Numerical studies of density transition injection in laser wakefield acceleration

F. Massimo[1*], A. F. Lifschitz[1], C. Thaury[1] and V. Malka[1,2]

[1]*Laboratoire d'Optique Appliquée, ENSTA ParisTech - CNRS UMR 7639, École Polytechnique, Université Paris-Saclay, 828 Boulevard des Maréchaux - 9172, Palaiseau Cedex, France*
[2]*Department of Physics and Complex Systems, Weizmann Institute of Science, Rehovot, 76100, Israe*
**francesco.massimo@ensta-paristech.fr*

The quality of laser wakefield accelerated electrons beams is strongly determined by the physical mechanism exploited to inject electrons in the wakefield. One of the techniques used to improve the beam quality is the density transition injection, where the electron trapping occurs as the laser pulse passes a sharp density transi-tion created in the plasma. Although this technique has been widely demonstrated experimentally, the literature lacks theoretical and numerical studies on the effects of all the transition parameters and of the laser parame-ters. We thus report and discuss the results of a series of PIC simulations where the density transition height and downramp length are systematically varied, to show how the electron beam parameters and the injection mechanism are affected by the density transition parameters. The effects of different laser pulse power on the injection process are also shown.

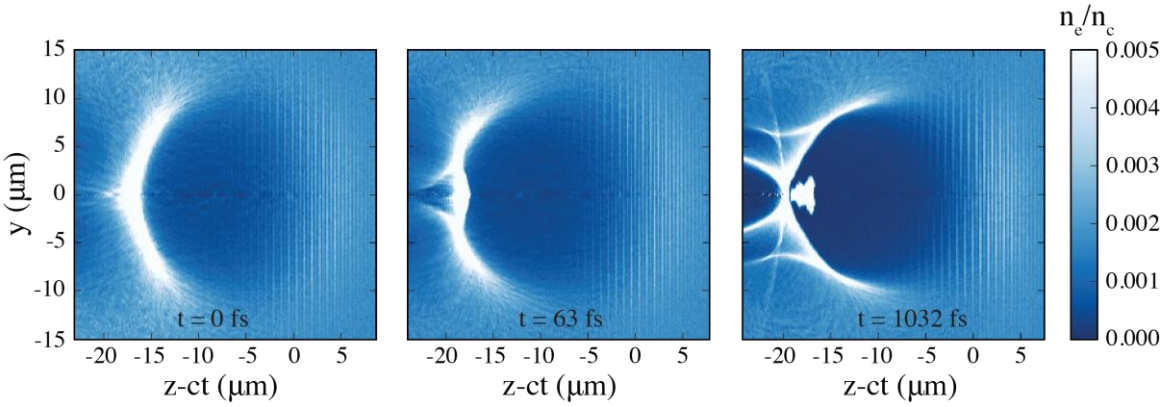

Figure 1. Snapshots of electron density n_e illustrating shock-front injection