Investigating 2D Scintillator Generated Proton Radiography Images as a Viable Alternative to Positioning Verification for Proton Beam Therapy

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Proton beam therapy, opposed to conventional x-ray radiation treatment, deposits the majority of dose directly to the tumor, which allows for targeted treatment that spares normal tissues. However, the steep distal fallout and limited range can result in underdosing the tumor and overdosing normal tissue in the absence of patient positioning verification. A novel positioning verification method using proton radiography developed by Muller, et al., takes advantage of the proportionality between the change in proton fluence and energy to the change in dose and thus image intensity. We investigated the implementation of the Logos System XRV-2000 2D 200mm x 200mm scintillator to produce proton radiography images using a proton beam supplied with 200nA current, 10MU, and two different energies depending on the mode. In scattered mode, the energy of the beam was unchanged from 6.5CM; while in absorption mode, an insertion of 4CM solid water plate between the beam and detector, effectively reduced the beam energy to 2.5CM. For each mode, the presence and absence of a lego was also captured. Using MATLAB to adjust for fluence inhomogeneity, a proton radiography image was successfully created. The robust edge detection demonstrated in the image shows promise for translating this proton radiography position method into small mammal models.