

AbstractID: 8330 Title: Characterization and Use of XRCT Radiochromic Film for CT Radiation Profile

Purpose: To quantify and evaluate the use of the self-developing Gafchromic XRCT film for its implementation in routine CT QA.

Method and Materials: The film was examined for several properties including delivered dose, dose sensitivity, and energy dependence. The digital image data of the film was taken by scanning using a flatbed color image scanner with a reflective mode. Radiochromic films (RCFs) are known to have microscopic and macroscopic non-uniformities. These variations in the response make the optical S/N (signal-to-noise ratio) lower, resulting in lower film sensitivity. To mitigate the effects of RCF nonuniform response, a self-developed optical common-mode rejection (CMR) scheme was applied. The optical CMR can improve the dosimetric sensitivity limit of a RCF through use of a set of color components, e.g. red and green outputs from an RGB color scanner. The response of the XRCT films to delivered dose ranging from 0.3 mGy to 120 mGy for tube voltages of 80 to 120 kV was analyzed by using an optical CMR scheme and the results were compared with those obtained by the conventional analysis using the red output. Dose profiles were obtained using the XRCT film based on an Aquilion 64 CT scanner.

Results: No energy dependence was observed for tube voltages of 80 to 120 kV. The dose-response curve showed that the XRCT film response is nonlinear, then, a second-order polynomial fit was applied to the curve. When analyzed by using the optical CMR, excellent agreement between predicted and measured optical densities was obtained in the low range less than 1 mGy, while those with the conventional analysis did not show a consistency with a fit.

Conclusion: This work indicates that this RCF film possesses unique and good characteristics which allows for its use in routine CT QA.