Cover page

Title: Multidimensional Full-Field Real Time Imaging Facility

Point of Contact: Kamel Fezzaa

Contributors: Kamel Fezzaa, Tao Sun, Francesco De Carlo

Advanced Photon Source

Abstract

Full-field imaging is an extremely versatile technique that is broadly applicable to almost all scientific and engineering disciplines. Its versatility is reflected by the fact that every major synchrotron facility in the world has a dedicated full-field imaging facility. In many cases, full-field imaging is the keystone linking a sample to other X-ray techniques such as ptychography, μXRF, μXANES, and μXRD.

The current APS source characteristics prevent the hierarchical characterization of dynamic systems and materials with spatial resolution below 1μm, without a major sacrifice in time resolution.

Another existing limitation is the large difference in spatio-temporal resolution between full-field and scanning probe techniques, in practice preventing the integration of different modalities around full-field imaging for dynamic systems.

The new APS-U source, besides increasing sensitivity and resolution for parallel beam full-field imaging (see figure 10), will also enable a Kirkpatrick-Baez (KB) based Cone Beam projection X-ray Imaging (CBI) system to become the ideal choice for hierarchical characterization of dynamic systems at 50-1000 nm. The upgrade will thus bridge the existing resolution gap while preserving the single pulse (80 ps) time resolution that currently only parallel white beam imaging can afford.

The proposed new beamline will provide a unique multimodal characterization platform (imaging, diffraction, and scattering) all spanning a large range of spatial and temporal resolutions as shown the figure 1.

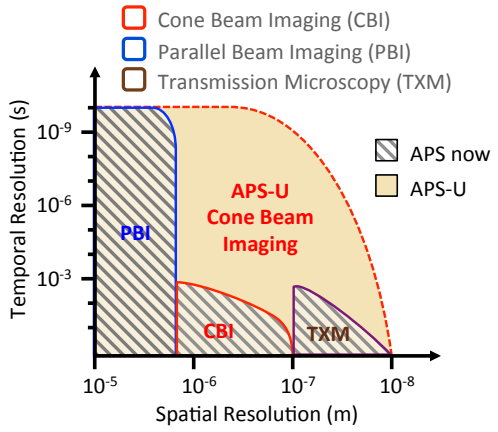

Figure 1 - Temporal and spatial resolution range for the proposed APS-U full-field imaging beamline.