

Review of GEANT4 hadronic integral cross sections

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Abstract

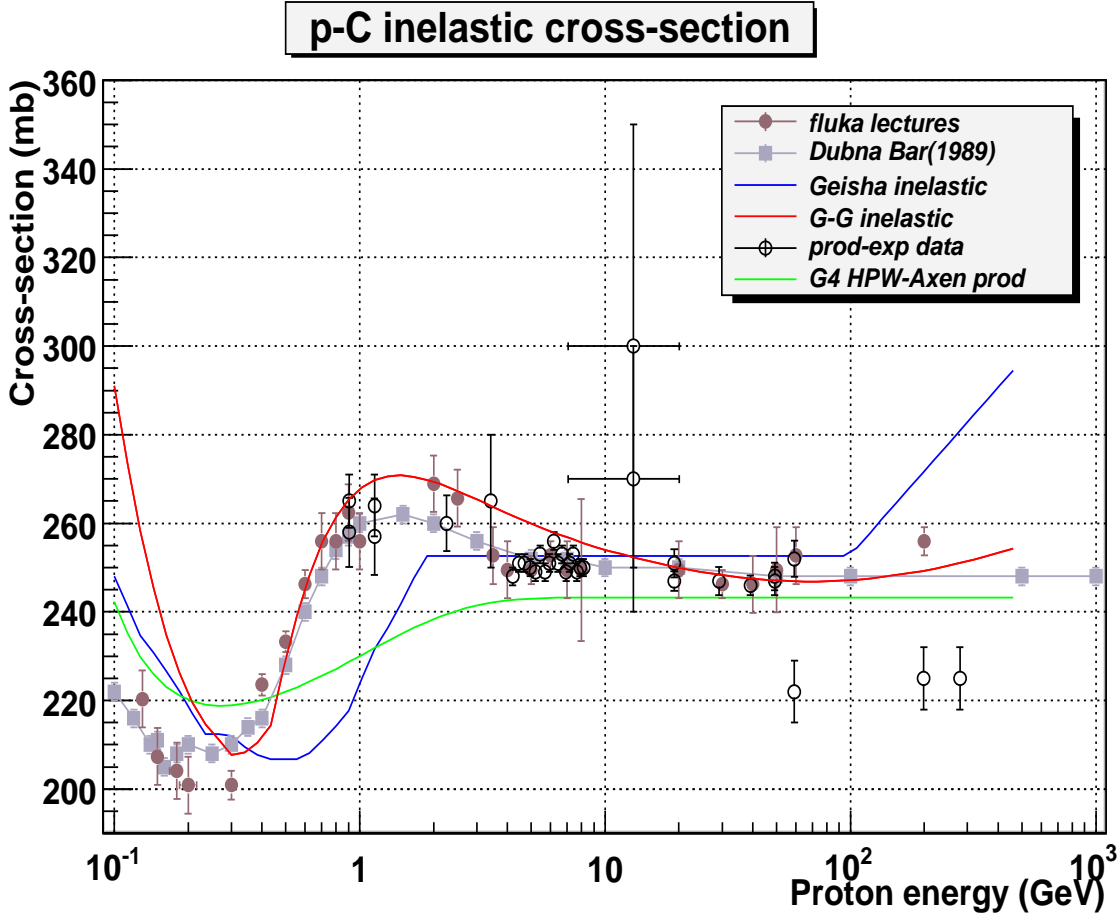
The current status of GEANT4 hadron integral cross sections is discussed. Different GEANT4 are compared with experimental data.

1 Introduction

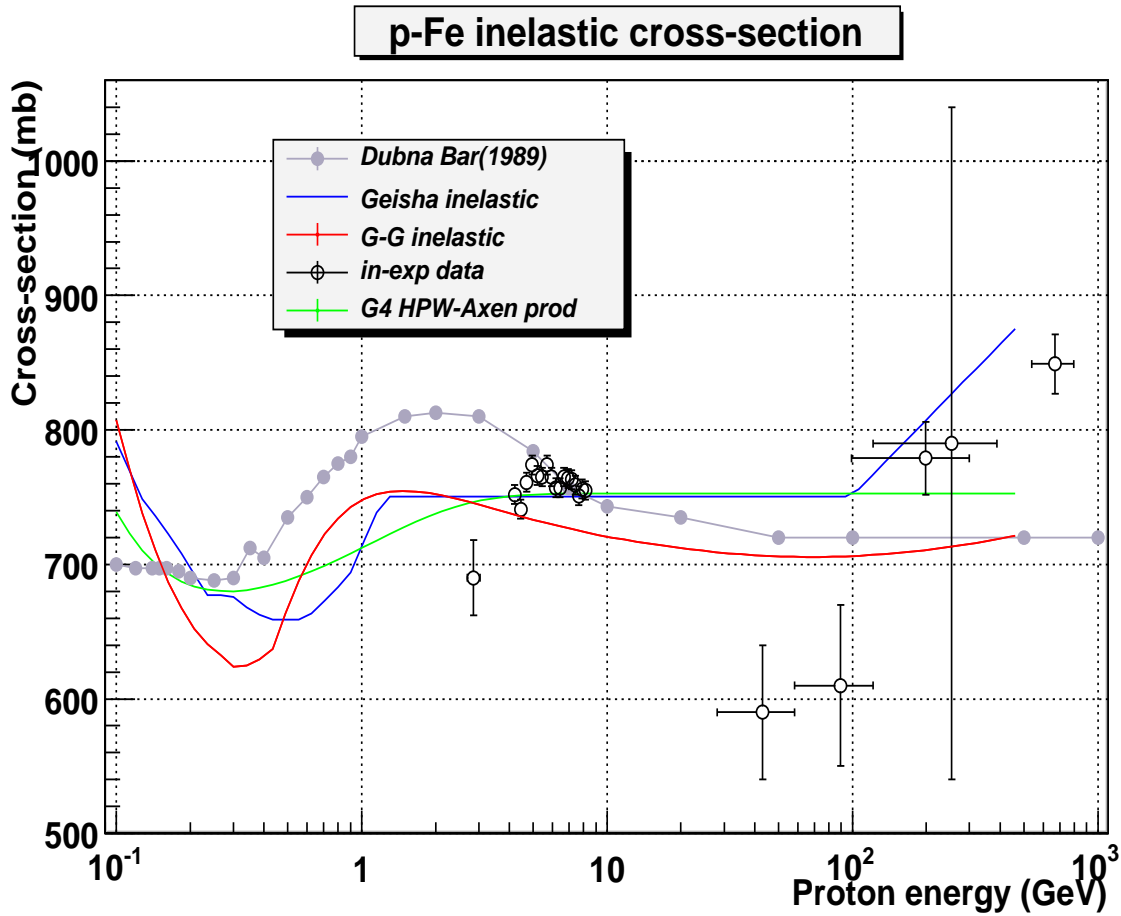
Here it is reported on verification of total and inelastic integral cross-sections for hadrons on different targets: $\sigma_{tot} = \sigma_{in} + \sigma_{el}$, $\sigma_{in} = \sigma_{prod} + \sigma_{qel}$. What we have in GEANT4 are the following models:

1. G4HadronCrossSections class for **inelastic and elastic** hadron integral cross sections in the spirit of GHEISHA.
2. G4PiNuclearCrossSection class for Barashenkov data interpolation for pions on nuclei (version of Gunter). Only σ_{in} access was implemented. σ_{tot} ?
3. G4ProtonInelasticCrossSection class for HPW-Axen parametrization model. Inelastic integral cross section.
4. New G4GlauberGribovCrossSection class for **total and inelastic** hadron integral cross sections in the spirit of Glauber model with Gribov correction. $\sigma_{el} = \sigma_{tot} - \sigma_{in}$.

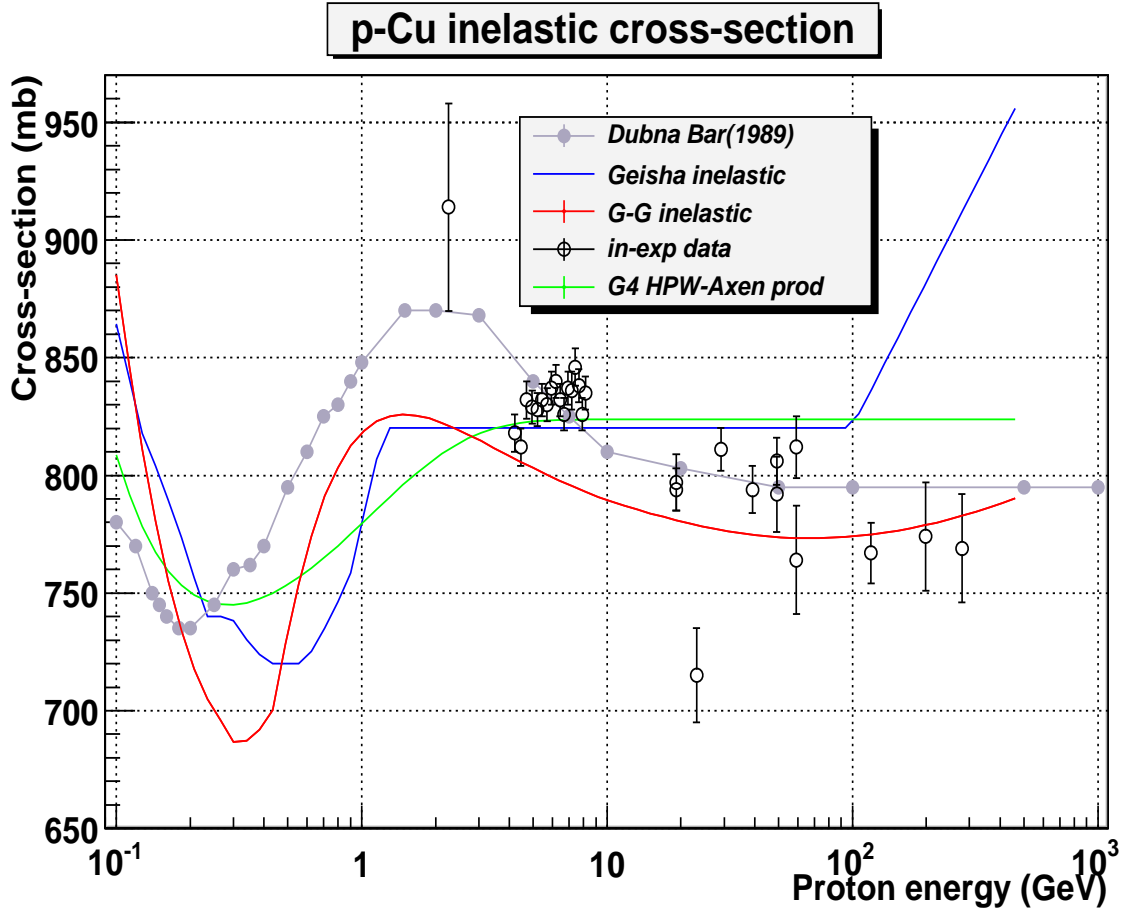
Data were taken basically from <http://wwwppds.ihep.su> IHEP-Compass database (thanks to Gunter) and from some other references (thanks to John).



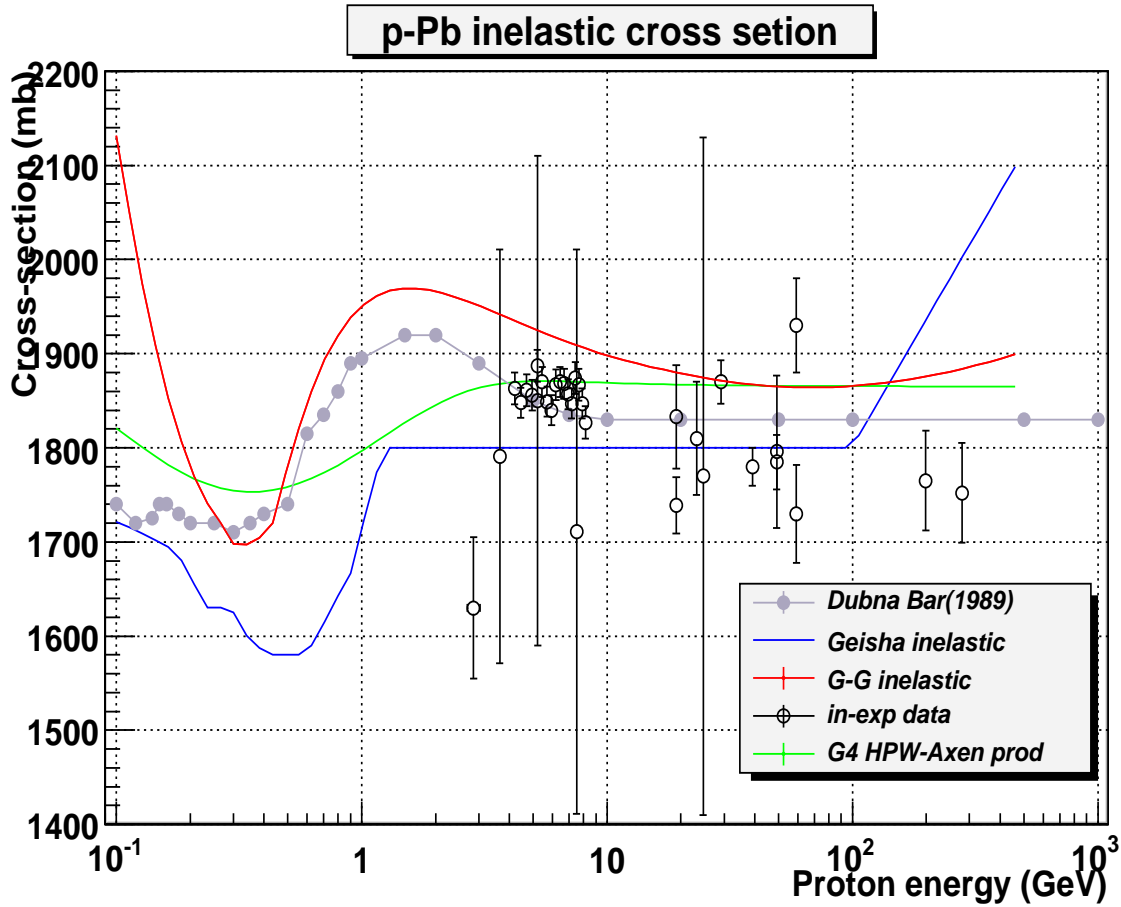
Inelastic integral cross section of protons on carbon target versus the proton energy in the laboratory frame.



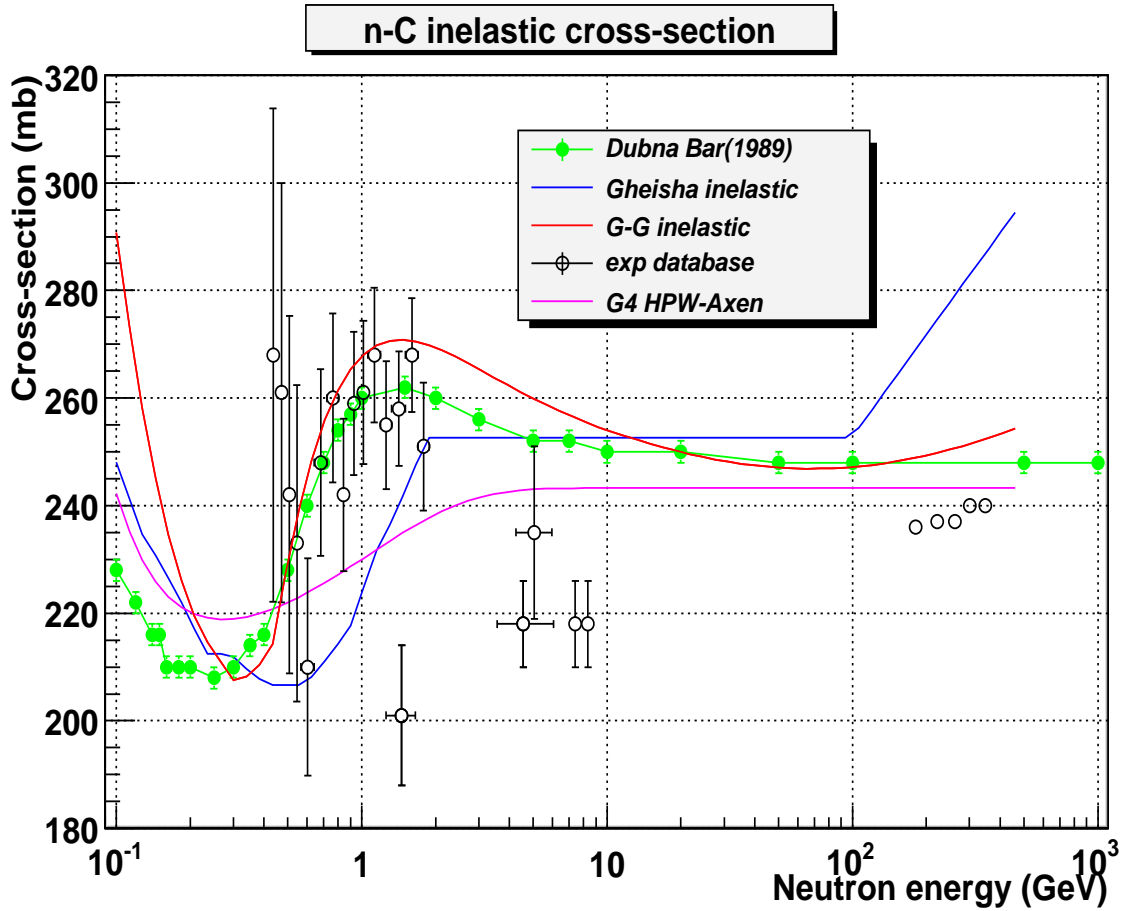
Inelastic integral cross section of protons on iron target versus the proton energy in the laboratory frame.



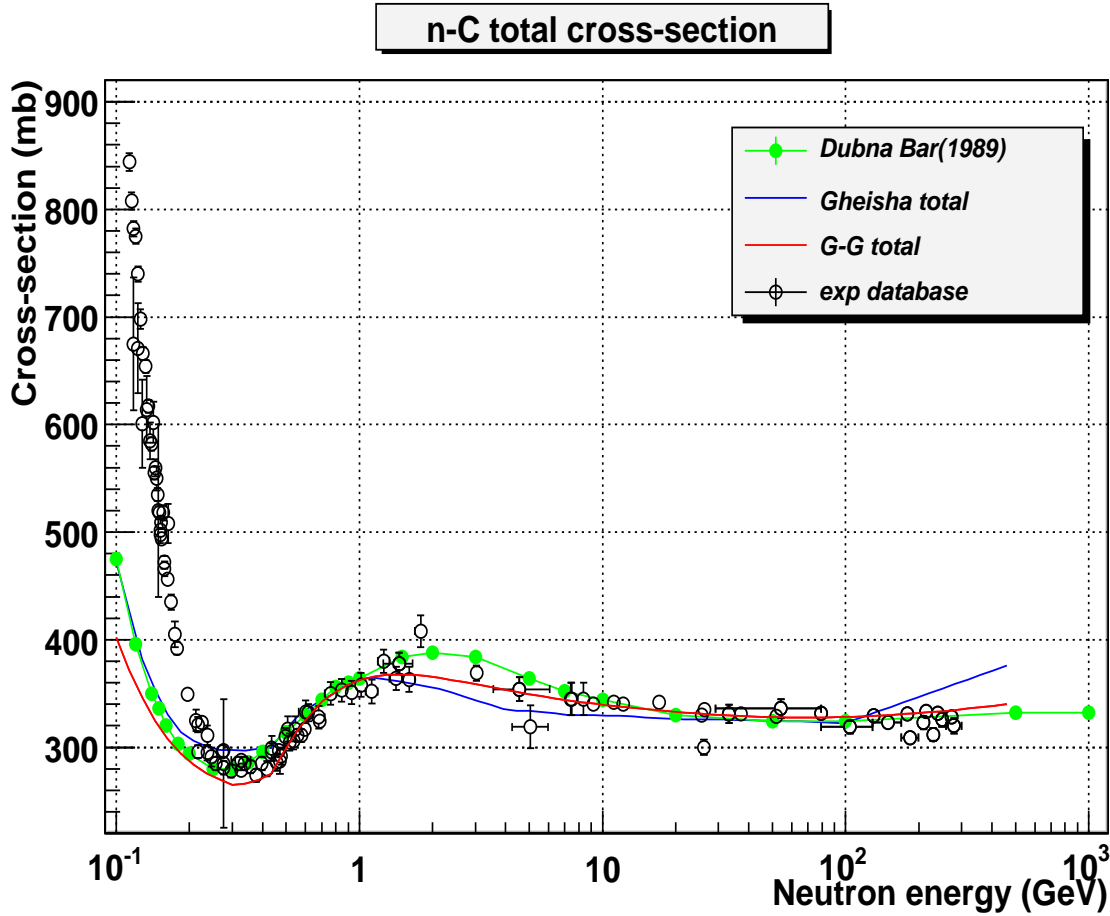
Inelastic integral cross section of protons on copper target versus the proton energy in the laboratory frame.



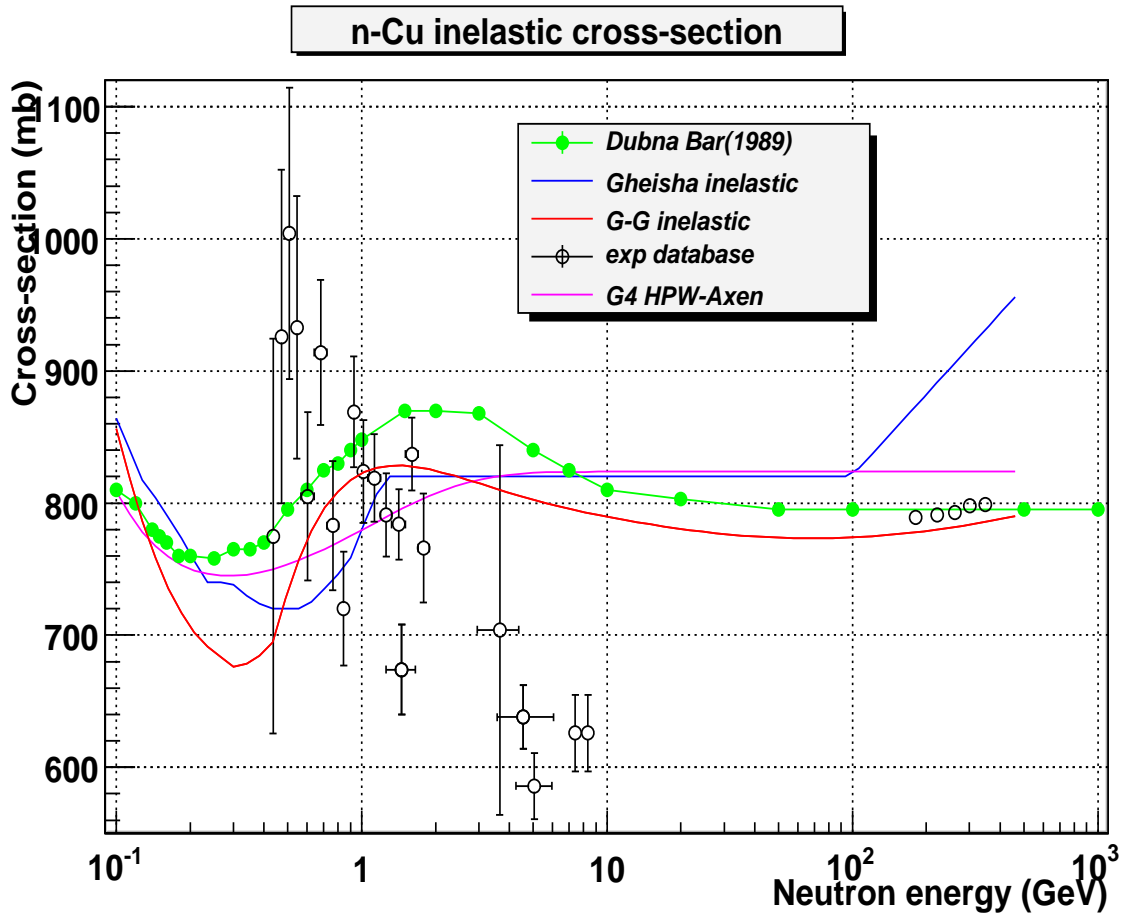
Inelastic integral cross section of protons on lead target versus the proton energy in the laboratory frame.



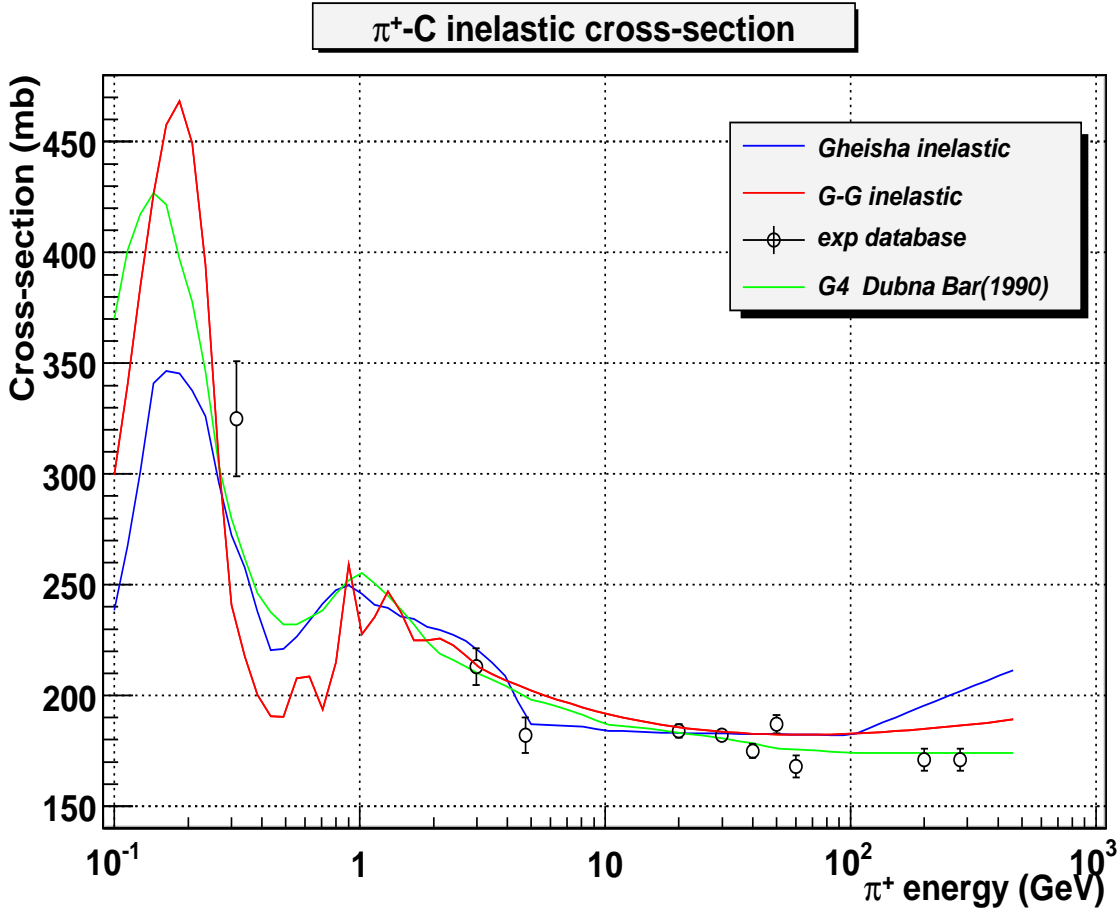
Inelastic integral cross section of neutrons on carbon target versus the neutron energy in the laboratory frame. Different GEANT4 models are shown.



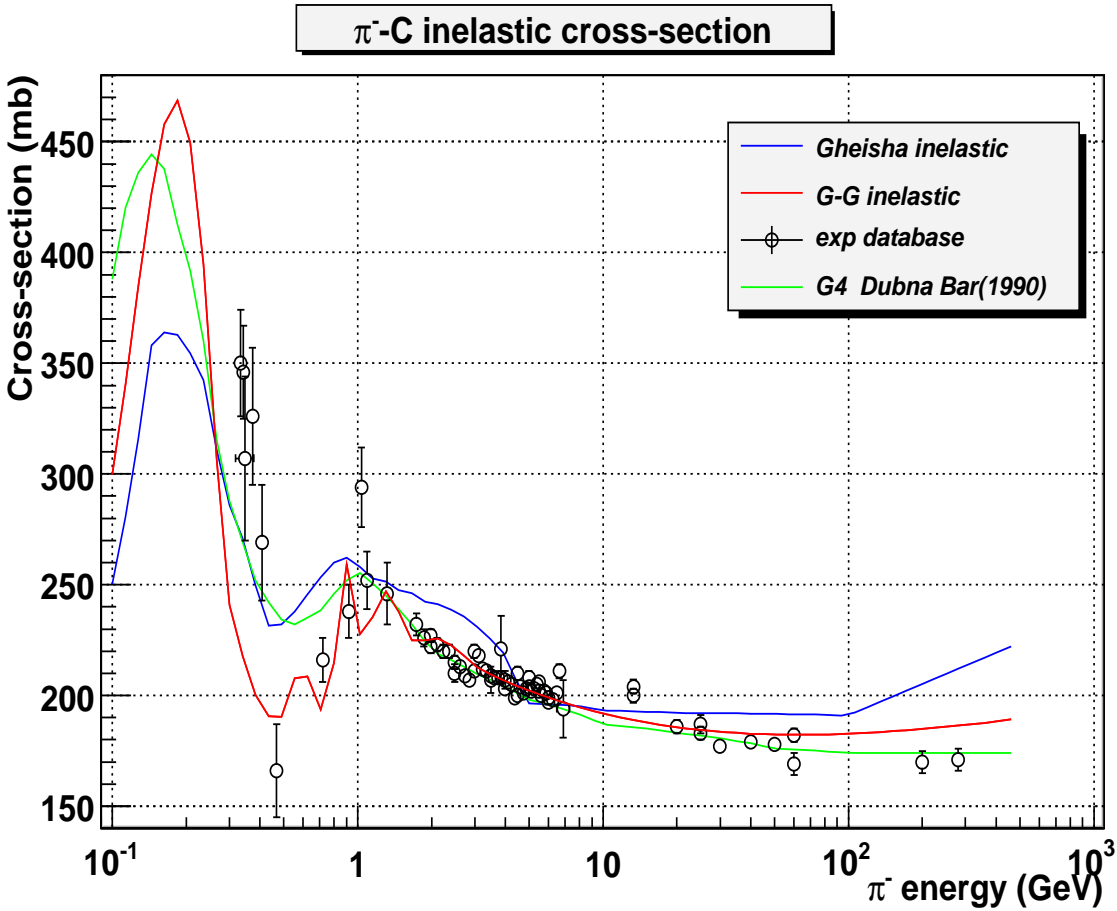
Total integral cross section of neutrons on carbon target versus the neutron energy in the laboratory frame. Different GEANT4 models are shown.



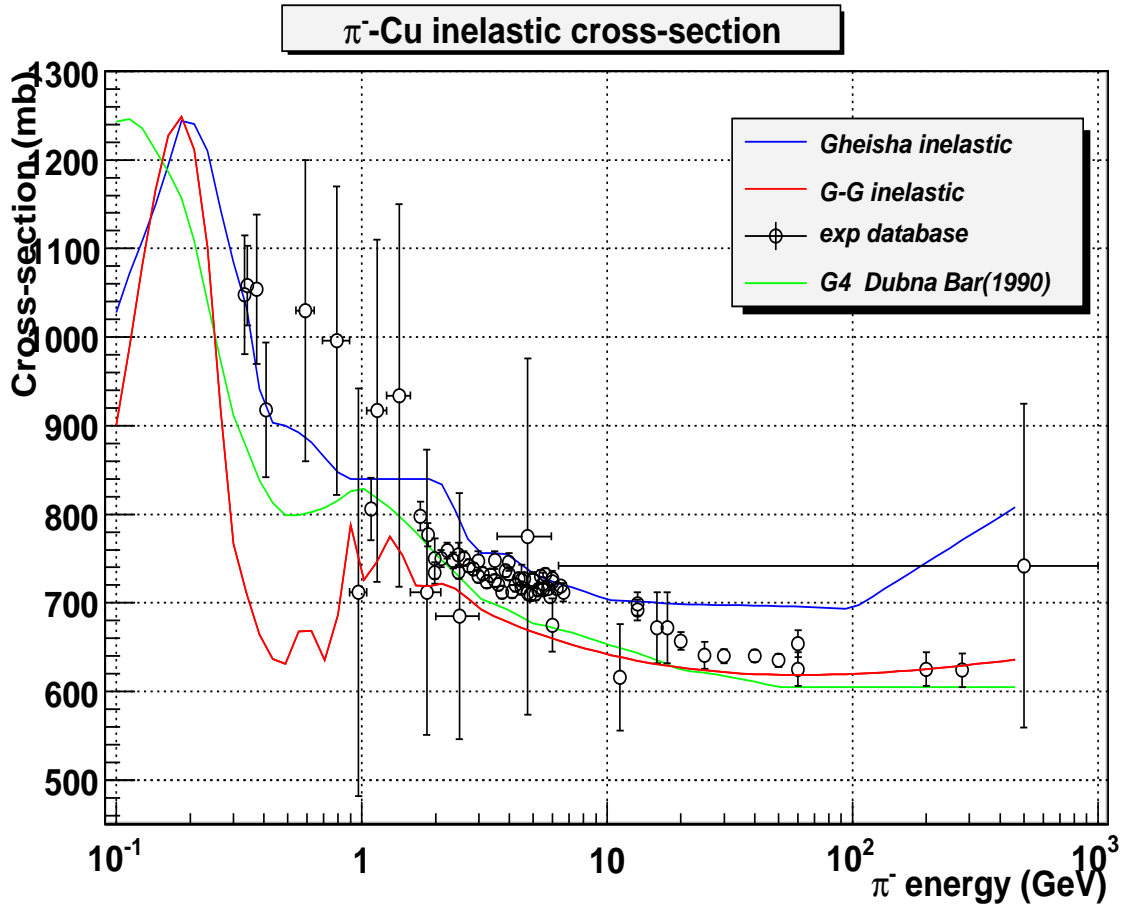
Inelastic integral cross section of neutrons on copper target versus the neutron energy in the laboratory frame. Different GEANT4 models are shown.



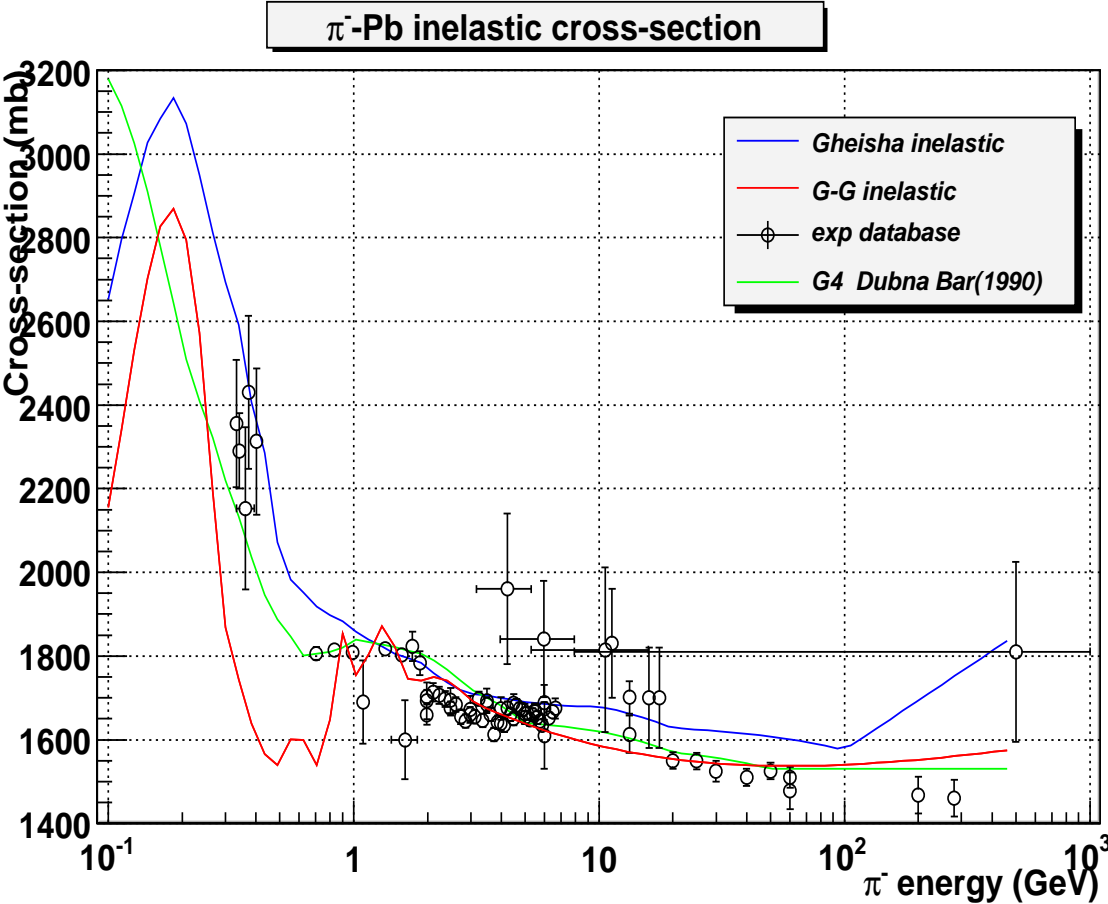
Inelastic integral cross section of π^+ on carbon target versus the π^+ energy in the laboratory frame. Different GEANT4 models are shown.



Inelastic integral cross section of π^- on carbon target versus the π^- energy in the laboratory frame. Different GEANT4 models are shown.



Inelastic integral cross section of π^- on copper target versus the π^- energy in the laboratory frame. Different GEANT4 models are shown.



Inelastic integral cross section of π^- on lead target versus the π^- energy in the laboratory frame. Different GEANT4 models are shown.

2 Summary and ToDo

1. Glauber-Gribov simplified model was extended for p, n, π^+ and π^- down to 0.2-0.3 GeV using N. Starkov parametrization for total hadron-nucleon cross sections. The model shows satisfactory agreement with experimental data on the level or better than other GEANT4 model.
2. Barashenkov data for nucleons on nuclei to be implemented as GEANT4 class (like inelastic cross section for pions)? Also for Barashenkov data on π^\pm total integral cross sections to derive elastic part as subtraction.
3. Dedicated Glauber model (N. Starkov) seems to be prolonged efficiently down to 0.1 GeV. For lower energy range other (optical models, parametrization) should be developed. The energy range 0.1-0.3 GeV can be considered as a boundary between the approaches.
4. More comparisons are in progress ...