

Electron injector for laser wakefield acceleration

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An electron injector for Laser Wakefield Acceleration

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The aim of the Eindhoven laser wakefield project is to accelerate electrons in the linear regime of a plasma wave. Therefore a “modest” 2 TW-laser is sufficient to drive a linear plasma wave in a slow discharged capillary hydrogen plasma. Due to the absence of self trapping of electrons in the linear regime, external injection of pre-accelerated electron bunches in the plasma channel are necessary. The external injected electron bunches will be accelerated in a 5 cm long plasma channel from 7 MeV to 100 MeV.

The creation of electrons, plasma and wakefield are separated by using an external electron source and a preformed plasma combined with a 2 TW-laser. These conditions allow to study the effects of the individual components on the final electron bunch and acquire a better insight in the interactions concerning laser wakefield acceleration.

A 2.5 cell 3 GHz RF photogun was developed at Eindhoven University of Technology to accelerate electrons for injection into a laser wakefield accelerator. The first electron bunches were produced in the fall of 2008. Measurements on these electrons show the feasibility of this injection scheme. Simulations were done to predict the performance of a laser wakefield accelerator with external injection.