

AbstractID: 4909 Title: Integration of AAPM TG-43 Formalism into a New Plastic Scintillator Dosimeter System

Purpose: To integrate the AAPM Task Group 43 (TG-43) brachytherapy dose calculation formalism directly into a new plastic scintillator dosimeter system.

Method and Materials: A novel plastic scintillator system specifically designed to obtain the dose distribution in three dimensions in real time around low-energy x-ray-emitting prostate brachytherapy seeds has been constructed. The small sensitive volume (0.5 mm diameter x 0.5 mm thick) allows unprecedented resolution in dose-mapping of brachytherapy sources. High sensitivity is achieved by proprietary electronic signal acquisition and processing methods, allowing measurements of the very low dose rates (down to 1 mGy / h) at distances of up to several centimeters from a seed mounted in a water phantom. The computer program that controls this automated dosimeter system has been designed to acquire and display data directly in the format specified by the AAPM TG-43 protocol for calculating brachytherapy seed dose distributions in terms of radial dose function and anisotropy function.

Results: The dose distributions around typical 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. Anisotropy functions at distances closer to the seed than those published for thermoluminescent dosimeter (TLD) measurements of an I-125 seed have been measured. In one case, use of this dosimeter allowed the rapid identification of a seed with an anomalous anisotropy function, later confirmed by a radiochromic film contact-exposure measurement.

Conclusions: The automation of this new, high sensitivity, high-resolution plastic scintillator dosimeter, incorporating the TG-43 dose calculation formalism, has allowed real-time characterization of the dose distribution around prostate brachytherapy seeds in a liquid water phantom.

Conflict of Interest: This work supported by NIST SBIR Grant SB1341-03-W-0815 and NSF Grant Nos. 0097450 and 0453430.