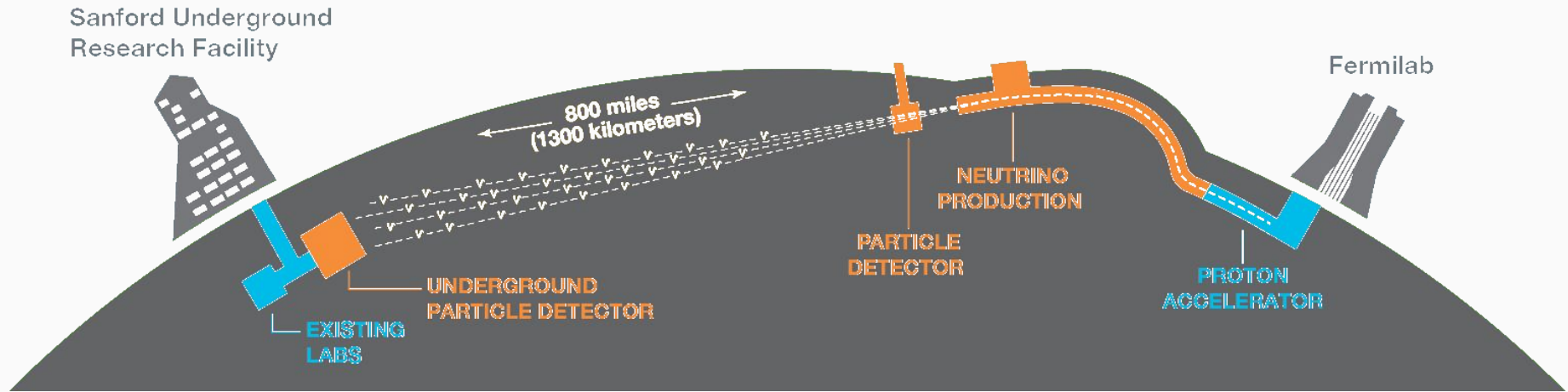


2x2 Reconstruction Study

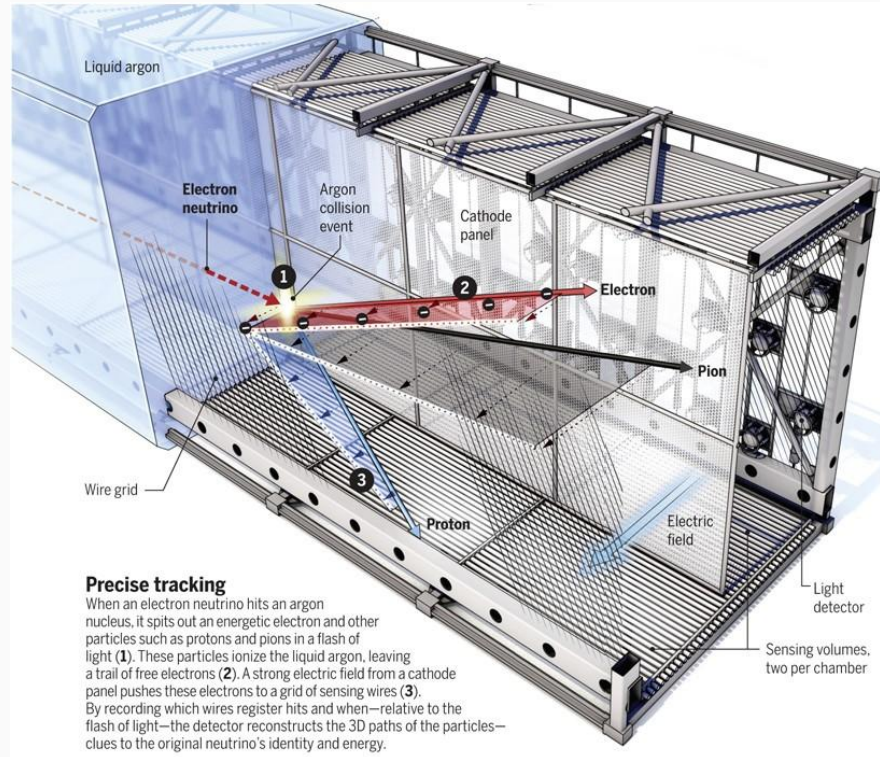
Orgho Neogi
Supported by DOE-SC-0010113



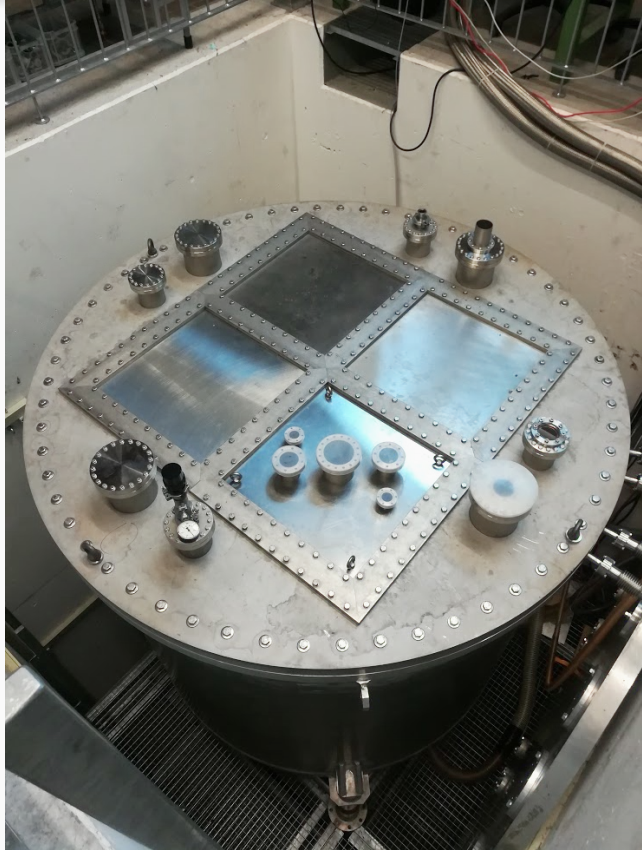
Deep Underground Neutrino Experiment (DUNE)



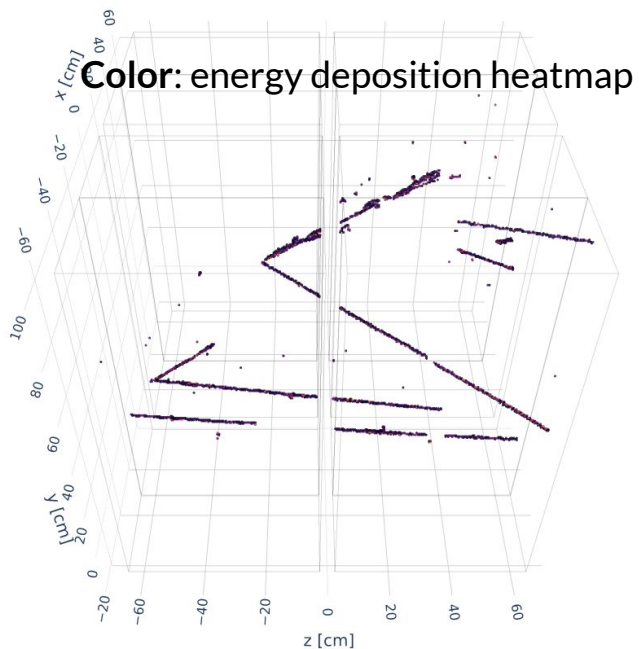
Liquid Argon Time Projection Chamber



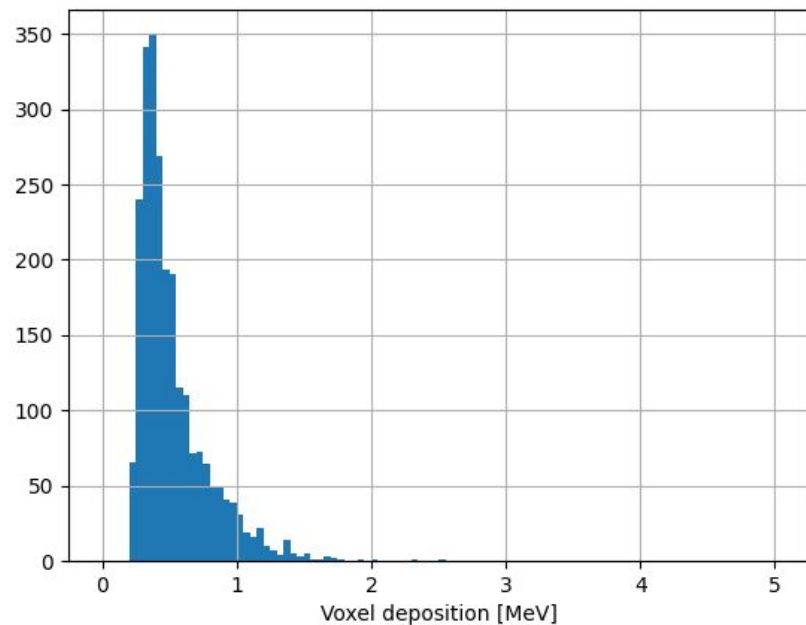
2x2 Near Detector Prototype



Event Display

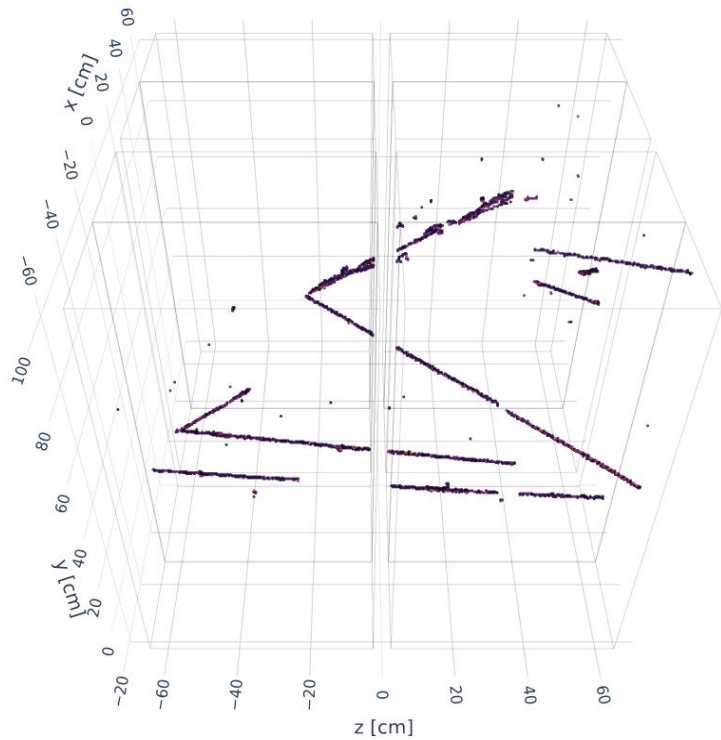


Energy Deposition Histogram

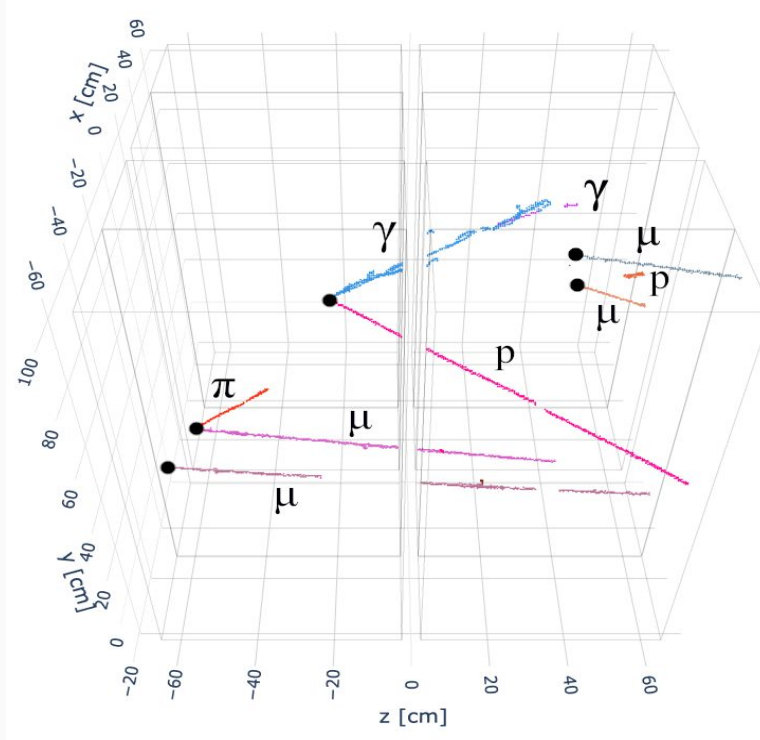


Input to Reconstruction

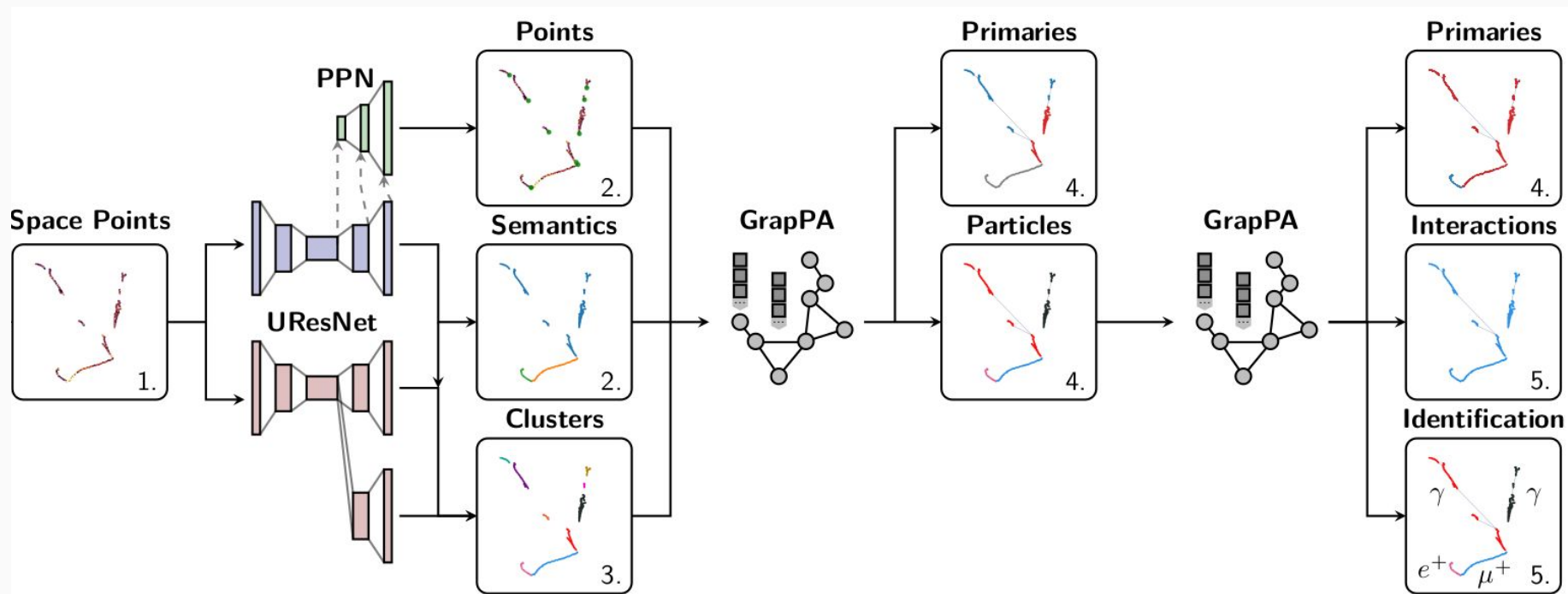
Raw Input



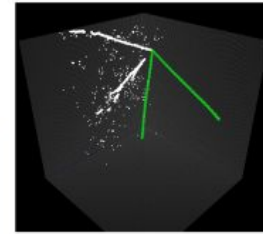
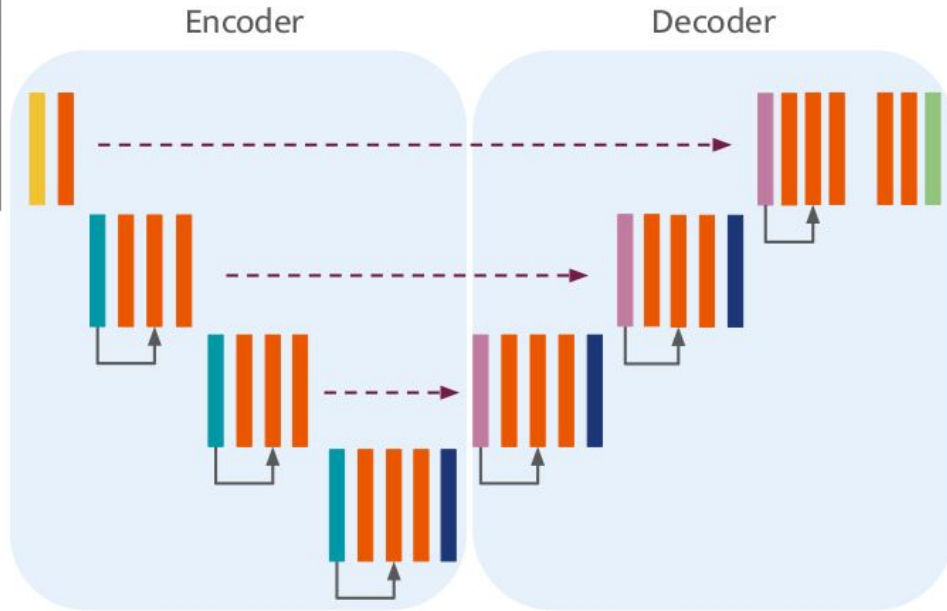
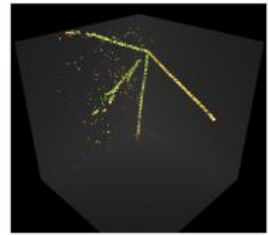
Reconstruction Output



IArTPC mlReco3D Pipeline



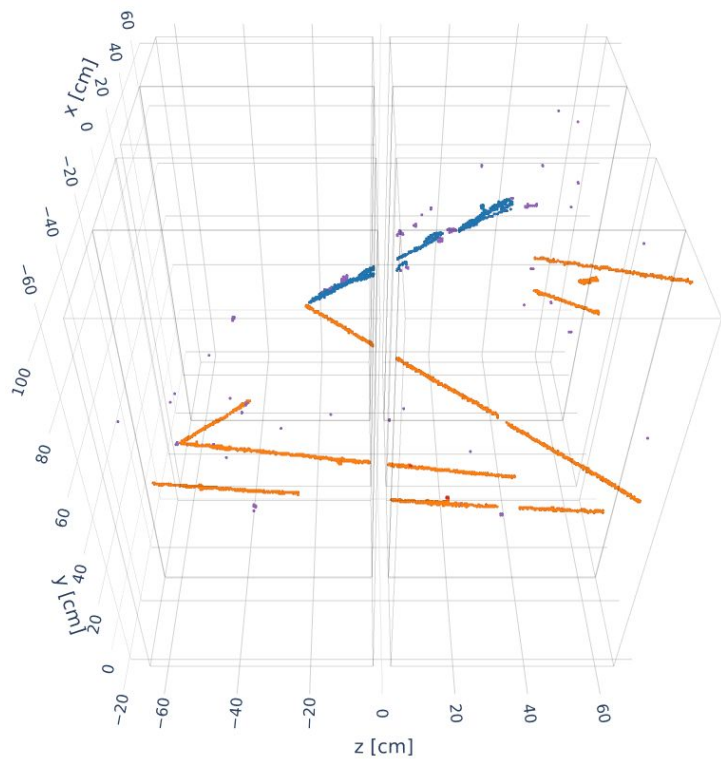
Convolutional Neural Network



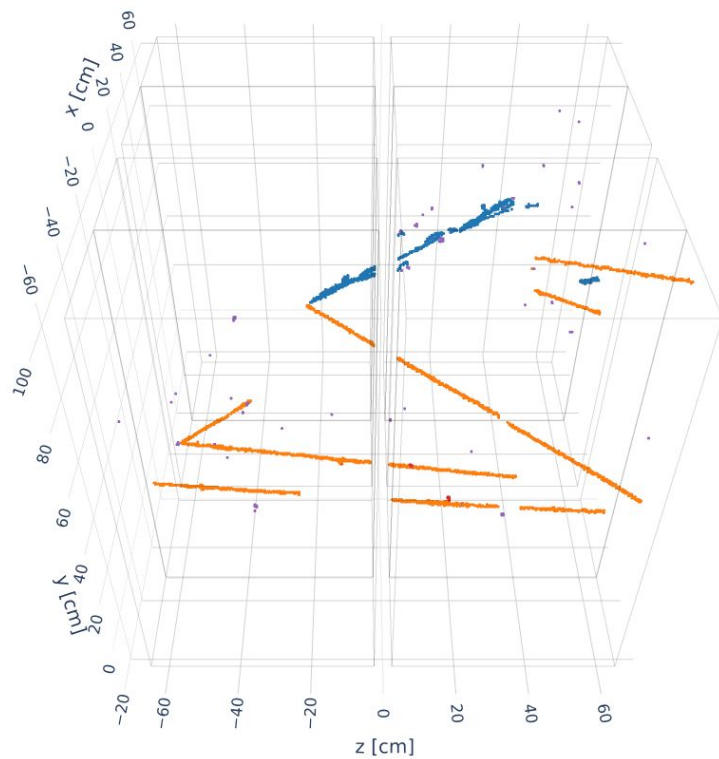
Paper: [PhysRevD.102.012005](https://arxiv.org/abs/1908.07544)

Semantic Segmentation Event Display

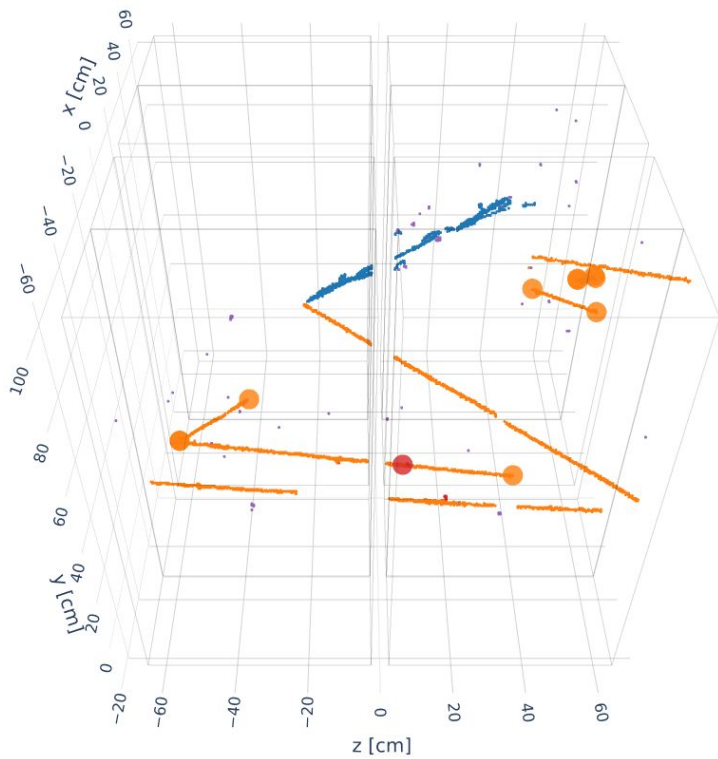
Label



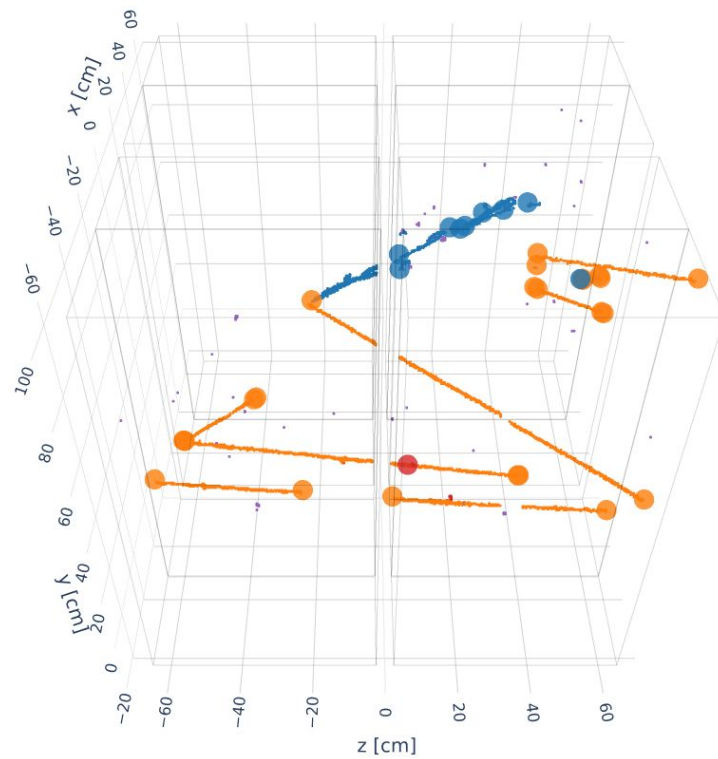
Reco



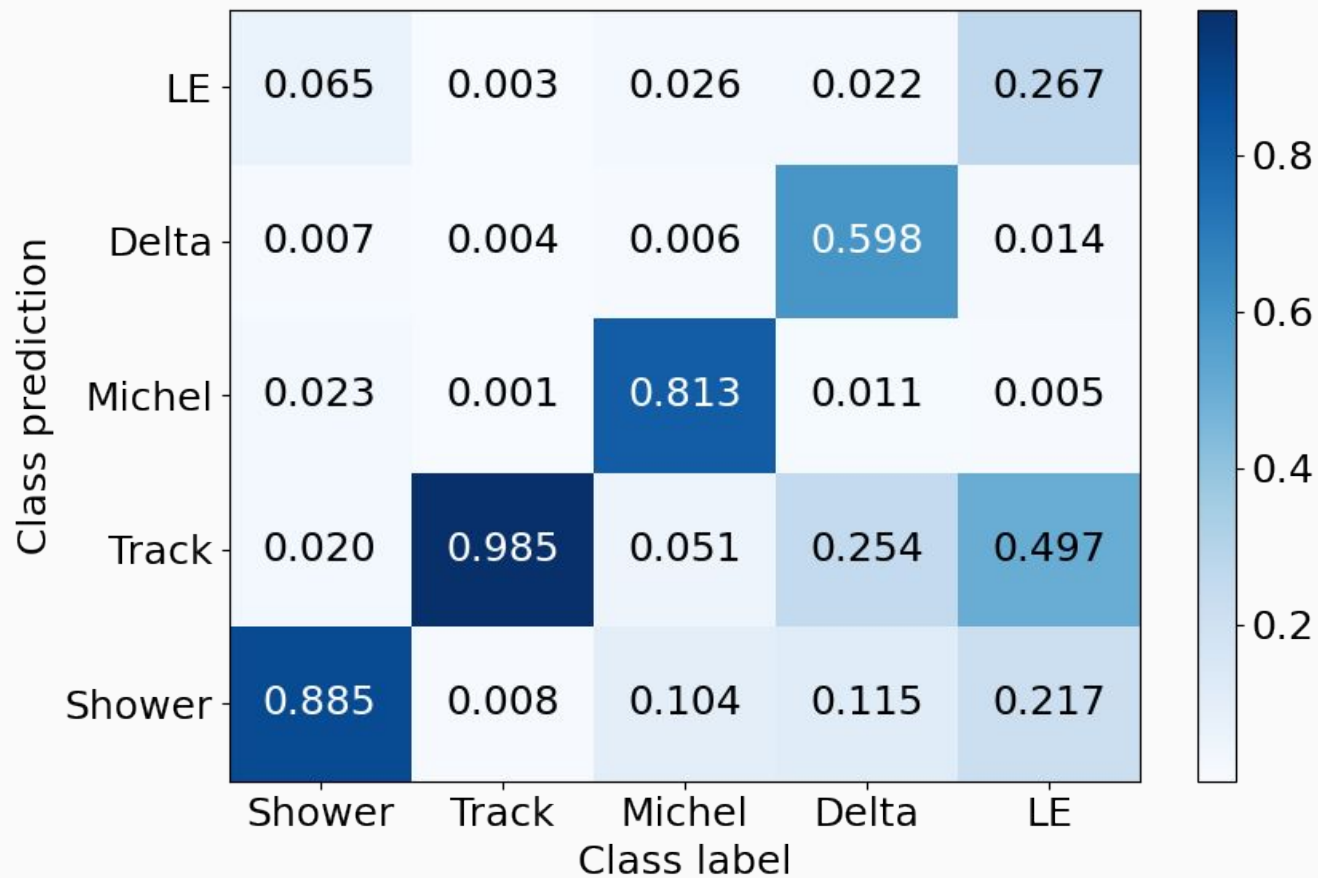
Label



Reco



UResnet PPN Accuracy



Graph Neural Net

Fragments

Edge Update

Node Update

Output graph

Groups

Input Graph

Feature extraction

EdgeLayer

NodeLayer

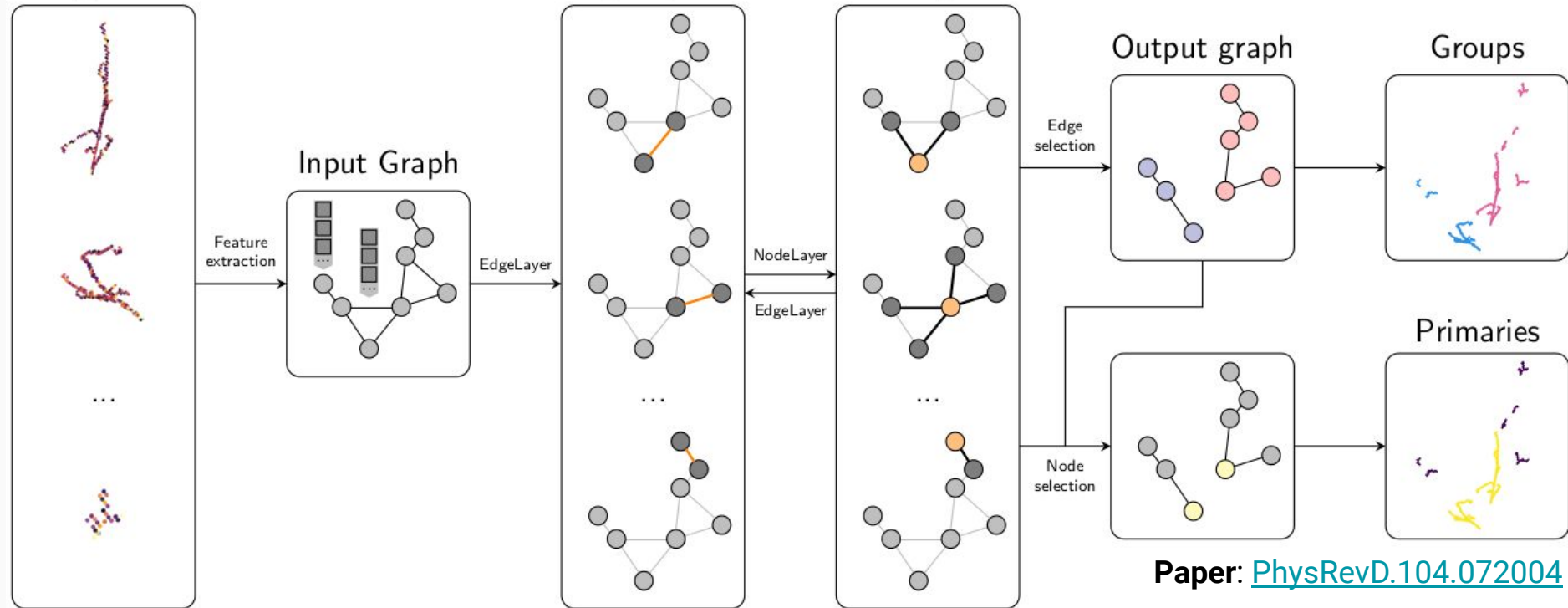
EdgeLayer

Edge selection

Node selection

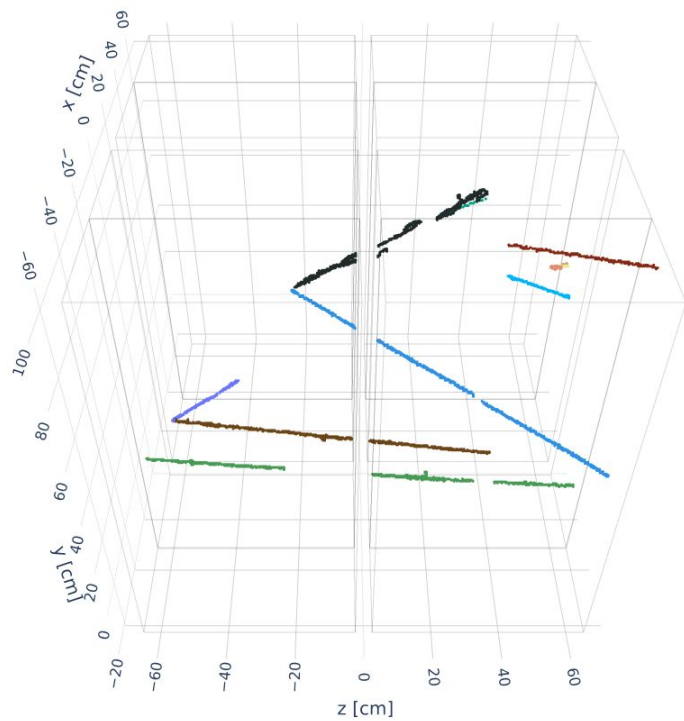
Primaries

Paper: [PhysRevD.104.072004](https://arxiv.org/abs/1404.7802)

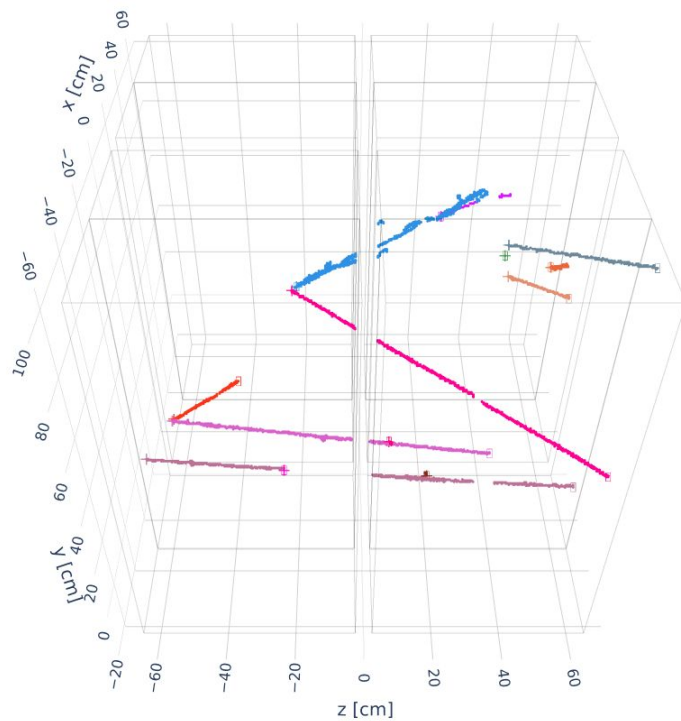


Particle Clustering Event Display

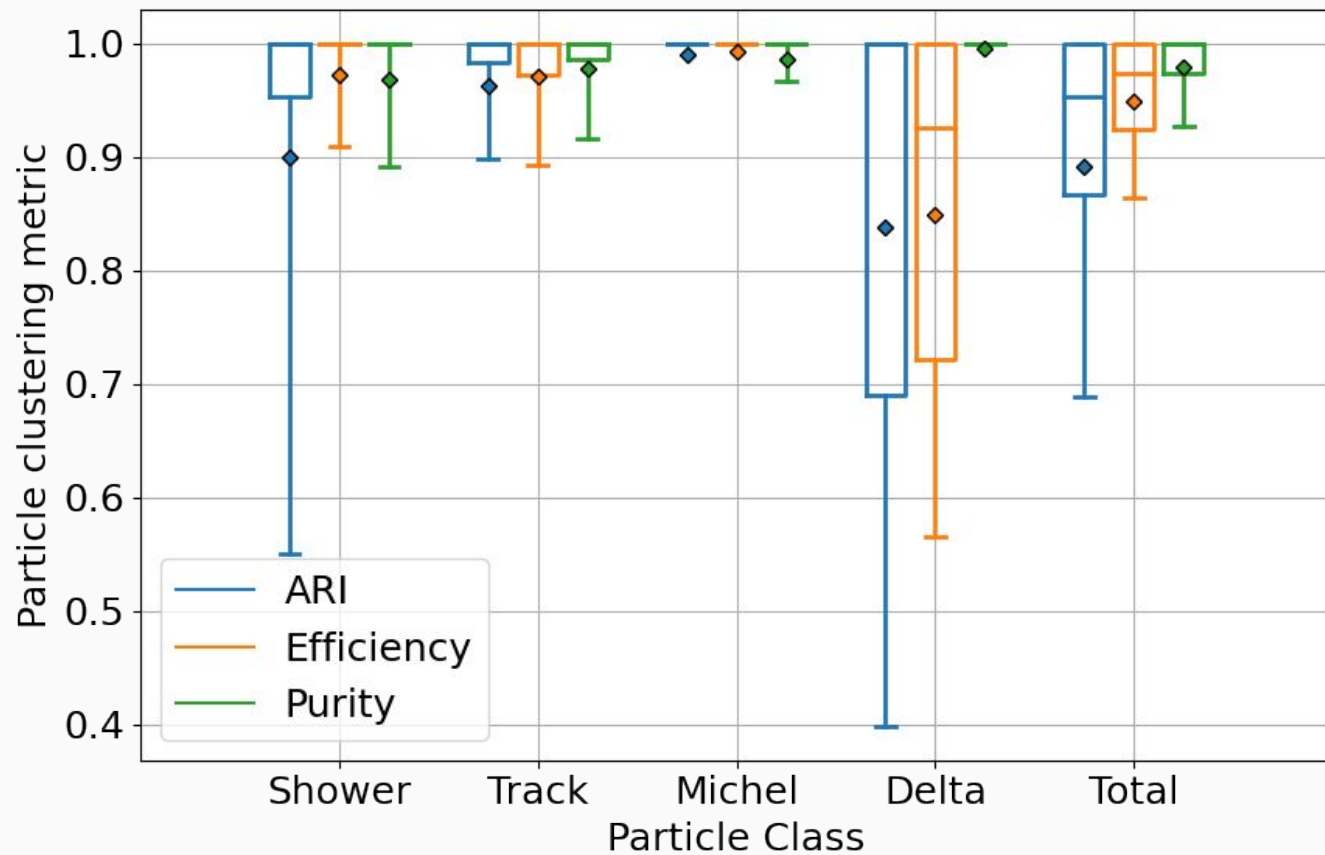
Label



Reco

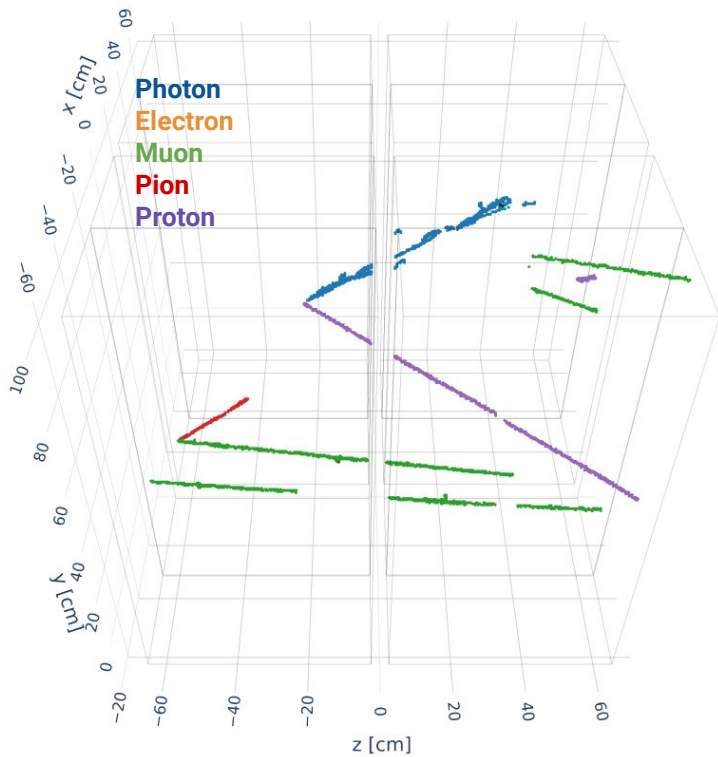


Particle Clustering Accuracy Metrics

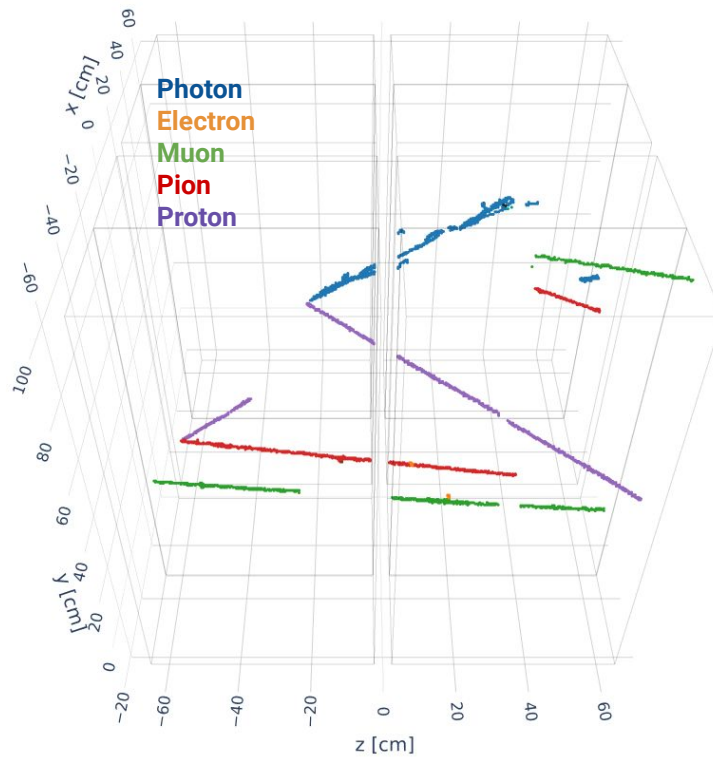


Particle ID Event Display

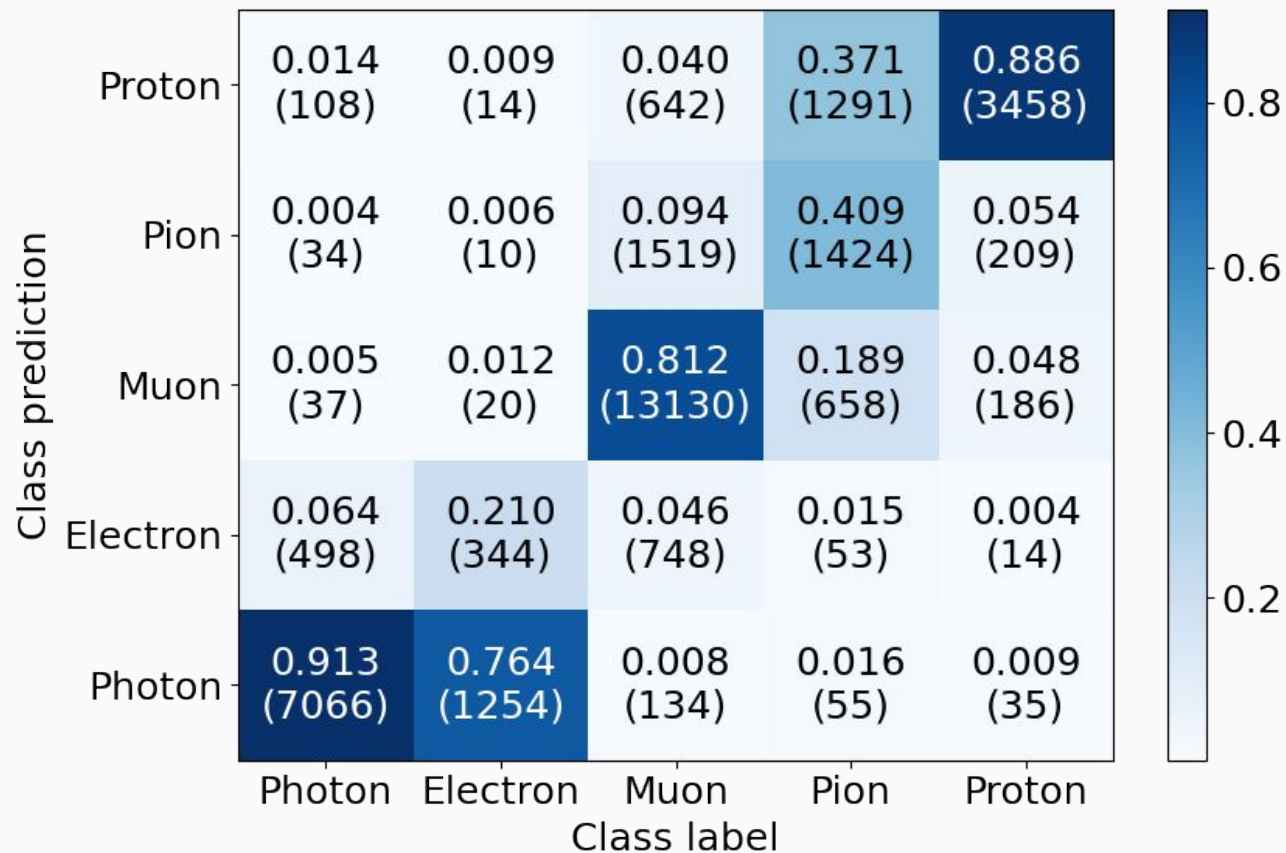
Label



Reco



Particle ID Accuracy



Fixing Labelling Issue

Retraining

Improving Accuracy

Improving Speed

Questions?

Set of **400k (train) + 100k (validation) 2x2 simulated images**

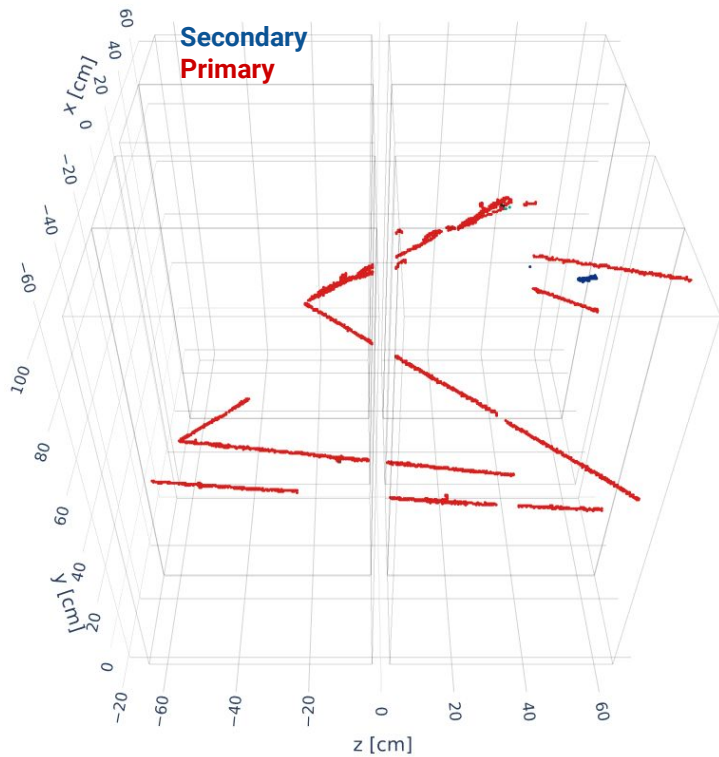
Isotropic **particle bombs** (nu-like)

Overlaid with isotropic **particles** (rock-like)

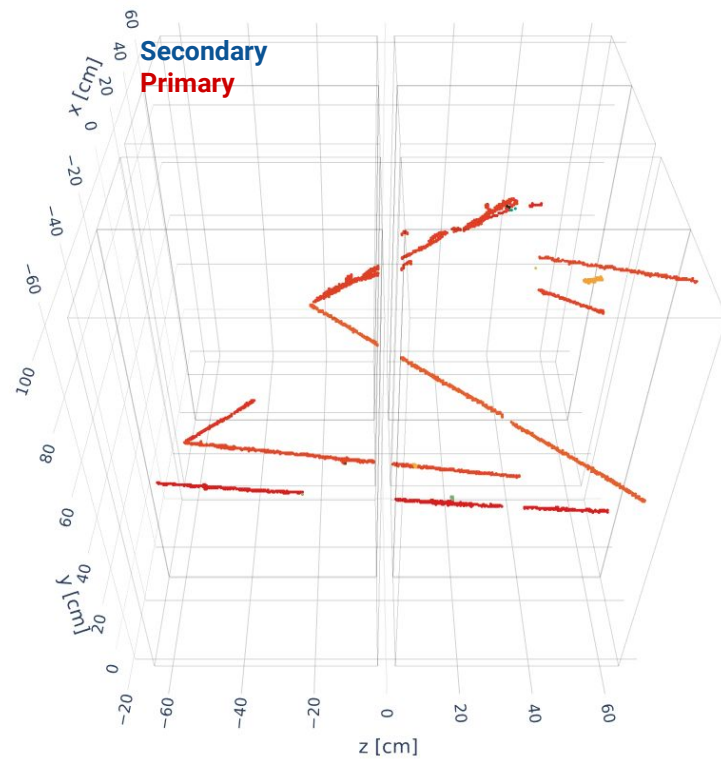
Set of ~40 k NuMI events (**MiniRun3 simulation**) processed so far through **larnd2supera**

Primary Classification Event Display

Label

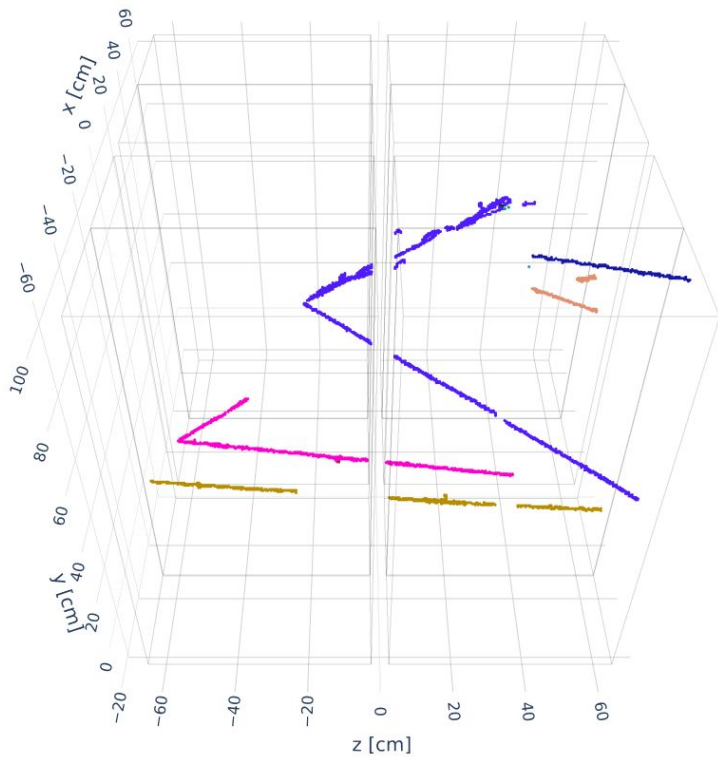


Reco

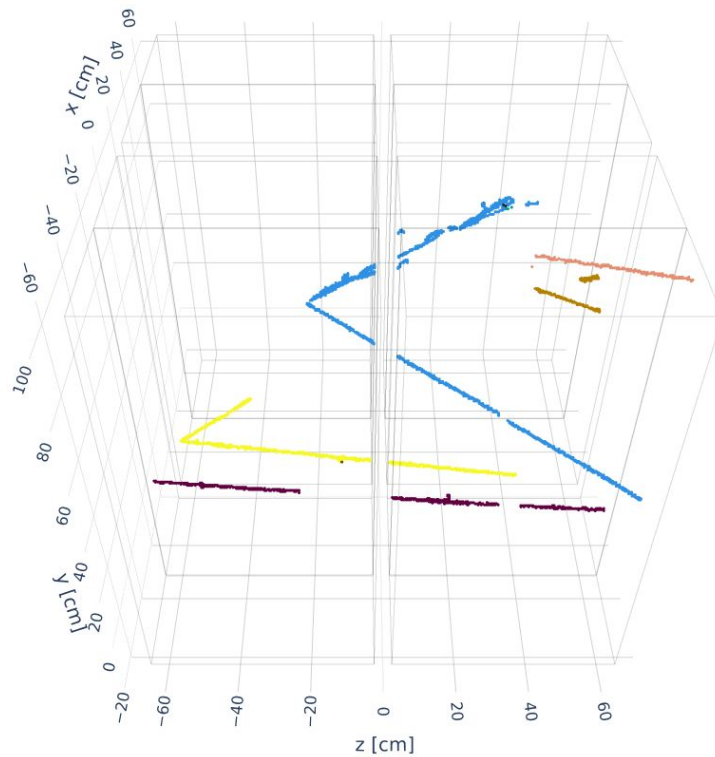


Particle Interaction Event Display

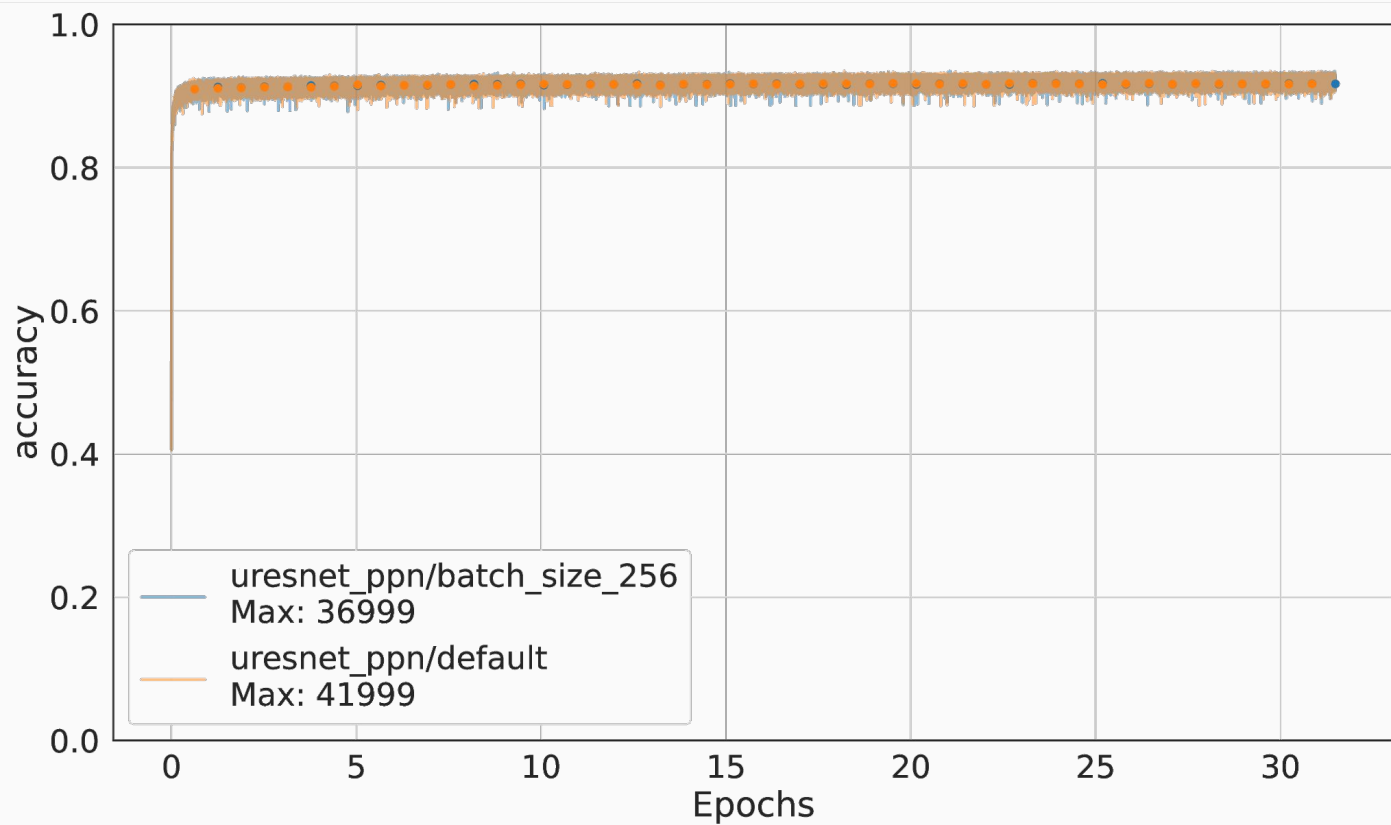
Label



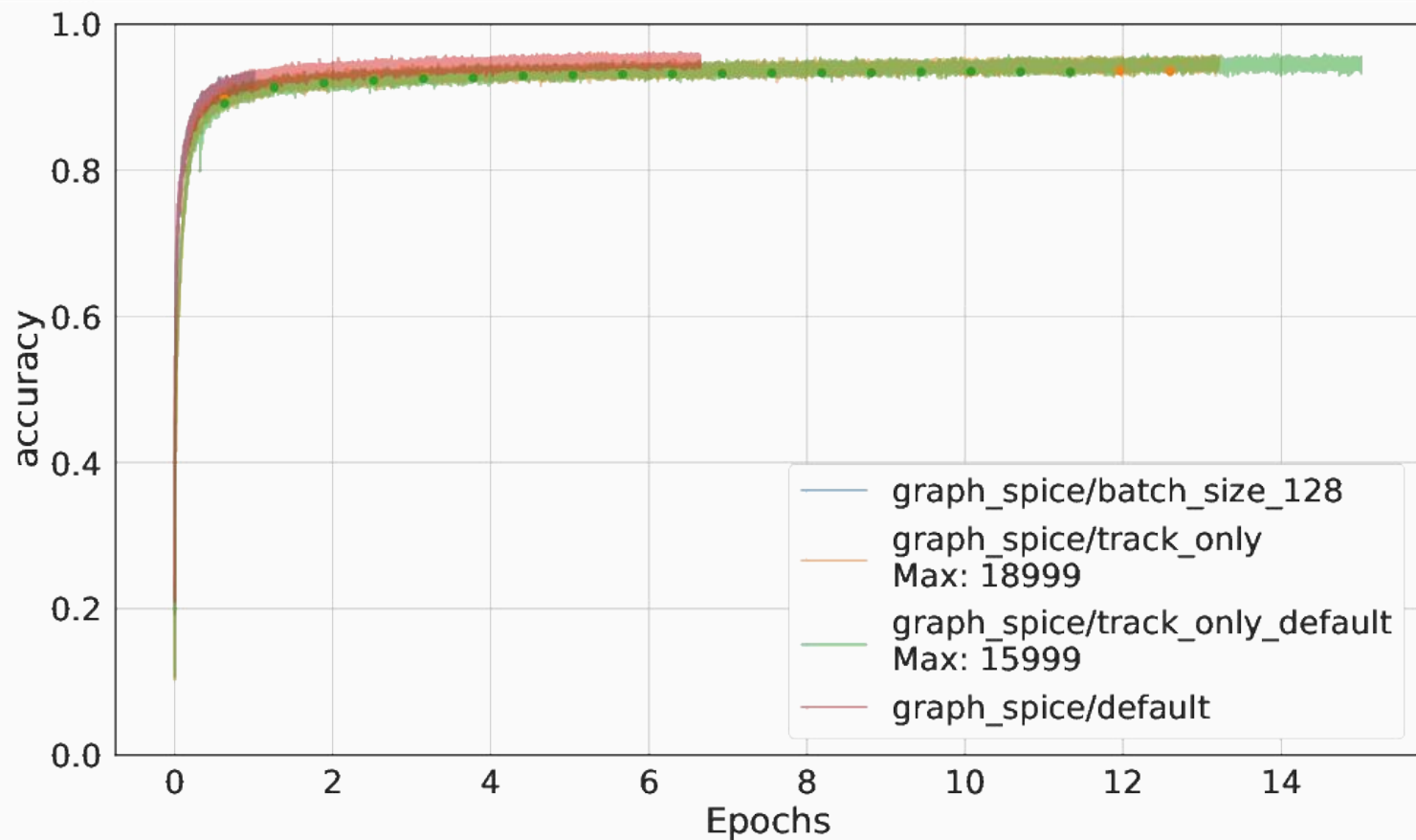
Reco



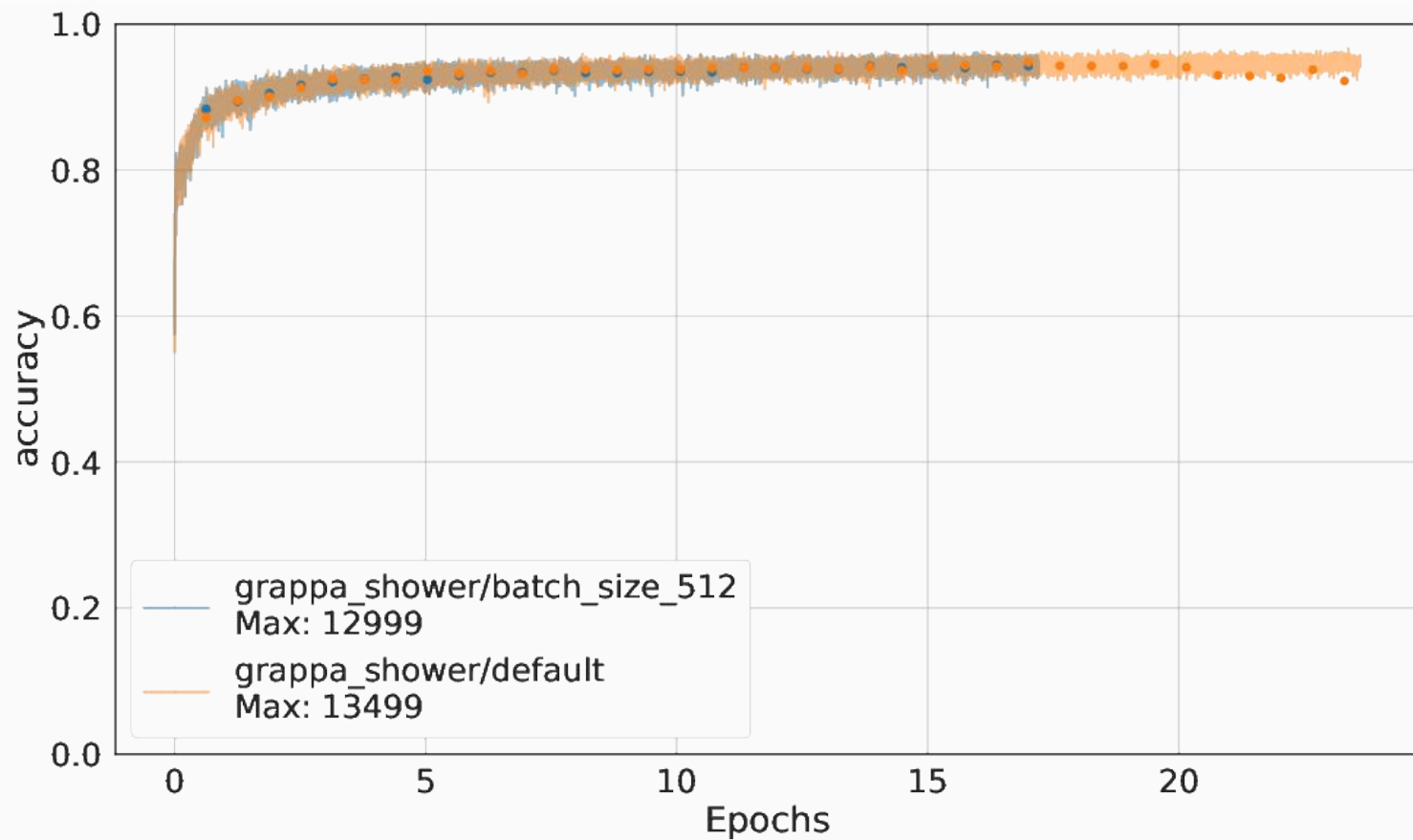
UResnet PPN Accuracy



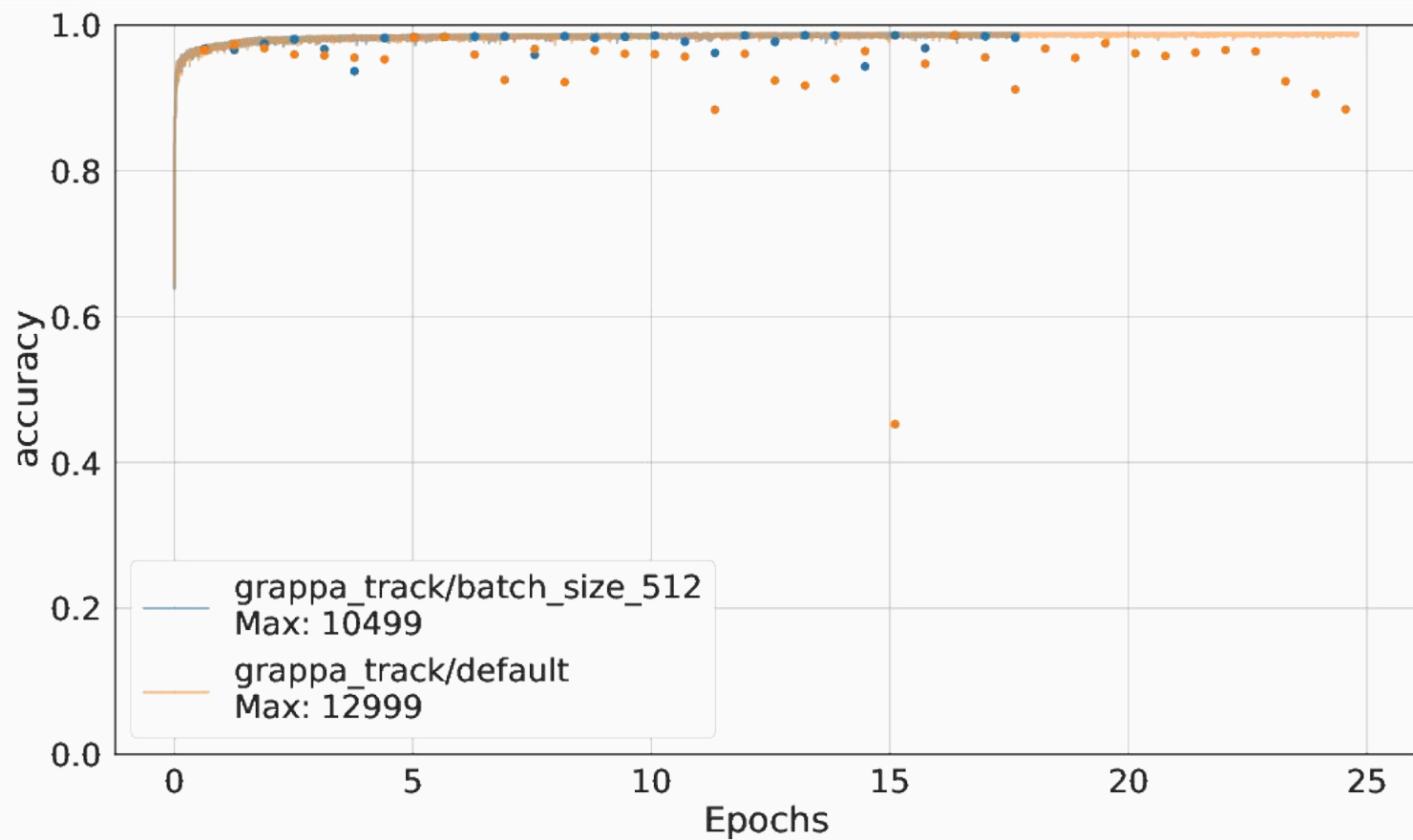
Graph Spice Accuracy



Shower Accuracy



Track Accuracy



Interaction Accuracy

