Progress Update

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UofT Neutrino/DM Meeting
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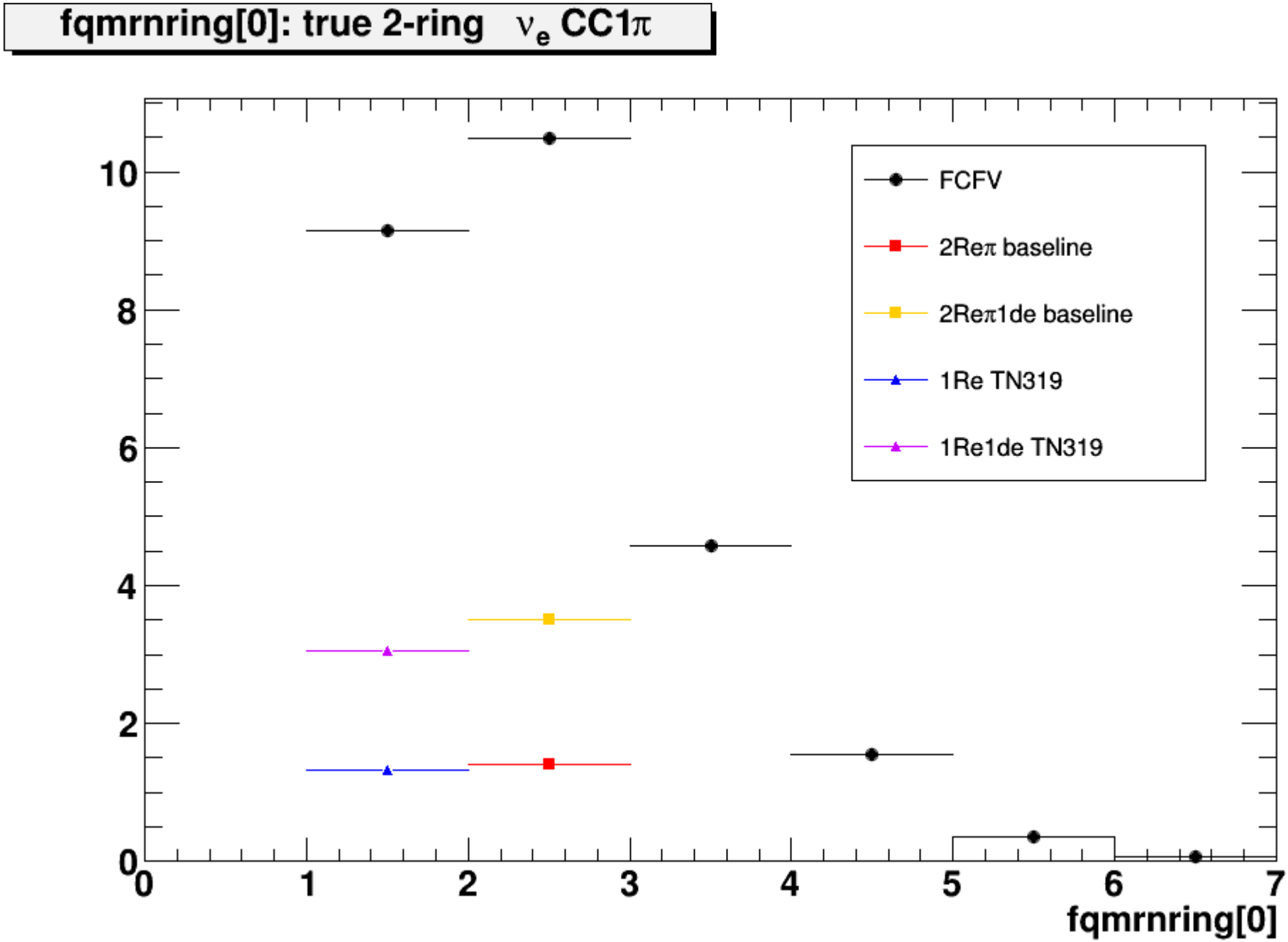
Trying to understand efficiency loss

- Why is there such a large efficiency loss of 2-ring ν_e CC1π events when the 2-ring cut is made?

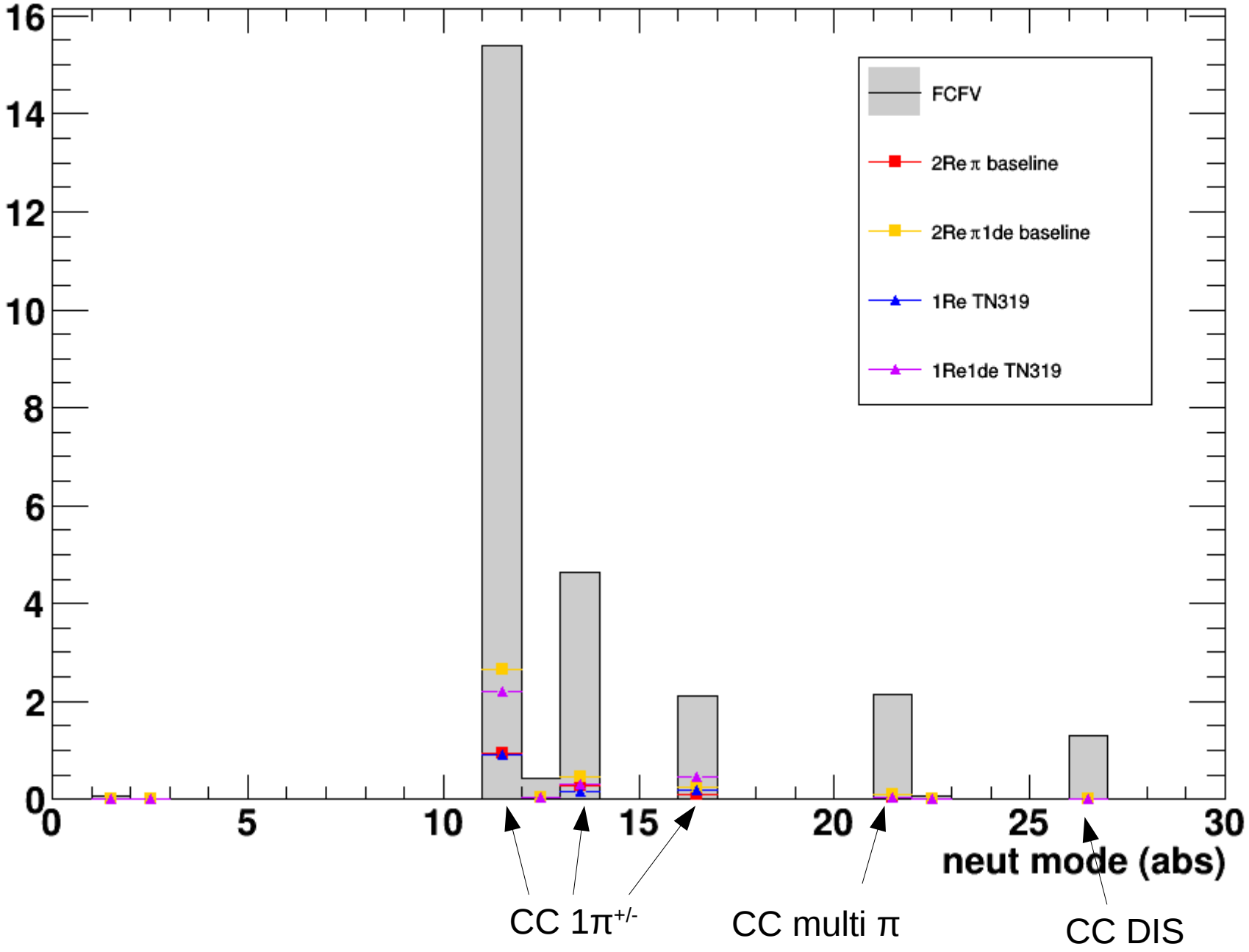
cut	$\nu_e/\bar{\nu}_e$ CC1$\pi^{+/-}$	$\nu_e/\bar{\nu}_e$ CCQE	$\nu_e/\bar{\nu}_e$ CCother	$\nu_\mu/\bar{\nu}_\mu$ CC1$\pi^{+/-}$	$\nu_\mu/\bar{\nu}_\mu$ CCQE	$\nu_\mu/\bar{\nu}_\mu$ CCother	NC $1\pi^+$	NC $1\pi^-$	NC $1\pi^0$	NC $N\pi$	NC 0π
FCFV	26.16	104.60	20.40	90.54	216.44	136.26	20.11	15.48	90.77	40.46	25.95
2 rings	10.48	7.44	4.37	33.85	20.95	16.93	5.48	4.20	68.85	6.91	8.33
eπ-like	7.74	1.82	0.42	1.42	0.72	5.22	1.12	0.84	1.92	1.49	0.93

These are events with one electron and one charged pion (above Cherenkov threshold + 30 MeV/c momentum), counted using the VCWORK stack where the pion must be flagged “to chase”



Lots of 2-ring ν_e CC1π events being reconstructed as 1-ring or 3-ring events

NEUT mode: true 2-ring ν_e CC1π



Thoughts on fqmrnring[0]

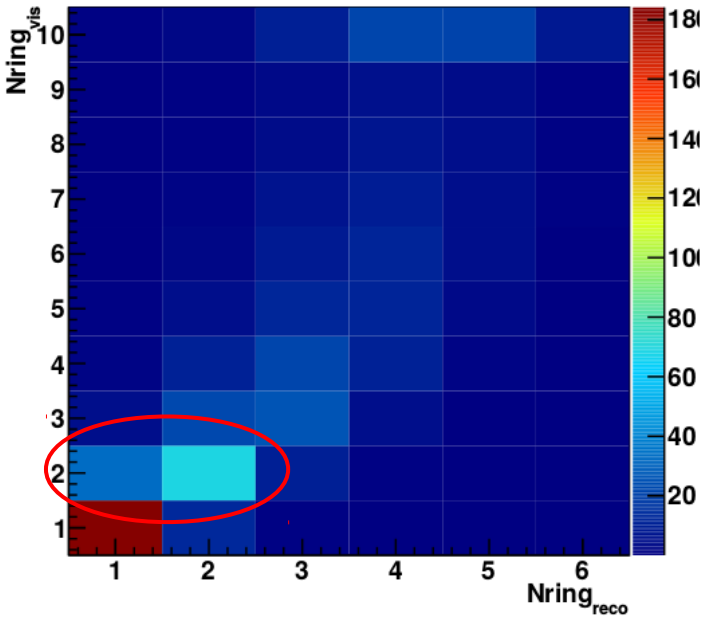
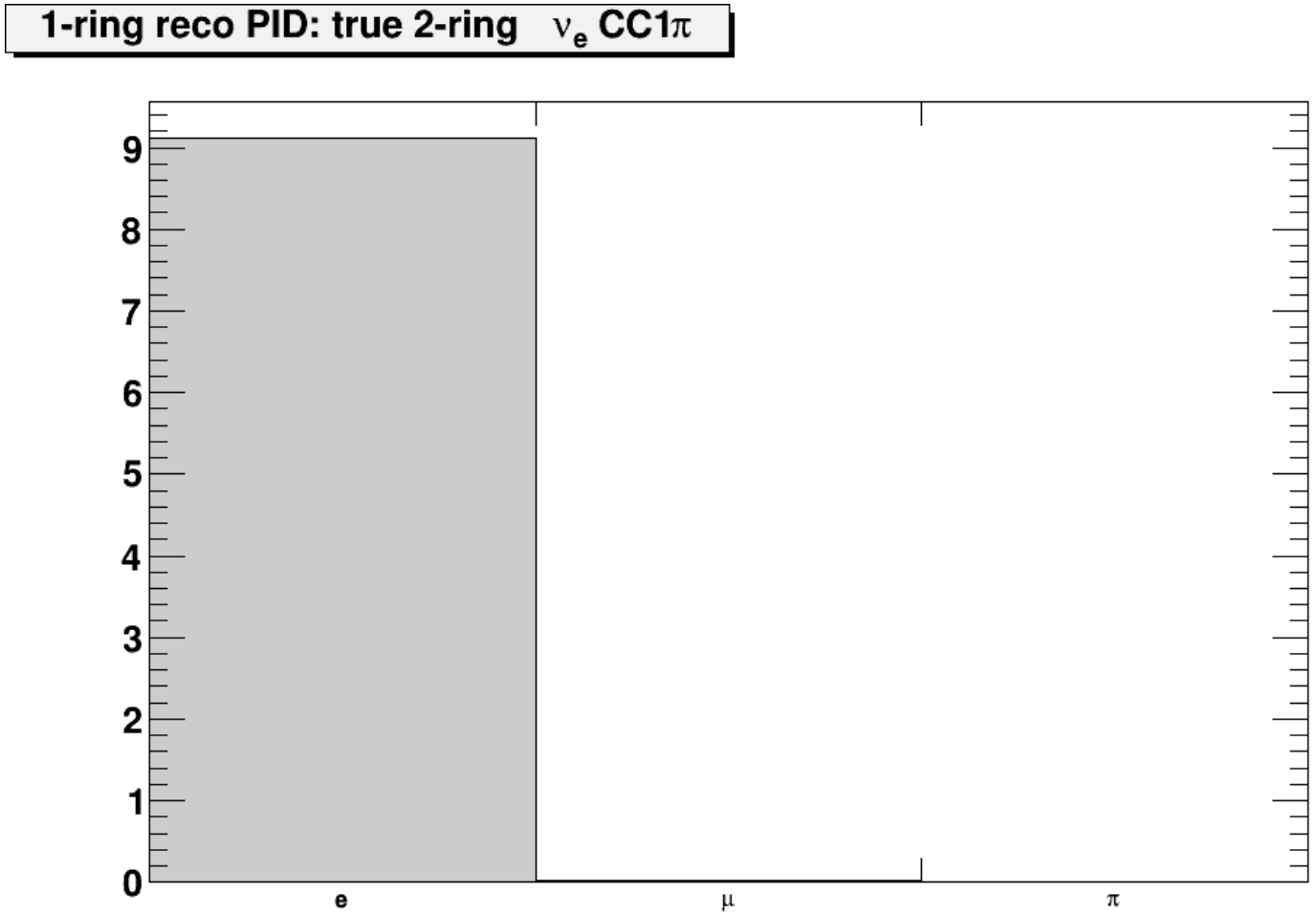


Figure 50 in TN319 showing number of true rings vs. number of reconstructed rings

- fiTQun's 2-ring cut designed to diagonalize this matrix
  - No specific interaction mode taken into account
  - Just so happens that diagonalization of this matrix works poorly for ν_e CC1π

What are 2-ring ν_e CC1π events being reconstructed as?



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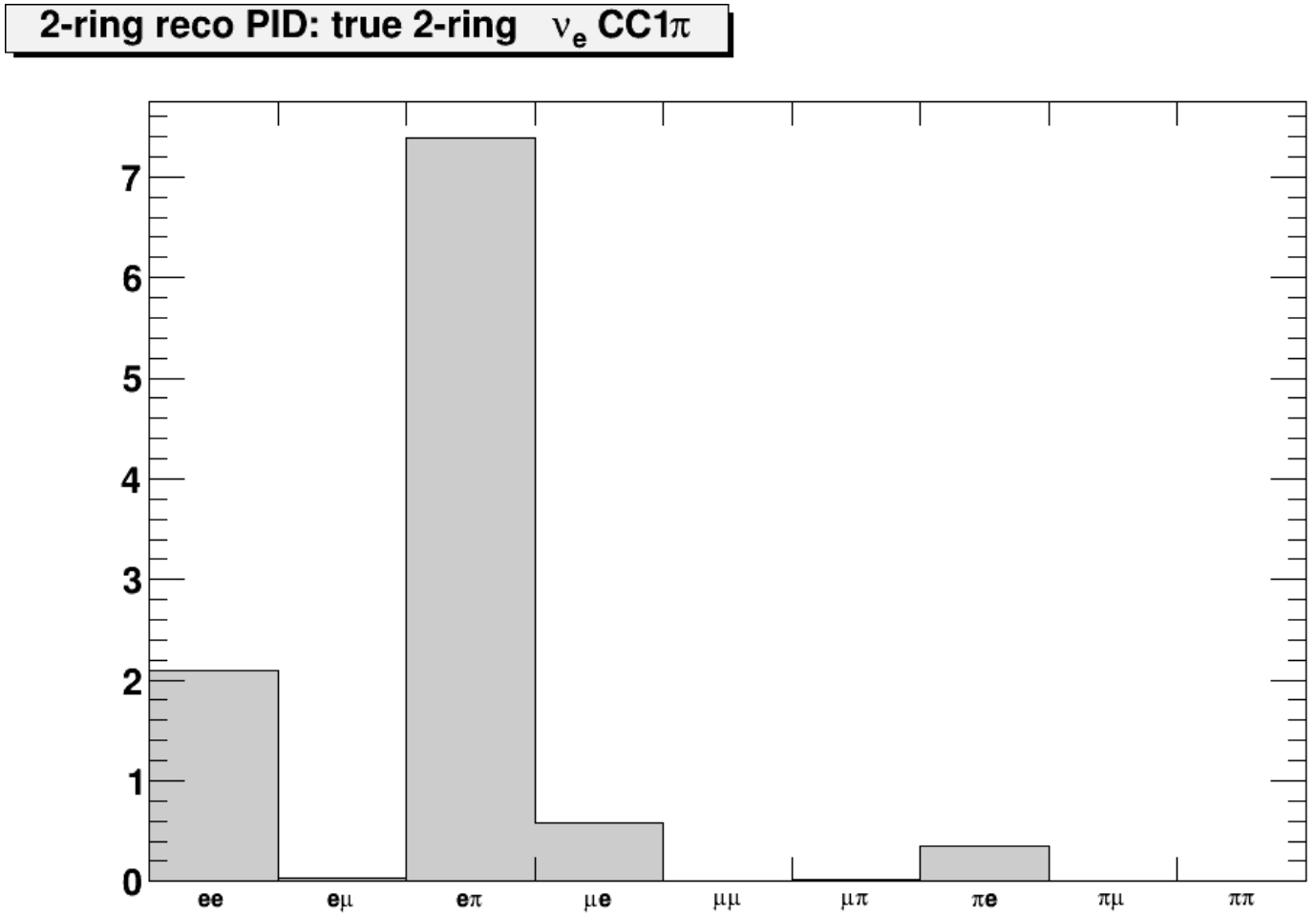

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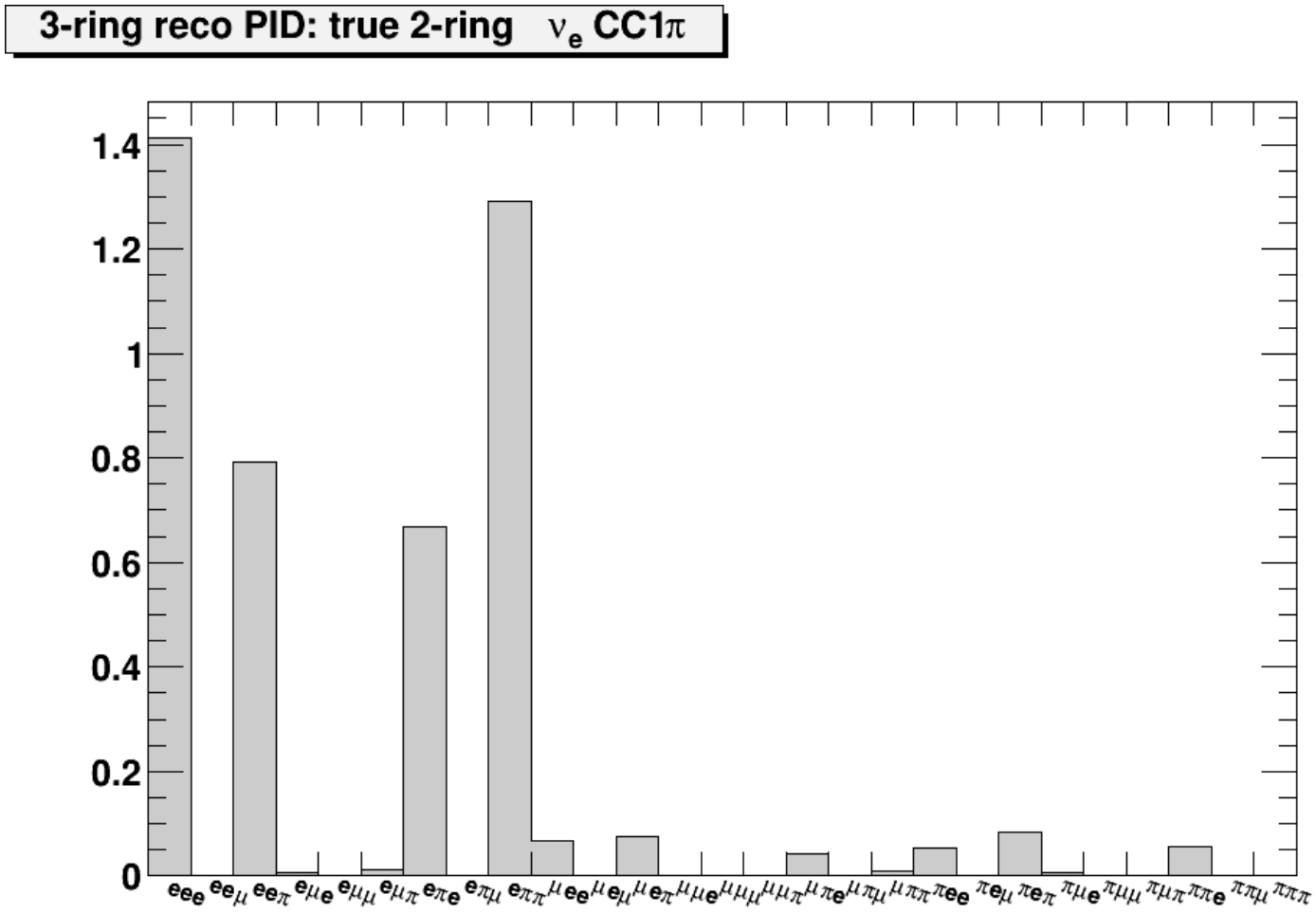
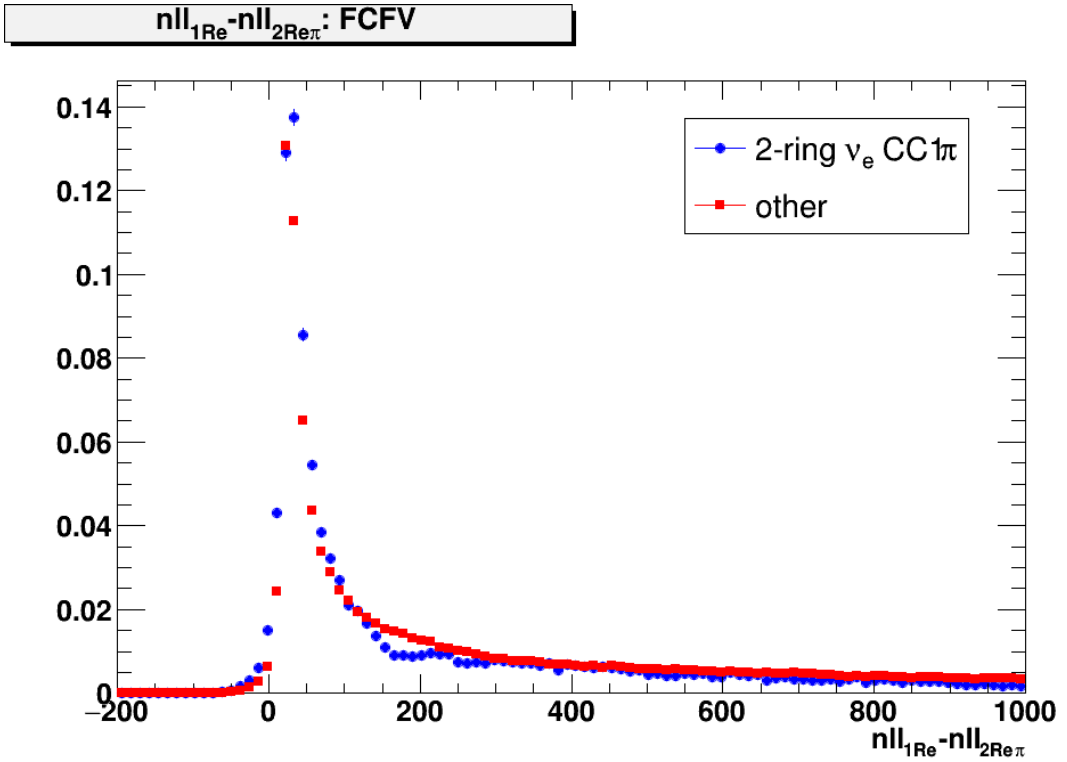
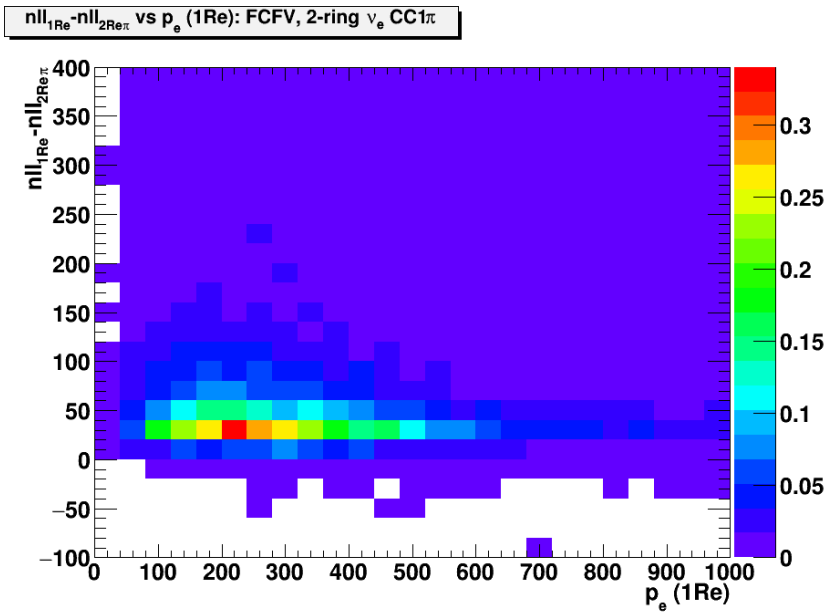


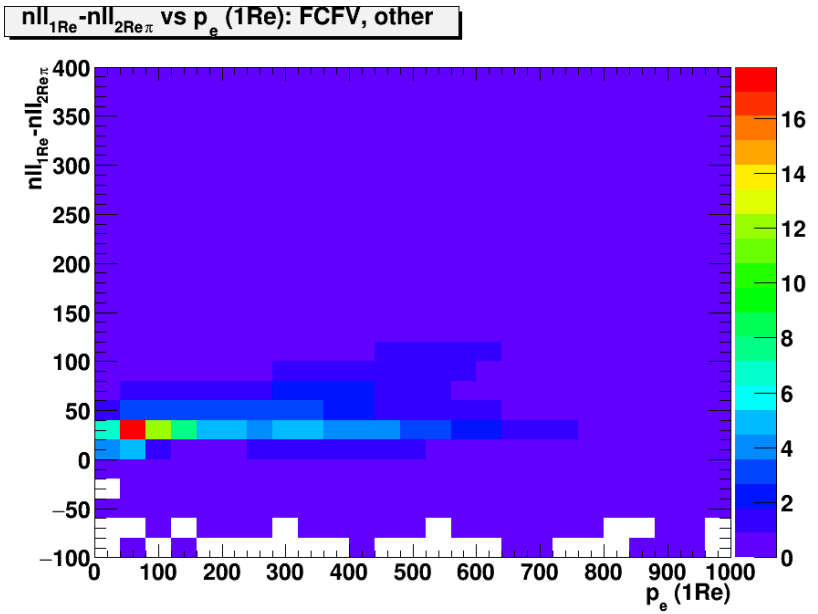
Likelihood Ratios

- Look at likelihood ratios **before 2-ring cut**
  - Use previous plots to guide which ratios should be looked at
  - Haven’t looked at 3-ring likelihoods yet

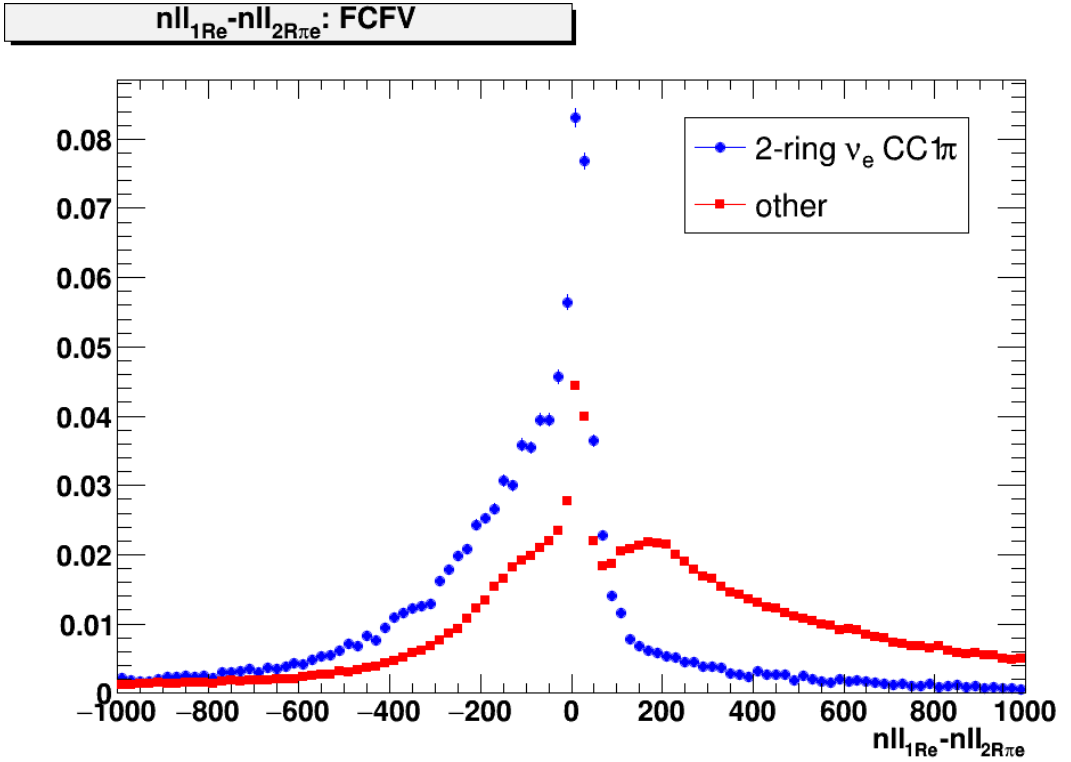
1Re vs 2Reπ

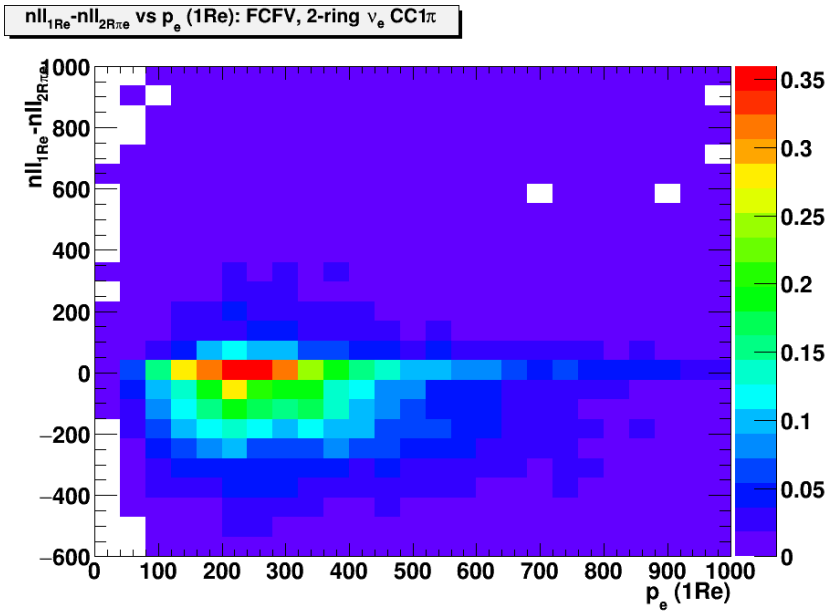

nll1Re-nll2Reπ: FCFV
2-ring νe CC1π
other
nll1Re-nll2Reπ

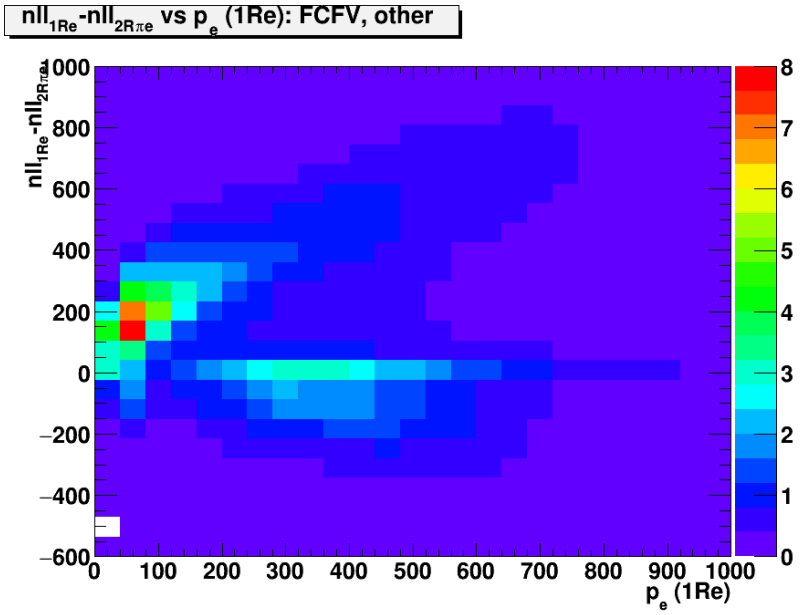

nll1Re-nll2Reπ vs pe (1Re): FCFV, 2-ring νe CC1π
nll1Re-nll2Reπ
pe (1Re)


nll1Re-nll2Reπ vs pe (1Re): FCFV, other
nll1Re-nll2Reπ
pe (1Re)

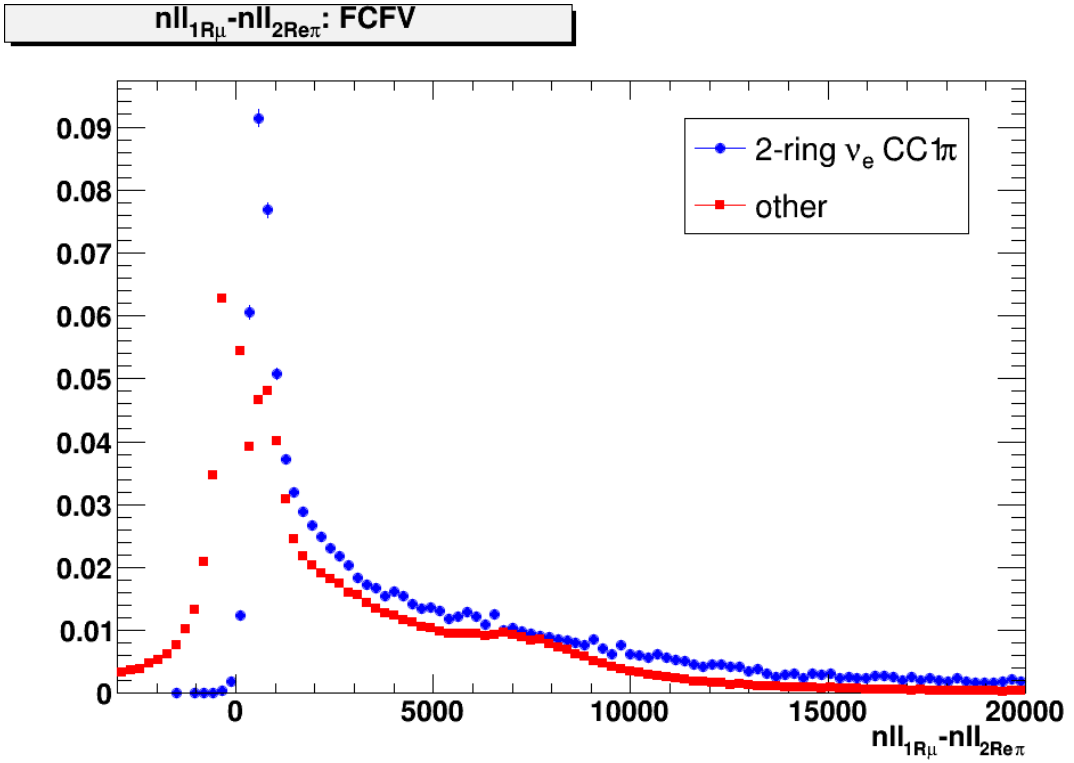
1Re vs 2Rπe

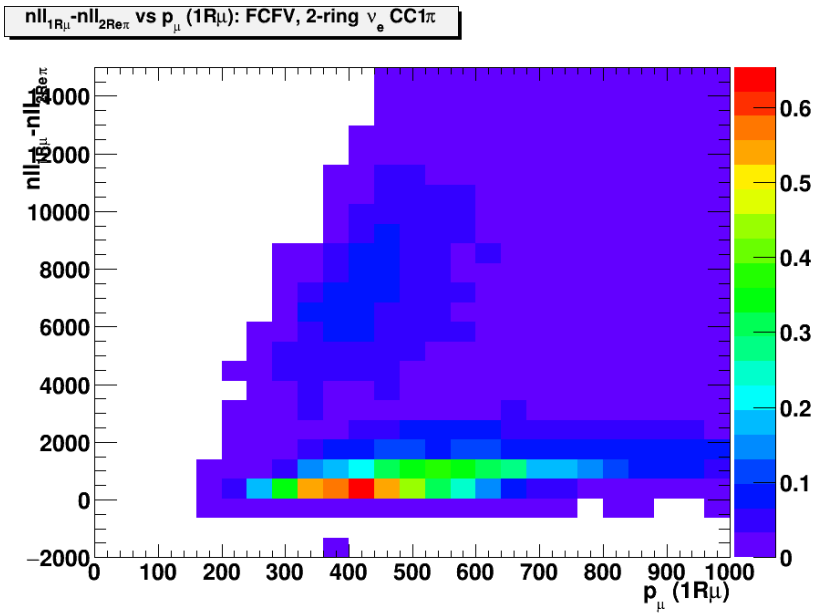

nll1Re-nll2Rπe: FCFV
2-ring νe CC1π
other
nll1Re-nll2Rπe

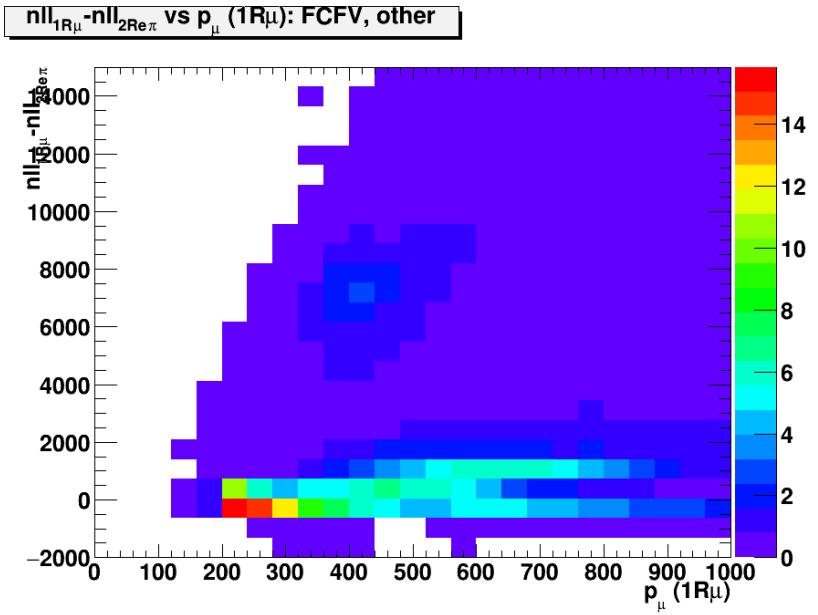

nll1Re-nll2Rπe vs pe (1Re): FCFV, 2-ring νe CC1π
nll1Re-nll2Rπe
pe (1Re)


nll1Re-nll2Rπe vs pe (1Re): FCFV, other
nll1Re-nll2Rπe
pe (1Re)

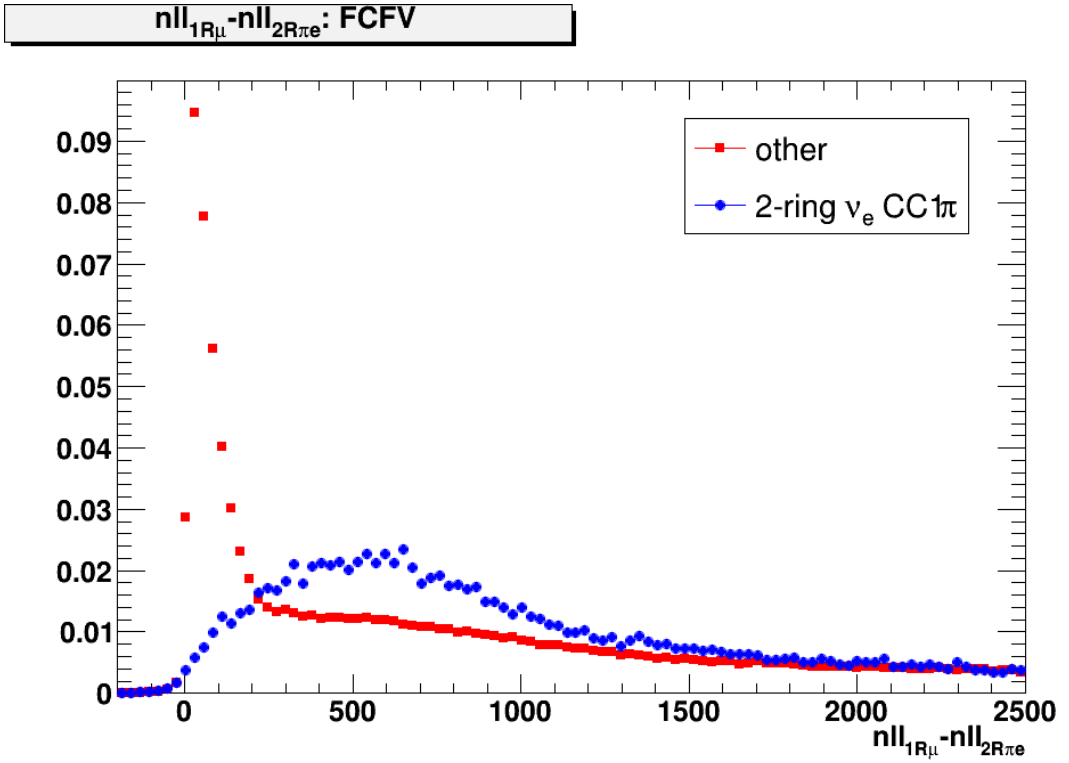
1Rμ vs 2Reπ

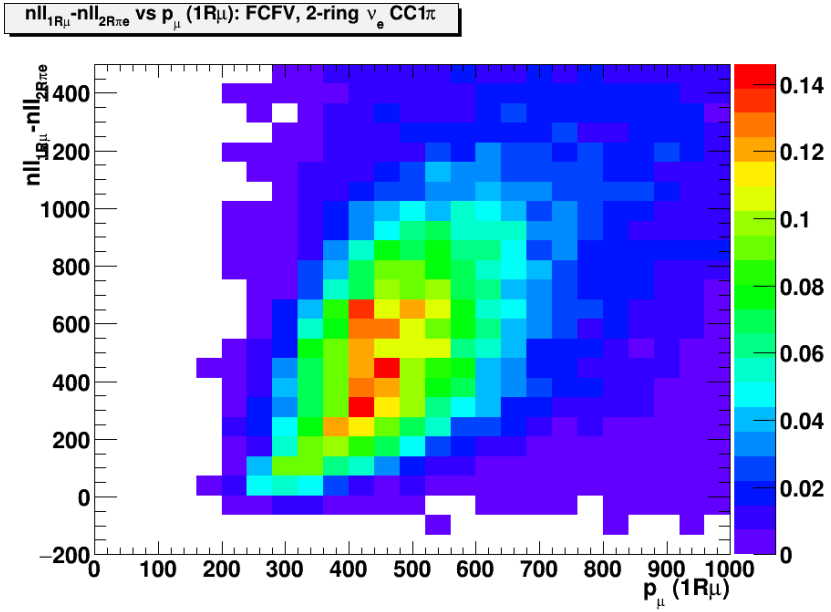

nll1Rμ-nll2Reπ: FCFV
2-ring νe CC1π
other
nll1Rμ-nll2Reπ

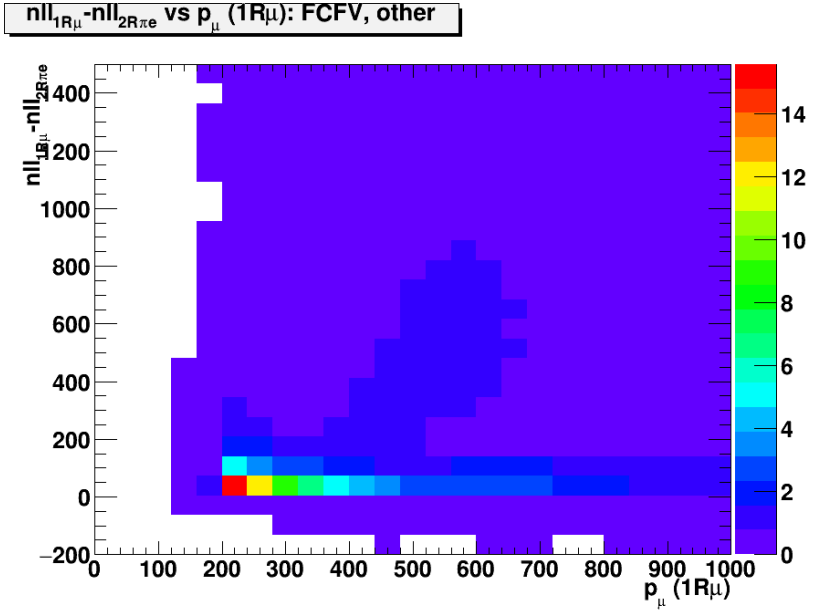

nll1Rμ-nll2Reπ vs pμ (1Rμ): FCFV, 2-ring νe CC1π
pμ (1Rμ)


nll1Rμ-nll2Reπ vs pμ (1Rμ): FCFV, other
pμ (1Rμ)

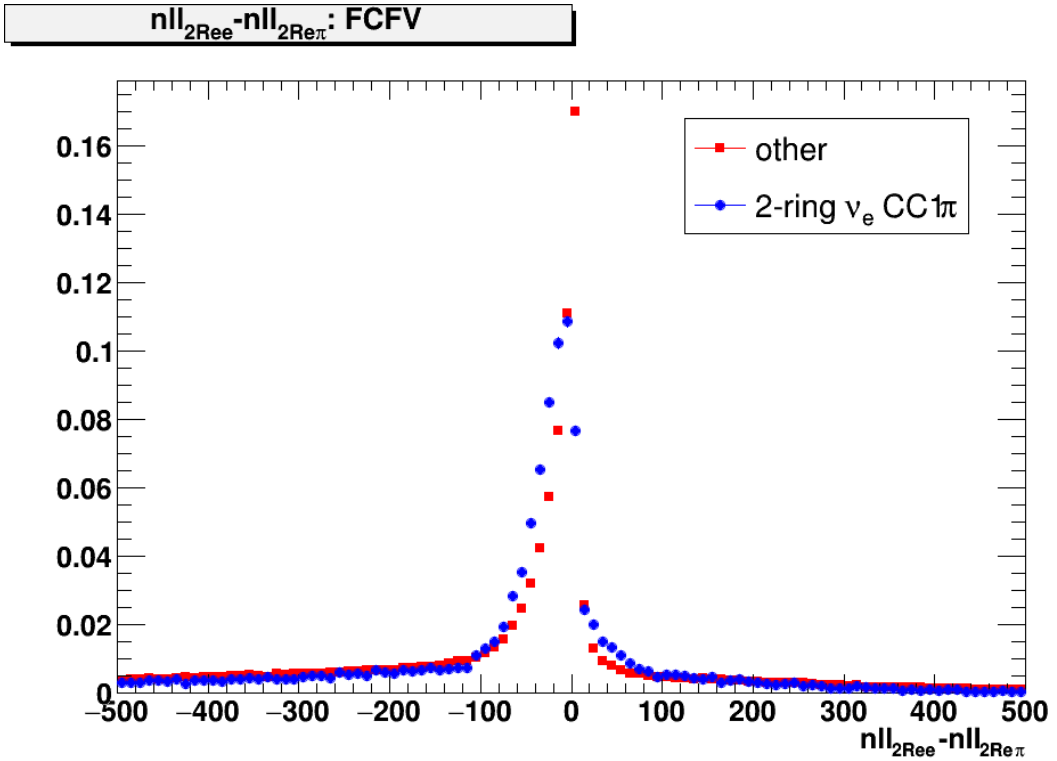
1Rμ vs 2Rπe

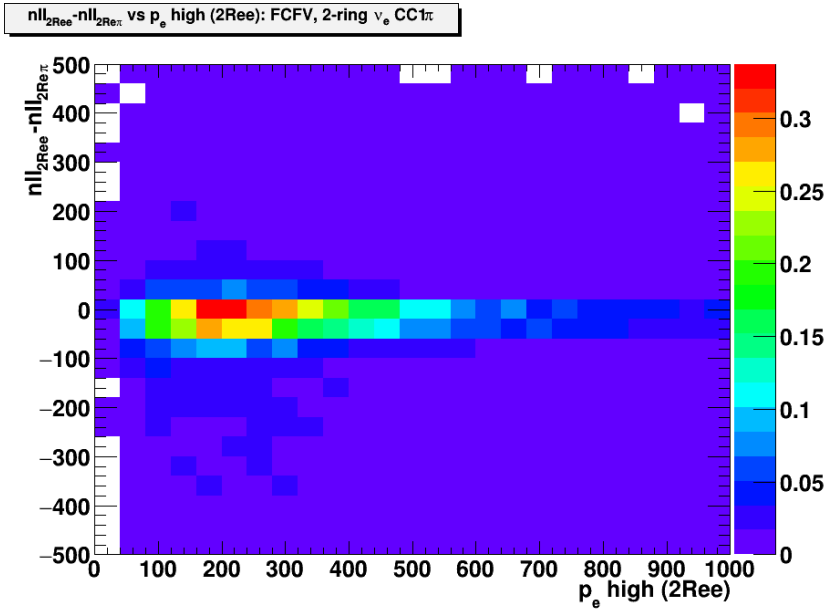

nll1Rμ-nll2Rπe: FCFV
other
2-ring νe CC1π
nll1Rμ-nll2Rπe

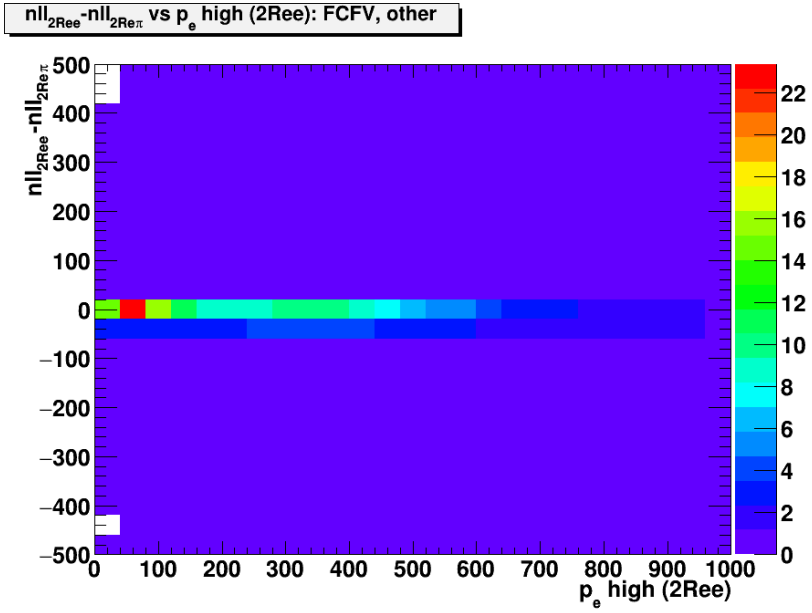

nll1Rμ-nll2Rπe vs pμ (1Rμ): FCFV, 2-ring νe CC1π
pμ (1Rμ)


nll1Rμ-nll2Rπe vs pμ (1Rμ): FCFV, other
pμ (1Rμ)

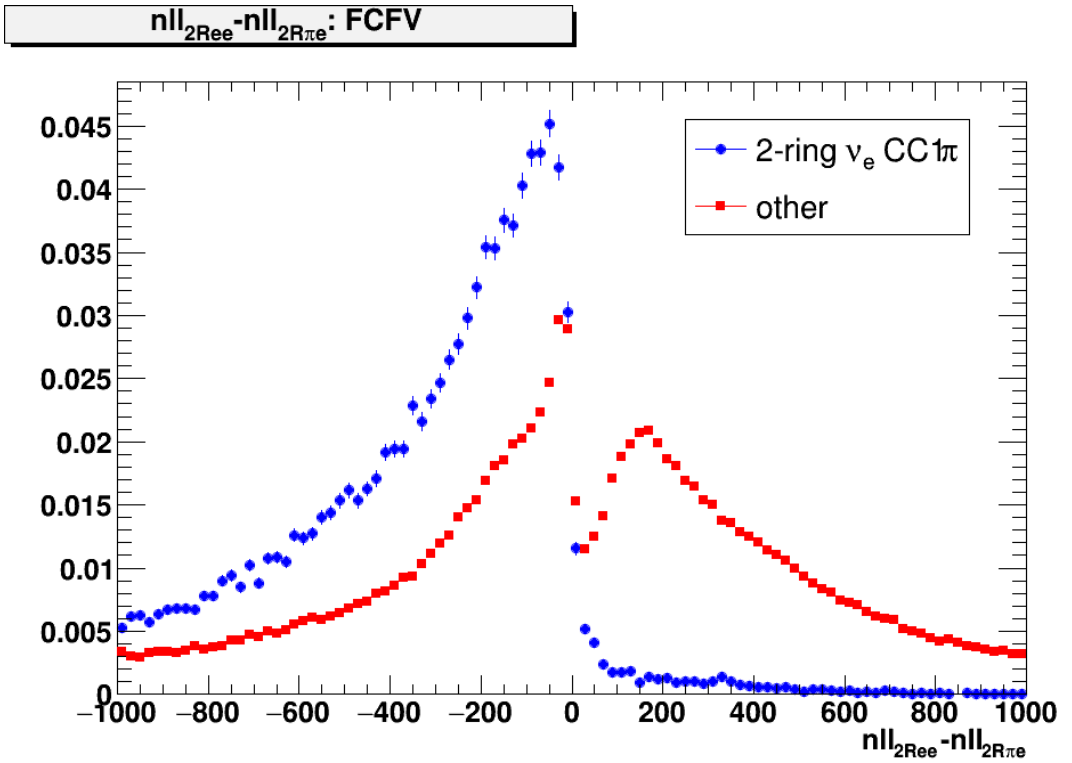
2Ree vs 2Reπ

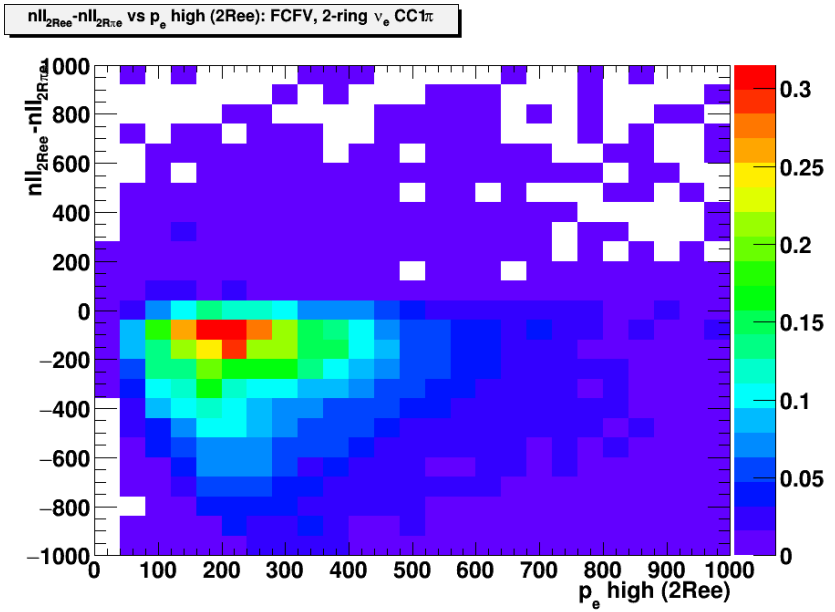

nll2Ree-nll2Reπ: FCFV
other
2-ring νe CC1π
nll2Ree-nll2Reπ

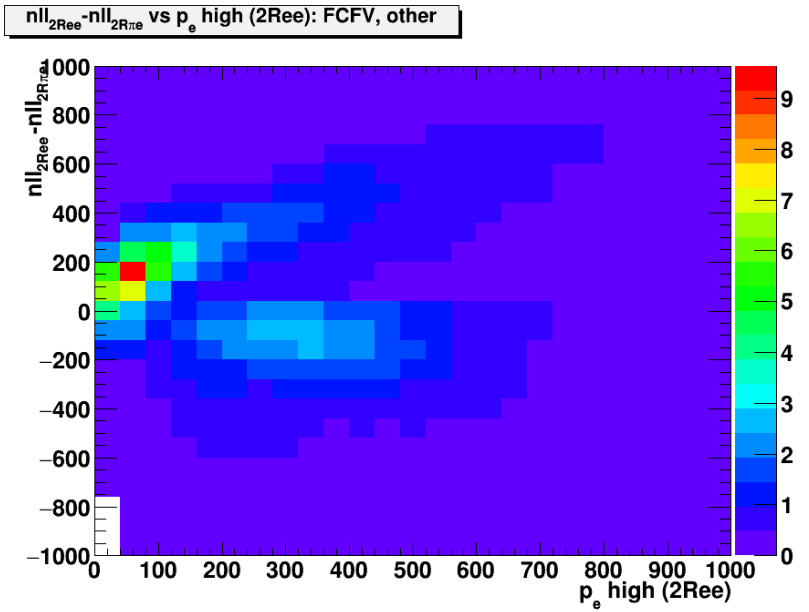

nll2Ree-nll2Reπ vs pe high (2Ree): FCFV, 2-ring νe CC1π
nll2Ree-nll2Reπ
pe high (2Ree)


nll2Ree-nll2Reπ vs pe high (2Ree): FCFV, other
nll2Ree-nll2Reπ
pe high (2Ree)

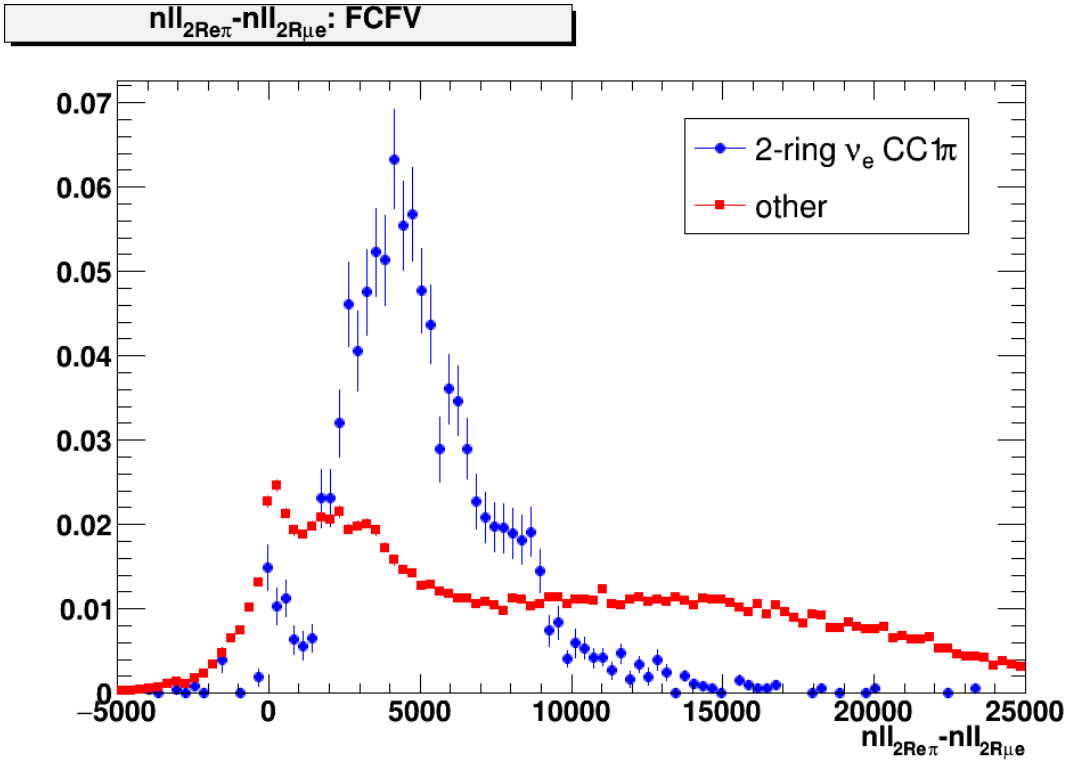
2Ree vs 2Rπe

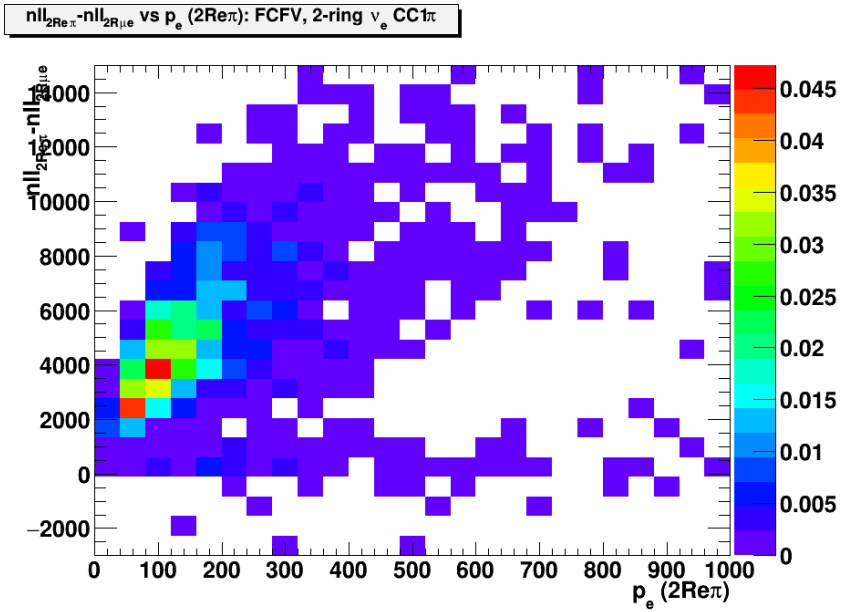

nll2Ree-nll2Rπe: FCFV
2-ring νe CC1π
other
nll2Ree-nll2Rπe

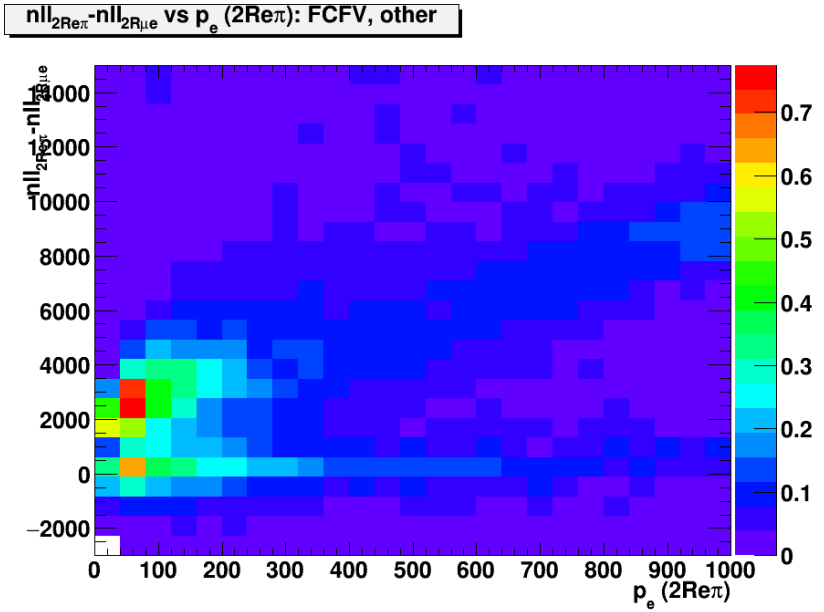

nll2Ree-nll2Rπe vs pe high (2Ree): FCFV, 2-ring νe CC1π
nll2Ree-nll2Rπe
pe high (2Ree)


nll2Ree-nll2Rπe vs pe high (2Ree): FCFV, other
nll2Ree-nll2Rπe
pe high (2Ree)

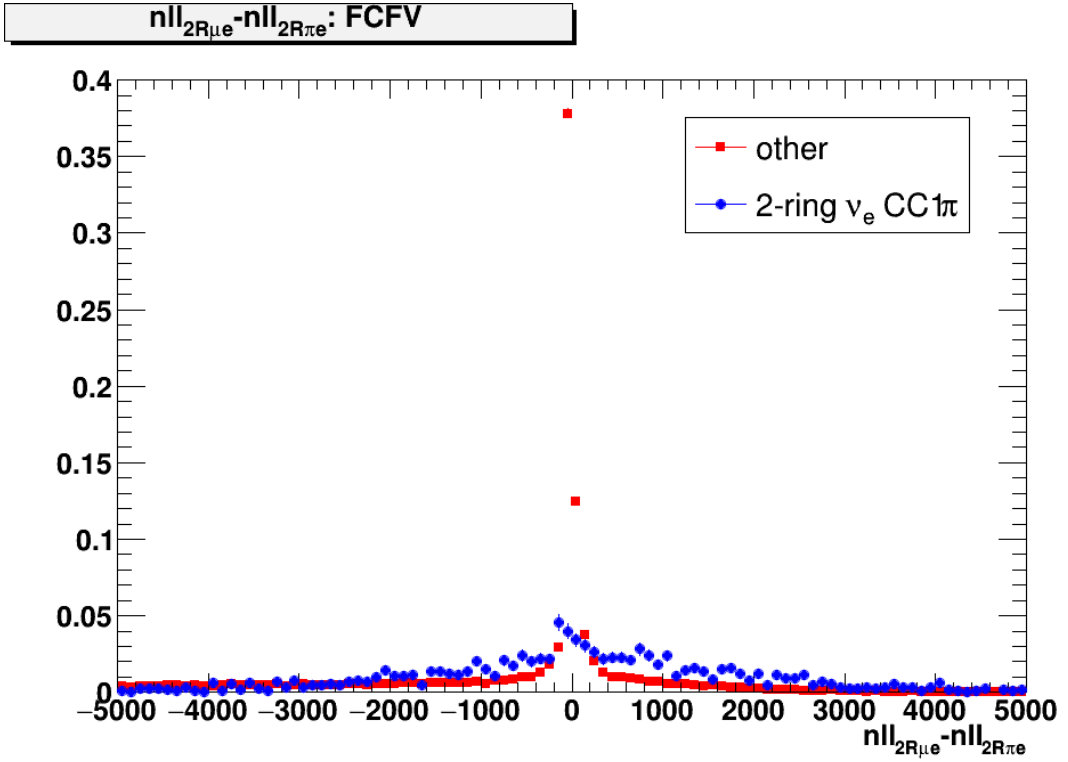
2Reπ vs 2Rμe

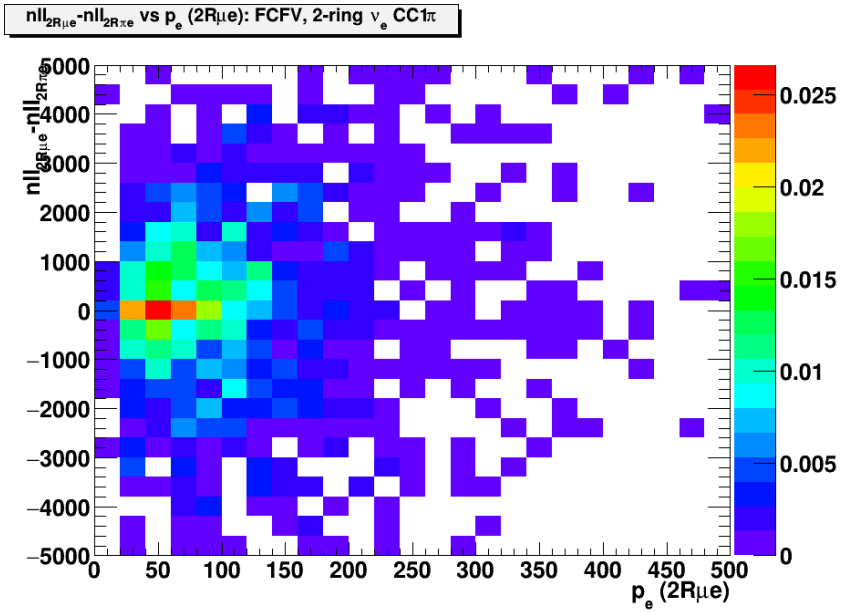

nll2Reπ-nll2Rμe: FCFV
2-ring νe CC1π
other
nll2Reπ-nll2Rμe

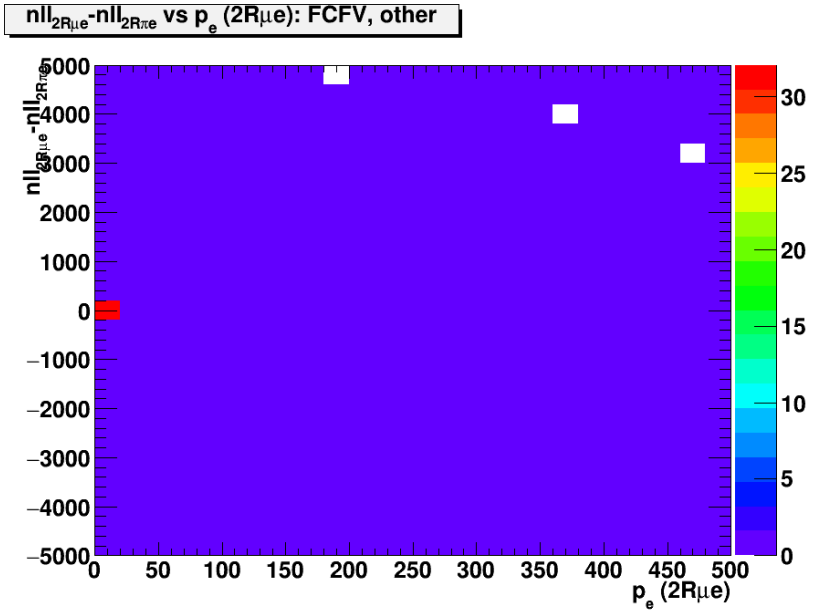

nll2Reπ-nll2Rμe vs pe (2Reπ): FCFV, 2-ring νe CC1π
nll2Reπ-nll2Rμe
pe (2Reπ)


nll2Reπ-nll2Rμe vs pe (2Reπ): FCFV, other
nll2Reπ-nll2Rμe
pe (2Reπ)

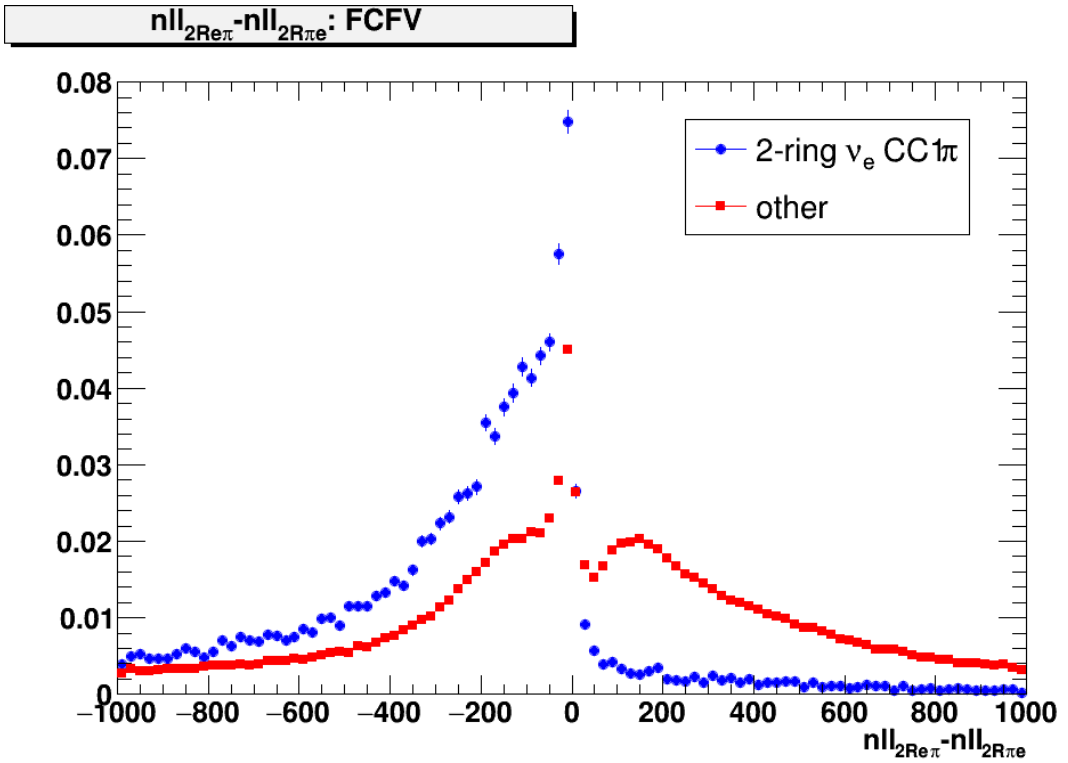
2Rμe vs 2Rπe

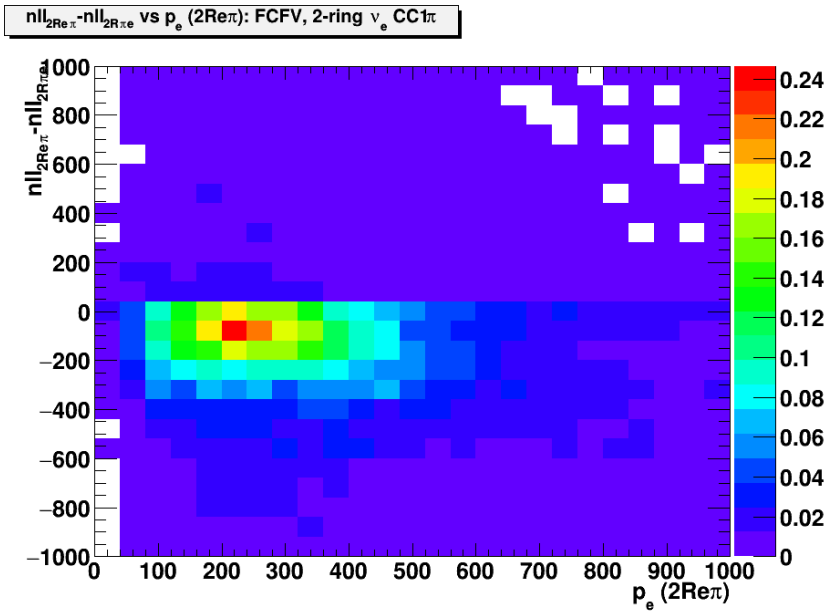

nll2Rμe-nll2Rπe: FCFV
other
2-ring νe CC1π
nll2Rμe-nll2Rπe

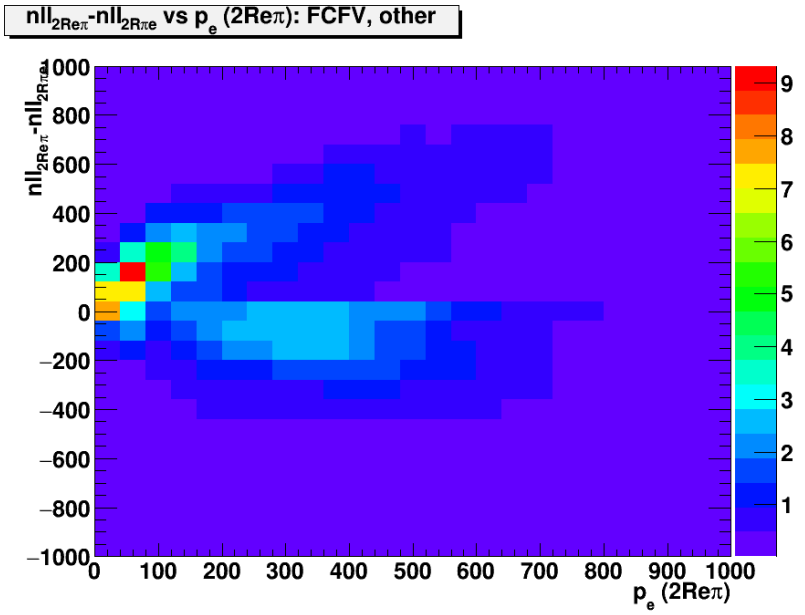

nll2Rμe-nll2Rπe vs pe (2Rμe): FCFV, 2-ring νe CC1π
nll2Rμe-nll2Rπe
pe (2Rμe)


nll2Rμe-nll2Rπe vs pe (2Rμe): FCFV, other
nll2Rμe-nll2Rπe
pe (2Rμe)

2Reπ vs 2Rπe


nll2Reπ-nll2Rπe: FCFV
2-ring νe CC1π
other
nll2Reπ-nll2Rπe


nll2Reπ-nll2Rπe vs pe (2Reπ): FCFV, 2-ring νe CC1π
nll2Reπ-nll2Rπe
pe (2Reπ)


nll2Reπ-nll2Rπe vs pe (2Reπ): FCFV, other
nll2Reπ-nll2Rπe
pe (2Reπ)

Where to go from here?

- Manually experiment with likelihood ratio cuts
  - see how easily efficiency can be improved
- Put likelihood ratios into BDT using TMVA
  - need to figure out way to reduce memory usage