



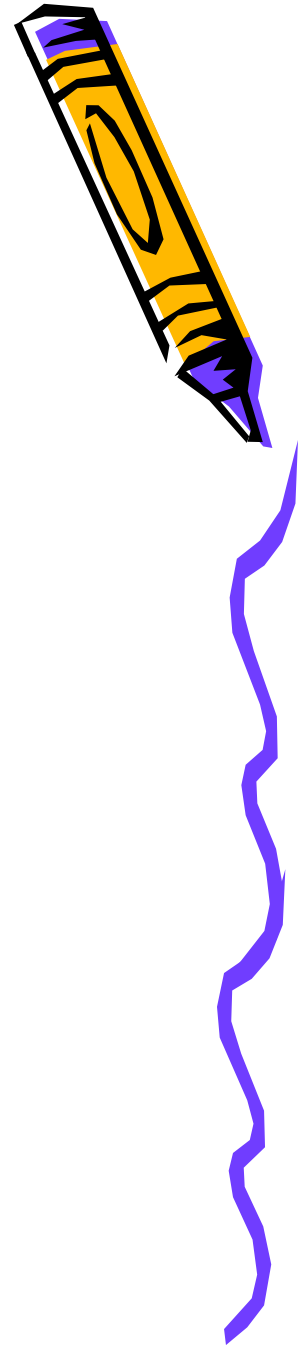
# Heavy Ion progress report

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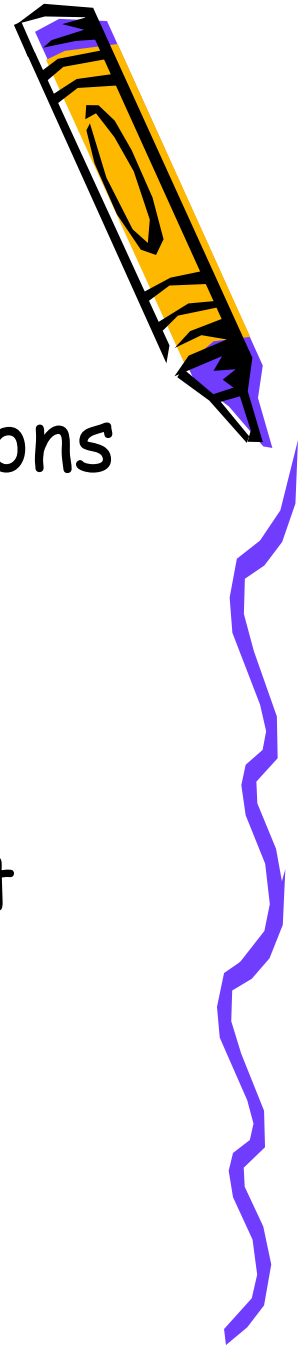
# Outline

- Current Capability of Geant4 for Heavy Ions interactions
  - G4BinaryLightIonReaction
  - G4WilsonAbrasionModel
- New Model based on QMD
- DPMJET-2.5 Interface
- Summary



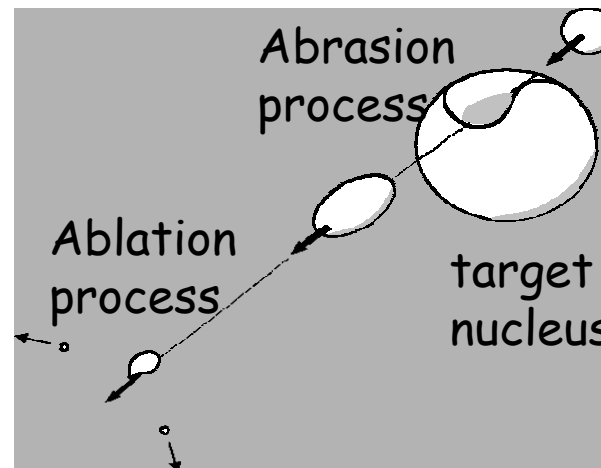
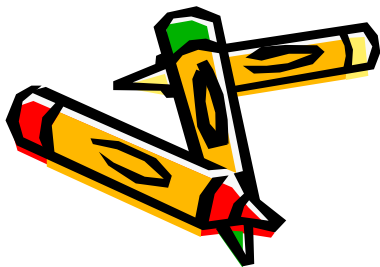
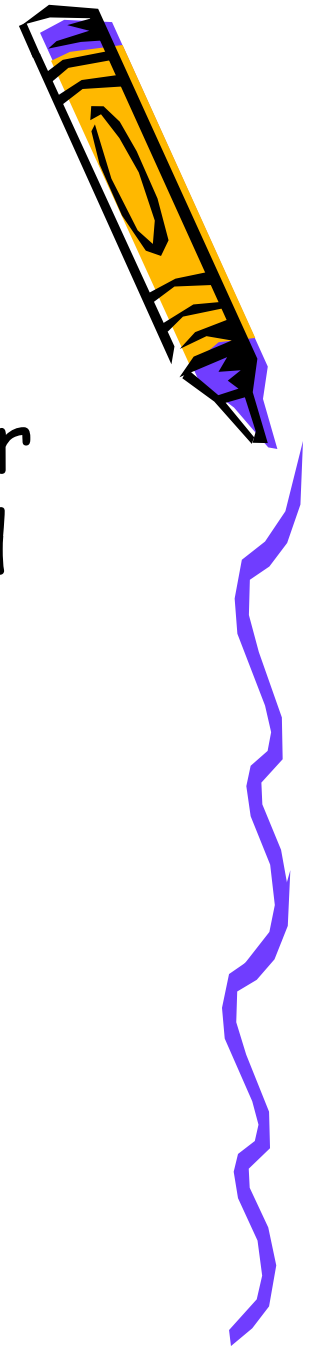
# G4BinaryLightIonReaction

- Extension of Binary Cascade for Ions Interactions
- Interactions between participants are neglected
  - These interactions become important when mass number of nucleus in the system increase.



# G4WilsonAbrasionModel

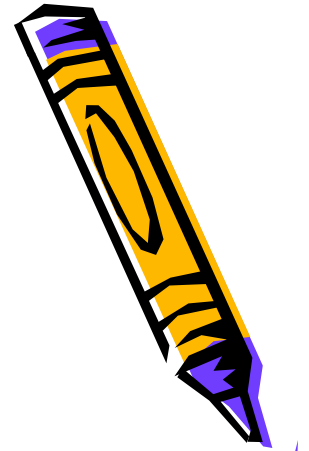
- A simplified macroscopic model for nuclear-nuclear interactions based largely on geometric arguments
- Energy distributions of secondary nucleons are not well described.



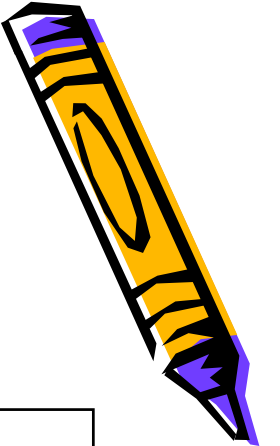
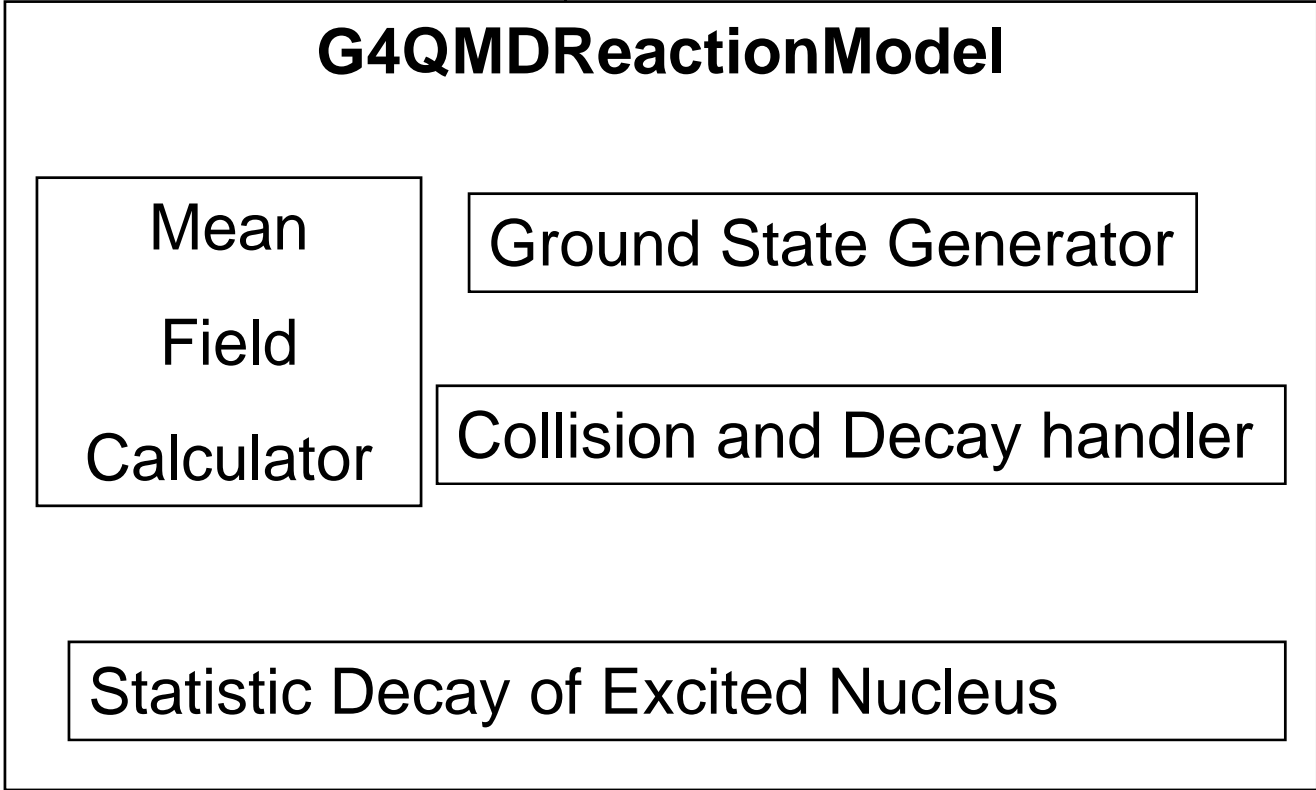
# Quantum Molecular Dynamics Model

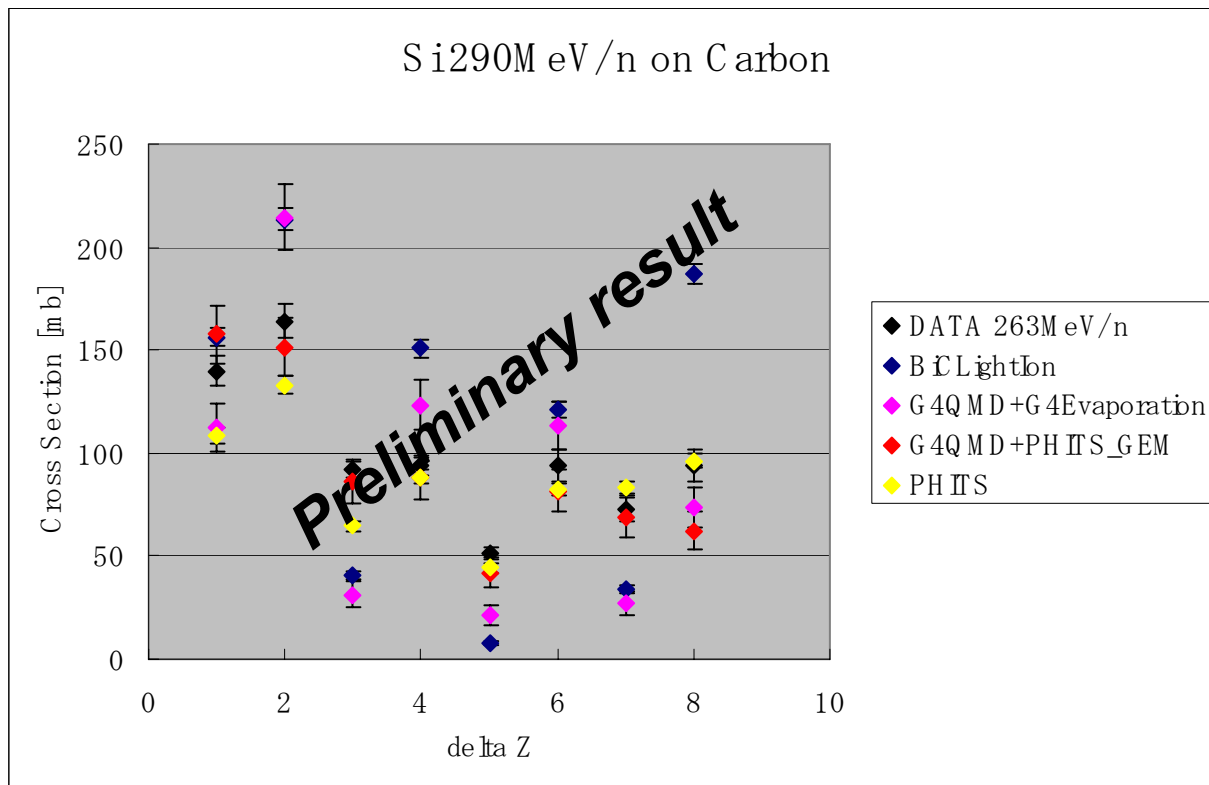
- QMD is quantum extension of classical molecular-dynamics model.
- QMD model is widely used to analyze various aspects of heavy ion reactions.
- Including interactions between participants
- Our implementation of QMD is base on JQMD (Jaeri QMD).

- JAERI-Data/Code 99-042

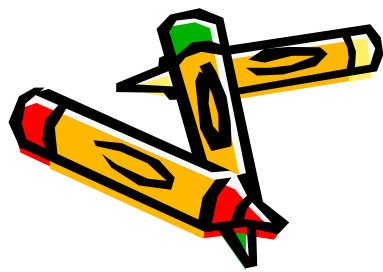


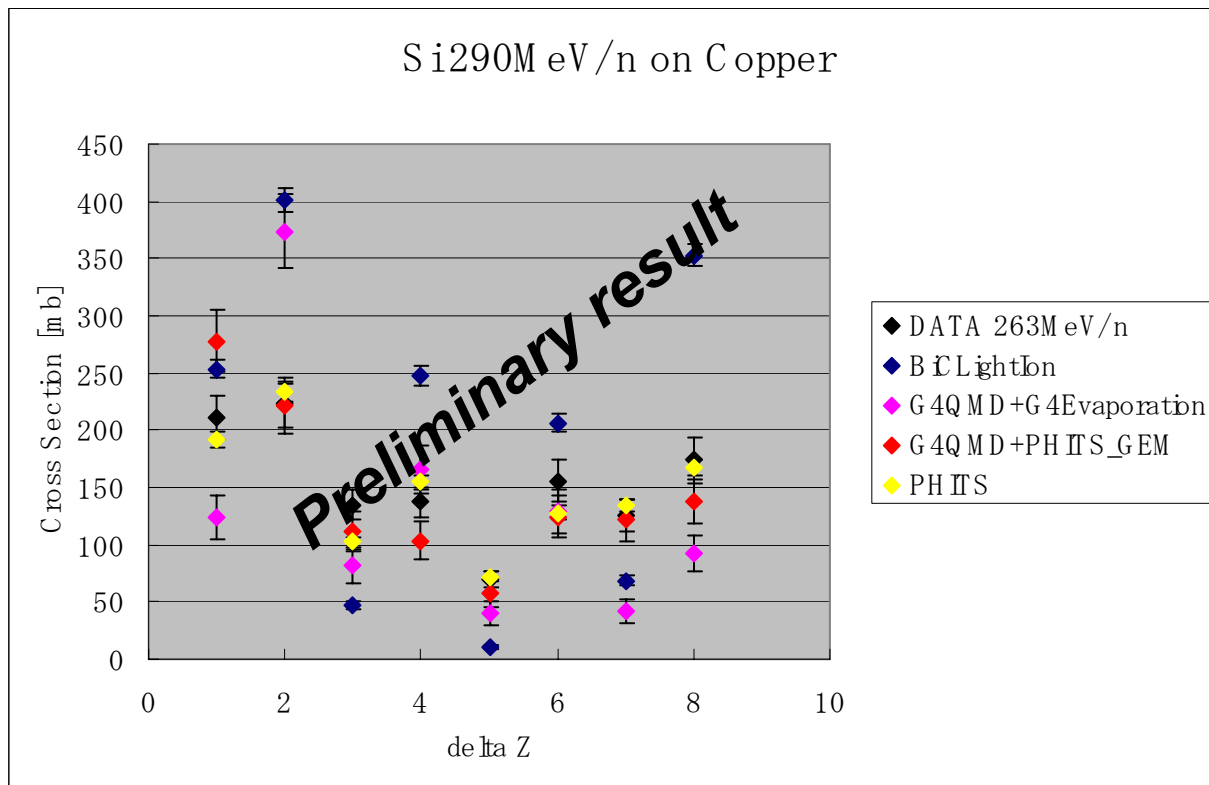
**G4HadronicInteraction**





Data: C. Zeitlin et al., Nuclear Physics A 784 (2007) 341-367.





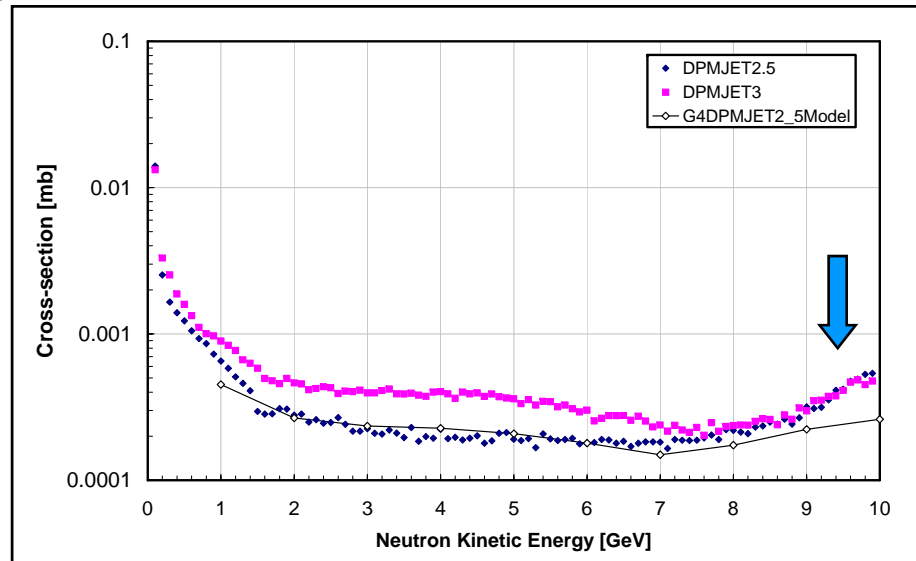
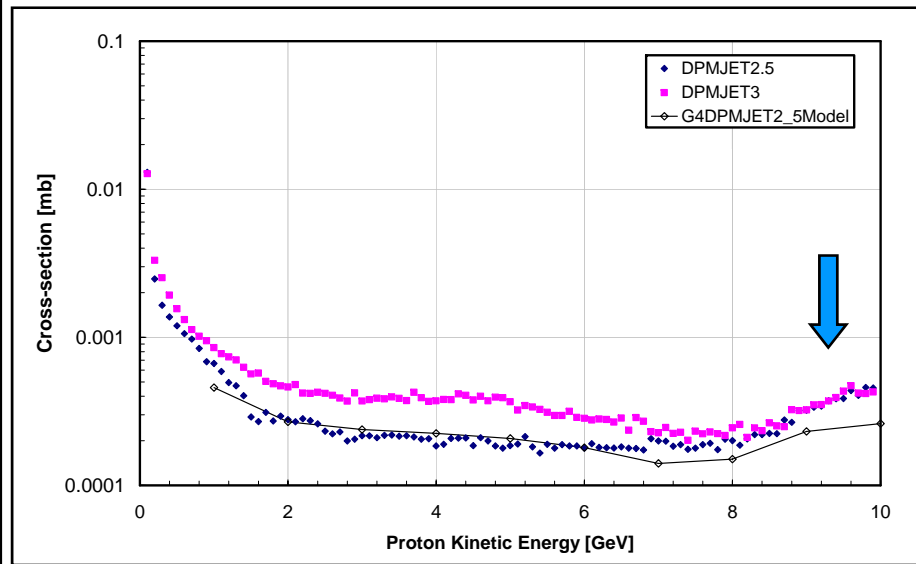
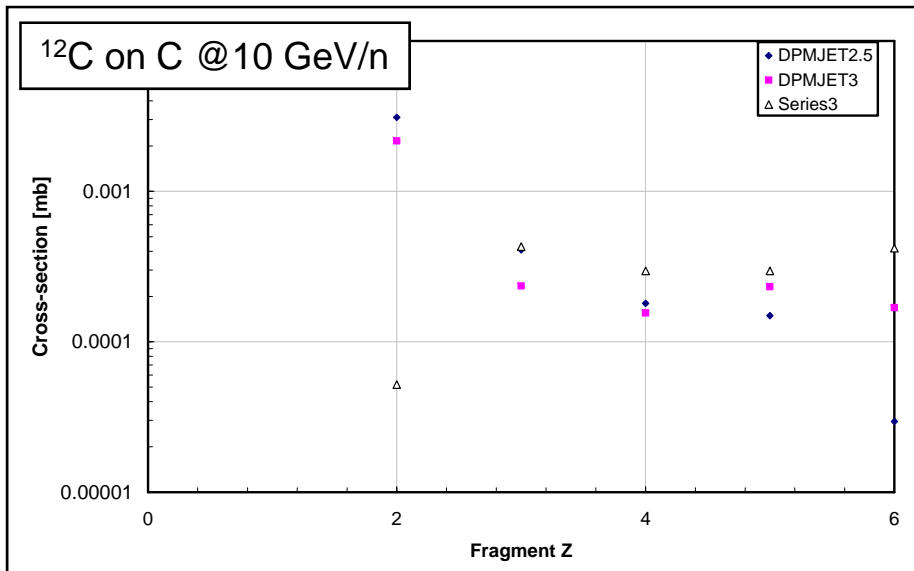
Data: C. Zeitlin et al., Nuclear Physics A 784 (2007) 341-367.



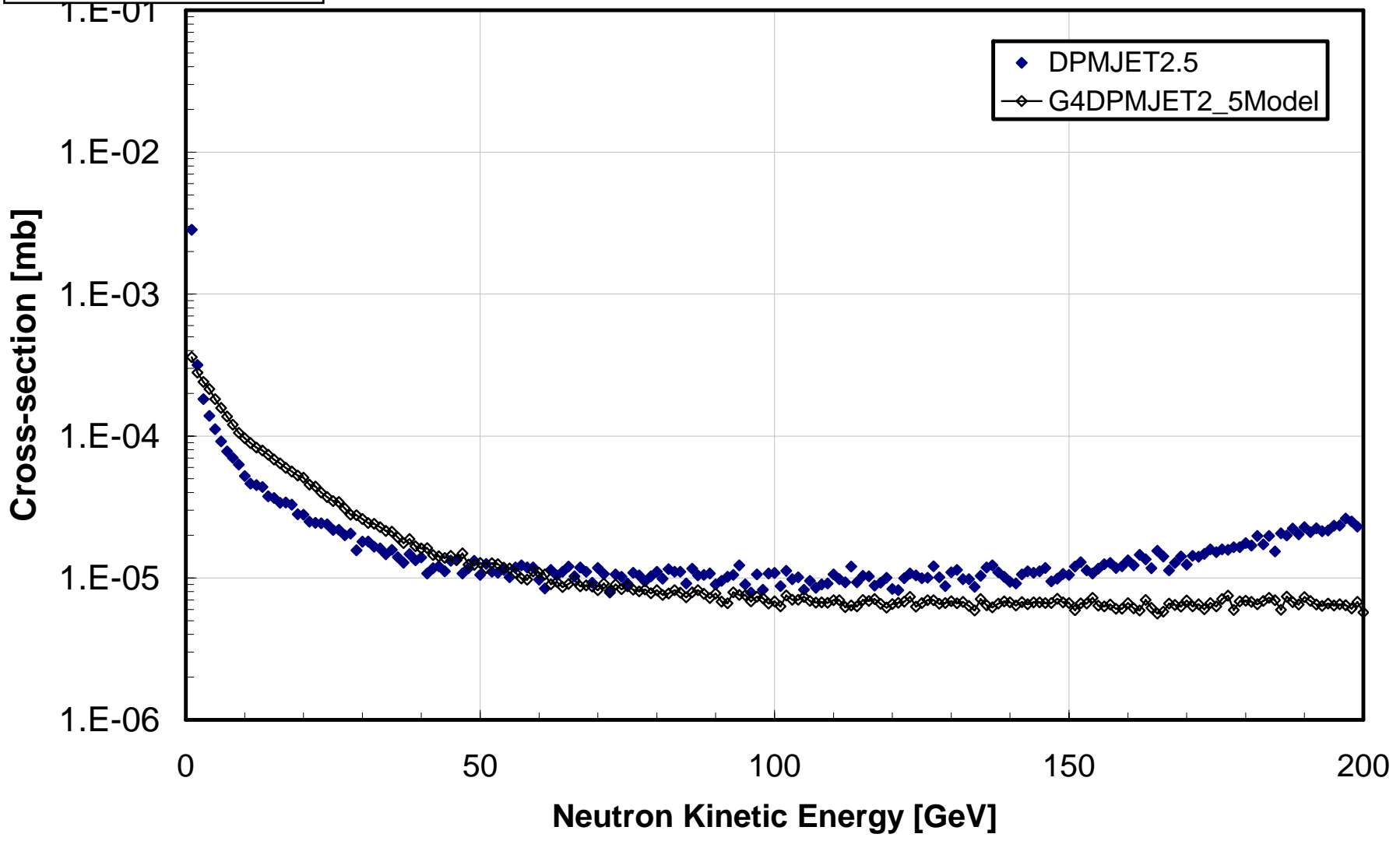


## DPMJET-2.5 Interface

- DPMJET treats hadron-nuclear and nuclear-nuclear interactions  $>5$  GeV/nuc, with the upper limit reported to be of order 1000TeV
- Two versions currently available, both of which treat nuclear-nuclear interactions:
  - DPMJET-2.5 (Johannes Ranft) – source code publicly released
  - DPMJET-3 (Stefan Roesler) – access to source controlled by Roesler
- Under the ESA MarsREM contract, QinetiQ is developing an interface with DPMJET-2.5 (G4DPMJET2\_5Model) specifically to treat nuclear-nuclear interactions.
- Attempting to complete during September (delays due to debugging anomalies in the results).

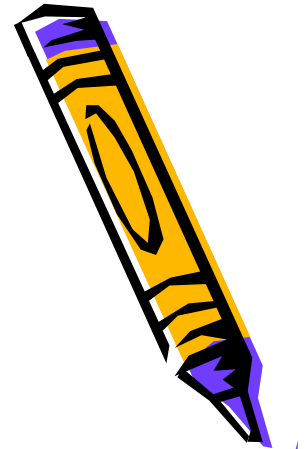


$^{12}\text{C}$  on C @200 GeV/n



# Summary

- QMD based heavy ions interaction model is under development
- Mean field calculator, ground state nucleus generator and elemental collision channels are already developed and under testing.
- DPMJET-2.5 Interface is also developing which can treat nuclear-nuclear interactions from  $5\text{GeV/nuc}$  to the order of  $1000\text{TeV/nuc}$ .



# Ion Models Inventory

*at Dec07??*

