

AbstractID: 12771 Title: Directional dependence of the response of plastic scintillation detectors in photon beams

**Purpose:** The plastic scintillation detector (PSD) is a promising dosimeter for *in vivo* dosimetry due to its high spatial resolution and excellent water equivalency. The arbitrary orientation of PSD, when placed inside a patient body, may affect its relative response. This study investigates the directional dependence of the response of PSD in photon beams by Monte Carlo simulations. **Method and Materials:** Two PSDs (BC-400 and BCF-12), each coupled to an optical fiber stem, are modeled. The directional dependences of the response of both PSDs in a water phantom are studied for a 6 MV spectral photon beam and a 300 keV mono-energetic photon beam. Different optical fiber core materials (plastic, glass, and air) are used in the calculation model to study the influence of the optical fiber materials upon the directional dependence of the detector response. **Results:** For the majority of angles between the detector axis and the incident beam direction, the response of the PSDs is within 1~2 % irrespective of the photon energy or the optical fiber material used. For the case when the optical fiber stem is pointing to the source, the PSDs with glass or air cored optical fibers show larger deviations (6 % for 6 MV beam and 15 % for 300 keV beam) while the response for the PSDs with plastic cored optical fibers is still within 2 %. **Conclusion:** If plastic is used for the fiber core, the directional dependence is not of concern at 2 % level in photon beams. If glass or air is used for the fiber core, the PSD response has a 6 % deviation or more when the optical fiber stem is pointing to the source, which is probable for *in vivo* applications as the orientation of the detector cannot be guaranteed. Supported by the NCI (1R01CA120198-01A2)