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Spectral Features in Laser Driven Proton Acceleration from Cylindrical Solid-density Hydrogen Jets CHANDRA CURRY, MAXENCE GAUTHIER, ROHINI MISHRA, JONGJIN KIM, SEBASTIAN GOEDE, ADRIENNE PROPP, FREDERICO FIUZA, SIEGFRIED H. GLENZER, SLAC National Accelerator Laboratory, JACKSON WILLIAMS, JOHN RUBY, CLEMENT GOYON, ART E. PAK, Lawrence Livermore National Laboratory, SHAUN KERR, YING Y. TSUI, University of Alberta, BHUVANESH RAMAKRISHNA, Indian Institute of Science Education and Research, BASTIAN AURAND, OSWALD WILLI, Heinrich-Heine-University Dusseldorf, CHRISTIAN ROEDEL, Friedrich-Schiller-University Jena — The generation of monoenergetic proton beams by ultrashort high-intensity laser-plasma interactions is of great interest for applications such as stopping power measurements, fast ignition laser confinement fusion, and ion beam therapy. In general, the commonly used mechanism of target normal sheath acceleration (TNSA) does not provide the required energy spread or maximum proton energy. Here we study alternative acceleration mechanisms, which have been identified in particle in cell (PIC) simulations, to overcome the limitations of TNSA. Using the Titan laser system at the Lawrence Livermore National Laboratory, we investigate proton acceleration from wire targets and a cryogenic solid-density hydrogen jet. Due to the cylindrical geometry, TNSA is suppressed allowing other accelerations mechanisms to become observable. Quasi-monoenergetic features in laser-forward direction are observed in the proton spectrum indicating radiation-pressure-driven acceleration mechanisms. Our experimental results are accompanied by supporting PIC simulations.

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