Generators session summary

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Introduction

- ‘Generator’ session:
  - NEUT: Y. Hayato
  - NuWro: J. Sobczyk
  - GENIE: C. Andreopoulos
  - Nuclear Effect: L. Pickering
  - PYTHIA: T. Katori

Overview

- All generators, NEUT/GENIE/NuWro, has common feature in their improvements:
  - Adopt 'long-range' and 'short-range' forces
    - e.g. RPA + multi-particle interaction for QE-like interactions
  - Improve modeling of π production
    - single π, coherent π, multi-π/DIS, and π-less Δ decay
  - Improve Final State Interactions
    - Cascade model, effective hA FSI model, etc
- And, several other improvements
  - kaon production, eta production, etc

NEUT:Y. Hayato

Plan for improvement #1 ~ Primary interactions ~

1) Interactions on Deuteron

Discussing the best way

Dedicated model only for Deuteron and Hellium?

2) Quasi-elastic – like (incl. multi-particle interactions)

Implement Local Fermi gas with RPA correction ***(Started!)***

a) *R. Gran, J. Nieves, F. Sanchez, MJ Vicente Vacas*

b) *M. Martini, M. Ericson*

TEM model (*A. Bodek, M. E. Christy, B. Coopersmith)*

3) Single pion production

Model by M. Kabirnezhad will be implemented in ~ year.

(not near term) Nakamura – Sato model

4) Single K production

strangeness violating process ***(Work started)***

5) Single ¥eta production **(Pending)**

new model (currently using resonance decay

using Rein-Sehgal resonance production)

Plan for improvement #1 ~ Primary interactions ~

6) Deep inelastic scattering

Better fragmentation with new data & new PYTHIA

Work started by C. Bronner and T. Katori

Update Bodek-Yang correction

Pending (Need to be included at the same time.)

New production version (v2.10.0) - New models

A new production version (**v2.10.0**) was released on **Nov. 2, 2015**.
v2.10.0 is a **model introduction release** (default model/tune unchanged).

- Bodek-Christy-Coopersmith eff. spectral function (EPJC (2014) 74:3091).
  B. Coopersmith and A. Bodek (Rochester)
- Very-High Energy extension (up to 5 TeV, working towards PeV scales)
  K. Hoshina (Wisconsin)
- Inclusive η production.
  J. Liu (W&M)
- Berger-Sehgal resonance model (PRD 76, 113004 (2007))
  J. Nowak (Lancaster) and S. Dytman (Pitt)
- Kuzmin-Lyubushkin-Naumov resonance model (MPL A19 (2004) 2815)
  J. Nowak (Lancaster), I. Kakorin (JINR) and S. Dytman (Pitt)
- Improved INTRANUKE/hA FSI model.
  S. Dytman and N. Geary (Pitt)
- Single K model by Alam, Simo, Athar, and Vacas (PRD 82, 033001 (2010)).
  C. Marshall (Rochester) and M. Nirkko (Bern)

Developments in NuWro

NuWro

NuWro is not an official MC in any experiment and serves as a laboratory for new developments.

New (or relatively new) ingredients:

- Berger-Sehgal coherent pion production
- distribution of π's from Δ decay
- effective density and momentum dependent potential for CCQE

  C. Juszczak, J. Nowak, JTS
- eWro - electron scattering module (a work in progress)

  C. Juszczak, K. Graczyk, JTS, J. Żmuda

Summary

for the first part

- Several improvements in generators
  - Implementing new models, etc
- Need to be tested/validated with existing/new data from MiniBooNE/ArgoNeut/MINERvA/ T2K/NOvA/MicroBooNE/electron scattering data, etc
- Very important for current and future neutrino oscillation experiments