Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Proton energy enhancement in multiple-beam solid foil interaction MARCO SWANTUSCH, JUERGEN BOEKER, RAJENDRA PRASAD, MIRELA CERCHEZ, MARIE SCHROER, STEPHANIE BRAUCKMANN, SVEN SPICKERMANN, THOMAS WOWRA, TOMA TONCIAN, OSWALD WILLI, Institute for laser and plasma physics, Heinrich Heine University Duesseldorf, Germany
— Laser driven ion acceleration from solid foils has been a spectacular field of research for more than a decade. The target normal sheath acceleration has been addressed as main mechanism. Recent research has been focused on increasing the proton energy by using multiple laser beams. Understanding the dynamics of multiple beams interaction is relevant for several multi beams high power laser facilties. The multi-MeV ion acceleration in an electrostatic sheath field is investigated by applying two ultrashort laser pulses onto thin foil targets. We resolve for the first time the fs-dynamics of the acceleration mechanism in the ultrashort pulse regime by varying the delay between two laser pulses. The experiments were carried out at the ARCTURUS laser system in Düsseldorf. Two ultrashort (30 fs) laser pulses were focused onto a 5 μm thick titanium target to intensities of 10^{20}W/cm^2. The enhancement of the proton energy was significant for the time delay of around 200 fs, between the two pulses. The maximum proton cutoff energy was obtained for the zero time delay. Consequently, this implies that the addition of multiple beams for energy enhancement is most effective while the beams are synchronized. The Particle-In-Cell simulations are in good agreement with our experimental results.

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Date submitted: 11 Jul 2014 Electronic form version 1.4