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Ion acceleration beyond 100MeV/amu from relativistic laser-matter interactions DANIEL JUNG, CORT GAUTIER, RANDALL JOHNSON, Los Alamos National Laboratory, SAMUEL LETZRING, Retired, RAHUL SHAH, SASIKUMAR PALANIYAPPAN, TSUTOMU SHIMADA, JUAN FERNANDEZ, MANUEL HEGELICH, LIN YIN, BRIAN ALBRIGHT, Los Alamos National Laboratory, DIETER HABS, University of Munich — In the past 10 years laser acceleration of protons and ions was mainly achieved by laser light interacting with micrometer scaled solid matter targets in the TNSA regime, favoring acceleration of protons. Ion acceleration based on this acceleration mechanism seems to have stagnated in terms of particle energy, remaining too low for most applications. The high contrast and relativistic intensities available at the Trident laser allow sub-micron solid matter laser interaction dominated by relativistic transparency of the target. This interaction efficiently couples laser momentum into all target ion species, making it a promising alternative to conventional accelerators. However, little experimental research has up to now studied conversion efficiency or beam distributions, which are essential for application, such as ion based fast ignition (IFI) or hadron cancer therapy. We here present experimental data addressing these aspects for C^{6+} ions and protons in comparison with the TNSA regime. Unique measurements of angularly resolved ion energy spectra for targets ranging from 30 nm to 25 micron are presented. While the measured conversion efficiency for C^{6+} reaches up to $\sim$7%, peak energies of 1 GeV and 120 MeV have been measured for C^{6+} and protons, respectively.

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