


# nusystematics

## Implementation update

Luke Pickering, K. Mahn , K. McFarland, D.  
Ruterbories, C. Wret, K. Bays, J. Wolcott  
DUNE LBL Physics  
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## Implementation in fit needs some iteration with analysers

Uncertainty	Mode	Description
✓ $M_A^{QE} \rightarrow z$ exp.	1p1h/QE	D <sub>2</sub> constraint
✓ BeRPA	1p1h/QE	RPA/nuclear model suppression
➤ $E_b$	1p1h/QE	Shift in nuclear model removal energy
✓ MnvaTune1	2p2h	Strength into (nn)pp only
✓ MnvaTune2	2p2h	Strength into np pairs only
✓ MnvaTune3	1p1h/QE+2p2h	Strength into 1p1h vs. 2p2h
✓ ArC2p2h	2p2h Ar/C scaling	Electron scattering SRC pairs
➤ $E_{2p2h}$	2p2h	Energy dependence
✓ Non-res bkg	RES	Non-resonant background
✓ Low $Q^2$ $1\pi$	RES	Low $Q^2$ (empirical) suppression
✓ MK model	RES	Alternate strength in W
✓ GENIE FSI	all	Nominal FSI
➤ $E_{avail}/q_0$	all	Extreme FSI-like variations
✓ NC/multi- $\pi$ 50%	CC/NC with > 1 pion	Increased uncertainty
✓ $\nu_e/\nu_\mu$	$\nu_e$	Large uncertainty since $\nu_e$ unique phase space
✓ $\nu_e/\bar{\nu}_e$ norm	$\nu_e, \bar{\nu}_e$	McFarland&Day, PRD86 053003

✓ **Physics Implementation done**

➤ **Need some Physics inputs**

# Status

- `nusystematics` Implementation details ~finalized.
  - Some inputs need calculating:  $O(1-1.5 \text{ postdoc-week})$  of studies estimated.
  - Due to format, newly developed systematics included in new releases should be picked up when a new CAFMaker run is performed (very very fast compared to production timescales).
  - Fits should (and are) proceeding with not-final list of systematics.
- A few parameters are intrinsically multi-dimensional, need to iterate with LBL analysers to check how (if at all) problematic their linearization is in the fit:
  - There's no step-by-step event-by-event weighting in CAFAna, right?
- Validation document will be produced soon(-ish) after code release that includes the full list of systematics.
- TDR section will evolve from previous document: well underway (Thanks Kendall + Kevin).