

truthOverlap studies with particle separation

By 4th-year student
Heorhii Sheredeko

Taras Shevchenko National University of Kyiv
Scientific supervisor: Olga Gogota



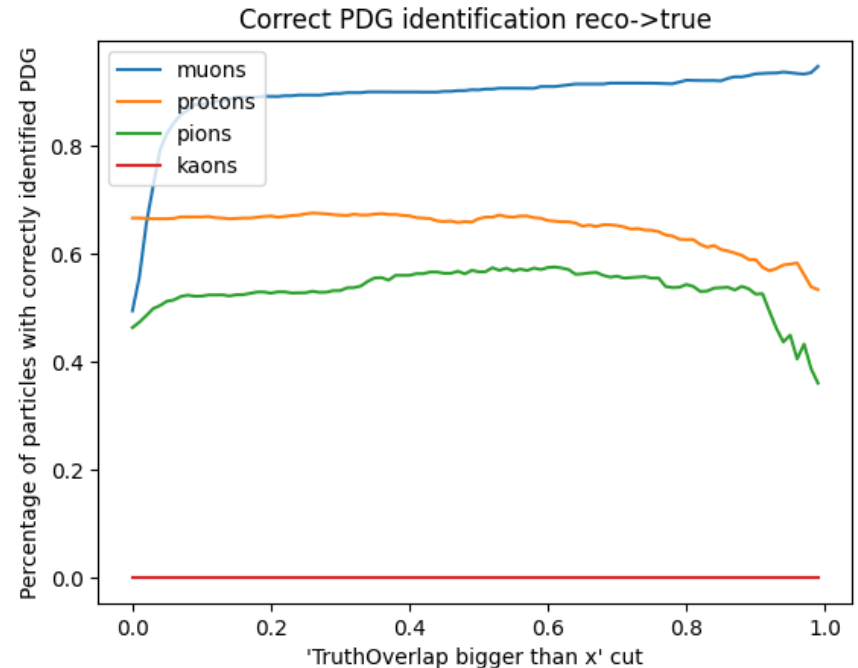
**TARAS SHEVCHENKO
NATIONAL UNIVERSITY
OF KYIV**

Overview

- Used files: MiniRun4.5 flat CAFs
- Only a fraction of the files is used due to processing power limitations
- The goal is to show how DLP machine learning reconstruction performs depending on cuts applied to `common.ixn.dlp.part.dlp.truthOverlap`
- Particles with at least 1 cm track length are chosen, and if they have primary match from MC associated with them

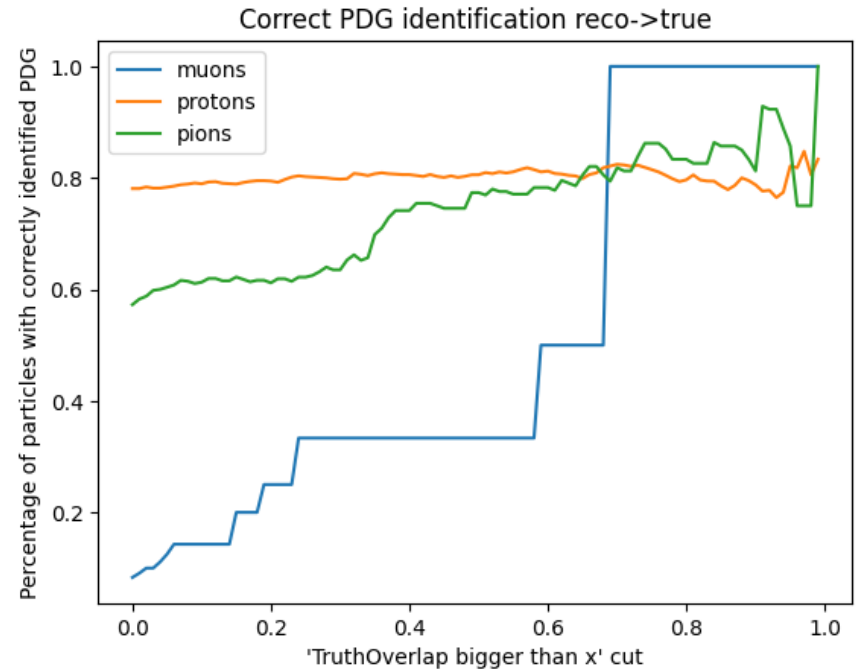
Purity of particle recognition

- Tracks aren't restricted to sensitive volume of 2x2 - some of them leave the detector
- Y-axis is the percentage of time a given particle is correctly identified on average
- X-axis is the minimum value of truthOverlap below which associated particles are ignored
- Only muons seem to benefit from setting a cut to truthOverlap



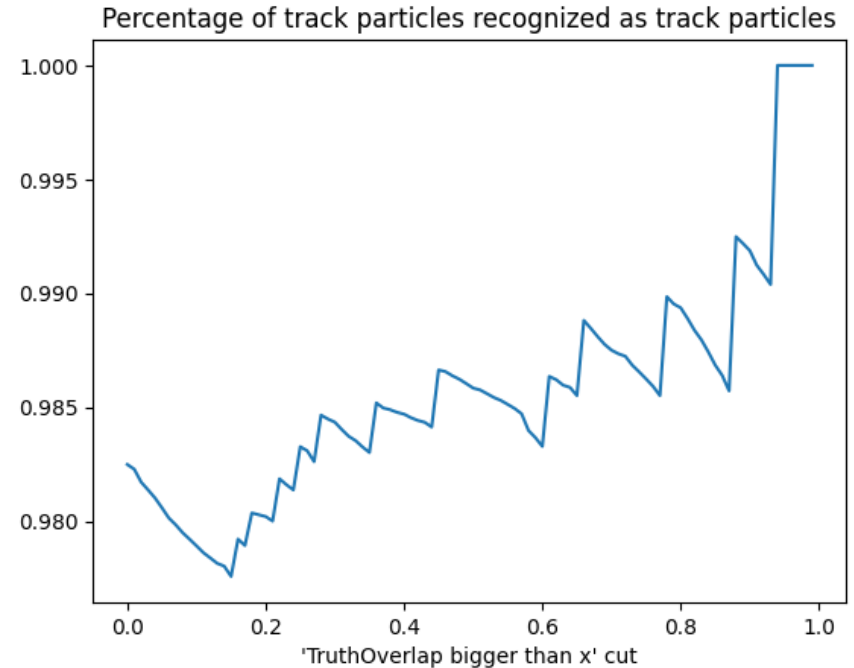
Purity of particle recognition

- Only tracks fully contained inside the 2x2 detector are considered
- There is a low amount of contained muons
- Compared to previous plot, better performance for protons and pions, roughly 20% improvement (from 60% to 80%)



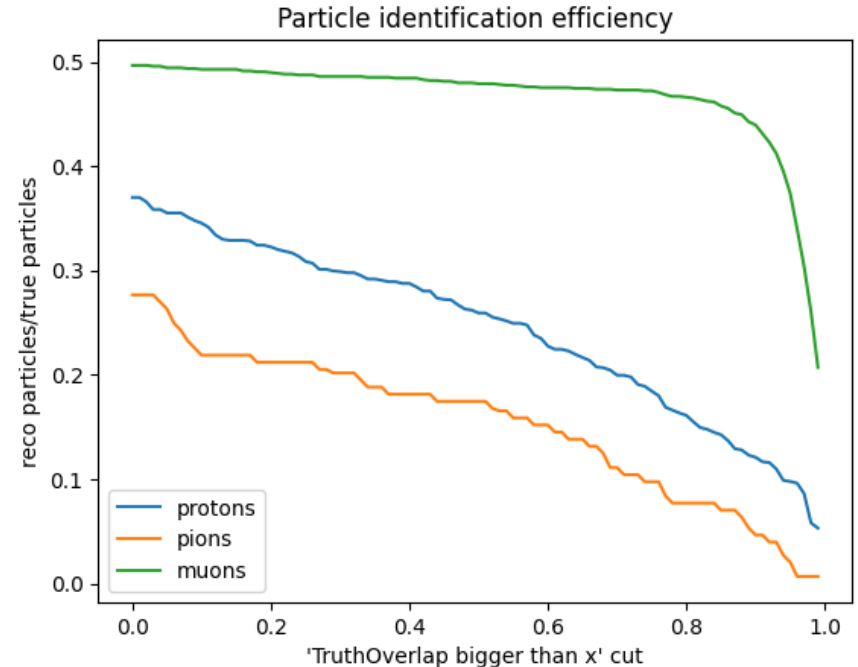
Track and shower separation

- Only tracks fully contained inside the 2x2 detector are considered
- As track particles are considered either proton, muon or pion.
- For example, if reconstruction identified proton as pion, it's considered correct for the plot
- Reconstruction recognizes track particles as track particles at least 98% of the time.



Particle identification efficiency

- Pions and muons must be contained. However, muons that leave the detector are still considered - otherwise the plot for muons would be nearly at zero
- Y-axis is calculated as (total amount of reco particles)/(total amount of true particles in associated MC neutrino interactions)



Summary

- Reconstruction is worse at identifying particles that leave the detector compared to fully contained ones
- The identification performance of only muons (and pions to a lesser degree) appear to be significantly affected by truthOverlap
- Stricter cuts applied to truthOverlap lead to much lower statistics on reco particles