

Purpose: To evaluate the adequacy of radiochromic film/CCD-flatbed scanner system as a tool for tomotherapy IMRT delivery verification.

Methods and Materials: In this study, EBT Gafchromic film and Epson flatbed scanner were used. IMRT plans created using tomotherapy treatment planning were delivered to a phantom which incorporates the film and ion chamber. To obtain accurate and reproducible results a film protocol was setup. First the scanner was evaluated in terms of OD variations due to film position on the scanner, direction of film relative to the motion of CCD-array, and temperature of the glass during read out. From preliminary findings, a simple protocol was developed in which each film was scanned pre/post irradiation in the same position and orientation. The time between exposure and scan was ≥ 6 hrs. This protocol is applicable for doses ranging from 0-300 cGy. For scanning, 48-bit RGB mode was employed and the resolution set to 72 dpi. From the resulting TIFF-images, the red channel images were extracted, filtered, and analyzed using an in-house film dosimetry software. Since the pre and post irradiation images were co-registered, the background was subtracted point by point and the pixel value converted to OD. The measured dose distributions were compared with values calculated by tomotherapy at the location of the film. Comparison between measured and calculated dose distributions is expressed using the γ -index.

Results: The measured dose uncertainty with this protocol is $\pm 2.0\%$. A 2D correction matrix was obtained to account for the non-uniformities of the film, light source, glass plates, and CCD array. For the distributions compared, the passing rates $\gamma \leq 1.0$ were larger than 90%.

Conclusion: The use of Gafchromic film and an Epson scanner in conjunction with a proper scanning protocol provides an accurate and efficient tool for dosimetric verification of IMRT fields produced by serial tomotherapy.