Beamstrahlung pairs studying concerning changing L* (for BeamCal)

Lucia Bortko, 9 Mar'15, DESY

Guinea Pig files

- **Guinea Pig produces files:**

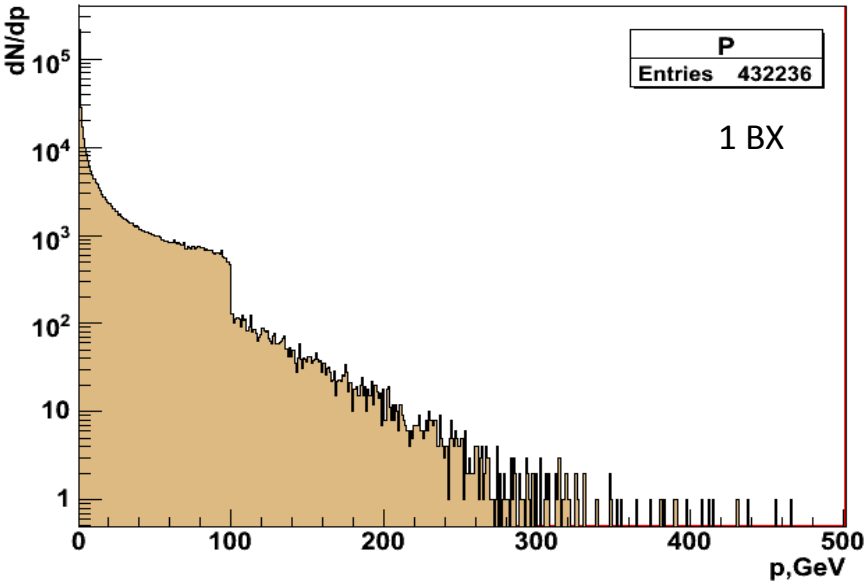
  - "beam1" and "beam2" - files, containing particles of the beams after collision
  - "Beamstrahlung photon" output file - contains beamstrahlung (BS) photons
  - **"Pair"** output file - contains secondary particles coming from incoherent pair creation or from compton scattering
  - "Lumi" output files - contain the colliding particles
  - "Hadron" output file - contain colliding photons that produced a hadronic event

- For this studying fails "Pair" is used
  Upgrades beam parameter set 1000 B1b (1 Tev in center-of-mass)
  In total each file (each BX), contain ~430 000 lines (particles)

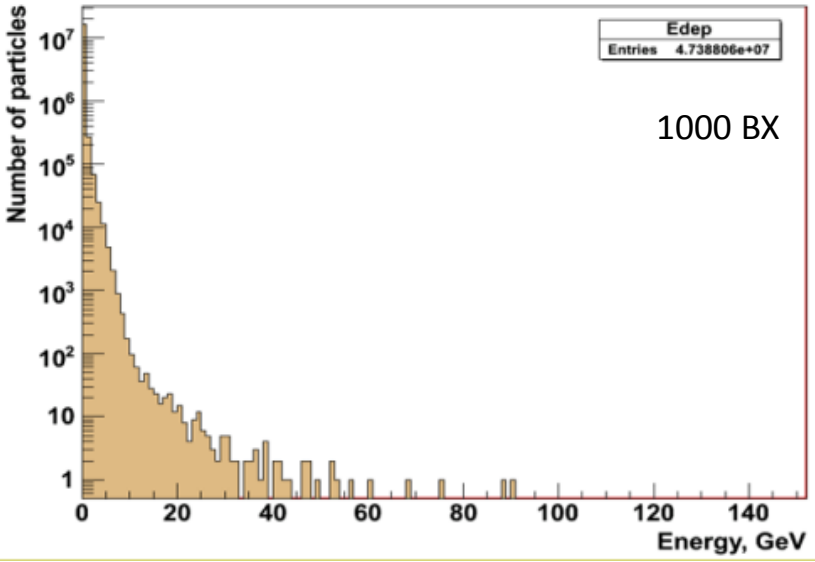
- Xo, Yo, Zo coordinates of BS pairs has values of around micrometers (not bigger than 1mm), therefore in further calculations for curling step and radius of curling of beamstrahlung particles values of these coordinates will be taken as zero.

Studying beamstrahlung pairs parameters

For studying one Pair.dat file (Number 500) were used.

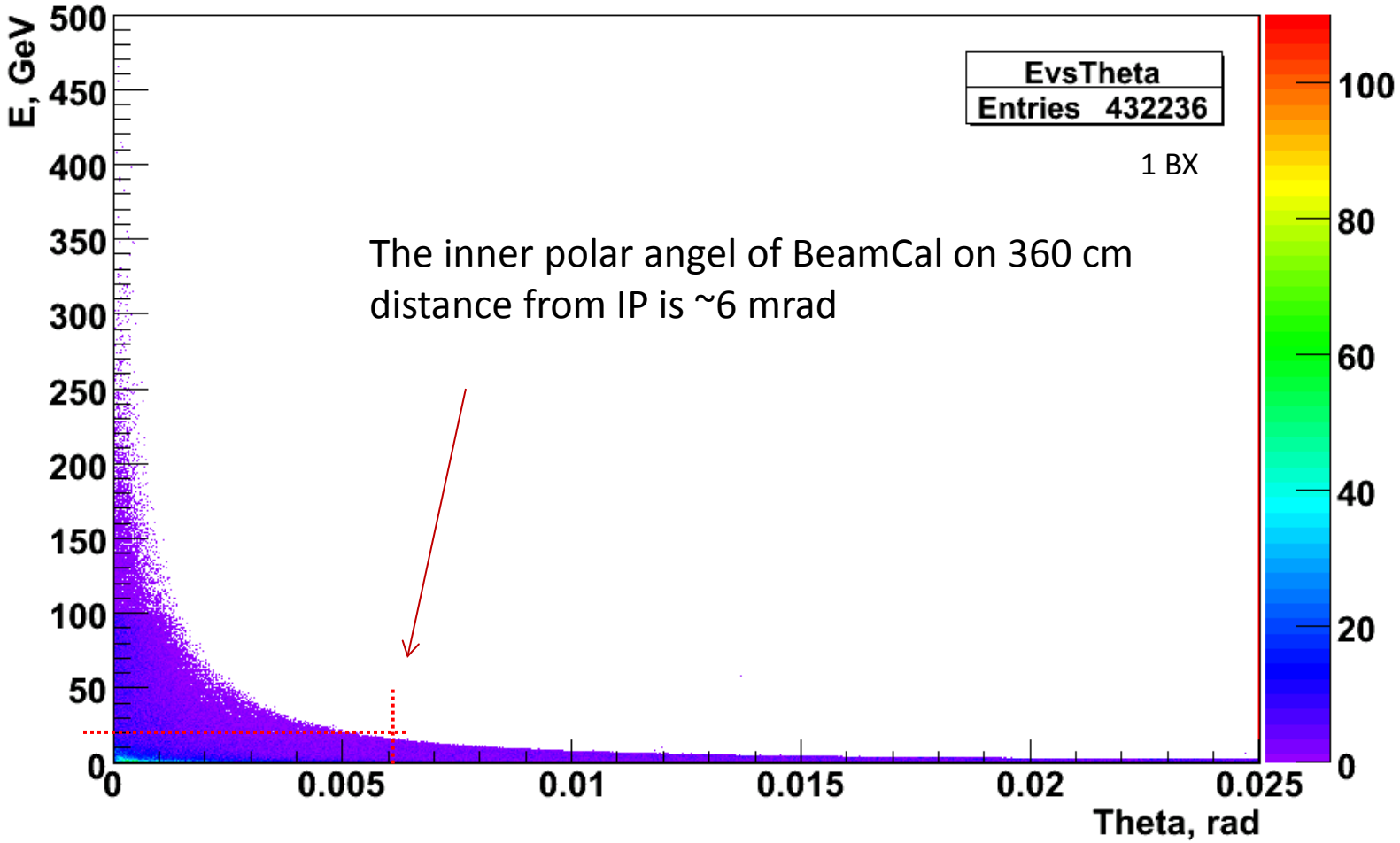


Distribution of momentum of particles



Energy distribution of beamstrahlung pairs that hit BeamCal

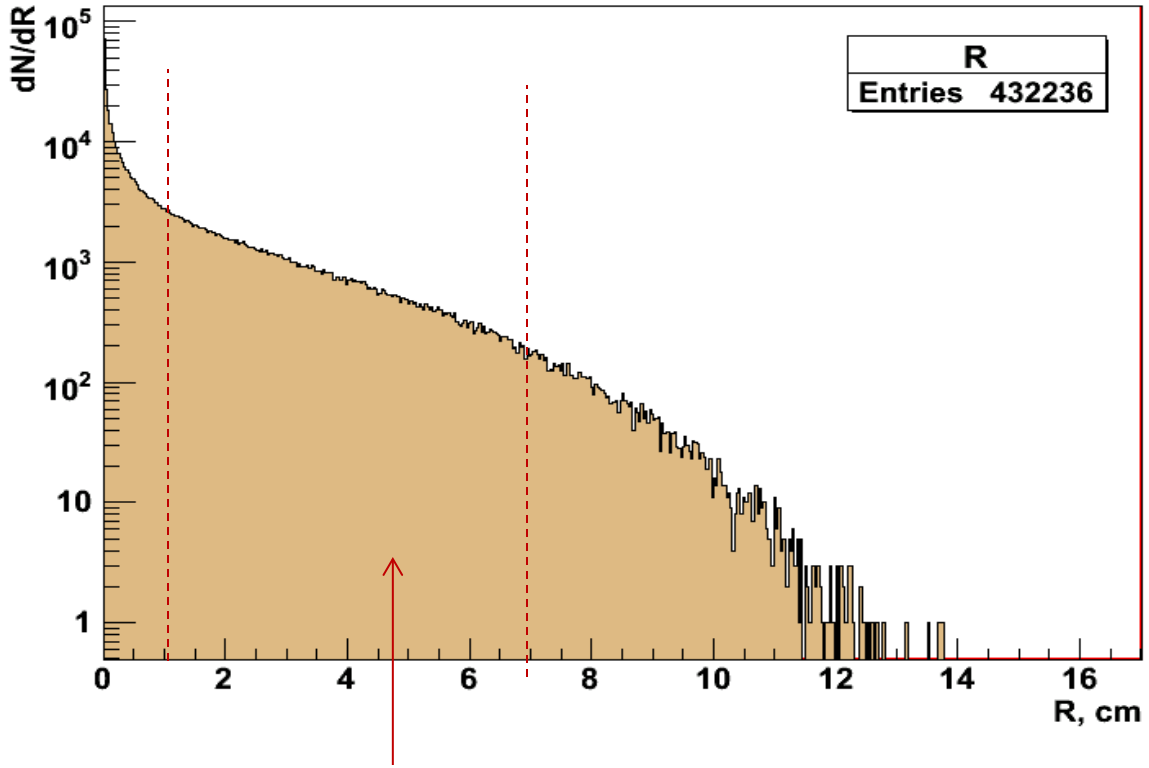
Energy distribution as a function of emission polar angle theta



Curling radius

Born electrons and positrons curling in magnetic field B = 4T (field map antiDID).

Distribution of radius of curling



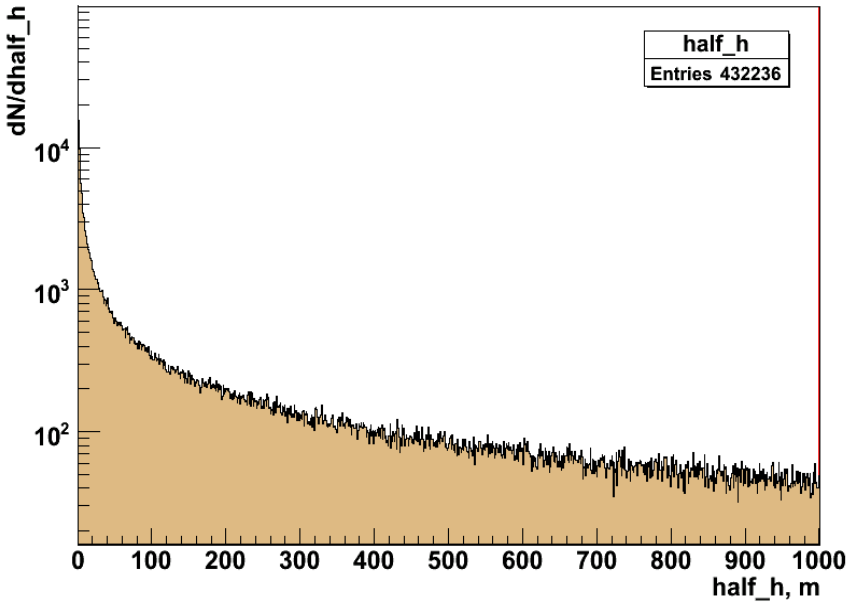
Radius of BeamCal is from 2 to 15cm, that correspond curling radius 1 to 7.5cm.

Step of curling h

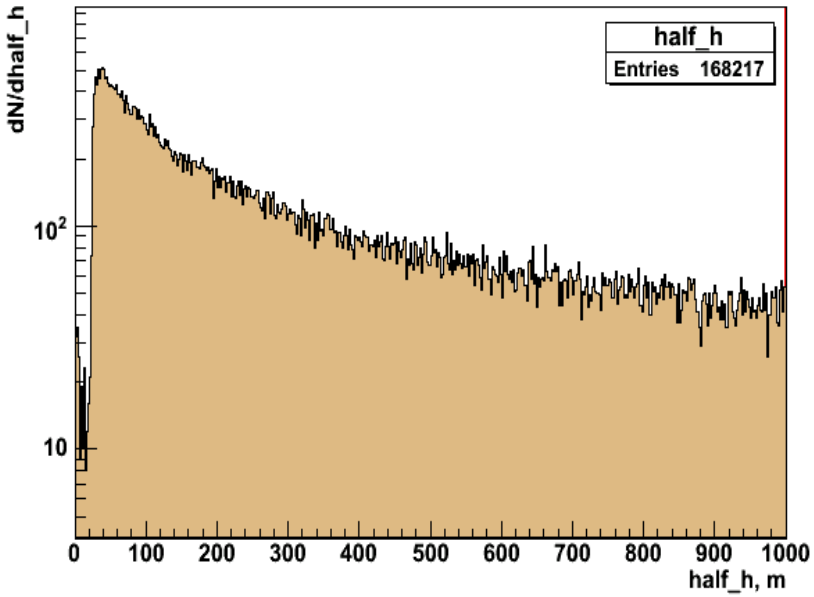
Halfstep* h/2 distribution:

** Halfstep means the point when particle has maximal deviation from the beam axis*

for all pairs



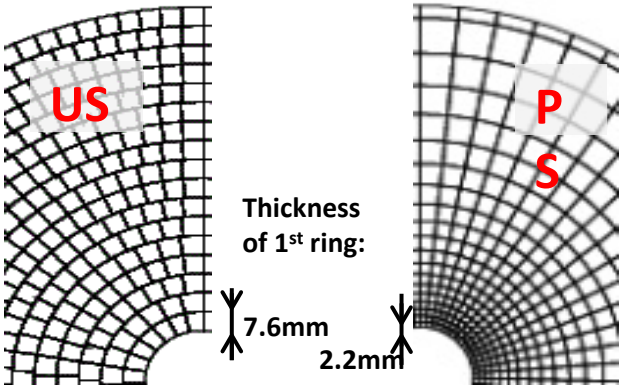
radius bigger then 1cm



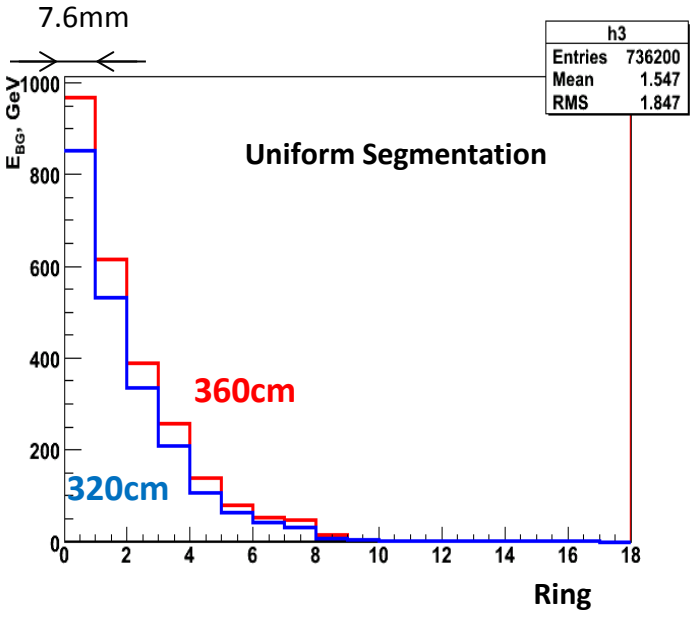
Most of the particles, which will hit BeamCal, have curling halfstep from 20 m and up to the kilometers. That means that the cross section size of the beamstrahlung particles package is increasing along z axis while moving out from IP. When BeamCal moves closer to IP it covers bigger polar angles(both: inner and outer angle), hence deposited energy from beamstrahlung pairs will be smaller.

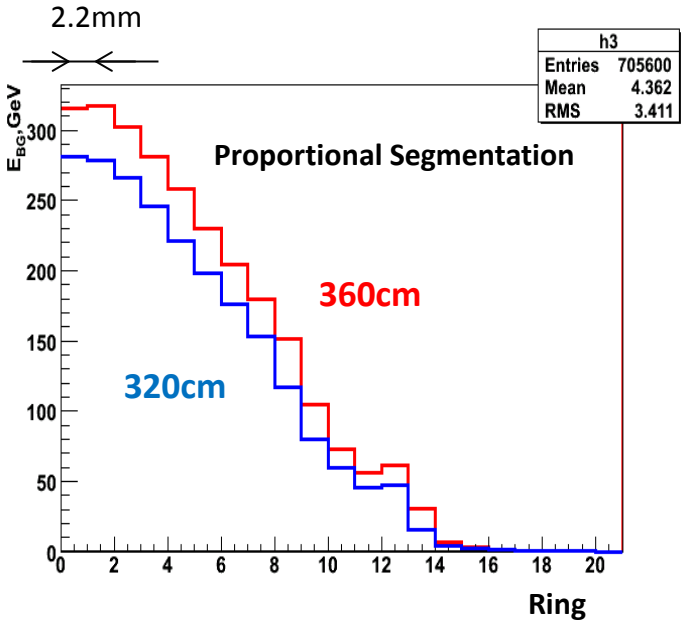
Energy deposition in BeamCal at 320 and 360 cm distance from IP

Pattern of segmentations and rings geometry



Energy deposition in BeamCal vs rings over the all azimuthal angles for two distances from IP:

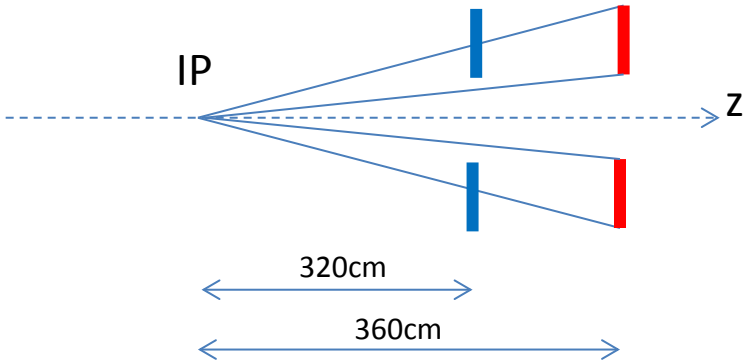




Some summaries

- Deposited energy per ring for 320cm distance is about 14 percent smaller then for 360cm one.

  In the same time polar angle is getting ~13% bigger



- To cover on 320cm the same inner polar angle as on 360cm, inner radius of BeamCal should be 1.78cm instead 2cm.

- Note: outer polar angle of BeamCal is limited by inner angle of LumiCal/pipe, therefore moving BeamCal closer, outer polar angel of BeamCal should be reconsidered…

- If Rin stays without changes, it makes situation easier from the point of BG , but from other side BeamCal should mask QD0 !