Contribution ID: **122** Type: **talk**

Demonstration of a millimeter-scale electron-beam driven plasma wakefield accelerator based on hybrid staging

Thursday, 19 September 2019 18:00 (20 minutes)

Plasma based electron acceleration is widely considered as a promising concept for compact electron accelerators with broad range of applications. These accelerators can be driven by either ultra-intense laser beams (LWFA) or high-current particle beams (PWFA).
Here, we report on a novel approach to combine both schemes in a compact experimental setup. In our "LWFA + PWFA"hybrid accelerator, the electron beam generated by a LWFA stage drives a subsequent PWFA stage where a witness beam is trapped and accelerated. This aims to combine the unique features of both plasma acceleration techniques: the LWFA stage provides with a compact source of high-current electron beams required as PWFA drivers, while the PWFA stage acts as an energy and brightness transformer.
In this work, we show the first experimental evidence of accelerating a distinct witness bunch in a LWFA-driven PWFA (LPWFA) within only about one millimeter acceleration distance. In the self-ionizing case, we observe witness energies of around 50 MeV. By utilizing a counter-propagating pre-ionization laser, the interaction with the plasma becomes stronger, increasing the final energies to around 130 MeV. Thus, yielding a field gradient of 70 GeV/m which is comparable to what has been shown at large scale PWFA facilities.

Primary authors: KURZ, T. (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics); HEINEMANN, Thomas (Univ. Strathclyde / DESY)

Co-authors: SCHOEBEL, Susanne (Helmholtz-Zentrum Dresden-Rossendorf); COUPERUS CABADAĞ, J. P. (Helmholtz-Zentrum Dresden -Rossendorf, Institute of Radiation Physics); KONONENKO, Lena (Ecole Polytechnique); CHANG, Y.-Y. (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics); BUSSMANN, Michael (Helmholtz-Zentrum Dresden-Rossendorf); CORDE, S. (LOA, ENSTA ParisTech, CNRS, Ecole Polytechnique, Institut Polytechnique de Paris); DEBUS, A. (Helmholtz-Zentrum Dresden -Rossendorf, Institute of Radiation Physics); DING, H. (Ludwig-Maximilians-Universität München; Max Planck Institut für Quantenoptik); DÖPP, A. (Ludwig-Maximilians-Universität München; Max Planck Institut für Quantenoptik); GILLJOHANN, M. F. (Ludwig-Maximilians-Universität München; Max Planck Institut für Quantenoptik); HIDDING, B. (Scottish Universities Physics Alliance, Department of Physics, University of Strathclyde; Cockcroft Institute, Sci-Tech Daresbury); KARSCH, S. (Ludwig-Maximilians-Universität München; Max Planck Institut für Quantenoptik); KÖHLER, Alexander (HZDR); PAUSCH, R. (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics); ZARINI, Omid (Helmholtz-Zentrum Dresden - Rossendorf e.V.); SCHRAMM, U. (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics); MARTINEZ DE LA OSSA, A. (Deutsches Elektronen-Synchrotron DESY); IRMAN, A. (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics)

Presenter: HEINEMANN, Thomas (Univ. Strathclyde / DESY)

Session Classification: WG1 - Hybrid staging and future PWFA experiments

Track Classification: WG1 - Electron beams from plasmas