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Acceleration of low-divergence quasi-mono-energetic electron bunches to MeV-scale energies at 1 kHz with few-cycle laser pulses FATHOLAH SALEHI, MANH LE, LUKE PASCALE, HOWARD MILCHBERG, University of Maryland, College Park — We demonstrate acceleration of quasi monoenergetic electron bunches with a small divergence angle to MeV-scale energies at 1 kHz repetition rate using laser pulses with ˜5fs duration and ˜2.5mJ energy focused on a near-critical density gas target. Our previous experiments using 30fs laser pulses showed that using a near-critical density gas jet lowers the critical power for relativistic self-focusing sufficiently to enable MeV-scale electron acceleration using a high repetition rate laser system with mJ-scale pulse energy.....[1]. Those electron bunches, accelerated in the self-modulated wakefield regime, had a large energy spread and divergence angle. Using few cycle laser pulses, generated through a hollow core fiber as the drive pulse and operating in bubble regime led to quasi-mono-energetic beams with smaller divergence angle and varying shot to shot stability of the beam pointing depending on the laser beam focusing geometry.....[2]. In this work, employing supersonic hydrogen jet targets with sharp boundaries, along with the 5fs drive pulses, we accelerate quasi monoenergetic electron bunches with superior energy spread, transverse beam profile, and pointing stability. [1] F. Salehi, A. J. Goers, G. A. Hine, L. Feder, D. Kuk, B. Miao, D. Woodbury, K. Y. Kim, and H. M. Milchberg, Opt. Lett. **42**, 215 (2017). [2] F. Salehi, High Repetition Rate Laser-Driven Electron Acceleration to Mega-Electron-Volt Energies, University of Maryland College Park, 2019.

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