OPTIMIZATION AND ANALYSIS OF NEUTRON DISTRIBUTION ON 30 MeV CYCLOTRON-BASED DOUBLE LAYER BEAM SHAPING ASSEMBLY (DLBSA)

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Abstract	Design and optimization of double layer Beam Shaping Assembly (DLBSA) has been conducted using the MCNPX code. The BSA is configured to comply with such a construction having typically a double moderator, a reflector, a collimator, and a filter. The optimization of various combinations of materials that compose the moderator, reflector, and filter yields such quality and intensity of radiation beams that conform to the requirements for Boron Neutron Capture Therapy. The composing materials are aluminum and BiF3 for moderator, lead and graphite for the reflector, nickel and polyethylene borate for the collimator, and iron and cadmium for the filter. Typical beam parameters measured at the exit of the collimator are epithermal neutron flux of 1.1.10(9) n/(cm(2).s), the ratio of epithermal neutron flux to thermal neutron and fast neutron flux 344 and 85, respectively, and the values of fast neutron and gamma dose to epithermal neutron flux 1.09.10(-13) Gy.cm(2) and 1.82.10(-13) Gy.cm(2), respectively. Analysis of epithermal neutron flux and neutron beam spectrum using the PHITS code reveals that the distribution of epithermal neutron spreads out in the DLBSA. The highest intensity is found in the moderator and decline downstream of the collimator and filter. The spectrum of neutron beams displays a narrow spike with that peaks at 10 keV.
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