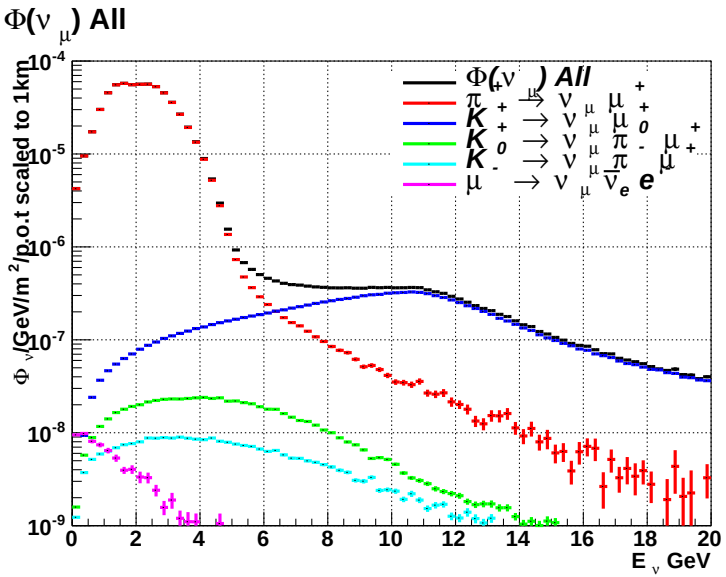
Neutrino Beam Flux in the ND and ND/FD Extrapolation

Mary Bishai

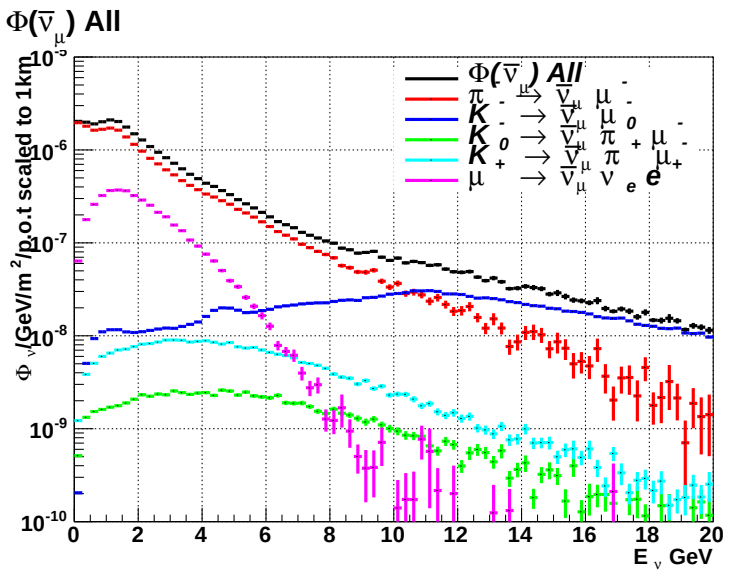
March 27, 2017

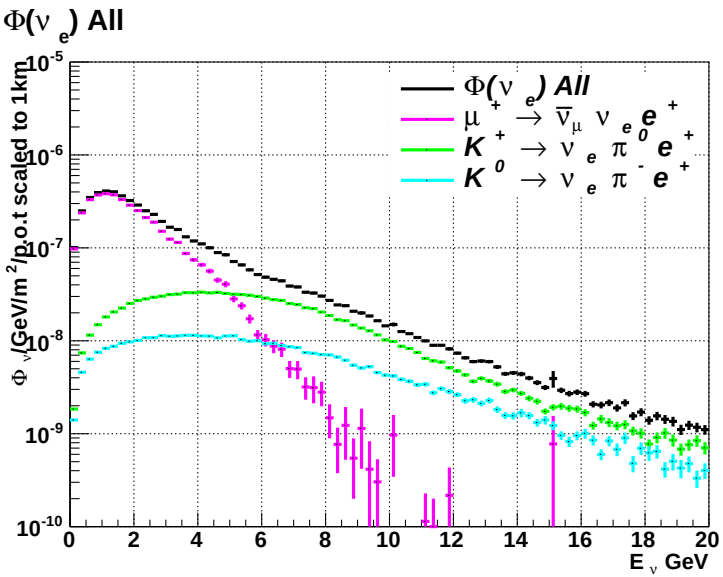
Flux Components in various ND locations



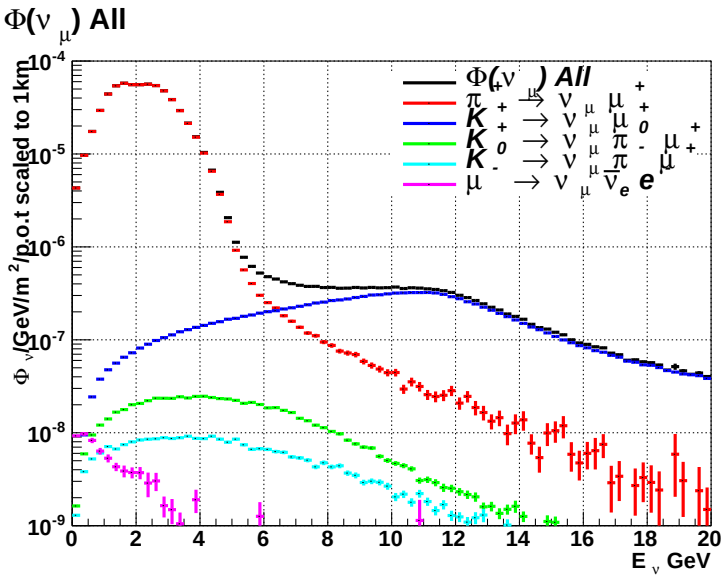
ND 360

Normalized to 1km using baseline as measured to middle of decay channel.



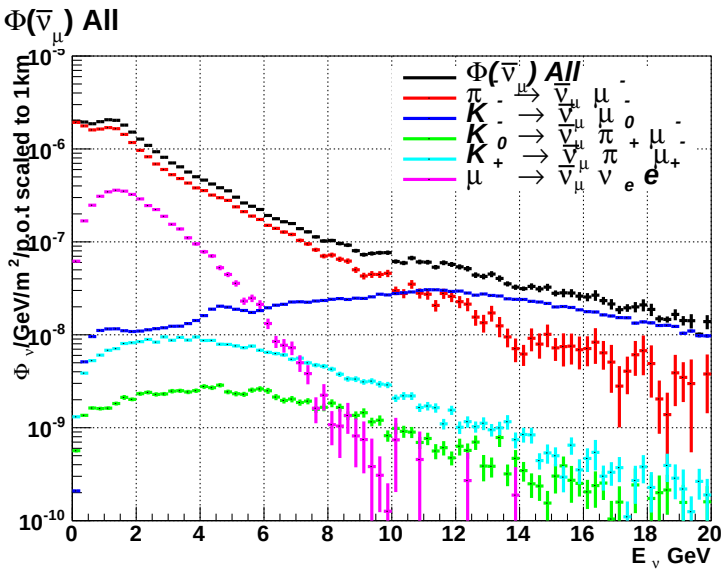


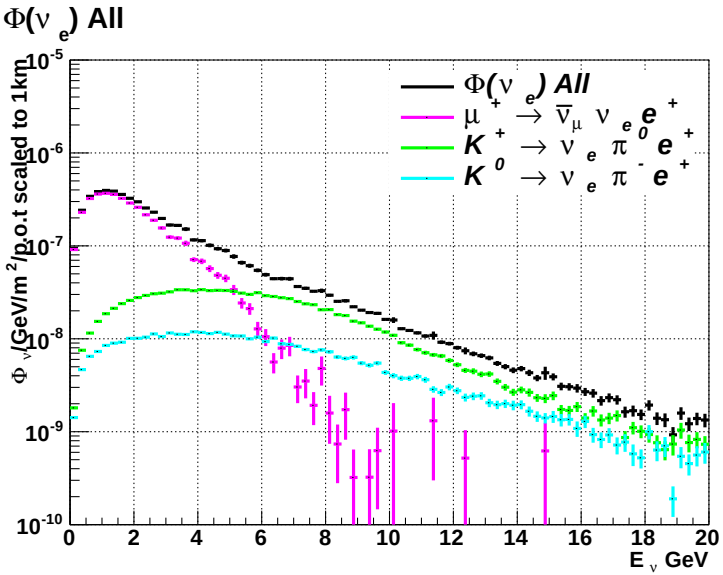
Flux Components in various ND locations



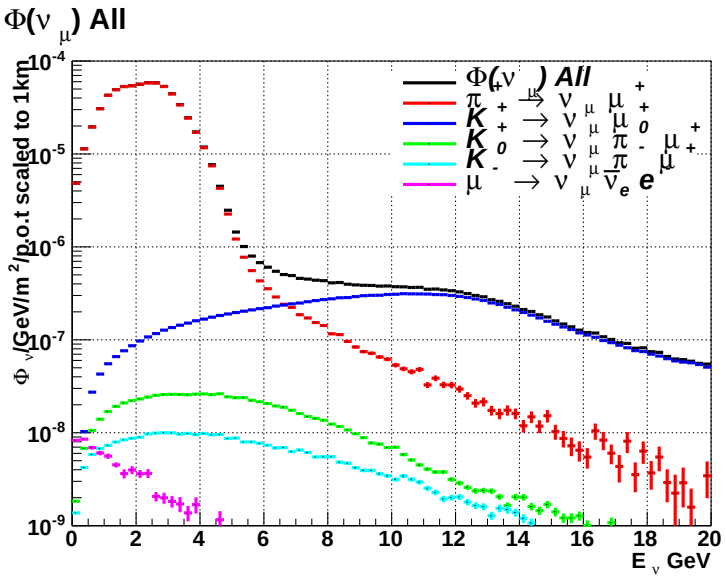
ND 380

Normalized to 1km using baseline as measured to middle of decay channel.



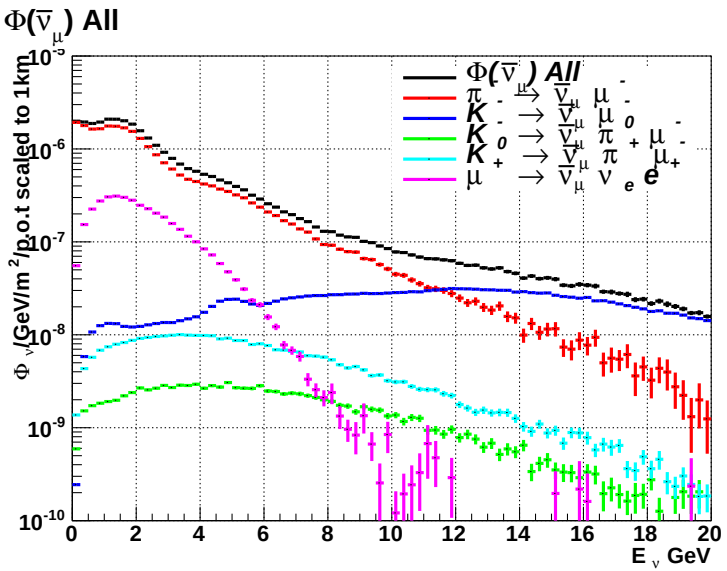


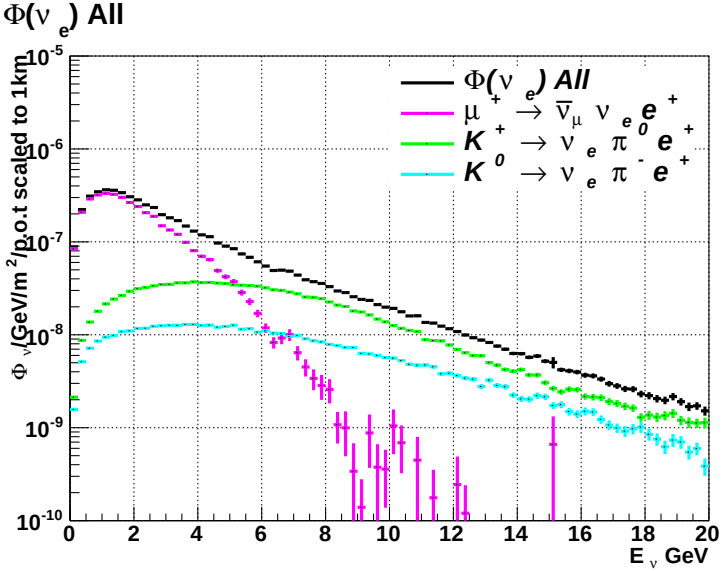
Flux Components in various ND locations



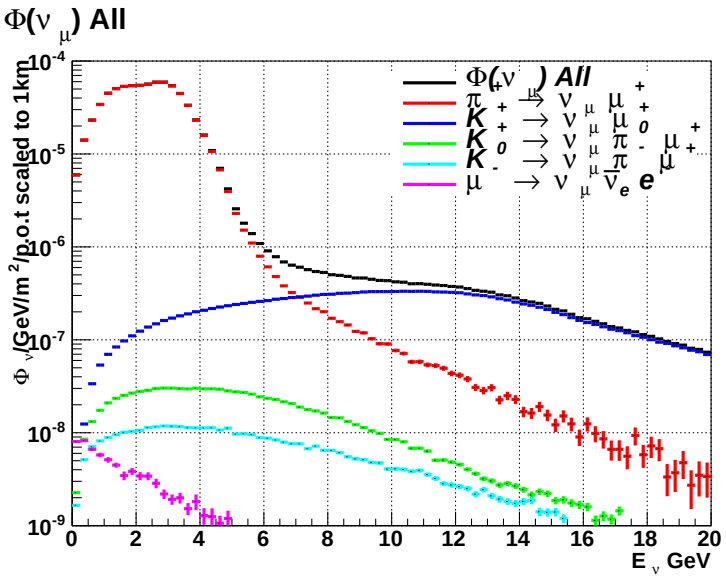
ND 570

Normalized to 1km using baseline as measured to middle of decay channel.



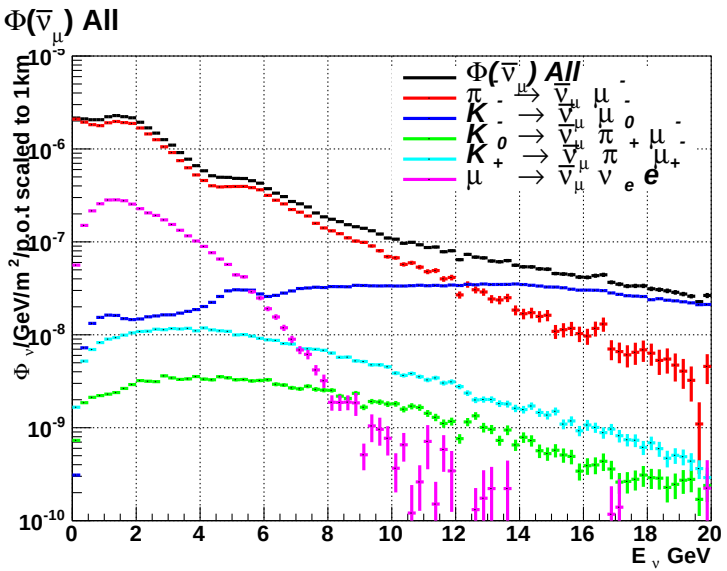


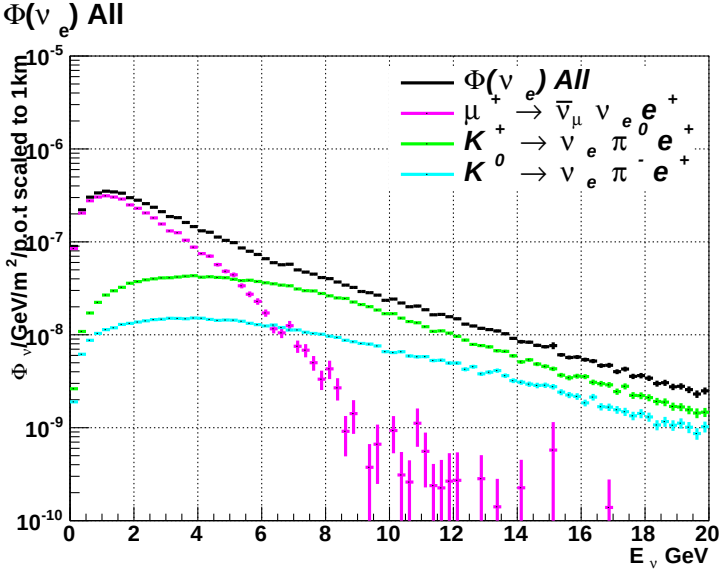
Flux Components in various ND locations



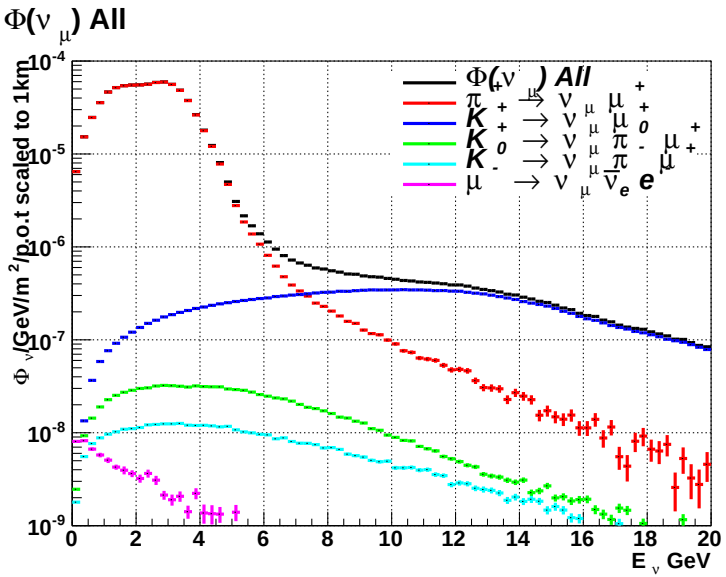
ND 2km

Normalized to 1km using baseline as measured to middle of decay channel.



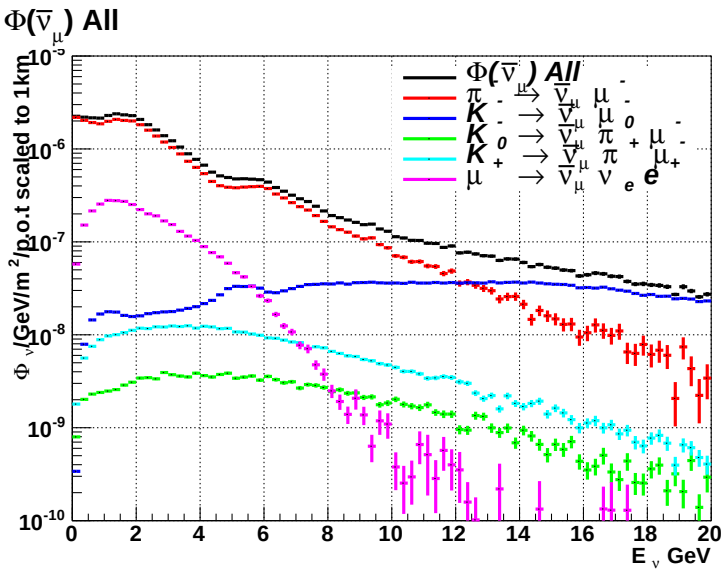


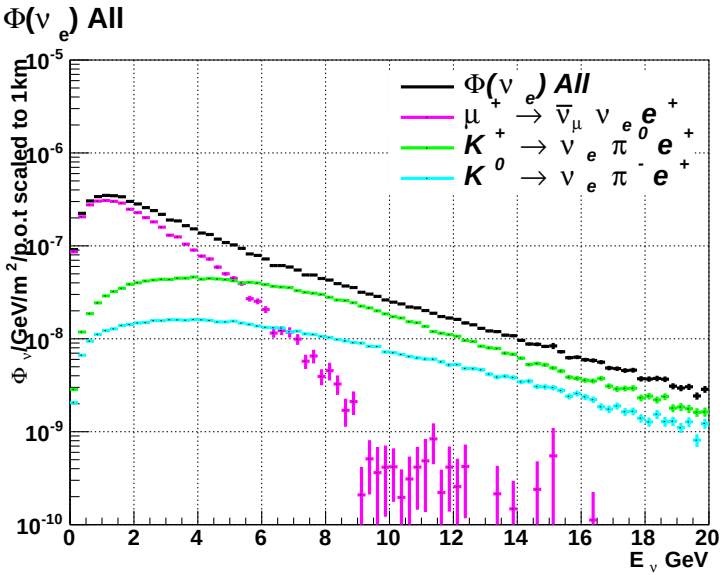
Flux Components in various ND locations



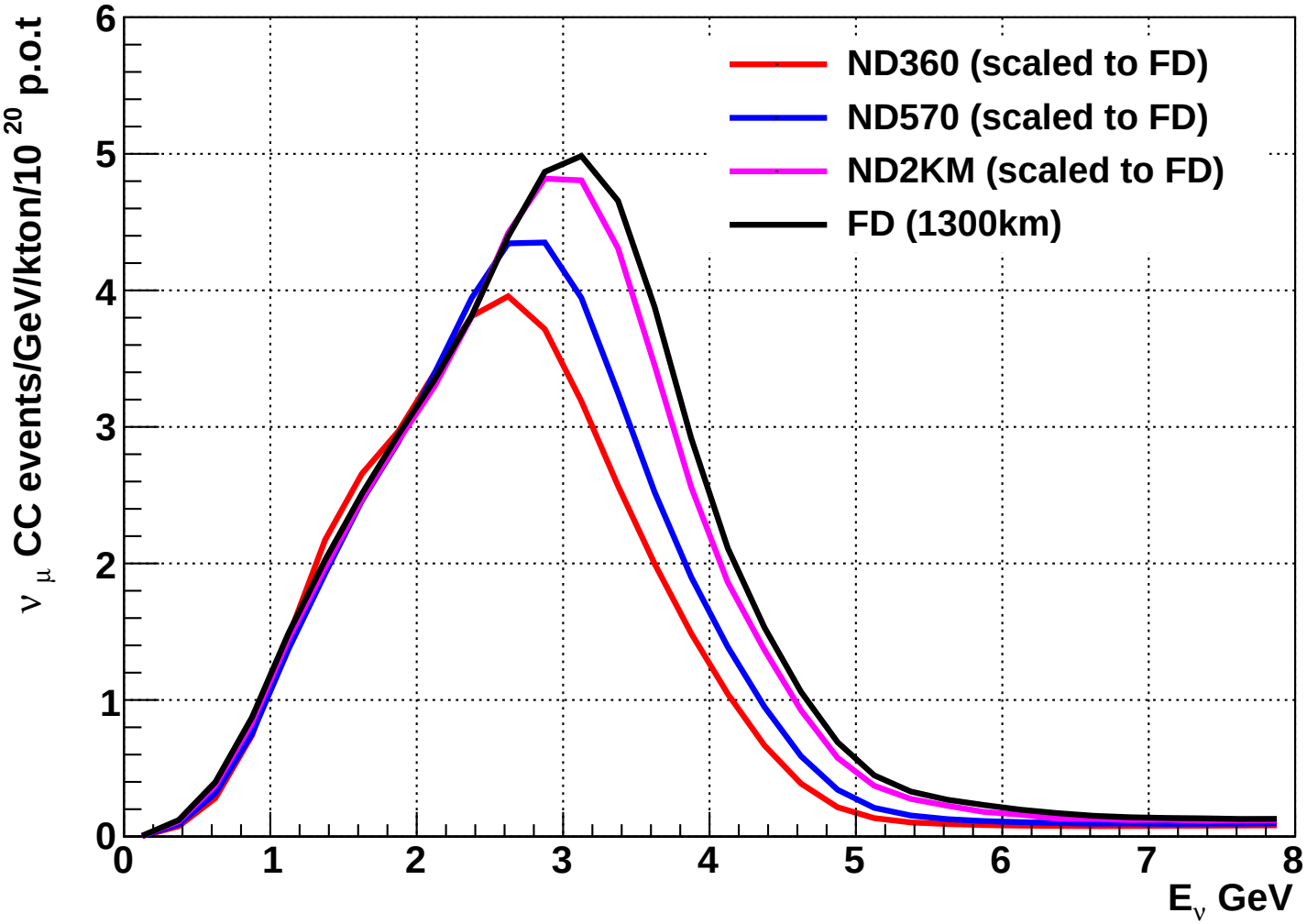
FD 1300km

Normalized to 1km using baseline as measured to middle of decay channel.



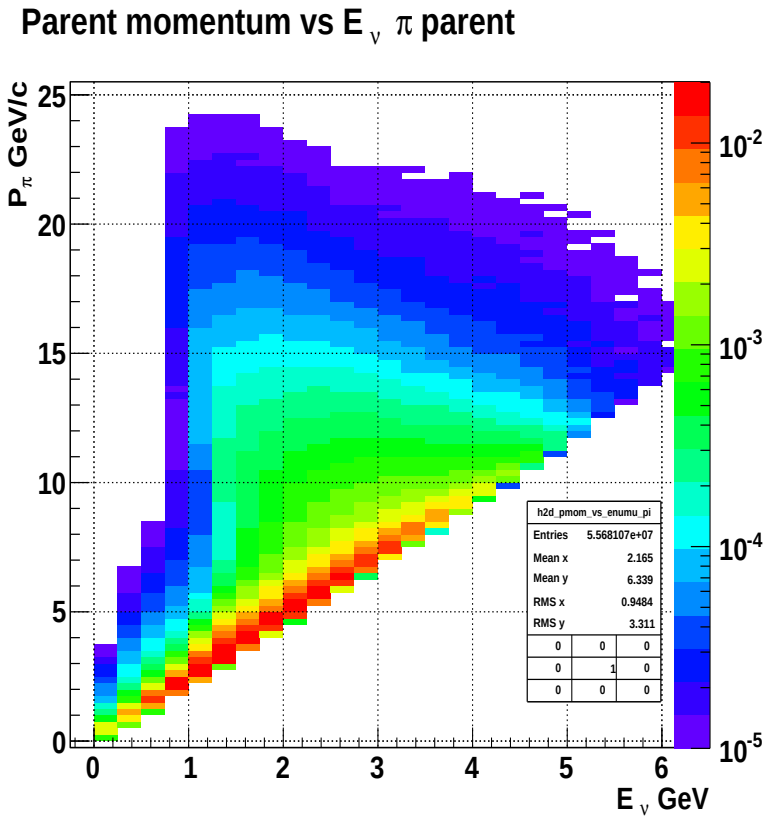


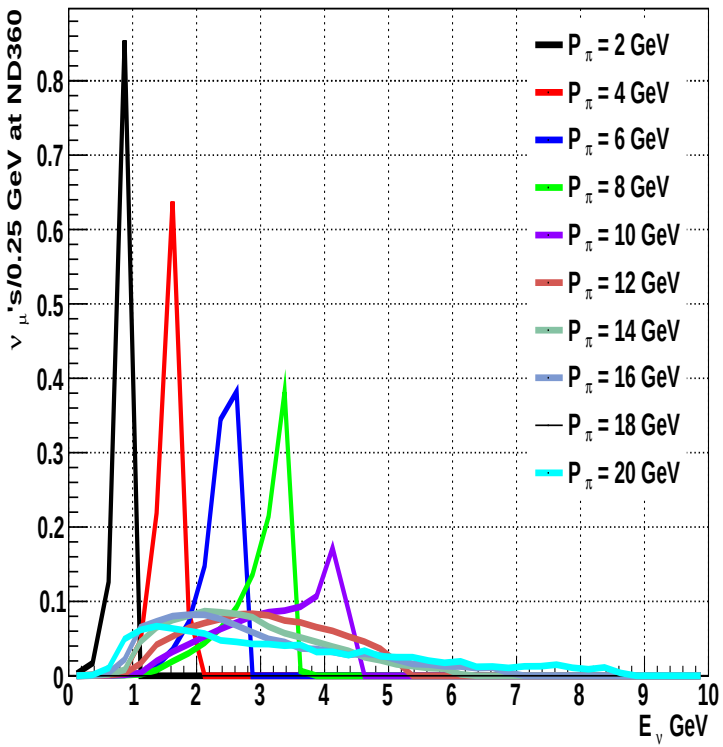
Flux Components in various ND locations



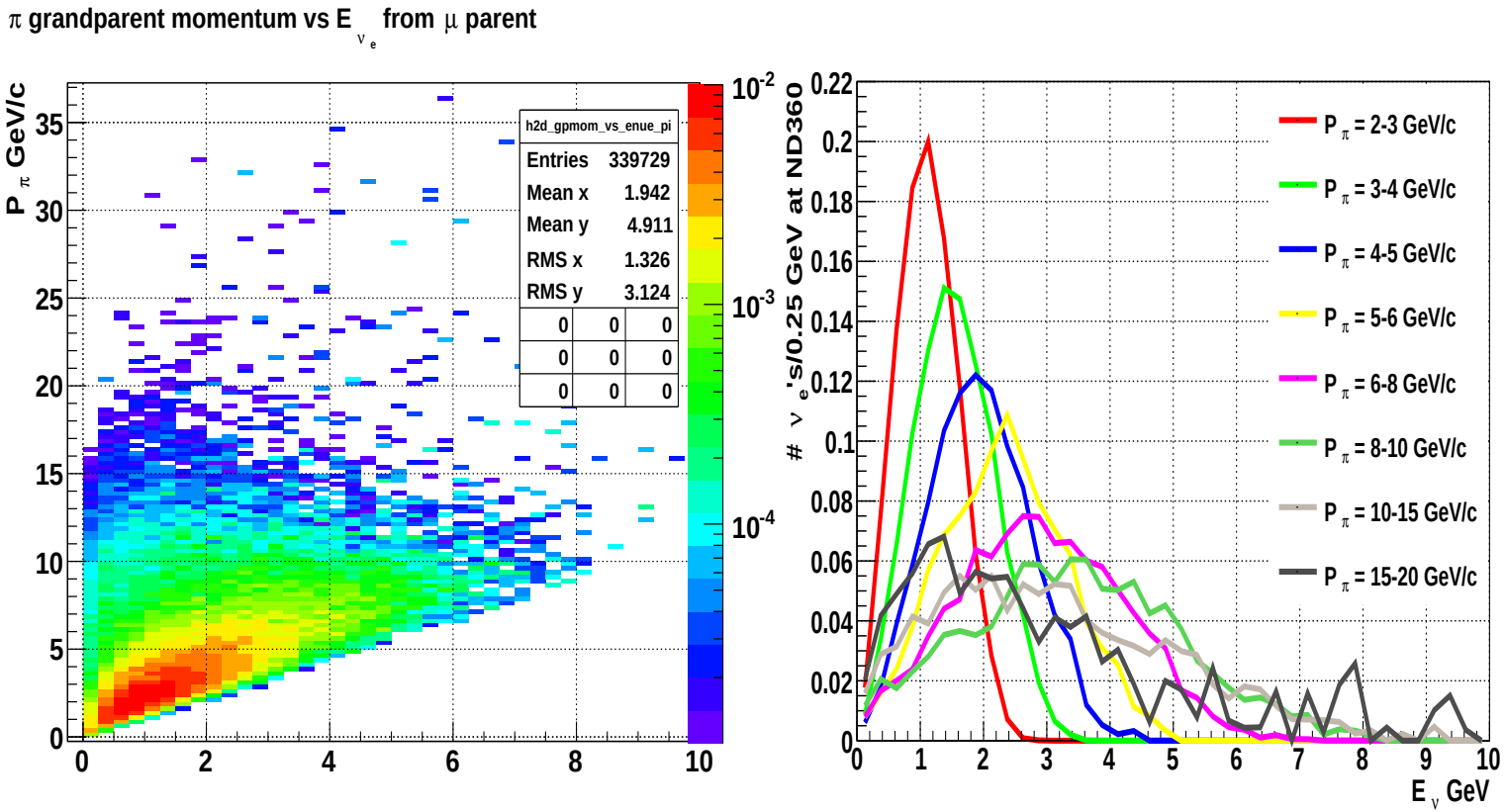
The ν_μ CC spectrum - BL scaled to FD from center of decay channel

Parent π Momentum vs ν Momentum at ND574

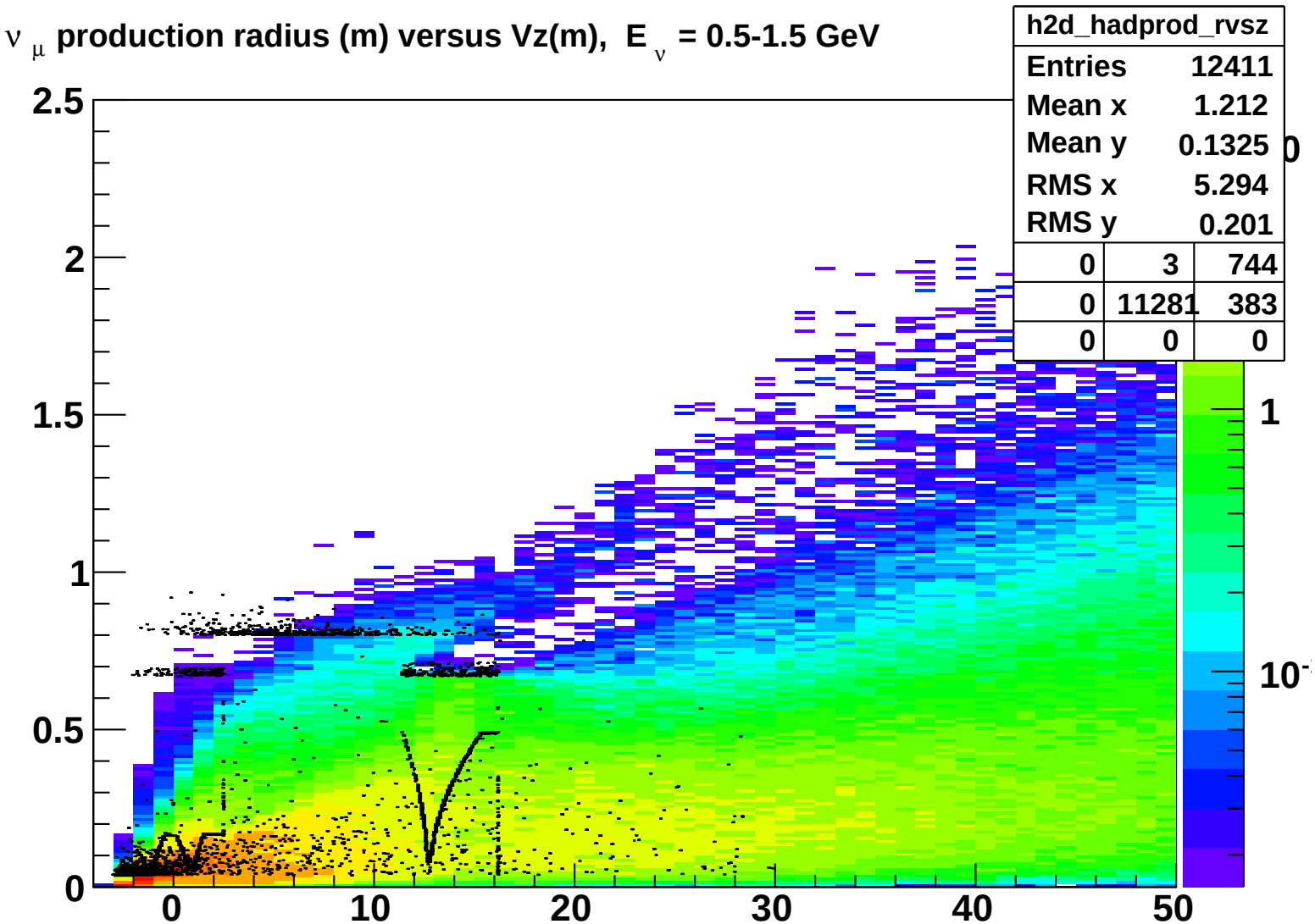




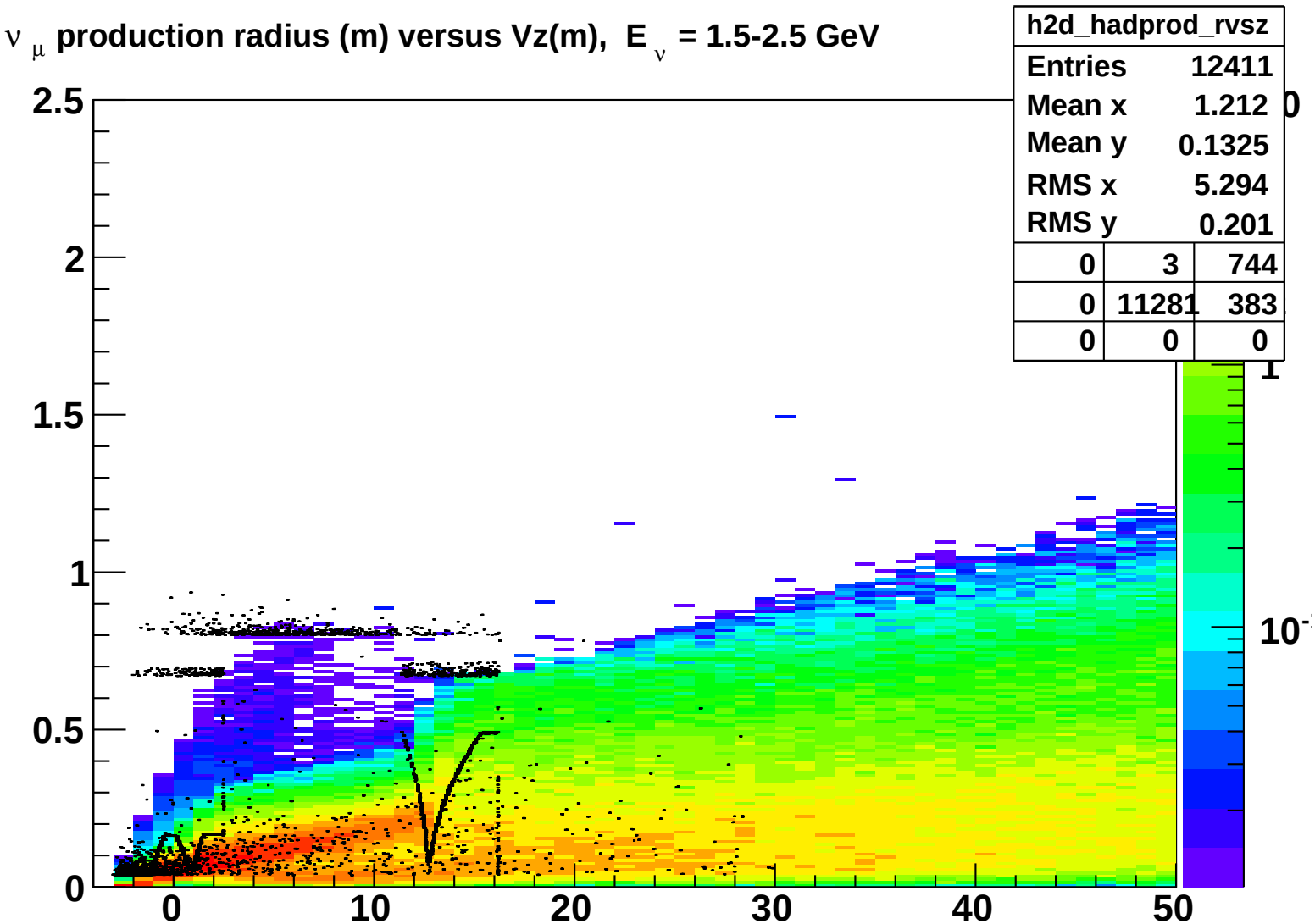
Parent π Momentum vs ν Momentum at ND574



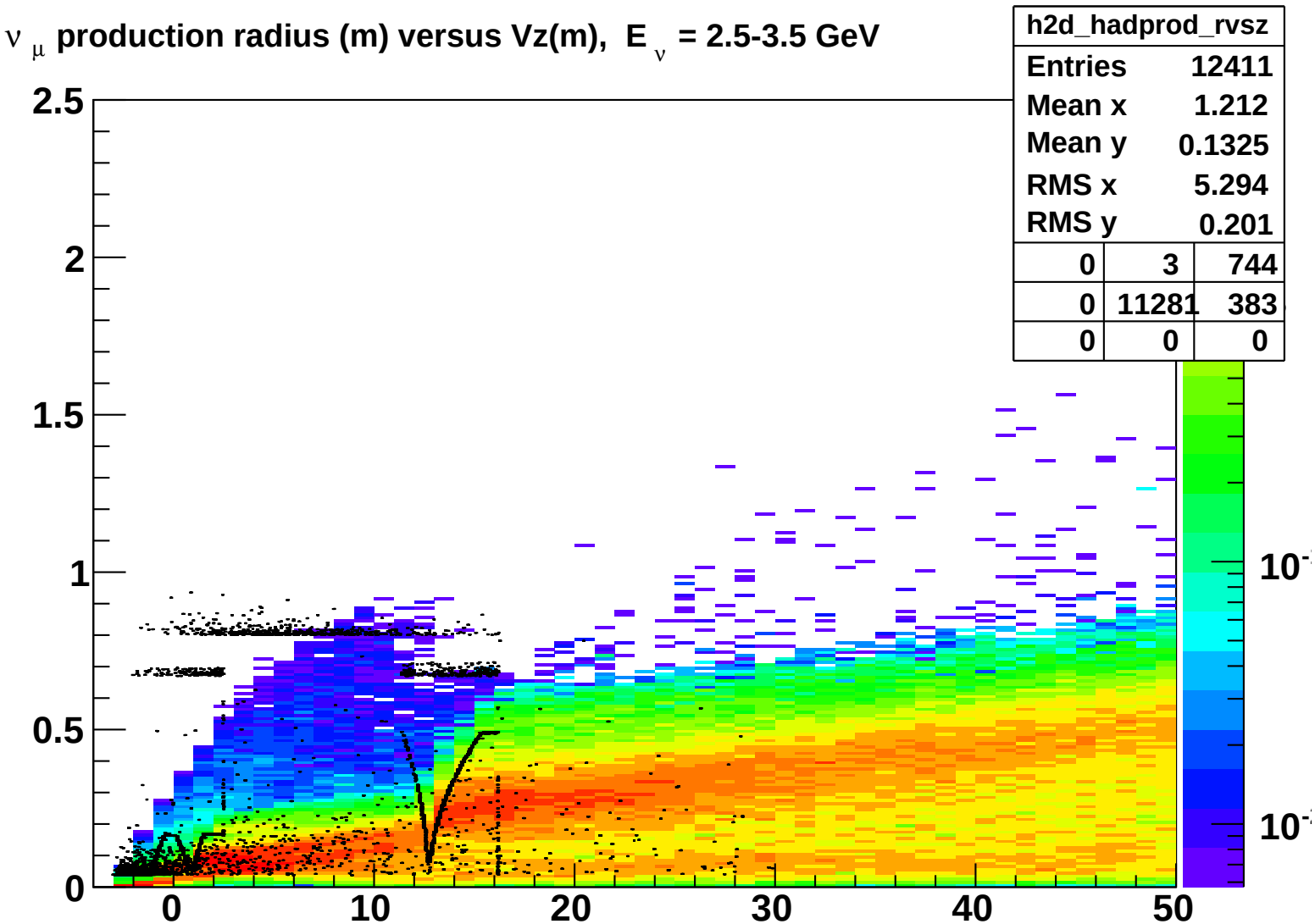
Origin of Neutrinos (ND570)



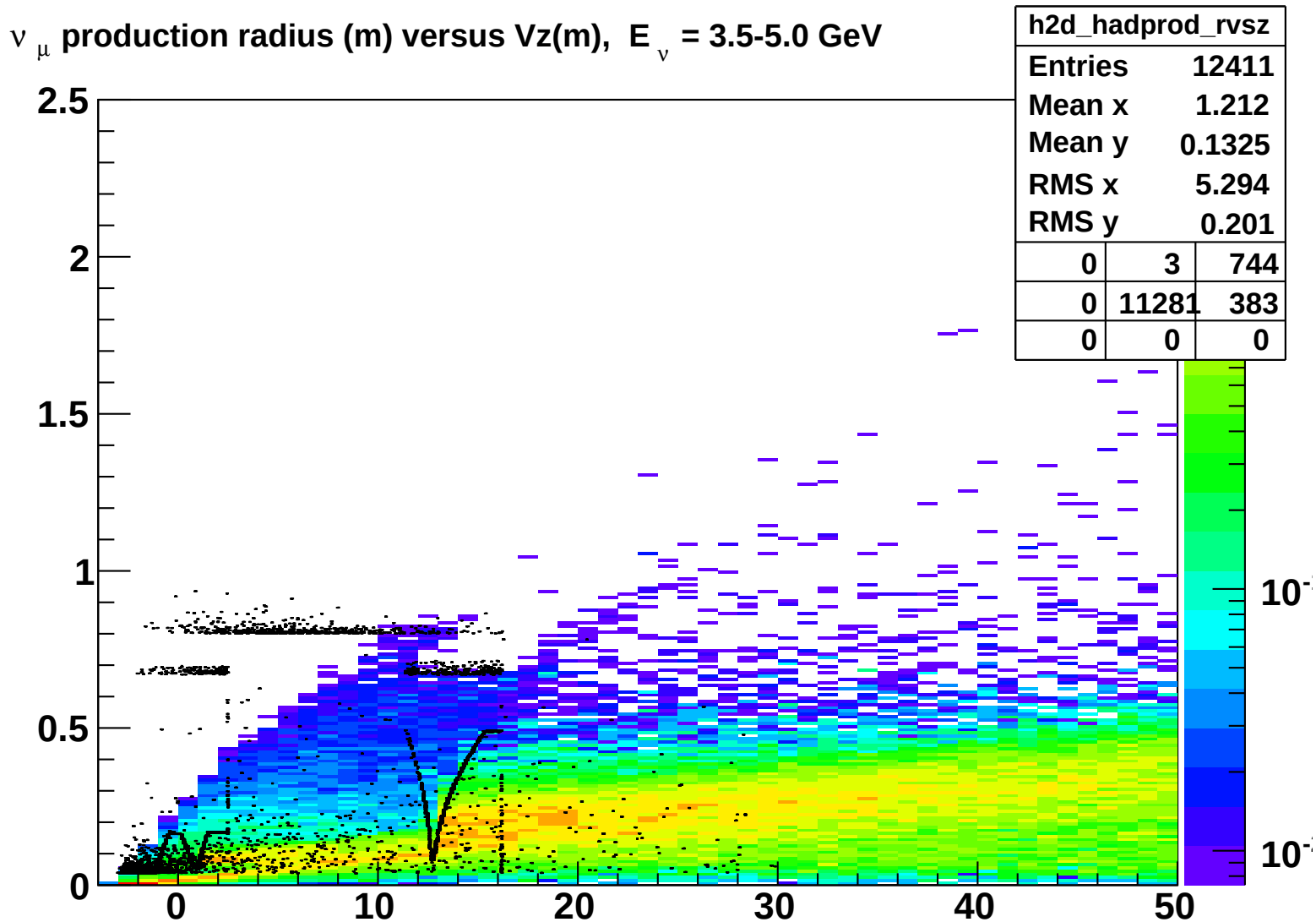
Origin of Neutrinos (ND570)



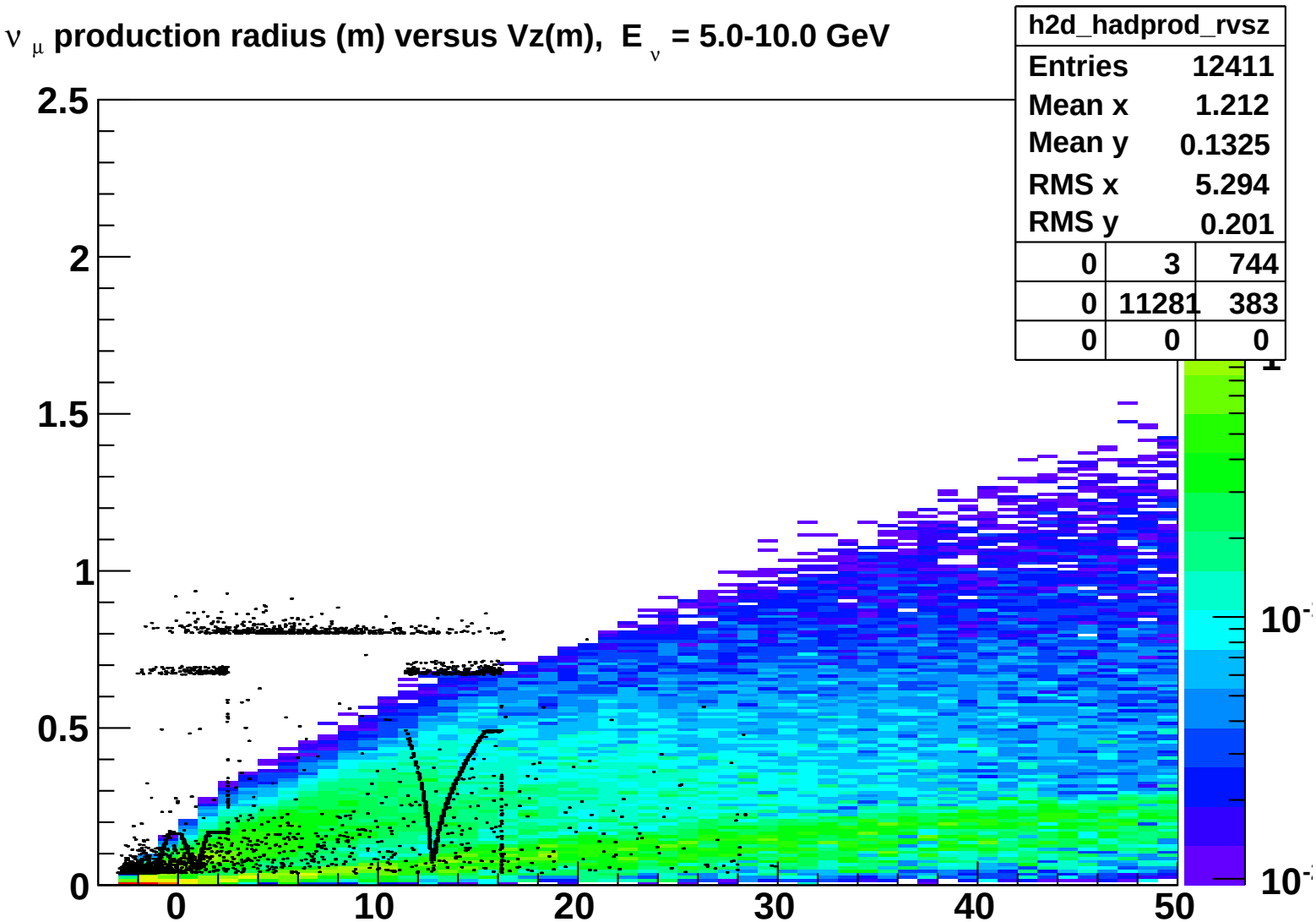
Origin of Neutrinos (ND570)



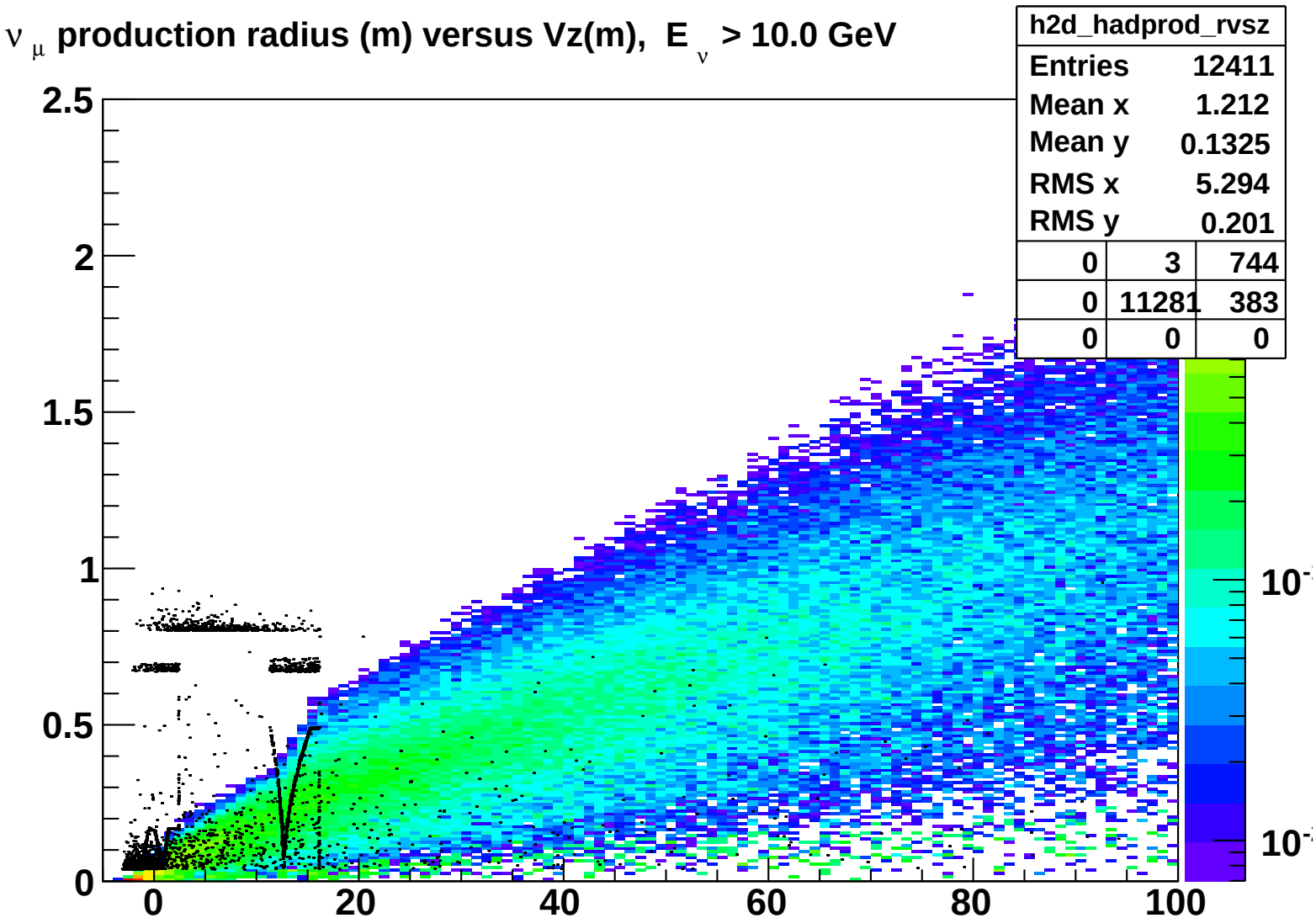
Origin of Neutrinos (ND570)



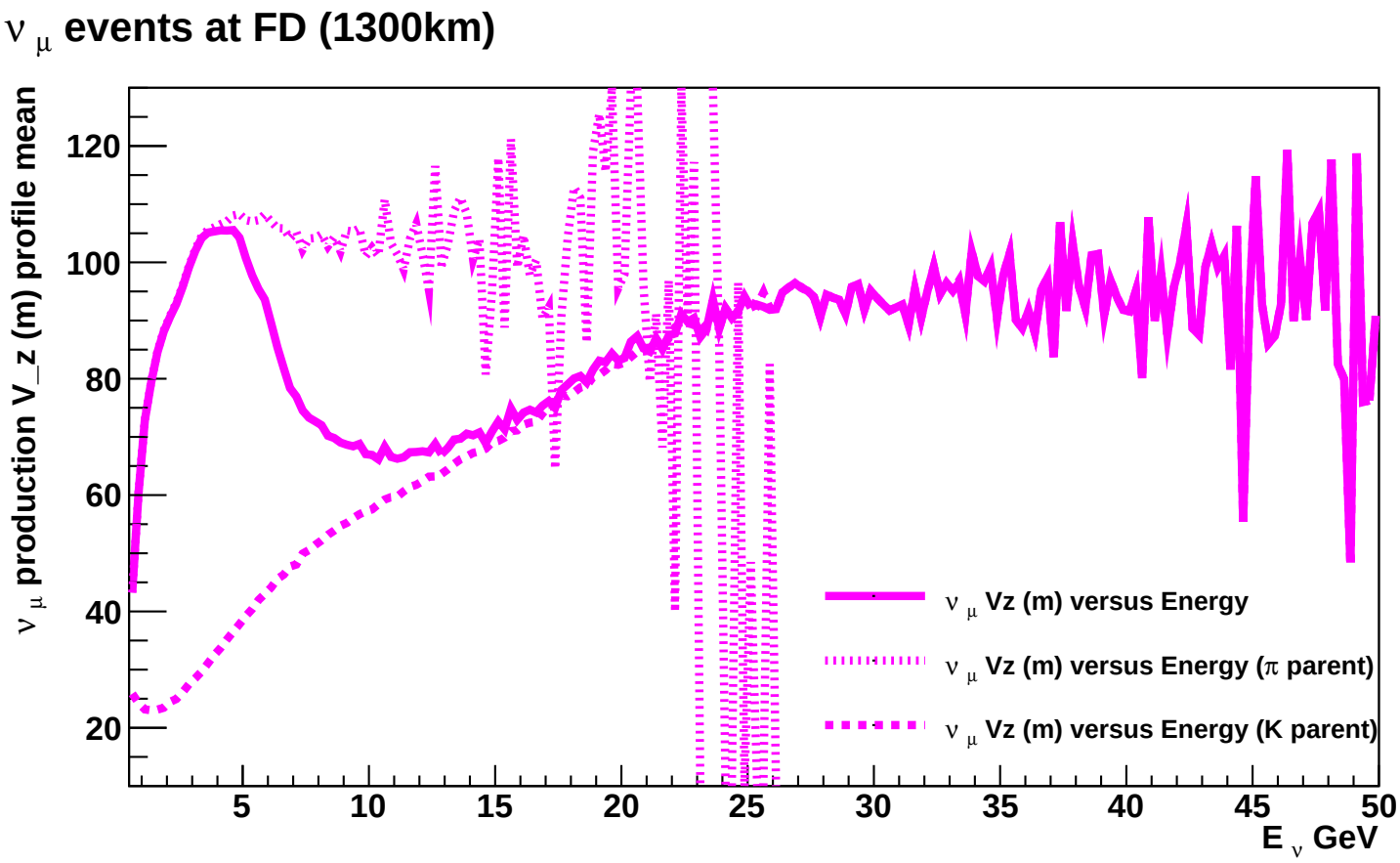
Origin of Neutrinos (ND570)



Origin of Neutrinos (ND570)

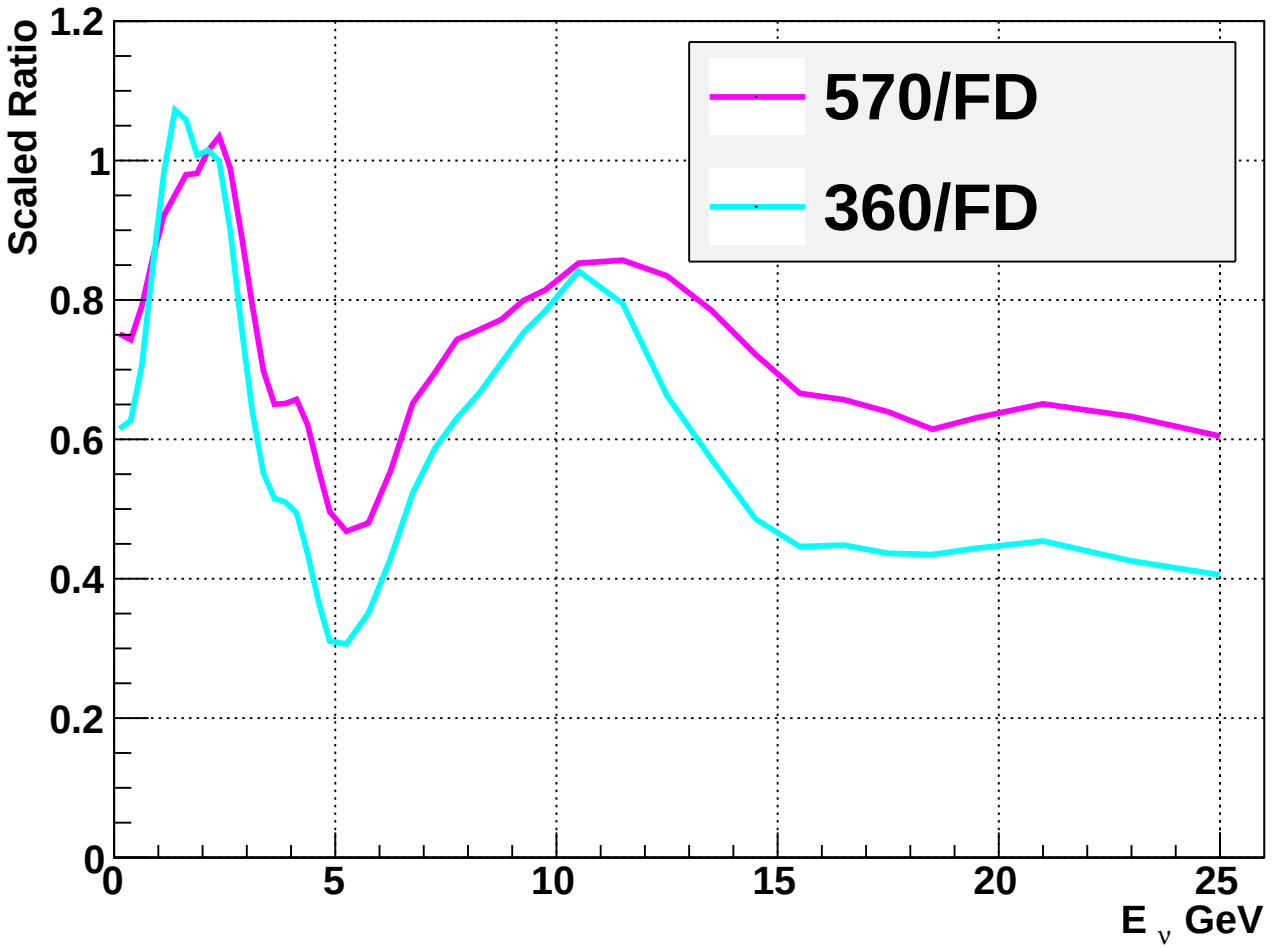


Profile of ν Z decay location (1300km)



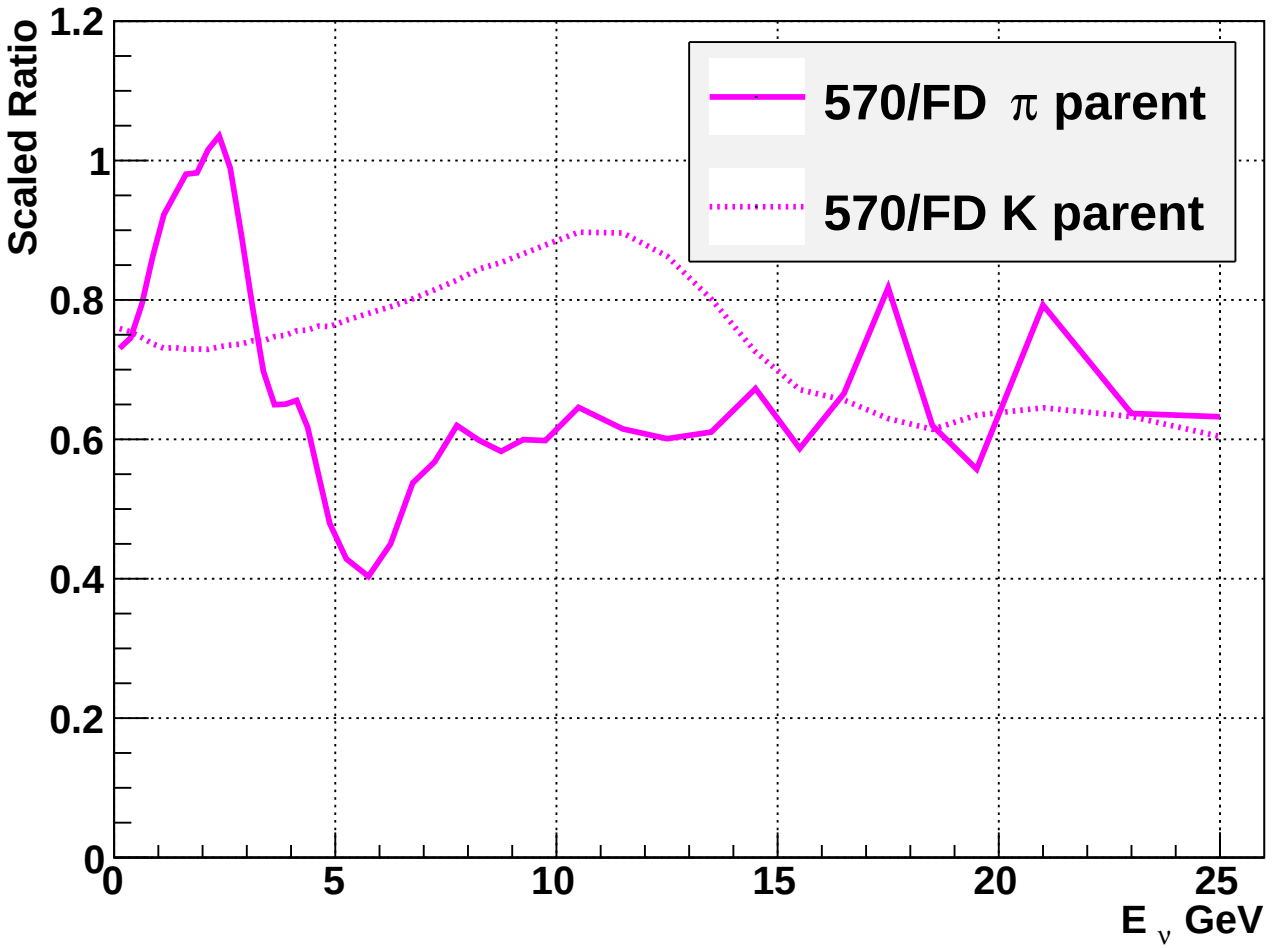
Center of decay channel is at $Z \sim 110$m.

N/F Ratios at Various Locations



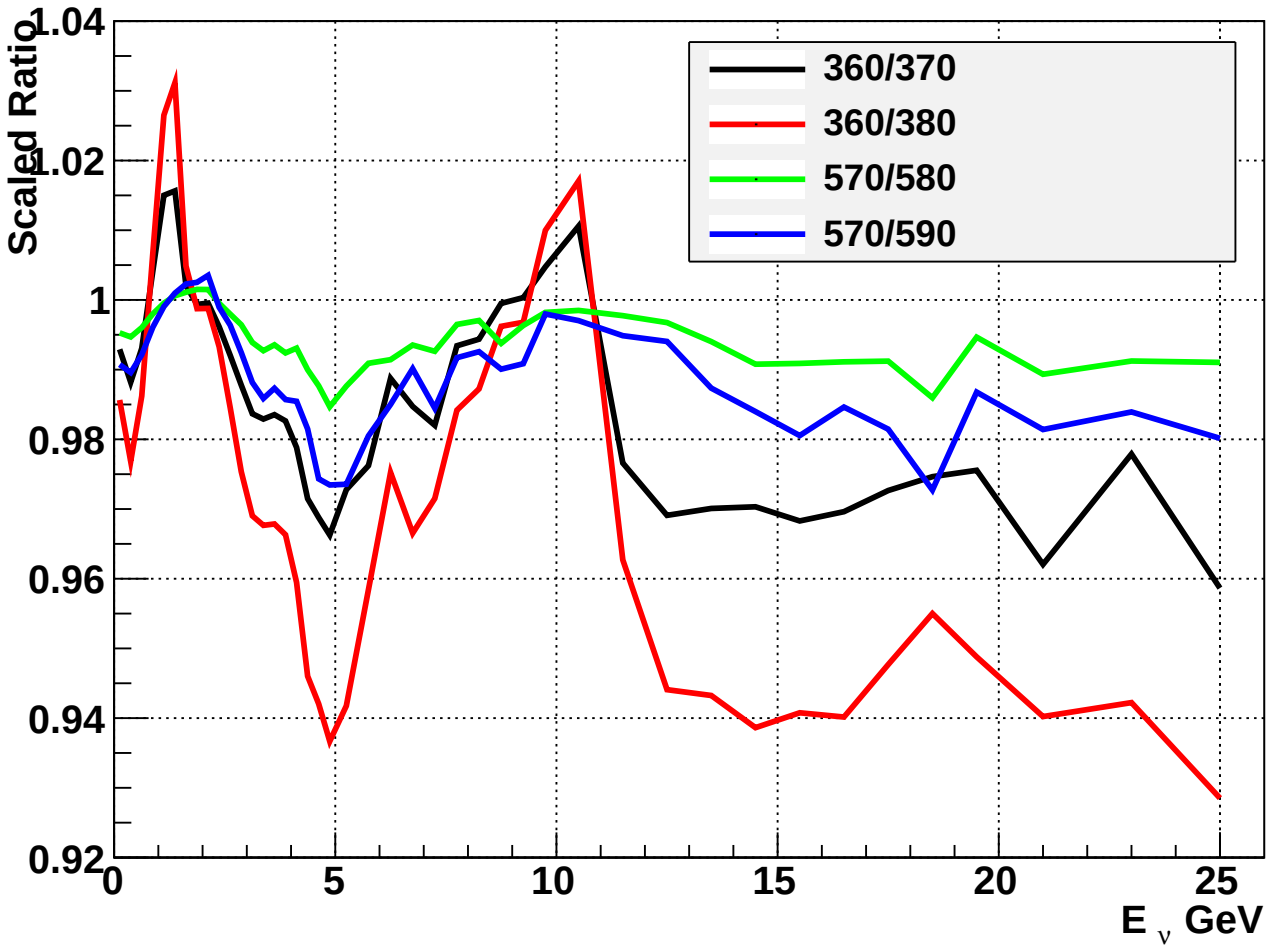
BL scaled from center of decay channel ($\sim$ 110m).

N/F Ratios at Various Locations



0-5 GeV N/F dominated by π. $>$ 10*GeV* dominated by K^+

N/F Ratios at Various Locations

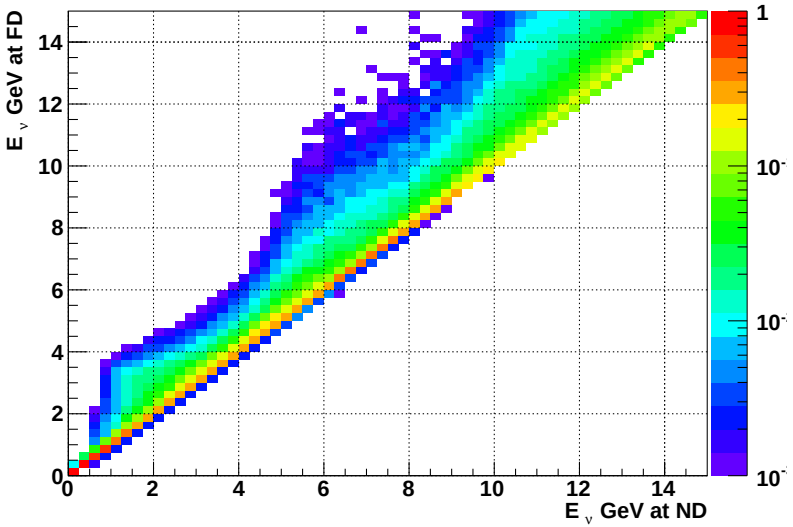


The same N/F effects on a smaller scale 10m apart

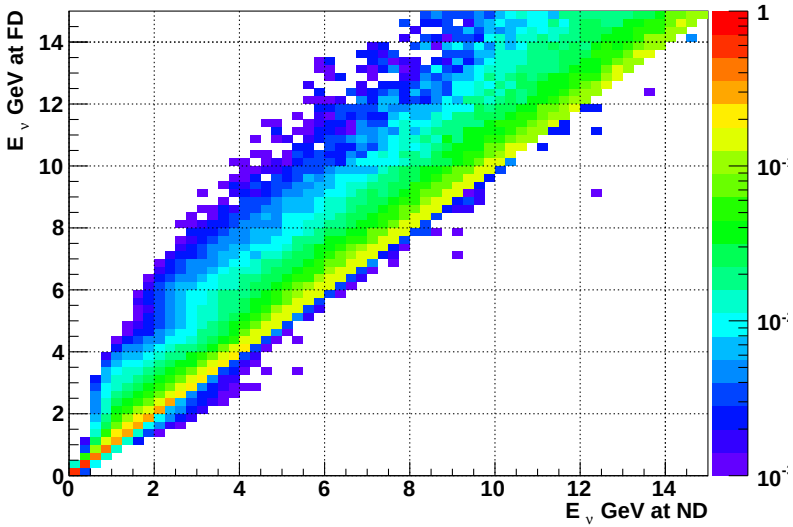
Beam Matrix: $\Phi_i^{FD} = \sum_j \underbrace{(\Phi_{ij}^{FD}/\Phi_j^{ND})}_{\text{Beam Matrix}} \Phi_j^{ND}$

ND360

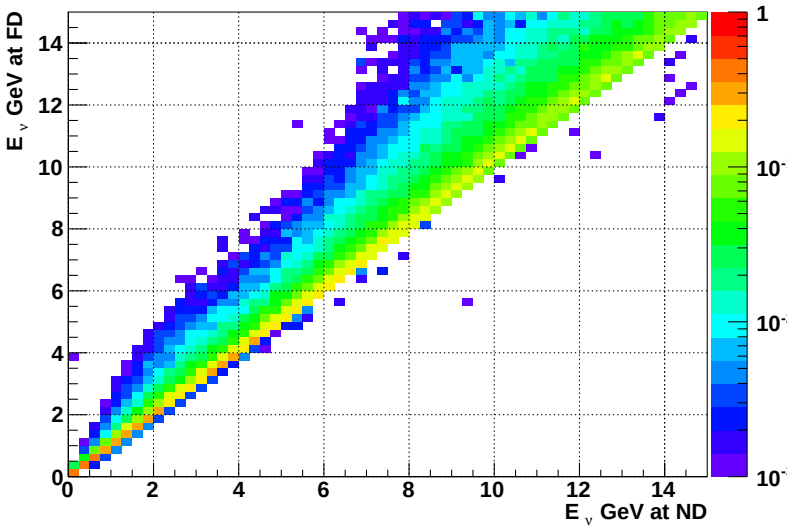
Normalized FD/ND ν_μ flux ratio



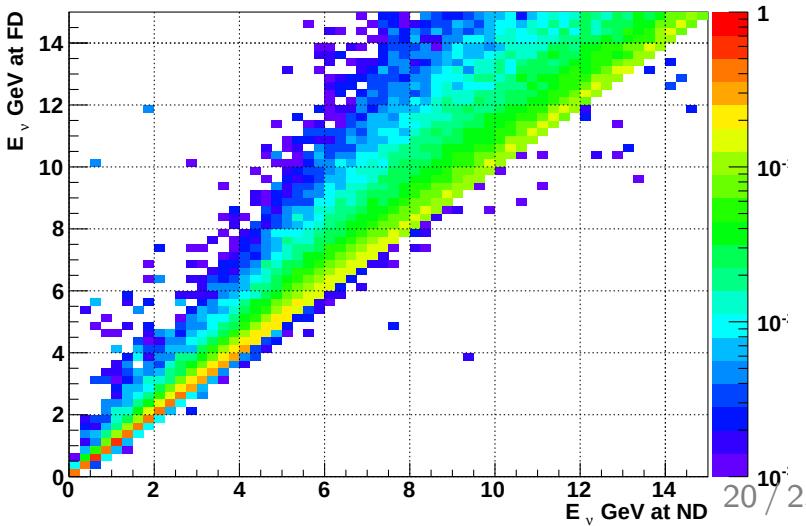
Normalized FD/ND $\bar{\nu}_\mu$ flux ratio



Normalized FD/ND ν_e flux ratio

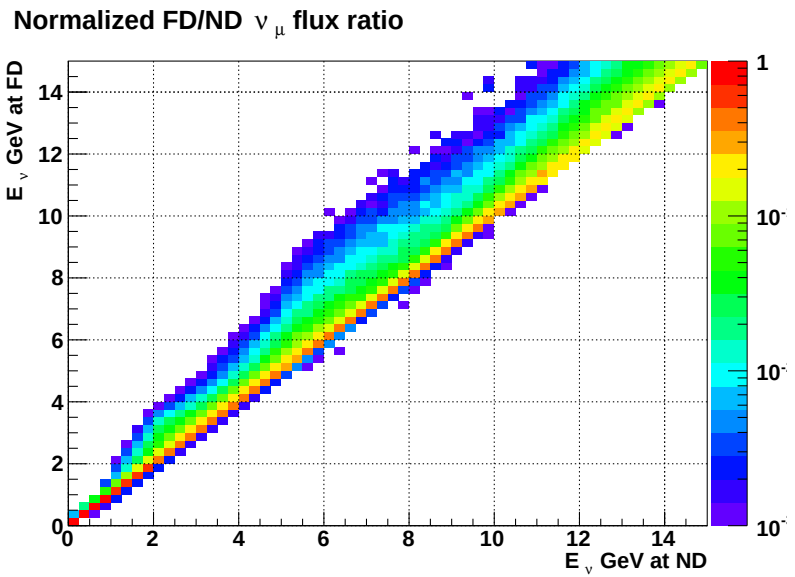


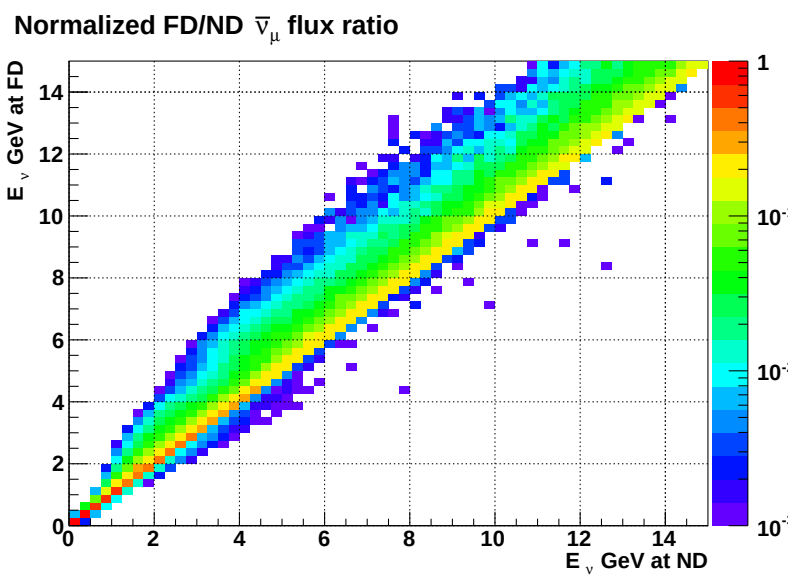
Normalized FD/ND $\bar{\nu}_e$ flux ratio

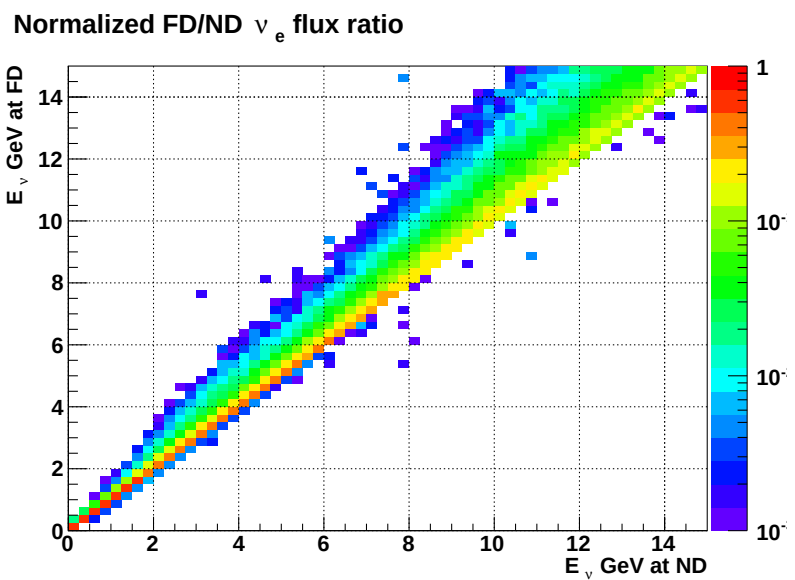


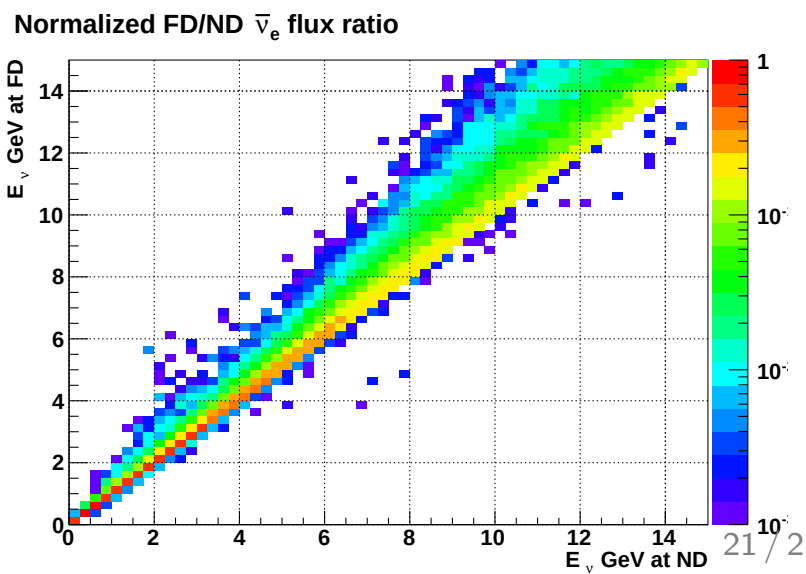
Beam Matrix: $\Phi_i^{FD} = \sum_j \underbrace{(\Phi_{ij}^{FD}/\Phi_j^{ND})}_{\text{Beam Matrix}} \Phi_j^{ND}$

ND570





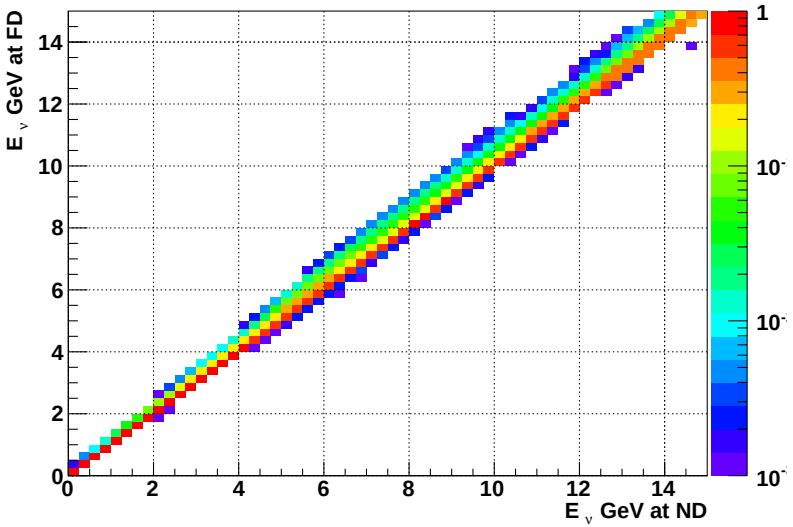




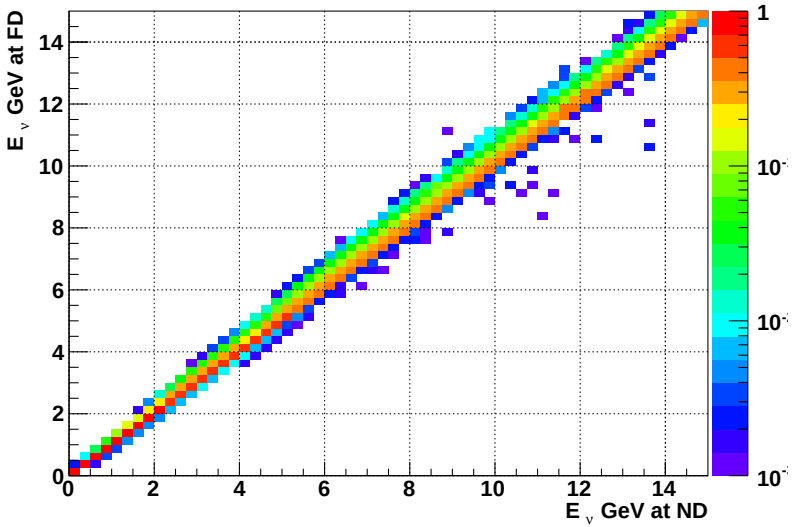
Beam Matrix: $\Phi_i^{FD} = \sum_j \underbrace{(\Phi_{ij}^{FD}/\Phi_j^{ND})}_{\text{Beam Matrix}} \Phi_j^{ND}$

ND2km

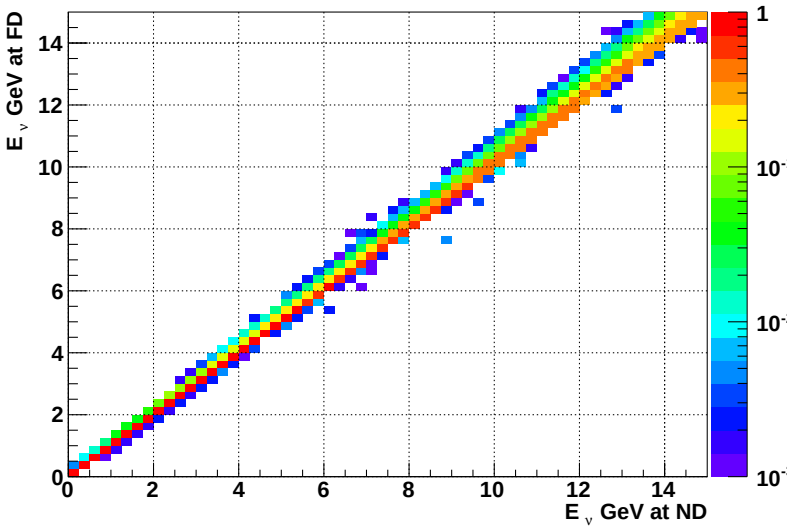
Normalized FD/ND ν_μ flux ratio



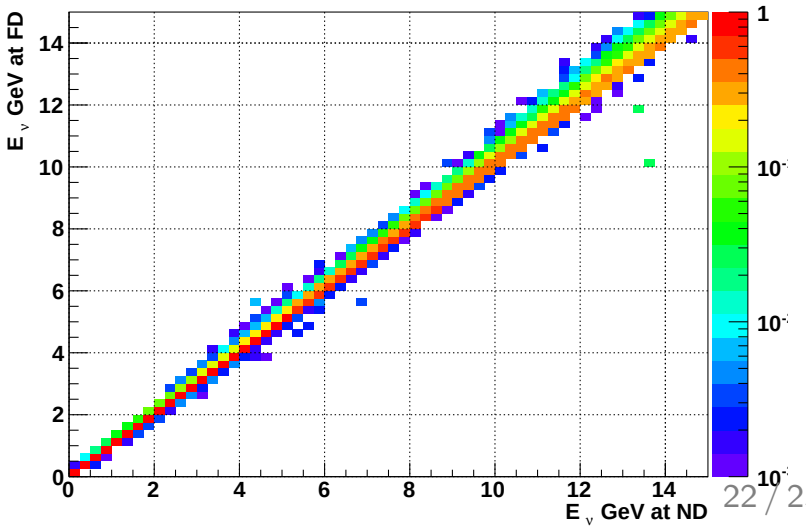
Normalized FD/ND $\bar{\nu}_\mu$ flux ratio



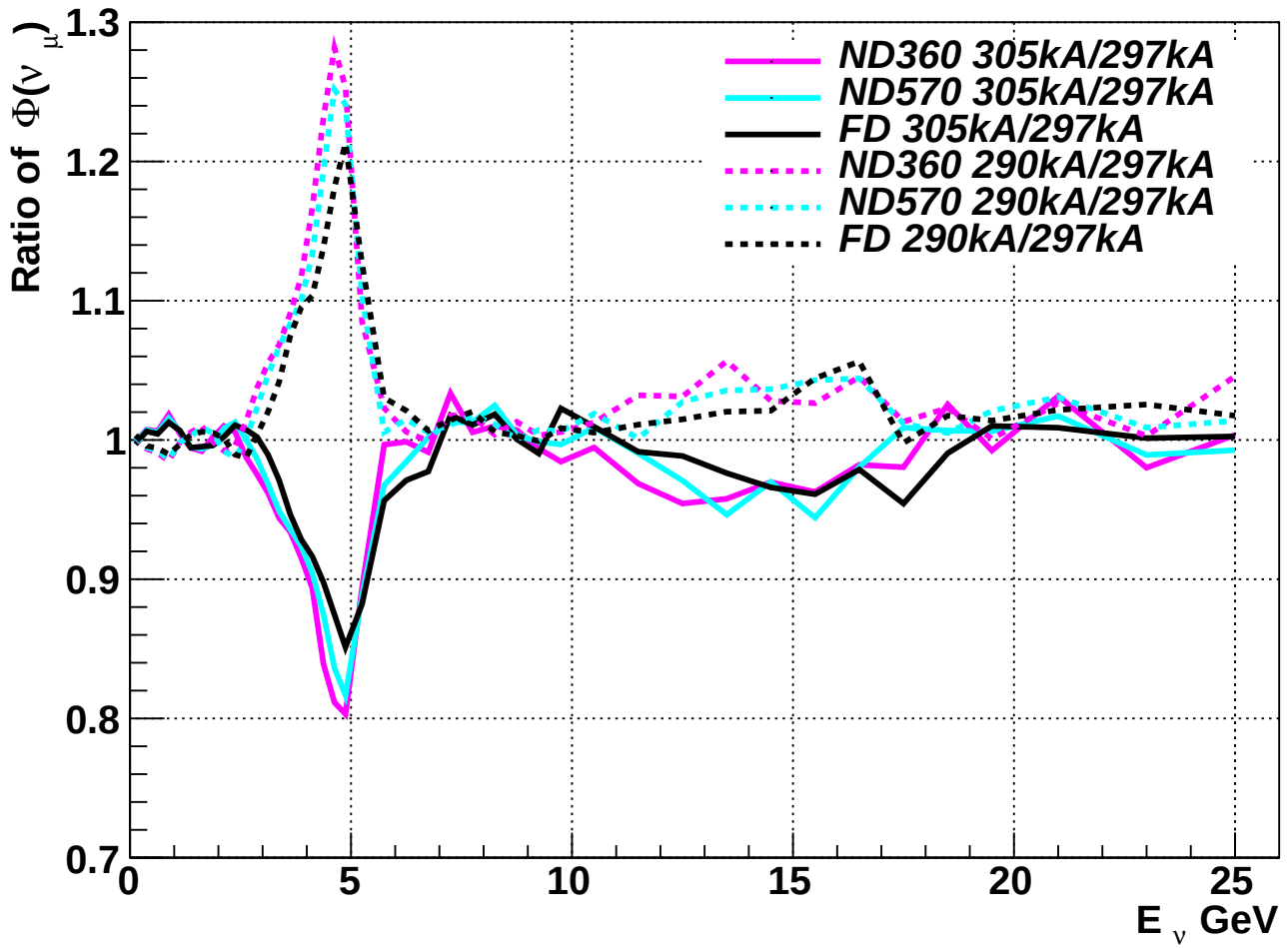
Normalized FD/ND ν_e flux ratio



Normalized FD/ND $\bar{\nu}_e$ flux ratio

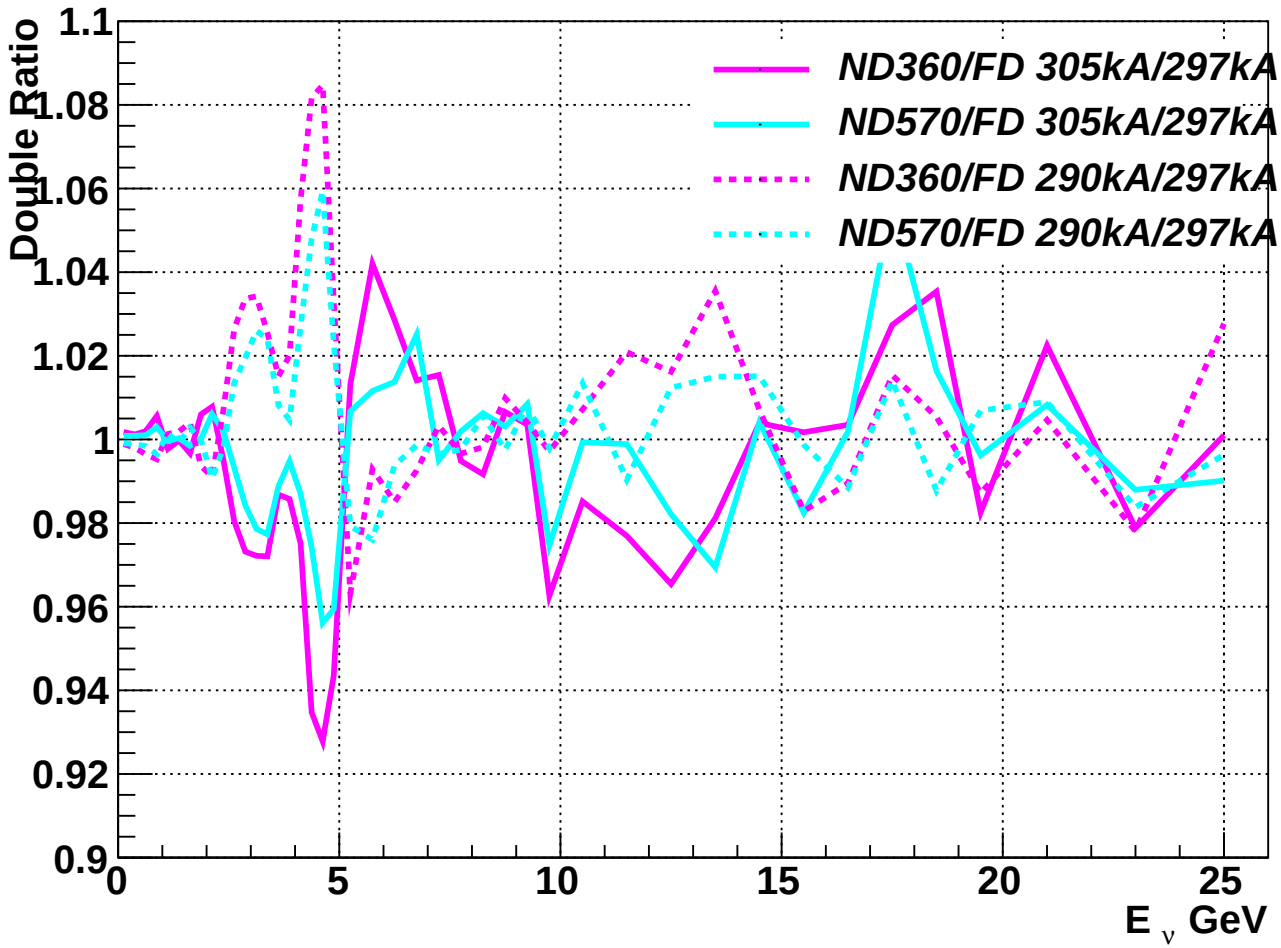


Vary Horn Current



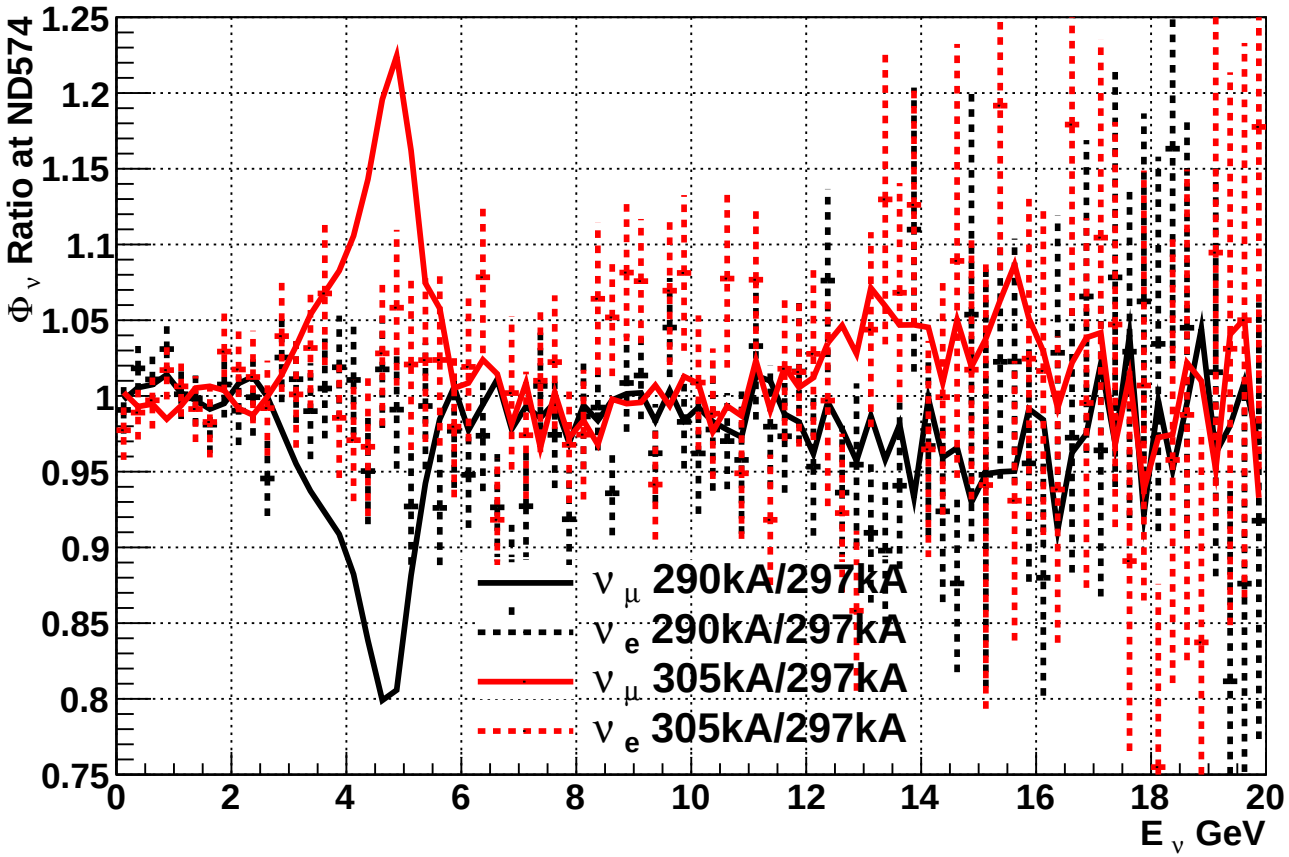
The nearer the detector - the *more sensitive* to focusing effects

Vary Horn Current



Focusing effects have the smallest cancelation in N → F

Vary Horn Current



Focusing effects have smaller effects on $\Phi(\nu_e)$