NEUT
Status and plan

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for the NEUT contributors

Current release ~ NEUT 5.4.0.x

Default models in this release

- Charged current quasi-elastic
  - Local Fermi-gas model (J. Nieves, F. Sanchez, B. Bourguille)
- Multi-nucleon CCQE-like scattering (MEC)
  - Valencia model (J. Nieves, F. Sanchez, R. Gran)
- Neutral current elastic
  - Simple global Fermi-gas model
- Single π production
  - Rein-Sehgal model with Garczyk-Sobczyk form factors
- Coherent π production
  - Berger-Sehgal model

Current release ~ NEUT 5.4.0.x

Default models in this release

- Multi pion production (W<2GeV) : Update by C. Bronner
  - Custom code using GRV98 PDF with Bodek-Yang correction
- Deep inelastic scattering (W>2GeV) : Update by C. Bronner
  - PYTHIA 5.72 (GRV98 PDF with Bodek-Yang correction)
- Nuclear effect ~ Cascade model
  - Pion interaction mean free paths have been re-tuned
    - using various data including recent DUET results.

Plan ~ NEUT 5.5.x

Multi-Nucleon interaction

SuSA-v2 MEC model (G. Megias)

Single pion production

Complete implementation of Minoo's model.

Start implementing the (Sato and Nakamura's) DCC model.

Multi pion production (W<2GeV)

& Deep inelastic scattering (W>2GeV)

Correct treatments of neutral current interactions.

Some part of the codes uses the formulas for charged current and apply the scaling parameters based on the experimental results.

Nuclear effect ~ Cascade model

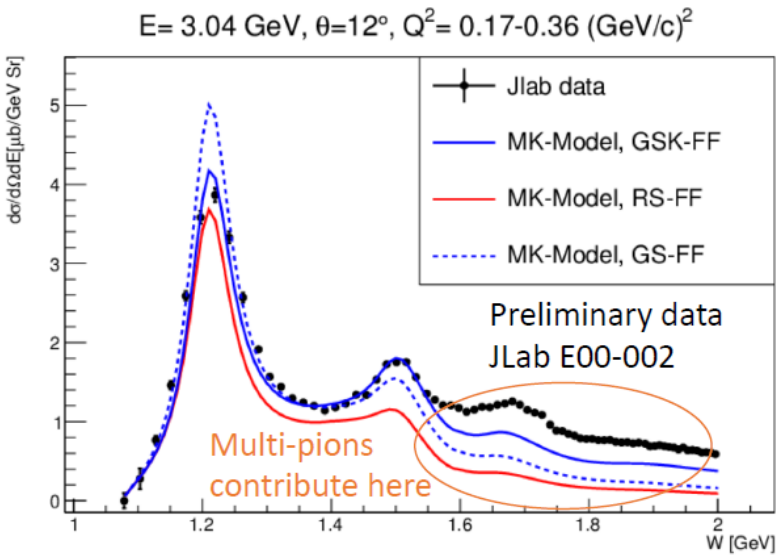
Nucleon re-scattering parameter optimizations

Single π production ~ MK model ~

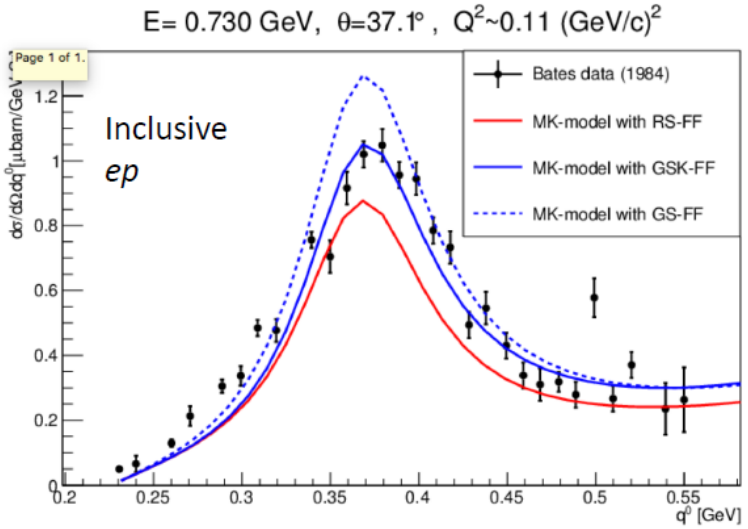
Minoo-san is preparing the code of neutrino interaction for NEUT.
Also, we decided to prepare independent program
to simulate electro-pion production.

MK-model improvement (Vector part)

- MK-model with Graczyk-Sobczyk (GS) form factor does not agree with inclusive electron scattering data.



More data comparison in backup

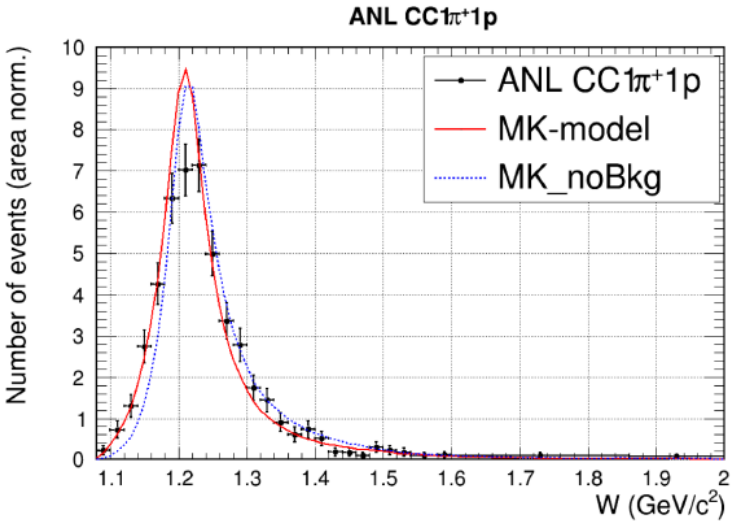


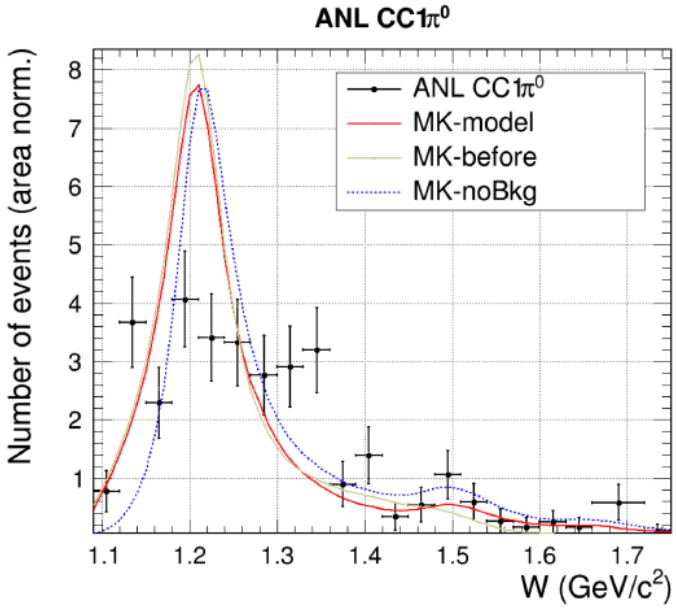
- Vector form factor is updated version of GS form factor. It is called "GSK" form factor to distinguish.

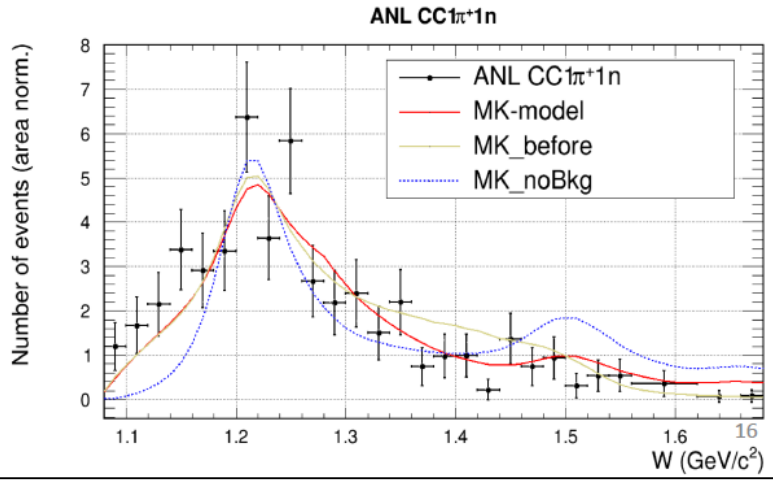
Single π production ~ MK model ~

We are trying to prepare the neutrino and electron pion production code together with pion cascade (nuclear effect) simulation.

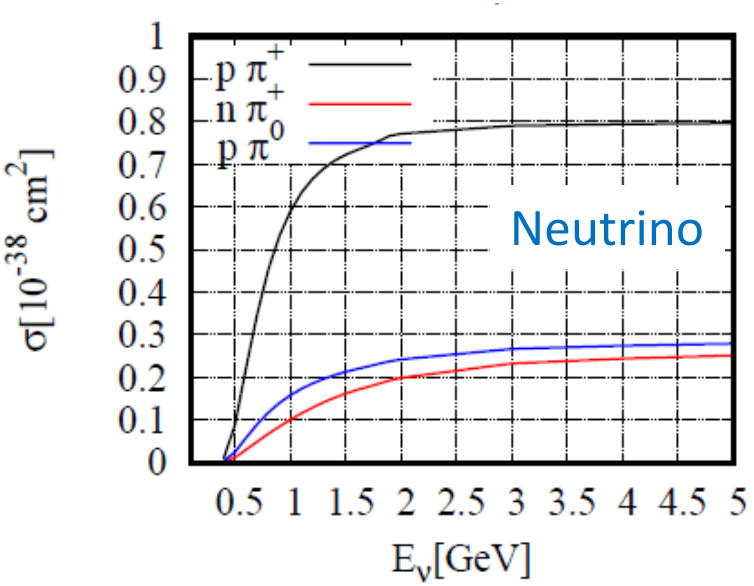
ANL W-distribution

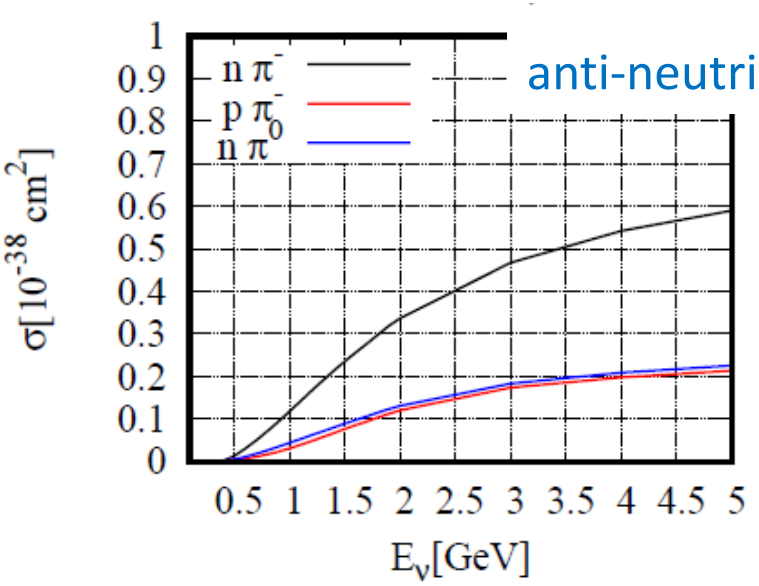




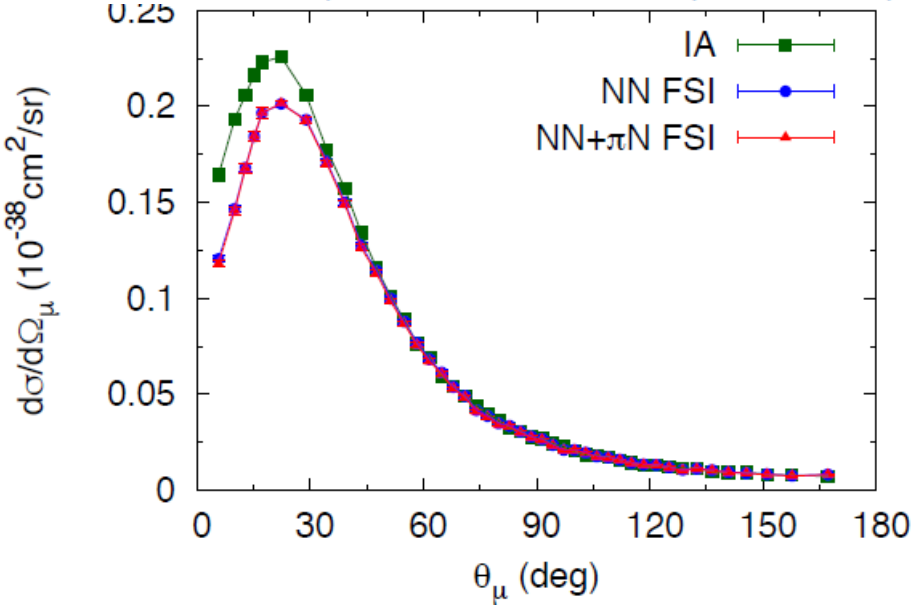


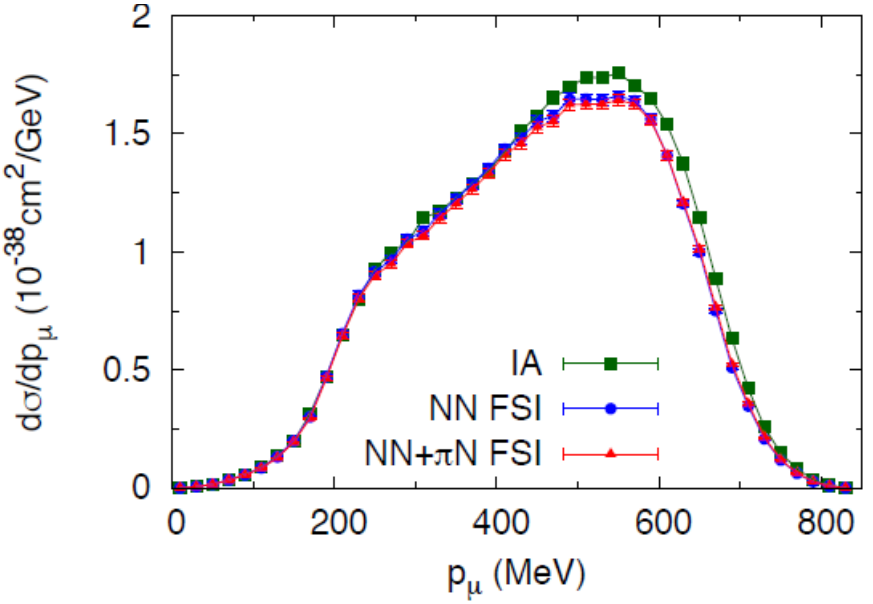
Single π production ~ DCC model ~





$d\sigma/d\Omega_\mu$ and $d\sigma/dp_\mu$ for $\nu_\mu d$ ➔ $\mu^- \pi^+ p\, n$ at E_ν = 1 GeV

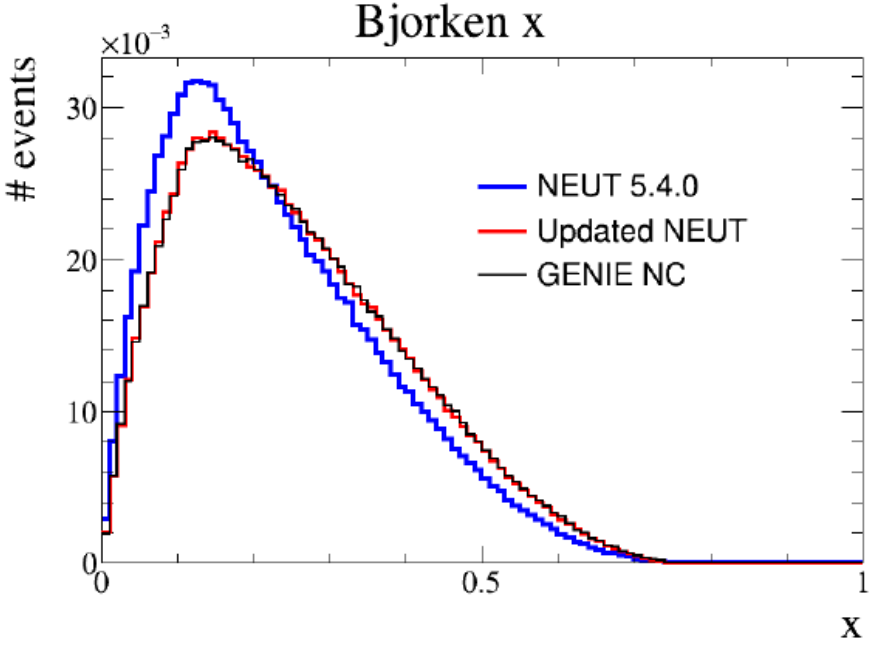


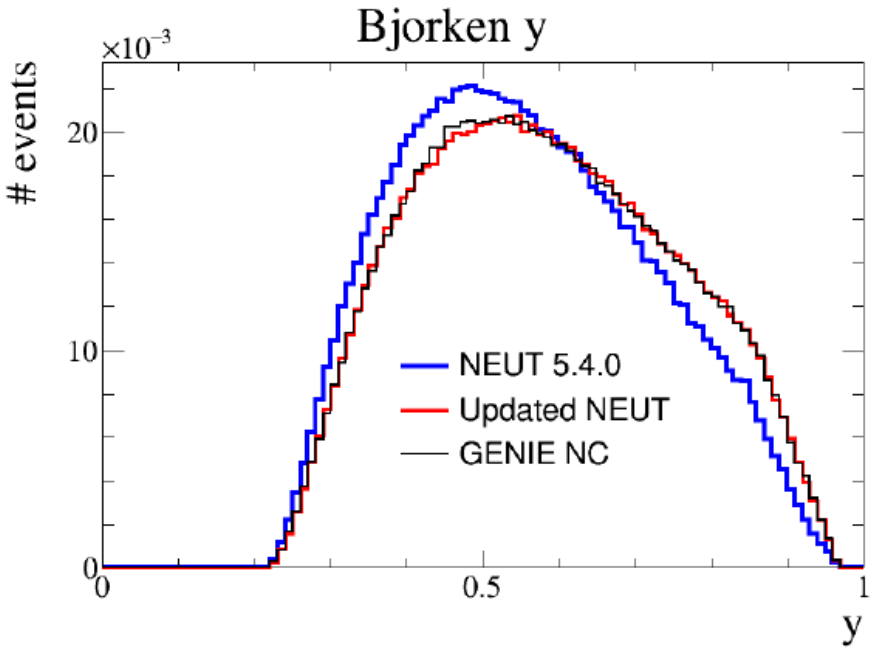


Neutral current modes

- So far only presented CC DIS modes
  In 5.4.0, NC DIS modes uses CC structure functions (without CKM matrix element), and NC DIS cross-section obtained from CC one

- Started working on implementing correct NC structure functions.
  After this updates, low W NC mode compatible with GENIE
  (2 GeV $\bar{\nu}_\mu$ on free neutrons, usual settings to have agreement)

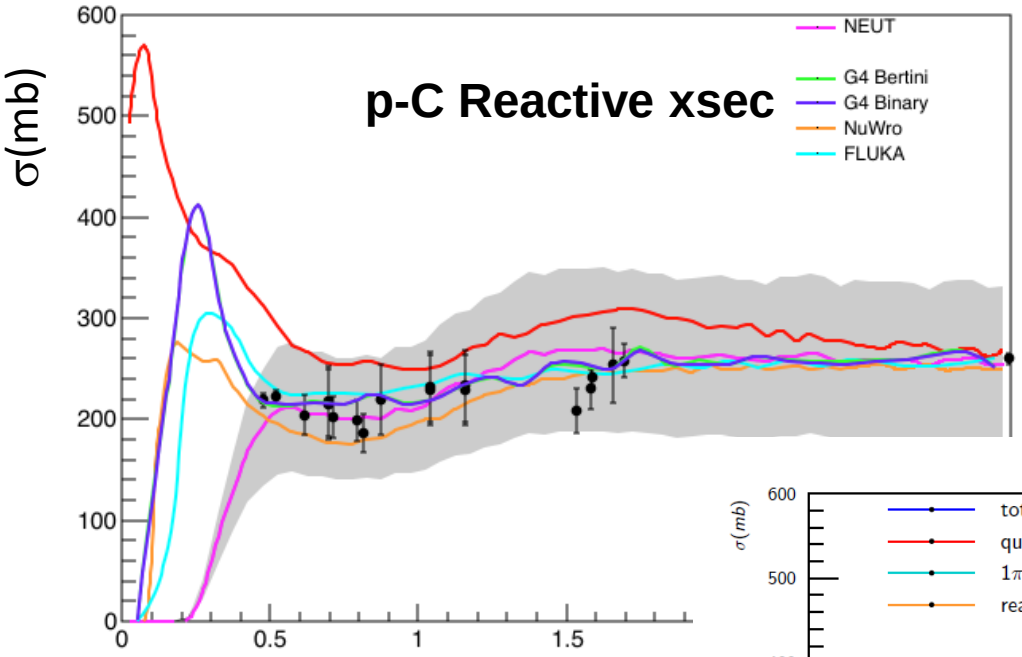




- Next step will be to compute NC cross-section by integrating $d^2\sigma/dxdy$

Nucleon re-scattering

First trial of the tuning (W. Ma)



Current trial (T. Nonnenmacher)