AbstractID: 11155 Title: Operating Parameters of a Novel CVD Diamond Detector for X-ray Dosimetry

Purpose: To determine optimal operating parameters of a clinical x-ray detector based on chemical vapor deposition (CVD) diamond while using conventional dosimetry instrumentation.

Method and Materials: A prototype diamond detector was fabricated based upon commercially available single crystal diamond (0.5 x 3 x 3 mm^3) synthesized via CVD and Perspex encapsulation that was designed to adapt to an existing Solid Water phantom used for routine clinical dosimetry. 6 MV photons from a Varian 600C linear accelerator were measured using a SSD of 90 cm and 10 cm phantom depth with a 10 x 10 cm^2 field size in the central axis of the beam. A 2570/1 Farmer Dosemeter and Keithley 6430 SourceMeter were used to measure dose. Response dynamics e.g. rise and fall times, sensitivity, stability, and linearity of dose and dose rate were observed as functions of operating voltage.

Results: Photocurrent rise and fall times were observed as a function of operating voltage ranging from 50 to 200 V. Differences in rise times were found to be nearly negligible. A nonlinear decrease in fall times of detector current was observed, ranging from 42 to 5 s for 100 to 200 V. Average current and sensitivity as a function of voltage followed a power-law relationship, with average sensitivity values of 276 and 474 nC Gy^{-1} mm^3 for 100 and 200 V, respectively. Small deviations were observed in the fitting parameter Δ for photocurrent as a function of dose rate for different voltages.

Conclusion: Results indicate that using voltages of 175 V and above minimize response times and provide sufficient sensitivity with negligible dark currents. However, more investigations are needed to improve temporal response, especially below 175 V. Studies of desired properties and parameters are ongoing to evaluate and optimize detector performance.