

**High-Performance OMEGA Cryogenic Implosions:** The objectives of the the July 2018 cryogenic target implosions were completed with goals that included comparing the performance of 960- and 980- $\mu\text{m}$ -diam CD shells and testing a new predictive-model pulse shape. The 960- $\mu\text{m}$ -outer-diam CD shell was 7.6- $\mu\text{m}$  thick with a 40.5- $\mu\text{m}$  DT layer, while the 980- $\mu\text{m}$  shell was 8.1- $\mu\text{m}$  thick with a 41.3- $\mu\text{m}$  DT layer. A higher implosion velocity was expected for the 960- $\mu\text{m}$ -outer-diam shell. The DT yield averaged over seven detectors for this target was  $1.51 \times 10^{14}$ . A DT yield of  $1.51 \times 10^{14}$ , the highest yield to date for an OMEGA cryogenic implosion. The pulse shape created from the predictive model (red curve) is shown in Fig. 1 and is compared to the pulse shape used previously (blue curve).<sup>1</sup> The significant feature of this new shape is the decrease in power before the final high-intensity spike. This pulse shape was designed to increase the implosion areal density. Areal densities ranged from 160 to 180  $\text{mg}/\text{cm}^2$ .

Figure 2 is a plot of the yield versus the areal densities for the OMEGA cryogenic implosions. Data from the July 10 shots are shown as black circles. The generalized Lawson criterion derived by Chang<sup>2</sup> are scaled to a NIF energy of 1.9 MJ and are shown as curves. The  $\chi_{\text{no } \alpha} = 1$  line represents the onset of ignition in an ICF implosion on the NIF. July cryogenic implosion data have crossed the NIF  $\chi_{\text{no } \alpha} = 0.8$  line and clearly show improved direct-drive implosion performance. These are the highest-performing direct-drive cryogenic implosions to date.

**Omega Facility Operations Summary:** The Omega Facility conducted 188 target shots in June with an average experimental effectiveness (EE) of 93.1%. The OMEGA laser had 123 shots with EE of 95.5% and the OMEGA EP laser had 65 shots with EE of 88.5%. The ICF program was responsible for 73 target shots led by LLE and the HED program had 78 shots for experiments led by LLNL, LANL, the University of Michigan, and LLE. Nineteen target shots were taken for NLUF experiments led by the University of Nevada–Reno and MIT. One LBS experiment led by LLE had 8 target shots and one ARPA-E campaign accounted for 11 shots.

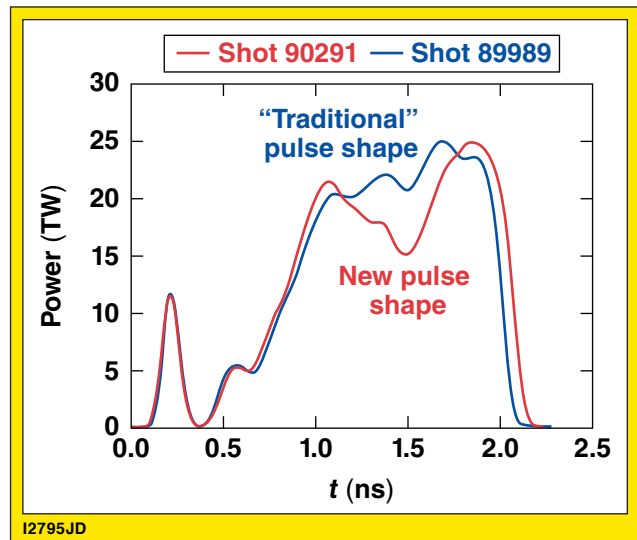


Figure 1. New laser pulse shape created from the predictive mode (red curve) compared to the previous pulse shape shown in (blue curve).

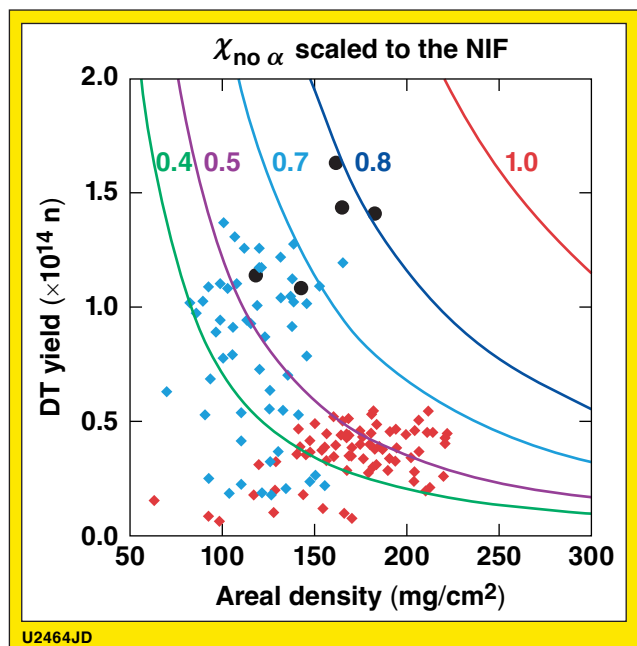


Figure 2. Plot of the yield versus the areal densities for the OMEGA cryogenic implosions. Data from the July cryogenic implosions are shown as black circles. The blue diamonds are data from the optimized cryogenic implosion campaign and the red diamonds are data from the low-adiabat implosions.

1. S. P. Regan *et al.*, Phys. Rev. Lett. **117**, 025001 (2016); **117**, 059903(E) (2016).

2. P. Y. Chang *et al.*, Phys. Rev. Lett., **104**, 135002 (2010).