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Laser drive development for the APS Dynamic Compression Sector[1] THOMAS LAGRANGE, DAMIAN SWIFT, BRYAN REED, JOEL BERNIER, MUKUL KUMAR, JAMES HAWRELIAK, JON EGGERT, SHAM DIXIT, GILBERT COLLINS, Lawrence Livermore National Laboratory — The Dynamic Compression Sector (DCS) at the APS synchrotron offers unprecedented possibilities for x-ray diffraction and scattering measurements in-situ during dynamic loading, including single-shot data collection with x-ray energies high enough (tens of kV) to study high-Z samples in transmission as well as reflection. Dynamic loading induced by laser ablation is an important component of load generation, as the duration, strain rate, and pressure can be controlled via the energy, spot size, and pulse shape. Using radiation hydrodynamics simulations, validated by experiments at several laser facilities, we have investigated the relationship between irradiance history and pressure for ablative loads designed to induce shock and ramp loading in the nanosecond to microsecond range, and including free ablation and also ablation confined by a transparent substrate. We have investigated the effects of lateral release, which constrains the minimum diameter of the focal spot for a given drive duration. In this way, we are able to relate the desired drive conditions to the total laser energy needed, which dictates the laser technologies suitable for a given type of experiment.

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