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3D detectors for personalised particle therapy

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In particle therapy and in particular in scanning beam proton therapy, fast, accurate, and efficient characterization of intensity and energy-modulated beams and patient-specific quality assurance of such beams is a considerable challenge.
Each Intensity Modulates Proton Therapy (IMPT) beam in a treatment may employ thousands of individual pencil beams or "spots"of variable intensities, energies, and positions to produce highly inhomogeneous dose distributions within the target. The sum of contributions of all such beams is the desired dose distribution in the target.
For IMPT continuous profile scanning with a conventional 2D detectors (ion chamber or diode) is not feasible because the pencil beam sweeps continuously over a certain line in a given time, and any profile acquired with a moving detector would not be a representative of a true dose profile.

Complex systems combining several layers of 2D detectors have been used with good results but low spatial resolutions in the z direction (1cm)
A conformal 3D printed system using liquid scintillators with a patient specific segmented 3D reproduction of the target might solve some of the above questions –one could even include gold nano particles and assess their contribution to the treatment.
Furthermore the simultaneous use of Geant4 could complete the full understanding of the full dosimetry and specifically define target and surrounding healthy tissue regions with high precision helping the preparation of a personalised treatment planning.

TRACK

Applications

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