Update on michel analysis

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ProtoDUNE sim/reco meeting

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Updates

- Improved the sample purity a bit more
- Obtained the energy spectrum from the reco hits of true michels
- Tuned the cone parameters to obtain an improved michel energy spectrum

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Improved sample purity

- Added an additional upper limit cut on number of nearby hits from candidate muon end position
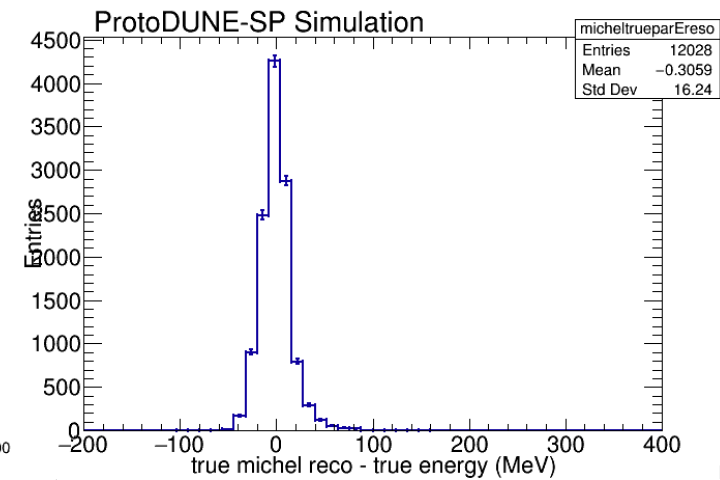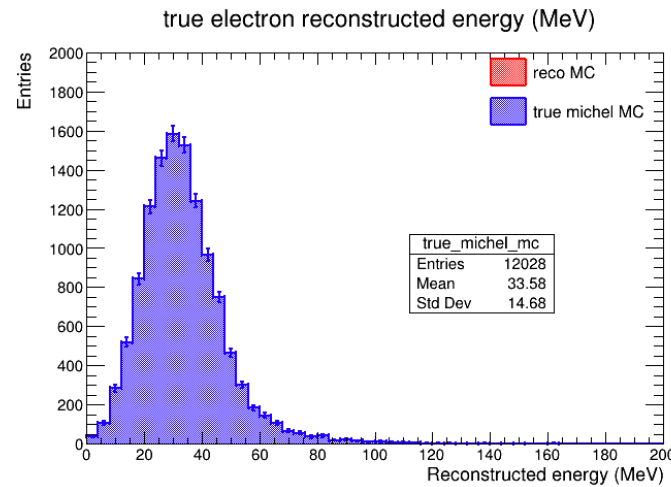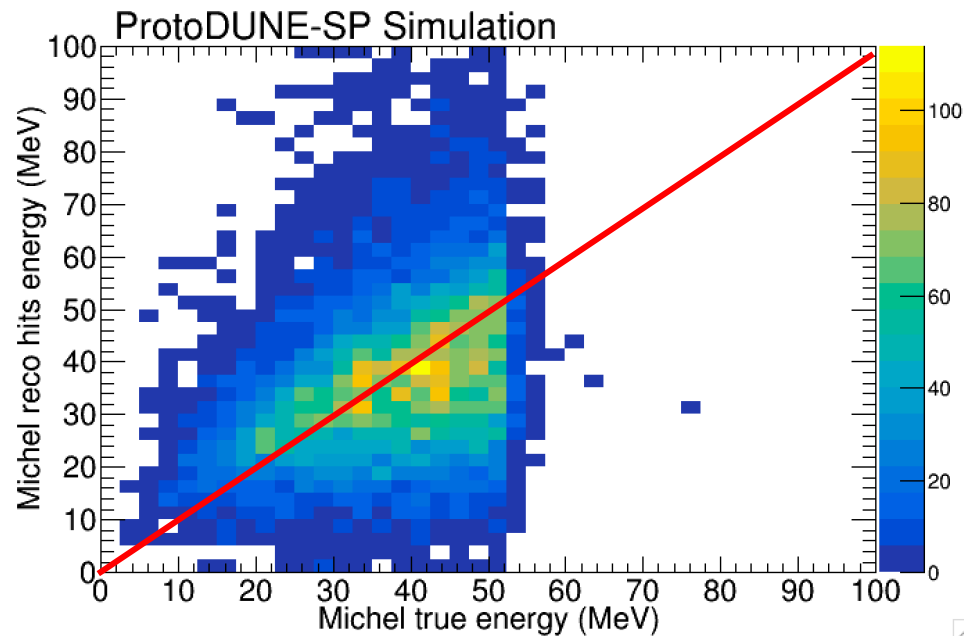
Purity 87% → 89%
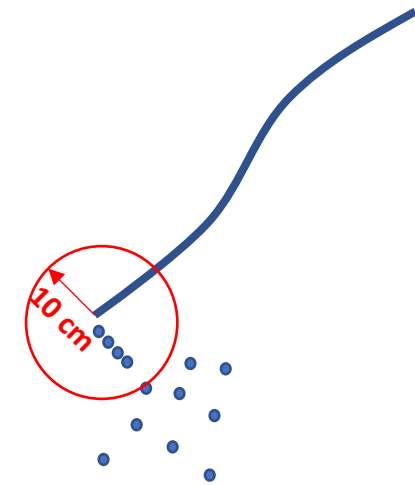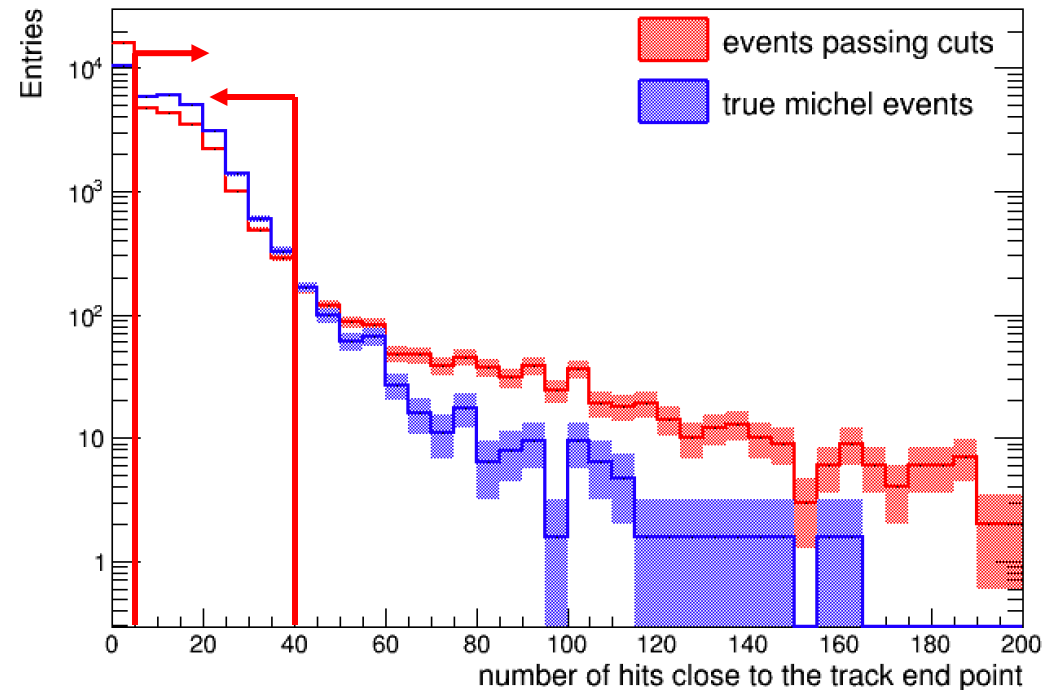
How to improve michel energy spectrum

- Wanted to check how precise michel energy spectrum can be obtained
- Used the backtracker to obtain "reco hits of the true michel" in an event
- Used energy calibration on the reco hits of the true michel

Michel energy spectrum

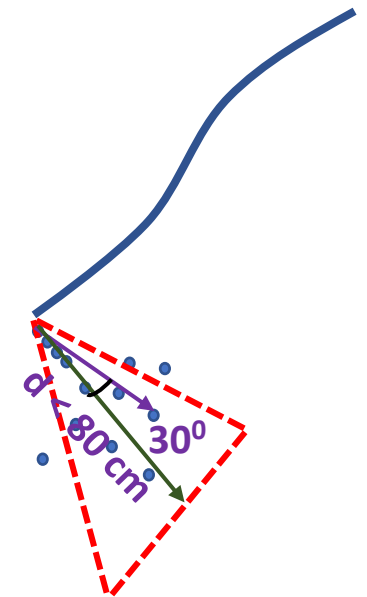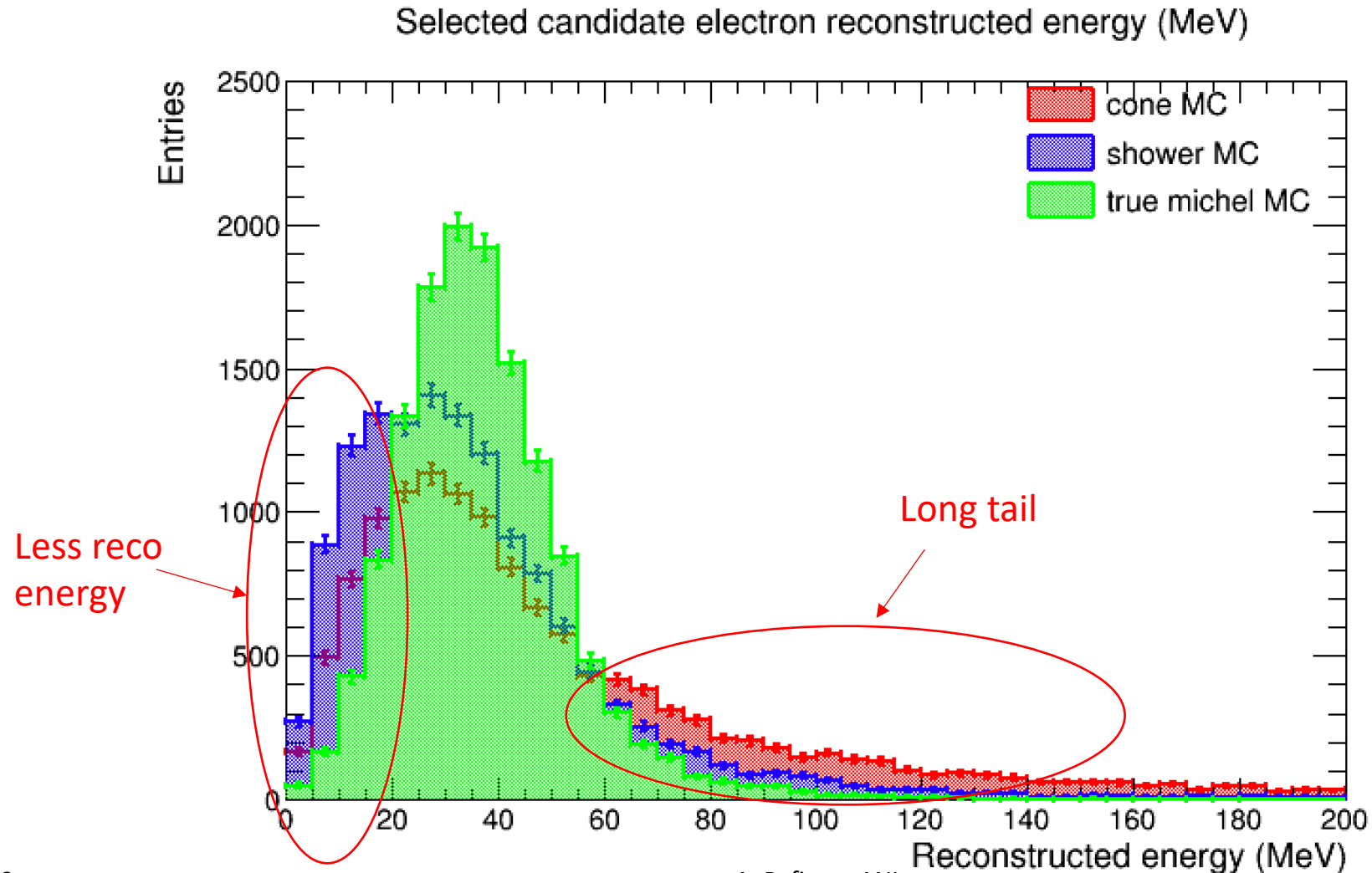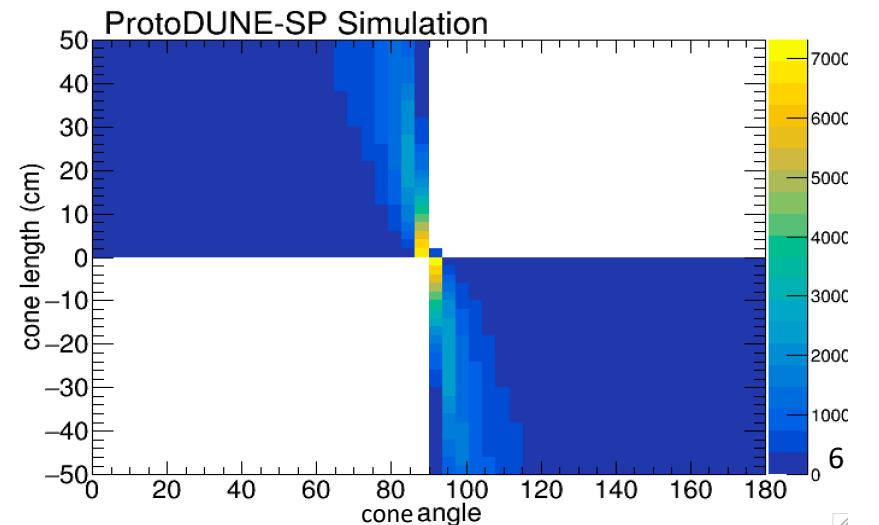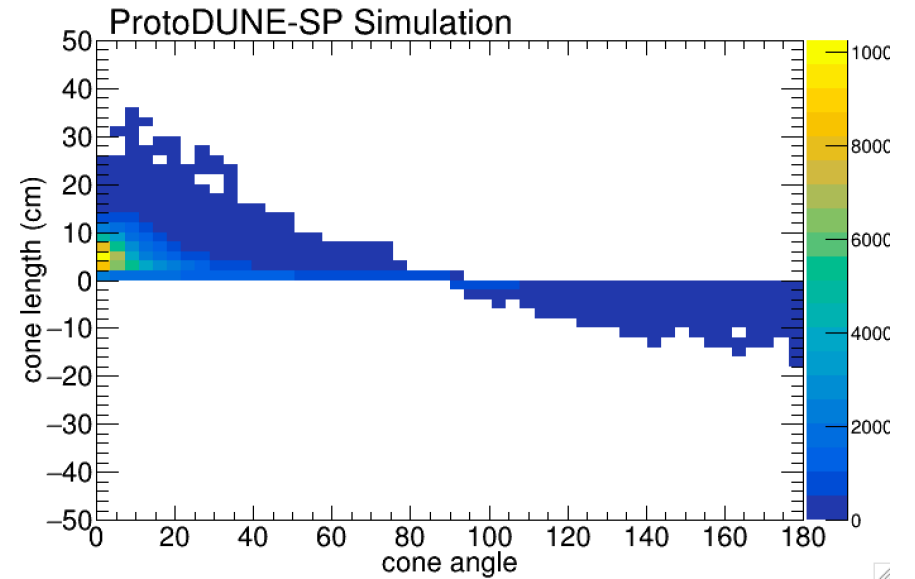Selected candidate electron reconstructed energy (MeV)

Tuning the cone parameter
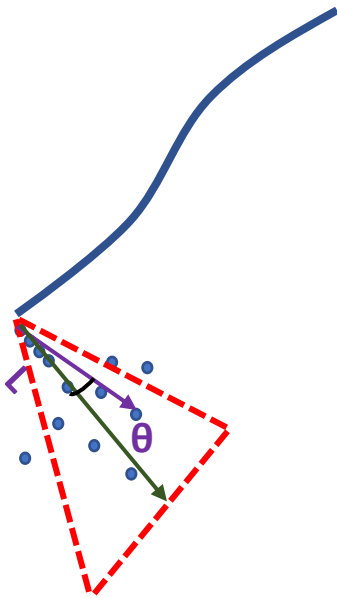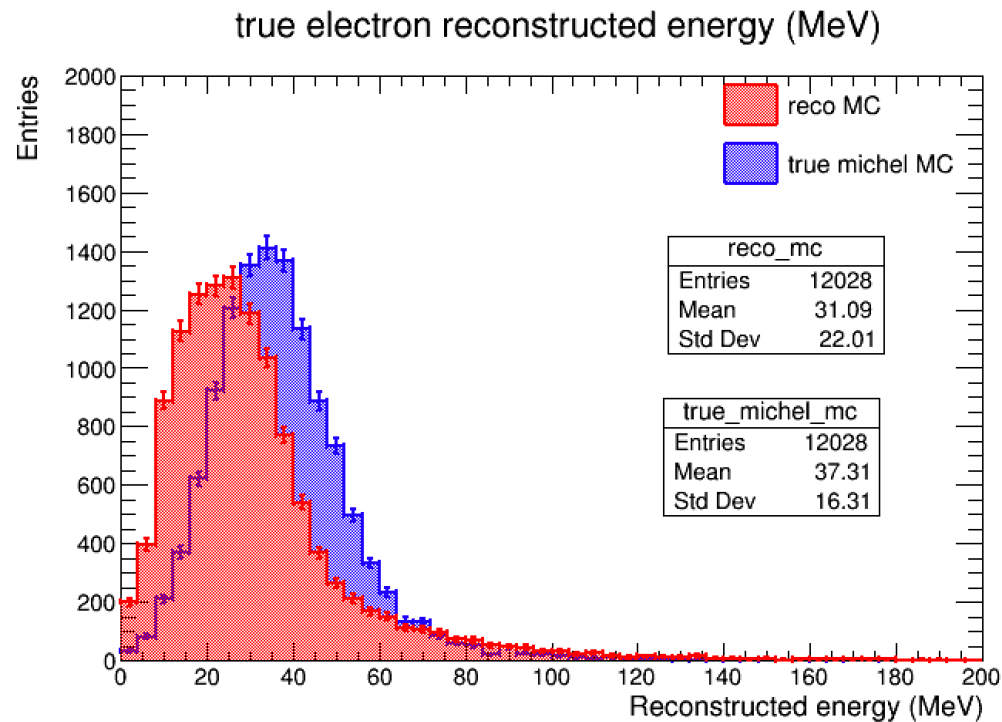

True michel reco hits

All other hits of the events
except for the parent muon
or any other track having > 10
cm track length

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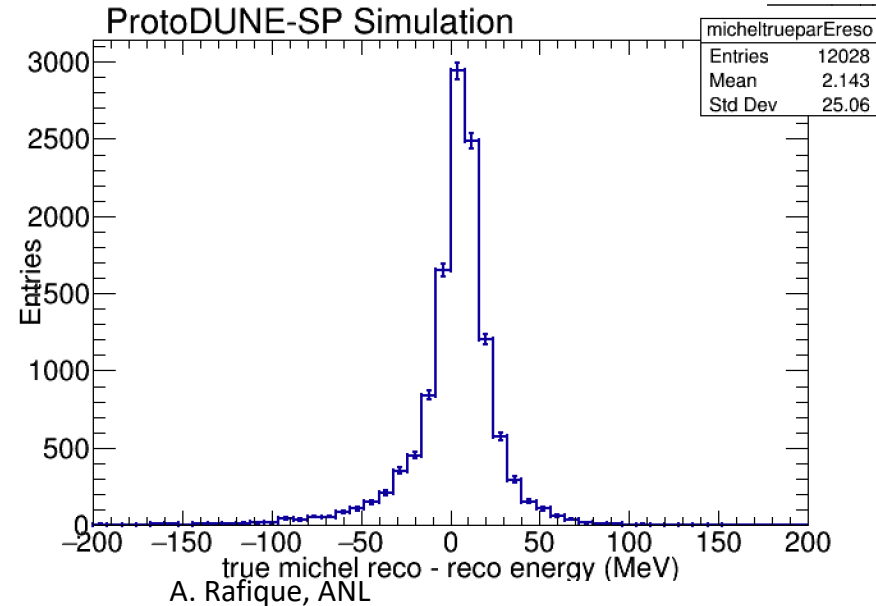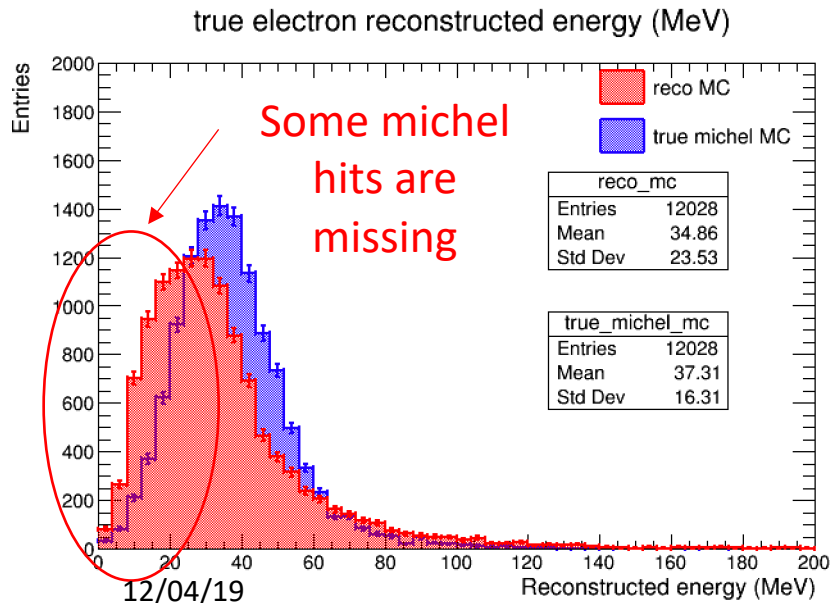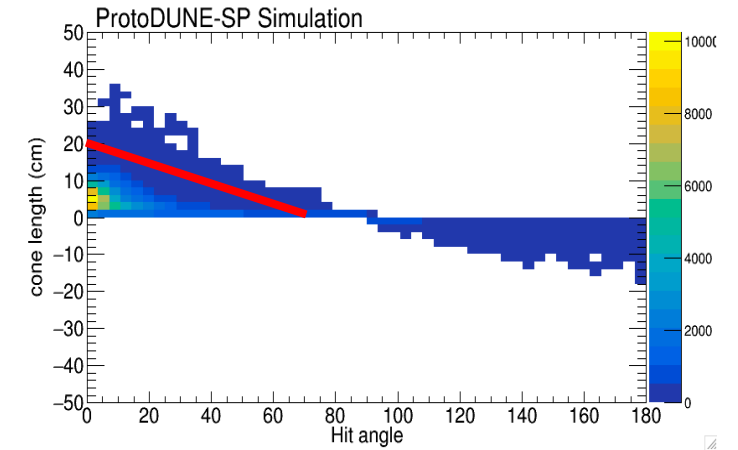# Tuning the cone parameters

Cone angle = 45^0
Cone length = 15 cm
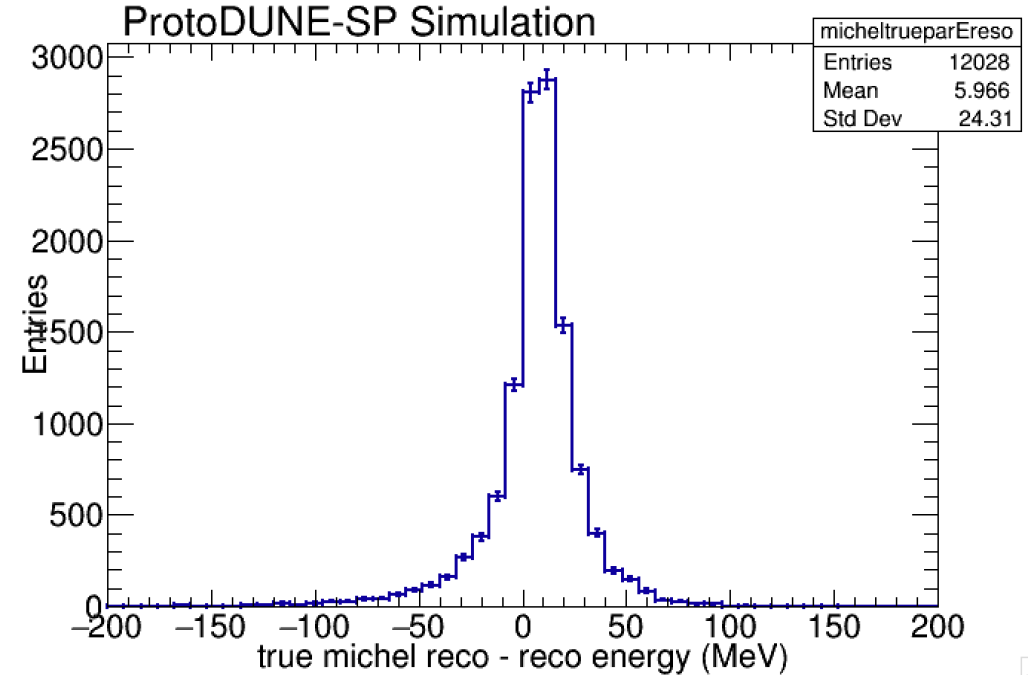
Tuning the cone parameters

Considering all points point under this line:

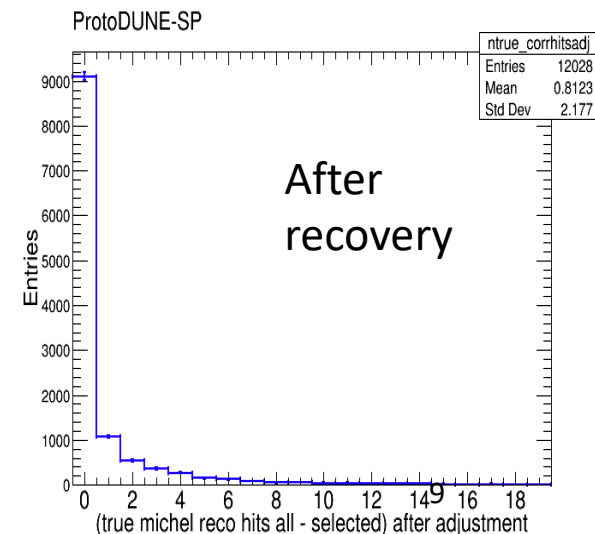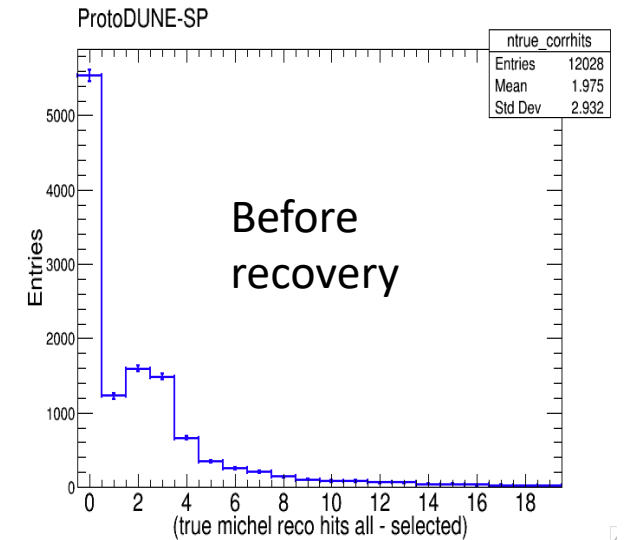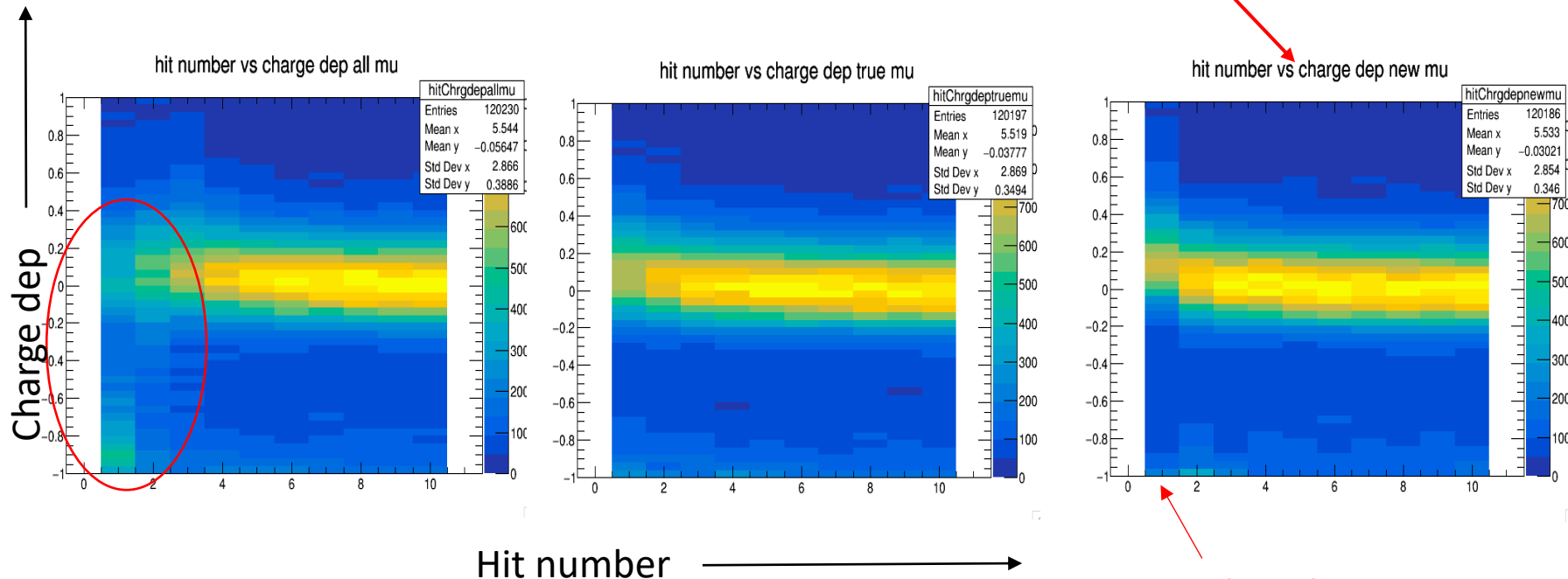Cone angle (y-intercept) = 75^0
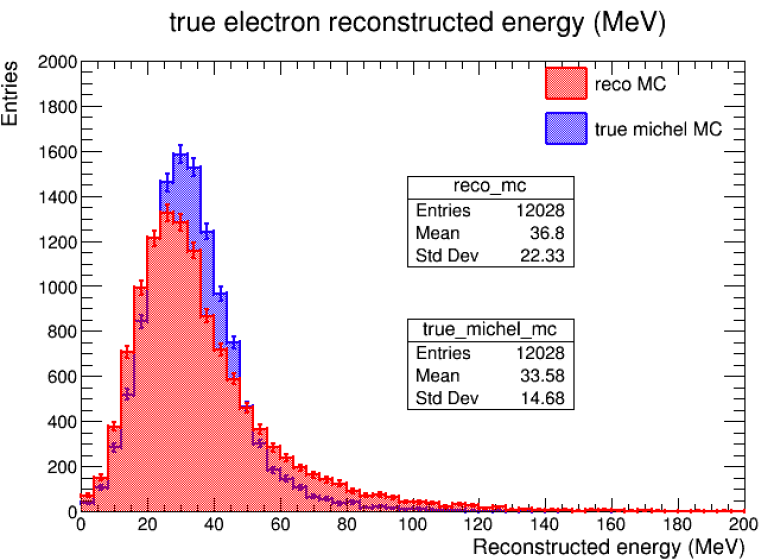Cone length (x-intercept) = 20 cm

# Recovering some michel hits from parent muon

- Look at the charge deposition at the last 10 hits of reco muons
- Charge dep = $(Q_i - Q_{i-1})/Q_{i-1}$
- After removing hits beyond the maximum truncated charge value
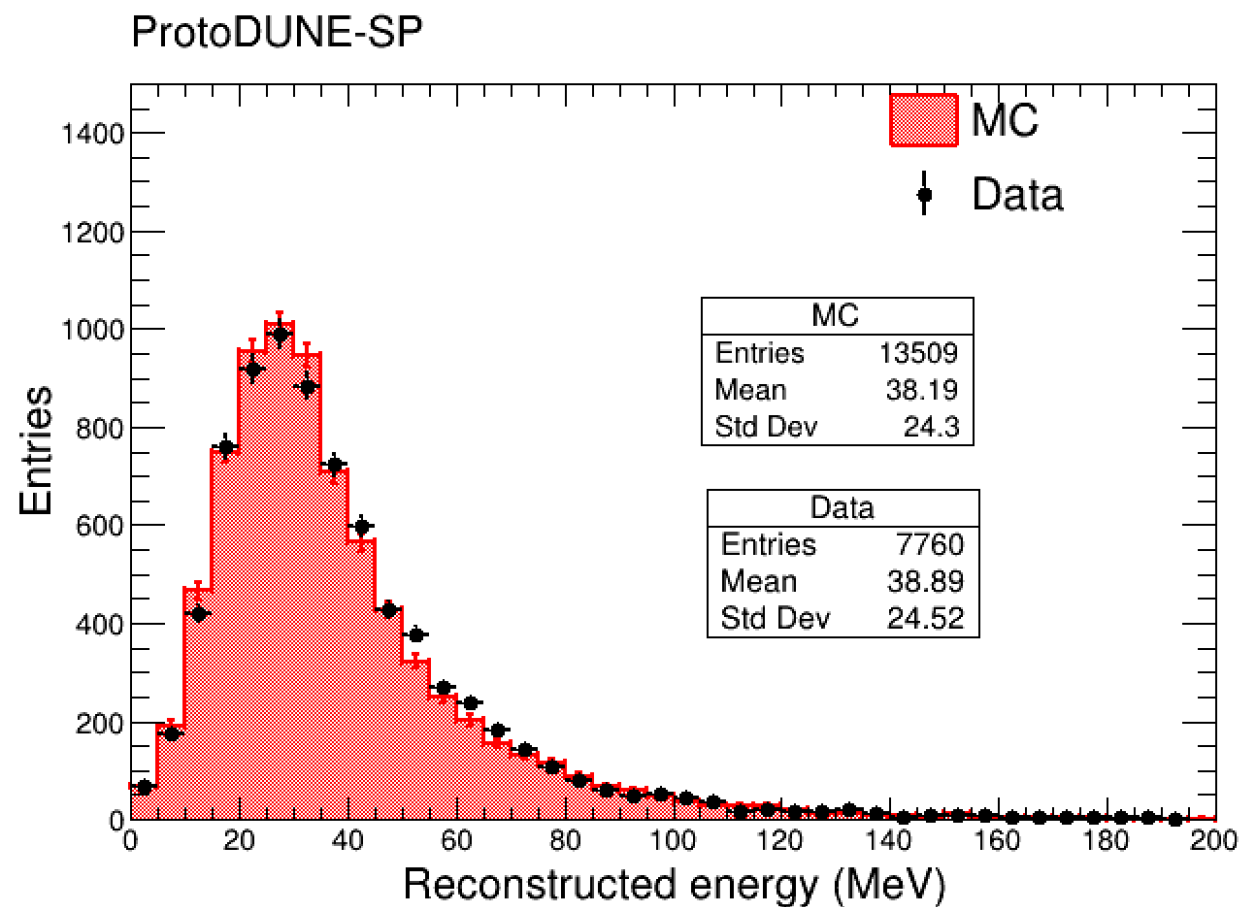 - Recovered 6% of the total missing michel hits

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Michel energy spectrum in MC

Tuned cone parameters:
Cone angle (y-intercept) = 60^0
Cone length (x-intercept) = 15 cm
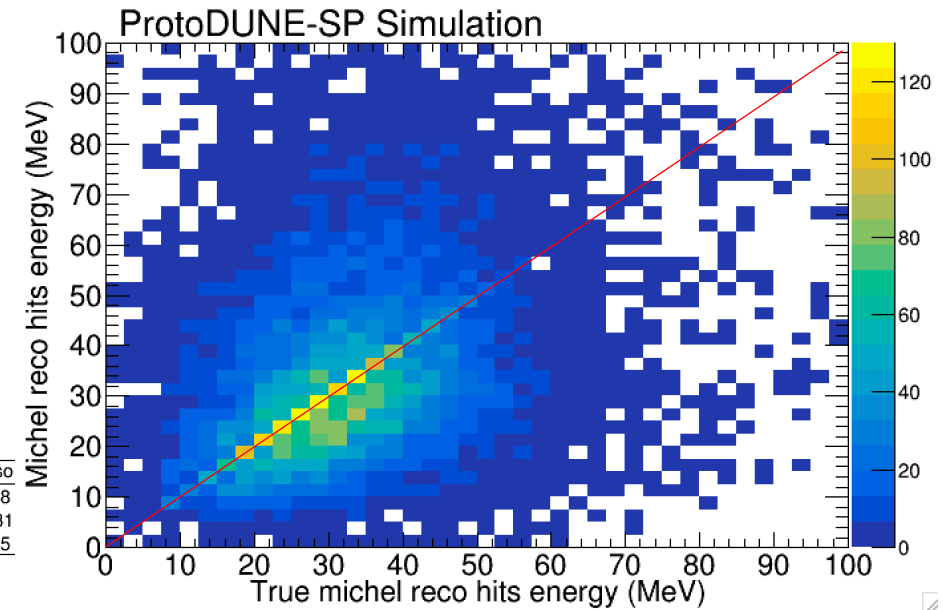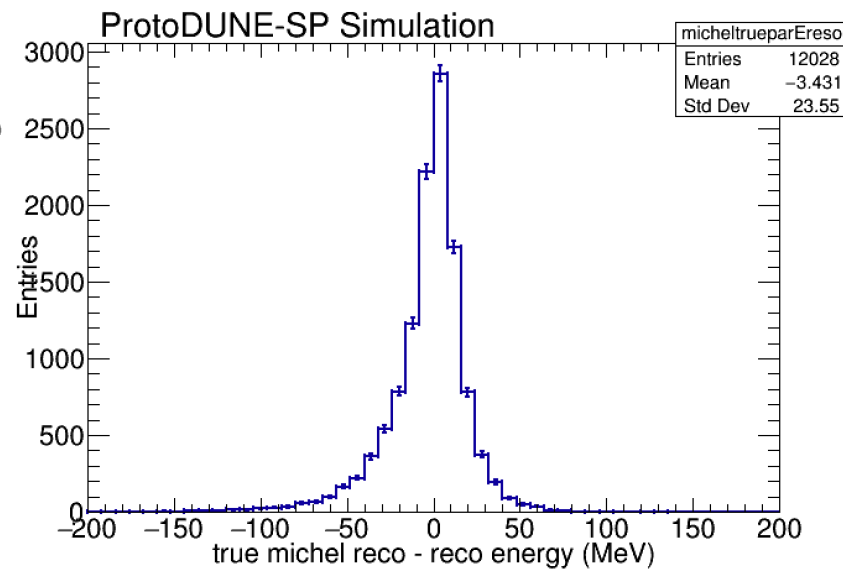
Michel energy data/MC comparison

A very good agreement in ProtoDUNE data and simulation

Summary

- Improved sample purity was obtained

- Improved michel energy spectrum is obtained

- Good data and MC agreement for the michel energy spectrum