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14.1 High Resolution (> 12,000) X-Ray Spectroscopy in the 6-100 keV Range

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Transmission crystal spectrometers have been fielded at NIF, JLF, LLE, and other major international laser facilities for the purpose of recording survey spectra in the > 6 keV energy range. Spectrometer sensitivities have been measured at the NIST national standard x-ray calibration facility using the absolute NIST exposures (air kerma) to establish an energy-dependent response function. This presentation will describe on-going efforts to experimentally demonstrate high resolving power (> 12,000) using a compact spectrometer geometry that is compatible with diagnostic instrument manipulators at major laser facilities such as NIF. Resolving power of 12,000 has already been experimentally demonstrated, using a cylindrically bent Si (331) crystal and the 8 keV Cu K lines, with the capability for 20,000 resolving power using the same crystal and 0.5 m long spectrometer geometry. Experimentally measuring such high resolution requires the careful measurement of the detector spatial resolution, of image plates and scanners for example, and of the source broadening of the spectral lines resulting from natural lifetime broadening and other effects. These techniques have been developed and experimentally demonstrated at NIST and will be described.

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