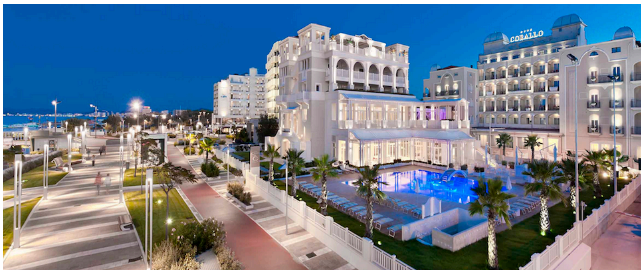

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Concept of a New Method for Determining the Transverse Profile of Wide-Aperture Beams

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This study describes the concept of a method for the measurement of flux density distribution in the transverse plane of wide-aperture beams such as radiotherapeutic medical beams. Currently, various approaches are used to modulate a radiation field of photons, electrons, protons and ions. However, all of these methods require continuous monitoring of the dose and spatial parameters of the beams. Therefore, the development of new methods for determining the beam's spatial parameters during the creation and modernization of linacs and hadron installations is a vital task.
One of the main requirements of detectors intended to determine parameters of therapeutic beams is the possibility of real-time measurement without disturbing the beam and with high resolution. This study proposes a new method for lateral beam profile determination by multiangle scanning to meet these requirements.
The proposed approach is based on integral transformations by inverse Radon reconstruction of data that could be obtained by multiple scanning of the therapeutic beam at different angles with a fixed angle step. This idea was to evaluate by numerical experiment.
For this purpose, we chose a distribution that is characteristic of the radiotherapeutic field. The test distribution has one maximum and one minimum in the lateral beam profile.
The two-dimensional projections are obtained from the original image of the beam test distribution using the MatLab software package. The dataset is obtained in such a way that the value at each point is the sum of the intensities in the column perpendicular to the scanning line, and the displacement angle is set in accordance with the required number of projections. The total displacement angle should not be less than 180°. These data are used to restore the original image with a different number of projections.
The images of the test distribution were reconstructed by the inverse Radon transformation for a different number of projections from 2 to 180. The results obtained show that 12 or more projections allow the initial distribution to be visually determined.
The proposed approach will enable the determination of the full beam density distribution in the transverse plane and ensure the continuous monitoring of therapeutic beam parameters in both plan verification and treatment. It is shown that 12 projections are enough to obtain reliable results. The multiangle beam scanning method could be applied for different types of radiation including beams of photons, electrons, protons and ions.

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