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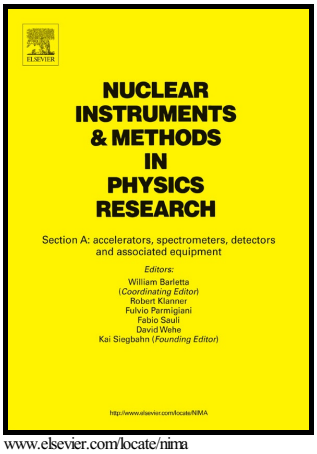

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Measurement and Simulation of the TRR BNCT beam parameters

Elham Bavarnegin[1,2], Alireza Sadremomtaz[2], Hossein Khalafi[1], Yaser Kasesaz[1*], Mohadeseh Golshanian[1], Hossein Ghods[1], Arsalan Ezzati[1], Mehdi Keyvani[1] and Mohammad Haddadi[1]

[1]Nuclear Science and Technology Research Institute (NSTRI), Tehran, Iran

[2]Department of Physics, University of Guilan, Rasht, Iran

[*]Corresponding author. Nuclear Science and Technology Research Institute (NSTRI) ,Tehran ,Iran. ykasesaz@aeoi.org.ir

Abstract

Recently, the configuration of the Tehran Research Reactor (TRR) thermal column has been modified and a proper thermal neutron beam for preclinical Boron Neutron Capture Therapy (BNCT) has been obtained. In this study, simulations and experimental measurements have been carried out to identify the BNCT beam parameters including the beam uniformity, the distribution of the thermal neutron dose, boron dose, gamma dose in a phantom and also the Therapeutic Gain (TG). To do this, the entire TRR structure including the reactor core, pool, the thermal column and beam tubes have been modeled using MCNPX Monte Carlo code. To measure in-phantom dose distribution a special head phantom has been constructed and foil activation techniques and TLD700 dosimeter have been used. The results show that there is enough uniformity in TRR thermal BNCT beam. TG parameter has the maximum value of 5.7 at the depth of 1 cm from the surface of the phantom, confirming that TRR thermal neutron beam has potential for being used in treatment of superficial brain tumors. For the purpose of a clinical trial, more modifications need to be done at the reactor, as, for example design, and construction of a treatment room at the beam exit which is our plan for future. To date, this beam is usable for biological studies and animal trials. There is a relatively good agreement between simulation and measurement especially within a diameter of 10 cm which is the dimension of usual BNCT beam ports. This relatively good agreement enables a more precise prediction of the irradiation conditions needed for future experiments.