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Advanced Ignition Experiments on OMEGA

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A comprehensive scientific program is being pursued at the Laboratory for Laser Energetics to explore the physics of inertial confinement fusion (ICF) beyond the baseline "hot-spot" designs. The OMEGA EP high-energy petawatt laser was completed in April 2008, adjacent to the existing 60-beam OMEGA Laser Facility. OMEGA EP consists of four beamlines with a NIF-like architecture. Two of the beamlines can operate in short-pulse mode, with up to 2.6 kJ each in a 10-ps pulse duration. The two short-pulse beams can be directed into either the OMEGA (co-propagating) or the OMEGA EP target chamber (co-propagating or orthogonal illumination). The combined OMEGA/OMEGA EP facility will be used to study advanced concepts such as the fast-ignitor approach to ICF. Fast ignition separates the fuel assembly and fuel heating by using an ultrafast laser in addition to a driver that compresses the fuel to high density. Fuel-assembly experiments with low-adiabat implosions and cone-in-shell targets on OMEGA have demonstrated high fuel-areal densities of up to 200 mg/cm^2 and shown that the cone does not significantly perturb the core fuel assembly. Integrated fast-ignitor experiments on OMEGA with cone-in-shell targets are planned for the Summer of 2008. This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302. Contributors: K.S. Anderson, R. Betti, J. Bromage, J.A. Delettrez, V.Yu Glebov, S.J. Loucks, J.H. Kelly, B.E. Krushwitz, R.L. McCrory, F.J. Marshall, D.D. Meyerhofer, S.F.B. Morse, J. Qiao, T.C. Sangster, W. Seka, S. Skupsky, V.A. Smalyuk, A.A. Solodov, L.J. Waxer, UR/LLE, J.A. Frenje, C.K. Li, R.D. Petrasso, PSFC, MIT, R.B. Stephens, GA.