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Demonstration of CO2-Laser-Driven Laser-Wakefield Acceleration at Brookhaven's Accelerator Test Facility RAFAL ZGADZAJ, JAMES WELCH, MICHAEL C DOWNER, University of Texas at Austin, IRINA PETRUSHINA, Stony Brook University, PRABHJOT KAUR, Brookhaven National Laboratory, PIETRO IAPOZZUTO, Stony Brook University, LGIA DIANA AMORIM, Lawrence Berkeley National Laboratory, JIAYANG YAN, NAVID VAFAEI-NAJAFABADI, PRABHAT KUMAR, ROMAN V SAMULYAK, VLADIMIR LITVINENKO, Stony Brook University, CHAOJIE ZHANG, CHAN JOSHI, University of California Los Angeles, IGOR POGORELSKY, ROTEM KUPFER, MIKHAIL POLYANSKIY, MIKHAIL FEDURIN, MARCUS BABZIEN, KARL KUSCHE, CHRISTINA SWINSON, Brookhaven National Laboratory, WARREN MORI, University of California Los Angeles, WEI LU, Tsinghua University — The advent of multi-TW CPA CO2 lasers[1] is opening mid-IR wavelengths for laser wakefield accelerators, favoring low plasma densities ne[2], and large accelerating structures enabling precise external lepton injection and optical and electron probing of wake density and field structure. We report (experiment AE95 BNL/ATF) the demonstration of electron acceleration, in the self-modulated regime, using the ATF CO2 mid-IR laser (2ps, 5J, w0˜30μm). Electron self-injection and acceleration was observed in a 2mm long H2 gas jet (˜1e17 <ne<1e18cm-3) with bunch charge exceeding 10pc and energies exceeding 10MeV. The results agree well with 3D PIC simulations. [1] M. N. Polyanskiy et al., OSA Continuum 3, 459-472 (2020) [2] I. Pogorelsky et al, Plasma Phys. Control. Fusion 56, 084017 (2014)

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