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Proton acceleration with a CO2 laser at the Accelerator Test Facility

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Long-wave infra-red lasers, like the TW CO2 laser at the Accelerator Test Facility (ATF), offer a number of benefits in studying laser-driven ion acceleration, including favorable scaling of the critical density, and the ability to access relativistic regimes at lower intensities. We present recent work studying hole-boring radiation pressure acceleration (HB-RPA) and collisionless shock acceleration at near-critical densities with a0~1. We demonstrate spectrally peaked, MeV level protons for shaped, near-critical density hydrogen gas targets, showing good agreement with the predicted HB-RPA energy scaling. We also report on decreasing proton energy spreads with increasing target density, down to 5%. Finally, we report on the new opportunity for shock imaging via a 100fs Ti:sapphire probe capability available now at the ATF.

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