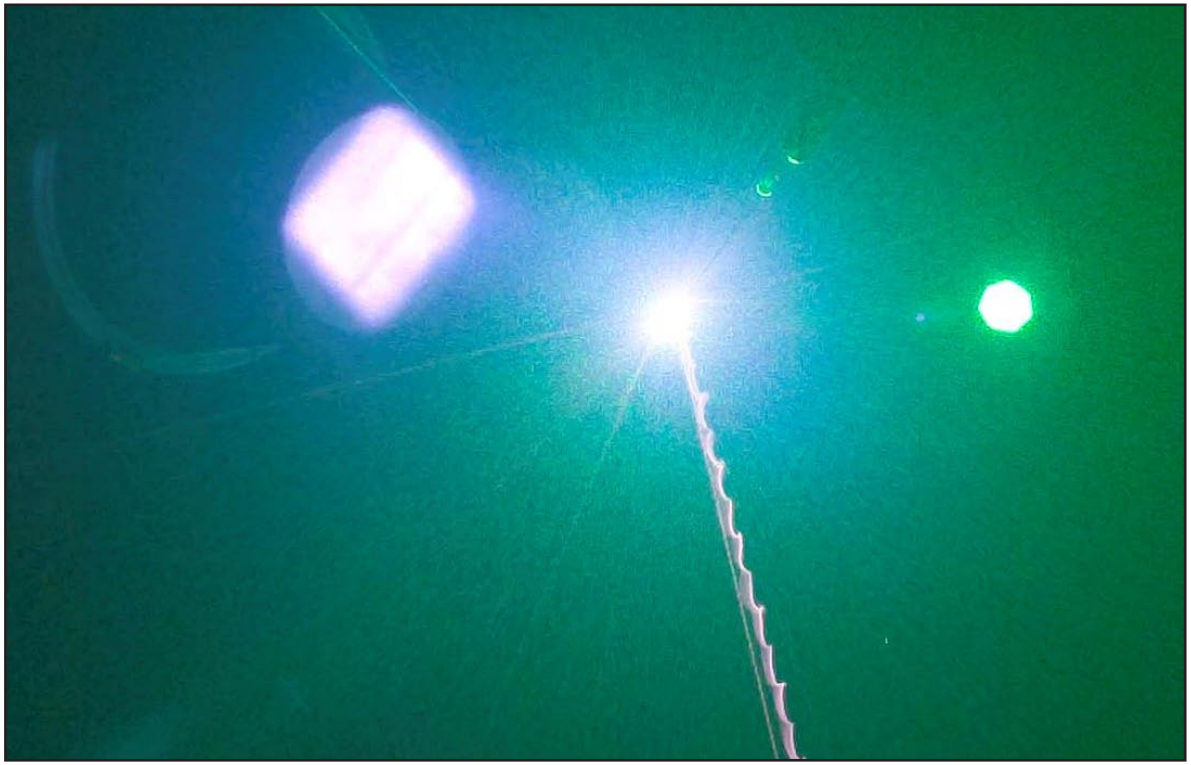
Omega Facility Operations and Scheduling



S. F. B. Morse
Omega Facility Division Director
University of Rochester
Laboratory for Laser Energetics

Omega Laser Facility
Users' Group Workshop
Rochester, NY
29 April – 1 May 2009

Summary

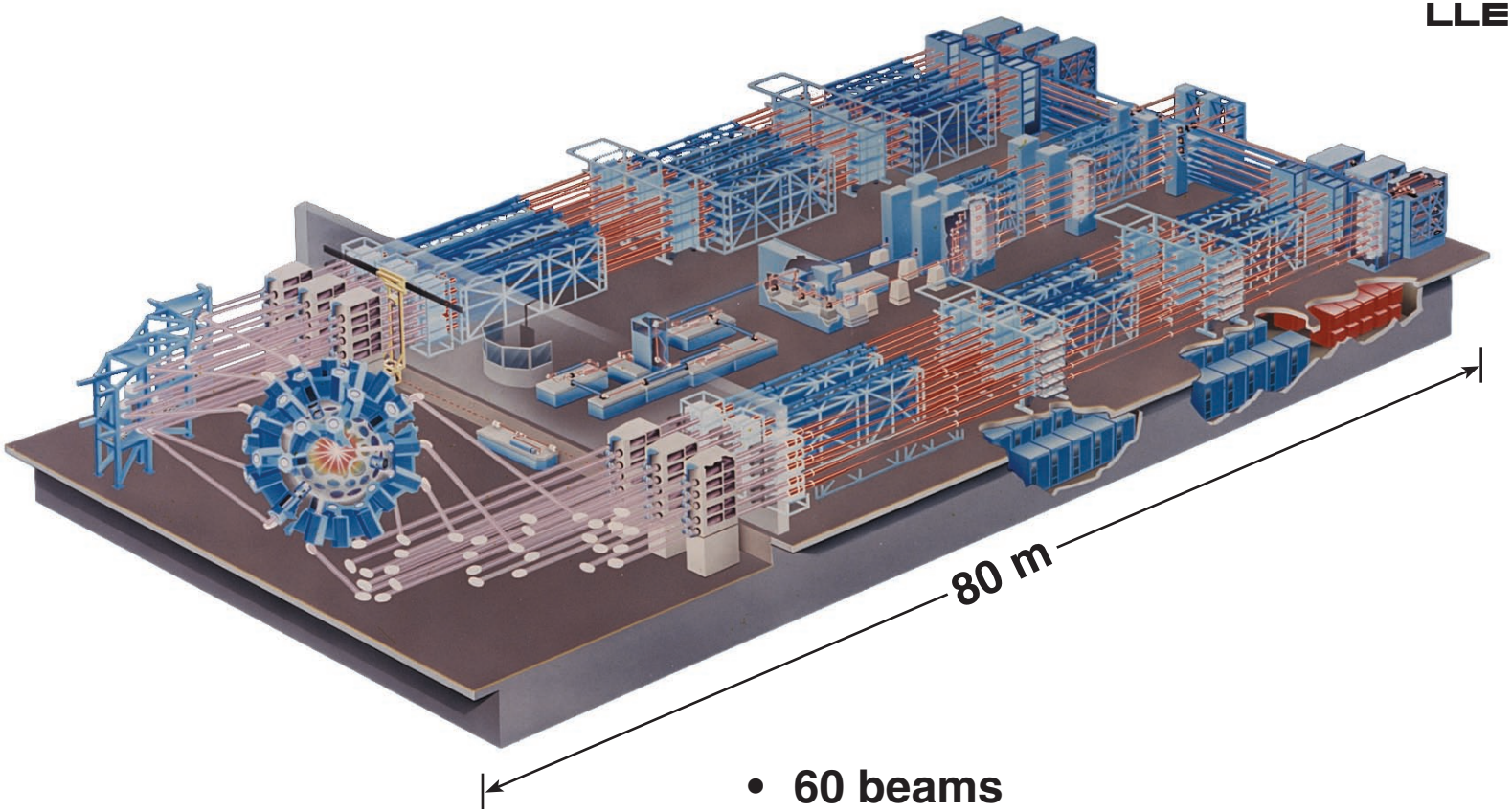
The Omega Laser System is an accessible and effective high-energy-density research facility

UR LLE

- The Omega Laser System operates
  - as an HED user facility for LLE, weapons laboratory, and university/industry researchers, and
  - with high availability and effectiveness.
- The addition of OMEGA EP to the Omega facility in FY08 significantly expanded research opportunities.
- An Omega governance plan that balances the needs of NNSA's mission and basic science has been developed.
- OMEGA EP is part of the Omega Laser Facility and therefore has no separate governance plan.

The OMEGA laser is designed to achieve high irradiation uniformity with flexible pulse-shaping capability

UR LLE



- 60 beams
- >30-kJ UV on target
- 1% to 2% irradiation nonuniformity
- Flexible pulse shaping
- Short shot cycle (1 h)

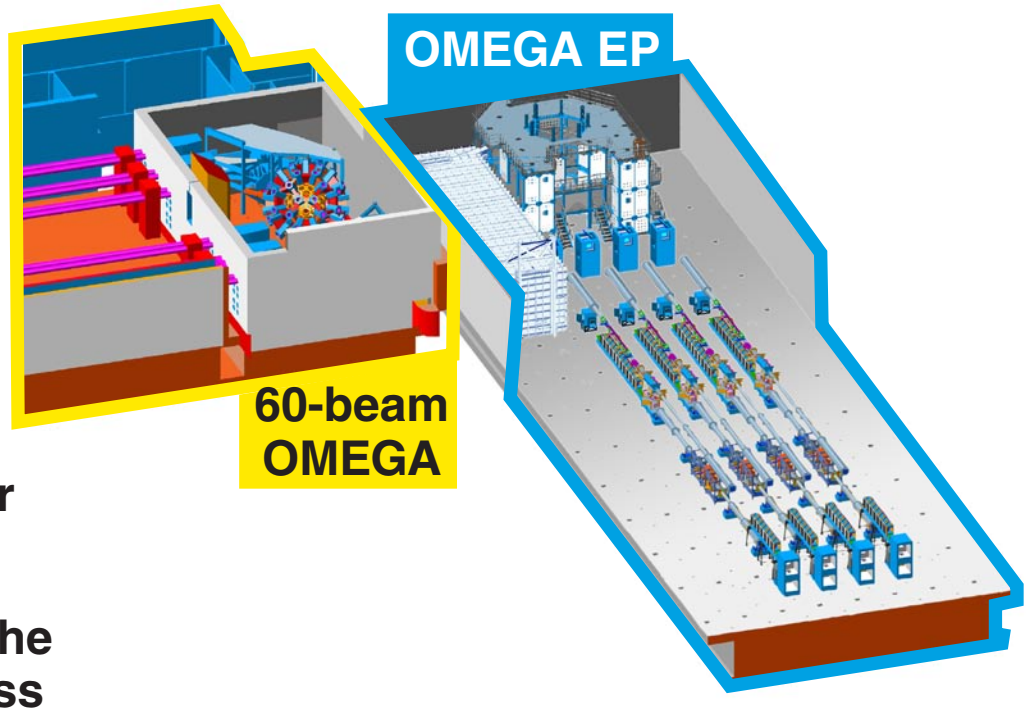
Fully instrumented

Successfully operated for 14 years

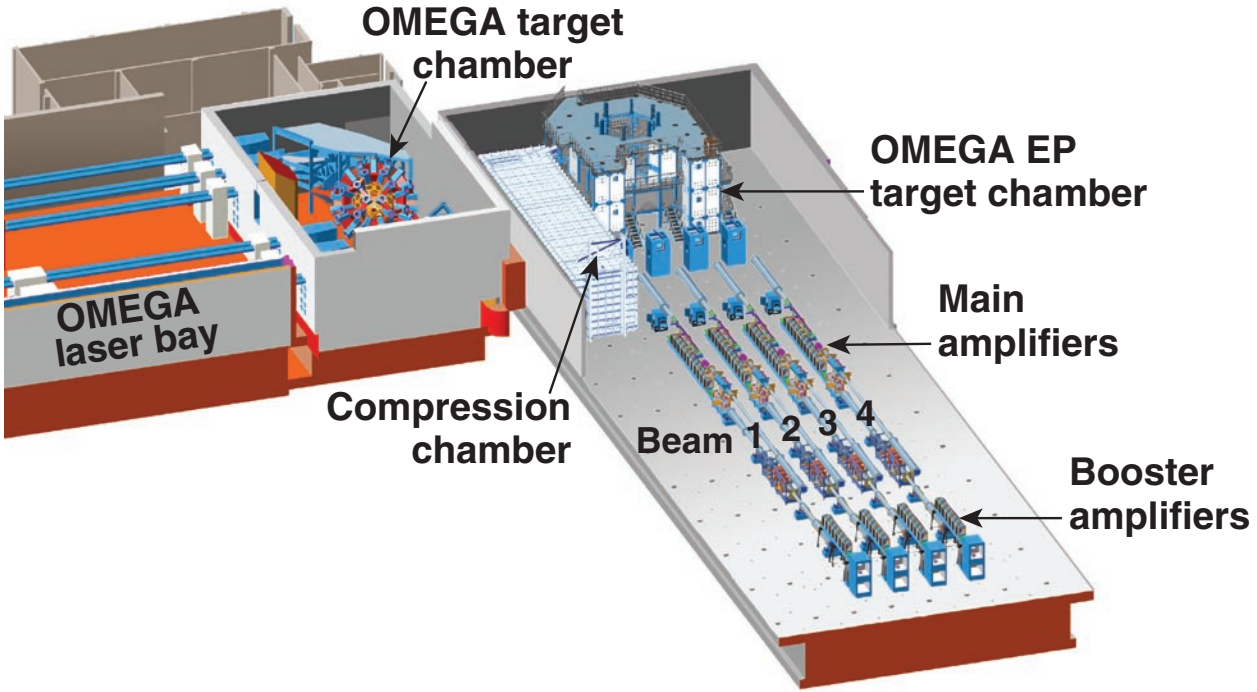
TC2998s

The Extended-Performance (EP) addition to OMEGA has five primary missions

1. Extend HED research capabilities with high-energy and high-brightness backlighting
2. Perform integrated advanced-ignition experiments
3. Develop advanced backlighter techniques for HED physics
4. Provide a staging facility for the NIF to improve its effectiveness
5. Conduct ultrahigh-intensity laser–matter interactions research



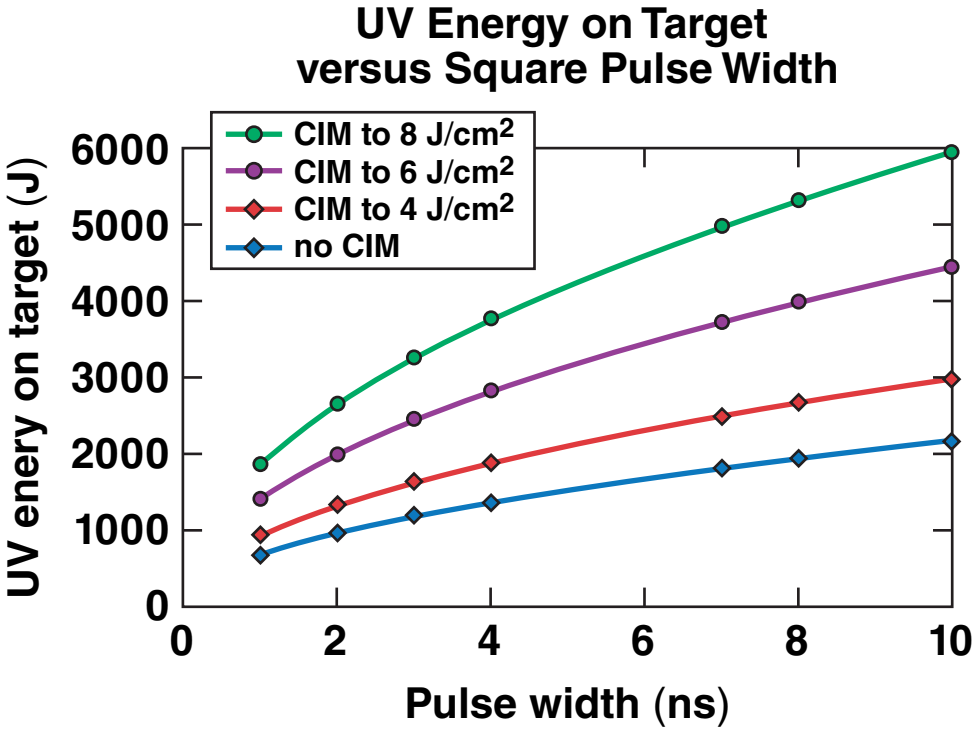
Short-pulse OMEGA EP beams can be directed either to OMEGA or to the new OMEGA EP target chamber



Performance capabilities	Short-pulse Beam 1	Short-pulse Beam 2	Long pulse (any beam)	
Wavelength	Infrared (IR)	Infrared (IR)	Ultraviolet (UV)	
Pulse width	1 to 100 ps	1 to 100 ps	1 ns	10 ns
Energy on target (kJ)	2.6 kJ, 10–100 ps grating limited <10 ps	2.6 kJ, 80–100 ps beam combiner limited <80 ps	2.5	6.5
Intensity (W/cm^2)	3×10^{20}	~2×10^{18}	3×10^{16}	8×10^{15}
Focusing (diam)	>80% in 20 μm	>80% in 40 μm	>80% in 100 μm	

G6957v

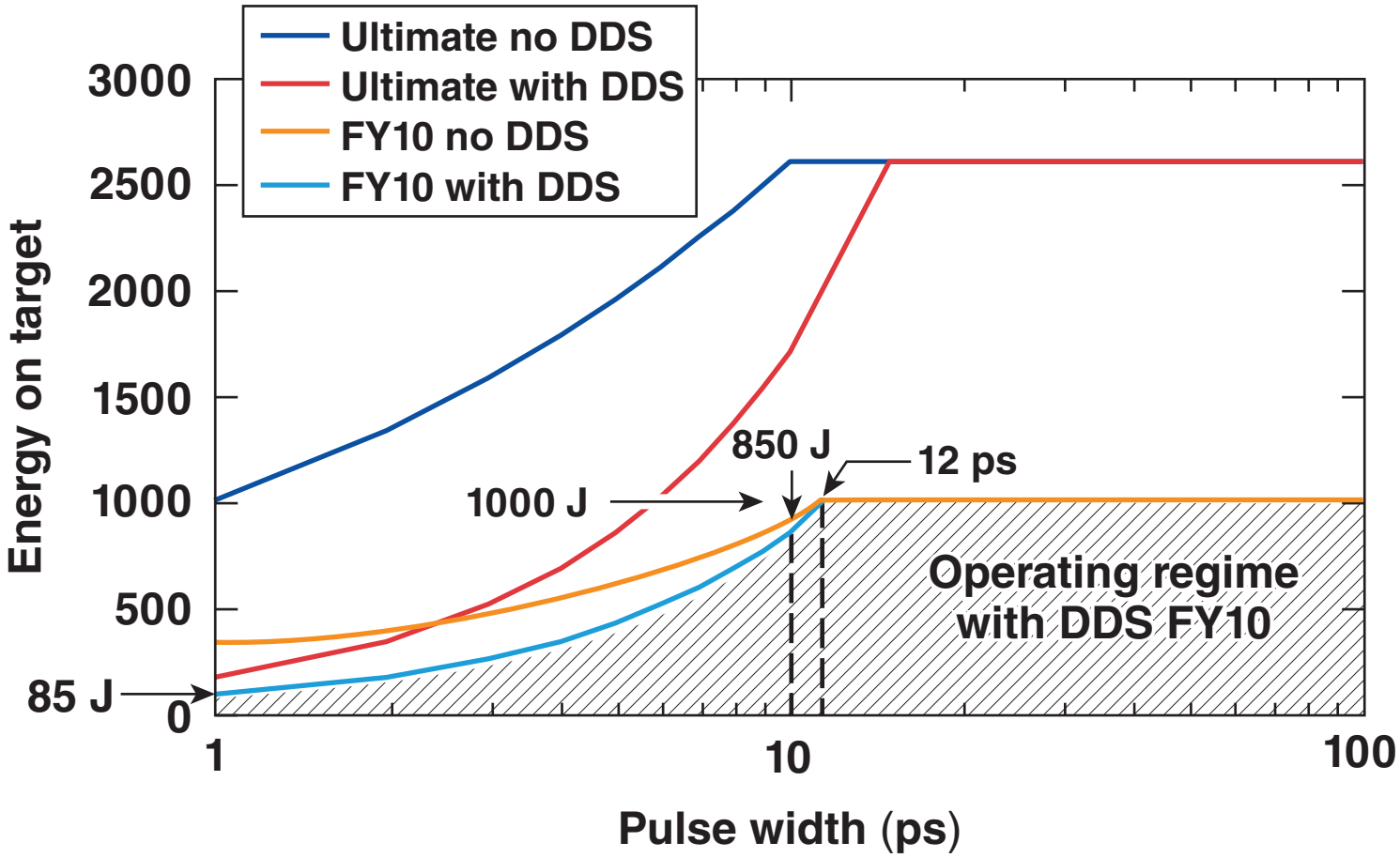
UV-optic laser-damage thresholds will limit initial OMEGA EP fluence



- LLNL is managing the procurement of replacement optics for OMEGA EP
- Bulk fused-silica inclusions and surface-finish quality limits UV laser-damage threshold (LDT) of initial optics
- LLNL procedures, quality control, and processing are required to achieve high LDT's

The FY10 short-pulse operating envelope is constrained by a disposable debris shield (DDS) B-integral below 12 ps

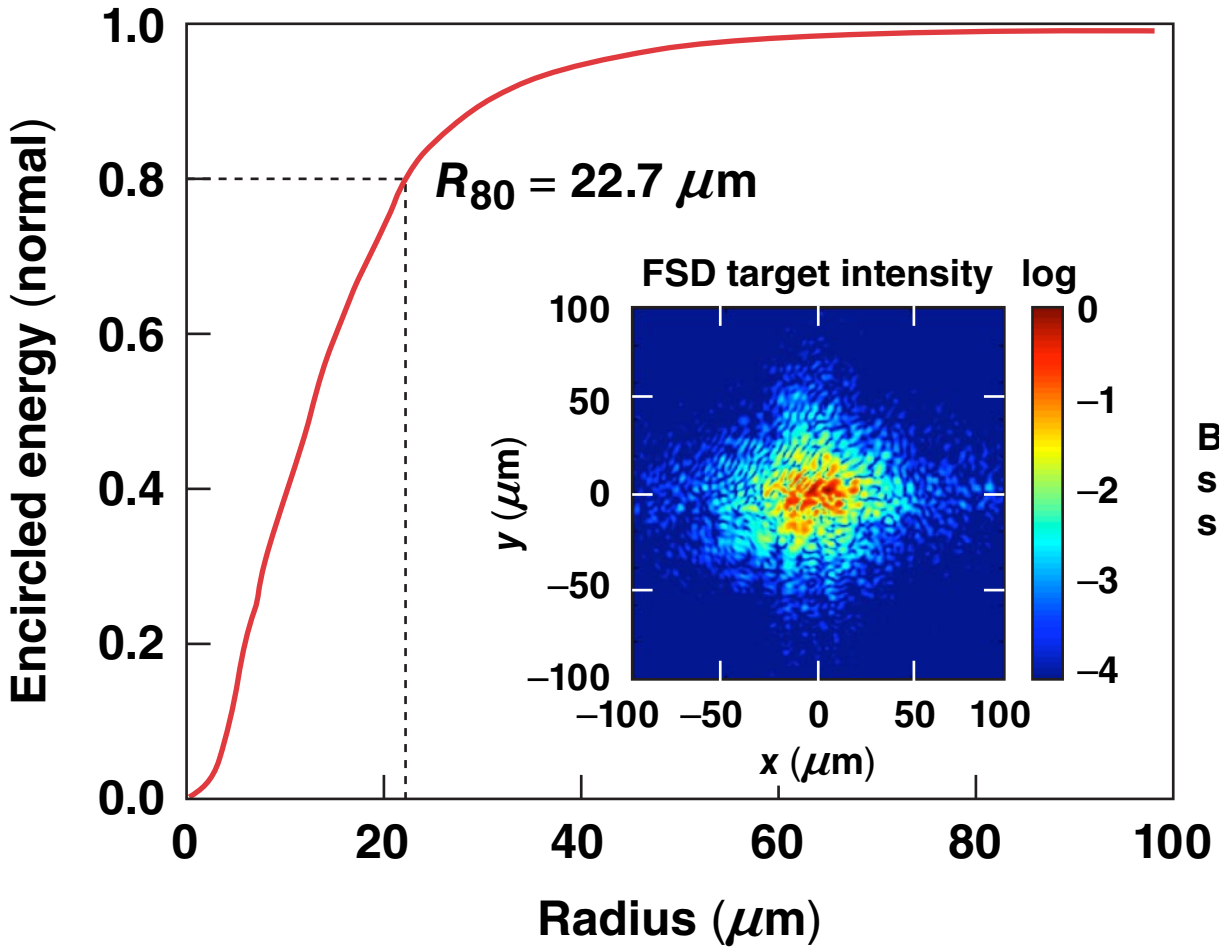
UR LLE



Focal-spot measurement and quality are compromised by the debris shield.

G8476a

The OMEGA EP focal spot typically has $R_{80} < 25\ \mu$m and is improving

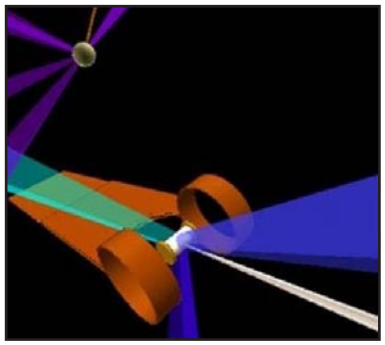


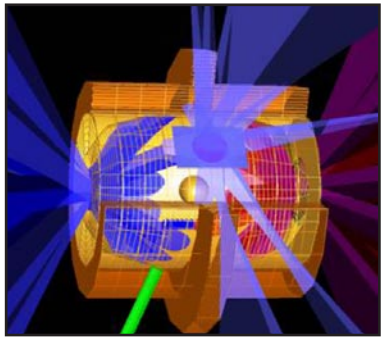
BL1 to OMEGA EP sidelighter indicated, shot 4800

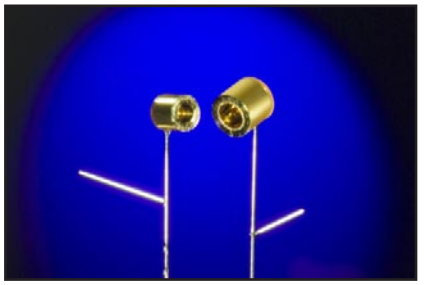
G8730

OMEGA effectively supports a large number of complex experiments for a variety of users

- Can operate 12 weeks per quarter with one week of planned maintenance
- The configuration flexibility allows scheduling 6 to 10 unique experiments per week



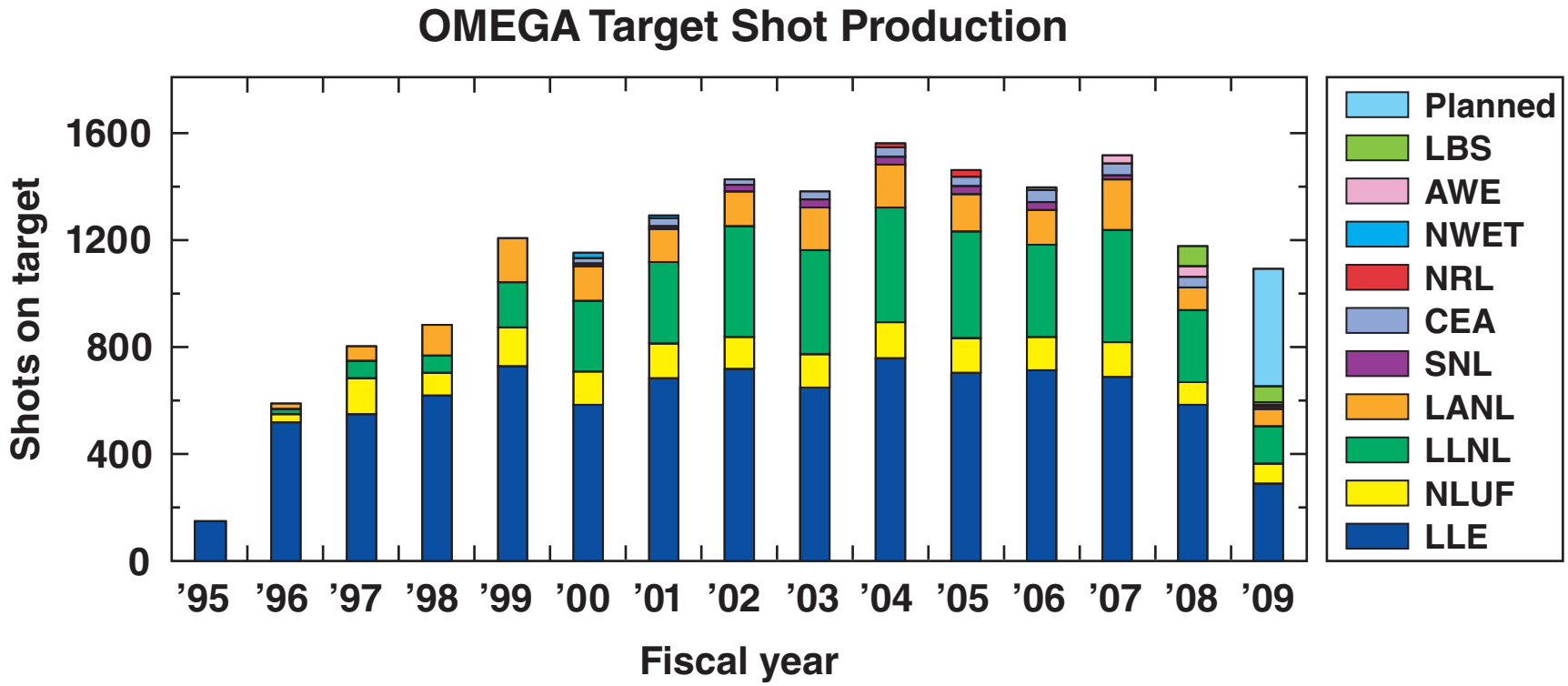




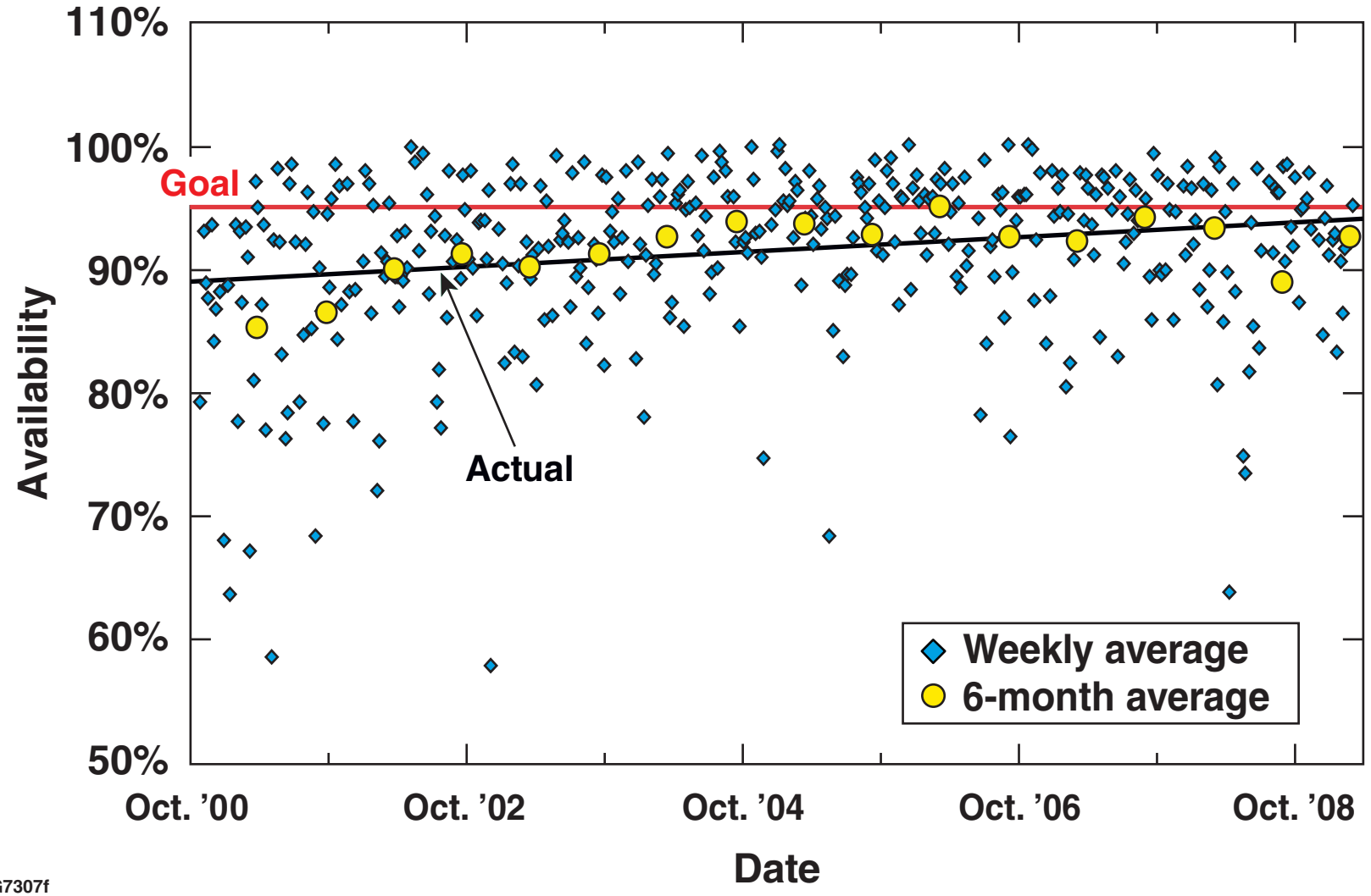
OMEGA's flexibility and reliability are exceptional.

OMEGA has conducted >16,500 target shots and continues to be an effective facility

UR LLE

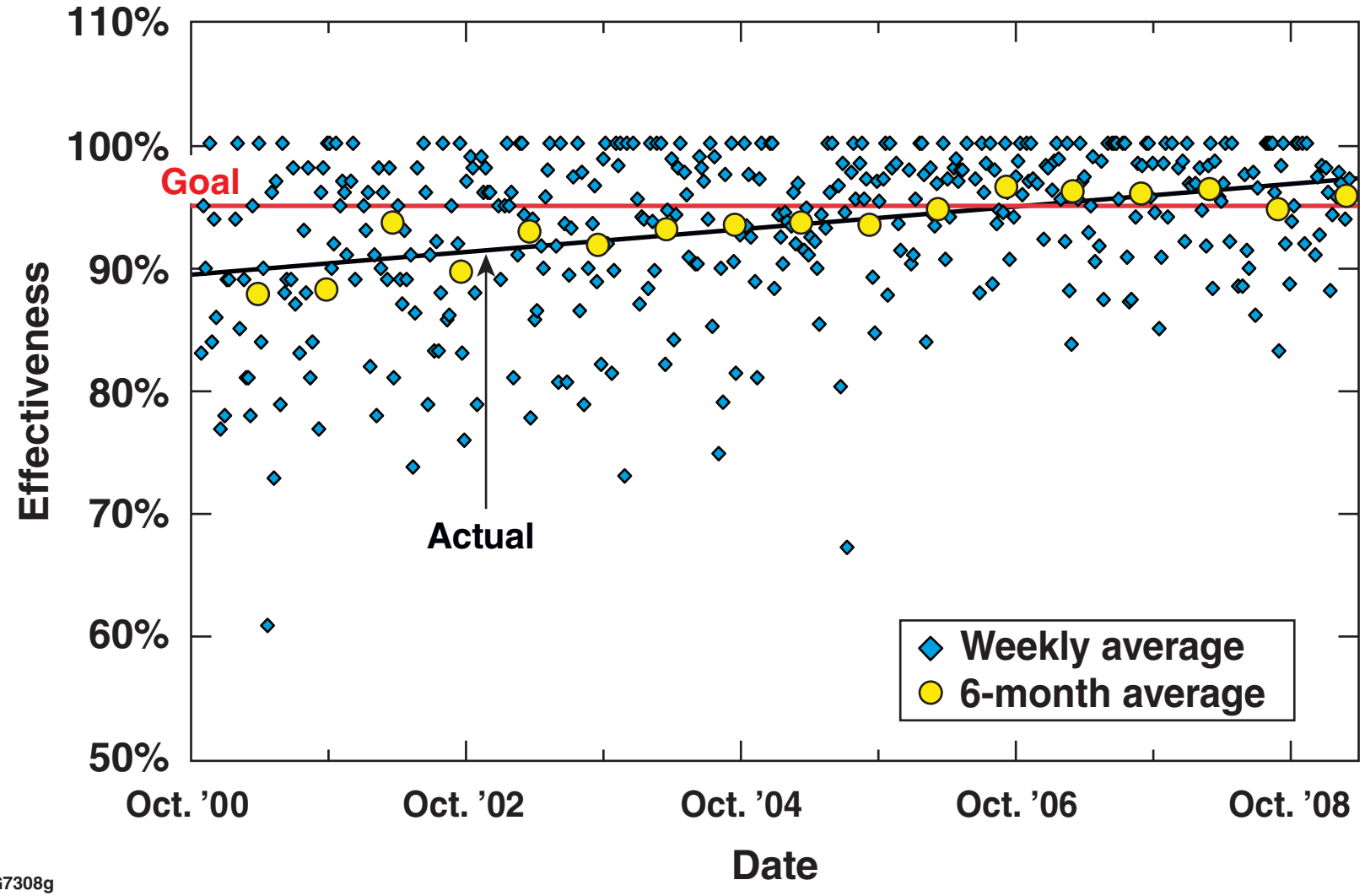


OMEGA availability tracking stimulates improvements and promotes sustained performance



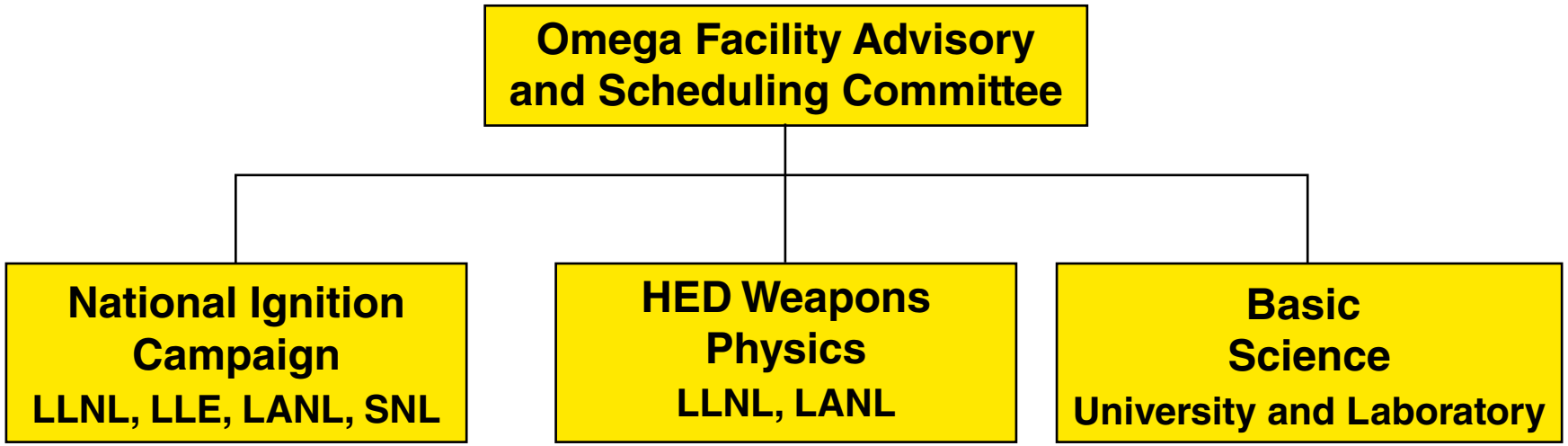
G7307f

OMEGA experimental effectiveness is being maintained at a high level



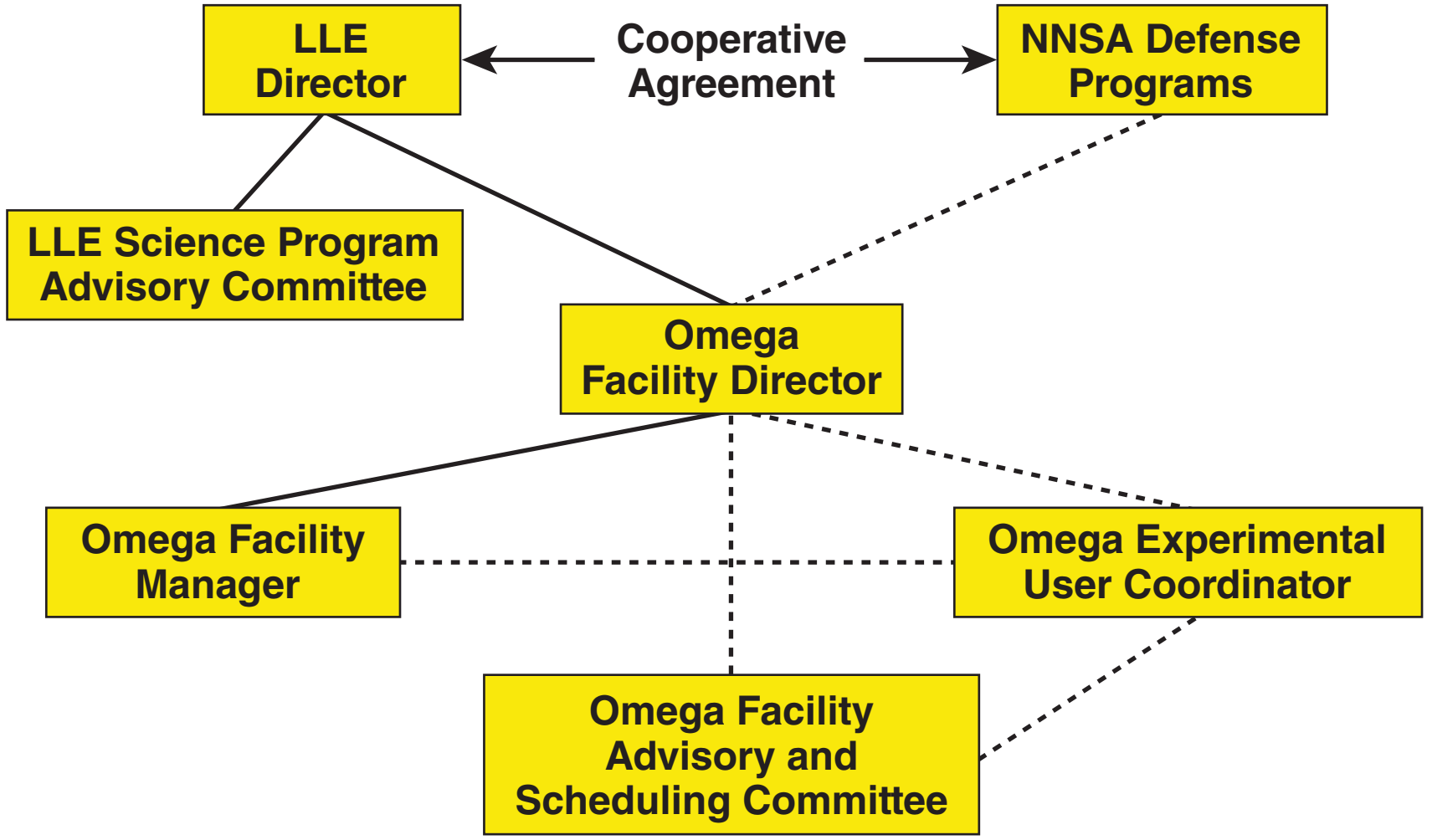
G7308g

A governance plan formalizes scheduling Omega as an NNSA user facility



- Reviews experimental proposals based on merit and program requirements
- Recommends system time-allocations and facility schedule
- Promotes effective user community
- Reviews facility availability and effectiveness

A governance plan was implemented to schedule Omega as a major NNSA user facility



G8267

Shot time on OMEGA is divided between structured NNSA missions and basic science

UR LLE

- Direct mission related
  - The National Ignition Campaign–ICF
  - Weapons physics
- Basic Science
  - University/Industrial users–NLUF
  - Weapons Laboratories and LLE (e.g., LDRD)
- In the scheduling process, it is assumed that the Direct mission-related programs
  - are integrated plans
  - priorities have been peer reviewed as a whole
  - the LLE FASC does not peer review the individual shot plans, but does consider relative priorities and looks for synergies
- The two basic science categories are externally peer reviewed with rankings presented to the FASC.

The balance among the various user categories is proposed by the FASC with the LLE Director making the final decision

UR LLE

- By February before the FY, NNSA provides guidance on draft allocations.
- In June the FASC produces a draft schedule and a recommended allocation among categories.
- The final allocation is proposed by the FASC after considering all proposals.
- The results of the FY09 scheduling process:

Category	Subcategory	FY09 Initial		FY09 Current		FY10 Notional
National Ignition Campaign		102	48%	104	61%	45%
HED		38	18%	26.5	16%	25%
Basic Science	NLUF	24	11%	23	13%	10%
	LBS	25	12%	17	10%	15%
Contingency		21.5	10%	—		5%
	12-h days	210		171		

*13 University, 12 Laboratory

Summary/Conclusions

The Omega Laser System is an accessible and effective high-energy-density research facility

UR LLE

- The Omega Laser System operates
  - as an HED user facility for LLE, weapons laboratory, and university/industry researchers, and
  - with high availability and effectiveness.
- The addition of OMEGA EP to the Omega facility in FY08 significantly expanded research opportunities.
- An Omega governance plan that balances the needs of NNSA's mission and basic science has been developed.
- OMEGA EP is part of the Omega Laser Facility and therefore has no separate governance plan.