AbstractID: 9160 Title: Predicting radiographic film response in therapeutic photon beams using Monte Carlo methods

Radiographic film is often used to verify IMRT treatments. In uniform fields, the energy-dependent sensitivity of the high-Z materials in the film emulsion can be accounted for almost entirely during film calibration, by matching the field size and depth with the treatment field, since the scatter and primary components are relatively constant within the fields. However, in large intensity modulated fields, where the scatter dose is high and the primary dose may vary greatly within the field, points with a scatter-to-primary ratio that differs significantly from the calibration fields will be measured incorrectly. It is the purpose of this work to find a spectral parameter that predicts this film artifact based upon measurements with uniform fields. This parameter may be used to correct film measurements in IMRT fields. The dose-response of radiographic film in 6 and 15 MV photon beams was measured for fields from 5×5 cm^2 up to 40×40 cm^2 and for depths from d_{max} to 20 cm in polystyrene. The maximum variation in dose-response was 40%. Monte Carlo calculations provided the photon spectra at the location of the film. The film artifact is shown to be highly correlated with the fraction of photons in the spectrum that are below 0.1 MeV. This spectral parameter generally predicts the artifact to within 1%, independently of field size and depth. Calculation of the photon spectrum at a few points within the IMRT field combined with the intensity pattern can be used to correct the film artifact in IMRT fields.