

AbstractID: 1675 Title: Quantitative Assessment of RadioChromic Film Absolute Dose Measurements for Low Dose Brachytherapy Sources

Radiochromic film (RCF) is a promising secondary planar dosimeter for low dose-rate (LDR) brachytherapy because of its high spatial resolution, near tissue equivalence, and reproducibility. Its accuracy has been established for high dose-rate brachytherapy and other acutely administered radiation fields. However, the prolonged irradiation times (days to weeks) needed for LDR irradiation, compared to the acutely-exposed calibration films, may introduce significant dose-measurement errors since RCF post-exposure OD growth depends on time sequence and fraction of dose delivery.

To assess RCF dose measurement accuracy and the influence of temporal mismatch of brachytherapy and calibration films, model MD-55-2 RCFs were irradiated with a  $^{137}\text{Cs}$  intracavitary source in a PMMA phantom over 6-7 day periods. Calibration films were irradiated to graded doses using a calibrated 6-MV x-ray beam immediately prior to completion of the  $^{137}\text{Cs}$  irradiations. OD distributions, measured using a HeNe 2D laser scanner at intervals ranging from 0.5 to 1500 hours following irradiation, were converted to 2-D absolute dose distributions. Dose-measurement errors were quantified via pixel-by-pixel deviations of the measured dose from that estimated by Monte-Carlo photon-transport simulations.

For typical irradiation-to-densitometry intervals (48 hour), RCF and Monte-Carlo agree within 1-4% over the 5-100 Gy dose range with standard deviations of 1-3% for doses exceeding 10 Gy and 30% at 2 Gy. The pattern of discrepancies shows a small but systematic dependence on irradiation-to-densitometry interval, with films scanned at 0.5-2 hour over-responding by 5% compared to films scanned between 48 and 1500 hours. Supported in part by NIH R01 CA 46640.