SKZP for NOvA

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SKZP Weight-Calculator

- Re-weights events in the beam-line model to reflect best-fit parameters from MINOS running in a variety of beam configurations.
- Using this tuning procedure to look at the off-axis flux at NOvA from on-axis MINOS info.
- We can use this to re-weight the beamline model in light of NOvA data (when we get it.)

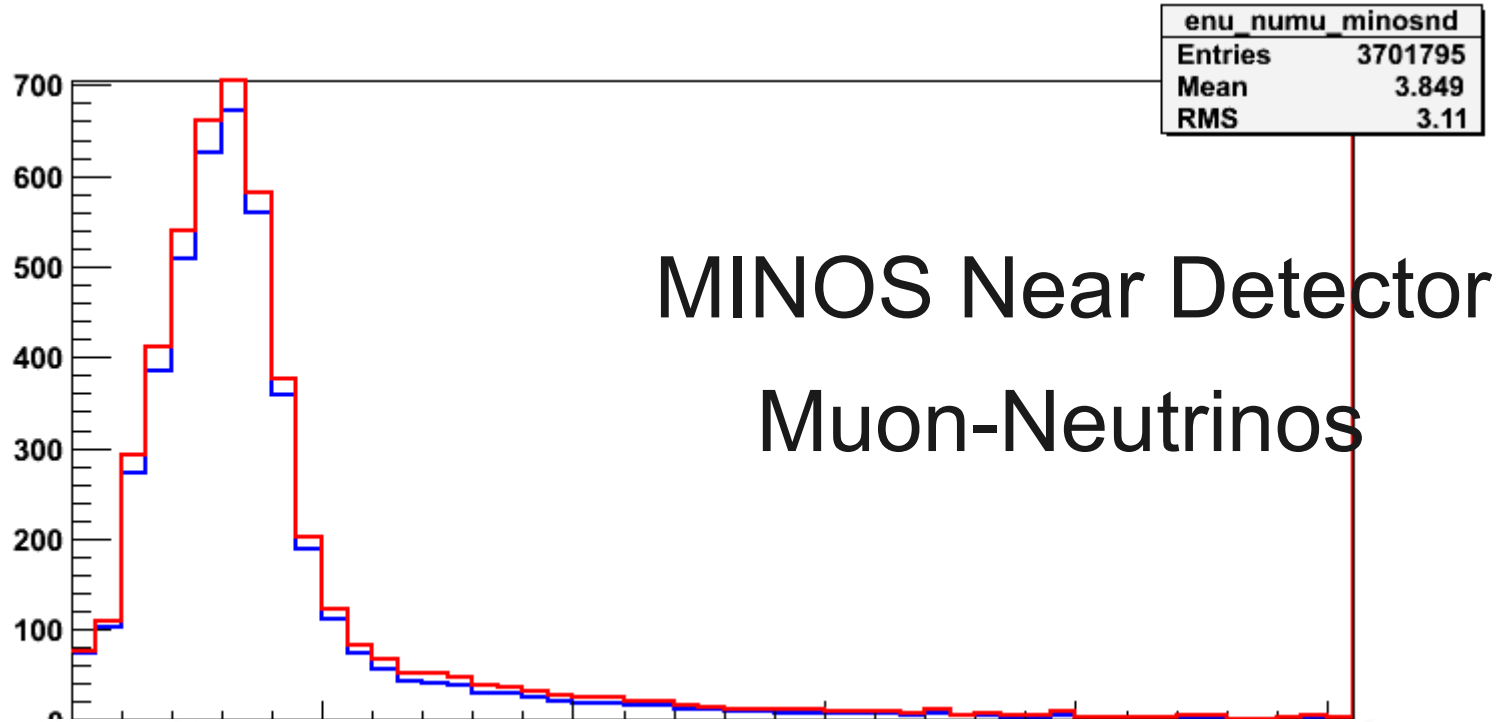
SKZPWeightCalculator:: GetBeamWeight()

- SKZP is in MCReweight Package for MINOS.
- SKZP weights are the product of three factors
- GetRunWeight() for target decay
- Zbeam::GetWeight() for uncertainties in focusing horn current calibration and modeling
- **Zfluk::GetWeight()** for uncertainties in hadron production rates.

Implementing Zfluk in NOvA

- I created **MCFlux::FlukReweight()** based off of Zfluk::GetWeight() for SKZP
- Zbeam isn't implemented yet, it will soon
- Histograms generated to compare tuned/weighted and untuned/unweighted
- Validate with Mark Dorman's “Beam Fit Position Paper” (minos doc-db-7146)

From MCFlux FlukReweight() :

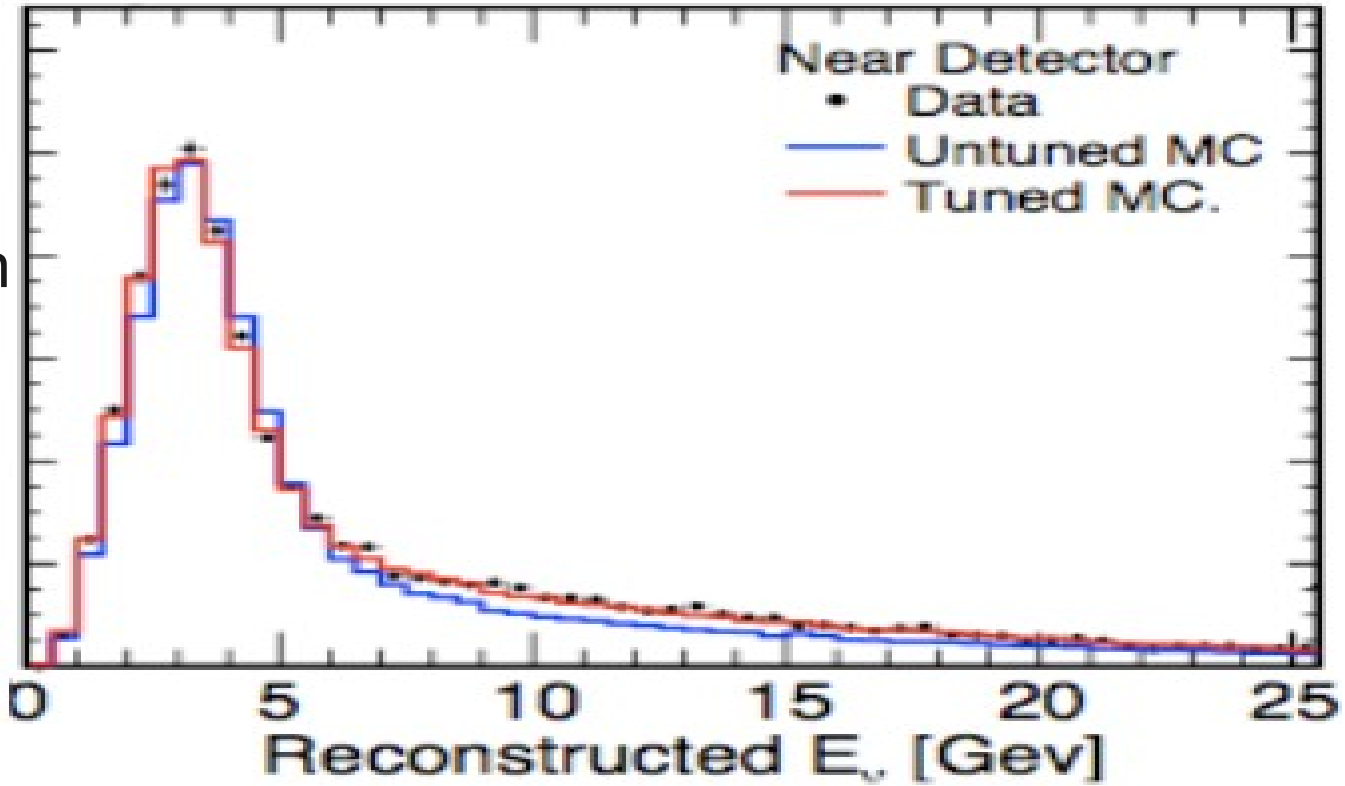


MINOS Near Detector

Muon-Neutrinos

- Weighted
- Unweighted

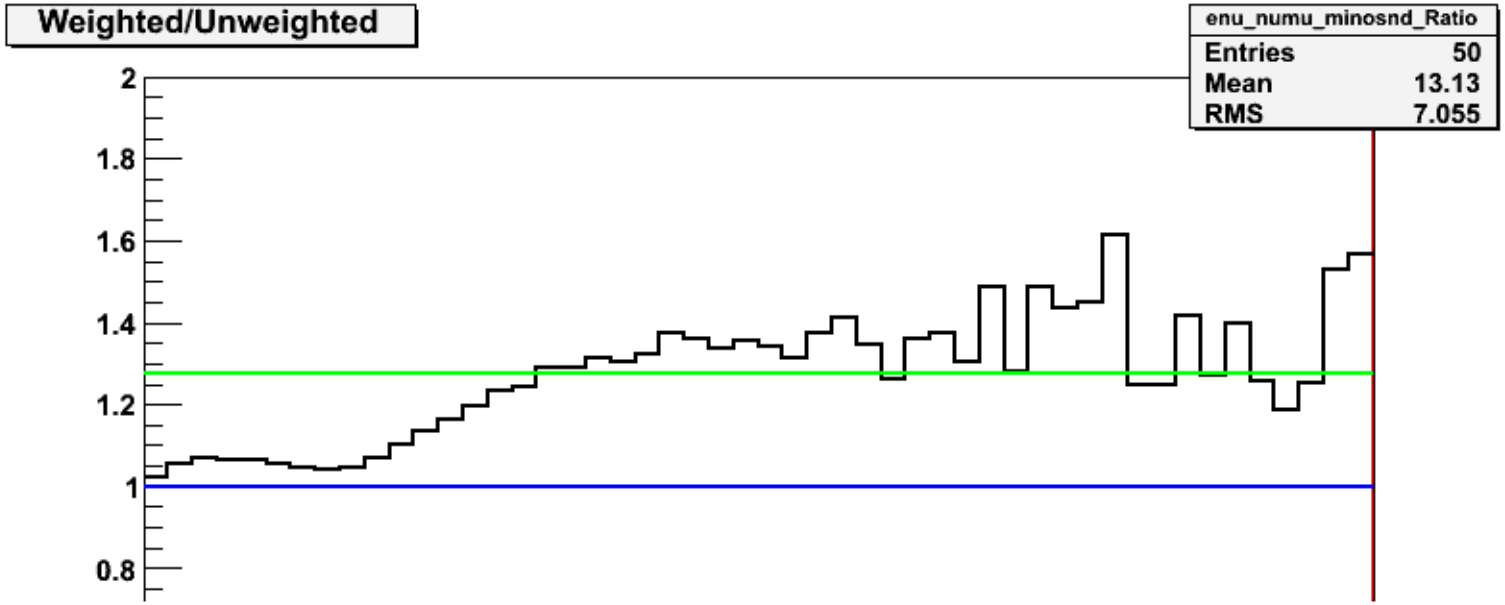
From Mark Dorman paper Figure 9:



From MCFlux

FlukReweight() :

- Weighted-Unweighted Ratio
- Average
- Unity

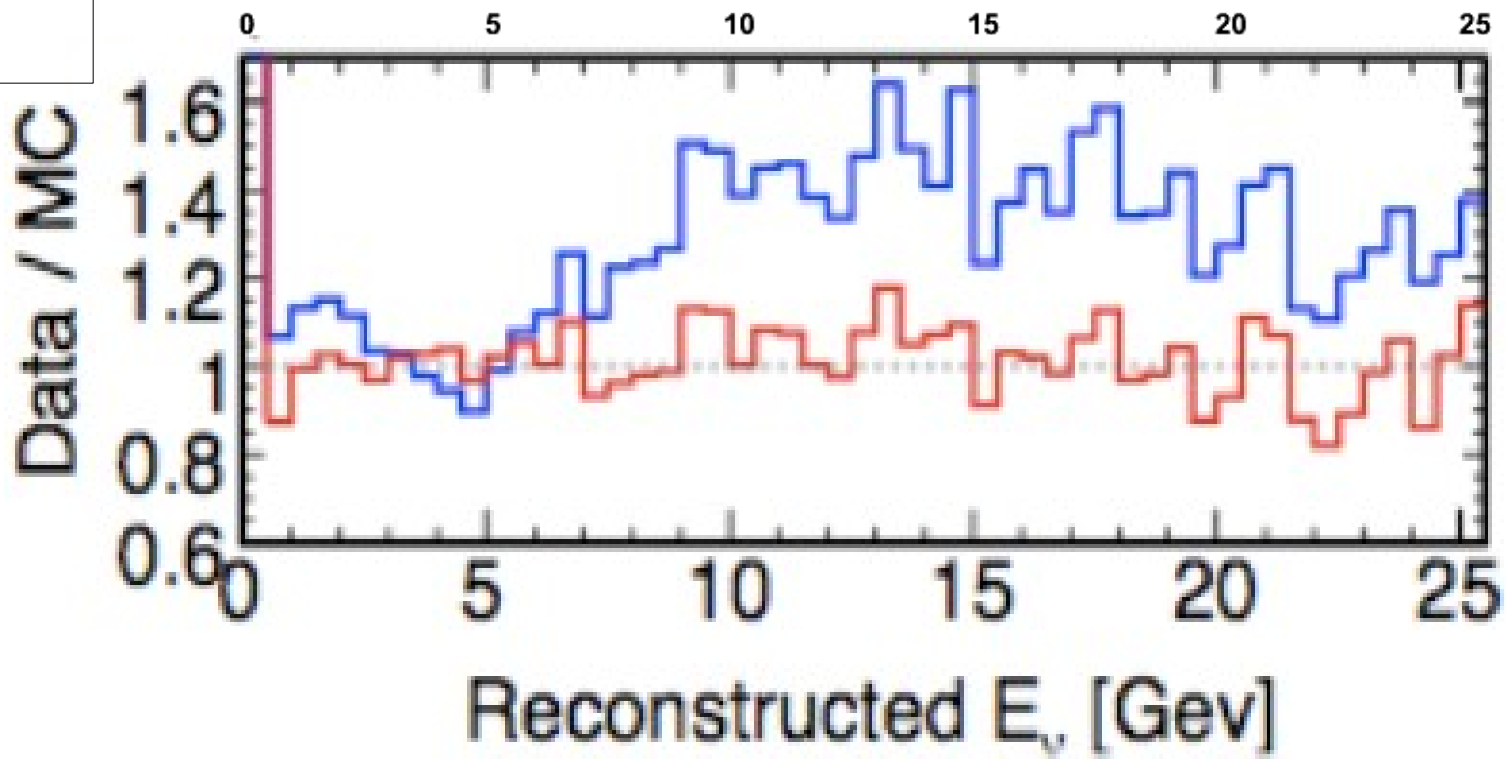


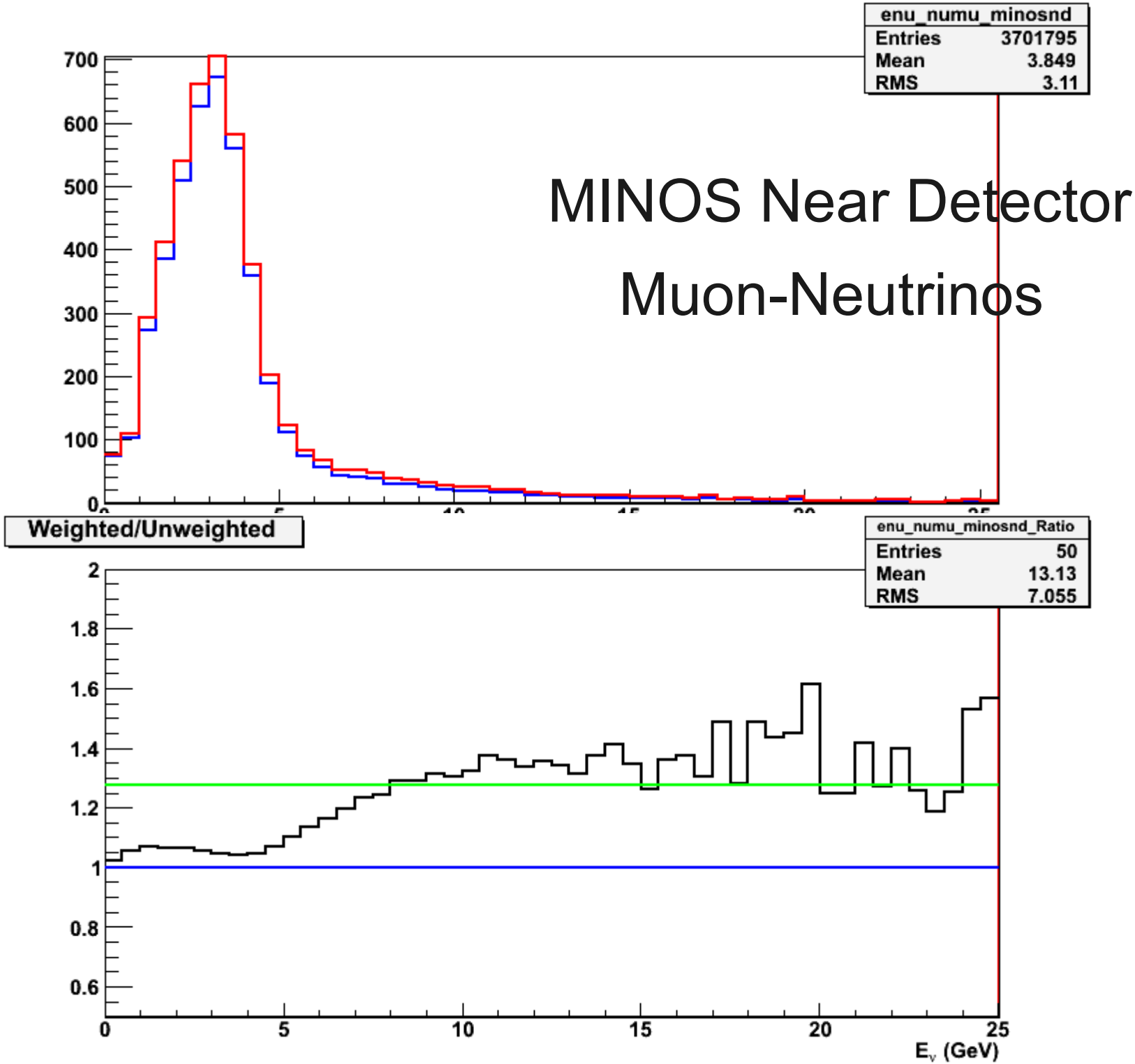
MINOS Near Detector Muon-Neutrinos

From

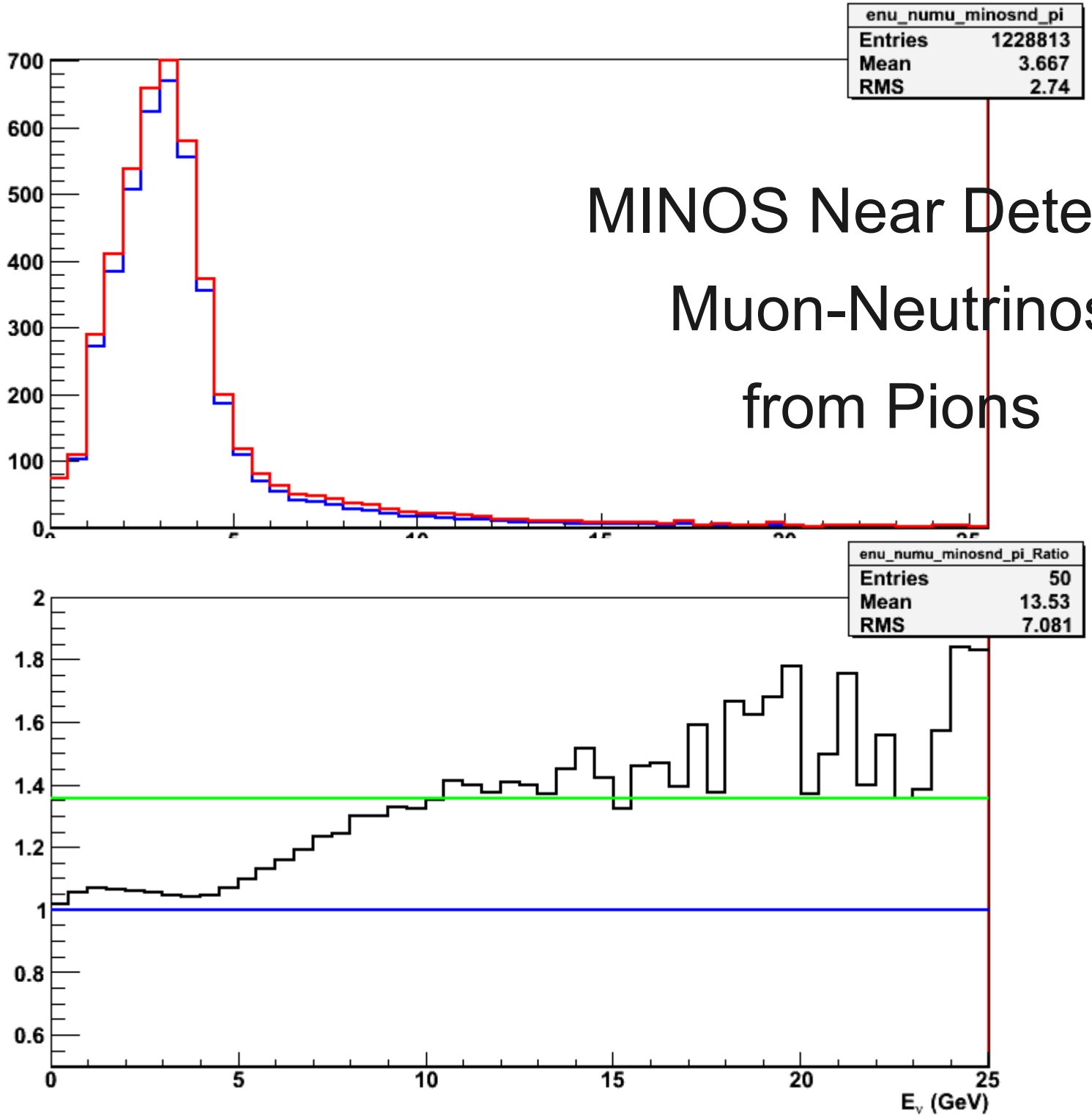
Mark Dorman

paper Figure 9:

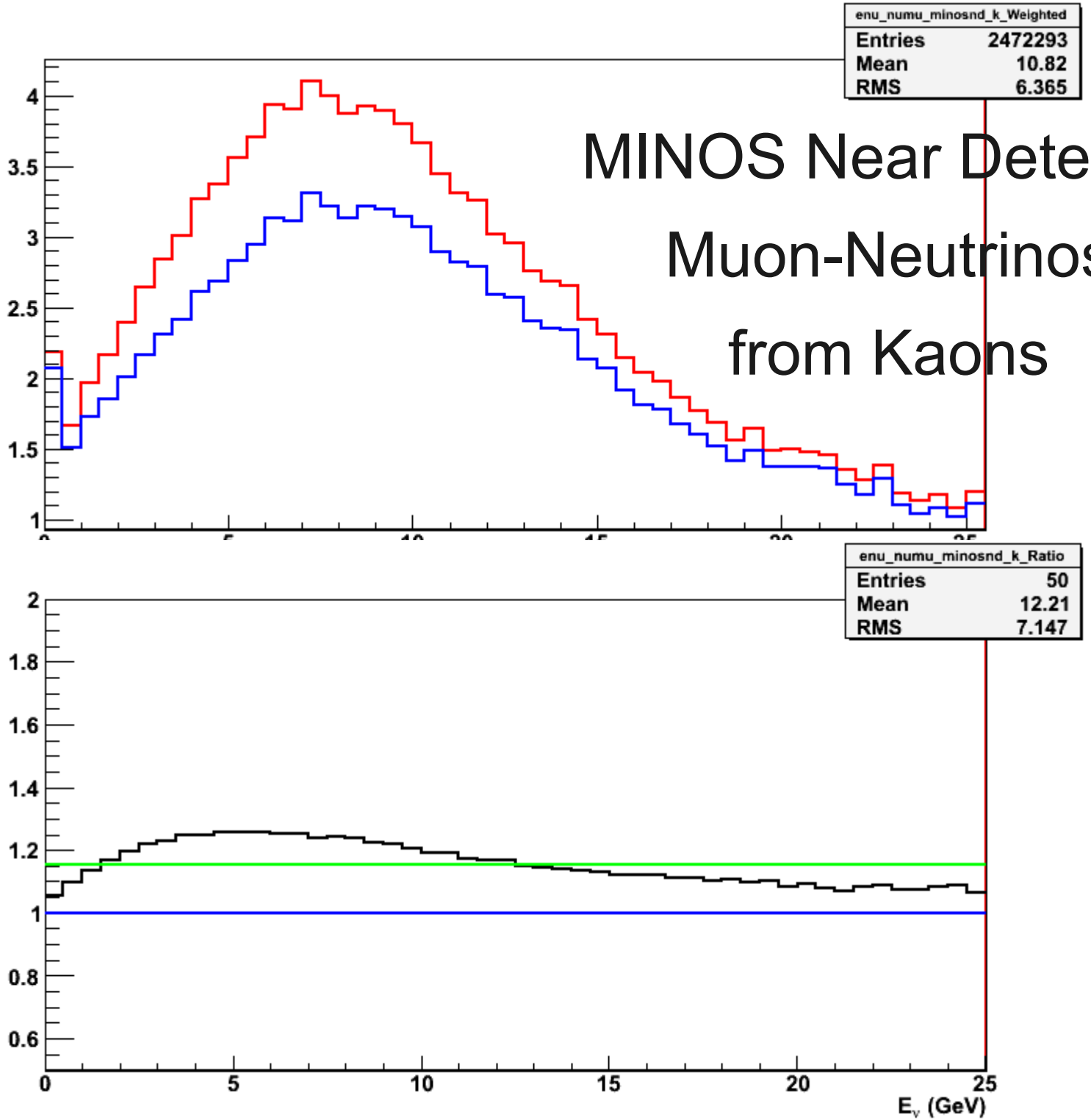



enu_numu_minosnd
Entries 3701795
Mean 3.849
RMS 3.11
MINOS Near Detector
Muon-Neutrinos
Weighted/Unweighted
enu_numu_minosnd_Ratio
Entries 50
Mean 13.13
RMS 7.055
E_ν (GeV)

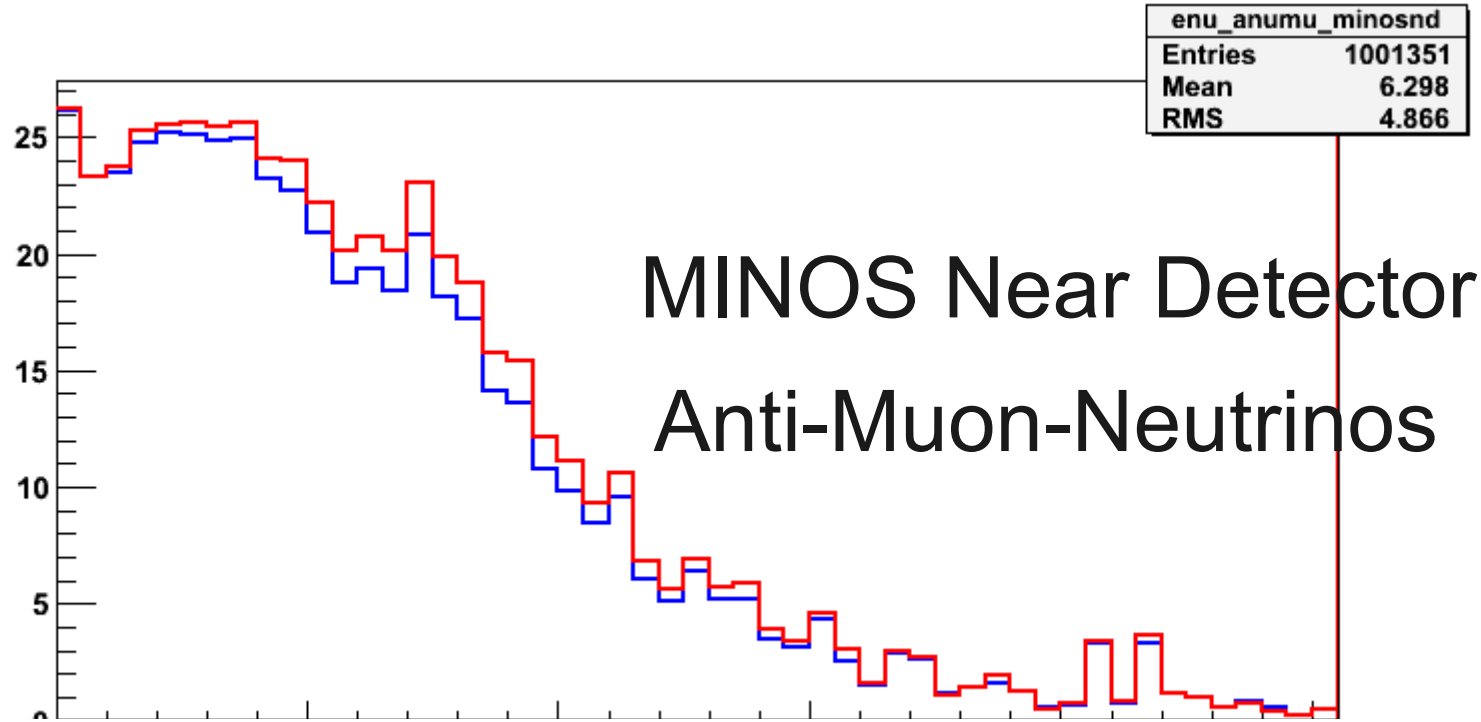
MINOS Near Detector Muon-Neutrinos from Pions



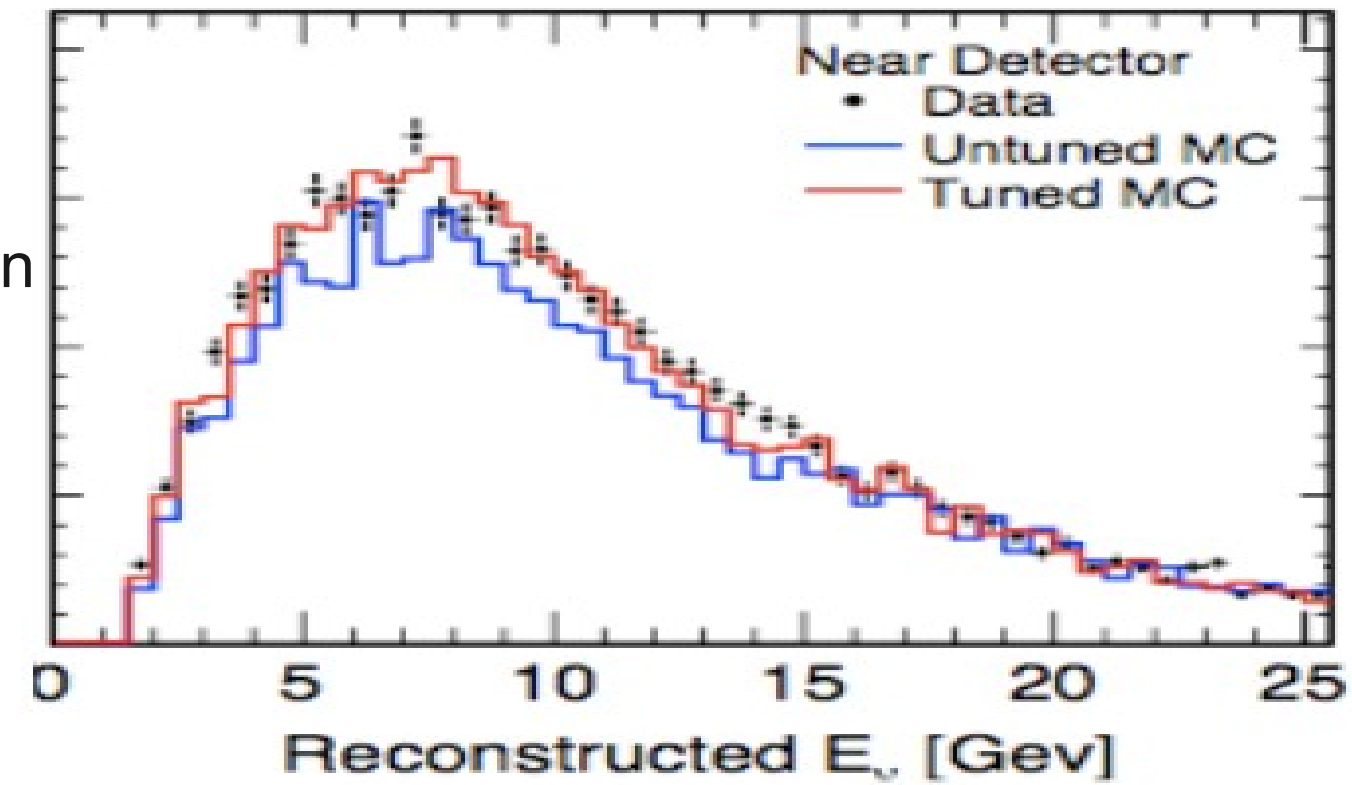
MINOS Near Detector Muon-Neutrinos from Kaons



From MCFlux FlukReweight() :



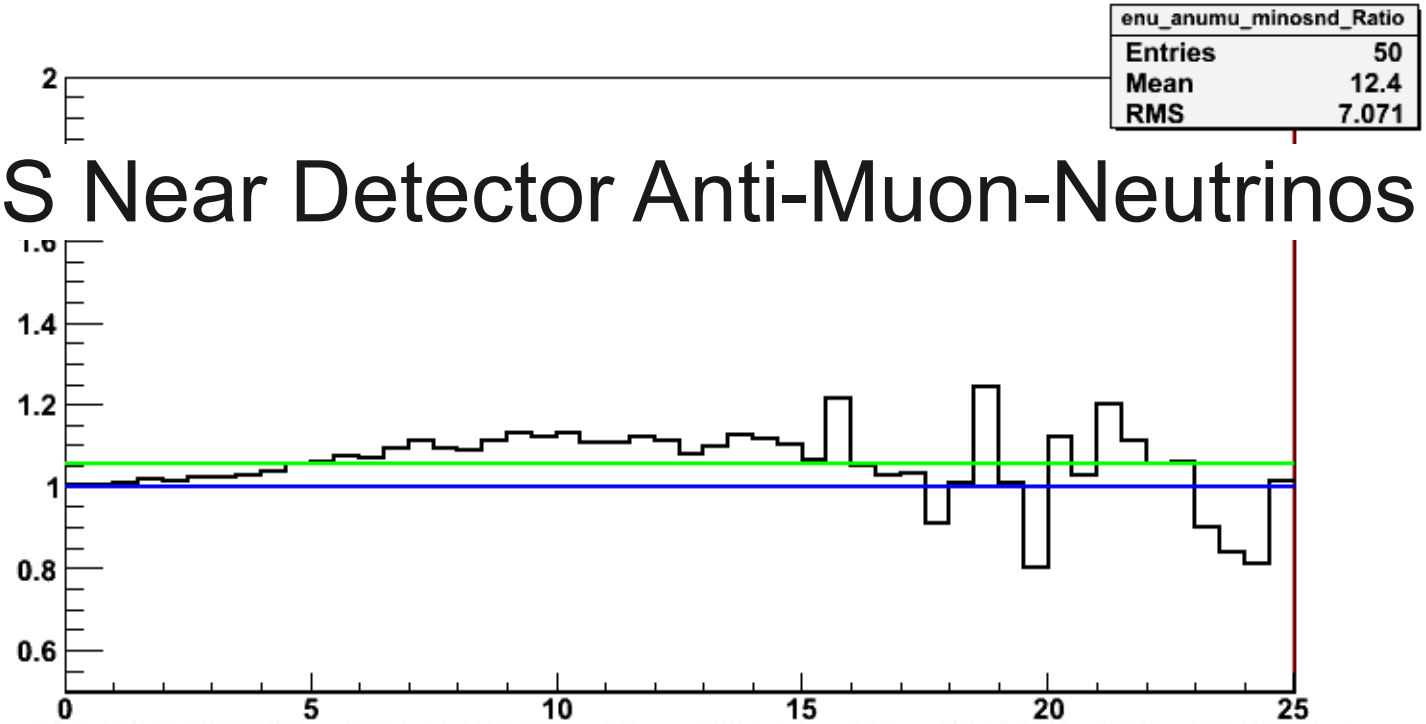
From Mark Dorman paper Figure 9:



MINOS Near Detector Anti-Muon-Neutrinos

From MCFlux

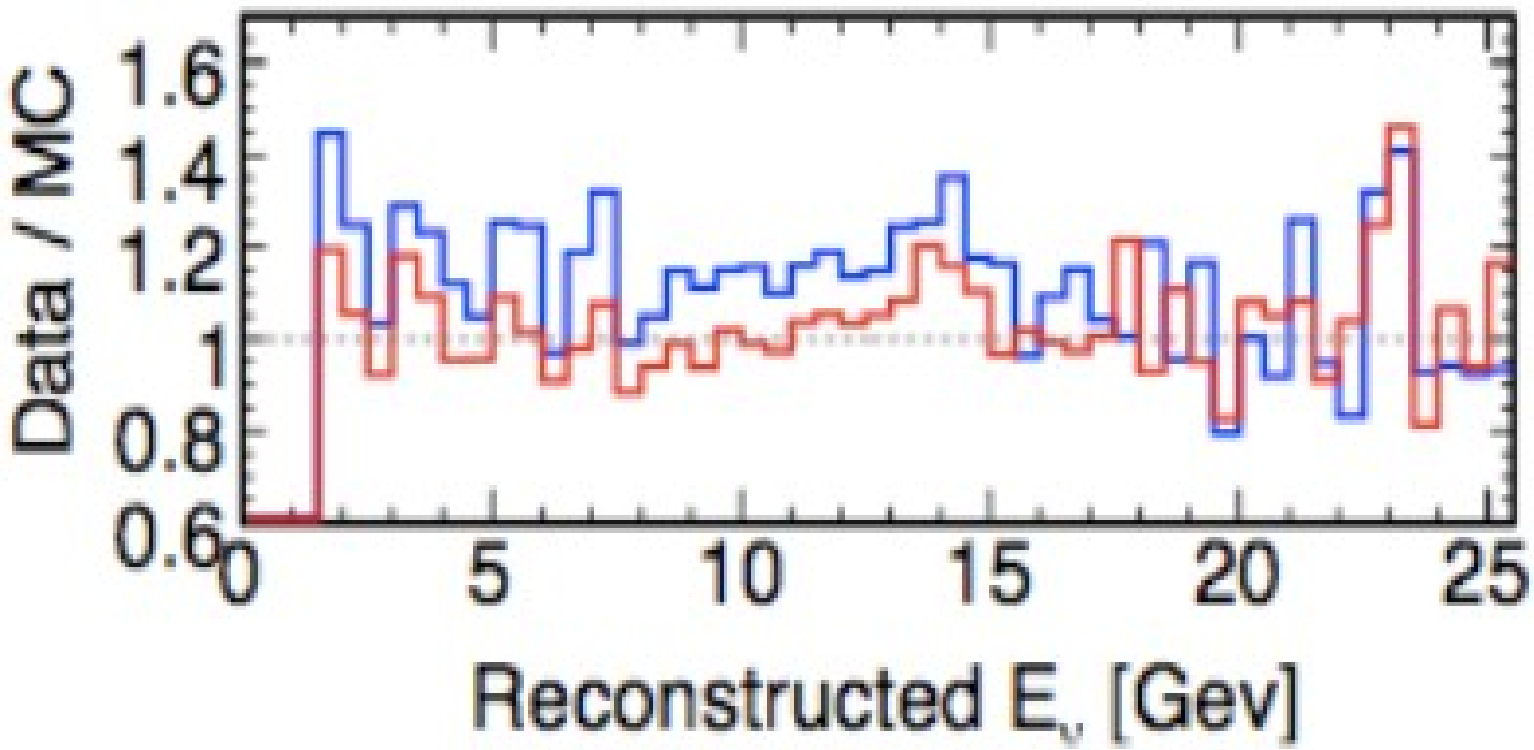
FlukReweight() :

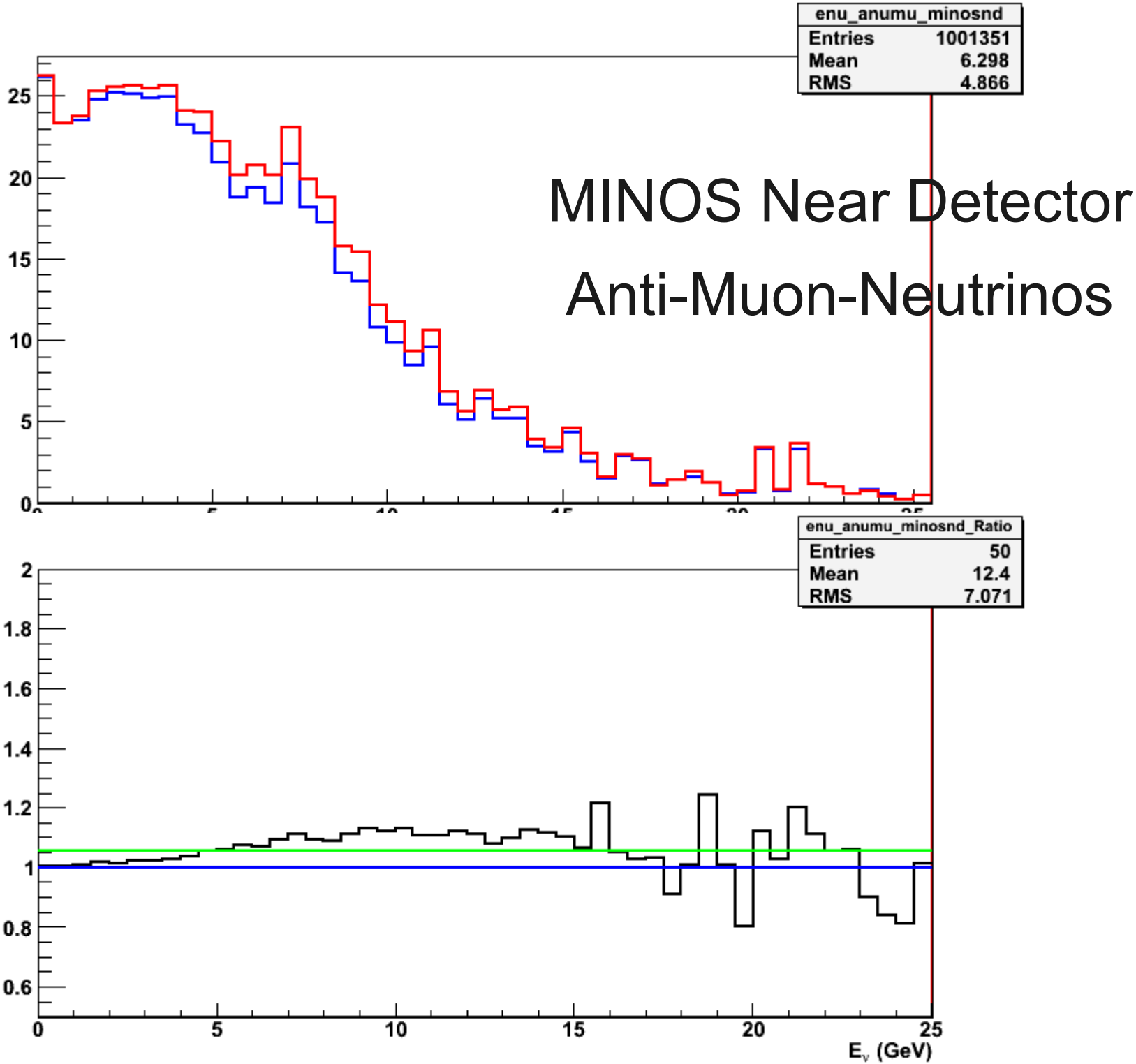


From

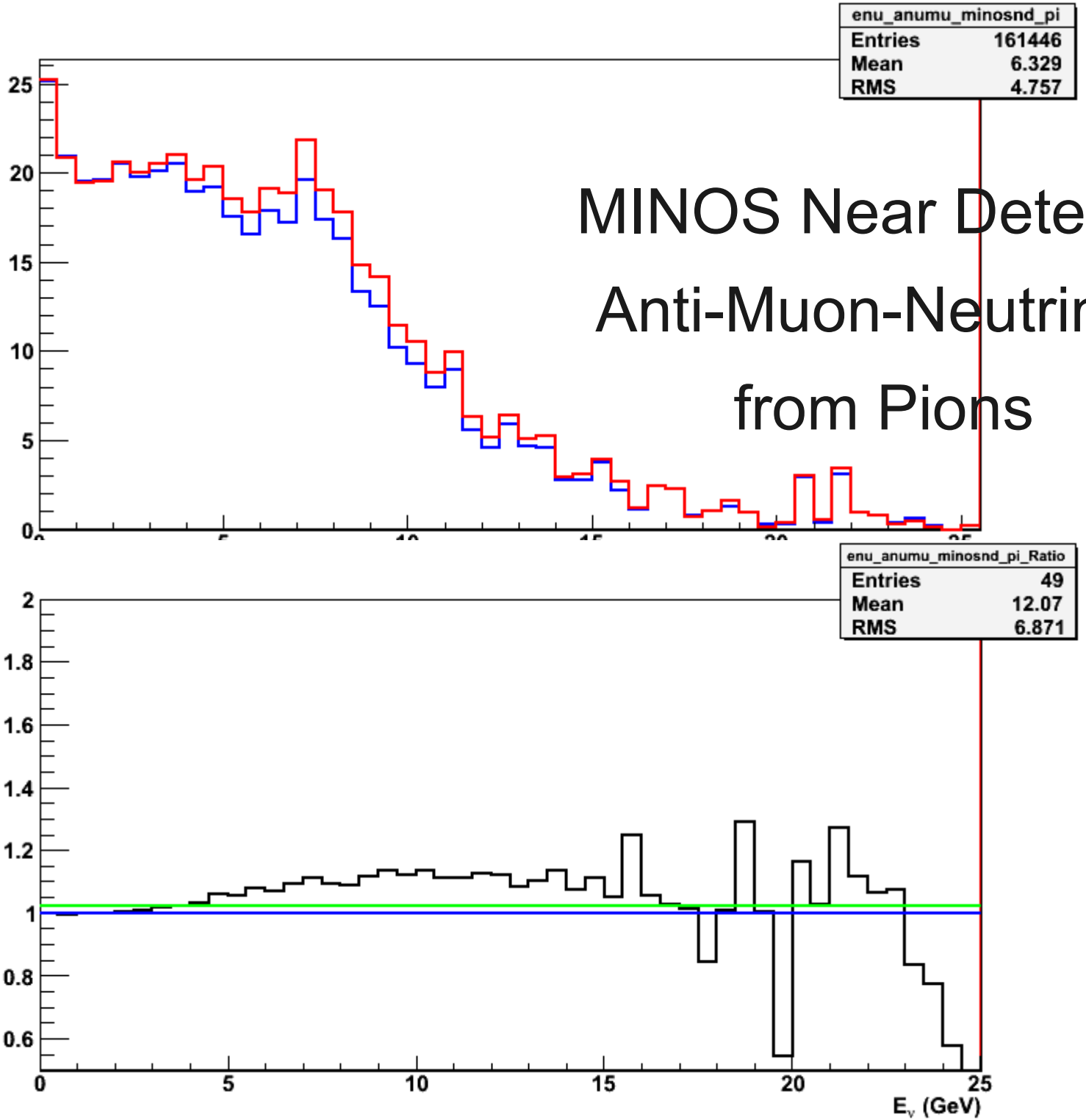
Mark Dorman

paper Figure 9:

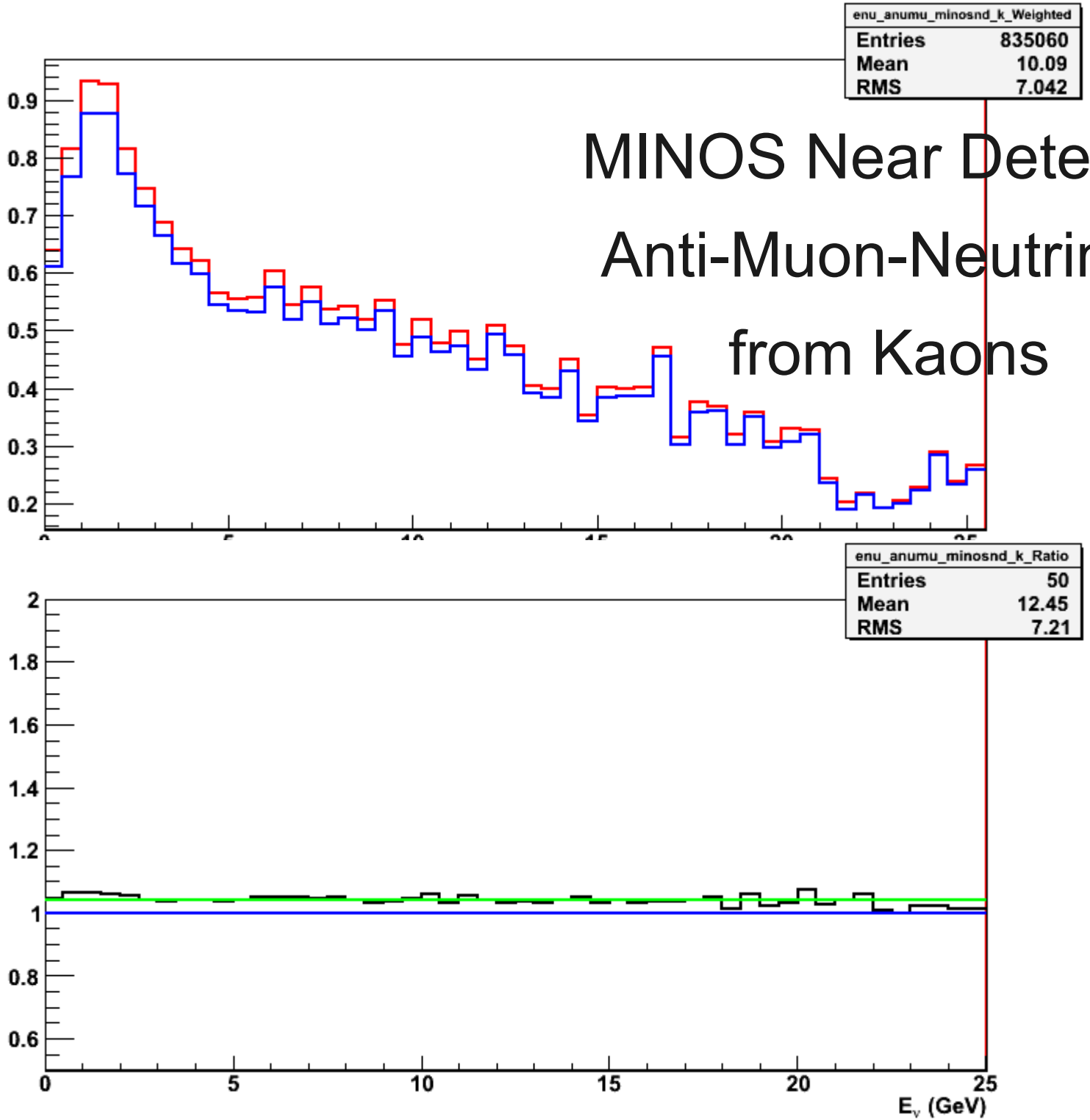


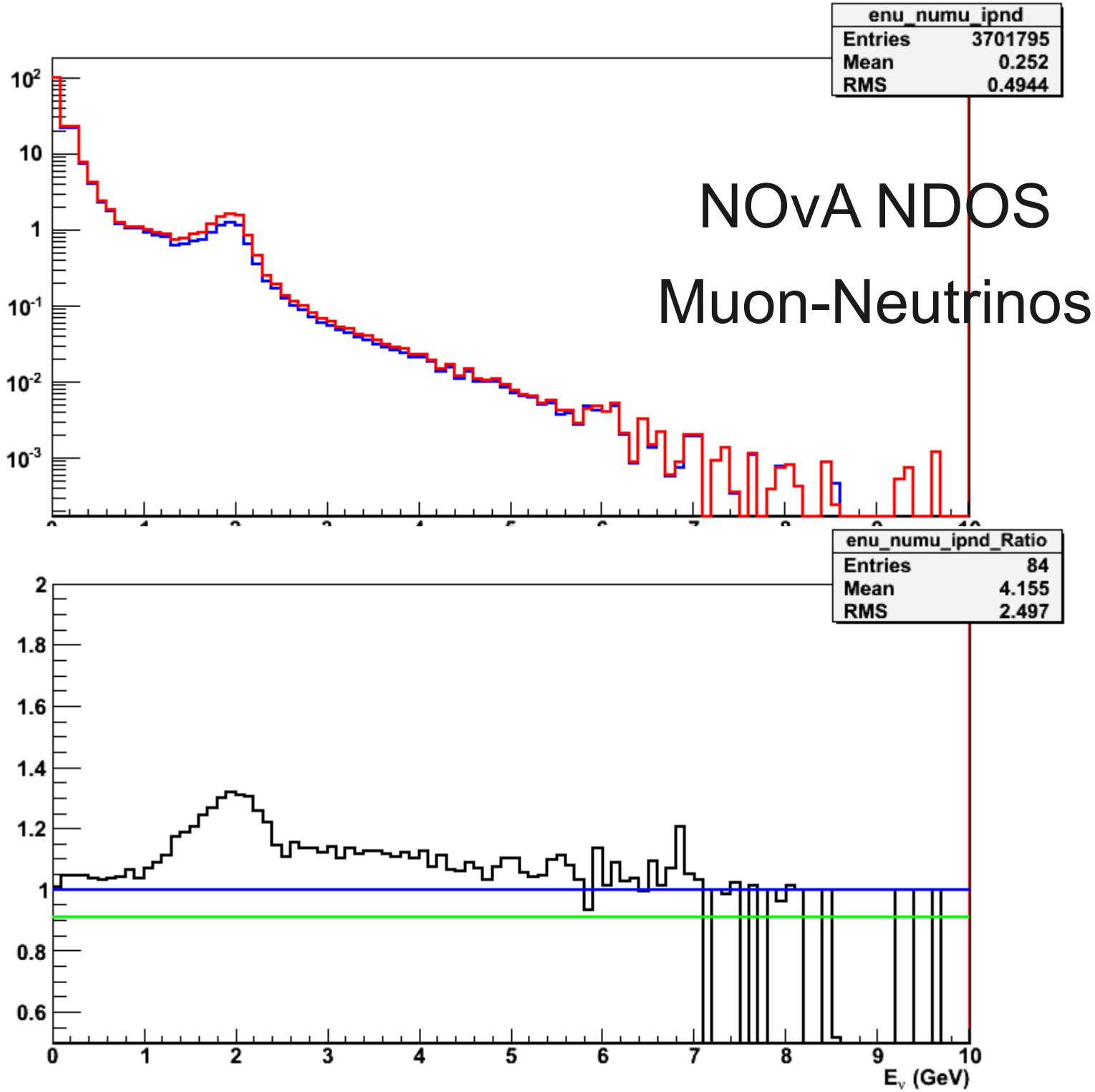

enu_anumu_minosnd
Entries 1001351
Mean 6.298
RMS 4.866
MINOS Near Detector
Anti-Muon-Neutrinos
enu_anumu_minosnd_Ratio
Entries 50
Mean 12.4
RMS 7.071
E_ν (GeV)

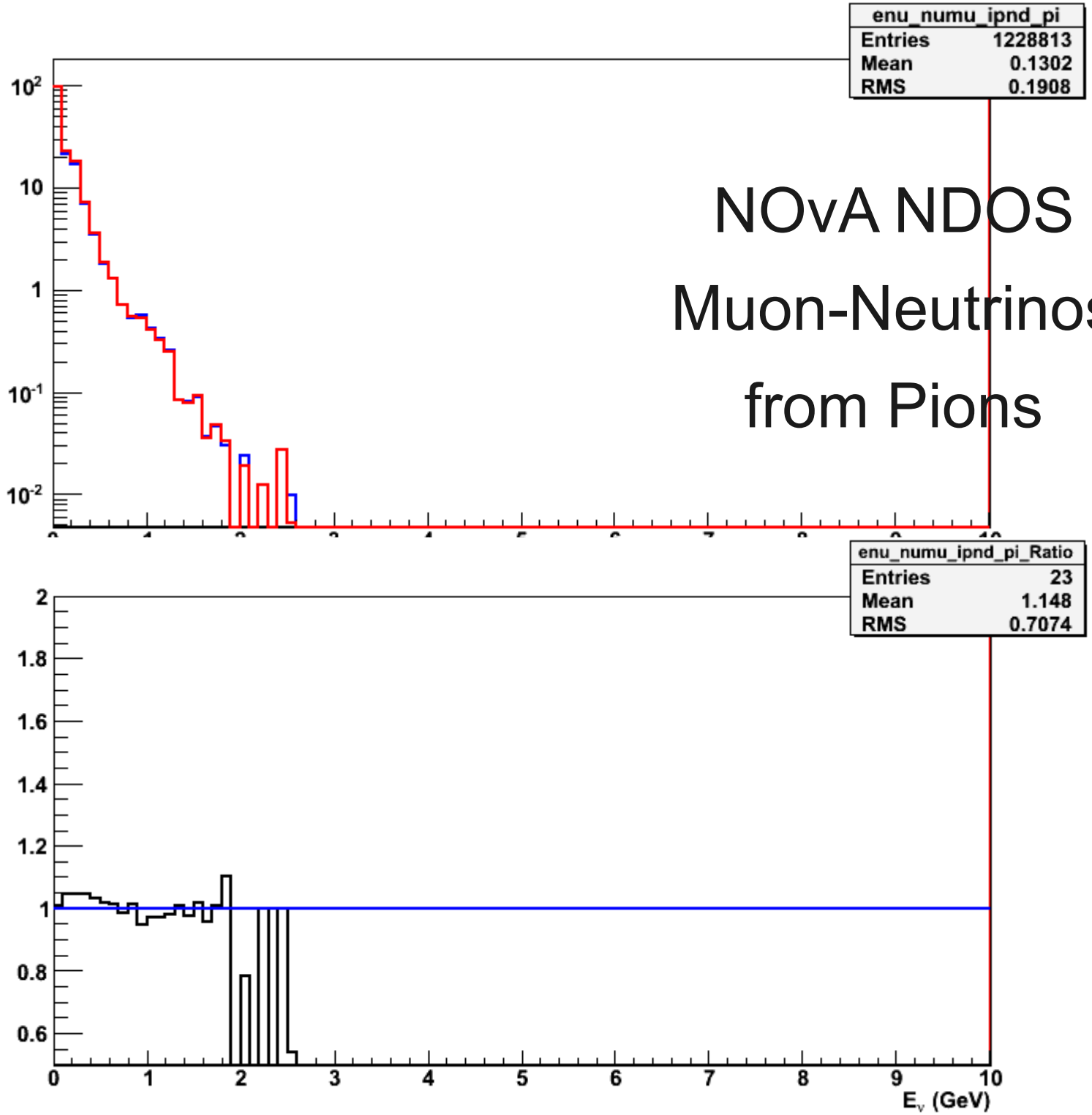
MINOS Near Detector Anti-Muon-Neutrinos from Pions



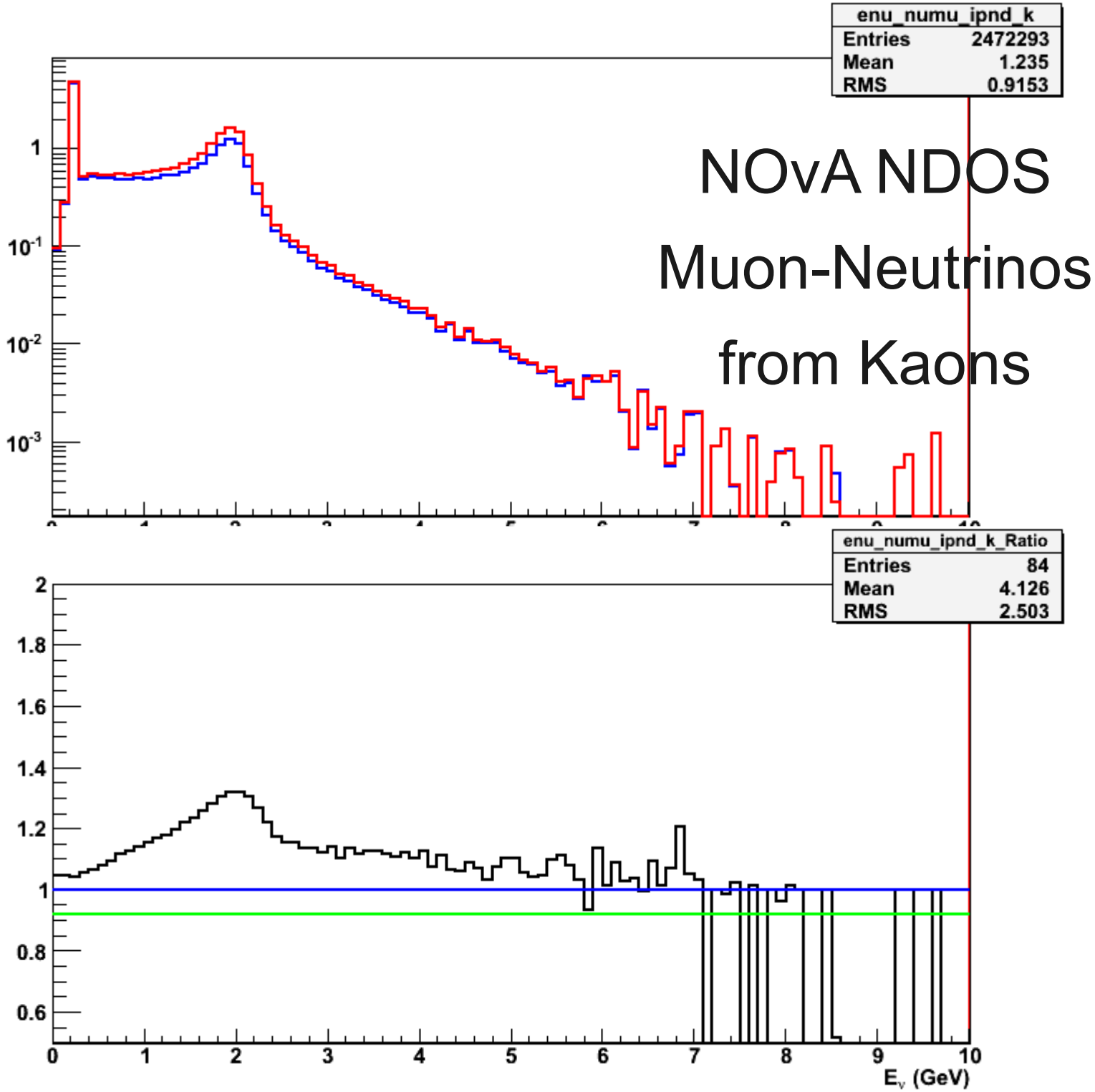
MINOS Near Detector Anti-Muon-Neutrinos from Kaons



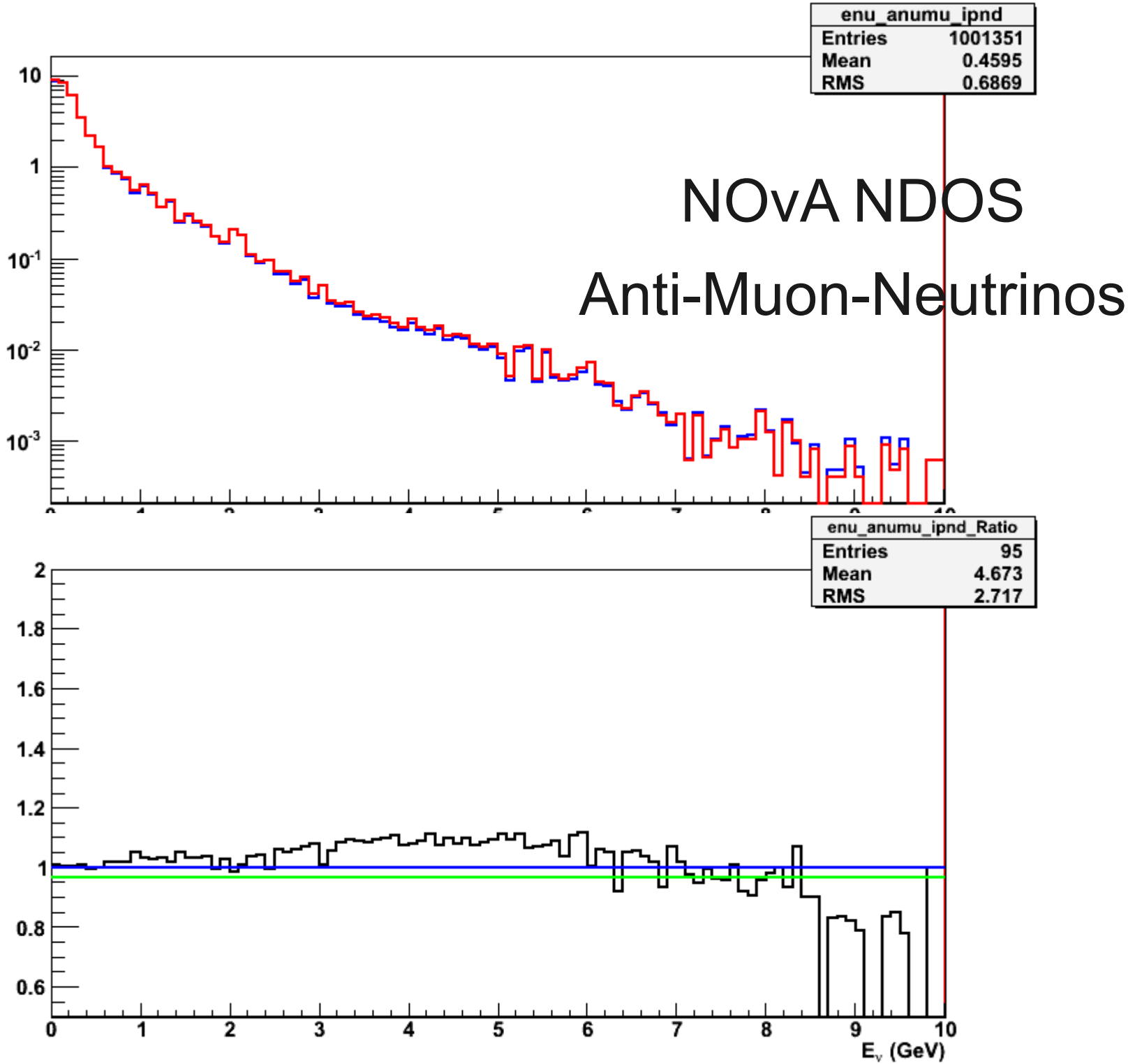

enu_numu_ipnd
Entries 3701795
Mean 0.252
RMS 0.4944
NOvA NDOS
Muon-Neutrinos
enu_numu_ipnd_Ratio
Entries 84
Mean 4.155
RMS 2.497
E_ν (GeV)



NOvA NDOS Muon-Neutrinos from Pions

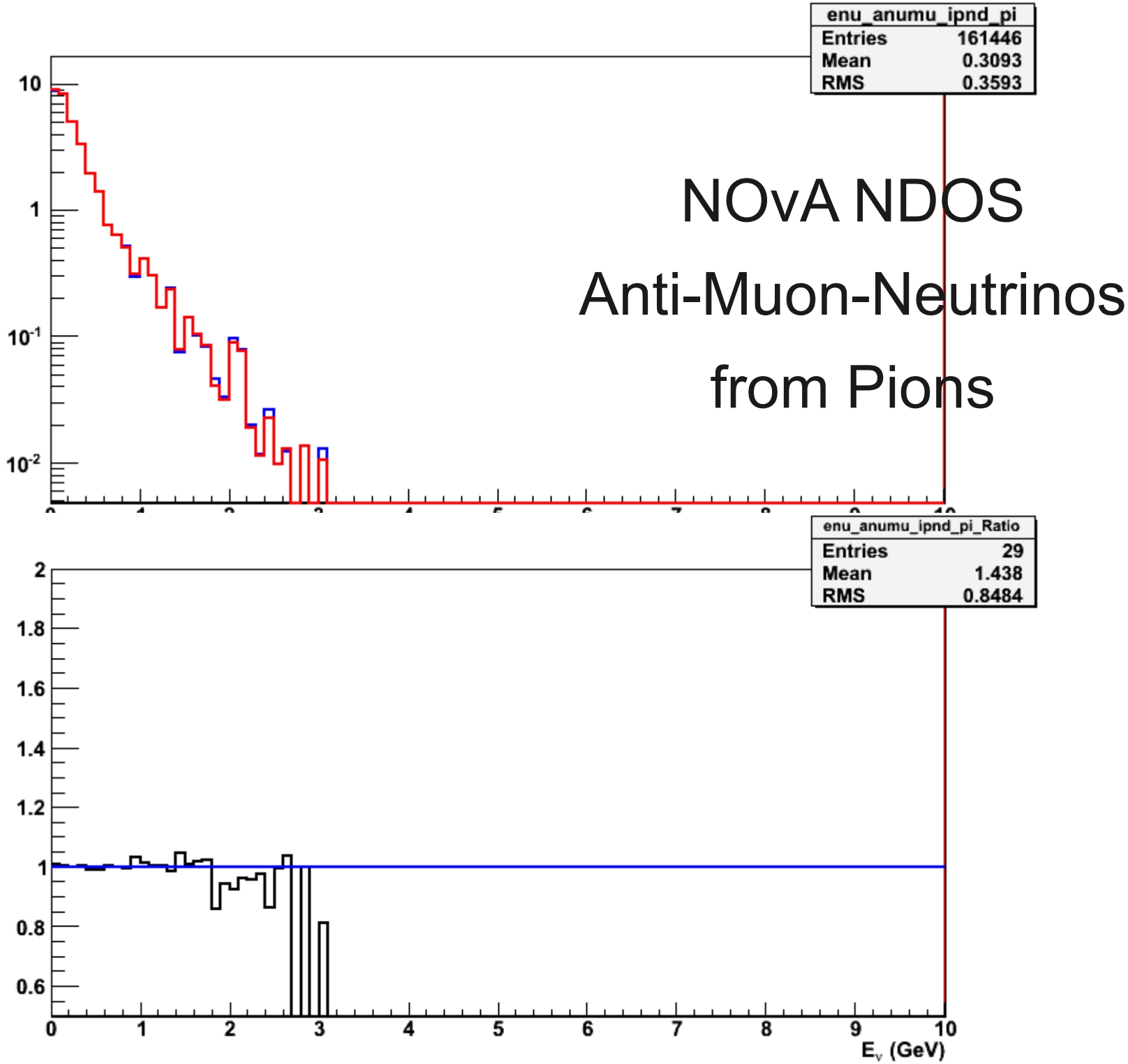


NOvA NDOS Muon-Neutrinos from Kaons

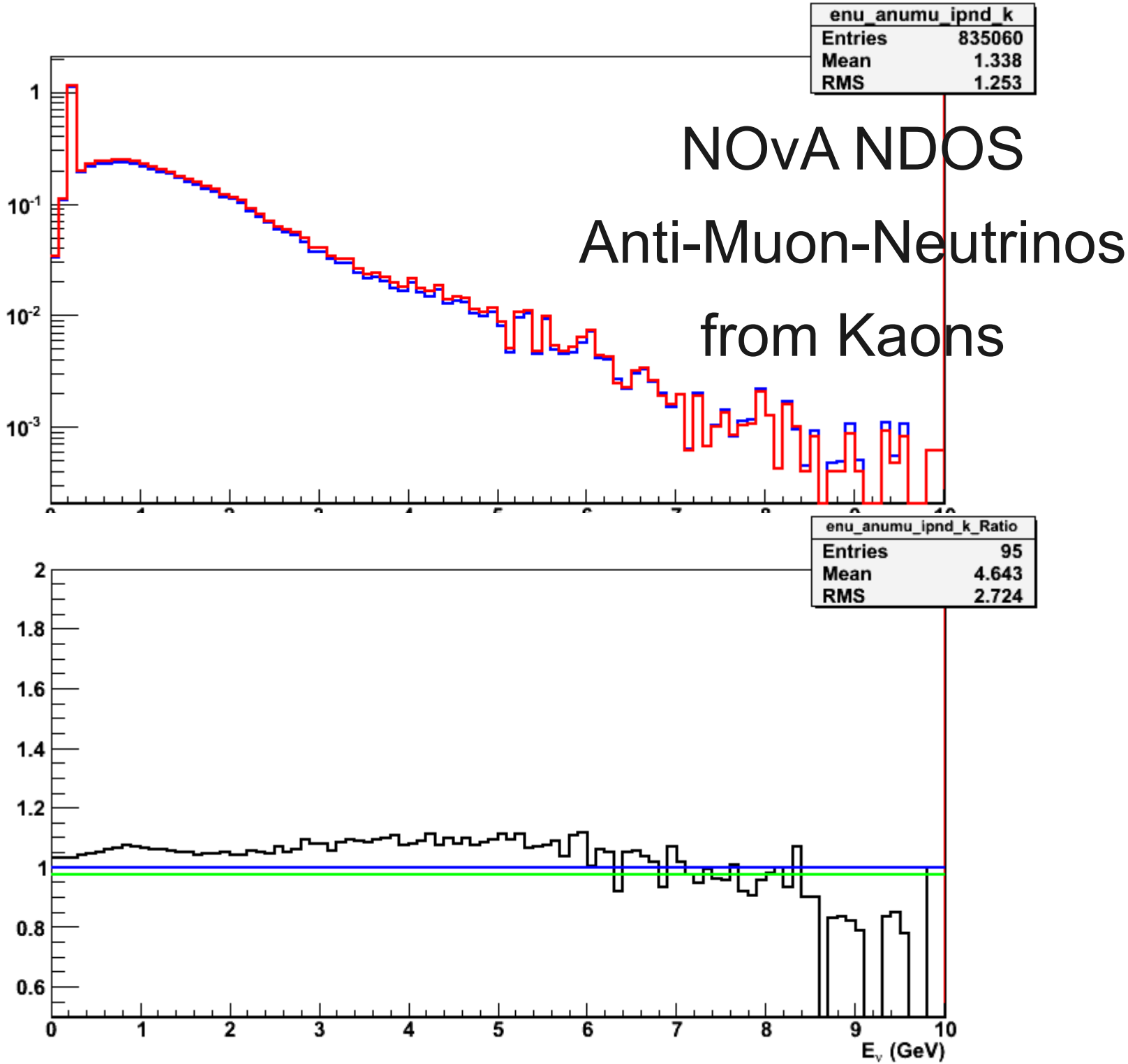


NOvA NDOS

Anti-Muon-Neutrinos



NOvA NDOS Anti-Muon-Neutrinos from Pions



NOvA NDOS
Anti-Muon-Neutrinos
from Kaons

Conclusions/Outlook

- Preliminary results show consistency with original MINOS implementation
- In NDOS, FlukReweight enhances kaons
- Zbeam, reweighting from horn focusing uncertainties, to be added in near future
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