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Investigation of efficient shock acceleration of ions using high energy lasers in low density targets P. ANTICI, M. GAUTHIER, LULI, École Polytechnique, E. D'HUMIERES, Univ. Bordeaux, B. ALBERTAZZI, LULI, École Polytechnique, C. BEAUCOURT, Univ. Bordeaux, J. BÖKER, Heinrich Heine Universität Düsseldorf, S. CHEN, V. DERVIEUX, LULI, École Polytechnique, J.L. FEUGEAS, Univ. Bordeaux, M. GLESSER, INRS-ENT, A. LEVY, LULI, École Polytechnique, P. NICOLAI, Univ. Bordeaux, L. ROMAGNANI, LULI, École Polytechnique, V. TIKHONCHUK, Univ. Bordeaux, H. PEPIN, INRS-ENT, J. FUCHS, LULI, École Polytechnique — Intense research is being conducted on sources of laser-accelerated ions and their applications that have the potential of becoming novel particle sources. In most experiments, a high intensity and short laser pulse interacts with a solid density target. It was recently shown that a promising way to accelerate ions to higher energies and in a collimated beam is to use under-dense or near-critical density targets instead of solid ones. In these conditions, simulations have revealed that protons are predicted to be accelerated by a collisionless shock mechanism that significantly increases their energy. We present recent experiments performed on the 100 TW LULI laser (France) and the TITAN facility at LLNL, USA. The near critical density plasma was prepared by exploding thin solid foils by a long laser pulse. The plasma density profile was controlled by varying the target thickness and the delay between the long and the short laser pulse. When exploding the target, we obtained proton energies that are comparable if not higher than what was obtained under similar laser conditions, but with solid targets which make them a promising candidate for an efficient proton source.

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