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Evaluation of the possibility of a multichannel detector application for electron beam profile measurement by the multi-angle scanning method

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This research on the transverse profile of ionizing radiation beams and the development of a multi-angle beam scanning detection system is highly significant and applicable in various fields.

In technological and research applications, it is crucial to accurately determine the transverse profile of ionizing radiation beams for effective quality control purposes. However, most existing detectors do not meet all the necessary requirements. The proposed multi-angle beam scanning method addresses this issue by collecting data from multiple detectors at different angles. This method can provide high spatial and energy resolution, short processing time, and low beam distortion during measurements.

This study aims to find the optimal number of detectors for the development of a multichannel scanning system. For this purpose, experimental distributions of a 6 MeV electron beam were obtained using Gafchromic EBT3 dosimetry film. The obtained distributions were represented as matrices of image brightness values in each pixel. By summing up the values in each column, projections of the images at different angles were obtained. This allowed for the reconstruction of the electron beam test distributions at different numbers of detectors.

Based on the reconstructed images, it was demonstrated that a minimum of eight detectors is required to accurately determine the beam profile. This information is valuable for the design and implementation of multi-angle beam scanning detection systems. Overall, this research contributes to the development of improved detectors for determining the transverse profile of ionizing radiation beams.

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