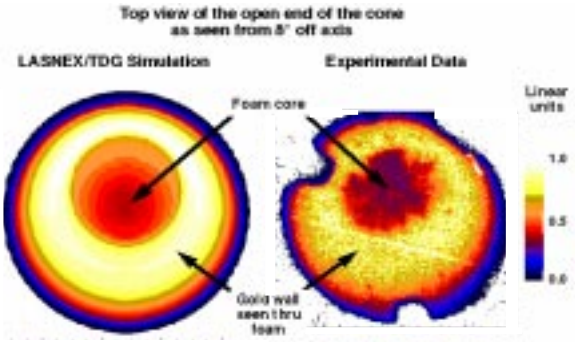
December 1994 Highlights of the Light Ion Inertial Confinement Fusion Program



Comparison of soft x-ray image of open-cone lithium target with LASNEX simulation shows foam is optically thin.

PBFA II experiments with the titanium sublimation getter pump and the RF glow discharge cleaning system have begun. Three downline shots and one short circuit shot were completed. We are evaluating and improving the operational reliability of the new hardware. The first shot with the improved magnetic field profile, without implementing the surface cleaning hardware, increased lithium beam power by over 25%.

On SABRE, rapid anode heating, surface glow discharge cleaning, and a cryogenic cathode have demonstrated a significant increase in the number of lithium ions produced and decrease in the impurity ions accelerated. An improved magnetic field profile also increases the total lithium beam intensity. However, we have not seen experimental evidence that these two techniques are additive or that cleaning the LiF emission surface or altering the field profile reduces beam divergence. We are investigating whether divergence measurements are being affected by plasma formation at the pinhole camera aperture and are thus an overestimate of the actual divergence. Spectroscopy of the anode and cathode plasma suggests further improvement in ion source purity would result from increased anode heating or a shorter time interval between the cleaning and accelerator firing. Development of a continuum pulsed source will allow a direct line absorption measurement of neutrals in the AK gap at densities of $10^{13}/cm^3$.

A new analysis of the March 1993 open-cone target series suggests the radiation was smoothed within the ion-heated hohlraum. The third lithium target series on PBFA II, scheduled for March 1995, will include closed cylinders and open cones. The cones provide good characterization of hohlraum response (see figure) because of the large viewing angle; the cylinders should produce hotter temperatures. Hardware design drawings are being prepared. Significant changes to the target holder will be required if we use the Laser EVaporation Ion Source (LEVIS), rather than the LiF source as in previous target series, because of presence of a reflective conical mirror to provide uniform laser irradiation of a lithium-enriched surface.

Analysis of October 1994 target experiments on Nova indicates that we are successfully demonstrating our internal-pulse-shaping concept for targets, that is, the use of a pulse shaping layer to modify the shock strength in an ICF capsule/ablator material. These experiments used polystyrene (CH) wedge-shaped witness plates with titanium and boron nitride pulse-shaping layers.

At NRL, a diagnostic is being developed to measure the net magnetic field inside a partially current-neutralized intense ion beam by Zeeman splitting. The diagnostic is crucial to understanding beam transport issues in light ion ICF such as gas breakdown, ballistic transport, and self-pinched transport.

Contact: Jeff Quintenz, Inertial Confinement Fusion Program, Dept. 1202, 505-845-7245, fax: 505-845-7464, email: jpquint@sandia.gov
Highlights are prepared by Mary Ann Sweeney, Dept.1241, 505-845-7307, fax: 505-845-7890, email: masween@sandia.gov.
Archived copies of the *Highlights* beginning July 1993 are available at http://www.sandia.gov/pulspowr/hedicf/highlights.