NEUT
current status and plan

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for the NEUT contributors

Latest version ~ NEUT 5.4.1 (to be released soon)

- CCQE
  - Nieves LFG (default)
    - Two treatments of the separation/binding energy.
  - Global Fermi-gas (old model)
  - Spectral function
    - based on Ankowski/NuWro implementation with Benhar's spectral function.
- 2p2h
  - Nieves model
    - Hadron-tensor based implementation (default)
    - Pre-calculated cross-section implementation

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- Single π production
  - Rein-Sehgal (Berger-Sehgal) model
    - Original form factor (as appeared in the original paper)
    - Garczyk-Sobczyk form factor tuned with data
- Single meson/gamma productions
  - Based on Rein-Sehgal model for pion
- SIS (multi π production, W<2GeV)
  - Custom code
  - GRV98 PDF with Bodek-Yang correction
- DIS
  - PYTHIA 5.72/JetSet (comes with CERNLIB)
  - GRV98 PDF with Bodek-Yang correction

Development of the simulation libraries with simple API

- Simple API
  Provide minimum information to the function.
  (flavor and energy of neutrinos and target nucleus?)
  Return the cross-sections and kinematics of the final state particles.
- Use the codes from the authors (of the model) as much as possible and discuss with them about the implementations.

- First trials
  - QE (and 2p2h) in collaboration with G. Megias.
    - Super Scaling model
    - Relativistic mean field model
  - Single pion production
    - Sato-Nakamura model

Plan of the coming releases of NEUT

- Use the new building scheme (autoconf)
- Release the models in preparation
  - Single π production (M. Kabirnezhad)
- New models
  - Single π production (Sato-Nakamura)
  - QE/2p2h (G. Megias et al.)
- Improve SIS/DIS models
  - Updated Bodek-Yang correction for PDF
  - Improve treatment of NC interactions
  - Tuning of PYTHIA parameters
- Improve nucleon re-scattering models
  - Parameter tunings using the models
- Electron, nucleon and pion scattering simulation programs

Issues to be solved

- Neutrons ~ emission probability of neutrons from neutrino-nucleus interactions and nuclear de-excitations.
  - Next Spring, SK will introduce Gd into the water.
  - Efficiency of neutron detection becomes much higher.
  - Just number of neutrons can be provided and no energy information but there is no energy threshold.
- SIS and DIS
  - We'd like to avoid tuning old CERNLIB PYTHIA/JetSet.
  - Preparation of new library to use PYTHIA 8(6?) is another urgent task.
  - Expand W region (up to 4 $\mathrm{GeV/c^2}$?) of the existing SIS code may be one possibility. However, we need to think about the treatment of the hadrons other than pions, i.e. Kaons etc.