GenerateSingleParticleStdhepEvents

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Introduction

- It was reported recently samples being used to calibrate Ecal with MC using samples generated via GenerateSingleParticleStdhepEvents in hps-java

  - Advertised to "Evenly populate x-y rectangle bounded by Ecal top/bottom front face"

  - No check of this claim in advertisement

- Want to validate that behavior of that code to make sure there won't be issues in calibrating Ecal using these samples

  - Generate samples with 3.74 GeV, 3 GeV, 2 GeV, 1 GeV, and 0.5 GeV electron energies

  - 99999 events per electron energy, using b-field for 3.74 GeV beam energy

  - Target position is set to the origin

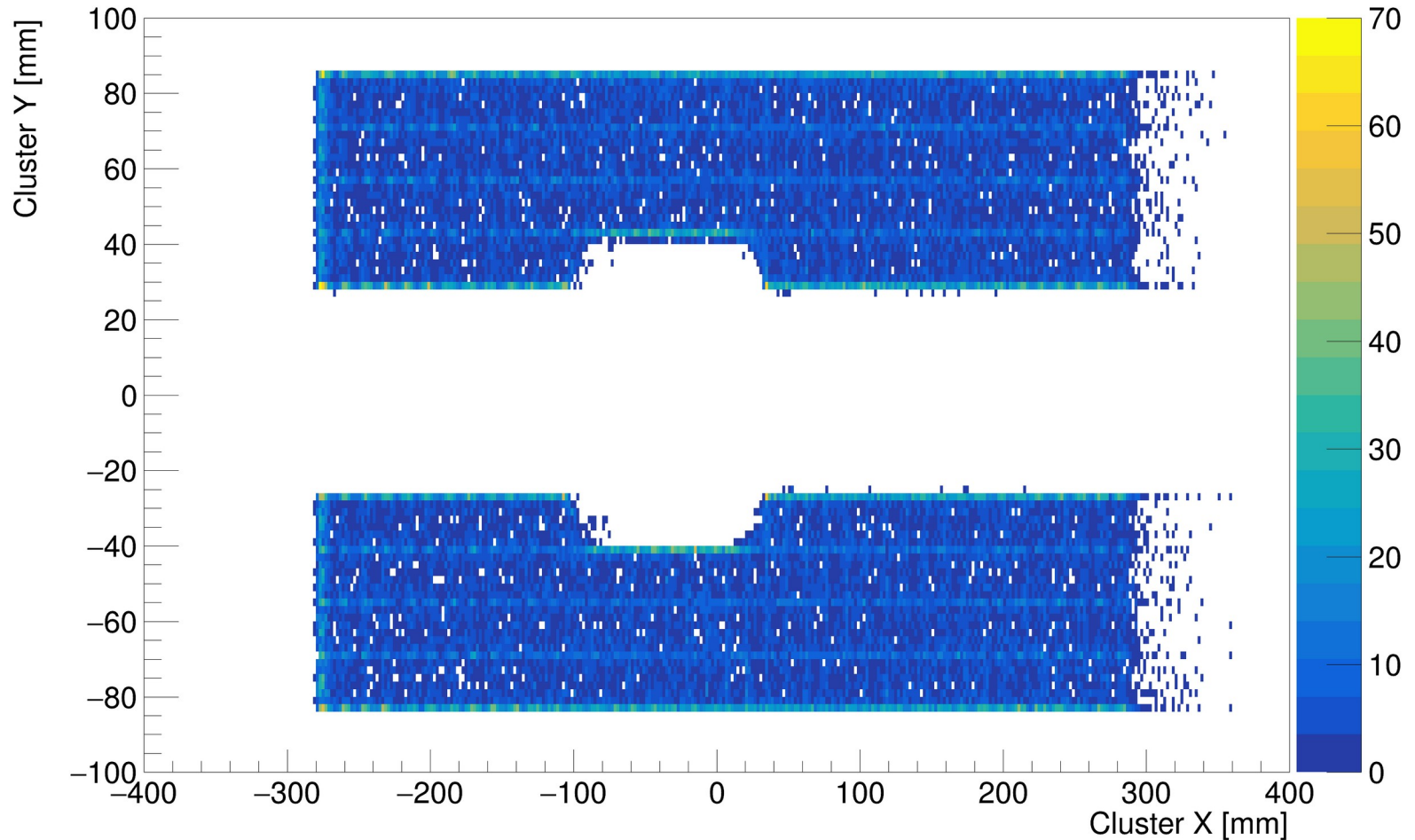 - Using hps-java master at commit 4d2daf8

2

Reconstructed ECal Cluster Multiplicity
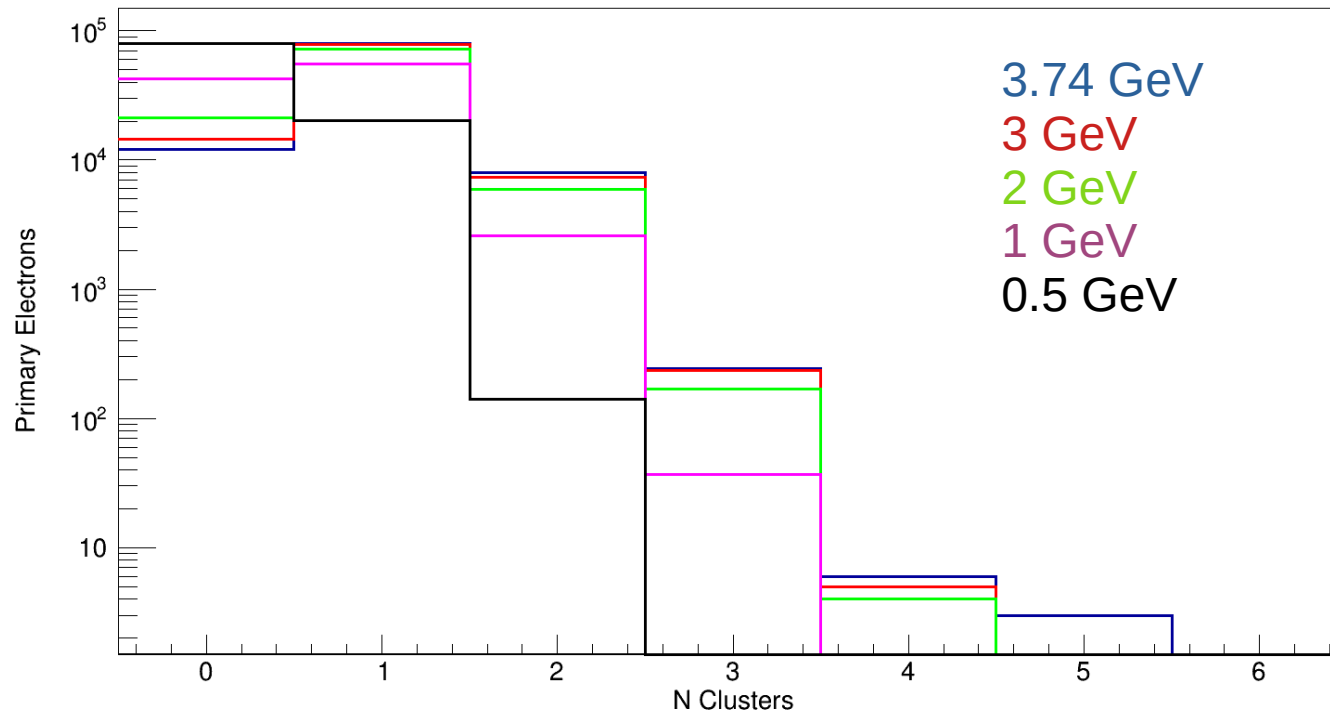
- The number of clusters has an unexpected energy dependence

- Most of the primary electrons at 0.5 GeV do not make a cluster

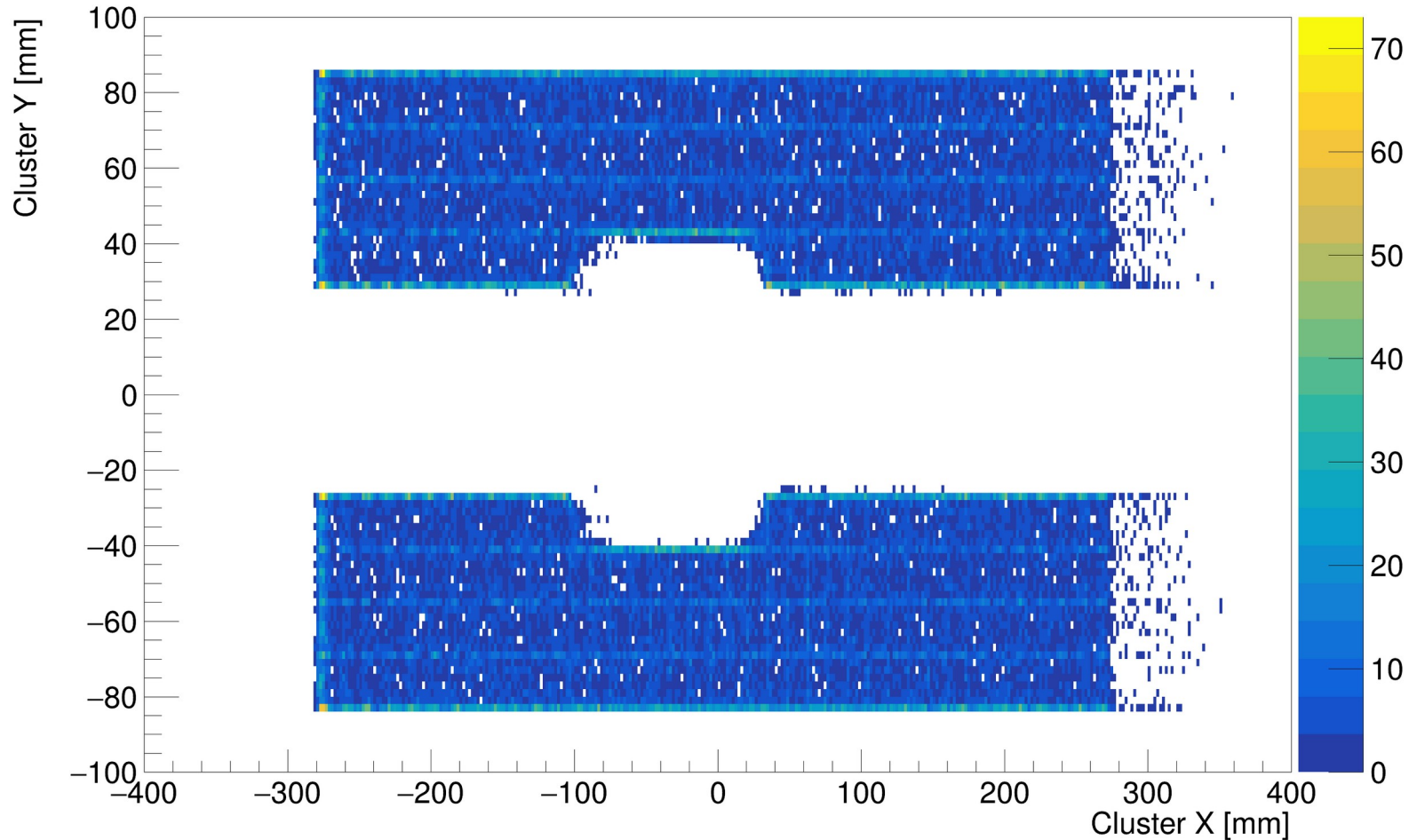- Lets look a bit more to see what could be going on

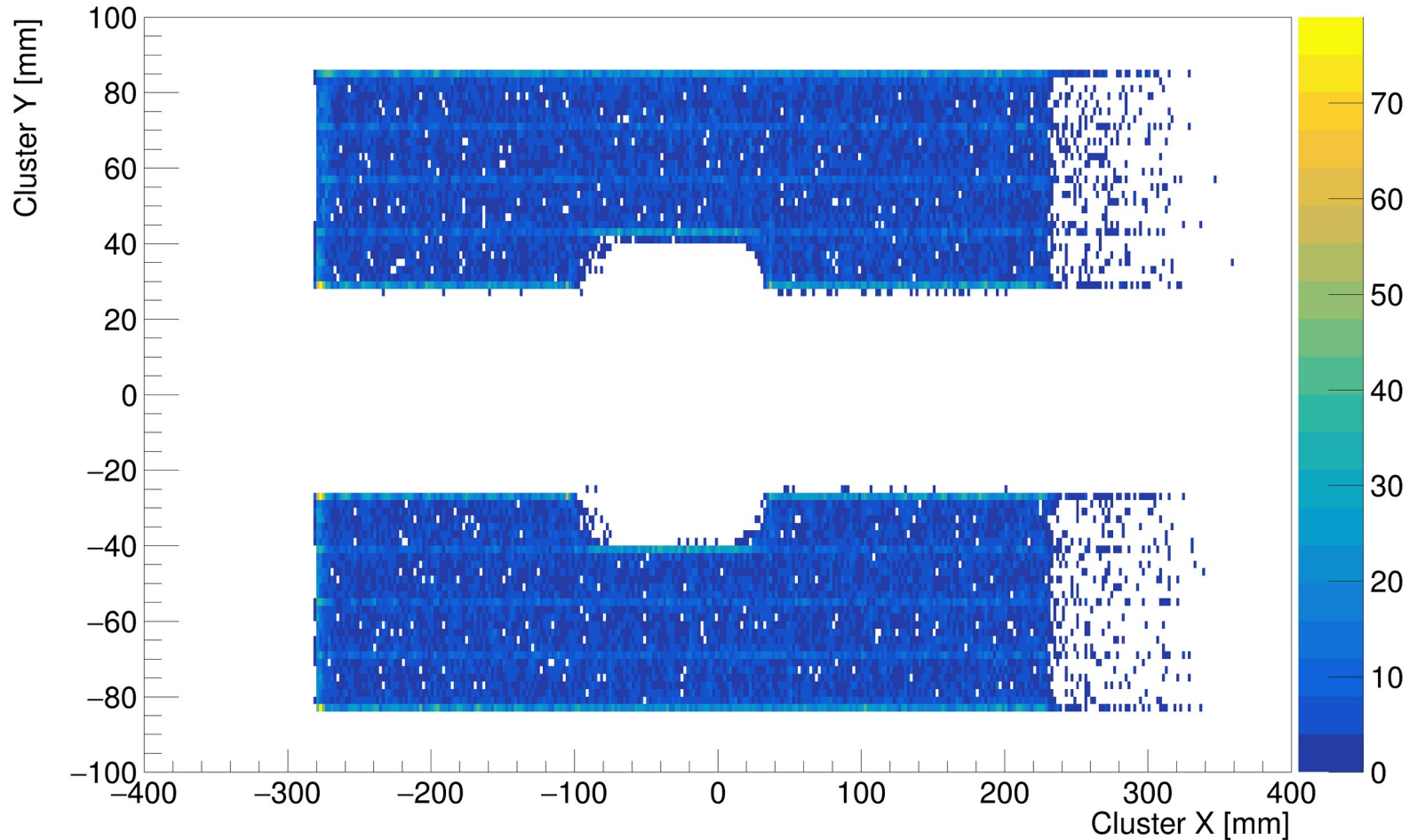# ECal Cluster Positions for 3.74 GeV Electrons

clusPos3pt74_hh

ECal Cluster Positions for 3 GeV Electrons

clusPos3pt0_hh
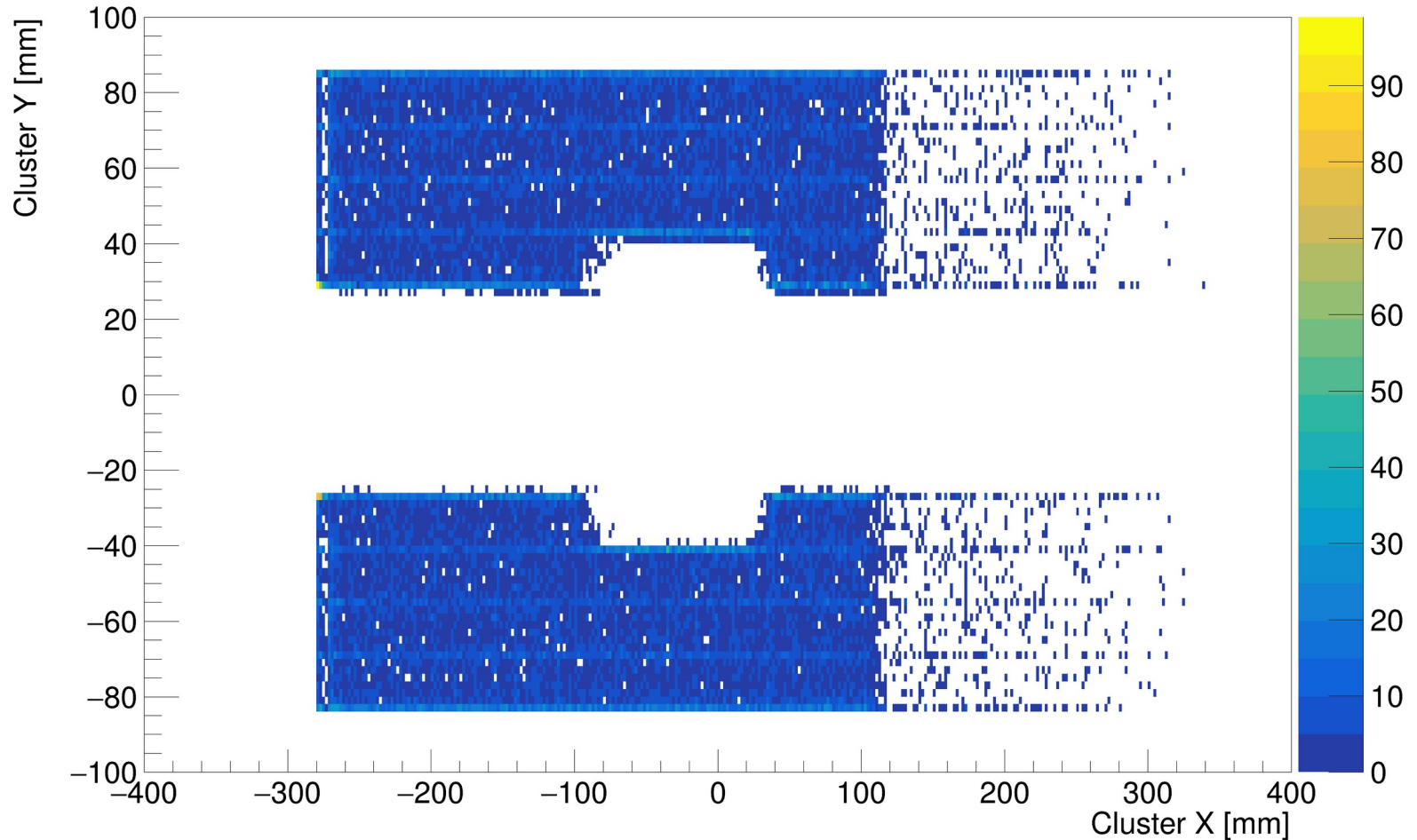
ECal Cluster Positions for 2 GeV Electrons

clusPos2pt0_hh

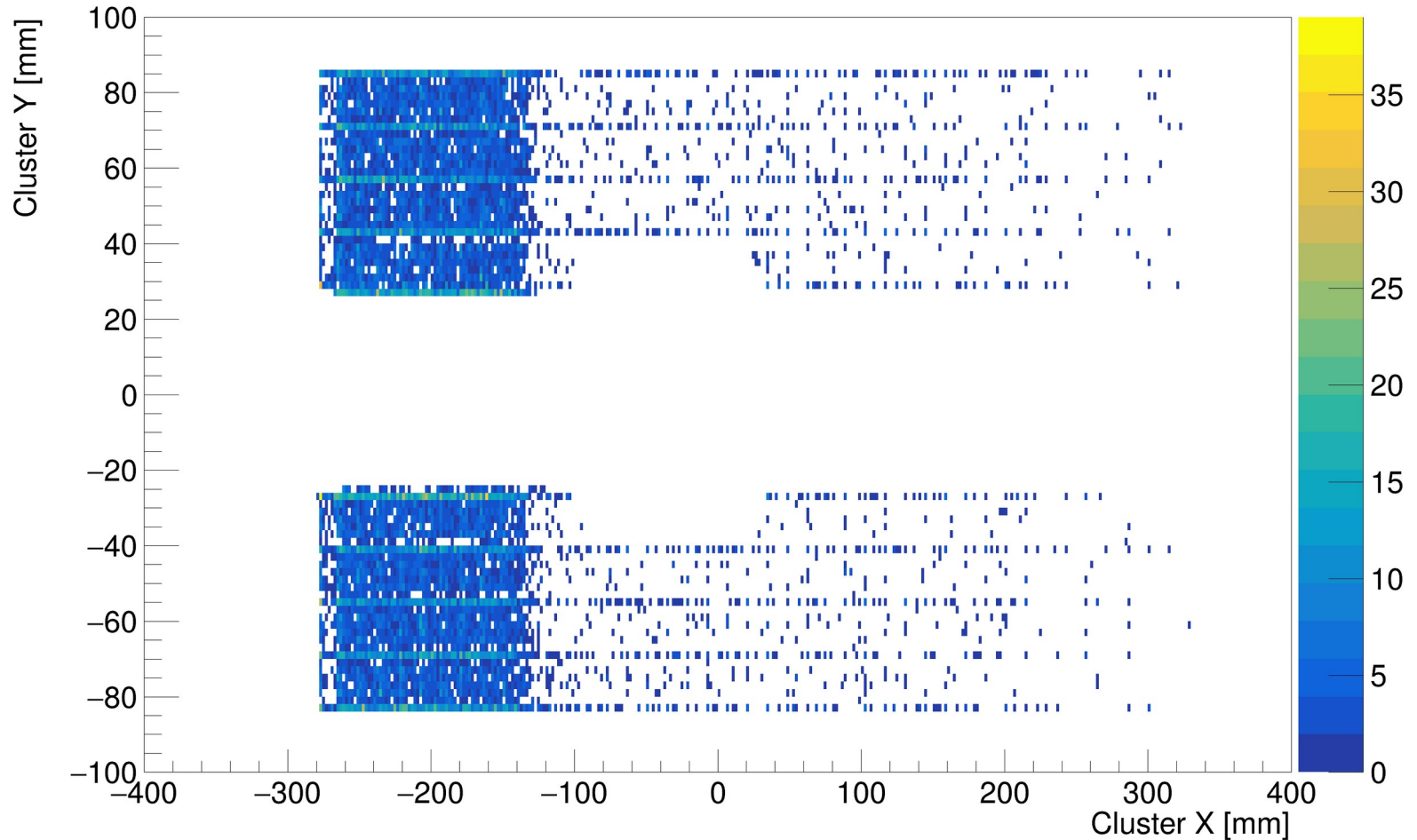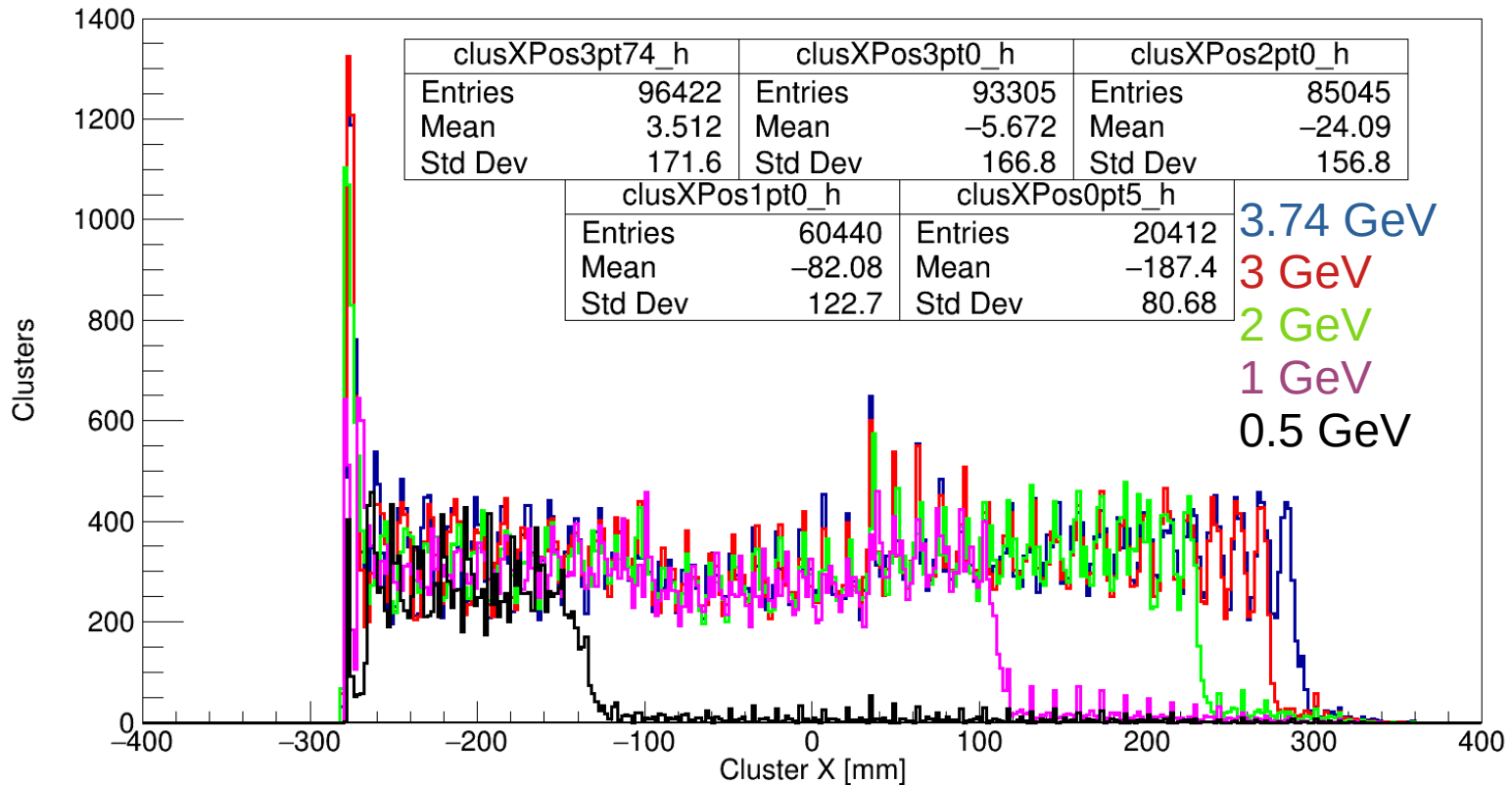# ECal Cluster Positions for 1 GeV Electrons

clusPos1pt0_hh

ECal Cluster Positions for 0.5 GeV Electrons

clusPos0pt5_hh

ECal Cluster X Positions

- A quick review of the code made it clear that the phi0 distribution used assumed the tracks are straight, but none of our tracks are straight

- Caution to ECal group using these samples for calibrations

9

Geant4 General Particle Source (GPS)

- There already exists a feature in slic (via geant4) which allows users to generate events with configurable distributions in angle, position, and energy

  - This is a well documented feature of geant4

  - Used already by multiple members of HPS for MC studies

- Abhisek recently merged a PR with an example of how to use GPS in slic to hps-mc

  - This example has a point source of electrons emanating from the origin isotropically at the beam energy

  - Provided example macro can easily be changed to do everything already provided by the featureful GPS of geant4

Discussion

- Need to be careful using samples produced by GenerateSingleParticleStdhepEvents in hps-java

  - Turns out they do not "Evenly populate x-y rectangle bounded by Ecal top/bottom front face" which gets worse as charged particle energy decreases

- New example in hps-mc (thanks Abhisek) which makes it easy to generate samples via geant4 GPS

  - No need to redevelop tools in java to make general distribution of single particles, tool for this is already developed in c++ for this and is already integrated into SLIC

  - Let me know if you would like some help writing a macro for a distribution you are interested in studying