Tests of a Generic Event Selection with Beta3

Richie

Introduction

- Beta3 CAFs have corrected many of the bugs from the first two iterations of MiniRun 4.5
- This presentation shows the updated plots with updated definitions of acceptance.
- It will evaluate the efficiency of measuring final state particles given the selection.
- It also shows a Day 0 event selection for a Day 0-style detector paper.

To find more information on how we do MINERvA matching please refer to: https://indico.fnal.gov/event/63315/

Definitions of Good Matches for this presentation:
For neutrino event selection:

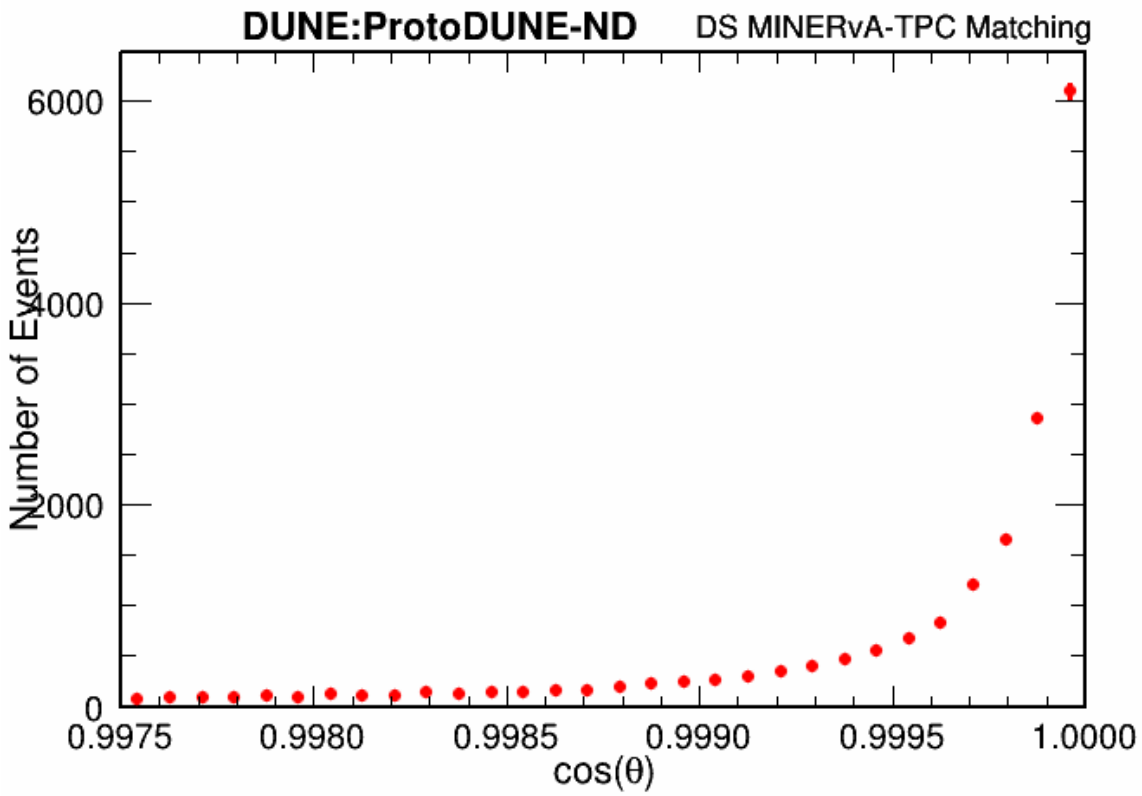
- Reconstructed neutrino is matched to a true interaction in the fiducial volume on argon and is a CC numu/numubar interaction with a deltaR of the reco vertex and true vertex of 5 cm in X, 5 cm in Y, and 5 cm in Z.

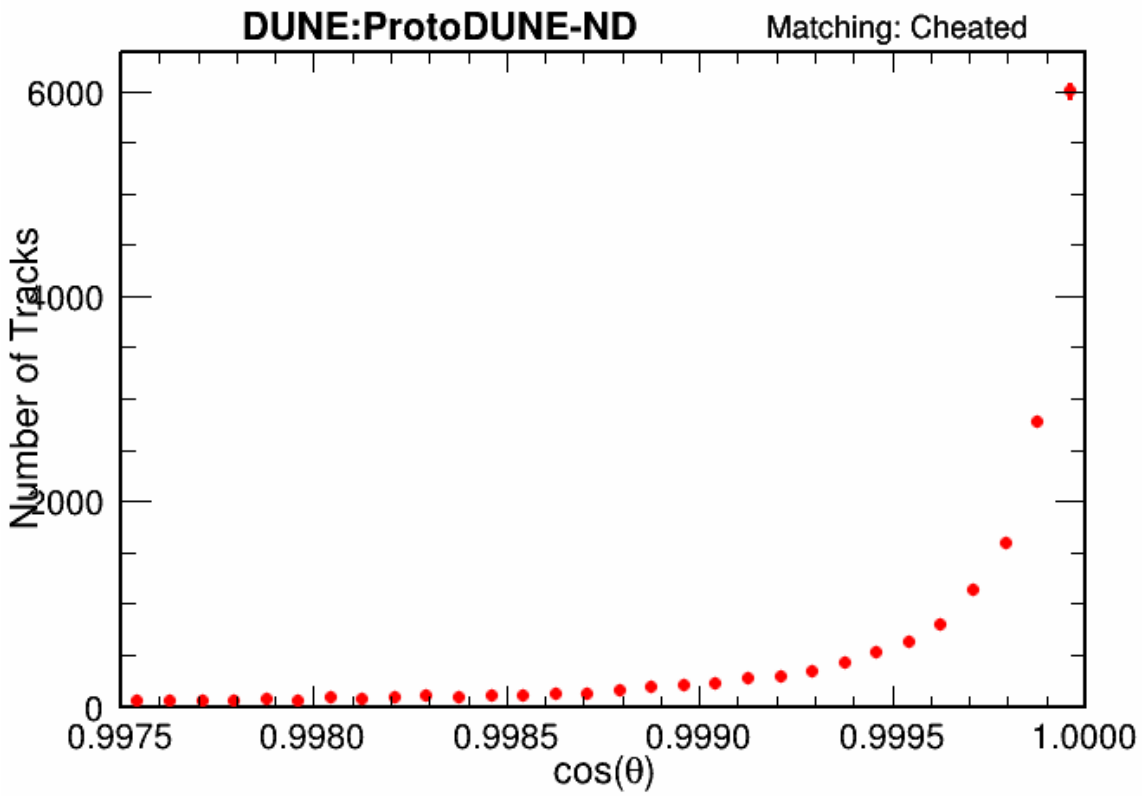
For MINERvA matching:

- The G4 information of the MINERvA particle needs to match the G4 information of the matched reco. particle.
  - There was a bug that put this into question if this was done correctly in Beta2.
  - I had my own bug that forgot to compare the truth interaction of the MINERvA backtracking and the reco particle interaction backtracking.

MINERvA Matching

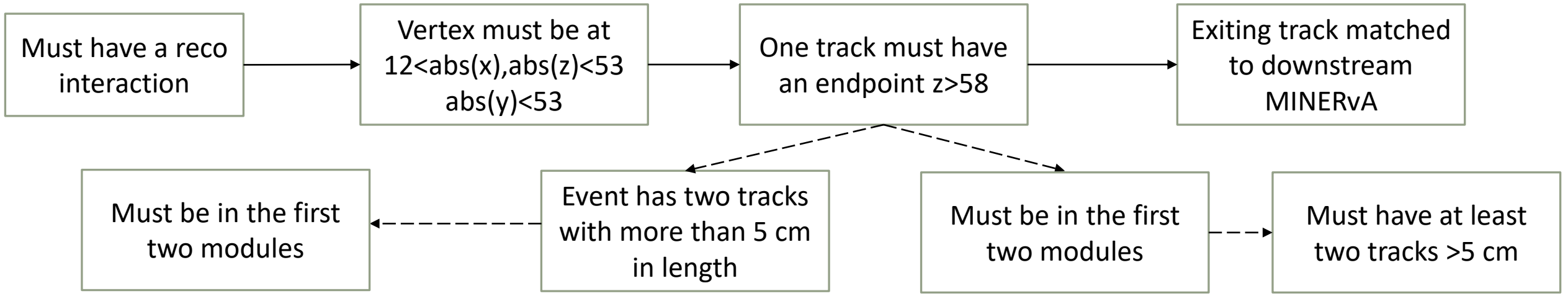
- Purities for downstream matching are 0.96 and for upstream, through-going particle matching 0.67.
- There is an “in-time” purity if the MINERvA track agrees with the TPC track within 10 cm in the drift distance. That is 99.5% for good matched tracks in the downstream MINERvA. Essentially, these muons are most certainly “in-time.”





Event Selection

- I have divided the event selection into with and without MINERvA.
  - There are wishes to get a quick “analysis” the moment we get beam, so we should prepare the event selection for a TPC-only analysis.
- There are a total of 7080 CC numu/numubar interactions between 12<abs(x),abs(z)<53 and abs(y)<53 cm.



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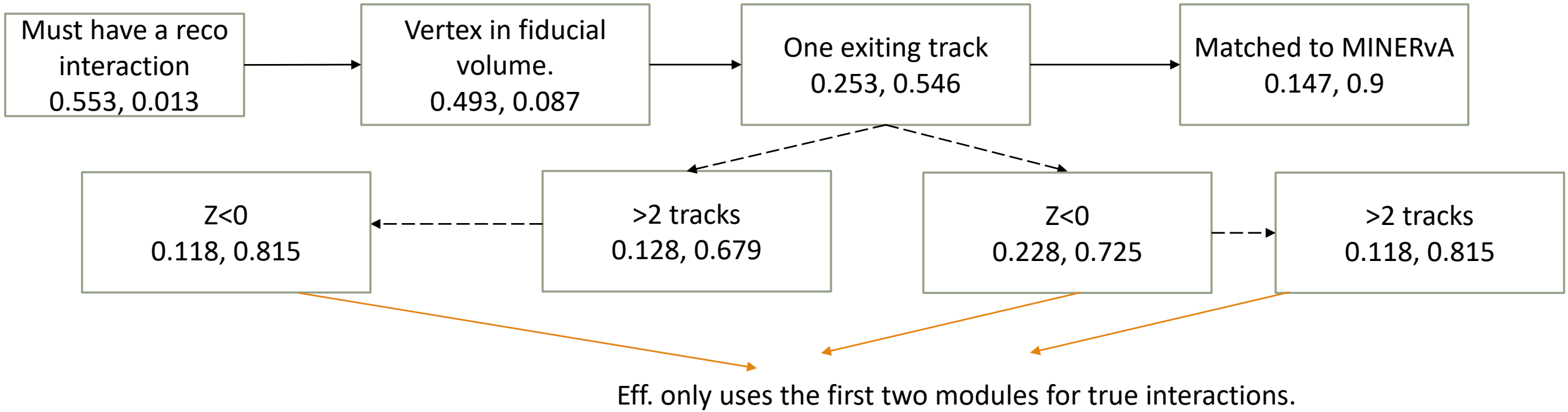
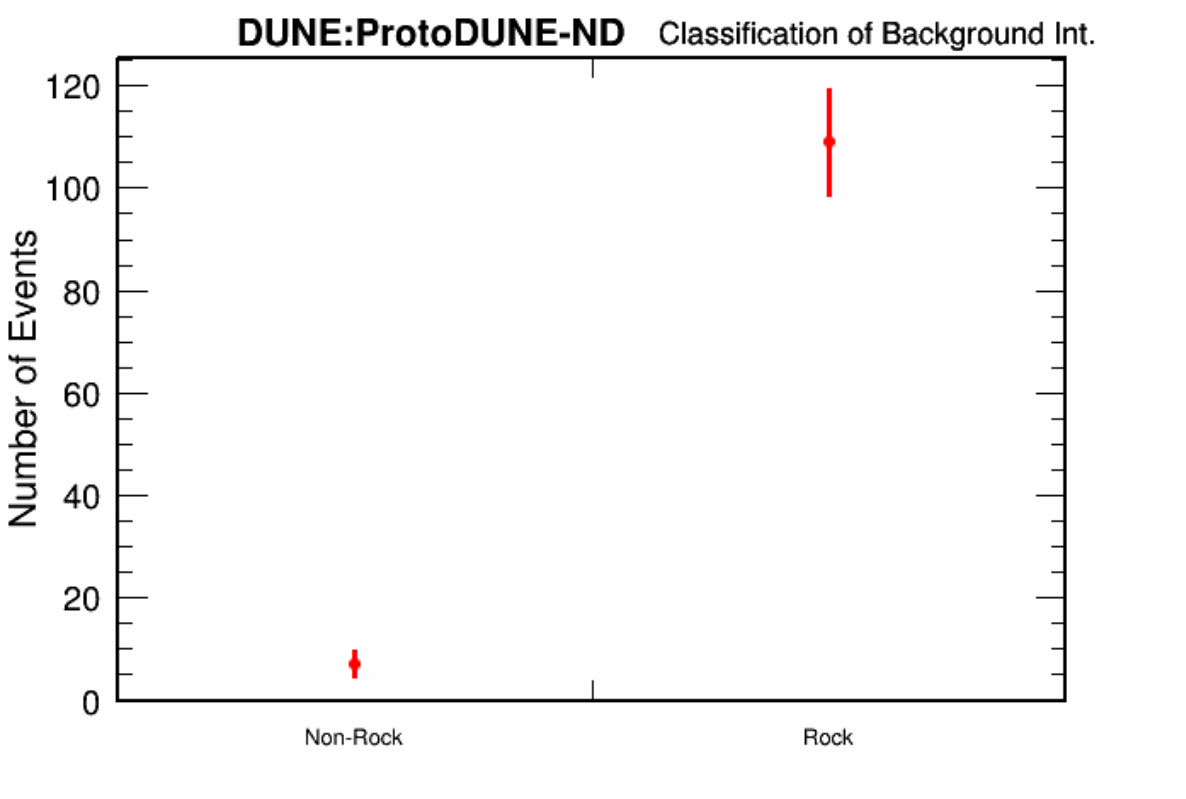
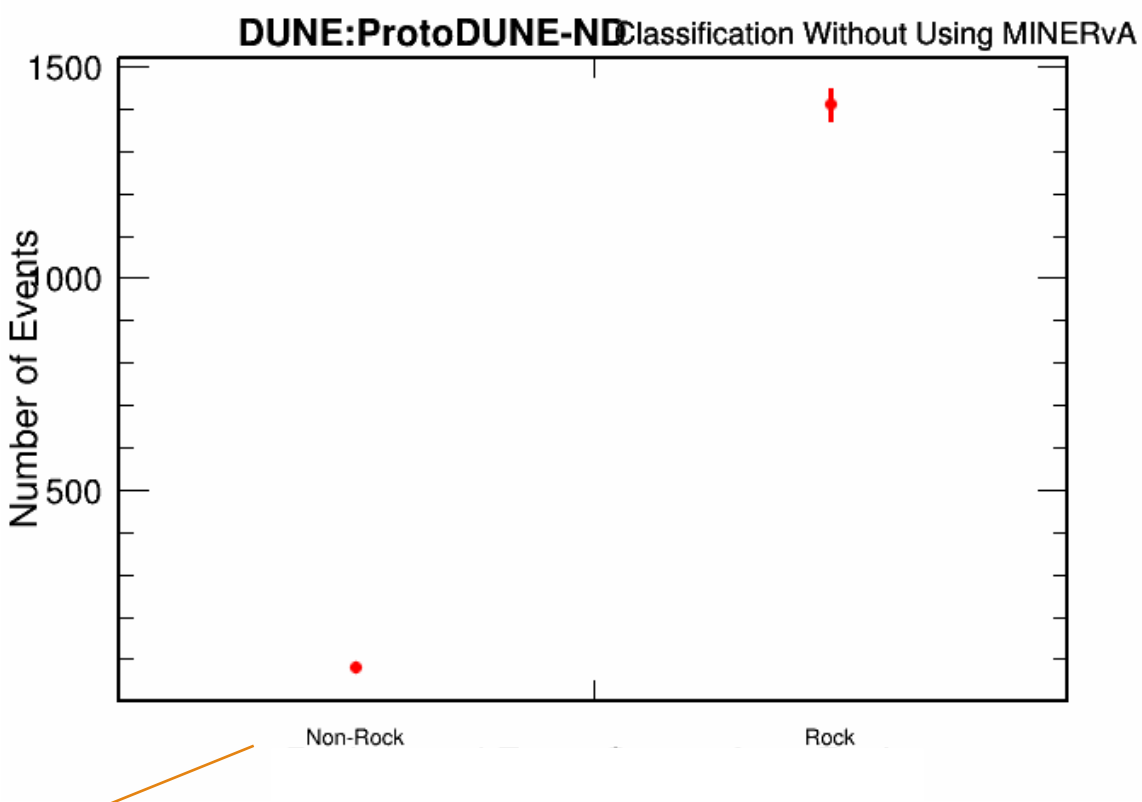
- There are a total of 7080 CC numu/numubar interactions between 12<abs(x),abs(z)<53 and abs(y)<53 cm.
  - There are 3482 CC numu/number interactions in the first two modules.
- Flow chart is presented with efficiency and purity.



Backgrounds for MINERvA Matched Events

- This is with just one exiting track and any number of other tracks.
- None of the non-rock background is from nues or NC events. Just interactions with bad vertices.

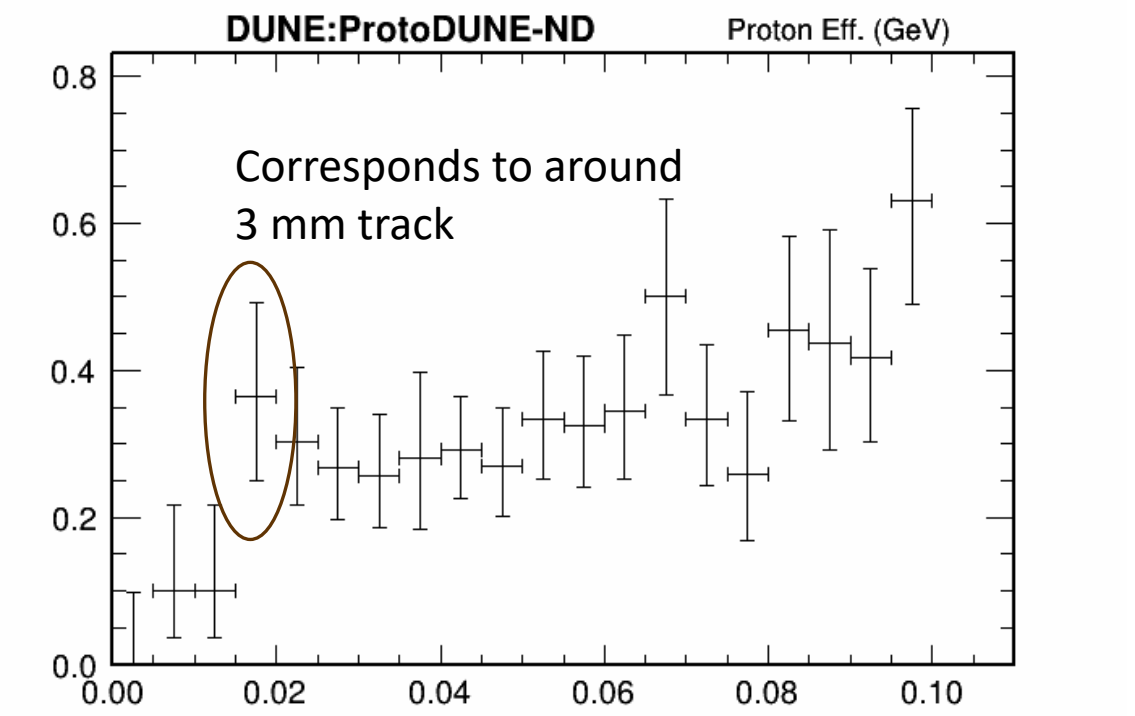


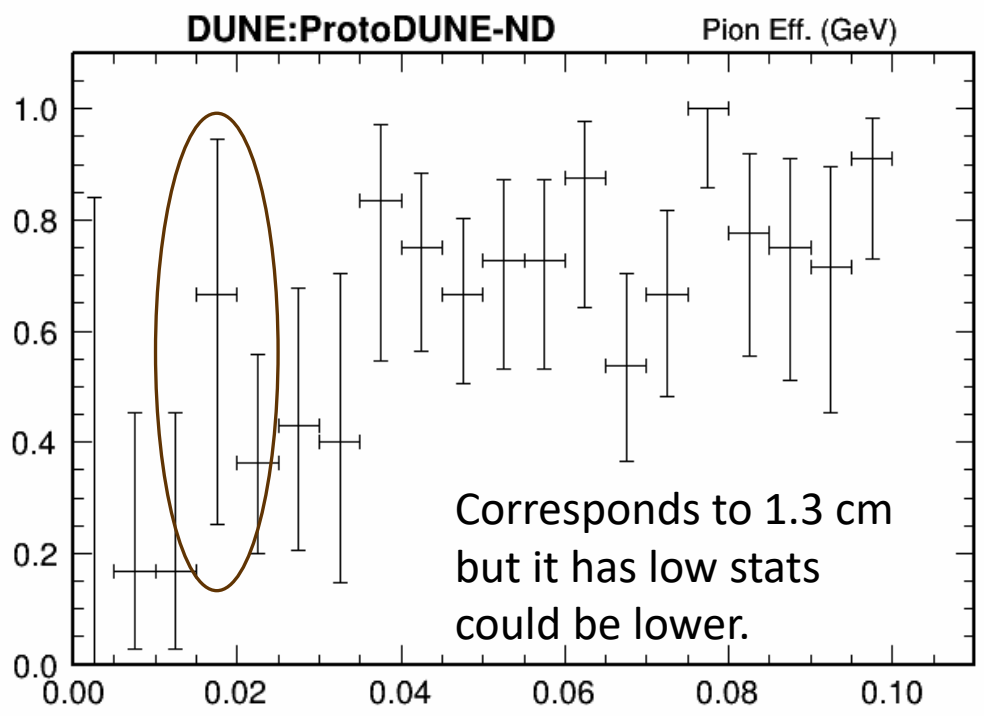


This includes backgrounds with bad vertices, not on argon interactions, and not CC or numu/numbar.

Hadron Reco. Eff. with MINERvA Matched Evts.

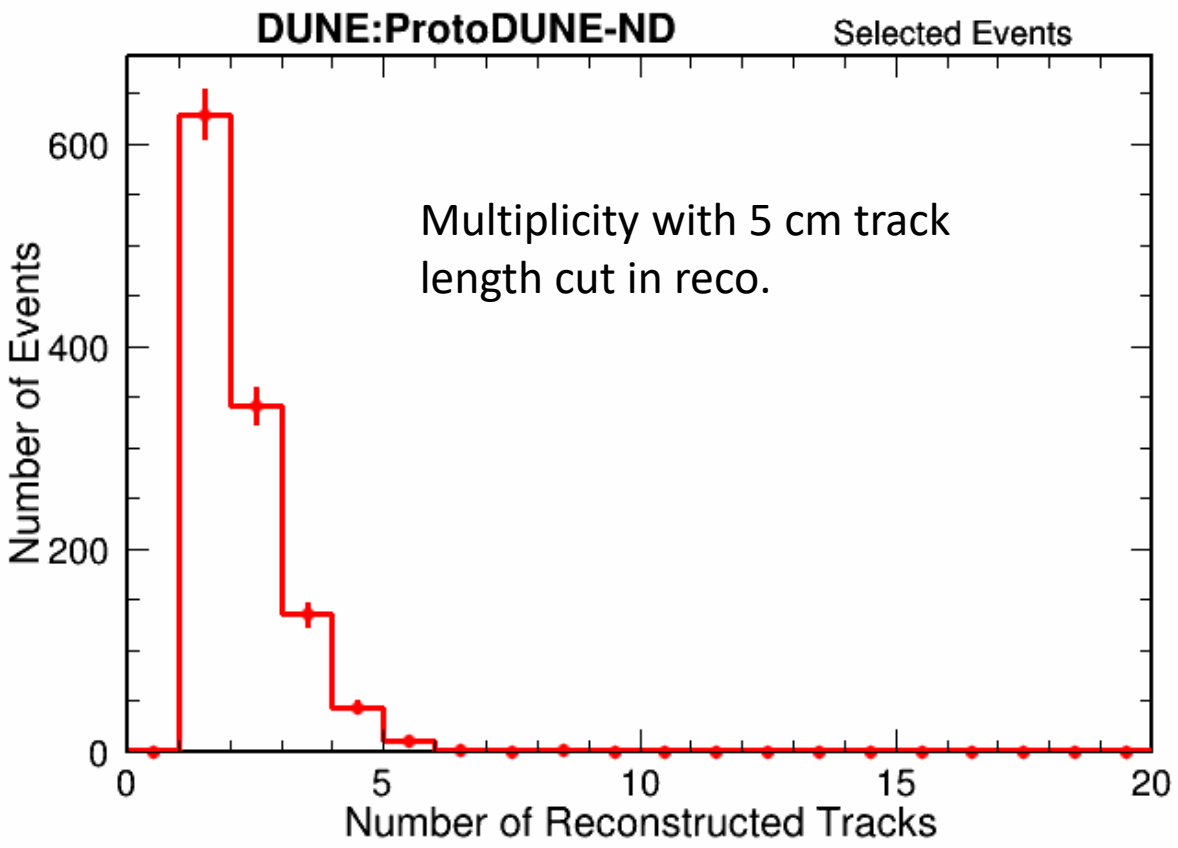
- What is the efficiency of selecting charged hadrons in the liquid argon?

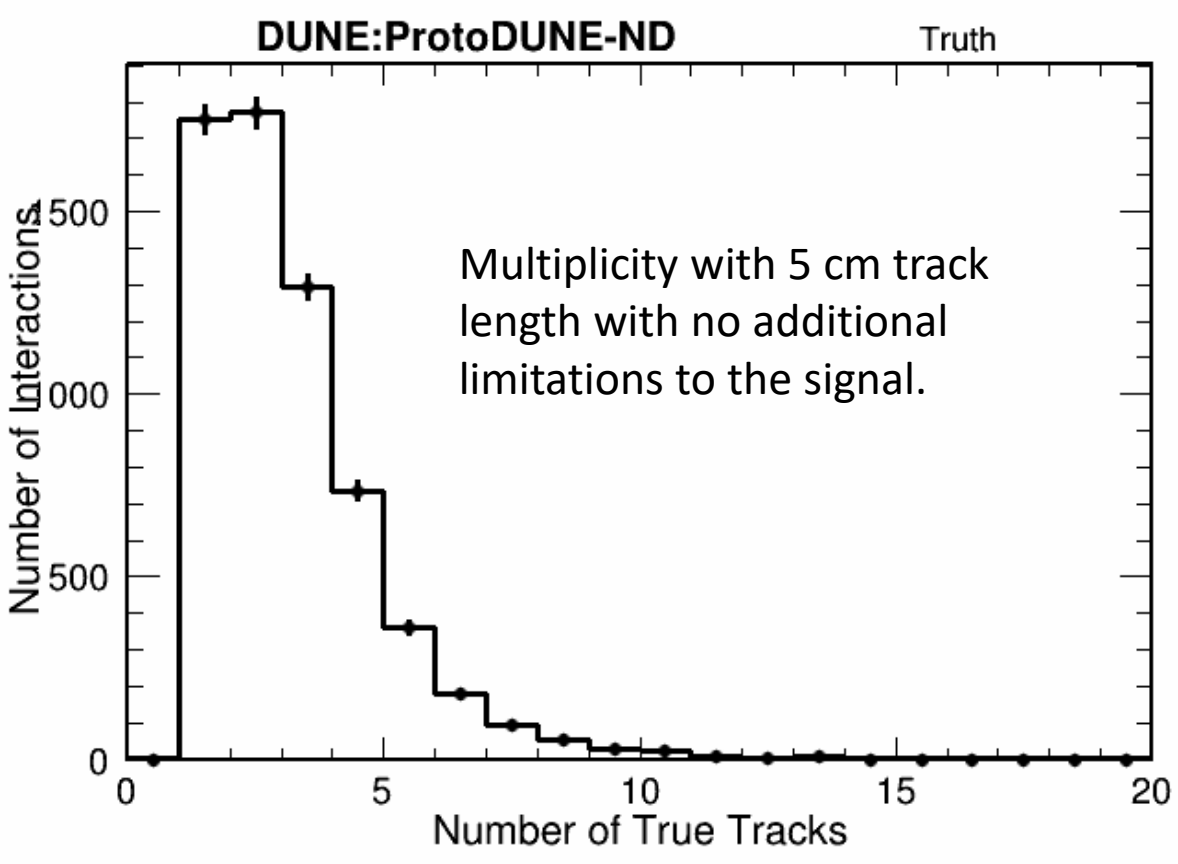




Conclusion

- Presented the preliminary results with beta3 now that we can apply the full signal definition.
- MINERvA matching bug, on my side, is fixed and the purities are now evaluated.





Backtracking information with MINERvA Sel.

- Contains 3 interactions where a muon was not the main match to MINERvA but MINERvA still selected the event.
- Shows the cosine in the liquid argon of the track being matched to MINERvA.
- We should probably put angle restraints; I was surprised by how orthogonal this is because I put limits that it has to “punch-through”.
- I need to investigate this further as this will guide the cosL cut on the signal definition.