Energy, angle, position resolution with ORCA4

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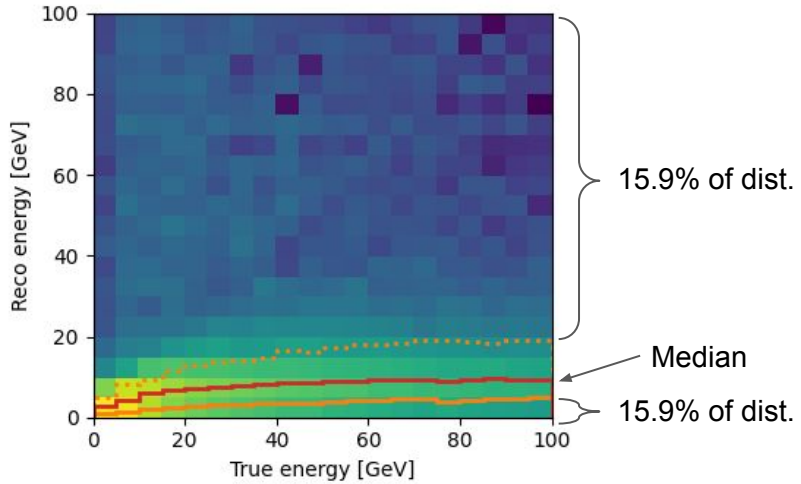
Introduction

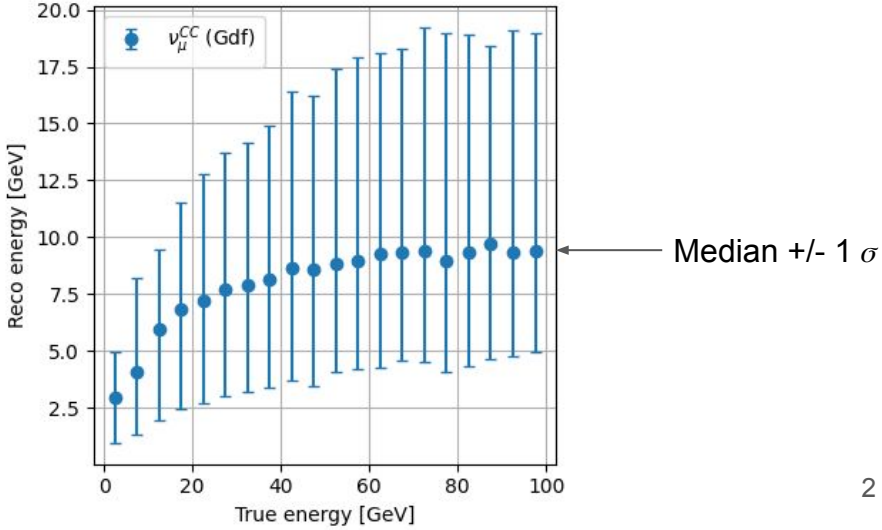
Based on neutrino MC samples

- Produced by Lodewijk at stbc
  - Jsh and Jgandalf

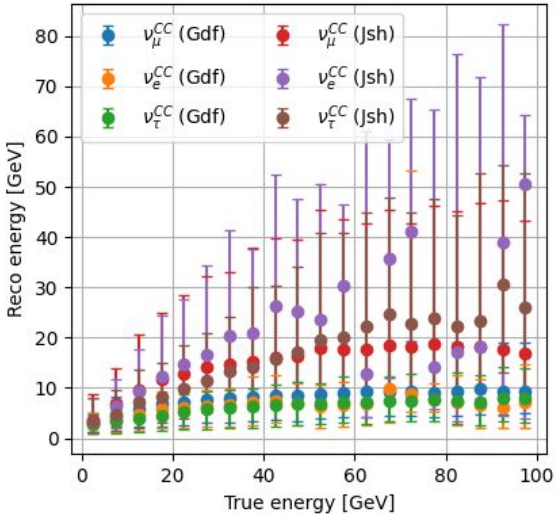
Method :

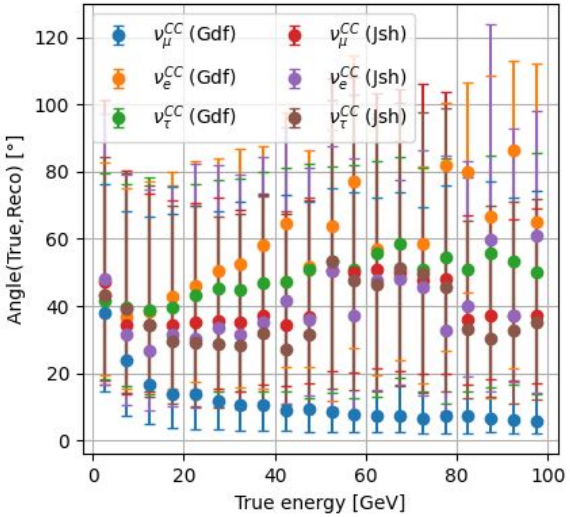
- Produce 2D map, e.g. energy :
  - For each bin in True energy, measure where are 15.9%, 50% and 84.1% of the distribution
  - Gives median +/- 1 σ

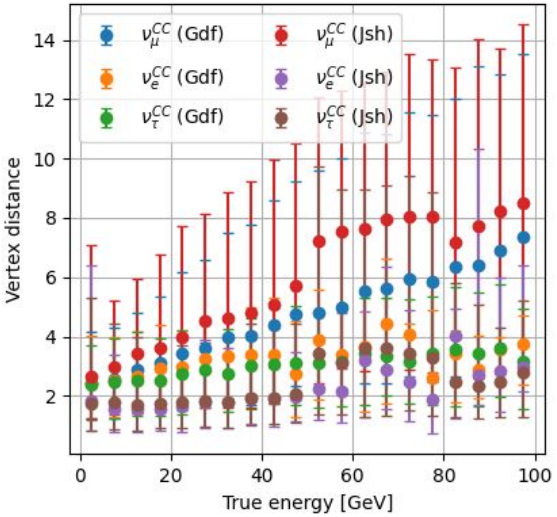


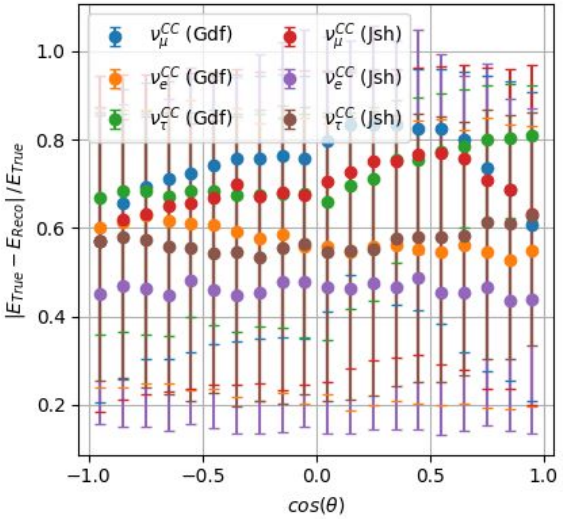


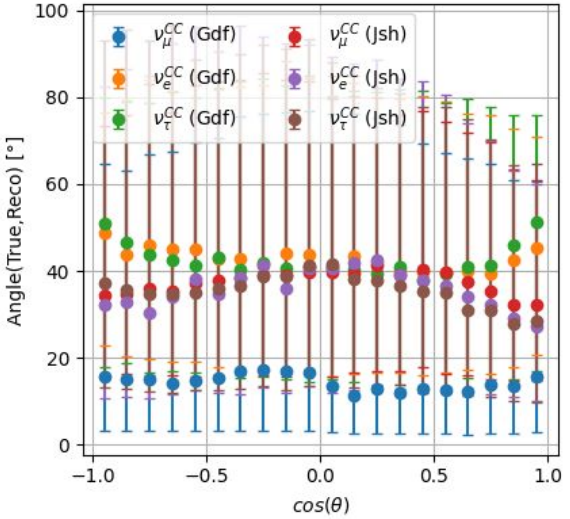
No cuts (almost no, only E [1:100] GeV)

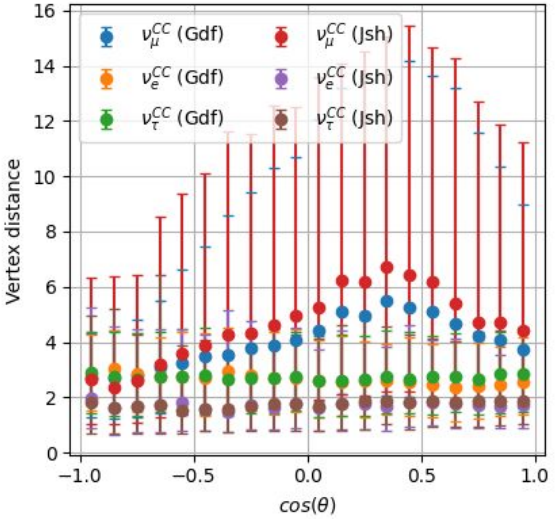












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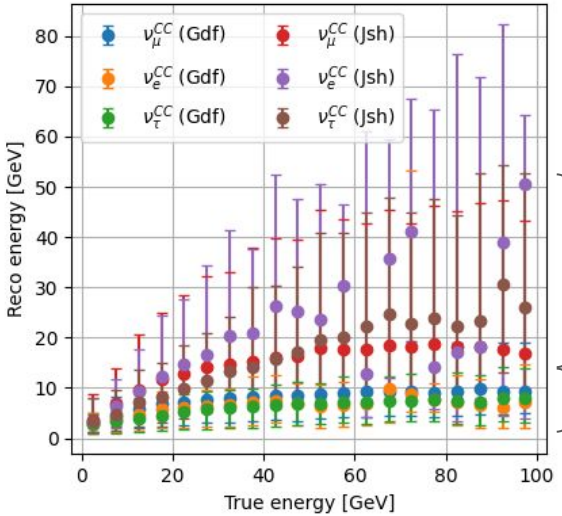
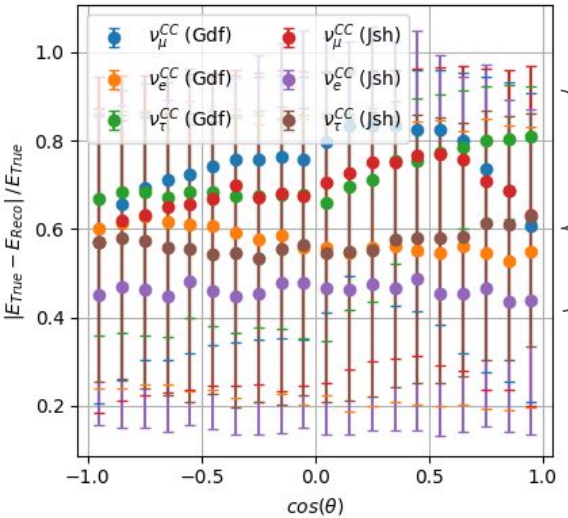


Shower energy reco is better, even for nu_mu

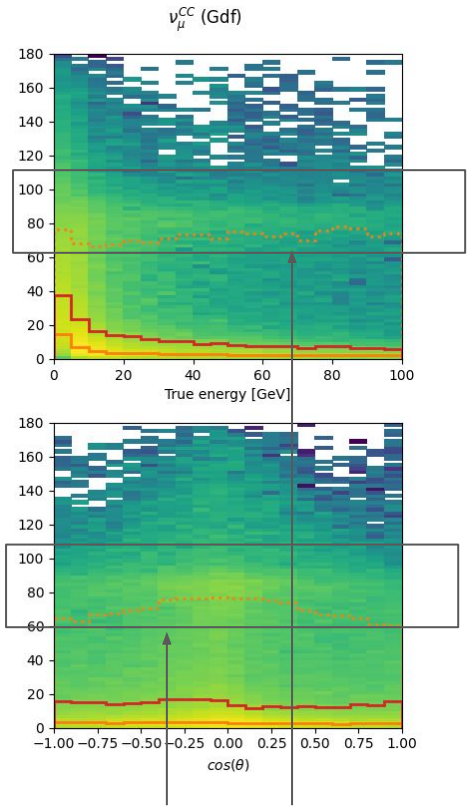
Track energy reco is very bad above 10 GeV



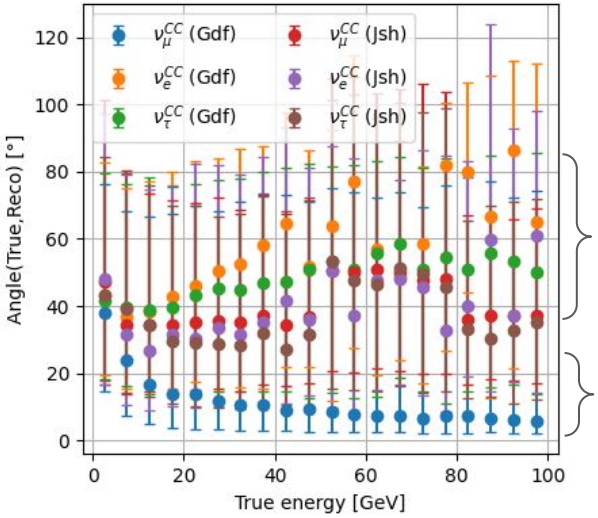
Looking at blue points, track energy reco is better for vertical tracks

Shower energy reco not sensitive to direction (to detector size)

No cuts (almost no, only E [1:100] GeV)

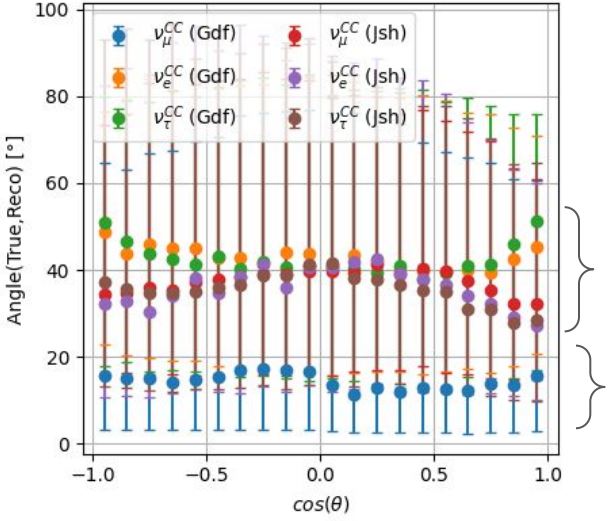


Nu_mu significantly impacted by ambiguous track direction



Small improvement with jsh compare to JGandalf for nu_e and nu_tau

Nu_mu tracks angular resolution improve greatly with energy



Small effect with cos(theta), bad

Nu mu tracks angular deviation doesn't depend on cos(theta)

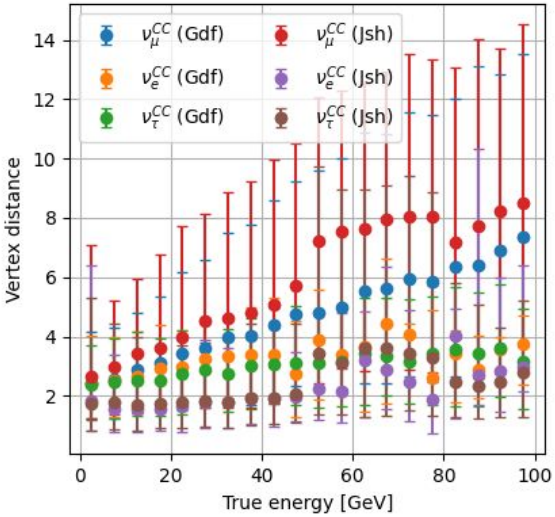
No cuts (almost no, only E [1:100] GeV)

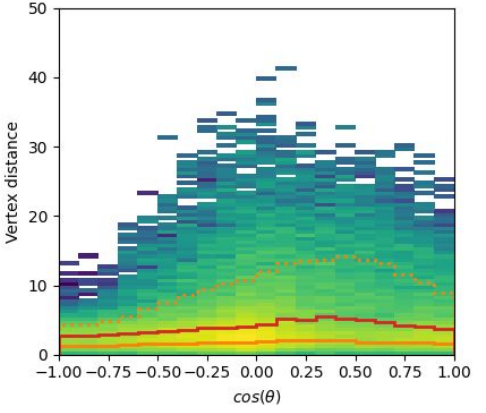
Vertex distance [m] :

Distance between true and reco interaction point

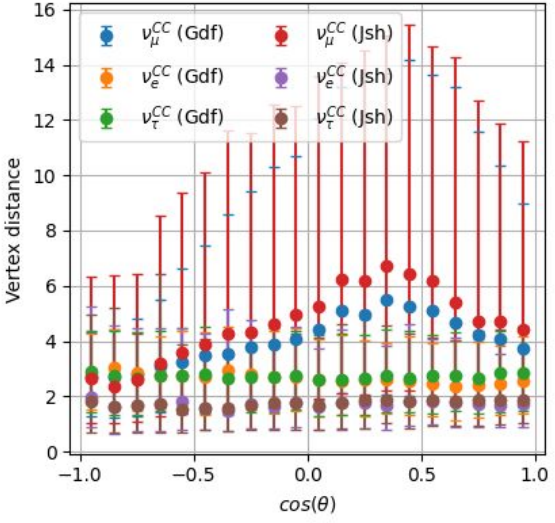
Gdf and Jsh pretty close for nu_mu
Degrade with energy (track length ?)
4m at 40GeV, so 10 m track length

Good results for showers !





Large variation for nu_mu in function of cos(theta). Worst for upgoing …



No cuts : summary

Energy resolution:

- Seems better in any case with Jsh, worth to trying it for Track energy reco

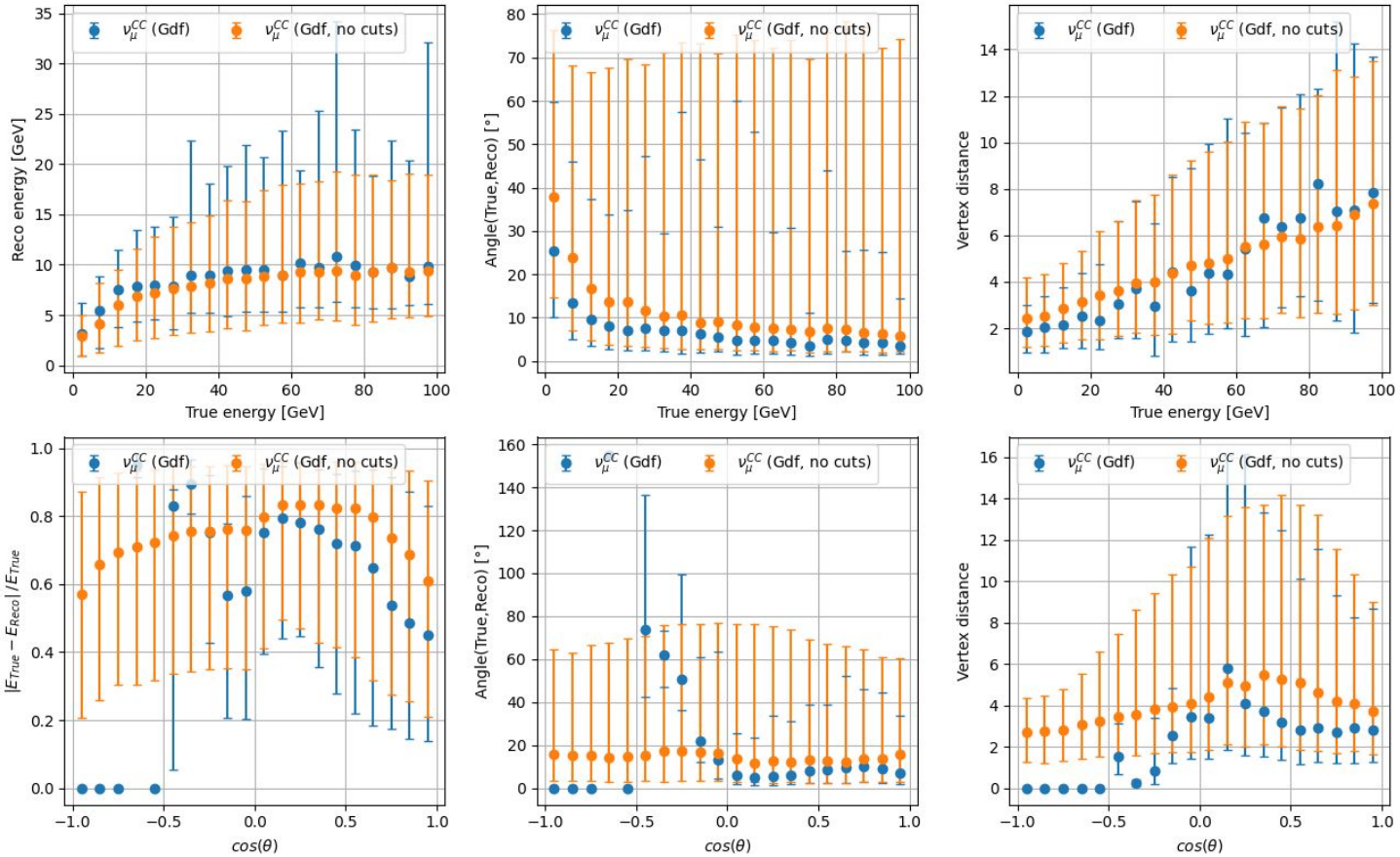
Angular resolution:

- Quite small improvement in performances for nu_e and nu_tau with Jsh. jgandalf performs well with nu_mus, except in case of ambiguous reco.

Interaction point resolution:

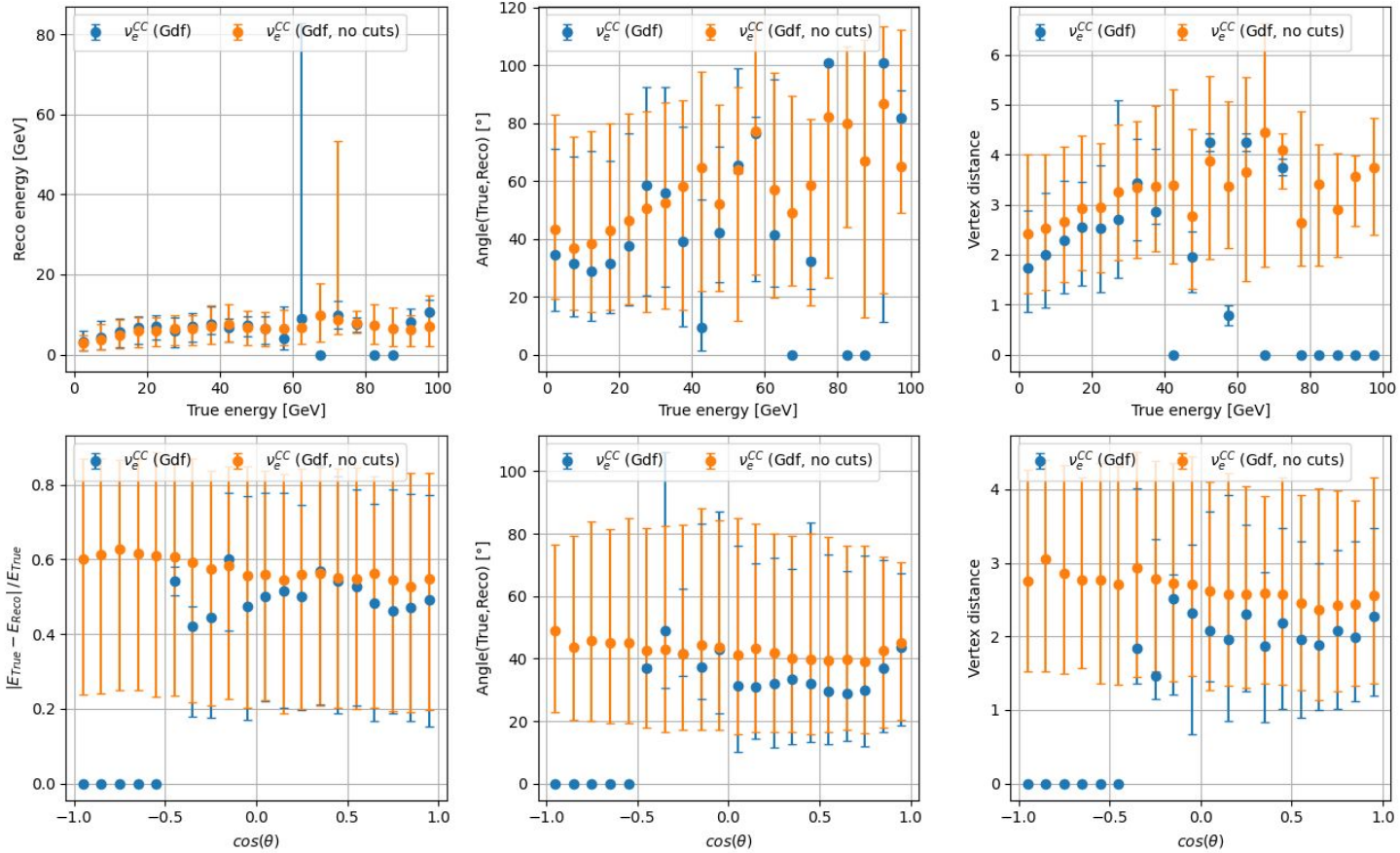
- Gdf and Jsh perform similarly with nu_mu
- Good improvement with Jsh for nu_e and nu_tau

Jannik cuts : nu_mu impact



Most significant difference is on the angular resolution at low energy, and the mitigation of the spreading induced by ambiguous tracks.

Jannik cuts : nu_e impact



Same behavior with or without cuts for nu_e reconstructed with gandalf