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Sample Extractor for Serial Crystallography at XFELs and Synchrotron sources

The short X-ray pulses produced by X-ray Free Electron Lasers (XFELs) can produce diffraction information on time scales that outrun radiation damage processes, enabling structural investigations using extremely small and weakly diffracting crystals at ambient temperatures. Since each crystal exposed is destroyed in the process, full datasets are assembled from a series of still diffraction images collected from many individual crystals delivered in progression, a process known as Serial Femtosecond Crystallography (SFX).

Here we describe a new sample delivery device for SFX, the Sample Extractor, that may be used to deliver delicate crystals directly from native crystallization solutions. The Sample Extractor operates at ambient temperatures and pressures minimizing the mechanical stress subjected to the crystals. The device was recently used to collect complete SFX datasets at the LCLS XFEL and the SSRL synchrotron. Details of the device including fabrication, operation, data collection and results will be presented.