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Magnetic field generation in intense laser-plasma interaction and their impact on ion acceelration ROHINI MISHRA, MAXENCE GAUTHIER, SLAC National Accelerator Laboratory , CHANDRA CURRY, University of Alberta, Edmonton, Alberta, CANADA , JONGJIN KIM, SIEGFRIED GLENZER, FREDERICO FIUZA, SLAC National Accelerator Laboratory — Mass limited targets can bring advantages to laser-driven ion acceleration including enhanced laser absorption and higher proton energy. However, these targets can be subject to pre-expansion due to the laser pre-pulse and form low-density plasma in the rear side of the target. We have investigated the generation of magnetic fields in pre-expanded targets and the role of these fields on the ion beams. Multidimensional (2D and 3D) particle-in-cell (PIC) simulations motivated by ion acceleration experiments show two dominant magnetic fields generation mechanisms: i) Weibel or current-filamentation instability associated with the background return current and ii) Biermann Battery or fountain effect (associated with fast electron dynamics). They can both contribute to modulate the ion beams. The interplay between these two mechanisms depends on the pre-plasma scale length present at the rear surface of the target. We also present an analytical model to estimate the magnetic fields based on proton energies and modulations observed in the experiments, which is consistent with the PIC simulation results. This work is supported by DOE FES under FWP 100182 and FWP 100237.

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