Abstract Submitted
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Ultra-low-emittance electron bunches from a laser-plasma accelerator measured using single shot X-ray spectroscopy[1] C.G.R. GEDDES, G.R. PLATEAU, M. CHEN, C. BENEDETTI, E. ESAREY, A.J. GONSALVES, N.H. MATLIS, K. NAKAMURA, C.B. SCHROEDER, S. SHIRAISHI, T. SOKOLIK, J. VAN TILBORG, CS. TOTH, T.S. KIM, M. BATTAGLIA, W.P. LEEMANS, LBNL, D.B. THORN, TH. STOEHLKER, EMMI Darmstadt, S. TROTSENKO, Helmholtz Jena — Single-shot spectroscopic measurements of betatron X-rays are reported, and used to infer the transverse bunch size of both broadband sub-100 MeV and low-energy-spread 0.5 GeV electron beams produced by a laser-plasma accelerator. The measurements use semiconductor detector arrays, and spectra are obtained via single pixel absorption and cluster techniques. By matching the X-ray betatron spectra to analytical and numerical models of betatron radiation, the electron bunch radius inside the plasma is estimated to be $\sim 0.1 \mu$m. Combined with simultaneous electron spectrum and divergence measurements, the normalized transverse emittance is estimated to be as low as 0.1 mm mrad, consistent with three-dimensional particle-in cell simulations. This emittance is lower than previously measured, important for applications including gamma sources and colliders.

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C.G.R. Geddes
LBNL

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