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Interaction of high density, thin, gas jets with ultrashort laser pulses at 1 kHz repetition rates[1] YAN TAY, DONGHOON KUK, HOWARD MILCHBERG, KI-YONG KIM, Univ of Maryland-College Park — We have investigated the interaction of thin (50 ˜150 microns), high-density (10^{19} ˜10^{21} cm^{-3}) gas jets with 30 fs, >5 mJ, 800 nm laser pulses at a 1 kHz repetition rate. Capillary tubes with various diameters (50 ˜500 microns) are used to produce dense gas jets in continuous flow at high backing pressure (˜1000 psi) and cryogenic temperature (130 K). The gas/plasma density profiles are characterized by optical interferometry, and Rayleigh/Mie scattering is measured to characterize coexisting atomic clusters. Our result shows a peak plasma density of 10^{21} cm^{-3} near the nozzle orifice, approaching the critical plasma density at 800 nm laser wavelength. This high density plasma efficiently produces X-rays and terahertz radiation, as well as energetic electrons and ions at high-repetition-rates (kHz), without generating unwanted debris as in solid targets.

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