AbstractID: 5068 Title: On the suitability of radiographic film for low density material dosimetry and photon algorithm verification

Purpose: To assess potential errors in radiographic film dosimetry in low density materials and to compare film measurements to dose estimates of a commercial convolution/superposition photon (CSP) dose calculation algorithm.

Method and Materials: A standard film phantom was modified by replacing water-equivalent slabs (30 HU) in its central portion with very low-density material (-960 HU) to produce a lung slab phantom. Experiments were performed irradiating this phantom with 6 and 18 MV photons and field sizes of 2x2, 5x5, and 10x10 cm with 13 films placed between slabs. With unprocessed film in place , the phantom was then imaged in a computed tomography scanner and Monte Carlo (MC) and CSP calculations were done for each field size and energy combination. The phantom was then rescanned without film and dose was recalculated using MC to estimate the effect of the film in the prior MC calculations.

Results: Measurements and MC calculations demonstrated field size and energy-dependent dose perturbations at film planes in the low density material (up to 20% of maximum dose). In the phantom with film, central axis measurements and MC calculations matched within about 3%. The CSP algorithm was not perturbed by the film and overestimated dose in the low density region. Relying on film measurements alone would indicate a maximum overestimate of about 17% for 6 MV beams and 30% for 18 MV beams for the 2x2 cm fields. The filmless MC calculations show the true error to be about 6-9% higher.

Conclusion: The error in CSP calculations will be underestimated if film is used as a dosimeter in very low-density materials. The use of somewhat denser lung-equivalent materials (*e.g.*, -700 HU) would likely result in reduced, but still significant, error estimates.

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