Access to experimental facilities worldwide for IFE-based research.

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Facilities located around the world

Lasers:

North America/Asia	Europe
Omega60/Omega EP, LLE	Luli2000, France
NIF, LLNL	PALS/Eli-Beamlines, Czech Republic
Aleph, Colorado	Orion, UK
Zeus, Michigan	CLF, UK
ShenGuang-II, China	LLC, Sweden
GeKKO, Japan	CLPU, Spain
LFEX, Japan	LMJ, France

Accelerators:

LCLS, Stanford, USA
EXFEL, DESY, Germany
ESRF, France
GSI, Germany
Eli-NP, Romania
Sacla, Japan

Pulsed-Power:

Z machine and Star 2SLGG, SNL, USA
First Light Fusion, UK

Large scale laser facilities have a variety of capabilities.

NIF

192 beams, 3ω
Variable 80 ps-30 ns lengths
Various energies (upto 4 kJ/beam)
ARC beam, 0.4-1.7 kJ in 1.3-38 ps

Omega-EP

4 beams
1ω:
500 J/ 0.7 ps
2.3 kJ/ 100 ps
3ω: 0.1-10 ns/ 5 kJ
5 TIMs
Optical probe

Omega-60

60 beams
3ω: 500 J /1 ns
6 TIMs

SG-II

8 beams
Total:
1ω: 40 kJ/ 3 ns or
3ω: 24 kJ/ 3 ns
PW SP capability

Laser MegaJoule + PETawatt Aquitaine Laser

22 beams, 3ω
0.7-25 ns
1.3 MJ max
+ PETAL SP 500 fs-10 ps/ few kJ

Orion

10 LP, 2 SP
3ω: 500 J/ 1 ns
1ω(2ω) : 500 J (300 J)/ 0.5 ps
6 TIMs

The Omega Laser Facility, designed, built and operated by LLE, is a unique national resources currently delivering ~2100 shots/year for NNSA ICF/HED campaigns (~70%) and basic science research (~30%)

National Nuclear Security Administration

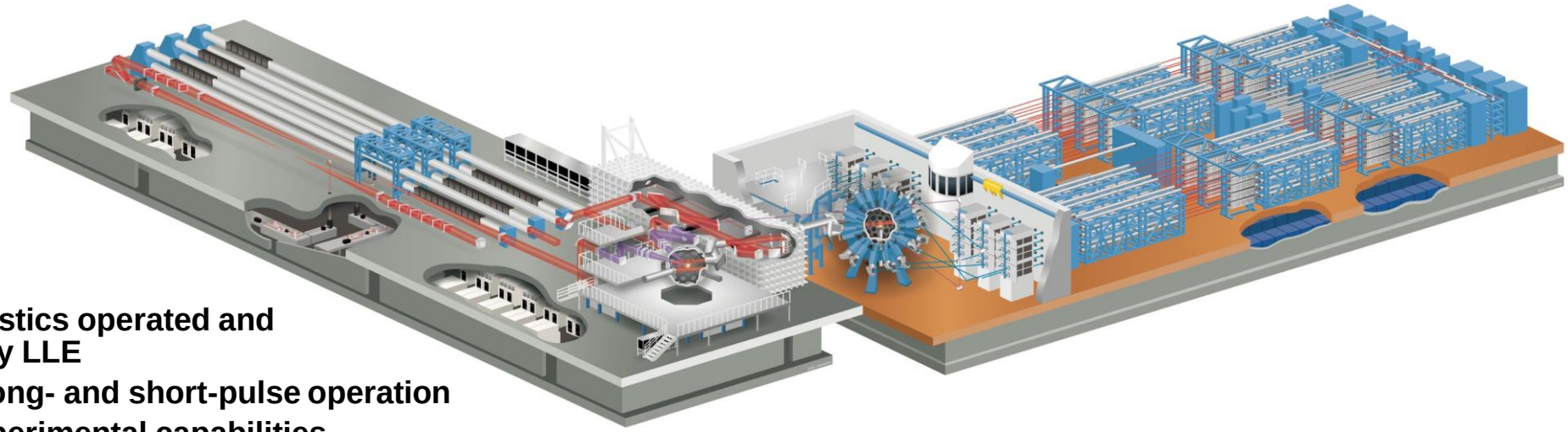
UR LLE

OMEGA EP Laser System

- Operating since 2008
- 4 NIF-like beamlines
  - 5-kJ/beam UV (10 ns)
- Two IR beams can be kJ-class petawatt
- IR beam(s) or one tunable UV beam can be coupled to OMEGA

OMEGA Laser System

- Operating since 1995
- 60 beams, 30 kJ UV on target
- Spherical and cylindrical compression
- 1% to 2% irradiation nonuniformity
- Flexible pulse shaping

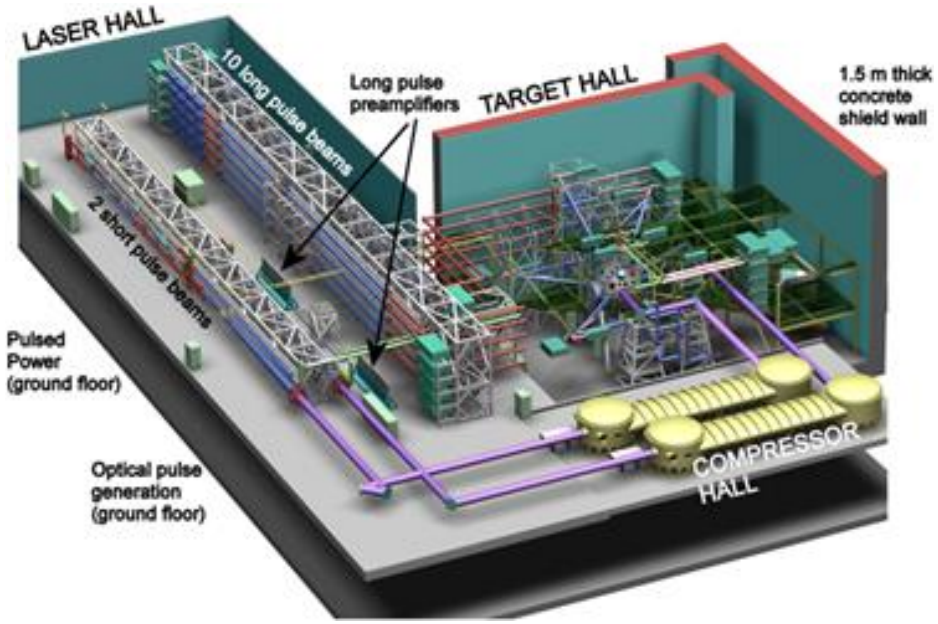


- >200 diagnostics operated and supported by LLE
- Combined long- and short-pulse operation
- Versatile experimental capabilities
- Magnetic fields (~50 Tesla)

More than half of Omega shots are led by external users from national laboratories and universities including international users.

The Orion Facility

- Provides AWE's capability in laser-driven HEDP
- Operational since 2013
- Up to 15% facility time available to UK academic led experiments



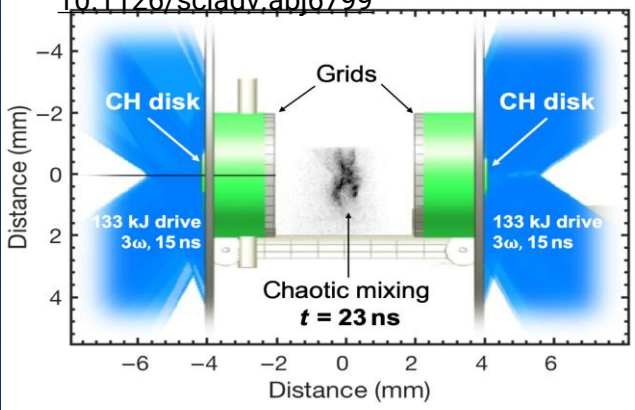
- 10 LP (10x500J, ns @ 351nm) beamlines in 5 beam opposed clusters
- 2 Petawatt (1x500J, 500fs @ 1053nm, 1x300J @ 527nm ultra-high contrast) beamlines

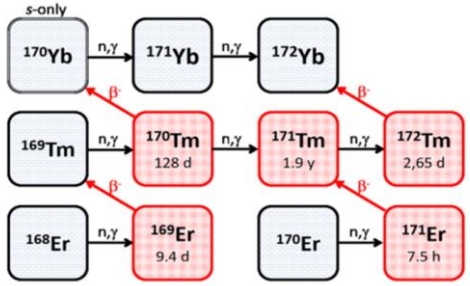
Previous proposals on large-scale laser facilities have included:

NIF

Neutron Capture in a Plasma Environment (Appelbe)
TDyno (Gregori)
Direct drive (with LLE) & Shock-augmented ignition (Scott)

10.1126/sciadv.abj6799



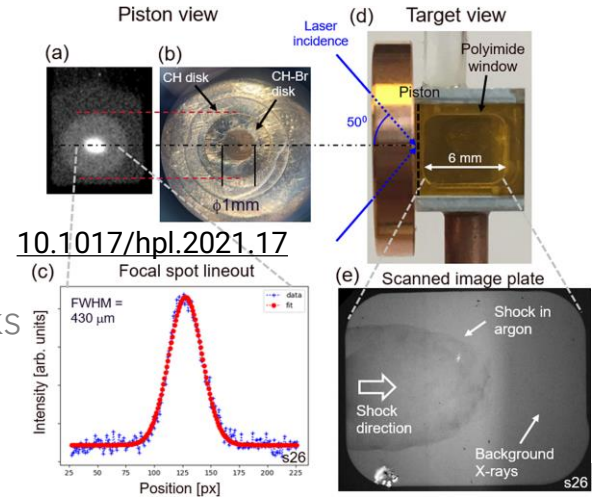


SG-II

Radiative shocks (Suzuki-Vidal)

Omega

TDyno (Gregori)
Measuring Astrophysical s-factors for light ion reactions (Appelbe/Forrest)
Angular momentum transport, Magnetised ICF, (Suzuki-Vidal)
Differentially rotating plasma flows(Suzuki-Vidal)
Magnetic fields generated in hohlraum-like conditions (Tubman)
Magnetised, collisionless shocks (Tubman)
Shock ignition, instabilities, direct-drive,
Diagnostic development (Scott)



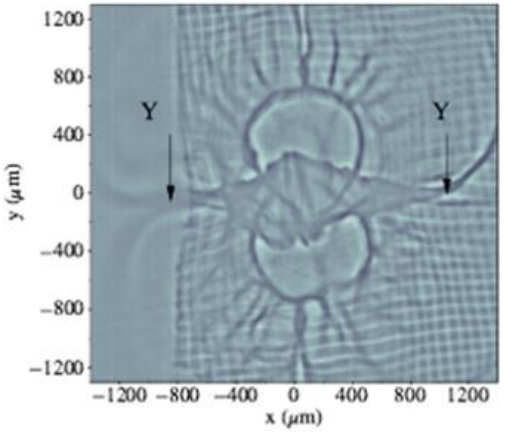
Orion

Suzuki-Vidal,
Woolsey,
Gregori,
Higginbotham

LMJ

Magnetised cylindrical implosions (Suzuki-Vidal)
TDyno/Foam Filled hohlraums (Gregori)

10.1038/s41467-020-20387-7



LFEX, Japan

Collisionless shock ion acceleration (Woolsey)

Eli-NP
LBS
NLUF
Internal
LaserNet US
LaserLab Europe
NSF
Discovery Science

Previous proposals on small-scale laser facilities have included:

PALS, Czech Republic

Probing radiative precursors (Suzuki-Vidal)

LPI, side SRS (Woolsey)

1315 nm: 1 kJ/ 350 ps &
1 J/ 40 fs probe beam

ALEPH, Colorado

Non-linear Compton scattering (Mangles)

X-ray absorption spectroscopy of WDM (Mangles)

400 nm: 10 J/ ~30fs

CLF

Many!

Vulcan 20-20
Gemini
DiPOLE

Zeus, Michigan

Non-linear Compton scattering (Mangles)

QED (Lancaster)

LP: 1ω (2ω) 110 J(75 J)/ 10 ns
Or 50 J (35 J)/ 1.5 ns
SP: 5/25J, 25 fs (500 TW/1 PW)
High rep-rate

Luli2000

Ion acceleration (Borghesi)

Accretion shocks/Turbulence (Gregori)

3 beams
1ω: 450-800 J/beam/ 0.5-15 ns
1-30ps/ 30-50 J
Additional probe beams

JLF, USA

Titan laser
2ω: upto 250 J/ 0.7-20 ps
1ω(2ω): 1 kJ (700 J)/ 0.35-20 ns
Janus laser
1ω(2ω): 1 kJ (700 J)/0.35-20 ns
Comet laser
1ω: <10 J/ 0.5-750 ps or 0.5-5 ns

LLC Lund

LWFA (Murphy)

35 fs, 40 TW laser

HiLASE, Czech Republic

Fast neutrons at high-rep rate (Kar)

1 kW 105 J/ 10 ns

Eli-NP
LBS
NLUF
Internal
LaserNet US
LaserLab Europe
NSF
Discovery Science

Previous proposals on accelerators and pulsed power machines have included:

GSI, Germany

Particle acceleration in turbulent plasma (Gregori)
X-ray Phase contrast imaging (Woolsey)
Accelerator (100 TW proton beam) and PHELIX laser (1 kJ/ 0.5 - 20 ns and 0.5 ps short pulse)

Eli-NP, Romania

Non-linear Compton scattering (Mangles)
Nanowires (Lancaster)

EUXFEL, DESY, Germany

Plasma transport coefficients (Gregori)

ESRF, Grenoble

Skidmore, FLF

LCLS, SLAC, USA

Plasma transport using scattering (Gregori)

Sacla, Riken, Japan

Developing x-ray scattering (Gregori)

Z machine, SNL, USA

Flyer driven hydrodynamic pressure amplifier system for the study of quartz Hugoniot (Skidmore, FLF)
Marz reconnection shots (Hare, Bland)

Star 2SLGG, SNL, USA

Experiment linked to Z shots (Skidmore, FLF)

Saturn, SNL, USA

Radial arrays (Bland)

Eli-NP
LBS
NLUF
Internal
LaserNet US
LaserLab Europe
NSF
Discovery Science

Access schemes

Facility	NIF	Omega-60	Omega-EP	CLF & Orion	LMJ	SG-II, China	GEKKO/LFEX, Japan
Call	Discovery Science	NLUF, LBS	Lasernet, LBS, NLUF	Internal	Internal	Contact for proposing experiments	Internal
Open?	Annual (Letters of intent June, Proposals Sept)	NLUF: Every 2 years (Oct) LBS: Annual (Feb/Mar)	Annual (Feb/Mar) NLUF: Every 2 years(Oct)	Bi-annual (CLF limited until ~2029)	Calls in 2014 and 2016		Annual, March
Link	https://nifusergui de.llnl.gov/	https://www.lle.roch ester.edu/omega-laser-facility-2/	https://www.lle.roche ster.edu/omega-laser-facility-2/	https://www.clf.stf c.ac.uk/Pages/Usin g-our-laser-facilities.aspx		https://lssf.cas.cn/e n/facilities-view.jsp?id=ff808081 4ff56599014ff5a31a bb004a	https://www.ile.osaka-u.ac.jp/eng/collabora tion/application/inde x.html

Besides the programmatic ICF/HED research led by NNSA laboratories and LLE, three programs provide general user access for basic research

National Nuclear Security Administration

U.S. DEPARTMENT OF ENERGY
Office of Science

Laboratory Basic Science (LBS)	National Laser Users' Facility (NLUF)	LaserNetUS
• For U.S. national laboratories and LLE researchers since 2008 • ~10% of the Omega shot time • Annual call managed by LLE	• For U.S. academic and industry researchers since 1979 – Longest running high power laser user program • ~18% of the Omega shot time with target support • Biennial call managed by LLE	• Open access to all LaserNetUS users since 2019 – International researchers can be the lead • Additional (but limited) beamtime on OMEGA EP • Annual call by LaserNetUS

International users including students can get access to the Omega Laser Facility through their collaborations with U.S. researchers on various projects including ICF/HED, NLUF and LBS.

POC: Dr. Mingsheng Wei (mingsheng@lle.rochester.edu), NLUF Manager

Access schemes

LaserNet USA

Annual Call (typically Dec)

Access to:

-ALEPH, Colorado State University
-Zeus, University of Michigan
-Jupiter laser facility, LLNL
-Scarlet Laser, Ohio State
-Omega-EP
-Bella, LBNL
-MEC, SLAC

https://lasernetus.org/

Laserlab Europe

Specific calls depending on facility

Access to:

-CLF
-CLPU (Vega PW laser) no calls since 2020?
-GSI (PHELIX) was open for calls until Nov 2023.
-LULI Annual (March)
-FERMI
-PALS
-HILASE
-LLC

https://www.laserlab-europe.eu/

LCLS, SLAC, USA
Bi-Annual Feb/Sept

ESRF, Grenoble
Bi-annual Mar/Oct

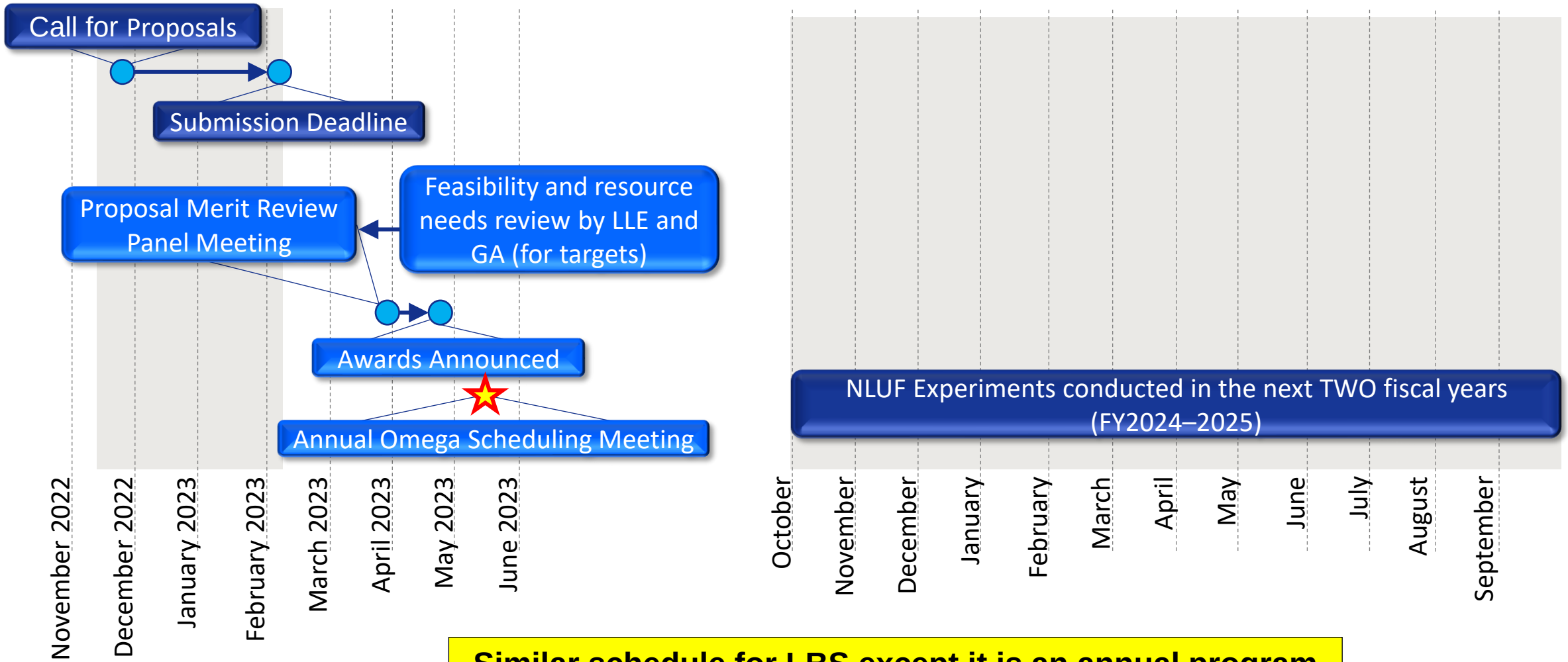
ELI-NP and ELI-Beamlines
Bi-Annual Mar/Oct

EuXFEL, DESY, Germany
Call about to open (March)
Closing mid-April.
Bi-annual

Key contacts:

- Omega- Mingsheng Wei (NLUF Manager and Coordinator for LBS and LaserNet)
- NIF- Bruce Remington (Discovery Science Program Leader)
- Orion- Colin Danson (Orion Academic Access Coordinator)
- Laserlab-Europe and CLF- John Collier (Director CLF and Executive Director Laserlab Europe)
- GEKKO- Contacts listed via research area (https://www.ile.osaka-u.ac.jp/eng/step-1/index.html)
- SG-II- Zhang Yan
- LaserNet- Chandra Breanne Curry (LaserNetUS Coordinator)
- Zeus- Karl Krushelnick (Director)
- ELI-NP- Calin Ur (Project Director)
- Sandia National Laboratories- https://www.sandia.gov/prf/plasma-research-facility/contact/

Typical NLUF program cycle



Similar schedule for LBS except it is an annual program

Join us at the

15th OMEGA Laser Facility Users Group (OLUG) Workshop

16–18 April, 2024, Rochester, NY

- ***Invited talks on HED science and the OMEGA and future facility***
- ***Review progress on the prior OLUG* Findings & Recommendations**
- ***Poster Sessions on diverse HED Science and Technology***
- ***Student-postdoc Town Meeting with Facility Recommendations***
- ***Career panel discussion***
- ***Tour of the OMEGA Facility***