AbstractID: 2612 Title: Development of a New Fiber Optic Scintillator Dosimeter System

Purpose: To develop a new fiber optic scintillator dosimeter system with high sensitivity and spatial resolution for absorbed dose measurement of low-energy x-ray emitting brachytherapy sources in water.

Method and Materials: A novel fiber optic scintillator dosimeter system has been developed to obtain the dose distribution in three dimensions in real time around low-energy x-ray-emitting prostate brachytherapy seeds. A unique combination of small sensitive volume (0.5 mm diameter x 0.5 mm thick), novel scintillator geometry and low noise detector electronics allows unprecedented resolution in dose-mapping of brachytherapy sources. High sensitivity and wide dynamic range is achieved by proprietary detector technology and signal processing methods, allowing measurements of the very low dose rates at distances of up to several centimeters from a seed mounted in a water phantom. A simple USB interface connects the dosimeter to a host PC for data acquisition and analysis.

Results: The detector has been mounted in a water phantom and the dose distributions around I-125 and Pd-103 prostate brachytherapy seeds have been measured. A comparison of the results to published TG-43 data for several seed models shows excellent agreement in most cases. The lower limit of practical dose-rate measurements for low-energy x-ray emitting sources is estimated to be 1mGy / h.

Conclusions: The development of this new, high sensitivity, high-resolution fiber optic scintillator dosimeter, has allowed real-time characterization of the dose distribution around prostate brachytherapy seeds in water. Compared to the state-of-the-art TLD systems currently in use, this fiber-optic scintillator-based dosimeter system allows more rapid dose distribution measurements directly in liquid water instead of tissue-equivalent plastic.

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