

## Development of a Small-Angle X-ray Photon Correlation Spectroscopy Beamline for Studying Dynamics in Soft Matter

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### Abstract

This white paper proposes an “in-place upgrade” of the X-ray Photon Correlation Spectroscopy (XPCS) beamline at 8-ID operating in the small-angle regime. The hallmark of APS-U is the dramatic increase in coherent flux, which will revolutionize XPCS, for example expanding its dynamic range by up to 6 orders of magnitude. The proposed beamline will be world leading in probing fluctuation dynamics in materials, over unprecedented length scales of 5  $\mu\text{m}$  – 1 nm and time scales of 10 nanoseconds – 1000 seconds. As the science case below illustrates, this spatiotemporal range aligns well with key problems in soft matter. In addition, leveraging the APS-U, the beamline will have capabilities for sample environments, such as *in situ* rheometry, nanofluidic flow, and high pressure to access dynamics under conditions that are difficult or impossible to achieve today. The research enabled by the beamline will significantly impact key problems in soft matter and advance their potential applications in technologies across an array of sectors, from energy and transportation to health, agriculture and national defense.

