

Week 5 Review

Alessio I., Gursimran K.

Self Intro: Alessio Illari

- Education
 - UConn: Graduate student (1st year)
 - UConn: B.S. in Physics
- I love
 - Bird watching
 - Reading books
 - Playing games
 - My cats back home



Self Intro: Gursimran Kainth

- Education:
 - UCONN: Grad student (2nd year)
 - UCONN: B.S. in Engineering Physics
- Hobbies:
 - Travelling
 - Reading
 - Walking my dog



Overview of Summer Work

- ZDC Simulation: Goal is to evaluate ZDC performance and reconstruct Lambda baryons produced through the Sullivan Process. The ZDC can detect the neutron and photons produced during the Lambda decay which can then be used to reconstruct it
- This process is two step: understanding which lambda particles reach the ZDC and how to cluster those hits to reconstruct the vertex

$$\Lambda \rightarrow \pi^0 n \rightarrow \gamma\gamma n$$

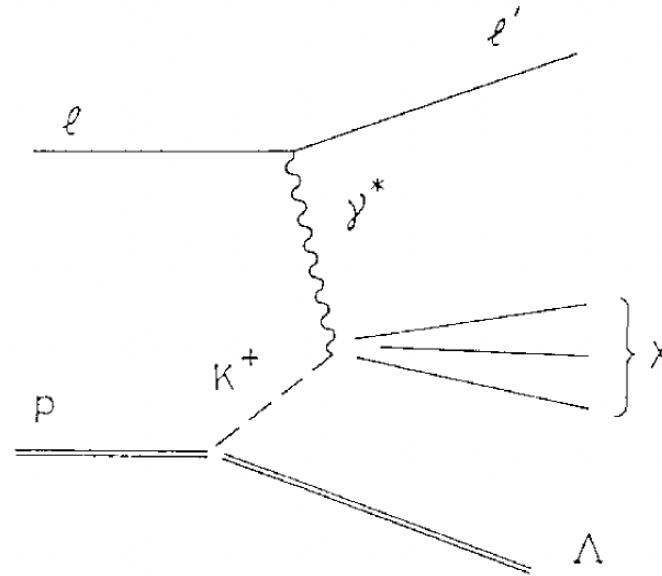


Fig. 1: Semi-inclusive production of Lambda baryon via DIS of the proton by a charged lepton through the Sullivan process [1]

Overview of Summer Work

- TPC Build: Goal is to build a Gas Electron Multiplier (GEM) Time Projection Chamber (TPC) and use it to collect and analyze data (cosmic rays and from a radiative source)

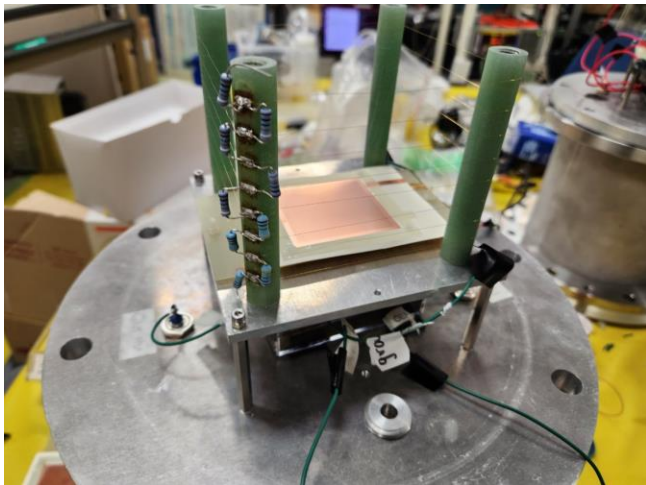


Fig. 2a: GEM Cage

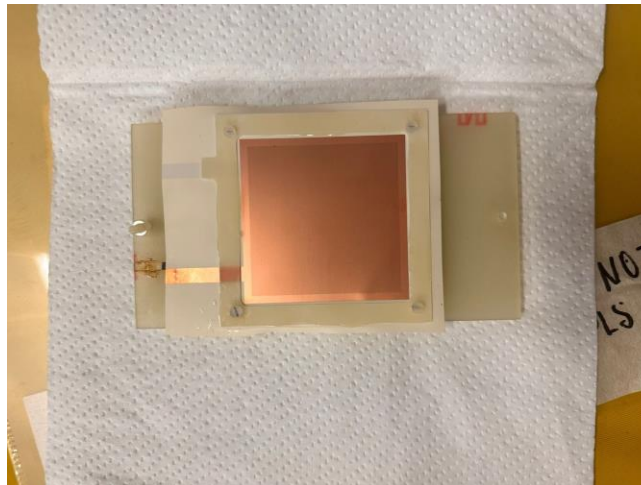


Fig. 2b: GEM Foil



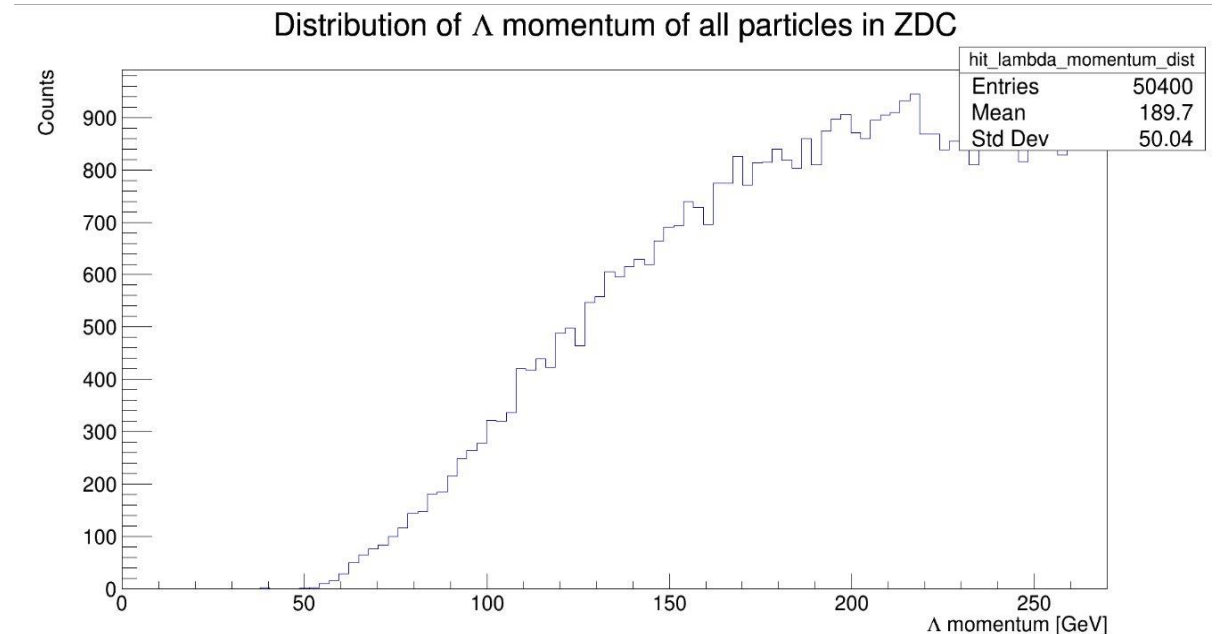
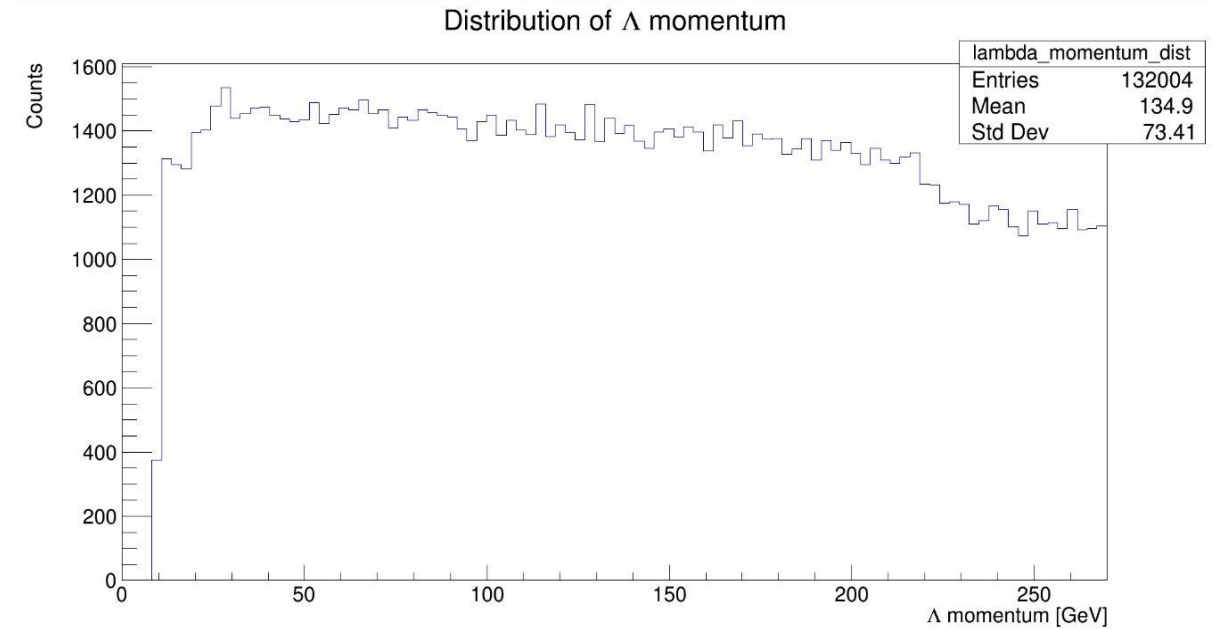
Fig. 2c: Complete TPC

ZDC Simulation:

- Study to determine ZDC efficiency for lambda to neutron and neutral pion channel
- Currently using Lambda gun from interaction site to test this
- 140k events (pre-cuts), 25mrad (directly at ZDC), 0 to 270 GeV Lambda momentum
- Study acceptance as function of 2 parameters: Lambda momentum and decay position
- Determined if events could be reconstructed if neutron and 2 gamma land in ZDC's Ecal

ZDC Simulation:

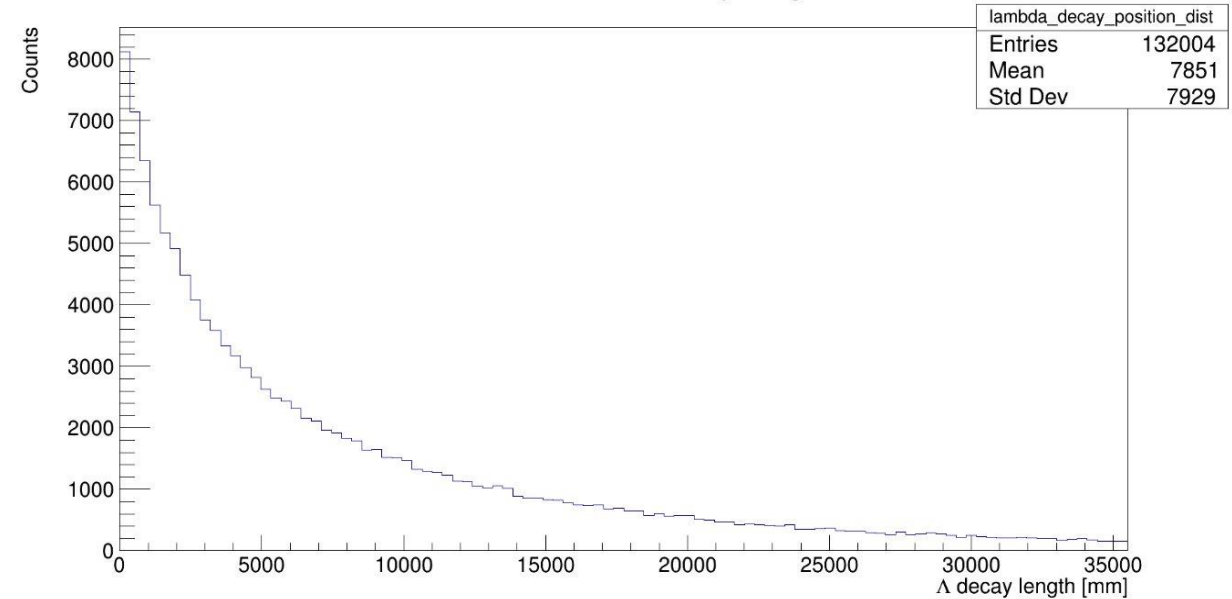
- Momentum before and after cuts on all particles in ZDC
- Enhancement of higher momentum lambda baryons



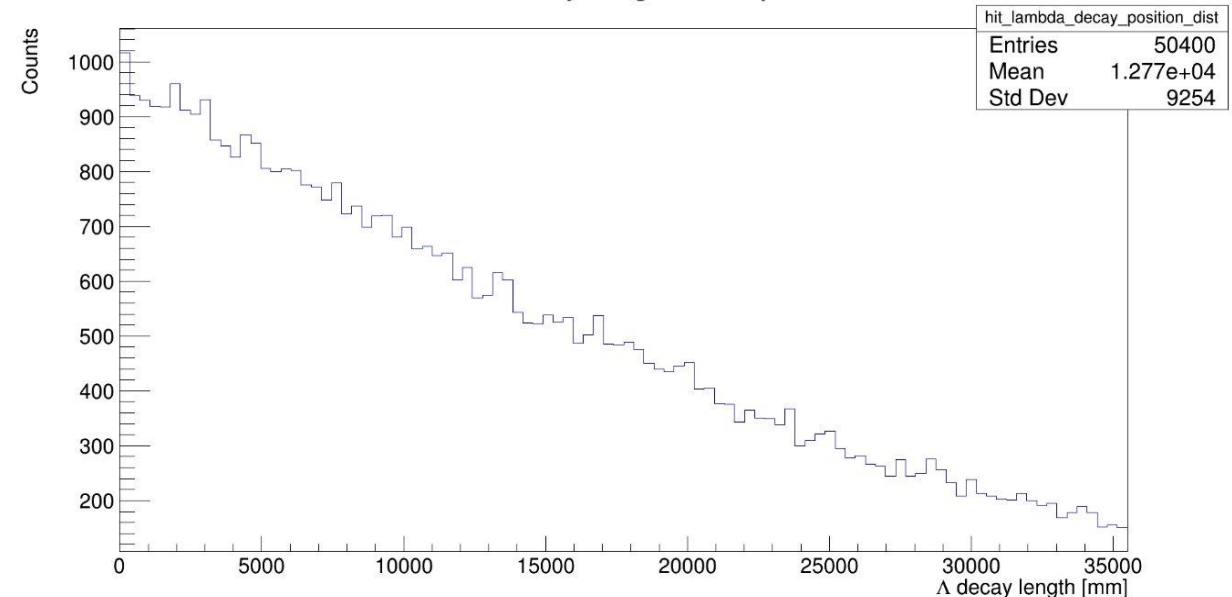
ZDC Simulation:

- Decay distance before and after cuts on all particles in ZDC
- Enhancement of higher decay distances lambda baryons

Distribution of Λ decay length

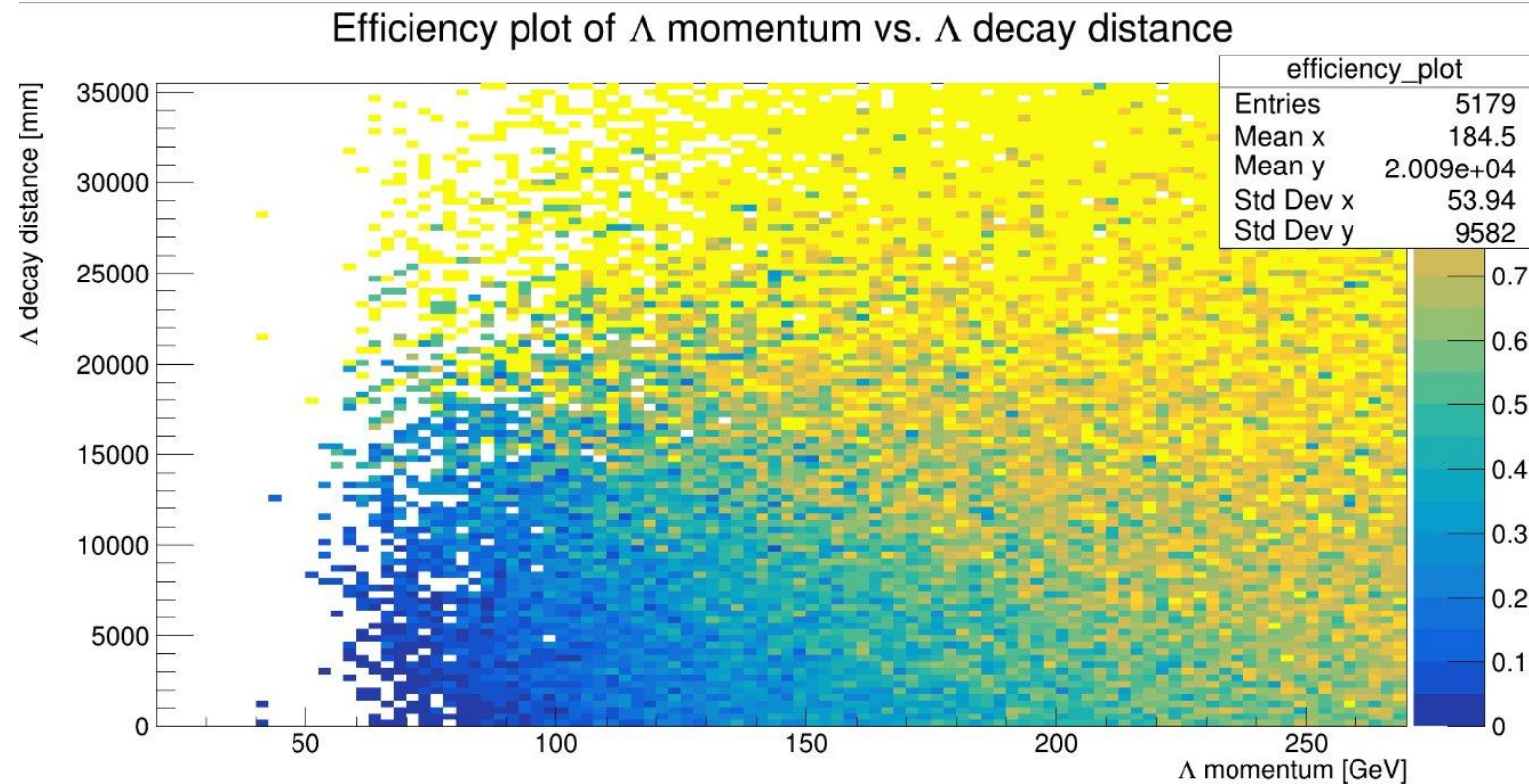


Distribution of Λ decay length of all particles in ZDC



ZDC Simulation:

- Efficiency plot of potential lambda reconstruction
- Made by dividing momentum vs. decay position after cuts by the one before cuts



ZDC Simulation Outlook

- Simulate data with slight lambda angle
- Communicate with researchers working on meson structure simulation to see the status of Sullivan process simulation
- Continue working on clustering algorithms to determine which events can be reconstructed and the angular resolution
- Put it together to calculate the reconstructed invariant mass

TPC Build:

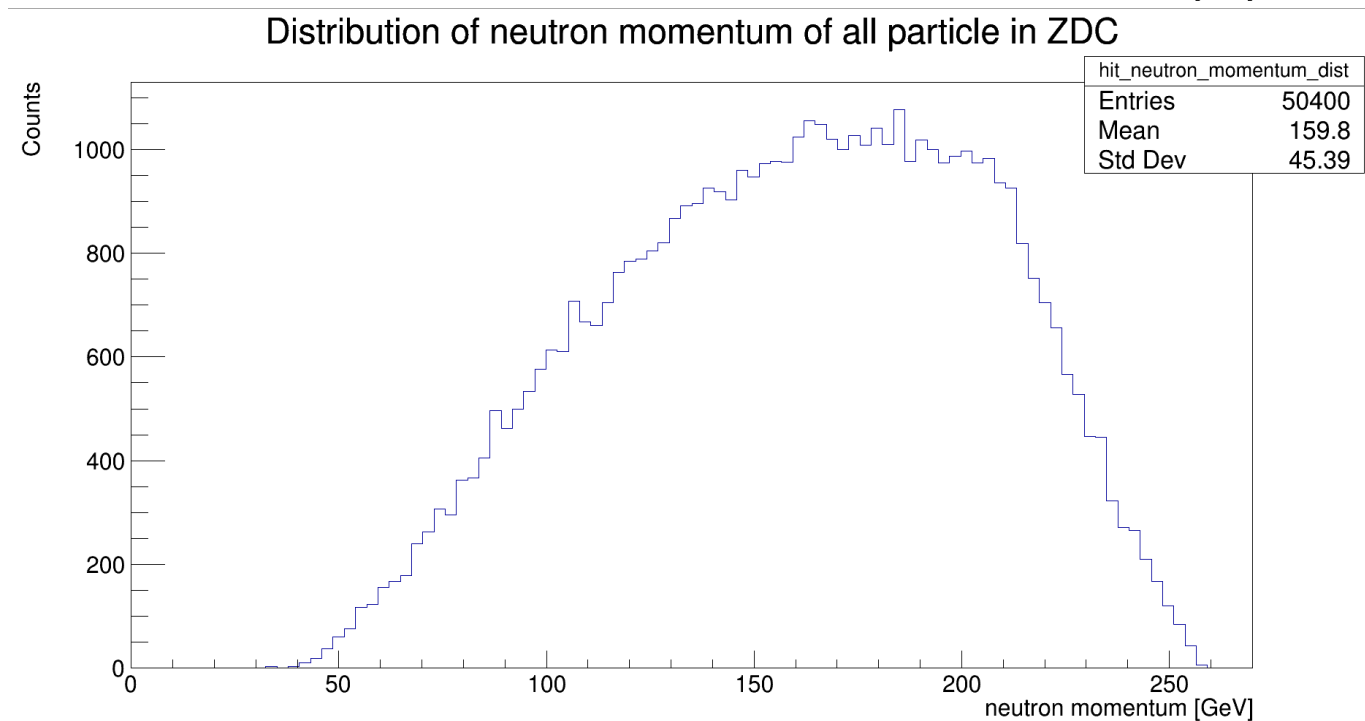
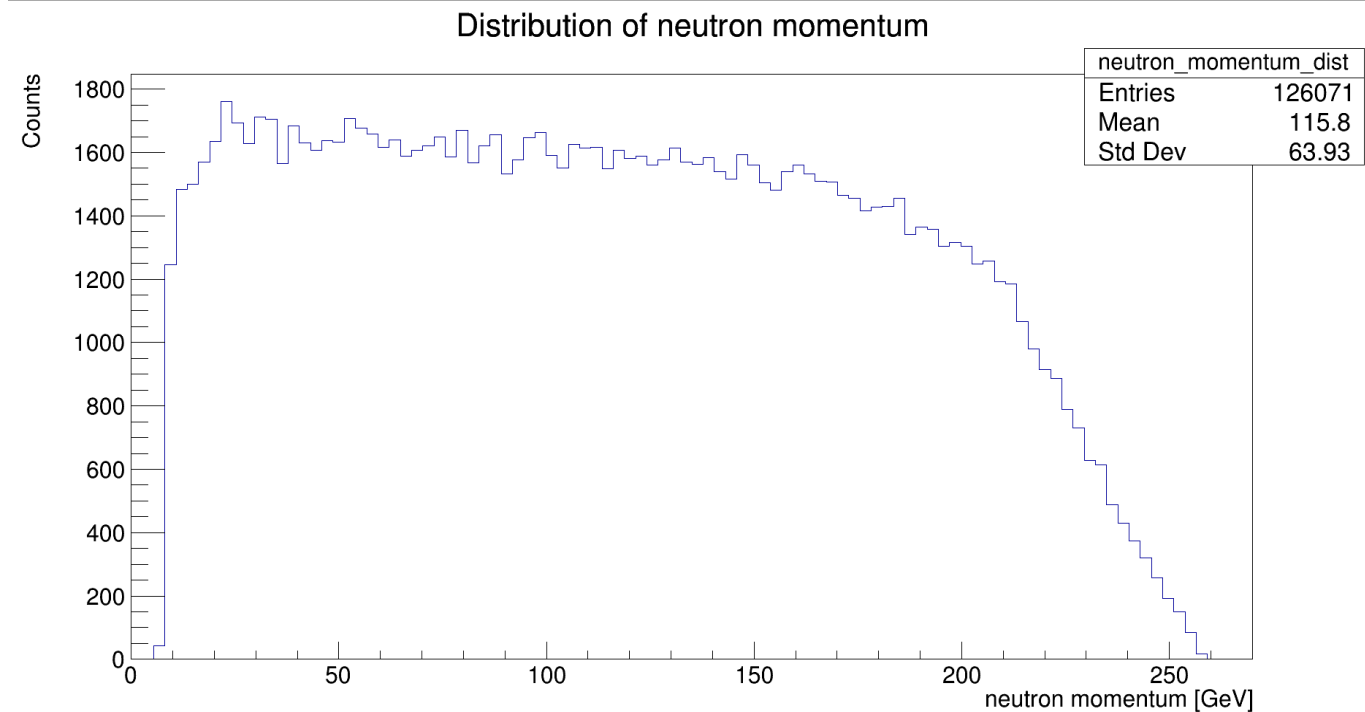
- Completed the TPC build and are now working on understanding the TPC output, which is a mixture of real signal and discharge
 - Using the Kromek MCA/Oscilloscope to see the spectrum of the signal/signal for different GEM voltages (800 – 1200V) with the field voltage on and off
 - Flush TPC with N₂ for two hours before filling it with P10
 - Remove moisture from the TPC
 - Opened TPC and retaped the circuitry
 - To prevent any unwanted discharge from circuitry

Sources:

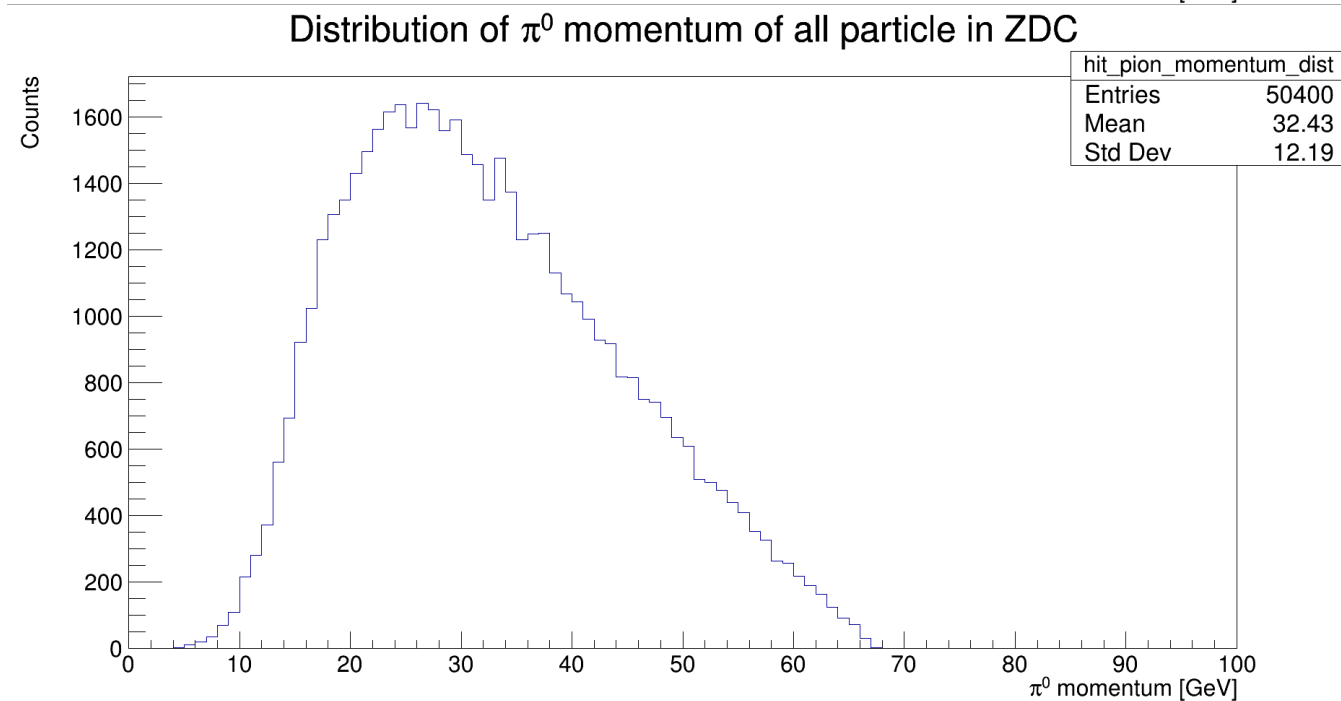
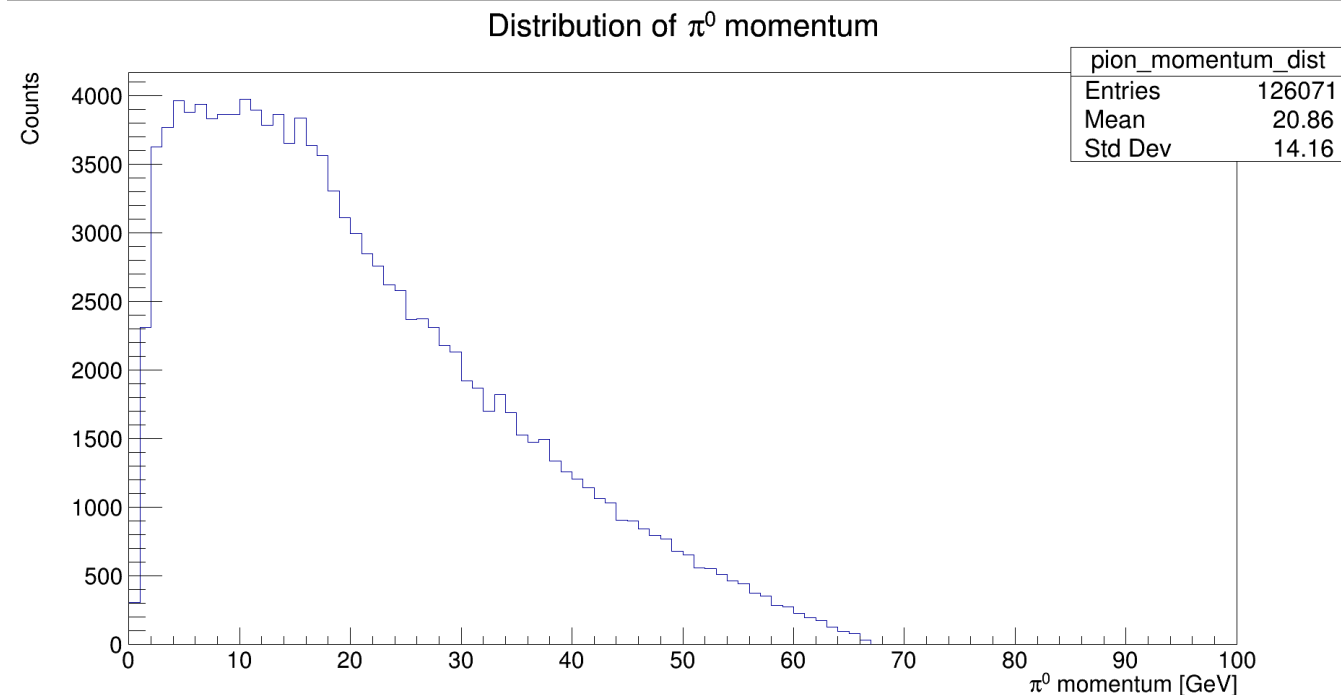
- [1] Hwang, WY.P., Wen, CY. Semi-inclusive Λ production and generalized sullivan processes. Z Phys A - Particles and Fields 358, 415–422 (1997). <https://doi.org/10.1007/s002180050349>

Extra Slides

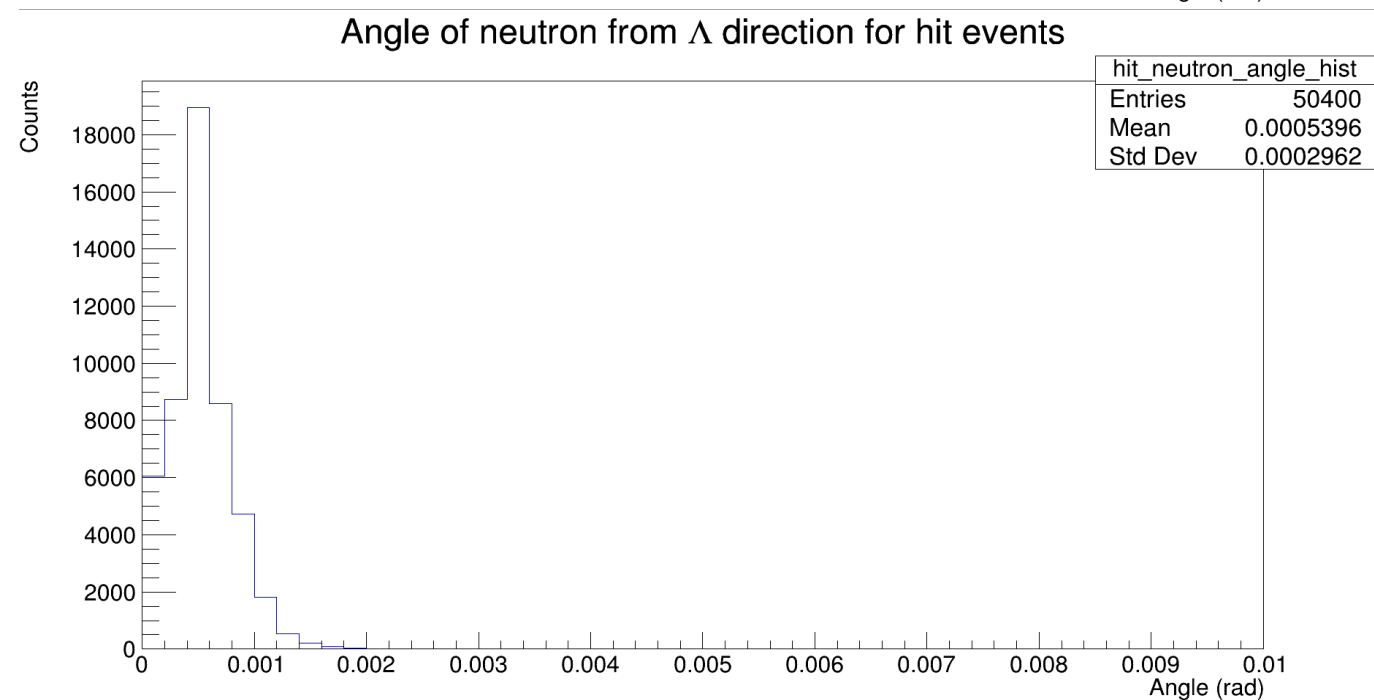
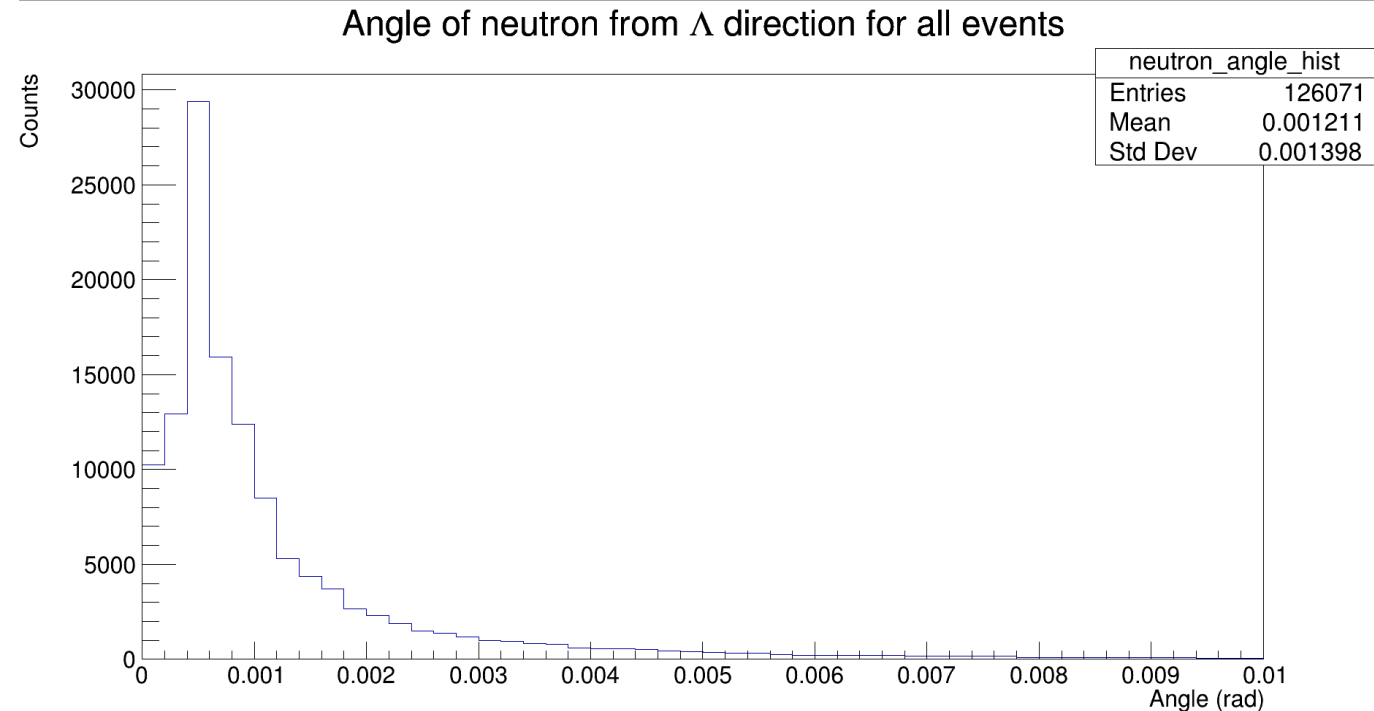
Neutron momentum



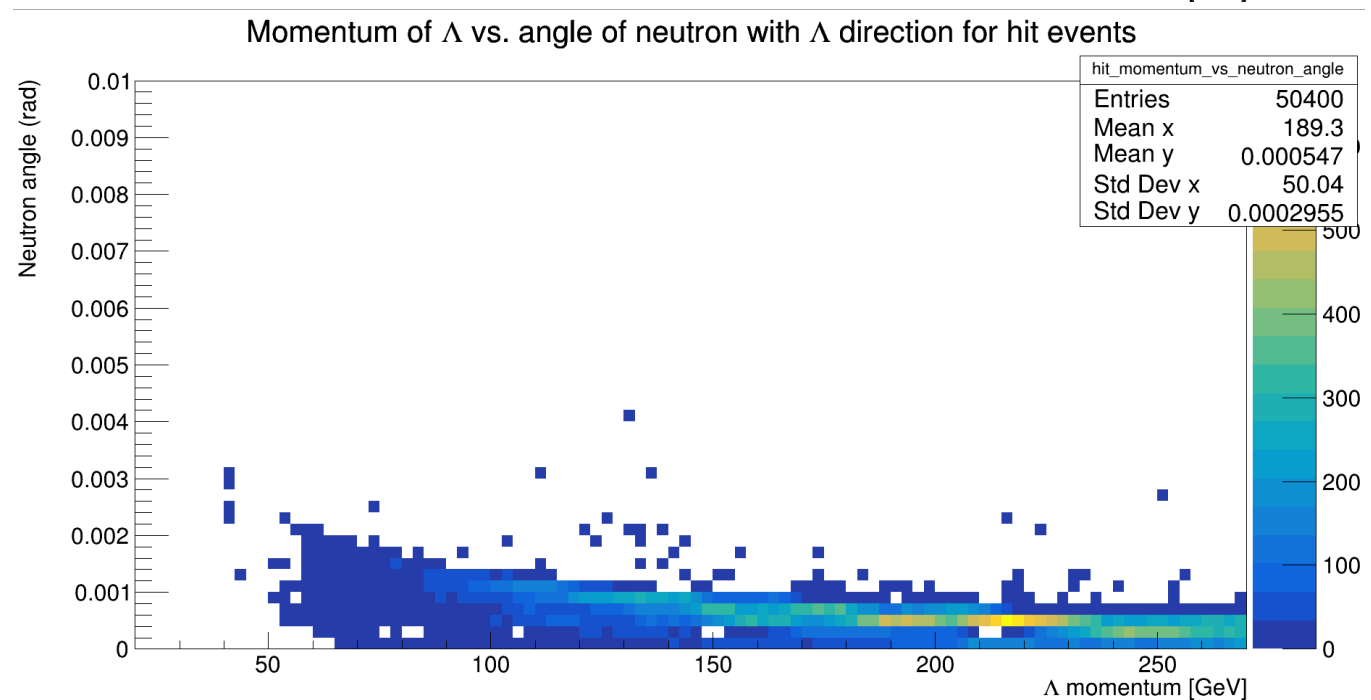
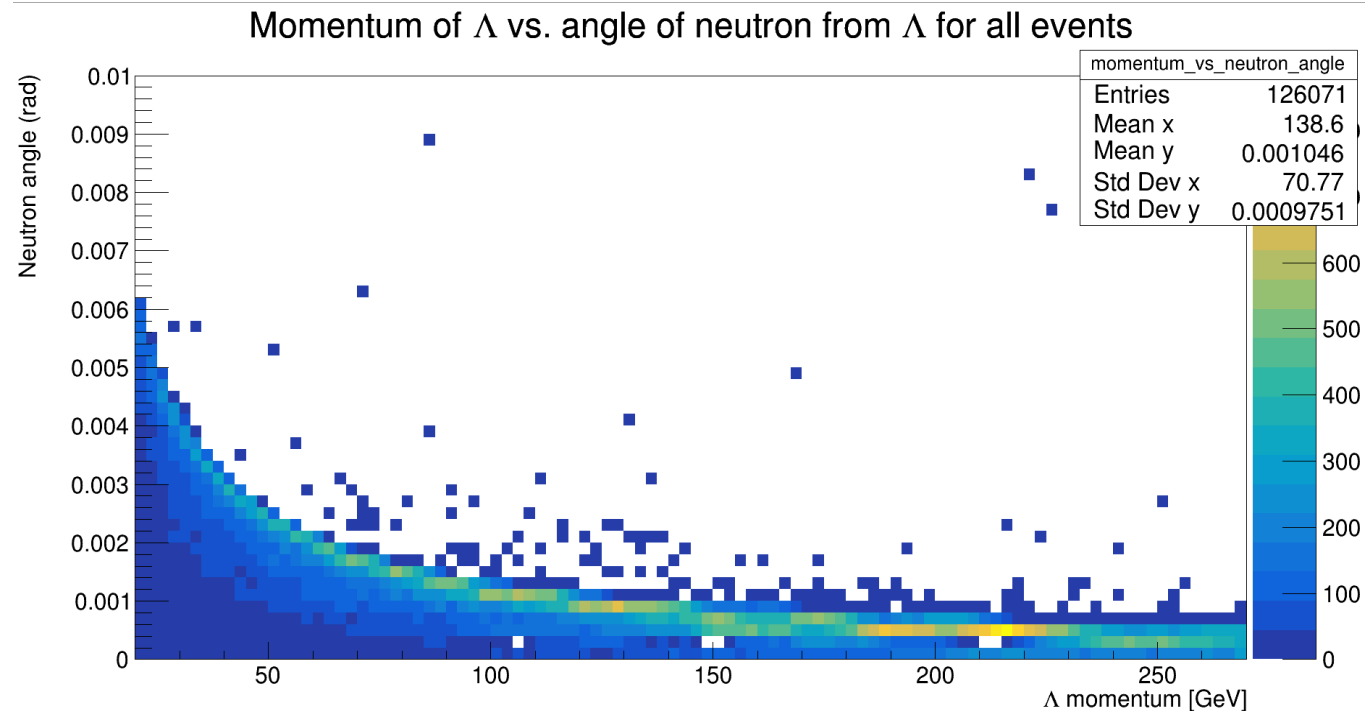
Pi0 momentum



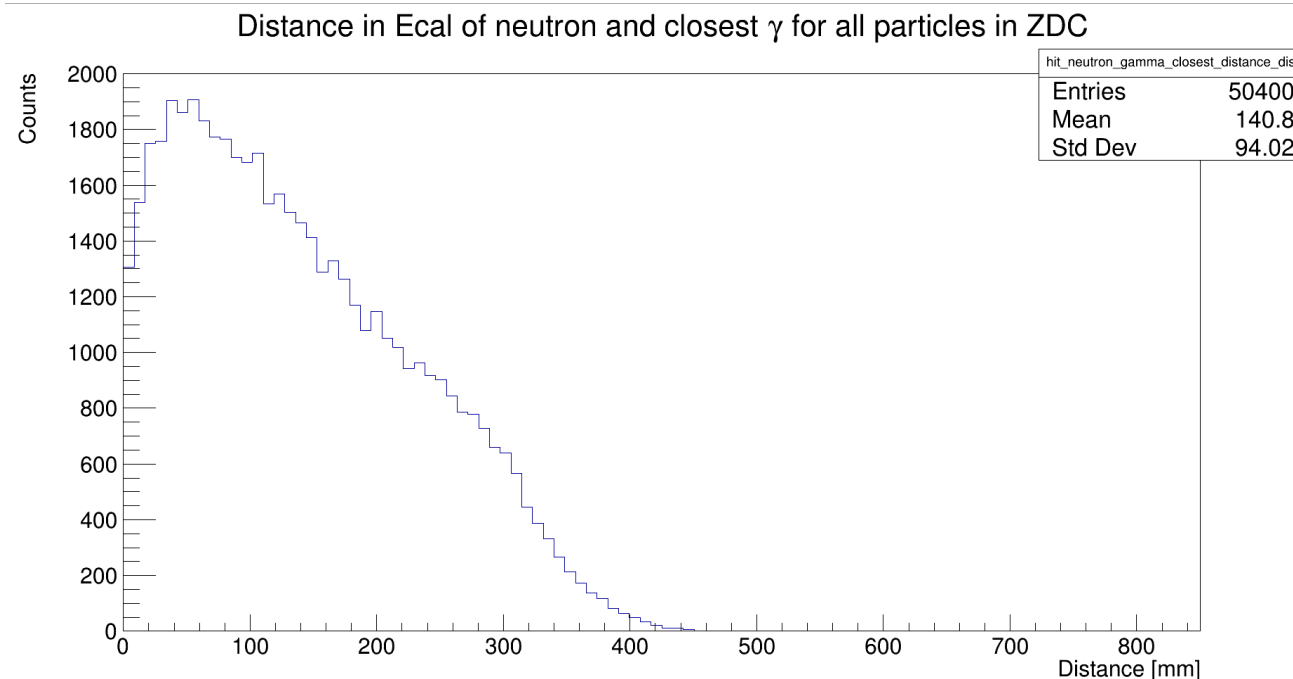
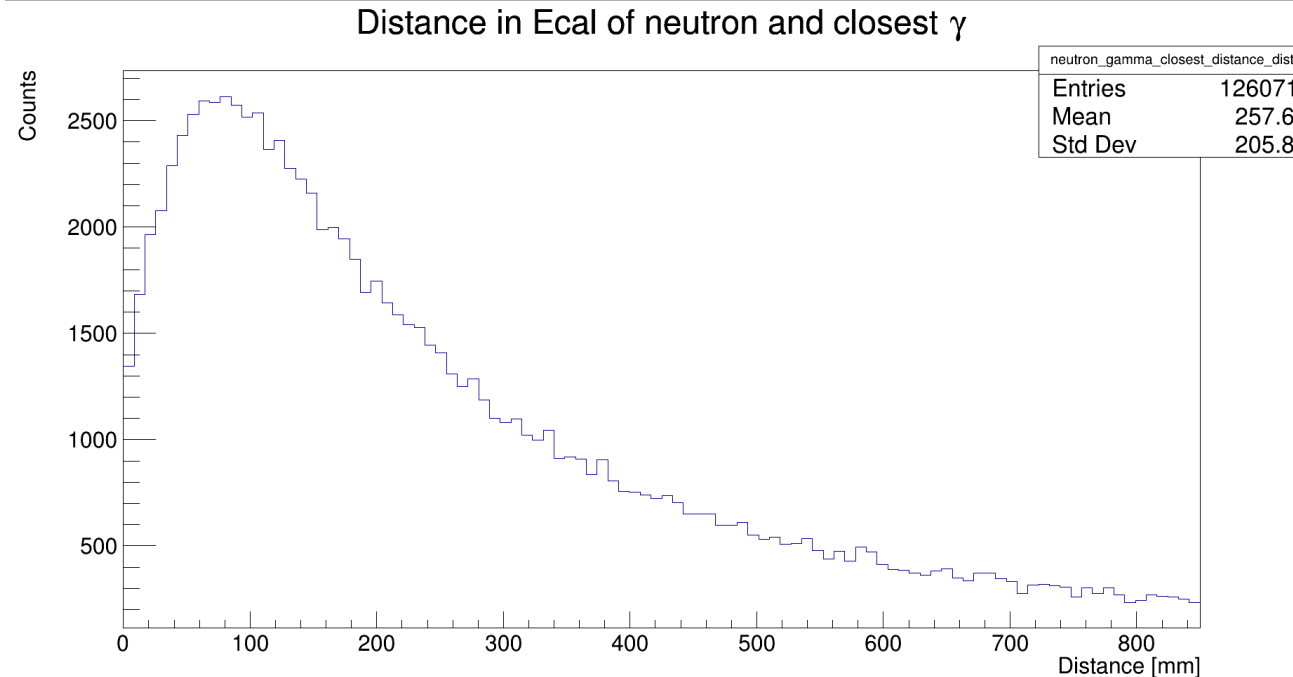
Neutron angle from Lambda direction



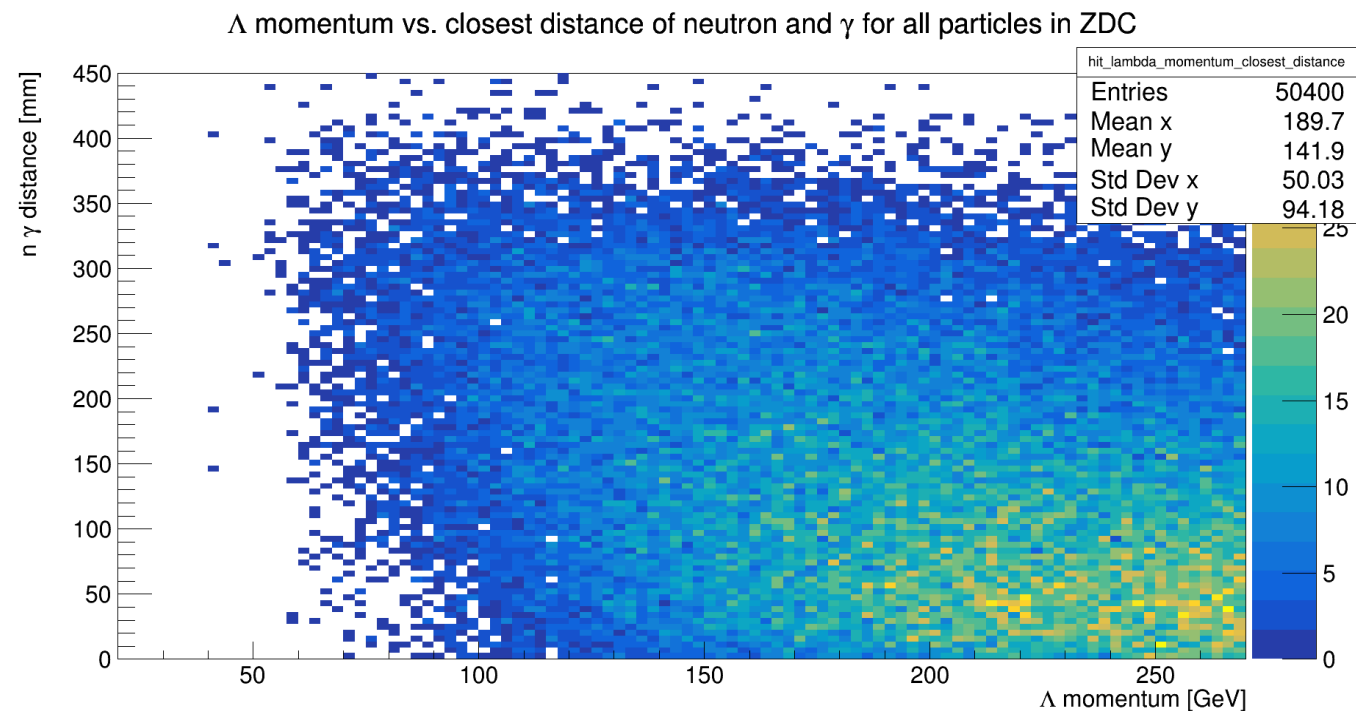
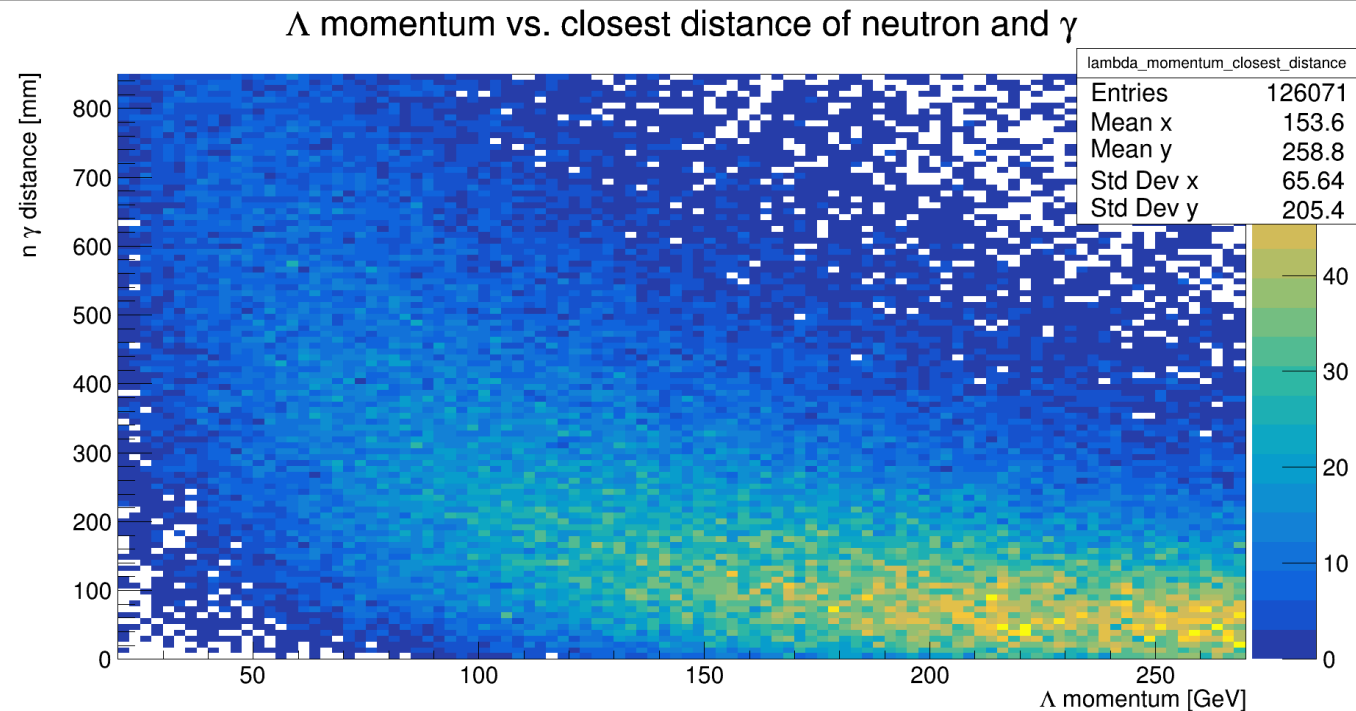
Neutron
angle from Lambda
direction, function
of Lambda
momentum



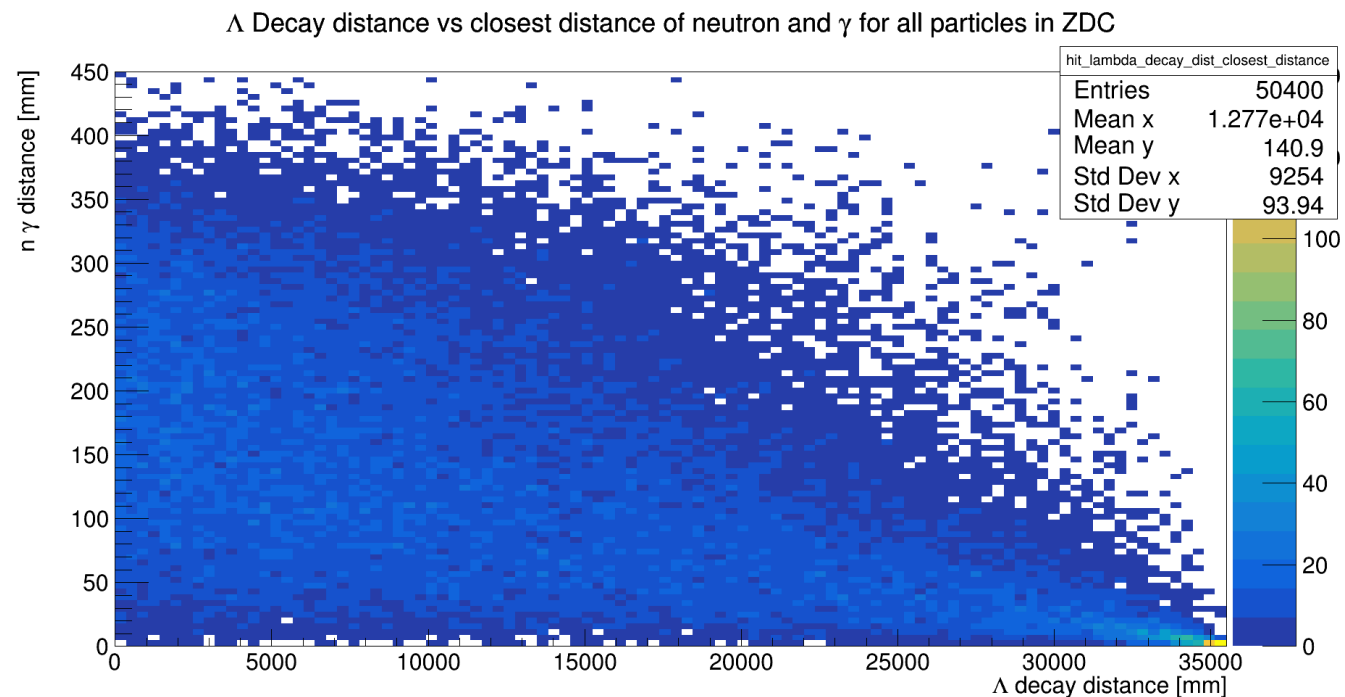
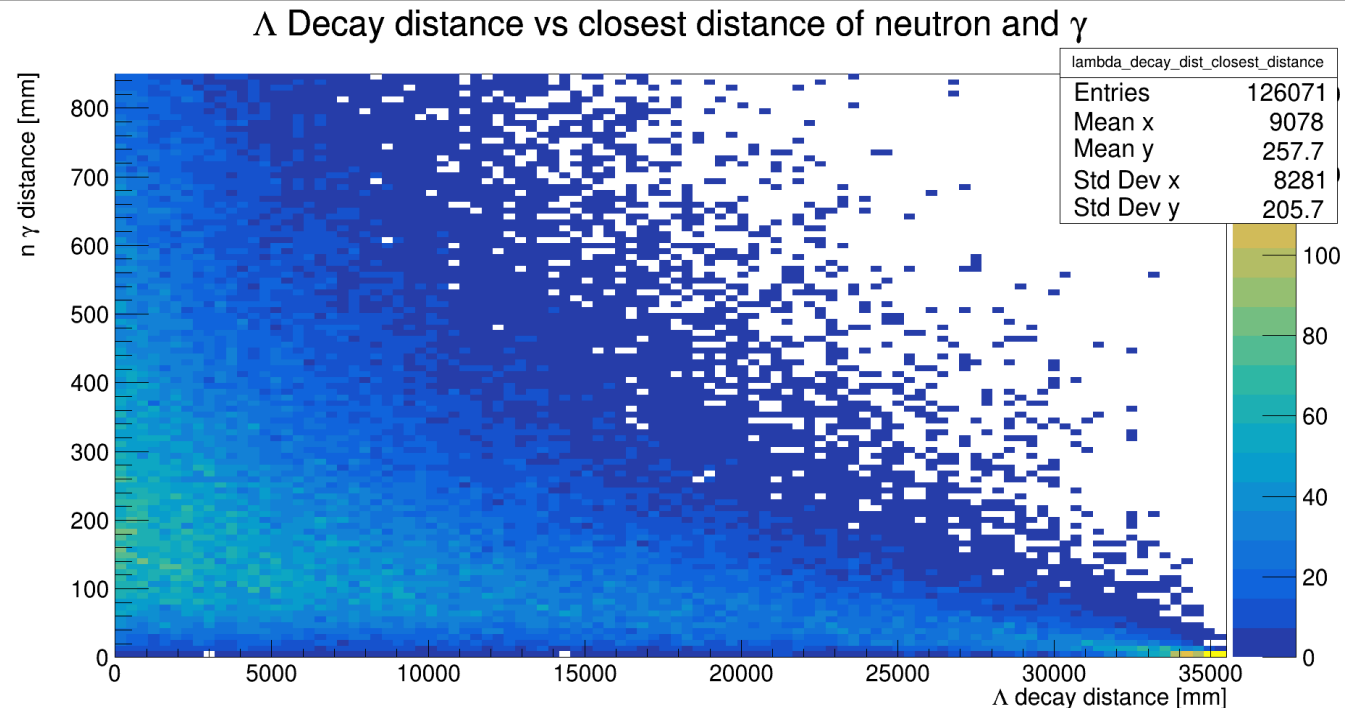
Distance between neutron and closest gamma



Closest distance
of neutron to a
gamma vs
Lambda momentum

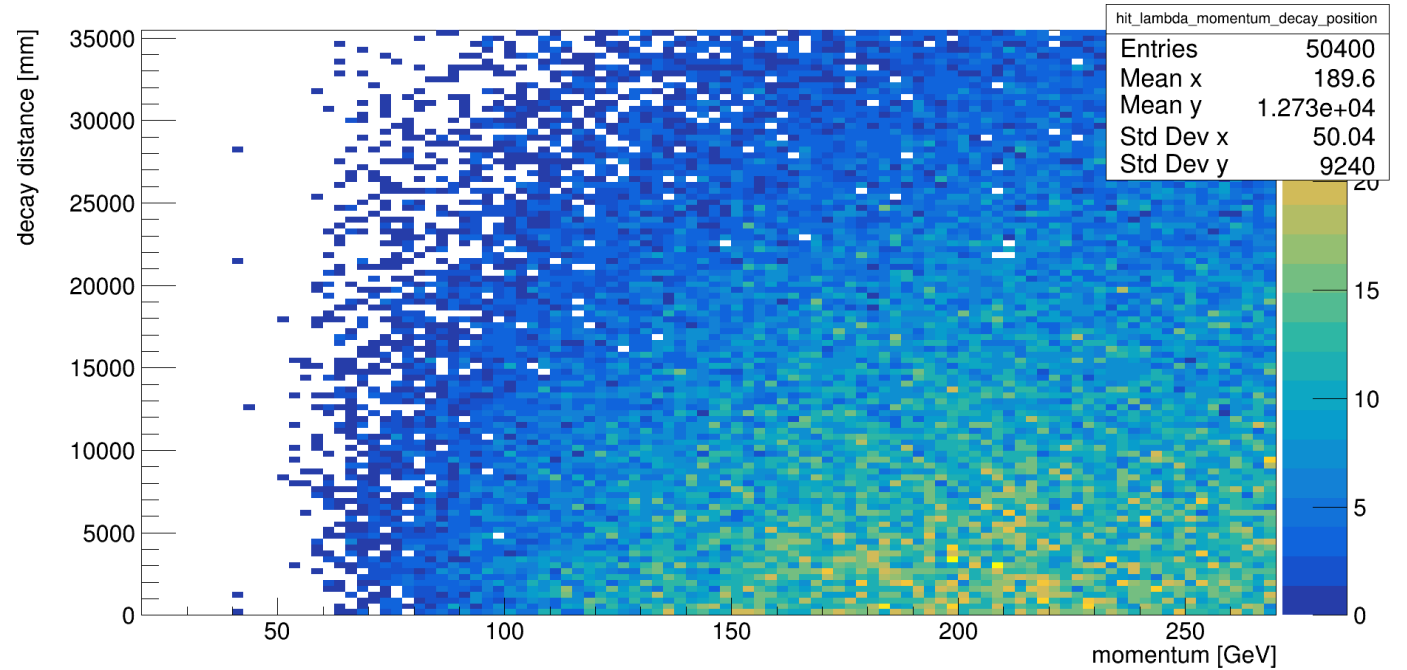


Closest distance
of neutron to a
gamma vs Lambda
decay position



Momentum vs decay position

Λ momentum vs. decay position of all particle in ZDC



Λ momentum vs. decay position

