Nuclear Physics Group Meeting 7/12

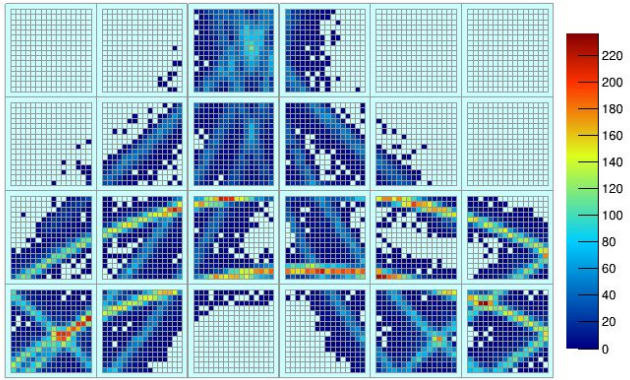
Week 7 Recap

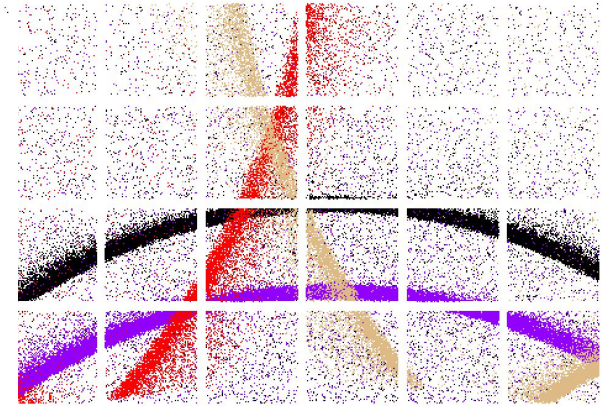
Jenna Lawson - Dr. Greg Kalicy - Imran Hossain

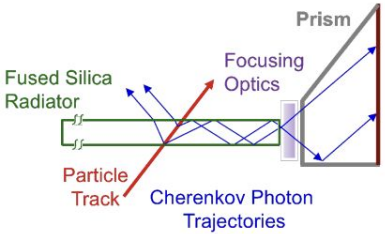
What has been done … (This Week)

- Continued the Path in the Prism Study presented on Monday
- Wrote a Python script to create the color coded hit pattern and time graphs
- Fought (a lot) with said Python script
- Learned a small amount of C++ because I nearly gave up on using Python
- Read a fair amount of ROOT Documentation

Path in the Prism Hit Pattern (Using -c 2031) - Week 6





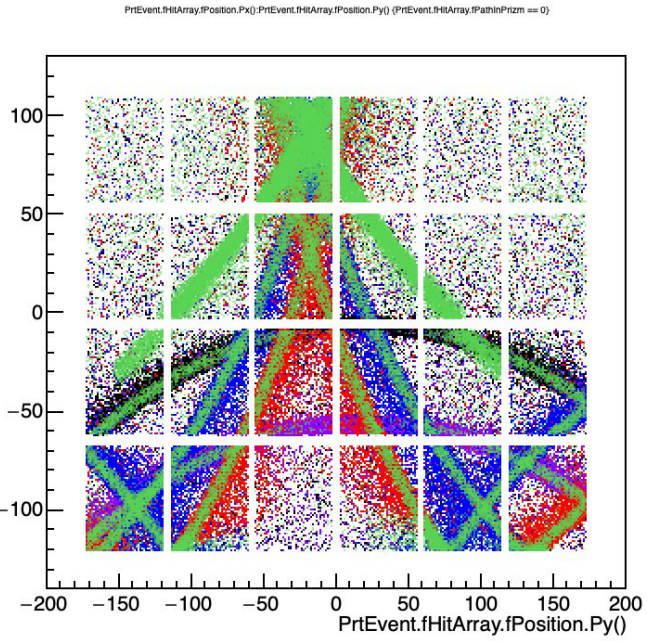


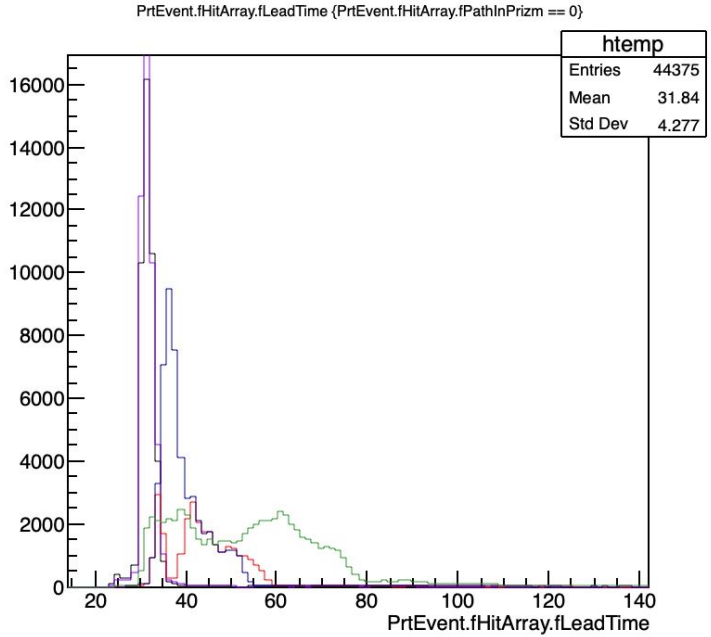

```
root [32] tree1->Draw("PrtEvent.fHitArray.fPosition.Px():PrtEvent.fHitArray.fPosition.Py()","PrtEvent.fHitArray.fPathInPrizm==3","same")
Info in <TCanvas::MakeDefCanvas>:  created default TCanvas with name Canvas_1_n6
(long long) 48085
root [33] tree1->Draw("PrtEvent.fHitArray.fPosition.Px():PrtEvent.fHitArray.fPosition.Py()","PrtEvent.fHitArray.fPathInPrizm==3","same")
(long long) 48085
root [34] tree1->Draw("PrtEvent.fHitArray.fPosition.Px():PrtEvent.fHitArray.fPosition.Py()","PrtEvent.fHitArray.fPathInPrizm==0","")
(long long) 44375
root [35] tree1->Draw("PrtEvent.fHitArray.fPosition.Px():PrtEvent.fHitArray.fPosition.Py()","PrtEvent.fHitArray.fPathInPrizm==0","")
Info in <TCanvas::MakeDefCanvas>:  created default TCanvas with name Canvas_1
(long long) 44375
root [36] tree1->Draw("PrtEvent.fHitArray.fPosition.Px():PrtEvent.fHitArray.fPosition.Py()","PrtEvent.fHitArray.fPathInPrizm==3","same")
(long long) 48085
root [37] tree1->Draw("PrtEvent.fHitArray.fPosition.Px():PrtEvent.fHitArray.fPosition.Py()","PrtEvent.fHitArray.fPathInPrizm==31","same")
(long long) 11451
root [38] tree1->Draw("PrtEvent.fHitArray.fPosition.Px():PrtEvent.fHitArray.fPosition.Py()","PrtEvent.fHitArray.fPathInPrizm==32","same")
(long long) 15767
root [39]
```

Prism Path:

Black = Direct
Purple = Bottom
Red = Bottom, Right
Orange = Bottom, Left

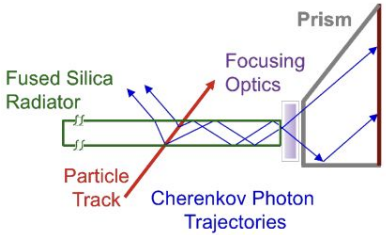
Path in the Prism Hit Pattern (Using -c 2031) - Week 7 - Part 1





Prism Path:

Black = Direct
Purple = Bottom
Blue = Right/Left
Red = Bottom - Right/Left
Green = Any Other Reflections

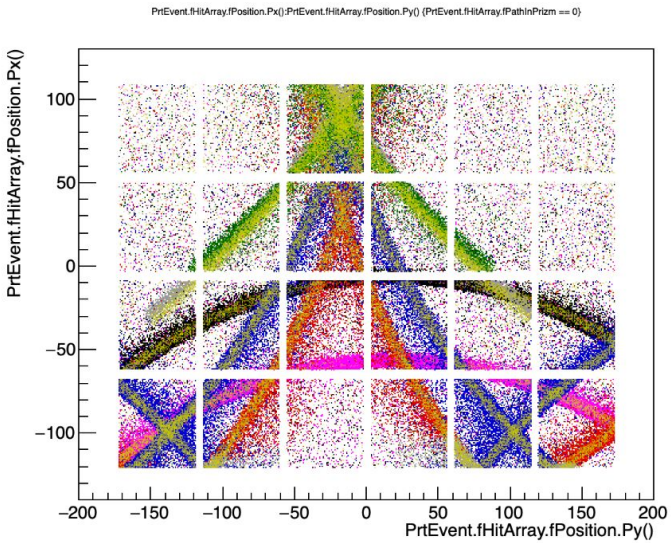


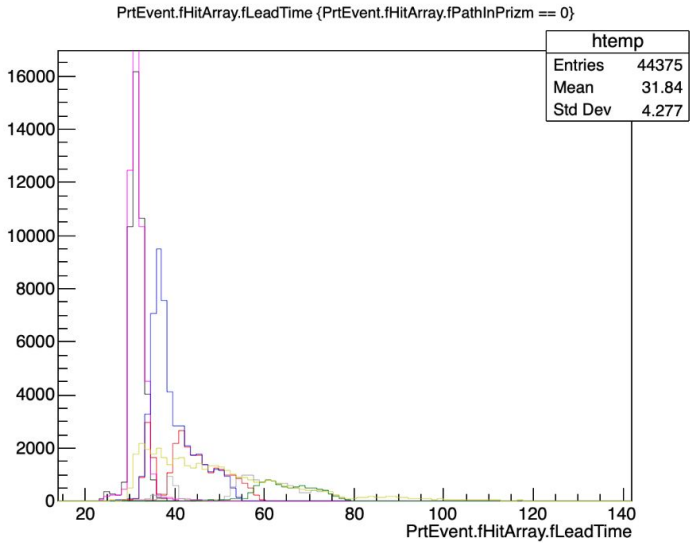
- 5 Draw() conditions so slightly repetitive but easily completed in ROOT interface
- Blanket condition for anything other than the first 4 conditions
- Too much information combined

Getting from Part 1 to Part 2

- There are 16 named attempts at this script in Python, C, and C++
- Never managed to calculate the length of the entries. Anything beyond 3 reflections was going to be one color so I hard-coded all of the possible paths with 3, 2, and 1 reflections and assigned these colors
- Somewhat inefficient and poor coding practice but resulted in the first successful run at 9:09 PM
- Benefits of the struggle: I can very quickly run this study on more simulation files

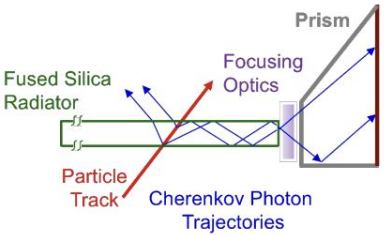
Path in the Prism Hit Pattern (Using -c 2031) - Week 7 - Part 2





Prism Path:

Black = Direct
Purple = Bottom
Pink = Top
Blue = Right/Left
Red = Bottom - Right/Left
Gray = Any Other 2 Reflections
Green = Any 3 Reflections
Yellow = More than 3 Reflections



- Needed the length of each entry in the branch which proved harder than assumed
- Can run for different angles (or any other variable altered in the simulation) - only need to change the uploaded simulation information in the Python script

What needs to be done … (Next Week)

- Discuss the meaning of the colored time plots I can now generate
- Generate more of these plots and investigate for differences that occur with changes in simulation variables
- Discuss next steps for my project

Final Presentation (First 3 Slides)

Jenna Lawson - Dr. Greg Kalicy - Imran Hossain

Context and Purpose of the EIC and DIRC Technology

EIC:

Purpose: To explore the fundamental structure of matter by colliding electrons with protons and ions.

Timeline: Expected to start operations in the early 2030s.

Location: Brookhaven National Laboratory, USA.

DIRC:

Role in EIC:

- Crucial for precise charged particle identification.
- Enhances the ability to differentiate between pions, kaons, and protons.

Working Principle:

- Detects Cherenkov light produced by charged particles.
- Utilizes internally reflected Cherenkov light to determine particle identity.

Photon Sensors - Crucial to Detector Performance

Significance:

- Sensor performance directly affects the accuracy and efficiency of particle identification
- High-resolution and efficient sensors are vital for the success of DIRC detectors
- High-resolution sensors are expensive and the DIRC detector contains many of these sensors

My Research this Summer

Research Goals:

- Achieve a comprehensive understanding of various photon detectors.
- Conduct studies on time resolution and time cuts to evaluate performance.

Tools:

- Data-analysis using ROOT software.
- Simulations with Geant4 to model detector behavior.
- Review and analysis of existing literature for potential improvements.