Reclaiming back-exiting tracks for nue analysis

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Introduction

- Simple study: similar to what I did before
- This time should be much more closely comparable with Melanie’s work
- Perform usual track cuts, but only on back-exiting tracks
- (Here “signal” is any $\nu_e$ CC, no energy cut)
\( \mathcal{L}_{EM} - \mathcal{L}_{LT} \)

(Arbitrary) POT normalized

Area normalized

- Require exactly one fiducial 3D track which exits the back
- Calculate likelihoods from default pdf histogram
  - Long term: separate “exiting” hists, but this seems to work
- For rest of plots, cut at 0 (though higher might be better)
Width of hits, varmom fit, node direction

(Arbitrary) POT normalized
Area normalized

More separation available
Width of hits, ignoring track fit

(Arbitrary) POT normalized

Area normalized

- For rest of plots, cut at 4 (eyeballed)
Number of TPC PIDs

(Arbitrary) POT normalized

Area normalized

- Could require 0 (more for containment than selection)
Remaining contained background

- Selected BG evts remaining after Melanie’s cuts plus width
- See backup slides for evt displays
- Conclusions: we’re down to hadronic tracks and $\pi^0$s
  - Eliminating $\pi^0 \sim$impossible(?)
  - Eliminating hadrons could use shower shape info? Contiguity/occupancy?
Conclusions

- Can do pretty well at reclaiming back exiters even without TPC
Legend for event displays

- Unreco'd hit
- Reco'd hit

Truth

- Neutron
- Proton
- $\gamma$
- $e^\pm$
- $\mu^\pm$
- $\pi^\pm$
- Other charged
- Other neutral
Event 10390

- EM-like track is following hadrons
Hadronic shower. Hits at end missed. Maybe shower finder can help.
Event 482

- Backward $\mu$. Hadronic shower gives large width at end
Event 6503

$\pi^0$
Event 12061

▶ Charged pion
Event 5076

\[\pi^0\]
Event 12386

Top (X-Z)

Side (Y-Z)

\[ \pi^0 \]
Event 6163

▶ Hadrons
Event 14104

Top (X-Z)

Side (Y-Z)

$\pi^0$
Event 6286

Top (X-Z)

Side (Y-Z)

\[ \pi^0 \]
I had to hunt for this one, but it's fairly spectacular. MC says it has an $\eta$. 
Event 3300raretrajonly

Previous event with only trajectories shown