

Purpose: To evaluate the characteristics of commercial-grade flatbed scanners and medical-grade scanners for radiochromic EBT film dosimetry.

Methods: Performance aspects of a Vidar Dosimetry Pro Advantage (Red), Epson 750 Pro, Microtek ArtixScan 1800f, and Microtek ScanMaker 8700 scanner for EBT2 Gafchromic film were evaluated in the categories of repeatability, maximum distinguishable optical density (OD) differentiation, OD variance, and dose curve characteristics. OD step film by Stouffer Industries containing 31 steps ranging from 0.05 to 3.62 OD was used. EBT films were irradiated with dose ranging from 20 to 600 cGy in 6x6 cm² field sizes and analyzed 24 hours later using RIT113 and Tomotherapy Film Analyzer software. Scans were performed in transmissive mode, landscape orientation, 16-bit image. The mean and standard deviation Analog to Digital (A/D) scanner value was measured by selecting a 3x3 mm² uniform area in the central region of each OD step from a total of 20 scans performed over several weeks. Repeatability was determined from the variance of OD step 0.38. Maximum distinguishable OD was defined as the last OD step whose range of A/D values does not overlap with its neighboring step.

Results: Repeatability uncertainty ranged from 0.1% for Vidar to 4% for Epson. Average standard deviation of OD steps ranged from 0.21% for Vidar to 6.4% for ArtixScan 1800f. Maximum distinguishable optical density ranged from 3.38 for Vidar to 1.32 for ScanMaker 8700. A/D range of each OD step corresponds to a dose range. Dose ranges of OD steps varied from 1% for Vidar to 20% for ScanMaker 8700.

Conclusions: The Vidar exhibited a dose curve that utilized a broader range of OD values than the other scanners. Vidar exhibited higher maximum distinguishable OD, smaller variance in repeatability, smaller A/D value deviation per OD step, and a shallower dose curve with respect to OD.