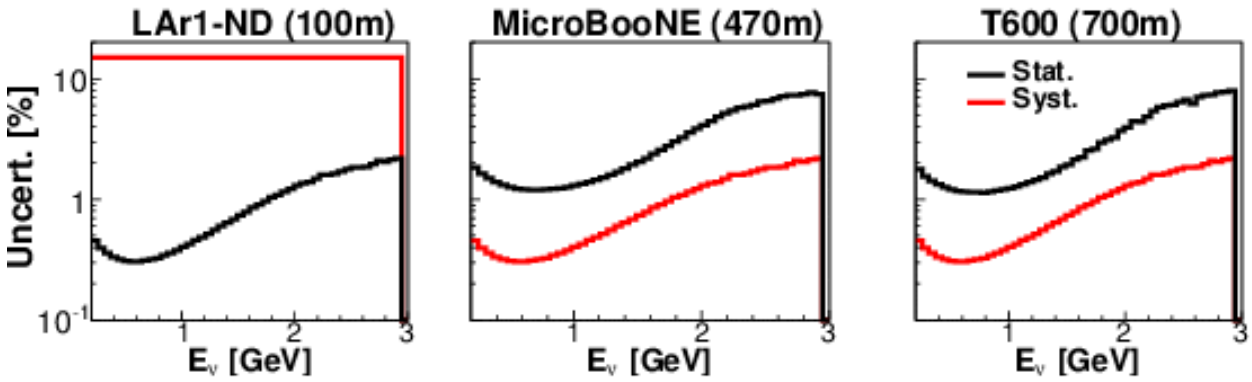
THE UNIVERSITY OF CHICAGO

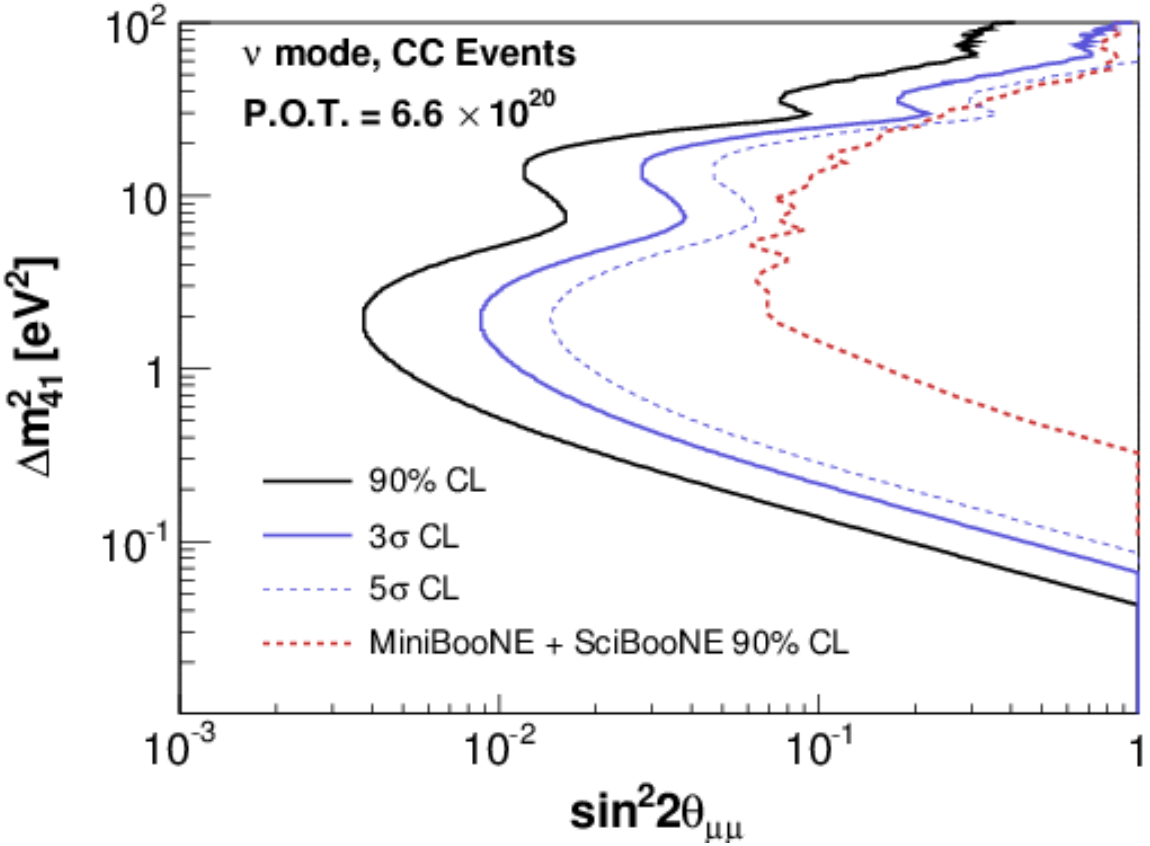
SBNE Planning Meeting: Sensitivity Studies

Joseph Zennamo, Corey Adams

May 2nd, 2014

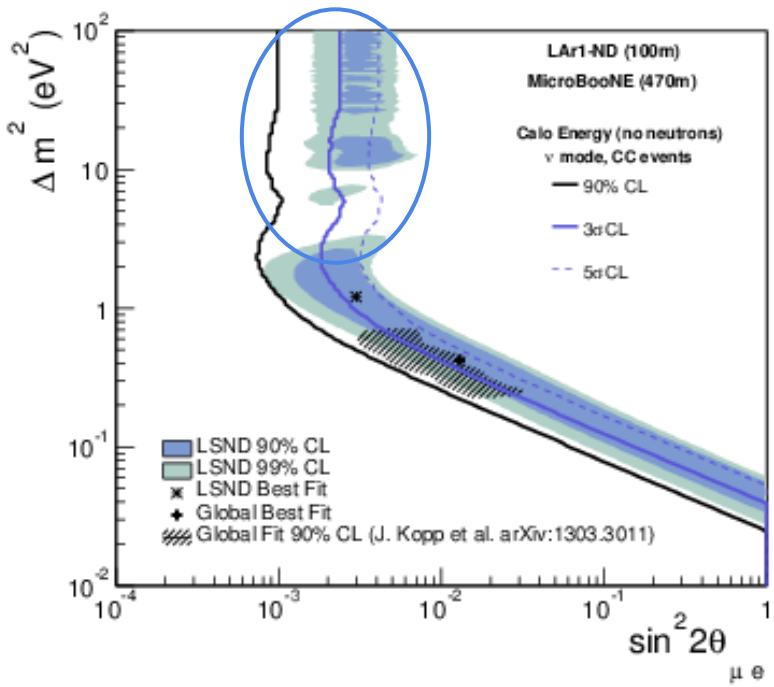
ν_μ Disappearance (T600 @ 700m)

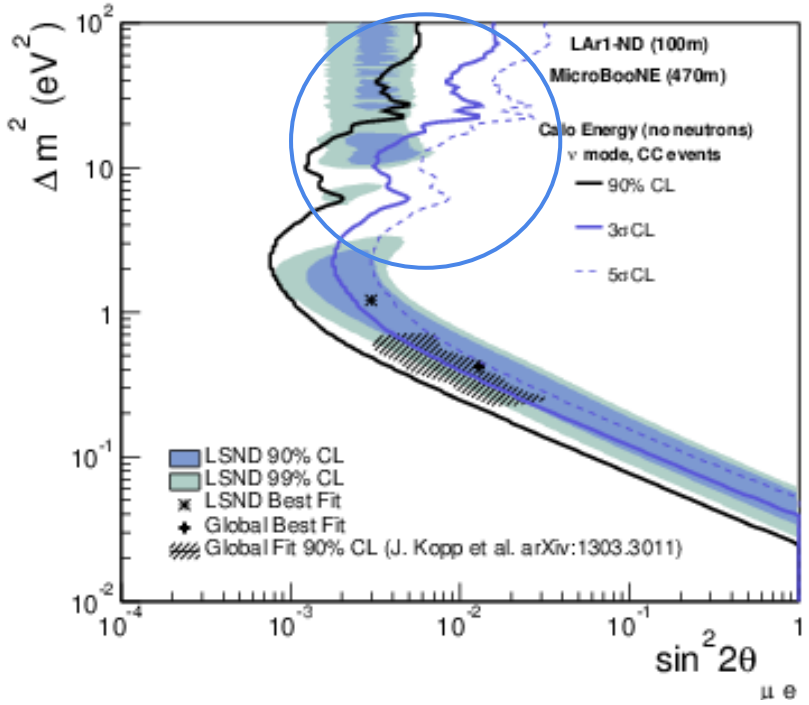




Limiting case sensitivity is if statistics of ND events constrain the predictions in μBooNE and T600 without additional systematics

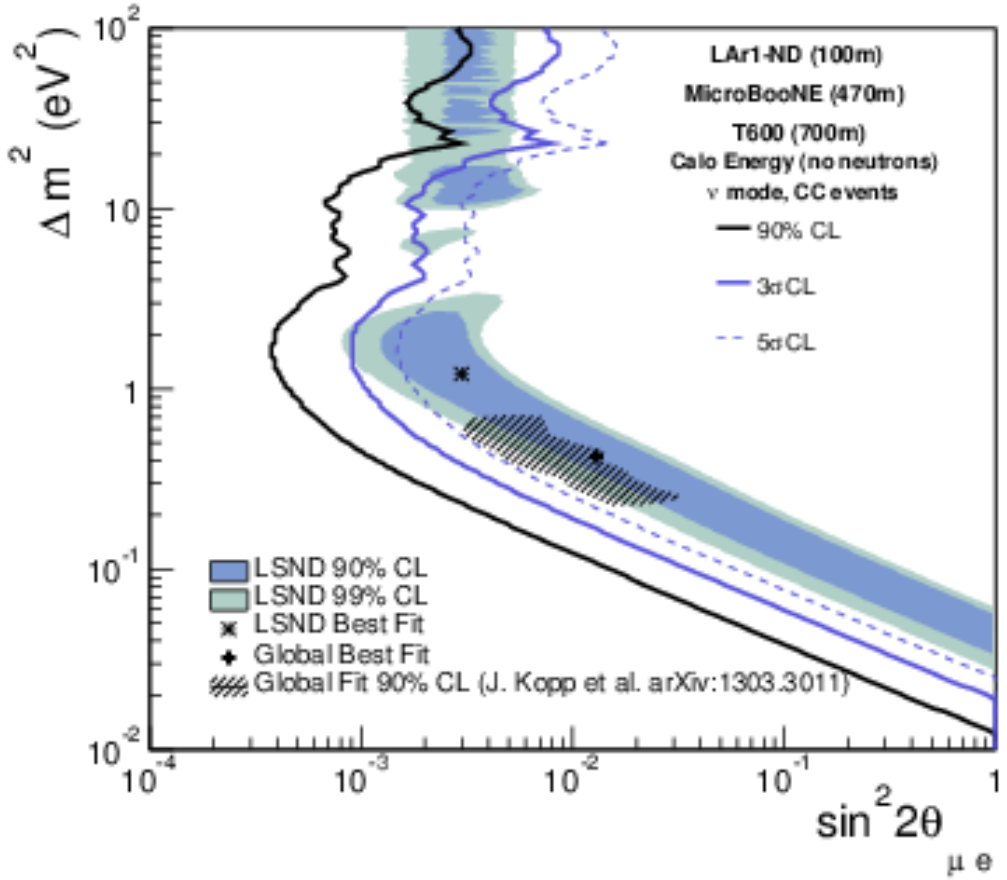
Electron Neutrino Appearance Sensitivity Convergence

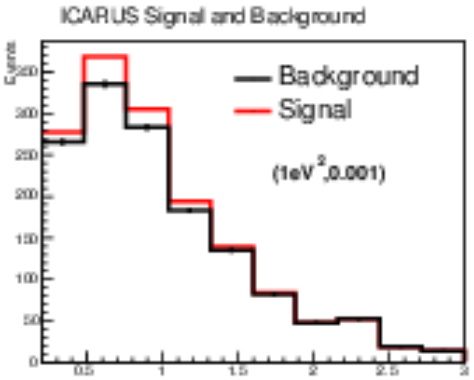


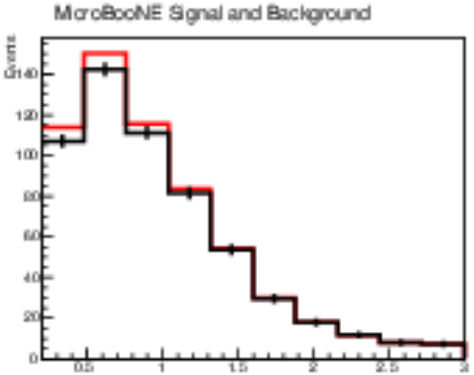


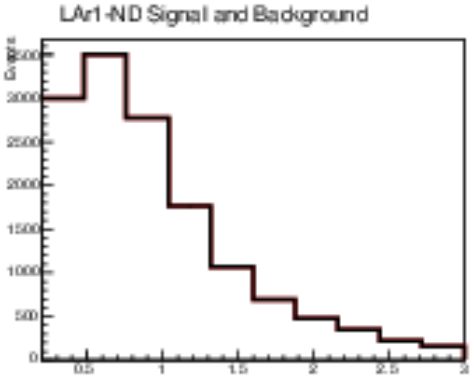
Thanks to some great discussions yesterday we have reached a consensus on the sensitivity calculation! Have implemented same approach to shape-only oscillation analyses.

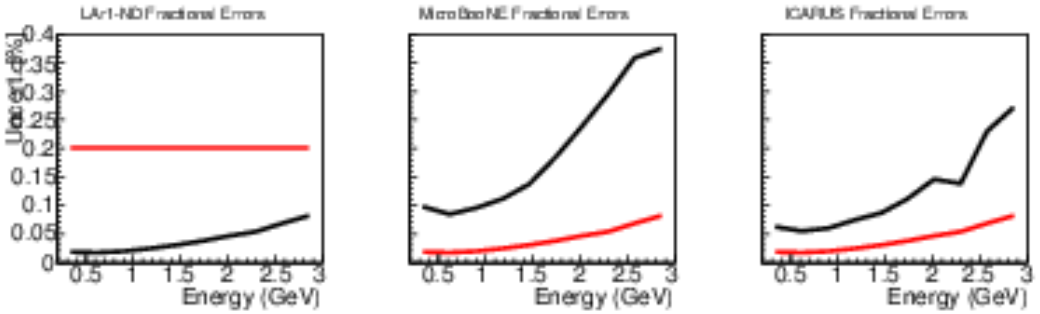
ν_e Appearance (T600 @ 700m)





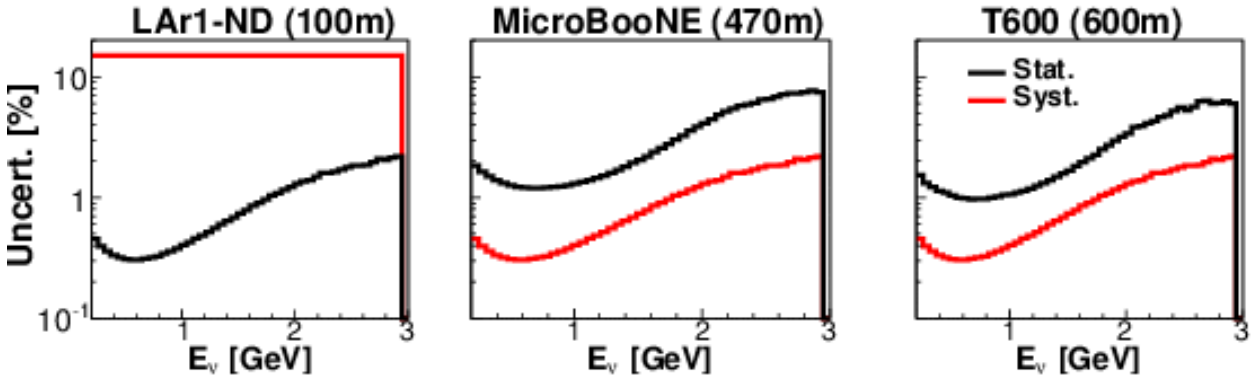


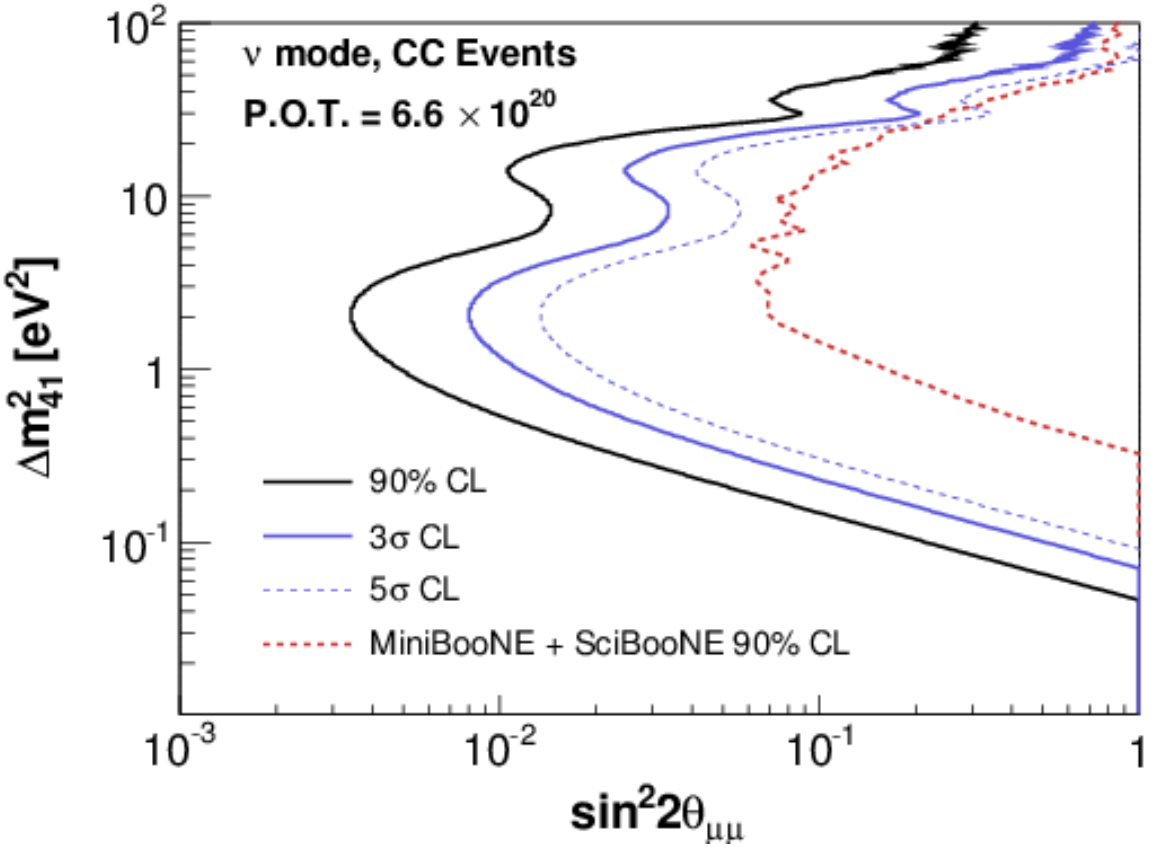




stat
syst

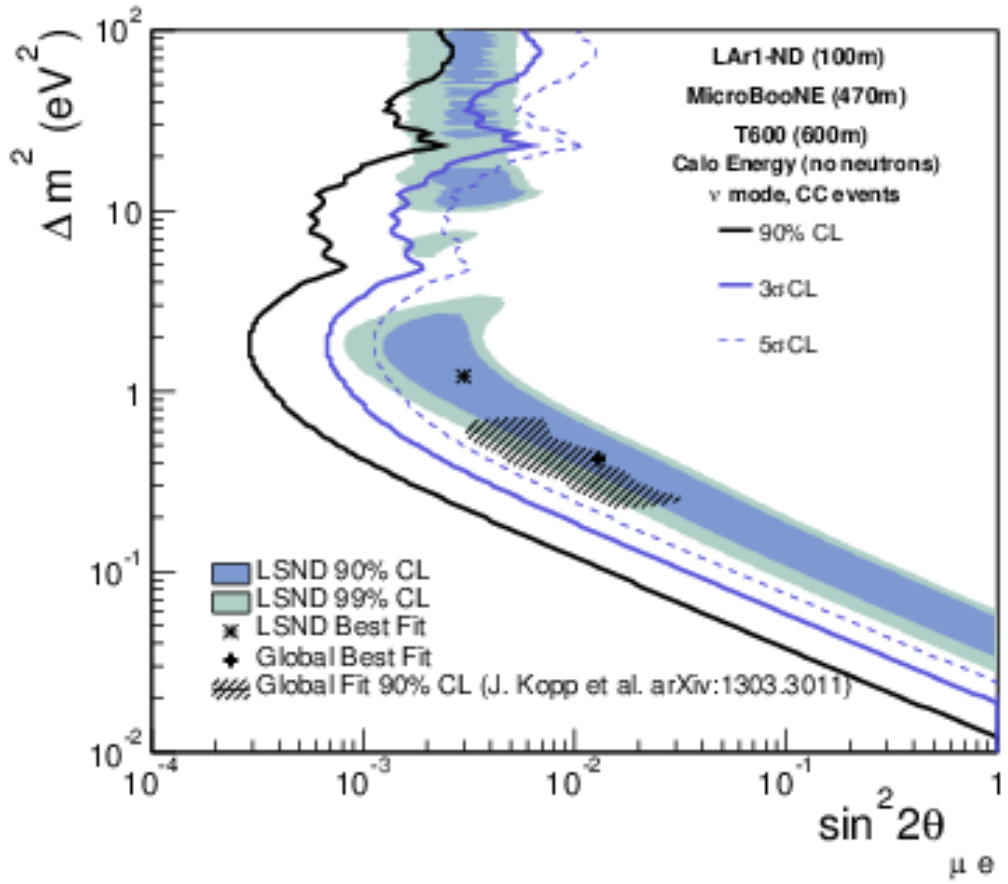
ν_μ Disappearance (T600 @ 600m)

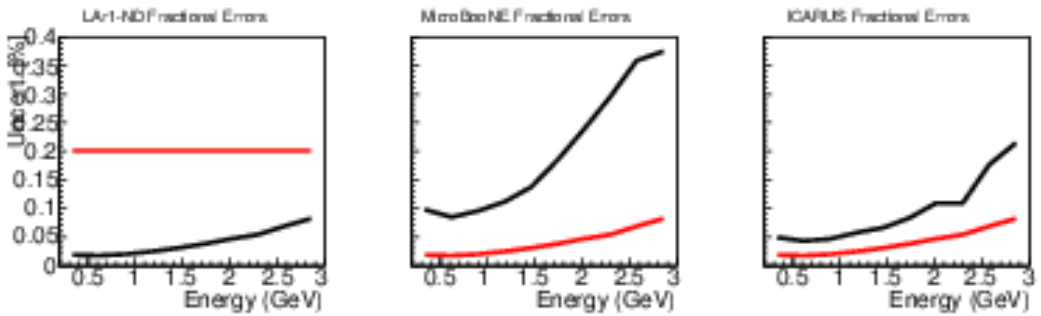




Slight increase in statistics in the T600 as one would expect

ν_e Appearance (T600 @ 600m)





stat
syst

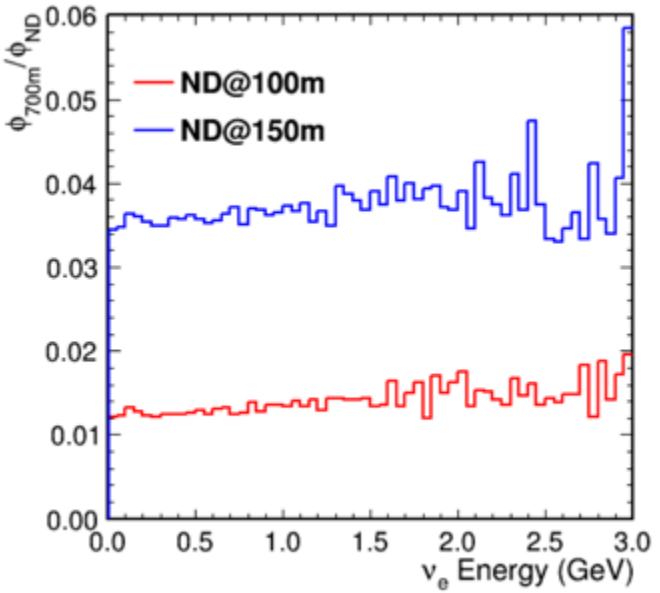
Slight increase in statistics in the T600 as one would expect

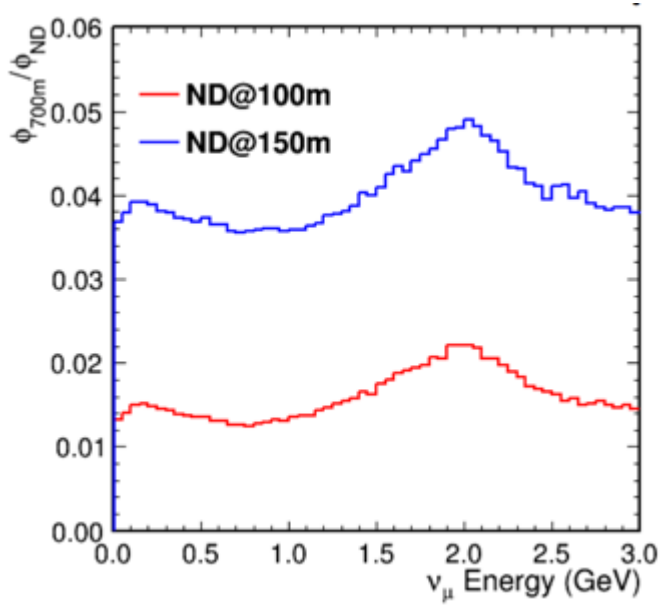
Flux Ratio Uncertainty

The next thing for us to add will be an uncertainty on the ratio of the fluxes for the near and far detector

The machinery exists to propagate uncertainties using the MiniBooNE beam Monte Carlo

In the coming weeks this will be implemented

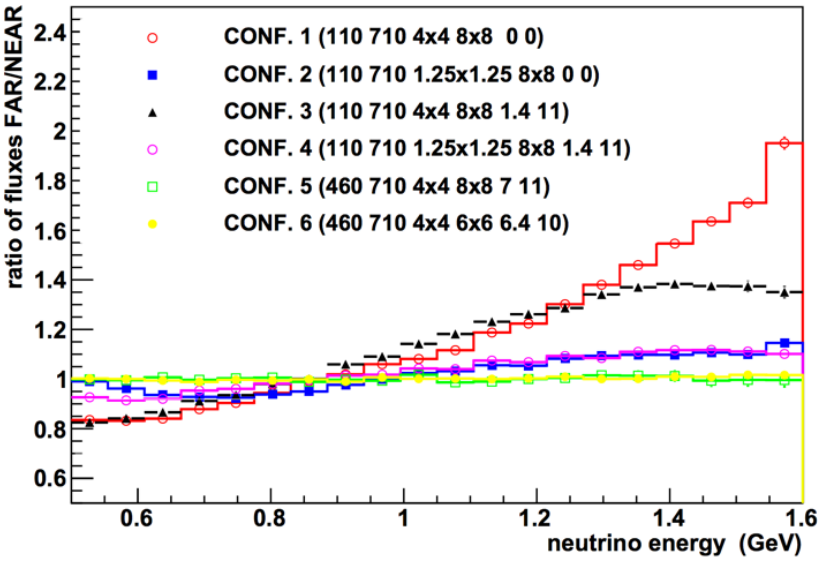


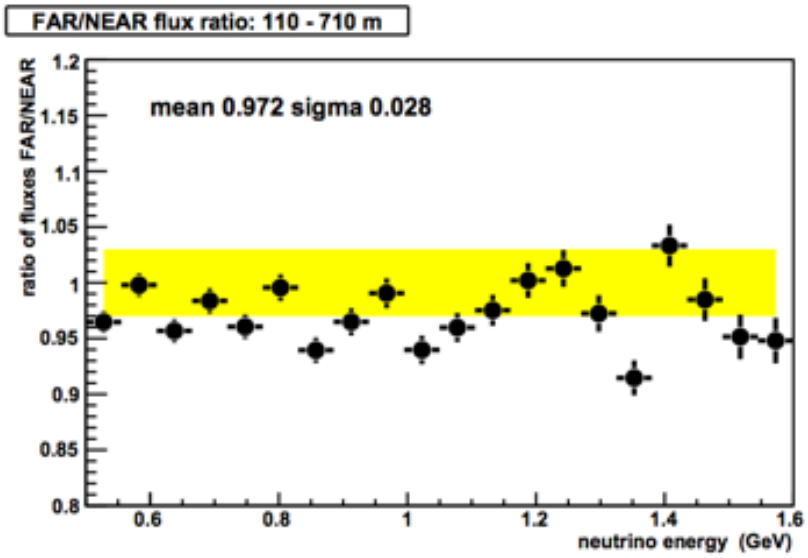


Flux Ratio Uncertainty (II)

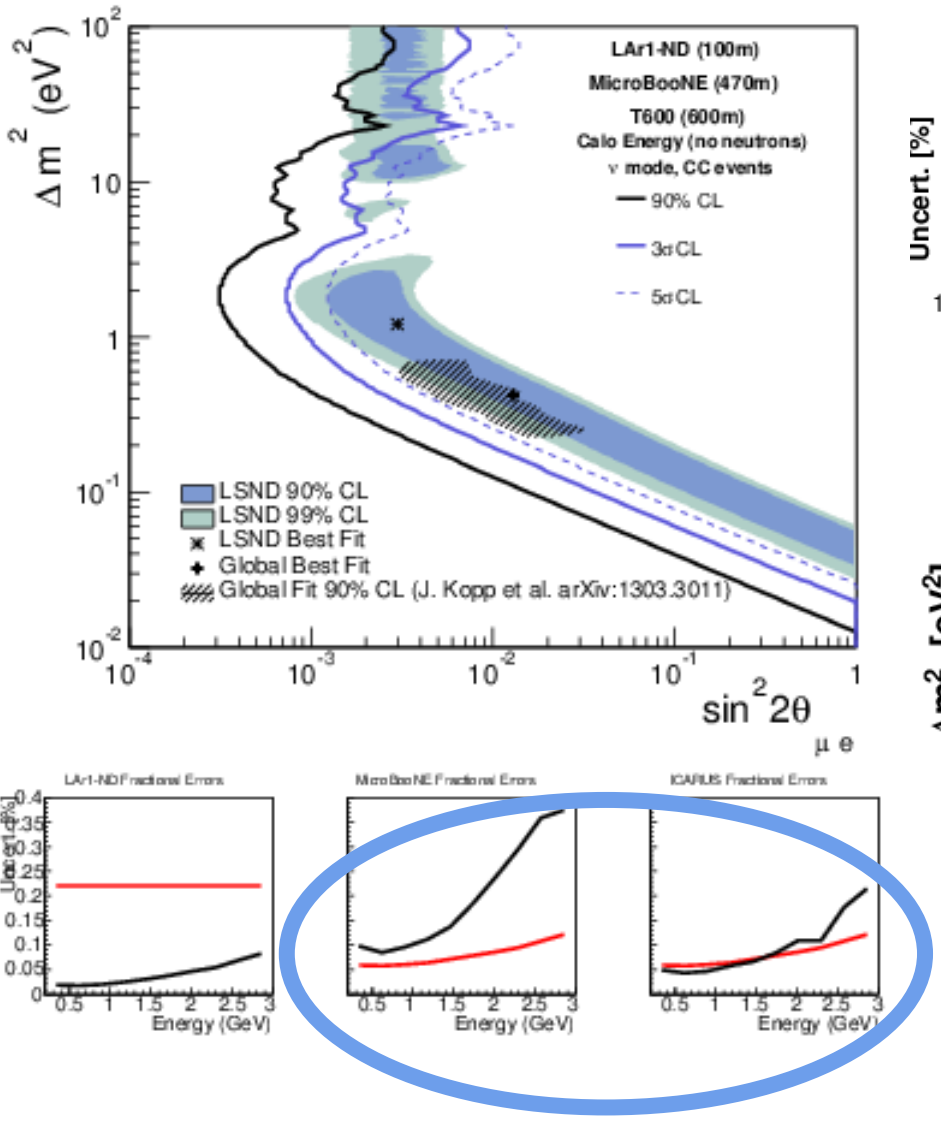
In the mean time we can approximate this uncertainty

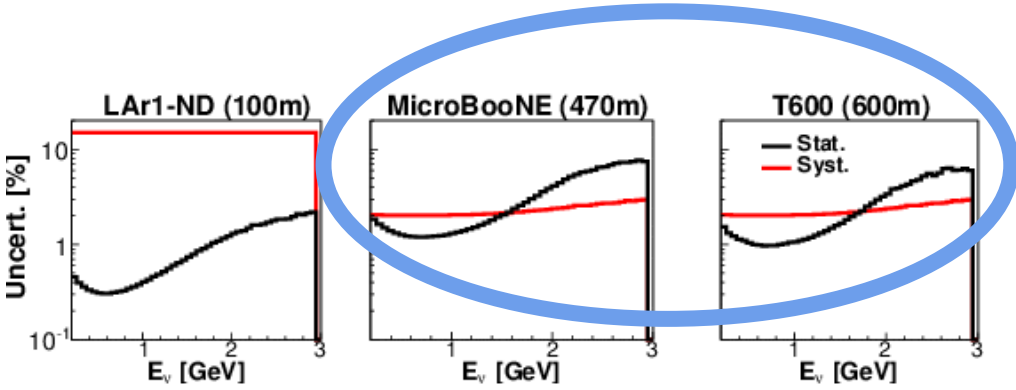
Studies (from the NESSiE collaboration) have shown that the systematics on the ratios are in the 2-3% range

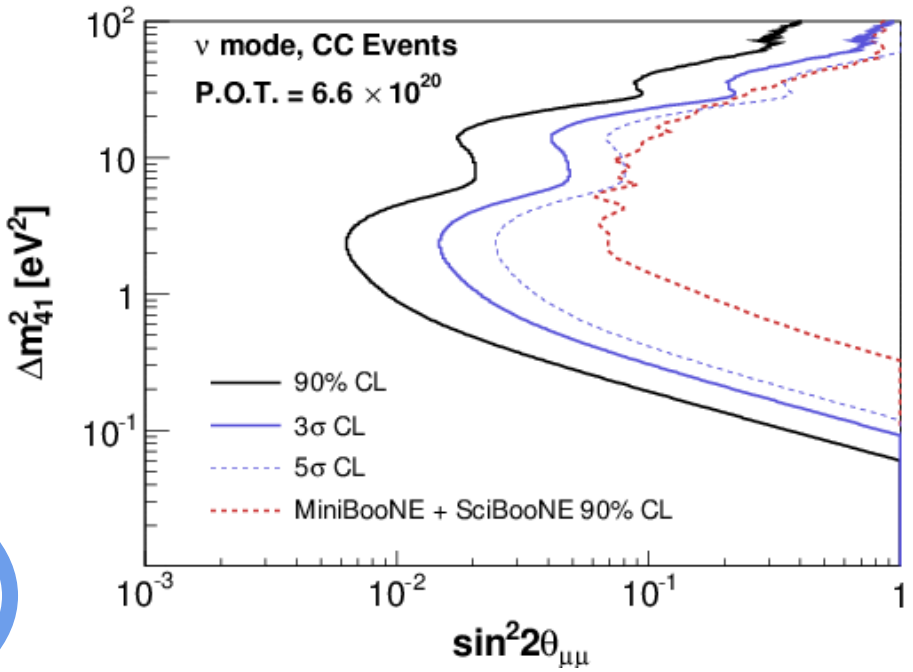




Approximating a Flux Uncertainty







Containment and Acceptance Syst.

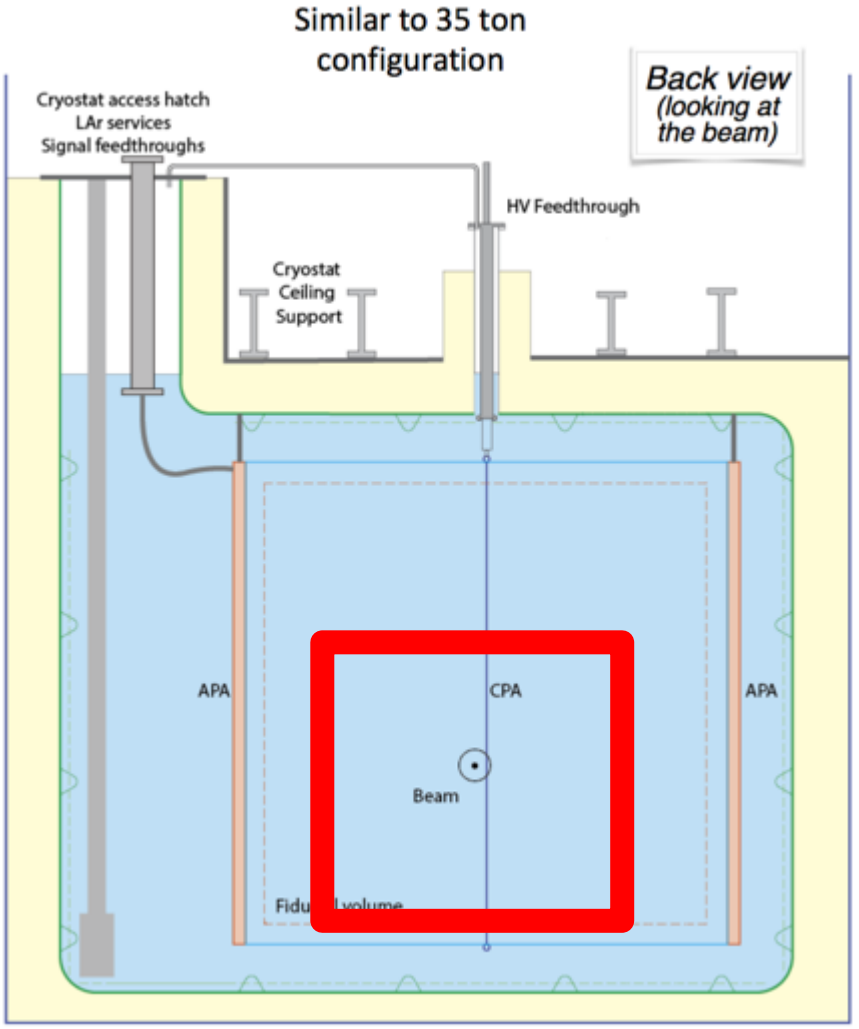
Another possible systematic that was discussed would come from differences in containment and acceptance in different detectors

To mitigate this effect we tried to modify the fiducial and active regions to be as similar as possible in both LAr1-ND and T600

This would have the effect of minimizing this systematic

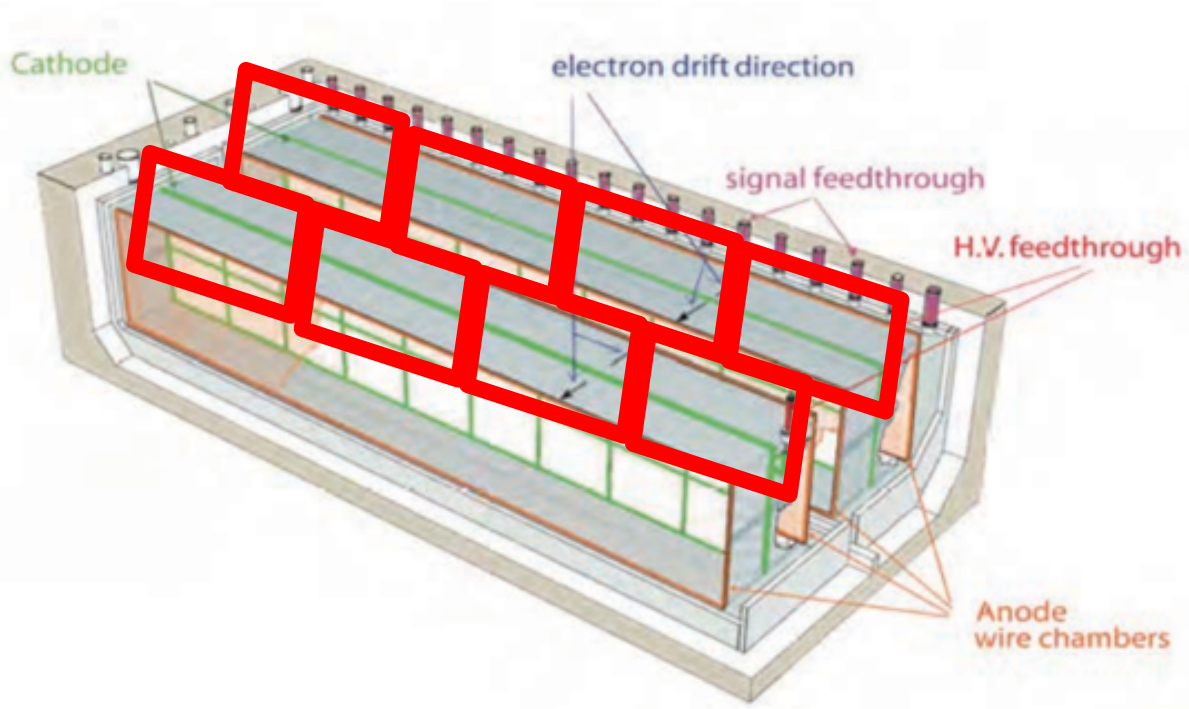
Modified Active and Fiducial Volume:LAr1-ND

Using the cross sectional area of one of the T300 modules we center a newly defined active and fiducial volume around the beam spot

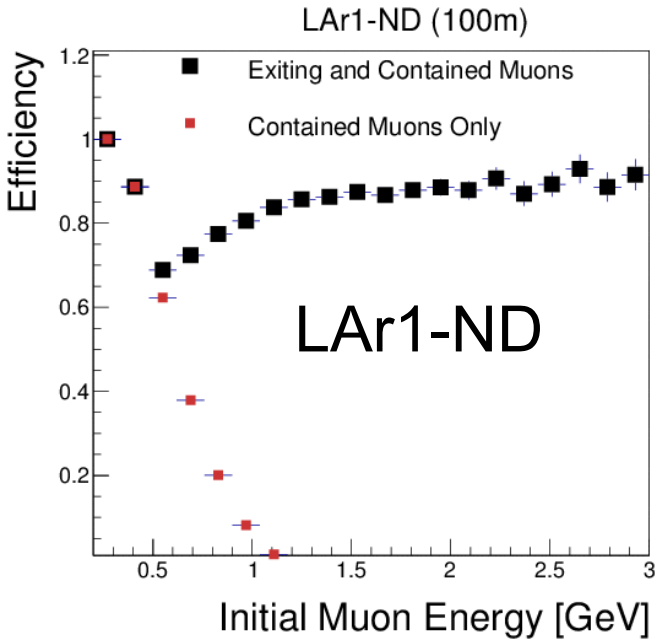


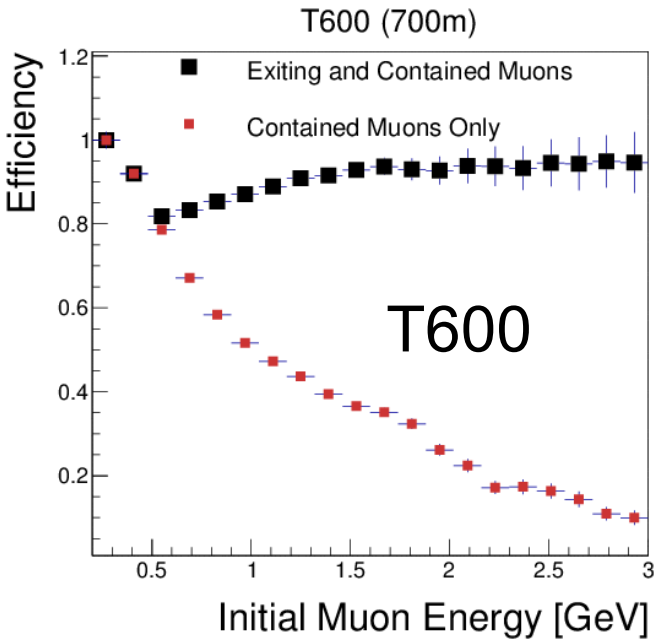
Modified Active and Fiducial Volume: T600

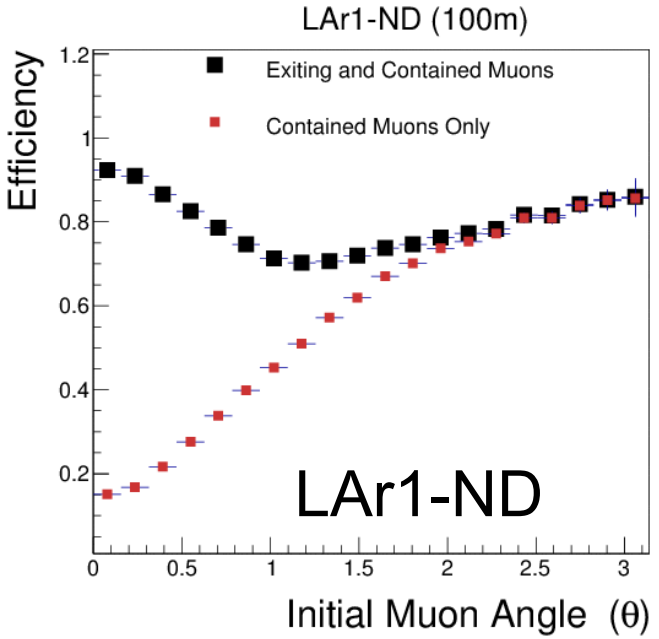
A similar exercise can be done with the T600, where it can be broken into roughly 8 LAr1-ND length sub-sections

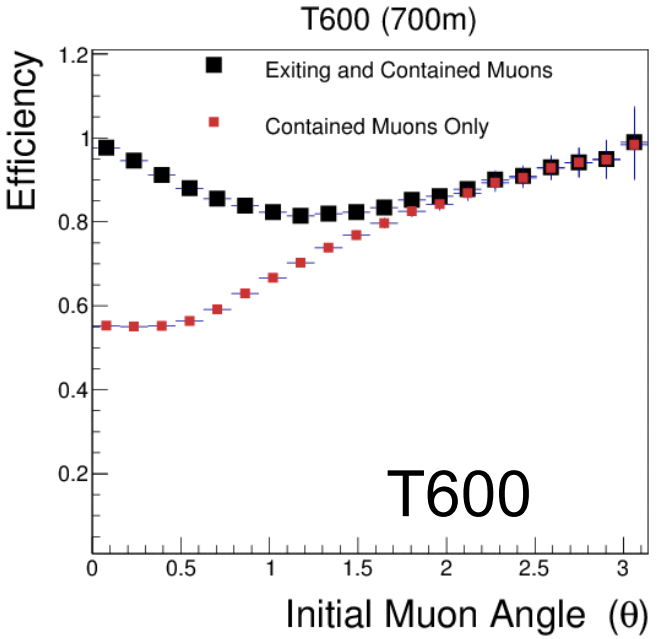


Effect on Acceptances: Before

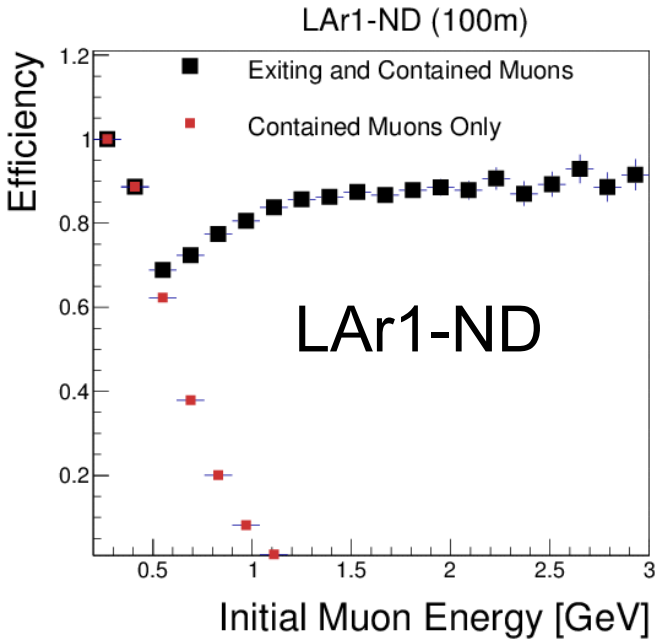


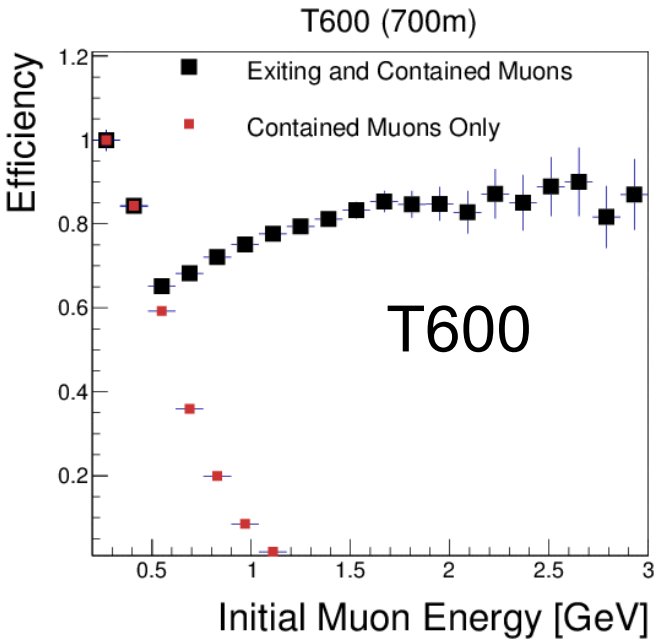


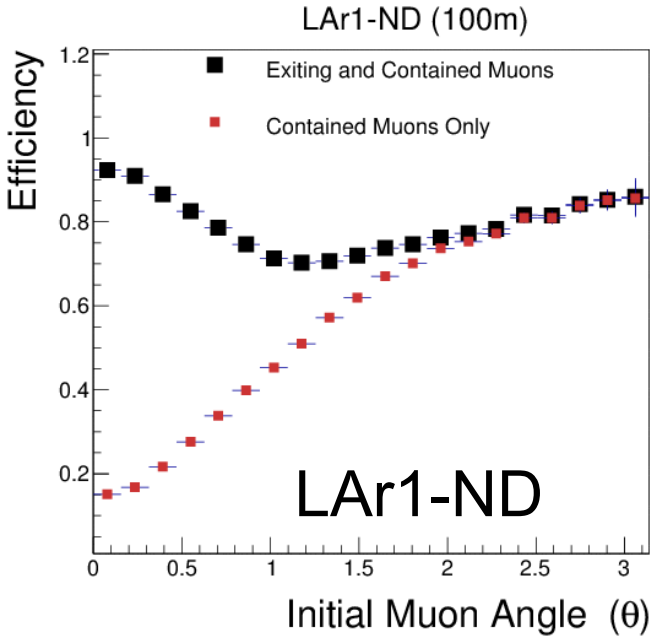


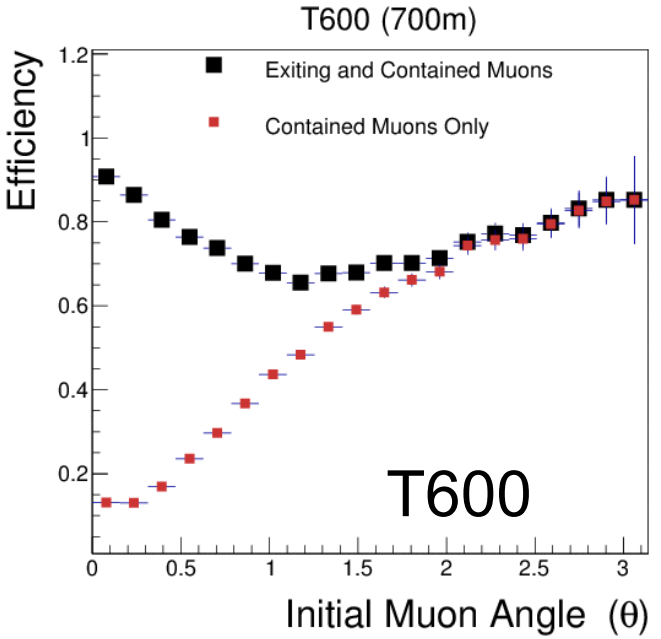


Effect on Acceptances: After





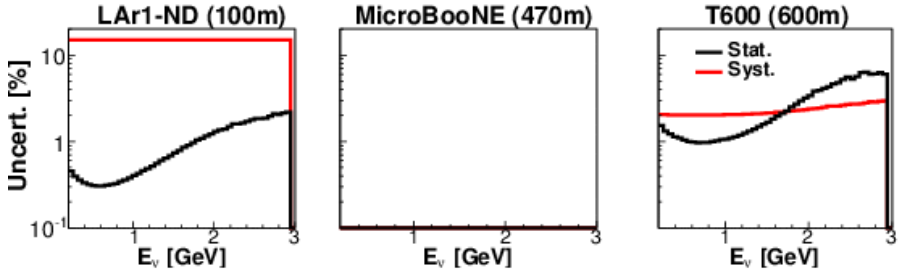


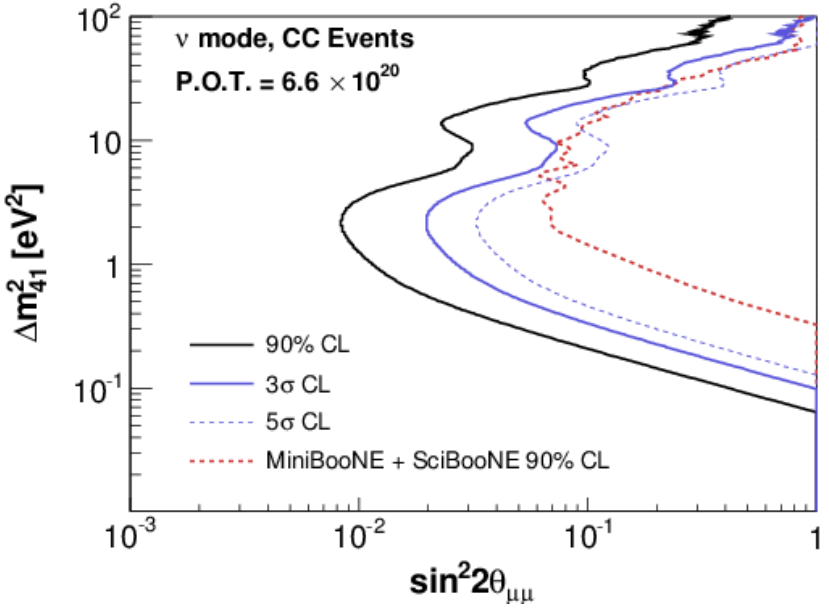


Matched Acceptances

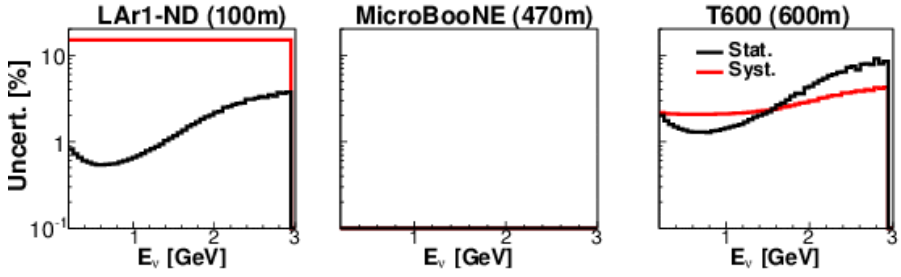
The effect of this modification is to minimize this systematic but at the cost of reducing the statistics some in both detectors

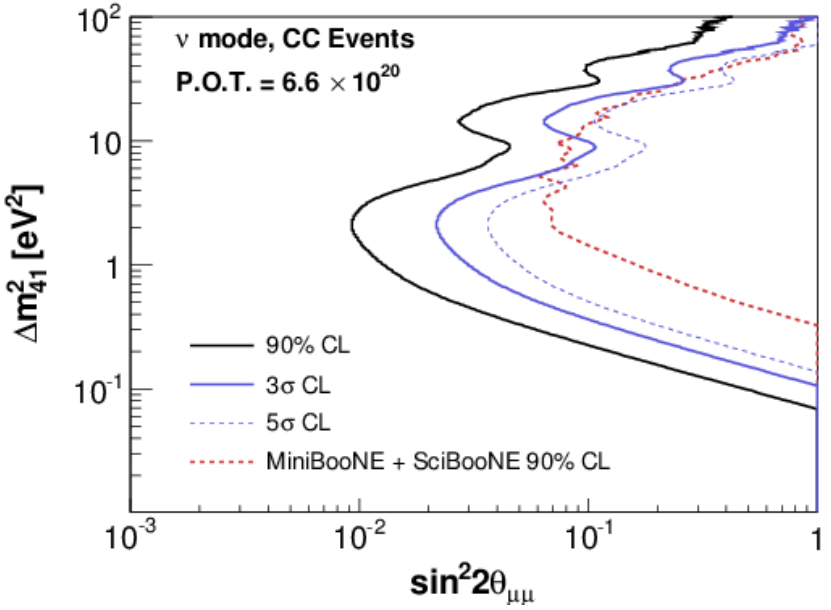
Before





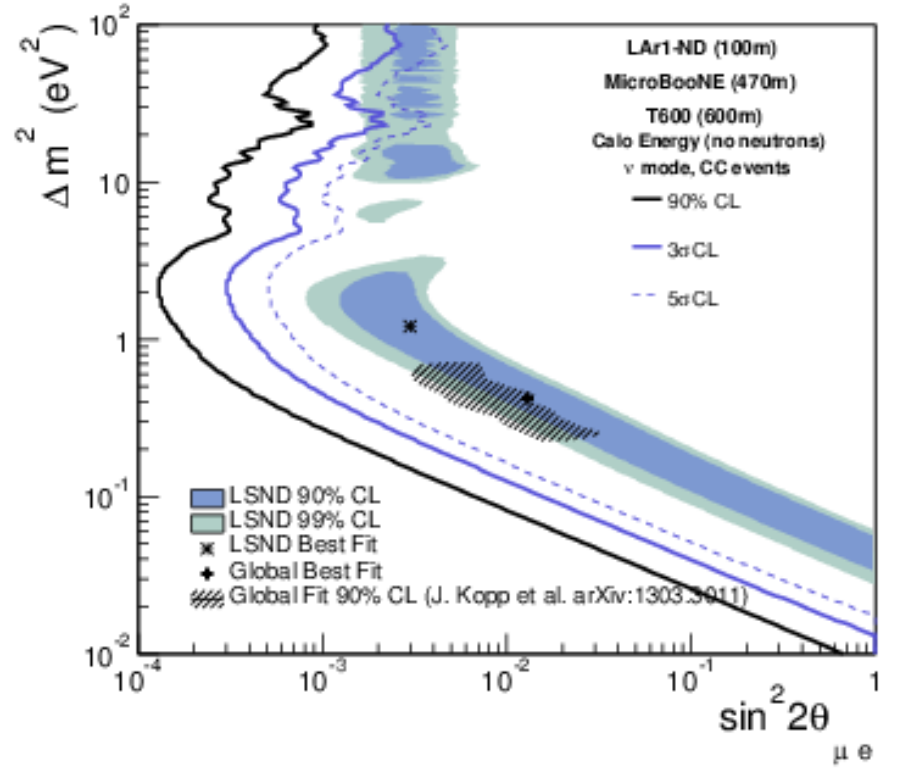
After

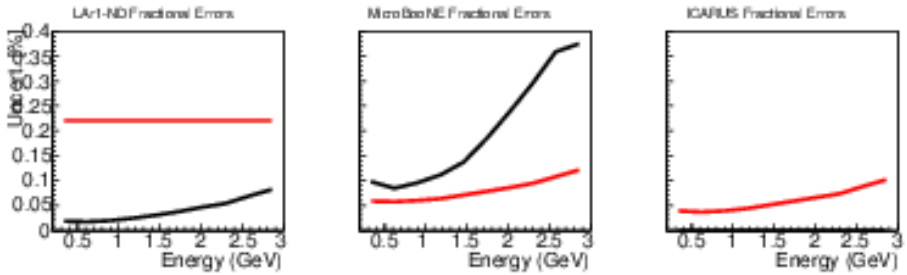


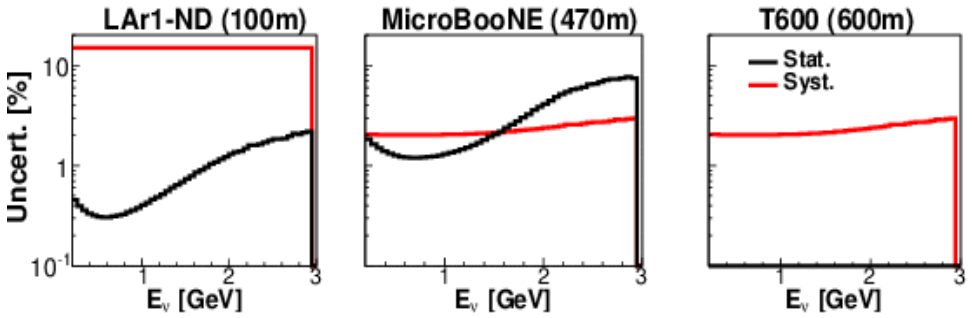


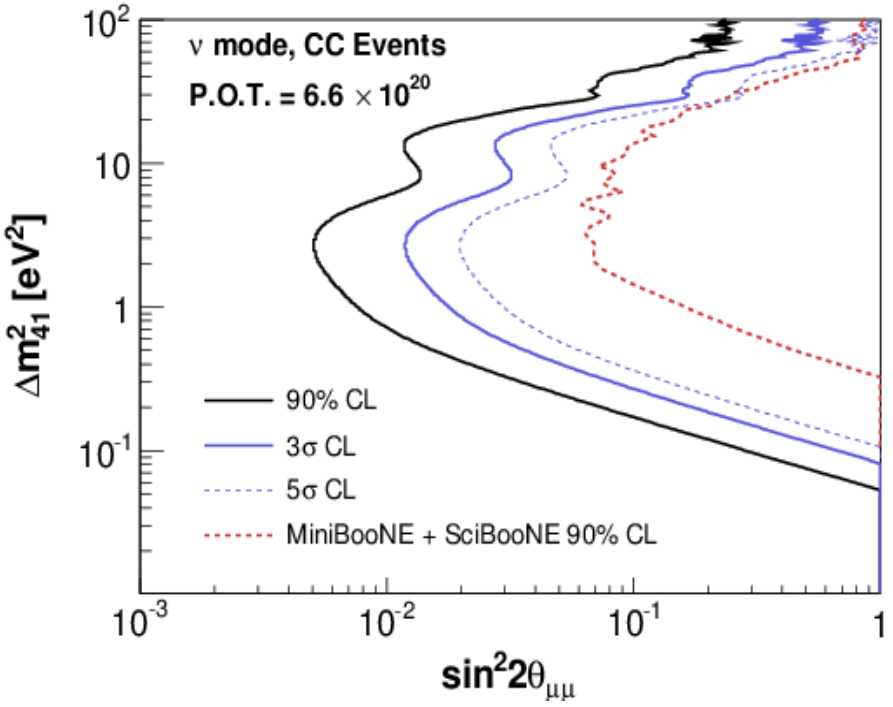
T600 with Infinite Statistics

Here the systematics are the ND stats + 2% flux ratio uncertainty propagated to the far detectors







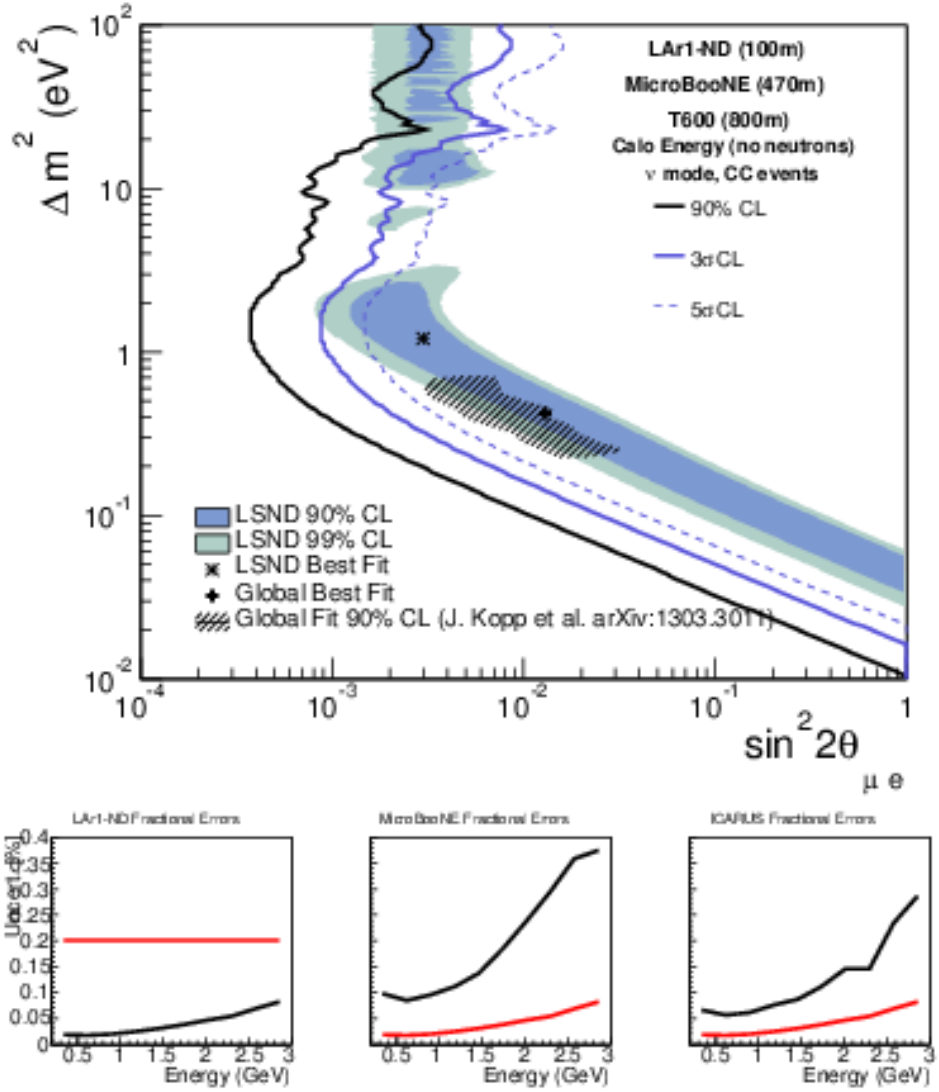


Additional Study: T600 @ 800m

Another choice would be to locate the T600 at **800m**

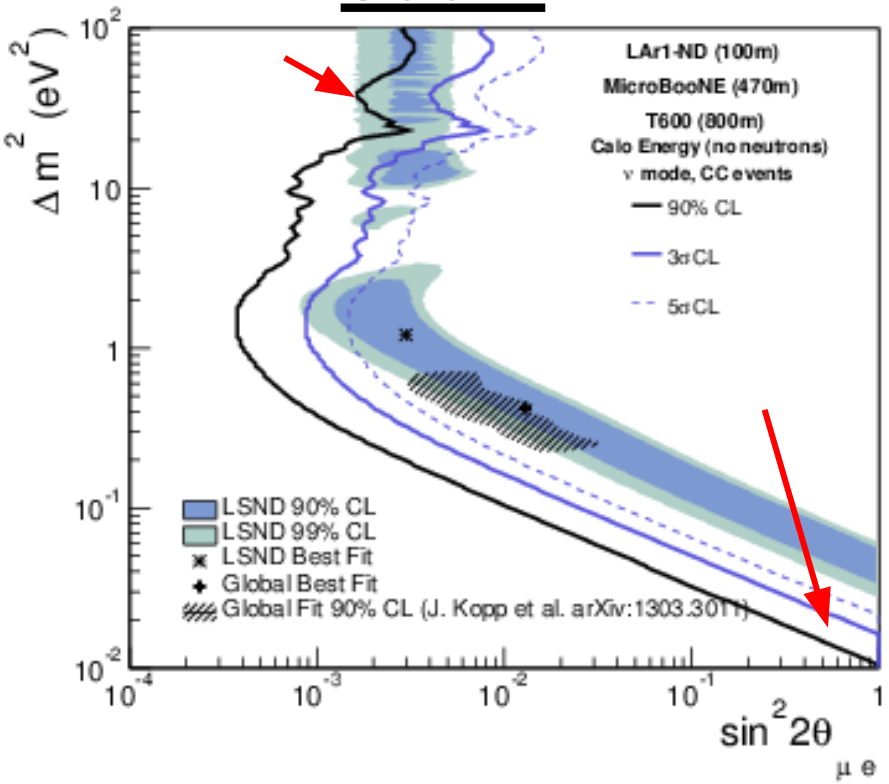
This has the downside of reducing the flux

We see a reduced sensitivity at high Δm^2 but an improved sensitivity at low Δm^2

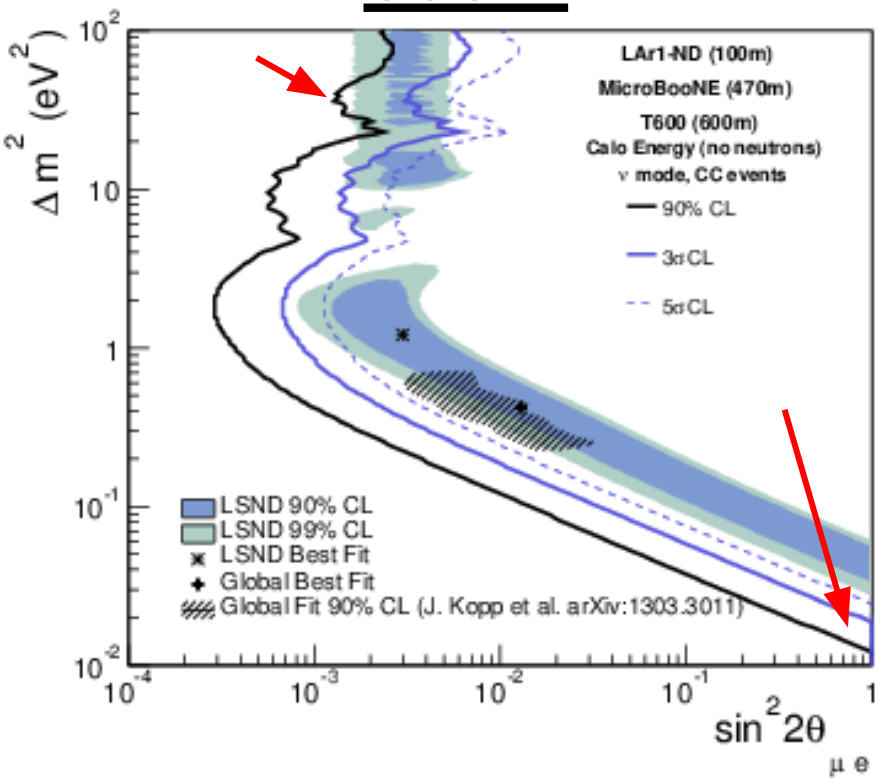


[NOTE: No Flux Uncert

800m



600m



[NOTE: No Flux Uncert Included]