

# AbstractID:9542 Title : Tissue Ablation by Medium Intensity Focused Ultrasound for Breast Cancer Treatment: Preliminary Study

**Purpose:** Focused ultrasonic radiation is known for its ability to induce thermal effects for therapy deep in tissue without surgical intervention. To design a medium intensity focused ultrasound (MIFU) system with distributed ultrasound transducers for breast cancer therapy, physical properties of the acoustic field must be fully characterized.

**Method and materials:** Custom made ultrasound transducers and driving system were calibrated with 1MHz sine wave input (1mW power). Calibrated gain of RF amplifier was utilized for ultrasound power control. Numerical simulation of the ultrasound radiation field was carried out with Rayleigh-Sommerfeld integral. The mathematical model for simulation was verified by measuring the acoustic output with a hydrophone. Heat distribution model was established based on the simulated ultrasound field. The heating experiment was implemented under different control strategies (duty cycle, pulse repetition) with tissue-mimicking phantoms (12W each transducer) and animal tissue phantoms (20W each transducer).

**Results and discussion:** The output power for MIFU can be controlled accurately with calibration of ultrasound driving system. The focal length of the transducer was found to be 6.9cm with resonance frequency 1MHz. At -6dB focal zone, the beam width was 0.3cm and the focal zone depth was about 3cm. The mathematical model of the ultrasound field was quite comparable with the measured results. In the simulation of ultrasound field generated by two orthogonal transducers, the area of -6dB focal zone was 6mm x 6mm. The mathematical model of thermal field distribution was verified with heating experiment. The temperature of the target point rose up to 65 °C from ambient temperature within 3 minutes of sonication. Significant lesion was visible in the tissue ablation experiment.

**Conclusion:** From the mathematical model and experimental results, it appears that MIFU can potentially be used for soft tissue ablation such as treating breast cancer with better skin sparing.

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