



VMC based T2K Beamline simulation Studies

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Introduction

T2K simulation based on FLUKA (target) + GEANT3 (beamline)

- FLUKA problematic for various reasons (licence, old versions...)
- GEANT3 also not very convenient (old FORTRAN code, 32-bit compilation...)

➡ At some point, one should migrate all to GEANT4

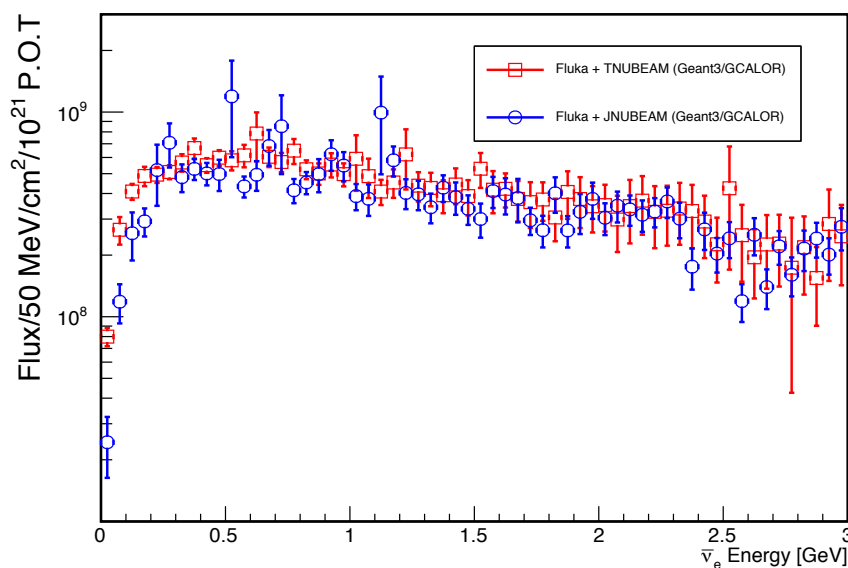
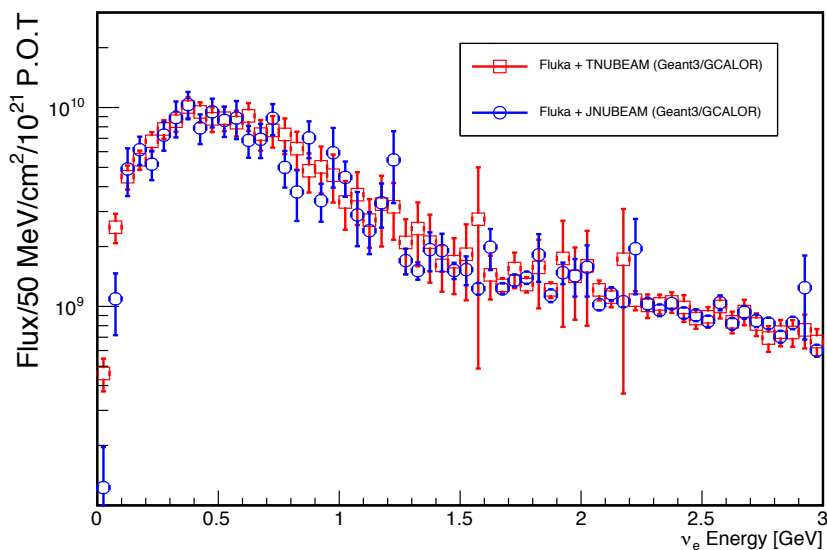
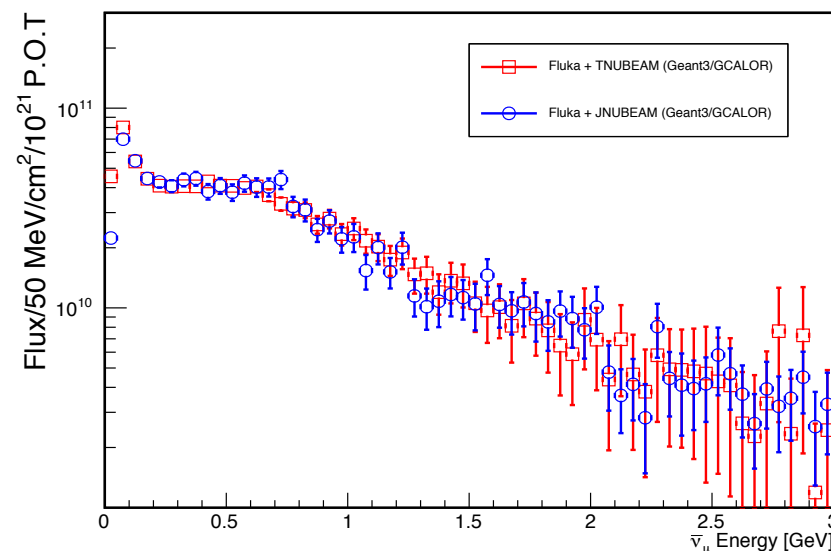
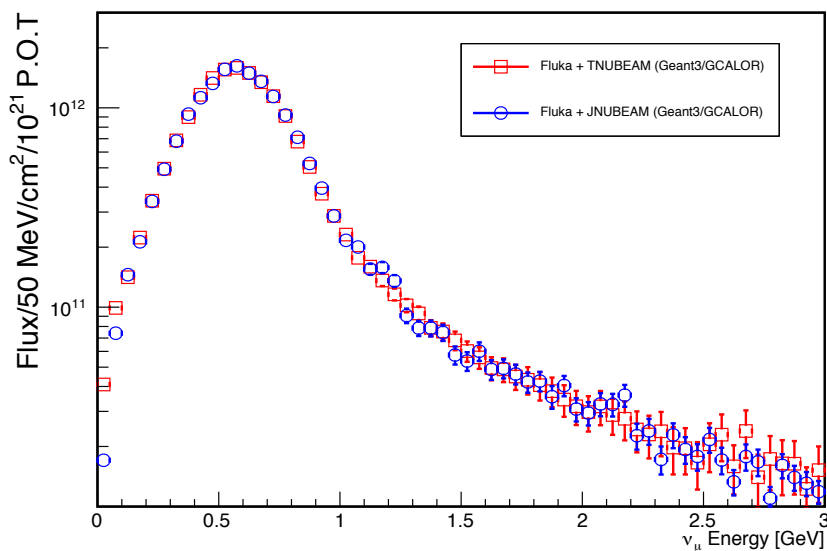
- For transition process, extensive comparisons between FLUKA and GEANT4 (target) and between GEANT3 and GEANT4 (beamline) should be made
- Tool needed for easy comparisons between MCs

➡ TNUBeam Virtual Monte Carlo

TNuBeam Virtual Monte Carlo

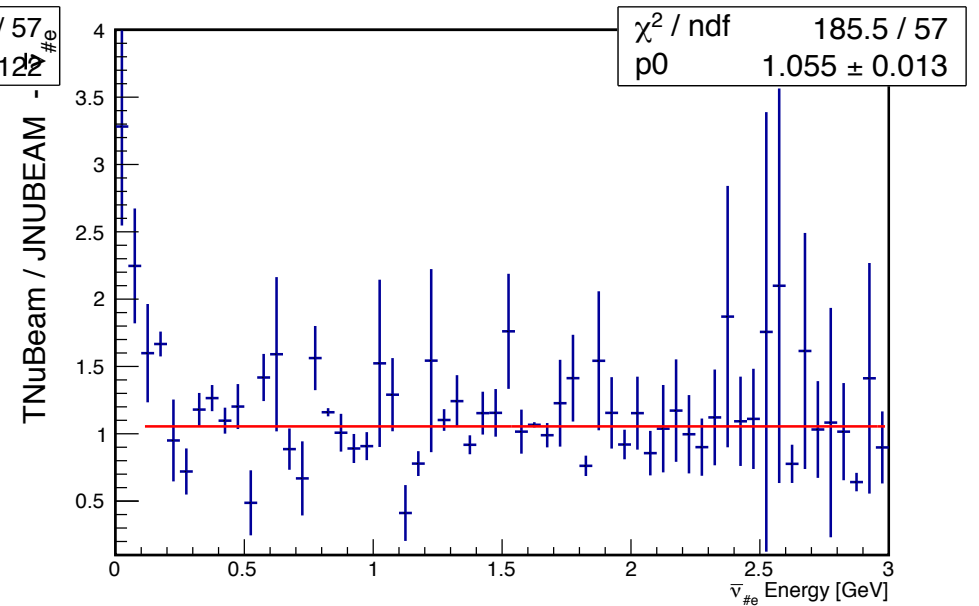
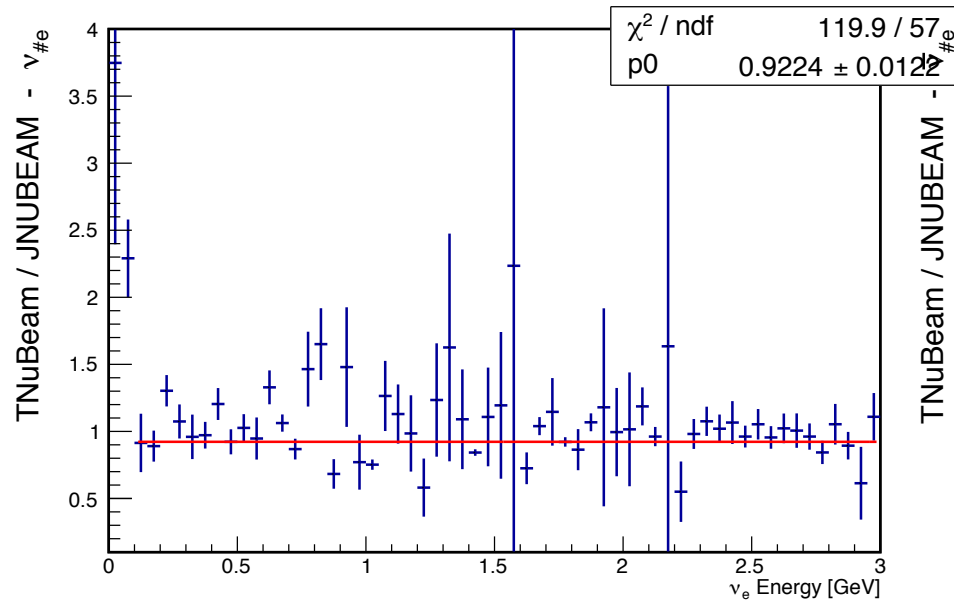
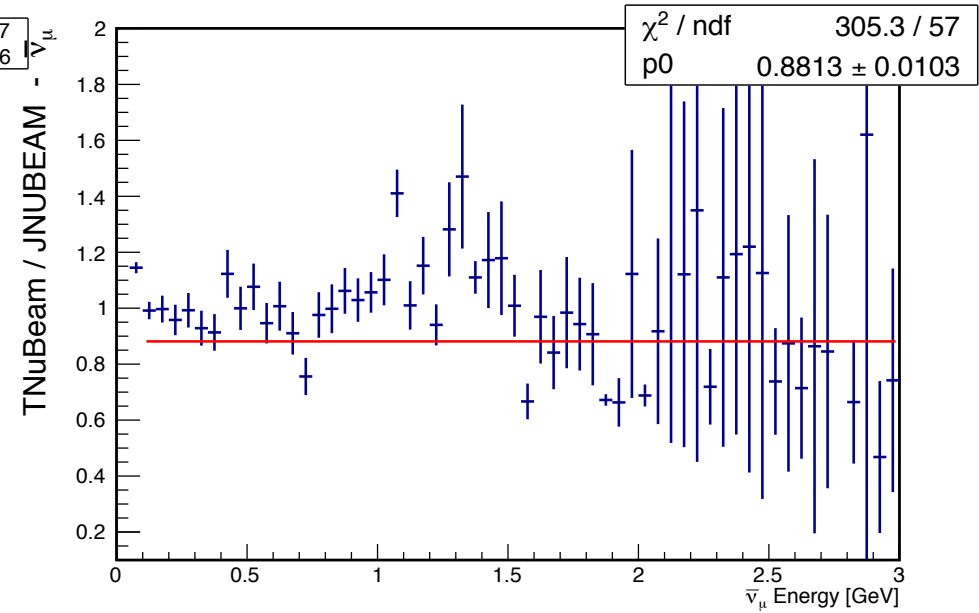
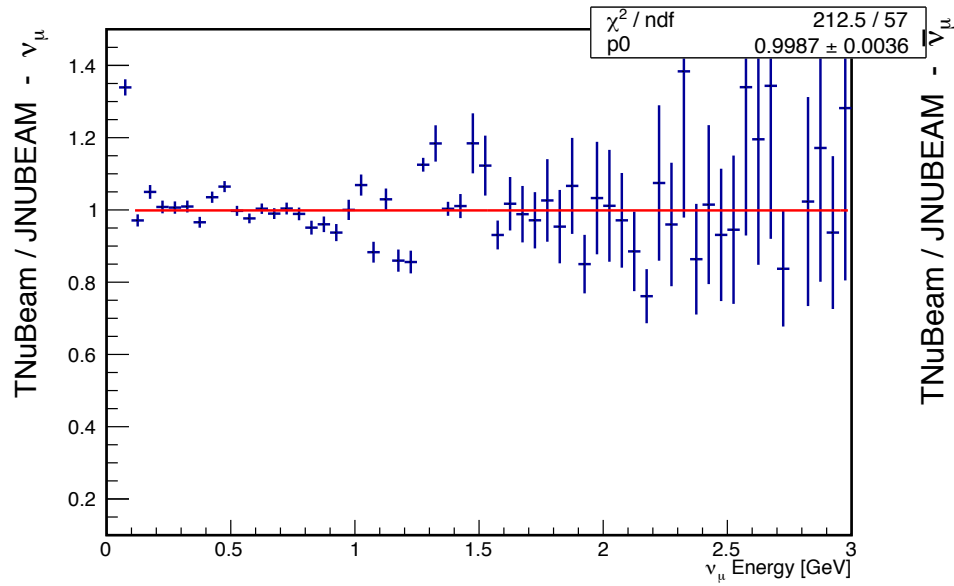
- VMC (Virtual Monte Carlo) is a Root-based C++ framework developed first for ALICE, providing a common interface to different MCs.
- Aimed to run in the same framework FLUKA, GEANT3 and GEANT4, but FLUKA interface not working at the moment
- User is supposed to provide some Classes for detector description, beam definition, output variables, then VMC manages event generation in the same way for GEANT3 and GEANT4.
- TNuBeam is a software developed at LPNHE by A. Robert, B. Popov and L. Zambelli in the VMC framework.
- It provides T2K (target and/or beamline) simulation based on GEANT3 and GEANT4, as well as simulation of various NA61 configurations (Thin Target, Replica Target, ...) and of HARP experiment for comparison with hadron measurements
- It can take FLUKA simulation as input for comparison with T2K (JNUBEAM) simulation

Flux comparison between TNUBEAM and JNUBEAM

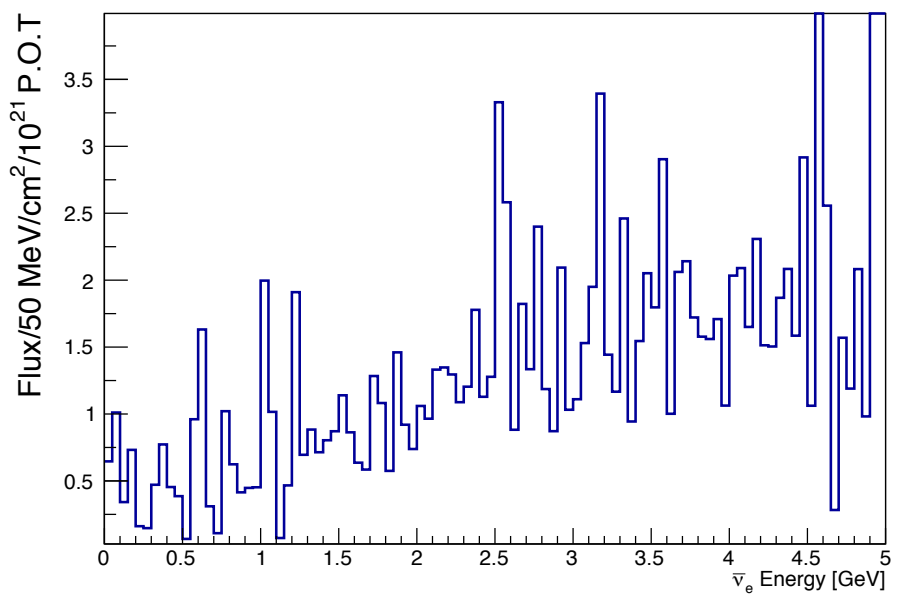
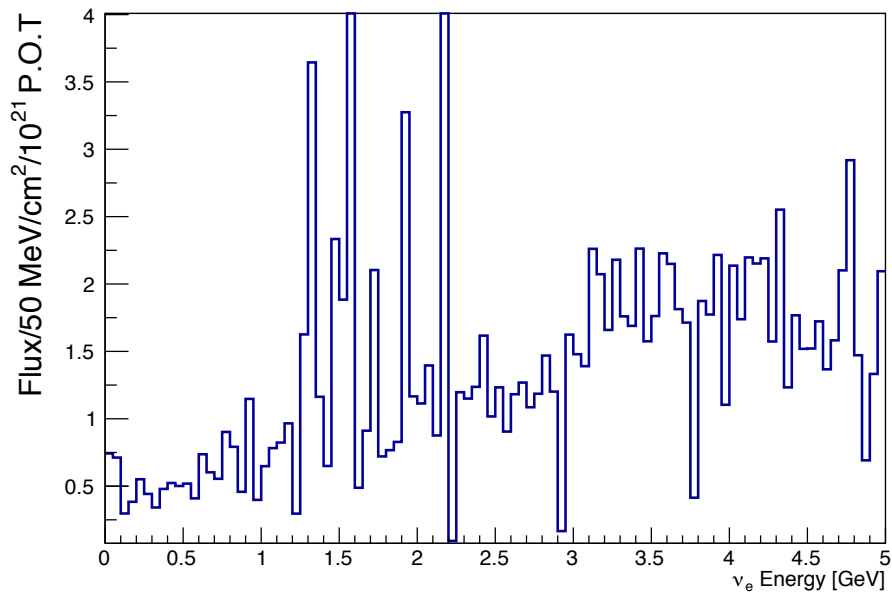
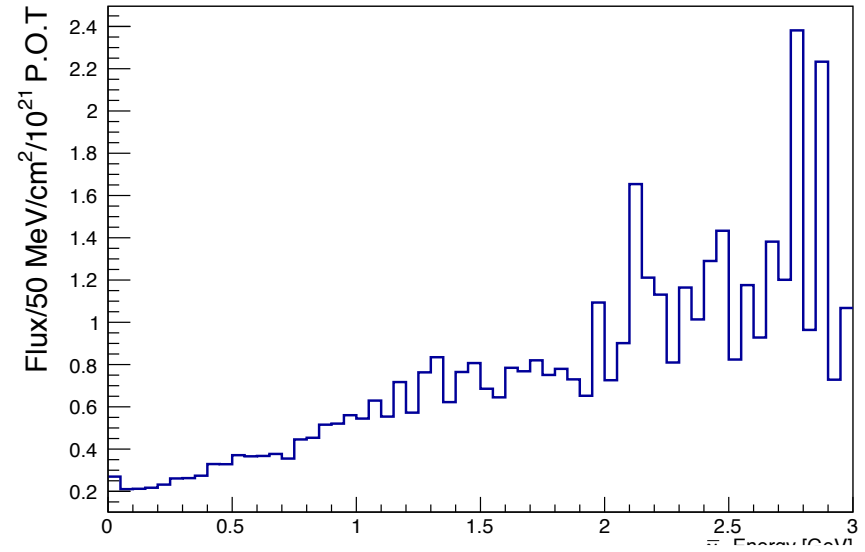
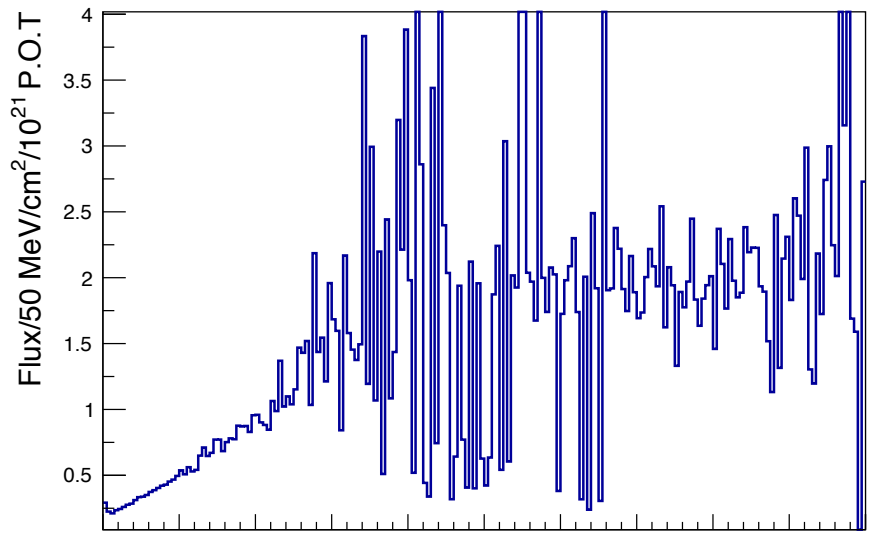


- Target simulation based on FLUKA for both simulations
- Neutrino Flux in ND280 detector

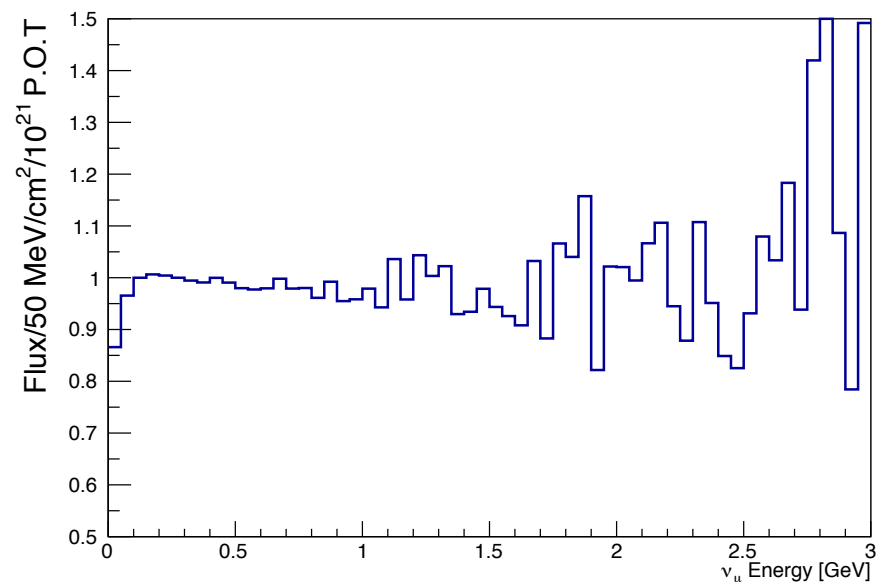
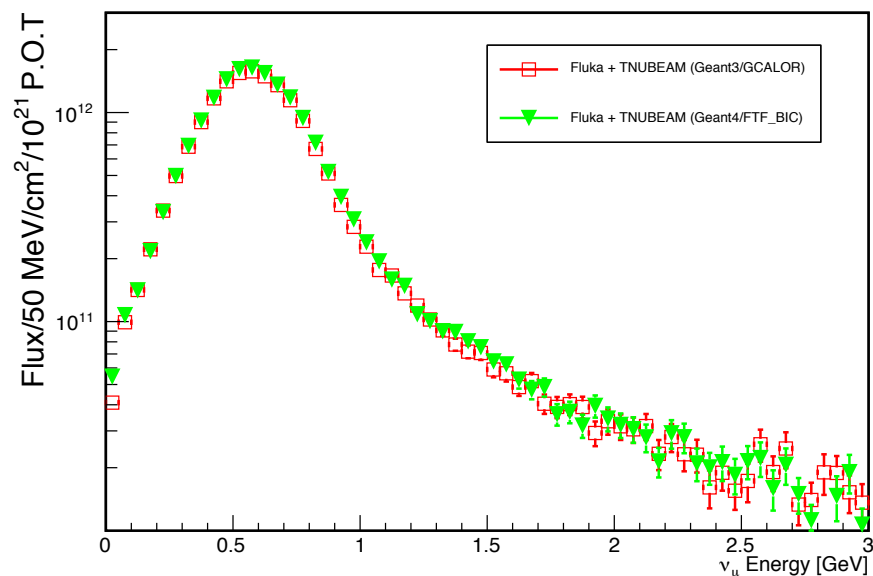
Flux ratio TNUBeam / JNUBEAM



Flux error ratio TNUBeam / JNUBEAM

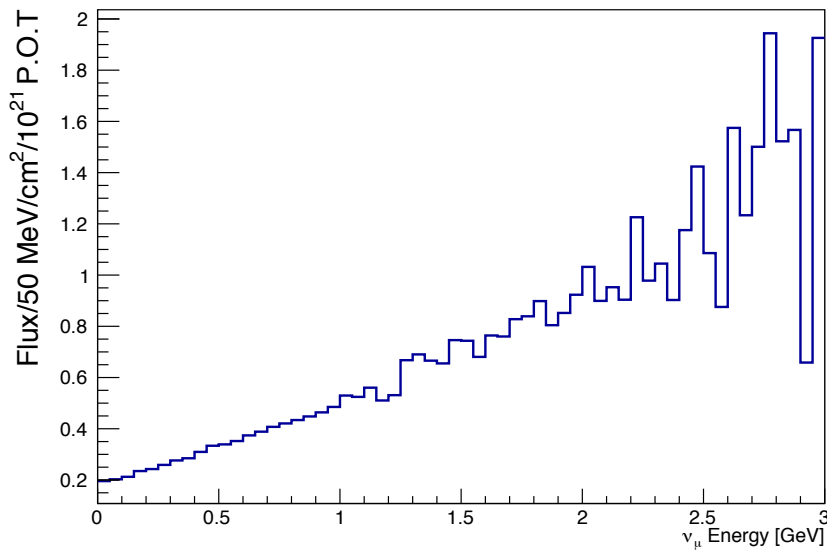
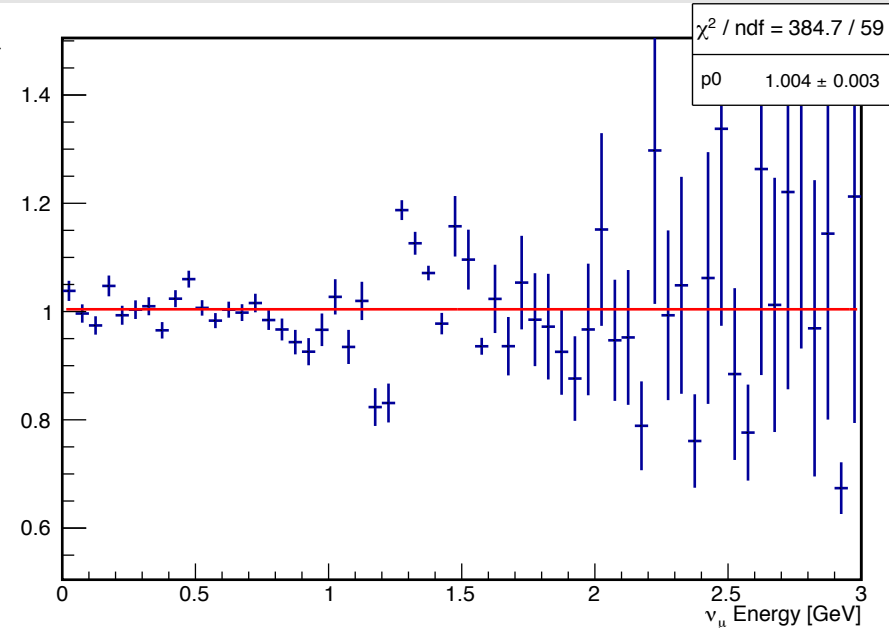
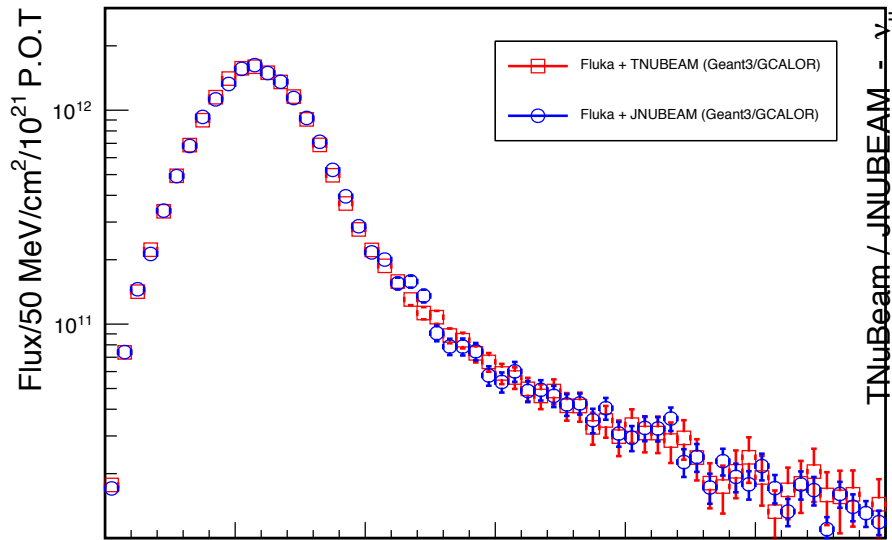


Flux comparison TNUBeam – Geant3 vs Geant4



Problem with errors but also with timing (TNubeam x5 slower)
not specific to Geant3 (VMC consistent Geant3 vs Geant4)
→ check Geant3 flags and cuts TNUbeam vs JNUBEAM

Flux comparison TNUBeam (new cuts) vs JNUBEAM



Timing improved by 2-3, also low energy difference solved but errors problem still present → still some cuts to change in TNUbeam

Ongoing study

- New cross-checks on cuts
- Weight calculation to investigate in TNubeam vs JNUBEAM
- Improvement of TNuBeam structure and user interface still under development.