AbstractID: 9254 Title: Identification of a 3D dosimeter best-suited for use by the RPC

Purpose: To characterize several 3D dosimeters and identify one that is best-suited for use by the RPC in its anthropomorphic phantoms. This study will also provide useful data to other researchers when selecting a 3D dosimeter.

Methods and Materials: Three different dosimeters were investigated in this study: PRESAGE™ (a polyurethane and leuko dye dosimeter), and BANG® and PAGAT polymer gels. Each dosimeter was characterized to determine the dose response, linearity, reproducibility, spatial stability, and dose resolution. Both MRI and OCT were used to identify the best-suited imaging modality for each polymer gel formulation. Goals were established for each parameter. These were used to evaluate the dosimeters' characteristics and identify the dosimeter best-suited for use by the RPC.

Results: Each 3D dosimeter demonstrated a useful dose range up to 10 Gy. Only the BANG® dosimeter provided a linear dose response over this range. The uncertainty in the determination of the response of the dosimeter was ~2% when imaged with OCT; however, MRI yielded uncertainties < 1%. The low uncertainties achievable with MRI resulted in improved dose resolution. OCT required shorter imaging times than MRI; OCT produced planar images in 30 seconds. The BANG and PAGAT dosimeters displayed overshoots in response adjacent to regions of high dose gradient. No response overshoots were observed in PRESAGE™ dosimeters irradiated with steep gradients. The intra and inter-batch reproducibilities of PRESAGE™ exceed the goals established for these parameters. The spatial stability and reproducibility of the polymer gel formulations is in progress.

Conclusion: This study provides a framework for evaluating 3D dosimeters and identifying one best-suited for a particular use. This study also provides the first comparison of polymer gels characterized with both MRI and OCT.

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