

### **Time-resolved Studies with Pulsed X-rays at BioCARS: Present Capabilities and Future Directions**

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Static structures for many molecules are available at high resolution but the mechanism by which these molecules function and the structures of intermediate states often remain elusive. Time-resolved crystallography is a unique technique for determining the structures of intermediates and excited states in biomolecular and chemical reactions. Using the Laue X-ray diffraction technique at the high-brilliance third-generation X-ray sources (ESRF, APS, SPring-8, etc.) snap shots are taken of molecules in action with a time resolution of about 100ps, the typical duration of a single X-ray pulse at synchrotron sources. We present the status of a user facility for time-resolved studies at the BioCARS beamline 14-ID at the Advanced Photon Source. During the past years a continuously growing time-resolved user community has developed; projects under investigation include light and chemically triggered reaction mechanism. Results from most recent studies of photo-sensitive proteins will be discussed. An overview will also be given on the current efforts in enhancing the technical capabilities for time-resolved experiments at BioCARS. The technical upgrades will improve resources for complementary optical monitoring of reactions in crystals, update the laser systems, and most importantly improve the X-ray optics to enable single X-ray pulse experiments.

**Keywords:** time-resolved Laue diffraction, structure and function, synchrotron radiation instrumentation