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Laser plasma accelerator: Control of electron beam parameters in colliding laser pulses scheme

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Stable and high quality electron beams are produced when two laser pulses collide in underdense plasmas. In addition to the improvement of the stability of the electron beam, the use of a second laser pulse allows the control of the electron beam parameters (energy, relative energy spread, and charge). The experimental features are well explained by the use of PIC simulations which underline physics processes which were not predicted by fluid model. This control is obtained by changing laser pulse energy, laser pulses polarization or electron density. With a total of 1 J laser energy, a 10 pC electron beam at 200 MeV with relative energy spread smaller than 1% has been measured for the first time. Using higher laser energy PIC simulations predicted that 3 GeV electron beam with 0.9% should be produced in this scheme after 3.8 cm propagation length. In collaboration with J. Faure and C. Rechatin, Laboratoire d'Optique Appliquée, École Nationale Supérieure de Techniques Avancées, École Polytechnique, CNRS, UMR 7639, 91761 Palaiseau, France; A. Ben-Ismail, Laboratoire d'Optique Appliquée, and LLR, École polytechnique, CNRS-IN2P3, 91128 Palaiseau, France; J. Lim, Laboratoire d'Optique Appliquée; X. Davoine and E. Lefebvre, Commissariat à l'Energie Atomique, DIF, Bruyères-le-Châtel, France; and A. Specka and H. Videau, LLR, École polytechnique.

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