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Imaging electron trajectories in a laser-wakefield accelerator by measuring the betatron x-ray spectrum angular dependence[1] FELICIE ALBERT, BRADLEY POLLOCK, Lawrence Livermore National Laboratory, JESSICA SHAW, UCLA, ALETHIA BARNWELL, PAUL CAMPBELL, NICHOLAS CHAVEZ, Lawrence Livermore National Laboratory, KEN MARSH, UCLA, YU HSIN CHEN, DAVID ALESSI, Lawrence Livermore National Laboratory, CHRIS CLAYTON, UCLA, ARTHUR PAK, JOSEPH RALPH, Lawrence Livermore National Laboratory, SIGFRIED GLENZER, SLAC, CHAN JOSHI, UCLA — We have performed experiments using the 200 TW Callisto laser system at LLNL to produce GeV-class electron beams and keV Betatron x-rays. The laser was focused into various gas cells with sizes ranging from 3 to 10 mm that contained a mixure of gases (He, N, Ar). We demonstrate that it is possible to do a tomographic reconstruction of electron trajectories inside the channel of the laser-wakefield accelerator from the angular dependence of the Betatron x-ray spectrum, using an image plate-based spectrometer with differential filtering. Experimental results are benchmarked against a code that solves the equation of motion of electrons oscillating in the plasma wake and by calculating the corresponding x-ray radiation spectrum and profile. This combined single-shot, simultaneous spectral and spatial x-ray analysis allows for a 3D reconstruction of electron trajectories in the plasma with micrometer resolution.

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