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Scaling on Spot Size in Laser Acceleration of Protons Using Multi-Ion Foils[1] TUNG-CHANG LIU, XI SHAO, CHUAN-SHENG LIU, University of Maryland, College Park — We present the numerical study of the effect of the spot size of the circularly polarized laser beam on the energy of quasi-monoenergetic protons in laser proton acceleration with a thin carbon-hydrogen foil. In this acceleration scheme, protons are accelerated by a combination of laser radiation pressure and shielded Coulomb repulsion of carbon. We observed that the spot size plays a crucial role in determining the net charge of the electron-shielded carbon ion foil and consequently the efficiency of proton acceleration. Using a laser pulse with half-sine time profile and fixed input power and energy impinging on a carbon-hydrogen foil, we found that a laser beam with smaller spot sizes can generate higher energy but fewer quasi-monoenergetic protons. We also studied the scaling of the proton energy with respect to the laser spot size and obtained an optimal spot size for maximum proton energy flux. With such an optimal spot size, we can generate a 80 MeV quasi-monoenergetic proton beam containing more than 10^8 protons using a laser beam with power 250 TW and energy 10 J.

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