Reconstructed neurtino energy

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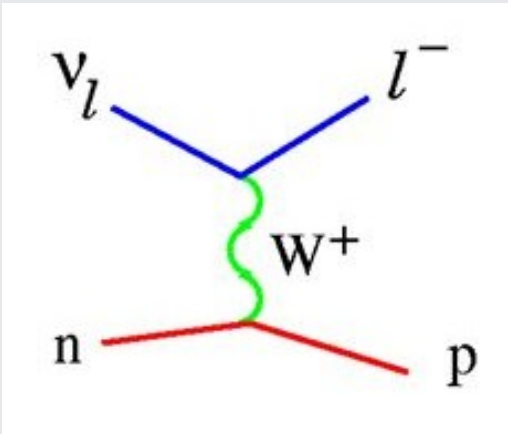
Introduction
T2K and NEUT

Using the NEUT simulation code, the reaction studied was:

- $\nu_\mu \rightarrow {}^{12}C$

CCQE or CC0π



T2K

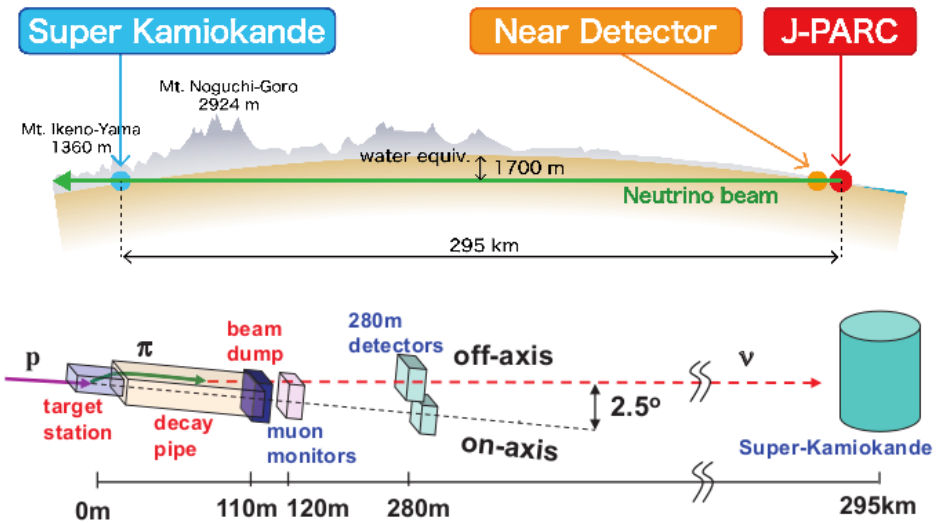
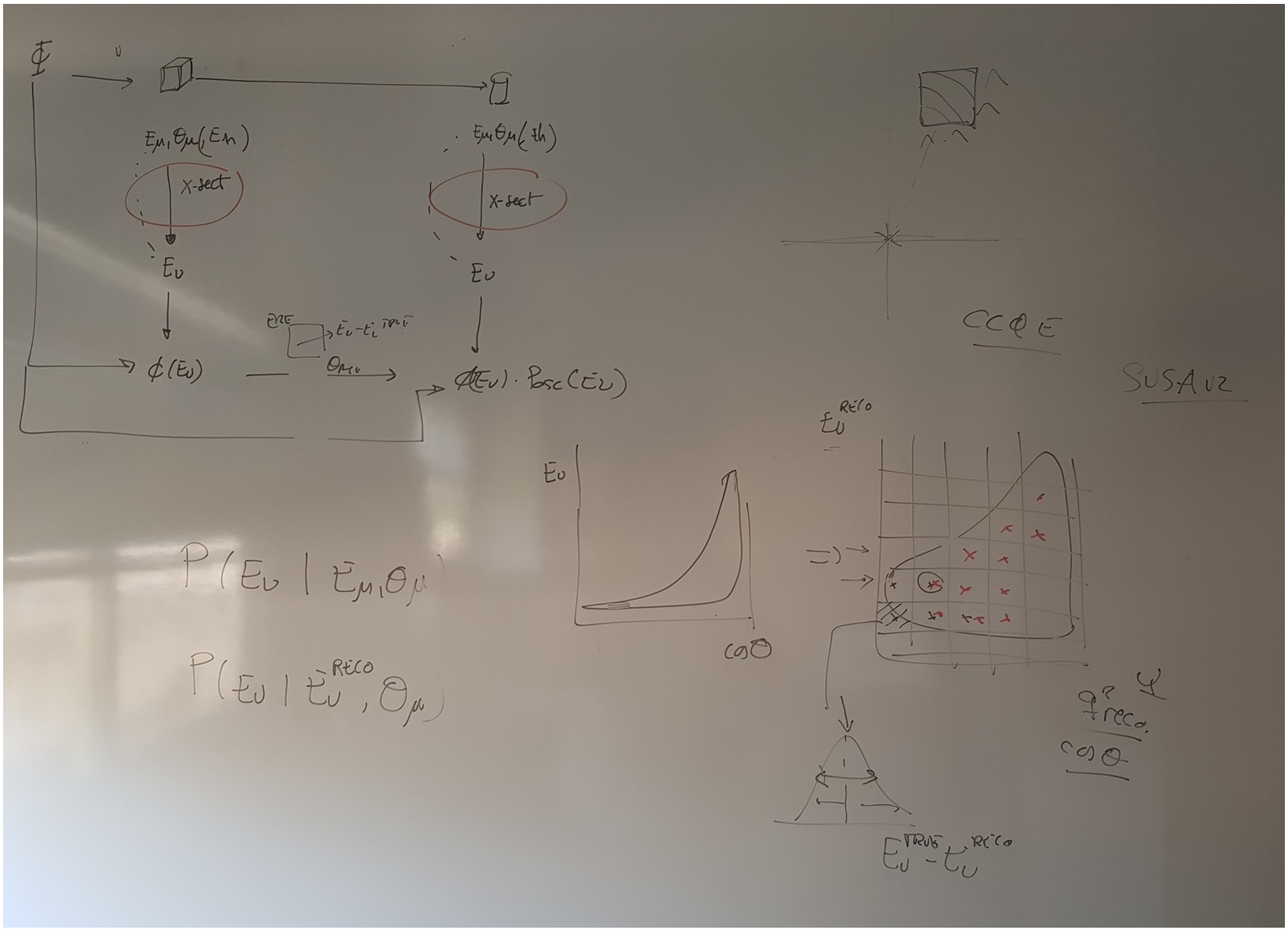


Figure 4.8: Schematic representation of the T2K configuration.

- $L_{near} = 280$ m;
- $L_{far} = 295$ km.



Theoretical Model

Equations for CCQE

Reconstructed neutrino energy (E_ν^{rec}):

$$E_\nu^{rec} = \frac{2(M_n - E_B)E_\mu - (E_B^2 + M_\mu^2 - 2M_n E_B + \Delta M^2)}{2(M_n - E_B - E_\mu + |\vec{k_\mu}|cos\theta_\mu)} \quad (1)$$

$$\Delta M^2 = M_n^2 - M_p^2$$

$$E_\mu = \sqrt{|\vec{k_\mu}|^2 + M_\mu^2}$$

Transfered momentum (Q^2_{rec}):

$$Q^2_{rec} = 2\ E_\nu^{rec}\ (E_\mu - |\vec{k_\mu}|cos\theta_\mu) - M_\mu^2 \quad (2)$$

- $M_n = 939.565379$ MeV;
- $M_p = 938.272046$ MeV;
- $M_\mu = 105.6583715$ MeV;
- $E_B = 24$ MeV.

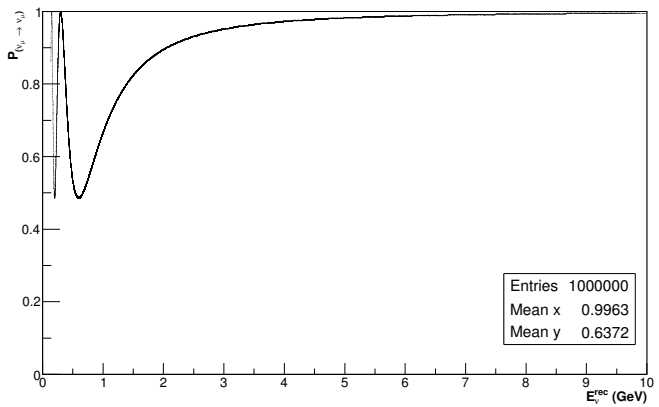
Theoretical Model

Equations for oscillation probability

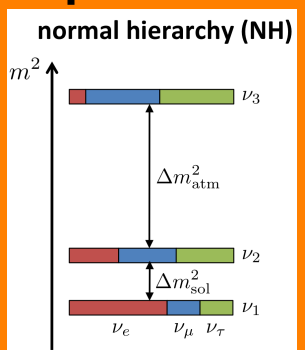
Probability of disappearance of the ν_μ:

$$P_{(\nu_\mu \to \nu_\mu)} = 1 - sen^2\theta_{23}\ sen^2\left(1.267\ \frac{\Delta M^2_{32}\ L_{far}}{E^{rec}_{\nu}}\right) \quad (3)$$

- $sen^2\theta_{23} = 0.514$;
- $\Delta M^2_{32} = 2.51 \times 10^{-3}$ eV^2.



Important!!!



Results

Reconstructed neutrino energy

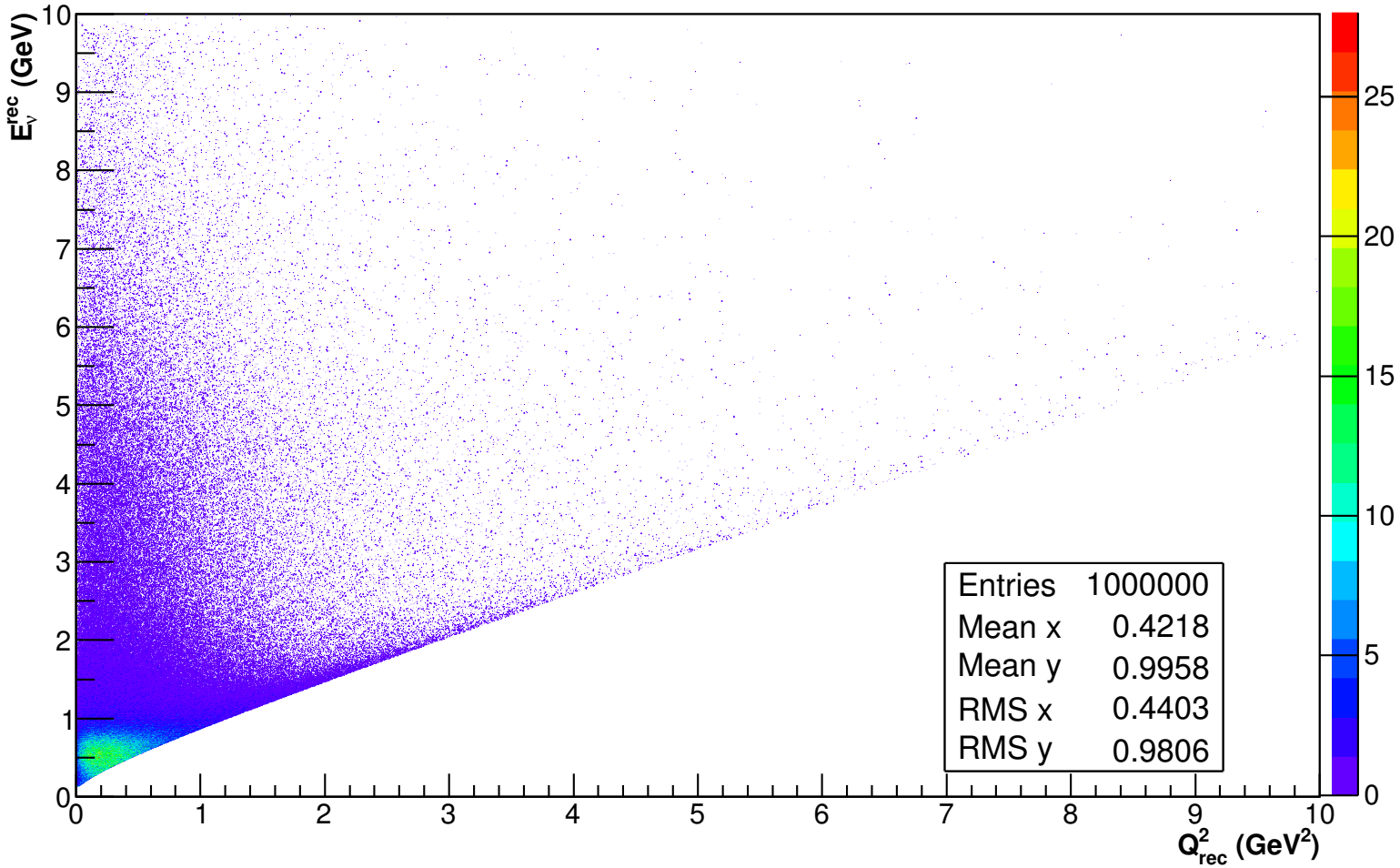


Figure 1: Reconstructed neutrino energy vs. transfered momentum.

Results
Reconstructed neutrino energy

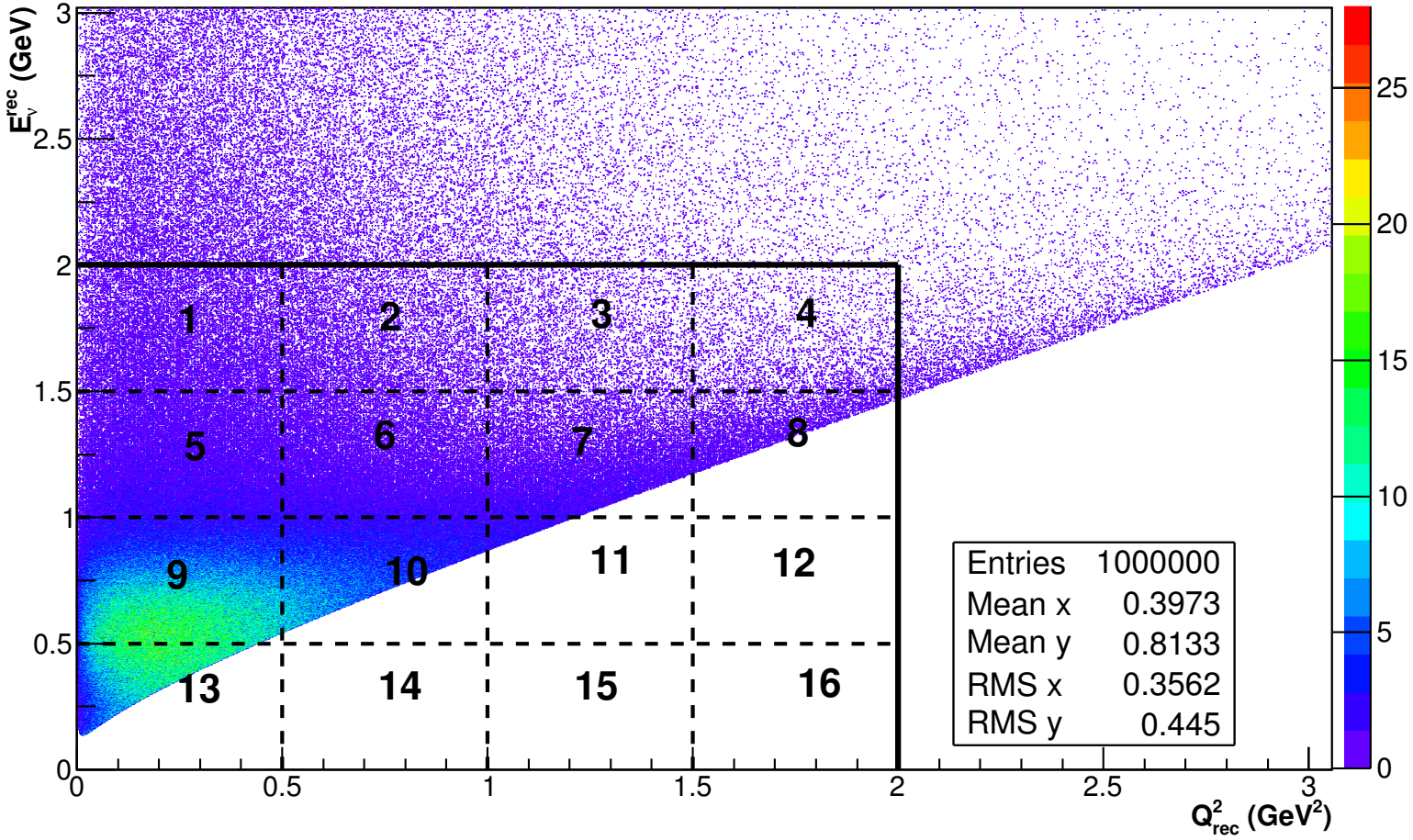


Figure 2: Reconstructed neutrino energy vs. transfered momentum matrix with bins of 0.5 GeV for E_ν^{rec} and 0.5 GeV for Q^2_{rec}.

Results
Reconstructed neutrino energy

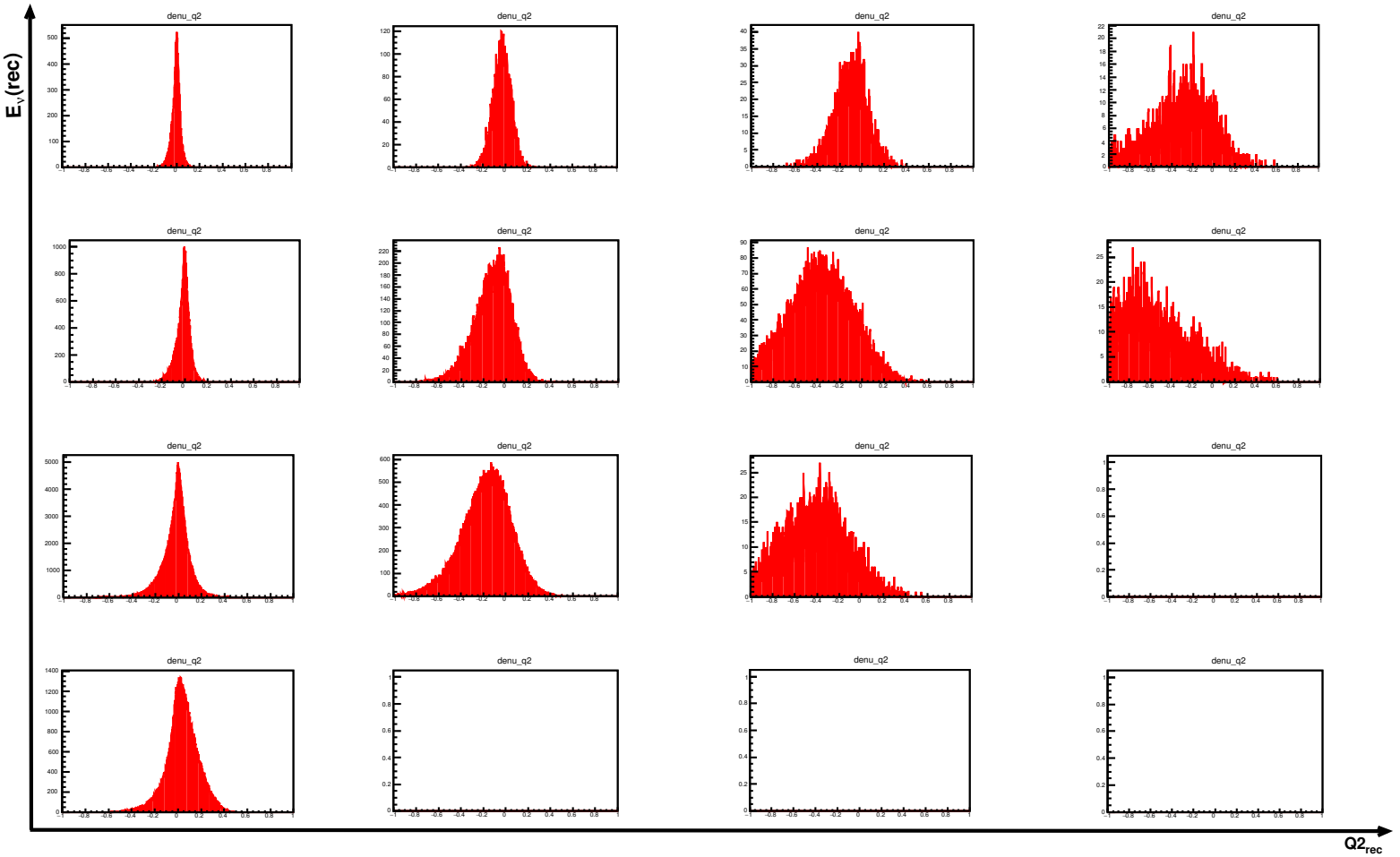


Figure 3: No. of ν_μ events vs. $1 - (E_\nu^{rec}/E_\nu^{true})$ for each block of the matrix.

Results

Reconstructed neutrino energy

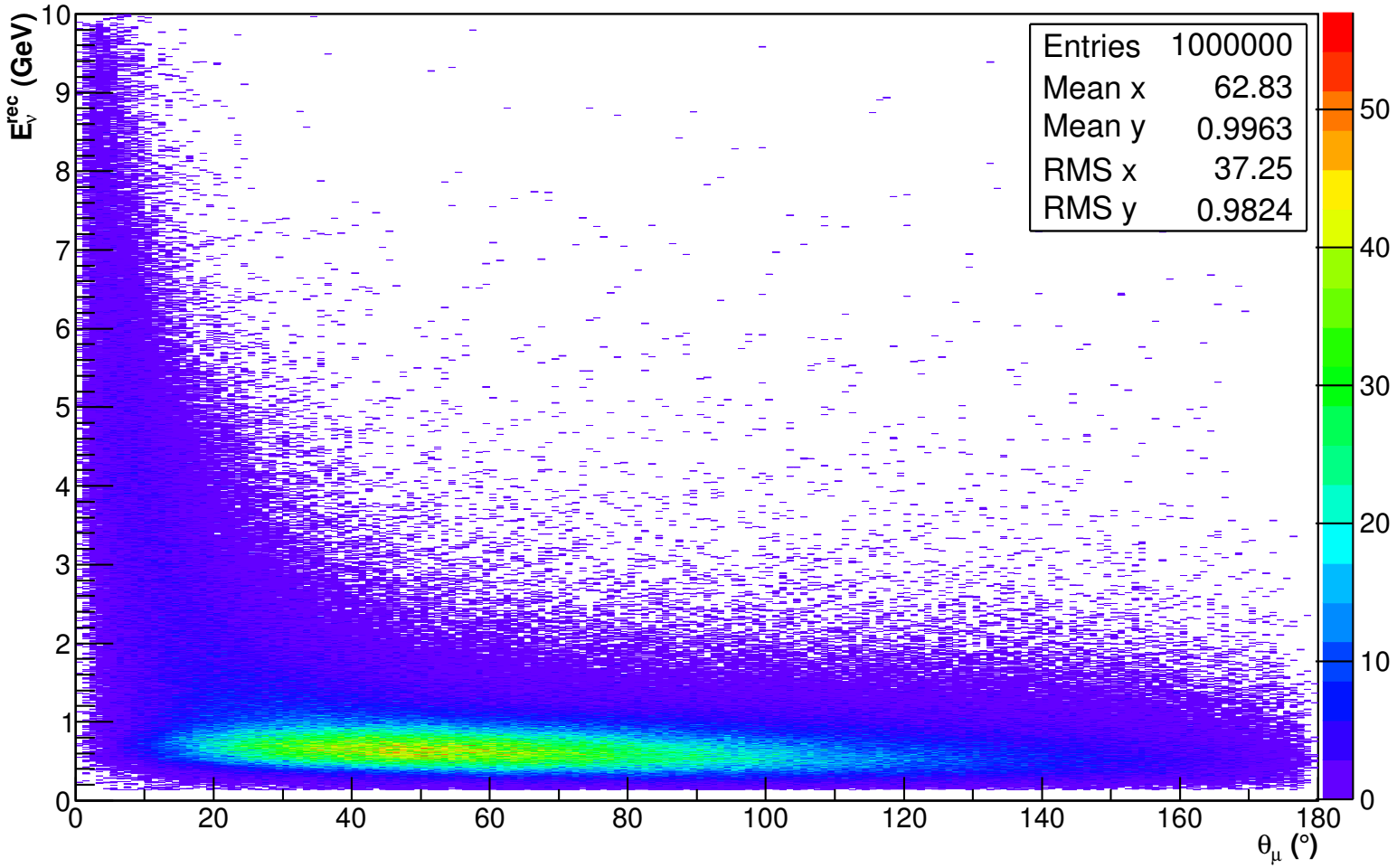


Figure 4: Reconstructed neutrino energy vs. muon angle.

Results

Reconstructed neutrino energy

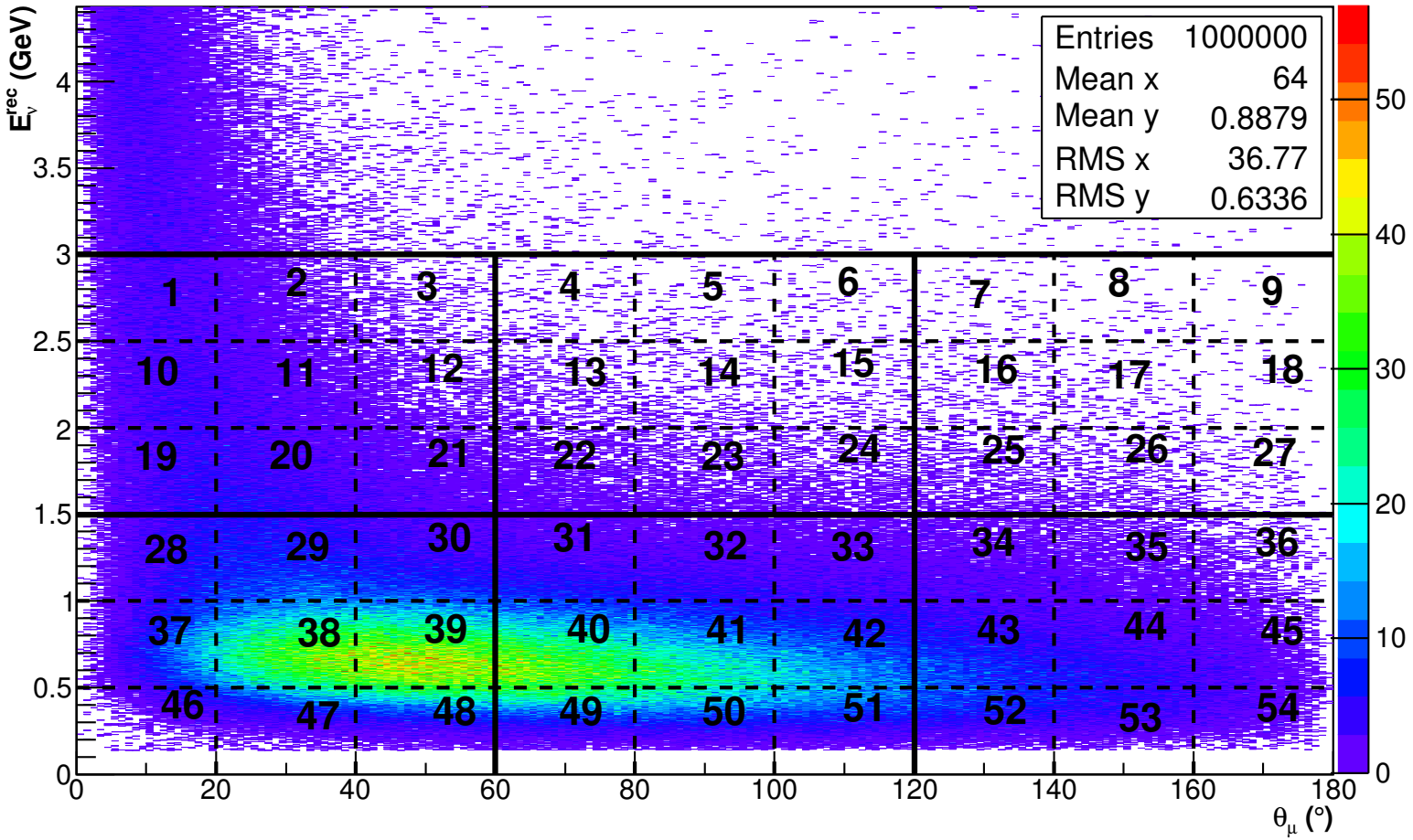


Figure 5: Reconstructed neutrino energy vs. muon angle matrix with bins of 0.5 GeV for E_ν^{rec} and 20° for θ_μ.

Results
Reconstructed neutrino energy

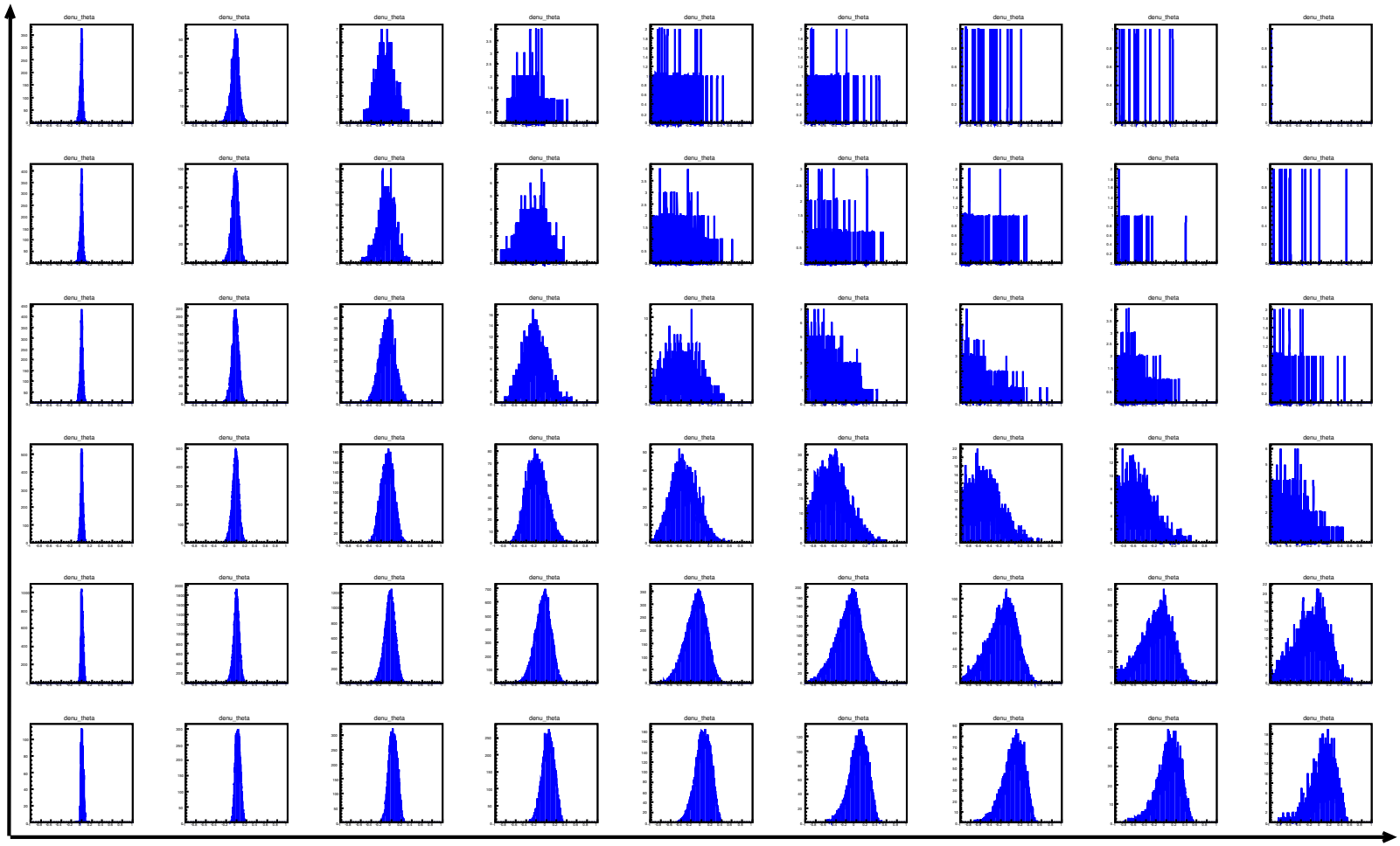


Figure 6: No. of ν_μ events vs. $1 - \left(E_\nu^{rec} / E_\nu^{true}\right)$ for each block of the matrix.

Results

Reconstructed neutrino energy

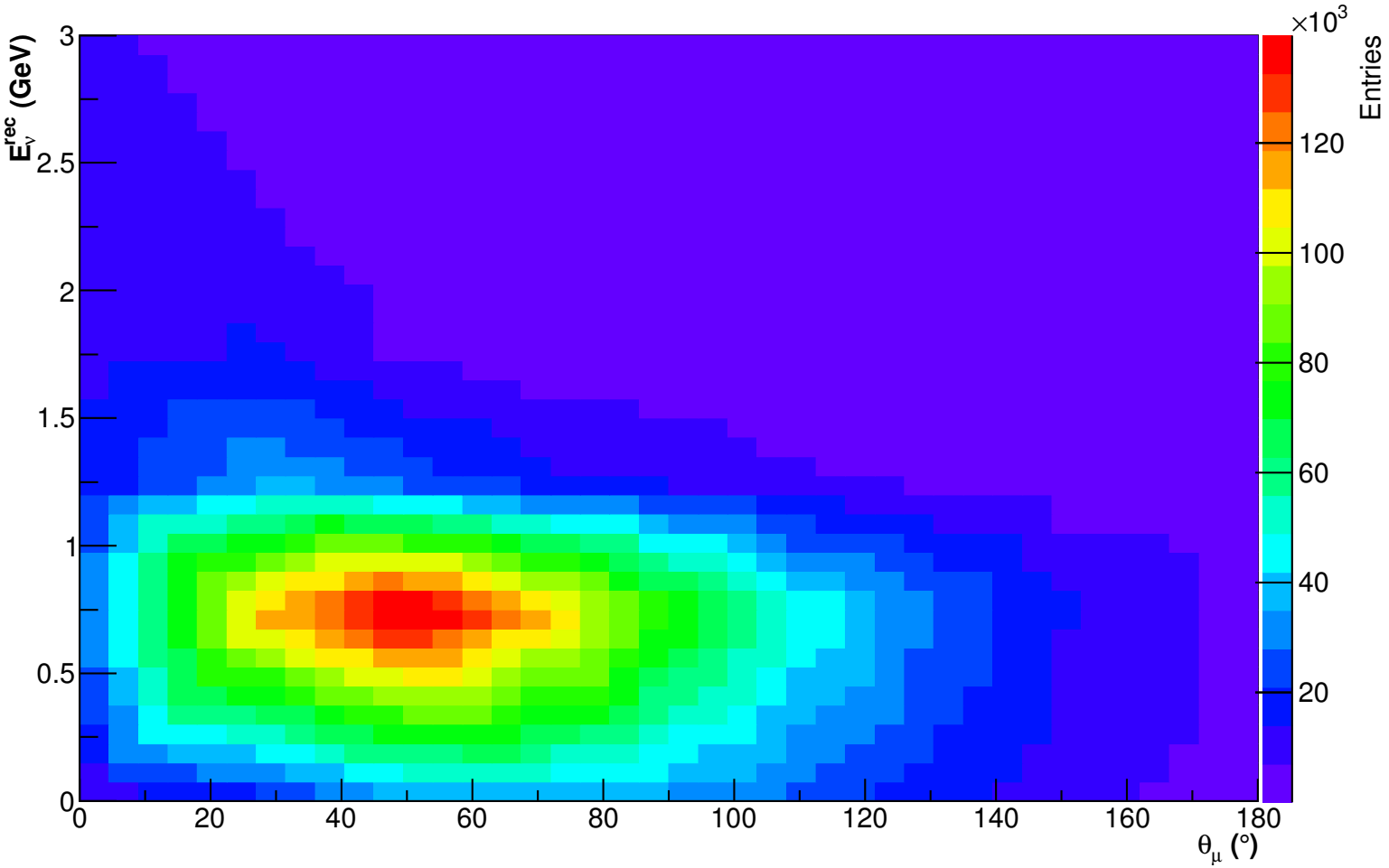


Figure 7: Entries data of each distribution of no. of ν_μ events vs. $1 - (E_\nu^{rec}/E_\nu^{true})$.

Results
Reconstructed neutrino energy

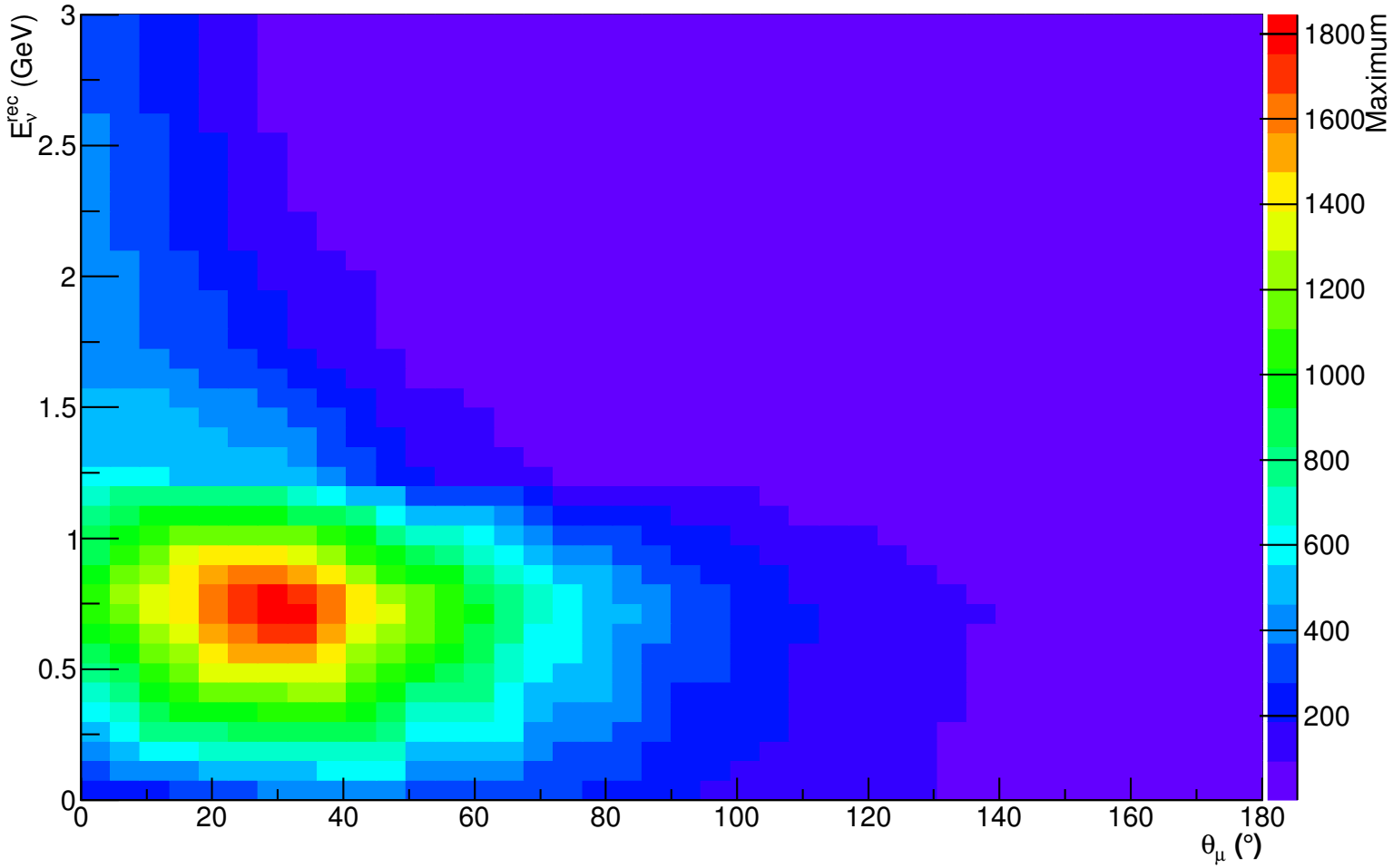


Figure 8: Maximum data of each distribution of no. of ν_μ events vs. $1 - (E_\nu^{rec}/E_\nu^{true})$.

Results
Reconstructed neutrino energy

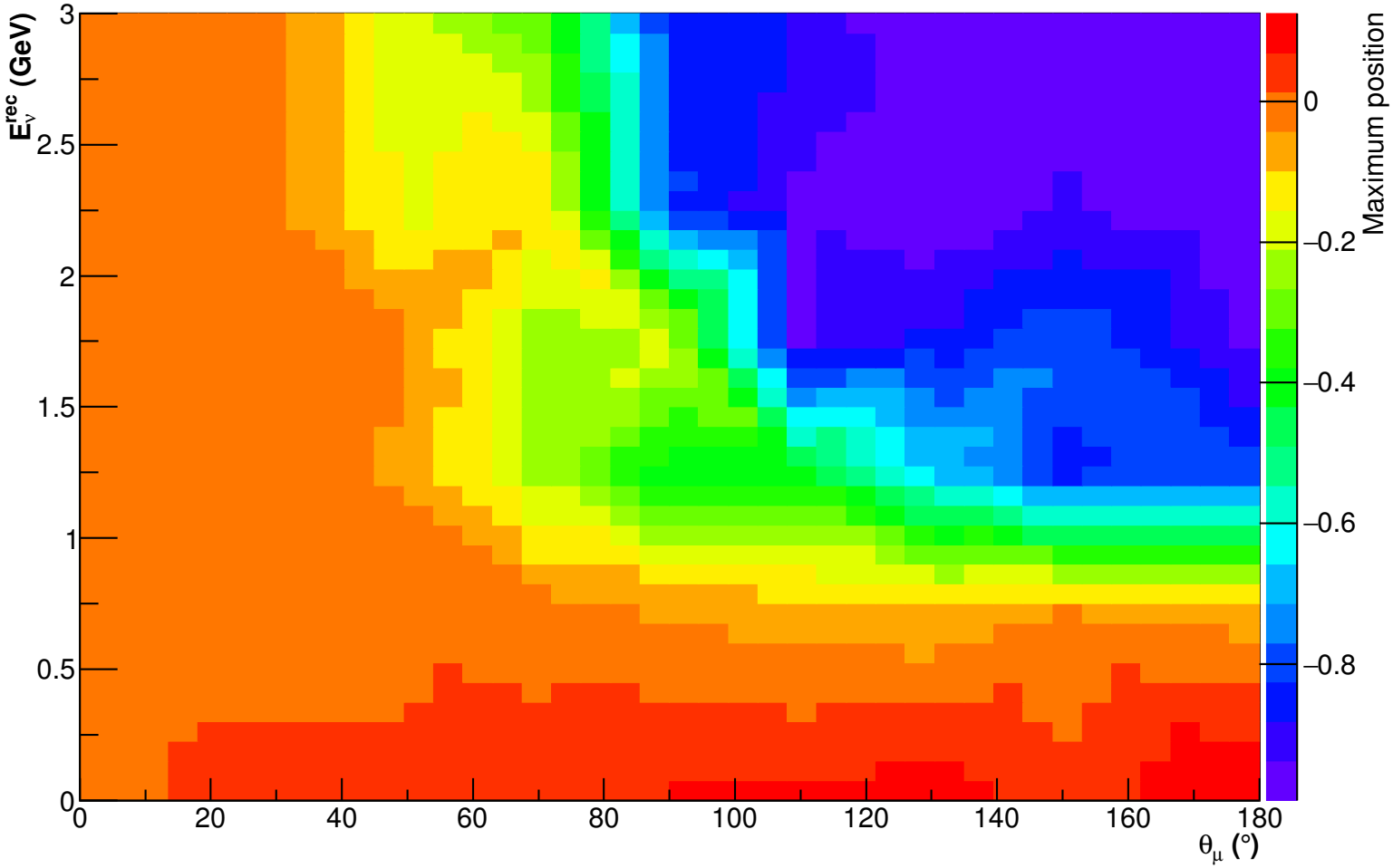


Figure 9: Maximum position data of each distribution of no. of ν_μ events vs. $1 - (E_\nu^{rec}/E_\nu^{true})$.

Results
Reconstructed neutrino energy

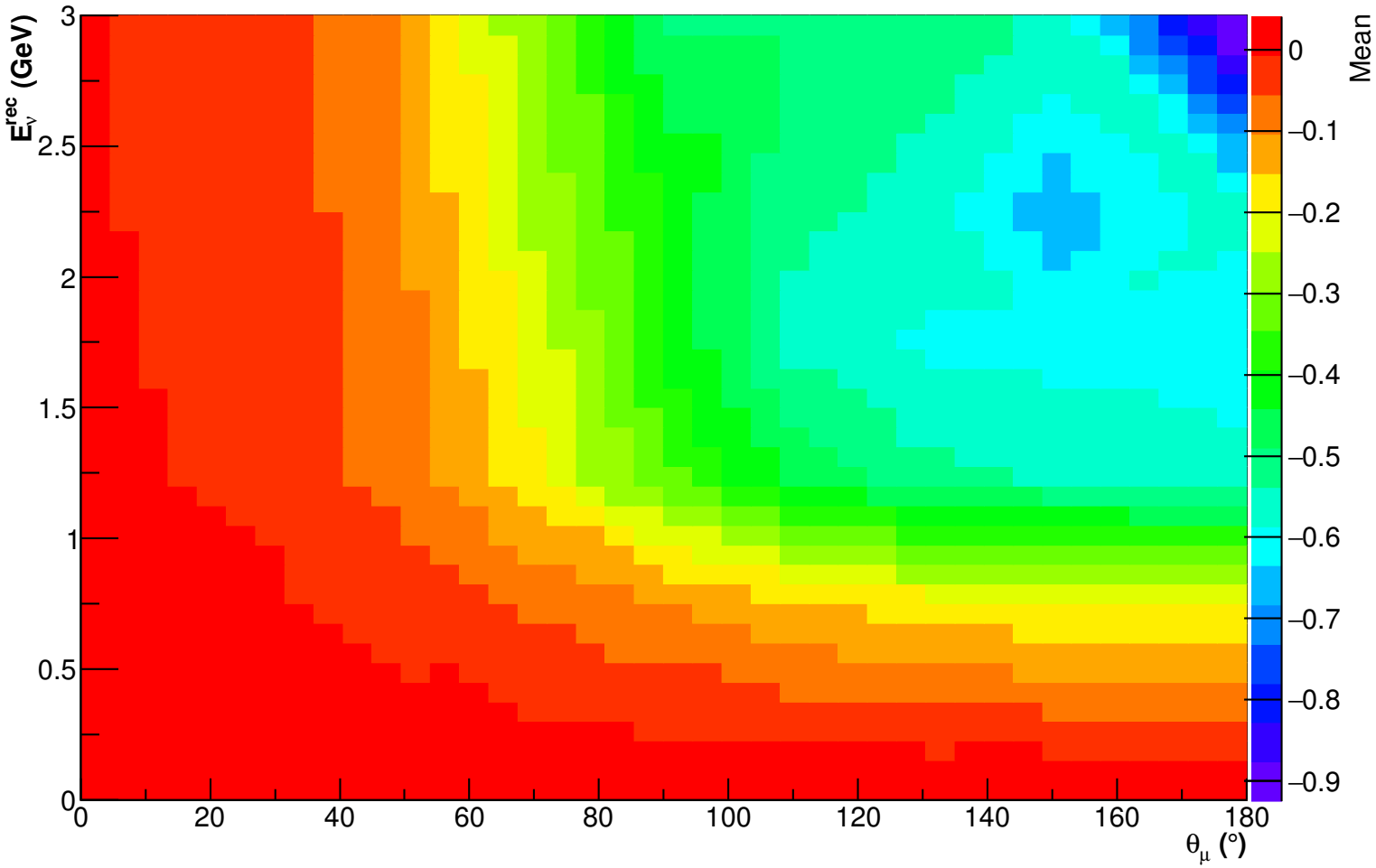


Figure 10: Mean data of each distribution of no. of ν_μ events vs. $1 - \left(E_\nu^{rec}/E_\nu^{true}\right)$.

Results

Reconstructed neutrino energy

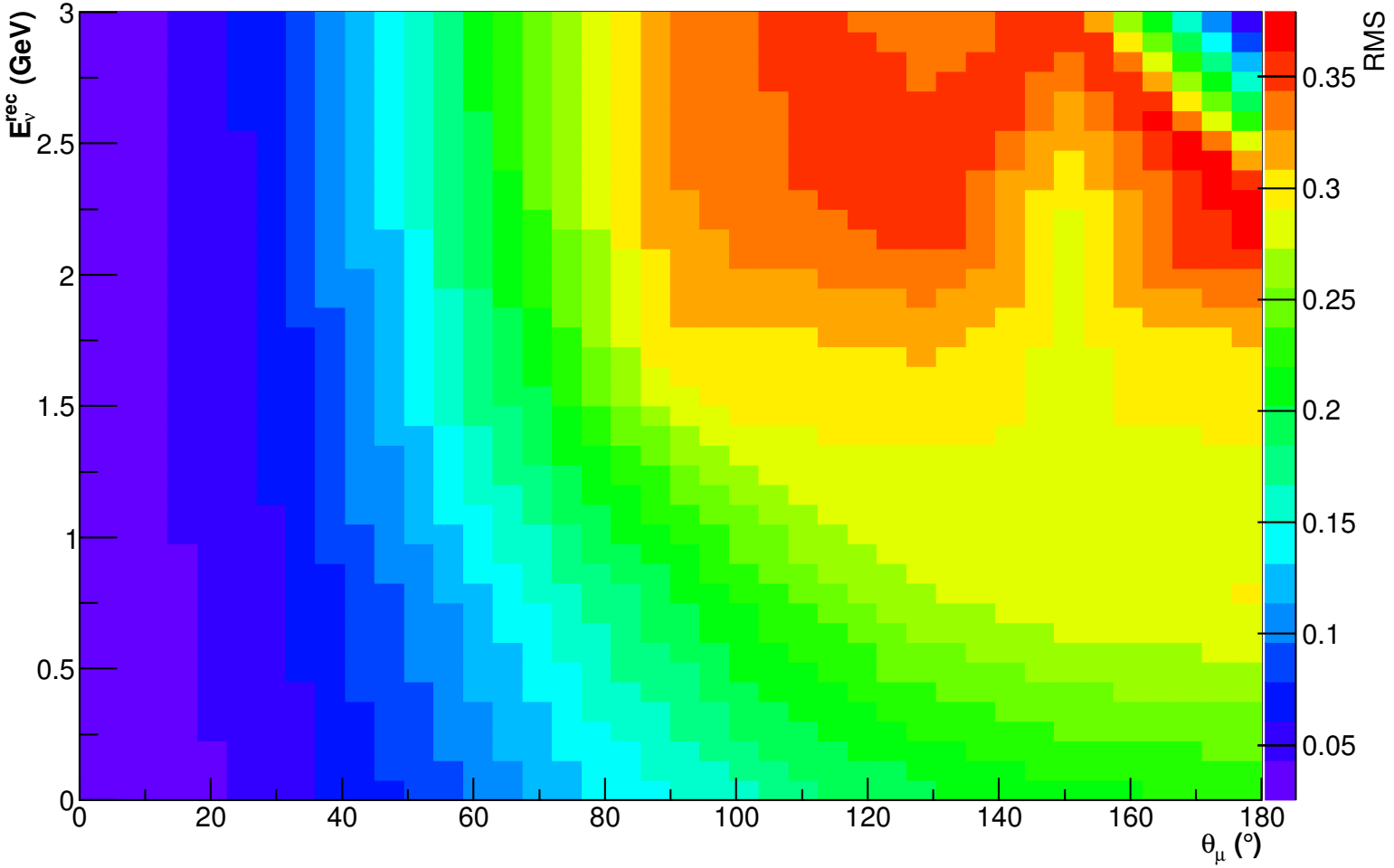


Figure 11: RMS data of each distribution of no. of ν_μ events vs. $1 - (E_\nu^{rec}/E_\nu^{true})$.

Results
Reconstructed neutrino energy

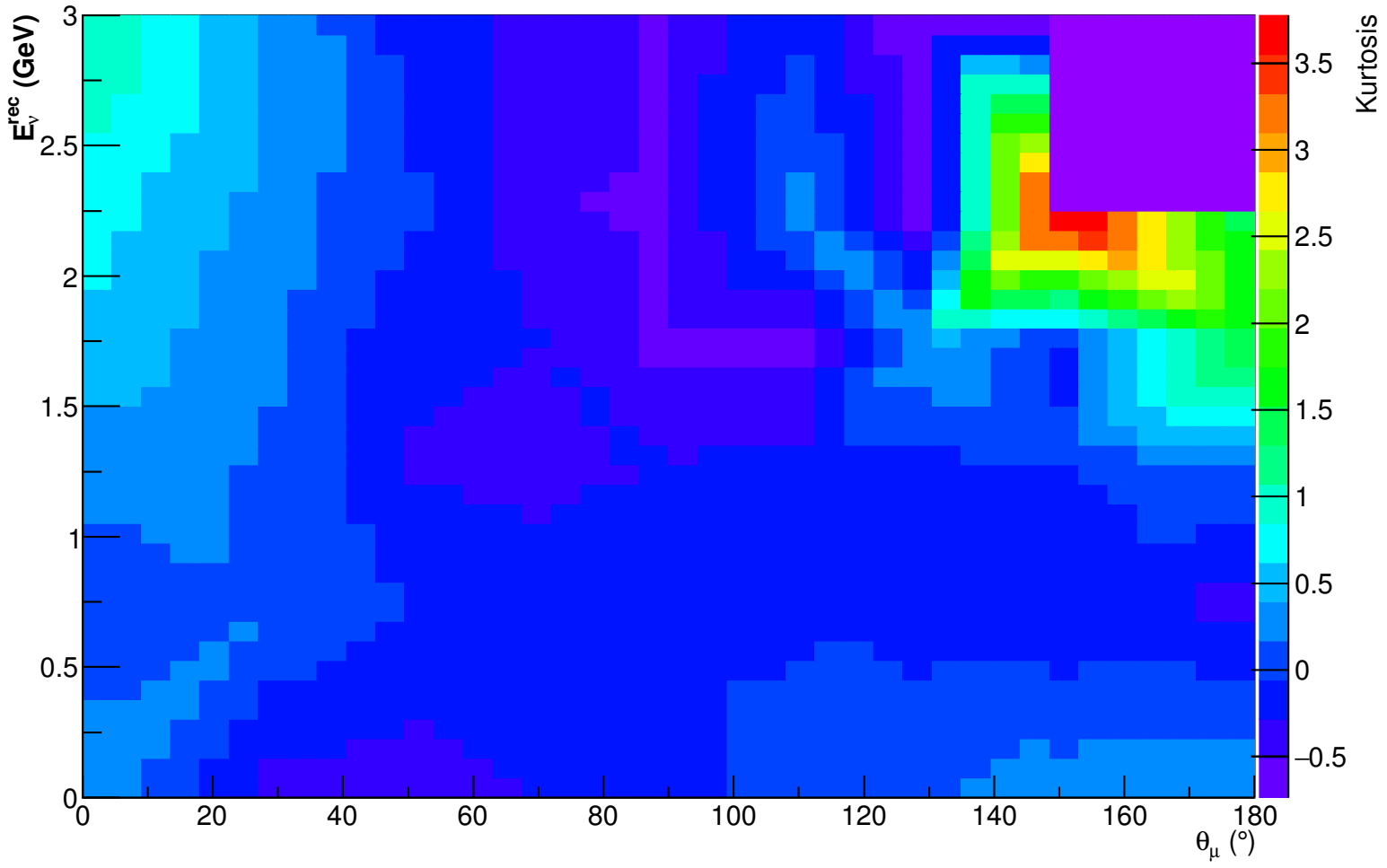


Figure 12: Kurtosis data of each distribution of no. of ν_μ events vs. $1 - (E_\nu^{rec}/E_\nu^{true})$.

Results
Reconstructed neutrino energy

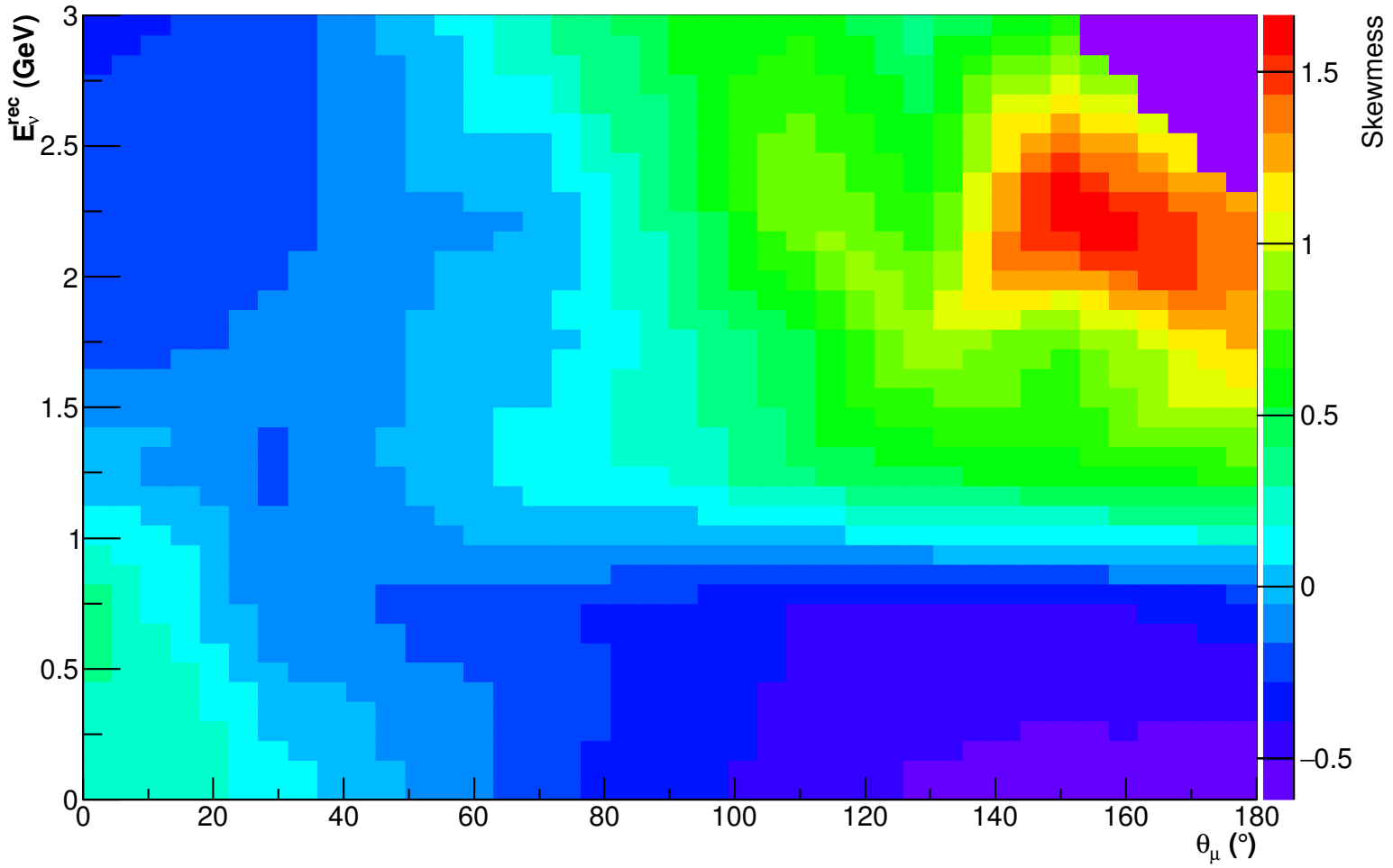


Figure 13: Skewmess data of each distribution of no. of ν_μ events vs. $1 - (E_\nu^{rec}/E_\nu^{true})$.

Results

ν_μ disappearance probability

Figure 14: Probability of disappearance of the ν_μ (Working on it!!!) .

Thank you!!!