Direct-Drive Campaign at the National Ignition Facility: The first demonstration of hemispheric wavelength detuning as a potential mitigation strategy for cross-beam energy transfer (CBET)[1] was successfully conducted in polar-direct-drive implosions at the National Ignition Facility (NIF). As shown in Fig. 1, this technique uses cone swapping in one hemisphere to produce a wavelength shift across the equator, where CBET has the strongest effect. The interaction of incoming and outgoing rays at different wavelengths has been predicted to move the CBET resonance region in such a way as to reduce the overall effect of CBET and increase the energy coupling around the equator.[2] CBET reduces the ablation pressure of NIF-scale targets by ~60% (Ref. 3).

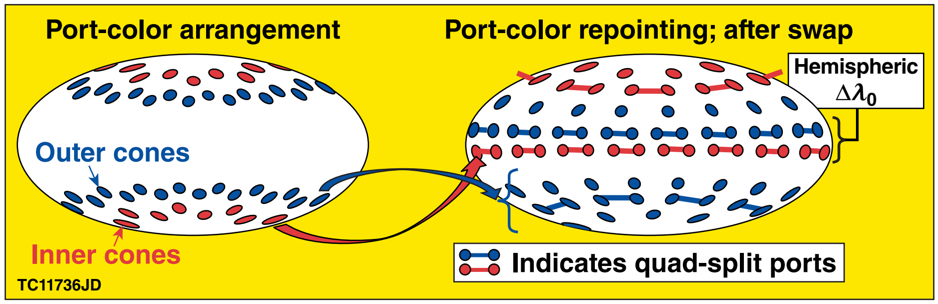

Figure 1. Repointing of the National Ignition Facility (NIF) laser beams for hemispheric wavelength detuning experiments on the NIF using cone swapping. In the southern hemisphere, the inner cones were repointed to the equator and the outer cones were repointed toward the pole. This enables the use of NIF's current $\Delta\lambda$ capabilities between inner (red) and outer (blue) quads to introduce a non-zero wavelength difference between beams overlapping near the equator in a polar-direct-drive experiment, where cross-beam energy transfer has the strongest effect.

These experiments used 100-μm-thick CH capsules with a diameter of 2330 μm that were irradiated by ~580 kJ in a 8.7-ns pulse, with a wavelength separation across the equator of either $\Delta\lambda = 0$ or $\Delta\lambda = 4.6$ Å (UV). The wavelength separation of 4.6 Å (UV) is the largest achieved on the NIF to date, but is still smaller than what is estimated to be required for a direct-drive–ignition platform (12 Å). The implosions were radiographed using a laser-driven Fe backlighter foil. The resulting measured and simulated x-ray framing-camera images of the implosion at a convergence ratio of CR ~ 2 are shown in Fig. 2. The use of $\Delta\lambda = 4.6$ Å (UV) produces significant qualitative differences in the shape of the imploded shell relative to $\Delta\lambda = 0$. The overall shape is prolate for $\Delta\lambda = 4.6$ Å and oblate with $\Delta\lambda = 0$. This result signifies stronger energy coupling at the equator as a result of the reduced effect of CBET. In addition, an implosion with $\Delta\lambda = 4.6$ Å shows an equatorial band of high density that does not appear in the $\Delta\lambda = 0$ experiment. Both of these features and the trends in shape between $\Delta\lambda = 0$ and $\Delta\lambda = 4.6$ Å (UV) are in excellent qualitative agreement with the predictions of pre-shot 2-D *DRACO* simulations. Quantitive analysis is underway. These results represent the first experimental validation of wavelength detuning as a CBET-mitigation strategy for direct drive and are an important step toward validating direct drive as a viable ignition platform.

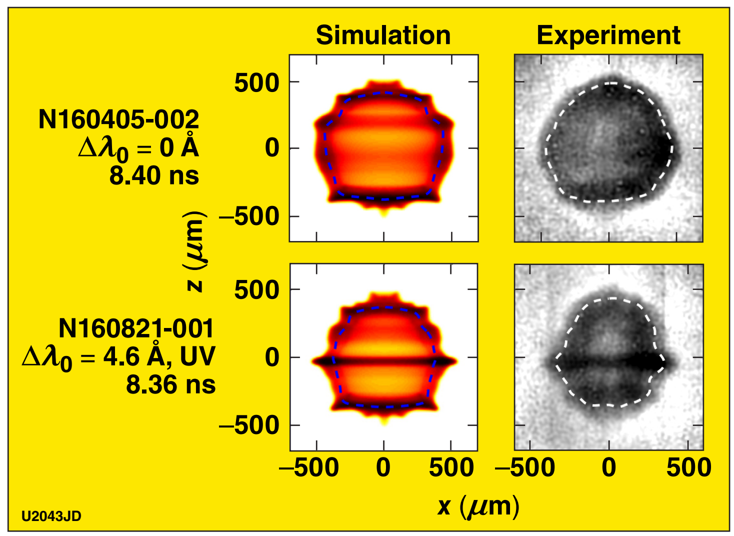

Figure 2. Measured (right) and pre-shot 2-D *DRACO*-simulated (left) backlit x-ray radiographs of implosions with $\Delta\lambda = 0$ (top) and $\Delta\lambda = 4.6$ Å (UV) (bottom), at a convergence ratio of CR ~ 2.

Omega Facility Operations Summary: The Omega Laser Facility conducted 191 target shots in September with an experimental effectiveness (EE) of 95.0%. This total includes 96 shots on OMEGA with an EE of 97.4% and 95 on OMEGA EP with an EE of 92.6%. The ICF campaign accounted for 52 target shots for experiments led by LANL, LLNL, LLE, NRL, and SNL principal investigators. HED experiments accounted for 84 shots for experiments led by LANL, LLNL, and LLE. Twenty-one target shots were taken for three NLUF experiments led by principal investigators from Princeton University. The LBS program accounted for 12 target shots for an LLNL experiment and two experiments from CEA had 22 target shots.

1. C. J. Randall, J. R. Albritton, and J. J. Thomson, Phys. Fluids **24**, 1474 (1981); 2. J. A. Marozas *et al.*, presented at the 44th Annual Anomalous Absorption Conference, Estes Park, CO, 8–13 June 2014; 3. P. B. Radha *et al.*, Phys. Plasmas **23**, 056305 (2016).

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