Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Ion acceleration from pre-expanded thin foils irradiated by petawatt laser[1] JAN PSIKAL, FNSPE, Czech Technical University in Prague, VOJTECH HORNY, Institute of Plasma Physics CAS, Prague, Czech Republic, MARTINA ZAKOVA, ELI-Beamlines project, Institute of Physics ASCR, Prague, Czech Republic, MARTIN MATYS, FNSPE, Czech Technical University in Prague
— In this contribution, we demonstrate that the ions in the pre-expanded foils with near-critical density plasma before its interaction with the main ultrashort petawatt laser pulse may be accelerated to higher energies than that from intact ultrathin foils. In order to investigate the mechanisms responsible for the acceleration of the most energetic ions, we used tracking of particles in multidimensional particle-in-cell simulations. These simulations show that high-energy ions originate from a small region of the depth below one micron and the width about the laser focal spot size in the case of targets with a steep density gradient on its rear side. On the other hand, the depth of this region exceeds a few microns for pre-expanded target with long density gradients on both sides. When the laser pulse propagates through near-critical density pre-expanded targets, a high-density electron bunch is formed and travels with the laser pulse behind the target. Behind this electron bunch, a relatively long longitudinal electric field accelerates ions. Moreover, additional ion acceleration can be observed later due to expanding transverse magnetic field generated by propagating electrons.

[1]The work was supported from European Regional Development Fund - Project "Center for Advanced Applied Science" (No. CZ.02.1.01/0.0/0.0/16-019/0000778).

Jan Psikal
FNSPE, Czech Technical University in Prague

Date submitted: 20 Jun 2019 Electronic form version 1.4