Progress Update

Trevor Towstego

2-Ring ν_e CC1π^+ Meeting

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Overview

- Compare three different sets of pre-BDT cuts and variables:
  - v1 pre-BDT cuts, trail 8 variables
    - fiTQun index used in both pre-BDT cuts and in BDT training
  - v0 pre-BDT cuts, trial 8 varables
    - fiTQun index used only in BDT training
  - v0 pre-BDT cuts, trial 10 variables
    - fiTQun index not used at all
- Three definitions of “signal” used in BDT training:
  - $1e^{\pm}1\pi^{\pm}$, $\nu_e/\bar{\nu}_e$ CC$1\pi^{\pm}$, $\nu_e/\bar{\nu}_e$ CC
- Three definitions of “signal” used in FOM evaluation:
  - $1e^{\pm}1\pi^{\pm}$, ν_e CC$1\pi^{+}$, ν_e CC

v0/v1 pre-BDT Cuts, Trial 8/10 Variables

v0 and v1 pre-BDT cuts		
	0 decay e	**1 decay e**
FCFV	Wall > 50 cm	
not 1Re	not 1Re-like (TN319)	
sub-sample selection	2Reπ, 2Rπe, and 3Reππ sub-samples	1Re, 2Ree, 2Reπ, 2Rπe, 2Rμe, and 3Reππ sub-samples
0 decay e	1 sub-event	2 sub-events
E_{rec}*	$E_{rec}(p_e,p_\pi) < 1.5$ GeV	

v1 only

Trial 8 and 10 BDT variables
1R v 1R -ln(L) 1R v 2R -ln(L) 2R v 2R -ln(L) 2R v 3R -ln(L) 3R v 3R -ln(L) 1R+2R fit kinematics fiTQun fit indices of 1R, 2R, and 3R fits E_{rec}*, towall e*, towall π*, p_{low}*, $m_{\pi 0}$

Trial 8 only

* Event reconstruction done using fiTQun's 2Reπ-like fit

0 decay e: $1e^{\pm}1\pi^{\pm}$ Training

pre-BDT Cuts	Training Variable Trial	FOM Signal	FOM
v0	8	$1e^{\pm}1\pi^{\pm}$	0.58
		ν_e CC$1\pi^+$	0.52
		osc ν_e CC	0.44
	10	$1e^{\pm}1\pi^{\pm}$	0.55
		ν_e CC$1\pi^+$	0.50
		osc ν_e CC	0.43
v1	8	$1e^{\pm}1\pi^{\pm}$	0.59
		ν_e CC$1\pi^+$	0.53
		osc ν_e CC	0.44

- v0, trial 10 performs modestly worse for all FOM signal definitions

0 decay e: $\nu_e/\bar{\nu}_e$ CC1$\pi^\pm$ Training

pre-BDT Cuts	Training Variable Trial	FOM Signal	FOM
v0	8	$1e^\pm 1\pi^\pm$	0.43
		ν_e CC1π^+	0.55
		osc ν_e CC	0.73
	10	$1e^\pm 1\pi^\pm$	0.39
		ν_e CC1π^+	0.50
		osc ν_e CC	0.68
v1	8	$1e^\pm 1\pi^\pm$	0.59
		ν_e CC1π^+	0.54
		osc ν_e CC	0.45

- v0, trial 10 performs significantly worse with $1e^\pm 1\pi^\pm$ FOM signal, modestly worse with ν_e CC1π^+ FOM signal, and in the middle with osc ν_e CC FOM signal

0 decay e: $\nu_e/\bar{\nu}_e$ CC Training

pre-BDT Cuts	Training Variable Trial	FOM Signal	FOM
v0	8	$1e^{\pm}1\pi^{\pm}$	0.32
		ν_e CC$1\pi^{+}$	0.49
		osc ν_e CC	1.33
	10	$1e^{\pm}1\pi^{\pm}$	0.30
		ν_e CC$1\pi^{+}$	0.47
		osc ν_e CC	1.28
v1	8	$1e^{\pm}1\pi^{\pm}$	0.52
		ν_e CC$1\pi^{+}$	0.48
		osc ν_e CC	0.52

- With v0 pre-BDT cuts, this training method essentially becomes an inclusive selection

1 decay e: $1e^{\pm}1\pi^{\pm}$ Training

pre-BDT Cuts	Training Variable Trial	FOM Signal	FOM
v0	8	$1e^{\pm}1\pi^{\pm}$	1.17
		ν_e CC$1\pi^+$	1.22
		osc ν_e CC	0.99
	10	$1e^{\pm}1\pi^{\pm}$	1.15
		ν_e CC$1\pi^+$	1.19
		osc ν_e CC	0.96
v1	8	$1e^{\pm}1\pi^{\pm}$	1.20
		ν_e CC$1\pi^+$	1.26
		osc ν_e CC	1.03

- v0, trial 10 performs modestly worse for all FOM signal definitions

1 decay e: $\nu_e/\bar{\nu}_e$ CC1$\pi^\pm$ Training

pre-BDT Cuts	Training Variable Trial	FOM Signal	FOM
v0	8	$1e^\pm 1\pi^\pm$	1.14
		ν_e CC1π^+	1.37
		osc ν_e CC	1.12
	10	$1e^\pm 1\pi^\pm$	1.09
		ν_e CC1π^+	1.33
		osc ν_e CC	1.09
v1	8	$1e^\pm 1\pi^\pm$	1.14
		ν_e CC1π^+	1.37
		osc ν_e CC	1.11

- v0, trial 10 performs modestly worse for all FOM signal definitions

1 decay e: $\nu_e/\bar{\nu}_e$ CC Training

pre-BDT Cuts	Training Variable Trial	FOM Signal	FOM
v0	8	$1e^{\pm}1\pi^{\pm}$	1.06
		ν_e CC$1\pi^{+}$	1.27
		osc ν_e CC	1.05
	10	$1e^{\pm}1\pi^{\pm}$	1.02
		ν_e CC$1\pi^{+}$	1.23
		osc ν_e CC	1.01
v1	8	$1e^{\pm}1\pi^{\pm}$	1.15
		ν_e CC$1\pi^{+}$	1.36
		osc ν_e CC	1.12

- Loss of performance with v0, trial 10 is more significant, but FOMs in general are poorer than in previous slide

Thoughts

- Mixed results for 0 decay e sample
  - Perhaps use BDT trained against a signal of $\nu_e/\bar{\nu}_e$ CC1$\pi^{\pm}$ for v0, trial 10
- Strong motivation to move to v0, trial 10 for 1 decay e sample
  - When trained against a signal of $\nu_e/\bar{\nu}_e$ CC1$\pi^{\pm}$, still get strong FOM (see slide 8)
- May shift to these BDT selections from now on to avoid future headaches when studying systematics
  - v0 pre-BDT cuts
  - Trial 10 variables
  - BDT training signal of $\nu_e/\bar{\nu}_e$ CC1$\pi^{\pm}$
- Mike @ T2K-SK meeting:
  - Why not just use “inclusive” selection? (see v0 trial 10 on slide 6)

Current Work

- Inclusive BDT
  - Reject 1-ring ν_e CCQE, 1-ring ν_e CC1π^+, and 2-ring ν_e CC1π^+
  - Train BDT to select for remaining ν_e CC
  - BDTs have been trained
    - Now just need to modify existing code to analyse results
- Will then start focusing on systematics
  - Start with FSI/SI systematics