

BeamFluxInput_module.cc:

**A LArSoft Module for Starting the LArIAT Simulation
Chain with a Beam Flux File**

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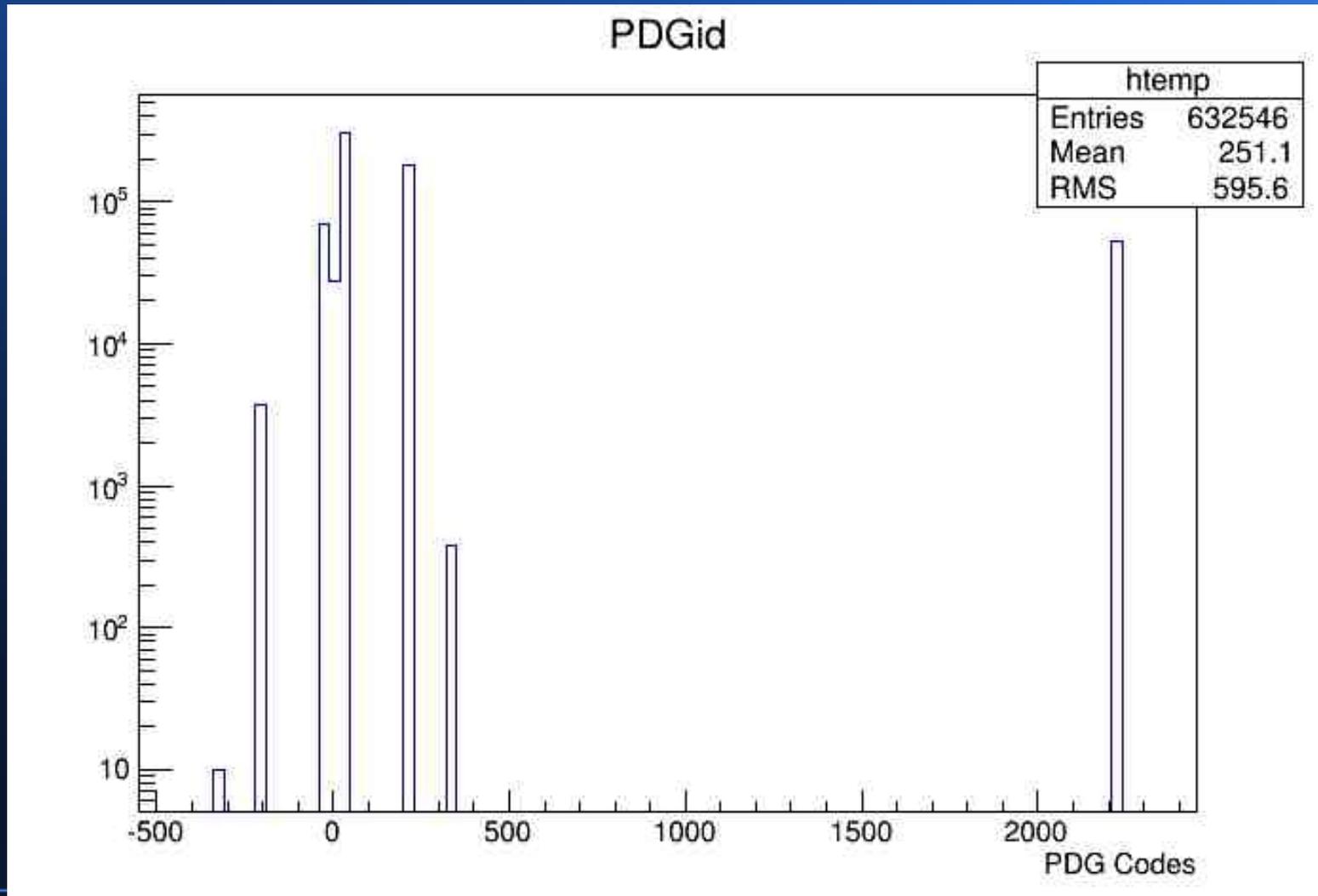
Purpose

- BeamFluxInput_module.cc is a LArSoft Module designed to start the LArIAT simulation chain with a particle flux file simulated for the MCenter beamline
- By using a flux file instead of the SinglesGen module, LArIAT simulations can be made to better reflect the expected experimental conditions

The Flux File

- Written to a ROOT file as a set of TTrees
- Consists of 632,546 particles of various types such as pions, kaons, protons, electrons, and photons at the front face of the LArIAT detector
- Positions in coordinates in mm relative to the beamline target
- Momenta up to about 2 GeV

Histogram of Flux File PDG Codes



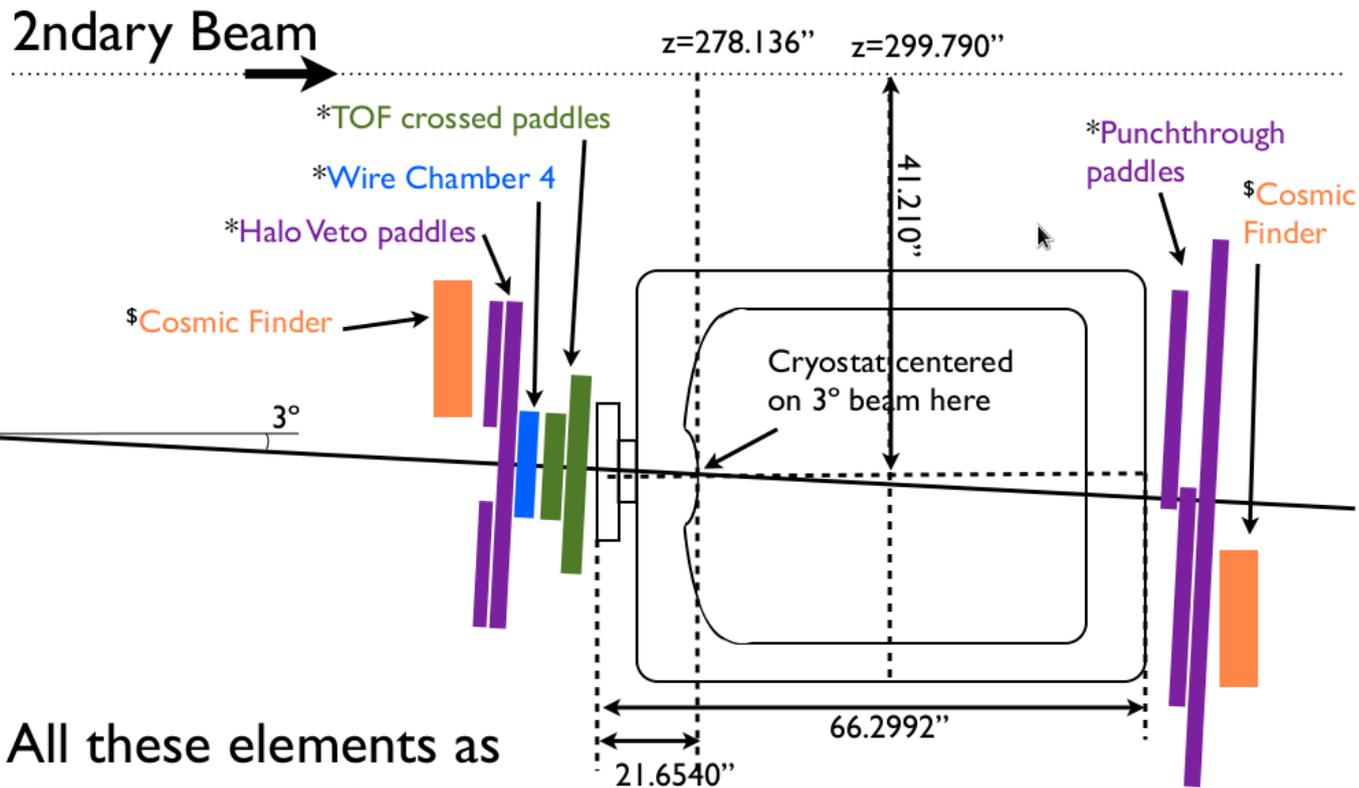
The LArIAT Geometry

- In Beam Coordinates, the front face of the LArIAT TPC is at 7368 mm in the z direction
- In the GDML file used in LArSoft, the center of the front face of LArIAT is at (23.75, 0, 0)
- The Field Cage is 371 mm in front of the TPC face according to Jason St. John
- In addition, the beam should enter LArIAT at an angle of 3 degrees based on the T1034 Block Diagram
- These differences result in a translation of coordinates from (0, 0, 7368) to (237.5, 0, -3710) mm and a rotation of momenta through -3 degrees

LArIAT in Beamline Coordinates from T1034 Block Diagram

Detail of area surrounding TPC cryostat

top view



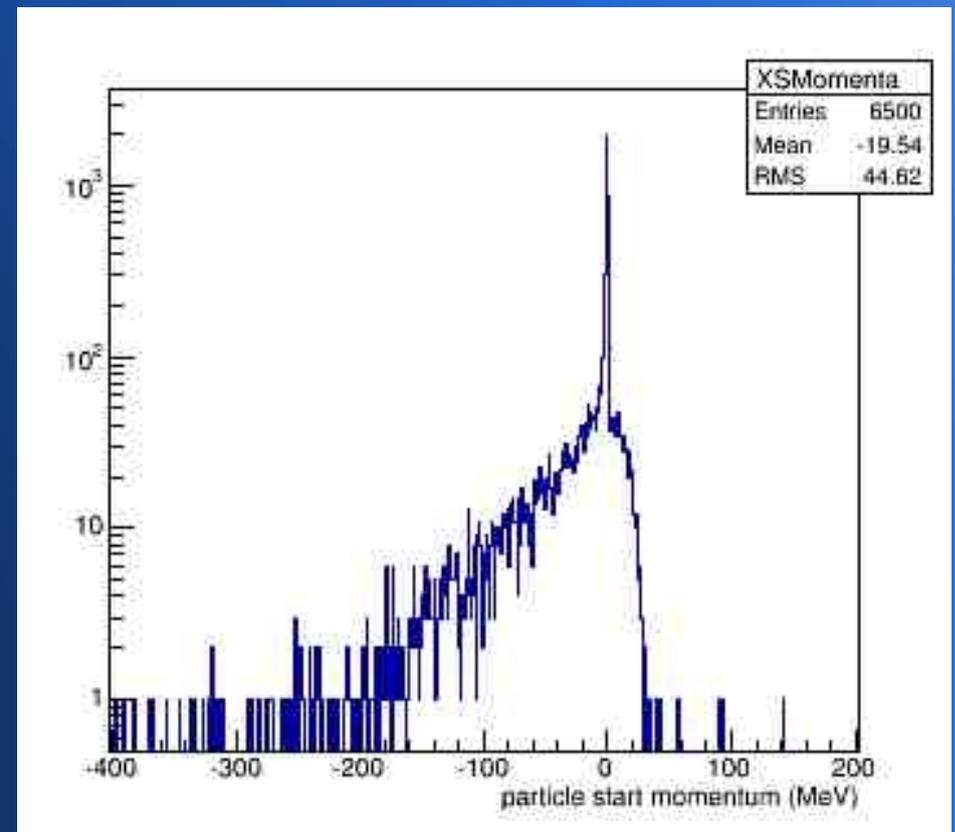
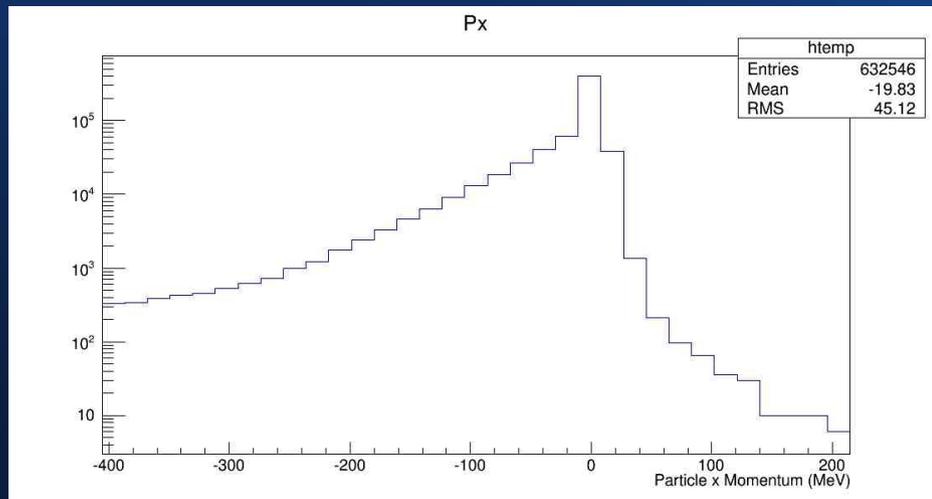
All these elements as close as possible to cryostat.

- * - Centered, square on 3° beam
- \$ - Square to 2ndary beam & cryo

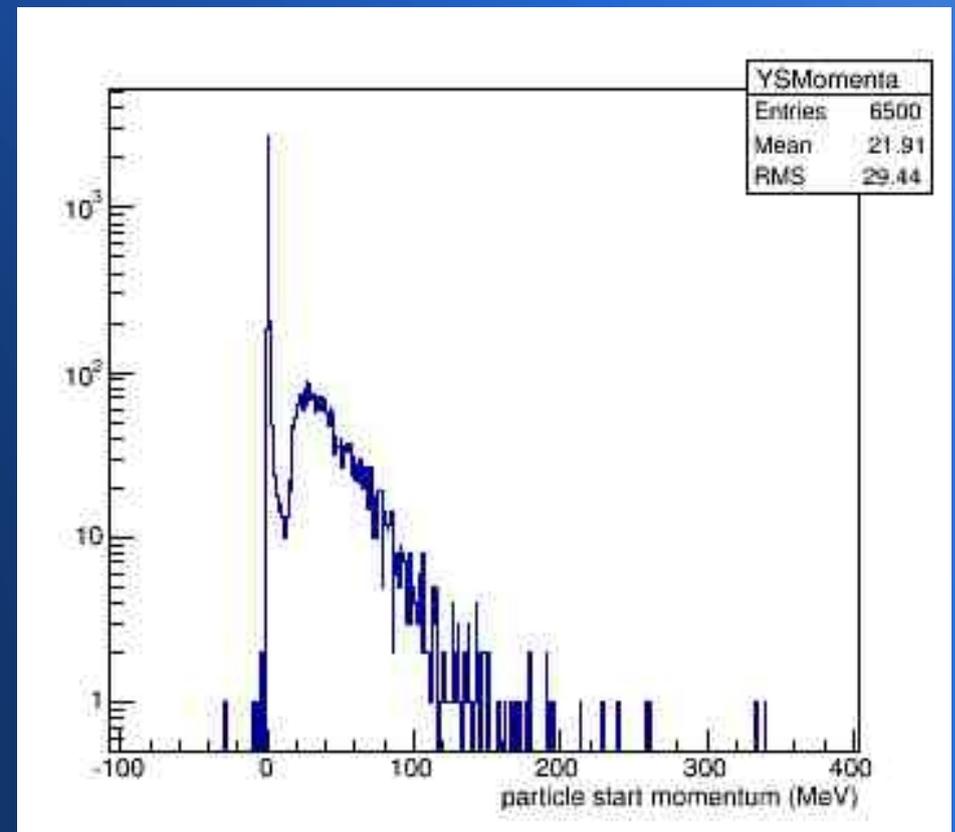
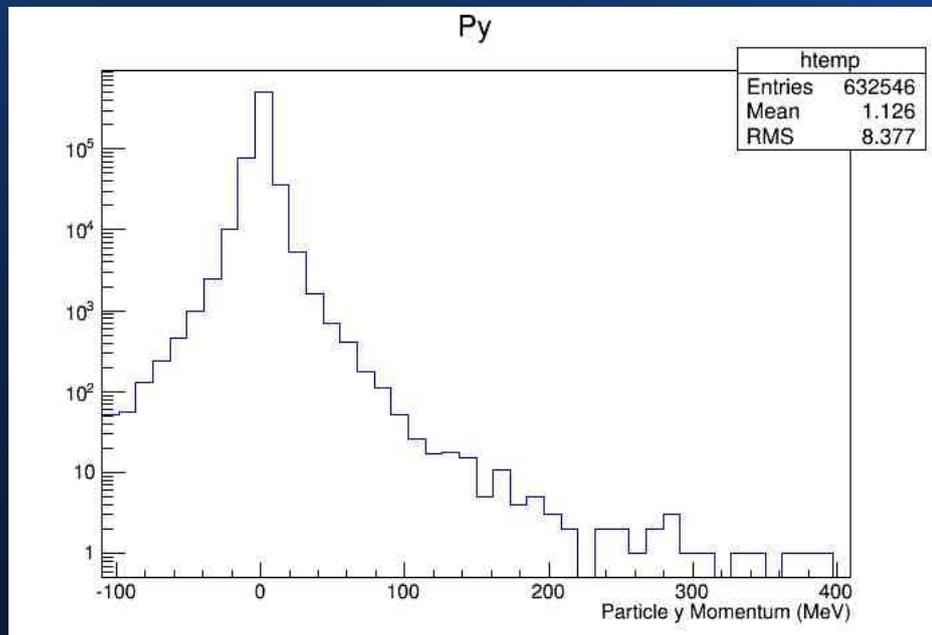
The Module

- Based on filemuons_module.cc by Eric Church from EventGenerator directory
- Uses ROOT to open the flux file and create a TNtuple of the variables stored inside
- Creates an MCParticle and an MCTruth object for each particle and saves one truth object to each event
- One run is prepared to be sent to largeant when module has finished running for all particles in the flux file

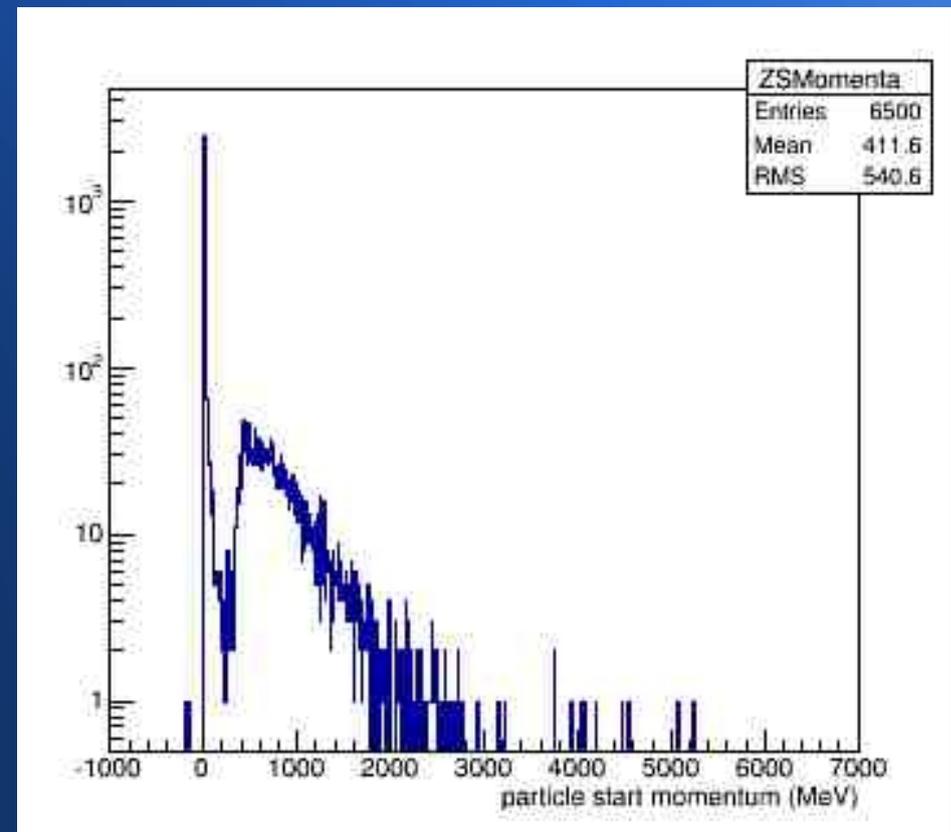
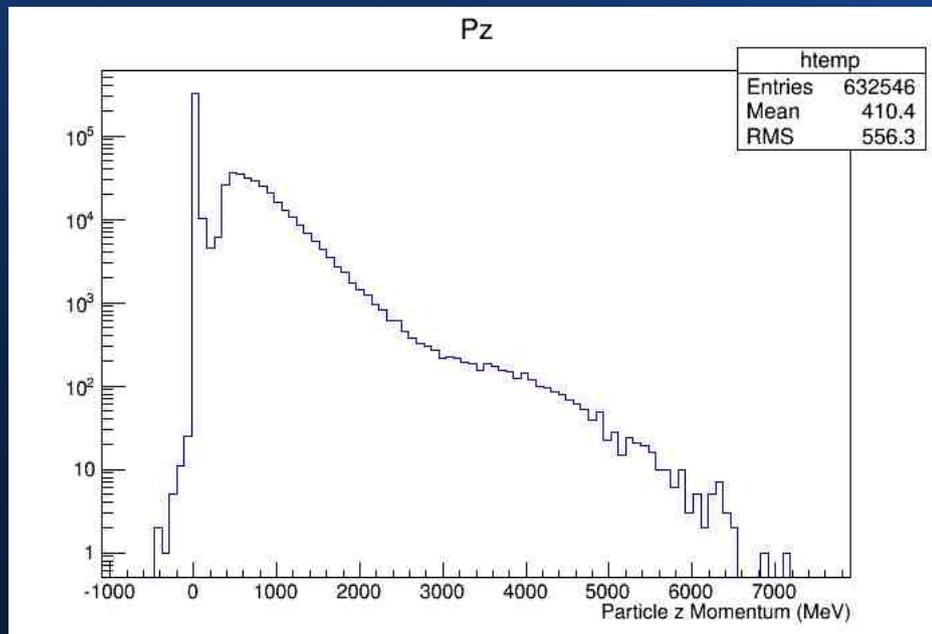
X Momenta Comparison



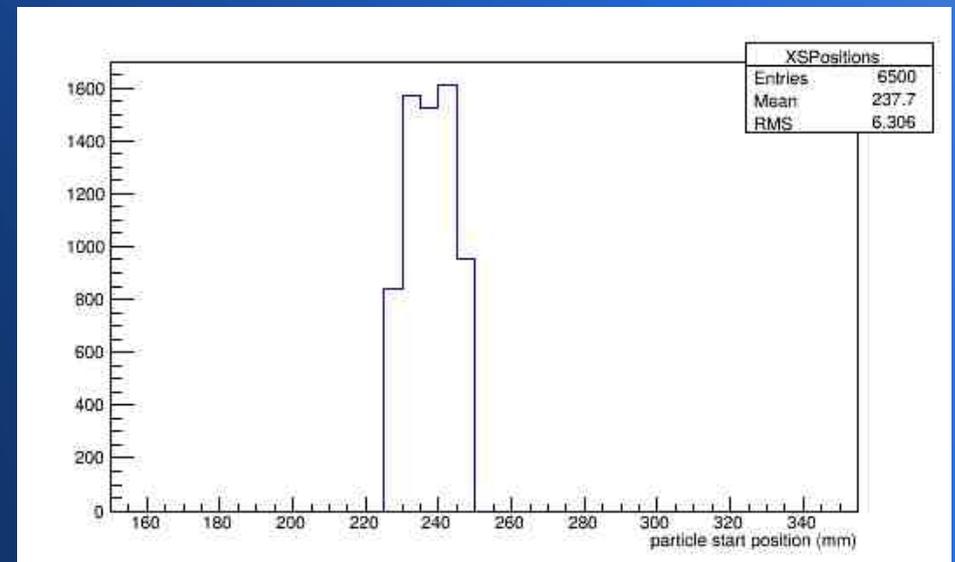
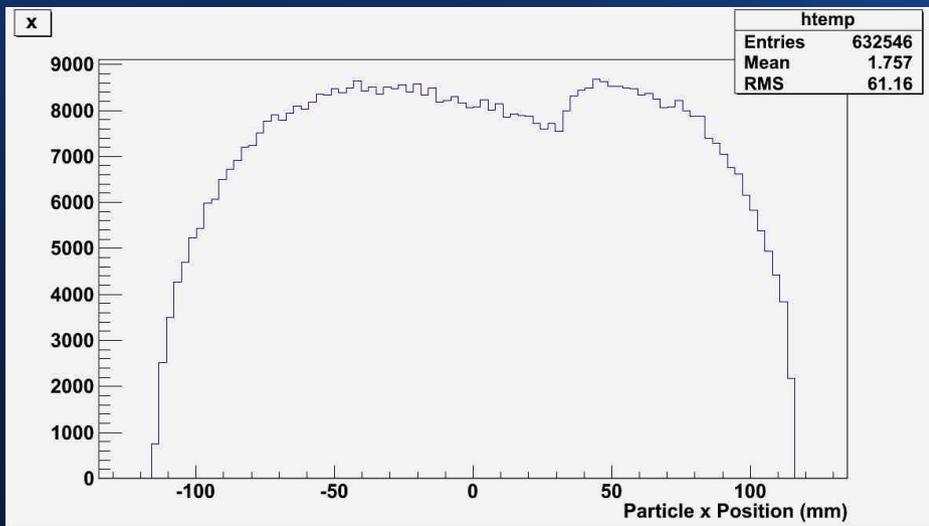
Y Momenta Comparison



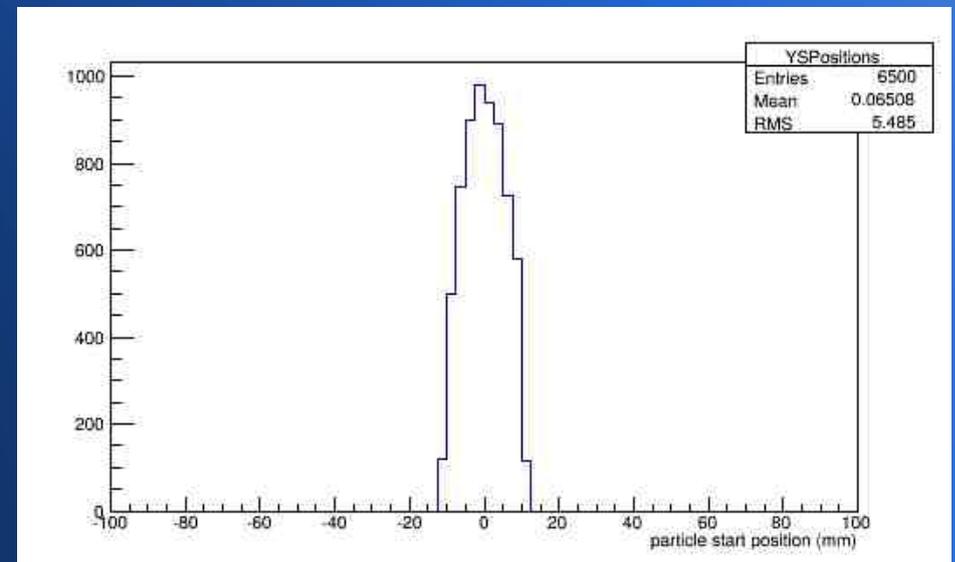
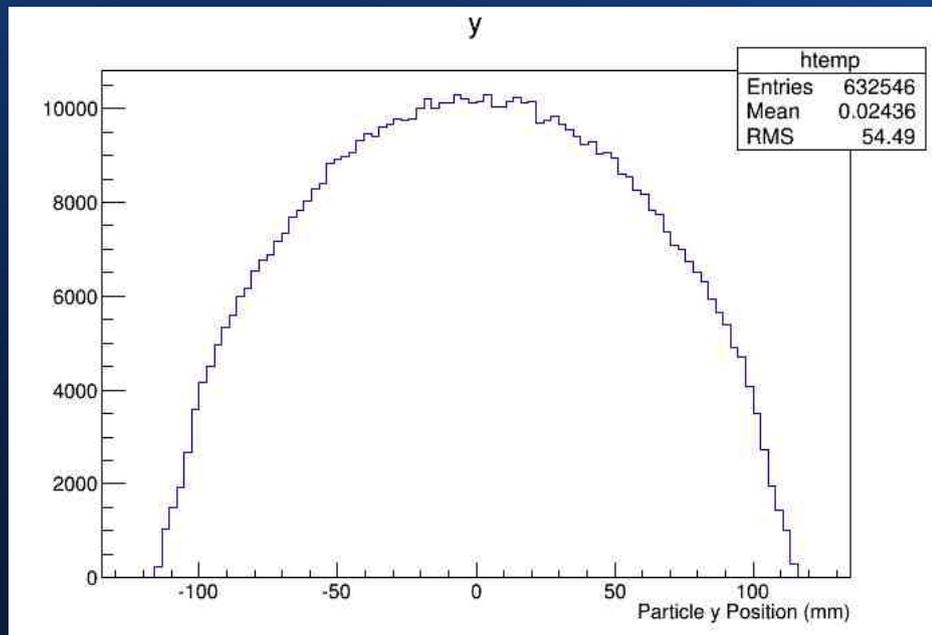
Z Momenta of Particles after largeant



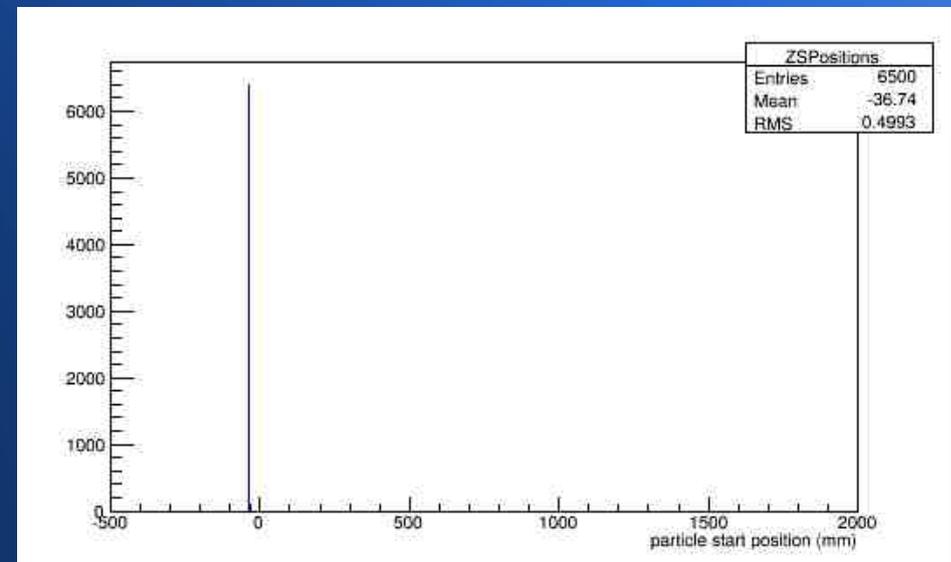
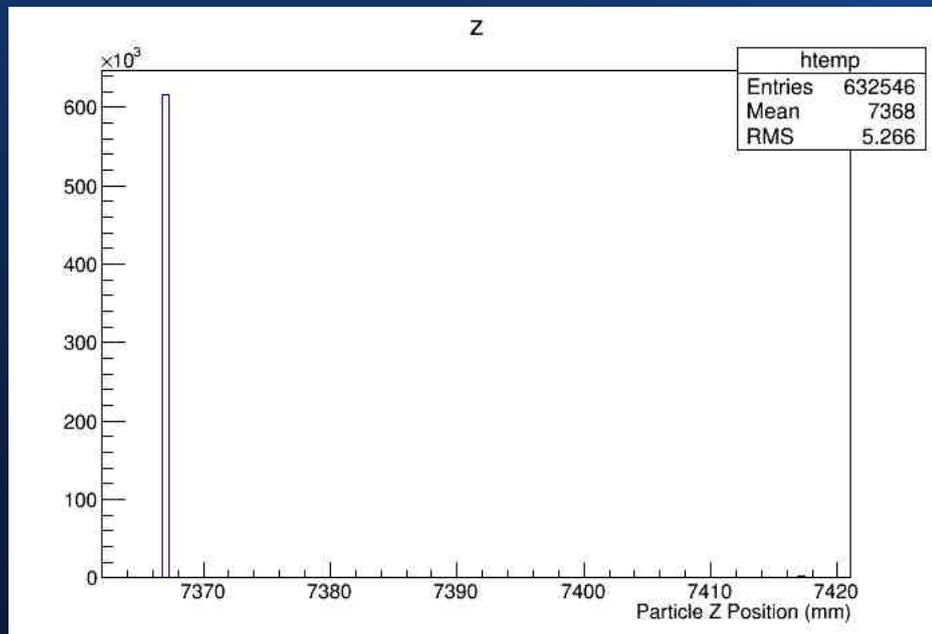
X Position Comparison



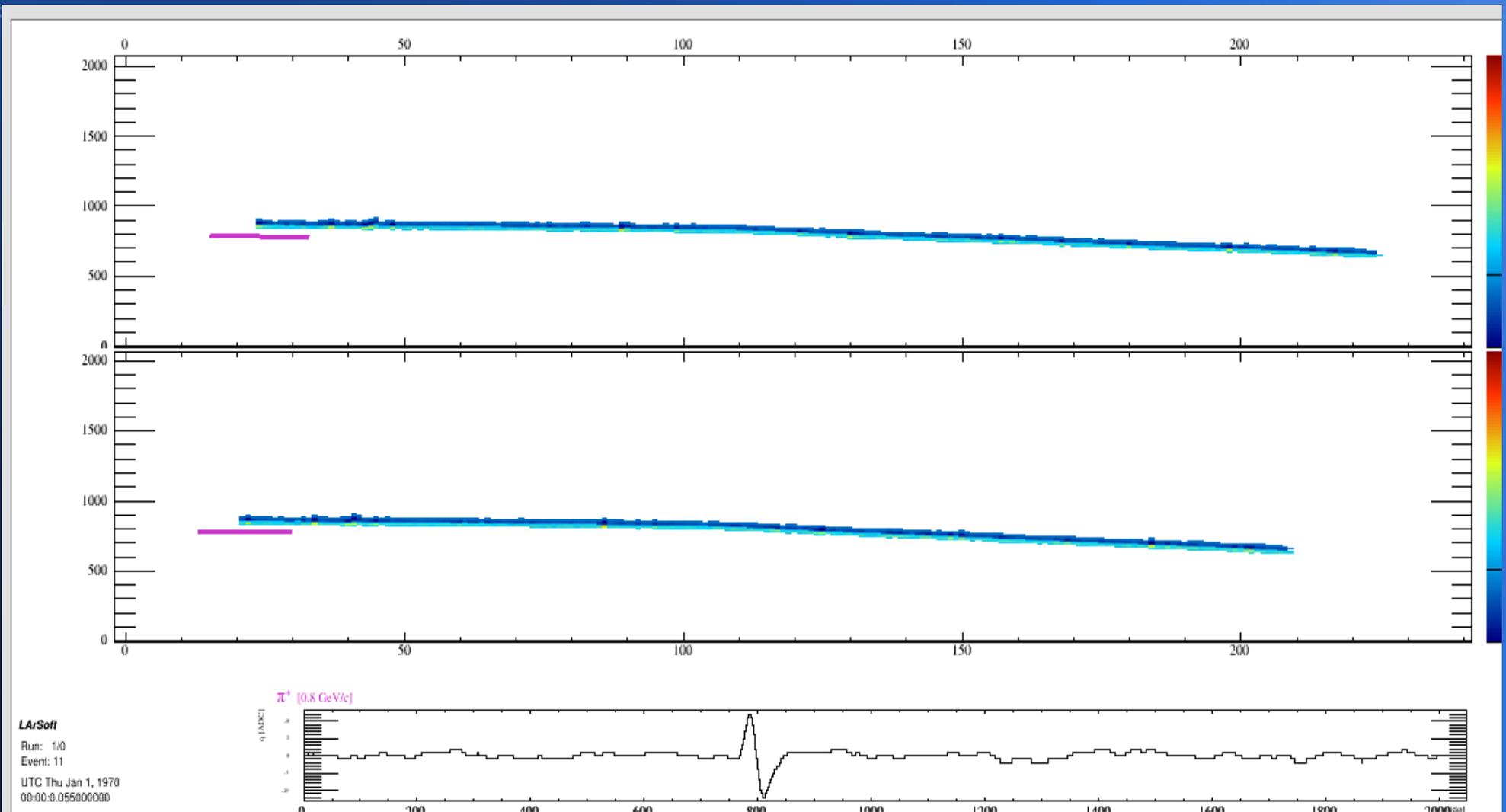
Y Position Comparison



Z Positions of Particles after largeant



Example Event Display: π^+ in LArIAT



Conclusions and Future Work

- BeamFluxInput_module.cc serves as a connection between the beamline simulation and LArIAT in LArSoft
- A parameter to select only certain particles based on pdg code will be added to the module
- What other parameters are needed?
- Units need to be corrected for largeant
- Smaller files (~1000 events) have been successfully reconstructed and analyzed, but reconstruction of larger numbers of particles (6500 events) has failed so far