Depolarization of Protons Accelerated in the PW Laser Driven Magnetic Vortex

M Wen[1]

[1] *Department of Physics, Hubei University, Wuhan, China*
Contact Email: wenmeng@hubu.edu.cn

Laser driven ion acceleration in a pre-polarized hydrogen halides gaseous target is expected to generate energetic spin polarized protons economically. The acceleration and spin-precession of protons appear not only in the relativistic plasma channel and the wakefield driven by petawatt lasers inside the underdense plasma, but also in the electric field induced by the transverse expanding magnetic vortex outside the plasma. 2D particle-in-cell simulations show strong depolarization happens in the magnetic vortex outside the plasma, but not inside the plasma target. It is different with previous findings. By analyzing dynamics of accelerated protons and the structure of the fields, dependence of the final beam energy and polarization on laser and plasma parameters is discussed. Optimized results show near GeV proton beams with polarization about 70 % can be obtained with the cascade acceleration driven by 3 petawatt lasers in a gaseous target.