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14.44 A novel x-ray crystal spectrometer for the diagnosis of high energy density plasmas at the National Ignition Facility

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The spectrometer, described in this paper, employs as the Bragg diffracting element a new type of focusing crystal, which is bent in the shape of a torus with a very large major radius, R, and much smaller, minor radii, ρ, which vary in magnitude and their angle of inclination with respect to the major radius, R, along the crystal surface. The source is placed close to the crystal surface to maximize the photon throughput; and the curvature of the crystal is such that, for each wavelength λ, a perfect image of an ideal point source would be obtained in the detector plane, which is at the distance, R sin[Θ(λ)] from the reflecting crystal points, where Θ(λ) is the Bragg angle for a wavelength λ. The spectral resolution is, therefore, not affected by source-size broadening and can be very high. This spectrometer also provides a high, one-dimensional, spatial resolution perpendicular to the dispersion plane since the crystal-detector distance is much larger than the crystal-source distance [K. W. Hill et al., this conference]. First tests of the spectrometer concept will be conducted with a micro-focus x-ray tube and a Si [220] crystal, which will be glued on 3D-printed substrate. *Supported by U.S. Department of Energy contracts: DE-AC02-09CH11466 and DE-AC52-07NA27344

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