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# X-ray backlighter requirements for refraction-based electron density diagnostics through Talbot-Lau deflectometry

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## ABSTRACT

Talbot-Lau x-ray interferometers can map electron density gradients in High Energy Density (HED) samples. In the deflectometer configuration, it can provide refraction, attenuation, elemental composition, and scatter information from a single image. X-ray backlighters in Talbot-Lau deflectometry must meet specific requirements regarding source size and x-ray spectra, amongst others, to accurately diagnose a wide range of HED experiments. 8 keV sources produced in the high-power laser and pulsed power environment were evaluated as x-ray backlighters for Talbot-Lau x-ray deflectometry. In high-power laser experiments, K-shell emission was produced by irradiating copper targets (500 × 500 × 12.5 $\mu$m$^3$ foils, 20 $\mu$m diameter wire, and >10 $\mu$m diameter spheres) with 30 J, 8-30 ps laser pulses and a 25 $\mu$m copper wire with a 60 J, 10 ps laser pulse. In the pulsed power environment, single (2 × 40 $\mu$m) and double (4 × 25 $\mu$m) copper x-pinches were driven at ~1 kA/ns. Moiré fringe formation was demonstrated for all x-ray sources explored, and detector performance was evaluated for x-ray films, x-ray CCDs, and imaging plates in context of spatial resolution, x-ray emission, and fringe contrast.