AbstractID: 5792 Title: Dosimetry for linear sources in heterogeneous prostate phantom

Purpose: To characterize the light distribution from linear diffusing optical fibers in a prostate-simulating phantom. The light distribution depends on the geometry and optical properties of the phantom and on the geometry of the light sources. Light distributions were measured in homogeneous and inhomogeneous phantoms.

Method and Materials: Measurements were performed in homogeneous and inhomogeneous prostate simulating phantoms with linear light sources of lengths (1 – 5 cm) placed in the phantom through transparent catheters. The optical fluence rate was measured using isotropic detectors at various distances from the linear source using a computer-controlled stepper motor. Results for a point source were also presented to predict the light fluence rate for linear sources with the intensity distribution of the linear sources taken into account. Attempts were made to predict the light fluence rate distribution in 3D using calculation with a kernel-based method.

Results: The profiles of linear sources with lengths between 1 and 5 cm were scanned at 0.3, 0.5 and 0.7cm away using isotropic detectors in homogeneous and inhomogeneous phantoms. The increase of light fluence in lower absorption region in an inhomogeneous phantom is due to the increase of effective optical penetration depth. Scans measured around a 5cm linear source show a clear difference in optical properties for the case when the detector passes through the urethra, prostate tissue and tumor.

Conclusion: We have demonstrated the ability to characterize the light distribution inside the prostate using a methodology compatible with clinical measurement. Our method is sensitive enough to differentiate between the optical properties of the prostate, tumor and urethra in our model system.