Development of X-ray Tomography Methods to Complement Light and Electron Correlative Microscopy Workflows

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Laboratory X-ray microscopy (XRM) has recently emerged as a powerful technique to perform nondestructive 3D imaging on samples over a range of length scales and material types.[1] XRM has shown the ability to provide valuable context and navigational information in the correlative microscopy environment, complementing information from light and electron microscopy instruments.[2]

The combination of XRM imaging with post-mortem analysis (such as FIB-SEM) presents several unique opportunities. This work will highlight specific examples from Materials Science and Life Science, how correlative workflows have been enabled through the implementation of XRM information via a modern correlative workspace (Atlas). In Materials Science, XRM tomograms collected on an Al 7075 aluminum alloy are used to locate inclusions and pores within the interior of the microstructure, which are then selected and examined at higher resolution by targeted FIB-SEM serial sectioning at defined regions of interest.[3] In Life Sciences, XRM presents a unique opportunity to bridge the length scales between light and electron microscopy, easing the ‘needle in a haystack’ navigation problem for locating the same region of interest using multiple microscopy tools.[4] Application of XRM to multi-modal brain tissue imaging will be presented.

Figure: XRM dataset of stained (for EM) mammalian brain tissue, used to navigate to specific subsurface volumes of interest quickly, thereby multiplying the efficiency of 3D EM techniques. Work is in collaboration with NCMIR @ UCSD.