

OMEGA EP Project Completion: The OMEGA EP performance criteria for Critical Decision 4 (CD-4) were achieved in April and documented in a report presented and approved by the DOE/NNSA Federal Project Director. The system-activation requirements of the CD-4 Project Completion Plan, S-AD-M-018, included the following short-pulse (two beams) and long-pulse (all four beams) criteria:

Beams 1 and 2 activated for high-intensity experiments with a joint OMEGA target shot with the following short-pulse conditions:

- Beam 1 having a pulse width of ≤ 100 ps (demonstrated 83.8 ps); Beam 2 having a pulse width of ≤ 10 ps (demonstrated 9.5 ps, see Fig. 1)
- Timing of Beam 2 with respect to Beam 1 to the desired delay with an uncertainty of < 20 -ps rms (demonstrated 7-ps rms)
- OMEGA EP beams timed to OMEGA beams to the desired delay with an uncertainty of < 20 ps (demonstrated 6-ps rms for both beams)
- Each short-pulse beam having an on-target energy of > 400 J [demonstrated 631 J at 83.8 ps (Beam 1) and 463 J at 11.5 ps (Beam 2)]
- For short-pulse (IR) beams, a focal spot with $> 80\%$ of on-target energy within a $40\text{-}\mu\text{m}$ spot (demonstrated $\leq 70\text{-}\mu\text{m}$ spot (Fig. 2)—continued reductions in spot size are expected with additional development)
- Irradiation of a backlighter foil in OMEGA using Beams 1 and 2 with the above criteria and repeated within 2 hours (demonstrated with a time interval of 1.7 hours)

All four beams activated for single-sided irradiation of a foil target in the auxiliary (OMEGA EP) target chamber included the following conditions:

- Pulse durations between 1 and 10 ns for each beam, configurable (system design)
- On-target total energy > 1000 J per beam at 351 nm, at 2 ns or longer (demonstrated > 1038 J at 2 to 4 ns for each of the four beams)
- All four beams co-timed to less than 40-ps rms (demonstrated 12-ps rms)
- Focal-spot conditions with $> 95\%$ of the UV energy contained in a 1-mm spot (demonstrated $> 95\%$ energy in spots ranging from 0.22 to 0.30 mm)

In addition to meeting the CD-4 criteria, the project team released the required system documentation, completing a comprehensive final safety analysis and hazard report. Project completion required having trained and qualified operators for the minimum single shift of target shots. The acceptance testing was performed as part of the system-activation process and was completed on 28 April 2008. Thus, the OMEGA EP project was completed on time, on budget, and met the system-performance requirements.

OMEGA Operations Summary: The OMEGA facility conducted 118 target shots in April with an average experimental effectiveness of 95.8%. Eighty-nine of these shots were conducted for the NIC program (26 for IDI by LLNL and 63 for DDI by LLE). There were 18 target shots provided for the LANL HED program, and 11 target shots were taken for an LLE Laboratory Basic Science (LBS) program. In addition, 25 system activation shots were conducted on OMEGA EP; OMEGA EP beams were directed into the OMEGA chamber on 22 of these shots.

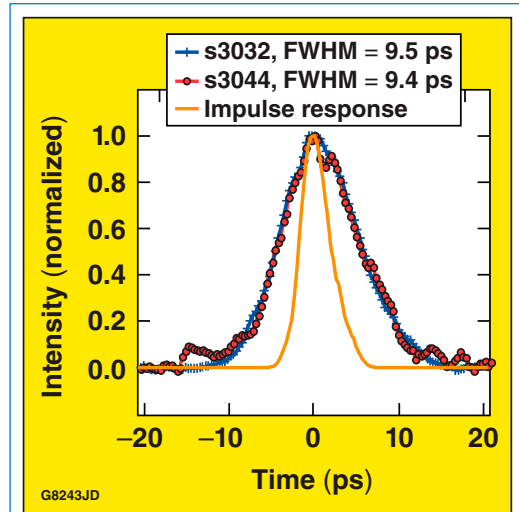


Figure 1. Pulse-width measurements were conducted with an ultrafast streak camera (UROSS). The graph shows the impulse response (~ 4 ps) of the streak camera and reduced streaks from two shots (3032 with a FWHM of 9.5 ps and 3044 with a FWHM of 9.4 ps).

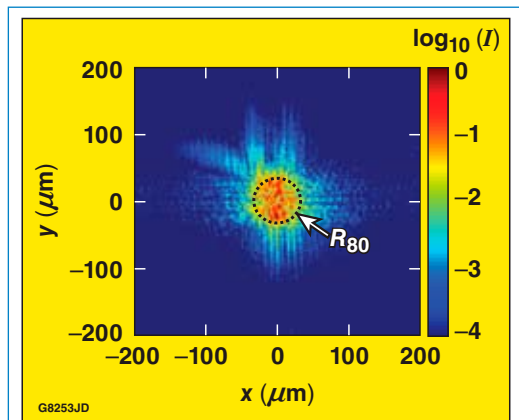


Figure 2. Measurement of an on-target short-pulse (IR) beam focal spot taken with the OMEGA EP focal-spot diagnostic (FSD). The FSD uses an on-shot wavefront measurement to produce a calculated on-target energy distribution. The dashed circle shows the 80% encircled energy radius for the focal spot ($R_{80} \sim 32.5 \mu\text{m}$).