

System for Radiation Dose Distribution Monitoring in Radiotherapy Treatment Planning

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According to World Health Organization (WHO) cancer is a leading cause of death worldwide, accounting for nearly 10 million deaths in 2020, or nearly one in six deaths. Each year, an estimated half a million children and adolescents develop cancer. A correct cancer diagnosis is essential for appropriate and effective treatment. Often treatment includes radiotherapy, especially when other options like surgery are limited due to the cancer type or location of the tumor. Therefore under a research project "A reconfigurable detector for measuring the spatial distribution of radiation dose for applications in the preparation of individual patient treatment plans" we developed a scalable detection system for evaluation of the dose distributions in 3D phantom during the preparation of the treatment plans under the photon radiotherapy procedure. Having a fast, efficient, and safe treatment is essential for every patient. Therefore, the development of a system capable of monitoring the real-time dose deposition in 3D can significantly improve the procedure, resulting in safer and faster treatment. This, in turn, enables hospitals to assist more patients effectively.

The system consists of a configurable 3D phantom that is based on tissue-equivalent printed scintillator cubes. It also includes a dedicated data acquisition (DAQ) system. The phantom can be fully customized to allow for setting arbitrary 3D configurations, with a granularity of 1 cm³ (possibly shrunken to 0.125 cm³). The measurement system is based on multichannel photomultiplier tubes, which are readout by a dedicated application-specific integrated circuit (ASIC). This ASIC is controlled by a field programmable gate array (FPGA) and managed by specialized software. During the conference, we will present the design and performance of the system, along with the results obtained during test-beams in the treatment plant using a therapeutic accelerator.

Collaboration

Role of Submitter

I am the presenter

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