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Enhancing efficiency in high-resolution 2D mapping: arbitrary geometry scanning for μXRD/SAXS and μXRF at MAX IV

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Advanced materials exhibit complex hierarchical architectures across multiple length scales, characterized by spatially heterogeneous chemical element distributions. Comprehensive understanding of such materials necessitates high-resolution mapping of both structural and elemental compositions. Two-dimensional micro X-ray diffraction/small-angle X-ray scattering (μXRD/SAXS) and micro X-ray fluorescence (μXRF) are well-suited for this purpose. Existing continuous scanning methods at MAX IV enable efficient mapping over large sample areas but are constrained to rectangular scan geometries. This limitation leads to inefficiencies when targeting arbitrarily shaped regions of interest, resulting in prolonged scan times due to the inclusion of irrelevant surrounding areas. To address this limitation and enhance scanning efficiency, we present a new arbitrary-geometry scanning solution utilizing a time-resolved hardware synchronization system. This advancement enables users to define and scan custom-shaped areas aligned with specific experimental demands, based on the probing technique rather than relying on optically visible boundaries. Preliminary tests at the DanMAX beamline demonstrate that the reduction in scan time is proportional to the decrease in sample area relative to the original rectangular scan region, thereby significantly enhancing the efficiency of high-resolution structural and compositional mapping workflows.
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Footnotes

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