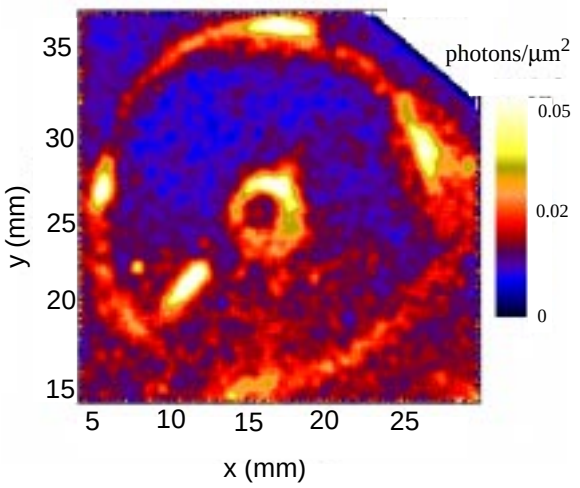
October 1993 Highlights of the Light Ion Inertial Confinement Fusion Program



Time-integrated x-ray pinhole camera view of lithium ion beam target image at 4.5 keV on shot 5936.

The uncertainty of the FY94 budget is limiting our ability to plan research efforts. Nevertheless, we are focusing on our primary objective of achieving three-digit hohlraum temperatures by August 1994 and our secondary objective of developing the technology and physics understanding necessary to establish a credible Laboratory Microfusion Facility (LMF) design.

Eight additional two-stage diode shots were completed on PBFA II, and the first large-area, single-stage "Pinocchio" shot was taken. In this series we are studying the effect of feed vs cathode tip electrons on diode behavior and testing power coupling at large anode-cathode gap spacings. A portion of the chief lithium ion beam diagnostic for the FY94 target series will be tested during an upcoming shot.

Anode surface contaminants desorbed from the LiF ion source at about 450°C may be a major contributor to the parasitic load current. On PBFA II we will use the fastest and least expensive heating method: DC heating with technology developed previously for the electro-hydrodynamic (EHD) ion source. We are assessing vacuum system modifications to remove the contaminants released by anode heating.

Ion beam characteristics on the FY93 lithium target series have been analyzed. On the most intense shots lithium focused 3-4 mm above the target midplane at the gold cone location. There is evidence of marked steering errors: the lithium beam intensity at 10 mm from the target axis is a factor of ten larger than the intensity at 3 mm on shot 5936 (see figure). Intensity variations of 24% to 30% along the gold cone midplane are comparable to that during the proton target series. We will assess the origin of these variations to develop methods to improve shot-to-shot reproducibility and focus on target in the next target series.

SABRE was restarted following modifications to improve timing synchrony and data acquisition and the installation of the plasma opening switch and a generator to inductively heat the LiF. We are using particle-in-cell simulations to optimize the single-stage diode and to design a two-stage diode. The extraction geometry and the magnetic field must be configured to avoid excess electron loss in the two-stage diode.

We are defining the beam transport window for LMF. A radiochromic film diagnostic fielded at NRL is providing a spatial map of ion fluence after travel through 1 Torr-m of air. Design of a compact junction box for the baseline National Ignition Facility system is complete, and diagnostic access in the target area has been improved by vertical orientation of the axis of the beam cones.

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