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Controlled injection of electrons in a laser wakefield accelerator

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To improve the stability and reproducibility of laser wakefield accelerators and to allow for future applications, controlling the injection of electrons, both in terms of position of injection and amount of injected charge, is of great importance.

We will present results from our recent experiment on controlled injection, using the scheme of colliding pulses, performed using the Lund multi-terawatt laser. Each laser pulse is split into two parts, close to the interaction point. The main pulse, containing approximately 500 mJ of energy, is focused on a 2 mm diameter gas jet to drive a nonlinear plasma wave below threshold for self-injection. The second pulse, containing approximately 40 mJ of energy, is focused to collide with the main pulse in the gas jet with a collision angle of 150 degrees.

Beams of accelerated electrons with low energy spread are produced using this set-up. Furthermore, the amount of accelerated charge is controlled by rotating the plane of polarization of the second pulse.

The experiment is a part of our studies on different schemes for controlled injection and the findings from this experiment will be compared to the schemes of ionization-induced injection and density down-ramp injection.

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