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Study of electron transport in overdense plasmas formed by multi-terawatt CO_2 laser[1] CHAO GONG, SERGEI TOCHITSKY, JEREMY PIGEON, CHAN JOSHI, Electrical Engineering Department, UCLA — CO_2 laser-plasma interactions provide a unique parameter space for particle acceleration in a gas jet plasma taking place at a critical plasma density n_{cr} -10^{19} cm^{-3} and even at higher densities. Here we report the latest results of our study of electron acceleration and transport in a wide range of plasma densities 1-10 n_{cr} using a multi-TW CO_2 laser system at the UCLA Neptune Laboratory. To gain insight into plasma density profile evolution during 100 ps long CO_2 laser-plasma interaction, we used laser interferometry with two 1 ps, 532 nm probe pulses separated by 5-100 ps. Electron beams recorded in our experiment had a divergence smaller than 15mrad and good shot-to-shot reproducibility. Combination of measurements of relativistic electron transport in a near critical density plasma and optical diagnostic of its evolution open opportunities to study laser and electron beam filamentation at a_o (2-3) and improve understanding of other laser-plasma instabilities. This should also allow for optimization of CO_2 laser driven shock wave acceleration of low-divergence monoenergetic ion beams [1]

[1] Haberberger, et al. 2012 Colissionless shocks in a laser produced plasma generate monoenergetic high energy proton beams. Nat.Phys. 8, 95–99

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