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# THE OPERATIONAL METHOD FOR CALCULATING THE BIOLOGICAL PROTECTION OF LOW-ENERGY HEAVY ION ACCELERATORS

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Simple analytical formulas for operational evaluation of the yield and angular distribution of neutrons, which are necessary for calculating the biological protection of heavy ion accelerators with energies from 1 to 6 MeV/nucleon, are presented. Activities on creation of the new multipurpose isochronous cyclotron DC-140 [1] at the FLNR, JINR became the reason for the development of a method for operational preliminary calculation. The results of the calculation were compared with the results of calculations using the LIZE++ [2] and FLUKA[3] programs and with the available experimental data in the literature.
As a result of the comparisons, it can be argued that the proposed method for calculating the yield and angular distribution of neutrons from thick targets can be used to quickly assess the necessary biological protection of heavy ion accelerators under construction and reconstruction with energies from 1 to 6 MeV/nucleon. The deviation of the results of these calculations from the more accurate ones does not exceed a factor of two, which is comparable with the results of deviations in the calculation of biological shielding associated with a certain variety of spectra of produced neutrons and deviations in the protective properties of the materials used or their thickness.

## The speaker is a student or young scientist

Yes

## Section

1. Design and development of charged particle accelerators and ionizing radiation sources

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