Calorimeter simulation for Gen

0.1 Geometry and materials

Geometry of 3 main components of calorimeter: Shower, PreShower and Scintillators array was described.

1. PreShower: 2×27 blocks, each block dimensions (X× Y× Z [cm]): 8.5×37×8.5, material: $PbO(SiO_4)_2$

2. Scintillators: 13 blocks, each block dimensions (X× Y× Z [cm]):17×63.5×3.8, material: $CH_3(C_{10}H_8)_2$

3 Shower: 7×27 blocks, each block dimensions (X× Y× Z [cm]): 8.5×8.5×37, material: $PbO(SiO_4)_2$

Z - axis (the beam direction) .

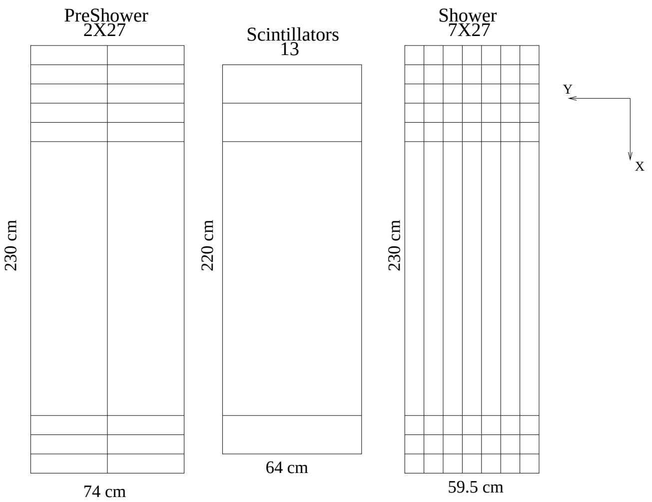


Figure 1: BigBite calorimeter(front view)

As described in http://hallaweb.jlab.org/experiment/E02-013/expdocs/SEI_MC.ps iron plane(thickness 0.63 cm) and aluminium plane(thickness 1.29 cm) have been placed in front of PreShower and Shower array respectively. Distance between PS backplane and Scintillators front plane 2.5 cm, distance between Scintillators backplane and aluminium plane in front of shower 2.5 cm. The source of generated electrons and pions located 4.5m far from the middle of PS front plane.

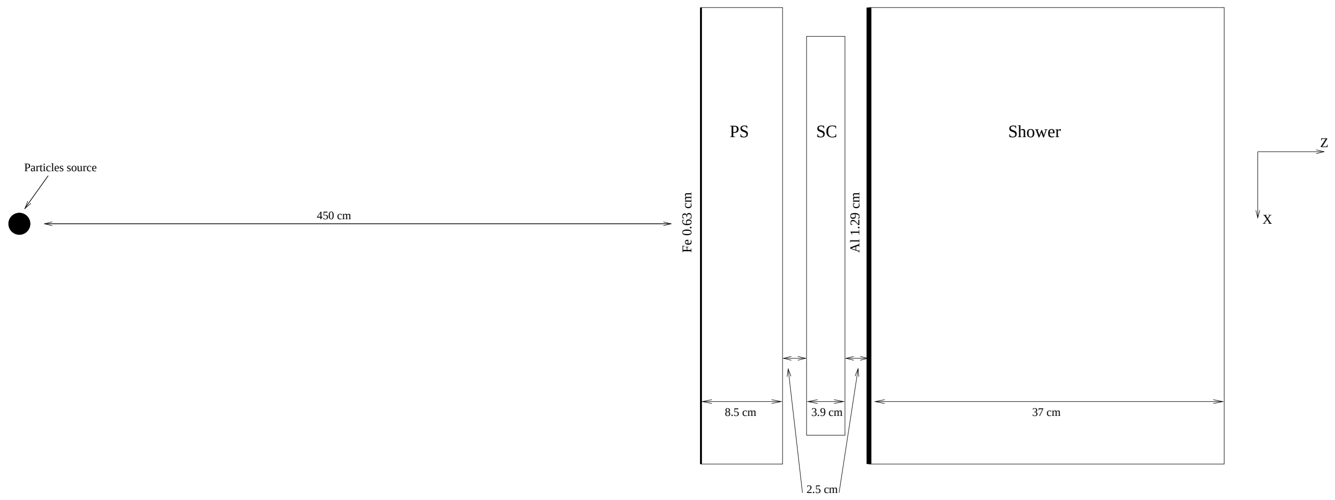


Figure 2: BigBite calorimeter(side view)

0.2 Simulation and results

Generated particles were negative and neutral pions with exponential energy distribution and monochromatic electrons. Generated electrons has momentum 2 GeV and their angular spread was defined to cover the whole detector. Output histograms contain energy distribution in Shower array and individual shower blocks; PreShower array and individual PreShower blocks, Scintillators array and individual scintillators as well as X and Y position of the point, where particle hit detector plane.

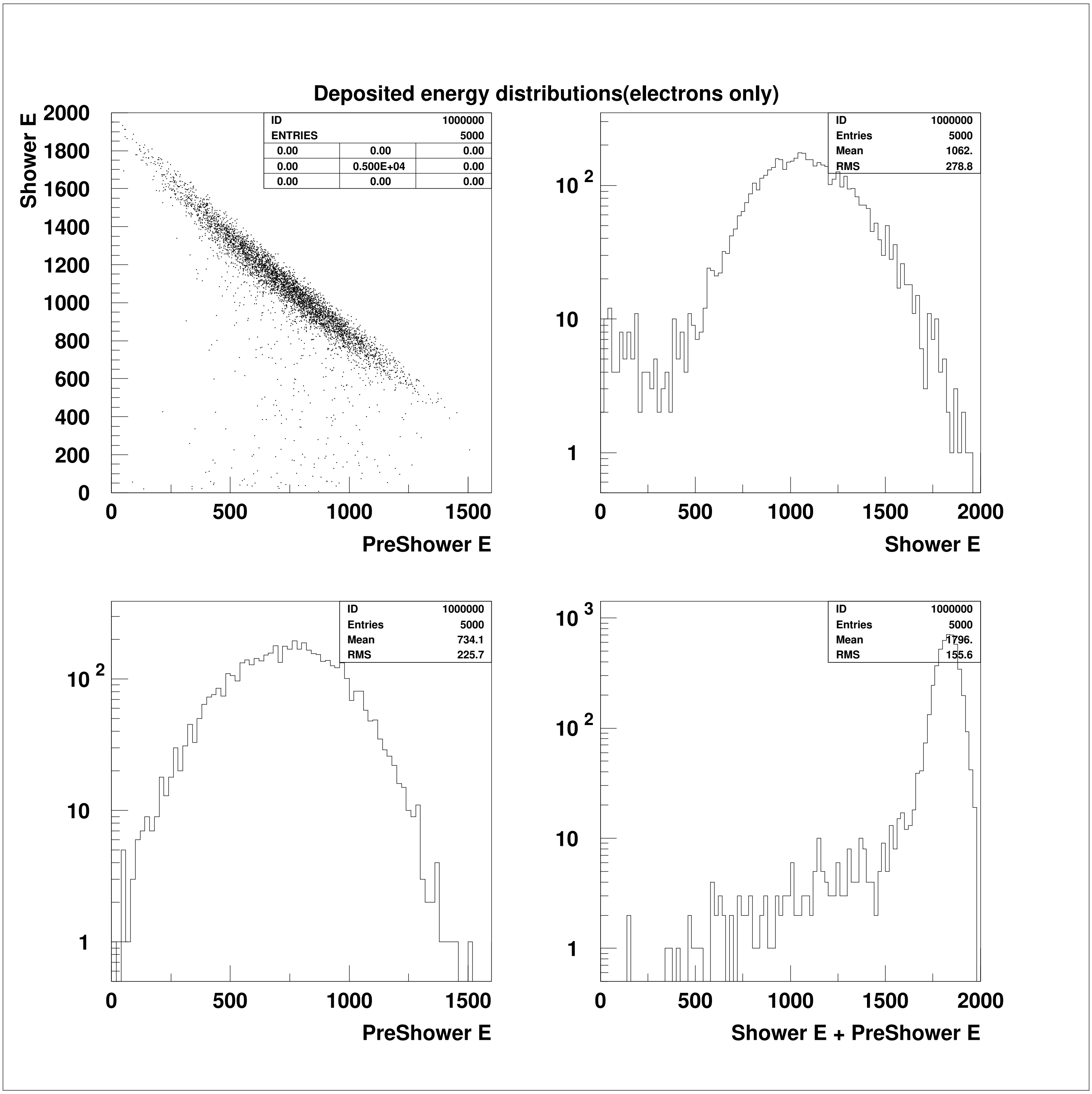

Deposited energy distributions(electrons only)
Shower E
PreShower E
ID 1000000
ENTRIES 5000
0.00 0.00 0.00
0.00 0.500E+04 0.00
0.00 0.00 0.00
Shower E
ID 1000000
Entries 5000
Mean 1062.
RMS 278.8
PreShower E
ID 1000000
Entries 5000
Mean 734.1
RMS 225.7
Shower E + PreShower E
ID 1000000
Entries 5000
Mean 1796.
RMS 155.6

Figure 3:

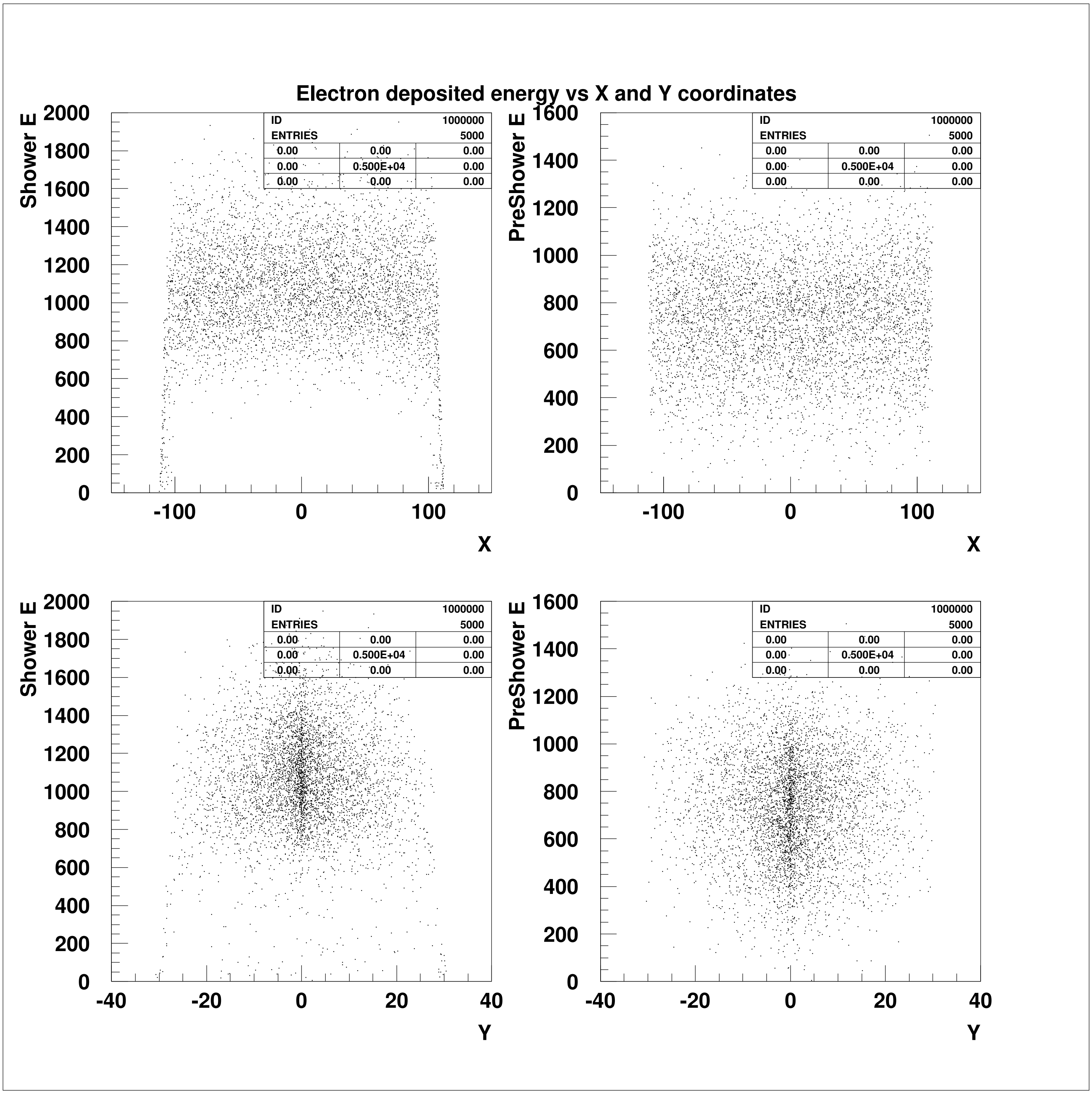
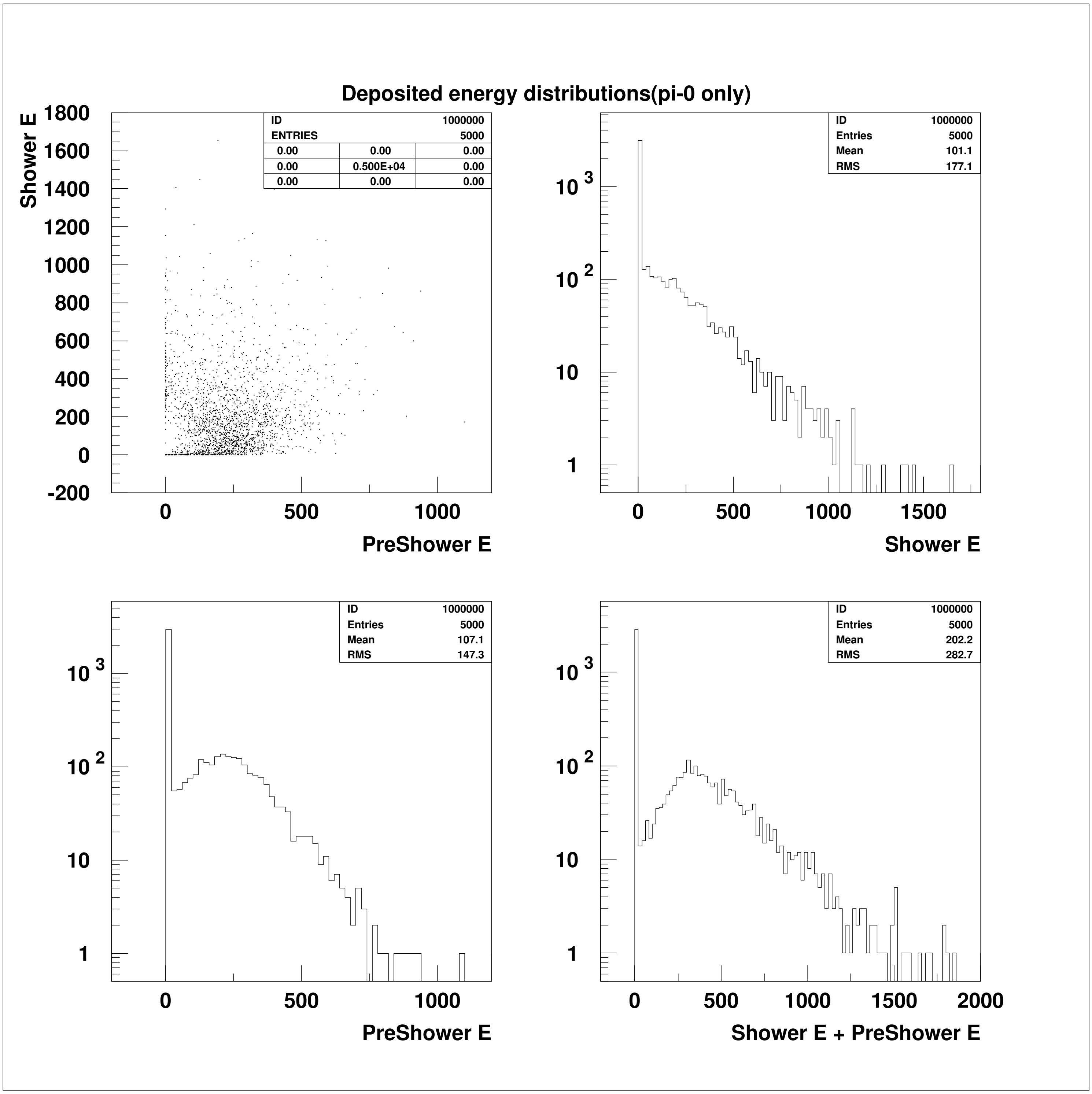
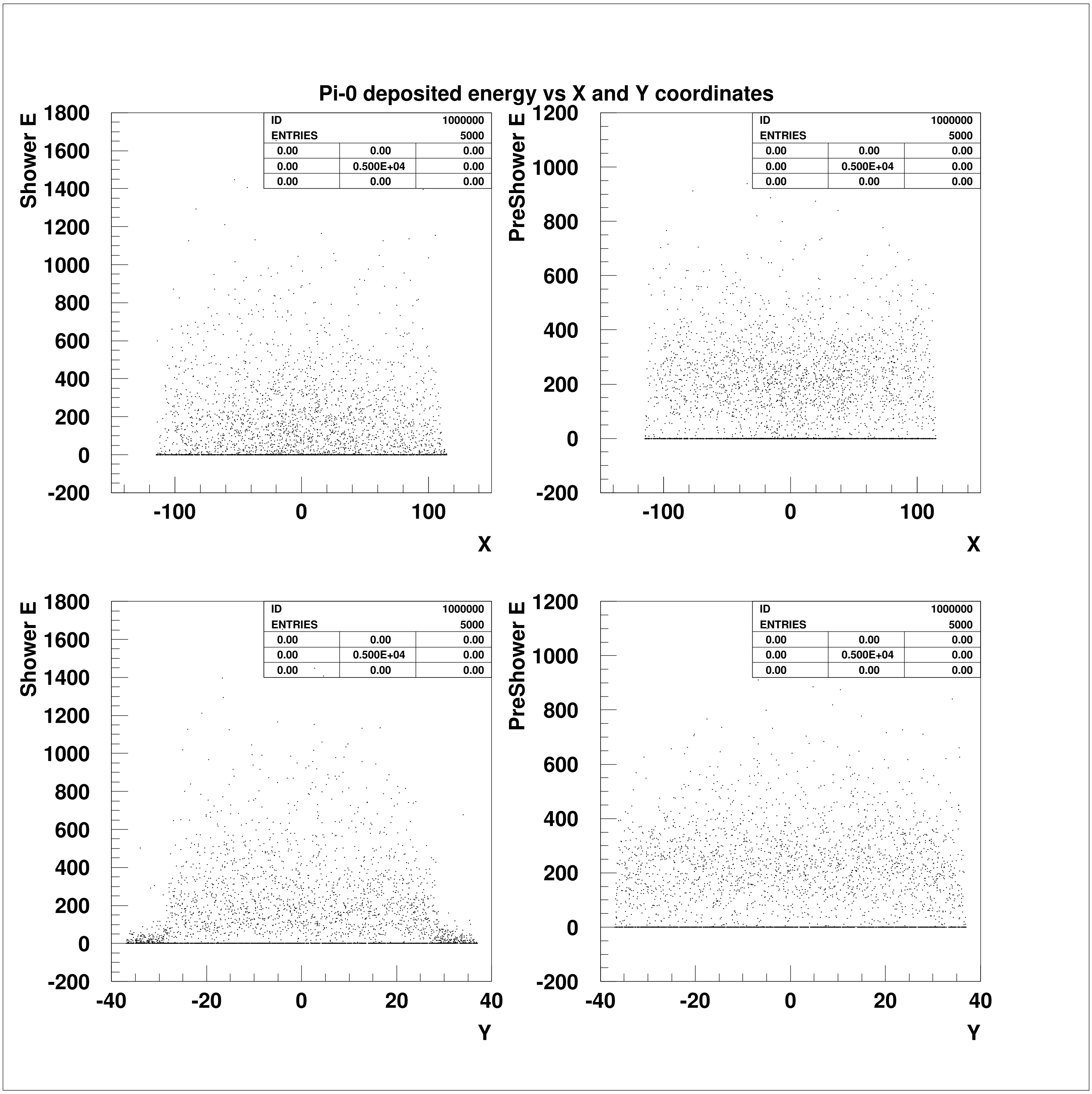

Electron deposited energy vs X and Y coordinates
Shower E
PreShower E
X
Y
ID 1000000
ENTRIES 5000
0.00 0.00 0.00
0.00 0.500E+04 0.00
0.00 0.00 0.00

Figure 4:



Deposited energy distributions(pi-0 only)
Shower E
PreShower E
ID 1000000
ENTRIES 5000
0.00 0.00 0.00
0.00 0.500E+04 0.00
0.00 0.00 0.00
Shower E
ID 1000000
Entries 5000
Mean 101.1
RMS 177.1
PreShower E
ID 1000000
Entries 5000
Mean 107.1
RMS 147.3
Shower E + PreShower E
ID 1000000
Entries 5000
Mean 202.2
RMS 282.7

Figure 5:



Pi-0 deposited energy vs X and Y coordinates
Shower E
PreShower E
X
Y
ID 1000000
ENTRIES 5000
0.00 0.00 0.00
0.00 0.500E+04 0.00
0.00 0.00 0.00

Figure 6:

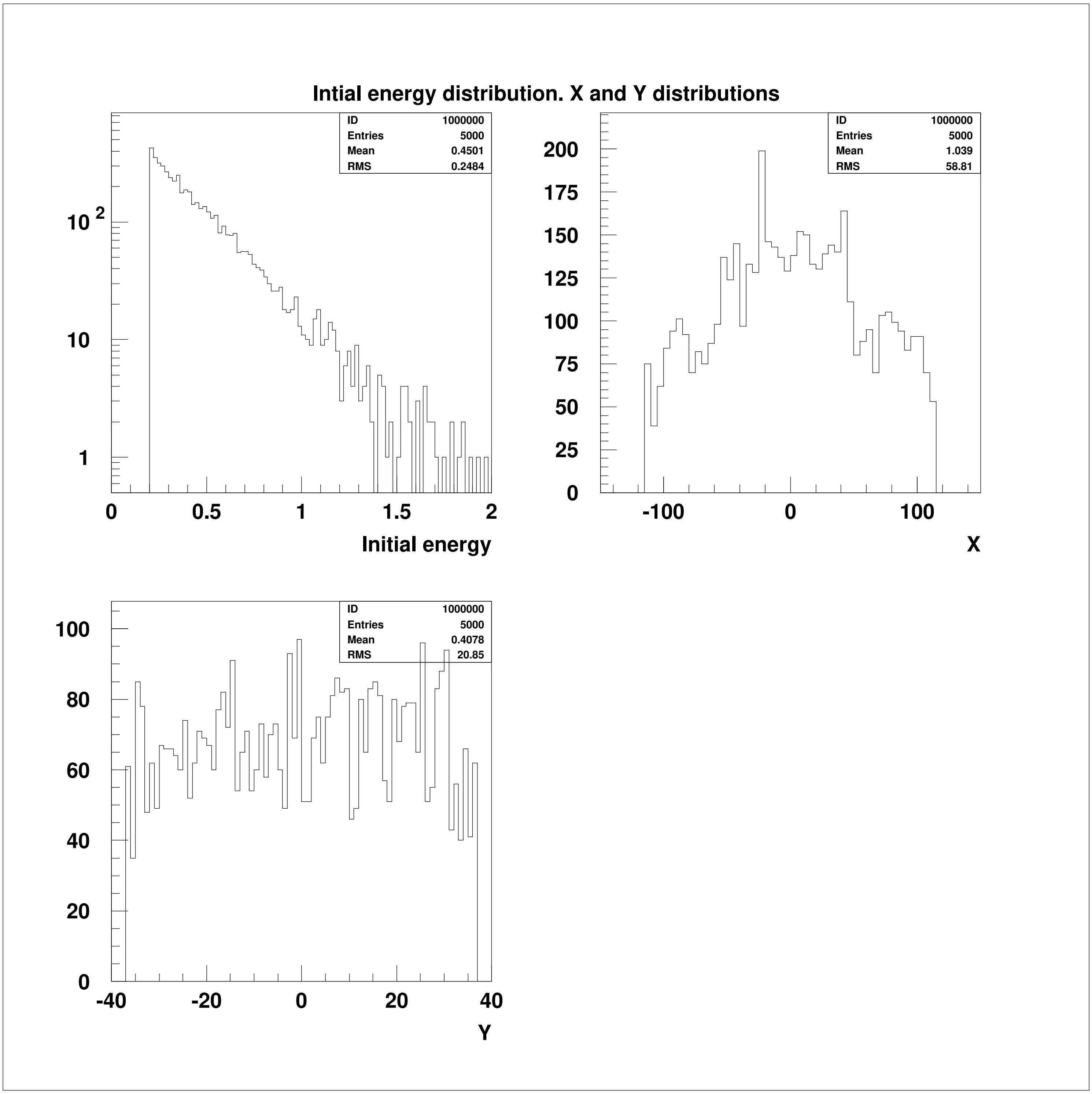
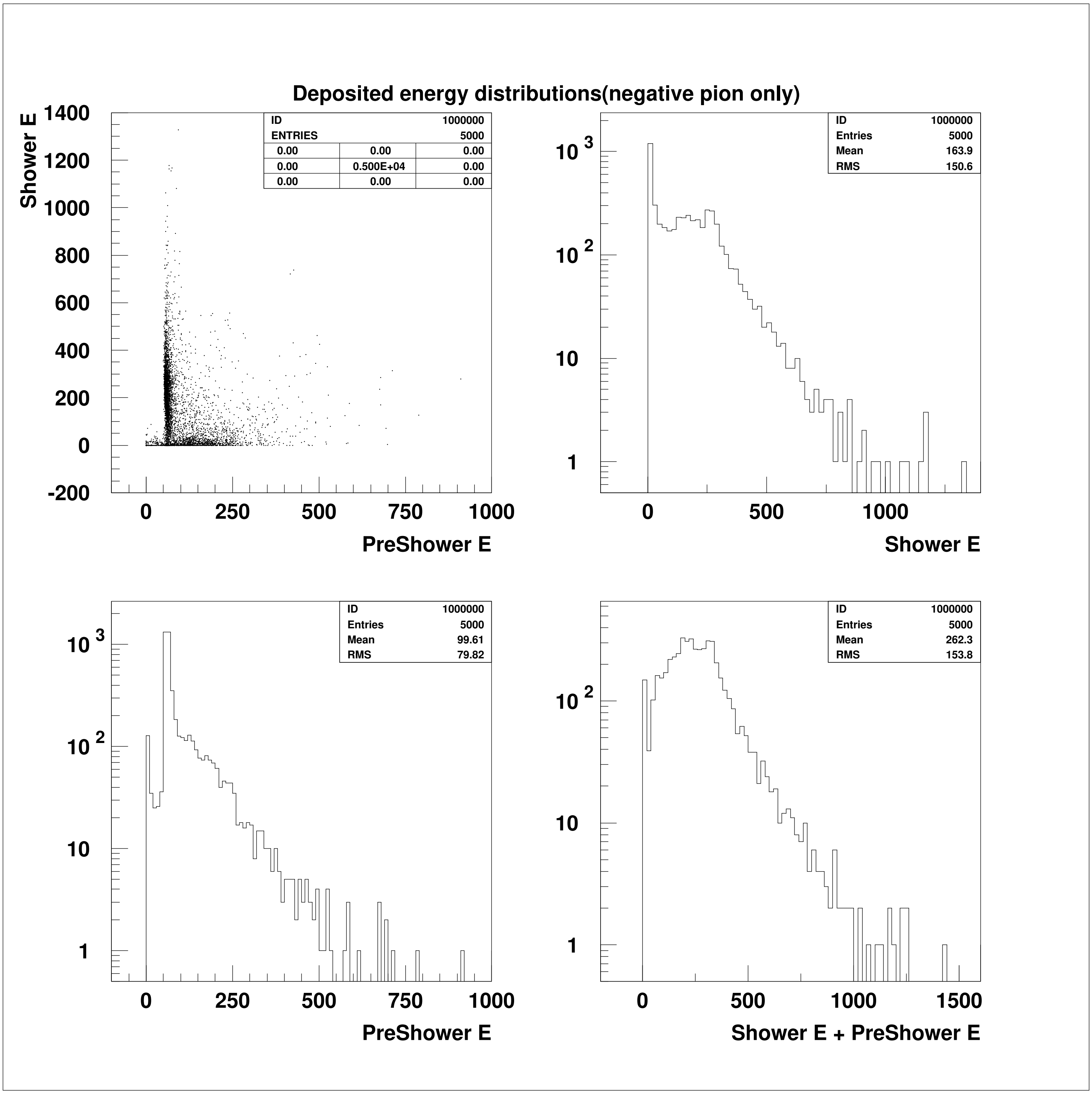
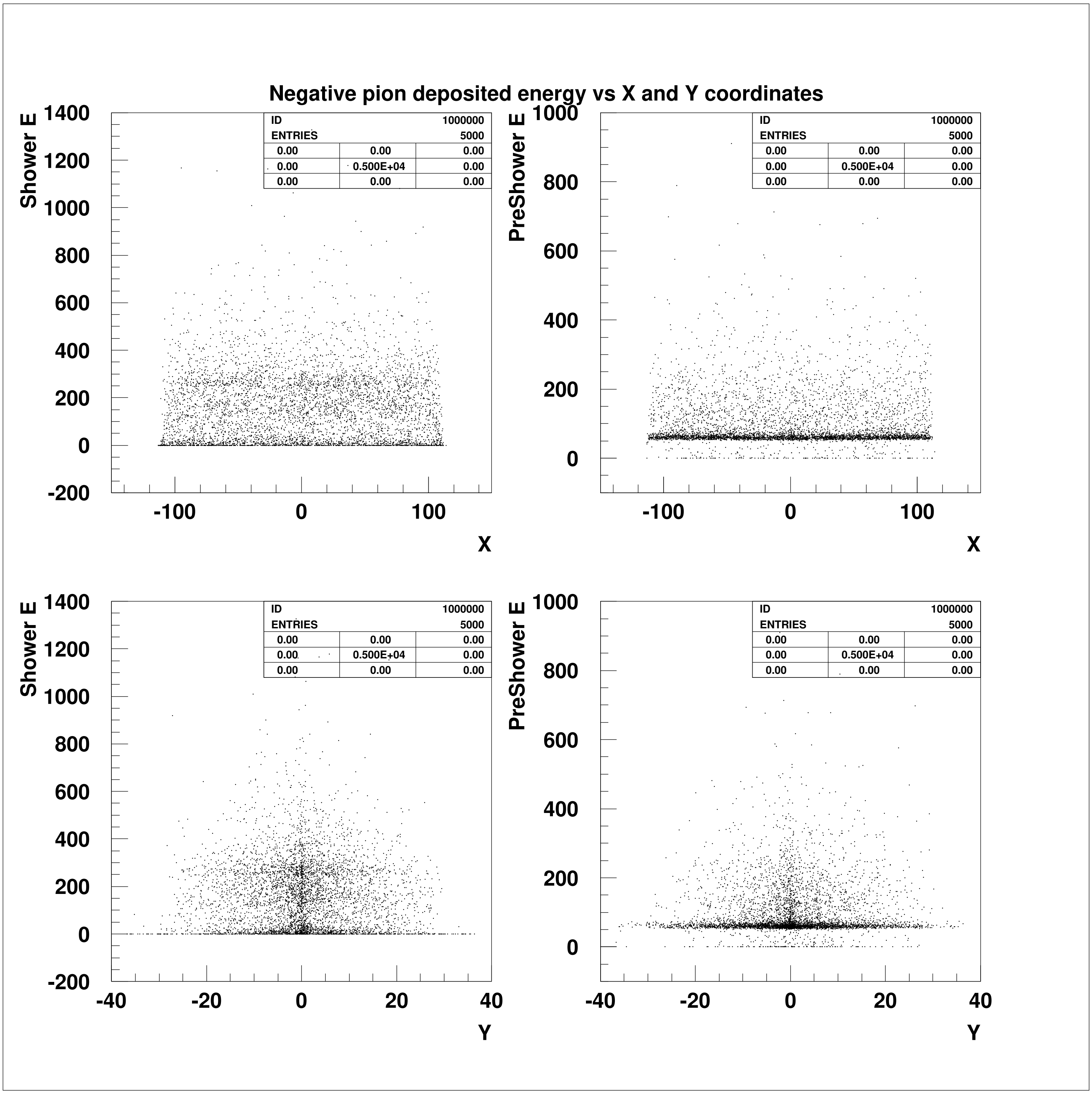

Intial energy distribution. X and Y distributions
ID 1000000
Entries 5000
Mean 0.4501
RMS 0.2484
Initial energy
ID 1000000
Entries 5000
Mean 1.039
RMS 58.81
X
ID 1000000
Entries 5000
Mean 0.4078
RMS 20.85
Y

Figure 7:



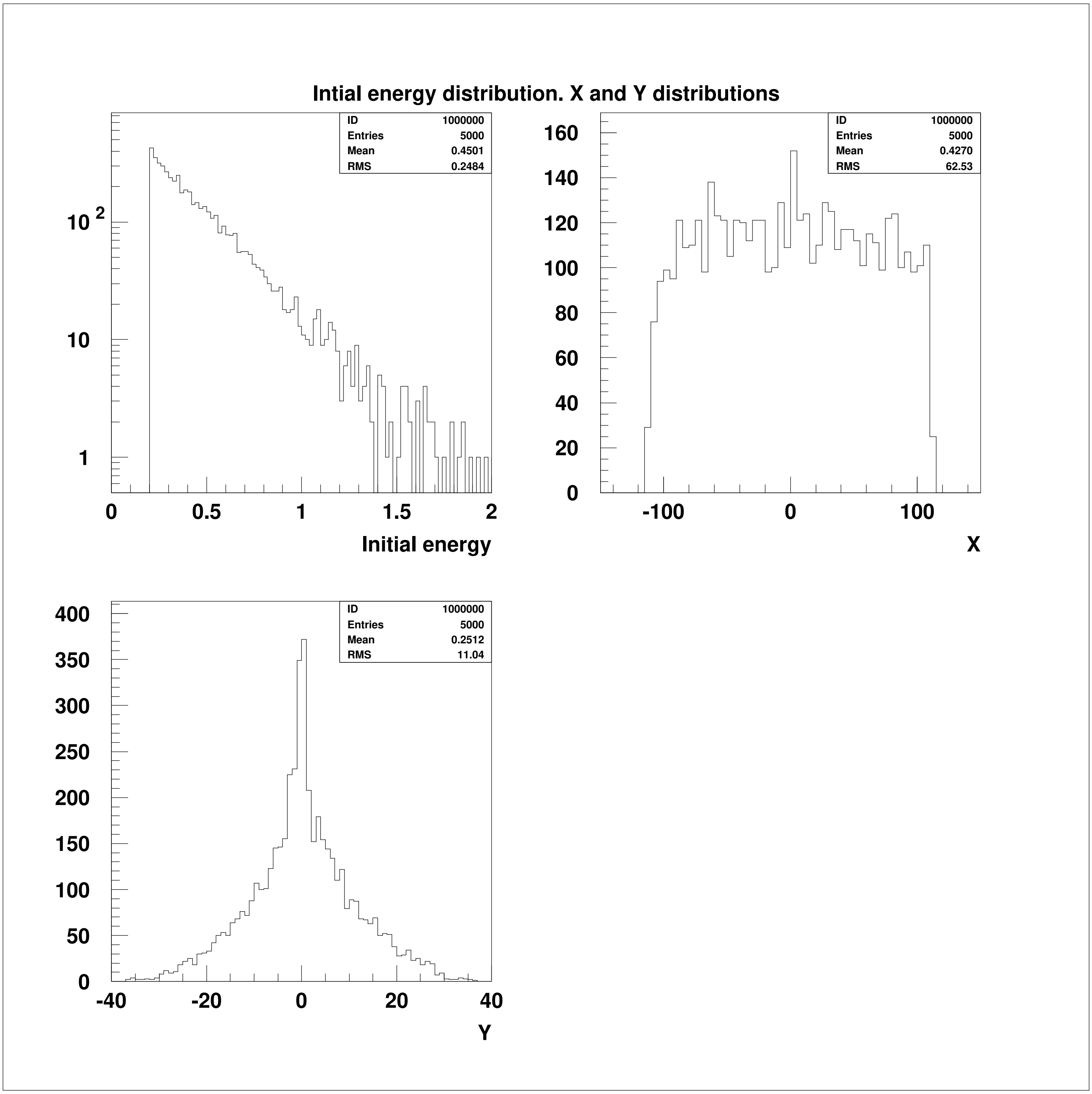
Deposited energy distributions(negative pion only)
Shower E
PreShower E
Shower E
PreShower E
Shower E + PreShower E
ID 1000000
ENTRIES 5000
0.00 0.00 0.00
0.00 0.500E+04 0.00
0.00 0.00 0.00
ID 1000000
Entries 5000
Mean 163.9
RMS 150.6
ID 1000000
Entries 5000
Mean 99.61
RMS 79.82
ID 1000000
Entries 5000
Mean 262.3
RMS 153.8

Figure 8:



Negative pion deposited energy vs X and Y coordinates
Shower E
PreShower E
X
Y
ID 1000000
ENTRIES 5000
0.00 0.00 0.00
0.00 0.500E+04 0.00
0.00 0.00 0.00

Figure 9:



Intial energy distribution. X and Y distributions
ID 1000000
Entries 5000
Mean 0.4501
RMS 0.2484
Initial energy
ID 1000000
Entries 5000
Mean 0.4270
RMS 62.53
X
ID 1000000
Entries 5000
Mean 0.2512
RMS 11.04
Y

Figure 10: