# The 12th Omega Laser Facility Users Group Workshop

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The 12th Omega Laser Facility Users Group (OLUG) Workshop was held virtually 27–30 April 2021. Over 200 researchers from 40 institutions in the U.S., China, France, Germany, Italy, Japan, Russia, and the UK registered for the meeting. This all-time attendance record for the OLUG Workshop was due to the absence of the on-site space limitations at LLE. The main goal of every OLUG Workshop is to facilitate a continuing dialog among OMEGA users; between the Users and LLE management; and between the Users and the broader scientific community. A major part of OLUG's responsibility is to also enhance the Omega Facility and its capabilities by defining a set of Findings and Recommendations (F&R's) each year. In addition, the workshop offers opportunities for students and young researchers to present their research in an interactive, yet informal, setting. This OLUG Workshop program included talks, posters, students and postdoc sessions, and a discussion of F&R's. In total, OLUG collectively submitted 29 F&R's to LLE management. The 13th OLUG Workshop will be held at LLE on 27–29 April 2022.

### Introduction

The impact of the Omega Laser Facility on the fields of high-energy-density physics and inertial confinement fusion (ICF) is substantial in terms of both breadth and depth. Omega offers tremendous opportunities for programmatic and basic-science research through NNSA's National Laser User Facility (NLUF) and Laboratory Basic Science (LBS) programs. These programs play central roles in providing researchers with unique opportunities to conduct science in the areas of laboratory astrophysics, hydrodynamics and atomic physics, hydrodynamic instabilities and radiation hydrodynamics, materials physics and behavior of the equation-of-state under extreme conditions, relativistic laser–plasma interactions and magnetized plasmas, advanced/alternative inertial fusion concepts, nuclear physics, atomic physics and spectroscopy, and advanced diagnostics capabilities. Additionally, these programs play an important role in the student and postdoc training. The annual OLUG Workshop brings users together from all over the world, facilitating a vibrant dialog among them about their experiences running experiments through the NLUF and LBS Programs at the Omega Laser Facility. It also facilities a dialog between users and the LLE management focused on enhancing the Omega Facility and its capabilities, resulting in a set of well-defined F&R's each year, thus encouraging collaborations that could be undertaken.

### **The Workshop Program**

The OLUG Program included the following invited science talks: "JASRI Experimental Platforms Using High-Power Optical Lasers at X-Ray Free Electron" (Toshinori Yabuuchi), "Overview of 2020 Royal Society Meeting to Update the EU/UK Roadmap for Inertial Fusion Energy" (Peter Norreys), "Findings from the Brightest Light Initiative Workshop" (Roger Falcone), "NNSA Internal 2020 Review of the Different ICF Approaches and Where We Are on the Road to Ignition" (Sean Regan), "Where's the Fusion? Overcoming Unexpected Challenges and the Road to Solutions for Ignition and Beyond" (Sean Finnegan), "Exploring Stellar Nucleosynthesis and Basic Nuclear Science Using High-Energy-Density Plasmas at OMEGA and the NIF" (Maria Gatu



Figure 1 A photo (computer screen shot) of some of the 2021 OLUG Workshop participants.

Johnson), and "Microphysics of Ultra-Dense Solids Common to Giant Planet Interiors and Macrophysics of Hot Plasmas Typical of Stellar Interiors" (Gilbert Collins). In addition, Ann Satsangi, Kramer Akli, and Slava Lukin presented National Nuclear Security Administration's, Office of Fusion Energy Sciences', and the National Science Foundation's perspectives on the role of the Omega Facility and Users in their programs. Other highlights included the talk "Commissioned MTW-OPAL Laser and Proposed 2 × 25 PW EP-OPAL Laser" by Jake Bromage (LLE); the facility talk "Omega Facility Update and Progress on OLUG Recommendations" by Sam Morse (LLE); and an update on NLUF/LBS/LaserNetUS activities by Mingsheng Wei (LLE). A student/postdoc panel discussion was led by Suzanne Ali (LLNL). A discussion of OLUG's Findings and Recommendations with LLE management was led by Liz Merritt (LANL) and Mario Manuel (GA). A roundtable discussion on "Careers in HED Science" was led by Suzanne Ali (LLNL). Student, postdoc, scientist, and facility posters totaling 50 poster presentations were organized in three poster sessions. Out of these posters, 37 of them were presented by graduate students, postdocs, and undergraduate students.

### **Nominations and Election**

An election was held in 2020 but due to the COVID-19 pandemic, there was no election in 2021. A nominating committee was formed in November 2019 to request January nominations for the February 2020 election of four new OLUG Executive Committee (ExCom) members. Johan Frenje (Chair, MIT), Will Fox (PPPL), and Paul Keiter (LANL) formed the election committee. From a four-candidate ballot, Maria-Pia Valdivia (Johns Hopkins University) and Louise Willingale (University of Michigan) were elected as University representatives to replace Mark Koepke (West Virginia University) and Petros Tzeferacos (formerly University of Chicago); Alison Saunders (LLNL) was elected as national lab representative to replace Mario Manuel (GA); and Katerina Falk (HZDR, Dresden Rossendorf, Germany) was elected as the non-U.S. representative to replace Alexis Casner (CEA, France). For the May 2021–April 2022 period, the OLUG ExCom members are (a) four from U.S. university/small business: Johan Frenje (MIT, Chair), Maria-Pia Valdivia (Johns Hopkins, Vice Chair) Maria Gatu Johnson (MIT), and Louise Willingale (University of Michigan); (b) three from national laboratory/major business: Liz Merritt (LANL), Sean Finnegan (LANL), and Alison Saunders (LLNL); (c) one non-U.S. researcher: Katerina Falk (HZDR, Dresden Rossendorf, Germany); (d) one from the Junior Researcher list: Suzanne Ali (LLNL); and (e) LLE, ex-officio: Jim Knauer. The OLUG ExCom thanks Mark Koepke, Petros Tzeferacos, Mario Manuel, and Alexis Casner for their service and excellent work making OLUG such a vibrant community.

## **Summary of Findings and Recommendations**

An important outcome of the annual workshop is the list of F&R's that OLUG submits to the LLE management. The 2021 F&R's are summarized below, categorized as Documentation (#1–#5), Calibration (#6–#9), Diagnostics (#10–#22), Target Capability (#23), Laser Systems (#24–#28), and Codes (#29). An update on the implementation of these F&R's will be presented by the LLE management at the OLUG satellite meeting on 9 November 2021 at the APS–DPP conference in Pittsburgh.

- 1. Ensure that users have access to detailed and up-to-date documentation on diagnostics.
- 2. Improve navigation on the diagnostic usage page (add links to the shot days for easier navigation to RID's with diagnostic setups).
- 3. Make OMEGA EP UV optics transmission measurements readily available to Users.
- 4. Improve Dante maintenance and documentation.
- 5. Make calibration data readily available on the PI portal.
- 6. Characterize gas-jet nozzles.
- 7. Characterize standard proton source on OMEGA EP.
- 8. Calibrate CPS1, CPS2, and MagSPEC with a Ra-221 source.
- 9. Bragg crystal inventory and characterization for streaked x-ray spectrometer.
- 10. Add a timing fiducial to Dante.
- 11. Fix SIM streak camera A (SSCA) UV timing fiducial.
- 12. Add an active shock breakout diagnostic (ASBO)/streak optical pyrometer on OMEGA EP TIM-14.
- 13. Add an optical Thomson scattering (OTS) diagnostic to OMEGA EP.
- 14. Provide more streak camera options for time-resolved x-ray spectroscopy.
- 15. Upgrade detector-finger holders for CPS1 and CPS2.
- 16. Time-resolved x-ray history measurements in high-neutron-yield environments.
- 17. Add the capability to infer directional flow vector on D<sub>2</sub>-gas-filled or low-DT-yield implosions.
- 18. Add a third VISAR leg on ASBO on OMEGA EP and/or OMEGA.
- 19. Add photocathode options for PJX2 and PJX3.
- 20. Improve accuracy of SSCA data acquisition time.
- 21. Provide a new sector-magnet electron-positron-proton spectrometer for use in a wide-range of HEDS experiments on OMEGA/OMEGA EP.
- 22. Implement quick-look for CR-39-based proton radiography.
- 23. Add planar cryo on OMEGA EP.
- 24. Increase UV power on OMEGA EP.
- 25. OMEGA: Any beam, any delay (or at least a third leg).
- 26. Add opposing OMEGA EP beams.
- 27. Add smaller distributed phase plates on OMEGA EP.
- 28. Add smoothing by spectral dispersion on OMEGA EP.
- 29. Shared VisRad license.

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