

Purpose: To commission and characterize a novel small animal irradiator, the XRad225cx from Precision X-Ray Inc. This system is capable of delivering both square and circular fields ranging in size from 1mm to 40mm. The combination of very small field size and relatively low energy (225kV) represents a substantial challenge in acquiring accurate dosimetry beam data. This work reports on commissioning studies using 2 independent dosimetry systems: EBT2 radiochromic film and PRESAGETM /optical-CT 3D dosimetry.

Methods: Initial measurements were made with 6x8cm pieces of EBT2 radiochromic film. Output factors were determined at 3 depths (0, 0.5 and 2cm) from films irradiated normally resting on the surface or sandwiched in solid water. Percent-depth-dose (PDD) measurements were made from films also sandwiched in solid water and irradiated edge on. Independent 3D dosimetry measurements were obtained using PRESAGETM radiochromic dosimeters and imaged with the Duke Large field-of-view Optical-CT Scanner (DLOS). Output factors and PDD's were obtained using a combination of small fields.

Results: The relative output factors and PDD's obtained from EBT2 and PRESAGETM showed agreement below 1 cm depth. For field sizes >1cm, relative output factors were found to be stable (~1.00) with differences between PRESAGETM and EBT2 <6%. At smaller field sizes the output relative to the 20 mm cone decreased substantially, down to ~0.5 for the smallest 1mm cone. A slightly greater drop was observed in the PRESAGETM measurements, which is currently being investigated.

Conclusions: Output factors and PDD curves were successfully obtained for all cones using a combination of EBT2 and PRESAGETM. Consistency was observed between both independent measurements after correcting for the lack of exact water equivalence of both the solid water and PRESAGETM. The 3D dosimetry system has potential advantages in terms of convenience, efficiency and comprehensiveness when commissioning small fields.

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