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LLE Review

Quarterly Report

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Contents

In Brief

This volume of the LLE Review, covering the period October–December 1999, includes a report on the stability of direct-drive NIF capsules. V. N. Goncharov, R. Betti, J. A. Delettrez, P. W. McKenty, S. Skupsky, and R. P. J. Town examine the conditions under which direct-drive NIF capsules ignite. Their numerical study uses two-dimensional hydrodynamic simulations in conjunction with a model that includes the various mechanisms that can influence target performance. Inner-surface roughness of the DT ice of the direct-drive cryogenic capsules and laser nonuniformities have been identified as the principal seeds of the instabilities that can potentially quench ignition. The authors conclude that a target gain greater than 10 can be achieved for a realistic inner-surface ice roughness when beam smoothing with 2-D SSD and a bandwidth greater than 0.5 THz is used.

Additional research highlights reported in this issue are

- R. Q. Gram, J. Hobler, L. D. Lund, and D. R. Harding report on the initial performance of the high-pressure deuterium- and tritium-filling portion of the Cryogenic Target Handling System. Thick-walled plastic targets have been successfully pressurized with deuterium to the required levels by the high-pressure filling system. Adequate control of the various factors influencing the filling process has been demonstrated, indicating that even thin-walled plastic targets (such as those required by the cryogenic target designs for OMEGA) can be successfully filled to the required high pressure.

- E. L. Alfonso, I. Anteby, and D. R. Harding present a numerical study of the principal sources of target nonuniformities for a cryogenic target when placed in the layering sphere. Deviations from idealized symmetry in the capsule-wall thickness, the displacement of the capsule relative to the center of the layering sphere, and the existence of temperature gradients on the layering sphere's inner surface can result in temperature gradients across the cryogenic target. This in turn affects the uniformity of the cryogenic fuel layer. Calculations of the temperature profile in these targets will be used to guide target fabrication and layering.

- T. H. Hinterman, C. Chiesa, B. Ferkovich, S. Johns, H. J. Kramer, D. J. Lonobile, and D. Lynch describe the target detection and the shroud pull-sequencing aspects of cryogenic target operations on OMEGA. The newly designed Cryogenic Target Detection System is based on existing elements of OMEGA controls and provides the necessary sequencing, safety features, and flexibility to allow for the evolution of cryogenic target operations.

- By implementing a contrast monitoring system on OMEGA, T. R. Boehly, Y. Fisher, D. D. Meyerhofer, W. Seka, J. M. Soures, and D. K. Bradley investigate laser prepulse levels on OMEGA and establish a contrast criterion for direct-drive implosions. Control of laser prepulses can be critical since high-intensity prepulses can potentially compromise the aluminum layer and cause unwanted laser damage to direct-drive targets. The authors find that while OMEGA intermittently produces measurable prepulses, the prepulse level is not expected to significantly degrade target performance.

- K. L. Marshall, M. J. Guardalben, and S. Corsello report on the successful design of dyes for a liquid crystal–based interferometer that will be used on OMEGA for a more-accurate wavefront characterization. Using state-of-the-art computational chemistry tools they have also demonstrated the effectiveness of modeling in guiding experimental searches for new dye compounds. Their work also has potential for other liquid crystal devices used in optical communications and sensor protection.

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Editor