

FY22 Laser Facility Report

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Under the facility governance plan, experimental time at the Omega Laser Facility is allocated to four NNSA-supported programs: Inertial Confinement Fusion (ICF), High-Energy Density (HED), National Laser Users' Facility (NLUF), and Laboratory Basic Science (LBS). FY22 will be the final year under these programs; beginning in FY23 the allocation will be determined by the combined HED Council per guidance from the NNSA Office of Experimental Science.

During FY22, the Omega Laser Facility conducted 1233 target shots on OMEGA and 889 target shots on OMEGA EP, with a total of 2122 target shots (see the shot summaries for OMEGA and OMEGA EP in Tables I and II, respectively). The ICF and HED Programs conducted 60% of the NNSA-supported facility shots in FY22. More than half of these experiments were conducted by scientists from Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), Sandia National Laboratories (SNL), and the Naval Research Laboratory (NRL). About 6% of the facility shots were used to maintain operational effectiveness. The NLUF and LBS programs described below conducted 15% of the NNSA target shots. The facility also delivered 199 shots (~9% of the total) for external users who purchased the shot time. Overall, externally led investigators used 59% of the facility time. (See Figs. 1 and 2 for the fractional use by the various programs, including shot time that was purchased by outside users for OMEGA and OMEGA EP, respectively).

OMEGA investigators rated the overall experimental effectiveness of the facility at 93.4%, while OMEGA EP was rated at 94.2%. OMEGA averaged 11 target shots per day, averaging 91.9% Availability. OMEGA EP averaged nine target shots per day, averaging 92.5% Availability.

During Q4, construction of the new laboratory and office space at LLE required additional effort to mitigate the effects of construction vibrations that will continue in FY23. The Shot Director was able to contact the construction manager to halt problematic vibrations for the final preparations and shot cycle. Construction can occasionally impact availability but has been effectively minimized by planning and procedure.

In FY22, the facility continued to evolve to meet the needs of the scientific community.

To achieve higher uniformity in the pulse power balance, LLE built a laser diagnostic to passively measure the transmission of each beamline. This diagnostic has helped to identify degraded optics and will be systematically employed in the future to decrease the effort required to balance beamline energetics.

The magneto-inertial fusion electrical discharge system (MIFEDS) was significantly redesigned to improve the high-voltage safety and increase reliability and efficiency of operations.

Table I: OMEGA Laser System target shot summary for FY22.

Program	Laboratory	Number of Campaigns	Planned Number of Target Shots	Actual Number of Target Shots
ICF	LLE	33.5	368.5	346
	LANL	3	33	35
	LLNL	4.5	49.5	46
	SNL	1.5	16.5	14
ICF Subtotal		42.5	467.5	441
HED	LLE	9	99	91
	LANL	9	99	106
	LLNL	12	132	117
	SNL	2	22	23
HED Subtotal		32	352	337
LBS	LLE	4	44	34
	LLNL	6.5	71.5	74
	PPPL	1	11	10
	SLAC	1	11	7
LBS Subtotal		12.5	137.5	125
NLUF		13.5	148.5	153
AIBS		2	22	17
CEA		3	33	35
APL		3	33	36
CMAP		1	11	8
OFES		1	11	14
Calibration		0	0	67
Grand Total		110.5	1215.5	1233

AIBS: Academic and Industrial Basic Science
 APL: Applied Physics Labs (Johns Hopkins University)
 CEA: Commissariat à l'énergie atomique aux énergies alternatives
 CMAP: Center for Matter at Atomic Pressures
 NLUF: National Laser Users Facility
 OFES: Office of Fusion Energy Sciences
 PPPL: Princeton Plasma Physics Laboratory

New diagnostics and upgrades to diagnostics in the LLE inventory continue to increase the breadth of measurements that can be achieved. Many of these projects are conceived and led by external laboratory researchers. Ten diagnostic upgrade projects were completed in FY22 including:

- Talbot–Lau x-ray deflectometer upgrade [led by Johns Hopkins University (JHU)]
- Applied Physics Lab fast accumulating radiometer diagnostic suite upgrades (led by JHU)
- gas Cherenkov detector modified with Ti puck (led by LANL)
- copper activation sampling (led by LLNL)
- scattered-light diode (led by LLNL)
- vacuum Cherenkov detector (led by LLNL)
- MiniDMX upgrade (data acquisition system and detector array) (led by CEA)

Table II: OMEGA EP Laser System target shot summary for FY22.

Program	Laboratory	Number of Campaigns	Planned Number of Target Shots	Actual Number of Target Shots
ICF	LLE	13	91	119
	LLNL	9	63	67
	NRL	2	14	17
	SNL	1	7	6
ICF Subtotal		25	175	209
HED	LLE	8	56	67
	LANL	6	42	53
	LLNL	18.5	129.5	157
	SNL	1	7	10
HED Subtotal		33.5	234.5	287
LBS		3.5	24.5	39
		4.5	31.5	54
		1	7	6
LBS Subtotal		9	63	99
NLUF		17.5	122.5	144
CEA		1	7	8
LaserNetUS		4	28	34
CMAP		5	35	47
Calibration	LLE	3	21	61
Grand Total		98	686	889

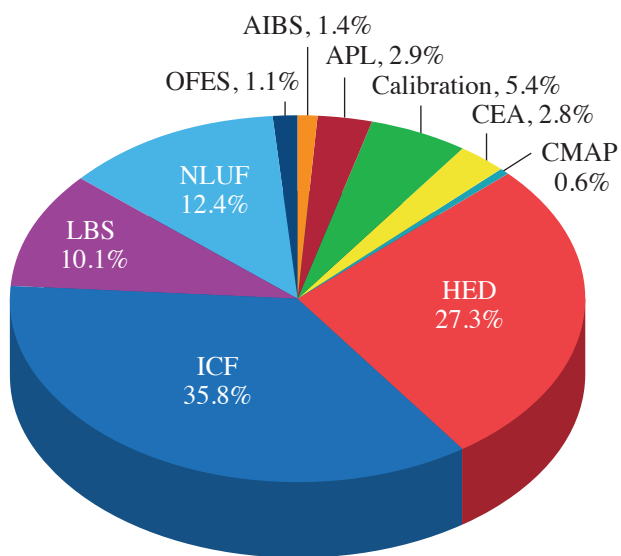
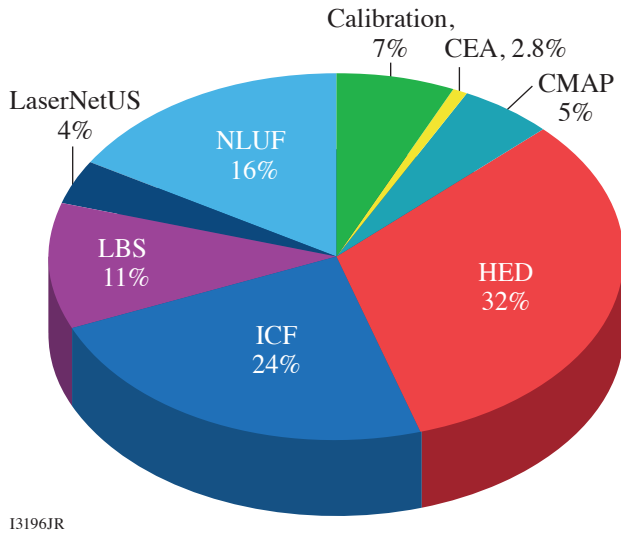


Figure 1
Fractional breakdown of FY22 shots on OMEGA by NNSA-supported programs.

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- transmission grating spectrometer image-plate modification (led by NRL)
- scattered-light uniformity instrument (led by LLE)
- THz background energy measurement diagnostic (led by LLE)



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Figure 2
Fractional breakdown of FY21 shots on OMEGA EP by NNSA-supported programs.