Update on low transverse momentum study and muon angle resolution

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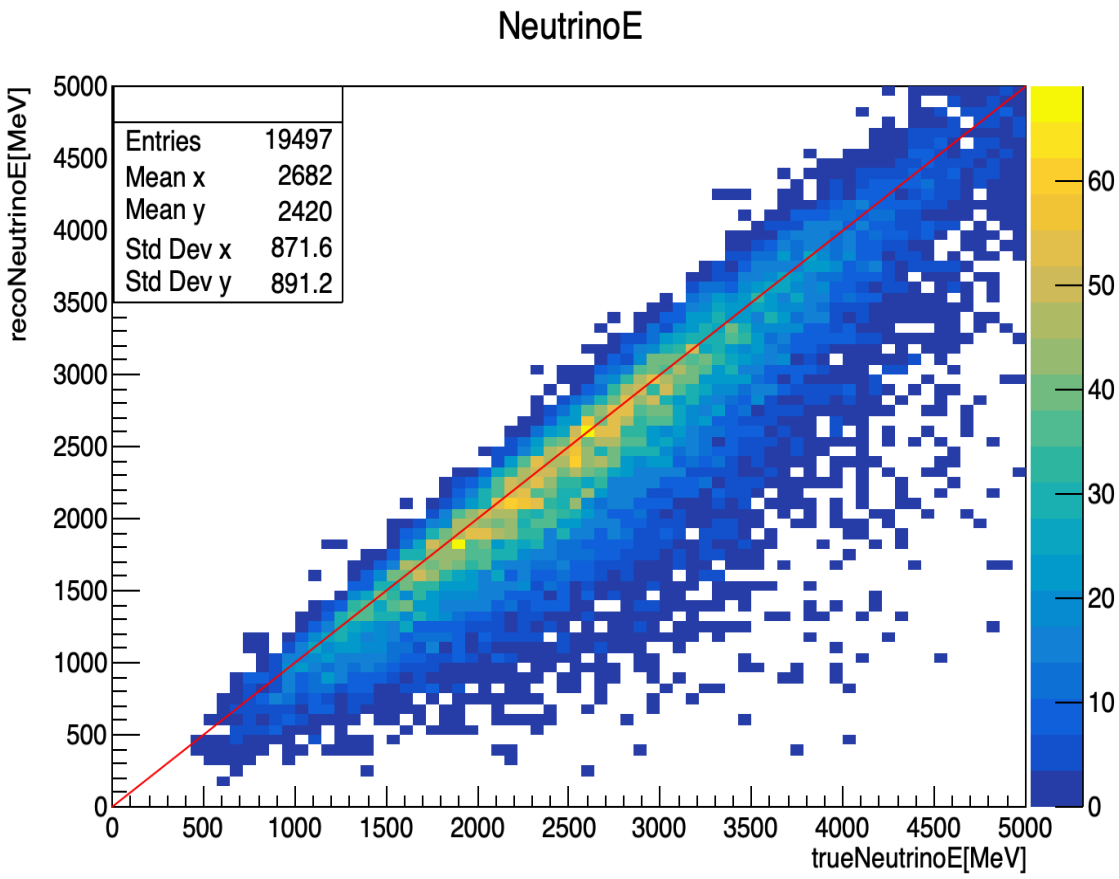
Outline

- Update reconstructed neutrino E on others channel(1cm cube)
- Low transverse momentum study(1cm cube)
- Muon angle resolution(1.5cm cube)

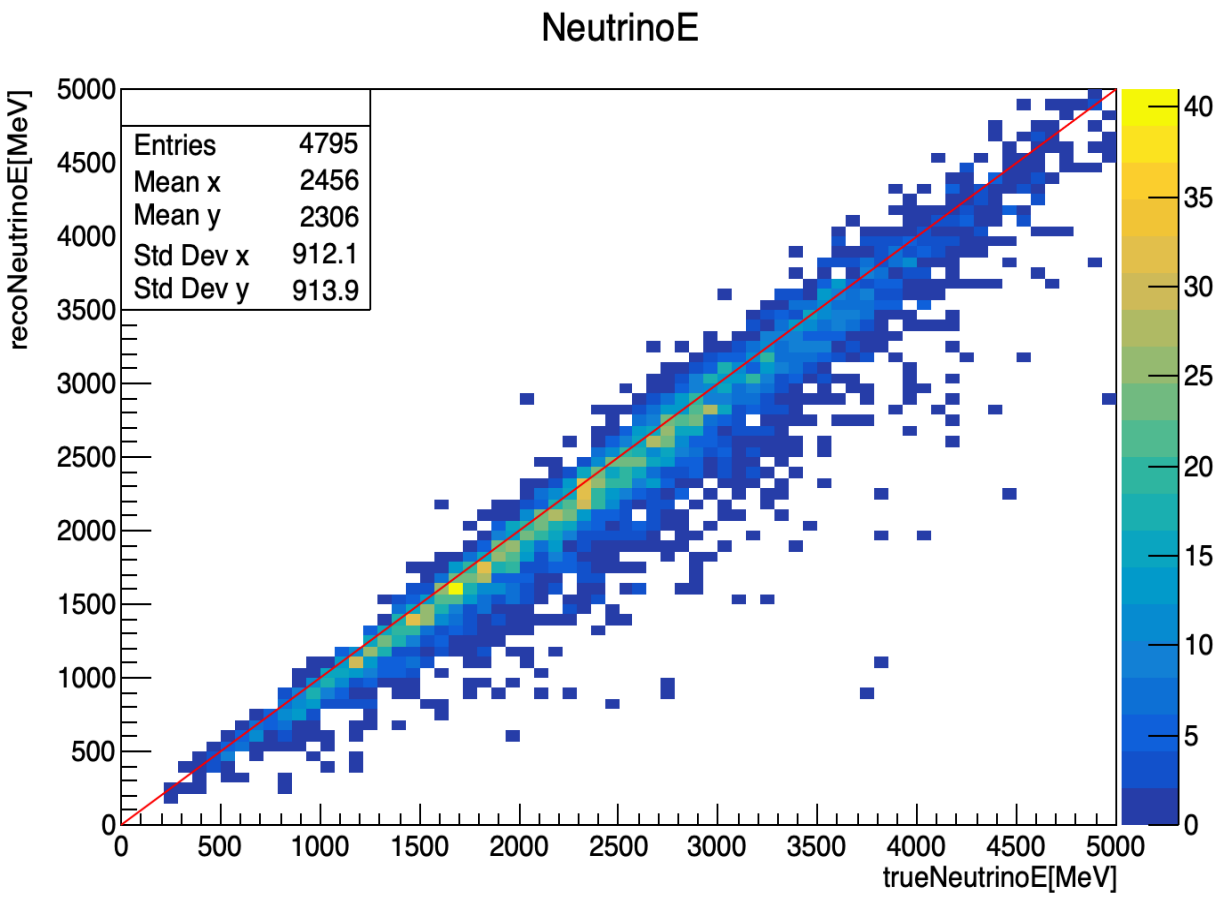
Update reconstructed neutrino E by summing all deposit E

"1cm"

CC1π^-

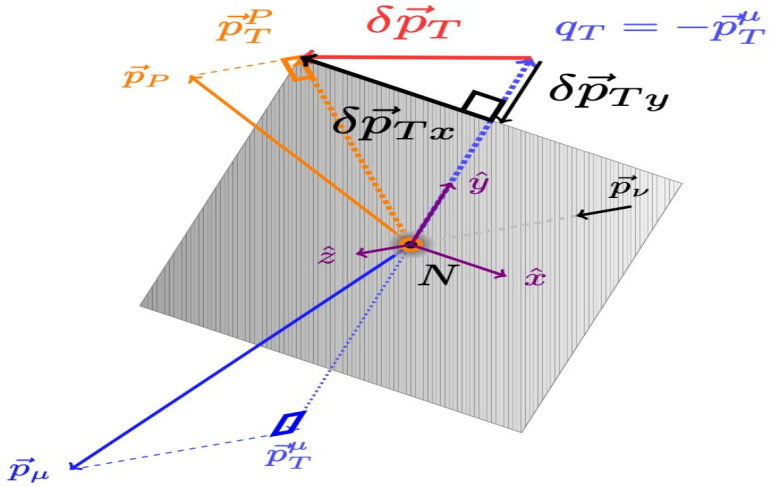


CC0π 2n



"The other channel is on backup slide!"

Low transverse momentum



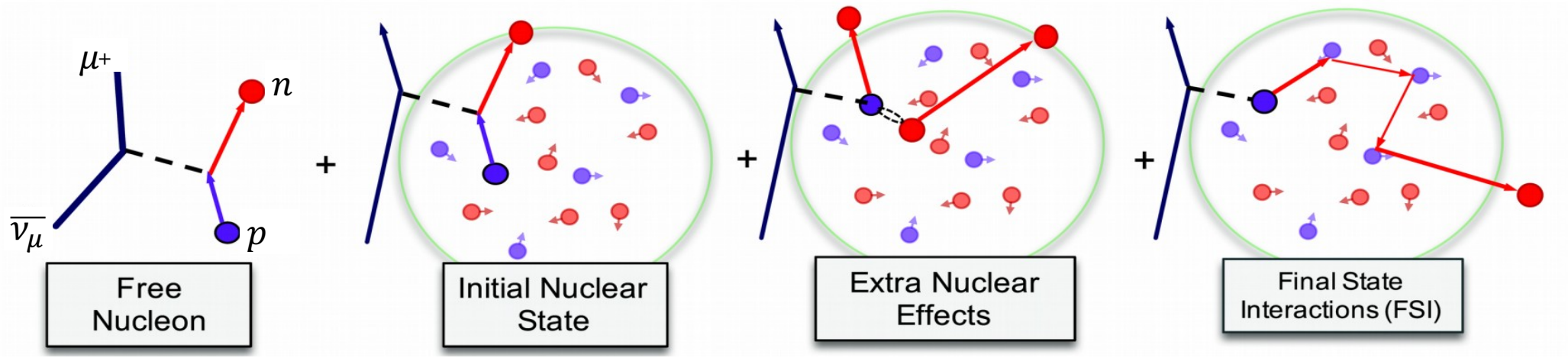
[arXiv:1910.08658v5]

- When neutrino interacts nucleon, there is nuclear effect.
For example Fermi motion, Binding energy and Pauli blocking etc.

- Nuclear effect impacts on final state particle momentum.

- It leads to bias the reconstructed neutrino energy.

- If we select the low δPT" sample, then we can obtain nuclear effect free sample.



[link]

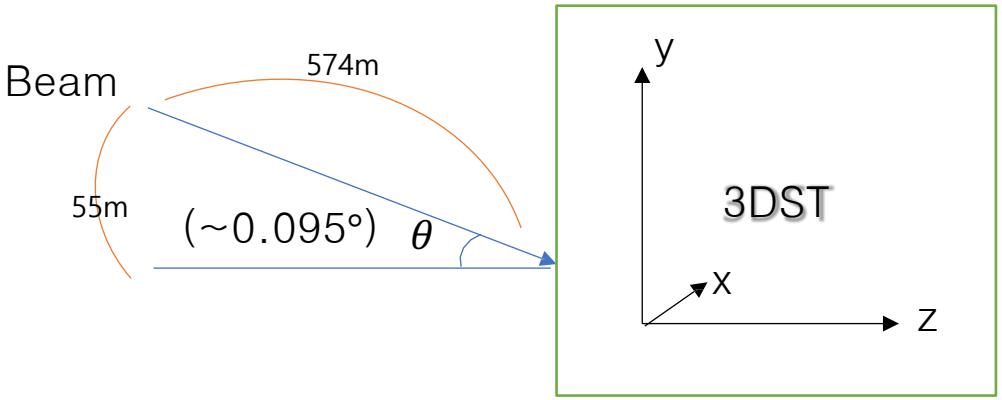
"1cm"

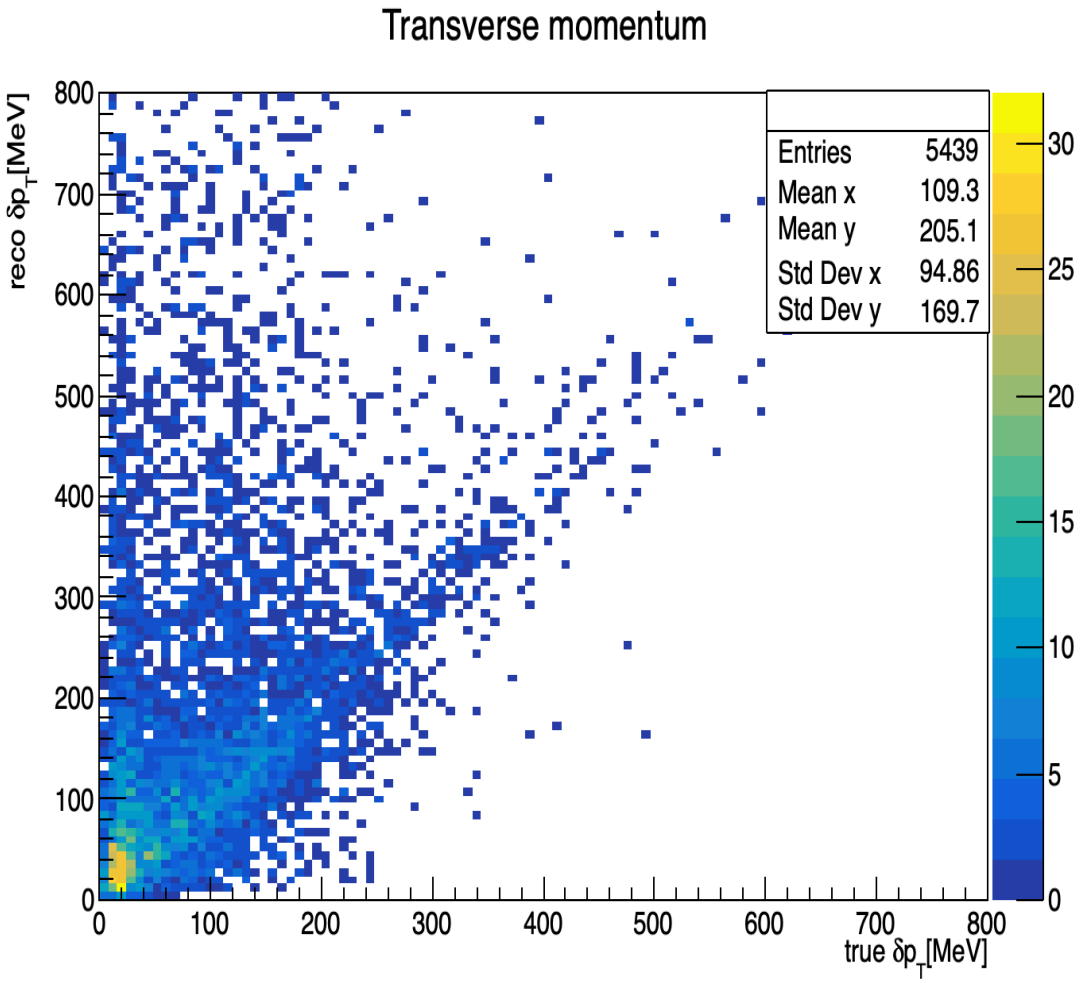
Reconstruct transverse momentum

➢First, only look Single track and single neutron event

➢Consider all final states as muon or neutron after background cut(purity 95%).

➢Get a muon momentum from true info considering 4% smearing .



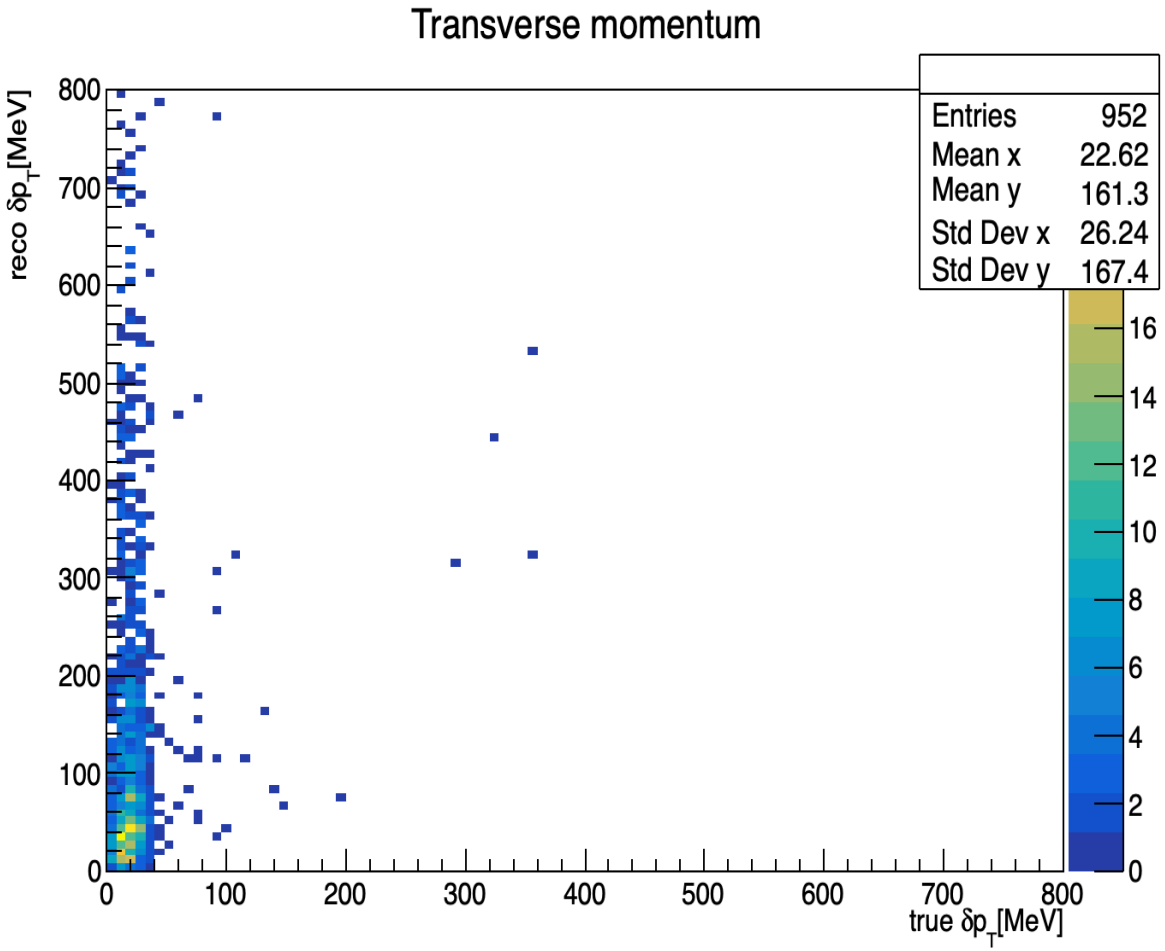


[Signal of Cluster]

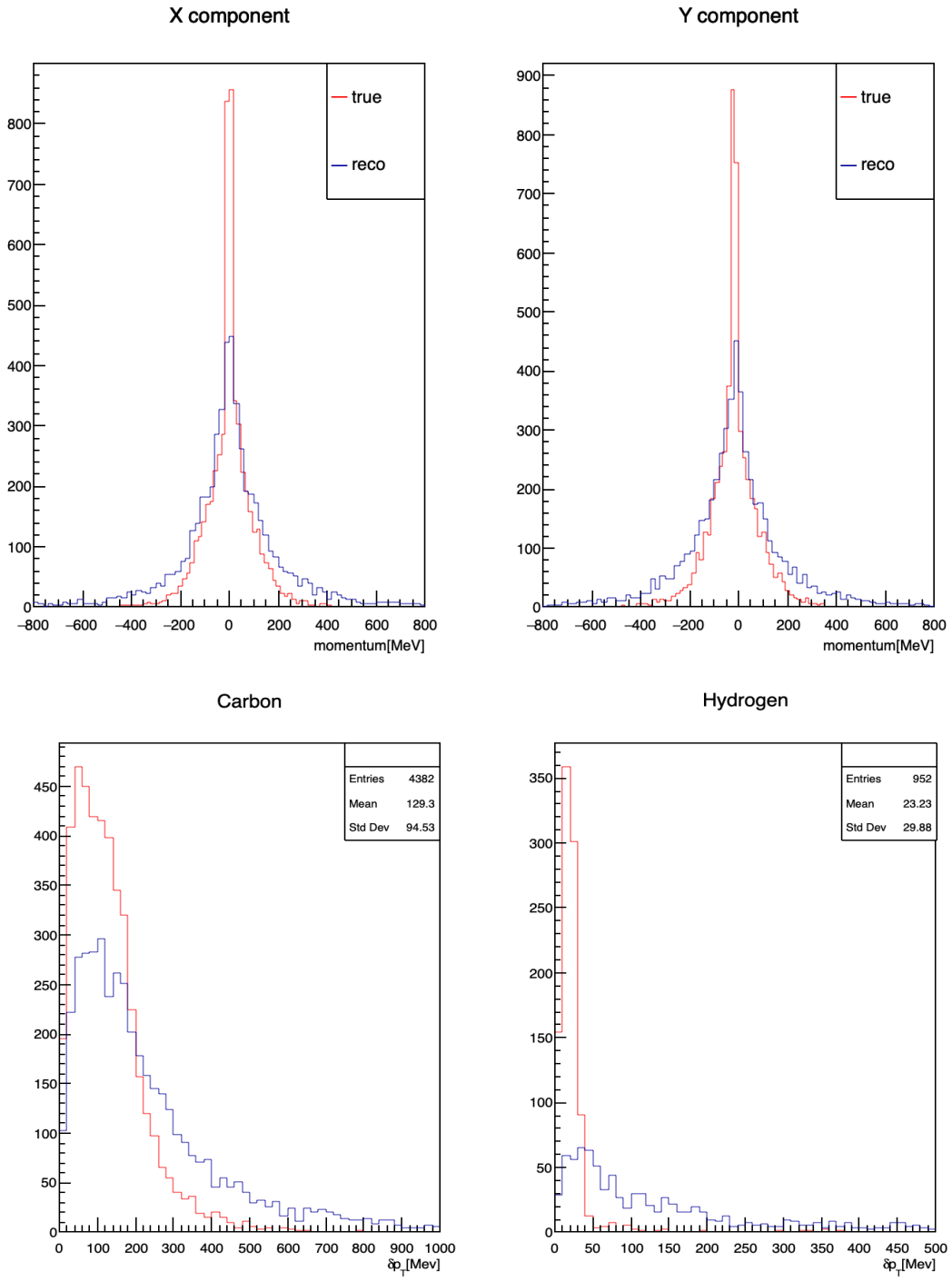
"Detect size and beam divergence are not considered"

Interact with hydrogen

"1cm"



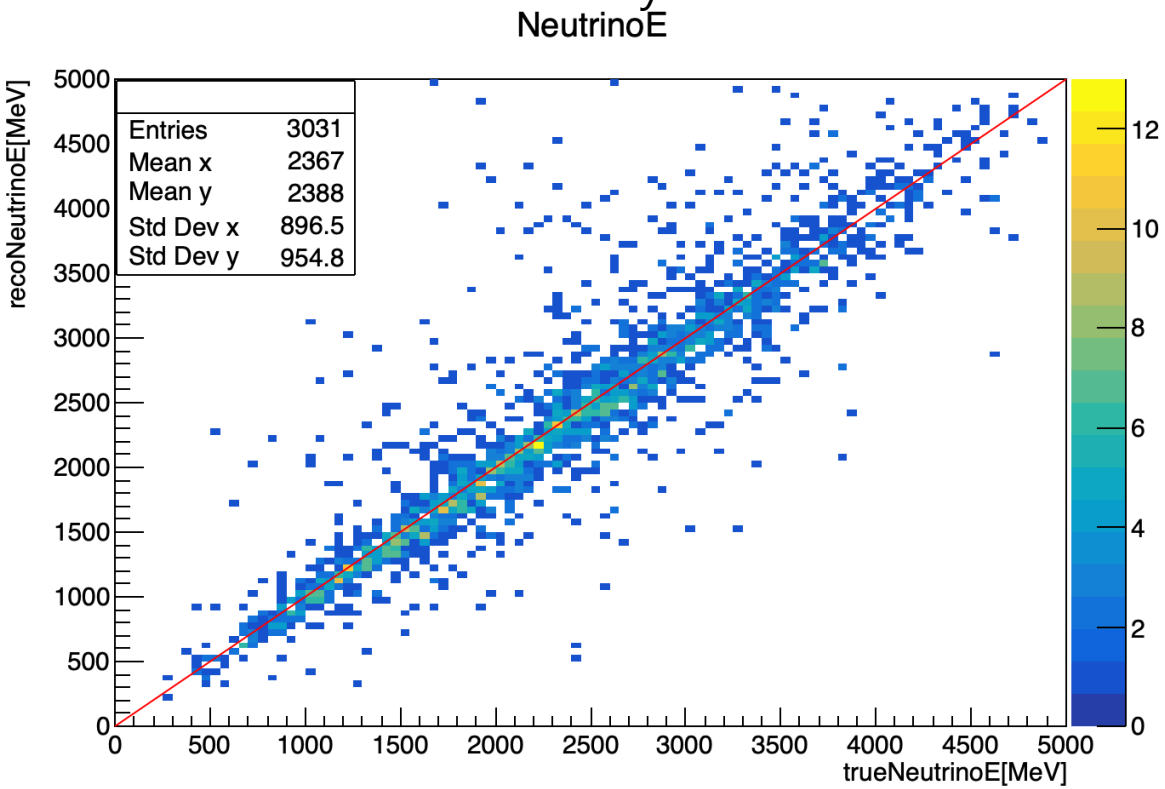
[Interaction with hydrogen]

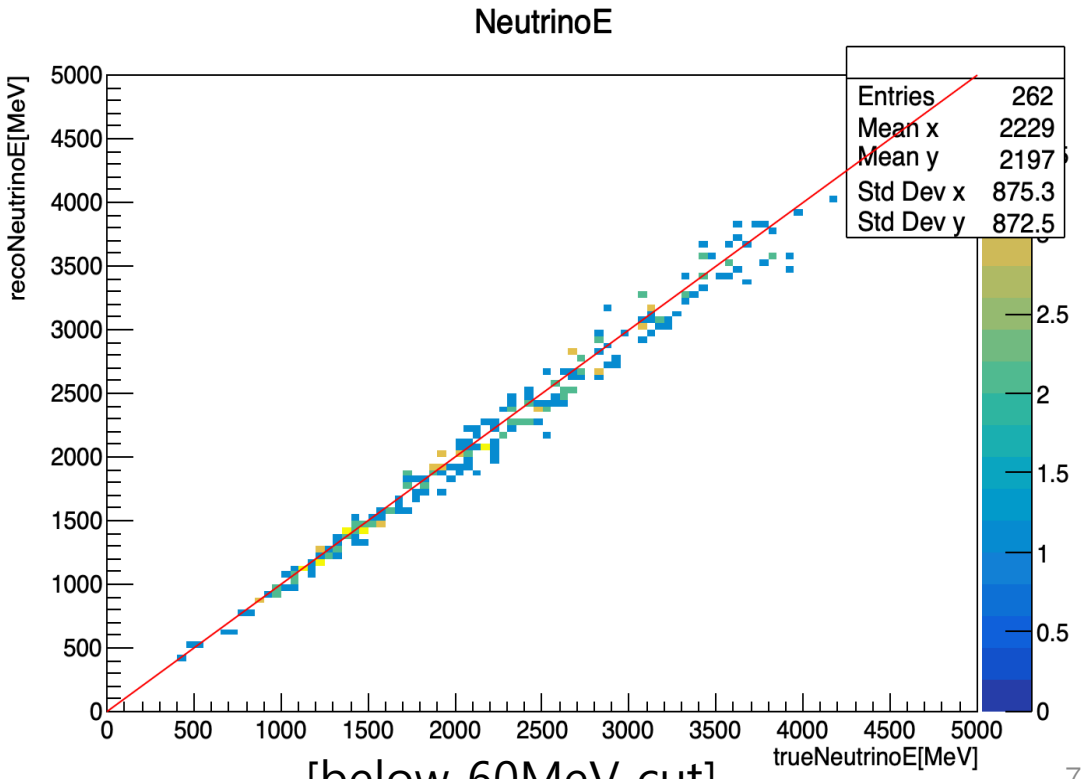


“1cm”

Reconstruction neutrino E

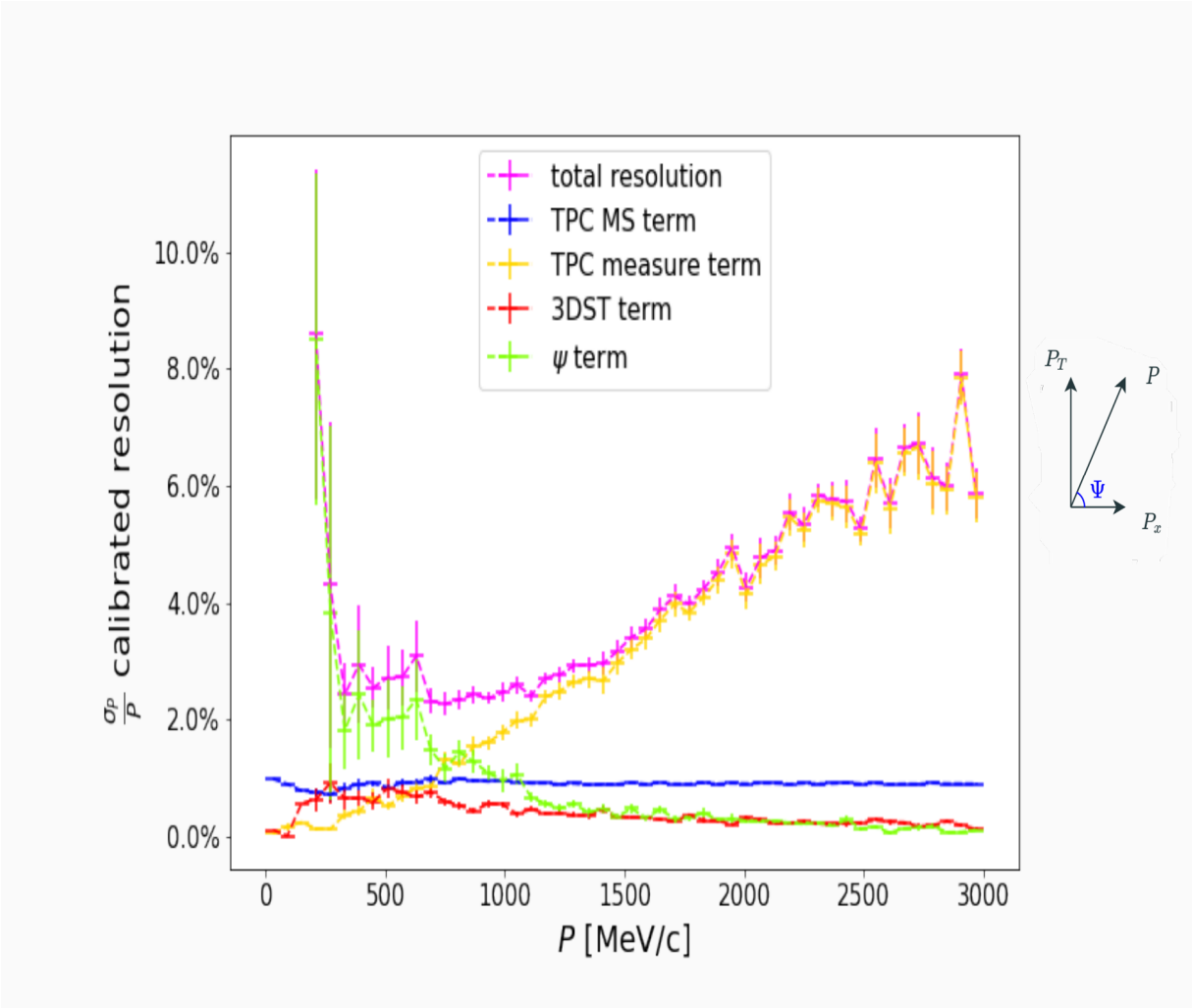
- Assume reconstruction neutrino energy equals to sum of neutron kinetic energy and muon energy.
- After applying low transverse momentum(below 60MeV), visually we can get better result but limited by statistics.
- Also we have low efficiency.





[below 60MeV cut]

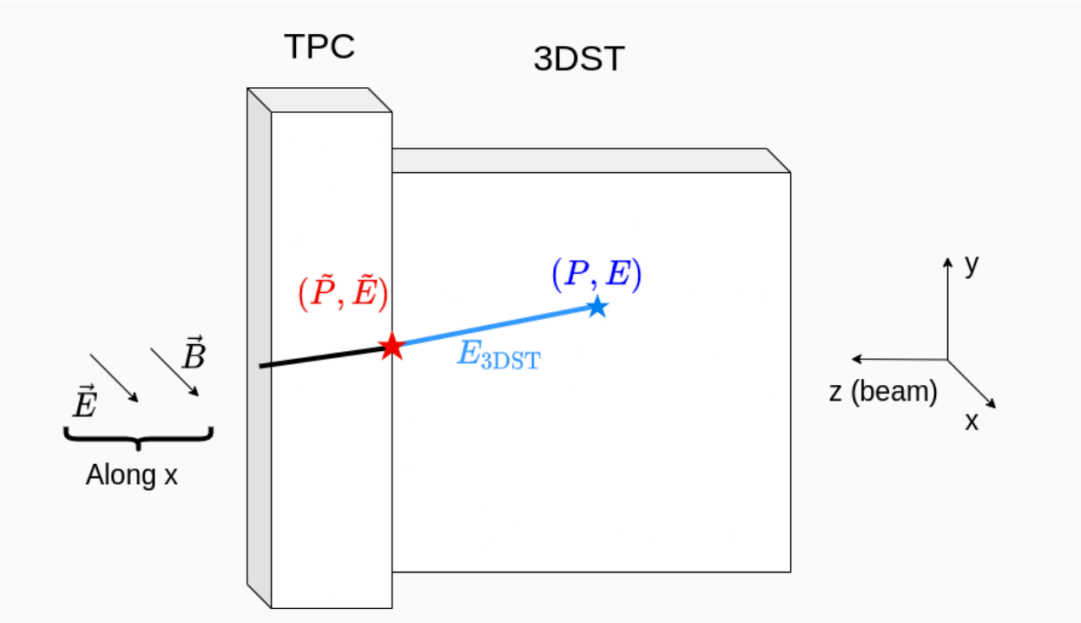
Muon angle resolution



from pierre last talk

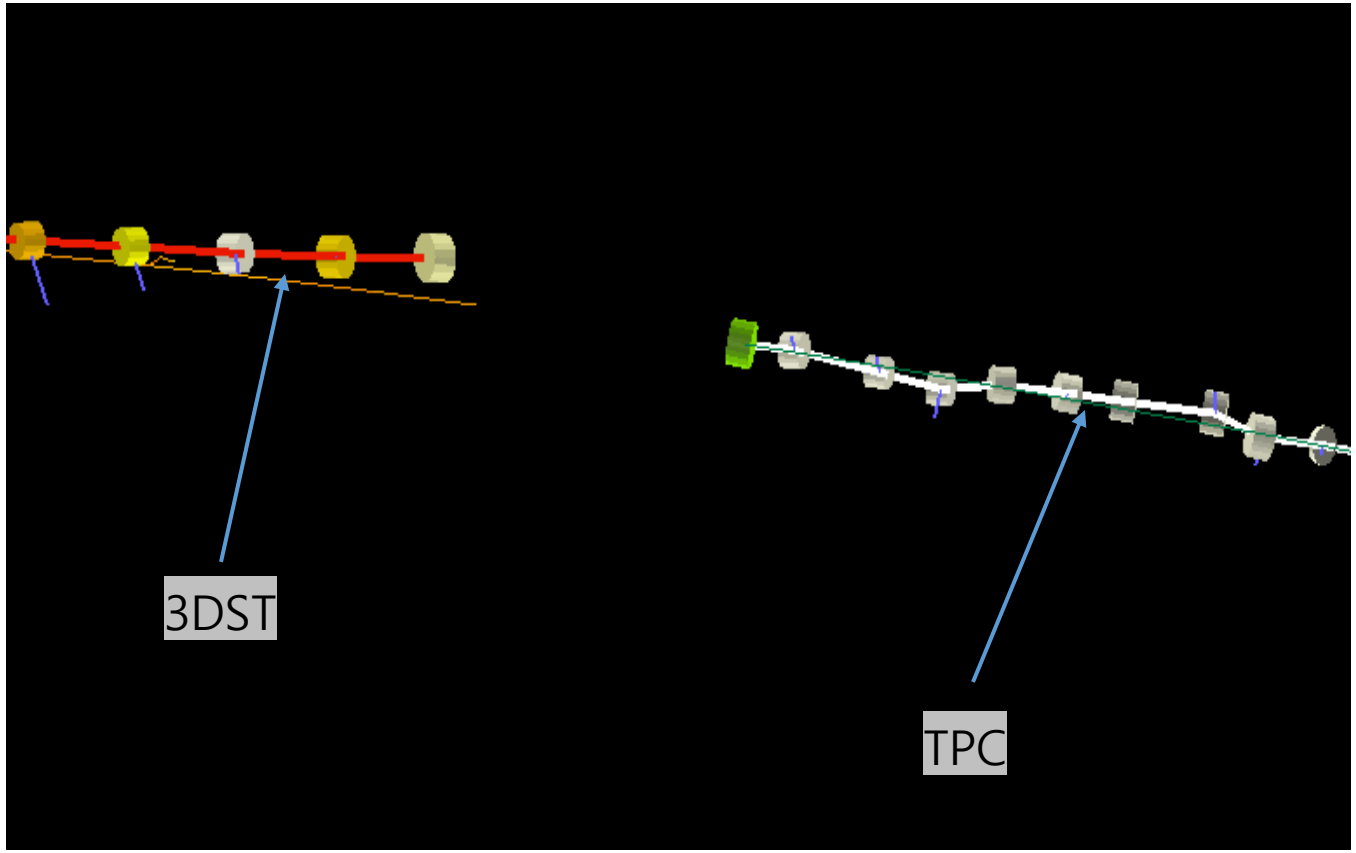
Motivation:
In TPC, the way measuring muon momentum is obtaining the curvature on YZ plane.

TPC can not determine X component, so we need to know X component of muon momentum on exiting position of 3DST.



Example

- We generate 1.5cm events which only have muon.
- Muon kinetic energy range is from 50MeV to 1000MeV.
- We can obtain difference between truth and reconstruction.

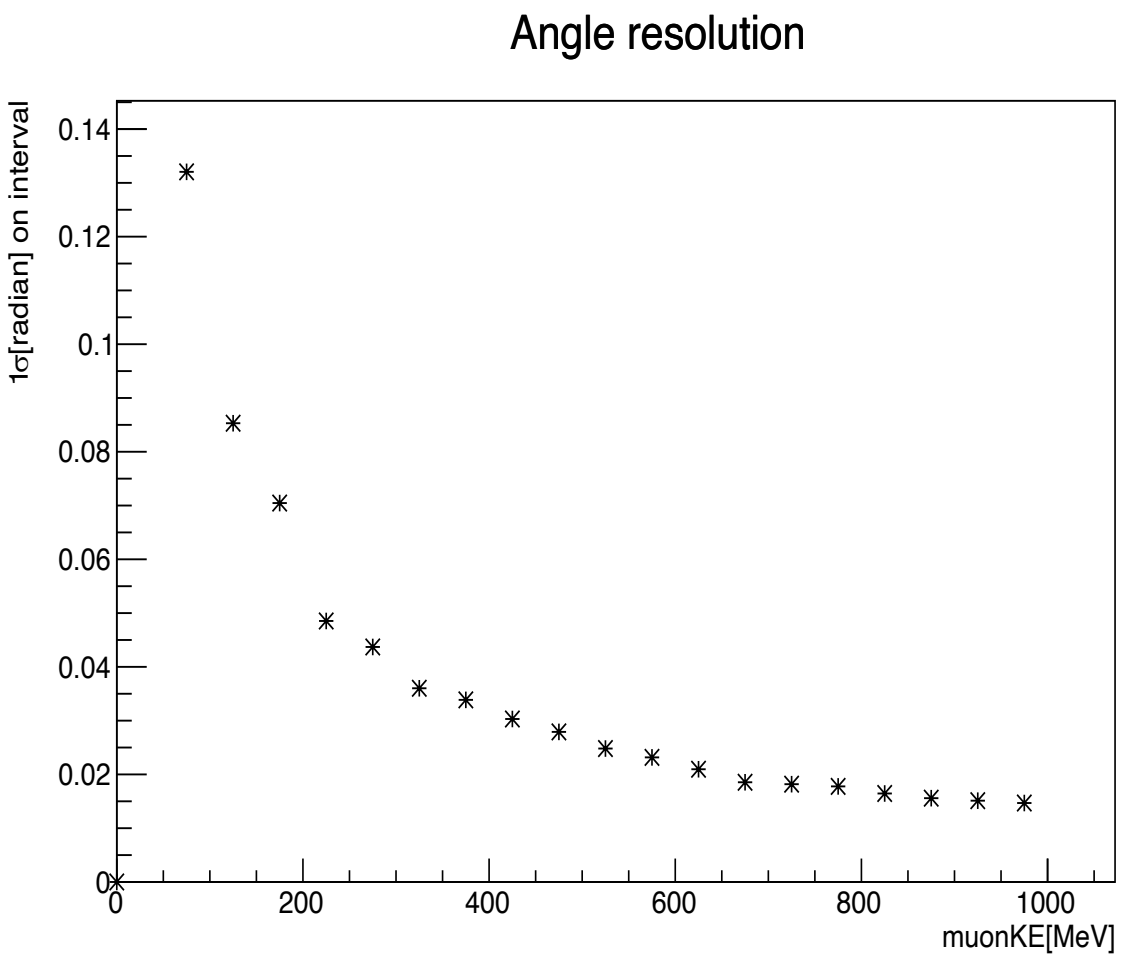


1.5cm

Exiting angle resolution

- We separate muon kinetic energy with 50MeV.
- 1 sigma means difference of angle with true and reco when the event rate becomes 68%.
- The larger muon kinetic energy is,
The better angle resolution gets.

"This result will be put on momentum resolution estimation of TPC"



Summary

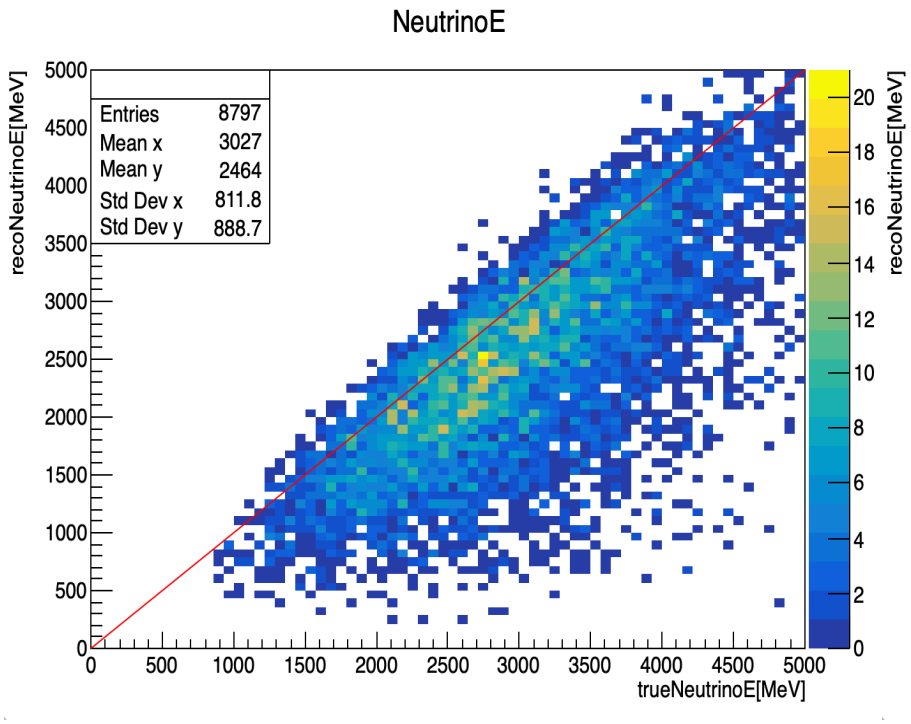
-After applying low transverse momentum(below 60MeV), visually we can reconstruct neutrino E well.

-The larger muon kinetic energy is, the better angle resolution gets.
Minimum angle resolution is 0.02 radian at 1000MeV

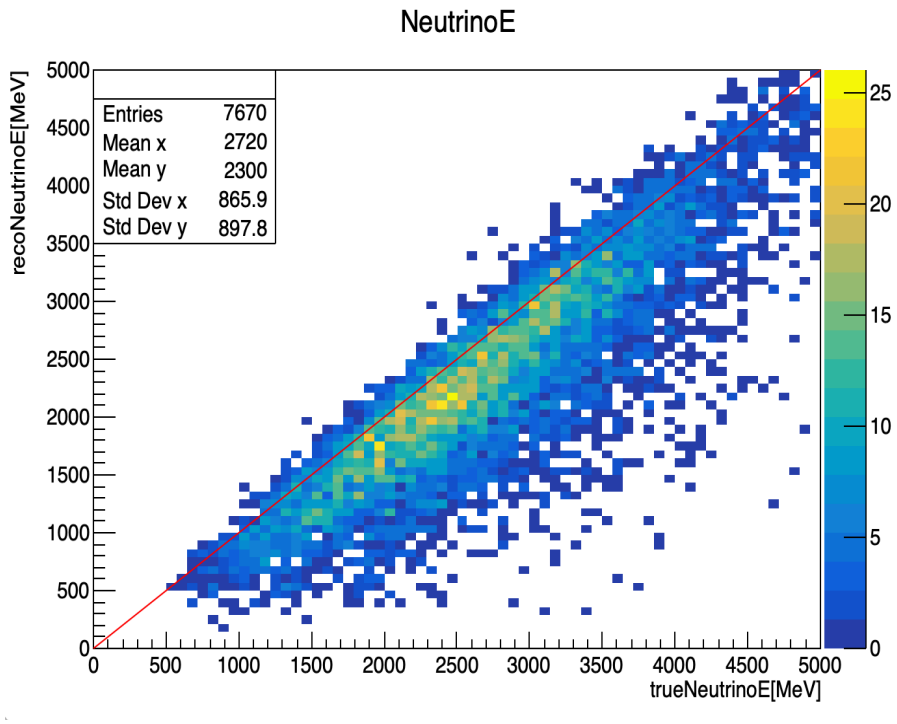
Back up

Neutrino E on other channels

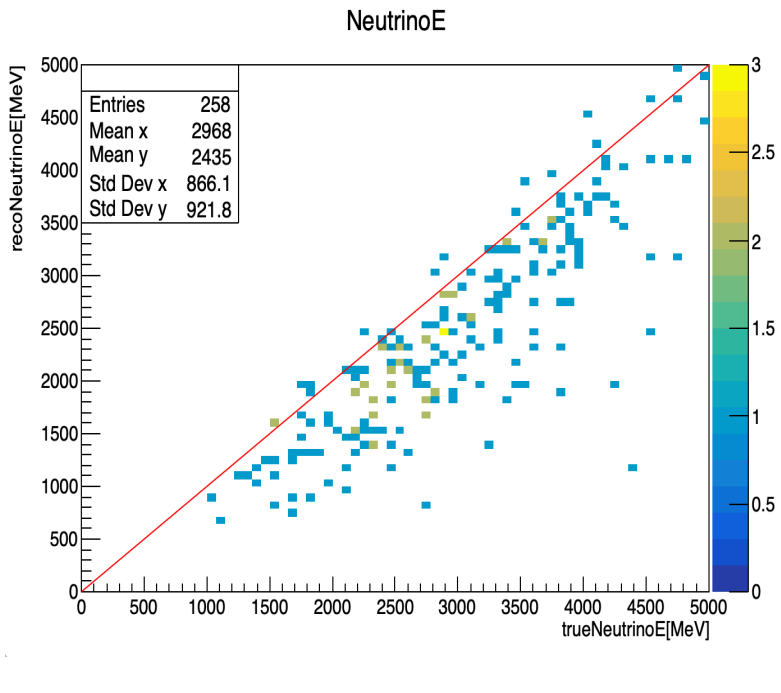
CC multipleπ



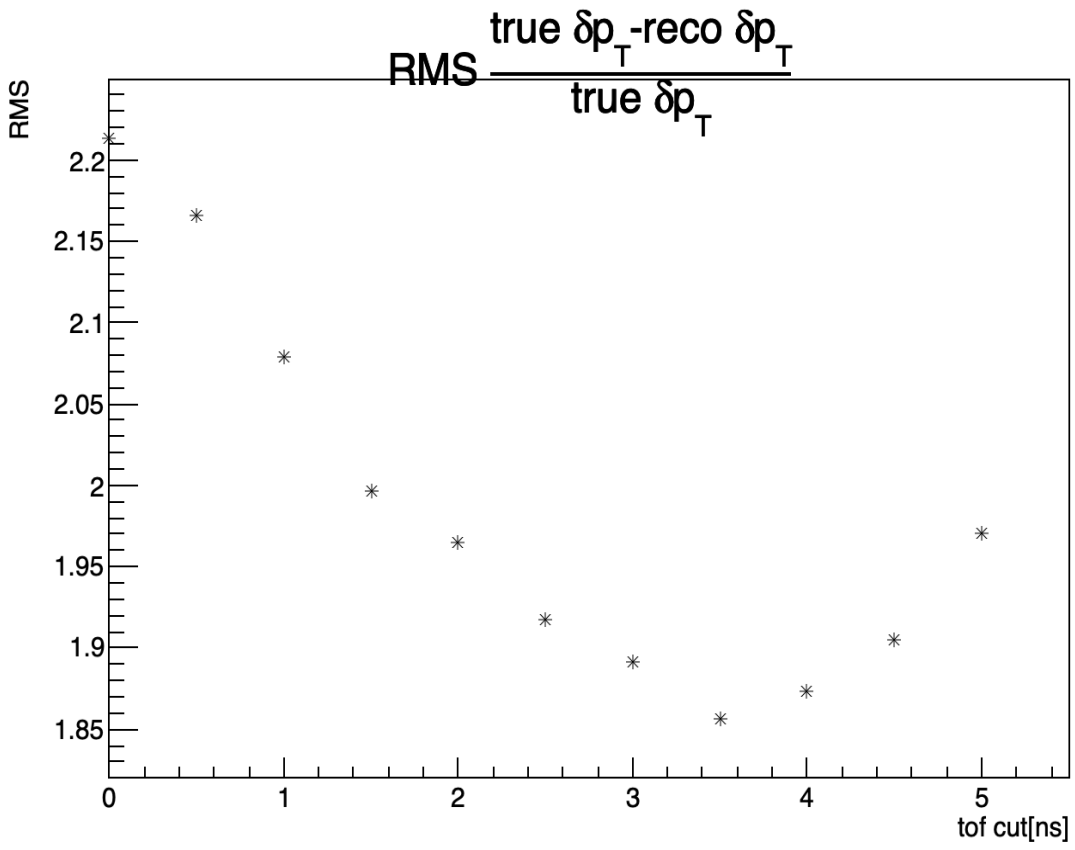
CC1π^0

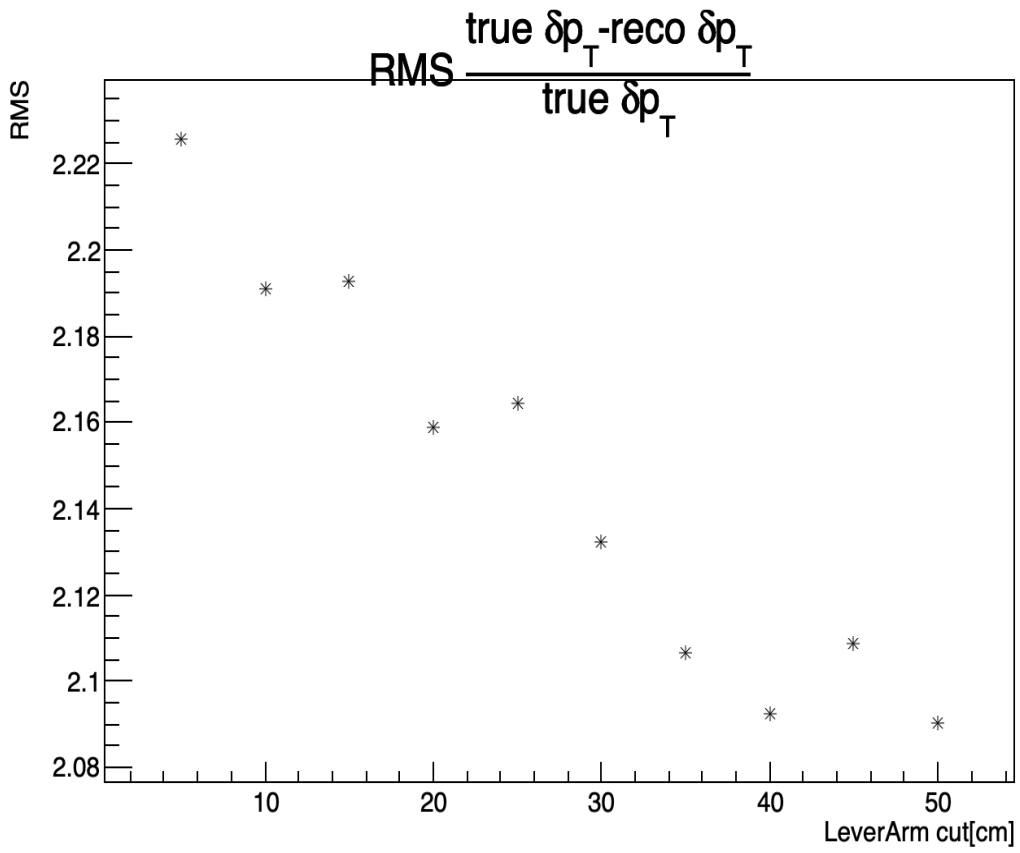


CC1π^+



Reconstruct transverse momentum





- If select 3.5ns tof cut and 20cm lever arm cut, we can get better reslut of $reconstructed\ \delta PT$".
- We can't cut on both variables since that will induce a KE cut directly.