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Influence of realistic plasma density profile on ionization-induced electron injection driven by laser wakefield

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Several important issues have to be addressed to optimize a laser plasma accelerator (LPA) for specific applications. In particular, for high energy physics, a multi-staged scheme consisting of one injector and several LPA stages connected by transmission lines appears most promising.

In the frame of the CILEX project, multi-stage experiments are planned with the multi-PW facility APOLLON. On-going studies are related to the development of the plasma target and characterization of the electron bunch produced by ionization-induced injection. A gas cell with variable length was designed and built by the LPGP and LIDyL groups.

Using this cell, the laser-plasma acceleration of a relativistic electron beam was investigated during an experimental campaign at the Lund Laser Centre in Sweden. A wide range of parameters have been explored, such as the pressure and composition of the gas, the cell length and its position relatively to the focal plane. We will focus on the role of the density profile and the relative focal plane position by comparison of the experimental data with theoretical ones obtained with 2D PIC numerical simulations using the WARP code.

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