Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Confounding Effect of Spot-Size on the Wavelength-Dependence of Tissue Ablation Metrics[1] M. SHANE HUTSON, GILMA ADUNAS, YAOWU XIAO, Vanderbilt University — Tunable free-electron lasers have been used in several previous studies to investigate the mid-IR wavelength-dependence of tissue ablation. These studies gave conflicting results on an important question: do the ablation metrics depend on targeting the laser energy to a water or protein vibration? Here, we investigate the effects of two parameters that varied widely in previous studies – fluence and focused spot-size. We measured ablation threshold, etch depth and collateral damage in porcine corneas for a set of five matched wavelengths – same absorption coefficients, but different primary chromophores. Although the ablation thresholds are similar, the slope of etch depth versus fluence (ablation efficiency) differs by up to a factor of five. These differences are most strongly dependent on the focused spot diameter, not wavelength. When spot sizes are matched, protein-targeting wavelengths still leave less collateral damage, but they remove tissue less efficiently. The confounding roles of fluence and spot size have strong implications for the interpretation of previous wavelength-dependent results.

[1]Supported by grant FA9550-04-1-0045 from the DoD MFEL Program.

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Date submitted: 21 Nov 2006 Electronic form version 1.4