

CCInclusive cross-sections in an mode

11-Dec-2012, Eric Church, Yale

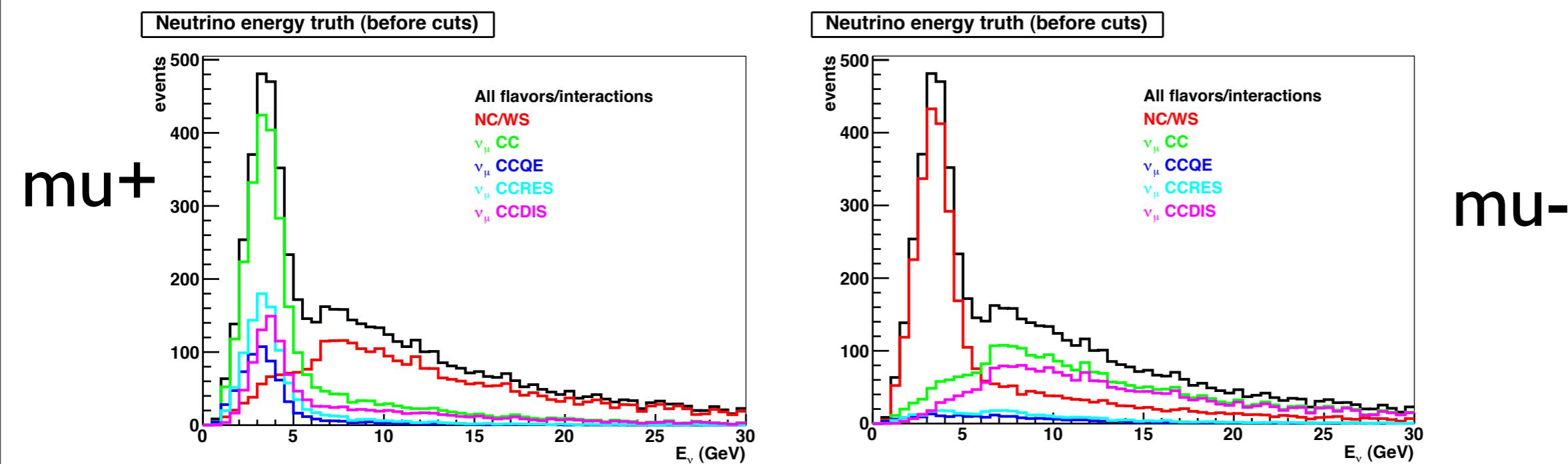
The measurement

- We measure the CC Inclusive cross-section in the NuMI beam, with 1.25E20 POT in anu mode.
- Follow-on to PRL 108, 161802 (2012), CC Inclusive cross-section with 0.85E19 POT in nu mode.
- we use anu MC from GENIE v3470

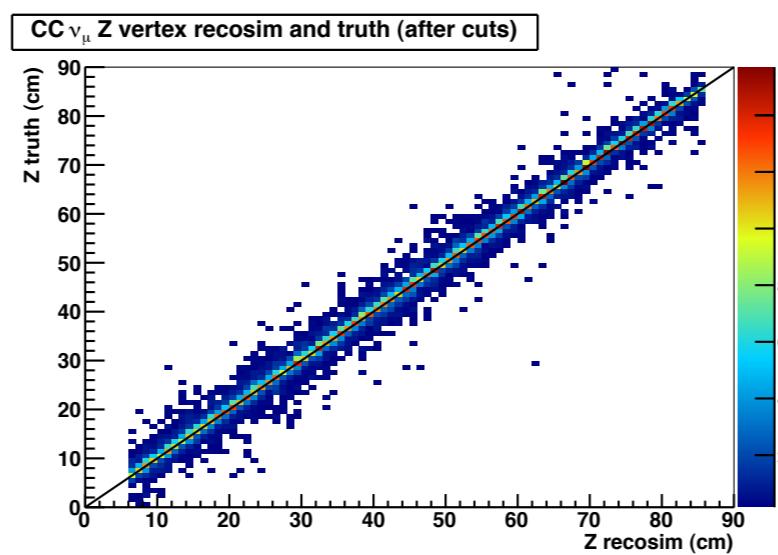
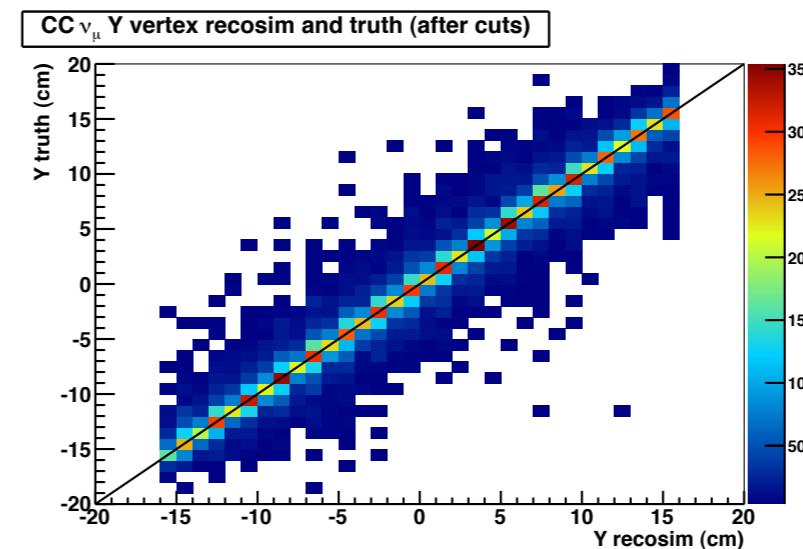
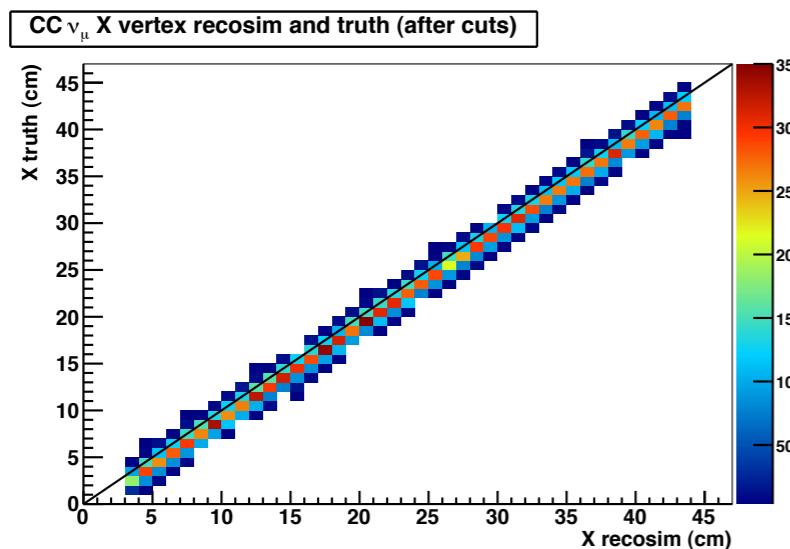
Beam Content

- The anu mode with its horn current reversed to that in nu mode has abundant neutrinos as well as anti-neutrinos. We produce a result for each.
- The neutrinos in this mode are dominantly high-energy, as high-energy π^- 's escape the focusing efforts of the rhc horn.
- Nomenclature: “WS” neutrinos here doesn’t refer, as is customary, to opposite-to-intended neutrino content, but to opposite-to-intended sign selection in anu mode.

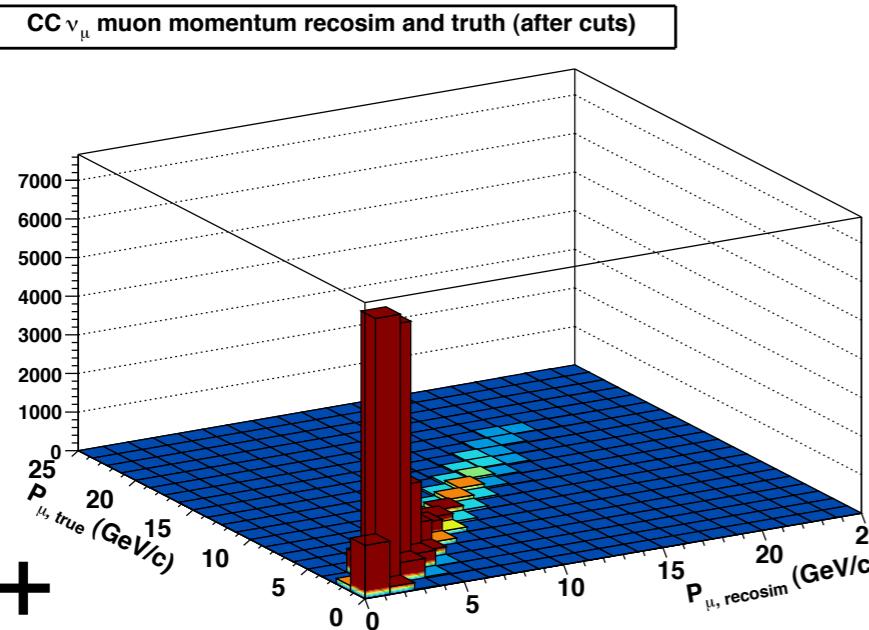
True E_ν composition of anu beam



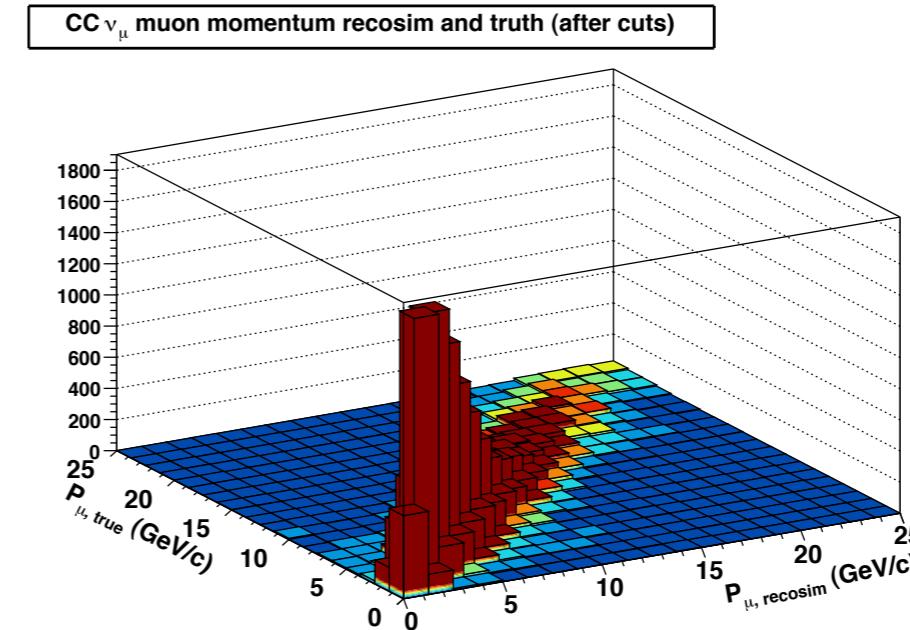
x,y,z Vertex Resolutions



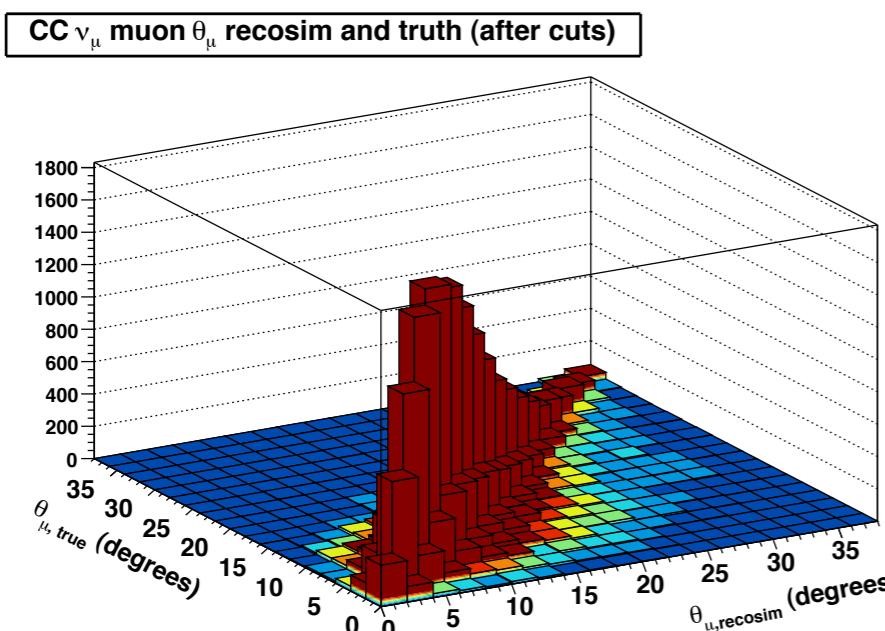
θ, p resolutions



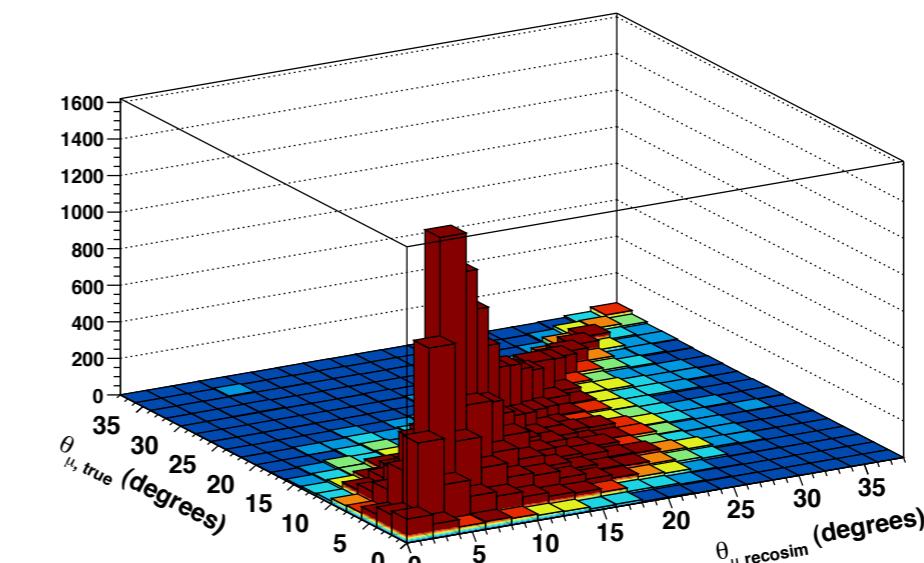
mu+



mu-



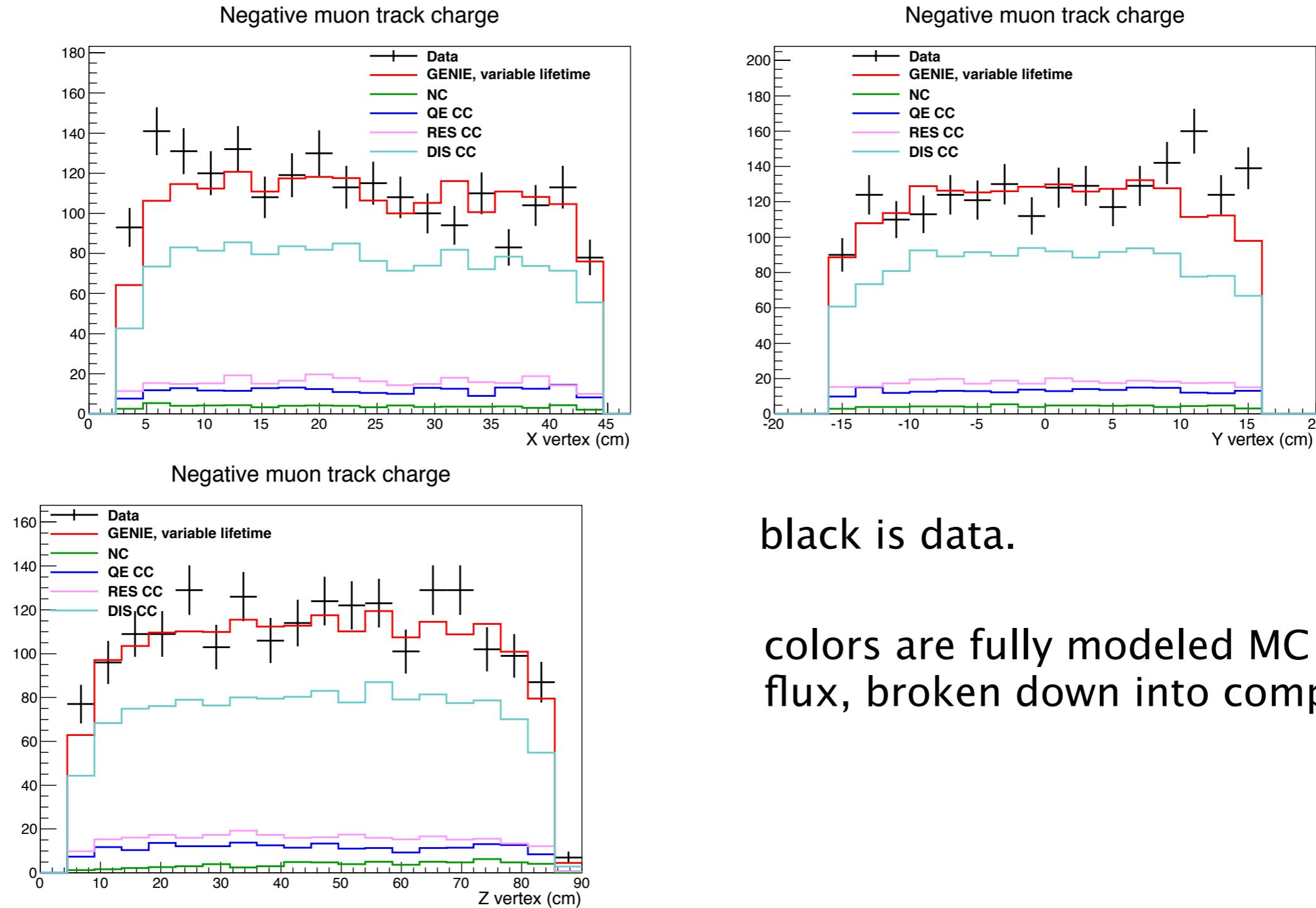
CC ν_μ muon θ_μ recosim and truth (after cuts)



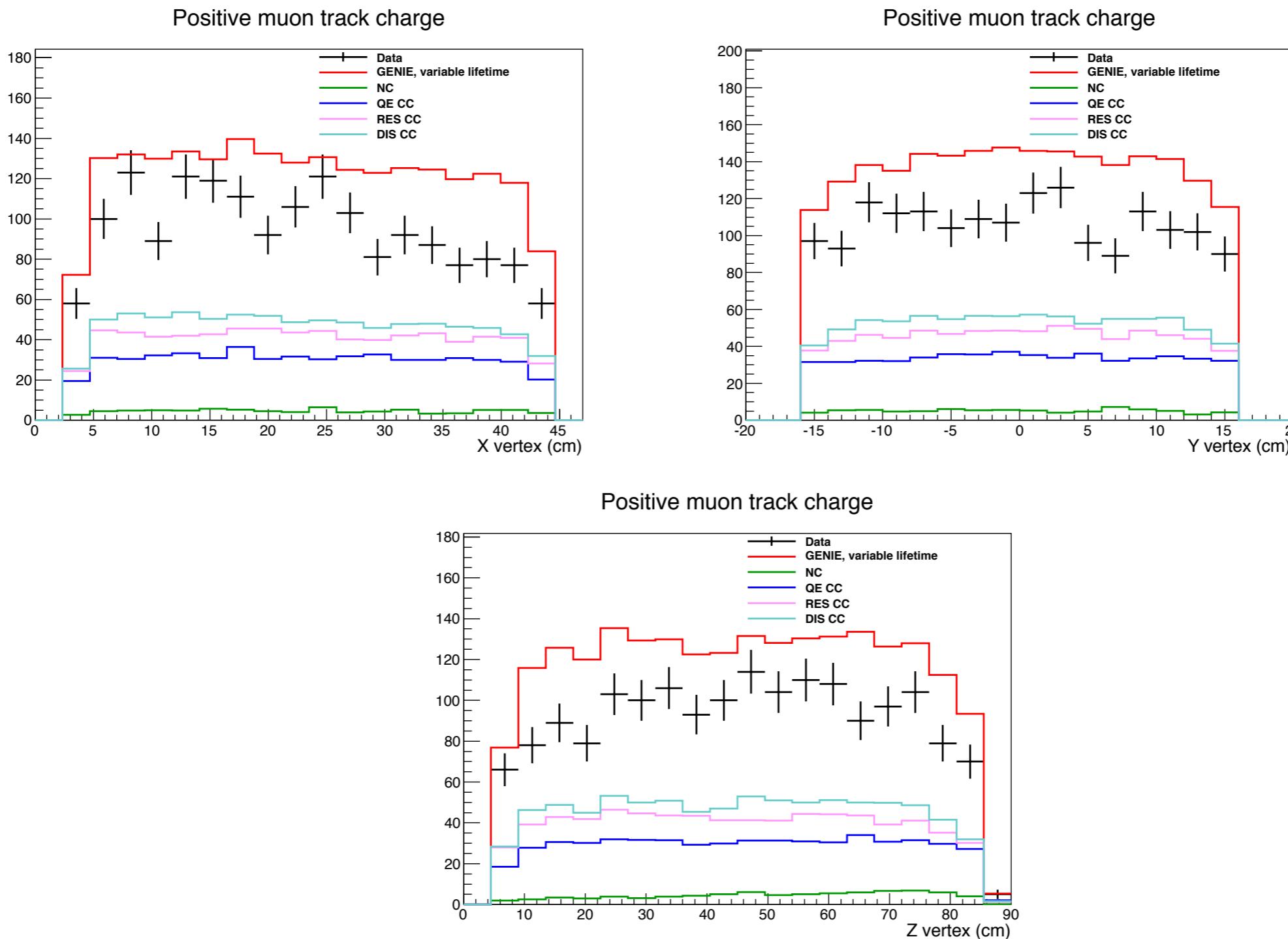
Backgrounds

- NC/WS (MC)
- TGMuon in MINOS matched to nu evt track

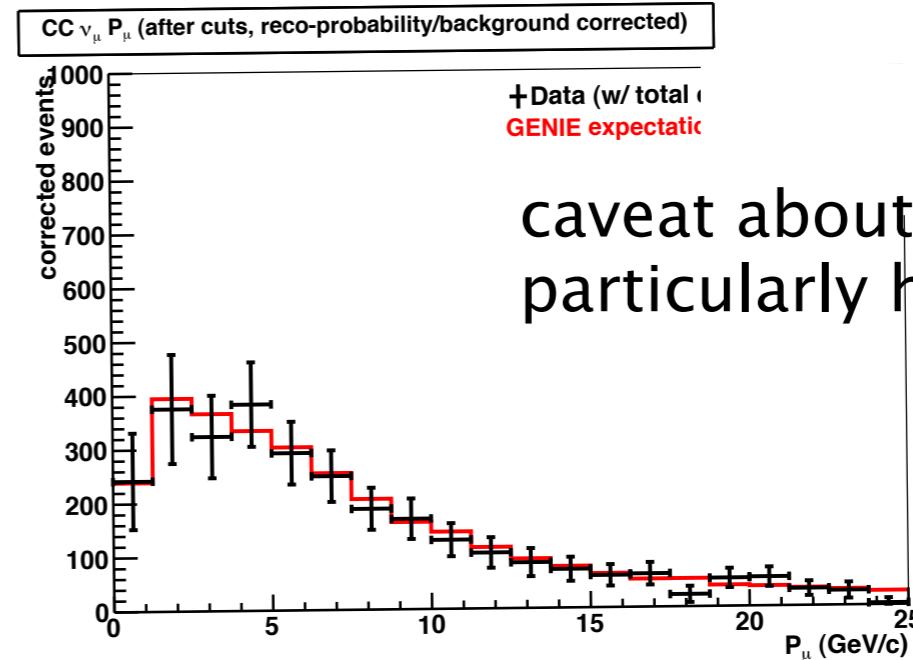
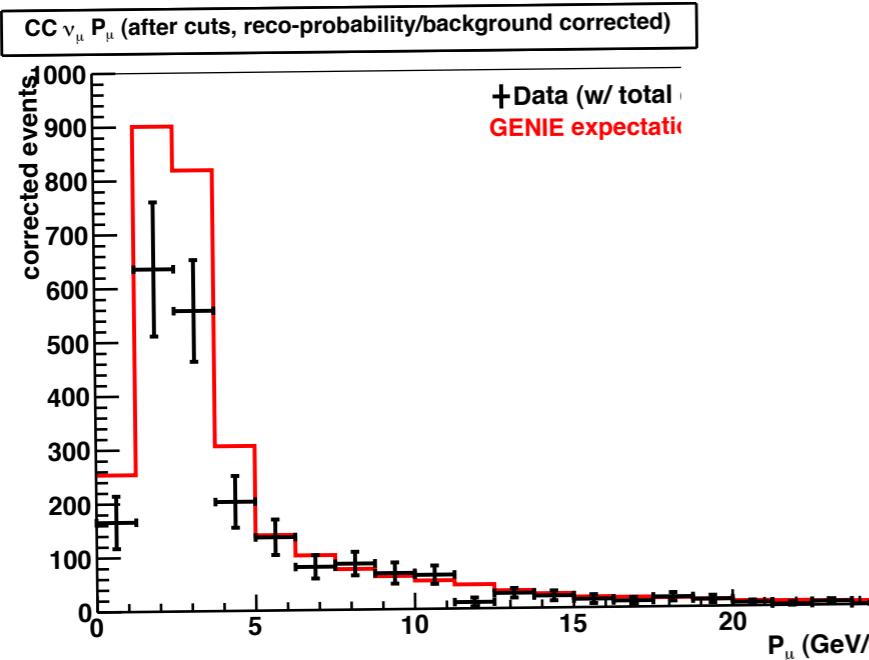
Event vertex (μ^-)



Event vertex (μ^+)



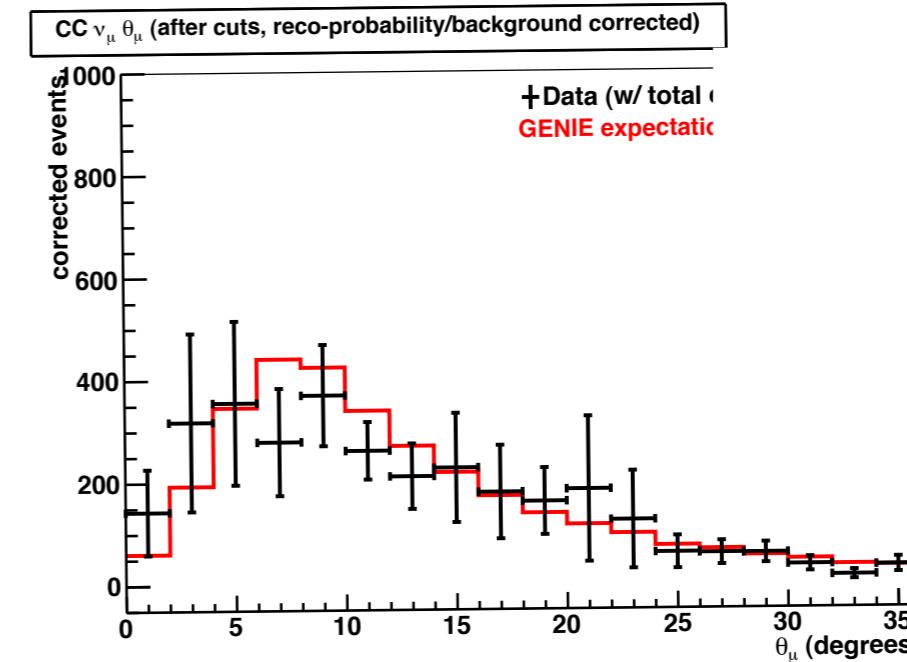
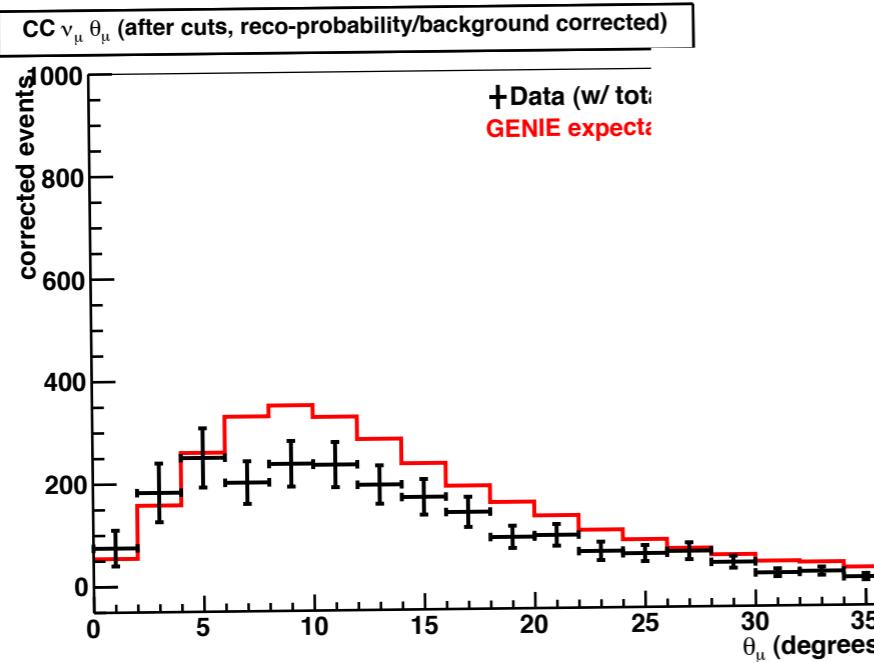
(Sig-bgd)/eff



caveat about flux,
particularly high E mu-

mu-

mu+



Summary Counts

w bkgd subtracted. Totals from integrated histograms.

	mu+Th	mu+Mom	mu-Th	mu-Mom
Data post-eff	2112	2132	3064	2922
MC post-eff	2880	2923	3195	3058
% diff from GENIE	26.			4.

Systematics

- vary FV by +/- 1 cm: few %
- $E_{nu} \rightarrow E_{true}$, $\theta_{nu} \rightarrow \theta_{true}$ gives resolutions in bins of E_{true} , θ_{true} : 10-20 % (except θ_μ -distn.)
- flux: 15.7% flat +?
- pot: 1%
- Ntargets: 1.56+/-0.03 mm/usec drift velocity
- handscan systematic?: 2 scanners?

Conclusions

- The result for the high energy neutrinos in anu mode seems close to GENIE expectations. Even this conclusion is subject to change, as the NuMI flux and its systematics are tuned/understood.
- In the more dominantly CCQE+Res events of the anti-neutrinos in the anu mode we see a deficit wrt GENIE.
- This is consistent with our $1\mu + Np$ analysis.