Abstract for an Invited Paper
for the DPP09 Meeting of
The American Physical Society

Acceleration to High Velocities and Heating by Impact Using Nike KrF laser

MAX KARASIK[1], Plasma Physics Division, Naval Research Laboratory, Washington DC

Shock ignition, impact ignition, as well as higher intensity conventional hot spot ignition designs reduce driver energy requirement by pushing the envelope in laser intensity and target implosion velocities. This talk will describe experiments that for the first time reach target velocities in the range of 700 – 1000 km/s. The highly accelerated planar foils of deuterated polystyrene, some with bromine doping, are made to collide with a witness foil to produce extreme shock pressures and result in heating of matter to thermonuclear temperatures. Target acceleration and collision are diagnosed using large field of view monochromatic x-ray imaging with backlighting as well as bremsstrahlung self-emission. The impact conditions are diagnosed using DD fusion neutron yield, with over 10^6 neutrons produced during the collision. Time-of-flight neutron detectors are used to measure the ion temperature upon impact, which reaches 2 – 3 keV. The experiments are performed on the Nike facility, reconfigured specifically for high intensity operation. The short wavelength and high illumination uniformity of Nike KrF laser uniquely enable access to this new parameter regime. Intensities of $(0.4 - -1.2)$ x 10^{15} W/cm^2 and pulse durations of $0.4 - -2$ ns were utilized. Modeling of the target acceleration, collision, and neutron production is performed using the FAST3D radiation hydrodynamics code with a non-LTE radiation model. Work is supported by US Department of Energy.

[1]In collaboration with J. L. Weaver, Y. Aglitskiy (SAIC), A. L. Velikovich, S. T. Zalesak, J. W. Bates, J. Oh (RSI), S. P. Obenschain, Naval Research Lab and Y. Arikawa, T. Watari, T. Sakaiya, M. Murakami, H.Azechi, Institute of Laser Engineering, Japan