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Low-emittance bunches from laser-plasma accelerators measured using X-ray spectroscopy CAMERON G.R. GEDDES, G.R. PLATEAU, LBNL, D.B. THORN, EMMI, M. CHEN, C. BENEDETTI, LBNL, D.L. BRUHWILER, E. CORMIER-MICHEL, Tech-X, E. ESAREY, M.W. FISHER, A.J. GONSALVES, N.H. MATLIS, K. NAKAMURA, S. RYKOVANOV, C.B. SCHROEDER, B. SHAW, S. SHIRAISHI, T. SOKOLLIK, J. VAN TILBORG, CS. TOTH, LBNL, S. TROTSENKO, Helmholtz Jena, T.S. KIM, J.L. VAY, M. BATTAGLIA, LBNL, TH. STOEHLKER, EMMI & Helmhotz Jena, W.P. LEEMANS, LBNL — The presence of low emittance beams in laser-plasma accelerators is indicated by single-shot spectroscopic measurements of betatron X-rays. 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 ∼0.1 micron. The variation of beam radius with accelerator tuning is discussed. Photon-counting spectra and statistical fitting are used to establish confidence ranges. Combined with simultaneous electron spectrum and divergence measurements, the normalized transverse emittance is estimated to be as low as 0.1 mm mrad. Simulations show how such emittances can be formed by the self trapping process in laser-plasma accelerators.

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