

AbstractID: 5507 Title: Characterization and Real-Time Measurements of Optical Density with GafChromic EBT Film

Purpose: Over the last few decades, various groups have investigated optical fiber-based dosimeters for *in vivo* measurements. Recently, two radiochromic films have also been considered for real-time *in vivo* point-based optical dosimetry, and both GafChromic MD-55 and GafChromic EBT films fared well in several criteria. However, GafChromic MD-55 was shown to have the change in optical density depend both on dose rate and on temperature, as measured immediately at the end of a given exposure. To continue with the search for a suitable medium for real-time fiber-based *in vivo* dosimetry, GafChromic EBT film is also being investigated for dose rate and temperature effects.

Method and Materials: 1 cm × 1cm pieces of film were irradiated with a 6 MV beam within a 30 cm × 30 cm × 10 cm Solid Water phantom fitted with optical fibers for real-time measurements, using a 10 cm × 10 cm field at SAD, 100 cm SAD, and 1.5 cm depth. Each exposure delivered a dose in 5 to 1000 cGy range at a dose rate in 14 to 520 cGy/min range. Changes in OD obtained immediately at the end of each exposure were compared. The percent uncertainty in ΔOD for a given dose was calculated by using all the values obtained, regardless of the dose-rate used.

Results: The percent uncertainty ranged between 1.8% and 3.6%, with an average of 2.8%. The expected variation in ΔOD within a single sheet of GafChromic EBT film for a given dose is 1.5% (two standard deviations). The average increase in uncertainty is 4%.

Conclusion: An increase in uncertainty of real-time ΔOD measurements is observed when variations in dose-rate are introduced for the doses in 5 to 1000 cGy range, and dose-rates between 14 and 520 cGy/min.