AbstractID: 6522 Title: Imaging linear accelerator startup using a high-speed scintillation based electronic portal imaging device (Hi-EPID)

Purpose: Using the high-speed scintillation based electronic portal imaging device (Hi-EPID), to analyze the characteristics of the fluence delivered from a commercial clinical linear accelerator (Synergy® S, Elekta). To study the fluence output at short time scales.

Method and Materials: The Hi-EPID consists of a high speed digital camera coupled with a fast terbium-doped gadolinium-oxy-sulfide (Gd2O2S:Tb) scintillator. The camera can record every single radiation pulse out of the accelerator, at up to 500 fps. Both open field and multileaf collimator (MLC) based intensity modulated radiation therapy (IMRT) fields were evaluated. The startup time of linac delivery was recorded.

Results: Fluence delivery irregularities were observed with the Hi-EPID device, within 250 ms. For the open field delivery, the fluence increased with time until it reached a plateau, in approximately 100 to 250 ms, and then remained constant. However, in the case of a six segment IMRT field delivery, the fluence variation differed between segments. For some segments, the fluence increased in the beginning and then reached a plateau. For others, the fluence rose and fell sharply, followed by a slower rise to the plateau. The rapid fluence variation before a plateau was as high as 60% of the maximum. A field size dependence of fluence was observed. An analysis of field shapes showed no unplanned motion of MLC was during step and shoot delivery, as has been reported for other clinical linac.

Conclusion: The Hi-EPID is capable of imaging the fluence out of a linear accelerator with high temporal resolution. The startup characteristics of the accelerator can be studied. For short time IMRT segments, fluence and dose rate varied over a significant portion of the segment. As the dose rate fluctuates during startup, its effect on IMRT delivery can be studied.

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