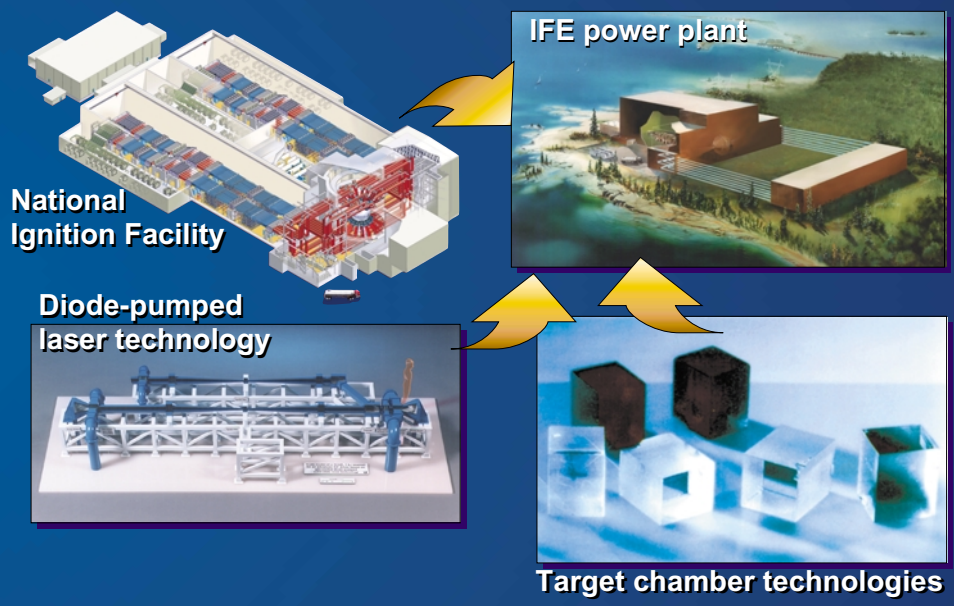
UCRL-MI-137867

Inertial Fusion Energy (IFE) based on Diode-Pumped Solid-State Laser (DPSSL) Drivers

Lawrence Livermore
National Laboratory

NIF, DPSSLs, and chamber developments provide pathway to IFE



Driver requirements for fusion energy substantially exceed those needed for ignition

Elements	NIF (ignition)	DPSSL (energy)
Pump light	Flashlamp	Diodes
Laser material	Nd:glass	Yb:crystal
Efficiency	0.5%	>5%
Reliability	10^4 shots	$>10^9$ shots
Rep-rate	1 shot/8 hrs	10 shots/sec

DPSSL technology is important for fusion, commercial, and military applications

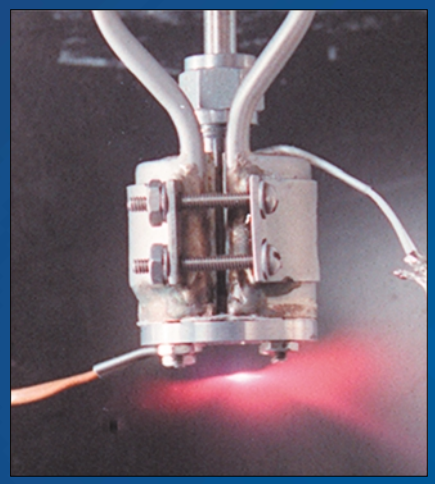
LLNL is collaborating with Japanese and French on DPSSLs for fusion

US-Japan Exchange for CY98:

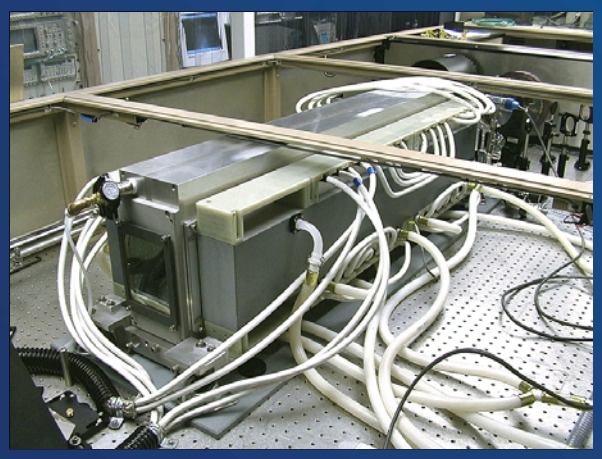
US-JAPAN Workshop on Laser-Driven Inertial Fusion Energy

Institutional Contacts:
US: Stephen Payne (LLNL, Livermore)
Japanese: Masanobu Yamanaka (ILE, Osaka)
Governmental Contacts:
US: William Dove (Fusion Energy Sciences, U.S. Department of Energy)
Japanese: Atsuo Iiyoshi (National Institute for Fusion Science)
Location: San Diego, USA
Co-Hosts: General Atomics and University of California, San Diego
Type of Interaction: Workshop (open only to nationals of each side)
Duration: 2-3 days
Timeframe: May 11-13, 1998, after CLEO meeting (May 3-8, 1998, San Francisco)

High-intensity lasers may generate sufficient neutrons for fusion materials tests



New laser weapons are based on solid-state lasers (U.S. Army)



10-kW laser weapon prototype

DPSSL market is growing rapidly: optical amplifiers in telecom ($1B/yr) and materials-processing ($100M/yr)

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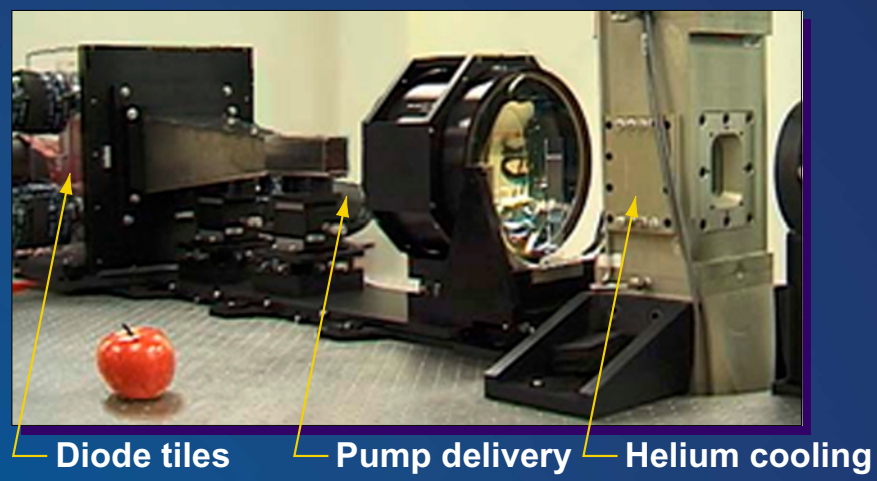
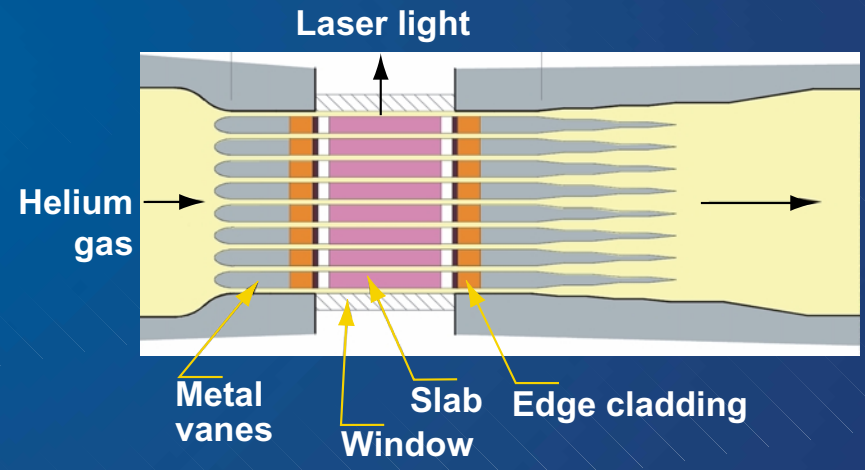
Mercury will be a 10 Hz, 10% efficient, 100 J, 5-ns laser at 1.05 μm

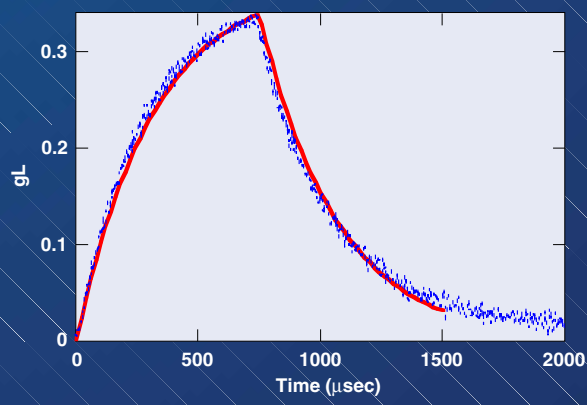
Prototype amplifier has been assembled



High-speed, helium-cooling for 10 Hz operation performs as planned



Integrated gain measurements have been made using surrogate Nd:glass slabs



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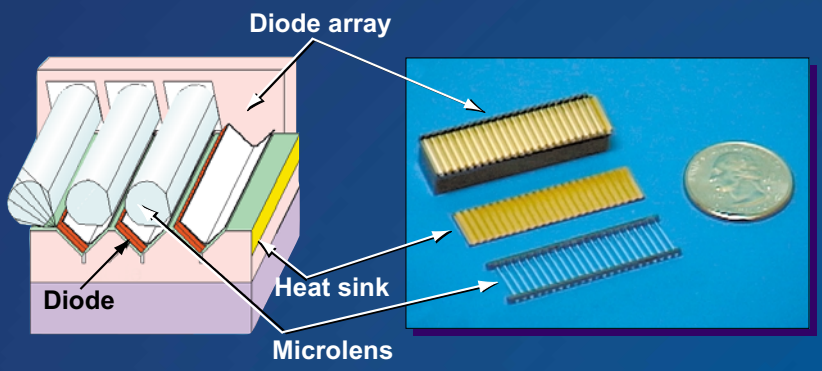
Critical technologies for DPSSL drivers include laser diodes and Yb:S-FAP crystals

Innovative package for fusion-laser diodes has been developed

Industrial partners: Coherent (CA) and Spectrolab (CA)



Yb:S-FAP crystals [$Yb^{3+}:Sr_5(PO_4)_3F$] discovered for advanced-fusion laser technology are being developed in 4×6 cm^2 size for Mercury

Industrial partners: Scientific Materials (MT) and Synoptics (NC)

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Laser Science and Technology

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