New SSRL Remote Access Program Supports Elevated-Temperature and Humidity-Controlled Experiments

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Expanding on its mature cryo-crystallography program, the Structural Molecular Biology (SMB) group at the Stanford Synchrotron Radiation Lightsource (SSRL) now supports a fully remote user-access program for diffraction experiments at controlled humidity conditions. During data collection at SSRL BL12-1, crystals can be maintained in a controlled temperature environment or at controlled humidity (and ambient temperature conditions) including stepwise crystal dehydration experiments. To enable robotic sample exchange at the beam line, 10 samples on standard magnetic bases fit into a new SSRL in-situ plate. The plate is a combination of a crystallization plate and a uni-puck, serving as a one-spot crystallization and sample storage and shipping container. For shock-free transport to the beam line, six SSRL in-situ plates fit inside an insulated thermal shipper which contains a phase-changing liquid to maintain the temperature for up to 7 days during transport using a standard courier service like FedEx. At the beam line, in-situ plates are loaded into a humidity-controlled bay accessible to the sample exchange robot. To initiate an experiment, the Blu-Ice control software incorporates a new user interface to mount samples from inside the in-situ plates.

These novel tools and automation offer SSRL users a seamless home-lab to remote-lab experience, opening the door to more advanced remote access diffraction studies. Exciting opportunities enabled by this technology include exploring phase transitions, controlled dehydration to achieve higher resolution data, and studying protein structure and dynamics at near physiological temperatures. For example, the possibility to trigger chemical reactions within enzyme crystals during serial diffraction experiments can provide detailed mechanistic information. To support and accelerate these goals, a number of advanced options are available to the SSRL user community that build upon this new remote-access program.