

Comparing the T2K and NOvA interaction model

Clarence Wret
Jeremy Wolcott

c.wret@rochester.edu

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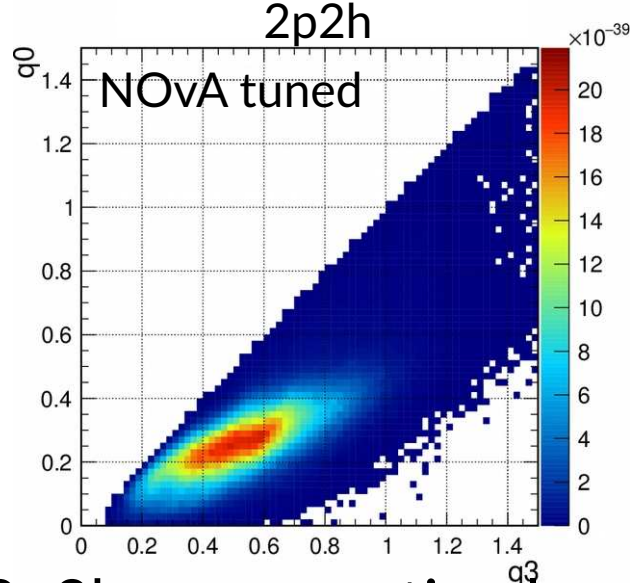
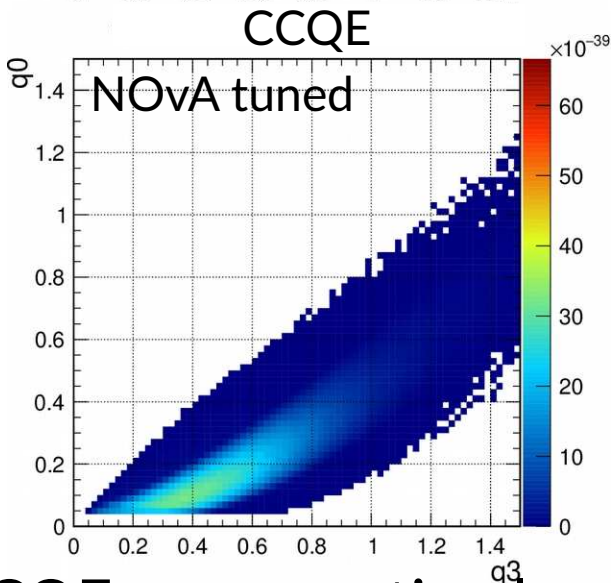
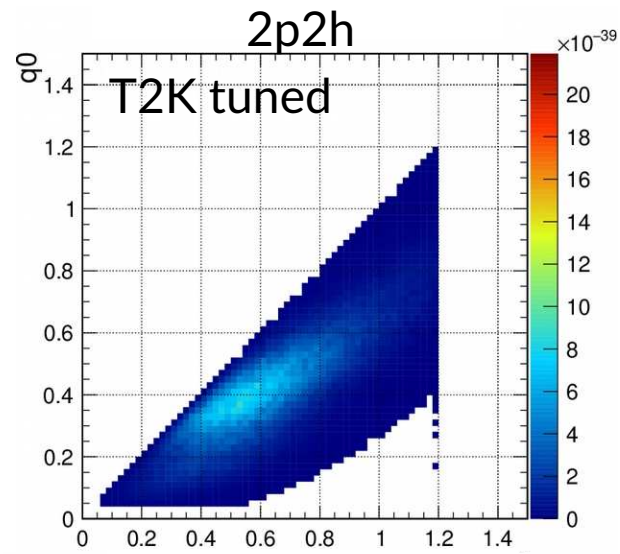
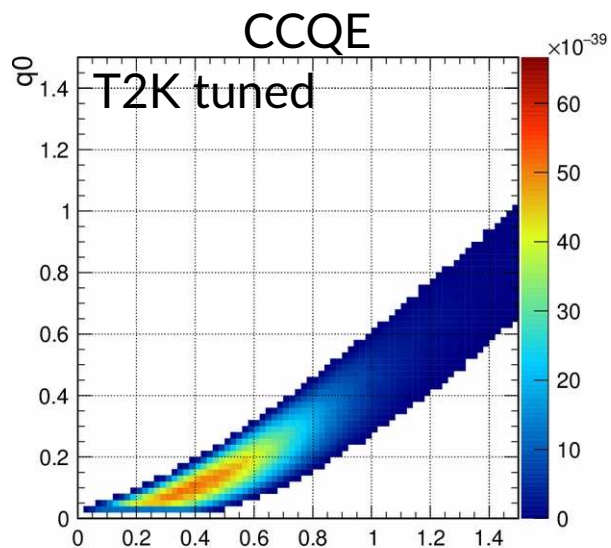
Overview

- One of the large challenges of the joint fit is unifying systematics
- Interaction systematics have a large impact on the error budget at both experiments
- The interaction systematics should be largely correlated
 - Neutrino interactions, e.g. CC0/ 1π , 2p2h, FSI models...
 - Secondary interactions of pions or nucleons
 - Wrong evaluation \rightarrow Bias in central value and/or uncertainty
- Crucial to study these for success of joint fit!
- Current plan: isolate of systematics that are important and need correlations



Comparing T2K and NOvA tunes

- Looked at some GENIE with NOvA tune and NEUT with T2K tune, scratched our heads and discussed



- e.g. CCQE cross-section larger at T2K, 2p2h cross-section larger at NOvA



What interaction parameters matter?

- What have we done this afternoon:
 - Informal discussion led to 2p2h/MEC, resonant/1π and $\underline{v}_e/\underline{v}_\mu$ differences

<i>Interaction model</i>			
<i>Critical to both</i>			
2p2h normalization, ν_e and $\bar{\nu}_e$	yes, T2K and NOvA		JW: Enushape knob on NOvA effectively does it; totally separate ν_e and $\bar{\nu}_e$
2p2h shape, C, O. T2K: Modify strength into QE-like vs. Delta-like. Interference terms scaled	yes, T2K and NOvA MEC shape. Identified in Oct 2017 workshop	yes. Complications: interrelationship with other QE, 2p2h parameters, energy scaling. T2K ~insensitive to np-pn pairs and hadronic kinematics, which NOvA may be using to apply a constraint	Need to understand assumed and reasonable energy scaling and how hadronic system may be interlinked to leptonic system.
ν_e/ν_μ and $\bar{\nu}_e/\bar{\nu}_\mu$ differences: Second class currents	yes, T2K. Unclear/small? NOvA.	yes	LP: Mass effects different in NEUT and GENIE for resonant model CW: resonant doesn't take mass effect in. 1p1h same, 2p2h -- how does it handle lepton mass effects?
ν_e/ν_μ and $\bar{\nu}_e/\bar{\nu}_\mu$ differences: radiative corrections	yes, T2K. Unclear/small? NOvA.	yes.	
<i>Critical to one or the other</i>			
pion final state interactions (FSI)	yes, T2K and NOvA (Dm2). Identified in Oct 2017 workshop	yes. Complications: T2K selection couples to pion multiplicity. What aspects of pion FSI impact NOvA selection?	KSM: We have to look at this by looking at a space where the models can be compared. generate pions at the center. JW: Model selection is hA and hN in GENIE-- we could be similar with hN. Dials don't work for hN-- and how to weight it. KSM: Decide how to compare and correlate, not same model

- Study effects using raw GENIE or NEUT passed through acceptance map, applying the tunes



Thanks