

AbstractID: 5330 Title: A Practical and Accurate 3D Dosimetry System for Radiation Therapy

Purpose: At present, clinical dosimeters are limited to point or planar measurement, and hence do not provide the comprehensive 3D information ideal for verification of advanced delivery techniques. In this work we present a clinically viable 3D dosimetry system comprising a PRESAGE™ dosimeter with read out by an optical-CT scanner.

Method and Materials: A novel solid dosimeter called PRESAGE™ has been developed which is composed of polyurethane polymer and radiochromic leuco dyes. PRESAGE™ exhibits a stable color change and hence optical density (OD) change when exposed to ionizing radiation. A PRESAGE™ cylinder of 16cm diameter x 11cm height was taken through the treatment planning process and a 5-field 6MV conformal radiation treatment was delivered by a Varian® linear accelerator. The radiation induced OD change was imaged in 3D by an optical-CT scanner and this measured distribution was then compared with the corresponding dose distribution calculated by the treatment planning system, as well as to independent measurement by GAFCHROMIC® film. Intercomparisons between the three dose distributions were made by superimposing isodose lines and calculating gamma maps (with criteria 4% dose difference and 4mm distance to agreement).

Results: Given stable temperature and protection from exposure to incandescent light, the dose response of PRESAGE™ was observed to be robust to all aspects of the lab. The 3D dose distribution measured in PRESAGE™ showed good agreement with the calculated treatment plan (Eclipse) as well as the independent film measurement at all percent doses >30% (i.e. in regions further than 1cm from the wall). Gamma comparison shows that the PRESAGE™ measurement agrees with both the calculation in treatment plan and the film measurement within 4% dose difference and 4mm distance to agreement.

Conclusion: This work presents the PRESAGE™/optical-CT combination as a practical 3D dosimetry system which can provide comprehensive quality assurance of advanced treatment techniques.