

AbstractID: 5591 Title: Comparison of Change in Optical Density Between Three Radiochromic Films Due to 100 cGy Dose-to-Water Delivered by X-rays in the 75 kVp to 18 MV Range

Purpose: Over the last few decades, optical fiber-based dosimeters for *in vivo* measurements have been investigated. One of the attractive features of optical dosimetry is the potential for improved water-equivalency, compared to methods that use electrical signals. The materials considered thus far have been scintillating and optically stimulated luminescent sensors, doped and scintillating optical fibers, and radiochromic films. Several of the radiochromic films, including GafChromic MD-55 and HS, have shown a lower response for a given dose when low-energy (orthovoltage) x-ray beams were used, compared to a Co-60 source. This study continues the investigation of suitability of another radiochromic film, GafChromic EBT, for real-time *in vivo* point-based dosimetry by considering its response to a given dose delivered by beams varying in nominal energy.

Method and Materials: 1 cm × 1cm pieces of MD-55, HS and EBT film were irradiated within a 30 cm × 30 cm × 10 cm Solid Water phantom fitted with optical fibers for real-time measurements. Each exposure delivered a dose of 100 cGy, using x-ray beams ranging in energy from 75 kVp to 18 MV. Changes in optical density (ΔOD) were compared for the three types of film across all beam energies used.

Results: Both MD-55 and HS films showed a decrease of approximately 35% in ΔOD for a 75 kVp beam compared to a Co-60 beam. Decrease in response for 225 kVp beam was less pronounced (approximately 15%). Both HS and MD-55 exhibited this trend, confirming previous reports and validating our technique. The EBT film showed no decrease in response through the orthovoltage range.

Conclusion: Due to a near-constant response of EBT film for a given dose delivered using 75 kVp to 18 MV x-ray beams, EBT medium is more suitable for *in vivo* measurements than MD-55 and HS films.