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OVERVIEW OF PROGRESS AND FUTURE PROSPECTS IN INDIRECT DRIVE IMPLOSIONS ON THE NATIONAL IGNITION FACILITY

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Alpha-particle self-heating, the process of deuterium-tritium (DT) fusion reaction products depositing their kinetic energy locally within the fusion reaction region and thus increasing the temperature in the reacting region with a concomitant exponential increase in the fusion reaction-rate, is the essential process needed for a fusion plasma to 'ignite.' For the first time in the laboratory, significant (but not dominant) alpha-heating in a fusion plasma was inferred in experiments where fusion 'fuel gain' was demonstrated [1] on the U.S. National Ignition Facility (NIF). Herein, we report on the achievement of generating alpha-particle self-heating *dominated* fusion plasmas where the measured energy yields exceed, by more than double, the yield resulting from the PdV (pressure times volume change) work done on the hot fusion plasma (the 'hot-spot') by the implosion process [2-5]. These experiments have achieved the highest yet recorded stagnation pressures ($p_{stagnation}$ > 150-230 Gigabar) of any facility based inertial confinement fusion (ICF) experiments, albeit they are still short of the pressures required for ignition on the NIF (i.e. ~300-400 Gbar), and have exhibited undesirable shape distortions that waste kinetic energy and need to be addressed in future work in order to make optimum use of the energy absorbed by the implosion process. As part of the talk, we'll review the issues that have been uncovered and discuss the program strategy and plan that we are following to systematically address the known issues as we press on. This work is performed under the auspices of the U.S. Dept. of Energy by Lawrence Livermore National Laboratory under Contract No. DE-AC52-07NA27344.

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