Measurement of Fast-Electron Preheat: An important parameter to be determined in ignition studies is the fast-electron's preheat (mostly due to the two-plasmon-decay instability). This preheat, detrimental to the target performance, can be determined from the measured hard x-ray emission (HXR). However, the HXR can be emitted by the entire target, whereas the detrimental preheat relates only to the portion of the fast-electron energy deposited in the dense imploding shell. To relate the preheat to the measured HXR, the divergence of the fast electrons must be known. For inwardly (radially) moving electrons the dense-shell preheat would be larger than for divergent electrons.

To study fast-electron divergence we use targets shown schematically in Fig. 1. The outer CH shell is irradiated by the 60-beam OMEGA laser at constant energy. An inner glass bead of varying diameter is coated with a 30-μm layer of Mo. The Mo K_α x-ray emission is a signature of the number of fast electrons hitting the inner ball. For radially directed electrons, the energy in K_α will be independent of the inner-ball diameter, whereas for divergent electrons, the K_α energy will be proportional to the inner-ball diameter. Figure 2 shows the preliminary results of irradiating the target shown in Fig. 1. Intensity of the K_α line emitted by the inner Mo layer as a function of the Mo-layer diameter, normalized to that of the 200-μm case. The rightmost point corresponds to a target with an outer Mo layer. The red lines on the left connect pairs of targets having the same thickness of the outer CH layer. The two green lines represent the curves that would be obtained if the fast electrons moved (a) radially in and (b) isotropically divergent. The ratio of the measured K_α and that calculated for the radial motion case gives the fraction of fast electrons intercepted by the Mo shell. This provides a useful constraint for code simulations of the electron preheat in fusion-target simulations. Follow-up experiments will have varying thicknesses of Mo (smaller than a typical fast-electron range) to single out the effects of refluxing electrons. Also, inner shells with additional diameters of 100 and 600 μm will be included.

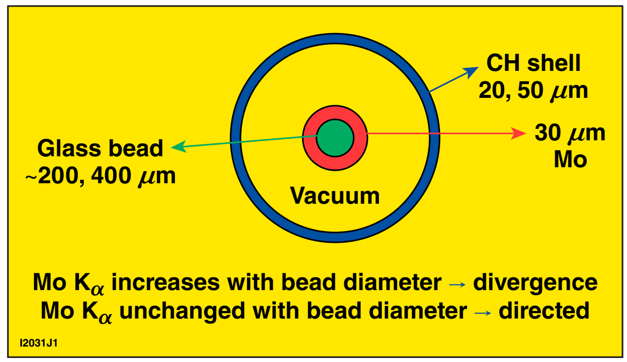

Figure 1. Schematic of the targets used to investigate the divergence of fast electrons. The K_α emission from the Mo layer (of different diameters) depends on the fraction of fast electrons hitting the Mo.

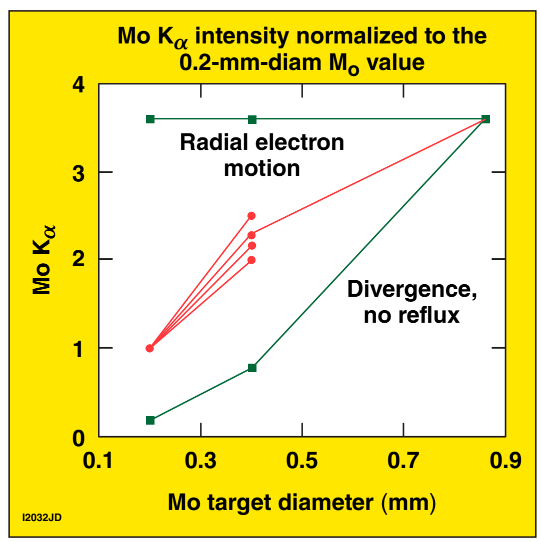

Figure 2. Intensity of the K_α line emitted by the inner Mo layer as function of the Mo-layer diameter, normalized to that of the 200-μm case. The two green lines represent the curves that would be obtained if the fast electrons moved (a) radially in and (b) isotropically divergent. The ratio of the measured K_α and that calculated for the radial motion case gives the fraction of fast electrons intercepted by the Mo shell.

Omega Facility Operations Summary: The Omega Facility conducted 212 target shots in February; 146 shots were conducted on OMEGA and 66 on OMEGA EP. February was the most productive month in the history of the Omega Laser Facility with a combination of extraordinary shot production on OMEGA and OMEGA EP with high experimental effectiveness on both lasers. The average experimental effectiveness for the facility was 97.4% (97.3% for OMEGA and 97.7% for OMEGA EP). The NIC performed a total of 76 target shots, while the HED program carried out 58 shots for experiments led by LLNL and LANL scientists. Seventeen targets shots were taken by two NLUF teams led by Rice University and the University of Michigan, respectively, and 61 shots were taken for six LBS experiments led by LLNL and LLE.

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