

AbstractID: 4699 Title: Water equivalent multichannel dosimeter arrays for external beam radiotherapy

Introduction: Scintillation dosimeters consisting of a single scintillating fiber coupled to an optical fiber and read with a CCD camera have shown accurate dose measurement in high-energy external beam radiotherapy. This work presents the next step, which is to investigate the development of a multi-channel dosimeter array in conjunction with a CCD camera for photodetection.

Methods and Materials: The light collection of the CCD camera (Apogee Alta U2000c) was first studied to evaluate the maximum number of detectors that can be read simultaneously. We then looked at possible sources of dose perturbation with a single-fiber detector surrounded by other optical fibers. We constructed a prototype array with 10 detectors. Finally, depth-dose and cross-plane profiles were compared with measurements taken with small ion chambers (Exradin models A14 and A16).

Results: We found up to 3000 individual fibers could be detected simultaneously with the full CCD chip. No dose perturbations were seen when a plastic optical fiber was used to transmit the light from the scintillating fiber to the CCD. Depth dose curves measured in water with a single scintillation dosimeter with up to 75 plastic optical fiber in the beam showed no discrepancy to within 0.3% when compared to the same curve taken with an ion chamber and without the plastic fibers. The ten-fiber prototype allowed precise evaluation of profile and depth dose curves in a single irradiation.

Conclusion: This work has shown that use of a multi-channel scintillation dosimeter is feasible. The prototype of 10 detectors produced excellent results and could be extended up to 3000 detectors in the near future.