



Low Energy Neutron Background – LDMX @ Fermilab

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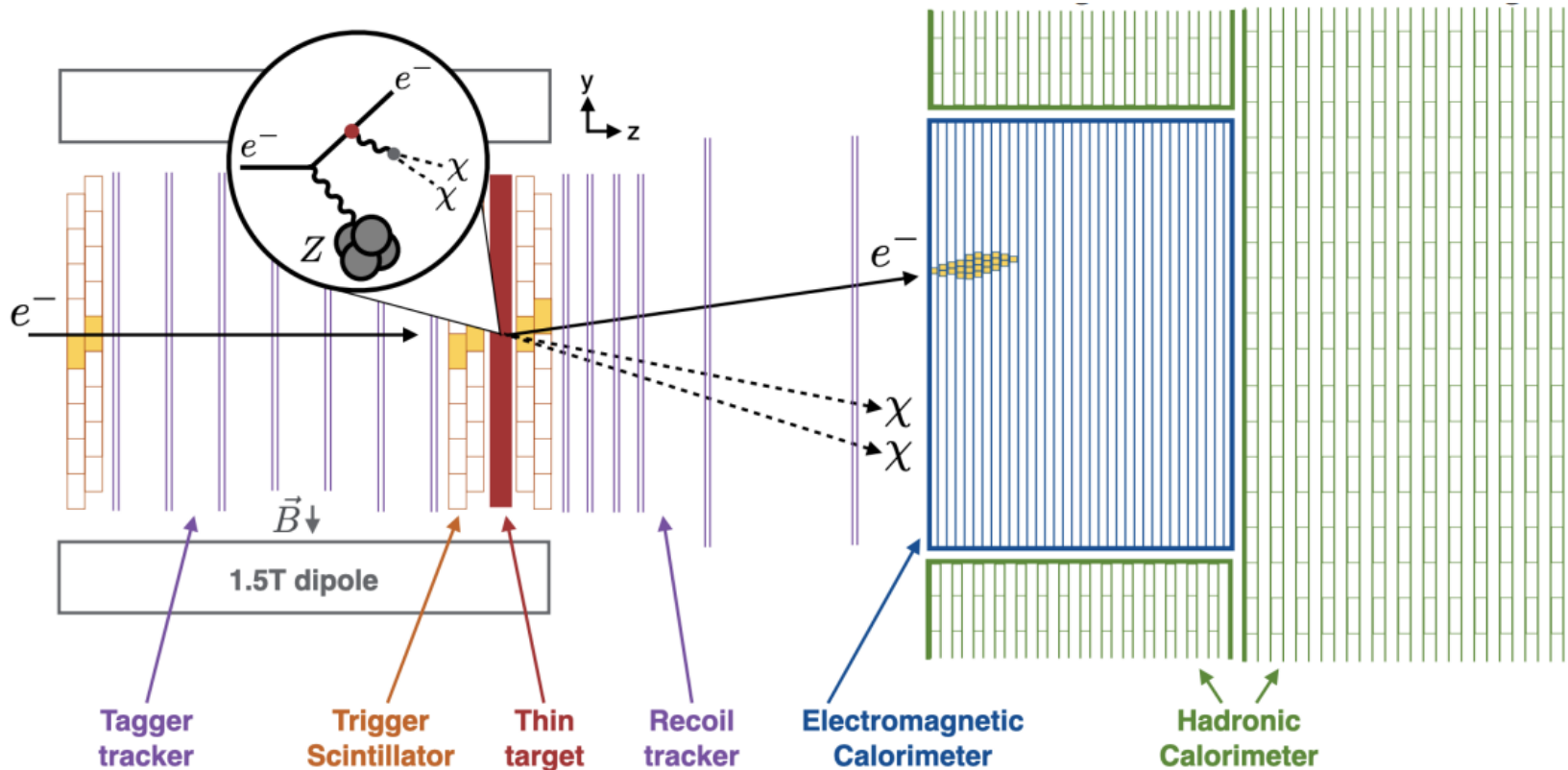
Supervisor: Dr. Cristina Mantilla Suarez

Final Presentation

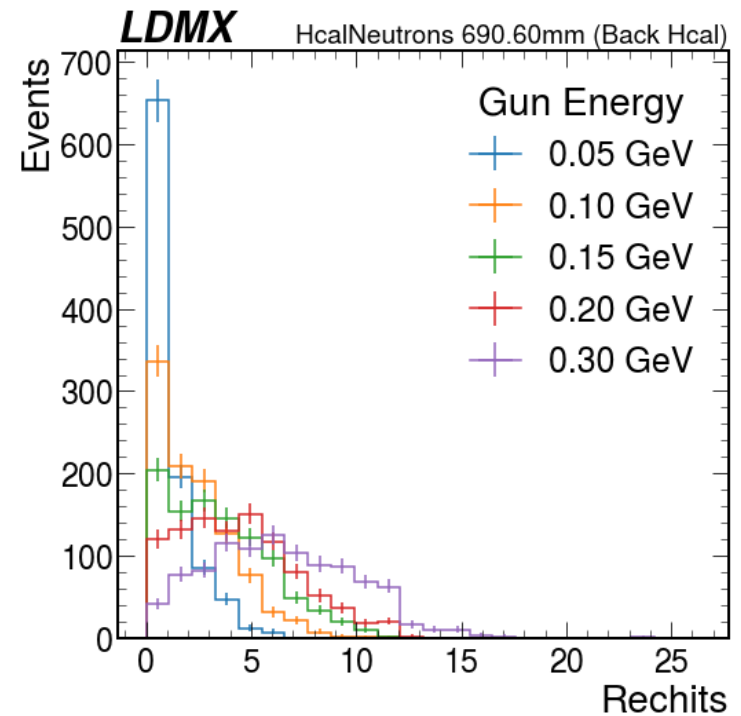
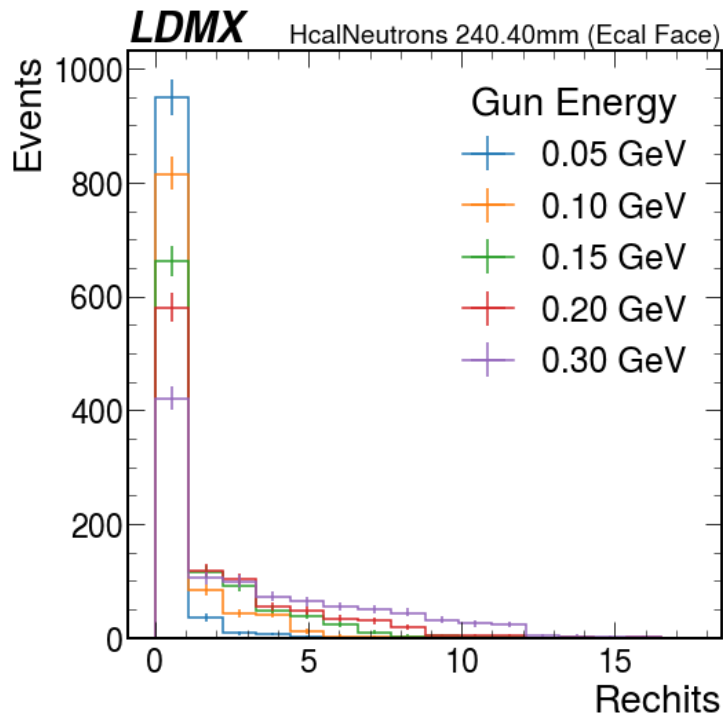
August 8, 2022

What is LDMX, and What is my Project?

Using Missing Momentum Methods to Detect Light Thermal DM

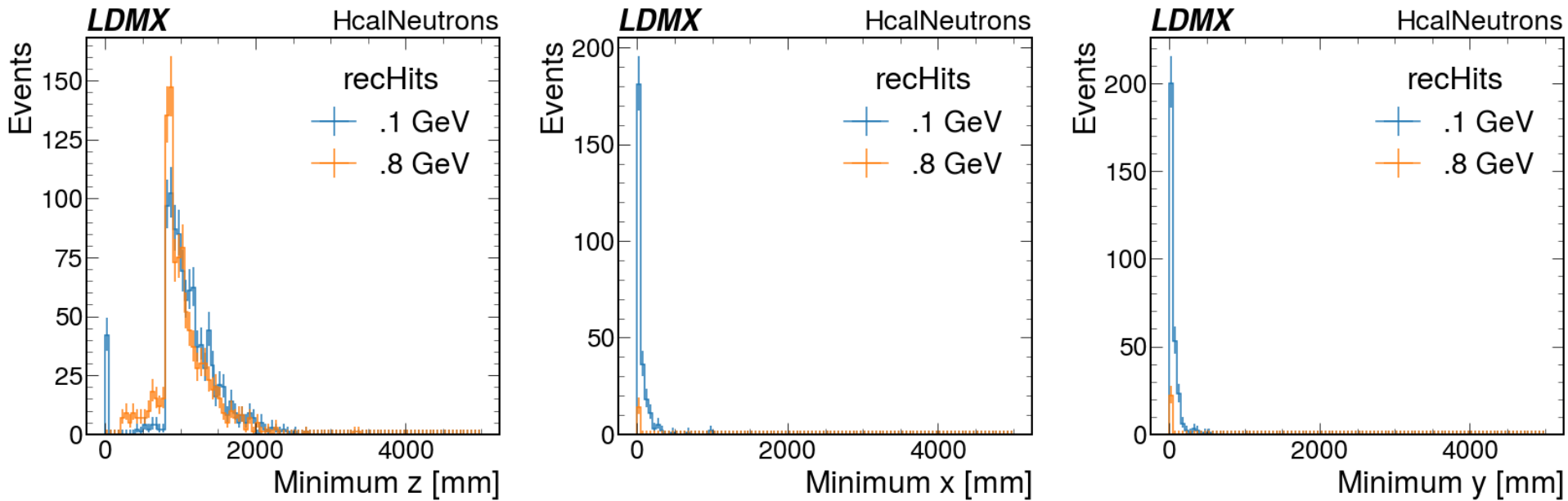


Preliminary Hcal Plots



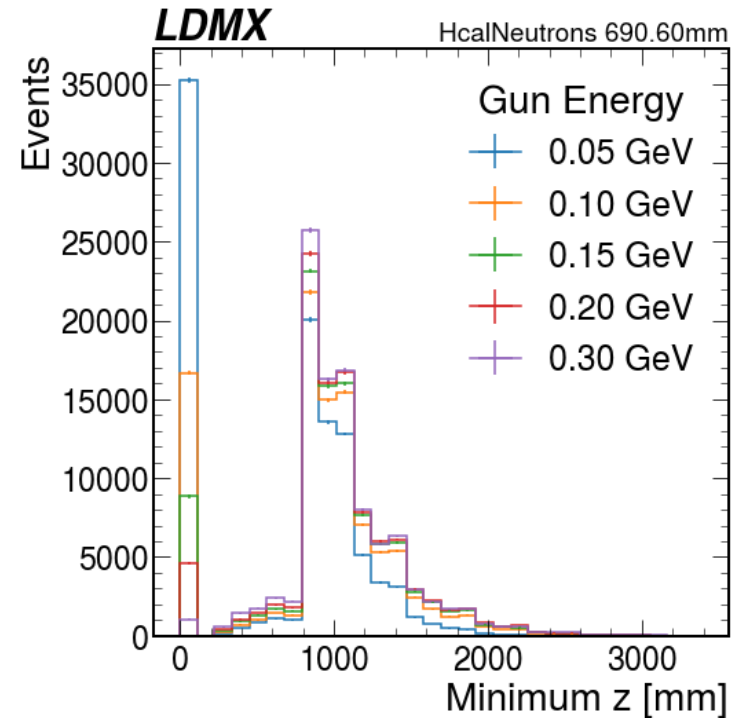
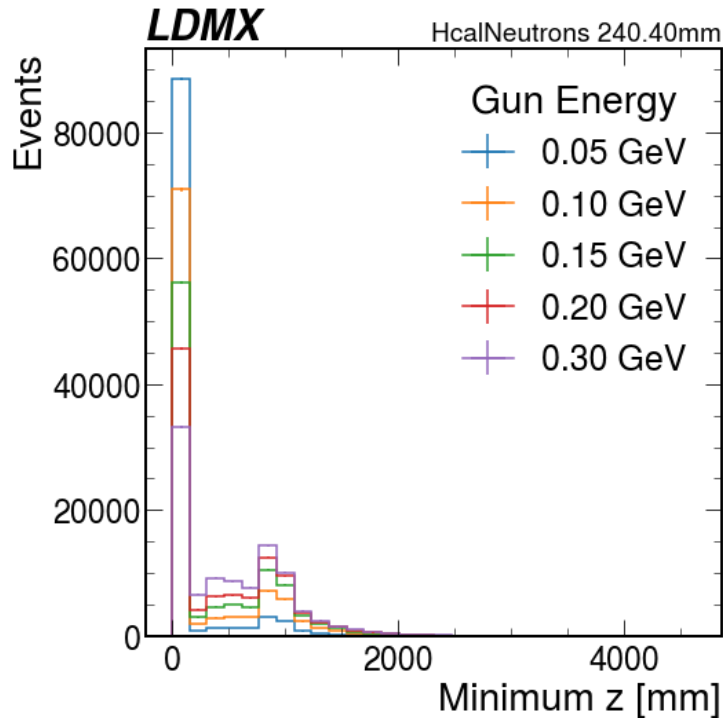
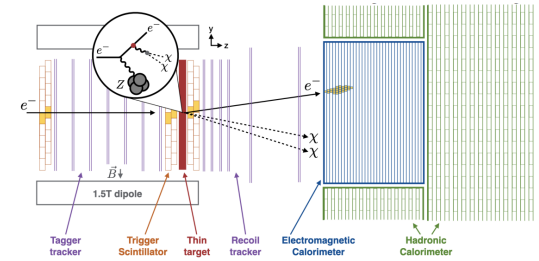
Most events have fewer Rechits!

Preliminary Hcal Plots



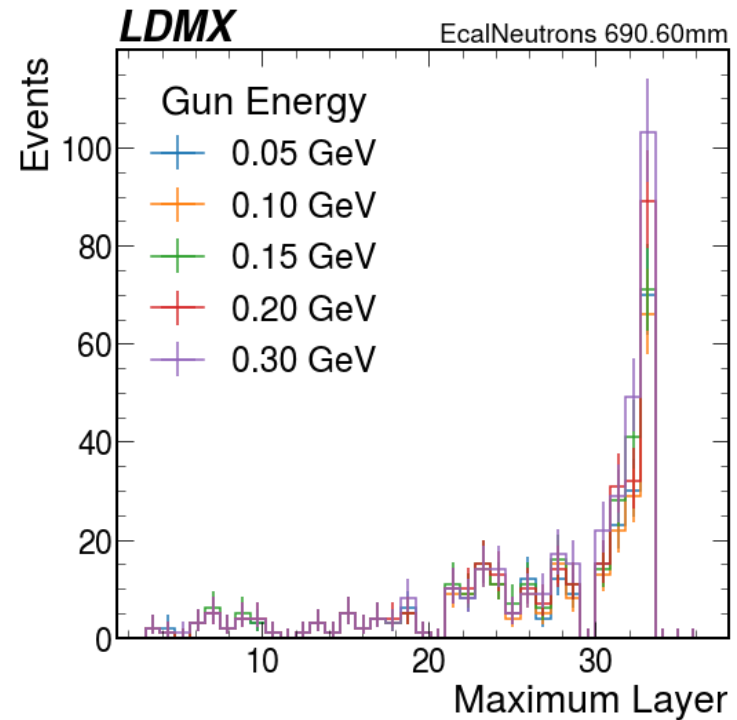
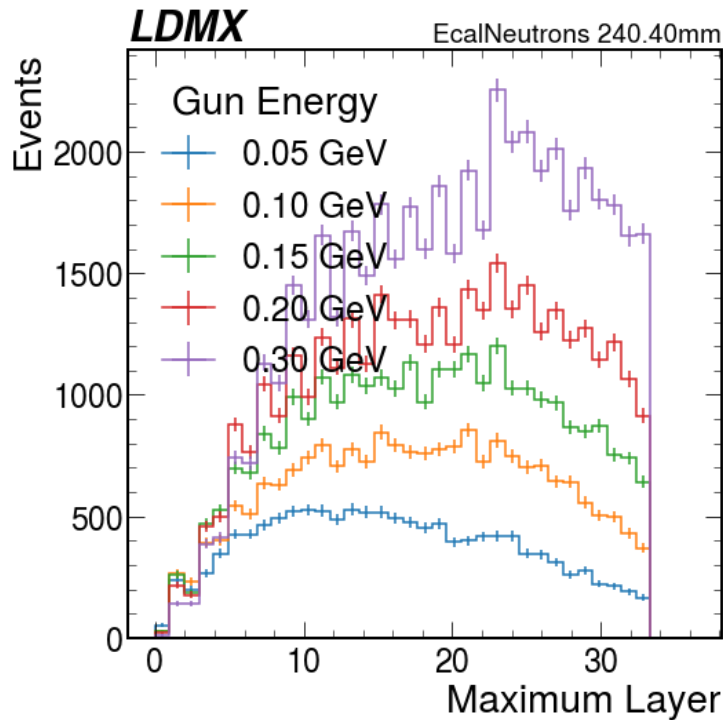
Null events are binned to zero, we want to explore the threshold of detection.

Looking Deeper at Low Energy Min z in the Hcal



As the energy of the gun increases, fewer hits are lost. This trend is the same for both locations, although more hits are lost when the gun is fired from the Ecal.

Checking if Missing Hcal Events are Caught in the Ecal

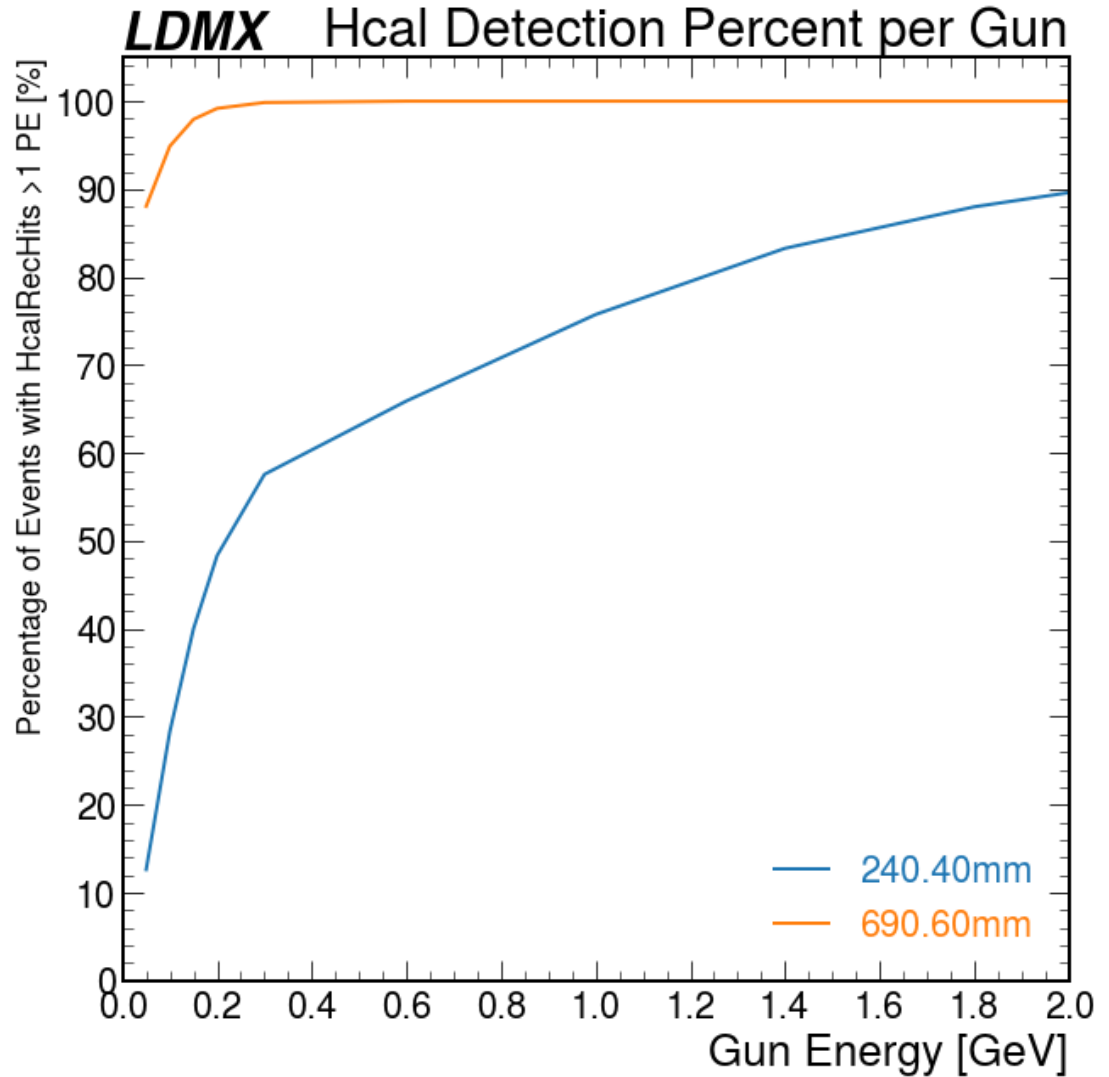


Many hits reach the end of the Ecal, and many are caught. However, looking at the y axis, we can see that many hits are missing.

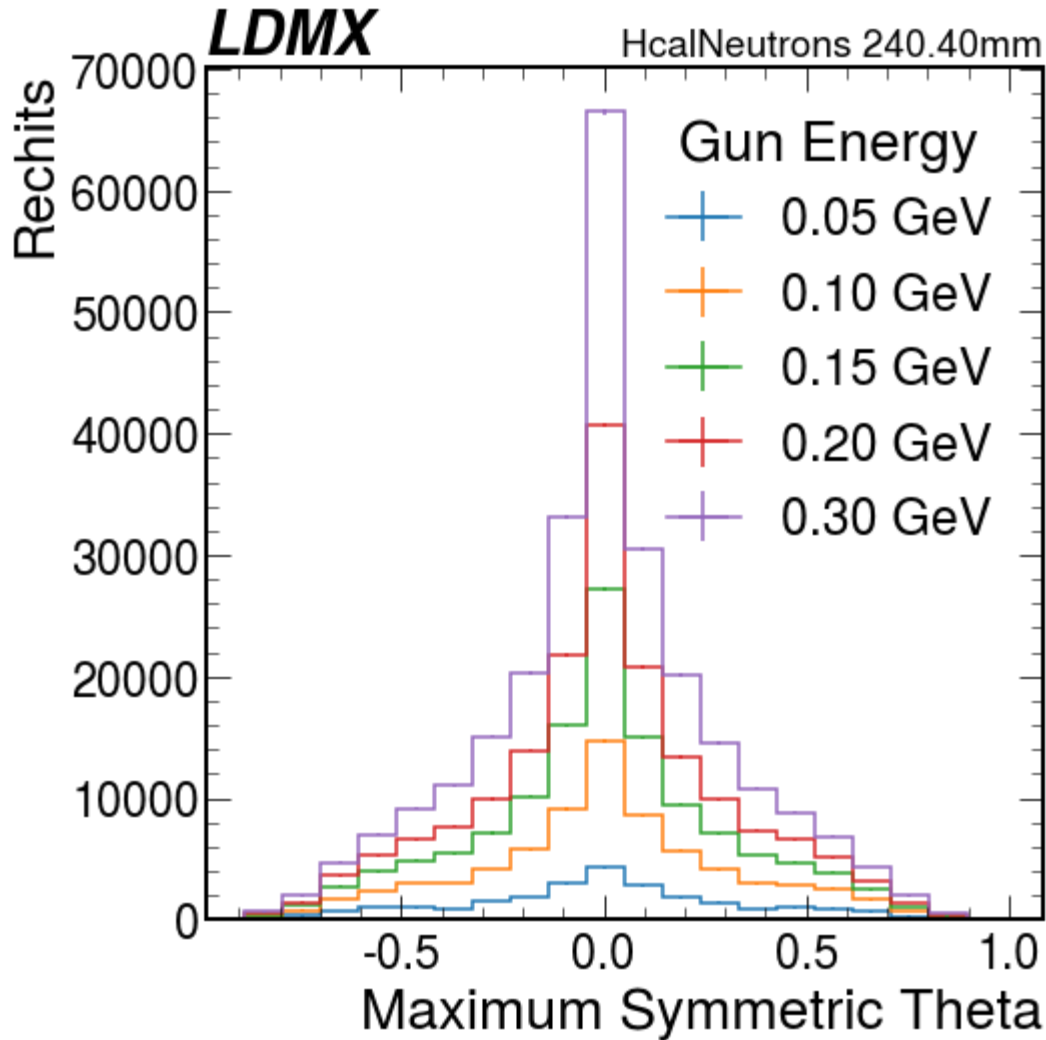
Hcal Detection Percentage

When fired from the Ecal, less than 20% of the low energy neutrons are caught at 0.05GeV.

The detection percentage is much better when fired directly into the Hcal.

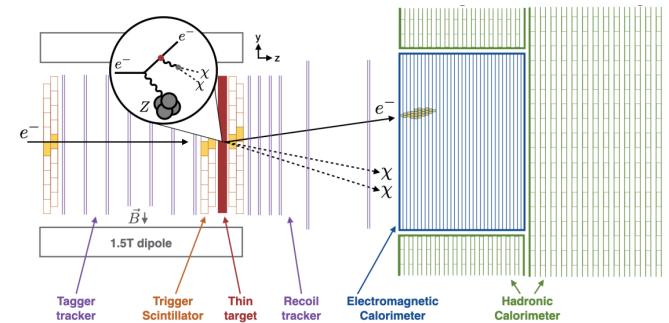


Theta Value Per Hit – Average Neutron Shower Size

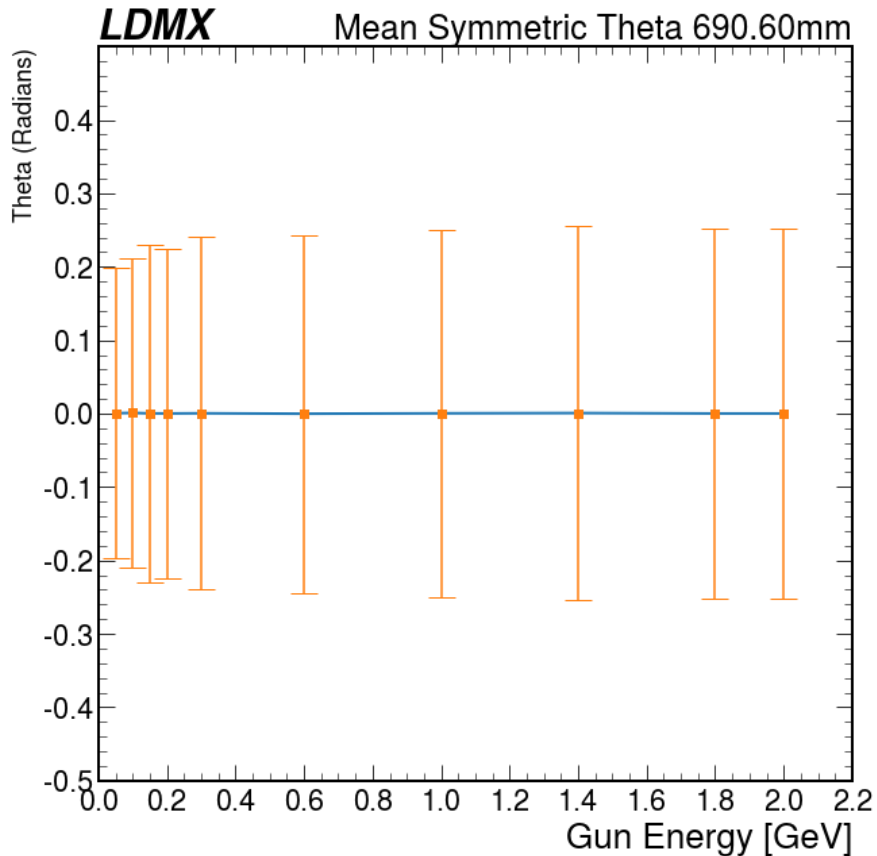


Looking at the spread of the neutron shower shows that the majority of hits occur dead on, with a falling distribution scattered farther away.

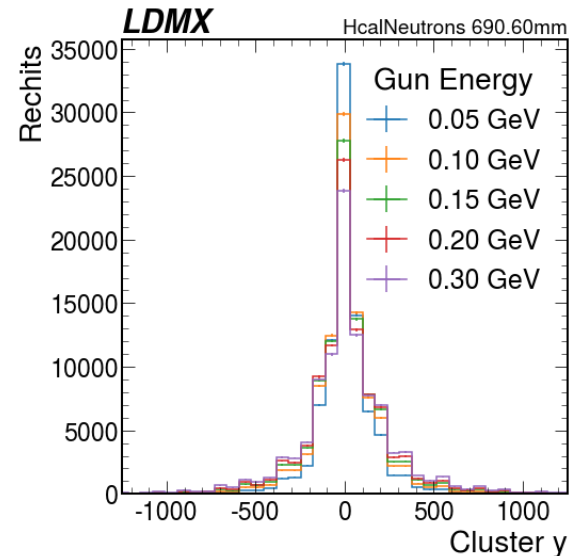
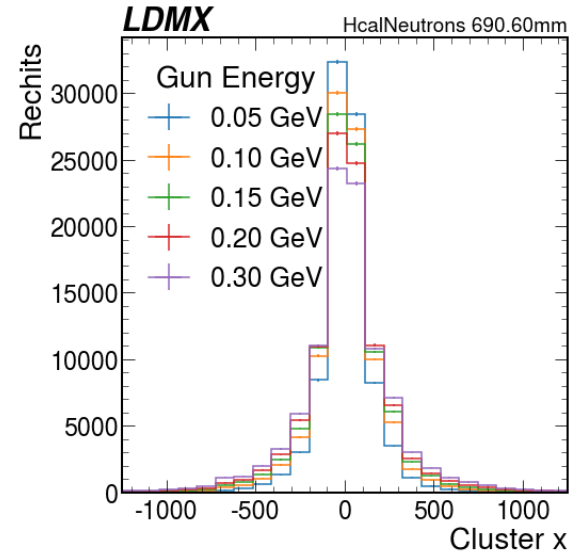
This graph shows the average cluster width as being about 0.5 degrees.



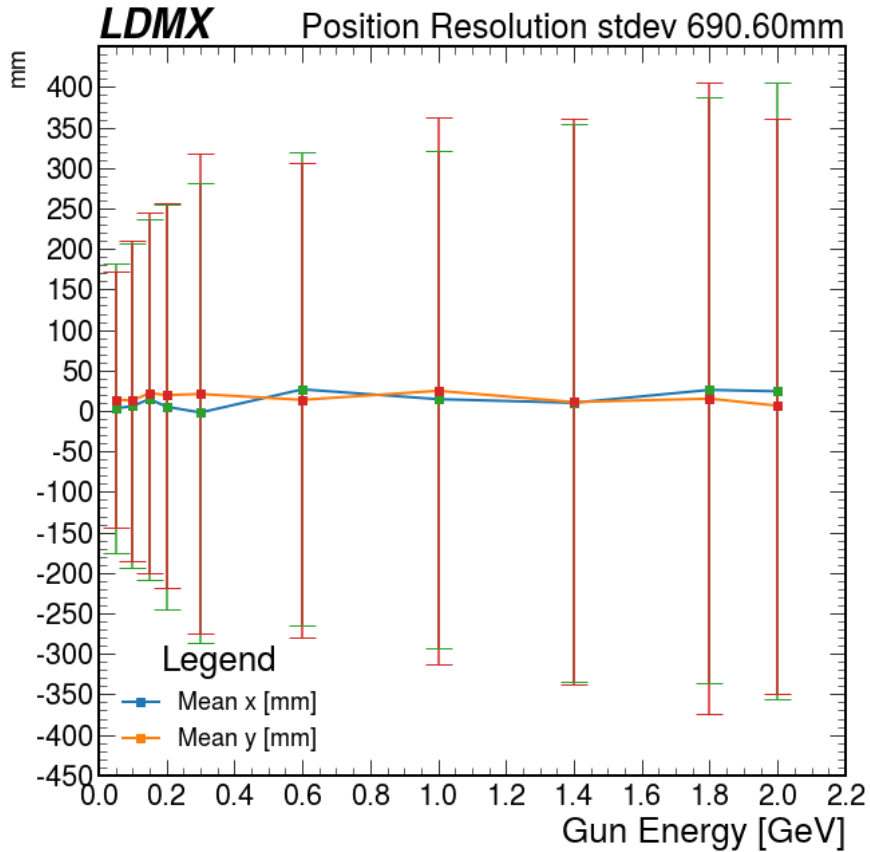
Angular Width



Our angular width seems to be tighter for lower energies. The blue line is the mean and the orange is the standard deviation per gun.



Position Resolution – Also a Bit Funky



The mean and stdev seem to skew slightly positive as energy increases.

Next steps will be to look at clustering methods and see if we can identify low energy neutron clusters.