TPS 11A – *In Situ* Serial Synchrotron Crystallography

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Abstract

The study of structure-function relations of macromolecules is a major aim in modern life science; synchrotron-based protein crystallography (PX) has become a powerful and fundamental technique to achieve that purpose. However, crystals of important macromolecules, such as membrane proteins, pathogenesis-related proteins and viruses, are usually small in sizes and have poor diffraction quality. In addition, some protein crystals are tougher to deal with (*e.g.* hard-to-harvest or hard-to-freeze), these samples are so-called "hard-to-handle crystals". Given that, NSRRC will build the third new PX beamline, TPS 11A (*in situ* serial synchrotron crystallography beamline), to tackle the challenging issue. The X-ray source of TPS 11A is a three meters long in-vacuum undulator (IU22), producing a high-brilliant X-ray beam. TPS 11A will house a cryocooled horizontal double-crystal monochromators (DCM), a cryocooled double multilayer monochromators (DMM), a horizontal focusing mirror (HFM) and a pair of Kirkpatrick–Baez mirrors to focus the beam to the fine spot. The expected focused beam size at the sample is about 1 μm (H) x 1 μm (V) with the photon flux of 1.0 $x10^{13}$ photons/s. The variable beam size at the sample position is designed for a range from 10 μm to 1 μm. TPS 11A will be equipped with a single-photon counting pixel detector and a high-speed robotic sample changer for automatically sample mounting and centering, making the data acquisition more efficient. TPS 11A, in particular, will provide four operation modes for PX communities: standard goniometer, in situ/tray (SBS plate) screening, fixed-target (microfluidic devices and thin film sandwich) and injector (LCP extruder) data collection. The optional mini-κ goniometer of the high precision micro-diffractometer enables crystal reorientation. Substantial user-support, remote access and mail-in service are also provided. The conceptual design of TPS 11A is given in this article.

Keywords –hard-to-handle crystals, in situ/tray screening, fixed-target and injector collection.