University of Sussex

Energy resolution parameterisation

Numu group, Aug 2016

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Version details

Using tagged release: **S16-08-04**

Using a decaf nonswap FD file:
/pnfs/nova/persistent/production/concat/R16-03-03-prod2reco.d/
prod_decaf_R16-03-03-
prod2reco.e_fd_genie_nonswap_fhc_nova_v08_epoch1-3c_numu_contain_v1_
prod2-snapshot.root

Energy resolution parameterisation

Using the MC to measure the the abs. resolution (reco-true) of muon and hadronic energy vs. (muon or had.) energy. Fit a polynomial to the res. vs energy plot, the fit is used to “look up” the resolution for a given energy

Absolute neutrino energy resolution is defined for each event as:

$$\sigma_\nu = \sqrt{(\sigma_\mu(E_\mu)^2 + \sigma_{had.}(E_{had.})^2)}$$

(Assuming no correlation)

σ_ν / E_ν is then used to define the energy resolution for each event

Using truth selection for resolution parameterisation

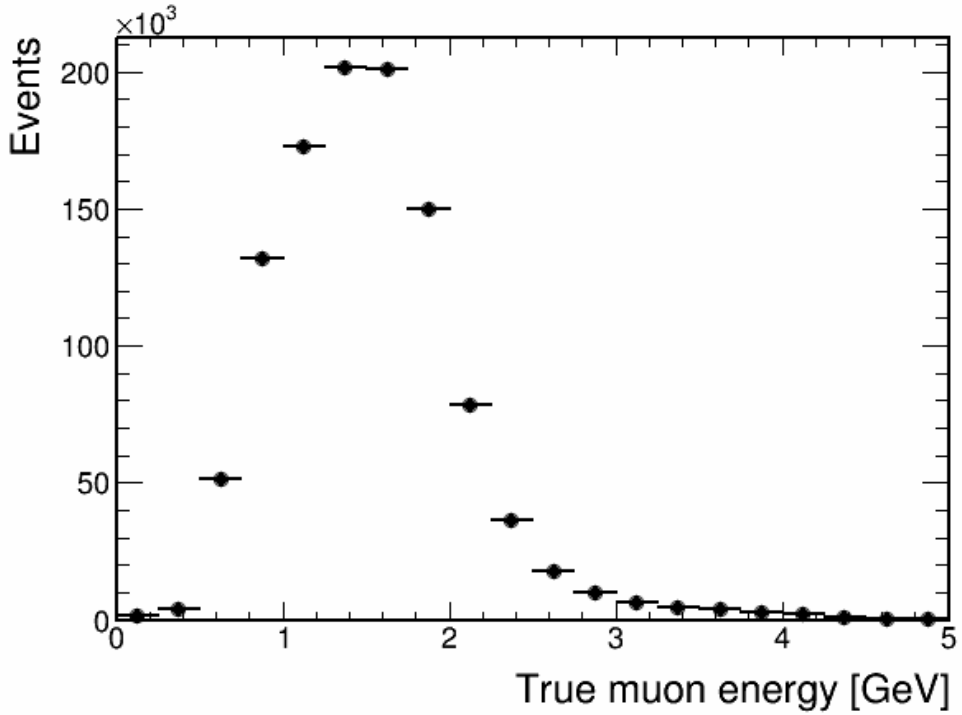
Note: At this stage parameterisation is done without applying oscillations to the FD MC

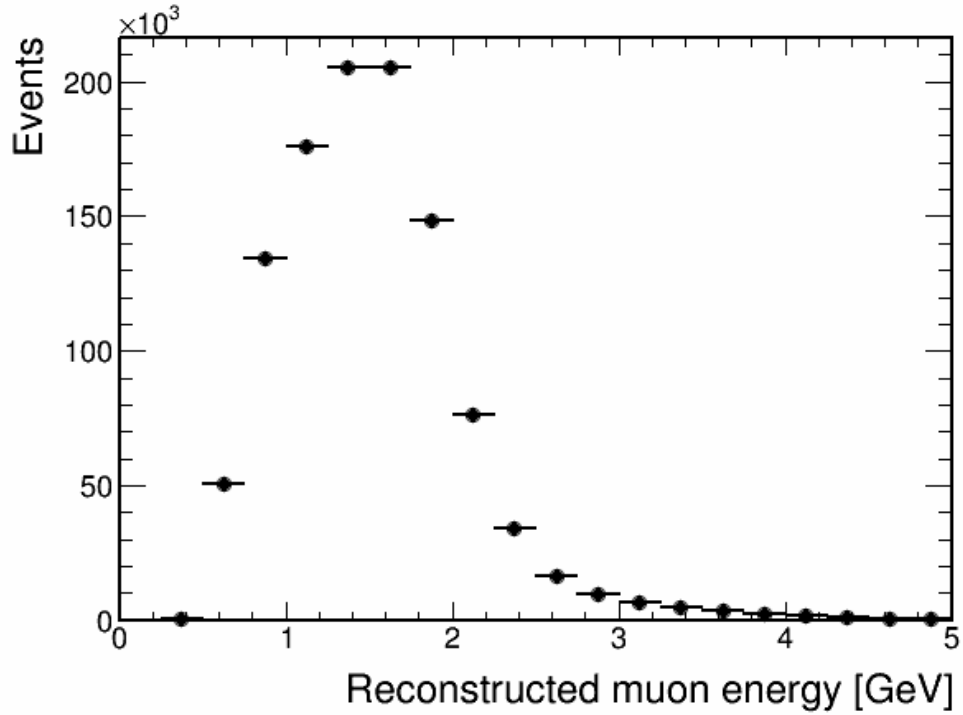
Selection

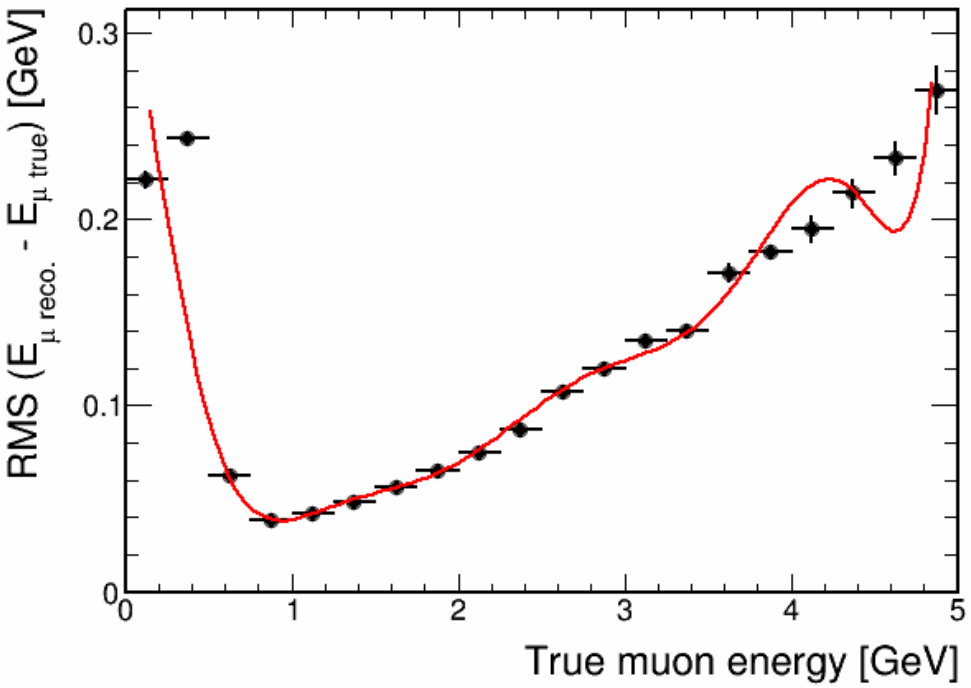
Use the standard **numu FD selection** (kNumuFD) and also the **truth selection** (kIsNumuCC)

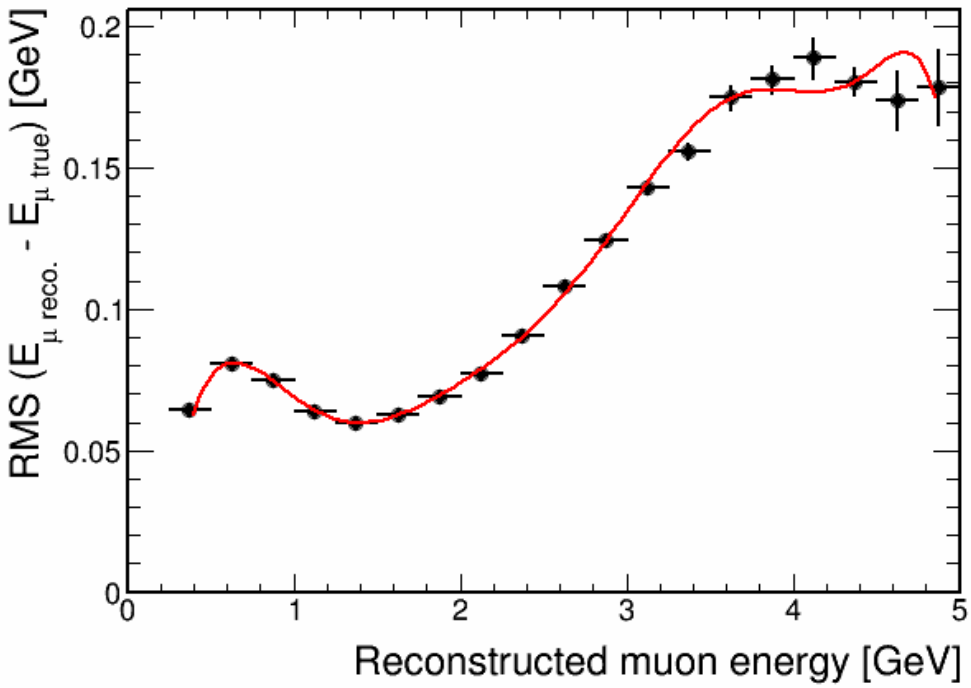
Need to use the truth selection to remove troublesome background. In particular the NC events, for which the true muon energy will be zero. That's a problem when we want to measure (reco. E – true E)

Muon energy resolution

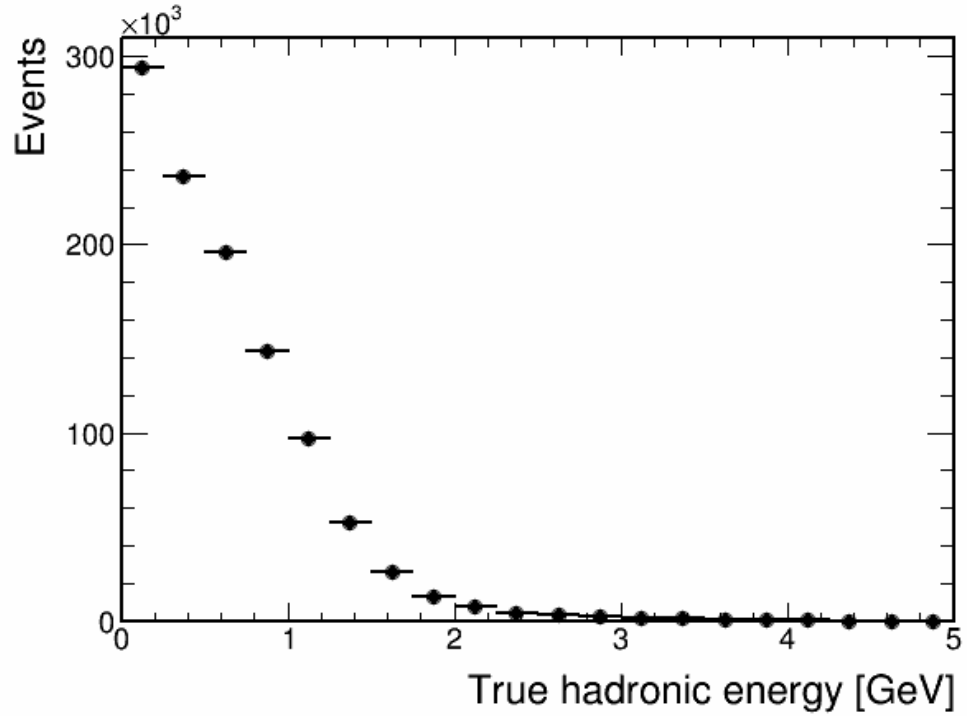


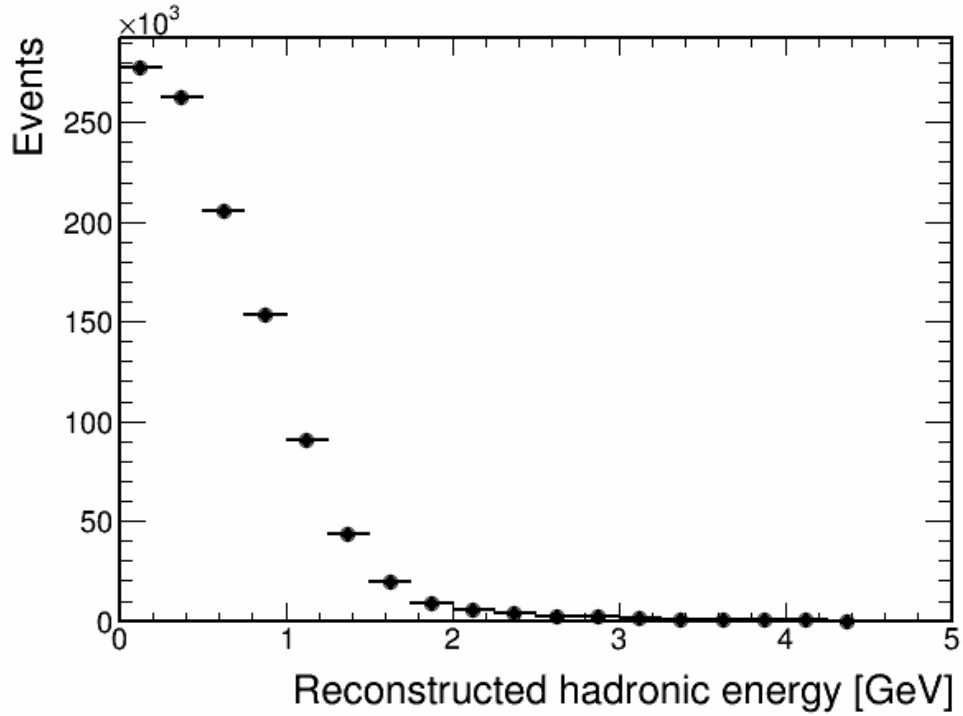


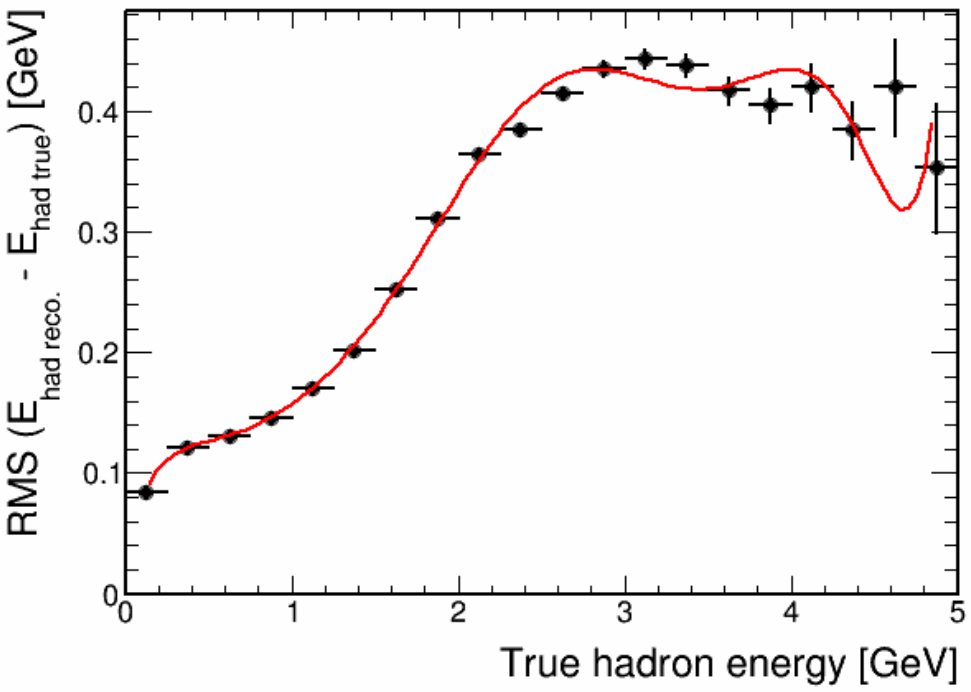


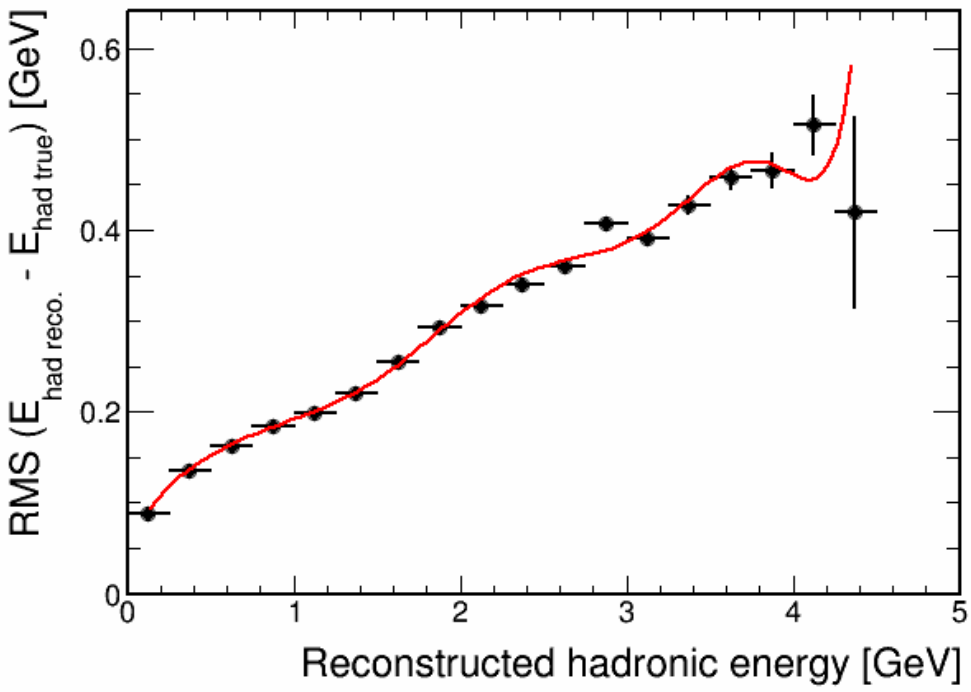


Hadronic energy resolution

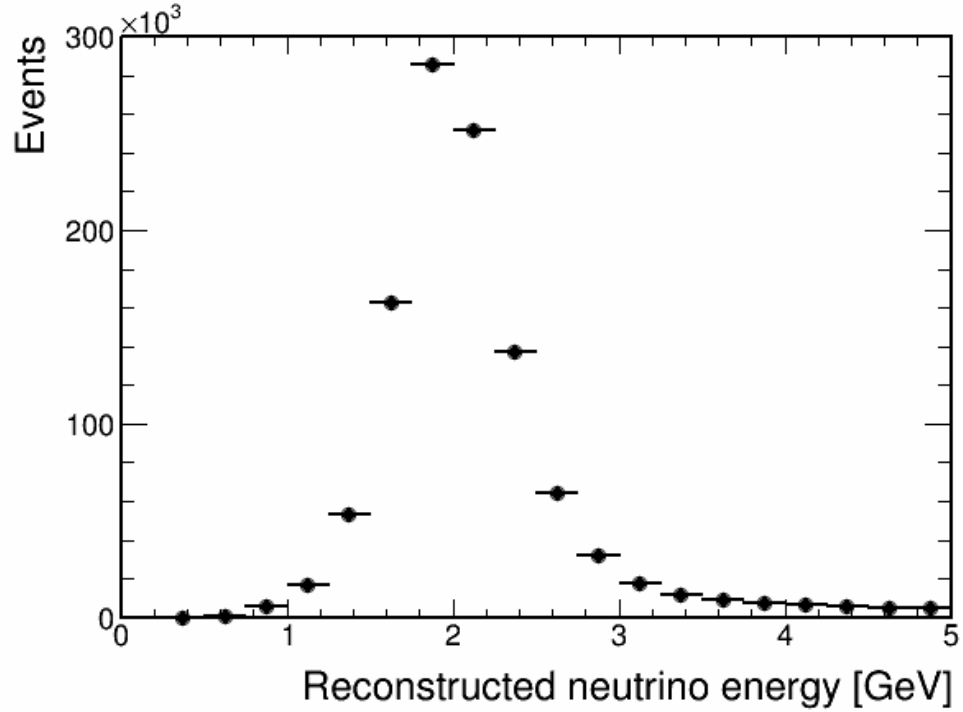


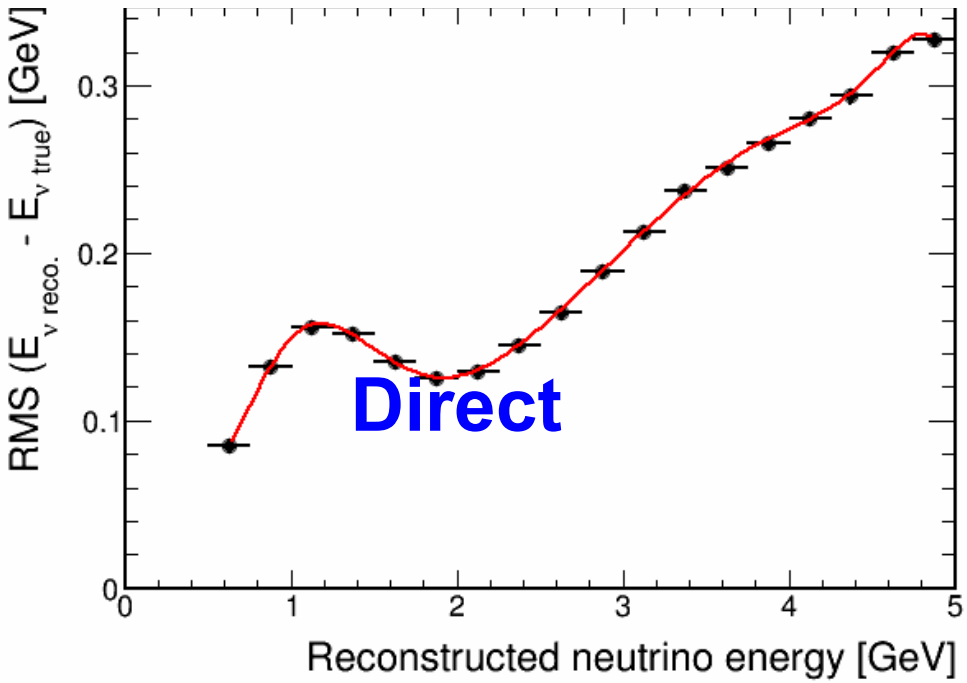


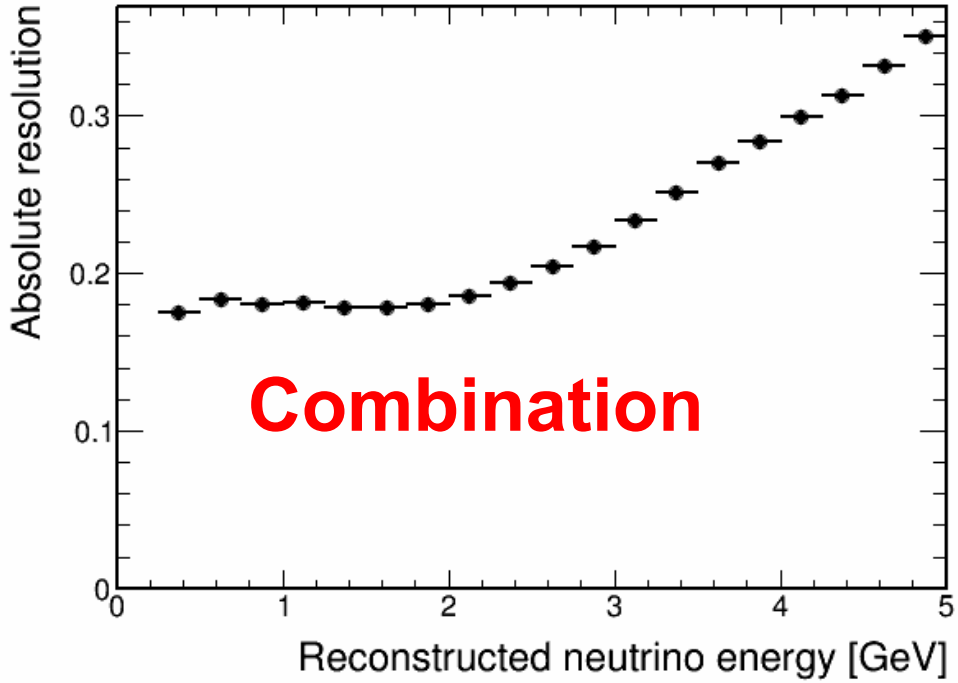




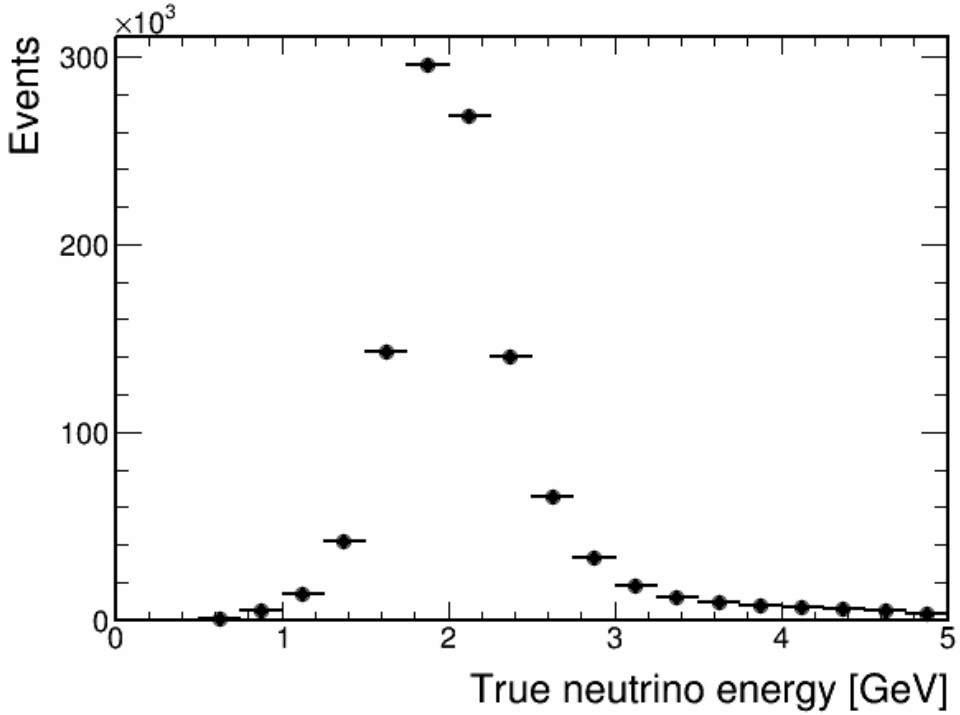
Neutrino energy resolution

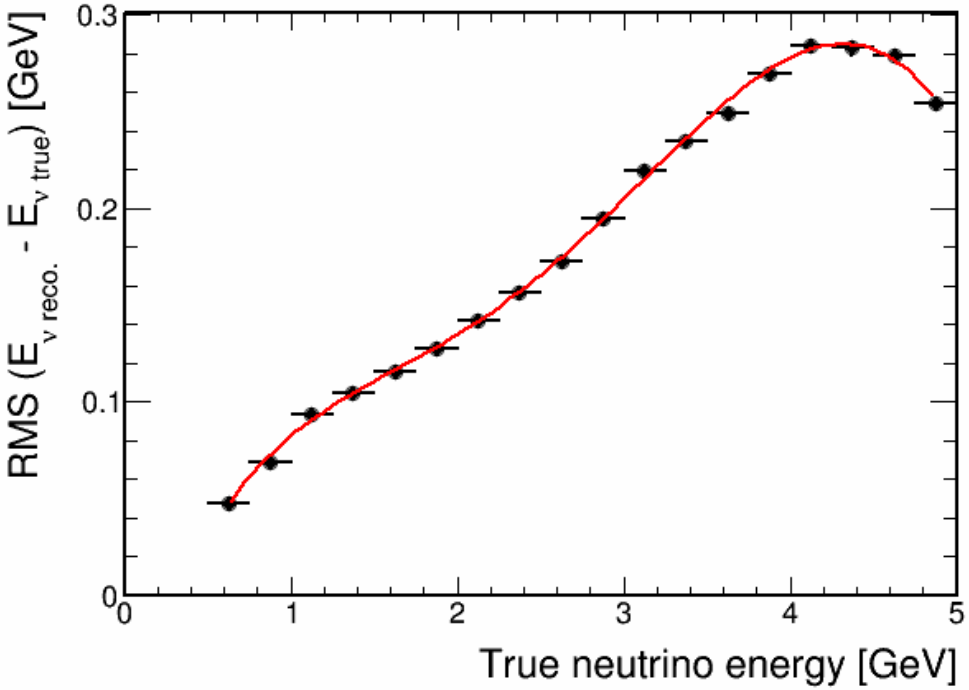


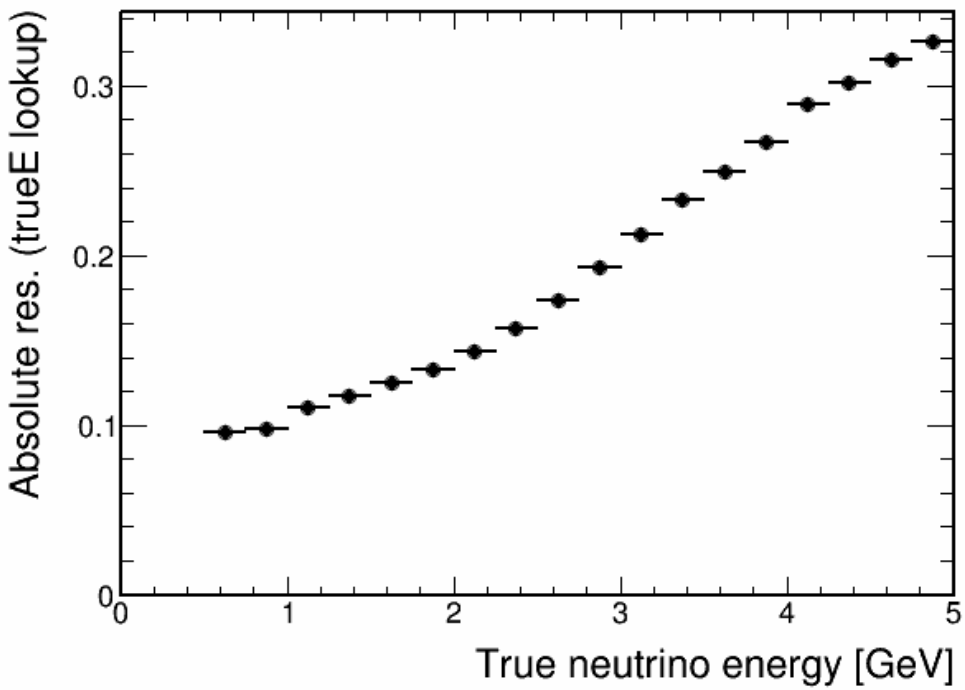




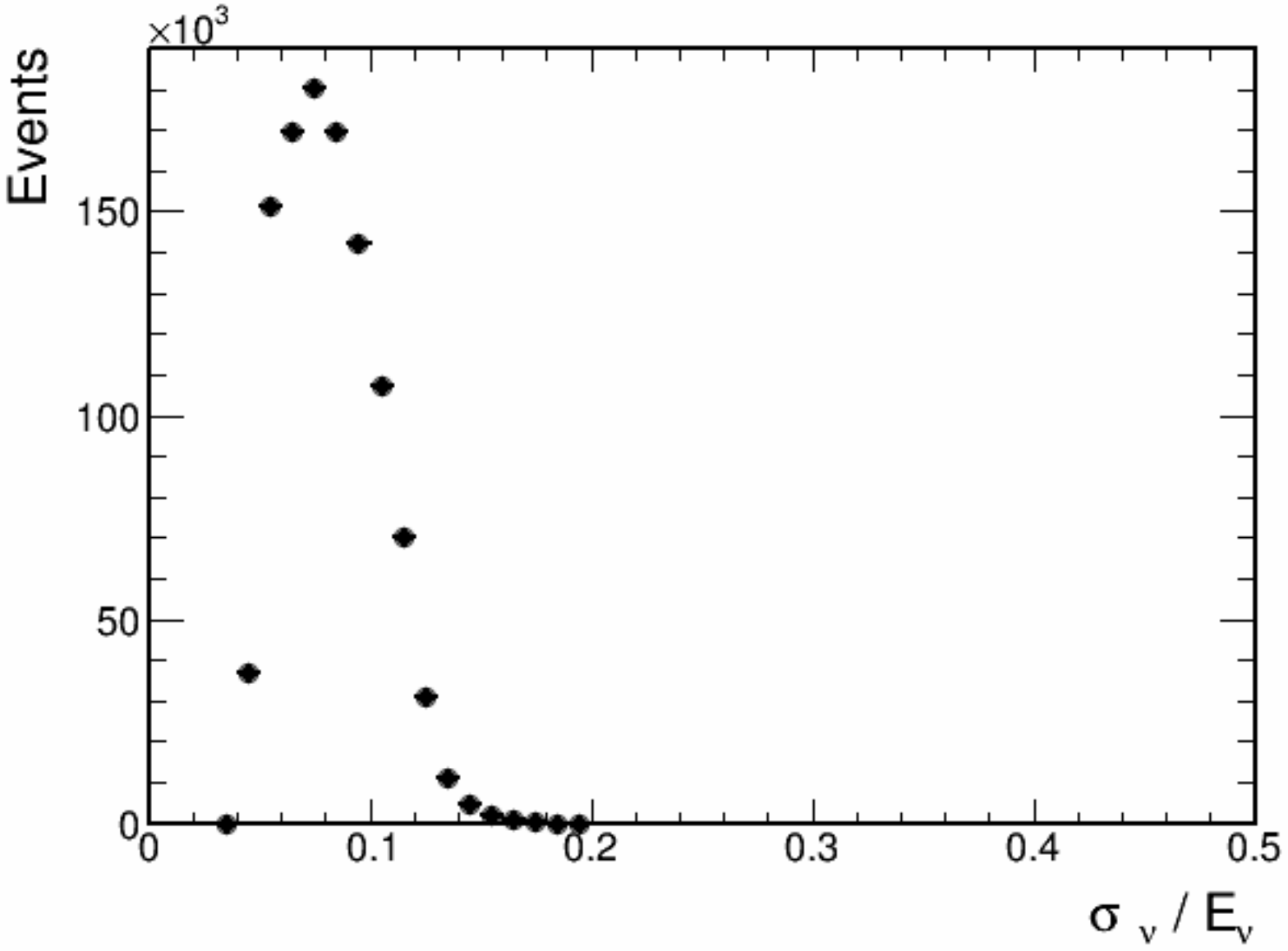
True neutrino energy resolution







Neutrino energy resolution



Summary

- Made first pass at parameterising the neutrino energy resolution as a function of muon and hadronic energy

Future plan

- Produce the energy spectrum (oscillated and un-oscillated) for energy resolution bins

- Make contours at max. mixing for combinations of energy res. bins
  - look for initial signs of improvement in the sensitivity

Backup