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Time resolved X-ray diffraction using the FIDDLE diagnostic at NIF

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The Flexible Imaging Diffraction Diagnostic for Laser Experiments (FIDDLE) is a new diagnostic at the National Ignition Facility (NIF) designed to observe in situ solid-solid phase (and eventually solid-liquid) changes at high pressures using time resolved X-ray diffraction. FIDDLE currently incorporates five Icarus Ultrafast X-ray Imager sensors that take 2 ns snapshots which can be tuned to collect X-rays for tens of ns. The platform utilizes the laser power at NIF for both the laser drive and the generation of 10keV X-rays for ~10 ns using a Ge backlighter foil. We aim to use FIDDLE to observe diffraction at different times during compression to probe the kinetics of phase changes. Pb undergoes two solid-solid phase transitions during ramp compression, as such it is an ideal candidate for our ability to test time resolved measurements with characteristic diffraction features associated with each phase. Results will be reported on the first shots using the FIDDLE diagnostic at NIF on ramp compressed Pb to a peak pressure of ~110 GPa. Improvements on background mitigation (via shielding from EMP disruption and shielding from X-ray sources) that has yielded the observation of time-resolved diffraction of ramp compressed Pb.

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