Progress Update

Trevor Towstego
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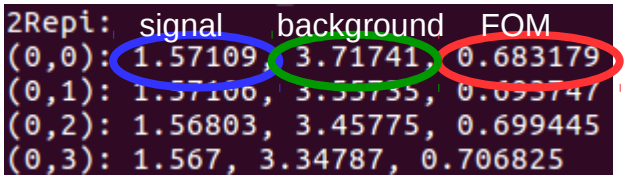
Comparing new cutflow to grid search

New cutflow result:

Sample	cut	numu/numub CC	intrinsic nue/nueb CC	osc nue/nueb CC	numu/numub NC	intrinsic nue/nueb NC	Signal	Bkgd	Purity	FOM
2Repi	baseline	1.48	2.00	1.76	3.17	0.21	1.76	6.87	0.20	0.601
	Erec < 1.5 GeV	0.28	0.82	1.57	2.45	0.16	1.57	3.72	0.30	0.683

Grid search result:



- Found typo in grid search script
  - grid search event numbers now match the new cutflow numbers
- Wrote simple code from scratch to check consistency with these two results

3rd Code – Consistency Check

New cutflow result:

Sample	cut	numu/numub CC	intrinsic nue/nueb CC	osc nue/nueb CC	numu/numub NC	intrinsic nue/nueb NC	Signal	Bkgd	Purity	FOM
2Repi	baseline	1.48	2.00	1.76	3.17	0.21	1.76	6.87	0.20	0.601
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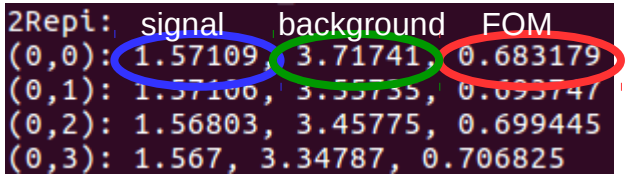
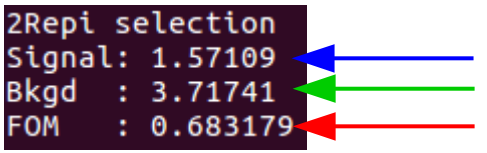
Grid search result:



Consistency check:

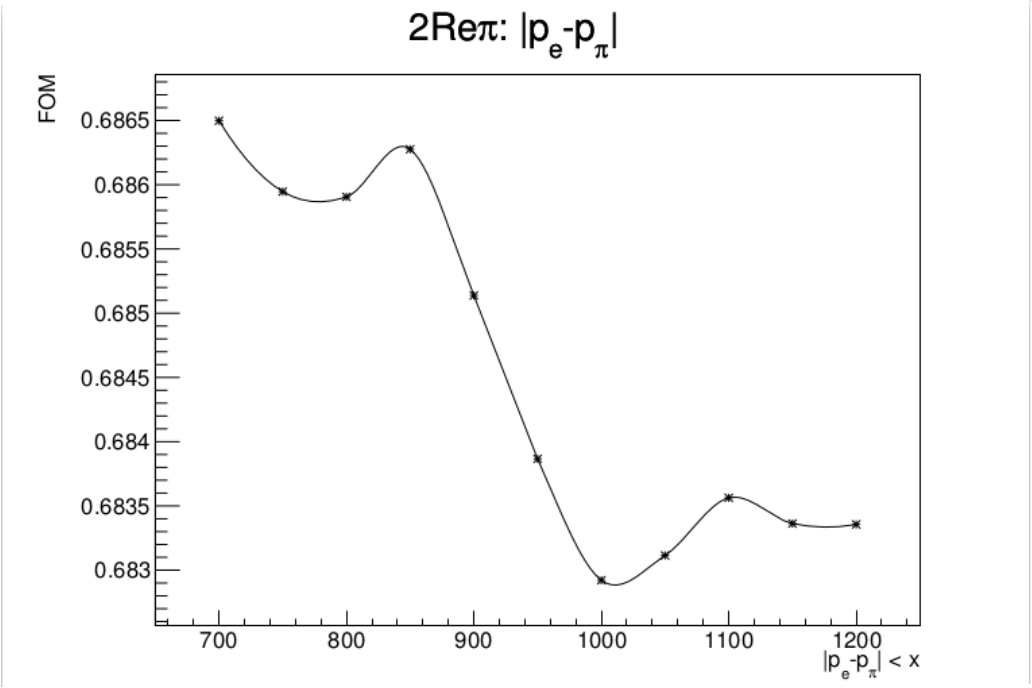


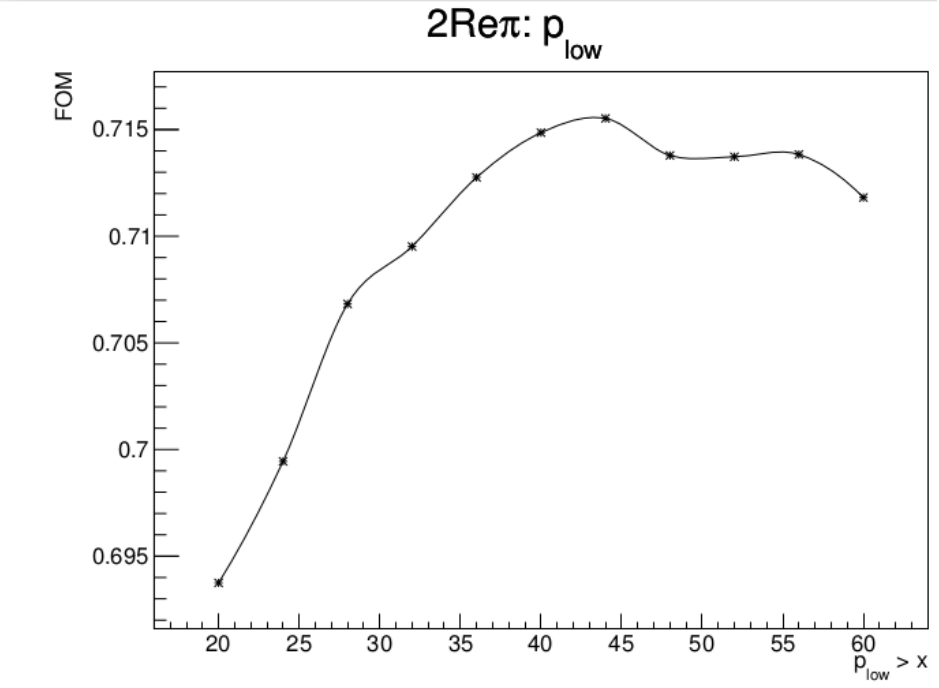
- Signal, background, and FOM are now consistent between three different codes
  - Safe to assume that these values are correct?

Some Grid Search Results

- 2 cuts (in addition to baseline cuts)
  - 1.5 GeV cut included in baseline
  - 2Reπ:
    - $|p_e - p_\pi|$
    - p_{low}
  - 2Reπ1de:
    - $|p_e - p_\pi|$
    - d2se

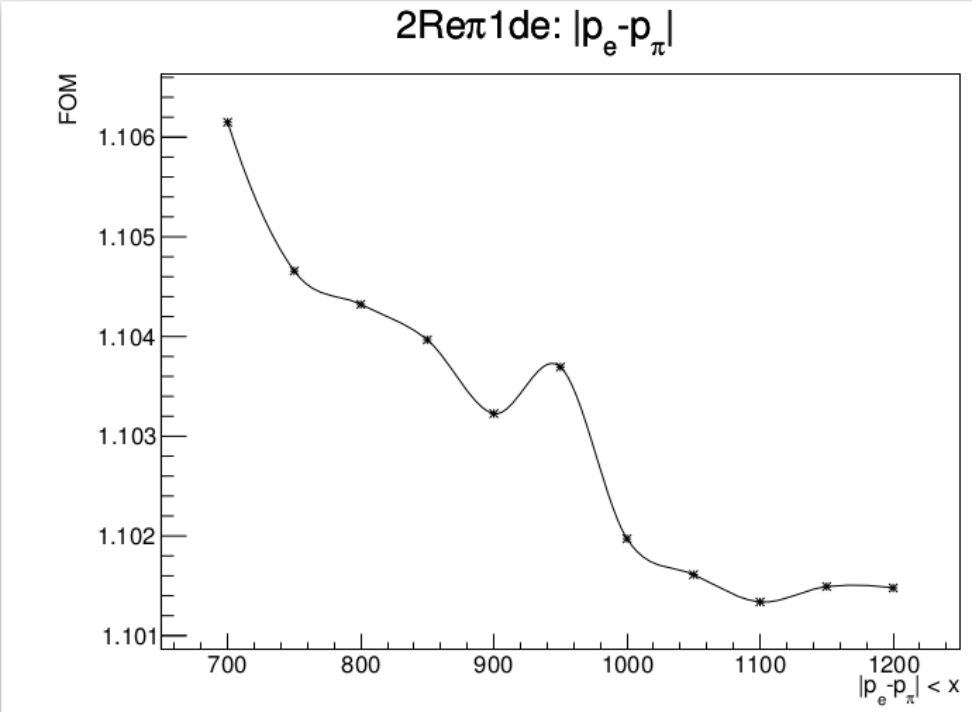
2Reπ

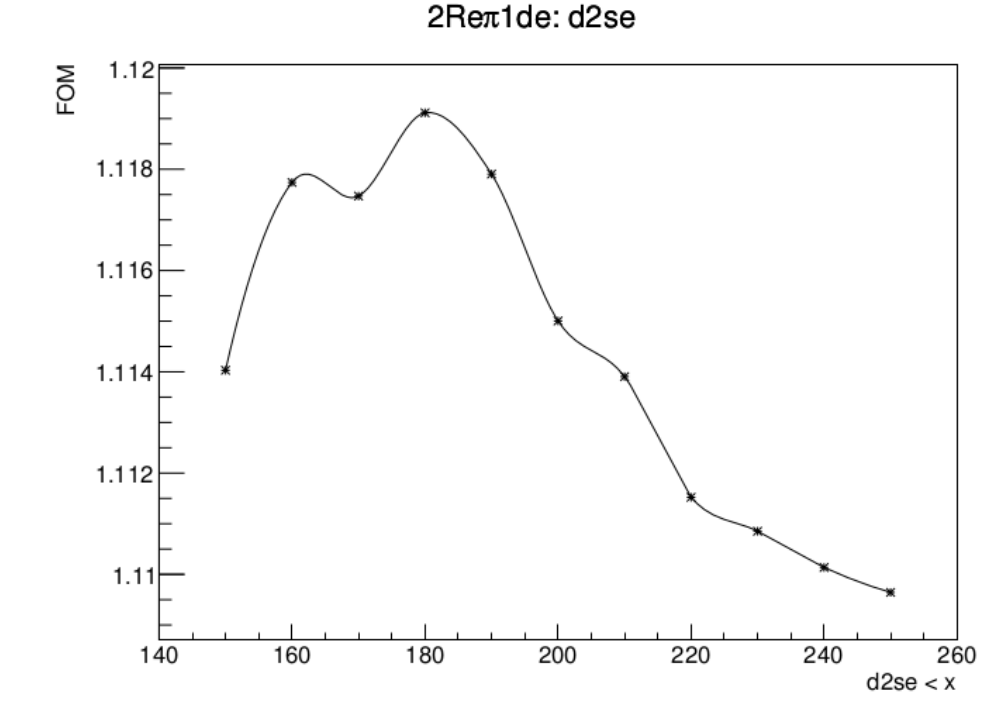




- Above plots show variation in FOM as cut parameters change (showing case where other cut is not performed)
- Maximum at (4,7): FOM=0.717554
  - $|p_e-p_\pi| < 850$ MeV, $p_{low} > 44$ MeV

2Reπ1de





- Above plots show variation in FOM as cut parameters change (showing case where other cut is not performed)
- Maximum at (1,4): FOM=1.12377
  - $|p_e-p_\pi| < 700$ MeV, d2se < 180 cm

Adding more cuts – some issues

- Started working on code for 6 cuts in 2Repi selection
  - $|p_e - p_\pi|$
    - (eventually would change this to have separate upper and lower bounds)
  - p_{low}
  - $m_{e\pi}$ lower boundary
  - $m_{e\pi}$ upper boundary
  - $nll_{2Re\pi} - nll_{2Ree}$ lower boundary
  - $nll_{2Re\pi} - nll_{2Ree}$ upper boundary

- **Issue 1**: can't make 6-dimensional arrays
  - Adapted code to use a 1-dimensional array instead, with size of n_{grid}^6
  - Ran into another issue...
- **Issue 2**: not enough memory for larger number of grid points
  - Anything greater than $n_{grid}=7$ required too much memory
  - Possible solutions:
    - Separate grid into a number of sections and run each one separately
      - Part of the reason that the code ran (reasonably) quickly is that it only had to go through each event once and performed all possible cuts on the event at the same time
      - This would slow the code down, but make the memory requirements more manageable
    - Put all grid points into a single histogram, rather than having separate histograms for all points
      - Might not even need to use histograms since we're only dealing with event rates – float array instead?