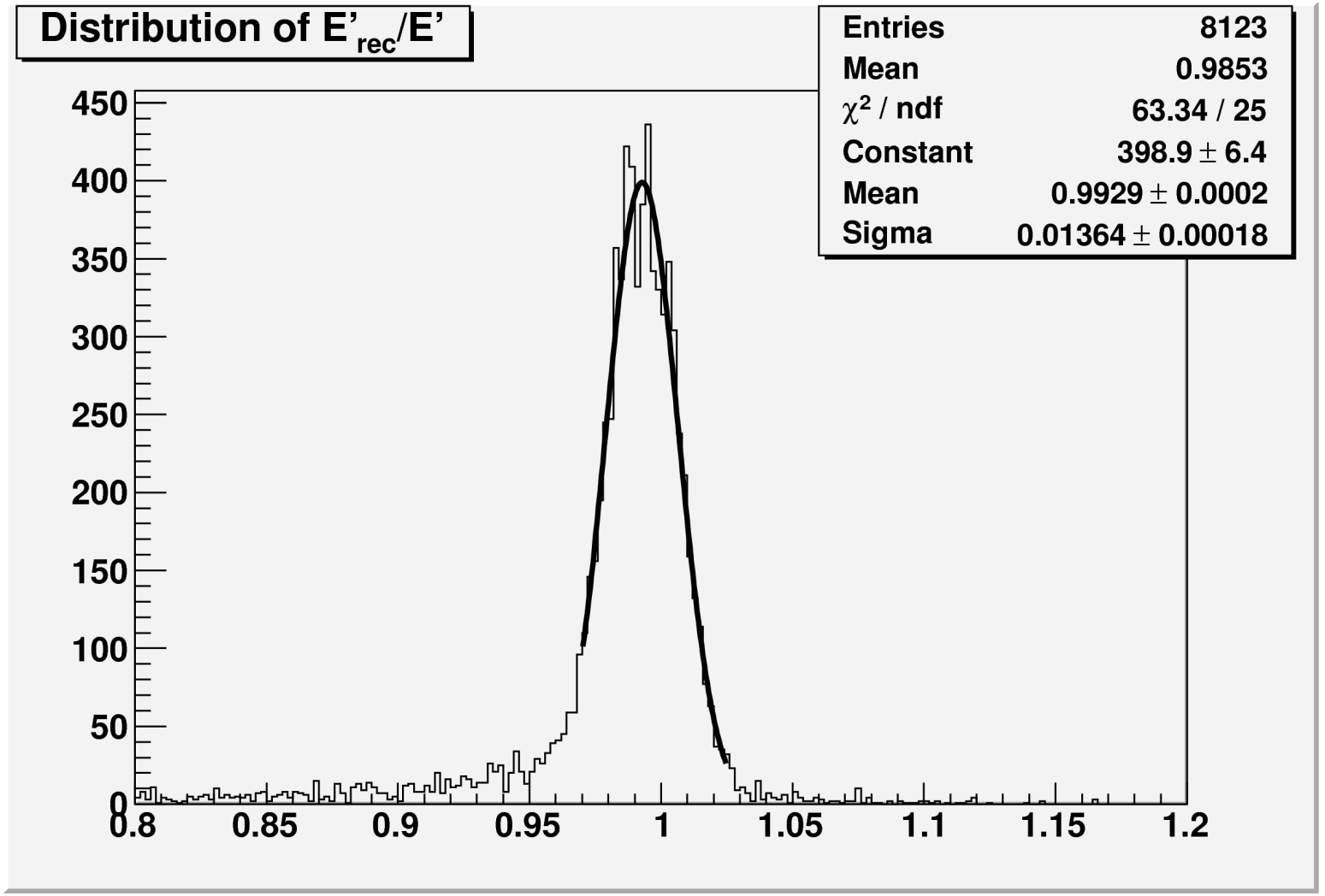
3) Assume constant magnetic field.

3) Find radius of curvature R of the track.

4) Use R and B to find momentum of particle.

$$P = 0.3 \cdot B \cdot R$$

Track Reconstruction



Process Simulation

DIS cross section from Peter Bosted fit with radiative corrections included.

Pion(0,+,-) cross sections from Wiser parametrization.

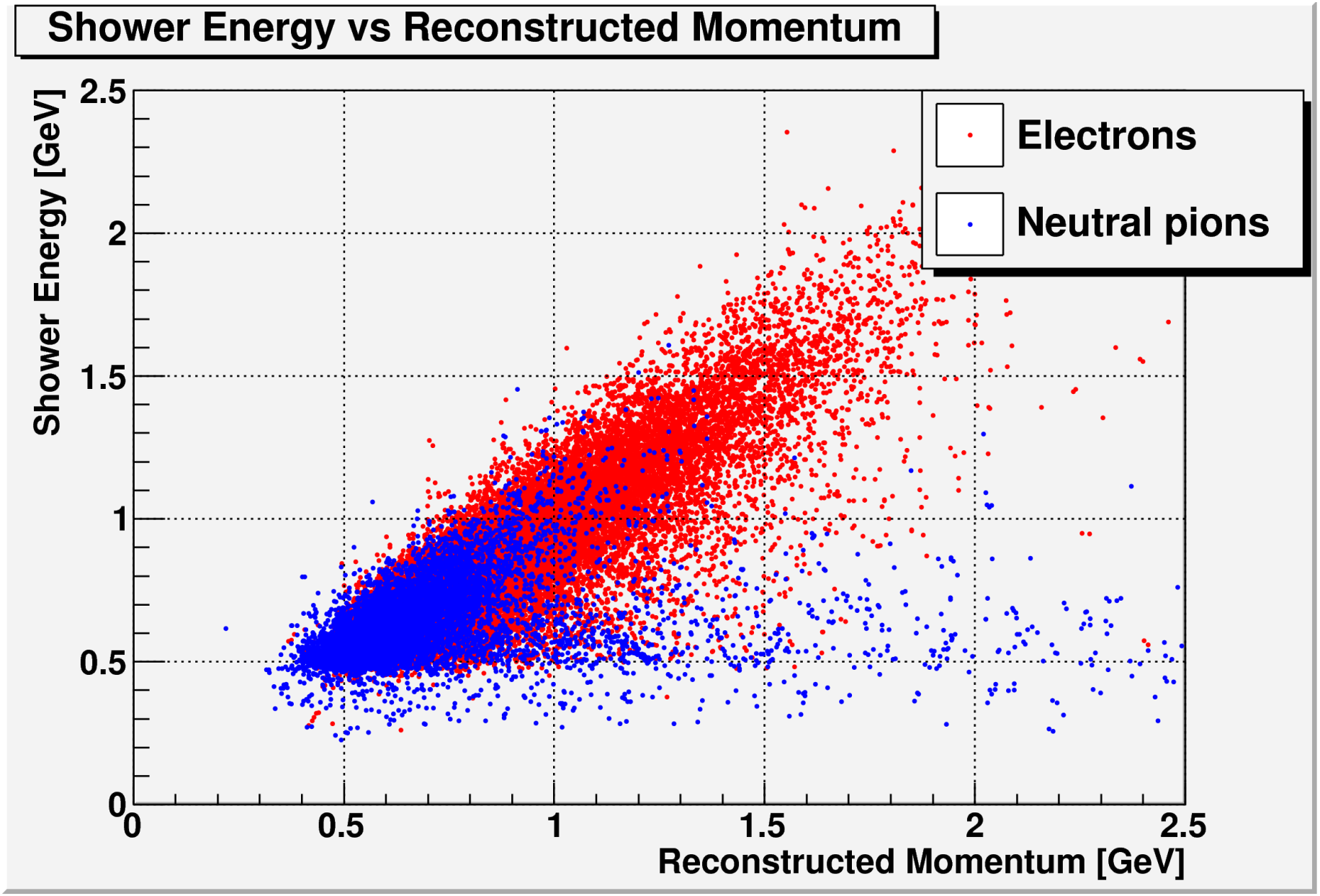
Events are weighted according differential cross sections.

Initial information of all tracks is kept in a root file as a tree.

Pair production, bremsstrahlung in each volume before drift chambers is kept in a tree.

Allows to study positron/electron ratio versus electron energy.

Charge Symmetric Background



Current Status

All detectors are simulated.

Magnetic field can be improved by using recent magnetic fields produced by Vladimir Nelubin (inside iron).

Track reconstruction is simple, can be made more realistic if necessary.

Total shower is calibrated with the same method as the real calorimeter. Very important since shower energy cut is included in trigger.

DIS and pion production cross sections are implemented.

Positron/electron ratio can be extracted.