C3 Beam Background Studies

Fall 2022

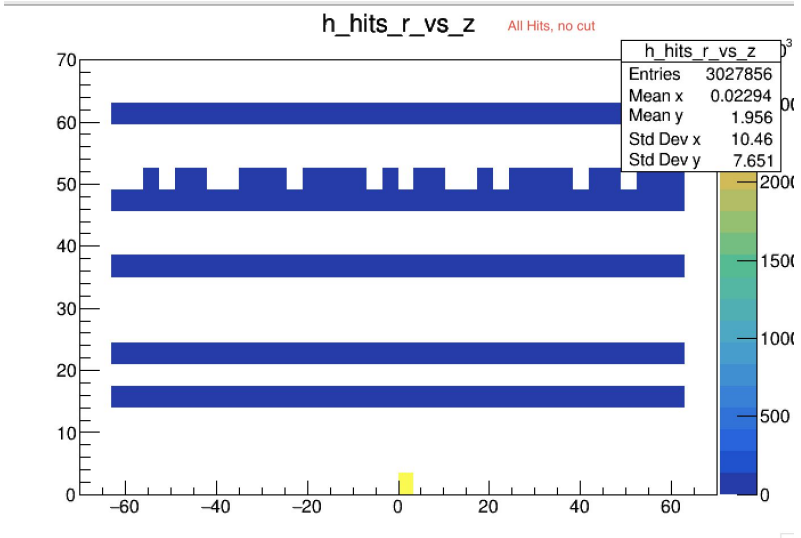
Cuts on GuineaPig Data

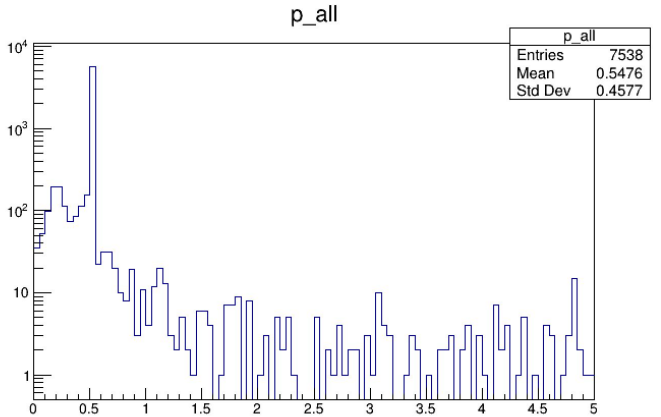
- Our data produced by GuineaPig is fed into Geant to use in event simulation
- We wanted to apply a cut on the GPig data to remove any of the particles that we assumed would never have enough energy/momentum to reach detector
- Tried various cuts on both mass and pT
- It appeared that even cutting the seemingly unimportant particles still drastically affected the number of hits in upper layers - no cut could be safely applied
- Moved on and produced a full bunch train of events with no cut

Vertex Barrel layer	Mean number of hits – 0 MeV cut	Mean number of hits – 10 MeV cut
1st layer	341.5 ± 2.6	218.5 ± 2.0
2nd layer	113.9 ± 1.8	101.5 ± 1.7
3rd layer	70.9 ± 1.8	63.2 ± 1.8
4th layer	51.1 ± 1.6	43.4 ± 1.7
5th layer	34.3 ± 1.4	25.1 ± 1.2
All 5 layers	614.8 ± 4.2	451.6 ± 4.1

Large Number of Hits at 0

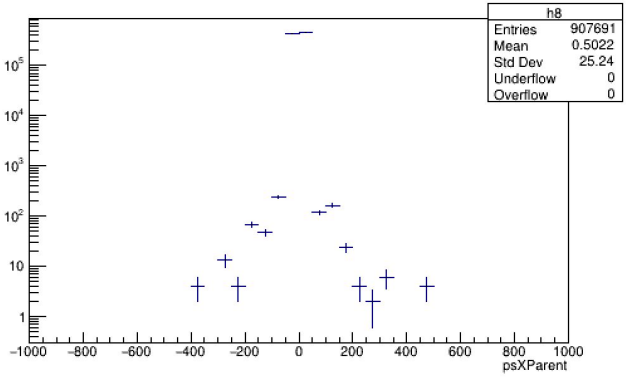
- Plotting Geant-produced data
- A vast majority of the hits were all placed at (0,0,0) within the detector
- Closer inspection showed these hits supposedly had enough momentum to reach at least the first layer, but did not for some reason
- Decided to look at the parents of these hits to better understand them

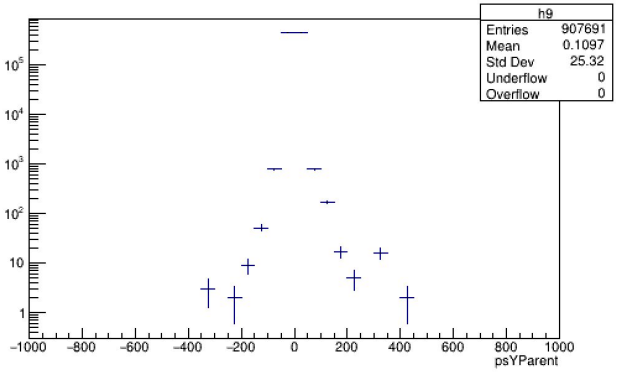


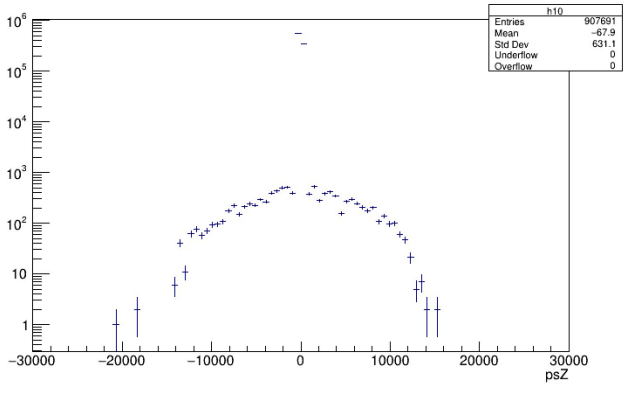


Swapping Over Code

- Accessing the parentage info was easier said than done
- Our old code was using C++ and ROOT to access the data directly from the root files that Geant produced, but it made matching up parents and daughters difficult
- Swapped over to python and accessed all of our Geant data through one consolidated parquet file
- Successfully accessed parentage info using new method







Parentage Info

- Parentage info revealed that the vast majority of these hits at (0,0,0) have far more momentum in the Z direction than the X and Y direction
- Also, the vast majority of these hits have no parents (ie, they are the root parents of all the hits that reach the detector layers)
- Likely that these hits have so much pZ compared to pT that they travel down the beam pipe before reaching the first layer, or they decay into other hits before reaching the first layer