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Energy Partitioning in FEL Tissue Ablation SHANE HUTSON, GILMA ADUNAS-RIVAS, YAOWU XIAO, Dept of Physics & Astronomy, Vanderbilt University — The wavelength-dependence of FEL tissue ablation has been attributed to partitioning of absorbed energy between protein and saline. We have taken two approaches to test the hypothesis that such energy-partitioning allows wavelengths targeting the protein component to diminish the structural integrity of tissue before water vaporization commences. First, models of this process predict that energy-partitioning should play little role in near-threshold ablation, but become much more important as the fluence is increased. Thus, we have measured the ablation efficiency on cornea across large swaths of the fluence versus wavelength parameter space. We find that the effects of energy-partitioning do grow as the fluence is increased. Second, we have analyzed the protein components of the ablation plume for signatures of protein structural change. FTIR and NMR spectra of plume components reveal that the secondary and tertiary structure of the protein (collagen) fibers has been lost. These spectra also reveal new functional groups in the ablated material, most likely nitriles or alkynes that could have arisen via oxidative degradation of the protein. However, there is no evidence for widespread scission of protein backbones.

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