

General purpose highresolution xray crystal spectrometer (abstract)

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General purpose high-resolution x-ray crystal spectrometer (abstract)

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(Presented on 18 March 1992)

This spectrometer was designed to give access to a wide range of Bragg angles and crystal focal lengths while using the Rowland circle radius as a free parameter. Stability is achieved using a rigid beam or "Rowland chord," which provides a reference axis for all the critical alignments, the chord length being variable between about 0.2 and 5 m. Crystals of size up to $100 \times 30 \times 0.5$ mm can be accommodated in a novel four-pillar jig, $(\lambda/\delta\lambda)$ is typically 10^4 in the wavelength range from 0.1 to 1.3 nm, depending on the crystal. Various detectors have been used, including photographic film, multiwire gas proportional counters and large area CCD detectors, the latter having a 2-D spatial resolution of $22.5 \mu\text{m}$ (1152×1242 pixels, $26 \times 28 \text{ mm}^2$), a quantum efficiency greater than 20% between 0.7 and 12 keV and an energy resolution of about 150 eV. By sacrificing energy resolution, a one-dimensional mode with on-chip binning allows \sim ms time resolution of spectra from high flux sources such as tokamaks and synchrotrons. Results presented include photographic spectra from tokamak, beam foil and laser produced sources, and CCD spectra from tokamak and standard electron-beam excitation laboratory sources.

Bragg rotor spectrometer for the JET tokamak (abstract)

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A Bragg rotor spectrometer uses diffractors ranging from LiF (420) ($2d=0.18$ nm) to a multilayer mirror (Ni-C $2d=11.7$ nm). The extension to longer wavelengths is particularly useful at JET, where radiated power and Z_{eff} are usually dominated by light impurities such as Be and C, whose H- and He-like transitions lie between about 2.5 and 10 nm. A hexagonal rotor scans six diffractors sequentially and gives either full coverage of the soft x-ray spectrum (to monitor a range of ionization stages of any possible impurity), or high monochromatic sensitivity (to monitor trace impurities and give time resolution of $\sim 10 \mu\text{s}$ for the study of transient events such as impurity injection). A large area gas proportional counter covers a Bragg angle range from 20° to 70° , with each of its ten anodes being connected to an independent amplifier-discriminator chain, allowing count rates up to 20 MHz to be processed. Moderate resolving power is provided by a 1:600 Soller collimator. A smaller rotor is mounted with a side-by-side array of four small diffractors, and is reciprocated over a relatively small Bragg angle range to give a time resolution of 20 ms for about ten representative lines (for routine analysis of radiated power components).