dosimetry

Prompt Gamma-ray Spectroscopy for Boron Dose Measurement

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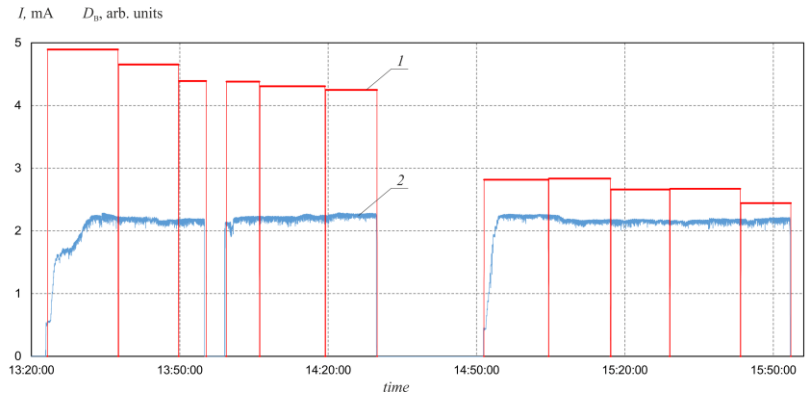
The $^{10}B(n,\alpha)7Li$ reaction itself provides a direct way to measure the boron dose, since one of the products of this nuclear reaction, the lithium nucleus, emits a photon with an energy of 478 keV in 93.9% of cases. Registration of such photons provides direct information about the number of nuclear reactions, i.e. about boron dose. Of course, this method of prompt γ-spectroscopy is well known [1], but has not been implemented for practical use in therapy.

The difficulty of implementation is that the γ-radiation spectrometer must be located in a neutron flux and have good energy resolution. It should be taken into account that photons with the same energy are emitted from the lithium target as a result of inelastic scattering of protons on lithium atomic nuclei. If we use a γ-spectrometer, which is relatively stable in a neutron flux, then the energy resolution does not allow us to separate the 478 keV line from the more powerful 511 keV line. The HPGe γ-spectrometer separates these lines, but it is not resistant to neutrons.

The report presents the results of a study that made it possible to measure the time dependence of boron dose in the treatment of a pet cat with adenocarcinoma in the nasal cavity. The study was carried out at the accelerator based neutron source VITA [2]. The figure shows the measured dependence of boron dose (*1*) and proton beam current (*2*). The results obtained made it possible to determine the absolute value of the absorbed dose, which is important for assessing the result of therapy.



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References:

1. T. Kobayashi, K. Kanda. Microanalysis system of ppm order B-10 concentrations in tissue for neutron capture therapy by prompt gamma-ray spectrometry. Nucl. Instrum. Methods Phys. Res. 204 (1983) 525–531.
2. S. Taskaev, *et al*. Neutron Source Based on Vacuum Insulated Tandem Accelerator and Lithium Target. Biology 10 (2021) 350.