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Studying of gamma-ray and neutron radiation in case of 1 – 2 MeV proton beam interaction with various construction materials

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In Budker Institute of Nuclear Physics it is proposed and created a source of epithermal neutrons based on the tandem accelerator with vacuum insulation and a lithium target. The neutron source is regarded as a prototype of a future compact device suitable for carrying out BNCT in oncology centers. It consists of two main parts: proton accelerator (2.5 MeV, 3 mA) and neutron-generating lithium target with a beam shaping assembly. Radiation hazard of the accelerator is determined by X-ray and gamma-ray radiation, but radiation hazard of lithium target is mainly determined by neutrons. When creating an optimal medical facility it is desirable to place these two parts in different rooms, adapted to suppress the corresponding radiation. The room of the accelerator should provide adequate protection against gamma-ray radiation even in case of emergency situation when the proton beam hits construction materials. In this work the measurements of the gamma-ray and neutron doses are presented in case of proton beam interaction (energy from 1 to 2 MeV) with various construction materials (Al, V, W, Ti, Cu, Mo, stainless steel, etc.). Also it is proposed an optimal construction material for beam transporting channel.

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Development of an accelerator-driven compact neutron source for BNCT in Nagoya University

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Development of an accelerator-driven compact neutron source has been started in Nagoya University for BNCT application based on a low-energy high-current DC accelerator, which has also extra possibilities of applications to fundamental physics experiments and industry uses.

The accelerator is a Dynamitron and produces a 2.8MeV, 15mA proton beam [1] and neutrons will be produced by the $^{7}Li(p,n)^{7}Be$ reaction. The resulting neutron flux will be moderated using a compact beam shaping assembly (BSA). From viewpoints of neutron production rates and the average and maximum neutron energies, it was reported that low energy protons incident on lithium target are the most suitable reaction for accelerator-based BNCT [2]. However, lithium target has several difficulties (low melting point, high chemical activity and ^{7}Be production) and we will develop a new Li-sealed target and a corresponded