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Relativistic Transparency Experiments at the Trident Laser[1] J.A. COBBLE, S. PALANIYAPPAN, D.C. GAUTIER, Y.H. KIM, D.D. CLARK, R.P. JOHNSON, T. SHIMADA, J.C. FERNANDEZ, H.W. HERRMANN, Los Alamos National Laboratory — With near-diffraction-limited irradiance of 3 x 10^{20} W/cm^2 on target and prelase contrast better than 10^{-9}, we have accessed the regime of relativistic transparency (RT) at the Trident Laser. The goal was to assess electron debris emitted from the target rear surface with phase-contrast imaging (PCI) and current density measurements (hence, the total electron current). Companion diagnostics show whether the experiments are in the target-normal-sheath-acceleration mode or in the RT regime. The superb laser contrast allows us to shoot targets as thin as 50 nm. PCI at 527 nm is temporally resolved to 600 fs. It has shown the evolution of electron behavior over tens of ps, including thermal electrons accompanying the ion jet, accelerated to many tens of MeV earlier in time. Faraday-cup measurements indicate the transfer of many uC of charge during the laser drive. As a ride-along experiment using a gas Cherenkov detector (GCD), we have detected gamma rays of energy > 5 MeV. This radiation has a prompt component and a lesser source, driven by accelerated ions, that is time resolved by the GCD. The ion time of flight is compared to Thomson parabola data. Electron energy spectra are also collected.

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