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标题: Feasibility demonstration of frequency domain terahertz imaging in breast cancer margin determination

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摘要: In breast conservation surgery, surgeons attempt to remove malignant tissue along with a surrounding margin of healthy tissue. Subsequent pathological analysis determines if those margins are clear of malignant tissue, a process that typically requires at least one day. Only then can it be determined whether a follow-up surgery is necessary. This possibility of re-excision is undesirable in terms of reducing patient morbidity, emotional stress and healthcare.

It has been shown that terahertz (THz) images of breast specimens can accurately differentiate between breast carcinoma, normal fibroglandular tissue, and adipose tissue. That study employed the Time-Domain Spectroscopy (TDS) technique. We are instead developing a new technique, Frequency-Domain Terahertz Imaging (FDTI).

In this joint project between UMass/Amherst and UMass Medical School/Worcester (UMMS), we are investigating the feasibility of the FDTI technique for THz reflection imaging of breast cancer margins. Our system, which produces mechanically scanned images of size 2cm x 2cm, uses a THz gas laser. The system is calibrated with mixtures of water and ethanol and reflection coefficients as low as 1% have been measured. Images from phantoms and specimens cut from breast cancer lumpectomies at UMMS will be presented. Finally, there will be a discussion of a possible transition of this FDTI setup to a compact and inexpensive CMOS THz camera for use in the operating room.

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