

AbstractID: 7393 Title: The IAEA initiative to standardize nuclear data for heavy charged-particle radiotherapy

Purpose: Protons and heavy ions lose energy via atomic and nuclear interaction processes. When simulating charged-particle beam characteristics, for example absorbed dose distributions or secondary particle fluences, accurate physics descriptions are required. Sophisticated computing techniques, e.g. Monte Carlo, are applied for high accuracy calculations. However, the availability of high-quality cross-section data for the simulation of heavy charged-particle interactions is far from being satisfactory. For example, the intra-nuclear cascade models that are employed for cross-section calculations are strictly valid only at high energies (>200 MeV per nucleon). Data libraries of charged-particle interactions are needed to validate the calculations using nuclear models and for direct use in calculations.

Method and Materials: The new IAEA coordinated research project on heavy charged-particle interaction data for radiotherapy comprises of a program to compile and evaluate charged-particle nuclear data for therapeutic applications. Plan is to review data and parameterizations for protons and heavy ions. Sensitivity analysis for different applications will be done with different codes for representative examples. The outcome will be a recommendation of preferred universal parameterization for all applications. Further, the aim is to work with code developers of the Monte Carlo codes FLUKA, Geant4, MCNPX, and SHIELD-HIT in order to implement reference models for use in charged-particle therapy simulations.

Results: This presentation will discuss the sensitivity of nuclear interaction data for various applications in heavy charged-particle therapy. We will discuss the nuclear interaction component in patient dose calculations, neutron background estimations, absolute dosimetry, and PET imaging for treatment verification. Based on these examples we will outline the specific aims of the IAEA initiative.

Conclusion: The IAEA initiative aims at standardizing the use of charged-particle nuclear interaction data for Monte Carlo simulations in proton and heavy ion therapy in order to improve the accuracy and compatibility of dosimetric studies.