LPA Electron Bunch Spatial Reconstruction Through CTR Imaging

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Due to their tiny accelerating cavities, laser-plasma accelerators (LPAs) can produce extremely low-emittance e-beams, but to date the smallest transverse LPA e-beam sizes have been characterized only indirectly inside the LPA by betatron x-ray spectroscopy. Here we report observations of visible coherent transition radiation (CTR) imaged from a foil placed immediately (<1mm) outside a ~300 MeV, 300 pC bubble-regime LPA. We use a double foil: the first reflects the drive laser pulse; the front edge of the second foil (0.5-1mm downstream) rejects emission from the first foil, while its back surface emits CTR from transmitted LPA e-bunches. We observe radially polarized annular distributions with a strong central minimum at many different wavelengths, which allows us to characterize the beam shape. The size and radial distribution of the CTR images, which we observe in conjunction with CTR and electron spectra, vary significantly and reproducibly as we translate the double foil over a ~1mm range along the e-beam propagation axis. We will present CTR data in conjunction with an e-beam 3D reconstruction model.