

NIF x-ray crystal calibration via multiple throughput measurement techniques

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Over the past three years, the National Ignition Facility (NIF) Spectrometer Calibration Station (SCS) has developed a methodology to calibrate x-ray crystals by measuring their absolute throughput. From this full instrument response measurement, we can infer the integrated reflectivity as a function of energy for the individual bent crystals used in such diagnostics.

In considering multiple crystals and/or crystal geometries, this work has revealed the importance of experimentally calibrating crystals as we show that theoretical calculations are not always a good estimate and that even crystals with identical fabrication specification can display different behavior. Multiple comparisons with theoretical calculations will be presented as well as a modeling study of the effect of in-plane crystal orientation on reflectivity. Additionally, our findings initiated a cross calibration effort through collaborative engagements, in order to ensure the quality of the experimental data. We will show and discuss the different calibration techniques used by the x-ray spectroscopy community, from both in-house NIF SCS work and external facilities. We will show results of cross calibration for different NIF spectrometers and present comparison with direct rocking curve measurement.

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