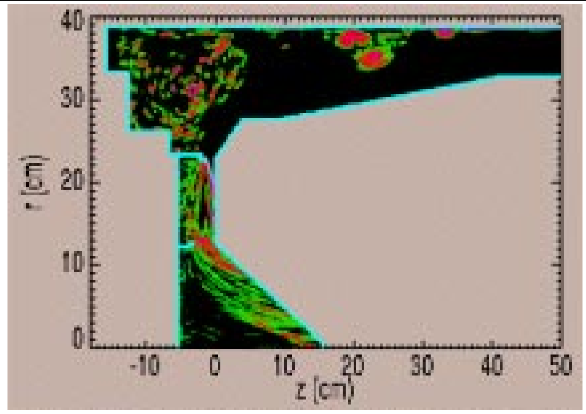
June 1995 Highlights of the Light Ion Inertial Confinement Fusion Program



Simulation geometry of the electron beam diode on PBFA X. Power flows in from the right. The inner (12.5 cm) and outer (23 cm) radius cathode blades are independently set.

The program was reviewed by the Inertial Confinement Fusion Advisory Committee. The pulsed power subcommittee endorsed our decision to modify PBFA II to drive an extraction diode. The full committee supported our increased role in the National Ignition Facility (NIF) and endorsed the changes in program emphasis. Invited and contributed talks were also given at the IEEE International Conference on Plasma Science.

The extraction diode feed hardware (PBFA X) is being installed. Initial experiments will use an electron beam diode as a power-flow test load for comparison with computer simulations used in designing the hardware. The diode has a double-ring cathode blade configuration as shown in the figure. These electron beam load experiments will test our ability to run the modified PBFA II accelerator at a high shot rate.

We completed SABRE experiments to assess the effect of microcharge non-neutrality on beam microdivergence. We created 5-mrad proton beamlets to evaluate the small nonuniformities that can produce microdivergence by this mechanism. We find that, for propagation in low pressure gases, the divergence is substantial. At higher pressures (0.1 - 1 Torr), plasma shielding eliminates the effect. In a continuation of ion source cleaning studies on SABRE, we are beginning to see further increases in lithium production by applying substrate coatings to the anode material to minimize participation of bulk contaminants.

Integrated 2-D LASNEX calculations (fuel capsule, hohlraum, and incoming ion beams modeled simultaneously with the intensity level and number of beams as input) confirm the design of an internally-pulse-shaped, high-yield target driven at ~ 50 TW/cm^2 by ~ 32 separate extraction lithium ion beams. Internal pulse shaping is a Sandia developed concept that uses components in the capsule to tailor the time-dependent pressure in the fuel. Internal pulse shaping may be relevant to heavy ion target design as well as to target design for NIF, since a shaped pulse of short duration is difficult to achieve, especially for an RF storage ring driver. We recently completed an internally-pulse-shaped ignition target design for NIF and demonstrated the feasibility of the concept in planar target experiments at LLNL on Nova.

We identified research activities that impact both high yield target physics with light ions and NIF core science and technology. These activities, which include diagnostic development, the internally-pulse-shaped target concept, and experiments and simulations to study issues relevant to the foot of the NIF drive pulse, will amount to ~ 15% of the FY96 budget for the light ion ICF program. In addition, as part of the subsystem design, a switch development facility is being constructed to evaluate the power conditioning system that will fire the main amplifier flash lamps on NIF.

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