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Update on X-ray Fluorescence Microscopy at the Australian Synchrotron.

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X-ray fluorescence microscopy (XFM) can be used for elemental and chemical microanalysis across length scales ranging from millimeter to nanometer. XFM is ideally suited to quantitatively map trace elements within whole and sectioned plant, biological specimens such as tissue sections, environmental and soil samples. The high elemental sensitivity of X-ray fluorescence microprobes coupled with deep penetration of hard X-rays enables measurement of an incredibly diverse range of samples in situ and under environmental conditions with a minimum of preparation.

Event mode X-ray fluorescence detection methods pioneered by the Maia detector system at the Australian Synchrotron XFM beamline enable high definition imaging which can approach megapixel per minute rates. The ability to rapidly acquire 2D images enables higher-dimensional studies such as fluorescence tomography, X-ray absorption near edge structure (XANES) imaging, and XANES tomography in realistic times.

Full spectral XANES imaging takes advantage of fast XFM and results in X-ray absorption near edge structure spectra from X-ray fluorescence at each pixel in the image. The speed and efficiency is gained by employing on-the-fly raster scanning and large solid angle, often multi-element, detectors with high count rate capabilities. The efficiency and speed ensures the lowest possible dose alongside high throughput.

In addition we are implementing high-resolution coherent imaging combining hard X-ray ptychography correlated with X-ray fluorescence imaging to reveal ultrastructure at high resolution.

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