New Capabilities of the Structural Science Group Beamlines before and after the APS Upgrade

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The Advanced Photon Source (APS) is undergoing an upgrade of the storage ring, after which the facility will be able to generate X-ray beams much brighter than today. The Structural Science Group (SRS) at APS operates five X-ray diffraction (XRD) and total scattering beamlines, 11-BM, 11-ID-B, C, D and 17-BM, serving a broad scientific community in the area of chemistry and materials science. Two of the three undulator beamlines, 11-ID- B and C, having been supporting in situ and operando high-energy x-ray powder XRD and pair distribution function (PDF) experiments for decades, expanded the capacity to study thin films and interlayers with recent addition of compound refractive lenses for beam focusing and hexapod platforms for precise sample alignment. Beamline 11-ID-D, being reconstructed during the APS upgrade, will be equipped with a newly developed optic offering a wide range of photon energy from 26 to 120 keV with adaptable bandwidth and submicrometer focusing, as well as an extended experimental hutch with a maximum sample-to-detector distance of 15 meters, able to offer the combination of XRD and total scattering with small angle X-ray scattering (SAXS). On the software side, the group is working closely with the computing and data science groups at APS to implement tools for automated data processing and on-the-fly data analysis. Other than performing experiments onsite or remotely, users can also access 11-BM, 17-BM and 11-ID-B through a mail-in service for simple XRD/PDF measurement.