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**Narrow energy spread electron beams from a laser plasma accelerator**

MANUEL KIRCHEN, University of Hamburg

The demonstration of a free-electron laser presents one of today's main challenges in the field of plasma acceleration. Driving the FEL process with laser-plasma accelerated electron beams requires low transverse emittances and high spectral charge densities. Here we present our recent progress on the generation of high-quality electron beams at the LUX beamline. Few-percent relative energy spread beams at several hundred MeV with tens of pC charge are produced from controlled injection in tailored plasma targets. The impact of laser and target parameter variations on the injection and acceleration dynamics are discussed and validated by Particle-In-Cell simulations.