Poster

Serial Microsecond Crystallography at ESRF-EBS

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Serial macromolecular crystallography (SMX) has emerged as a highly effective technique for uncovering the structures of biological macromolecules at room temperature (RT). While microfocus beamlines at third-generation synchrotrons are invaluable, their capacity for data acquisition is often restricted to the millisecond time scale due to limitations in photon flux and detector capabilities. The newly developed ID29 beamline at the European Synchrotron (ESRF), a flagship project of the upgraded Extremely Brilliant Source (EBS), was specifically engineered to capitalize on the attributes of the ESRF's fourth-generation source. ID29 stands out as the pioneer beamline dedicated to room temperature serial microsecond (µs) crystallography (RT-SµX) utilizing truly µs-pulsed X-rays. Its distinctive features, along with a compact and versatile diffractometer, facilitate swift sample environment changes accommodating various solid supports and three types of high-viscosity extruders (HVE). Our study underscores the essential combination of pulsed beams, a rapid JungFrau4M detector, and fully synchronized data collection setups for efficient RT-SµX or serial crystallography experiments. We demonstrate how the unique beam characteristics, made possible by the new ESRF 4th generation source, pave the way for microsecond time-resolved crystallography, capable of obtaining fully interpretable electron density map from a limited number of merged frames. Looking ahead, the demonstrated capabilities of room-temperature serial microsecond crystallography at ID29 are poised to find broad utility at forthcoming fourth-generation synchrotron sources worldwide.