***Electron Transport Modeling for Inertial Confinement Fusion Experiments:*** Ignition target designs rely on accurate control of both the main fuel entropy and the asymmetry growth due to the hydrodynamic instabilities during the implosion. Both the shell entropy and the instability seeding are set during the early stage of an implosion. The shock wave launched at the beginning of the foot pulse determines the shell entropy. In addition, the evolution of the shell asymmetry during the shock transit determines the initial conditions for the Rayleigh–Taylor (RT) instability.

To experimentally validate the shock velocity calculations, CH foils of different thicknesses were driven with a laser pulse at an intensity $I = 4 \times 10^{14}$ W/cm$^2$; the shock breakout time was measured using a line imaging velocity interferometer system for any reflector (VISAR). The results of these experiments are presented in Fig. 1(a). A flux-limited Spitzer thermal conduction model is used in these simulations. Figure 1(a) shows that a flux limiter of f = 0.06 is consistent with the shock-breakout measurements. To test the theoretical predictions for the evolution of perturbations during the shock transit across the shell, perturbation growth measurements were carried out on 40- and 60-$\mu$m-thick CH foils. The foils were driven with a maximum intensity of $4 \times 10^{14}$ W/cm$^2$ in 1.5-ns, fast-rise, flattop pulses, and x-ray backlighting was deployed to measure changes in the x-ray optical depth (OD) of the driven foils.

A comparison of the experimental results and simulations is shown in Fig. 1(b) where the modulation of the optical depth (defined as logarithm of the image intensity) is plotted as a function of time for the case of a 20-$\mu$m initial perturbation. The simulation with f = 0.1 is in good agreement with the experimental data [see Fig. 1(b)]. Such a large value of the flux limiter, however, is not consistent with the shock-timing measurements shown in Fig. 1(a). To resolve this discrepancy, a new nonlocal transport model was developed.[1] When applied to the shock-breakout simulations, the nonlocal model reproduces the experimental shock-velocity data very well [thin line in Fig. 2(a)]. To apply the results of the new transport model to 2-D hydrodynamic simulations, an effective flux limiter is obtained by taking the maximum ratio of the heat flux calculated in the laser deposition region (using the nonlocal model) and the free-stream limit $q_{FS}$. The flux limiter decreases in time from f = 0.09 at the beginning of the pulse to f = 0.045 at the end. An enhanced heat flux earlier in the pulse increases the rate of plasma corona formation, which results in earlier perturbation phase reversal. Comparison of the OD measurements with the results of simulations using the time-dependent flux limiter is shown in Fig. 2(b). The experimental data are consistent with simulations for both 20-$\mu$m and 30-$\mu$m perturbation wavelengths.

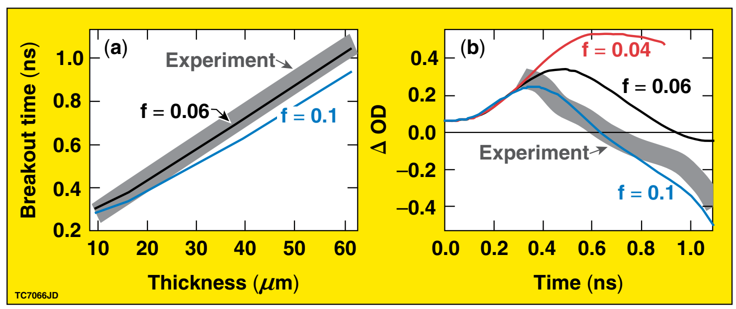


Figure 1. Predictions and measurements compared using a flux-limiter model. (a) VISAR-recorded shock-breakout time measurements (gray shaded region) compared to prediction using a flux limiter of f = 0.06. (b) Measured time evolution of change in the x-ray optical depth (shaded area) for 40-$\mu$m-thick CH foils with imposed 20-$\mu$m perturbations compared to predictions using several values of flux limiter f.

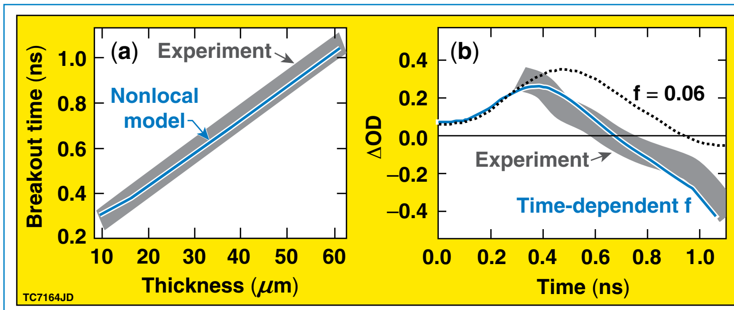


Figure 2. Predictions and measurements compared for the case of the nonlocal transport model. (a) Shock-breakout measurements (gray shaded region) and (b) growth of imposed 20-$\mu$m perturbations.

***OMEGA Operations Summary:*** During January 2006, OMEGA performed a total of 100 target shots. Of the shots taken, 96 were for the National Ignition Campaign (NIC); these shots were led by LLE, LLNL, and LANL scientists. Of the NIC shots, 56 were for the indirect-drive ignition program while 40 were for the direct-drive ignition program. Four target shots we taken by LLNL for the high-energy-density physics (HEDP) program. One week of the month was dedicated to scheduled maintenance.

1. V. N. Goncharov *et al.*, Phys. Plasmas **13**, 012702 (2006).

Contact: Wolf Seka (585) 275-3815; fax: (585) 275-5960; e-mail: seka@lle.rochester.edu
John M. Soures (585) 275-3866; fax: (585) 256-2586; e-mail: jsou@lle.rochester.edu