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LPA Electron Bunch Spatial Reconstruction Through CTR Imaging MAXWELL LABERGE, University of Texas at Austin, ALEX LUMPKIN, Fermi National Accelerator Laboratory, OMID ZARINI, Helmholtz-Zentrum Dresden Rossendorf, ANDREA HANNASCH, RAFAL ZGADZAJ, BRANT BOWERS, University of Texas at Austin, JURJEN COUPERUS CABADA, ALEXANDER KOEHLER, ALEXANDER DEBUS, ULRICH SCHRAMM, ARIE IRMAN, Helmholtz-Zentrum Dresden Rossendorf, MICHAEL DOWNER, University of Texas at Austin — The low transverse emittance of electron bunches from laser plasma accelerators (LPAs) makes these advanced accelerators attractive for compact FELs and colliders. To date, direct measurement of this emittance has proven difficult due to the micron-scale beam waist near the accelerator. Here we present single-shot coherent transition radiation (CTR) imaging and interferometry data from electron bunches only ˜1 mm after emerging from a 300 MeV LWFA. Using eight cameras with different wavelength bandpass filters, we image CTR emitted from a foil placed directly after the LPA. At each of these wavelengths, we observe radially polarized annular distributions, albeit with detailed shape variations, but sharing a strong central minimum, consistent with CTR. These images help us to characterize the micron-scale transverse beam shape. We employ a multioctave spectrometer to measure the spatially averaged TR spectrum from IR to near-UV wavelengths to characterize longitudinal beam shape. Wavelength-dependent variations in the size and radial distribution of the TR images can be correlated with features in the reconstructed longitudinal profile. Combining the longitudinal information acquired by the multi-octave spectrometer with multi-wavelength images of the foil, we observe features in the 3D beam that are unresolvable using other techniques, and, with the aid of physically reasonable assumptions about the bunch profile, to reconstruct a 3D charge distribution at the foil.

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