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Evaluation of Fluorescence Detectors for XAFS at High Flux Beamlines

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Detector technologies appropriate for fluorescence detection of XAFS are compared. The current workhorse methods of multi-element solid state detectors and filter-slit systems [1] need continued development to take full advantage of the fluxes available at modern synchrotron beamlines. These high fluxes create the potential for pushing XAFS measurements to extreme levels of diluteness (ppb) if the signal can be separated from the background. Both measurements and calculations are used to explore the ultimate limits for these technologies, and to compare them to alternative methods such as diffraction based analyzers. The measurements include the use of polycapillary optics as coupling optics for crystal analyzers and as improved slits in filter based detectors. The confocal nature of the polycapillaries significantly reduces the background for many samples, and they can be used for nearly perfect rejection of the filter refluorescence in filter based systems. The ultimate limit will be determined by processes such as inelastic scattering that produce backgrounds at the same energy as the fluorescence. These can be minimized but not eliminated by using detectors with high energy resolution.

[1] *E. A. Stern and S. M. Heald, Rev. Sci. Instrum., 1979, 50, 1579-82.*

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