AbstractID: 8639 Title: Design and study of a novel dosimeter based on carbon fiber material

Purpose: To design the new generation of dosimeters that incorporate carbon fiber materials as sensing components for dosimetric measurements in radiotherapy. **Method and Materials:** A carbon fiber dosimeter mainly consists of a carbon fiber sheet as sensing material and two PMMA slices as holders. The carbon fiber sheet was sandwiched between the two PMMA holders, each having a hole with 1.8×1.8 cm^2 dimension. Copper electrodes were made on one PMMA holder to make electrical contacts. The dosimeter was connected to a resistor array in serial. A Dose 1 digital electrometer was used to measure signals output from the dosimeter in real-time. Both 6 and 15 MV photon beams generated from a Varian Clinac 21 EX medical linear accelerator were used to test the dosimeter. Radiation dosimetric measurements were carried out by varying the dose rates, total dose, and field sizes to characterize various properties of the dosimeter. **Results:** This carbon fiber dosimeter responded to different ionizing radiation beams with a change in current amplitude. For both 6 and 15 MV photon beams, when dose rate was varied from 100 to 600 MU/min, the current changes measured by the dosimeter increased. The similar results were observed in diamond dosimeters. When the dosimeter was irradiated with total dose range from 100 to 600 MUs for 6 MV photon beams, excellent linear responses were displayed. The dosimeter measured increase signals with field size increased from 0.5×0.5 cm^2 to 1.8×1.8 cm^2. **Conclusion:** The carbon fiber dosimeter displayed excellent linear responses to total dose and was able to provide real-time information on dose and dose rate at the same time. The dosimeter is expected to offer a higher spatial resolution by miniaturizing the physical size of the carbon-based dosimeter design.