UNCERTAINTIES IN THE DETERMINATION OF THE X-RAY FLUX OF LASER-HEATED TARGETS UTILIZING DANTE[1]

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The Dante diagnostic is an absolutely calibrated filtered x-ray diode array which is capable of measuring the total x-ray flux in the 50 eV to 20 keV range with ±100 ps temporal resolution.[1-4] A key element of the analysis is the reconstruction of the emission spectrum from the measured signal (voltages) of each Dante channel. The broad and structured spectral response of each individual Dante channel prohibits an unambiguous determination of the spectral shape because there is a multitude of differently shaped spectra that would yield the same magnitude of signal for a given Dante channel. Even when combining the measurements from all channels, there is only very limited information about the spectral shape that can be extracted without applying additional constraints for the emission spectrum.[5-6]

Thus, assessing the uncertainty of the measured radiant intensity is not always achievable by analytic means.[7] The uncertainties of the calibration of the individual components, the sensitivity of the analysis algorithm to the applied constraints of the emission spectra, the dynamic response of x-ray detection and signal acquisition system, and the dependence of the measured signal on the specific geometry of the experimental platform have to be taken into account for a detailed error analysis. Requirements for conditions to obtain absolute radiant intensities with uncertainties of only ±5% will be presented together with a comparison of the derived uncertainties of Dante measurements from various target platforms that have been used at the National Ignition Facility.

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