Panel 4: Stagnation and Burn

To achieve hot-spot ignition and energy gain using the indirect-drive approach at the NIF, it is essential to set the correct conditions for the acceleration, coasting and deceleration phase of an implosion. Stringent requirements on the design of the cryogenically layered DT capsule and drive are therefore critical to obtain correct stagnation properties for optimal burn. This requires excellent understanding of the underlying physics that dictates and connects the:

- Strength and timing of the four sequential shocks used to compress the DT ice layer and set the fuel compressibility without significantly raising the fuel adiabat.
- Acceleration of the DT layer to highest possible velocity for maximum implosion kinetic energy while maintaining mix under control.
- Minimization of the coasting phase, which can decompress the DT fuel, raise the stagnation adiabat and the minimum kinetic energy required for ignition.
- Hot-spot formation during the deceleration phase and stagnation. Here, it is important to effectively convert the kinetic to thermal energy while at the same time minimizing the effect of mix.
- Alpha particle transport through the hot sport and high-density fuel for maximum bootstrap heating and effective burn propagation, which dictates the ignition threshold and energy gain respectively.

There are many issues involved in properly understanding the physical processes associated with each phase of the implosion, all of which play a critical role for setting the correct stagnation properties for optimal burn. Accurate modeling of the physics connecting the drive pressure, stagnation adiabat and energy required for ignition is therefore required. In current NIF experiments, there are still issues in forming the hot spot. The yield and pressures are lower than post-shot simulations and the hot-spot entropy is too high (large volume, small pressure and small mass), which might be due to shock mistiming (the fourth rise is causing hot release of inner ice layer), a fifth shock, inefficient conversion of kinetic to thermal energy, early termination of drive that increases the coasting phase, hydro jets caused by the fill tube and/or ice inhomogeneity.

In this panel, we will discuss how to better model (and better diagnose experimentally) this panoply of issues, and discuss the implications thereof for better implosion performance.

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