Parameters for laser-plasma-based collider using hollow plasma channels

LPA-collider based on staging of (near-)hollow plasma channels

Laser-plasma parameters/stage

LPA stage laser-plasma parameters.

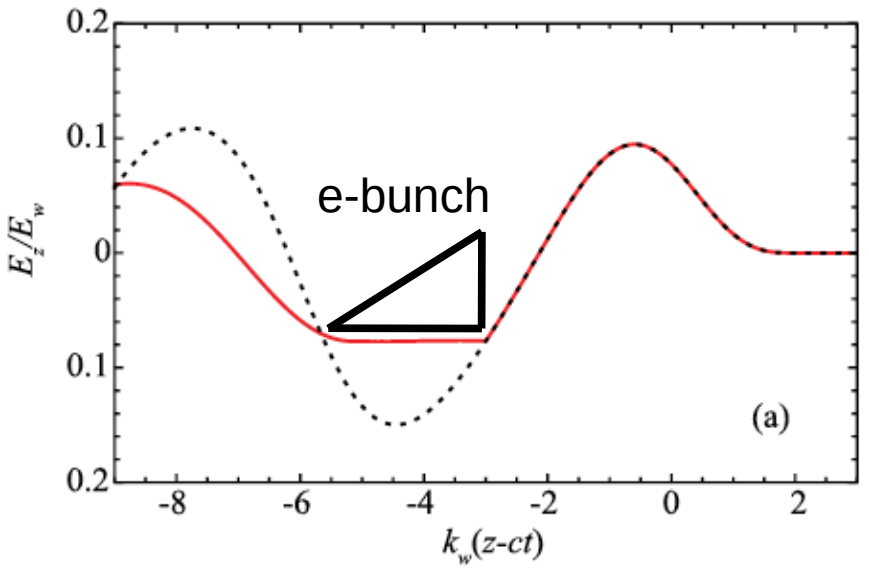
Plasma density (wall), n_0 [cm^{-3}]	10^{17}
Plasma wavelength, λ_p [mm]	0.1
Channel radius, r_c [μm]	22
Laser wavelength, λ [μm]	1
Normalized laser strength, a_0	1.2
Peak laser power, P_L [TW]	50
Laser pulse duration (FWHM), τ_L [fs]	130
Laser energy, U_L [J]	6.5
Normalized accelerating field, E_L/E_0	0.2
Peak accelerating field, E_L [GV/m]	6
Laser depletion length, L_{pd} [m]	8.7
Plasma channel length, L_c [m]	1.7
Laser depletion, η_{pd} [%]	20

Electron side: near-hollow channel (independent control of acc. / focusing wake)
Positron side: hollow-channel + external focusing

Bunch (electron/positron) parameters

Shaped electron/positron beam parameters.

Bunch phase (relative to peak field), φ	$\pi/3$
Loaded gradient, E_z [GV/m]	3
Beam beam current, I [kA]	3
Charge/bunch, $eN_b = Q$ [nC]	0.19
Length (triangular shape), L_b [μm]	36
Efficiency (wake-to-beam), η_b [%]	75
e^-/e^+ energy gain per stage [GeV]	5
Beam energy gain per stage [J]	0.93



C. B. Schroeder et al., Phys. Plasmas 20, 123115 (2013);
C. B. Schroeder et al., NIM A 829, 113 (2016);