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Reproducibility of Electron Beams from Laser Wakefield Acceleration in Capillary Tubes

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Laser wakefield acceleration of electrons is a promising scheme for future high energy particle accelerators, able to provide accelerating gradients up to 100 GeV/m. One of the key issues for the use of laser plasma accelerators is the control of the parameters of the accelerated electron beam. Relativistic electron beams are commonly generated by the complex process of self-injection in the non-linear regime of laser wakefield. To evaluate the feasibility of using such a mechanism as injector for an accelerator, the reproducibility of electron beam properties as a function of the laser parameters was studied.
In the frame of a Franco-Swedish collaboration, a study of the stability of electron beams produced by laser wakefield self-injection was performed at the laser facility of the Lund Laser Center. A multi-TW stabilized Ti:sapphire laser beam was sent into capillary tubes containing hydrogen gas in order to self-inject and accelerate electrons. The influence of laser and capillary parameters on electron beam properties was analyzed. We will discuss conditions required for the production of reproducible electron beams generated from stabilized laser wakefield.

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