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Gain Curves for Inertial Fusion Targets L. JOHN PERKINS, MAX TABAK, Lawrence Livermore National Laboratory — The gain curve for an inertial fusion target of a given class – that is, fusion energy gain as a function of driver energy – is a common central design need. However, the formal process of obtaining such data is a complex undertaking. In particular, as driver energy changes, target characteristics must change to optimize performance subject to constraints such as ignitability and stability. Accordingly, every point on a gain curve is a different optimized target design. In this paper we present a methodology for determining gain curves for a high-gain, laser direct drive reactor target. Formally, there are seven independent variables that must be defined to delineate a target design: driver energy on target, laser wavelength (blue, green, etc), laser power over the peak portion of the drive, shell outer radius, ablator thickness, fuel thickness and the in-flight adiabat. Given typical rad-hydro calculations take minutes per point through ignition and burn, a prohibitive amount of computational time would be expended to map this space even in 1-D. Accordingly, we have developed a fully dynamic 0-D model based on six coupled ODEs that describe energy, momentum and mass balances across the hotspot/cold fuel system. We obtain fast ($\sim$seconds) accounting of the processes from time zero through stagnation, ignition and burn, including full thermonuclear energy production under burn disassembly. Good agreement with 1-D simulations is obtained in gain-curve space for integral quantities such as gain, yield and stability margins.

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