Maia Mapper: High definition XRF imaging in the lab

Chris Ryan\(^{(1)}\), Robin Kirkham\(^{(1)}\), Gareth Moorhead\(^{(1)}\), David Parry\(^{(1)}\), Murray Jensen\(^{(1)}\), Andrew Faulks\(^{(1)}\), Steve Hogan\(^{(1)}\), Paul Dunn\(^{(1)}\), Roshan Dodanwela\(^{(1)}\), Louise Fisher\(^{(1)}\), Pete Siddons\(^{(2)}\), Anthony Kuczewski\(^{(2)}\), Ulf Lundström\(^{(3)}\), Alexia Trolliet\(^{(3)}\) and Ning Gao\(^{(4)}\)

\(^{(1)}\)CSIRO, Normanby Road, Clayton VIC 3168, Australia  
\(^{(2)}\)NSLS-II, Brookhaven National Laboratory, Upton NY 11973, USA  
\(^{(3)}\)Excillum AB, Torshamnsgatan 35, 164 40 Kista, Sweden  
\(^{(4)}\)XOS, 15 Tech Valley Drive, East Greenbush, NY 12061, USA

\texttt{chris.ryan@csiro.au}

Maia Mapper is a laboratory XRF mapping system for efficient elemental imaging of drill core sections serving minerals research and industrial applications. It targets intermediate spatial scales, with imaging of up to \(~80\) M pixels over a \(500 \times 150\) mm\(^2\) sample area, as part of the analytical workflow of the Advanced Resource Characterisation Facility [1], which spans spatial scales from ore deposit to atomic scales. It brings together (i) the Maia detector and imaging system [2], with its capabilities for high efficiency detection (1.2 sr solid-angle), event-mode operation, millisecond pixel transit times in fly-scan mode and real-time spectral deconvolution and imaging [3], (ii) the high brightness MetalJet D2 liquid metal micro-focus X-ray source from Excillum [4] with high-In I\(^2\) alloy anode and 200 W power at 70 kV into an effective 20 \(\mu\)m source size, and (iii) an efficient XOS polycapillary lens [5] with a flux gain >8000 at 19-24 keV into a \(~30\) \(\mu\)m focus, all integrated with stage raster scanning for automated imaging and analysis of drill-core sections.

Users select scan regions on a computer screen from a tiled optical image of the entire sample area. The list of scans is then executed in sequence with display of deconvoluted element component images accumulated in real-time in the Maia FPGA using a Dynamic Analysis (DA) method transform matrix constructed using the GeoPIXE software [3]. Further off-line refinement and re-processing (at rates of \(~10^5\) pixels per second) and exploration of the large image data-sets are done using GeoPIXE.