AbstractID: 2916 Title: Small Volume Dosimetry with Multiple Scintillation Probes

Purpose: To build a novel matrix dosimeter with high sensitivity, good precision and reproducibility based on plastic scintillation dosimetry. This dosimeter possesses excellent water equivalence as well as linearity to dose, dose rate and energy.

Methods and materials: A dosimeter was built by coupling scintillating fibers, chosen for their high collection efficiency, to clear optical fiber. Light measurements were performed with a color CCD camera in order to compare two techniques to remove the stem effect caused by Cerenkov radiation inside the optical fiber: background subtraction and chromatic filtering. Background subtraction is self-explanatory while chromatic filtering uses light at two different wavelengths (the green and blue channels of the CCD) to remove the undesired Cerenkov radiation. Irradiations were performed at 6 MV for various doses and field sizes.

Results: The dark images of the camera are uniform and variation between pixels represents less than 0.7 % of the signal produced by a dose of 10 cGy. Stem effect caused by Cerenkov radiation ranged from 5 % (5×5 field) to 35 % (30×30 field) of the total signal. Chromatic filtering and background subtraction both allow to extract from the signal the stem effect with a similar precision. Linearity of the system was validated down to 2.5 cGy (1.31 % standard deviation) with 0.0055 cm^2 probes. At 10 cGy the standard deviation dropped below 0.6 %. Depth dose curves were also measured with a precision below 1 % compared to ionization chamber measurements.

Conclusion: Chromatic filtering removes the necessity of a second optical fiber for background subtraction, therefore increasing the spatial resolution while maintaining a precision below 1 % for most of the dose range. The CCD camera allows more than 150 detectors in its field of view, which can be used in water, in phantom or *in vivo*.