# NRL LASER FUSION PROGRAM

## July-August 2002 Bimonthly Highlights

## Time Evolution of High-Z Layer Density Profile on Coated Plastic Targets

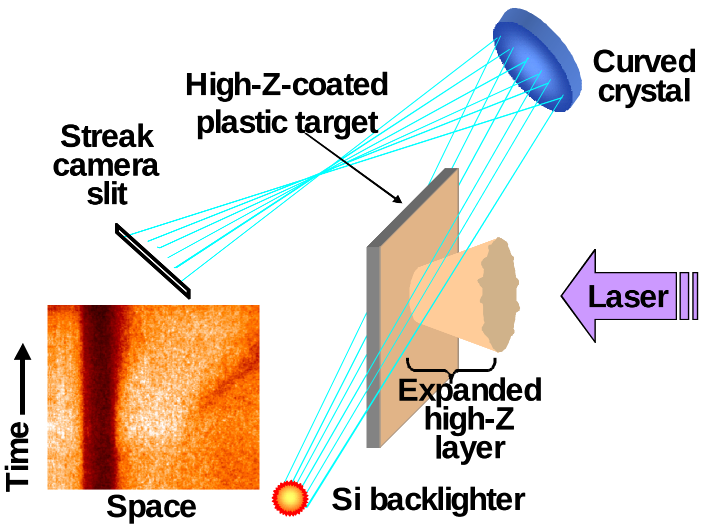


Fig 1: Schematic of the measurement setup.

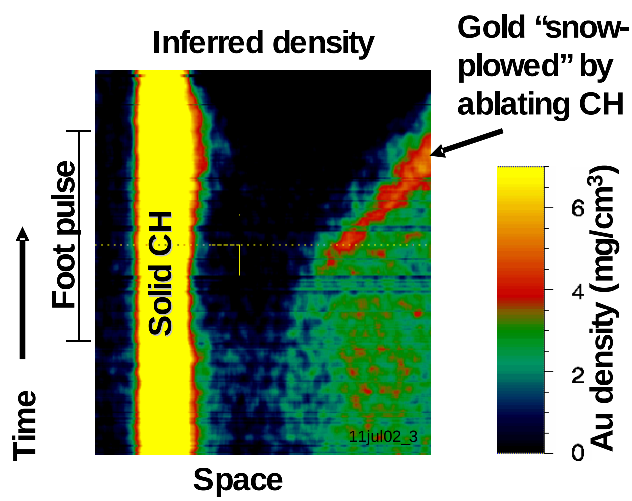


Fig 2: Measured gold density evolution.

Laser imprint is an important factor limiting pellet performance in direct-drive ICF. Large reduction in laser imprint has been observed for laser targets coated with thin (400-800Å) high-Z layers (S. P. Obenschain et al., Phys. Plasmas 9, 2234 (2002).). Most of the imprint occurs during the initial low-intensity part of the pulse, called the "foot" of the pulse, which is necessary to compress the pellet to achieve high gain. The mechanism of imprint reduction is thought to be a long scale buffering plasma formed by x-rays produced by the high-Z layer during the foot. This mechanism requires most of the laser light to be absorbed by the high-Z layer during the foot. In order to have a better understanding of the laser interaction with these targets, we have made measurements of the density profile of the high-Z layer normal to the target plane during and prior to the foot of the laser pulse. The measurement is performed with side-on monochromatic x-ray backlighting using Bragg reflection from a curved crystal coupled to an x-ray streak camera. The measurement setup is shown in Fig 1 above. An example of the time evolution of the gold density for a gold-coated target obtained from the data is shown in Fig 2. The results show that on the Nike laser, prior to the arrival of the foot of the pulse, the initially solid density high-Z layer is pre-expanded by a low energy, long duration (approx. 100ns) radiation from amplified spontaneous emission and beam-to-beam scatter. During the foot, the expanded high-Z layer is “snow-plowed” by the ablating underlying plastic. This results in a recompressed high-Z layer where the laser is likely absorbed and x-rays are produced. The underlying plastic is ablated by the x-rays produced in the high-Z layer, as thermal conduction is insufficient at such long (~100 µm) length scales, allowing smoothing of any laser non-uniformity and thus reducing laser imprint. These experimental results provide new insight into the behavior of high-Z layers and will be used to benchmark the simulations of laser interactions with high-Z coated targets.


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