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NIF Conceptual Design Studies of Bang Time Diagnostics Using d-t Fusion Gamma Rays[1] JOSEPH MACK, CARLTON YOUNG, SCOTT EVANS, HANS HERRMANN, Los Alamos National Laboratory, ROBERT MALONE, National Securities Technologies, MICHAEL MORAN, VLADIMIR GLEBOV, University of Rochester, Laboratory for Laser Energetics — Bang time and reaction history measurements are essential components of diagnosing failure-modes for ICF implosions on the National Ignition Facility (NIF). Fusion gamma rays are the preferred observable, as they offer the most direct link to deuterium-tritium (d-t) burn. NIF requirements dictate time resolution and timing accuracy of <10 ps and <50 ps, respectively. Current approaches use Gas Cherenkov Detectors (GCDs) that convert d-t fusion gamma rays to optical Cherenkov photons, which are collected and recorded by an appropriately fast system. GCD systems, based on ultra-fast photomultiplier tubes and streak cameras, have been developed and fielded successfully at the Omega laser facility. A comparative study of streak-camera-based designs, using optical transport and light pipes, are presented. Trade-off analyses are provided based on achievable throughput and bandwidth. Related studies are also described that attempt to optimize the most advantageous aspects of the case studies.

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