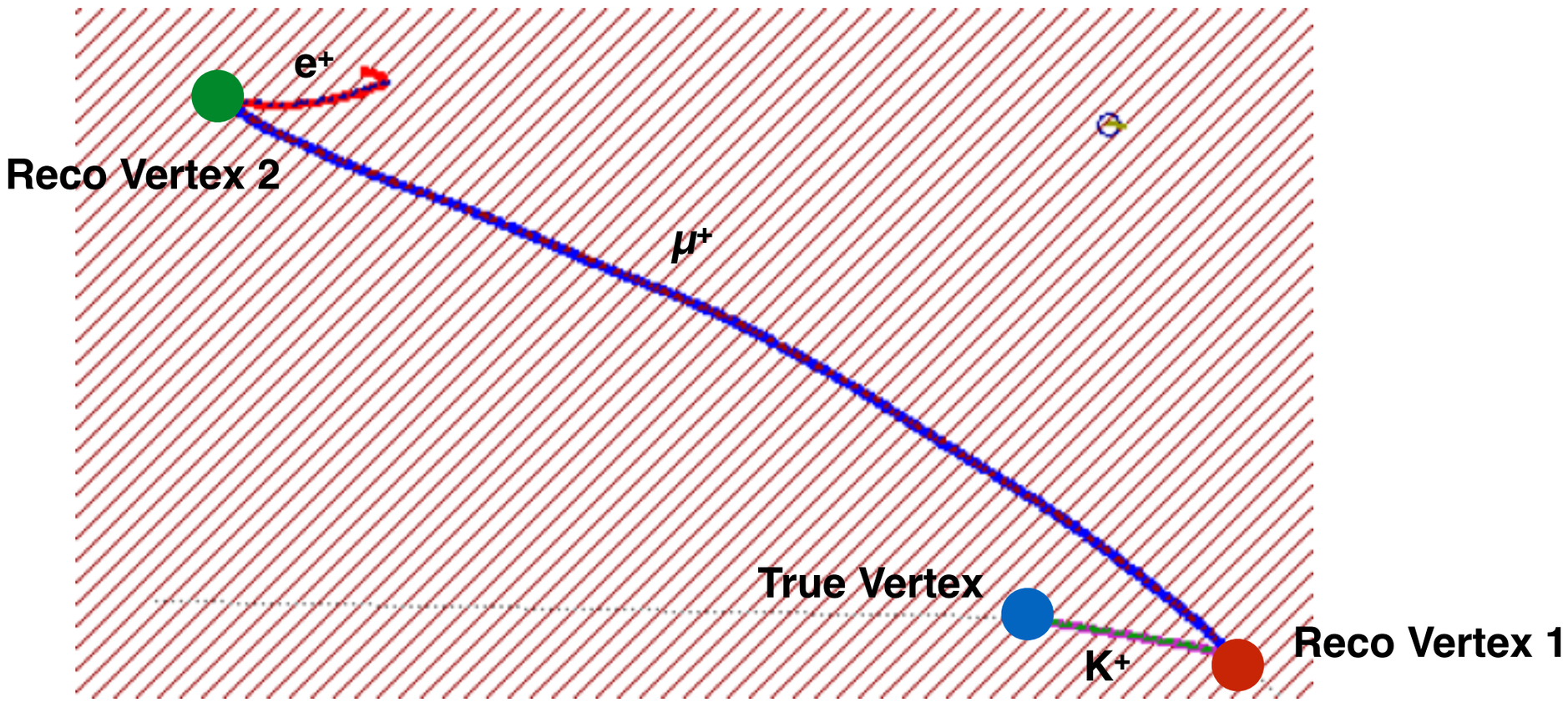
DEEP UNDERGROUND NEUTRINO EXPERIMENT

UNIVERSITY of HOUSTON
YOU ARE THE PRIDE
DEPARTMENT OF PHYSICS

Proton Decay, $p \rightarrow K + \bar{\nu}$

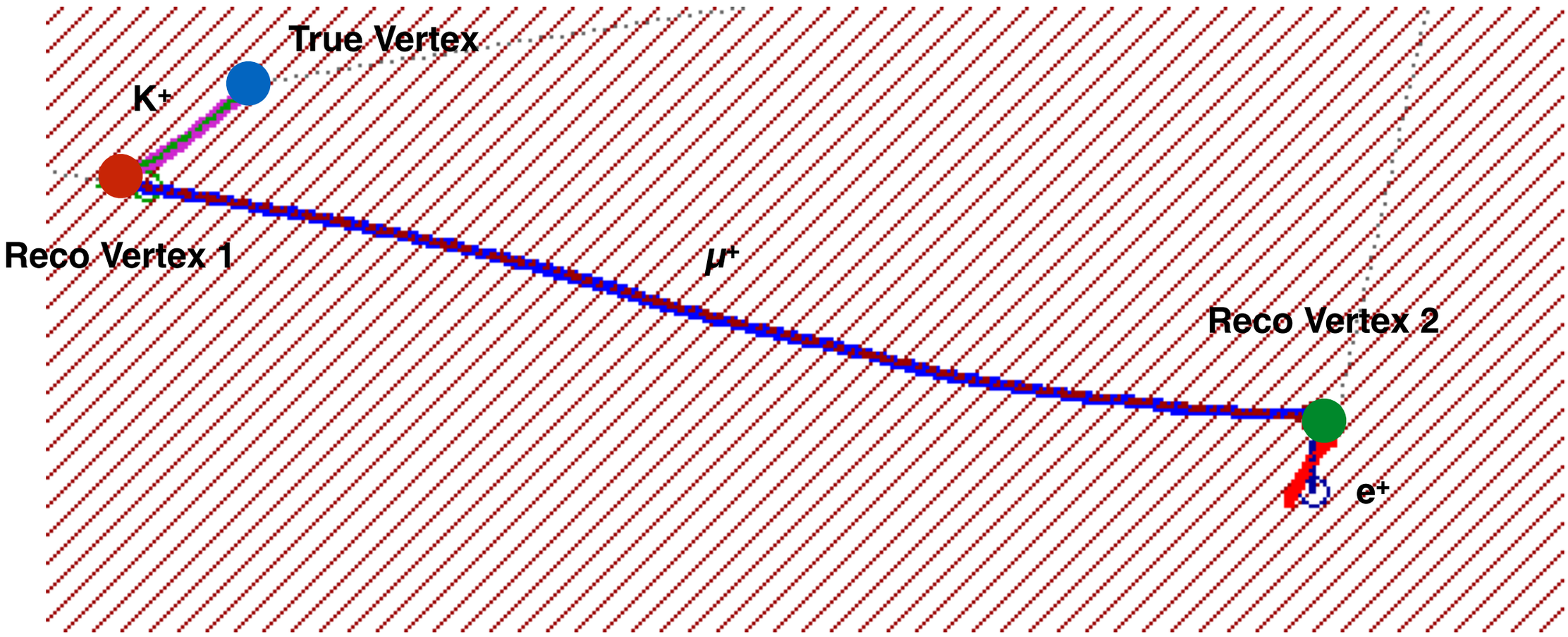
Aaron Higuera
University of Houston

Proton Decay, p → K+ $\bar{\nu}$



For p → K+$\bar{\nu}$ events the reconstruction always anchors the end of the kaon track and the muon track to make a vertex

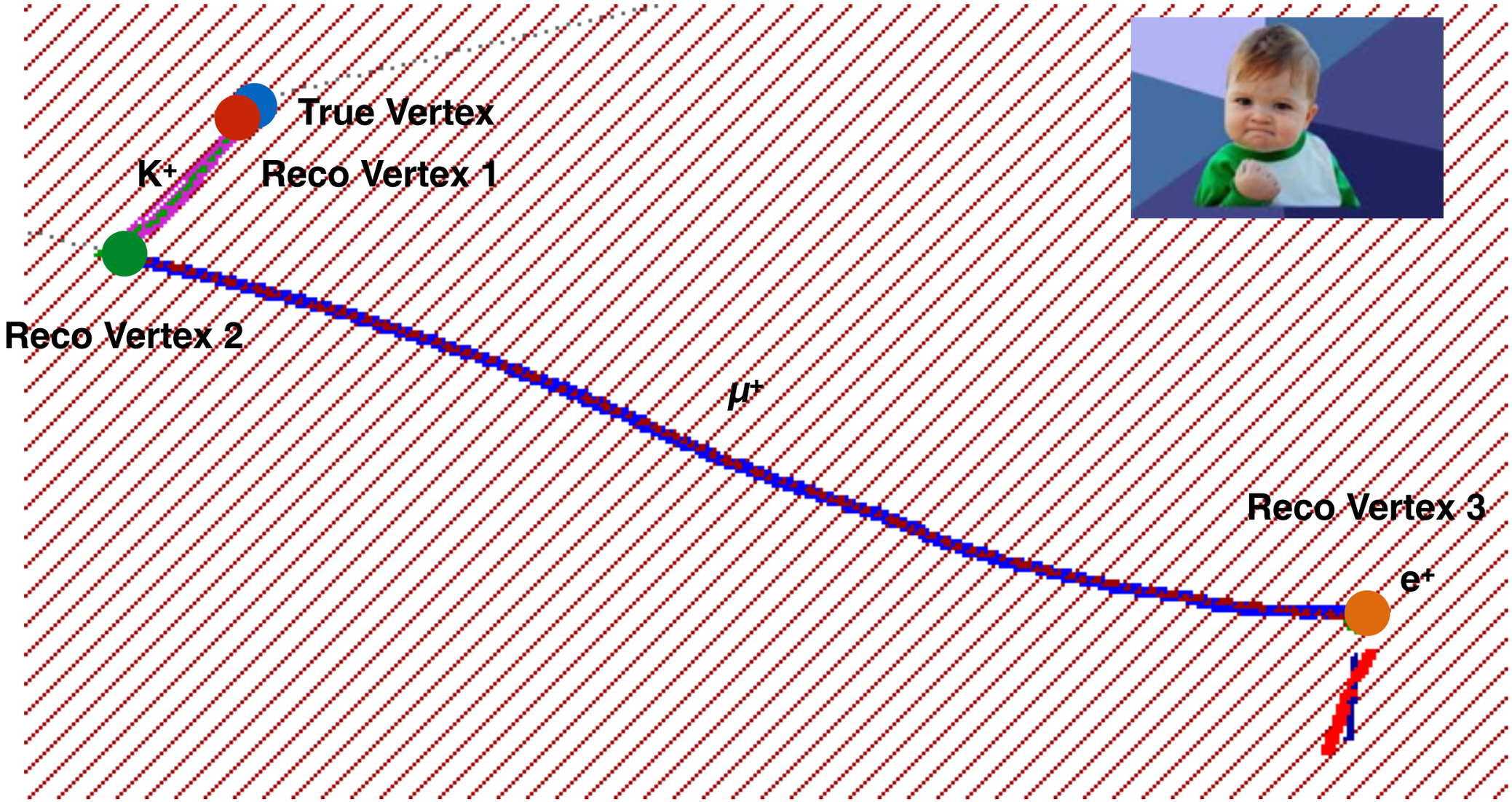
Proton Decay, p → K+ $\bar{\nu}$



To determine the direction of a track dQ/dx can be used to determine end/ beginning of tracks, there is the option to flip flop direction accordingly to dQdx

```
physics.producers.pmtrack.AutoFlip_dQdx: true
```

Proton Decay, p → K+ $\bar{\nu}$



My customize reconstruction

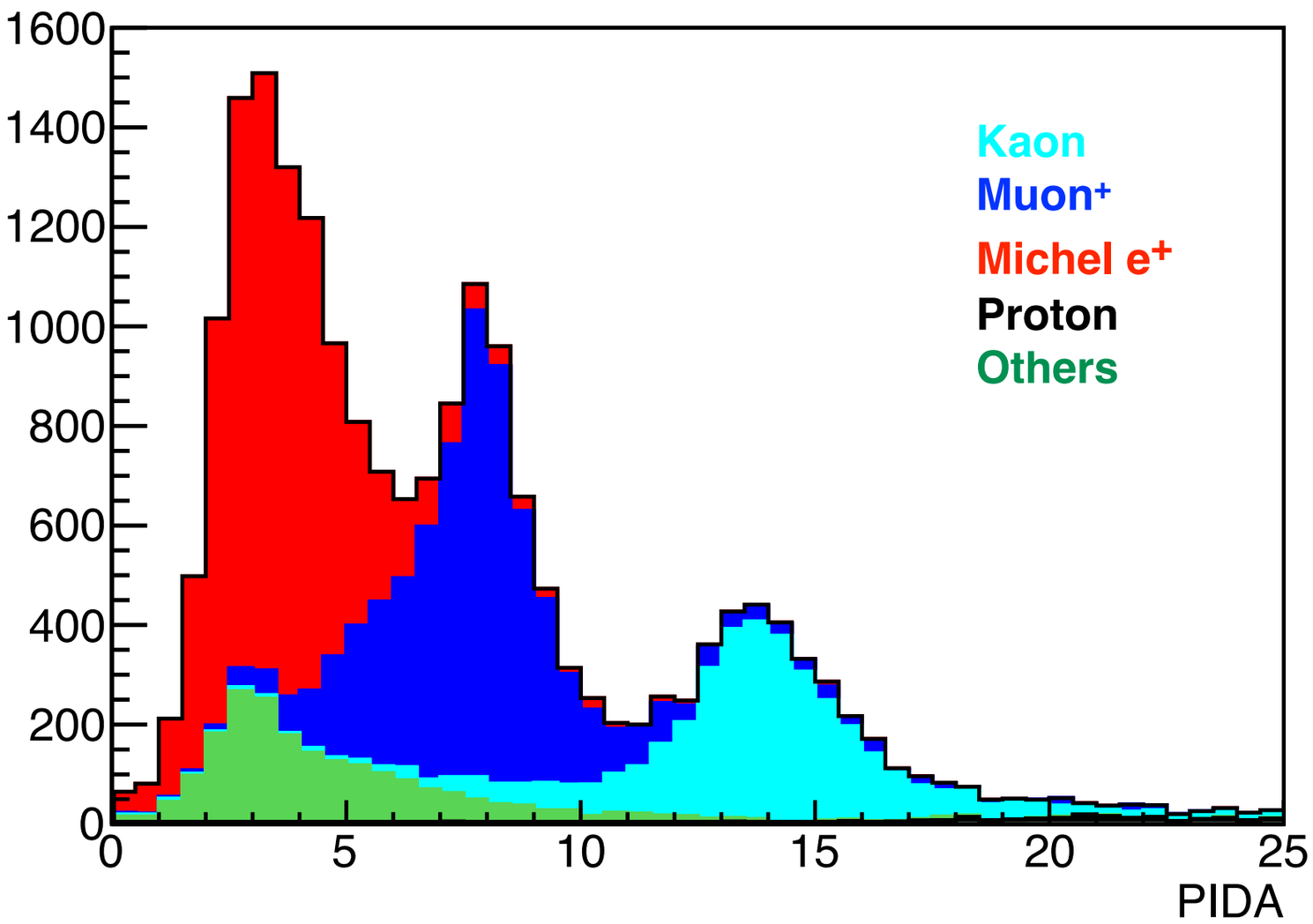
```
physics.producers.pmtrack.AutoFlip_dQdx: true
physics.producers.pmtrack.MinSeedSize2ndPass: 2
```

Proton Decay, p → K+ $\bar{\nu}$

For now we are going to focus only on K → μ^+ + ν_μ events

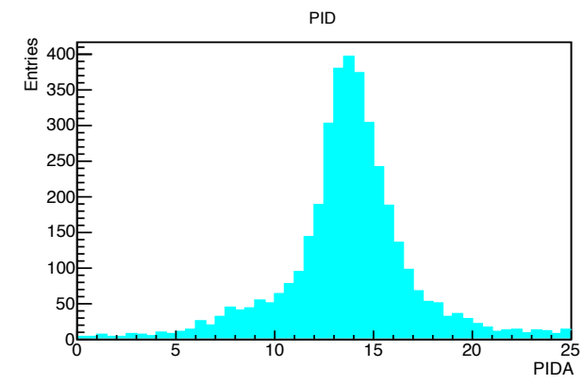
PIDA of the last 15 cm of track

$$PIDA_i = (dE/dx)_{calo} R^{0.42}$$



Proton Decay, p → K+ $\bar{\nu}$

Kaon-1sigma < PIDA < Kaon+1sigma



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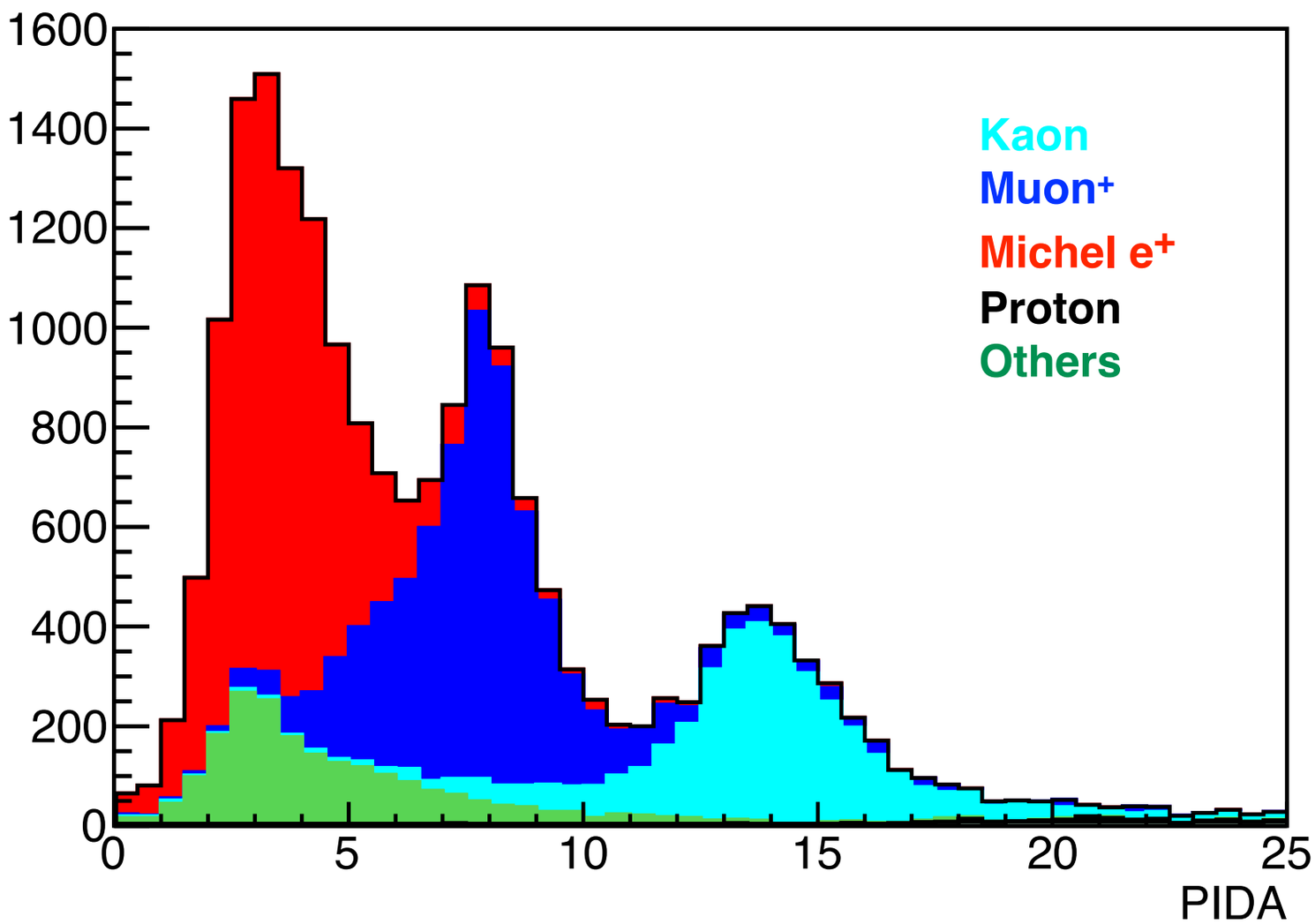
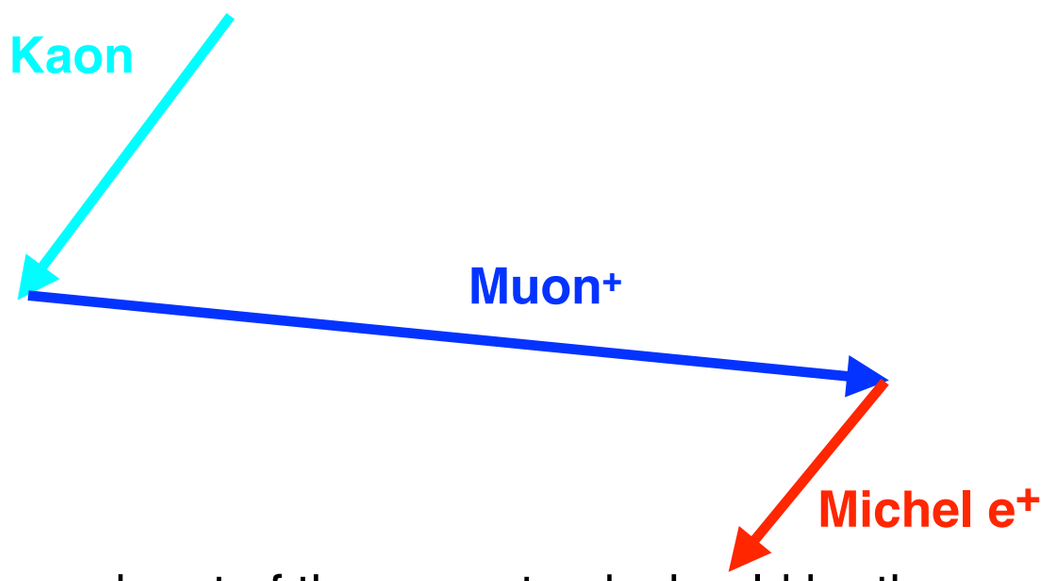


	Efficiency
Kaon	46.0%
Muon	72.3%
Michel e	64.6%
Kaon && Muon	31.7%
Kaon && Michel e	29.2%
Muon && Michel e	48.6%

Proton Decay, p → K+ $\bar{\nu}$

Once a muon has been identified select events based on topology

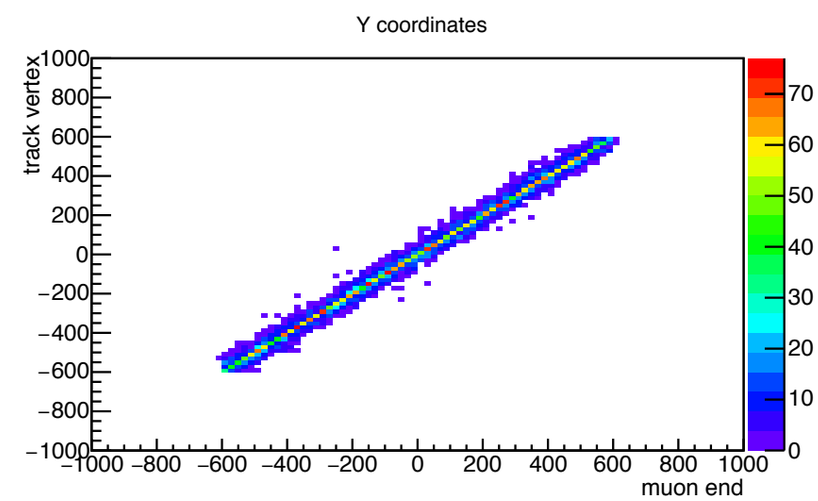


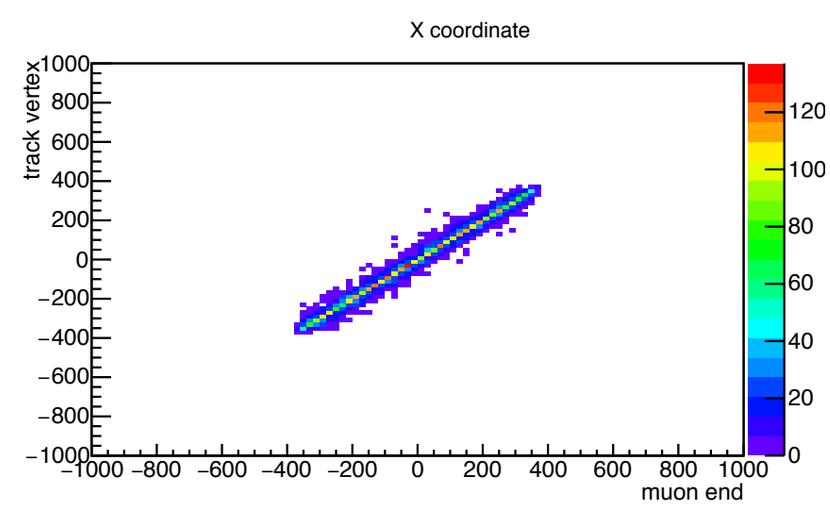
The end part of the muon track should be the same as the beginning part of the Michel electron

For atmospheric events the Michel candidate cut will remove CC ν_μ events significantly

(A PDS trigger will make this very trivial)

If at least two coordinates match we found a Michel candidate





Proton Decay, p → K+ $\bar{\nu}$

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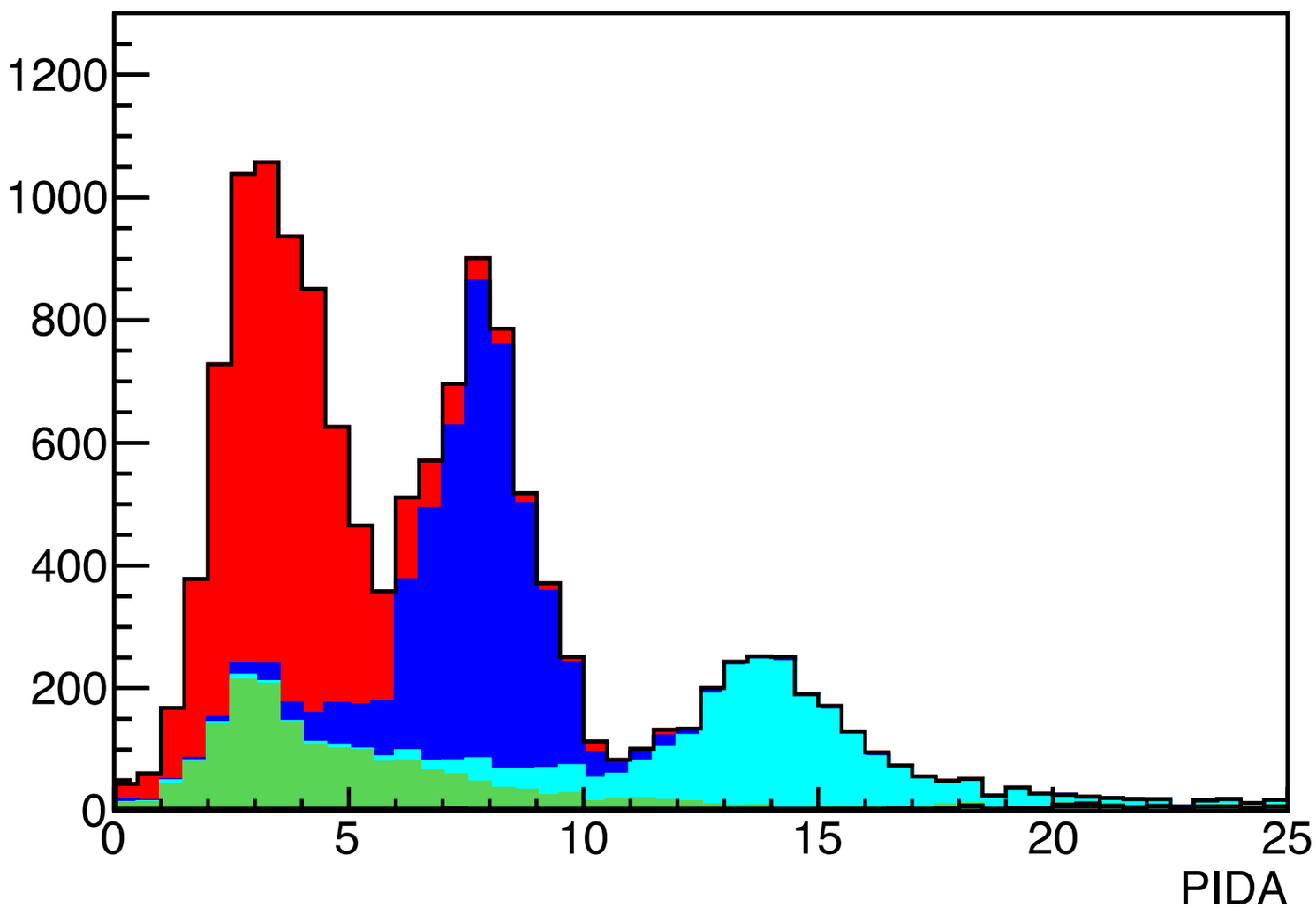

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Kaon && Muon	31.7%
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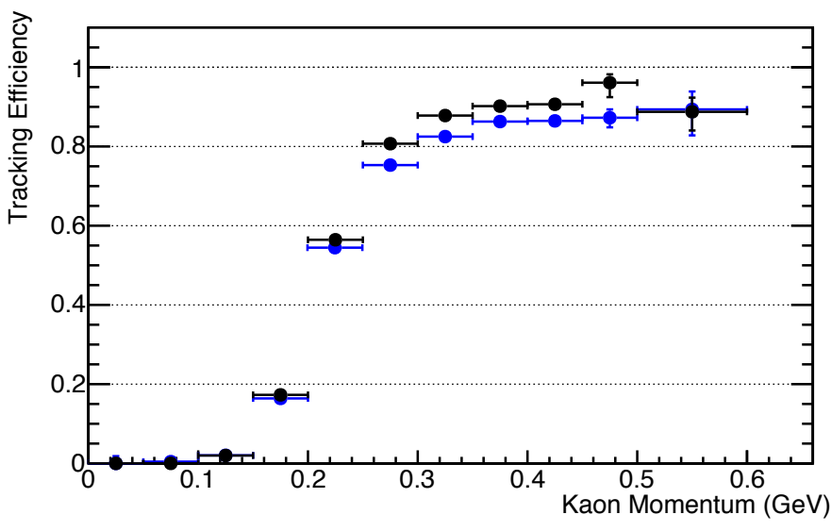
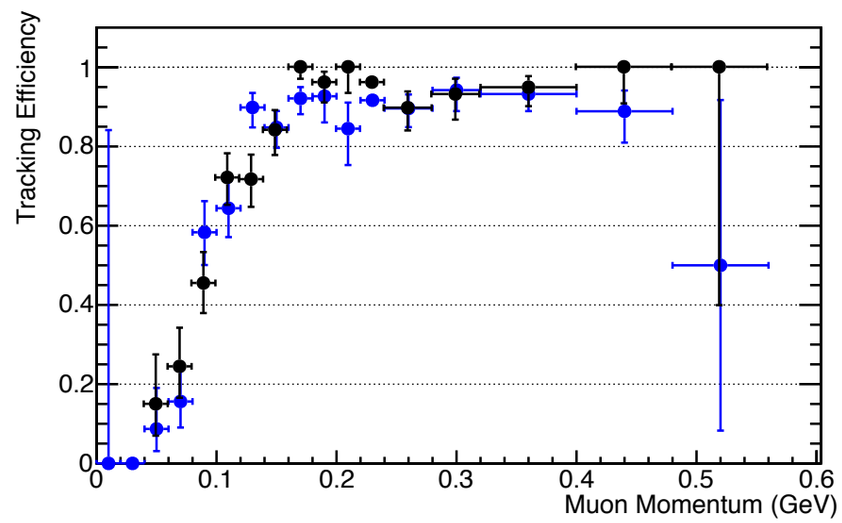
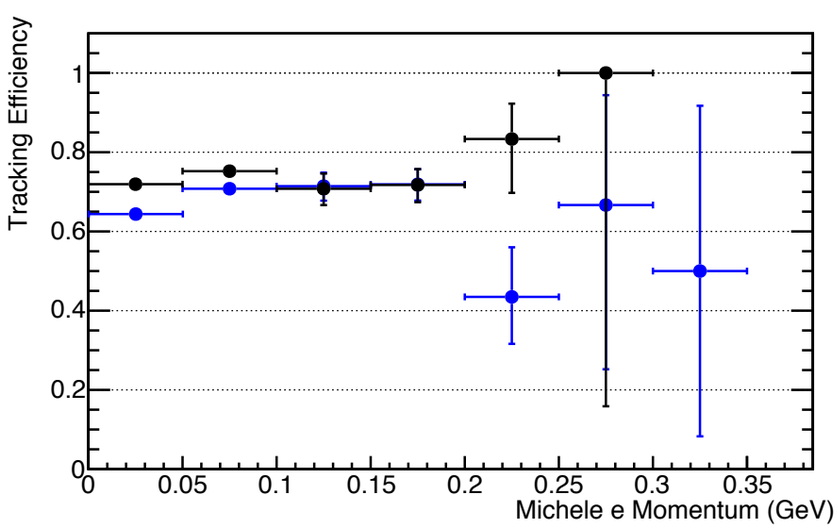
Muon && Michel e	48.6%
Muon && Michel e **based on topology**	**57.9%**

Proton Decay, p → K+ $\bar{\nu}$

There seems to be room for improvement with some tweaks








```
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```

Uses trajCluster as input instead of LineCluster

Comments

- So far best option is select muon from kaon decay
- Decay's topology can be useful for event selection
- Michel tag will remove CC ν_μ from atmospheric events significantly
- PDS trigger would be ideal, need good time resolution to resolve decays
- To do:

  Run customize reconstruction on proton decay and atmospheric events

  Calculate muon momentum (range?)
- Suggestions?

The End