DEBRIS AND SHRAPNEL ASSESSMENTS FOR NATIONAL IGNITION FACILITY TARGETS AND DIAGNOSTICS

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High energy laser experiments at the National Ignition Facility (NIF) have the potential to create debris and shrapnel capable of damaging laser optics and diagnostic instruments [1,2]. The size, composition, and location of target components and sacrificial shielding (e.g., disposable debris shields, or diagnostic filters)—and consequently the protection they provide—is constrained by many factors, including: chamber and diagnostic geometries, experimental goals, and material considerations. Therefore an assessment of the generation, nature and velocity of shrapnel and debris and their potential threats is necessary prior to fielding targets or diagnostics. In many cases, these assessments may influence target and shielding design, filter configurations, and diagnostic selection.

This paper will outline the approach used to assess the debris and shrapnel risks of NIF targets and diagnostics and present some aspects of two such assessments: First, the Material Strength Rayleigh-Taylor campaign [3-5] which consists of a large gold epoxy hohlraum driving rippled samples to generate Rayleigh Taylor instabilities which are imaged with a backlighter and passive diagnostic. A thick gold+CH shield attached to the hohlraum, covering the full view of the target, and extending past the ends of the hohlraum was proposed to block background from the hohlraum—creating a significant shrapnel threat to several layers of NIF optics. Second, the Mono Angle Crystal Spectrometer (MACS) [6], which requires a large aperture close to target chamber center with minimal filtration but capable of protecting fragile Highly Oriented Pyrolytic Graphite (HOPG) Bragg crystals. This paper will describe the mitigation strategies developed in response to the identified threats and observations of their successful application.

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