Report on Simulations for Solid Cerenkov

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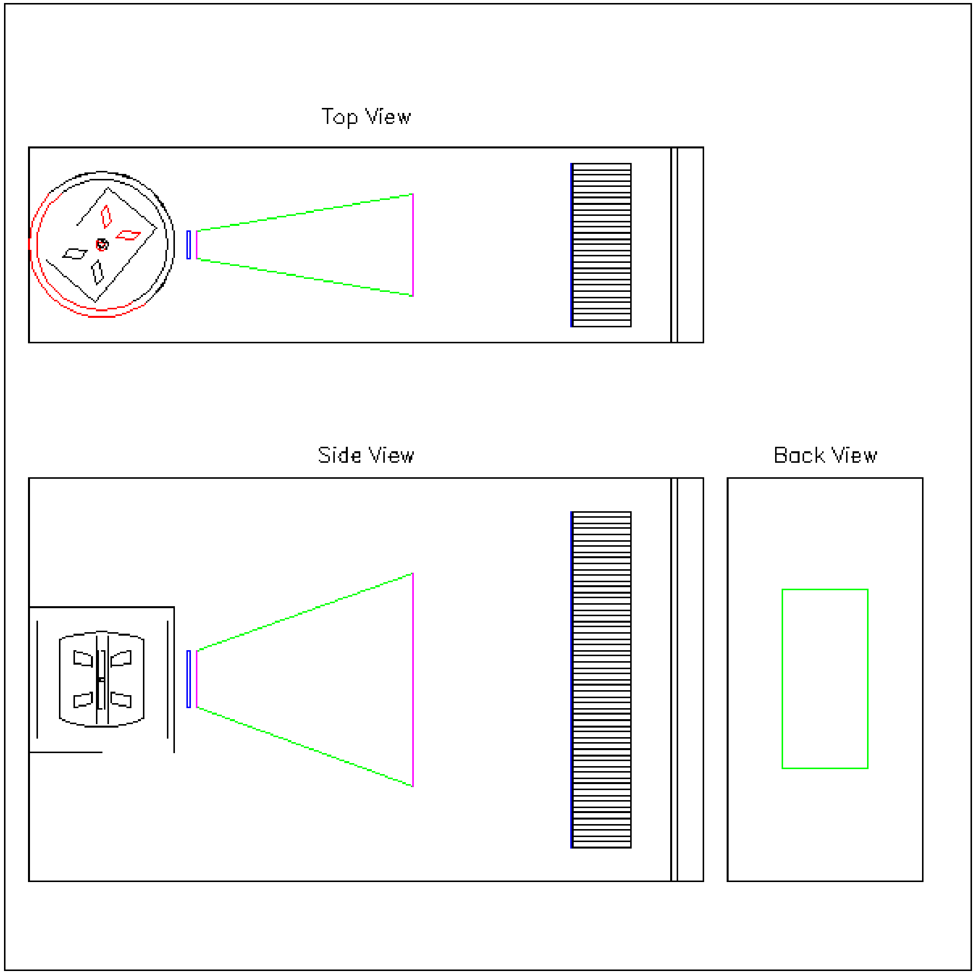
Experimental setup

- 40 cm x 20 cm quartz Cherenkov
- 60 cm from the target
- Assumed a thickness of 1.5 g/cm^2



Advantages

- Better vertex resolution

Can apply a vertex cut and remove non-target materials

- Determine particle sign?

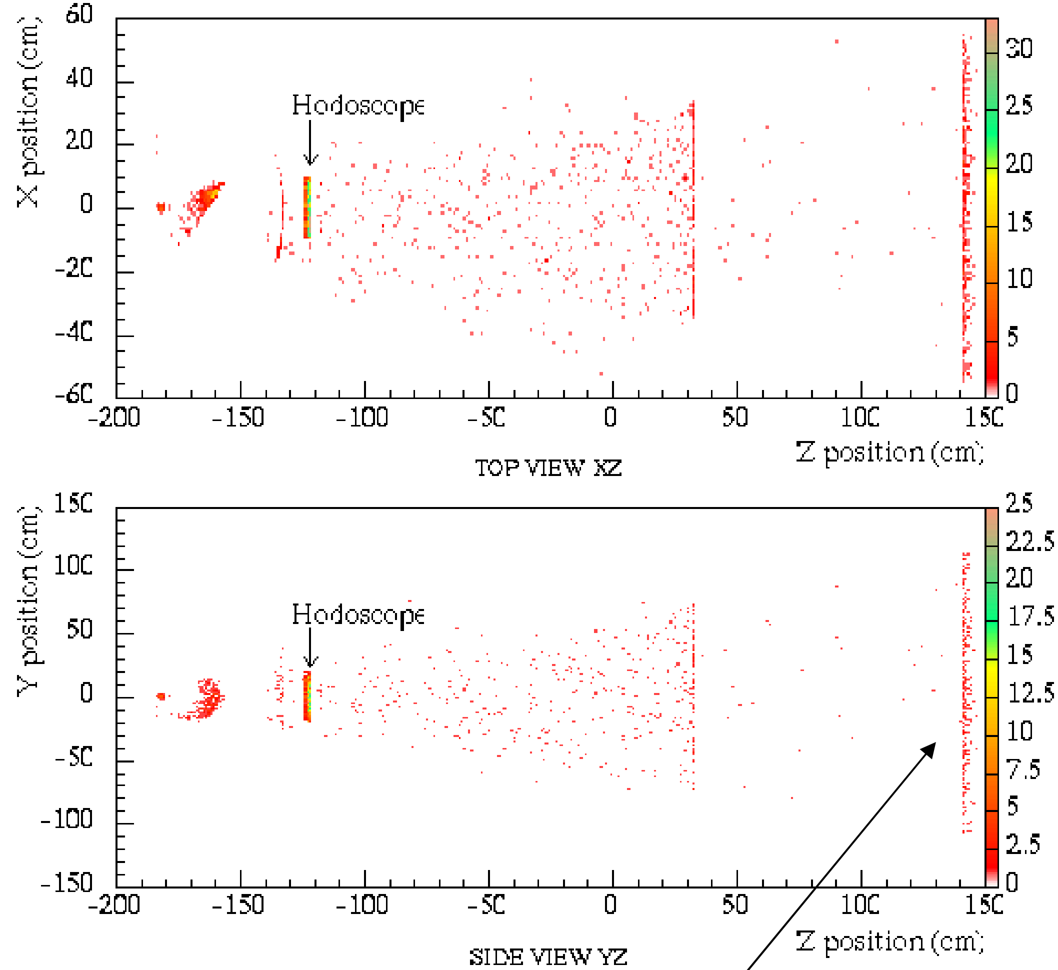
Main concern → Knock-ons

Secondary ionizing particles ejected by recoil

Simulation of knock-ons

- 1, 2 and 3 GeV pions
- One million events for each energy
- Theta, phi and target position were selected randomly
- Assumes if hits back Cherenkov window it is detected

Vertex position of secondary electrons

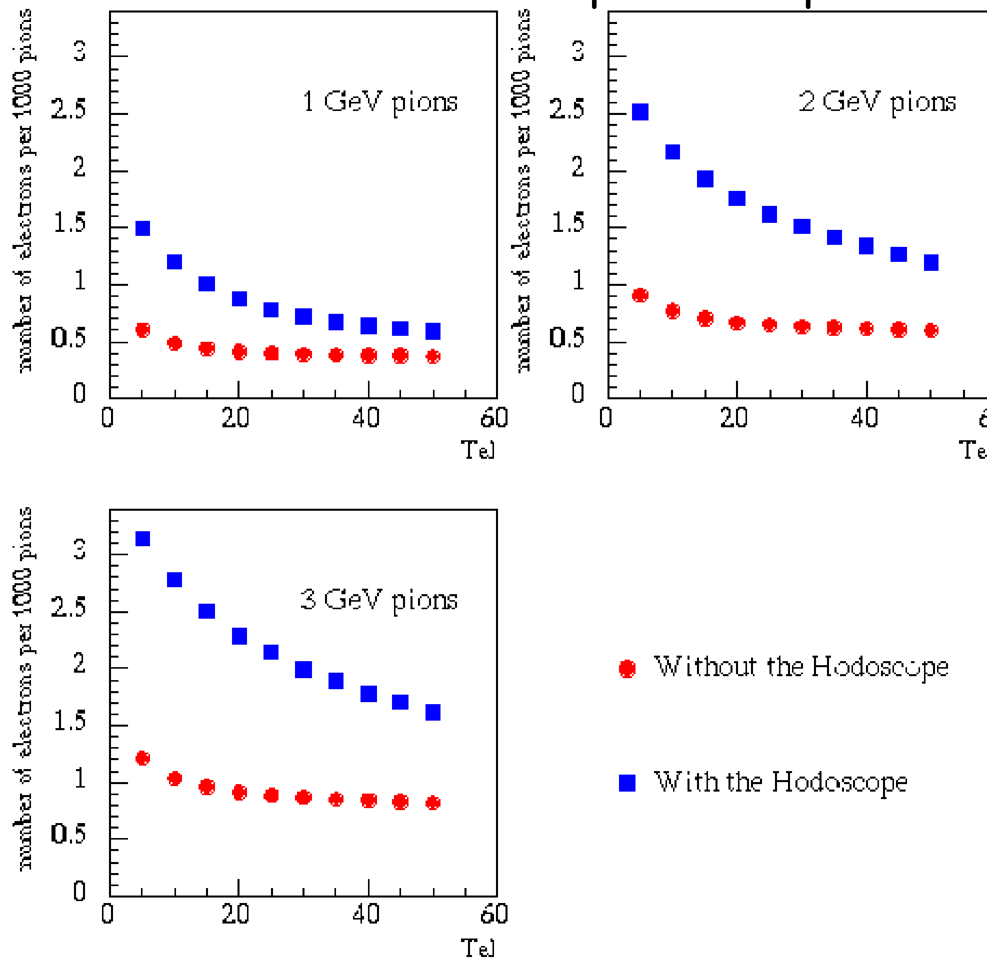


A cut to remove electrons which have their vertex at the Calorimeter but were scattered back into the Cerenkov

e(δ-ray)/π ratio for different pion energies

- δ-ray/π ratio increases by a factor of upto two with hodoscope of 1.5 g/cm^2
- Assumes a 100% electron detection efficiency for Cerenkov (needs Cerenkov optics model)
- Pion threshold for gas Cerenkov is 5.9 GeV $\rightarrow$ corresponds to a 21.5 MeV electron threshold

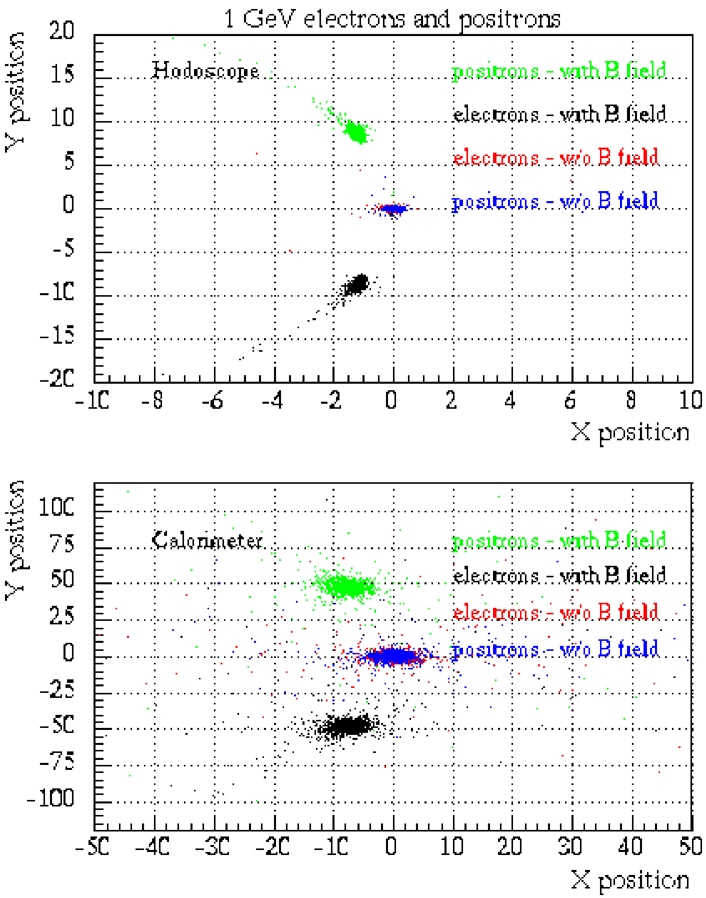
Number of electrons per 1000 pions



Electron threshold (MeV)

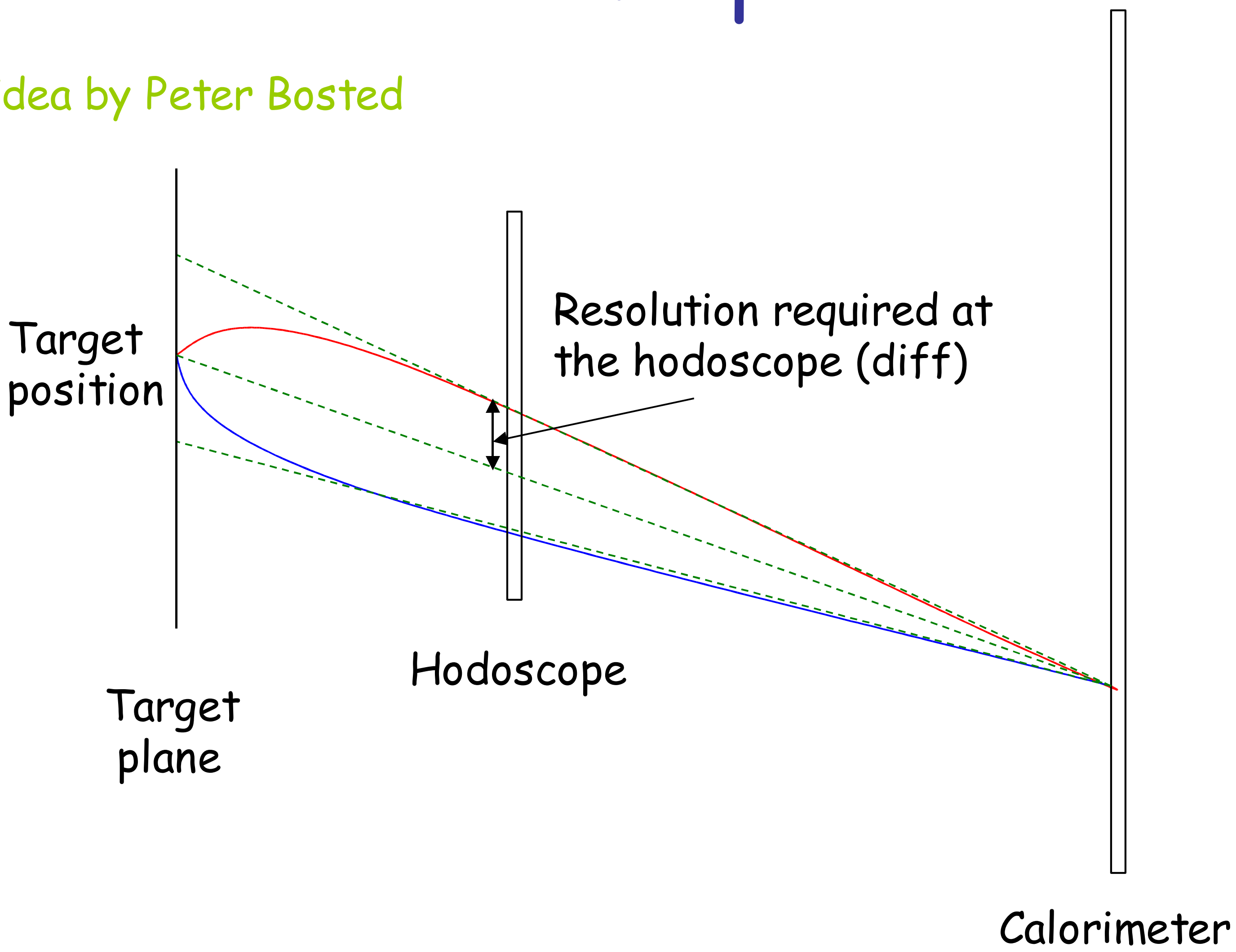
Target magnetic field to measure particle sign ?

- Electrons and positrons @ 1 GeV
- Theta = 40 deg phi horizontal
- X=0, Y=0 and took the full target length along beam line into consideration (3 cm in Z)



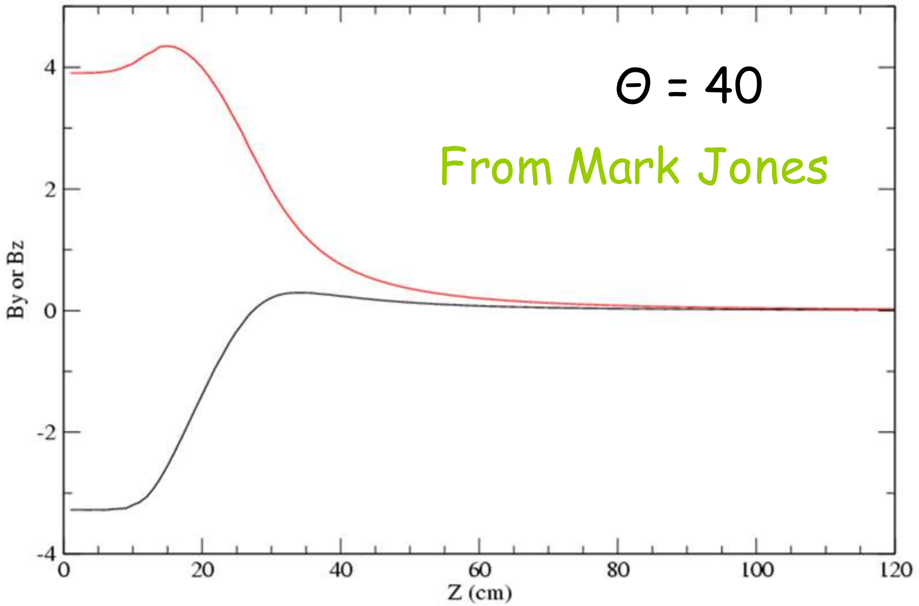
The concept

Idea by Peter Bosted



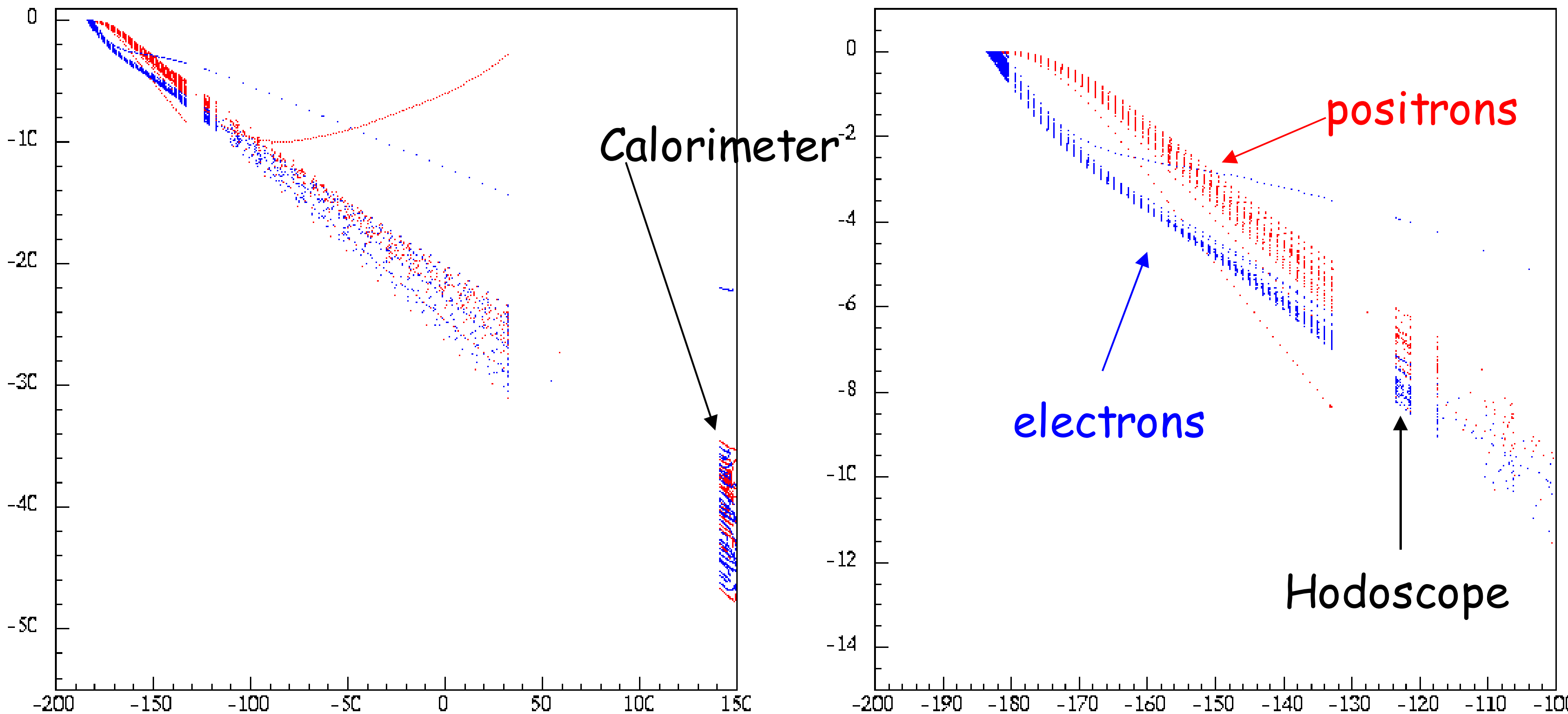
Target magnetic field

- The field is not zero even at 60 cm
- Separation at hodoscope is theta dependent
- Slightly better separation at larger angles



Particle trajectories

- Θ = 40 deg, 1GeV electrons and positrons
- same position in calorimeter
- Smearing due to target thickness is not small

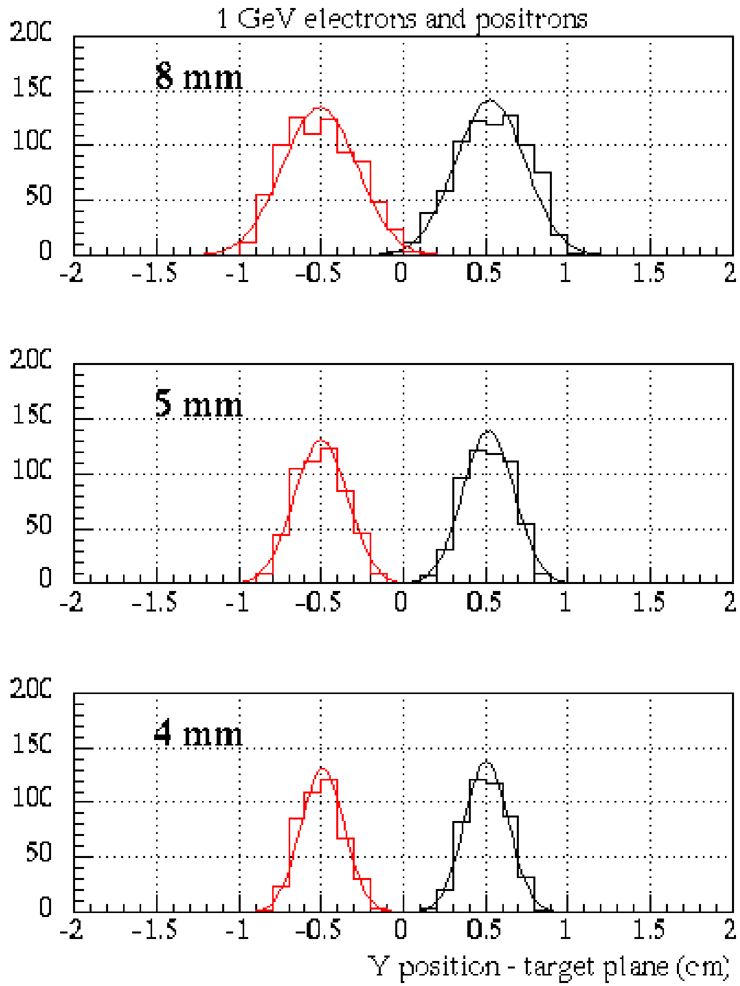


60 cm is not the optimal distance to place the hodoscope !

Granularity of hodoscope needed to measure particle sign

Requires at least 5mm resolution

Work in progress



Different resolutions applied at the hodoscope

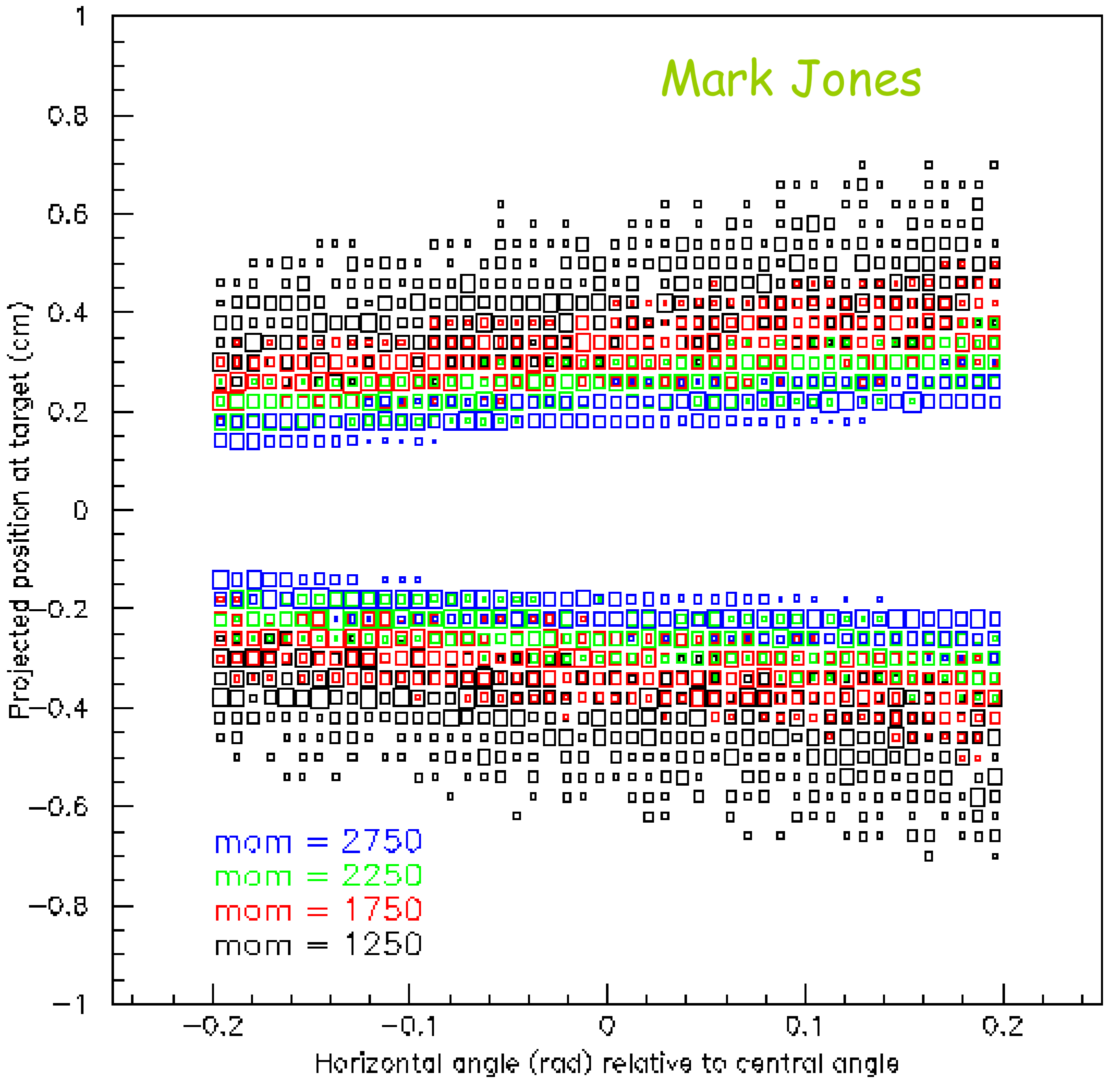
Diff (at hodoscope) is slightly different than the separation at target

1 GeV electrons

theta	diff(cm)
33	0.49
40	0.59
47	0.74

Projected position at target

- Good separation at target plane
- Better separation for low momentum particles
- Target length is not included in the simulation
  → More smearing



Summary

- π/e ratio looks reasonable if the total thickness is less than 1.5 g/cm^2
  To do : Needs to include Cherenkov optics model

- Simulations show 60cm from the target is not the best position to place the hodoscope

- Needs at least 5mm resolution

- More studies need to be done to determine the best position to place hodoscope