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Energy resolved emittance measurements and chromatic emittance growth of laser-wakefield accelerated beams

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A crucial parameter for the demonstration of a laser-plasma driven free-electron laser is the electron beam emittance and its stability. Here, we show energy resolved emittance measurements of ionisation-injected plasma electron beams performed with both a conventional quadrupole scan and measured from single-shots. We show that the initial phase-space properties obtained from both methods deviate by less than 10 % and are constant over a narrow energy-band considered for the retrieval. The initial beam emittance is as low as 0.7 mm mrad. Finally, we demonstrate first measurements of chromatic emittance growth for laser-plasma accelerated electron beams.

Primary authors: WINKLER, Paul (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany and DESY); HÜBNER, Lars (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany); Mr HUBERT, Björn (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany); JALAS, Soeren (Center for Free-Electron Laser Science and Department of Physics, University of Hamburg); KIRCHEN, Manuel (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany); LEROUX, Vincent (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany); MESSNER, Philipp (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany); SCHNEPP, Matthias (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany); TRUNK, Maximilian (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany); WERLE, Christian (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany); SCHMIDT, Bernhard (DESY); MAIER, Andreas (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany)

Presenter: WINKLER, Paul (Center for Free-Electron Laser Science & Department of Physics, University of Hamburg, Hamburg, Germany and DESY)

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