ESTIMATION OF BIOLOGICAL PROTECTION AT THE NEW CYCLOTRON COMPLEX DC-140 USING MONTE CARLO METHOD

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Currently, the Laboratory of nuclear reactions, Joint Institute of Nuclear Research (JINR), is working on the creation of a new cyclotron complex DC-140, designed to solve a wide range of applied tasks. The main objectives of the project include research in solid-state physics, radiation resistance of materials, surface modification, production of track membranes, as well as testing of avionics and electronic component base under heavy charged particles [1].

The declared parameters of the new cyclotron are as follows: ion energy 2.1 and 4.8 MeV/u; ions of elements from O to Bi or U; intensities: 2.1 MeV/u (up to Xe 10^{12} s-1, Bi: 1×10^{11} s-1, U $> 10^9$), 4.8 MeV/u (up to Xe $> 10^{11}$ s-1, Bi: 1×10^{10} s-1).

An important aspect of designing/engineering and exploitation/operation of accelerators is estimation of the radiation situation in the building. Estimation is performed by calculations that allow us to assess the possible radiation risk to the personnel, as well as to materials and equipment.

One of the methods of calculation is Monte-Carlo method, which is based on statistical modeling processes of interaction of particles with matter. Specialized simulation package FLUKA [2], which is based on this method, emerges as a powerful instrument for modeling the interactions of particles with matter and carrying out calculations of biological protection.

The new accelerator of heavy ions will be installed in the building previously occupied by the outdated cyclotron, hence requiring refinement of the radiation shielding. The simulation package FLUKA was utilized for computation. Performed computations allow us to evaluate the radiation situation of the building and indicate the maximum doses of ionizing radiation at various locations.

In [3], an estimate of the yield and angular distribution of neutrons has already been presented for calculating the biological protection of reconstructed heavy ion accelerators with an energy from 1 to 6 MeV/nucleon.

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