Priming for a Regression CNN for Energy and Vertex of Electrons

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Goals

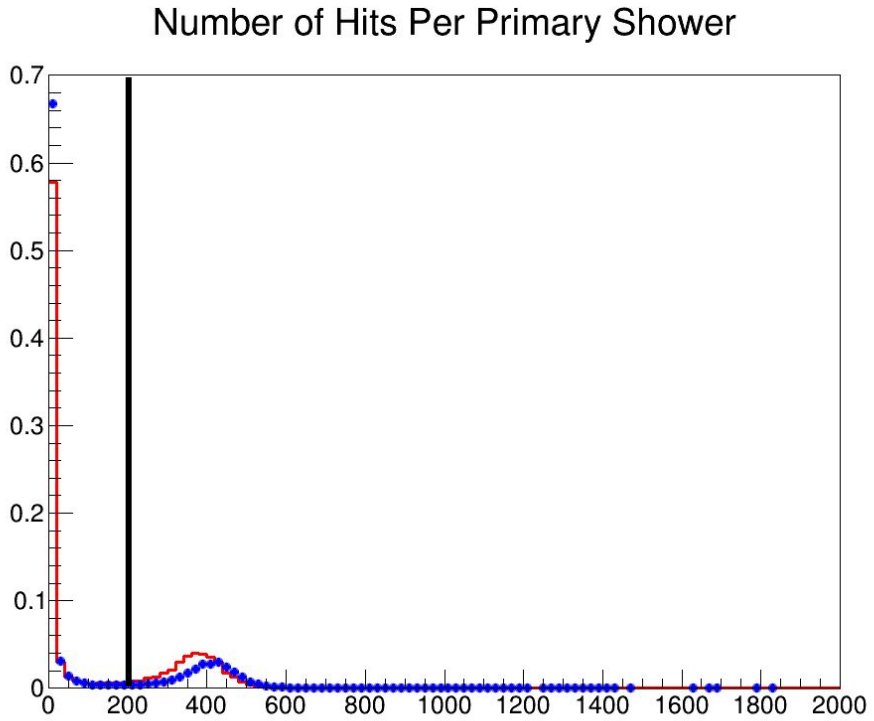
- The long term goal is to make a regression CNN to reconstruct energy and vertex of electrons for ProtoDUNE
- To Prepare for this, we start by doing checks on the basic variables, and compare between MC and data

Checking Basic Variables

- We look at 1 GeV data, from run 5809, and 1 GeV MC (SAM definition “PDSPProd2_MC_1GeV_reco_sce_datadriven”)
- Use dunetpc module “ProtoDUNEelectronAnaTree”
- Make cuts for electrons, complete showers, and reconstructed beam momentum

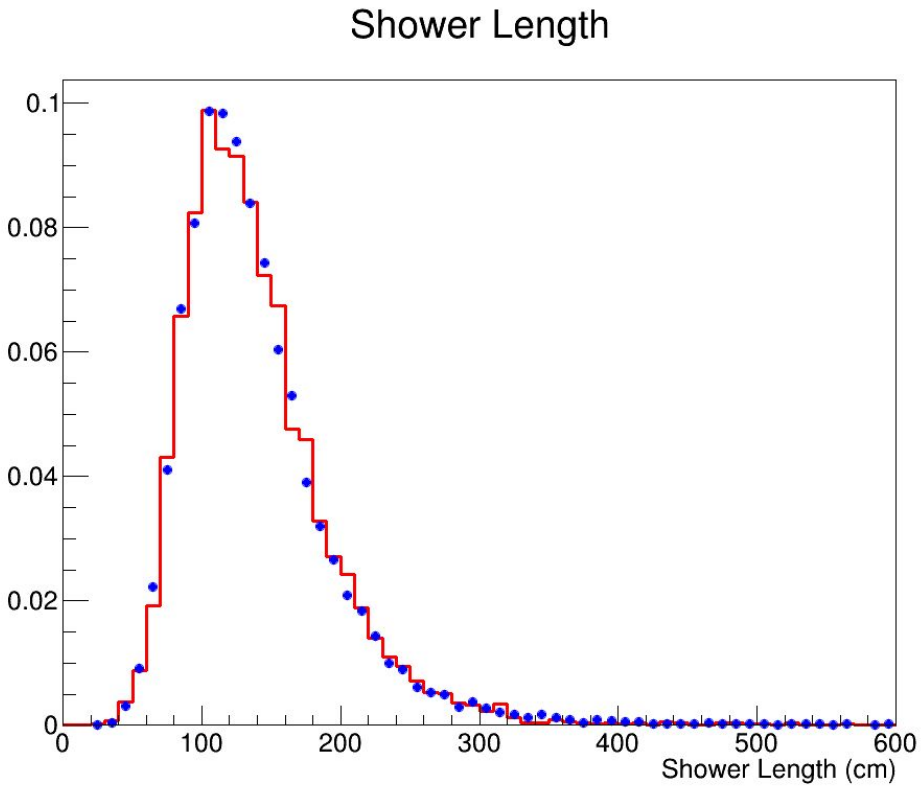
Cutting For Complete Showers...

- We apply a cut on number of hits per shower to remove incomplete showers
- We apply this at 200

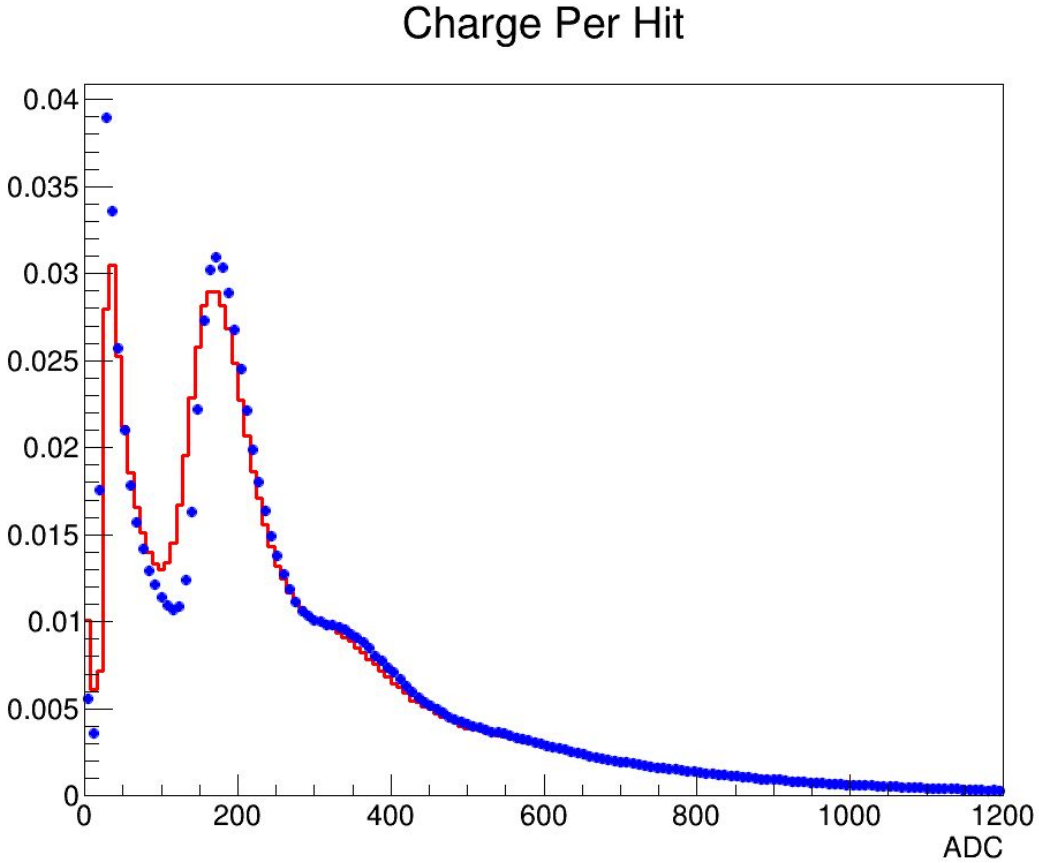


Checking Basic Variables

- Now we can look at our basic variables.
- Red is MC, blue is data

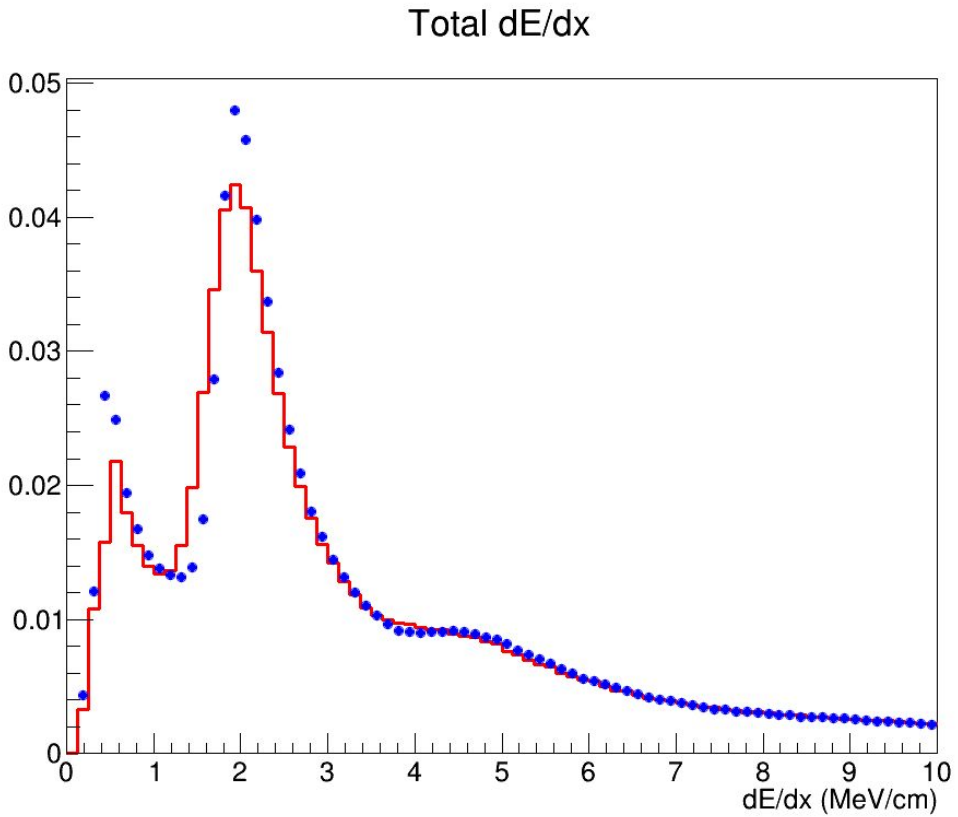


Checking Basic Variables



- This is charge per hit (of primary, complete showers in collection plane)

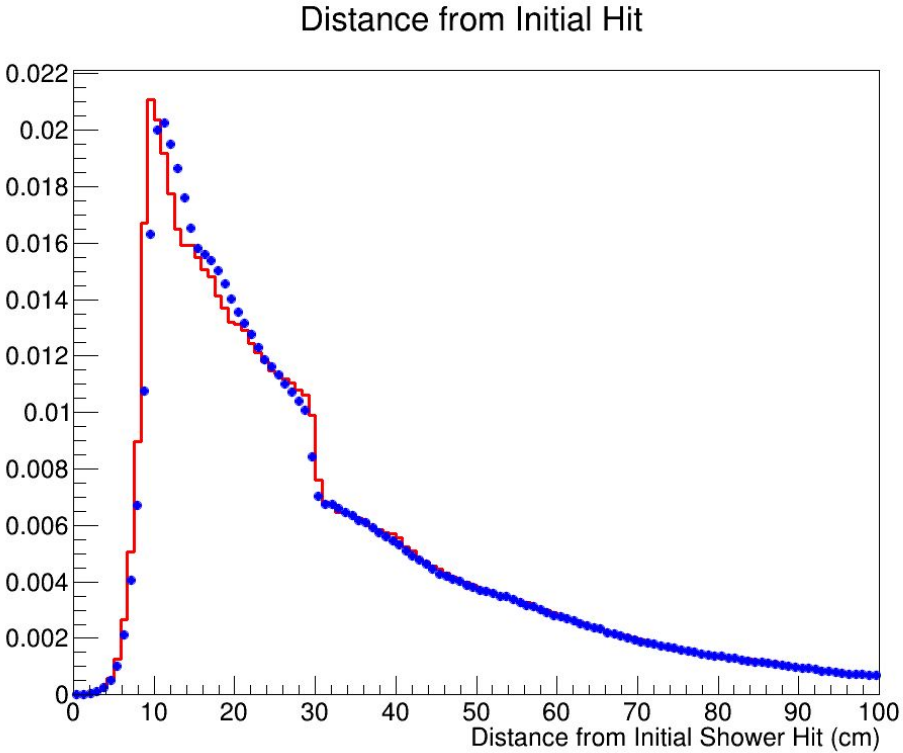
Checking Basic Variables



- Data sees higher peaks than MC for total dE/dx

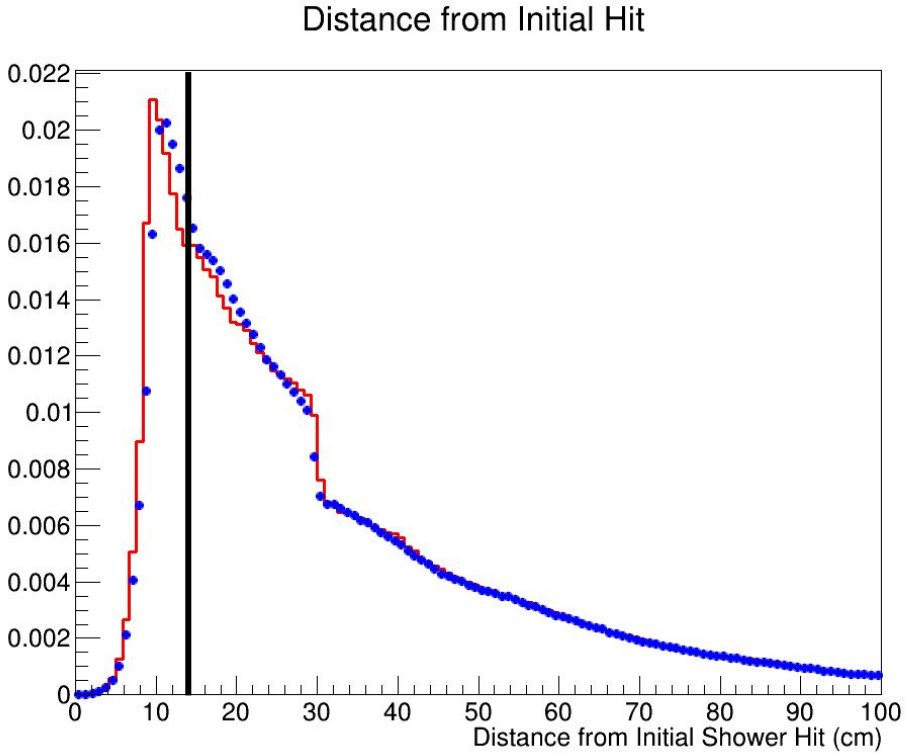
Checking Basic Variables

- We may also want to consider dE/dx in the beginning of the shower
- We look at distance of calorimetry entries from shower start



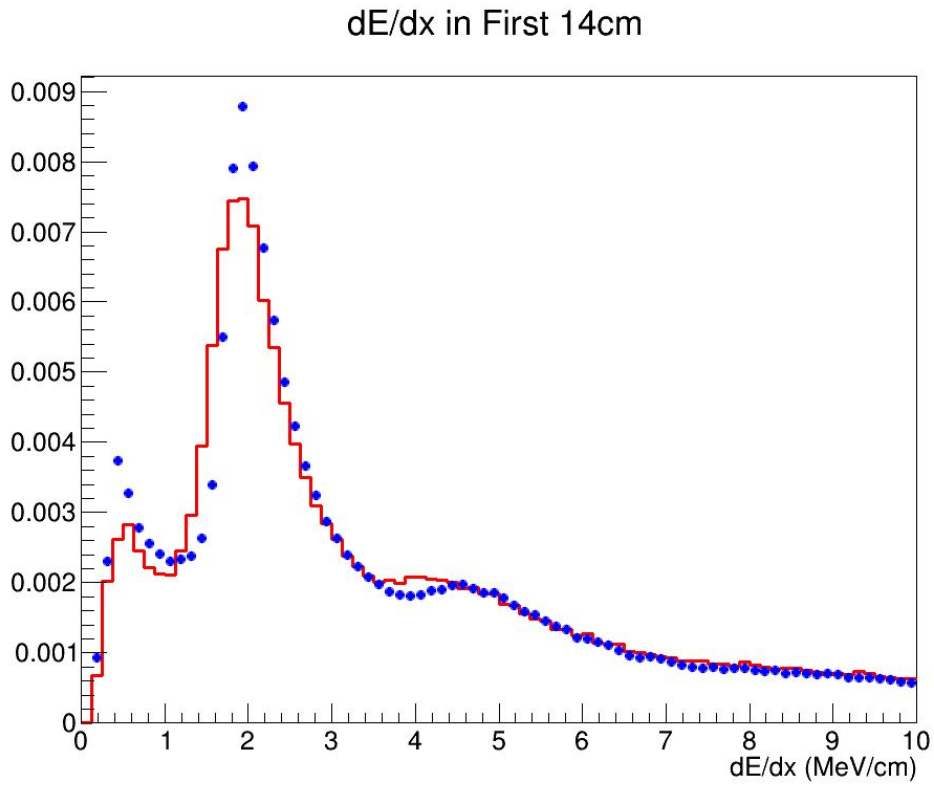
Checking Basic Variables

- We may also want to consider dE/dx in the beginning of the shower
- We look at distance of calorimetry entries from shower start
- We keep only entries under 14cm

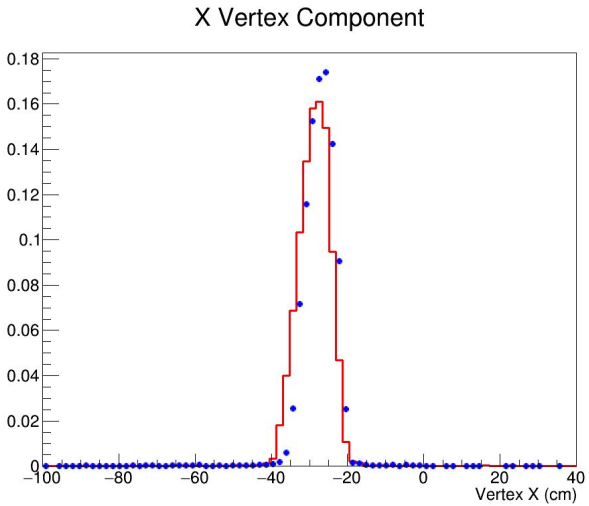


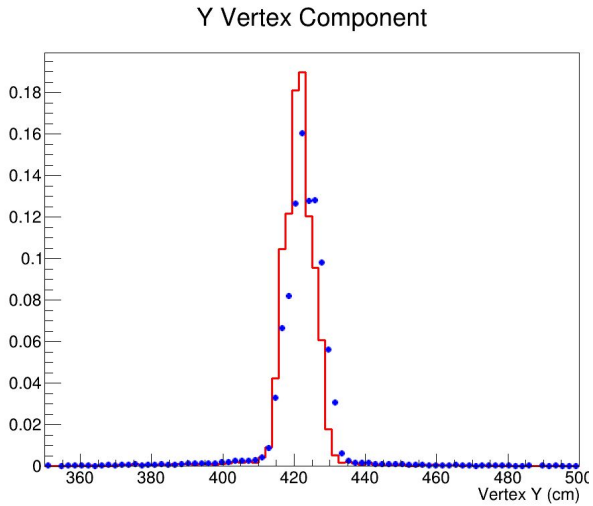
Checking Basic Variables

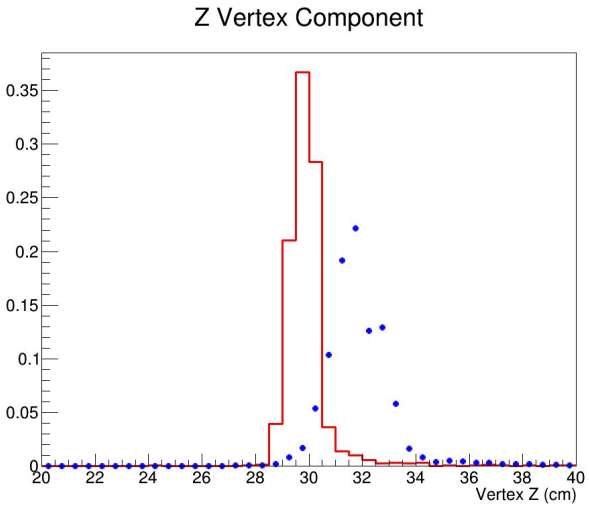
- Now we can see dE/dx at the start of the shower agrees a little less than total dE/dx



Checking Basic Variables







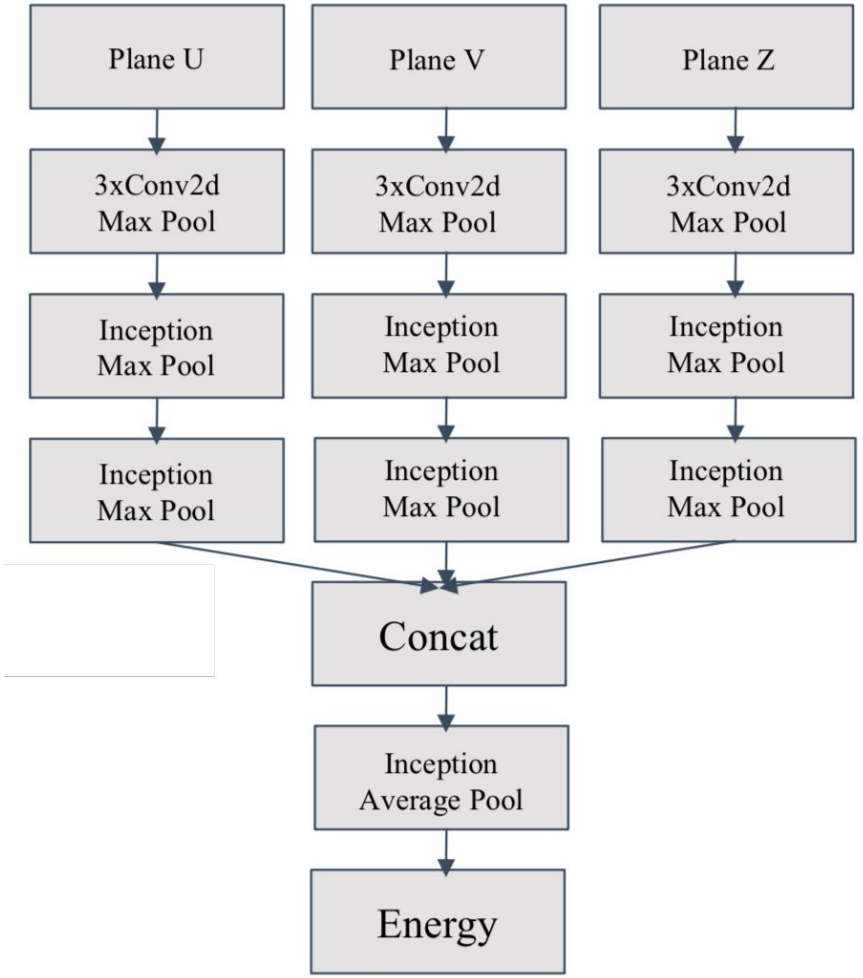
- X and Y vertices are in reasonable agreement, while Z is questionable

Next Steps

- Continue checks on basic variables (understand the differences we see)
- Perform checks on charge distributions over ADC and TDC
- Convert ROOT files of MC to pixelmaps in HDF5 format suitable for input to a CNN

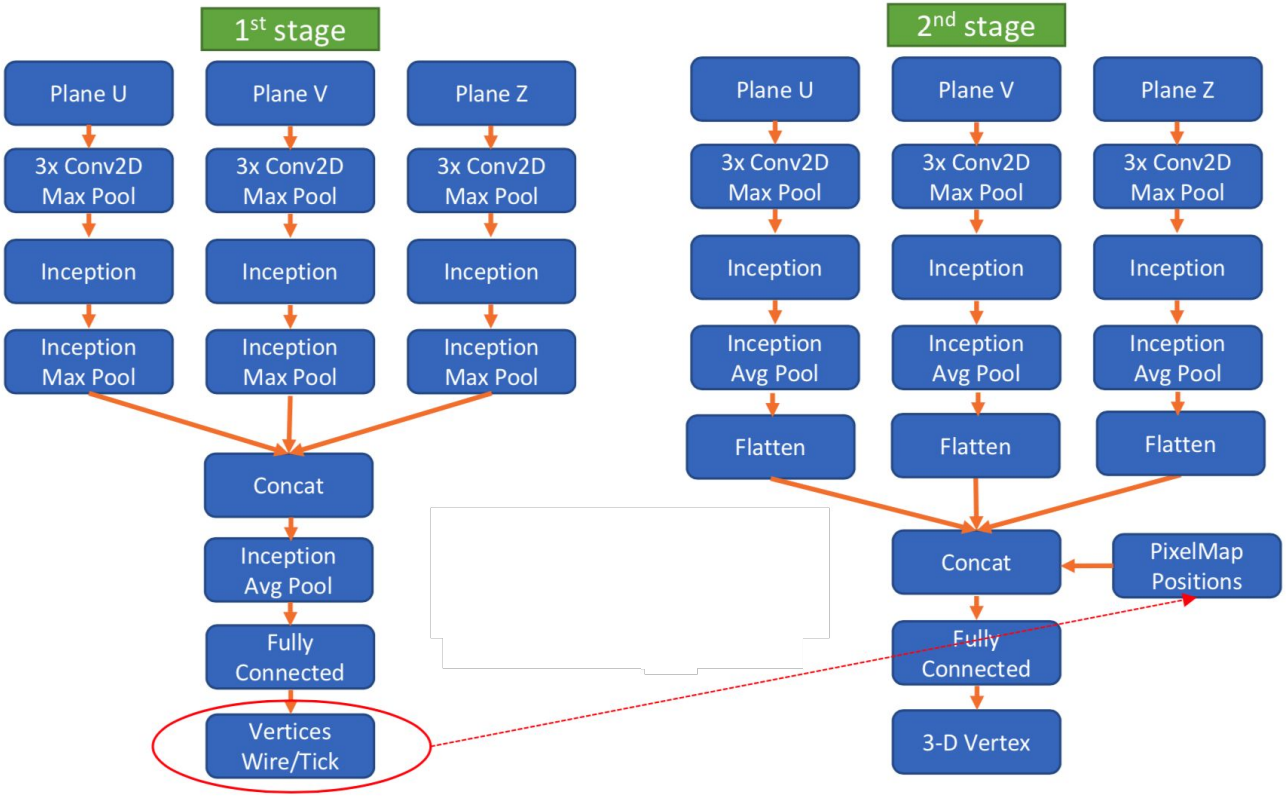
Architecture for Energy

- CNN Architectures for energy and vertex reconstruction designed for DUNE can be adapted for ProtoDUNE



Architecture for Vertex

- For vertex, a 2 stage network is used
- First stage feeds cropped pixelmap to second stage



Conclusions

- I have began a check of calibration, lifetime corrections, etc to validate basic variables
- After a satisfactory conclusion of this, we can began converting MC to pixelmap data to train CNNs adapted from existing, proven CNN architectures

The End