MINERvA Model to Describe (Anti)Neutrino-Nucleon Scattering

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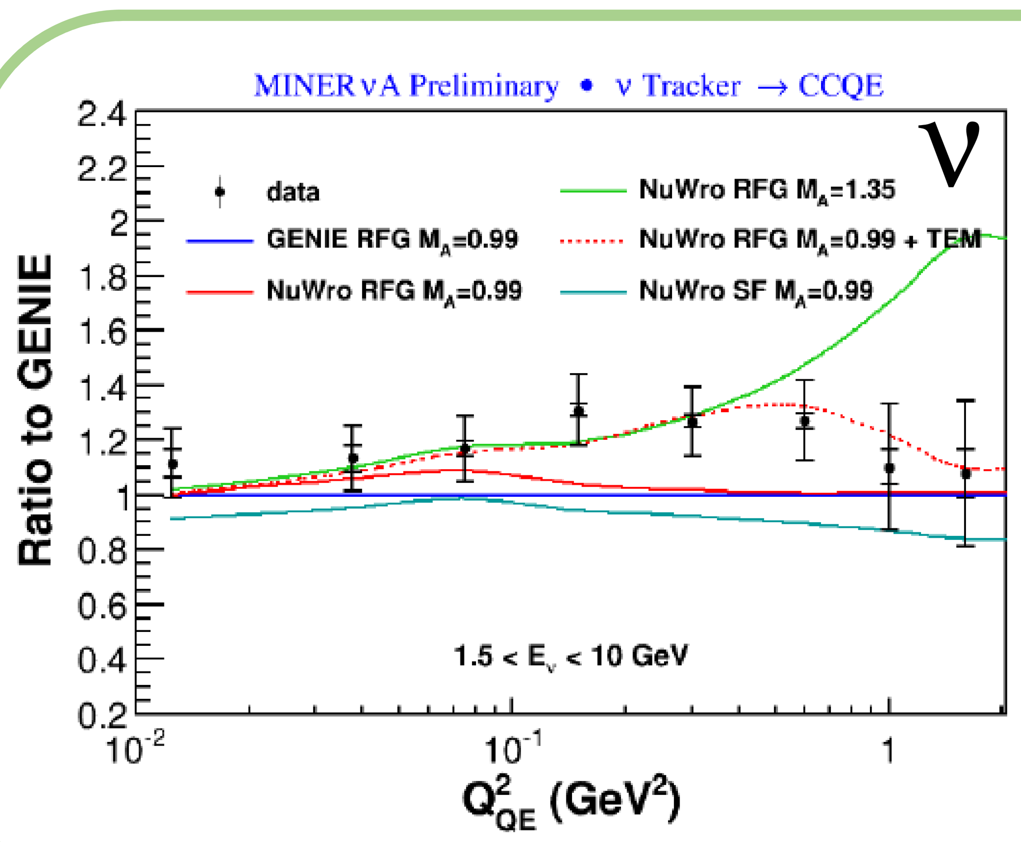
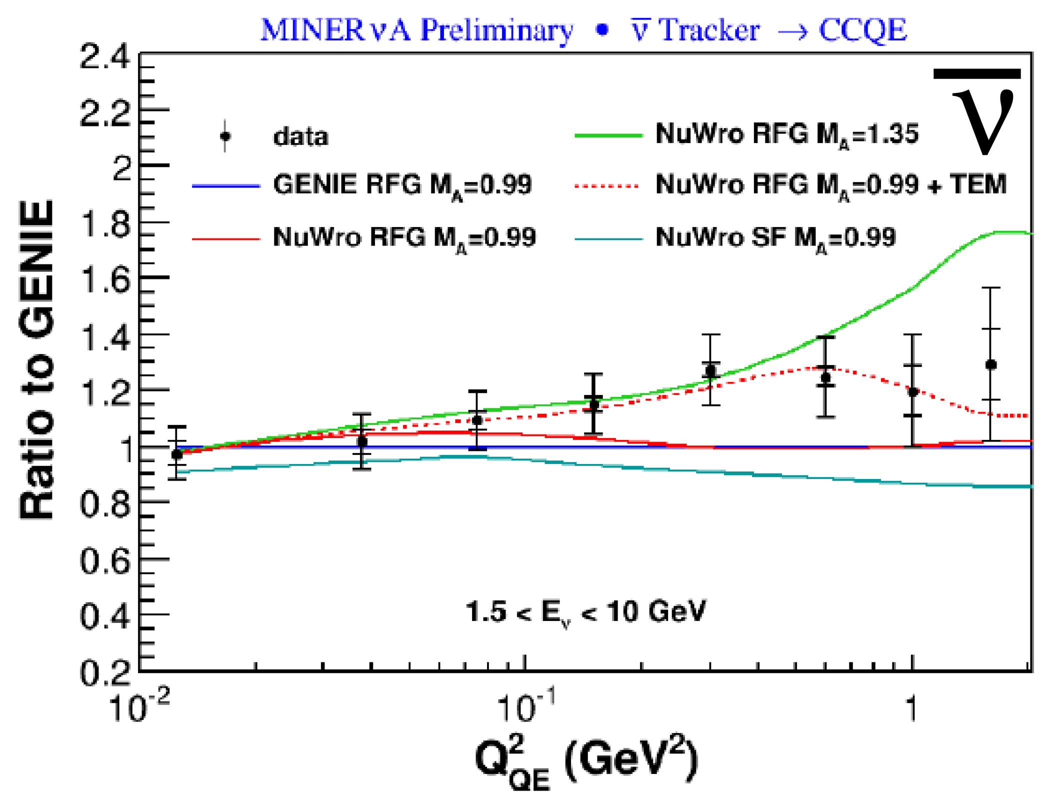
On behalf of the MINERvA Collaboration

Progress to a model describing MINERvA data

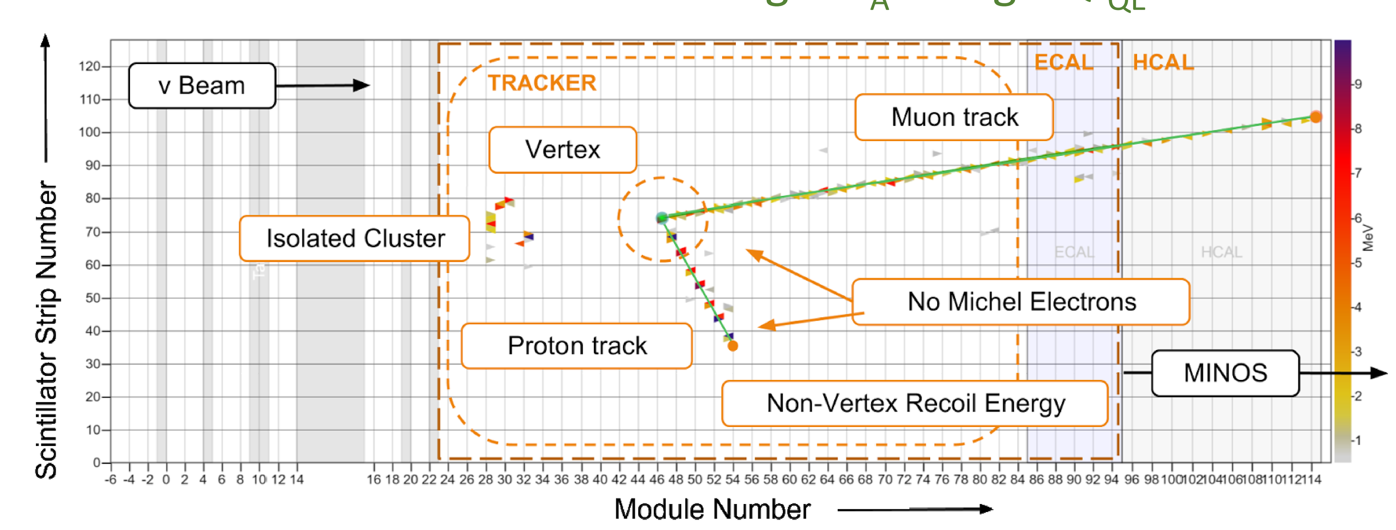
Original CCQE Results





Original CCQE results[1][2] of MINERvA preferred:

- Models which provide 2p2h-like effects
- Models which disfavor large M_A at high Q^2_{QE}



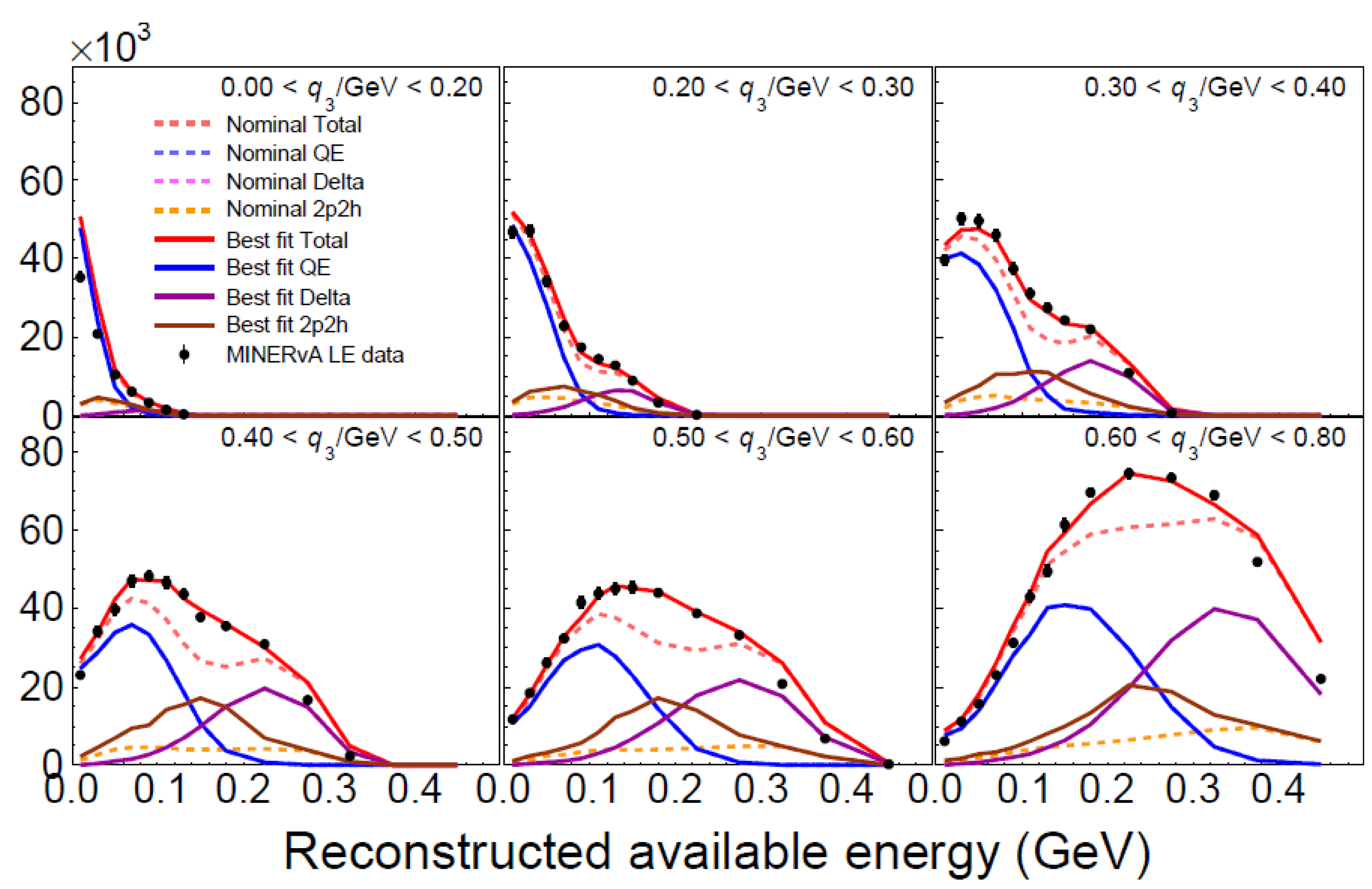
Neutrino Low Recoil $E_{avail.}$,q_3

Looking at the inclusive data, what is needed to describe our low recoil data[3].
Add Valencia 2p2h[4] and Valencia RPA[5]

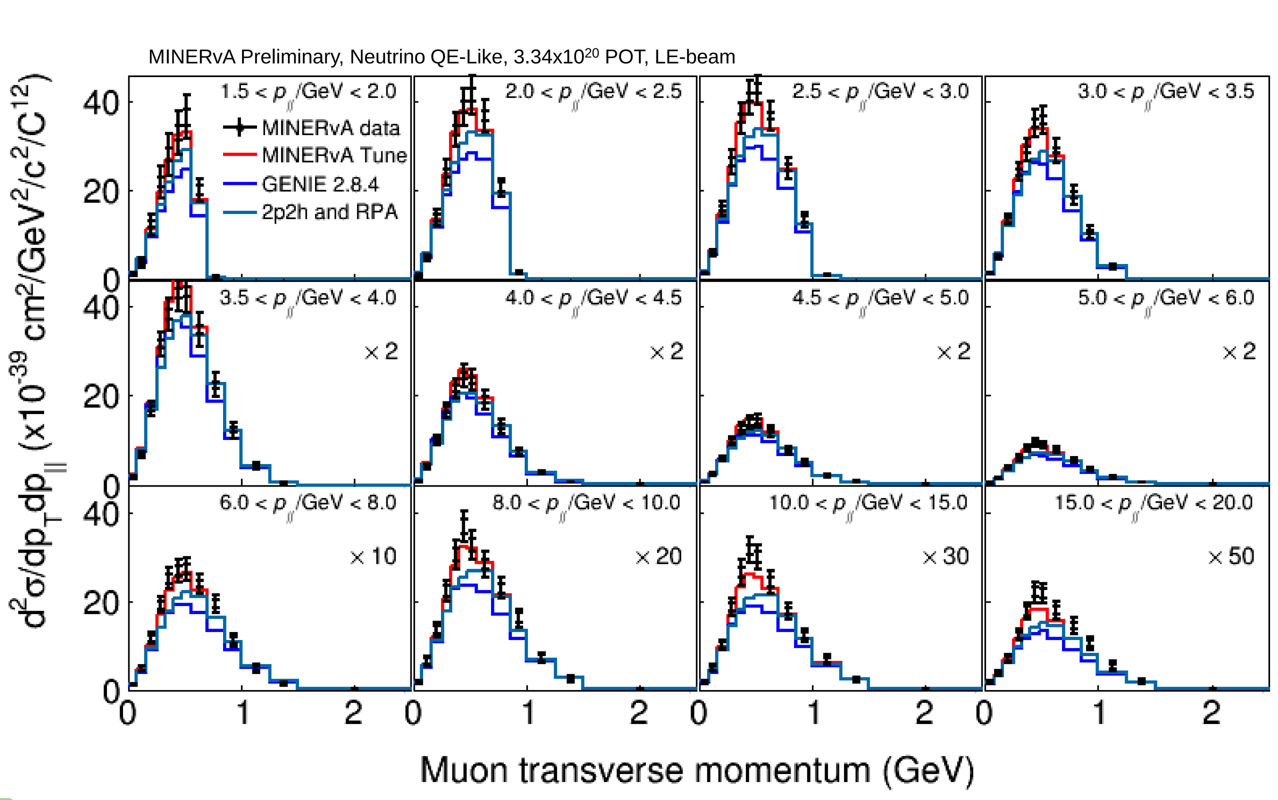
Need added strength in "dip" region
Fit $E_{avail.}$,q_3 with 2D Gaussian in *true* q_0q_3 space under the assumption the entire missing strength comes via the 2p2h channel.

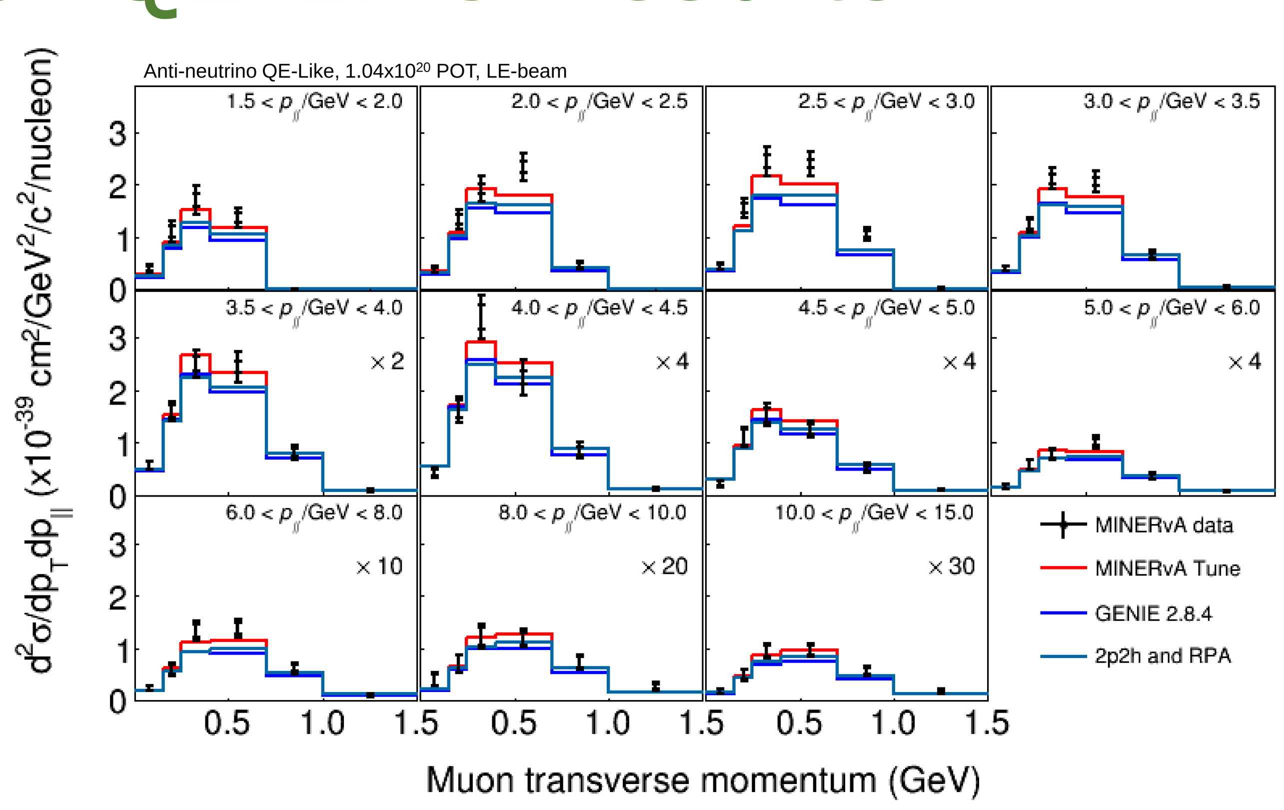
How to model of the systematics of this enhancement? Additional fits varying the 2p2h and 1p1h models to modify the energy deposited in the detector.

1) Fit with ONLY nucleon-nucleon initial state of the same type varied (nn or pp)
2) Fit with ONLY the np initial state varied
3) Fit with ONLY the 1p1h state varied



Double Differential QE-Like Results





Predicts the neutrino QE-Like result well

Improves the prediction of the **anti-neutrino QELike** result

Low recoil fit is done in a limited q_0q_3 and E_ν space

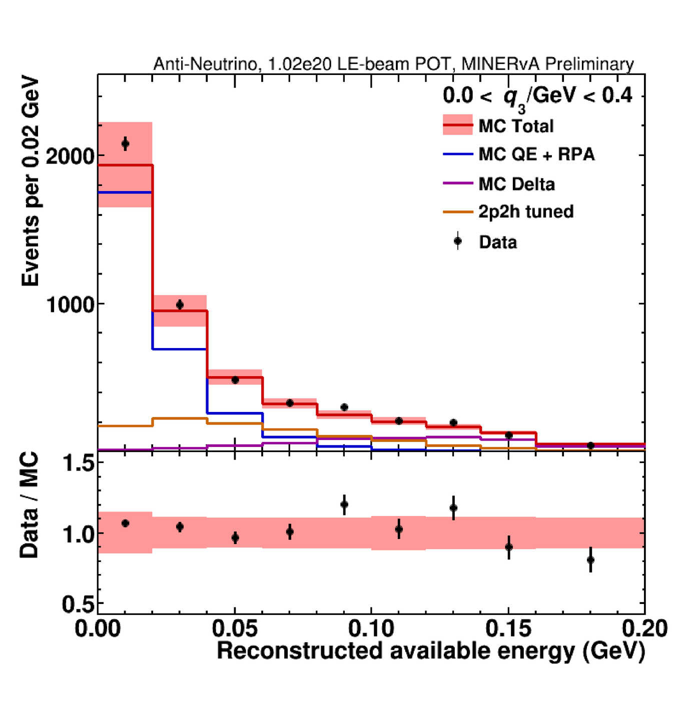
Both the neutrino and anti-neutrino results have larger acceptance in q_0q_3 and E_ν space

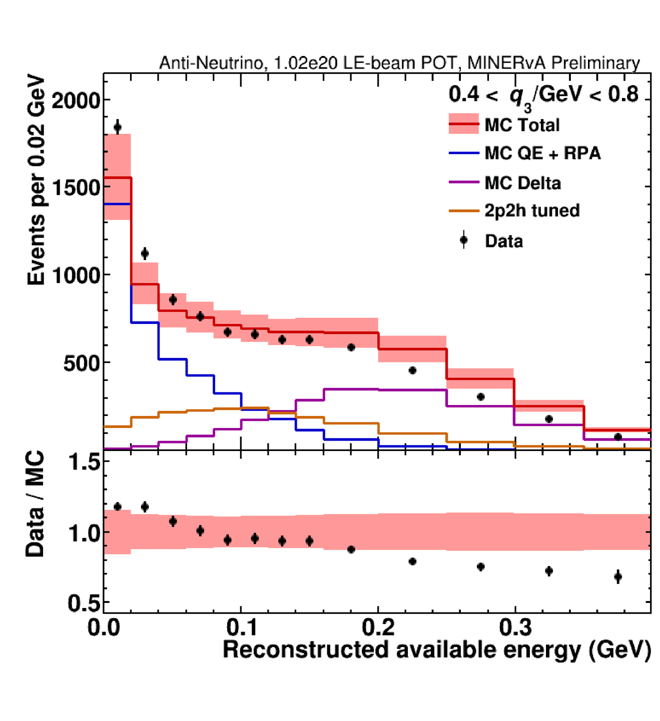
Anti-Neutrino Low Recoil $E_{avail.}$,q_3

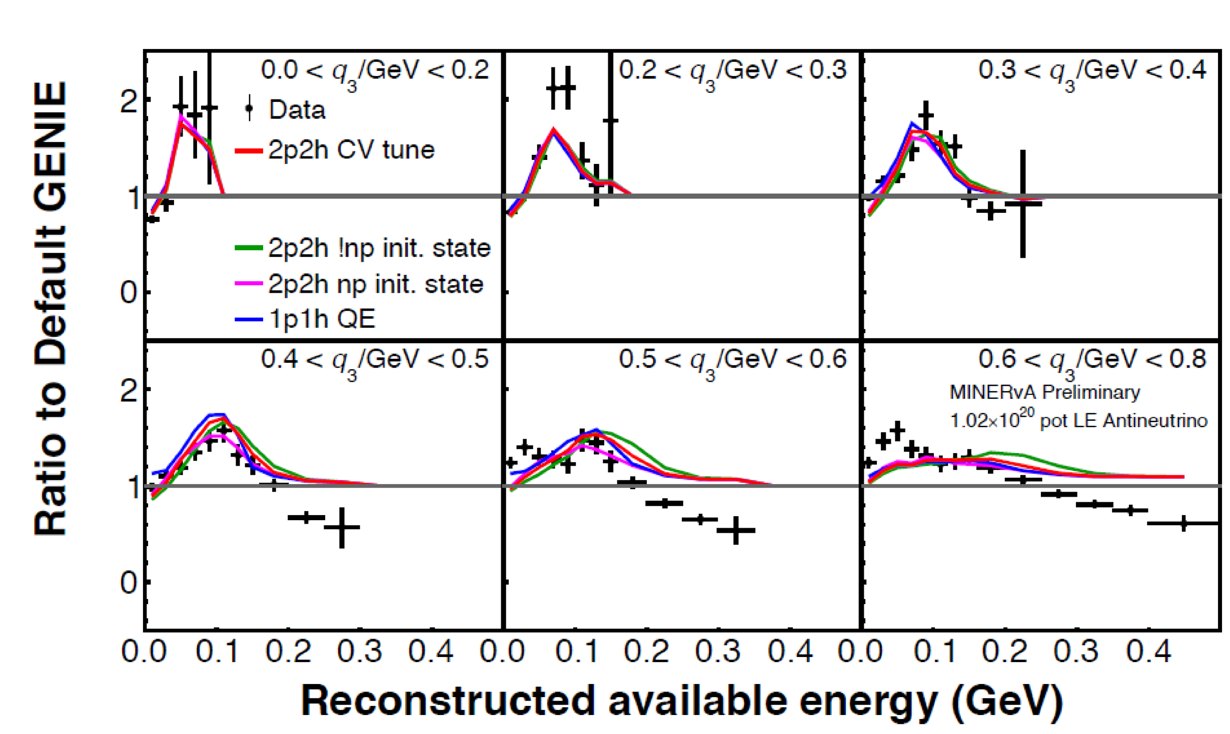
When applied to the Valencia 2p2h anti-neutrino cross section as a prediction the dip is better represented, but residual differences of >10% exist in the targeted region

Other regions, not targeted with this 2D Gaussian fit, show interesting differences across many samples. More work to do!

The neutron response in the anti-neutrino case is described in M. Elkins' poster







[1] Phys. Rev. Lett. 111, 022502 (2013)
[2] Phys. Rev. Lett. 111, 022501 (2013)
[3] Phys. Rev. Lett. 116, 071802 (2016)
[4] PRC 70, 055503 (2004); PRC 83, 045501 (2011)
[5] PRC 70, 055503 (2004); PRD 88, 113007 (2013)