



Contribution ID: 212

Type: **talk**

Electrons Injection, Boost and Collimation in Laser Plasma Accelerators

Tuesday, September 15, 2015 4:50 PM (20 minutes)

The density profile is a key parameter to optimize the properties of electron beams in laser-plasma accelerators [1,2]. Here we present three different experiments illustrating the use of density tailoring for injecting, increasing the energy or focusing relativistic electron beams. We show that shocks allow to confine injection and hence to reduce significantly the beam energy spread, compared to pure ionization injection, and with a different setup, shock fronts has been used to rephase the electron beam and to increase the electron energy by almost 50%. Finally, we present the principle of the laser-plasma lens [3] and show that this device can be used to reduce the electron beam divergence by a factor of almost 3 [4].

[1] A. Buck et al., Phys. Rev. Lett. 110, 185006 (2013).

[2] P. Sprangle et al., Phys. Rev. E 63, 056405 (2001).

[3] R. Lehe et al., Phys. Rev. Spec. Top. Acc. Beams 17, 121301 (2014)

[4] C. Thaury et al., Nature Comm. 6, 6860 (2015)

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Session Classification: WG1 - Electron beams from plasmas

Track Classification: WG1 - Electron beams from plasmas