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6.4 Implementing time resolved hot spot electron temperature capability on NIF using a streak camera

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The electron temperature (Te) of the hot spot within the core of imploded ICF capsules is an effective indicator of implosion performance. Currently, we have spatially and temporally integrated Te inferences using image plates. A temporally resolved measurement of Te will help elucidate the mechanisms for hot spot heating and cooling such as conduction to fuel, alpha-heating, mix and radiative losses. To determine the temporally resolved Te of hot spots, specific filters are added to an existing x-ray streak camera "Streaked Polar Instrumentation for Diagnosing Energetic Radiation (SPIDER)" to probe the emission spectrum during the x-ray burn history of implosions. One of the difficulties in inferring the hot spot Te is the attenuation of the emission due to opacity from the shell and fuel. A series of increasingly thick titanium filters were therefore used to select an x-ray band which reduces the influence of the shell/fuel optical depth while maintaining sensitivity to temperature. The signal level of the emission through the thicker filters are relatively poor so a dual slit (aperture) was designed to increase detected signal at the higher end of the spectrum. Herein, the design of the filters and slit and expected accuracy are described, and initial Te results are reported.

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