

# The 13th Omega Laser Facility Users Group Hybrid Workshop

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## Overview

On 27–29 April 2022, 158 researchers from more than 40 universities and laboratories and 13 countries gathered at LLE for the 13th Omega Laser Facility Users Group (OLUG) Hybrid Workshop (Fig. 1). Of these researchers, 103 had registered to attend the workshop in person and 55 had registered to attend the workshop virtually. The main goal of the three-day workshop was to facilitate a continuing dialog among the Omega users, the users and LLE management, and the users and the broader scientific community along with providing an opportunity for students and postdoctoral fellows to present their research at LLE in an interactive and informal atmosphere. What makes the annual OLUG Workshop unique is that it brings users together from all over the world, facilitating a vibrant dialog among them about their experiences running experiments at Omega, as can be seen in photographs shown in this summary.



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Figure 1  
In-person attendees at the 13th  
OLUG Hybrid Workshop.

A major part of OLUg's responsibility is to enhance the Omega Laser Facility and its capabilities by defining a set of Findings and Recommendations (F&R's) each year. In this year's workshop, the F&R discussions were stimulating and lively. As shown at the end of this report, 25 F&R's were defined and grouped into several categories. LLE management use these F&R's as a guide for making decisions about the Omega Laser Facility operations, priorities, and future changes.

The workshop included five science talks given by leading world authorities that described the breadth and excitement of high-energy-density (HED) science undertaken at Omega and other facilities in U.S. Two facility talks about the future of Omega proved especially enlightening to the OLUg participants. The workshop attendees also had a chance to hear the National Nuclear Security Administration's (NNSA's) and National Science Foundation's (NSF's) perspectives on the research conducted at Omega and how it fits into their national programs. A summary of this year's OLUg Executive Committee (ExCom) election was also presented. Another workshop highlight was the evening tutorial session given by LLE, in which the gas-jet platform, the MIFEDS (magneto-inertial fusion electrical discharge system) experimental platform, and as the *PlasmaPy* and *Fiducia* open-source codes were presented.

A student/postdoctoral-panel discussion was held to focus on their experiences at Omega and present their thoughts and recommendations on facility improvements. Several discussions were sparked by this forum, which resulted in the student/postdoctoral report summarized at the end of this summary. Another important event was the discussion on careers in HED science, which brought students together with potential future employers.

A total of 51 students and postdoctoral fellows (Fig. 2), 36 of whom were supported by travel grants from NNSA, attended the workshop and presented three sessions of posters. The presentations involved a large range of topics including target fabrication, inertial confinement fusion (ICF) experiments and simulations, and laboratory astrophysics, all of which generated spirited discussions, probing questions, and many suggestions. An award ceremony for the best student and postdoc posters was also held.



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Figure 2  
A total of 51 students and postdoctoral fellows attended the workshop and made engaging poster presentations.

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### The Workshop Presentations

A wide-ranging series of presentations and posters were presented during the workshop. The invited presentations covered facility, government, and science. The science talks focused on several interesting topics, including high-energy-density plasmas, laboratory astrophysics, and burning plasmas in ICF. Two facility talks—“The Renewal of the Five-Year LLE Cooperative Agreement” by Acting LLE Director Dr. Chris Deeney and “The LLE Sustainment Plan” by Omega Laser Facility Division Director Mr. Samuel Morse—presented important details on the status, performance, and path forward of the Omega Laser Facility. Mr. Morse also gave an enlightening talk on the “OMEGA Facility Update and Progress on OLUG Recommendations.” Dr. Sarah Nelson, Acting Director of the NNSA Office of Experimental Sciences, presented an excellent perspective on the importance of the Omega facility within her program, and Dr. Slava Lukin, the Director for Plasma Physics at NSF, provided an informative overview of his program and the importance of training and educating the next-generation scientist in the area of plasma physics. In addition to the invited presentations, 63 contributed posters, presented in three sessions, covered a wide spectrum of work at Omega including target fabrication, ICF experiments, diagnostics, HED-plasma theory and simulations, laboratory astrophysics, material science, and laser–plasma interactions along with diversity, equity, and inclusion. Out of these posters, 51 were presented by graduate students, postdocs, and undergraduate students. These poster sessions offered ample opportunities for informal discussions about Omega experiments and their connections to work at other facilities. A set of four exciting facility talks were also given by LLE in an evening tutorial session. Figures 3–8 provide a representative sampling of the workshop’s presentations and ambience.



Figure 3

In the plenary sessions, authorities spoke about science opportunities, government perspectives, and the evolving capabilities of the Omega Laser Facility to enable new science frontiers. (a) Dr. Chris Deeney, the Acting LLE Director, kicked off the workshop with a perspective on the renewal of the five-year LLE Cooperative Agreement; (b) Prof. Petros Tzeferacos of the University of Rochester (UR) gave an inspiring presentation on the Flash Center for Computational Science at the UR, and (c) Dr. Sarah Nelson, the Acting Director of the NNSA Office of Experimental Sciences, provided a bigger-picture perspective on the importance of the Omega Laser Facility within her program.

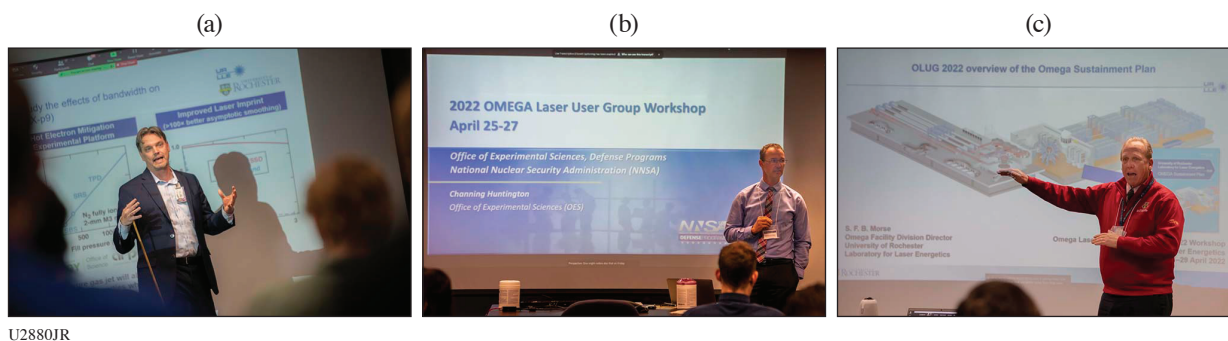
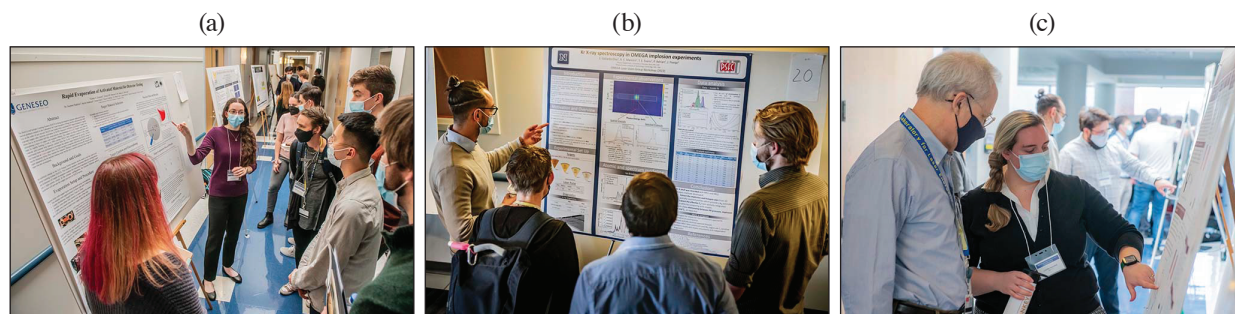


Figure 4

(a) UR Prof. Dustin Froula gave an exciting talk on the science that can be done on the Fourth-Generation Laser for Ultra-broadband eXperiments (FLUX); (b) Dr. Channing Huntington provided a wonderful personal account on his journey from a graduate student at University of Michigan (UM), conducting experiments at Omega, to working at the NNSA Office of Experimental Sciences; and (c) Samuel Morse (LLE) discussed the Omega sustainment plan, which is critical to the future of the laboratory and to the OLUG community. Mr. Morse’s extensive knowledge of the facility is invaluable to those planning Omega experiments.



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Figure 5

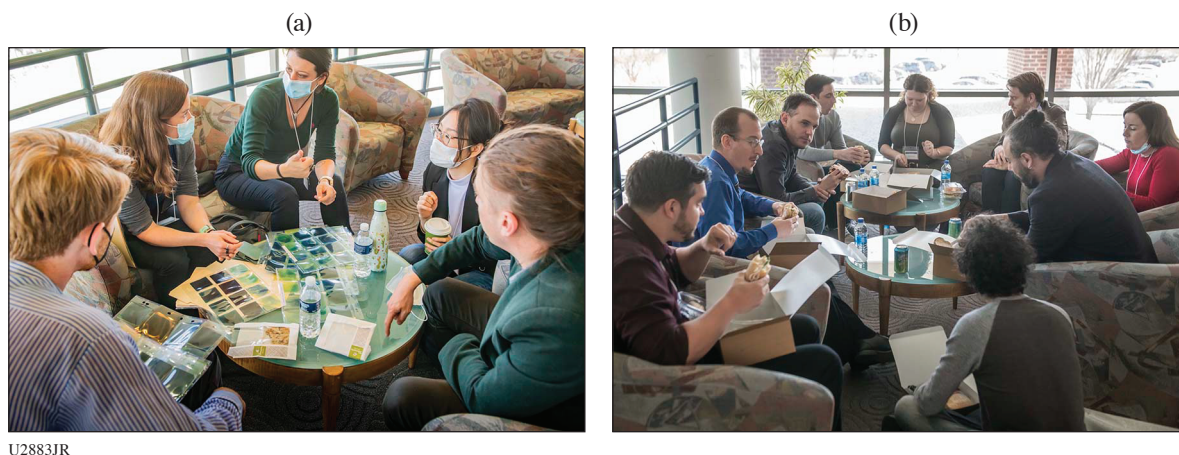
Sixty-three posters were presented in three sessions on a wide spectrum of work at Omega. Out of these posters, 51 were presented by graduate students, postdocs, and undergraduate students. In an interactive yet informal setting, these poster sessions provided opportunities for students and young researchers to present their research from Omega experiments and their connections to work at other facilities. (a) Undergraduate students Vizma Leimanis and Jessica Dawson [State University of New York (SUNY) Geneseo] discussed their work on “Rapid Evaporation of Activated Material for Detector Testing” with OLUG ExCom member Dr. Maria Gatu Johnson (MIT) and other students; (b) graduate student Enac Gallardo-Villaseca (University of Nevada, Reno) presented his work on “Krypton X-Ray Spectroscopy in OMEGA Implosion Experiments;” and (c) graduate student Camille Samulski (Virginia Tech) discusses her poster with LLE Senior Scientist Dr. Reuben Epstein on “Single-Feature Perturbation Seeded Rayleigh–Taylor Instability Studied in Planar Geometry.”



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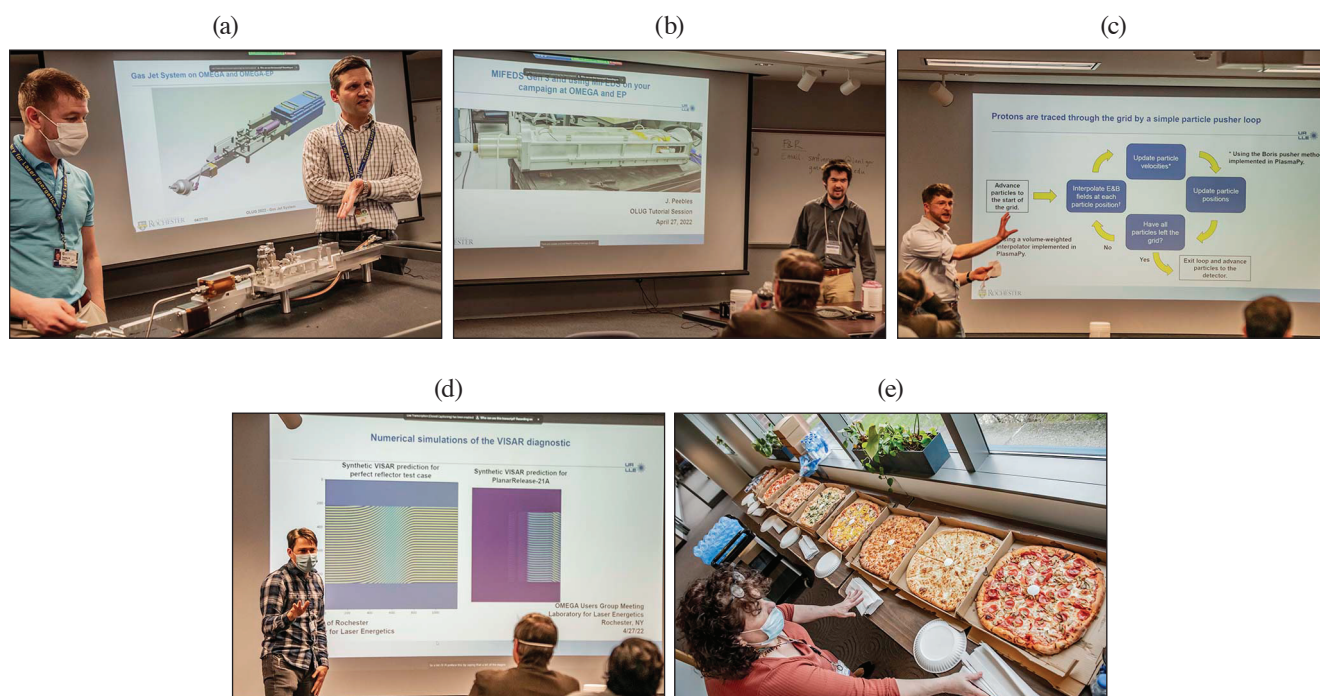
Figure 6

An award ceremony chaired by Drs. Liz Merritt and Jim Knauer was held for the best student and postdoctoral posters. (a) Graeme Sutcliffe (MIT) won the graduate student category; (b) Shu Zhang (Princeton) won the postdoctoral category. (c) Dr. Liz Merritt, Cameron Frank (graduate student at the University of Delaware), Michael Wadas [graduate student at UM (University of Michigan)], Abigail Armstrong (graduate student at UR), Skylar Dannhoff (graduate student at MIT), Graeme Sutcliffe (graduate student at MIT), Shu Zhang (postdoc at Princeton), Neel Kabadi (postdoc at MIT), and Dr. Jim Knauer. Not shown in the picture are Justin Kunimune (graduate student at MIT), Adam Brown (Houghton College) who won the undergraduate student category, and Jovahn Roumell (undergraduate student at SUNY Geneseo).



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Figure 7  
Productive discussions among researchers from around the world occurred in several informal settings.



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Figure 8  
An evening tutorial session given by LLE highly regarded by the OLUg workshop participants. (a) Dr. Steven Ivancic and Tim Filkins discussed the “Gas-Jet System on OMEGA and OMEGA EP,” which helped the external users get a better idea of what can be done with the system; (b) Dr. Jonathan Peebles gave an informative presentation on the “MIFEDS Generation-3 and Using It on Users’ Experimental Campaign on OMEGA and OMEGA EP;” (c) Dr. Peter Heuer gave an inspiring talk on the “*PlasmaPy* Open-Source Code;” which truly engaged the younger audience; (d) Dr. Daniel Barnak presented “*Fiducia* Open-Source Code and Analysis Software for the Dante-Diagnostic Data;” and (e) Mrs. Kim Truebger arranged for pizza to be served during the evening’s tutorial session.



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Figure 9

The student/postdoctoral panel presented important insights from young researchers working at the Omega facility. (a) Suzanne Ali (LLNL), not shown, Heath LeFevre (UM), Ellie Tubman (LLNL), Gabriel Perez-Callejo (University of Valladolid, Spain), and Brandon Russel (UM) led the discussion. (b) Graduate student Hongmei Tang (UM) brought her thoughts and recommendations.



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Figure 10

Mark Labuzeta and David Canning led tours of OMEGA and OMEGA EP, respectively. For many of the younger researchers, this was a great opportunity to learn about the facilities.

### Summary of Findings and Recommendations

A big part of OLUG's responsibility is to enhance the Omega facility and its capabilities by defining a set of F&R's each year. Drs. Maria Gatu Johnson (MIT) and Sean Finnegan [Los Alamos National Laboratory (LANL)] led this year's F&R session. As shown below, 25 F&R's were defined and grouped into several categories at this workshop, i.e., general (1), documentation (2), calibration (3), diagnostics (4–15), target capability (16–18), laser systems (19–22), and data management (23–25). The LLE management is using these F&R's as a guide for making decisions about the operations of the Omega Laser Facility, priorities, and future changes. An update on the implementation of these F&R's will be presented by the LLE management at the OLUG satellite meeting on 18 October 2022 at the American Physical Society Division of Plasma Physics (APS-DPP) Conference in Spokane, WA.

1. Add equipment for improved hybrid workshop execution.
2. Ensure that users have access to detailed up-to-date documentation on diagnostics.
3. Make calibration data readily available on the PI portal.

4. Add a third VISAR (velocity interferometer system for any reflector) leg on the active shock breakout (ASBO) diagnostic on OMEGA EP and/or OMEGA.
5. Increase VISAR etalon support thickness for improved ASBO resolution.
6. Add a timing fiducial to Dante, noted in the Sustainment Plan (requires modern digitizers).
7. Add an optical Thomson-scattering diagnostic to OMEGA EP (multiple submissions).
8. Add the capability to infer directional flow vector on D<sub>2</sub> gas-filled or low-DT yield implosions.
9. Add the capability for neutron time-of-flight detectors to measure secondary DT-neutron spectra.
10. Reduce min/max camera timing jitter.
11. Improve Dante maintenance and documentation.
12. Create the ability to run streaked x-ray diagnostics with a gas jet.
13. Add gated spatially resolved x-ray spectroscopy.
14. Provide an additional Target Positioning System, more (mini) ten-inch manipulators (TIM's) and/or nuclear diagnostic inserters for OMEGA.
15. Add a diagnostic for forward-scattered light on OMEGA EP.
16. Characterize gas-jet nozzles (a TIM lab nozzle characterization test bench is now available to users).
17. Provide planar cryo on OMEGA EP.
18. Enable the ability to change MIFEDS leads on shot day
19. Increase UV power on OMEGA EP.
20. Enable 20-ns pulse duration on OMEGA EP.
21. Increase the quantity of tight-focus circular super-Gaussian distributed phase plates.
22. Extend backlighter beam delay.
23. Update HDF5 and utilize standard meta-data formats (multiple submissions).
24. Enable instant analysis of data on shot day.
25. Develop more open-source analysis software.

### Findings and Recommendations from the Student/Postdoctoral Panel

Every year at the OLUG Workshop, a group of early career scientists, mainly students and postdocs, lead a discussion with the community on topics relevant to young researchers, including issues specific to the pandemic effects on early career scientists, the organization of the OLUG Workshop, and recommendations for the facility. Suzanne Ali [Lawrence Livermore National Laboratory (LLNL)] and Heath LeFevre (UM) led the discussion together with Ellie Tubman (LLNL), Gabriel Perez-Callejo (University of Valladolid, Spain), and Brandon Russel (UM). From these discussions, the following F&R were identified:

1. Develop a better framework for mentorship and guidance for early career scientists.
2. Facilitate cross-institution mentorship, matching up new researchers doing work at Omega with more-experienced mentors.
3. Form something like a journal club for topics related to experimental planning and analysis (monthly or biweekly, with a pre-meeting poll on the discussion topic).
4. Improve and modernize the web-based resources available to users.
5. Continue to improve documentation for diagnostic systems and targets.
6. Better advertise the existing online forum. A Microsoft Teams channel (or similar) is recommended specifically for users to ask questions to other users.
7. Record tutorials for some of the online resources for data access.
8. Enable access to calibration information for diagnostics via an online database.

### Nominations and Election of Members for the OLUG ExCom

An OLUG ExCom election was held this year to elect three new members. A nominating committee was formed in November 2021 to request January nominations for the February 2022 election. Pia Valdivia [Chair, University of California, San Diego (UCSD)], Hui Chen (LLNL), and Lan Gao (Princeton Plasma Physics Laboratory) formed the election committee. From a three-candidate ballot, Derek Schaeffer (Princeton) was elected as university representative to replace Maria Gatu Johnson (MIT); Verena Geppert-Kleinrath (LANL) was elected as national lab representative to replace Liz Merritt (LANL); and Heath LeFevre

(UM) was elected as the junior representative to replace Suzanne Ali (LLNL). In addition, Jim Knauer stepped down as the LLE ex-officio after 13 years of service. Jessica Shaw is the new LLE ex-officio.

For the May 2022–April 2023 period, the OLUG ExCom members are (a) four from U.S. university/small business: Johan Frenje (MIT, Chair), Maria-Pia Valdivia (UCSD, Vice Chair), Derek Schaeffer (Princeton), and Louise Willingale (UM); (b) three from national laboratory/major business: Verena Geppert-Kleinrath (LANL), Sean Finnegan (LANL), and Alison Saunders (LLNL); (c) one non-U.S. researcher: Katerina Falk [Helmholtz-Zentrum Dresden-Rossendorf (HZDM), Germany]; (d) one from the junior researcher list: Heath LeFevre (UM); and (e) LLE ex-officio: Jessica Shaw. The OLUG ExCom thanks Maria Gatu Johnson, Liz Merritt, Suzanne Ali, and Jim Knauer for their service and excellent work making OLUG such a vibrant community.



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Figure 11  
Dr. Pia Valdivia (UCSD) presented the results from the 2022 OLUG ExCom elections.



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Figure 12  
Members of the 2022 OLUG ExCom. (a) Back row (left to right): Jim Knauer (LLE), Liz Merritt (LANL), Katerina Falk (HZDR), Sean Finnegan (LANL), and Pia Valdivia (UCSD). Front row (left to right): Johan Frenje (MIT) and Maria Gatu Johnson (MIT); (b) Alison Saunders (LLNL); (c) Louise Willingale (UM); and (d) Suzanne Ali (LLNL) attended the workshop virtually.



**Conclusions and Future Workshops**

This OLUG Workshop, with 158 attendees, was part of a process that will keep members of the community involved in conversations and collaborations with each other and with the Omega Laser Facility. In addition, OLUG ExCom members and LLE management have an ongoing dialog to assess progress, compatibility with facility resources, and impact toward the implementation of the F&R's. An update on the implementation of these F&R's will be presented by the LLE management at the OLUG satellite meeting on 18 October 2022 at the APS-DPP Conference in Spokane, WA, and in depth at the 2023 OLUG Workshop.

**Acknowledgment**

This OLUG workshop was made possible in part by LLE at the University of Rochester for the use and availability of critical resources and support. In addition, OLUG thanks the LLE management for their exceptional responsiveness to our F&R's. For capturing the ambience and spirit of the workshop through his camera lens, we thank Eugene Kowaluk. To NNSA, we gratefully acknowledge the financial assistance for student/postdoctoral travel expenses. We also thank Kim Truebger for her incredible work setting up and executing the workshop.