Contribution ID: **331** Type: **Oral**

PROGRAM FOR QUICK CALCULATION OF ABSORBED DOSE DISTRIBUTION BY DEPTH IN HOMOGENEOUS OBJECTS

Tuesday 2 July 2024 17:30 (20 minutes)

The use of electron accelerators has become widespread throughout the world, becoming an integral part of scientific and technological development. Currently, accelerator-based installations are used not only in science, but also in medicine, industry, and agriculture. An important parameter for the efficiency of using accelerated electrons is the uniformity of the distribution of the absorbed dose over the volume of the object being processed. Therefore, the development of planning and quick calculation methods is relevant.
Despite the fact that the Monte Carlo method has become widespread for modeling the interaction of ionizing radiation with matter, its use has some limitations. To obtain accurate results and obtain satisfactory event statistics, computer simulation will be required, which can take from several hours to several days depending on the estimated power of the computer used.
It seems interesting to develop a program that allows, based on a database prepared using previously performed modeling, to obtain in a few seconds the distribution of the absorbed dose over depth in an object with a given size and density. Such a program will significantly reduce the planning time for scientific research in the field of application of accelerated electrons.
The goal of this work was to develop a program for calculating the depth distribution of the absorbed dose in a model phantom when irradiated by an electron beam with an energy spectrum in the range from 0.1 MeV to 20 MeV based on a database obtained through detailed modeling using GEANT4. A solution to the inverse problem has also been implemented, when using given distributions of the absorbed dose in water, plastic and aluminum it is possible to reconstruct the energy spectrum of the electron beam.
A comparison was made of the values of the distribution of the absorbed dose over the depth of the object obtained as a result of the created program with the values obtained by direct computer modeling using GEANT4. It is shown that the maximum deviation from the simulation results is no more than 3% over the entire range of energies, thicknesses and materials considered. At the same time, calculations using the developed program were performed on average in 2 seconds, while calculations using GEANT4 took about 7 hours using an average-power personal computer.
The research was carried out within the framework of the Development Program of the Interdisciplinary Scientific and Educational School of Moscow University “Photon and Quantum Technologies. Digital medicine”.

Section

Applications of nuclear methods in science, technology, medicine and radioecology

Primary author: STUDENIKIN, Felix (Lomonosov Moscow State University)

Co-authors: CHERNYAEV, Alexander (Faculty of Physics M.V.Lomonosov Moscow State University); Ms SUSTATOVA, Anastasia (Lomonosov Moscow State University); Mr KIM, Andrey (Lomonosov Moscow State University); BORSCHEGOVSKAYA P.YU. (Lomonosov Moscow State University, Physics Department, Moscow, Russia Skobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Moscow, Russia); ZOLOTOV, Sergei (Lomonosov Moscow State University); BLIZNYUK, Ulyana (Lomonosov Moscow State University)

Presenter: STUDENIKIN, Felix (Lomonosov Moscow State University)

Session Classification: Applications of nuclear methods in science, technology, medicine and radioecology