FAST ELECTRON GENERATION AND TRANSPORT STUDY WITH CONE-WIRE TARGET AT OMEGA EP LASER FACILITY

Toshinori Yabuuchi
Center for Energy Research, UC San Diego, USA

Fast electron generation and transport in reentrant cone is important for cone-guided fast ignition (FI). The OMEGA EP laser facility has enabled experimental research using FI-relevant laser pulses (kilo-joule level energy in 10 ps duration). We have injected 260 to 810 J laser pulses with 100 to 300 mJ amplified stimulated emission (ASE) into cone-wire targets and characterized the fast electrons escaping through the Au cone tip into the Cu wire (40 μm diameter, 1 mm long) with measurement of Cu Kα x-ray emission [1]. These were compared to similar experiments on the Titan laser (150 J, 0.7 ps) at the Lawrence Livermore National Laboratory where its < 10 mJ intrinsic prepulse was supplemented by injecting an artificial prepulse of up to 1 J [2], and its pulse length was stretched up to 7 ps.

Results show that the Kα X-ray yield linearly increases with the energy of OMEGA EP short pulse. Its lower Kα production efficiency, 3-4x smaller than the Titan intrinsic prepulse results, is as expected from the prepulse energy dependence seen at Titan. The efficiency is insensitive to the pulse duration. Radiation-hydrodynamic modeling of the prepulse shows that 300 mJ ASE produces a large preplasma with critical density 100 μm away from tip of the cone, thus, reducing the Kα production efficiency. The vacuum fast electron spectra measured on OMEGA EP show slope temperatures of 1.6-3.1 MeV, which are higher than the Ponderomotive scaling, as is seen with a large preplasma [3]. The PIC and hybrid PIC codes have been used to model the experiment. Details of the experiment and simulation results will be presented and discussed.

In collaboration with H. Sawada, M. S. Wei, B. Chrisman, T. Bartal, D. P. Higginson, T. Ma, F. N. Beg, (UCSD), K. U. Akli, R. B. Stephens (GA), H. Chen, M. H. Key, H. S. McLean, P. K. Patel, Y. Ping (LLNL), D. Batani (Univ. Milano-Bicocca), S. D. Baton (LULI), W. Theobald, R. Betti (LLE Univ. Rochester), L. A. Gizzi (IPCF-CNR), C. Spindloe, P. A. Norreys (STFC, RAL), R. Faehl, R. Mason (RAC), Y. Sentoku (UNR).

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* This work was performed in part at the LLE NLUF, and supported by US DOE under contract DE-FC02-04ER54789.

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