NIF 4ω Fiducial Laser: LLE delivered the fourth-harmonic fiducial (NIF4ωFidu) laser system (shown in Fig. 1) to LLNL where it will be used to temporally calibrate x-ray streak cameras on the NIF. The fiducial laser system and UV delivery fiber designs are based on a system operating at the Omega Laser Facility. Many NIF target diagnostics use optical fiducials generated in the master oscillator room (MOR) to cross time the target diagnostics and the main laser beams. X-ray streak camera photocathodes are not sensitive to infrared or visible light, so they cannot use the existing NIF 1ω and 2ω timing fiducial signals; however, they have sufficient sensitivity at the fourth harmonic (4ω, 263 nm) to generate a fiducial mark on the same streak window with the target diagnostic data. The DIM-insertable streak camera (DISC) will be deployed in DIM 90-315 at the equator of the NIF target chamber. The NIF4ωFidu laser system is comprised of five subsystems:

1. *Comb pulse stacker:* The NIF 1ω (1053 nm) fiducial system produces a single ~100-ps pulse that generates a well-characterized fiducial comb pulse with six pulses nominally spaced at 300-ps intervals. An all-fiber system is used to split, delay, and attenuate individual pulses before recombination into a comb pulse.
2. *PM transport fiber:* The comb-pulse seed signal will be delivered to the NIF4ωFidu laser enclosure in the target bay, located next to DIM 90-315, by polarization maintaining (PM) fiber.
3. *Nd:YLF regenerative amplifier:* The 1ω comb pulse is amplified to the millijoule level in a Nd:YLF regenerative amplifier that is Q-switched and cavity dumped using a Pockels cell switch.
4. *Frequency quadrupler*: The output of the regenerative amplifier is directed to fourth harmonic generation (FHG) crystals that convert the fiducial pulse to a 263-nm wavelength.
5. *UV fiber launcher and transport fibers:* The 4ω signal is launched into a three-fiber bundle of multimode UV fibers. One fiber is connected to a transport fiber link that delivers the fiducial signal to the DISC and another is used to monitor the 4ω signal energy. The third fiber is an installed spare that will be terminated during normal operation.

Figure 1. The NIF4ωFidu laser system is built in a portable workstation in the NIF target bay so that it can be removed easily for high-yield target shots. The enclosure serves as both a laser safety barrier and provides EMI protection to the laser and electronics during target shots.

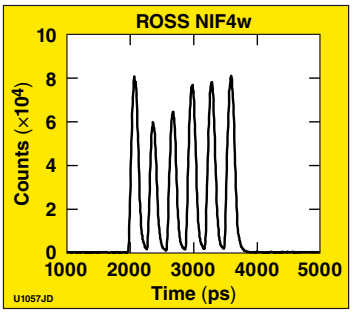

Figure 2. The UV fiducial comb pulse measured with a ROSS streak camera meets the NIF4ωFidu requirements.

NIF4ωFidu fiducial comb pulses, measured with a ROSS streak camera, are shown in Fig. 2. A prototypical 400-μm-core, UV fiber link simulated operation in the NIF. The measured comb pulses have high temporal contrast, pulse-shape and energy stability, and pulse-spacing accuracy (2 ps) that meet the NIF requirements. A measurement using a prototypical x-ray streak from LLNL is shown in Fig. 3. High temporal contrast is observed for the signal directly exposed by the UV-fiber-delivery system. A "ghost" image is also observed in the streak record that results from UV light reflecting between the photocathode and wire grid array in the streak tube. LLNL will optimize the streak camera to mitigate this effect and increase sensitivity.

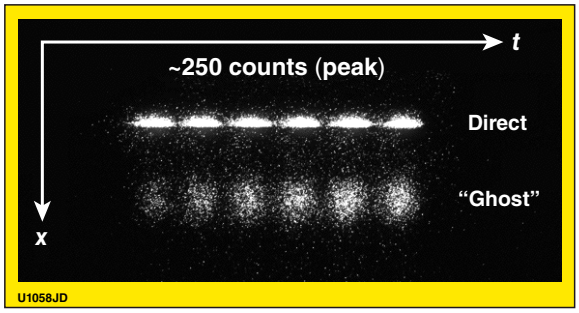

Figure 3. The UV fiducial comb pulse delivered to a prototypical x-ray fiducial streak camera with a prototypical UV fiber link produces a high-contrast fiducial mark with good signal to noise (direct).

OMEGA Operations Summary: During the month of December the Omega Laser Facility conducted a total of 125 target shots (89 on OMEGA and 36 on OMEGA EP) with an average experimental effectiveness of 94.4% on OMEGA and 93.1% on OMEGA EP. The NIC program accounted for 49 of the total shots. Other programs included 22 LBS target shots for experiments fielded by LLNL and LLE; 17 NLUF target shots for two experiments led by the University of California–Berkeley and the University of Nevada–Reno, respectively; 13 shots for the CRASH program at the University of Michigan; and 24 target shots for three HED experiments from LANL and LLE, respectively.

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