Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Ultrasound Thermometry for Therapy-level Radiation Dosimetry

COURTNEY TAYLOR, North Carolina State University — Radiation oncology is the process of administering a specified dose of radiation to a patient currently receiving treatment for a form of cancer. In this process, it is vital to know the delivered dose for a given radiation beam to correctly treat a patient. The primary reference standard for absorbed dose is established using water calorimetry. The absorbed dose, typically of order 1 Gy (J/kg) at therapy levels, is realized by measuring sub-millikelvin temperature changes using a thermistor in a sensitive Wheatstone bridge. Ultrasound technology has been investigated as an alternative to thermistor measurements since the speed of sound propagation in water varies with temperature. With ultrasonic time-of-flight and highly sensitive phase detection techniques, temperature sensitivity comparable to that of the thermistor bridge has been achieved without introducing non-water materials into the test area. A single ultrasound transducer transmitting and receiving at 5.0 MHz throughout the length of the water phantom, and the phase change of the sound wave was used to determine temperature increase from an irradiative source at specified depths of the phantom. In this experiment, the exposure period was varied from 15s to 160s cyclically by modulating a heat lamp, and a profile of the measured temperature response as a function of the period was obtained using Fourier analysis. Due to the large temperature gradient in the water phantom, measurements are prone to convection which was indeed observed and will be discussed.

Courtney Taylor
North Carolina State University

Date submitted: 19 Nov 2009 Electronic form version 1.4