Supernova Neutrino Generator

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Supernova neutrino generator

- Currently have generator written by AJ Roeth (LBNE-doc-8225-v1)
- It simulates ν_e-^{40}Ar CC interactions in a box:
  1 interaction per event for one neutrino energy
- It produces a text file with kinematics information for electrons and γs
- This text file can be used as input for LArSoft

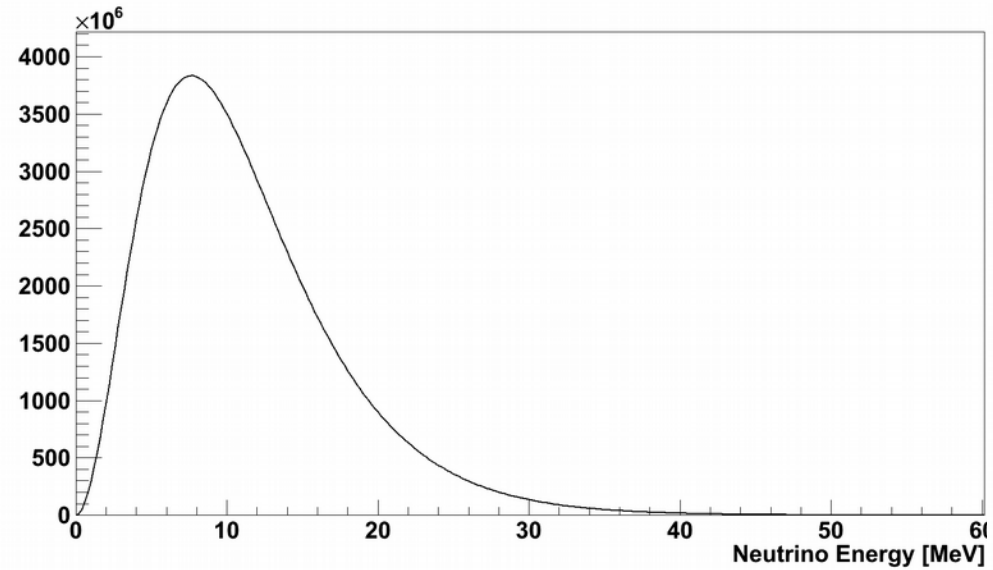
SNν generator improvements

- LArSoft implementation (`SNNueArCCGen_module`)
  - Rewrote the generator as an algorithm (`NueAr40CCGenerator`)
  - Produces `simb::MCTruth`
  - Simulates event with N neutrinos (Poisson distributed random number)
  - Sample SN ν_e spectrum – TGraph in root file
  - Interaction time random

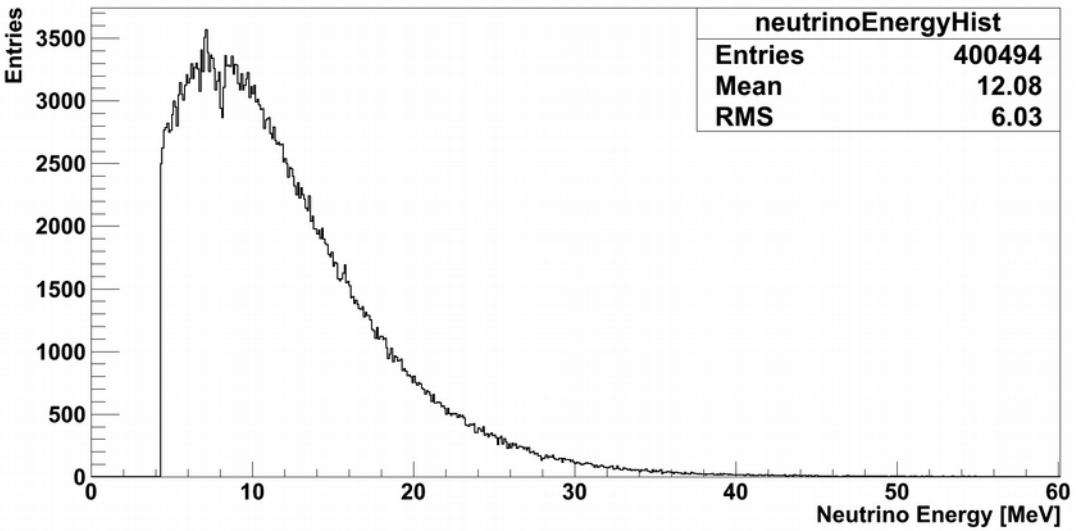
Parameters

```
EnergySpectrumFileName:“nue_spectrum.root”
MeanNumberOfNeutrinos: 40000
NeutrinoTimeBegin:    -100000.0
NeutrinoTimeEnd:       100000.0
ActiveVolume0:      [ -100.0, -100.0, -100.0 ]
ActiveVolume1:      [  100.0,  100.0,  100.0 ]
```

Comparison of input and output

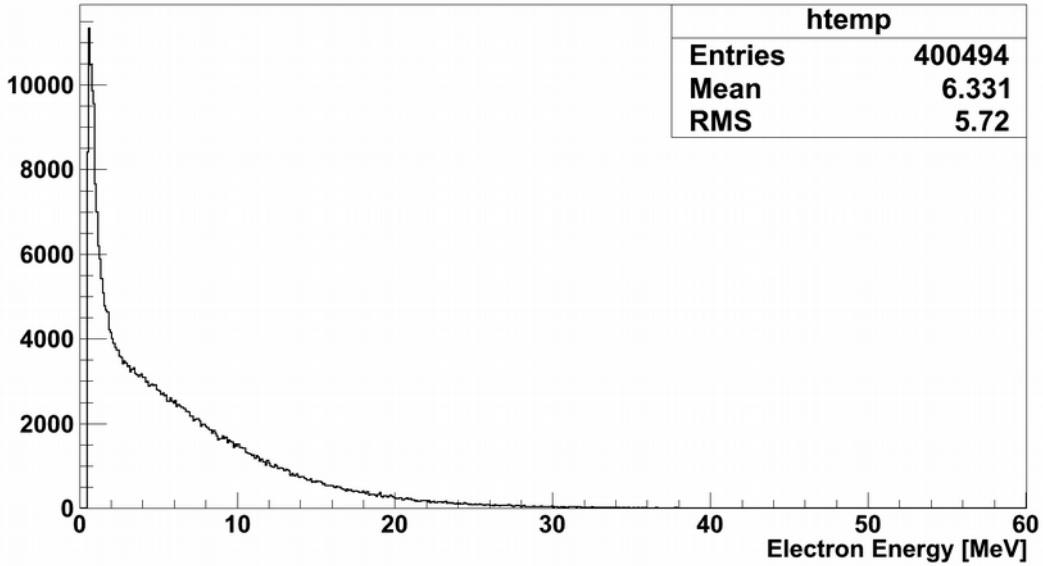


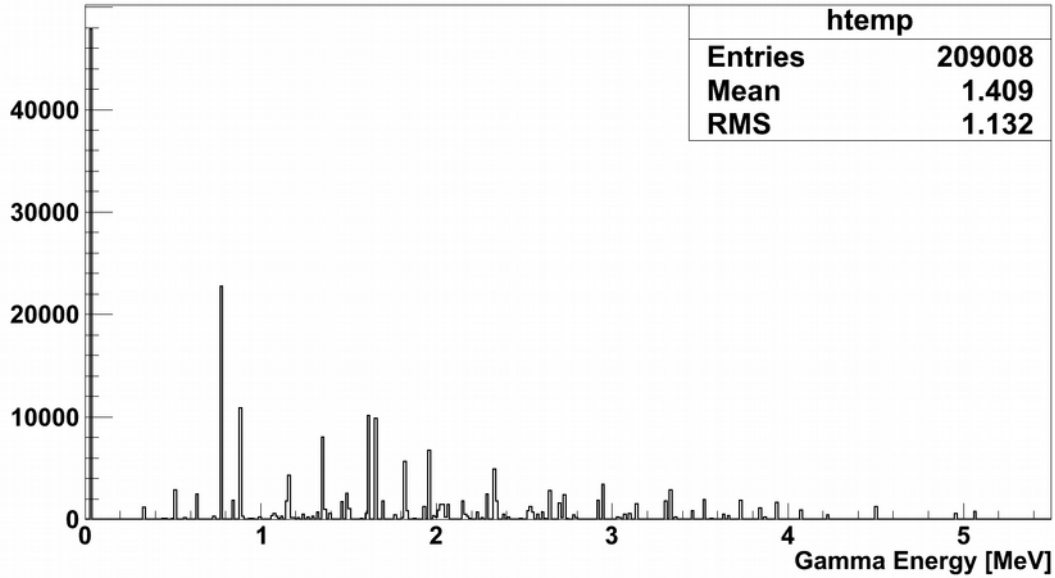
Primary neutrino energy



Electron energy
+ energy of all gammas

Energy spectra





To do

- Plan to use `geo::Geometry` to get active volume to simulate neutrinos in
- Plan to simulate neutrinos in readout window + drift window (also obtained from some service)
- Plan to use standard LArSoft random number generator service (currently use TRandom3)

Status

- `feature/gvsinev_SupernovaGenerator` in LArSim (will publish this afternoon)
- Module is compiled, but not yet tested
- Algorithm is tested
- I expect the module to be ready later today after I test it