Recent Geant4 Intensity Frontier Related Activities

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Simulations for Neutrinos
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New Physics Lists (in Geant4 10.1.beta)

- NuBeam (J Yarba)
  - Similar to FTFP_BERT
    - QGSP+G4LundStringFragmentation for protons at E>100GeV
    - Bertini to FTFP transition at 7-10GeV (instead of 4-5GeV)
  - Validation and tests in progress
- ShieldingM (KLG)
  - Almost like Shielding
  - Bertini to FTFP transition at 9.5-9.9GeV (instead of 4-5GeV)
    - to effectively "make it Bertini" for Mu2e
      - incoming proton beam energy 8 GeV
  - Mu2e has been using an equivalent internal list for many months now (with 9.6.p02); the list was created to better match pion production in the backwards hemisphere

Related Information: Geant4 release schedule

- Geant4 Collaboration adopted a yearly release schedule:
  - Beta release at the end of June
    - (a preview of the upcoming release)
    - 10.1.beta was released on June 27th
  - New release in early December
  - Patch releases as needed (no new features, bug fixes only)
    - 9.6.p03 was released on March 20th
    - 10.0.p02 was released on June 20th

Variable Model Parameters etc…

- G. Perdue presented a talk motivating the need for allowing Geant4 users vary important model parameters at the 37th Geant4 Technical Forum on March 20:

  http://geant4.web.cern.ch/geant4/collaboration/technical_forum/

  - Internal Geant4 discussions in progress
- Our group will also discuss MINERvA reweighting framework

Geant4 Validation

- Per S. Dytman suggestion, H. Wenzel has recently compared neutron induced production of p,d,t on thin Bi and Cu targets (for neutrons energies between 317-542 MeV) (Franz et al, Nuclear Physics A510 (1990) 774-802) using Geant4 v9.6.p02 and FTFP_BERT and FTF_BIC physics lists (two example sets of plots follow)
- The comparison was done using the art (framework) and Geant4 based toolkit (artG4Tk)
- Deuteron results show a large discrepancy
  - Due to lack of coalescence modeling?
- Also performed a short study of EM showers in LAr (with K. N. Barnett, Summer Student)

Proton Production

Target: Cu

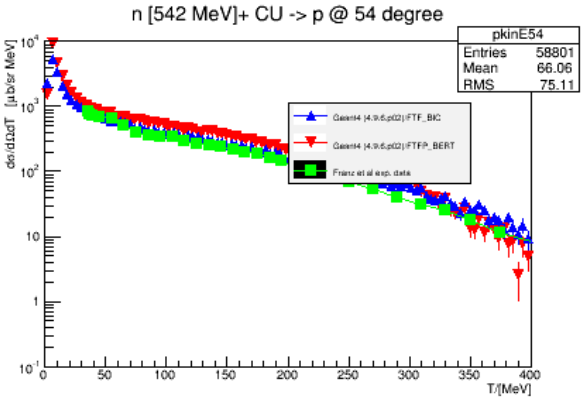
Beam: 542 MeV

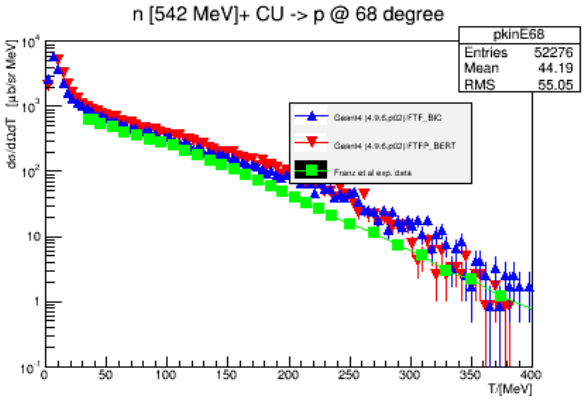
Green: exp. Data

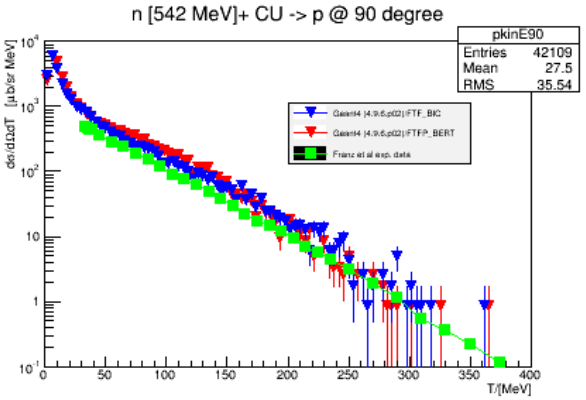
Blue: BIC

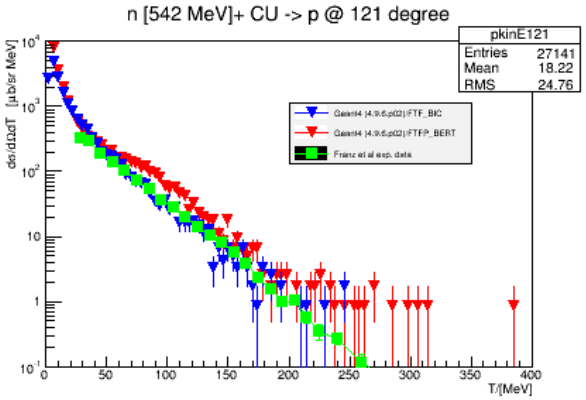
Red: Bertini

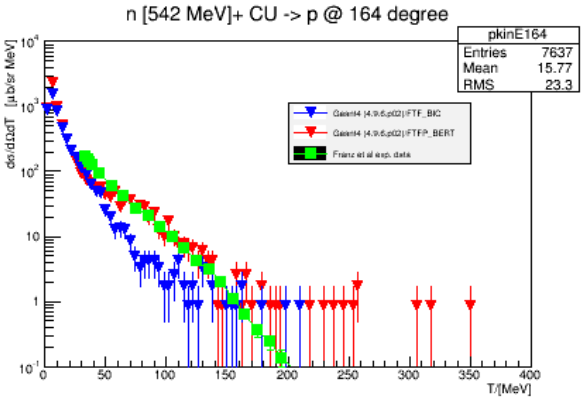
(comparison by H. Wenzel)











deuteron Production

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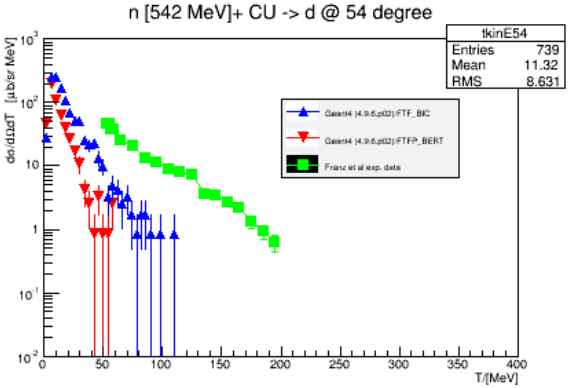

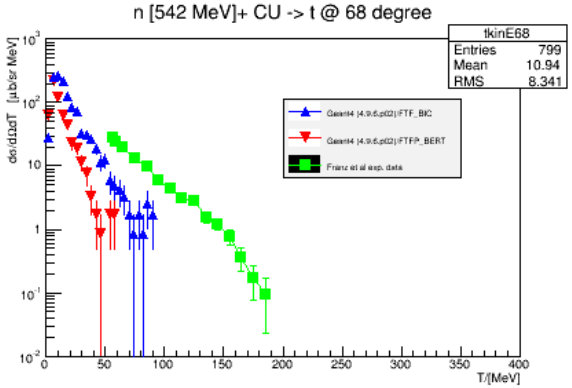

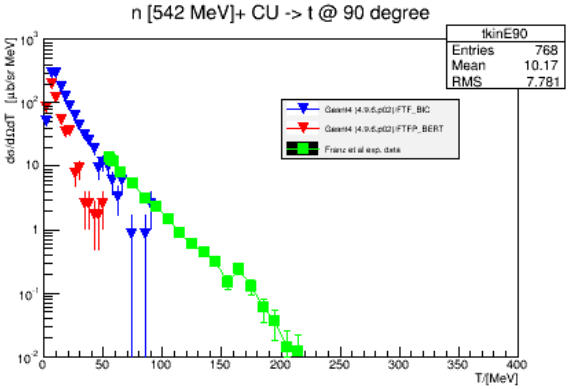

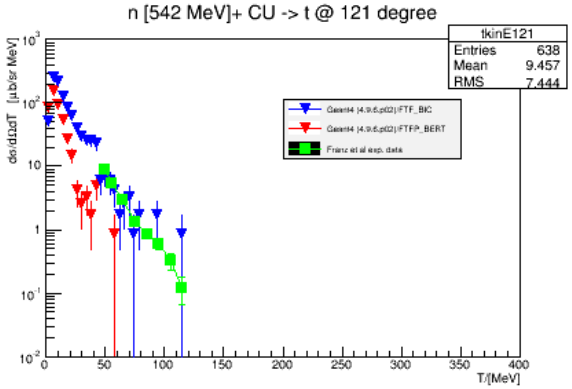

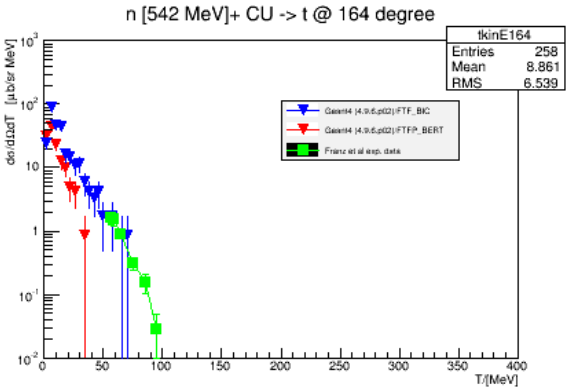

Geant4 Validation cont'd

- J. Yarba performed routine validation of Geant4 releases 9.6.p03 and 10.0.p01, using NA61 (31 GeV proton beam), NA49 (158 GeV proton beam), gamma-nuclear (on Cu and Pb below 1GeV) and proton and pion 1.4-7.5 GeV beam datasets (all mainly on C targets)
- 10.0.p02 and 10.1.beta validation in progress

- Validation results are being uploaded to the Validation Database:
  - http://g4validation.fnal.gov:8080/G4ValidationWebApp/G4ValHAD.jsp
- The database web interface is being reworked (Hans) to make the results available in a more interactive and user friendly way

- Also working on the statistical aspects of the comparison tools (Julia)
- The artG4Tk validation test will be migrated into internal Geant4 tests as appropriate
- artG4Tk can be used as a simple yet powerful experiment prototyping tool

- Hans is working with LArIAT on using artG4Tk to prepare to compare the upcoming test data with Geant4

Physics List Factory

- R. Hatcher became Geant4 collaborator and will work on a new implementation of physics list factory (similar to his implementation used by some of the neutrino experiments)

Possible Collaboration Opportunities

- Point to relevant experimental data which could be used for Geant4 validation
- Help in the validation process, esp. using artG4Tk
- Report problems with the toolkit, including with the physics distribution of interest
- Perform measurements of important observables