MULTI-KEV X-RAY YIELDS FROM HIGH-Z GAS TARGETS FIELDED AT THE NATIONAL IGNITION FACILITY*

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The National Ignition Facility (NIF) is a 192-beam laser system now operating at the LLNL. We report on the measured X-ray flux from gas-filled targets shot with 112-132 laser beams at the NIF. The targets were driven with up to 75 TW of laser power (350 kJ of 3ω laser energy delivered in a 5 ns modified-flat-top pulse). The laser delivered power and energy within 2% of the requested values on all shots. The targets were thin walled (25 μm), 4 mm long, 4 mm inner-diameter epoxy pipes designed to transmit X rays in the 1 – 10 keV spectral band. The pipes were filled with 1.2 atm of an Ar:Xe mixture. The emitted X-ray flux was monitored with multiple channels of the NIF facility's two X-ray-diode based DANTE instruments in the sub-keV range, as well as around 3.2 keV (Ar K-shell emission) and in the 4.0-6.5 keV band (Xe L-shell emission). Temporal waveforms of the emitted X rays, and the total emitted fluence are presented. Two-dimensional X-ray imaging (for energies > 8 keV) of the targets was performed with a gated X-ray detector that used a four-strip microchannel plate. The two dimensional images confirm supersonic, volumetric heating of the gas targets. Laser light scattered via laser-plasma instabilities from the target plasma was monitored with the facility's full aperture backscatter system (FABS), and hard X rays produced by hot electrons from the target plasma were measured with FFLEX diagnostic. We measure 15-20% laser-to-X-ray conversion efficiency for X rays with energies greater than 3.0 keV. This is significantly greater than any previous measurements in this spectral band.

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