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Numerical investigation of accelerated electrons generation from near-critical density targets under the action of petawatt-class laser pulses

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The generation of accelerated electrons from foam targets under the action of laser pulses is numerically studied in the work. This investigation is important for creation and optimization of laser driven sources of particles and radiation for diagnostics of matter states with high energy density. In performed 3D PIC simulations with the code VLPL, the foam is treated as plasma with near critical density. The laser pulse has parameters of the PHELIX laser with wavelength of 1 μm, duration of 400 fs and intensity of 4·1019 W/cm2. Possible mechanisms of electron acceleration relevant to this laser-plasma interaction conditions such as betatron resonance or stochastic heating in combined plasma and laser fields are considered by analyzing sample particles trajectories, high-frequency and quasistatic fields distributions. In simulations the length of plasma layer in the range of 100-400 μm and the plasma density in the near-critical range are varied to obtain the highest electron beam charge and the lowest divergence.

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