Application of scintillating optical fibers for 2-D dosimetry mapping.

In the last decade, dosimetry based on plastic scintillators coupled to clear optical fibers has shown interesting results for the measurement of the absorbed dose. The composition of the plastic scintillaors renders the detector suitable for dosimetry, especially because of its water equivalence in a wide radiation energy-range. Compared to commonly used detectors (diodes, films, TLD's), the plastic scintillating based dosimeters can provide additionnal advantages such as real time reading, high counting rate and high spatial resolution.

In this work, we will discuss a system based on a CCD camera readout detector coupled to an image intensifier through a fiber optics taper. The properties of three approches will be discussed in detail: a) plastic scintillating fibers coupled to clear fibers to guide the scintillation light up to the intensifed CCD; b) scintillator materials (BC-400 or LSO) coupled to clear fiber light guides then to the CCD; c) plastic scintillating fibers coupled directly to the CCD. The properties of these different system designs will be presented. To achieve an interesting map of the radiation of a 10x10 cm space with a 1-cm resolution, one would need at least 100 sensing positions. The optical cross talk is negligeable because the 18 mm format of the image intensifer photocathode easily allows the coupling of 100 fibers without touching each other. Furthermore, the light yield is found to be dependent of the interaction length which can be optimized for specific wavelength in axial irradiation.