Purpose: Obtain feasibility data on the use of multiple scintillators on a single optical line for dose measurements.

Methods: A CsI (Tl doped) crystal and a plastic (Rexon Inc, Rp-408) scintillator detectors, both transparent, were attached to the end of a fiberoptic line and connected to an Ocean Optics USB-2000 spectrometer. After baseline spectra, spectra with the two scintillators adjacent to each other and then separated by a 7.6 cm plexiglass spacer were obtained. Irradiations were performed using 6 MV X-ray beam from a Varian EX linear accelerator. Utilizing the baseline spectra the dose received by each scintillator were calculated from the measured spectral peaks of the linear scintillator assemblies. Linearity tests were performed by varying dose and the dose rate in a homogeneous radiation field covering both scintillators. Unequal doses were delivered to the scintillator by gradually closing the collimator from one direction, blocking one detector at a time. Doses to the scintillators were modulated by different amount of solid water placed over the two detectors, as well.

Results: Measured scintillation spectra agreed with the published spectra. The spectra did not change with depth in the phantom. The multi-scintillator system response was strictly linear between 1.67 and 40 MUs, (approx. 1.3 to 31 cGy) and dose rate independent between 100 to 600 MU/min. The profile curves obtained by closing the collimator agreed with qualitatively expected curves. Doses measured under different phantom thicknesses were in good agreement with ion chamber measurements on the same locations (+/- 3%). The linearity and dose rate independence allow absolute dose calibration for given beam energies and scintillator arrangement.

Conclusions: Multi-probe scintillation dosimetry along a single optical fiber is possible in therapeutic irradiation conditions. This is feasible by using signals from multiple select scintillators with distinct spectroscopic responses arranged along an optical fiber.