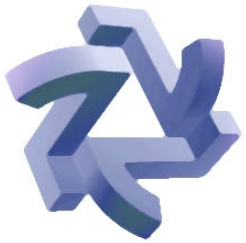


FarDNOP Update

Brian Rebel

April 2005

Data Set Used

- All data for the complete and magnetized far detector have been processed with either
  - R1.12 and Field map 201 - includes slot and chemistry corrections
  - R1.14 and Field map 202 - includes variable slot corrections
- Effectively have 2 data sets
  - Normal field running - July 2003 - mid-June 2004, February 2005 - April 2005 - 300 live days
  - Reverse field from mid-June 2004 - January 2005 - 150 live days
- Monte Carlo was generated with map 120, reconstructed with 201

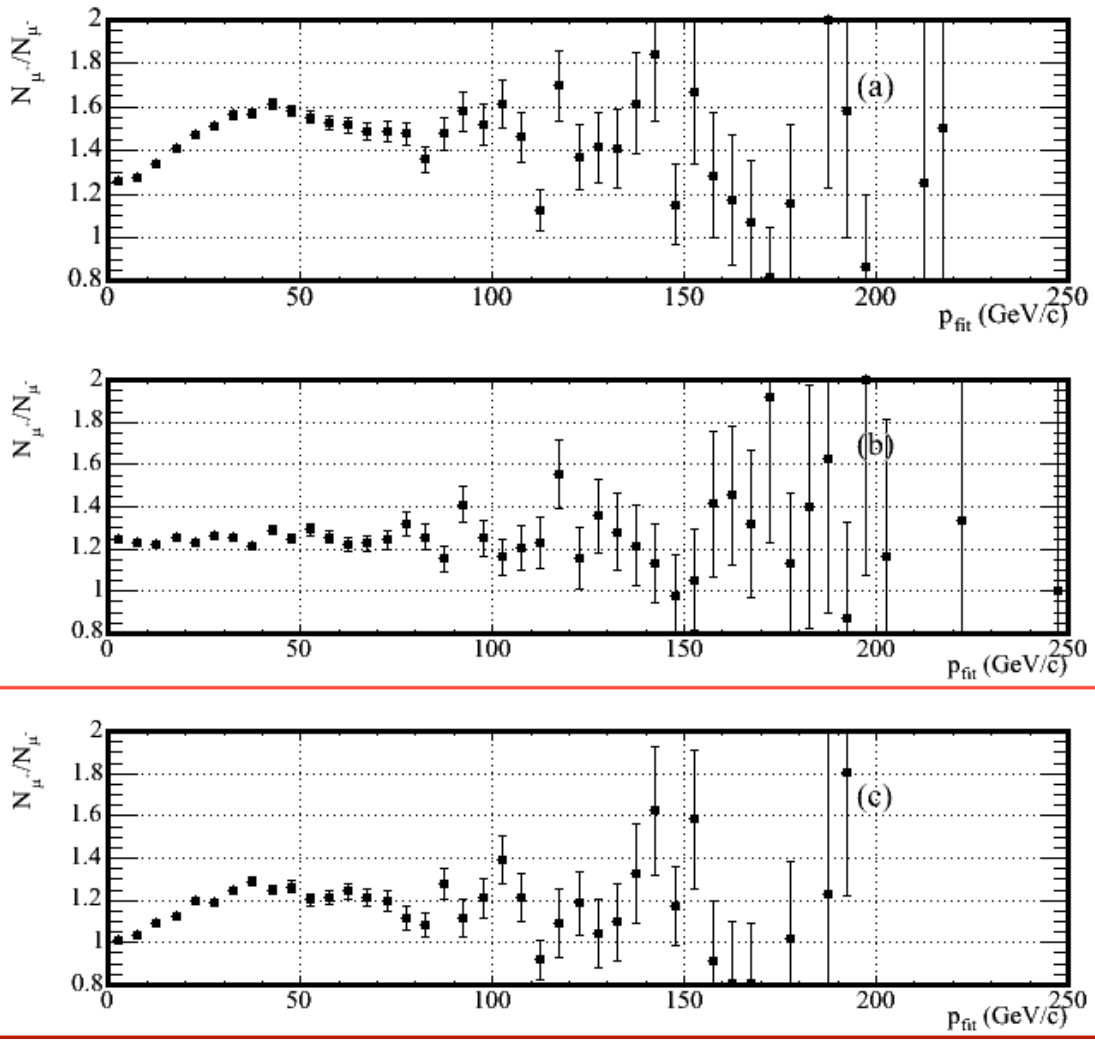
Event Selection

16×10^6 Events	Fraction Remaining	
cut	data	MC
none	1.0	1.0
>20 planes	0.759	0.763
> 2 m	0.755	0.758
passed fit	0.752	0.757
UV asymmetry	0.746	0.755
reduced χ^2	0.706	0.737
end points	0.704	0.736
fiducial dz,dr	0.688	0.720
track-like	0.687	0.720
double-end strip	0.687	0.720
consistent timing,direction	0.687	0.720

The Problem

- The problem shows up in several ways, the ratio as a function of fit momentum being the most physically obvious one
- A bump is present in the data ratio that is not in the MC
- Map 202 was used for these data
- Fit quality cut made at

$$(q/p)/\sigma_{q/p} \geq 2.5$$



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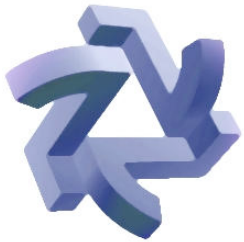
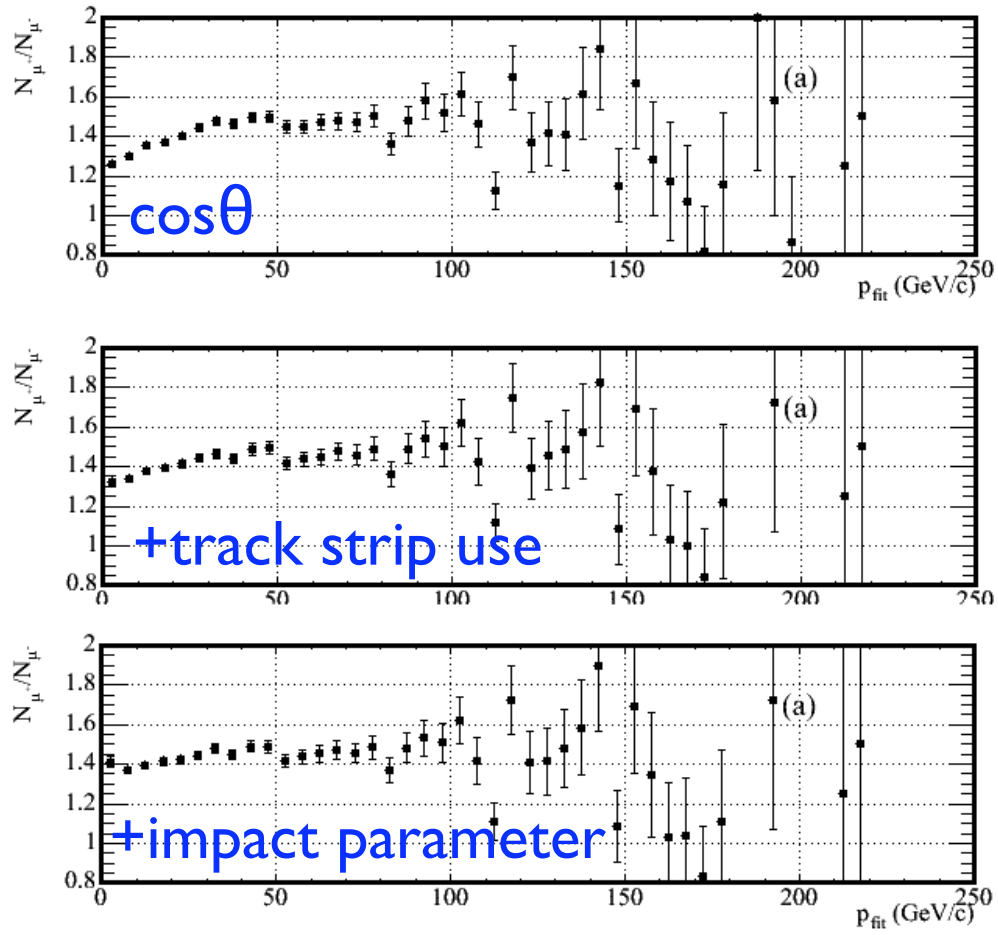


Attempts to Solve the Problem

- We have tried several things to solve the problem:
  - Alternative fitters: SA and Cambridge
  - Reconstructing with updated field maps: 120 →201→202
  - Reversing the field in the detector
  - More restrictive cuts: impact parameter, cosθ, track strip use fraction
- Making more restrictive cuts helps, but at the cost of throwing out events that are important to the neutrino-induced muon analysis
- None of the above really solve the problem, but they have given us some insight into what is going on

What We Have Learned - I

- The cosθ cut flattens out the bump
- Strip use fraction and impact parameter cuts affect low momentum fits
- Taken together, the cosθ and impact parameter cuts suggest that our knowledge of the outer field is poor
- This result also indicates that the fitter is incorrectly determining momentum as the bump goes away



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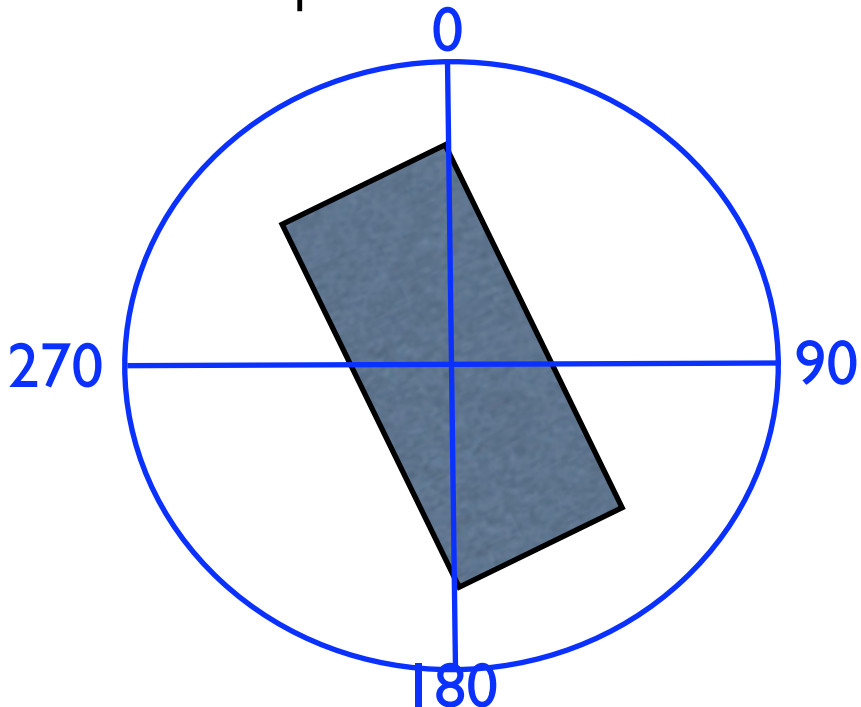
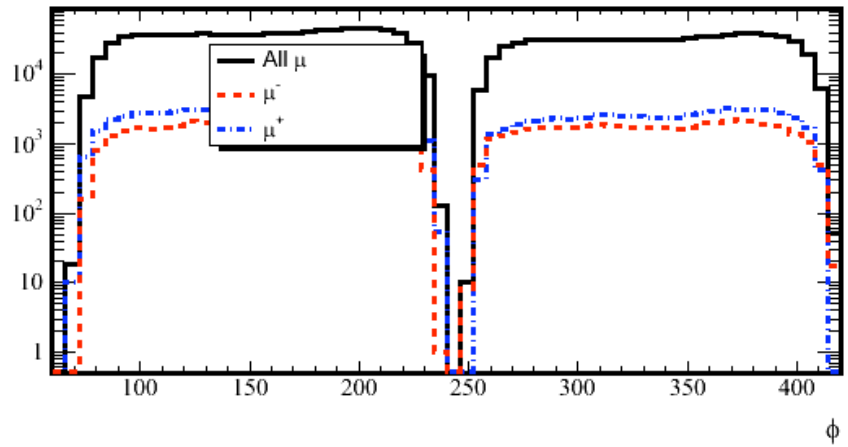
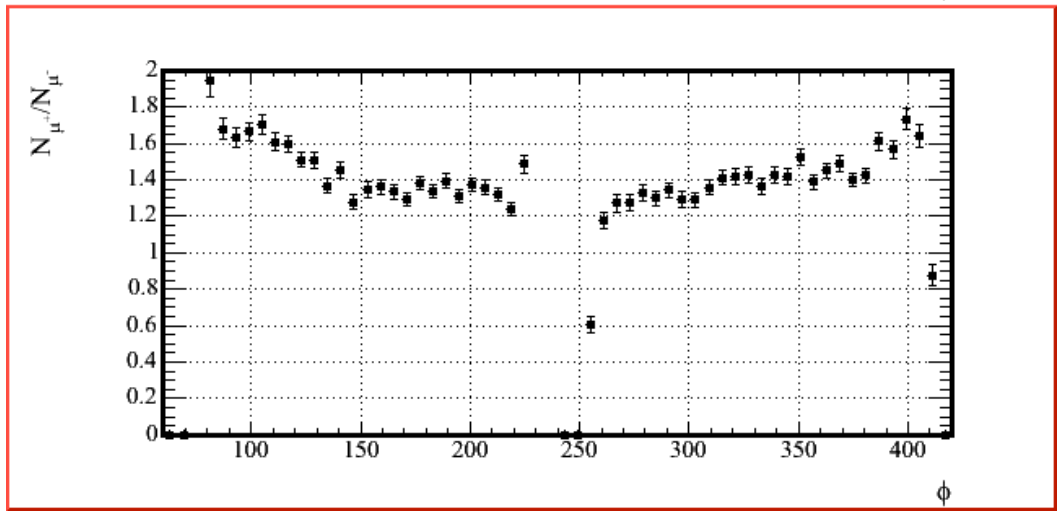
What We Have Learned - II

- Shown are the data after all cuts including cosθ, track strip use and impact parameter cuts
- The azimuthal ratio is consistent with the claim that the outer part of the field is a problem
- The bumps come from directions where the muons must travel through more of the outer part of the detector







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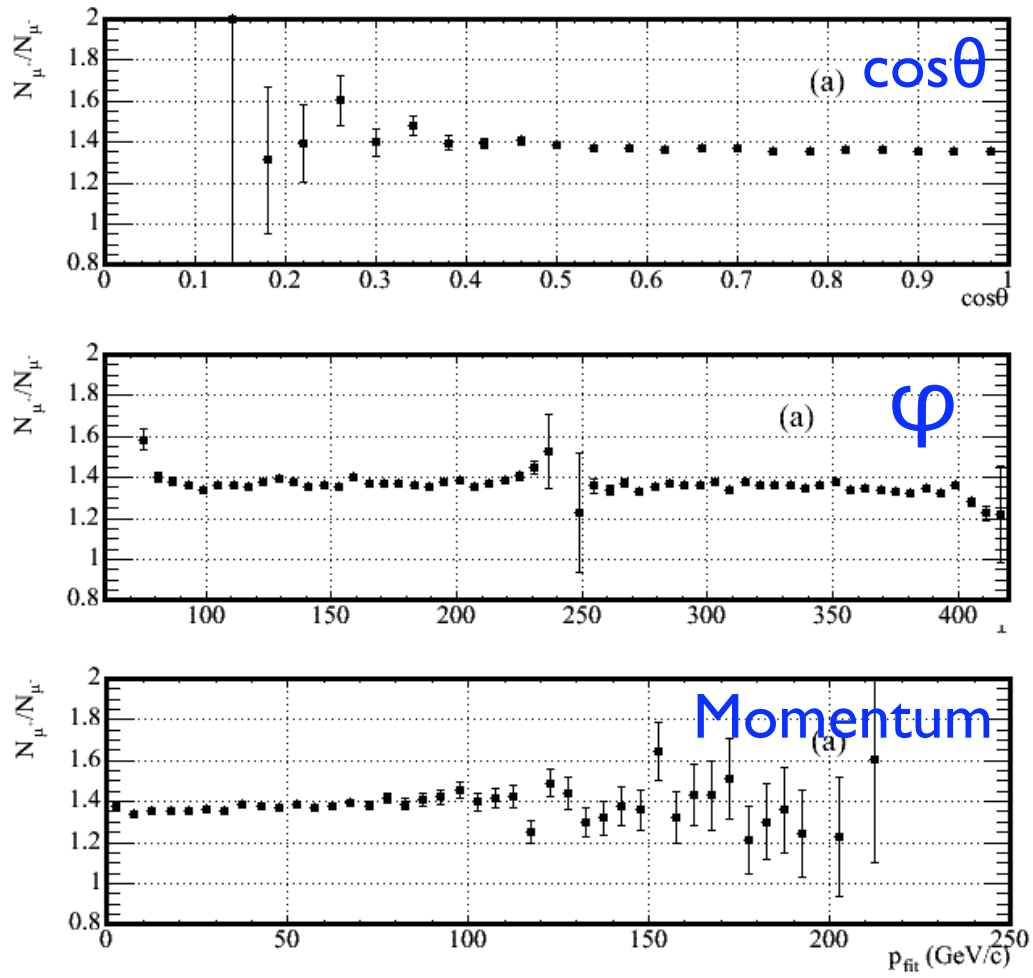
What We Have Learned - III

- Shown are the data after all cuts including cosθ, track strip use and impact parameter cuts
- Forward and reverse field data combined and weighted by live time
- The distributions become very flat, but still some structure in the fit momentum ratio
- There is a caveat....



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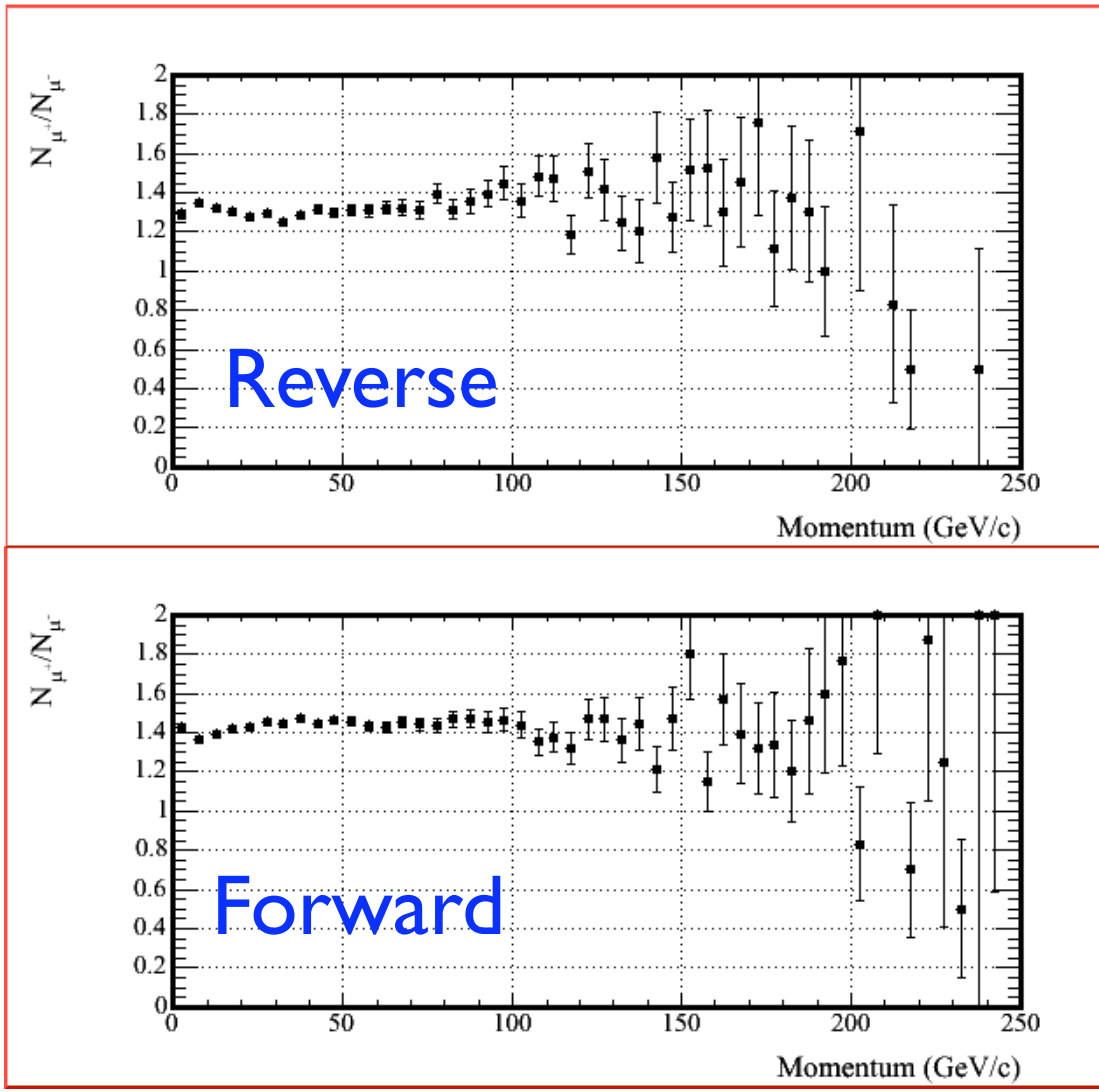
What We Have Learned - IV

- Shown are the data after all cuts including cosθ, track strip use and impact parameter cuts
- The forward and reverse data do not flatten out to the same level when all cuts are made
- This fact implies that there is a bias in charge identification as well



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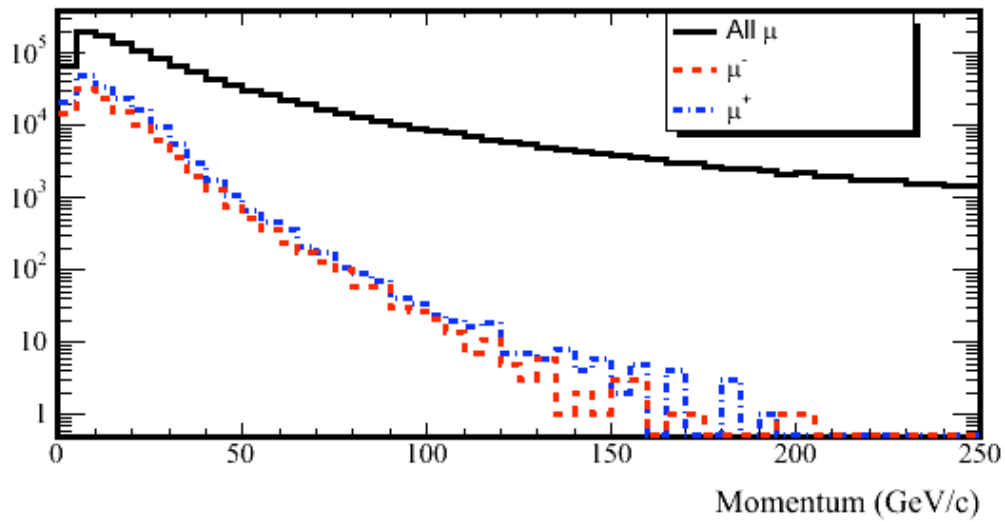
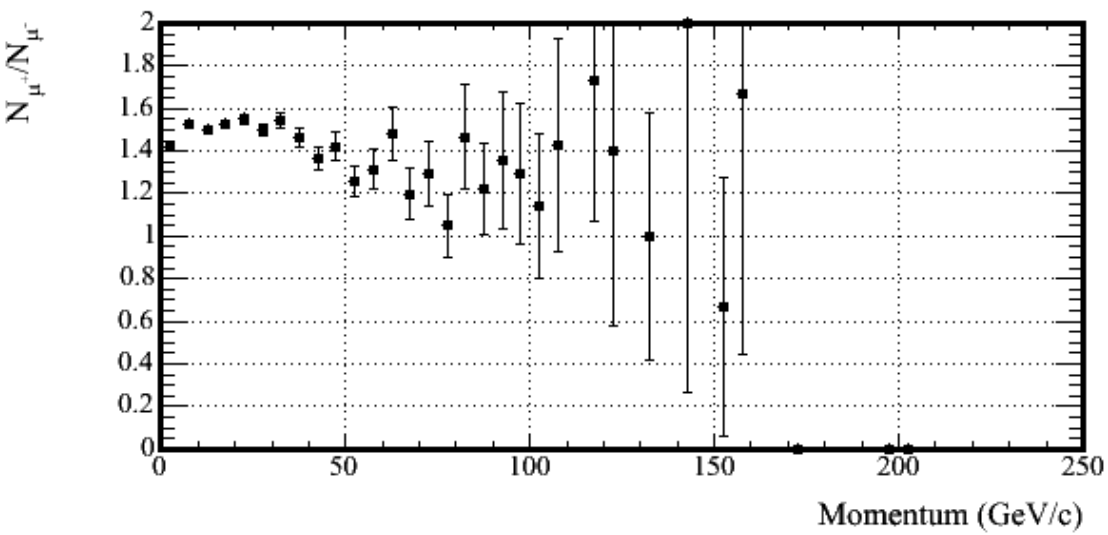
The Conjecture

- Hits near the vertex can have a big effect on how well the charge and momentum are determined
- Seen this before with the "hook" events
- Poor understanding of the outer part of the field means that the hits near the vertex are not where the fitter expects them to be
- If we don't use the hits outside of a radius of say 3m, we should see some improvements
- Altered CandFitTrackSR to only take clusters inside the defined radius - relies on the track finding to get the track mostly right
- Used runs from September 2003-April 2004 reconstructed with ~R1.15 and field map 202 to test the theory

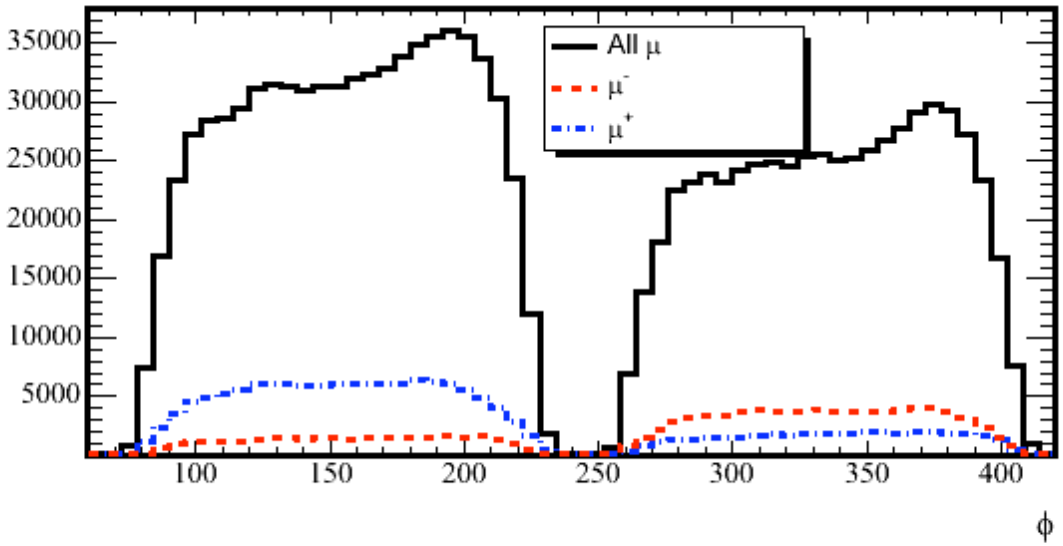
Initial Results for Excluding Hits in Outer Regions

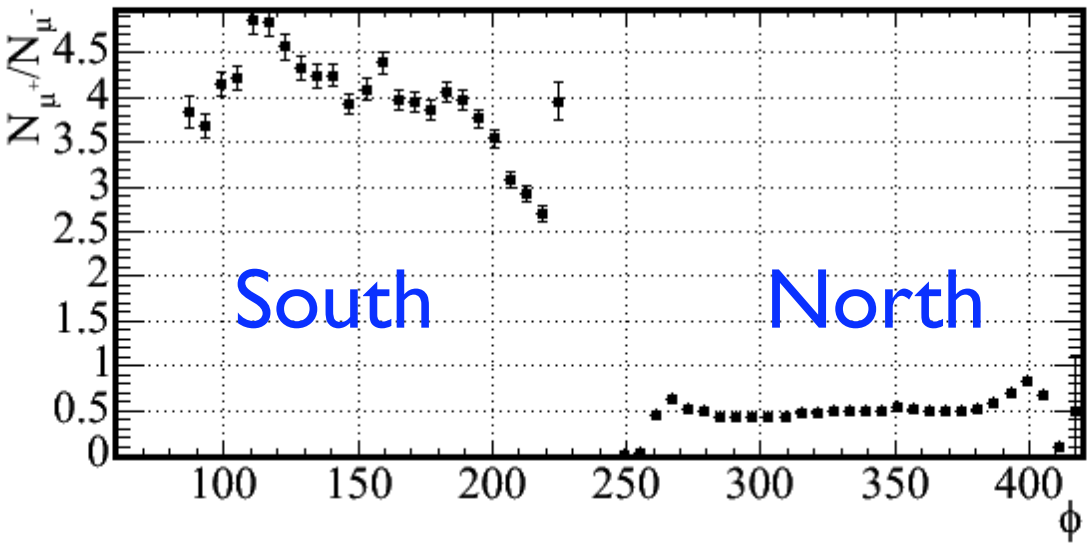




- Aside from initial point being low, relatively flat ratio up to 40 GeV/c
- Above 40 GeV/c the ratio falls towards 1, ie a coin flip for each event
- The flat part of the ratio levels off at 1.5 - a higher value than expected
- Need to look at events in first bin to look for pathologies in the reconstruction

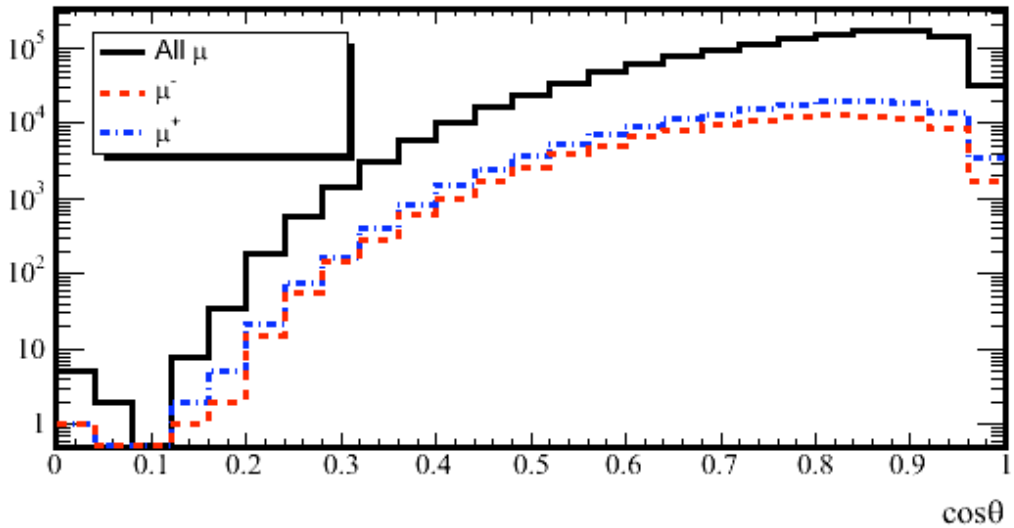
Initial Results for Excluding Hits in Outer Regions

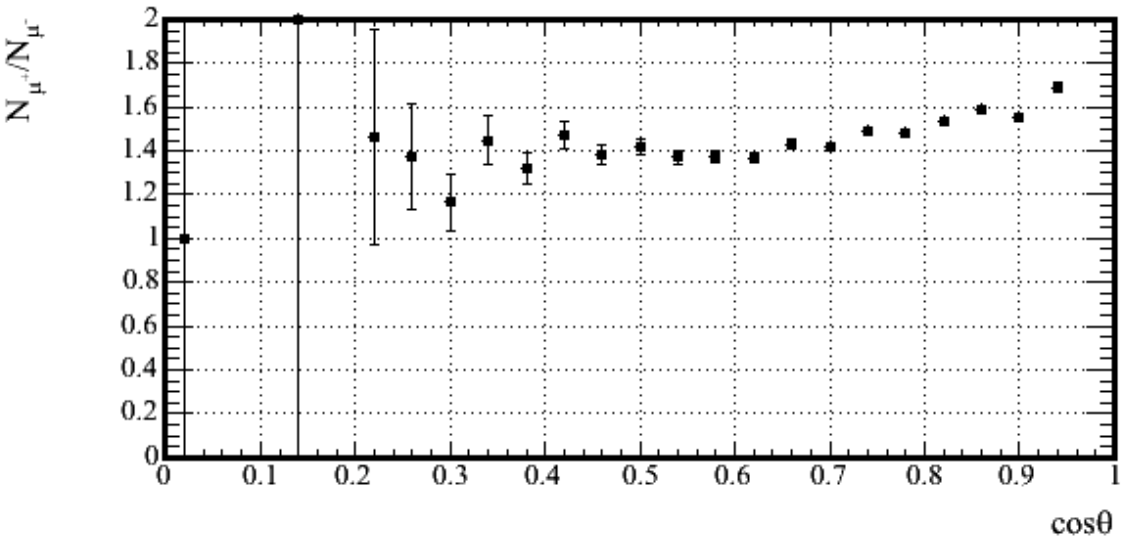




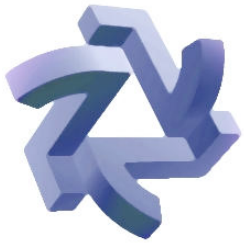
- Events from the south show a huge ratio and lots of structure
- Events from the north have a pretty flat ratio, except at the edges of the region
- Clearly there are events being reconstructed with the incorrect charge sign

Initial Results for Excluding Hits in Outer Regions





- Charge ratio climbs towards the zenith
- It looks like more thought needs to go into selecting clusters to use in the tracks



Conclusions

- We still think that the magnetic field plays a role in the Mufson Effect
- The problems we have seen to date seem to suggest that poor knowledge of the field in the outer regions of the detector contributes to the effect
- However, the first attempt to exclude hits in those regions seems to have a negative affect, suggesting that the problem lies elsewhere