Preheat in NIF Double Shell Capsules

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Both hot electrons and hard X-rays could preheat a double shell capsule. However aluminum ablator double shells show no evidence of stimulated Raman scattering, and little of hot electron production. Backscattered laser light is ~ 0.5%, all in Brouillin scattering. Gold M-band X-rays (2-6 keV) are calculated to be present, and the expansion from their deposition was measured using VISAR in a surrogate NIF capsule with only an outer beryllium ablator and central liquid deuterium. The pre-heat velocities agreed with calculations and showed less than calculated asymmetry. These same X-rays will penetrate the beryllium outer coating of the central capsule of the full double shell shown in Fig. 1, causing a shock to enter the inner tungsten shell. When it exits the tungsten into the central fuel, most of the shock is reflected, leaving only a weak pressure wave to pre-heat the fuel. However the whole tungsten layer is also heated by gold L-band X-rays from the hohlraum that are much less abundant, but higher energy (10-30 keV). This preheat is calculated to be strongly asymmetric, but weak, raising the tungsten temperature less than 1eV. Before they can significantly preheat the fuel, these pressure waves are overtaken by a strong shock from the laser pulse. If the preheats are several times larger than calculated, they may degrade performance. We will measure this preheat in the tungsten using a NIF double shell VISAR target in the fall of 2017. If measurements continue to agree with calculations, we expect that preheat will not be a problem for double shell implosions on NIF.

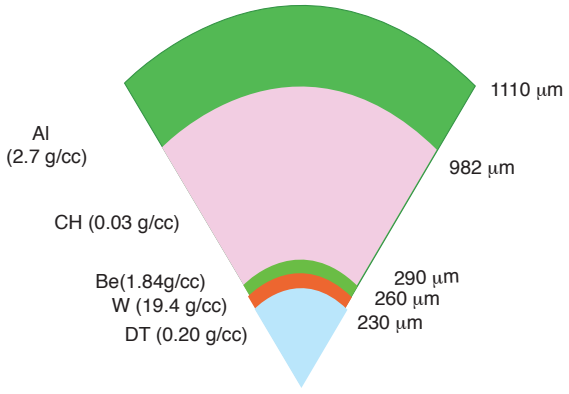

Figure 1: NIF 1.0 MJ Double Shell Capsule