The Sixth Omega Laser Facility Users Group Workshop

Introduction

A capacity gathering of over 100 researchers from 25 universities and laboratories met at the Laboratory for Laser Energetics (LLE) for the Sixth Omega Laser Facility Users Group (OLUG) workshop. The purpose of the 2.5-day workshop was to facilitate communications and exchanges among individual OMEGA users, and between users and the LLE management; to present ongoing and proposed research; to encourage research opportunities and collaborations that could be undertaken at the Omega Laser Facility and in a complementary fashion at other facilities [such as the National Ignition Facility (NIF) or the Laboratoire pour l'Utilisation des Lasers Intenses (LULI)]; to provide an opportunity for students, postdoctoral fellows, and young researchers to present their research in an informal setting; and to provide feedback from the users to LLE management about ways to improve and keep the facility and future experimental campaigns at the cutting edge. The interactions were wide-ranging and lively, as illustrated in the accompanying photographs.

The OLUG consists of over 400 members from 44 universities and many research centers and national laboratories. Names and affiliations can be found at **http://www.lle.rochester.edu/media/about/documents/OLUGMEMBERS.pdf**. OLUG is by far the largest users group in the world in the field of high-energy-density (HED) physics and also one of the most active.

The first two mornings of the workshop comprised six science and facility presentations. The facility talks proved especially useful for those unfamiliar with the art and complexities of performing experiments at the Omega Laser Facility. Since the facility is constantly evolving and improving, even experienced users significantly benefited from these updates. The overview science talks, given by leading world authorities, described the breadth and excitement of HED science either being currently undertaken at the Omega Laser Facility or well within the reach of the facility with improvements or upgrades.

A total of 63 students and postdoctoral fellows, 53 of whom were supported by travel grants from the National Nuclear Security Administration (NNSA), participated in the workshop. The content of their presentations encompassed the spectrum from target fabrication to simulating aspects of supernovae; the presentations generated spirited discussions, probing questions,

U1738JR

Figure 140.31
A capacity gathering of over 100 researchers, from universities and laboratories around the world, participated in this year's workshop. The Users Group itself has over 400 members who come from 44 universities and 25 laboratories, making it by far the largest users group in the world in high-energy-density physics. The next annual OMEGA Users Workshop will occur on 22–24 April 2015.

and friendly suggestions. In total there were 93 posters, including eight that focused on the Omega Laser Facility.

An important function of the workshop was to develop a set of **Findings and Recommendations** (p. 247) to help set and define future priorities for the Omega Laser Facility. They were grouped into three broad areas: OMEGA EP, 60-beam OMEGA, and general facility improvements and the accessibility and transparency of OMEGA operational information. LLE management uses these recommendations as a guide for making decisions about Omega Laser Facility operations, priorities, and future changes. In addition, the status of these OLUG **Findings and Recommendations** was updated and reviewed at a satellite evening meeting during the fall American Physical Society's Division of Plasma Physics Conference (New Orleans, 27 October 2014). They will also form the grist for the forthcoming workshop.

One highlight of the workshop, as in past workshops, was the panel of students and postdocs who discussed their experiences at the Omega Laser Facility along with their thoughts and recommendations on facility improvements. Engaging discussions sparked by this forum resulted in the student/postdoctoral recommendations for the facility.

A new and very well attended event was the Wednesday evening session, sponsored by the students and postdocs. The event featured the University of Chicago's Petros Tzeferacos, who gave a tutorial on the radiation–hydrodynamics code *FLASH* that is used widely in the HED community.

For the second time, three posters were presented by LLE's Summer High-School Research Program students. Participants found their work impressive!

Finally, one of the important decisions made at the workshop was the selection of 22–24 April 2015 as the date of the next workshop. Planning for this event has already begun.

Several of the **Findings and Recommendations** of past workshops were either completed or are well underway. Some of the most-recent accomplishments include an enhanced tritium fill capability; an update of the OMEGA Users Guide; establishing a support group from whom the users can get technical help and assistance contact (Chuck Source and team); development of low-energy neutron spectroscopy; initiation of high-resolution x-ray imaging; the Wednesday evening Student/Postdoc Tutorial session; full implementation of the super gas Cherenkov detector (GCD-3) gamma-ray spectrometer; implementation of compact 14.1-MeV neutron spectrometers; and initiation of the Phase I differential nuclear burn diagnostic for D_2, D^3He, and T^3He.

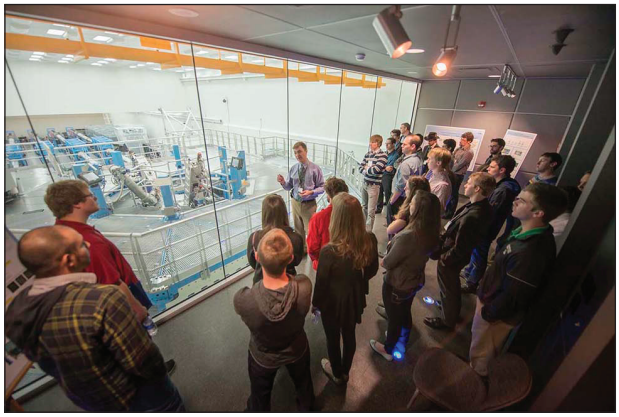
The photographs on the following pages provide a representative sampling of the workshop's talks, interactions, and ambience.

U1739JR

Figure 140.32
A total of 63 students and postdoctoral fellows attended and nearly all made poster presentations. An NNSA grant provided travel assistance for 53 of these attendees. The workshop emphasizes the participation and involvement of young researchers.

U1740JR

Figure 140.33
The Wednesday morning registration brought in researchers from around the world; MIT students welcome and registered the arrivals.



U1742JR

Figure 140.35
Tours of the OMEGA and OMEGA EP Laser Systems help researchers understand the complexity of the facilities and get a first-hand taste of the knowledge required to implement a successful campaign.

U1741JR

Figure 140.34
A total of 93 posters were presented in three different poster sessions, engendering lively discussions and often new insights. Students and postdocs, many of whom traveled to the workshop through the support of the NNSA travel grant, presented 63 of the posters.

U1743JR

Figure 140.36
The student and postdoc sessions/town meetings are wonderful forums for young researchers to talk about their current research, as well as to delve into issues that particularly concern them in the course of implementing an OMEGA campaign.

U1744JR

Figure 140.37
The spirited Findings and Recommendation sessions are central to the mission of the workshop for formulating and discussing ways, both technologically and through greater information transparency, to improve the facility and keep it at the forefront of high-energy-density research.

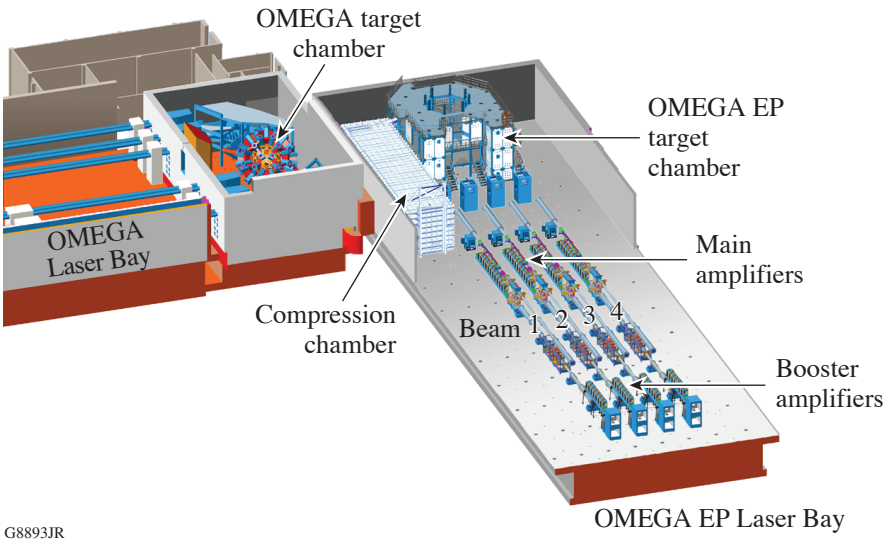


Figure 140.38
One of the important and challenging Findings and Recommendations, first discussed by General Atomic's Mingsheng Wei, is the redirection of OMEGA EP Beam 4 so that it opposes Beam 3.

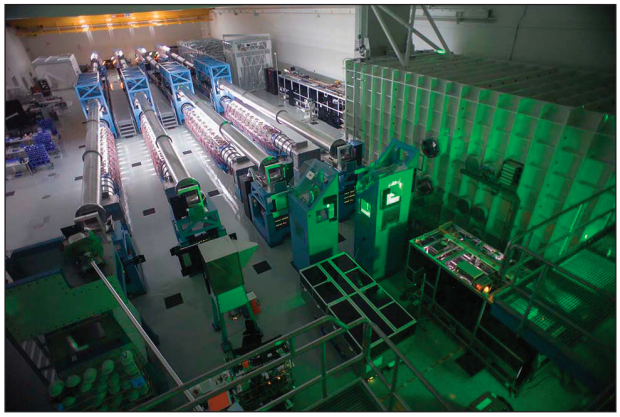


Figure 140.39
Beam 4 is the left-most beam in the OMEGA EP Bay, as seen from the target chamber.

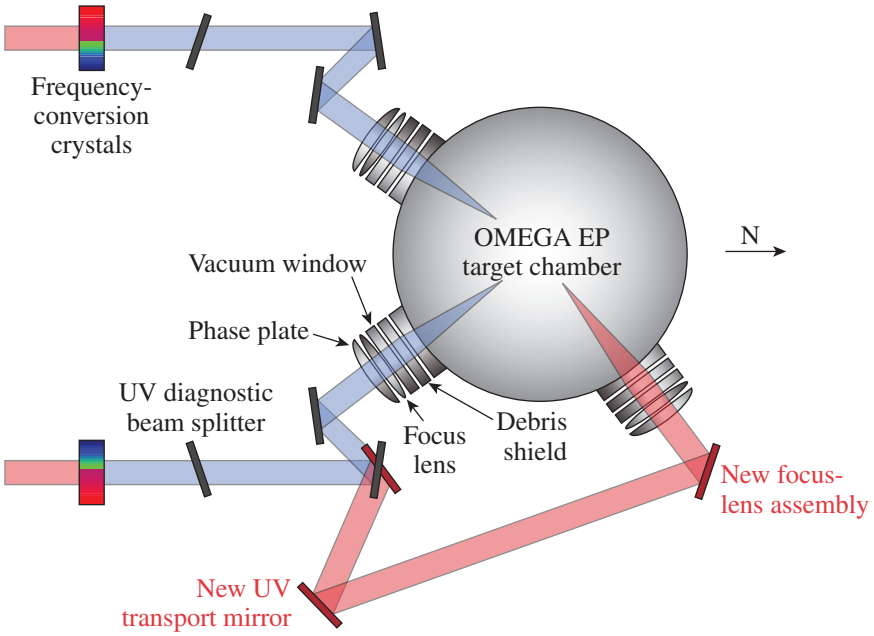


Figure 140.40
The cost and time to implement the "opposing beam" Findings and Recommendations is about $1.5 million and would take about 18 months to implement. Importantly, it would have a very minimum impact on facility use. The enabling high-energy-density laboratory physics science would be transformative; examples of this were presented by Mingsheng Wei, Patrick Harrtigan, Raymond Jeanloz, Chikang Li, Gianlucca Grigori, Michel Koenig, and Channing Huntington among others. The opposing-beam concept and white paper were presented to the Fusion Energy Sciences Advisory Committee on 4 June 2014.

Principal Findings and Recommendations of 2014 Workshop

OMEGA EP:

1. Thomson scattering on OMEGA EP with 4ω probe laser
2. Continuation of work for OMEGA EP to full specifications
3. Investigation of ~100-ns pulses on OMEGA EP
4. Opposing beams on OMEGA
5. Pulse-shaping capability of 1 ps to 10 ps on OMEGA EP
6. 4ω interferometry on OMEGA EP
7. Four phase plates similar to the IDI-300 for smoother, higher-intensity spots on OMEGA EP
8. Scoping of beam splitter on OMEGA EP for short-pulse mode
9. Developing guidance for OMEGA EP debris shield use

OMEGA Centric and Overarching Considerations:

1. A 61st beam for Thomson scattering OMEGA
2. Independent operations of the three legs of OMEGA
3. Improvements of streaked optical pyrometer/active shock breakout on OMEGA
4. *In-situ* gas-fill capability on OMEGA and OMEGA EP
5. Large phase plates for OMEGA (2 mm or larger, nominally ten in number)
6. Installation of hardware to enable the absolute timing of OMEGA neutron time-of-flight detectors
7. New and updated National Laser Users' Facility Guide
8. Theory/simulations and diagnostics to explore multifluid/kinetic effects
9. Reduction of D_2 contamination in ^{3}He to of the order of 1×10^{-6}

ACKNOWLEDGMENT

OLUG gratefully acknowledges the financial assistance of NNSA for travel support of students and postdocs to OLUG Workshop 2014; to the Fusion Science Center, to OFES, to MIT, and especially to LLE and Dr. Robert L. McCrory, Laboratory Director, for sustained support of myriad aspects of the Workshop and activities, including implementation of many of the User Findings and Recommendations. Thank you!

U1746JR

Figure 140.41
The Workshop banquet at the Meliora offers a wonderful time for old and new friends to mingle in a congenial ambiance.