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Insights from recent experimental campaigns towards Compton imaging for dosimetry in boron neutron capture therapy

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Boron Neutron Capture Therapy (BNCT) is an experimental form of radiotherapy that uses boron, injected to the patient within a target molecule that accumulates selectively in cancerous cells. This therapy exploits the large boron neutron capture cross-section to deliver a targeted dose from neutron irradiation. BNCT has shown great promise with the advent of accelerator-based technologies, which facilitate high-quality neutron beams in clinical environments [1].

One of the primary challenges in current BNCT is the accurate determination of the dose delivered to the patient. Since neutron captures in boron produce 478 keV gamma rays, this could be potentially used for real-time dose monitoring. To date, the main challenges remain dealing with very intense radiation fields that generate large count rates above detector reach; and in achieving enough boron sensitivity to image the boron in the tumor (65 ppm) above the overall boron in nearby tissues (18 ppm), on top of the strong background induced by harsh neutron and gamma ray fields generated during the treatments.

The i-TED Compton Camera array, originally designed for nuclear physics measurements of astrophysics interest, has expanded into medical physics through ion-range monitoring in HT [2], and further aiming now at BNCT [3]. Its large efficiency design and low neutron sensitivity make i-TED especially well suited for this task.

The state-of-the-art i-TED modules consist of large monolithic crystals of 15 mm thickness for the scatterer and 25 mm for the 4 absorbers. In the context of BNCT treatments, we require the use of new solutions for pixelated detectors in order to cope with the very large count rates present in these treatments. For such a task, the use of pixelated scintillators offers an approach to reduce the SiPM pixel firing rates without an overall efficiency loss.

This contribution will present the adaptations of the original i-TED imager, to optimize its performance for BNCT dosimetry. We will present the main results and observations from our last year campaign at Institut Laue Langevin (Grenoble, France), the changes implemented since then, and the first estimations from the most recent experiment at the LENA reactor (Pavia, Italy). In the latter, we have measured with a state-of-the-art i-TED module and an optimized one, consisting of thinner absorbers and a thin, pixelated CLLBC crystal as a scatterer. Comparisons between the performance of both versions will be discussed.

References

[1] K. Hirose et al., "Boron neutron capture therapy using cyclotron-based epithermal neutron source and borofalan (10B) for recurrent or locally advanced head and neck cancer (JHN002): An open-label phase II trial", Rad. & Onc. Vol 155, pp. 182-187, (2021)

[2] J. Balibrea-Correa et al., "Hybrid compton-PET imaging for ion-range verification: a preclinical study for proton, helium, and carbon therapy at HIT", The Eur. Phys. Jour. Plus, Volume 140, 870 (2025)

[3] P. Torres-Sánchez et al., "The potential of the i-TED Compton camera array for real-time boron imaging and determination during treatments in Boron Neutron Capture Therapy", App. Radiat. Isot. 217, 111649 (2025)

Abstract

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