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Energy Transport by MeV Hot Electrons in Fast Ignition Plasma Driven with LFEX PW Laser

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The absolute energy transfer efficiency from laser to hot electrons in fast ignition plasma was estimated by applying quantitative high energy Kalpha x-ray spectroscopy. The absolute yield of Sn, Ta and Au Kalpha lines were measured by a calibrated Laue spectrometer. The Laue spectrometer was developed to cover the high energy Kalpha lines from Mo (Kalpha 17.48 keV) to Au (Kalpha: 68.80 keV). Absolute calibrations have been carried out for the crystal and detector separately by using pre-calibrated laser produced Kalpha sources and radiation isotopes. The hot electron propagation inside the solid target and Kalpha photon generation is simulated with a Monte-Carlo simulation. Considering the Kalpha photon number measured by the Laue spectrometer, the transfer efficiencies were estimated by comparing the experimental measurement and simulation results.
The transfer efficiencies from LFEX to target were estimated with planar and cone-guided geometries. Four types of cone were used: the standard Au cone with 7-microm thickness; an open Au cone without tip; a W-shape Au cone with double Au layers; and a diamond like carbon (DLC) cone. The transfer efficiencies of LFEX laser to a guiding-cone was found to be much higher than the planar target case, and was quantified to be 20% to 50%.

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