World Academy of Science, Engineering and Technology
International Journal of Health and Medical Engineering
Vol:18, No:09, 2024

The BNCT Project Using the Cf-252 Source: Monte Carlo Simulations

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Abstract : The project can be divided into three main parts: i. modeling the Cf-252 neutron source and conducting an experiment to verify the correctness of the obtained results, ii. design of the BNCT system infrastructure, iii. analysis of the results from the logical detector. Modeling of the Cf-252 source included designing the shape and size of the source as well as the energy and spatial distribution of emitted neutrons. Two options were considered: a point source and a cylindrical spatial source. The energy distribution corresponded to various spectra taken from specialized literature. Directionally isotropic neutron emission was simulated. The simulation results were compared with experimental values determined using the activation detector method using indium foils and cadmium shields. The relative fluence rate of thermal and resonance neutrons was compared in the chosen places in the vicinity of the source. The second part of the project related to the modeling of the BNCT infrastructure consisted of developing a simulation program taking into account all the essential components of this system. Materials with moderating, absorbing, and backscattering properties of neutrons were adopted into the project. Additionally, a gamma radiation filter was introduced into the beam output system. The analysis of the simulation results obtained using a logical detector located at the beam exit from the BNCT infrastructure included neutron energy and their spatial distribution. Optimization of the system involved changing the size and materials of the system to obtain a suitable collimated beam of thermal neutrons.

Keywords : BNCT, Monte Carlo, neutrons, simulation, modeling
Conference Title : ICMPRPR 2024 : International Conference on Medical Physics, Radiation Protection and Radiobiology
Conference Location : San Francisco, United States
Conference Dates : September 26-27, 2024