

The FOCAL Spectrometer for Accurate X-Ray Spectroscopy of Fast Heavy Ions

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A system of two crystal spectrometers has been completed for accurate wavelength measurements of hard x-rays emitted by heavy ions in flight. The configuration is working in the Focusing Compensated Asymmetric Laue (FOCAL) mode along with high performance two-dimensional position sensitive micro-strip Ge detectors. Recent tests of the spectrometer have been performed securing quantitatively spectral resolving power and efficiency predicted by numerical simulations [1,2,3].

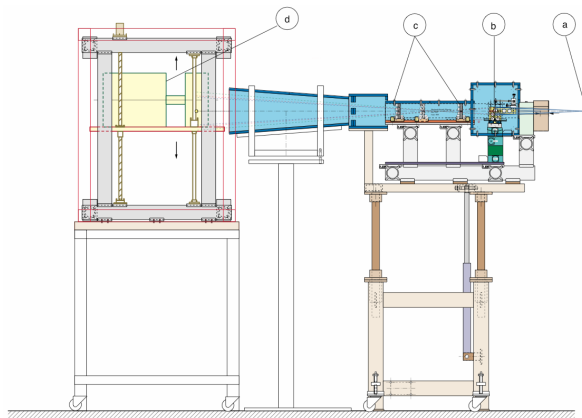


Fig. 1. The FOCAL spectrometer along with a detector stage on the left hand side. (a) is the position of the x-ray source, (b) the crystal part, (c) the slit assembly and (d) the detector. Each of the two spectrometers is approximately 3.2 m long.

Preliminary results have been obtained by mounting the micro-strip detector at the FOCAL test set-up. To investigate the position sensitivity of the detector, we have shifted the detector in steps of 50 μm and observed the centroid of the peaks from a radioactive ^{169}Yb source. The measurements of the Yb- $K\alpha_2$ line are shown in Fig. 2 and Fig. 3. The position of the line centroid shows a linear variation with the position of the detector. Therefore the consistency in all cases proves that the center of gravity of the lines observed can be determined with an accuracy better than 50 μm [4].

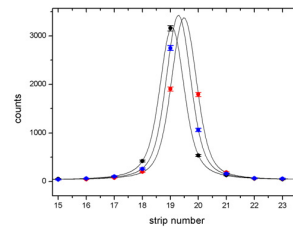


Fig. 2. The detector has been shifted in steps of 50 μm and the center of gravity of Yb- $K\alpha_2$ line was observed.

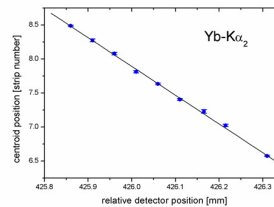


Fig. 3. The position (strip number) of the peak-centroid of Yb- $K\alpha_2$ is plotted as a function of the relative detector position.

The FOCAL spectrometer has been successfully tested reaching nearly all of its design goals. Important improvements are the boosted detection efficiency over other spectrometers, sufficiently high energy resolution and negligible Doppler broadening. Both the crystal optics and the two-dimensional position sensitive detector enable us to map complicated two dimensional intensity patterns on the detector plane.

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References

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