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Laser Plasma and Hydrodynamics Experiments with KrF Lasers[1]

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The proposed Fusion Test Facility (FTF) will exploit the unique features of Krypton Fluoride (KrF) lasers to achieve ignition and substantial gain (>20) at <500 kJ laser energies using direct drive.[1] The strategy uses highly uniform, high bandwidth, 248 nm KrF laser illumination at intensities near 2 x 10^{15} W/cm^2 to accelerate low-aspect ratio pellets to implosion velocities of 400 km/s. Higher than usual implosion velocity allows ignition at substantially reduced laser energy. Amplitudes of both hydrodynamic instability during the pellet implosion and deleterious laser plasma instability (LPI) in the corona must be kept sufficiently low if one is to achieve ignition and gain. Increased laser intensity reduces hydrodynamic instability because it allows acceleration of thicker, low aspect ratio pellets, but is also more likely to produce deleterious LPI. The deep UV wavelength of KrF should allow use of these higher intensities. Studies of hydrodynamic instabilities and laser plasma instabilities (LPI) are the subject of ongoing experiments at the 2-3 kJ Nike KrF laser. The Nike laser has demonstrated highly uniform UV irradiation of planar targets at moderate laser intensities (I$\sim 10^{14}$ W/cm^2), including the recent addition of short duration "spike" prepulses for hydrodynamic stability studies. A new effort in LPI physics is underway at the Nike facility where the peak intensity is being extended above 10^{15} W/cm^2 by a combination of smaller focal diameters and shorter pulse lengths. This talk will discuss progress in the ongoing experiments at Nike in support of the FTF design. [1] S. P. Obenschain, et al., Phys. Plasmas **13** 056329 (2006).

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