

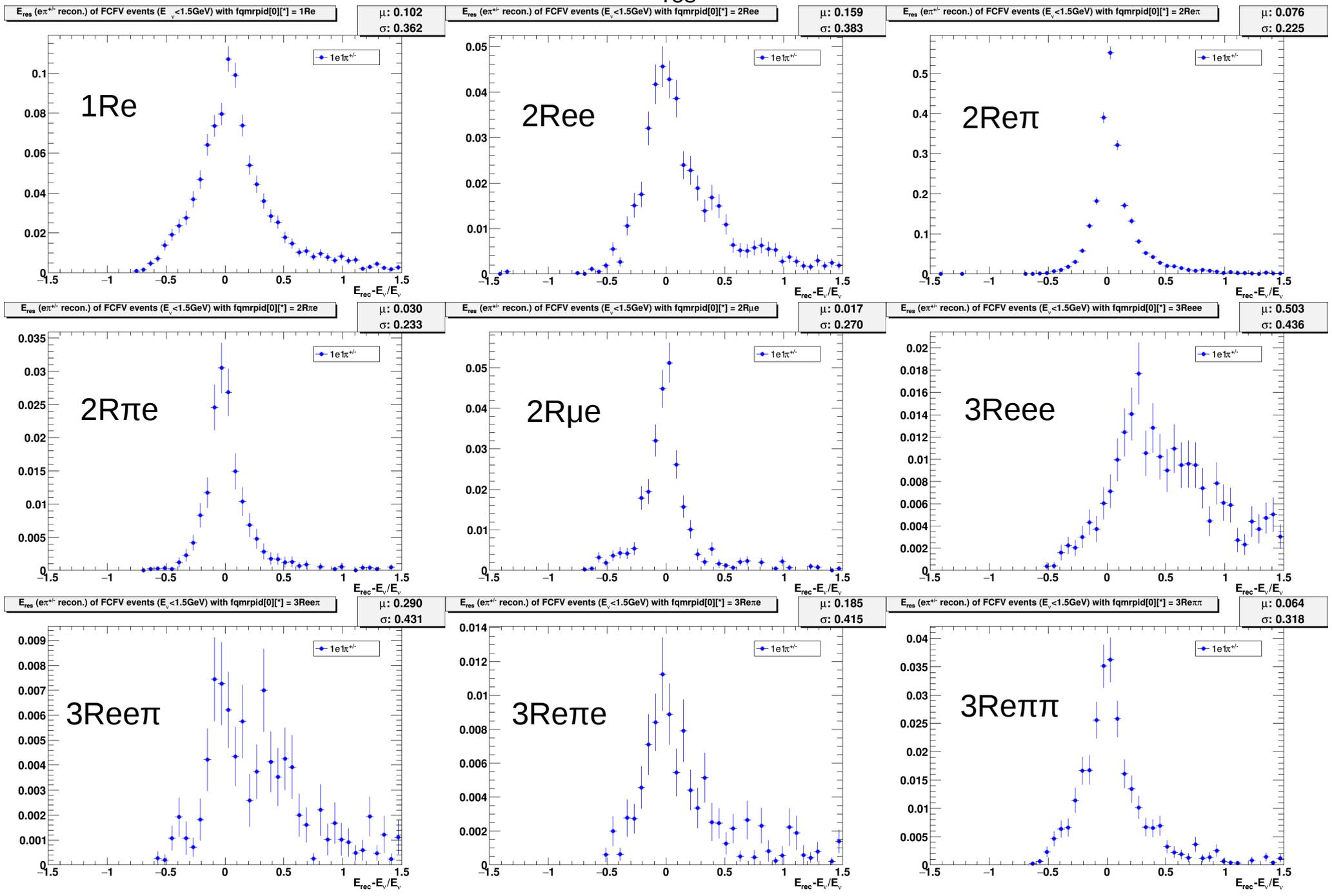
# Progress Update

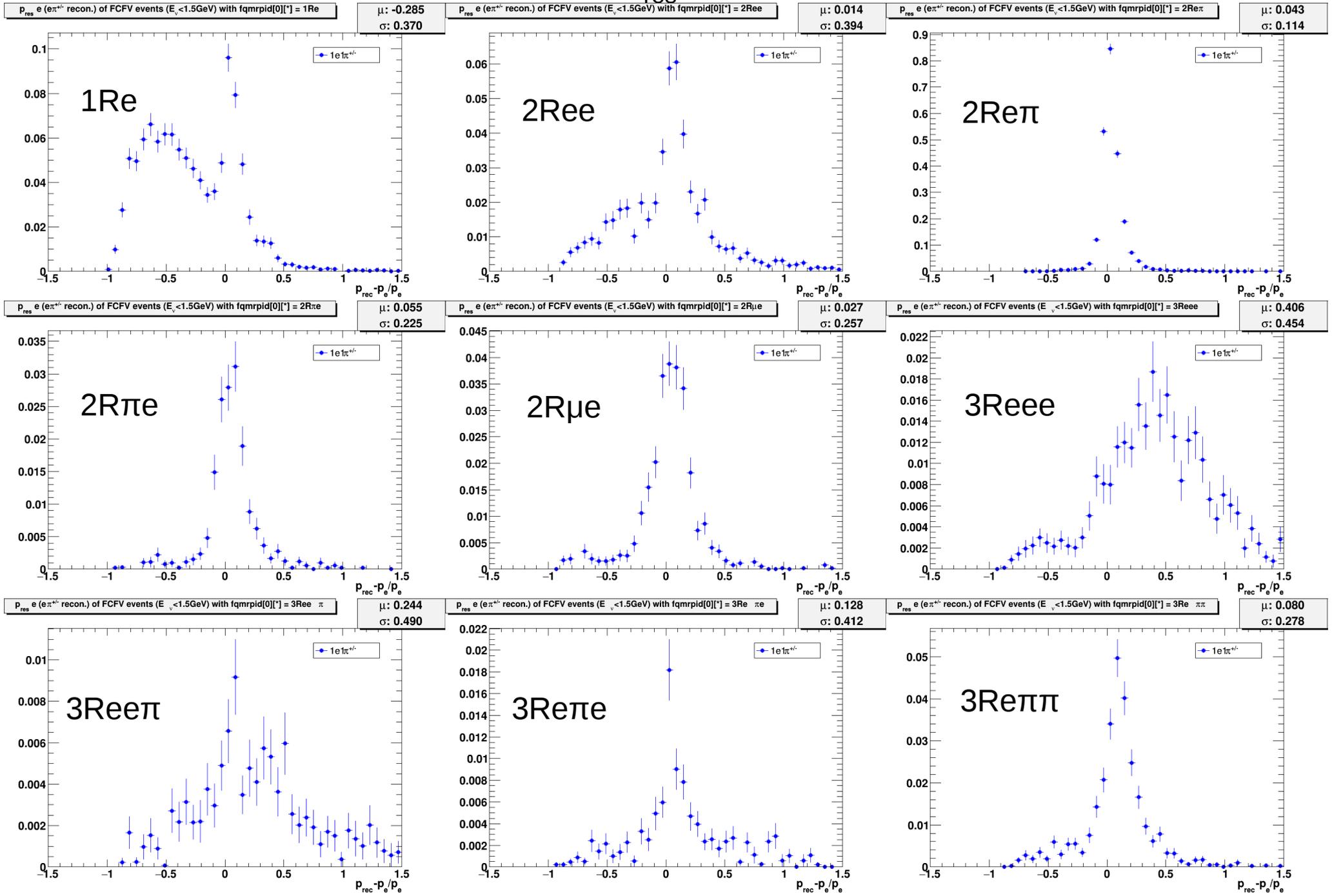
Trevor Towstego  
UofT Neutrino/DM Meeting  
July 25, 2018

# Evaluating 2Re $\pi$ -like Fits

- Look at  $E_{\text{res}}$ ,  $p_{\text{res}}$ , and  $vtx_{\text{res}}$  to evaluate performance of 2Re $\pi$ -like cuts for events where  $f_{\text{qmripid}}[0][*] \neq 1e1\pi^{+/-}$ 
  - “2Re $\pi$ -like” refers to either the  $e\pi$  or  $\pi e$  fit (whichever has a lower fitQun index)
    - The vast majority of the time it ends up being the  $e\pi$  fit

# E<sub>res</sub>

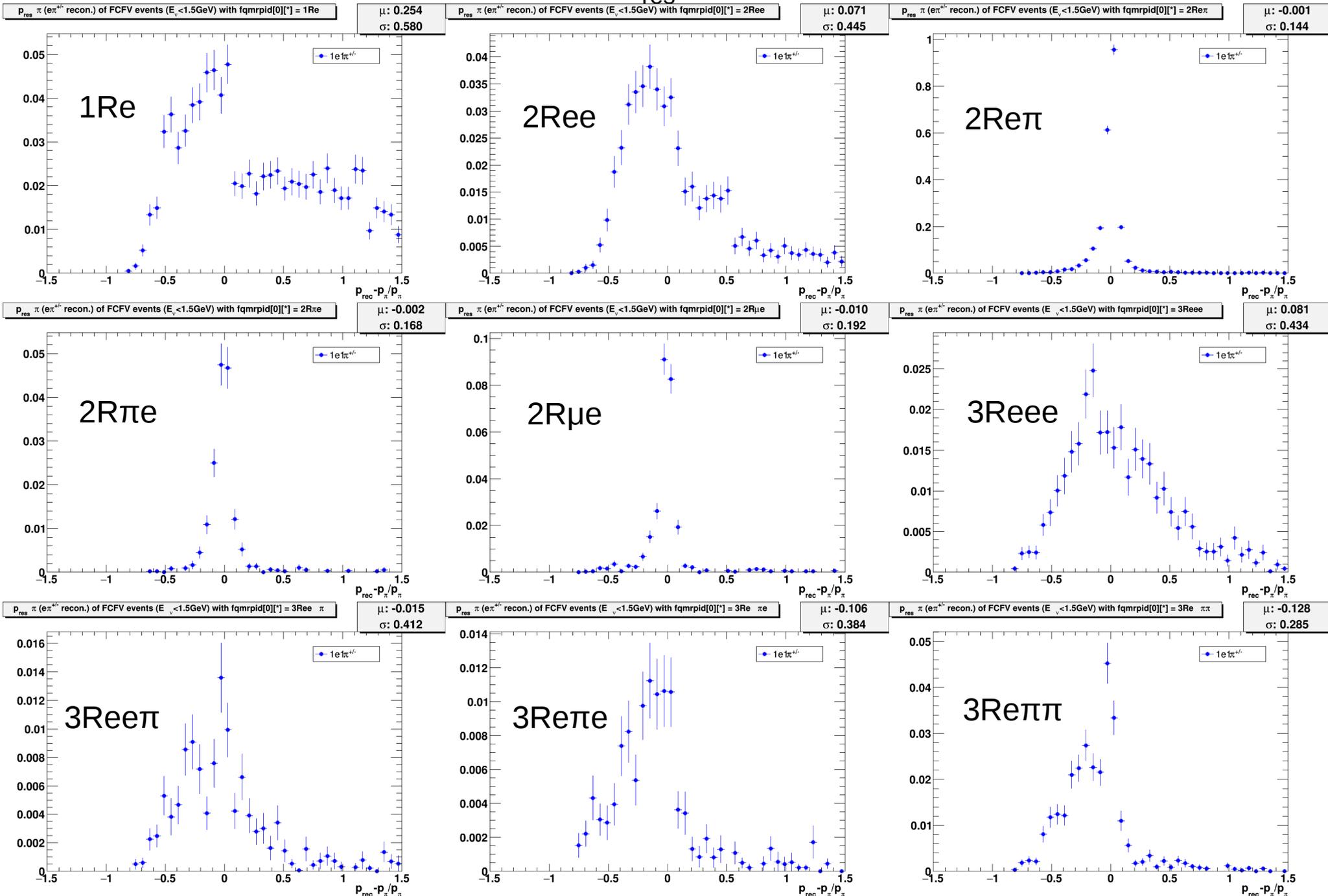


$\rho_{res} e$ 

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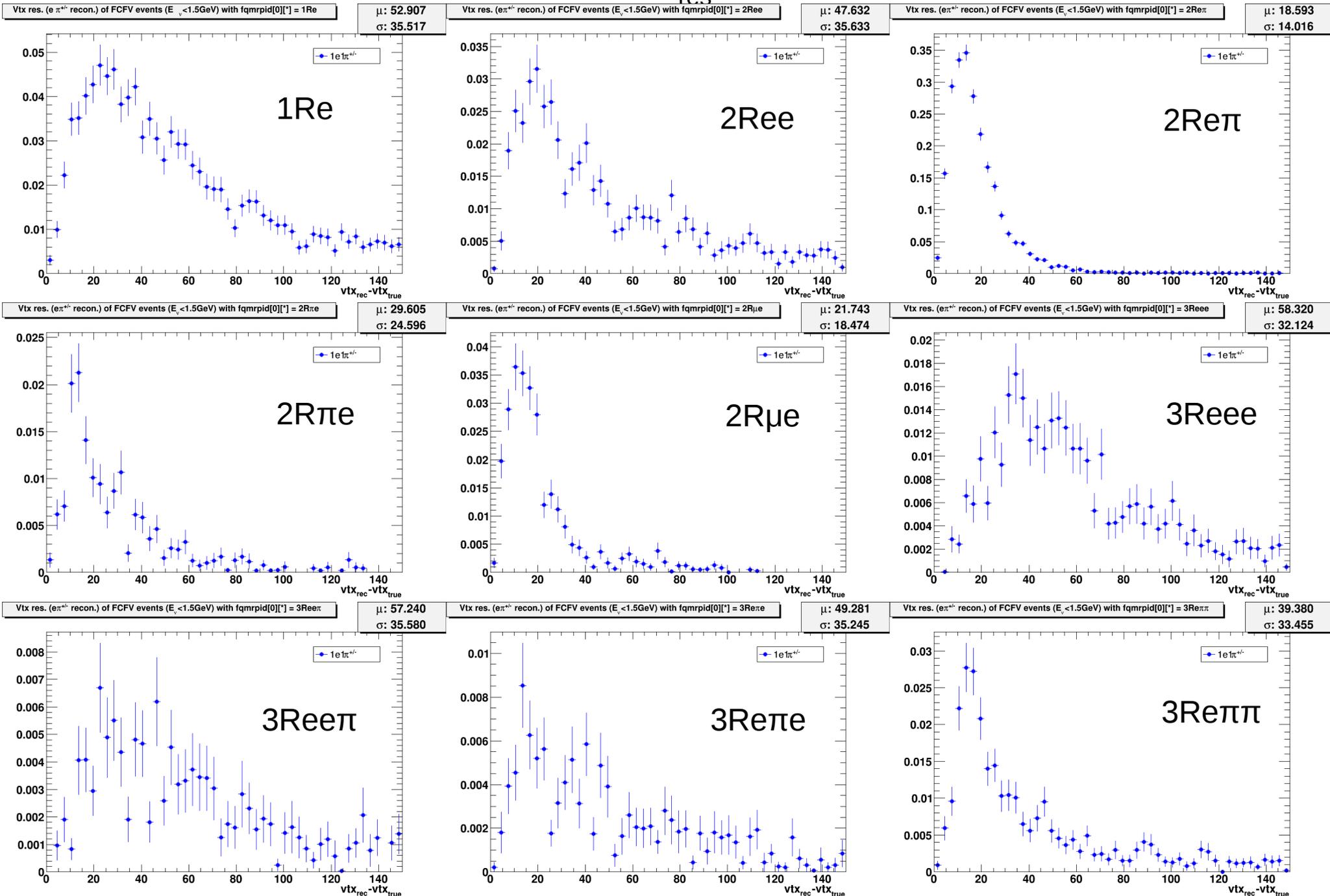
# $\rho_{res} \pi$



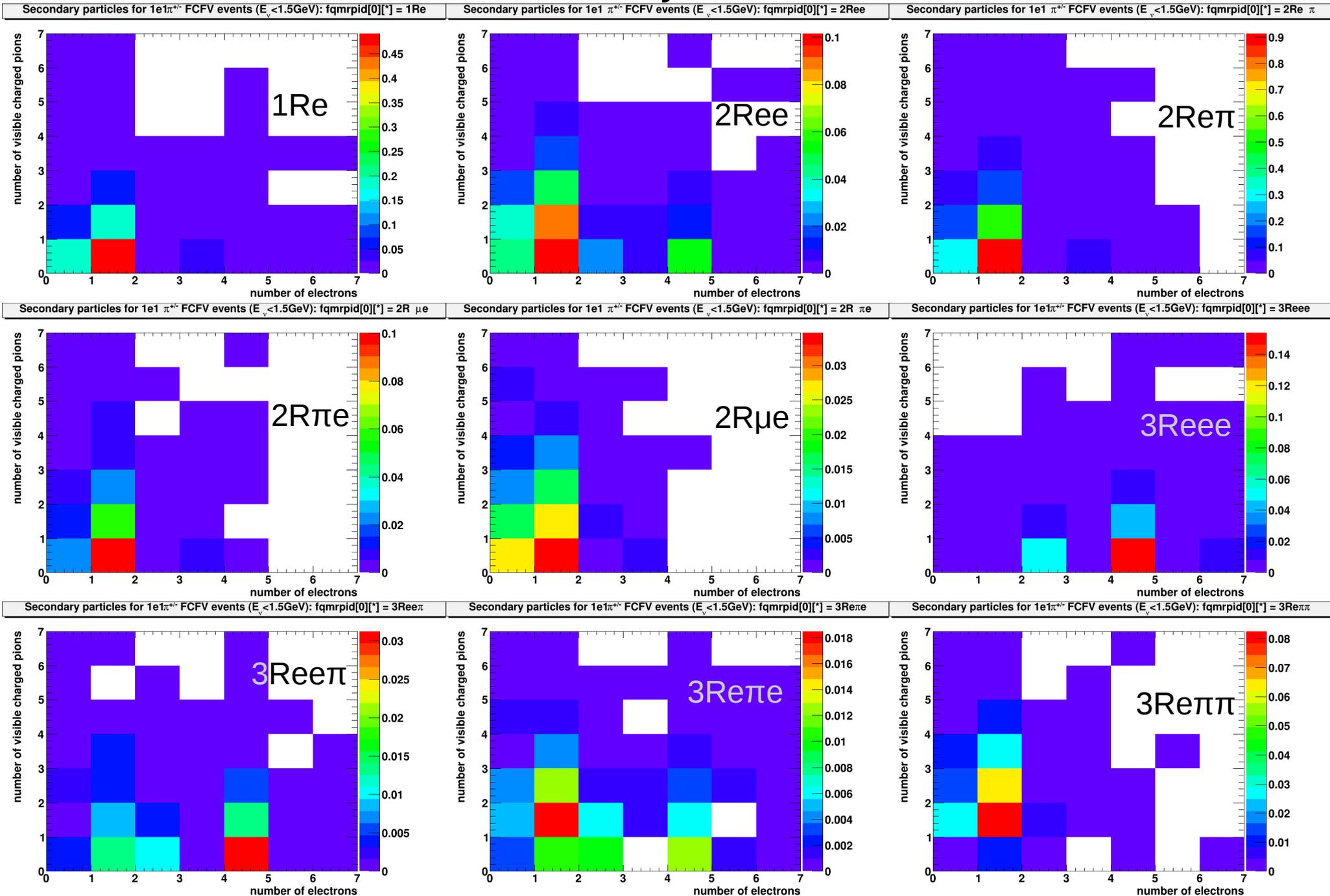
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# Secondary Particles



# Notes from T2K-SK Meeting

- Determine whether fitQun is fitting the electron to the correct ring
  - Use angle between  $e_{\text{rec}}$  vs.  $e_{\text{true}}$  and  $e_{\text{rec}}$  vs  $\pi_{\text{true}}$
- For `fqmrpid[0][*] = 3R***` events,  $E_{\text{rec}}$  might be better if using the two most energetic rings in the 3R reconstruction rather than the  $2Re\pi$  reconstruction
  - Or maybe most energetic e and most energetic  $\pi$ ?
    - Can get tricky when dealing with 3Reee fit

# BDT Notes

- Preliminary cuts:

- FCFV

- possible 2Repi

- 0 de:  $i2repi==0 \ || \ i2rpie==0 \ || \ i3repi==0$

- 1 de:  $( i1re==0 \ \&\& \ !s1re \ \&\& \ !s1re1de ) \ || \ i2ree==0 \ || \ i2repi==0 \ || \ i2rpie==0 \ || \ i2rmue==0 \ || \ i3repi==0$

- 1/2 sub-events

- separate samples

- $E_{rec}(1e,1\pi) < 1.5 \text{ GeV}$

		Signal	Bkgd	Purity	Eff	FOM
<b>2Reπ</b>	BDT 5*	0.51	0.33	61.2%	20.0%	0.561
<b>2Reπ1de</b>	BDT 5*	2.52	1.89	57.1%	50.0%	1.199

\* 3R nlls padded with zeros

BDT 5 variables: 1Rnll, 2Rnll, 3Rnll, kinematics (1R & 2R)

- Tried to further improve the efficiency by expanding the input sample by adding some more 3-ring-like events to the 0de sample and some 4-ring-like events to both samples
  - Used plots in backup as a guide
  - Have yet to surpass results (w.r.t. FOM) shown above
- Currently looking for loose cuts to purify input sample while maintaining large efficiency
  - Rather than just adding more “sub-samples”
- From T2K-SK meeting:
  - Talk to Cris about possibly re-running fitQun, forcing it to do more 3-ring (maybe 4-ring) reconstructions

# Current/Future Work

- Currently working on expanding input sample to TMVA
- Separate fit performance plots by number of decay electrons
- Also on the to-do list:
  - How to approach systematic uncertainties
  - Systematic method of removing BDT variables that don't significantly benefit selection performance

# Backup

