The descriptions of biophysical events from heavy ions are of interest in radiation biology, cancer therapy, and space exploration. The biophysical description of the passage of heavy ions in tissue and shielding material is best described by a stochastic approach that includes both ion track structure and nuclear interactions. A new computer code called the GCR Event-based Risk Model (GERM) code was developed for the description of biophysical events from heavy ions beams at the NASA Space Radiation Laboratory (NSRL) [1].

The GERM code calculates basic physical and biophysical quantities of high-energy protons and heavy ions that have been studied at NSRL for the purpose of radiation space biological effects. For mono-energetic beams, the code evaluates the range-energy transfer (Q), range (R), and absorption in tissue equivalent material for a given charge (Z), mass number (A) and kinetic energy (E) of an ion. In addition, a set of biophysical properties is evaluated such as the Poisson distribution of ion or delta-ray hits for a specified cellular area, cell survival curves, and mutation and tumor probabilities [2].

The GERM code also calculates the radiation transport of the beam line for either a fixed number of user-specified depths or at multiple positions along the Bragg curve of the particle. The contributions from primary ion and nuclear secondaries are evaluated [3-5]. The GERM code accounts for the major nuclear interaction processes of importance for describing heavy ion beams, including nuclear fragmentation, elastic scattering, and inelastic excitation processes by using the quantum multiple scattering model of heavy ions (QMSFRG) and the energy loss calculation (QMSFRG) model [6]. The QMSFRG model has been shown to be in excellent agreement with available experimental data for nuclear reaction cross sections [7], and has been used by the GERM code for applications to thick target experiments. The GERM code provides scientists participating in NSRL experiments with the data needed for the interpretation of their experiments [8], including the ability to model the beam line, the shielding of samples and sample holders, and the estimates of basic physical and biological outputs of the designed experiments. We present an overview of the GERM Code GUI, as well as providing training applications.

REFERENCES


Overview of the Graphical User Interface for the GERM code (GCR Event-based Risk Model)

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