Progress Update

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Grid Search

- Grid search code is working

  - But is it working properly? See following slides...

- Currently testing code using 2 cuts for each selection (on top of baseline cuts + E_{rec} < 1.5 GeV)

  - 2Reπ: $|p_e - p_\pi|$, p_{low}

  - 2Reπ1de: $|p_e - p_\pi|$, d2se

- 11 points for each cut (i.e. grid is 11x11 for each selection), as well as points where each cut is not performed

  - Ends up becoming 12x12 grid for each cut, where (0,0) is the case where neither cut is performed

Initially, some strange results

- FOM seemed to be too high, and # of events in general was higher than I got from previous cutflow studies

Previous cutflow result:

Sample	cut	numu/nu mub CC	intrinsic nue/nue b CC	osc nue/nue b CC	numu/nu mub NC	intrinsic nue/nue b NC	Signal	Bkgd	Purity	FOM
2Repi	baseline	1.48	1.00	0.88	3.17	0.11	0.88	5.76	0.13	0.342
	Erec < 1.5 GeV	0.28	0.41	0.79	2.45	0.08	0.79	3.22	0.20	0.392

```
                signal    background    FOM
(0,0): 1.57109, 3.7884,  0.678639
(0,1): 1.57106, 3.78174, 0.67905
(0,2): 1.56803, 3.77416, 0.678415
(0,3): 1.567, 3.75104, 0.679504
```

Grid search result:

These should be the same!

Checked to look for inconsistencies

- Histograms in the two separate root files used for the cutflow and for the grid search seemed to show the same number of events

  - Why are the scripts, which take in the histograms and count the events, showing different results?

- Re-ran the cutflow script, making a single change to the way one histogram is counted

  - Previously used hist->Integral(), change to hist->GetBinContent(2)

  - Only made this change to **one histogram**: the one that counts oscillated nue/nueb CC events (i.e. "signal" events)

  - Results were unexpected...

Previous 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	1.00	0.88	3.17	0.11	0.88	5.76	0.13	0.342
	Erec < 1.5 GeV	0.28	0.41	0.79	2.45	0.08	0.79	3.22	0.20	0.392

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

- It appeared that ALL nue event rates are higher by a factor of 2 after the change (not just oscillated, but intrinsic as well)

- I changed the script back to how it was before, re-ran it, and got the **same result**

- Note that the root file that this script uses has not changed since December (to my knowledge) and is stored locally on my laptop

Comparing new cutflow to grid search

New cutflow result:

| Sample	cut	numu/nu mub CC	intrinsic nue/nue b CC	osc nue/nue b CC	numu/nu mub NC	intrinsic nue/nue b 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:

```
                  signal    background   FOM
(0,0)  1.57109, 3.7884, 0.678639
(0,1): 1.57106, 3.78174, 0.67905
(0,2): 1.56803, 3.77416, 0.678415
(0,3): 1.567, 3.75104, 0.679504
```

- Signal events seem to match, but background doesn't quite match

- Overall, this shows a much better selection than was previously indicated

  – but is it correct???

What I originally wanted to show today...
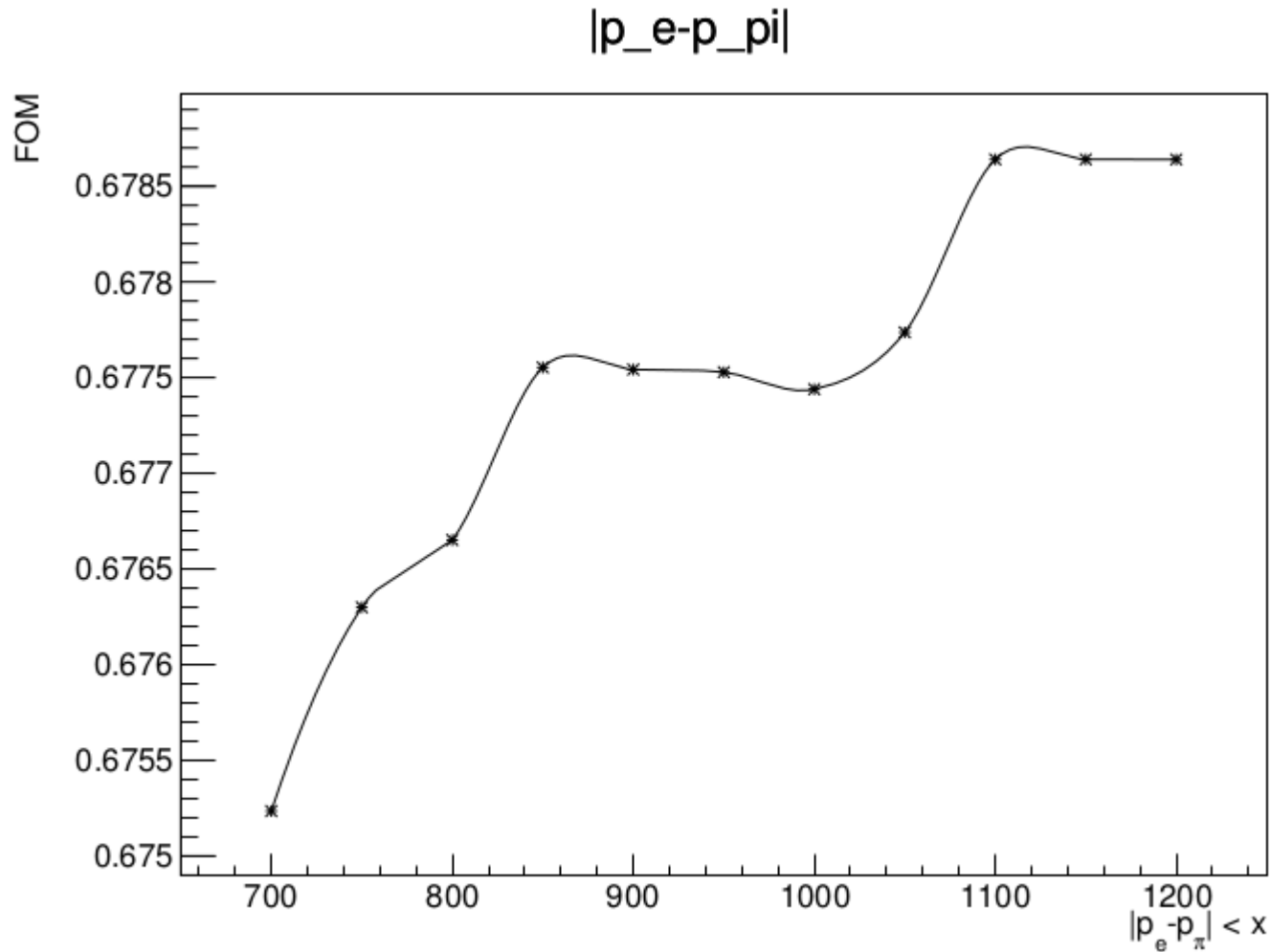
Thoughts

- Currently, my main suspicion is that something was wrong with the histograms I had been making for the cutflow

    - Perhaps I had half the bin width I intended to have, so the integral gave half the number of events

        - Unfortunately, if this is the case then I don't remember changing the bin width to the correct value

- I'm thinking the best way to resolve this is to make a third, simpler and straight-forward code and script to see if it is consistent with the new findings

    - Might be easier to identify problems if the code only has to deal with a single set of cuts, with no full cutflow (i.e. dealing with fewer loops and complications)