

AbstractID: 12773 Title: Study of response of plastic scintillation detectors in small field 6 MV photon beams

Purpose: The plastic scintillation detector (PSD) has many advantages over other detectors in small field dosimetry due to its high spatial resolution, excellent water equivalency and instantaneous readout. This study investigates the relative response of PSDs in a 6 MV photon beam for various field sizes by Monte Carlo simulations. **Method and Materials:** Two PSDs are modeled: BC-400 ($\phi 1\text{mm} \times 4\text{mm}$) and BCF-12 ($\phi 1\text{mm} \times 2\text{mm}$). A plastic optical fiber stem of length 3 cm coupled to the detectors is included in the simulation. Two orientations of the PSD are studied when positioning the detector at 10 cm depth in the 6 MV beam: (1) the axis of the PSD is *perpendicular* to the incident beam; (2) the axis of the PSD is *parallel* to the incident beam and the tip of the detector is pointing to the radiation source. The response of the detectors is calculated as the detector dose per unit water dose for various field sizes ranging from $10 \times 10 \text{ cm}^2$ down to $0.5 \times 0.5 \text{ cm}^2$. With the parallel orientation of the PSD, the off-axis dose profiles in the $0.5 \times 0.5 \text{ cm}^2$ photon beam are calculated from the simulation results of the PSDs and compared to the dose profile from a CC01 chamber (cavity only) simulation and the dose profile calculated in water only. **Results:** In perpendicular orientation, the response of BCF-12 shows only 0.5 % variation from $10 \times 10 \text{ cm}^2$ to $0.5 \times 0.5 \text{ cm}^2$, while the response of BC-400 shows more than 3 % deviation at $0.5 \times 0.5 \text{ cm}^2$ due to longer sensitive region. In parallel orientation of PSD, the response of both PSDs varies less than 0.4 % for the same range of field sizes. The dose profiles from PSD simulations (parallel orientation) are very close to that of water. **Conclusion:** PSDs are excellent dosimeters for small field measurement. Supported by the NCI (1R01CA120198-01A2)