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2003 Program
Small Business Technology Transfer (1-year project)

Project Title: Optical tomography system using short pulse laser for early lung cancer detection

Project Summary: Lung cancer, which accounts for 25% of all cancer deaths, is currently the most common cause of cancer death among men and women in the United States. Currently, lung cancerous tumors are usually located by using conventional x-rays, bronchoscopy, sputum assays, random biopsies, etc. Excisional biopsy followed by histology, the most common techniques used for early neoplastic changes and carcinoma detection, can have unacceptable false negative rates, often arising from sampling errors. Considerable savings and less patient discomfort might be gained if tumors could be detected at the earliest, presumably most curable stage, using a minimally invasive technique, and hence treated early. In the proposed new technique of time-resolved optical tomography, a short pulse laser is focused on the region to be probed and the time dependent scattered fluence rates are measured at different locations using ultrafast detectors. The intent of this method is to obtain information non-invasively about the interior of the tissue medium from the transmitted time-resolved and reflected optical signals.

Project Successes: The development of time-resolved optical tomography system as developed through this research promises to break new ground in the detection of lung cancer and tumors. The location, size and optical properties of lung tumors can be determined from measured scattered temporal reflected optical signals. Coupling and delivery studies of short pulse laser energy into tissues using hollow waveguides and tapers have been optimized. Optical tomography has the potential to perform *in situ* diagnosis on tissue without the need for sample excision and processing, with diagnostic information available in real time. In addition, since removal of tissue is not required for optical diagnostics, a more complete examination of the organ of interest can be achieved than that obtained from excisional biopsy or cytology. The experimental techniques developed in this project will aid in predicting how the measured temporal reflected optical signal changes with property distributions.

Publications from BRP funded research in Peer Reviewed Journals:
Trivedi A, Basu S, and **Mitra K**, Temporal analysis of reflected optical signals for short pulse laser interaction with nonhomogeneous tissue phantoms. *J Quant Spectrosc Radiat Transf;* 2004 pending.

Presentations from BRP funded research:
Trivedi A, Basu S, **Mitra K**, *Transient Discrete Ordinates Method and Experiments of Pulsed Radiative Transfer through Scattering Absorbing Media*. Charlotte, NC: ASME Heat Transfer Summer Conference; July, 2004.

Trivedi A, Basu S, **Mitra K**, *Temporal Analysis of Optical Signals for Short Pulse Laser Interaction with Tissue Phantoms*. Istanbul, Turkey: Fourth International Symposium on Radiative Transfer- Radiation IV; June, 2004.

New grants based in part on BRP-funded work:

Florida Photonics Center of Excellence (FPCE), University of Central Florida
Title: Laser-based system for lung cancer detection
Project period: 4/1/04 - 3/31/05
Award amount: $30,000