ALPtrino Update
FASERLiv August Meeting

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ALPtrino Recap

From last Liverpool FASER meeting :

- Fixed calo timing issue
- Difference between number of expected data events vs the number I was seeing
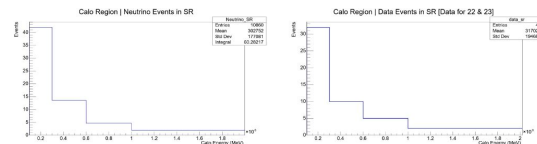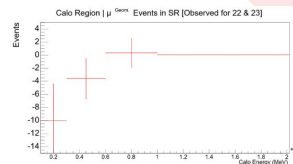- Waiting on 2024 neutral hadron sample

This time

- Data cutflow checks
- (Prelim) geometric muon estimate
- (Still) waiting on 2024 neutral hadron sample

Difference in number of events in data

- Noticed there was a difference in the number of events in data quoted in the alps paper vs that I see
    - This was the tip of the iceberg ....
- Checked each region and compared cutflows
- RDF code had different data cuts that Jacks ALPs code (and what was on the twiki)
- Needed to confirm what data cuts were used in ALPs analysis (and will be used in ALPtrino analysis)
- Will update these cuts on the alp twiki and add a note of these also to the current internal note - for future use!

Geometric Muon – Observed Events

- Looking at which events pass signal region cuts
    - Subtract mc neutrino events to correct for signal
- 0 events are observed in first 2 bins
    - Number of neutrino MC events in these bins is higher than number of observed data events
- Low in final bins

Calo Region | μ^{Geos} Events in SR [Observed for 22 & 23]

Calo Region | Neutrino Events in SR

Calo Region | Data Events in SR [Data for 22 & 23]

Calo Region

| Bin Number	ALPs Paper	My Work
1	45	27
2	15	10
3	10	10
4	4	2
5	0	0
Total	74	49

Difference in Data Cuts

- Notable differences
  - No Timing Saturation Cut
  - Calo E fit/raw compatibility check
    - Used to remove occurrences of some events where the fit_charge == 0, therefore "raw_charge/fit_charge" ratio would go to inf and so would Calo_total_raw_E_EM
  - Calo Timing > -5 ns ONLY
    - Too many events removed when Calo timing < 10 ns is also used
    - Also small mistake in Jacks timing code - very insignificant overall though
  - Raw Timing signal difference ?
  - PS nMIP > 0 Cut
  - Updated excluded times list
    - Jack's code was the one with the up to date list not the rdf code
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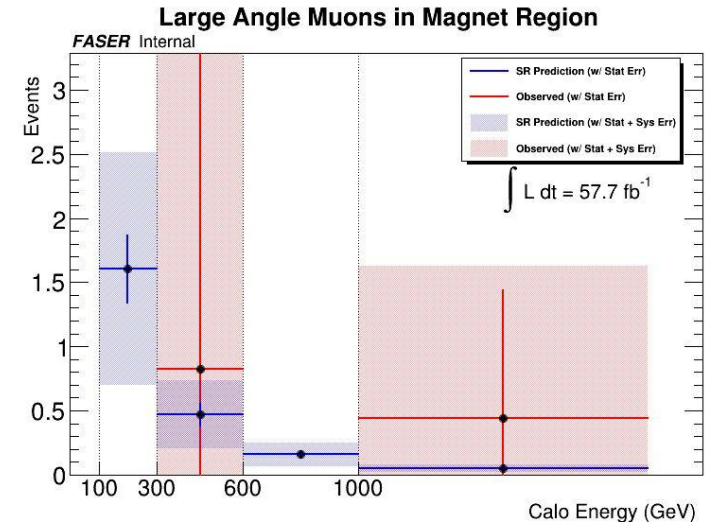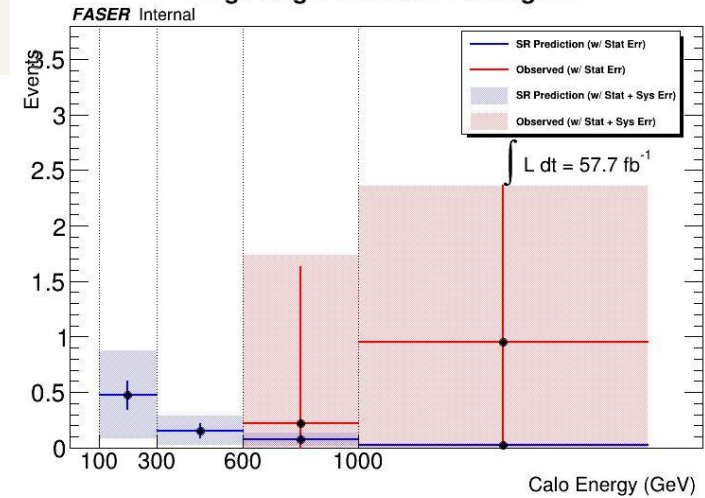| Cut | My Cutflow | | | Int Note | Difference |
---	Input	Pass	Cut Efficiency	Pass	
Excluded Times	1475574815	1467902034	99.4800141	1467902034	0
Colliding	1467902034	1467561631	99.97681024	1467561631	0
Calo trigger	1467561631	8747741	0.596073161	8747741	0
No Raw VetoNu Signal	8747741	149097	1.704405743		
No Raw Veto Signal	149097	87202	58.48675694	87202	0
Calo_E_fit_raw_compatible	87202	86603	99.31308915		
Calo_E_total_raw_compatible	86603	86599	99.99538122		
Calo_E_total_fit_compatible	86599	86599	100	86129	-470
Calo E > 20 GeV	86599	3647	4.211365027	3647	0
Calo Timing > - 5 ns	3647	2764	75.78831917	2915	151
Raw Timing Signal < 20 pC	2764	671	24.276411	495	-176
Preshower0 nMIP > 0 (Remove PS Ratio Division by Zero)	671	671	100		
PS ratio > 4.5	671	70	10.43219076	61	-9
PS 1 nMIP > 10	70	29	41.42857143	29	0
Calo E > 100 GeV	29	17	58.62068966		

Geometric Muon

- Nearly there with data cuts
- Ran over data using updated data cuts
- Also got updated correction factors for both veto nu and timing corrections
- Put this all together to get a prediction for geometric muons in the SR
- Observed and predicted agree to within uncertainty!!! Or prediction is an over prediction
-

ABCD for μ_{Geom} background : Calo Region

Large Angle Muons in Calo Region
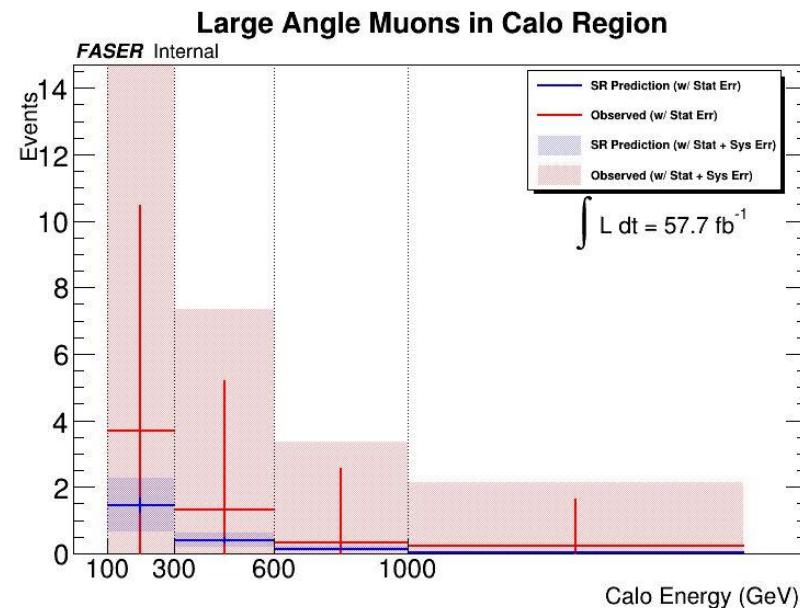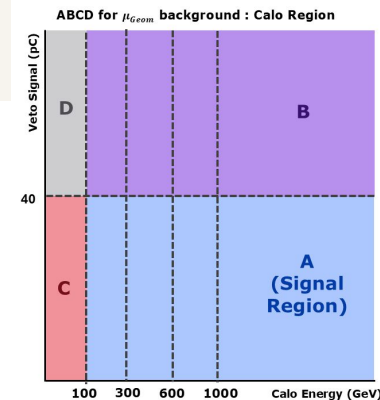
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Moving Forward

- Have an updated estimate for geom muons
    - Will share this at the alptrino meeting and will add these to Lottie's slides for the CM
- Soon will have 2024 data (and 2024 nh sample)
    - Will look at this independently of other years at first to see if there is a big difference in prediction of events in SR
    - Hopefully will be able to have nh background estimate by collaboration meeting
- Working on adding my contribution to internal note
- Presenting poster at NuFACT in september
- Back in Liverpool in September (apartment search permitting …)