



Sparse Segmentation

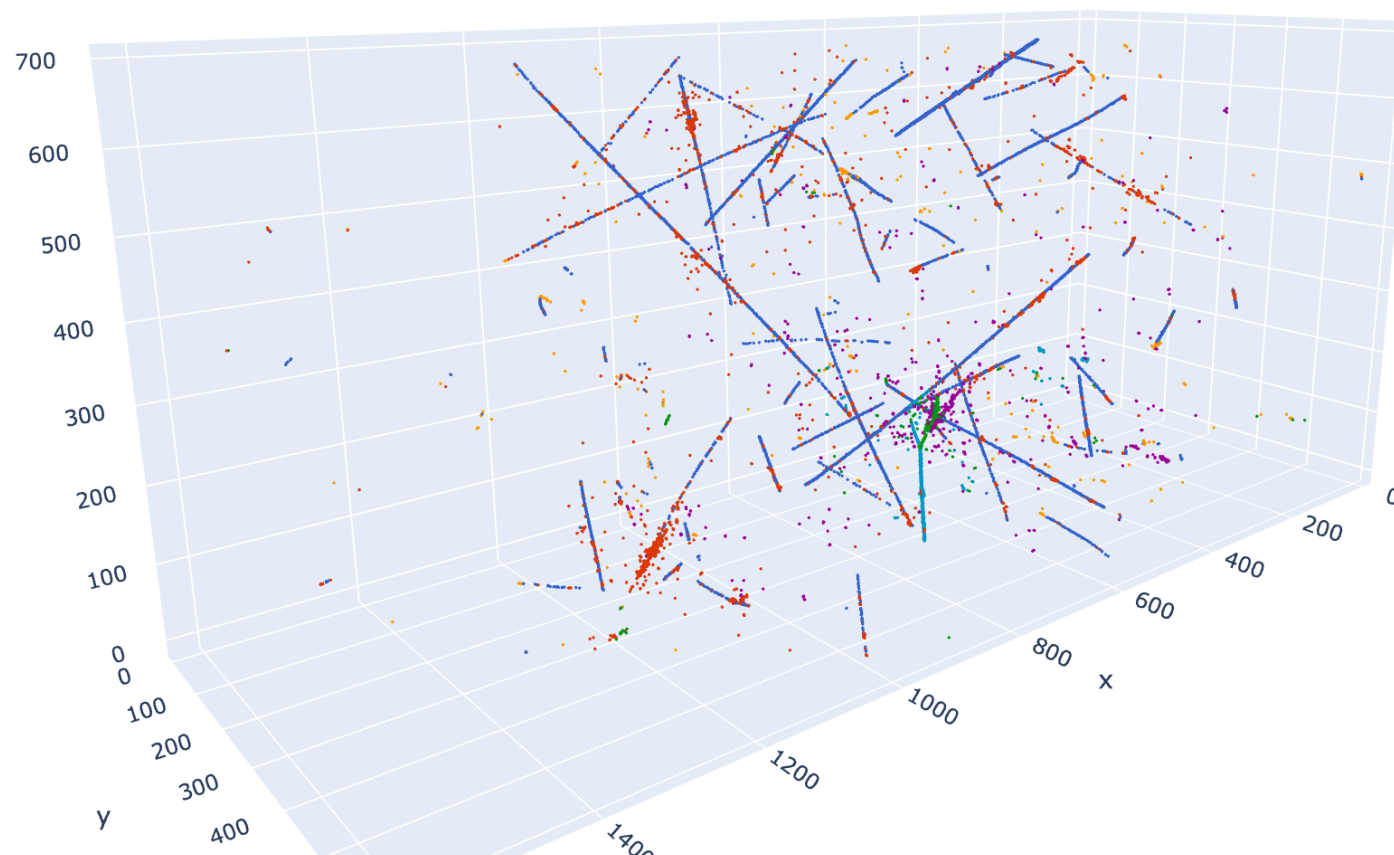
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6th July 2020
FD Sim/Reco Meeting

Outline

- Definition of the ground truth
- Results
- Summary

Semantic Segmentation

- Apply sparse CNNs for the task of semantic segmentation at a pixel level in ProtoDUNE



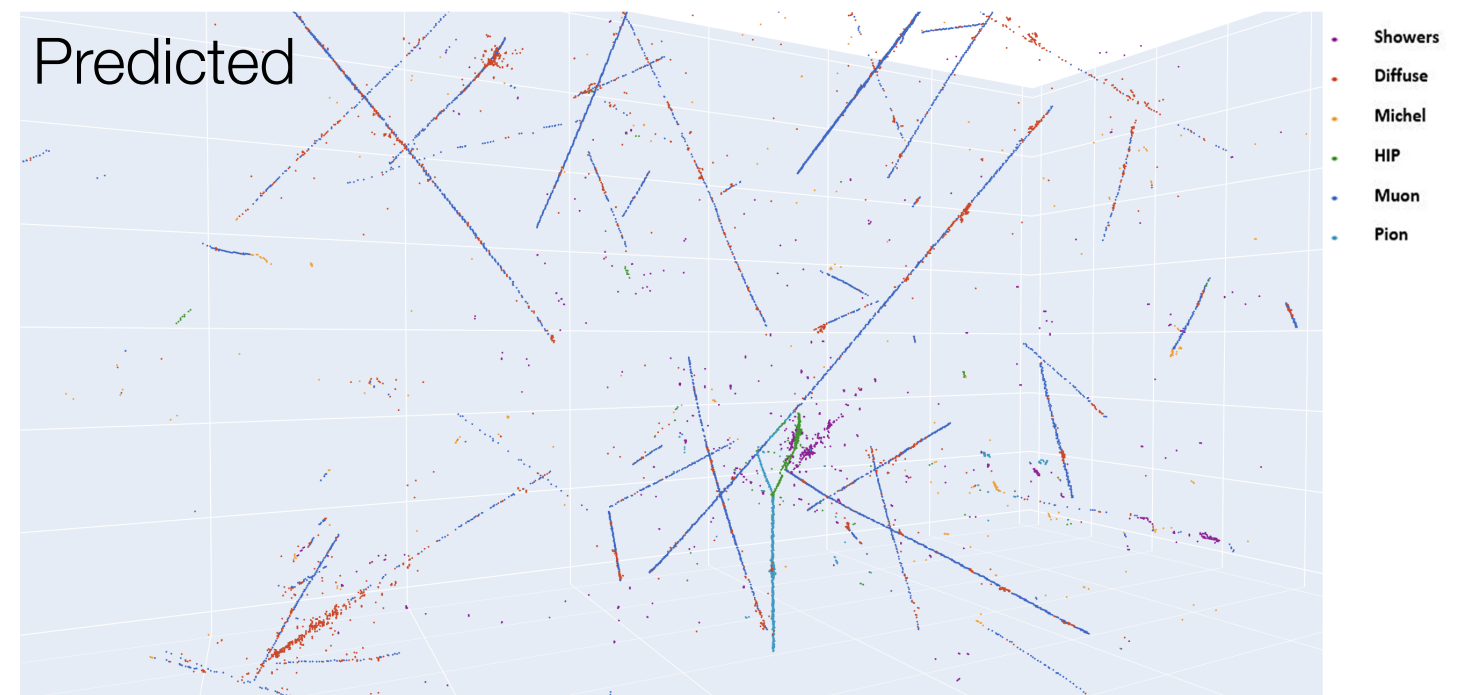
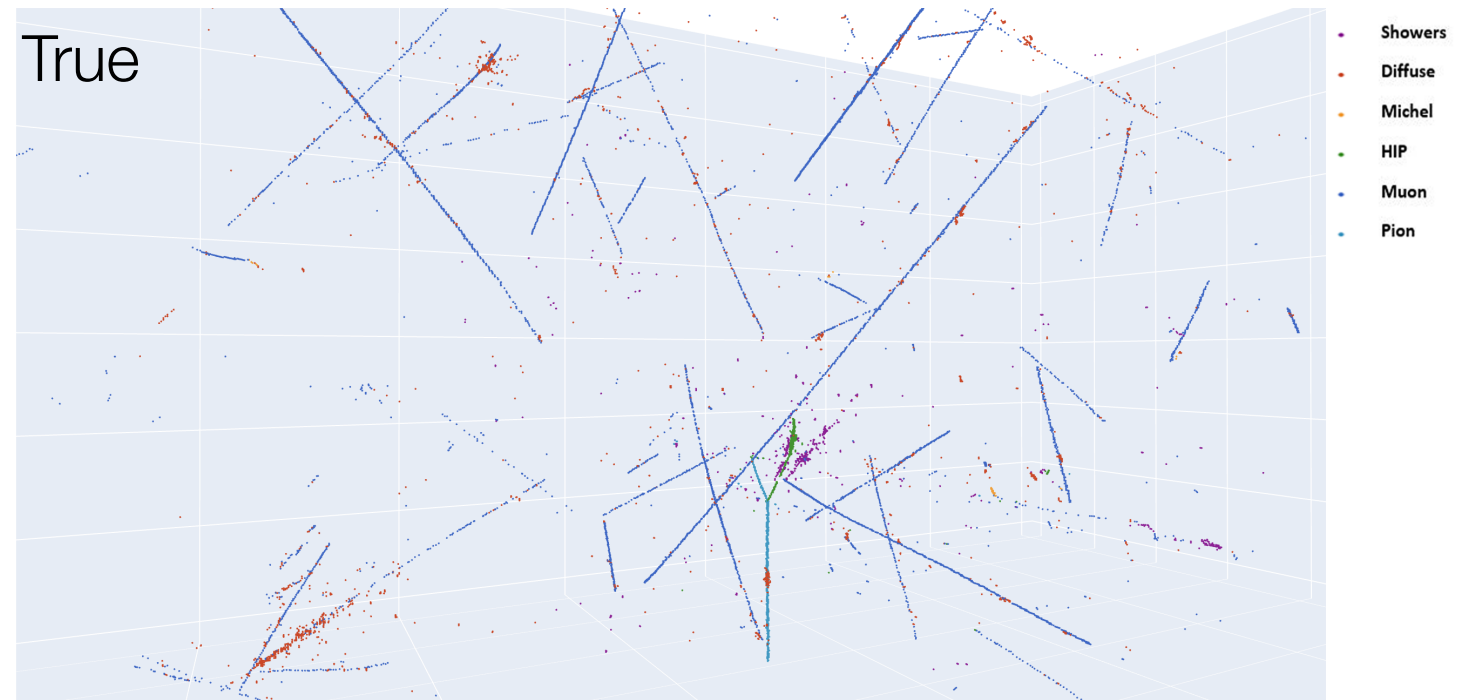
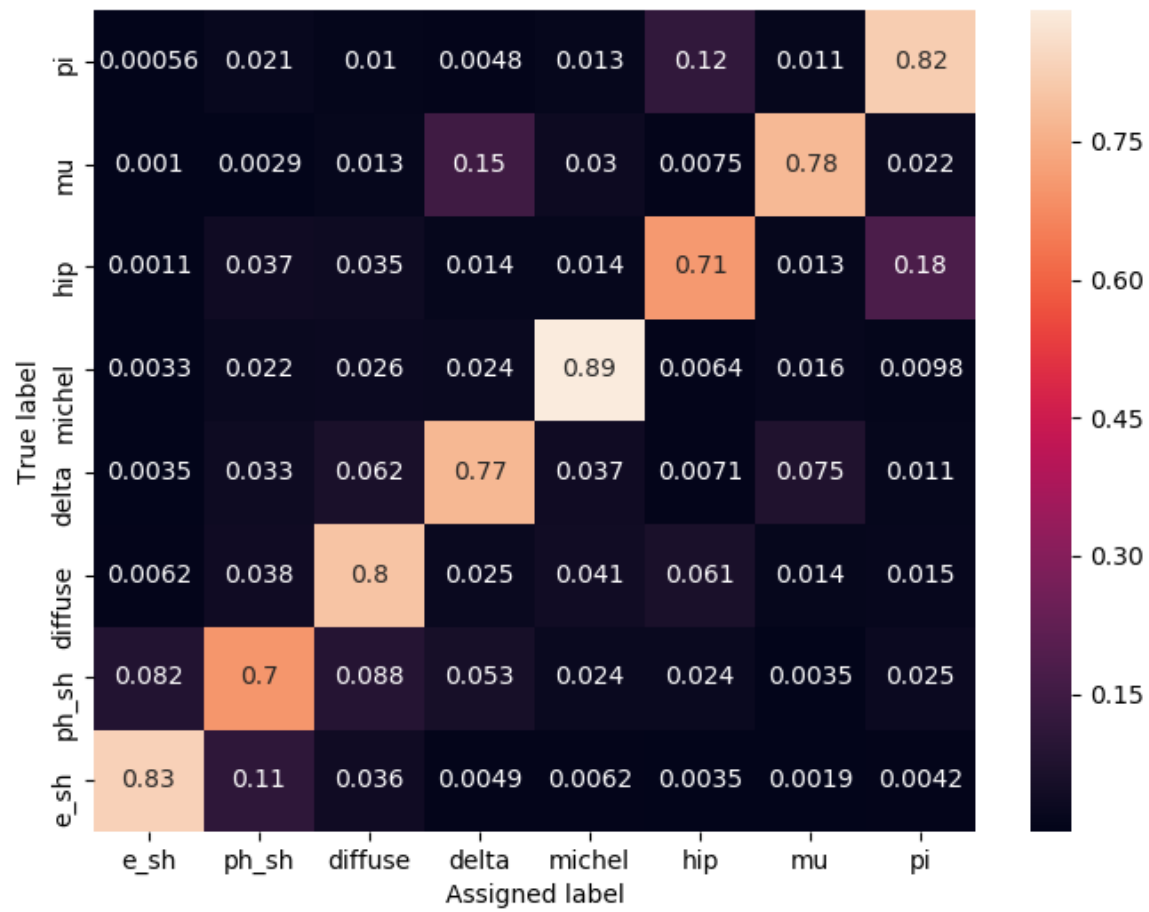
Ground Truth

- Classify each pixel into 8 different classes using information from the underlying simulation
 - **Muons**
 - **Pions**
 - **HIP** → **Protons, kaons & nuclei**
 - **Showers** → **Photons and e^-**
 - **Michel electrons**
 - **Diffuse Activity**
 - Record the fraction of energy deposited by each class per pixel
 - <https://indico.fnal.gov/event/20144/session/17/contribution/93/material/slides/0.pdf>

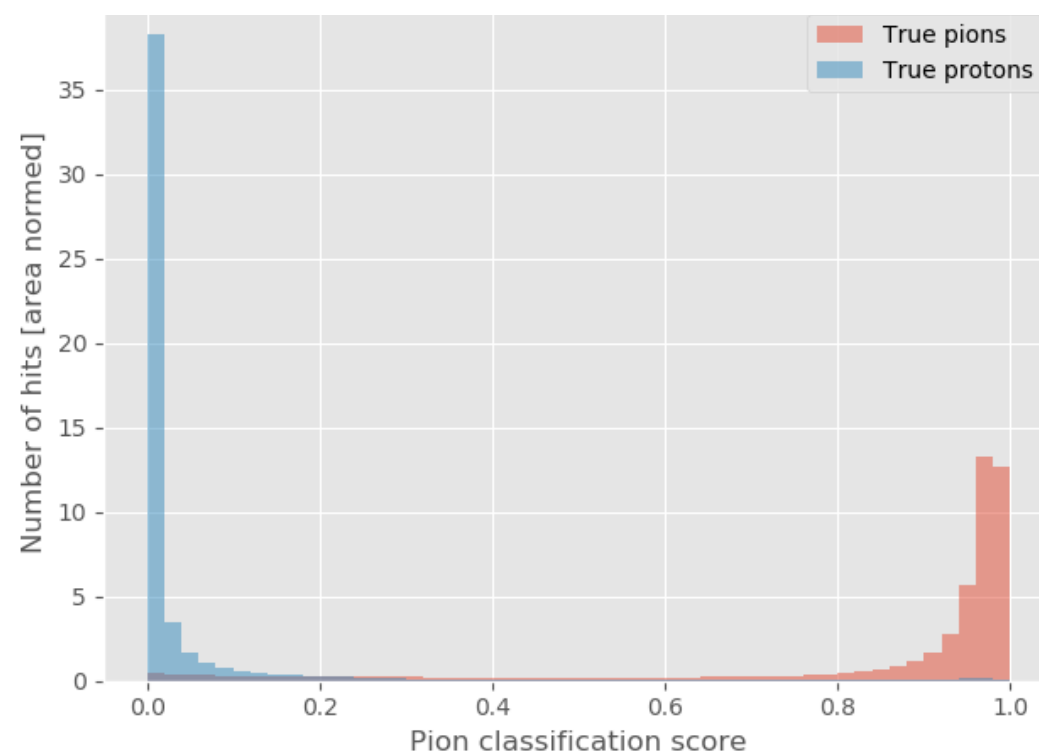
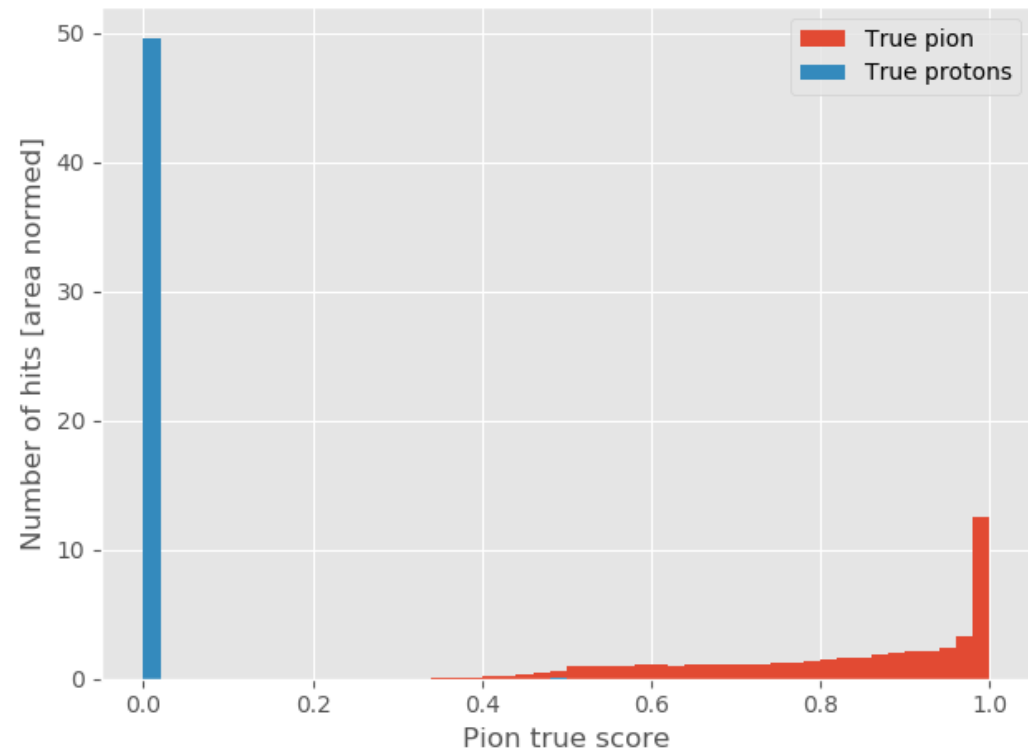
Training

- **Features:**
 - **7** (3 coordinates per hit, integrated charge per plane per voxel, number of hits per voxel)
- **Dataset:**
 - 70k 3D event displays split into **95%** and **5%** for train and test

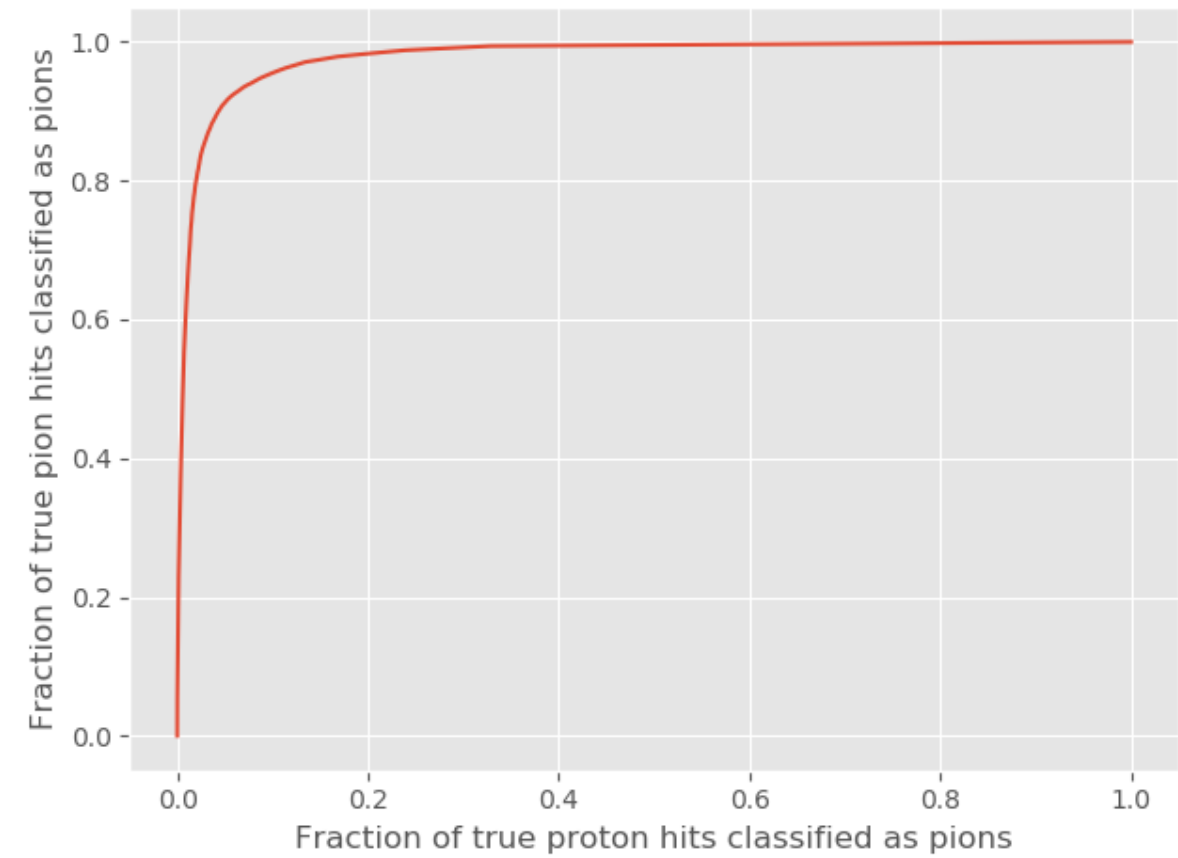
Results



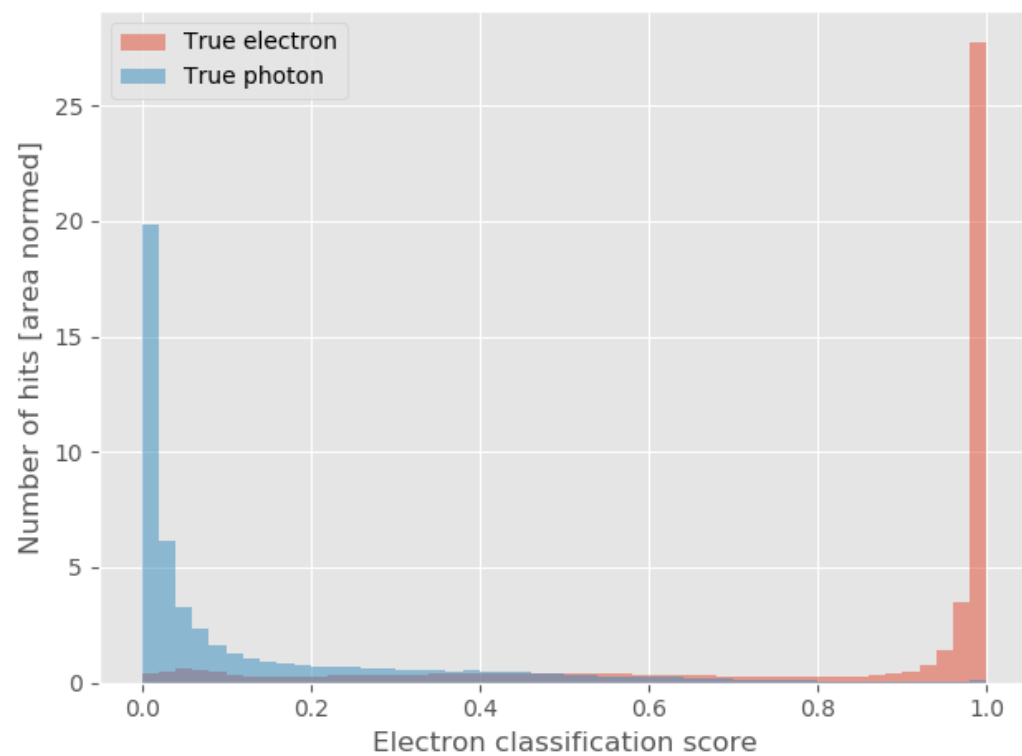
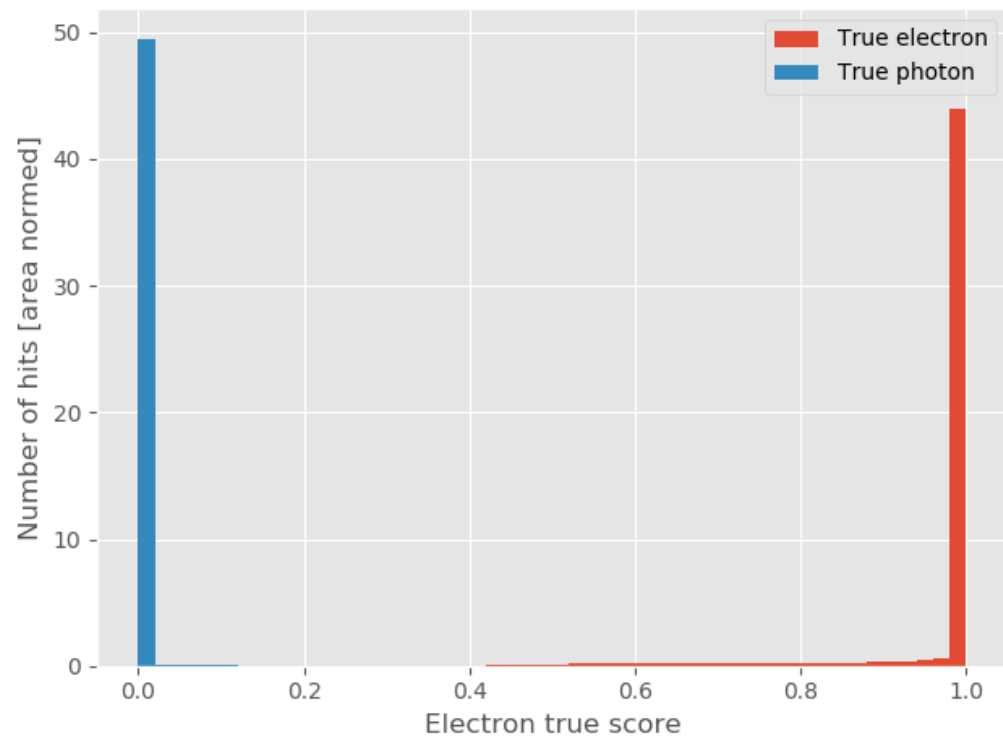
Pion-Proton Separation



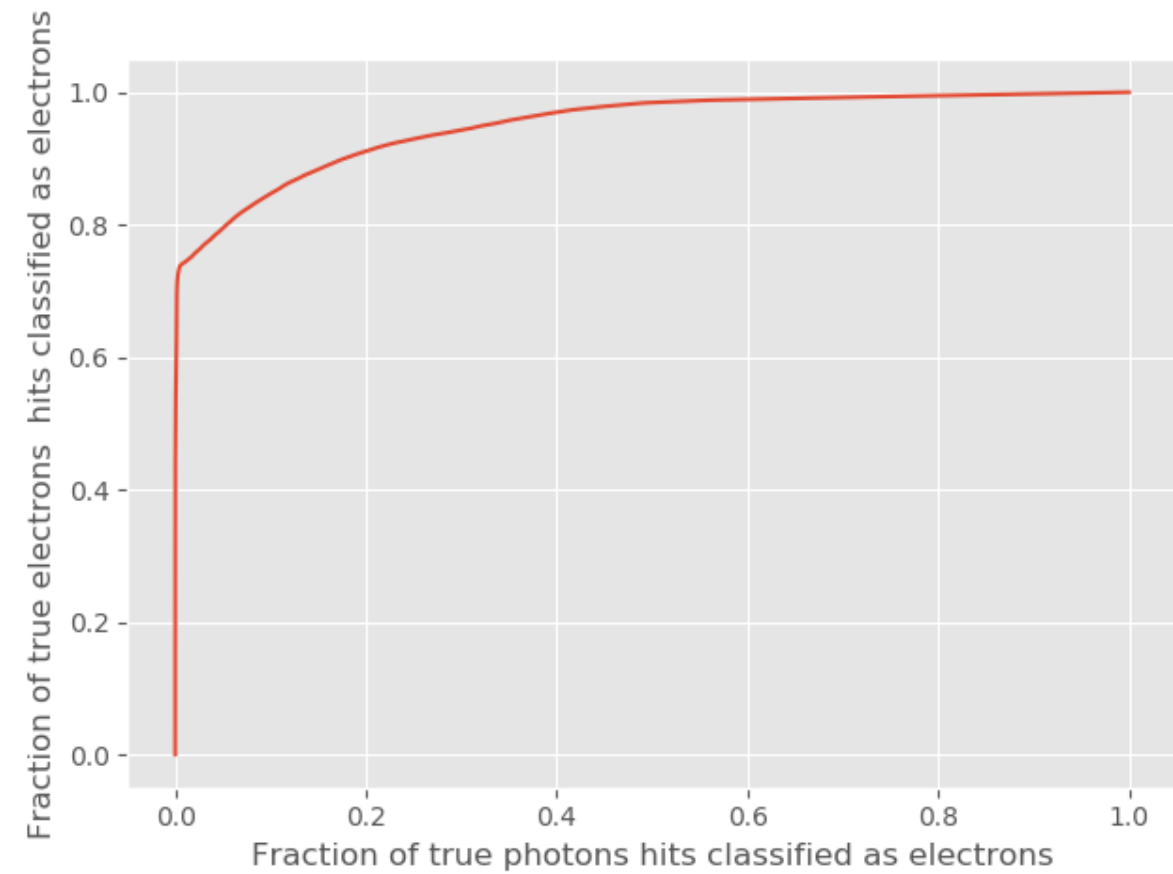
ROC curve



Electron-photon separation



ROC curve



Summary

- The networks shows a very good performance for the task of semantic segmentation
- Pions can be well separated from protons
- Comments and suggestions are more than welcome
- Thanks