TRAINS OF SUB-PICOSECOND ELECTRON BUNCHES FOR HIGH-GRADIENT PLASMA WAKEFIELD ACCELERATION

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Abstract

In the plasma wakefield accelerator (PWFA), high quality accelerated electron bunches can be produced by injecting a witness bunch behind a single drive bunch or a train of N bunches. To operate at large gradient the plasma density must be in the 10^{17}/cc range, corresponding to a typical bunch separation of the order of the plasma wavelength or ~100μm. We have demonstrated that such a sub-picosecond temporal bunch structure can be produced using a mask to selectively spoil the emittance of temporal slices of the bunch*. The bunches spacing, as well as their length can be tailored by designing the mask and choosing the beam parameters at the mask location. The number of bunches is varied by using an adjustable width energy limiting slit. The bunches spacing is measured with coherent transition radiation interferometry. Experimental results will be presented and compared to simulations of the bunch train formation process with the particle tracking code ELEGANT.

* P. Muggli *et al.*, to appear in Phys. Rev. Lett. (2008).

CONTRIBUTION NOT RECEIVED