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Visualization of evolving laser-generated structures by frequency domain tomography YENYU CHANG, ZHENGYAN LI, XIAOMING WANG, RAFAL ZGADZAJ, MICHAEL DOWNER, University of Texas at Austin — We introduce frequency domain tomography (FDT) for single-shot visualization of time-evolving refractive index structures (e.g. laser wakefields, nonlinear index structures) moving at light-speed. Previous researchers demonstrated single-shot frequency domain holography (FDH), in which a probe-reference pulse pair co- propagates with the laser-generated structure, to obtain snapshot-like images. However, in FDH, information about the structure's evolution is averaged. To visualize an evolving structure, we use several frequency domain streak cameras (FDSCs), in each of which a probe-reference pulse pair propagates at an angle to the propagation direction of the laser-generated structure. The combination of several FDSCs constitutes the FDT system. We will present experimental results for a 4-probe FDT system that has imaged the whole-beam self-focusing of a pump pulse propagating through glass in a single laser shot. Combining temporal and angle multiplexing methods, we successfully processed data from four probe pulses in one spectrometer in a single-shot. The output of data processing is a multi-frame movie of the self- focusing pulse. Our results promise the possibility of visualizing evolving laser wakefield structures that underlie laser-plasma accelerators used for multi-GeV electron acceleration.

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