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4.21 Investigating the Relationship between Noise Transfer inside the Gated X-ray Detectors Used on the National Ignition Facility and their Imaging Ability

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X-ray imaging at the National Ignition Facility (NIF) is performed by means of diagnostics that combine an imaging system (pinhole apertures or mirror-based x-ray microscopes) and a detector. A multitude of x-ray detectors are used on NIF, depending on the experimental requirements and constraints. All of these detectors have in common the fact that the x-rays are indirectly recorded: quanta are successively converted, amplified, or scattered; these three basic stages can take place in different orders and be repeated a different number of times. To predict how noise is transferred throughout these stages, we apply a cascaded linear model analysis to a Micro Channel Plate (MCP)-based framing camera. We establish a theoretical expression of the Noise Power Spectrum (NPS) at the detector's output and assess its accuracy by comparing it to the NPS of Monte Carlo simulations of the detector's response to a uniform illumination. We also demonstrate that fitting the NPS of experimental data against a parametric model based on this expression can yield valuable information on the Modulation Transfer Function (MTF) of framing cameras, for both DC-biased and pulsed MCP operation. Prepared by LLNL under Contract DE-AC52-07NA27344.

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