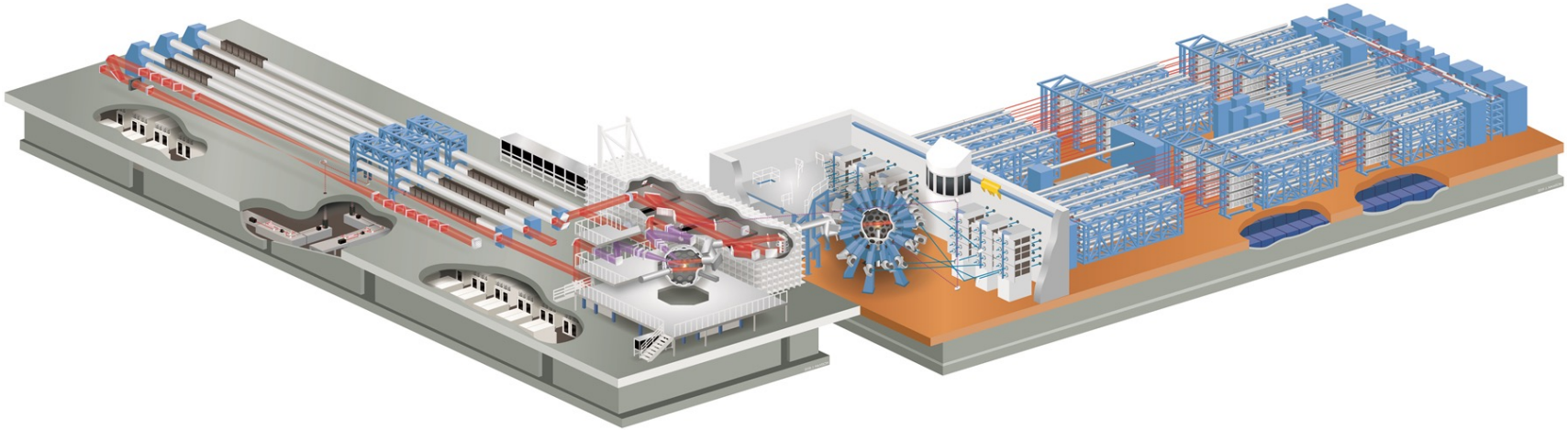
Omega User Programs Update and Perspective on FY22 OLUG Findings and Recommendations Status



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OLUG @ APS–DPP
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Summary

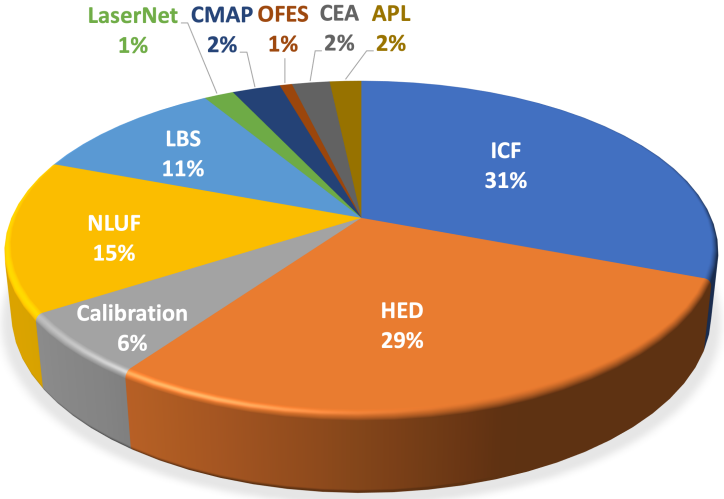
OLUG APS-DPP update – LLE values the Users' F&Rs and strives to address them

- Omega Facility delivered 2110 shots in FY22
- Progress continues on prior year OLUG Findings and Recommendations (F&Rs)
- LLE has developed a sustainment plan to extend Omega into the 2030's as part of the next Cooperative Agreement
- Plans are in place to address many of the 2022 F&Rs
- An LLE building expansion is under construction

Omega Facility delivered 2110 shots in FY22 – 27% for the Basic Science User Programs

- **Basic Science open-access users (NLUF, LBS and LaserNetUS) obtained a total of 572 target shots**
- **27 NLUF projects in FY22–23 led by 25 PIs from 15 different institutions**
  - **>50% led by early career scientists**
- **21 LBS projects in FY22 led by scientists from LLNL, LLE, PPPL and SLAC**
  - 19 LBS projects in FY23
- **3 LaserNetUS projects on OMEGA EP in FY22**
  - 5 new projects from Cycle-4 have shots scheduled in FY23

FY22 Omega Laser Facility Shots



68 graduate students from LLE external user institutions conducted research using Omega Facility during FY22.

The Diagnostic Development and Integration Group Supports many diagnostic projects

- **Omega continues to be a hub of diagnostic innovation**
- **The DD&I group leads integration projects (S. Ivancic, siva@lle.Rochester.edu)**
- **LLE is committed to a number of new and/or modified diagnostics for FY23 shots**

Ten additional diagnostic capabilities qualified in FY22

Diagnostic Name	Lead Lab	Diagnostic description
DACXRD	LLE	Enabling powder x-ray diffraction from precompressed diamond-anvil cell samples
Scattered Light Diode	LLNL	Measures scattered light during magnetized LPI experiments on OMEGA EP
Infrared Transmitted Beam (IR-TBD)	LLE	Platform enabling the study time-dependent LPI phenomena on OMEGA
MIFEDS	LLE	Requalification to address safety issue
CEA miniDMX-2000	CEA	Soft x-ray power and spectrum
Spherical Crystal Imager (SCI)- Schlieren	LLE	Modification to allow Schlieren imaging with the existing SCI platform for OMEGA and EP
SXS-XRFC “Gated SXS”	LLE	Permits gated x-ray spectra to be captured using the soft x-ray spectrometer with an framing camera
TRXRDIP	LLE	Time-resolved X-ray diffraction diagnostic with an x-ray framing camera
EP-TXD4	JHU	Talbot-Lau Deflectometry diagnostic
Neutron Activation Pack Array (NAPA)	LLNL	Modifies the Near Target Arm to accept nuclear activation samples

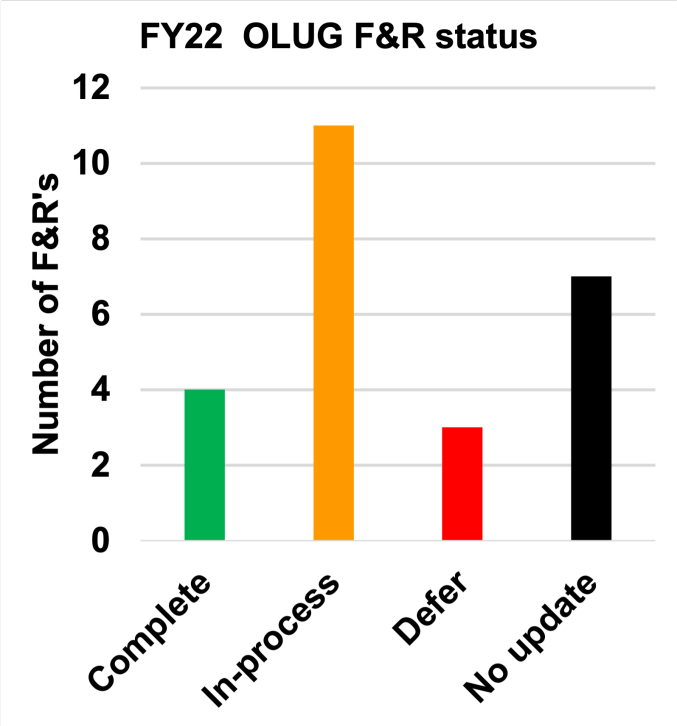
The OMEGA Sustainment plan includes a surge of activities

- **The plan boosts sustainment over the period of the next Cooperative Agreement (CA), FY24-28**
- **Laser, diagnostic, and target sustainment activities beyond periodic preventive maintenance are required to replace equipment and controls that are no longer supported**
- **Additionally, many systems need to take advantage of modern technology to ensure that the lasers operate with high efficiency, effectiveness, and availability into the mid 2030's**

It is anticipated that during the sustainment activities maintenance days will be required and the total number of available shot days will be reduced by up to 15% of the nominal allocation to accommodate this work.

Plans are in place to address many of the 25 2022 OLUG F&Rs

1. **Equipment for improved hybrid workshop execution**
   – Coliseum has added a camera for video conferencing
2. **Ensure that users have access to detailed, and up to date documentation on diagnostics**
3. **Make calibration data readily available on PI portal**
   – A process reviewing and updating documentations and calibration data for all available diagnostics has begun, expecting most of the work will be done in the next six months.
4. **3rd VISAR leg on ASBO at EP and/or OMEGA**
5. **Thicker VISAR etalon support for improved ASBO resolution**
   – ASBO upgrades remain of top priority. New lasers for ASBO have been approved to be ordered in FY23 which will improve the system reliability going forward
   – ASBO/SOP on EP in TIM-14 (2021 F&R) is planned for FY23



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6. **Add a timing fiducial to Dante, noted in Sustainment plan (requires modern digitizers)** – Four new four-channel digital oscilloscopes purchased in FY22 (thank you, LLNL!); the new system including a timing fiducial channel intended to be available in Q3FY23 (ahead of the Sustainment schedule).

7. **Add OTS Diagnostic to EP (Multiple Submissions)**

8. **Capability to infer directional flow vector on D2-gas-filled or low DT yield implosions**

9. **Request for capability for nTOF detectors to measure secondary DT-neutron spectra**

10. **Reduce min/max camera timing jitter**

    – A comprehensive timing test was developed and implemented for particularly timing sensitive experiments for the requester to ensure that the triggering system maintains a 50 ps RMS trigger jitter. The system performed to expectations.

    – Precision timing system project has been deferred in FY23

11. **Dante maintenance and documentation improvements** – see LLE response to #6.

Plans are in place to address many of the 2022 OLUG F&Rs

12. **Ability to Run Streaked X-ray Diagnostics with Gas Jet –** Use of x-ray framing and streak cameras with the gas jet is still disallowed in most cases. Stay tuned for more updates at OLUG 2023

13. **Gated SXS: gated spatially-resolved x-ray spectroscopy –** Gated SXS is a qualified diagnostic for OMEGA EP and has been used on several campaigns

14. **Additional TPS, more (mini) TIMs and/or NDIs for OMEGA –** TPS on H5 is planned for FY23

15. **Characterization of Gas Jet Nozzles –** Gas jet characterization is available on DTIM. We are working on a book of performance curves for standard nozzle designs.

16. **Planar Cryo on EP**

17. **Ability to Change MIFEDS Leads on Shot Day**

18. **Increased UV power on EP**

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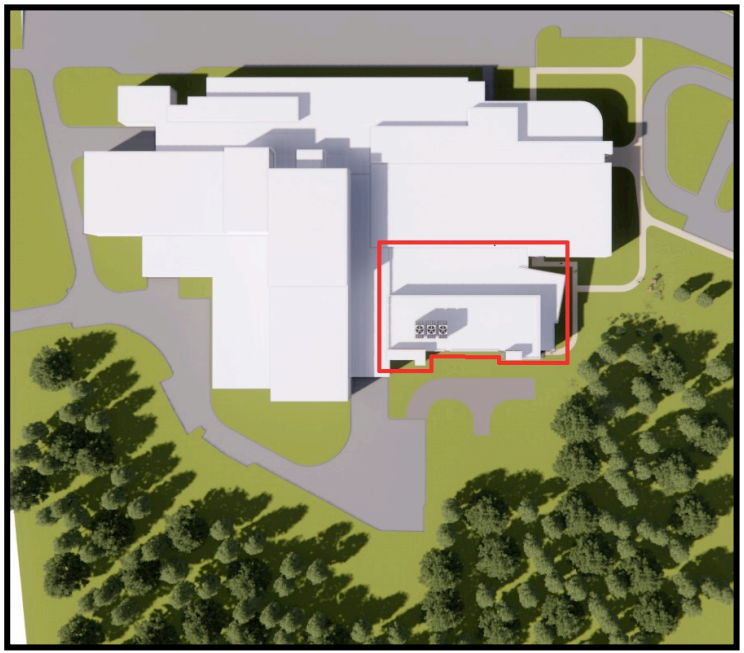
19. **20 ns pulse duration at EP** – Long development, glass regen in process in FY23
20. **Increase the quantity of tight focus circular Super-Gaussian DPPs**
21. **Extended Backlighter Beam Delay** – FY23 project (on track)
22. **Update to HDF5 and Utilize Standard Meta-Data Formats (Multiple Submissions)**

    –HDF5 support is ongoing, newer diagnostics are being introduced with HDF5. There is no plan at this time to convert everything to HDF5 in the facility
23. **Enable instant analysis of data on shot day**
24. **Develop more open-source analysis software** – Several new developments since the 2022 OLUG annual meeting (see next slide)
25. **Diagnostic for forward scattered light at OMEGA-EP –** Scattered light uniformity imager (SLUI) has been qualified for use on OMEGA EP (TIM-14) and will have it's first use this Thursday.

Open-source analysis software and other tools by LLE scientists since the 2022 OLUG meeting

- **Open-source analysis tools by P. Heuer**
  - Basic Thomson scattering fitting in PlasmaPy: https://docs.plasmapy.org/en/latest/ad/diagnostics/thomson.html#module-plasmapy.diagnostics.thomson
  - A tool for calculating particle deposition for RCF stacks (will be included in PlasmaPy within the next month): https://github.com/PlasmaPy/PlasmaPy/pull/1274
  - A Python toolkit for analyzing CR39 scans (.cpsa files): https://github.com/pheuer/CR39py
  - A (very preliminary) tool for analysis of AFR images from the 4w probe: https://github.com/pheuer/openAFR
- **Copies of four algorithms for direct inversion of proton radiographs or shadowgrahs by J. Davies**
  - https://zenodo.org/record/6638929#.Y0gi0nbMJaQ
  - https://zenodo.org/record/6638911#.Y0giMHbMJaQ
  - https://zenodo.org/record/6808105#.Y0giNXbMJaQ
  - https://zenodo.org/record/6808090#.Y0giOXbMJaQ
  - versions of two of these algorithms in Python: https://github.com/pheuer/InvertDeflectPy
- **V. Gopalaswamy and P. Heuer are working on upgrades to the lotus python package, not quite "open-source" but would be a solid tool accessible to external users with LLE PI accounts to access and analyze Omega data**
  - there would also be a way for external PIs to contribute back to the project and expand its capability. s

LLE office and lab expansion – a 66,000 ft^2 addition



The University funds the $42 million addition

LLE office and lab expansion project

- **Construction is well underway**
  - **scheduled to be completed March 2024**
- **Omega has operated in parallel with construction projects in the past and LLE is working to minimize the impact**
  - Some shot days may be impacted by vibration, noise, and other disruptions, and users are advised to expect some availability delays.
  - Side labs have periods of high vibration. Users plan extra time and/or off-normal hours to conduct side-lab work and bring any accommodations needed to the attention of the facility managers.

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LLE plans to issue calls for proposals this year for FY24–25 NLUF and FY24 LBS programs. LLE will continue to participate in the LaserNetUS cycle-5 call (imminent).