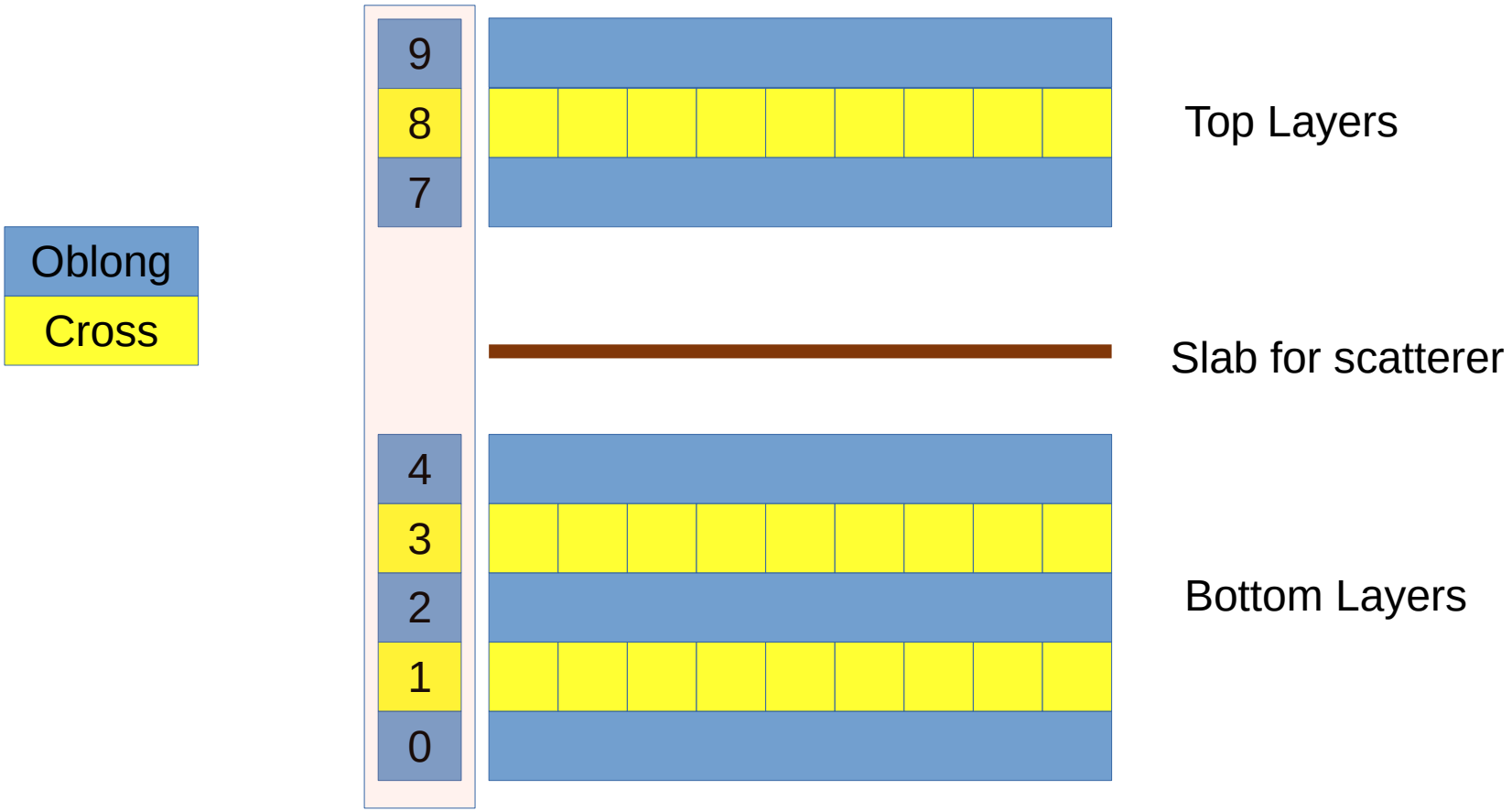
Muon tracks analysis updates

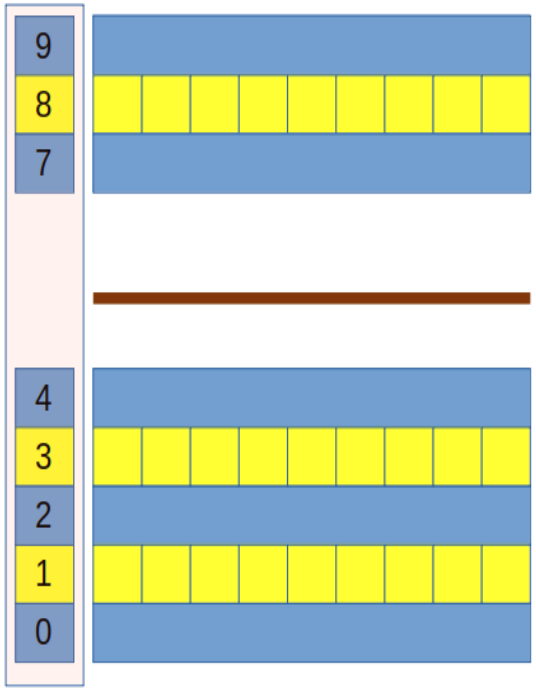
Simple Schematic



Idea : To improve the Hit point estimation in different layers

Previous attempt :

Get the hit coordinate along the axis of scintillator using parameterization.
Hit coordinate in the orthogonal direction was obtained using the layer above and below the inspected layer.
We were able to obtained the nice hit patter along the scintillators in layer 8.
Were not able to get the similar pattern in layer 7 and 9.

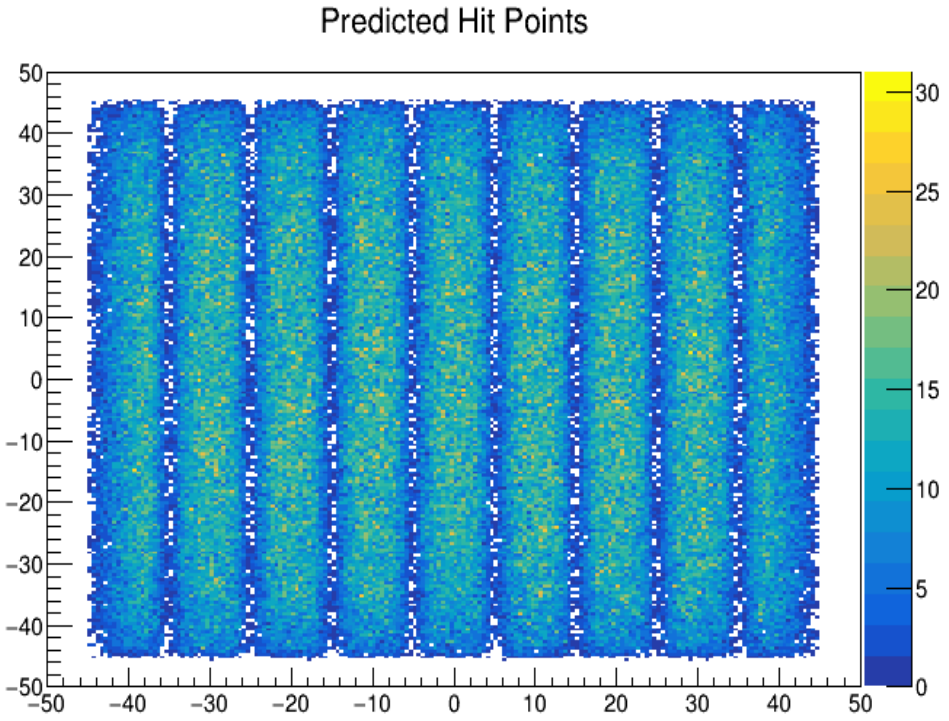


Using Machine Learning

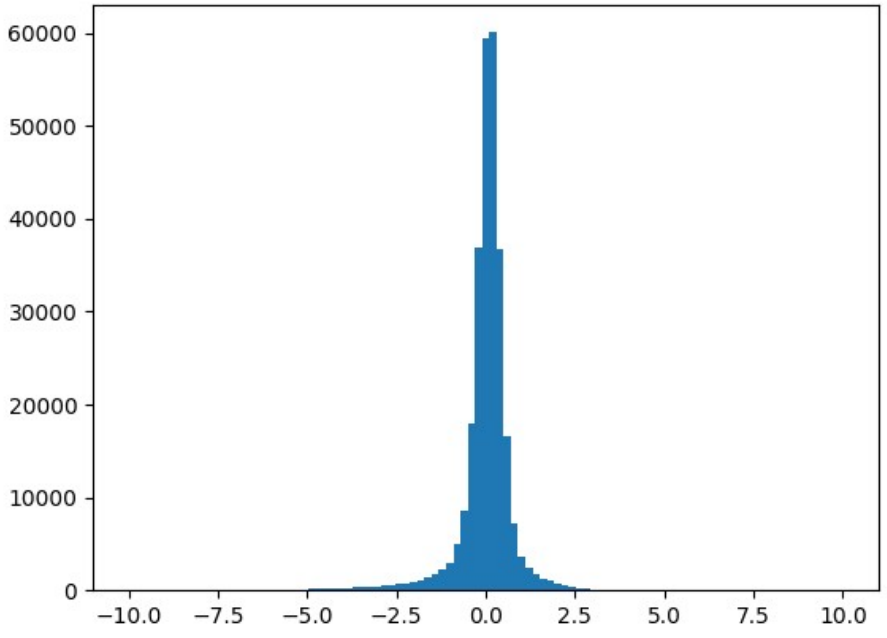
Get the hit coordinate along the axis of scintillator using parameterization.
Hit coordinate in the orthogonal direction is obtained by using a machine learning model, built using the simulated data.
Separated Model for each layer.
On simulated data the prediction were pretty good.
We are now able to see similar pattern in layer 7 & 9

Layer 8

Reconstructed Hit Points and Residual Plot using simulated data



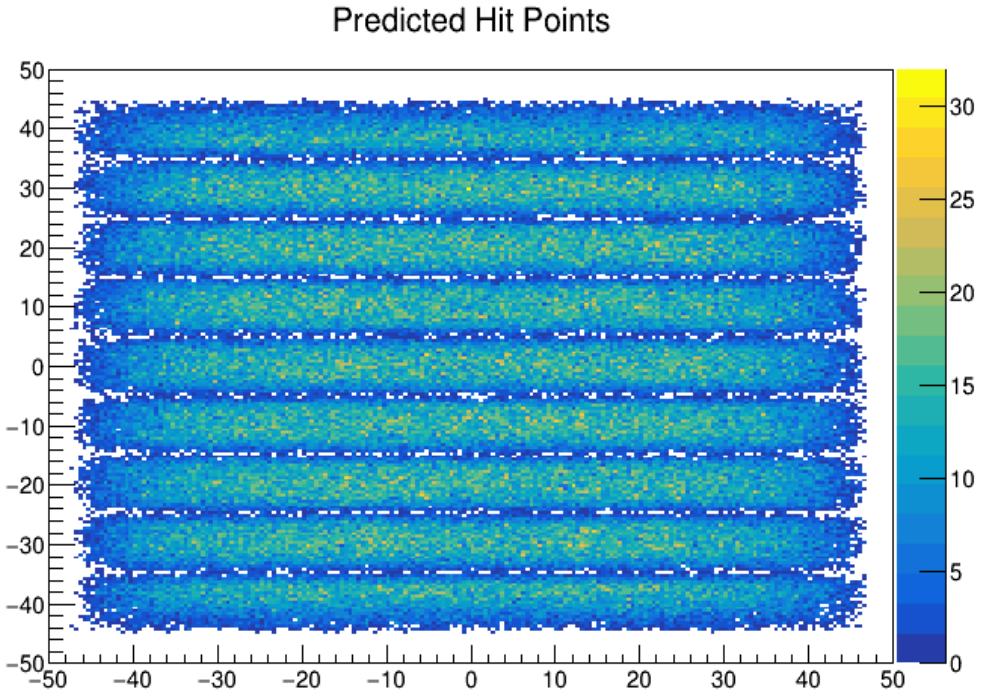
Hit Pattern in Cross Layer



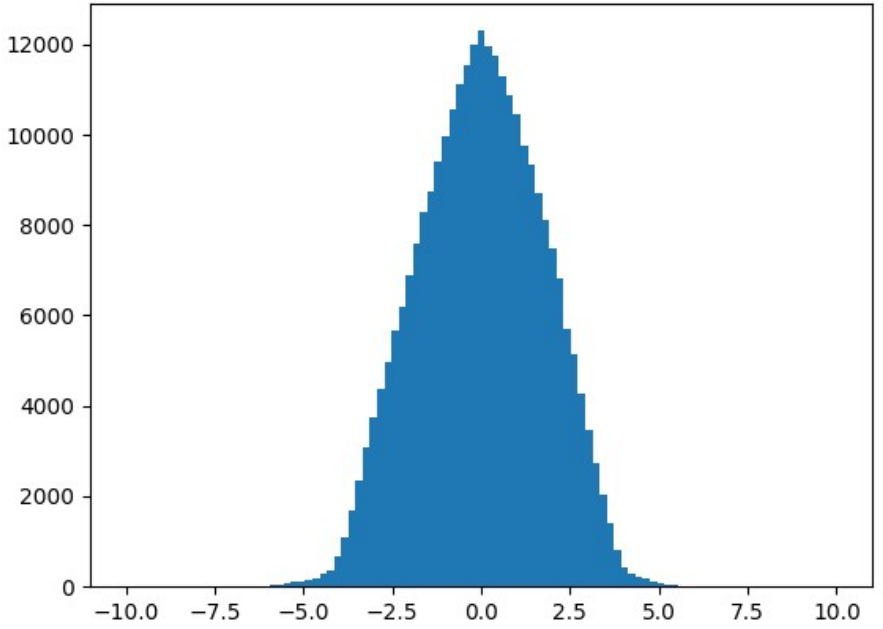
Histogram of Residuals

Layer 9

Reconstructed Hit Points and Residual Plot using simulated data



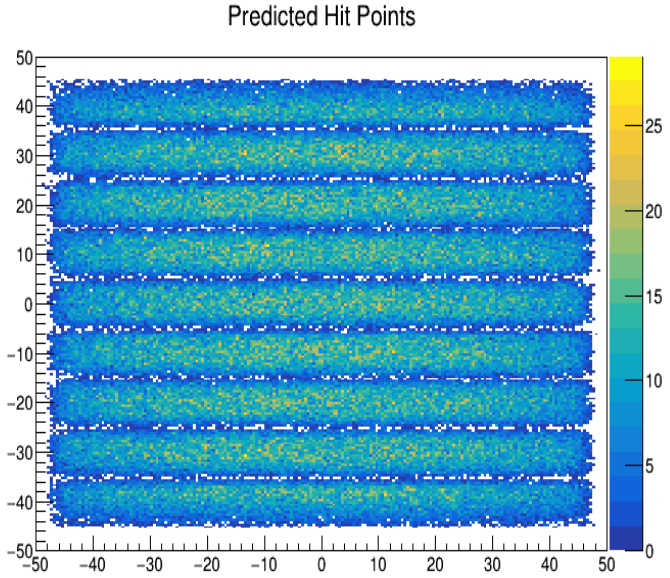
Hit Pattern in Oblong Layer



Histogram of Residuals

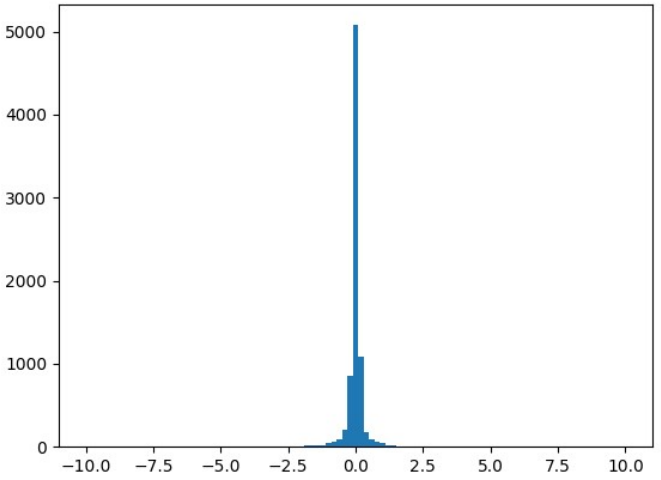
Layer 7

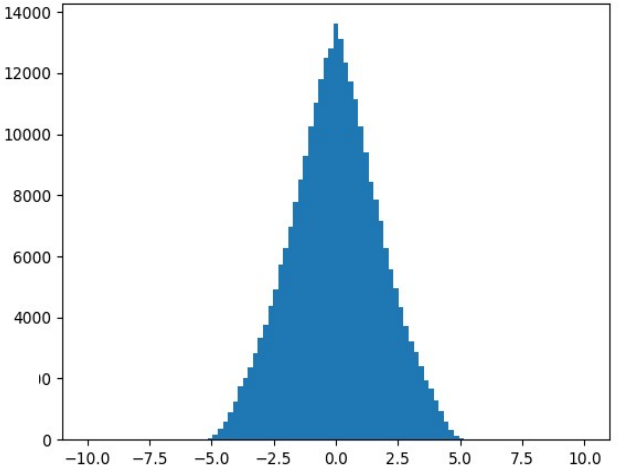
Reconstructed Hit Points and Residual Plot using simulated data



Hit Pattern in Oblong Layer

Histogram of Residuals using layer 8 & 3

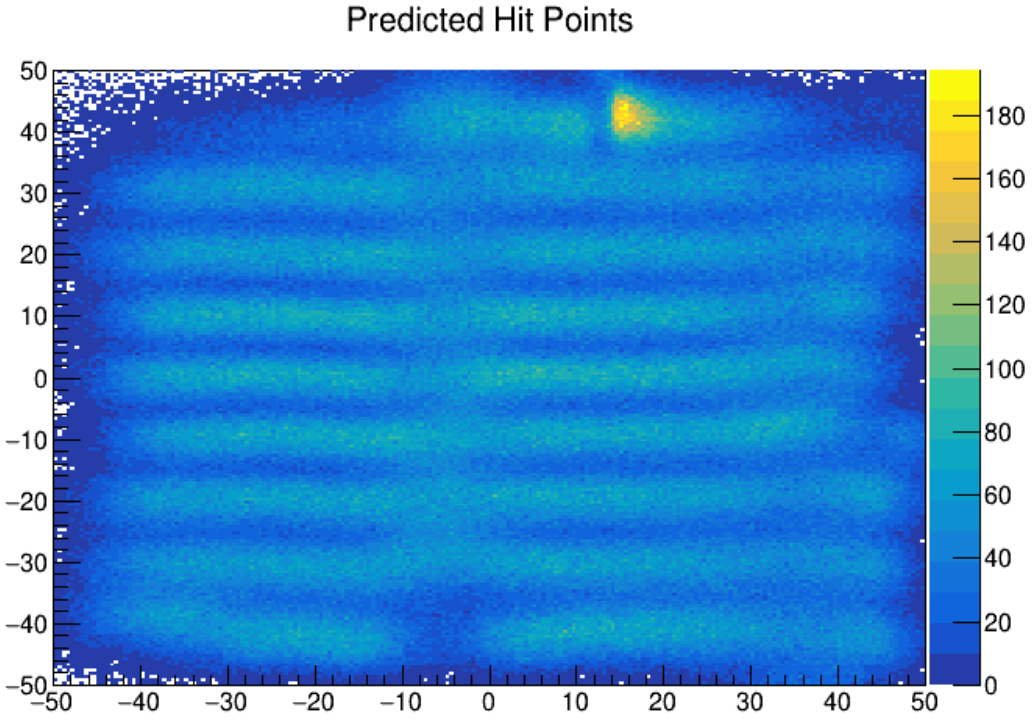




Histogram of Residuals using layer 9 & 8

Layer 9

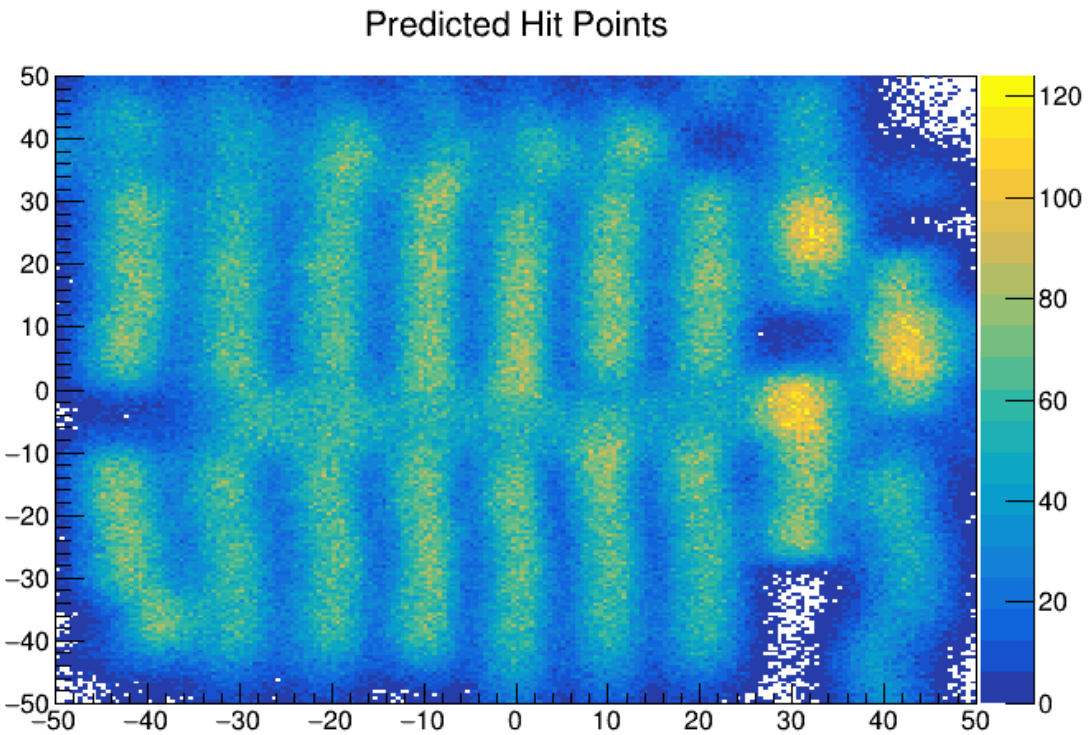
Reconstructed Hit Points using experimental data



Hit Pattern in Oblong Layer

Layer 8

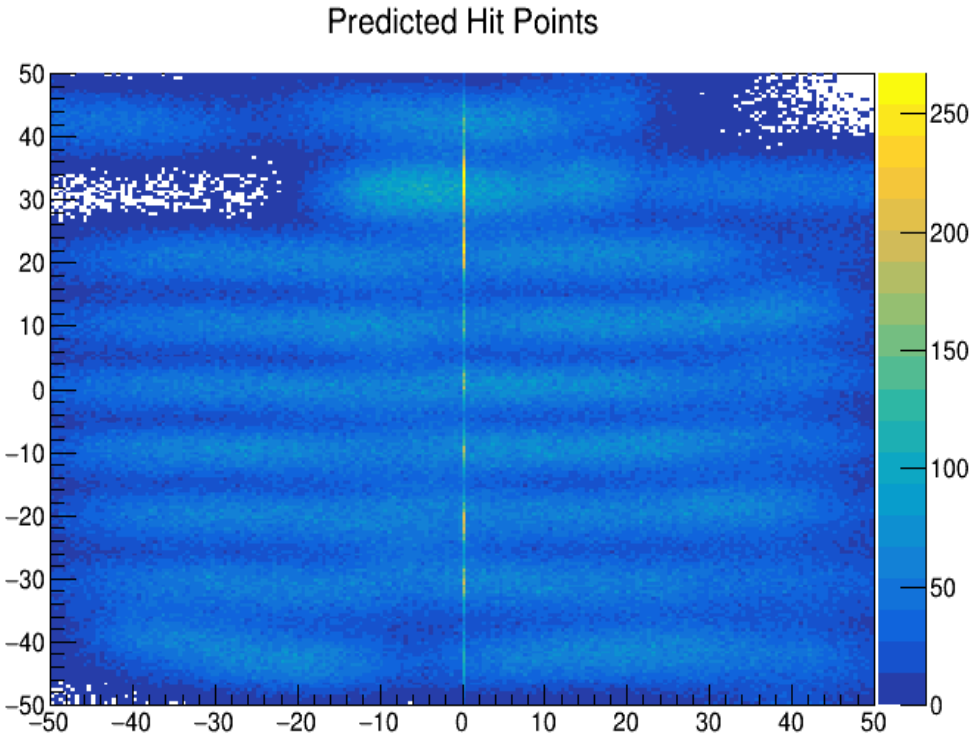
Reconstructed Hit Points using experimental data



Hit Pattern in Cross Layer

Layer 7

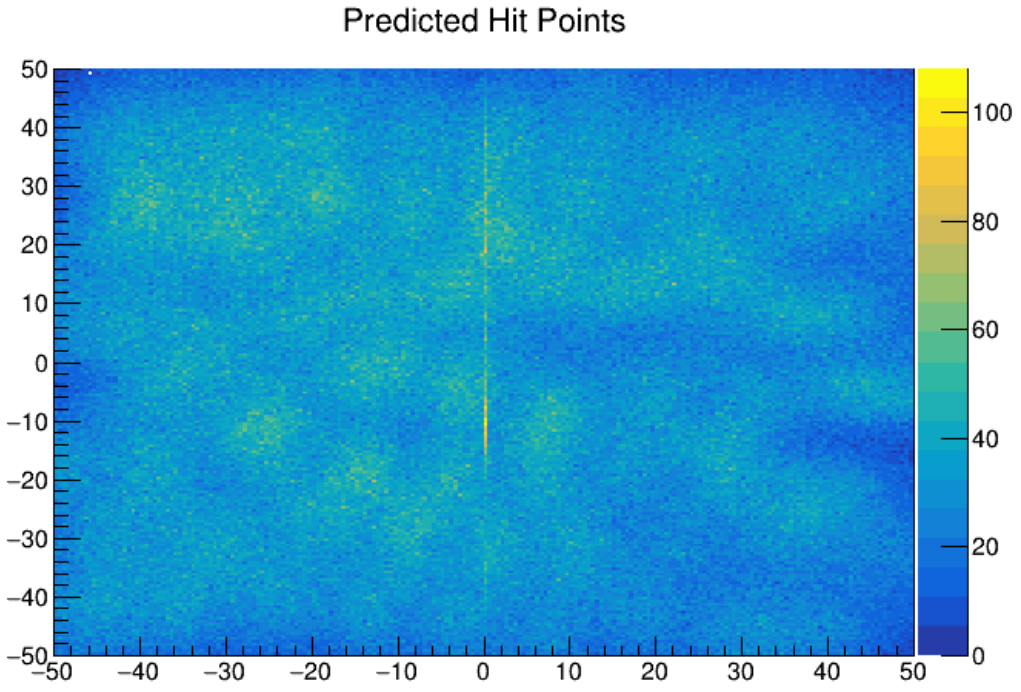
Reconstructed Hit Points using experimental data



Hit Pattern in Oblong Layer

Layer 1

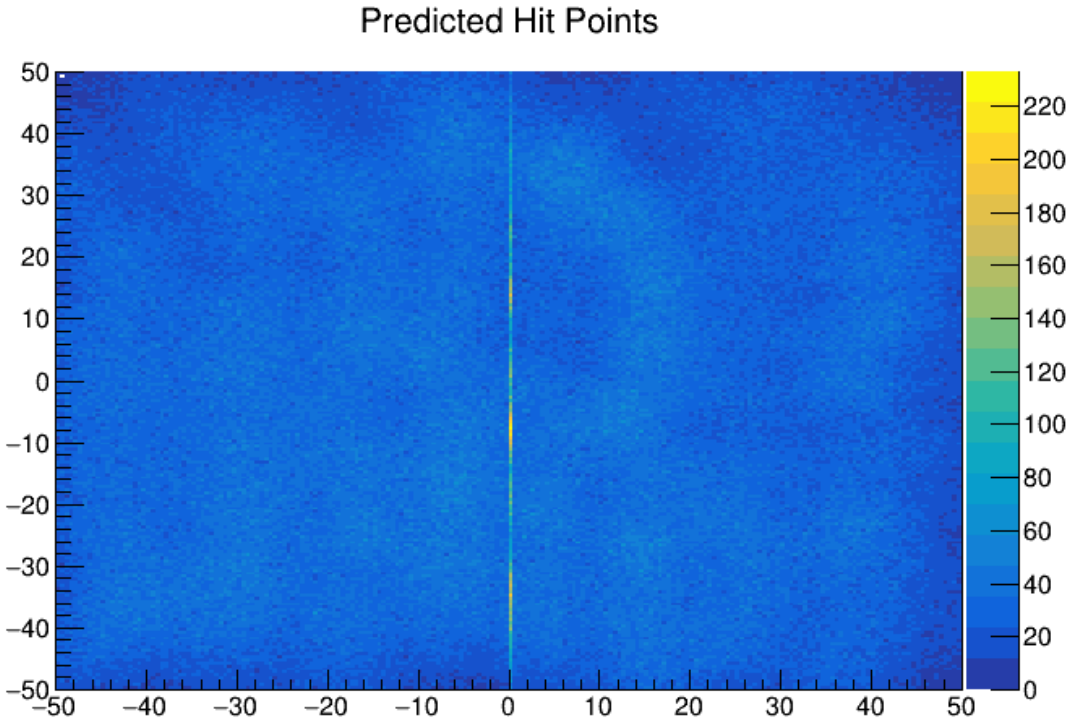
Reconstructed Hit Points using experimental data



Hit Pattern in Cross Layer

Layer 2

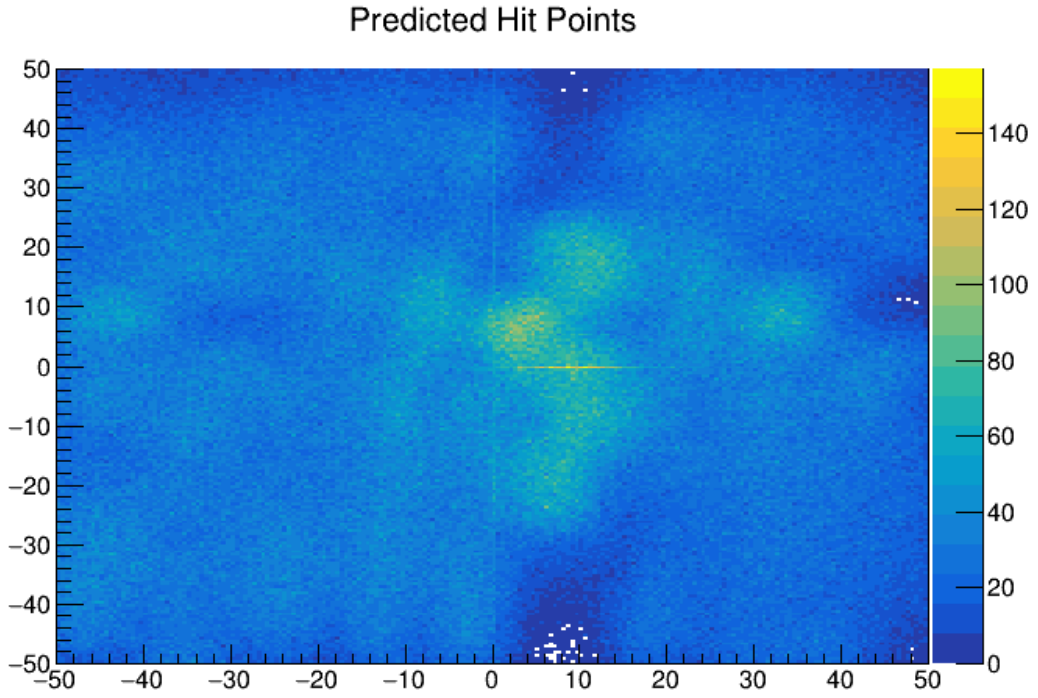
Reconstructed Hit Points using experimental data



Hit Pattern in Oblong Layer

Layer 3

Reconstructed Hit Points using experimental data



Hit Pattern in Cross Layer

Idea : Can we even improve the hit coordinate along the axis itself using ML

Using Machine Learning

Using simulation, build separate model for each scintillator.

Learning features :

DeltaT
Energy depostion
Hit coordinate along axis from simulation

Prediction :

Hit coordinate along axis, using DeltaT and energy deposition.

For this to be done, we need to inject the detector behaviour in the simulations.
(Suggestions ??)