Enhanced relativistic electron beam collimation using two consecutive laser pulses

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Here we report an experimental investigation of a scheme based on using of two consecutive intense laser pulses in order to optimize electron transport and collimation in dense matter. The two laser pulses, of different intensities, are focalized in a solid target at a given delay to generate two successive co-axial electron populations, where the azimuthal magnetic field generated by the first electron beam can guide the second one [1]. Previous experimental results have confirmed the general validity of the scheme: optimum delay time and intensity ratio yielding the best guiding effect [2]. It was shown that the ratio between the pre-formed magnetic field extension and the diameter of the second electron beam plays a major role in determining the guiding efficiency [3]. A systematic investigation of the scheme, exploring the role played by the radial extension of the seed magnetic field and the delay time between seed and main laser pulses, was recently carried out on the LULI-ELFIE facility. The experimental results showed a reduction of the electron beam size in the optimum conditions of both focal spot ratio and delay time between the first and the second laser pulses, yielding in factor of 2. In addition, we present the numerical simulations using hybrid PIC code and kinetic transport code that reproduce performed experimental parametrical study and benchmark the scheme efficiency.

References

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