

## **CORVUS IMRT Film Dosimetry Using Novel GafChromic EBT Film.**

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**Introduction:** IMRT treatment plans create a high gradient rapidly changing dose distribution in the treatment volume and require new methods to verify the absorbed dose. Film being a two-dimensional high spatial resolution dosimeter is a logical choice for IMRT QA. Film dosimetry using conventional radiographic film is affected by the processor characteristics at development time, creating the need for producing a film calibration curve each QA time, even for films from the same batch. Radiographic film response is energy dependent and can cause dosimetry errors in measuring changing energy spectrum IMRT fields. GafChromic film does not require processing and is nearly tissue equivalent, making it a good 2D dosimeter with the option of absolute dosimetry for IMRT QA. The new EBT GafChromic film (ISP, Wayne, NJ) was evaluated and compared with EDR2 (Eastman Kodak, Rochester, NY) for IMRT QA.

**Methods and materials:** IMRT treatment plans were generated on a Corvus (Nomos, NAS, Cranberry Township, PA) treatment planning system for a 25 cm x 25cm x 25cm phantom, using a 23MV photon beam (Siemens, Primus 23). The regular IMRT QA procedure is performed in two steps: relative film dosimetry with EDR2 film and ionization chamber dose measurement at the isocenter, which is located at the phantom center. One treatment fraction is delivered to the film positioned parallel to the beam axis in the transverse plane that includes the isocenter. Film dosimetry is performed using a Vidar VXR-16 Dosimetry Pro (Vidar, Herndon, VA) scanner and RIT 113 (Colorado Springs, CO) software. To compare EBT GafChromic film with EDR2 film, the same treatment was delivered to both films. H&D curves were measured for both films under the same treatment conditions perpendicular to the beam axis at treatment depth using a 23 MV photon beam. Film dosimetry using GafChromic film was performed at least 24 hours after irradiation using the same dosimetry system with an orange filter taped to the film. The GafChromic H&D films also were scanned at least 24 hours after irradiation. MSKCC's Contour film dosimetry software was used for dose overlays.

**Results:** Dose overlay of the same treatment plan delivered to EBT and EDR2 films sandwiched together in the phantom is presented in Fig.1. The intensity value of the EBT GafChromic film is depending on the scanning direction on the Vidar scanner. EBT films were digitized with the short film side parallel to the light source (vertically) and then rotated by 90 deg - with the long film side parallel to the light source axis (horizontally). The intensity vs. dose curves for horizontal and vertical scans for a 23 MV photon beam are presented in Fig 2. For IMRT QA the H&D curve and the QA film have to be scanned in the same direction. Scanning films in different directions can cause up to 30% error. Example of isodose distribution on the same film scanned in two different directions and processed using correspondent H&D curves is given in Fig.3. The difference in isocenter point dose is up to 2%.

**Conclusions:** EBT GafChromic film can replace EDR2 film for IMRT QA film dosimetry. EBT film does not require processing and can be used for absolute film dosimetry for each treatment plan using the H&D curve made for the same film batch.

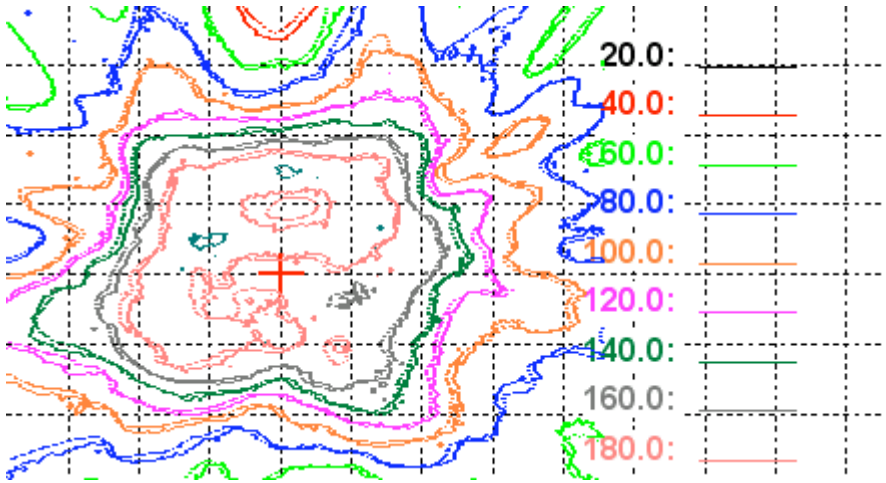


Fig. 1. Dosimetry overlay EBT vs. EDR2

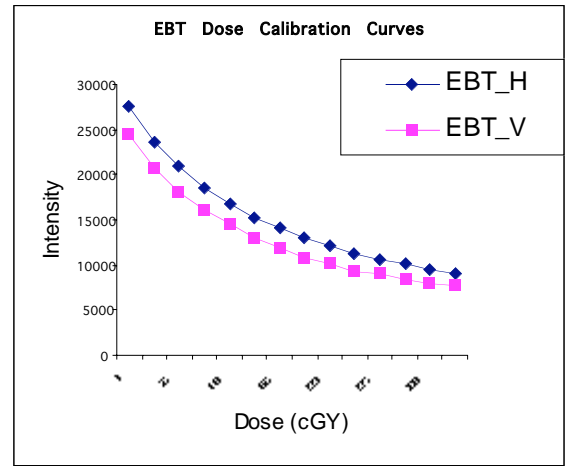
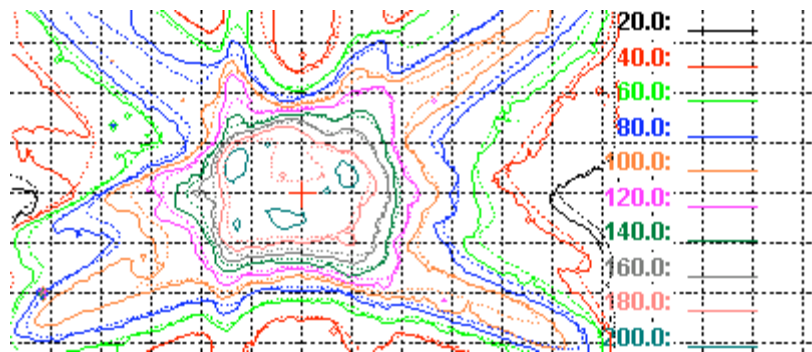
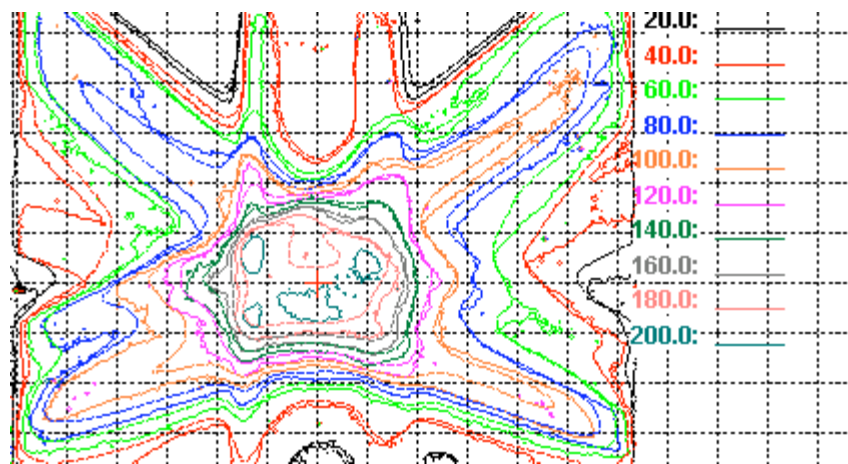


Fig. 2. Intensity vs. Dose for EBT films scanned vertically and horizontally



a.



b.

Fig. 3. a. Plan- EBT film dose overlay for horizontally scanned films, b. Plan- EBT film dose overlay for vertically scanned films