

AbstractID: 5781 Title: Orientation, position, and temperature dependence on optical density measurements when using sensitive radiochromic film and fluorescent CCD scanner

Purpose: We report systematic artifacts that were found to occur when scanning a commercial radiochromic film (RCF) (GAFCHROMIC EBT) with a charge-coupled device (CCD) film scanner. Potential systematic sources of optical density (OD) measurement error were found to be related to film orientation with respect to the scanner bed, film position on the scanner bed, and film temperature from repeated scanning.

Method and Materials: We investigated the use of two flatbed CCD scanners that have been previously reported for use with the RCF, as well as two point densitometers that measure diffuse OD. Change in OD with film orientation was studied with small uniformly irradiated RCFs that were rotated and repeatedly scanned. A RCF from an IMRT QA measurement was scanned in portrait and landscape orientations to assess the magnitude of possible clinical errors. Film uniformity was assessed by evaluating profiles in the scan direction for large RCFs with graded uniform ODs produced by exposure to sunlight. A thermocouple was placed on the bed of a CCD scanner RCF was repeatedly scanned while recording temperature.

Results: Sinusoidal variations of 15% were observed for rotating film measurements made with one CCD scanner (Epson) and 80% for the other (Microtek). The point densitometers did not demonstrate any variation with rotation. Changes in temperature in the range of 18-34°C lead to OD changes as large as 7%. The edges of the CCD scan beds demonstrated non-uniformities as large as 15%.

Conclusion: Care must be taken to avoid these systematic errors when using RCF for clinical dosimetry. We recommend: maintaining the orientation of films; scanning in the central portion of the scanner bed; and limiting the number of consecutive scans.

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