NuMI Monte Carlo in MicroBooNE

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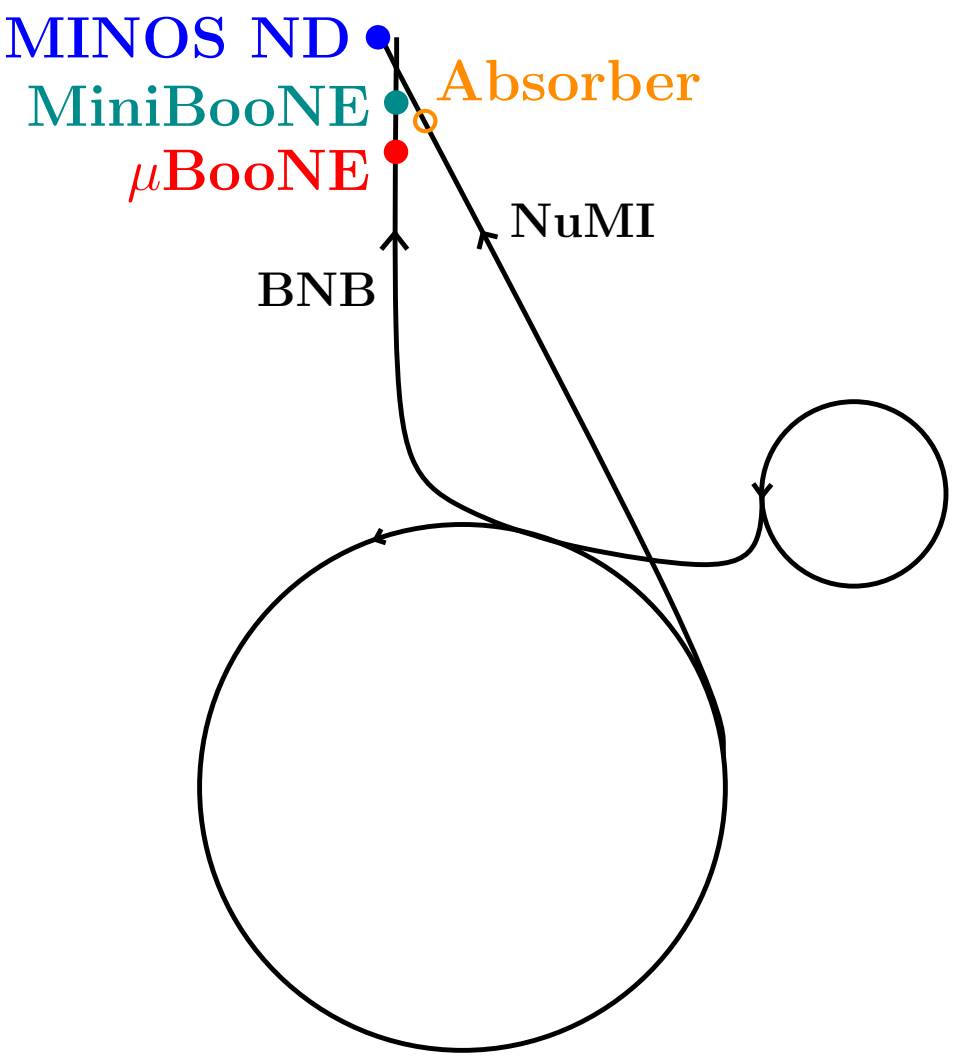
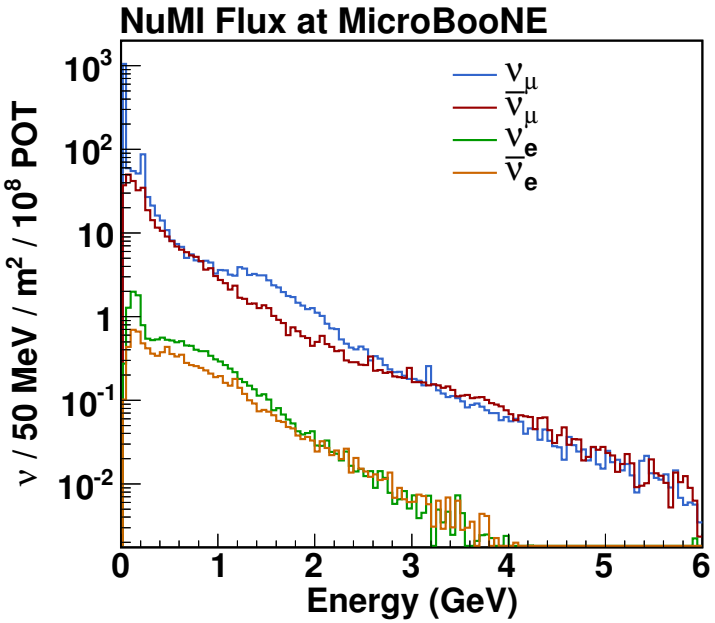
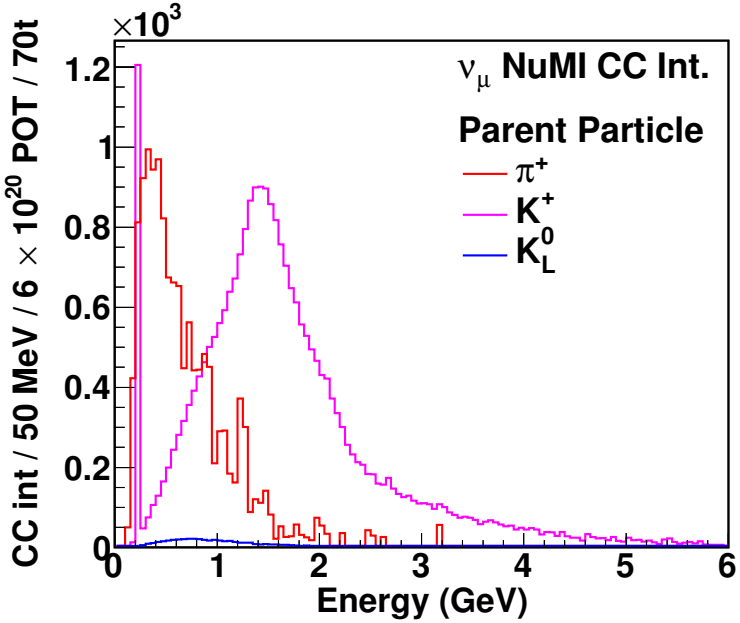
Quick Reminder (Repeating info from Žarko's mid-summer talk...)

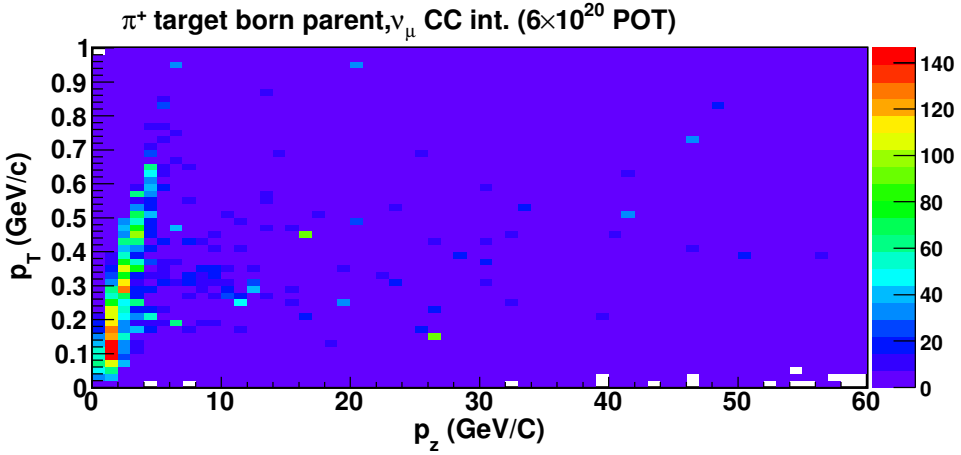


- NUMIX-doc-5-v1
- MicroBooNE – a LArTPC experiment.
- On axis to Booster.
- Approximately 130 mrad off axis to NuMI.
- $\sim$50% events produced from hadrons produced at target. Many shielding-born.
- $\pi^{\pm}$ parents (34% ν_μ events/46% $\overline{\nu}_\mu$) dominate at lower energy, $K^{\pm}$ at higher (65% ν_μ events/53% $\overline{\nu}_\mu$)
- Many more ν_e, $\overline{\nu}_e$ events from NuMI compared to BNB (from $K^{\pm}$ and K^0).
- MicroBooNE "in front" of NuMI absorber.
- Provide anchor for low momentum π's and K's.

Repeating Žarko's mid-summer talk cont.





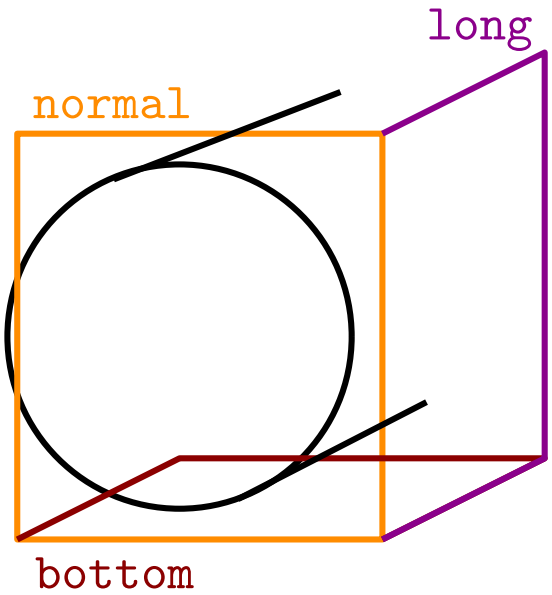


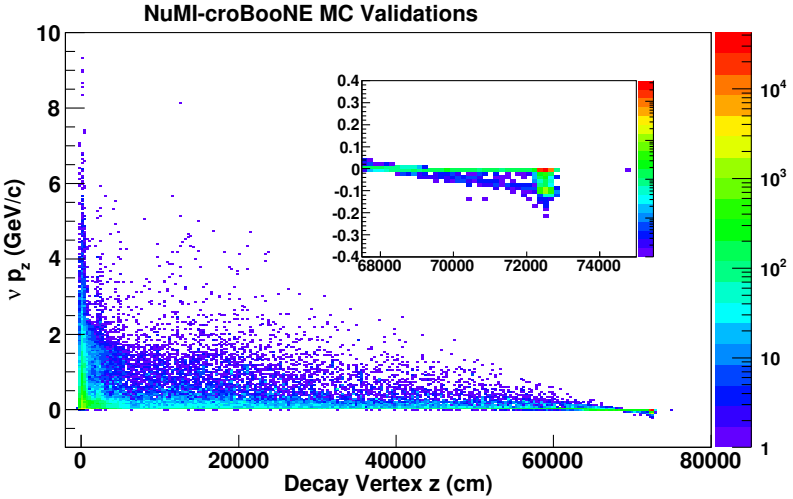
Events	BNB	NuMI
Total	145k	60k
ν_μ CCQE	68k	25k
NC π^0	8k	3k
ν_e CCQE	0.4k	1.2k
POT	6×10^{20}	8×20^{20}

Table : 2 – 3 years of running

Monte Carlo GENIE gsimple Flux Generation

- Neutrino MC is generated from NOvA FLUGG ntuples run through R. Hatchers GNuMIFlux → GENIE simple flux ntuples. Windows shadow the MicroBooNE detector to allow neutrino rays to propagate through.
- Three windows: Underneath MicroBooNE ("bottom"), in front of MicroBooNE & normal to NuMI ("normal"), along the length of the MicroBooNE cylindrical cryostat ("long"). Ratio bottom/long/norm = 3.18/2.27/1 per 10^8 POT.





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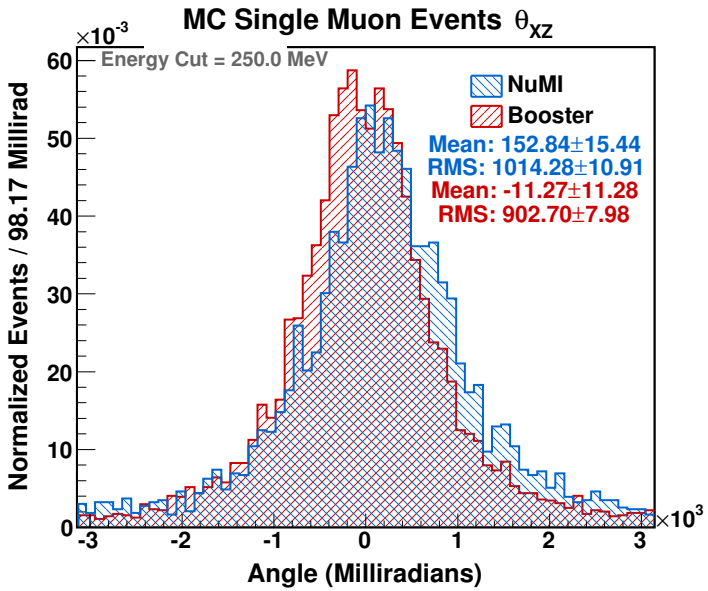
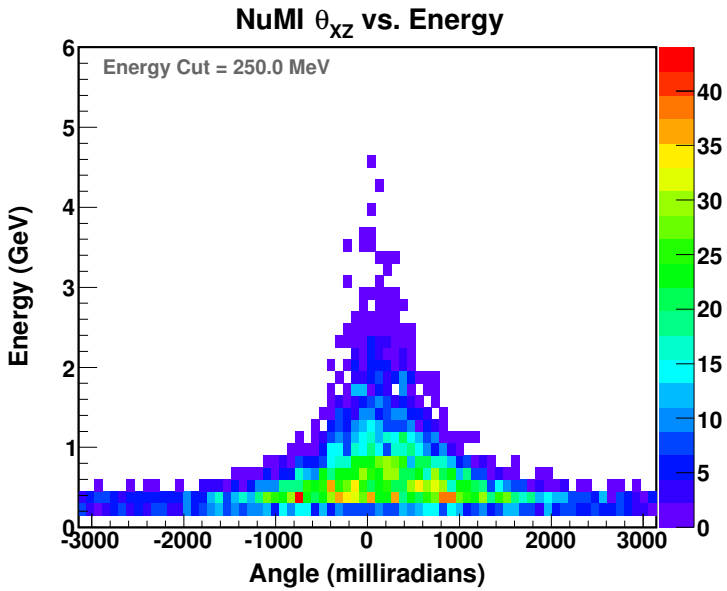
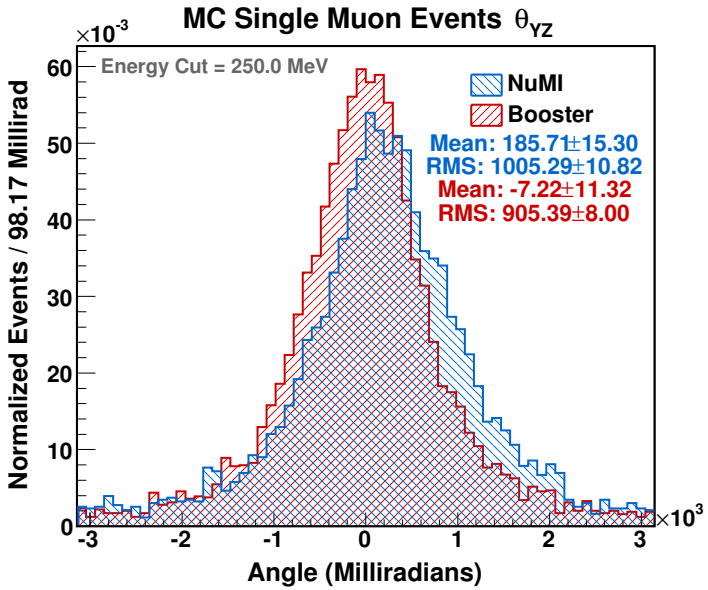
Looking down NuMI axis
(not to scale!)

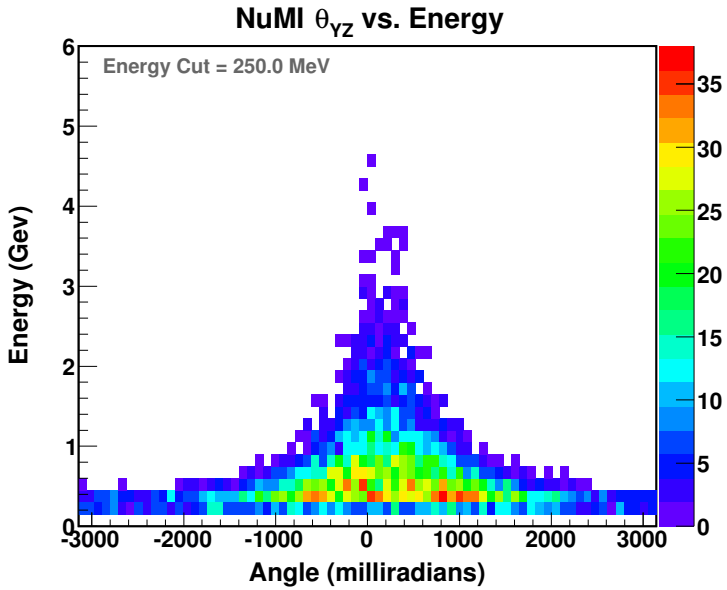
Some Early Monte Carlo Studies

- Looking at muons from CC ν_μ events

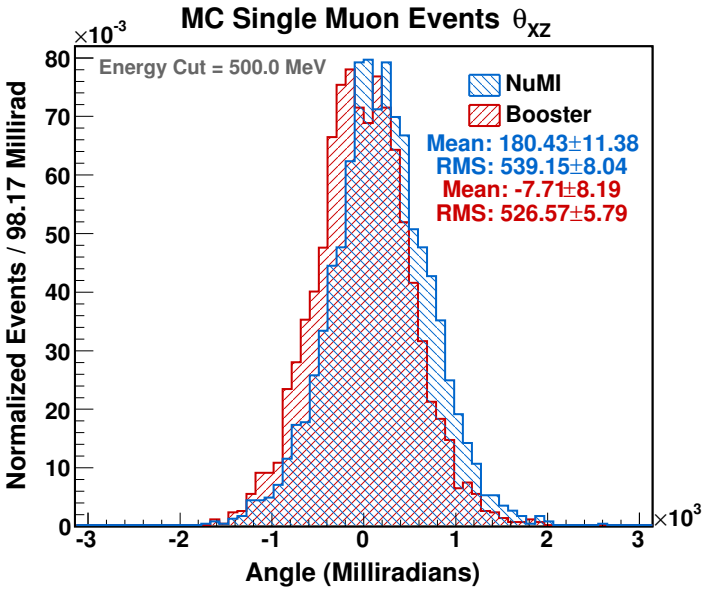


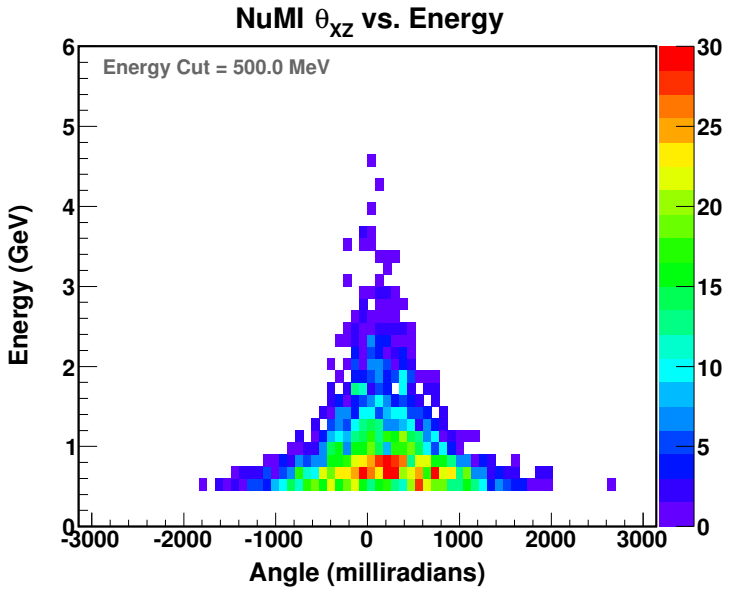


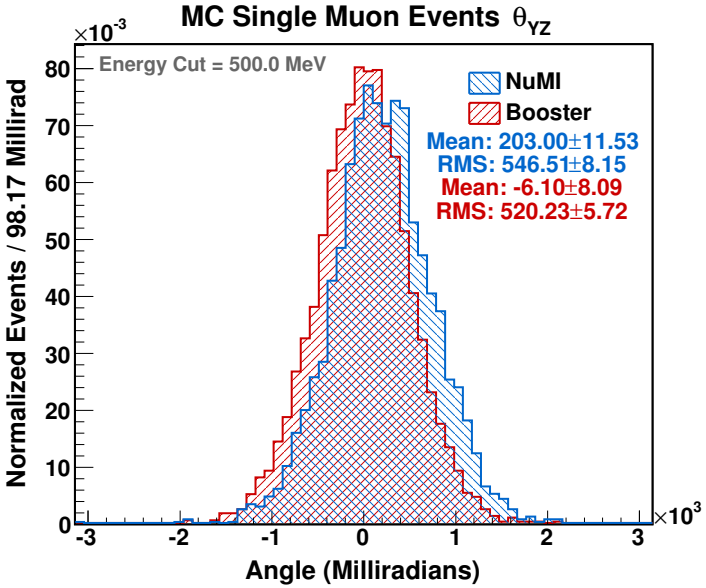


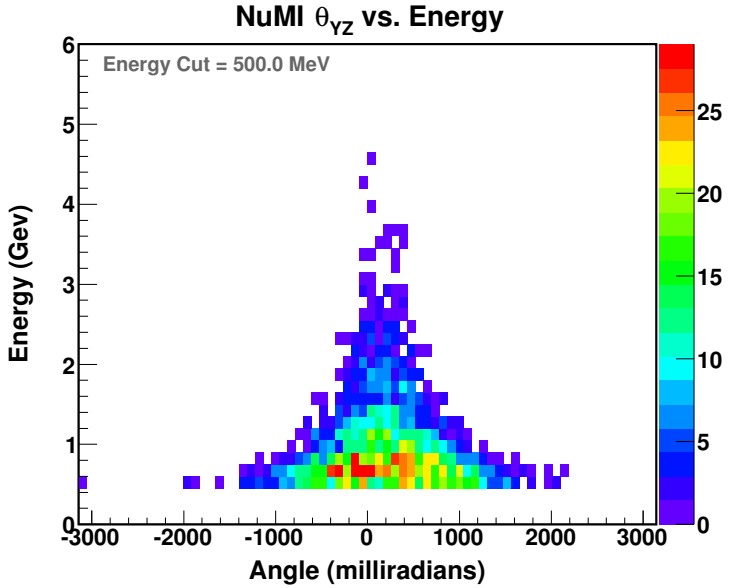


Some Early Monte Carlo Studies cont.



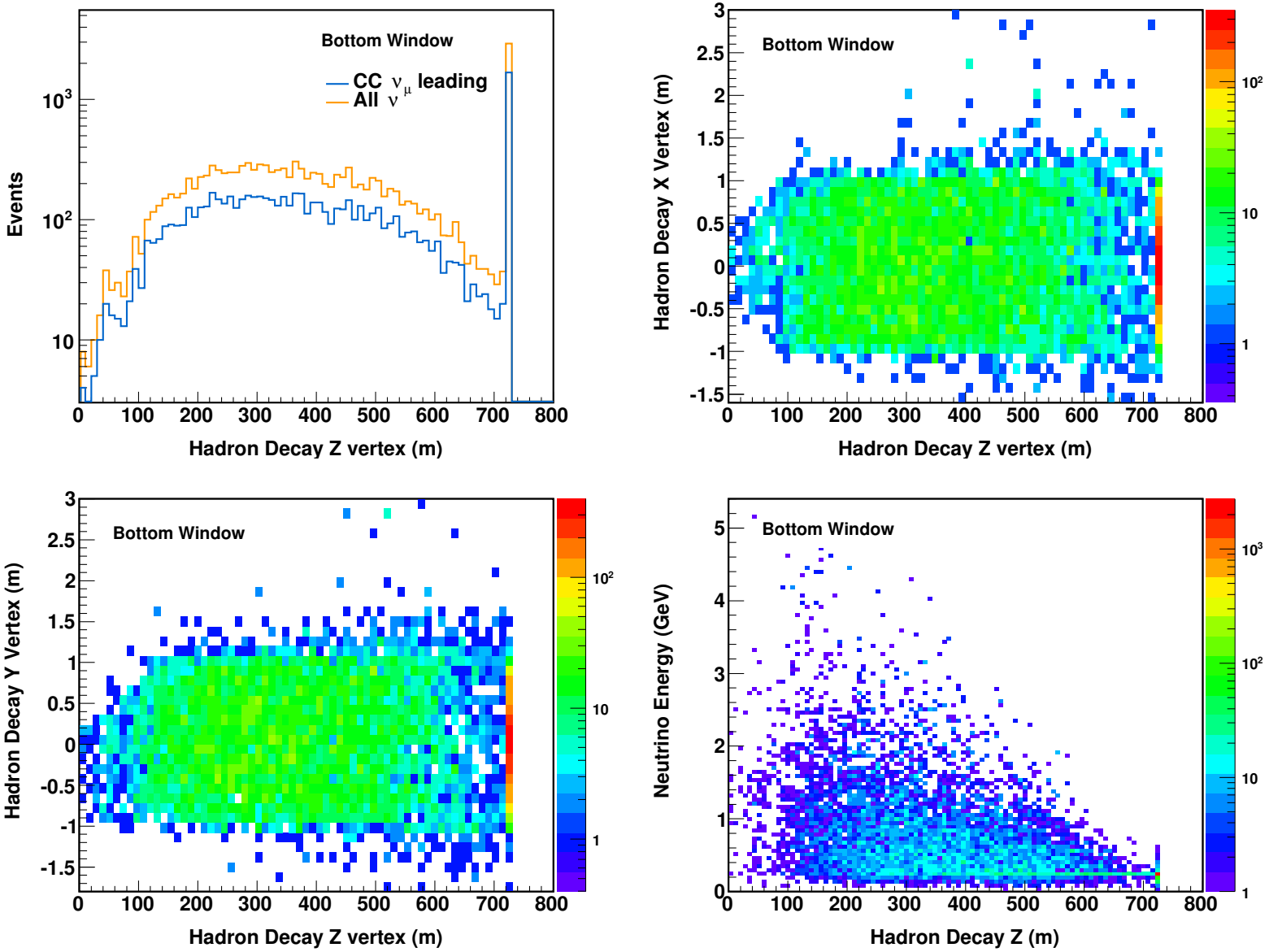






Some Early Monte Carlo Studies cont.

- Hadron decay vertex leading to neutrino interaction in MicroBooNE (NuMI coord.)



Summary

- Generating NuMI flux at MicroBooNE – Full Monte Carlo using NOvA `FLUGG` coming soon.
- NuMI studies in MicroBooNE are underway using `LArSoft`
- All windows to be studied
- Is there anything we can do/should we do anything with `g4numi`?