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POLARIS PEPT for Proton Beam Tracking

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Proton therapy offers an advantage over traditional radiotherapy by depositing a therapeutic dose within a small volume. By exploring the secondary radiation from proton-nuclei interactions in the target, the energy deposition can be monitored to make up for the lack of {\it in vivo} dose measurements. One such method is Positron Emission Particle Tracking (PEPT) using PolarisJ Cadmium Zinc Telluride (CZT) detectors. PolarisJ detectors are chosen due to their high position sensitivity and have been shown to detect positron emitters to sub millimeter precision. By placing two Polaris detectors face to face beside a target irradiated by a proton beam, the secondary 511 keV gamma ray pairs can be detected and identified. By applying a PEPT algorithm in the 2D plane perpendicular to the beam line, the position of the beam line is found as well as the positron production distribution within the target. This method can be used to evaluate the positron production along a 66MeV proton beam incident on water, HDPE and graphite targets. The positron production distribution from the proton beam is compared to Monte Carlo simulations predicting where along the beam line different β^+ reactions occur for the various target materials. As the position of these peaks occurs a fixed distance away from the Bragg Peak, the location of the dose deposition within the target can be located. The use of the PolarisJ detectors has the potential to improve the accuracy of dose measurements during proton therapy.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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