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Generation and Characterization of a Pulsed Dense Plasma with Helium*

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This contribution is about characterization of a Lorentz-drift based plasma accelerator in preparation for a colliding plasma experiment. The aim is to investigate the basics of a high energy density collision zone by accelerating two or more plasma sheets simultaneously against each other. A possible application for this device is the production of high densities for a plasma stripper.
The experimental setup has a total capacitance of 27uF at maximum voltages of 10kV. The maximum discharge current of 147kA is switched by a thyratron. Due to a low inductive setup of 130nH high current slew rates in the 10ˆ{11}A/s range are achieved. These are necessary to form a plasma sheet. All measurements have been performed in a vacuum chamber at 3 to 100mbar pressures with a 2% hydrogen in helium gas mixture.
For dynamic characterization and optimization of the acceleration process velocity and kinetic energy of the plasma sheet have been determined. For velocity measurements an array of six photodiodes has been used. Up to 80km/s velocities have been verified by the comparison to image of a fast framing camera. Moreover the images show the shape of the plasma sheet. The kinetic energy has been qualitatively examined by a piezoelectric element.
Additionally the results of spectroscopic measurements will be presented. The Stark broadening of the h_\beta-line has been measured by a 0.5m monochromator. The mean temperature has been determined via He I and He II line intensities. Electron density and temperature of the single accelerator are of great interest for the upcoming comparison to the collision experiment. In combination with the dynamic investigations the presented device is sufficiently characterized for collision.

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