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10.46 Progress On Next Generation Gamma-Ray Cherenkov Detectors For The National Ignition Facility

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Fusion reaction history and ablator areal density measurements for Inertial Confinement Fusion experiments at the National Ignition Facility are conducted using the Gamma Reaction History diagnostic (GRH-6m). Future Gas Cherenkov Detectors (GCD) will ultimately provide ~200x more sensitivity, reduce the effective temporal resolution from ~100 to ~10 ps and lower the energy threshold from 2.9 to 1.8 MeV, relative to GRH-6m. The first phase consisted of inserting the existing coaxial GCD-3 detector into a reentrant well which put it within 4 meters of the implosion. This diagnostic platform has allowed assessment of the x-ray radiation background environment within the well which will be fed into the shielding design for a follow-on "Super" GCD. It has also enabled use of a revolutionary new pulse-dilation photomultiplier tube (PD-PMT) to improve the effective measurement bandwidth by >10x relative to current PMT technology. The next phase is to improve sensitivity by increasing solid angle. This can be accomplished with a single GCD w/ PD-PMT on a TANDM diagnostic insertor, or multiple smaller GCDs on a TANDM with standard PMTs. The PD-PMT version would provide unprecedented temporal resolution, while the multiple GCD concept would allow for time-resolved mix measurements.

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