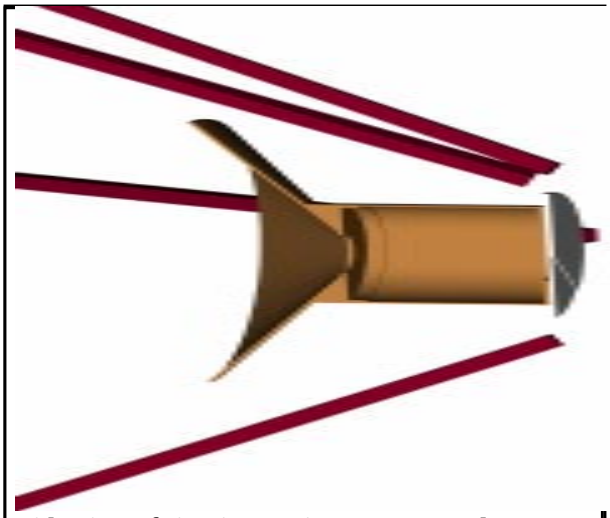
January 1994 Highlights of the Light Ion Inertial Confinement Fusion Program



Side view of titanium strips to measure beam profile in skeletal cone about cylindrical inner target.

We fielded five ion diode shots on PBFA II in the power coupling series and completed experiments in raised-cathode-cone geometry to increase flow impedance. The tests in the raised cone geometry verified our code predictions. Once current in non-lithium ions is reduced, these code simulations suggest that the higher flow impedance will increase the lithium beam power coupling.

A "parasitic" current, composed in part of energetic ions, limits the available lithium ion power on PBFA II. Faraday cups that view a large anode area indicate a substantial current of > 2-MeV ions. The rotation angle of damage on the outside edge of the gas cell skirts is evidence for proton emission at the outer edge of the anode. Continuum emission from plasmas formed in the diode may also be related to the parasitic current. Heating and cleaning the anode to remove contaminant ions should mitigate this current.

SABRE is operating with >95% pulsed power system reliability. Sixteen of the 17 experimental shots in January provided good conditions for ion source physics experiments. Machine and diode performance are very reproducible, with current, voltage, and Faraday cup waveforms from two sets of three similar shots in good agreement. High-spectral-resolution data from VUV spectroscopy indicate a four-milliradian C^{+3} source divergence with a wax flashover anode. This represents a significant step in characterizing the dependence of source divergence upon ion mass and charge. Next month we plan to add a visible spectroscopy system so that the divergence of neutral and ionized lithium can be compared.

Experiments will be done on Gamble II at NRL to evaluate ion beam transport issues for standoff. Diagnostics are being developed to provide data on the ion spatial distribution, ion beam bending in the magnetically-insulated diode, and the time-resolved ion current density.

We are preparing diagnostics for the June lithum beam target series. A new time-integrated x-ray pinhole array will allow us to view the target along the vertical axis, thereby simplifying the data analysis. A titanium "bird cage" diagnostic (see figure), consisting of three to five solid Ti strips, will be used to obtain the vertical beam focus and width and to provide a good measure of the azimuthal symmetry of the beam.

A reliable way to operate flash lamps in the National Ignition Facility has been confirmed by tests at American Controls Engineering. A third first-wall meeting was held in Albuquerque. The first-wall design is focusing on boron-coated aluminum panels. Final cost estimates have been made for the target chamber and target positioner. Our contributions to the Conceptual Design Report are now in draft form.

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