2x2 Chicago Meeting

March 12, 2024

Angela White and Elise Hinkle

2x2 Paper Update

Link to Overleaf Draft:

https://www.overleaf.com/8458358216drvhjgctvqpr#7b24bd

[Verbal Update]

UChicago 2x2 Posters at NEUTRINO 2024

We've submitted poster abstracts to NEUTRINO 2024! General topics are:

    Angela: Full Light Readout System

   **Elise:** 2x2 Overview + Initial Physics Goals (Focus on CC0pi + track mult.)

Follow-Up: 3D Reconstruction

ML Reco details presented on at [September 2023](#) and [January 2024](#) ND Prototypes Analysis Workshops

ML Reconstruction Chain

SLAC NATIONAL ACCELERATOR LABORATORY

Reconstruction flow:
1. Voxel semantic classification, point identification (**CNN**: [UResNet+PPN](#), **L. Dominé**)
2. Dense clustering (Smart DBSCAN, **CNN**): [Graph-SPICE](#), **D.H. Koh**)
3. Particle aggregation, shower primary identification (**GNN**: [GrapPA](#)-Track/Shower)
4. Interaction aggregation, particle identification, primary identification (**GNN**: [GrapPA](#)-Interaction)
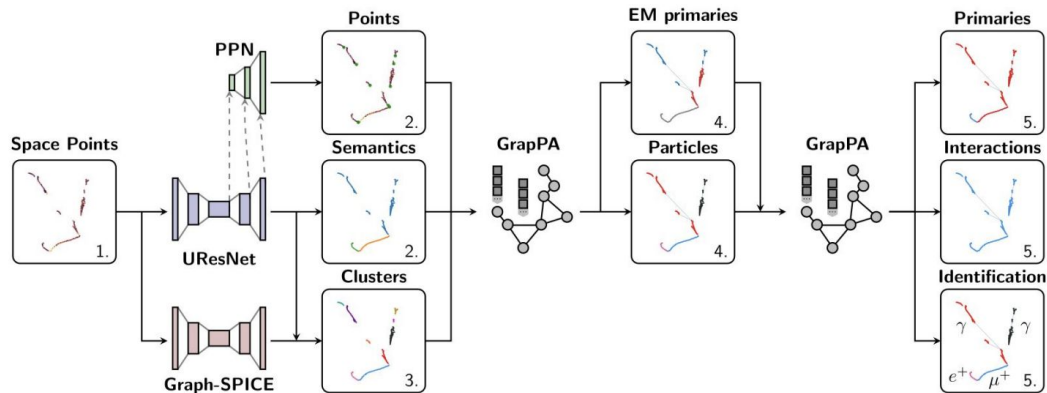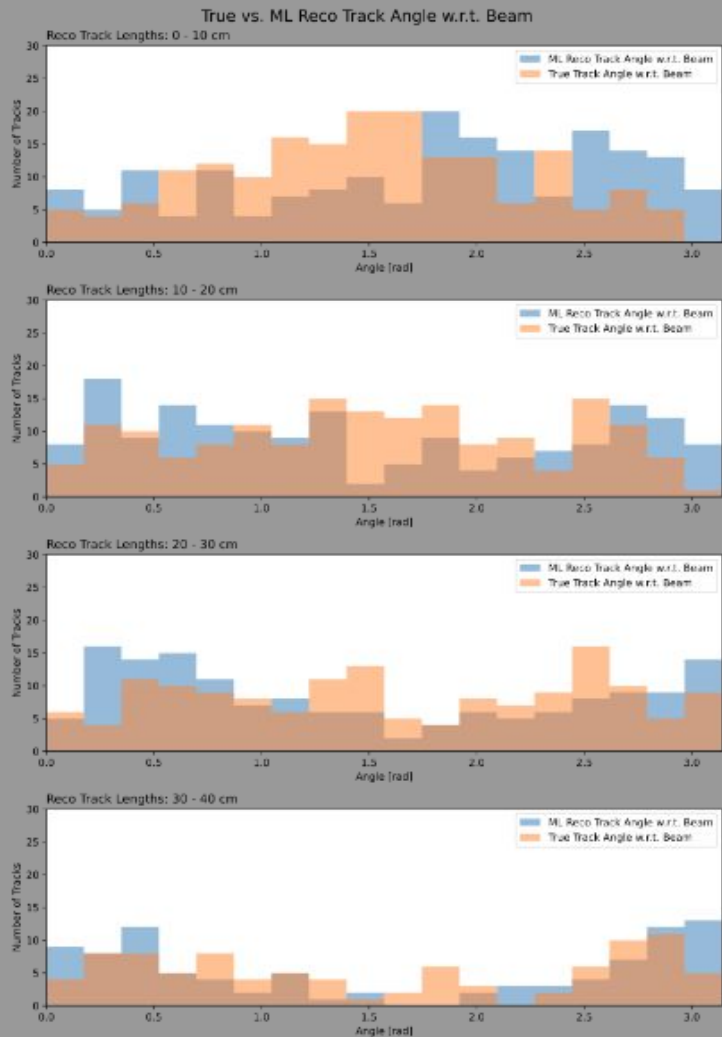
ML-Based Reconstruction for 2x2, F. Drielsma (SLAC)

Follow-Up: 3D Reco

Goal: benchmark ML Reco performance on simulation and/or data (currently using 2x2 simulation

Sample: reconstructed charged track-like particles (protons, pions, kaons, muons) with >0.5 "overlap" with a true particle

Current plots: True vs. ML Reco track angle with respect to beam (broken up by track length in 10 cm bins)
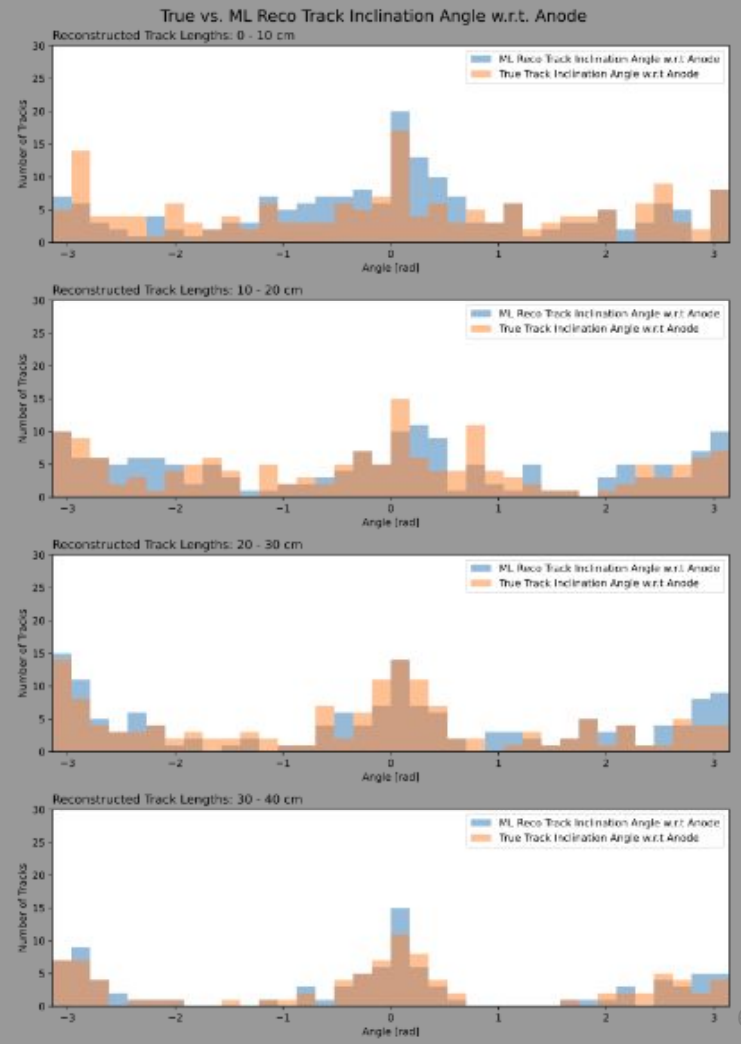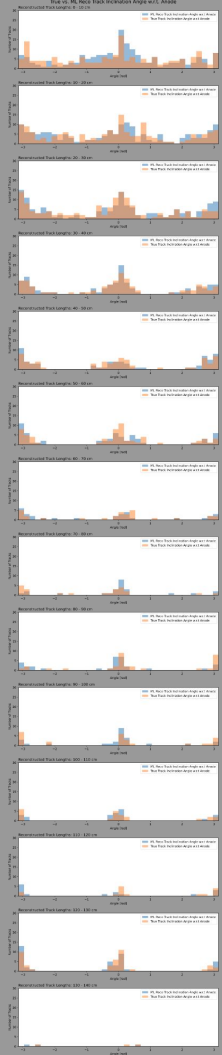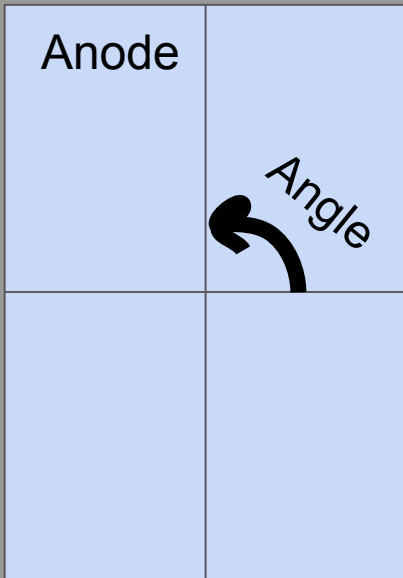
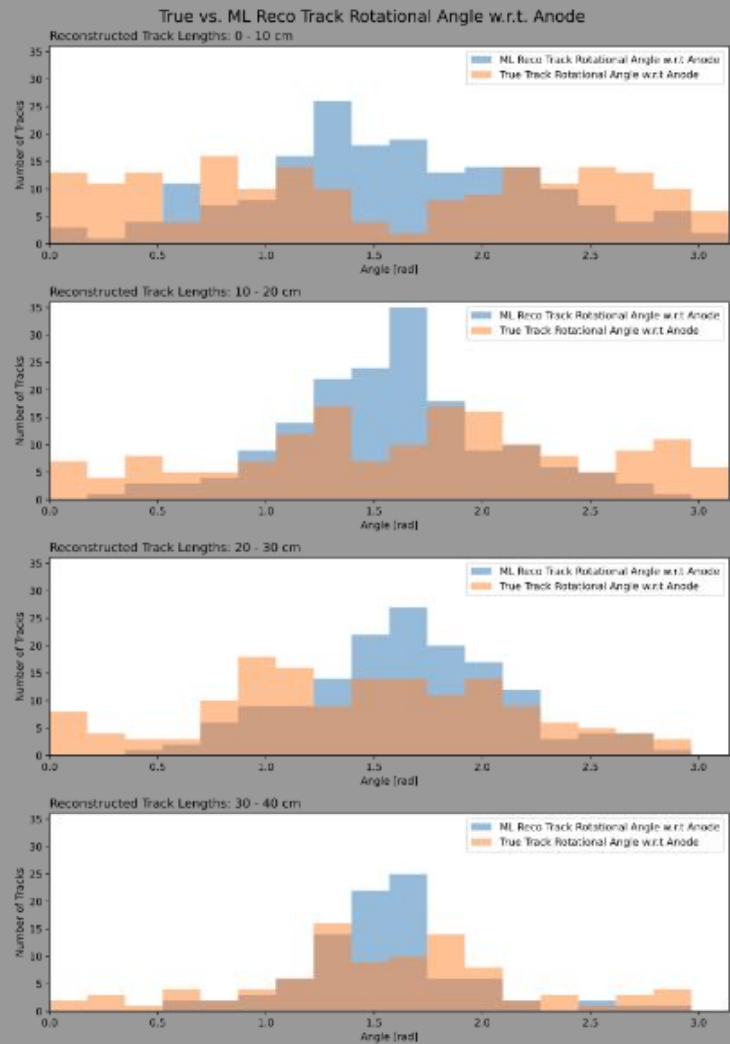**Follow-Up: 3D Reco**

Angle

Anode

Drift Direction

Current plots: True vs. ML Reco track inclination angle with respect to drift direction (broken up by track length in 10 cm bins)

Follow-Up: 3D Reco

Anode

Angle

Current plots: True vs. ML Reco track rotational angle with respect to pixel plane (broken up by track length in 10 cm bins)

True vs. ML Reco Track Rotational Angle w.r.t. Anode

Reconstructed Track Lengths: 0 - 10 cm

Reconstructed Track Lengths: 10 - 20 cm

Reconstructed Track Lengths: 20 - 30 cm

Reconstructed Track Lengths: 30 - 40 cm

Future (today) Work

Plan to present these + related studies in Analysis and Systematics Working Group Meeting tomorrow (Wednesday 3/13) at 10am CT

List of plots still to be made:

- Same angle plots with sample of **only** reconstructed protons
- Reco vs. true track length (all angles)
- Reco vs. true track start points
- Reco vs. true track end points
- Variation in "overlap" filter (i.e. how much overlap is required between reco particle and matched true particle)
- Representation of true charged track multiplicity at the vertex for each track (i.e. how well can we reconstruct tracks at vertices with high track multiplicity)