

AbstractID: 12792 Title: Backscatter factor measurements using Gafchromic EBT2 film

Purpose: To evaluate the accuracy of Gafchromic EBT2 film in the determination of kilovoltage x-ray backscatter factors.

Method and Materials: Backscatter factors (BSFs) were measured for x-rays beams in the energy range 50 to 280 kVp and field sizes from 2 to 6 cm diameter. Each BSF was determined by placing a 2×2 cm square of EBT2 film at the end of the applicator either in-air or at the surface of a solid water phantom. The optical density (OD) at the center of each film was measured 24 hours after irradiation using a point densitometer. An OD versus dose calibration curve was determined for each x-ray beam energy using the 6 cm diameter applicator and then used to determine the dose for each film sample. Reference BSFs were calculated by interpolation of the data in the AAPM TG61 kilovoltage dosimetry protocol. An uncertainty analysis in BSF determination was performed using the ISO methodology.

Results: The agreement between measured and calculated BSFs was within 3.8% for the majority of the film measurements. This agreement was for all the energies and field sizes studied and based on multiple film measurements. However a small number of measurements gave dose differences of up to 10% between films irradiated under the same conditions and these films were discarded. These differences were attributed to variations in the chemical composition on the film leading to differences in the relative photoabsorption.

Conclusion: We have demonstrated that Gafchromic EBT2 film is potentially suitable for the determination of kilovoltage x-ray backscatter factors but not as accurate as the previous version Gafchromic EBT film.¹

Reference: 1. J. Kim *et. al.*, "An investigation of backscatter factors for kilovoltage x-rays: a comparison between Monte Carlo simulations and Gafchromic EBT film measurements," *Phys. Med. Biol.* **55**, 783-797 (2010).