

AbstractID: 13157 Title: Dose response and energy dependency of Gafchromic EBT2 film over a wide range of beam energies and modalities

**Purpose:** The Gafchromic films have been used generally in absolute and relative dosimetry in radiation therapy. The ISP Corporation® has recently replaced a widely used Gafchromic EBT film by a newer version, namely, “EBT2” film. The purpose of this study is to evaluate the EBT2 film for its energy dependencies and dose responses for a broad range of energies and modalities used in clinical radiation therapies.

**Method and Materials:** The beams used for this study consisted of kilo-voltage x-rays (75,125, and 250 kVp), <sup>137</sup>Cs gamma (662 KeV), <sup>60</sup>Co gamma (1.17-1.33 MeV), Mega-voltage x-rays (6 and 18 MV), electron beams (6 and 20 MeV), and proton beams (100 and 250 MeV). The film’s response was measured over the range of 0.4-10 Gy, which corresponds to optical density ranging from 0.05 to 0.74, for each of the beam energies. An X-Rite pocket densitometer and an Epson flatbed scanner were used to read the films.

**Results:** The measured dose response for EBT2 film over the energy ranges investigated was  $\pm 4.5\%$  ( $1\sigma$ ). The two extremes among the dose response data for various beams were 100-MeV proton beams and <sup>60</sup>Co (or <sup>137</sup>Cs) beams. Uncertainty in beam calibrations was estimated to be 0.82% after compounding the margins of error from contribution of uncertainties in NIST calibration, ADCL calibration, and setup error and beam outputs. The film uniformity and film-to-film variation was found to be within 0.9% ( $1\sigma$ ) for a single batch.

**Conclusion:** Our results indicate that for measurement of relative and absolute dosimetry, EBT2 film is a robust dosimeter with weak energy dependency over a broad range of energies and modalities used in radiation therapy.