Study of Mg ion fragmentation cross-sections for shielding purposes using GEANT4

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INTRODUCTION

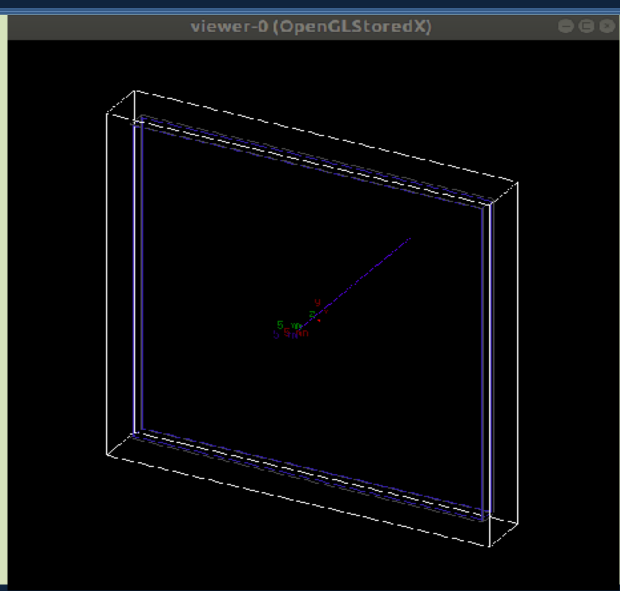
- The partial cross-section computation for Mg ion on C target using Monte Carlo code based Geant4 toolkit is performed.
- Two different physics models, the QMD and the INCL++ models are activated.
- The simulation results are comparatively analysed with respect to experimental and PHITS code data.

Simulation

- Single block of homogenous slab of C element is used as target material.
- The detector was exposed to the Mg ion beam incident normally to the face of C target.
- ROOT software is used to handle the data.
- Energy of beam used are 370A MeV and ~470 A MeV.
- Two physics models : the QMD model and the INCL model are activated for comparative study.

Geometry & Detector Construction

Sketch of the detector configuration used for the exposure to Mg ion beam of energy 370A MeV and ~470 A MeV on C element target to study fragmentation cross-section.



Software used

GEANT4- A SIMULATION TOOLKIT

ROOT- Data Analysis Framework

Results

In comparative study of fragmentation cross-section, Geant4 toolkit generates the cross-section for Mg ion on C target in good agreement to the experimental and PHITS data. The QMD model outcomes the cross-section with odd-even effect as well while the INCL model gave inline agreement result with slight deviation. Both model produce seems to follow the experimental data depending on Z of fragment.

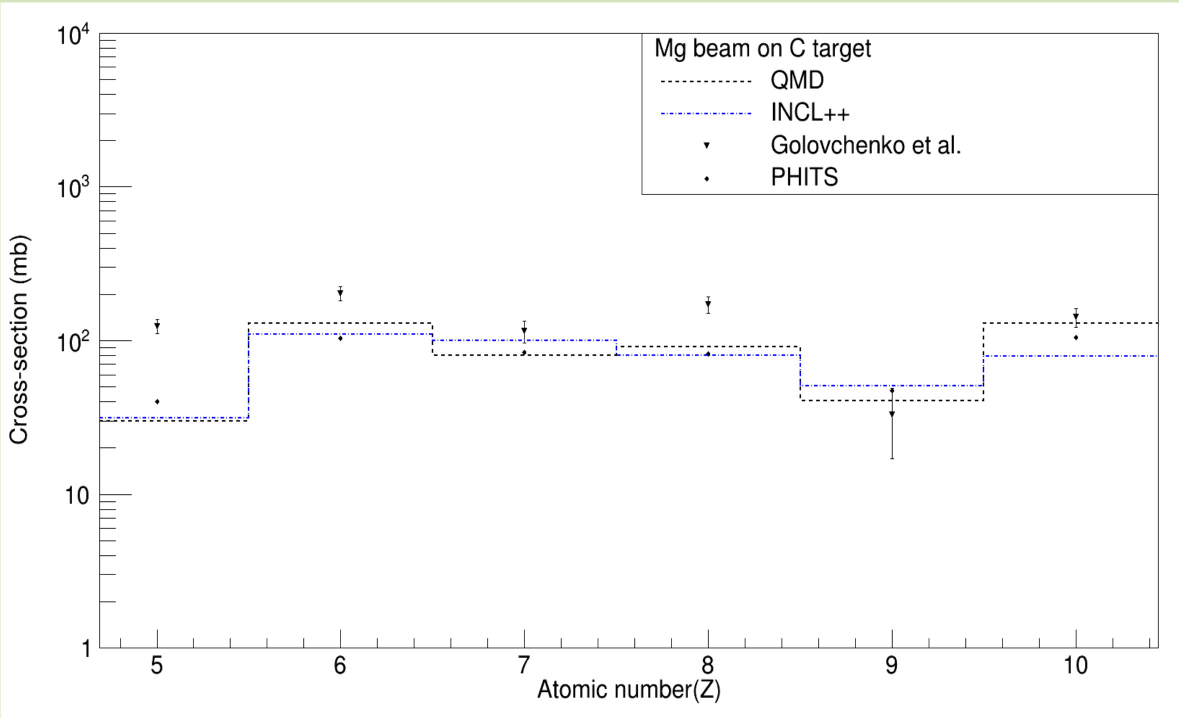


Figure 1. The fragmentation cross-section of Mg ion incident on C target with energy 370 A MeV.

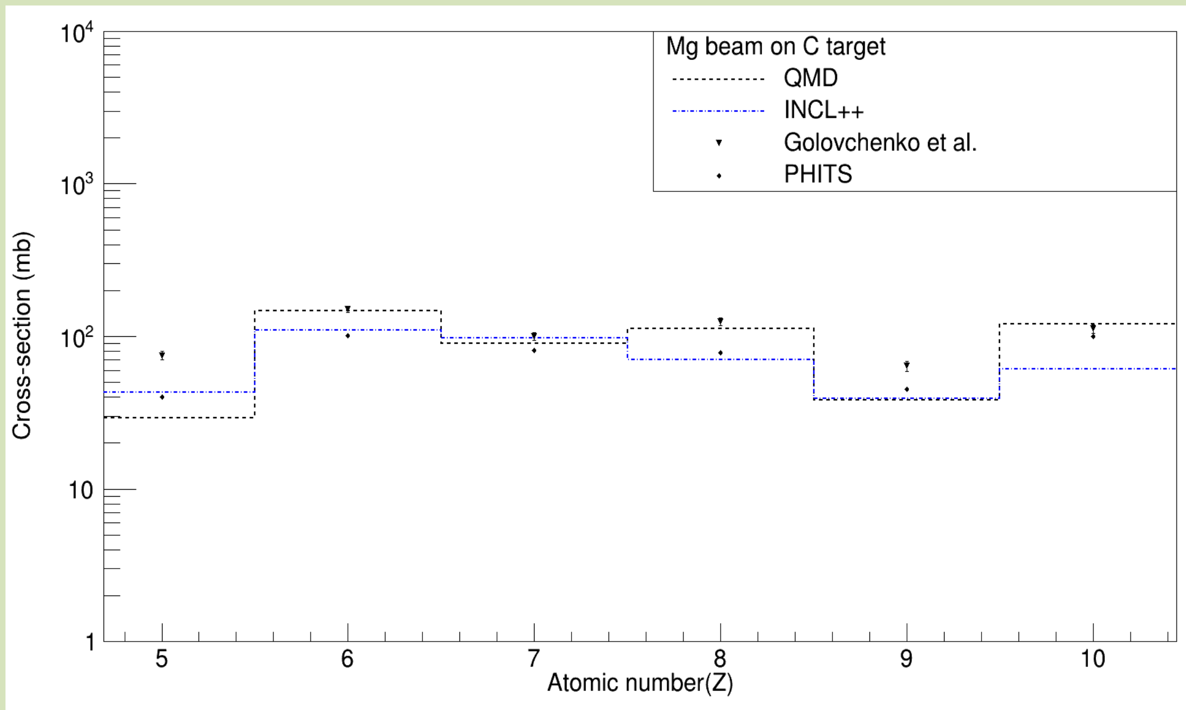


Figure 2. The fragmentation cross-section of Mg ion incident on C target with energy ~470 A MeV.

Conclusions

- Fragmentation cross-section study of Mg ion on C target using Geant4 software generates good results compared to experimental data and PHITS code data.
- The QMD model shows the odd-even effect.
- Both model shows close agreement for the mid Z fragments (Z=6-9).

References

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2. S. Agostinelli, J. Allison, K. Amako, J. Apostolakis, H. Araujo, P. Arce, M. Asai, D. Axen, S. Banerjee, G. Barrand et al., Nucl. Instrum. Methods Phys. Res (2003).