ADVANCES IN THE HIGH AVERAGE POWER LASER PROGRAM

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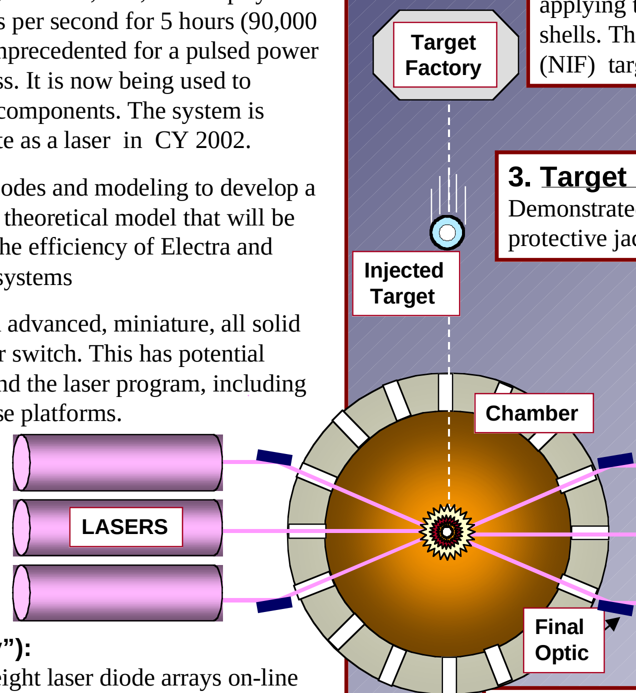
The goal of The High Average Power Laser Program is to develop a high energy, repetitively pulsed laser system for Inertial Fusion Energy and other DOE and DOD applications.

The program is in its third year. In 1999 and 2000 the research concentrated on the two laser concepts: Krypton fluoride lasers (KrF) at NRL, and diode pumped solid state lasers (DPPSL) at LLNL. In 2001 the program was expanded to incorporate a national team to address the other critical components of Laser Fusion Energy, including: target fabrication, target injection, final optics, fusion chamber, and materials. The key components are being developed in concert with one another, with the science and engineering issues being addressed at the same time. This "integrated systems" approach ensures Laser Fusion Energy can be developed as a viable energy source. Significant progress has already been made in this program. A few highlights are summarized here. Also shown is a rendition of a laser fusion power plant.

1. Lasers-

KrF Lasers ("Electra"):

- Commissioned the first generation pulsed power system. This 500,000 Volt, 100,000 Amp system can run at 5 pulses per second for 5 hours (90,000 shots), which is unprecedented for a pulsed power system of this class. It is now being used to develop the laser components. The system is expected to operate as a laser in CY 2002.
- Used advanced codes and modeling to develop a "basic principles" theoretical model that will be used to enhance the efficiency of Electra and design large KrF systems
- Demonstrated an advanced, miniature, all solid state pulsed power switch. This has potential applications beyond the laser program, including all- electric defense platforms.



DPSSL ("Mercury"):

- Brought two of eight laser diode arrays on-line .Each of these 800 discrete diode elements produces 80,000 Watts of light, and is ten times more powerful than existing arrays in the US.
- Working closely with industrial partners, produced the first large, high quality, Yb :S-FAP crystals needed for Mercury. Fourteen are needed to commission the entire laser system.
- Completed the Mercury optical layout. The full system is expected to produce "first light" by CY 2002.

2. Target Fabrication

Developed advanced foams and methods of applying thin metallic coatings on spherical shells. These are needed for both IFE and ICF (NIF) targets.

3. Target Injection

Demonstrated the use of a recyclable protective jacket (sabot) for injecting targets.

4. Chamber

Developed an integrated, self consistent model that calculates the output of the fusion target (neutrons, x-rays and charged particles) and used this to predict the response of the reactor chamber wall. Established a potential "operating window" that allows successful target injection, long-term wall survival, and reasonable plant efficiency.

5. Final Optics

Measured laser damage threshold on aluminum coated mirrors. Mirrors are five times more resistant to damage if they are angled sharply as envisioned for a fusion power plant. Defined acceptable thickness for a fused silica optic, based on radiation self healing.

6. Materials

Used the Sandia Z and RHEPP facilities to expose candidate fusion materials to relevant x-rays and energetic ions to evaluate fusion chamber wall concepts.