Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Transverse electron beam profiles from a few-cycle laser wakefield accelerator.[1] FATHOLAH SALEHI, MANH LE, LUCAS RAILING, HOWARD MILCHBERG, University of Maryland, College Park — Our prior experiments using 30fs, mJ-scale, kHz repetition rate laser pulses and near-critical density gas jet targets [1] lead to electron acceleration to ˜MeV levels in an exponential energy distribution [2]. Our more recent experiments, using ˜5 fs, <3 mJ pulses, lead to operation in the so-called bubble regime and the generation of quasi mono-energetic electron bunches up to 15 MeV [3]. Here, we describe how axially (z) scanning the focused laser beam waist with respect to the gas jet affects the transverse shape of the accelerated electron bunch. When the laser beam waist is located at the exit side of the jet in the density down-ramp, accelerated electron bunches have a Lorentzian transverse shape of the form$\sigma_q \propto [1+((x-x_0)/w_x)^2+((y-y_0)/w_y)^2]^{-3/2}$. Our measured profiles are compatible with the so-called Kappa distribution [4], a non-thermal distribution well-known in space plasmas, but heretofore unobserved in laser plasma acceleration experiments.

1. F. Salehi, *et al.*, Rev. Sci. Instrum. **90**, 103001 (2019).

2. F. Salehi, *et al.*, Opt. Lett. **42**, 215–218 (2017).

3. F. Salehi, *et al.*, FiO+LS, JW4A.116, 2019

4. G. Livadiotis, J. Geophys. Res. Sp. Phys. **120**, 880 (2015).

[1]This work is supported by the US Dept. of Energy (DESC0015516) and the National Science Foundation (PHY1619582).

Fatholah Salehi
University of Maryland, College Park

Date submitted: 30 Jun 2020 Electronic form version 1.4