AbstractID: 10833 Title: Liquid scintillation detector system for real-time IMRT quality assurance

Purpose: A liquid scintillation (LS) detector system has been developed to verify dose delivered to a 3D volume. The feasibility of such a system as an IMRT quality assurance device is demonstrated.

Method and Materials: The LS detector system consists of an opaque tank (20cm x 20cm x 23cm), a light-tight conduit and an air-cooled CCD type camera (Luca, Andor Technology, South Windsor, CT) placed 80 cm away from the center of the tank to minimize stray radiation. The Liquid Scintillator used in this system is BC-531 (Saint-Gobain, Newbury, OH). The detector system was irradiated with a 6-MV photon beam in step-and-shoot IMRT delivery mode from a Varian Clinac 21EX. A series of light images were acquired during beam-on time over all segments of one treatment field. The measured light was compared with the predicted light signal, which was calculated from forward projection of the convolved 3D dose volume obtained from the treatment planning system.

Results: An integration time of 150 ms was adequate to provide a resolution of 1 cGy at a dose rate of 400 cGy/min. Frame-by-frame acquisition demonstrated the advantage of reduced noise over a single long-time acquisition. Images acquired during irradiation could easily be distinguished from dark images, since their standard deviation was higher by at least a factor of three. The measured light signal showed good agreement with the predicted light image. Differences occurred due to the light scattering and light reflection.

Conclusion: We have validated the LS detector system during step-and-shoot IMRT delivery. Further improvements are required to optimize the blurring filter kernel, improve the efficiency of the workflow and add a quantitative analysis of the light output.