Upgrade of 8-BM for High Throughput Trace Element Analysis.

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Abstract:

The application of x-ray fluorescence (XRF) to the measurement of trace metals in the life and environmental sciences is a very exciting area in the scientific community, as evidenced not only by numerous recent publications, but also by rapidly increasing user demand. While very successful, conventional approaches, such as x-ray fluorescence microscopy, remain severely limited in the scope of study due to the time necessary to acquire statistically significant data in a scanning microprobe, in particular for low-probability events. Therefore, we propose to upgrade an existing bending magnet beamline (8-BM) into a dedicated beamline for the high-throughput analysis of trace elements in the life sciences. Such an instrument will substantially increase the throughput for XRF analysis, and address a broad range of scientific questions which currently cannot be interrogated. Specifically, we plan to house dedicated experimental setups that allow the high-throughput analysis of micro-arrays and tissue sections, to improve our understanding of trace metals and their essential role in health and disease. In particular, the instrumentation will enable the rapid acquisition of large data sets necessary for clinically relevant interpretation. We will also incorporate X-ray cytometry, to study the total trace element composition of single cells to examine large cell populations on an individual basis, enabling experiments with a large scope that are currently not possible. Lastly, by combining XRF with both traditional and cutting-edge proteomics technologies, we will enable unprecedented scientific inquiry into metal-mediated regulation of biological pathways.