



## Eli Lilly and Company

### LRL-CAT

(Lilly Research Laboratories – Collaborative Access Team)

## EXPRESS CRYSTALLOGRAPHY PROGRAM

### Policies and Procedures

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# 1. Overview

LRL-CAT offers "Express Crystallography", a **MAIL-IN** protein crystallography service, to industrial, government and academic users of the Advanced Photon Source. Through this program, researchers are able to obtain data from the highly automated X-ray facility. LRL-CAT personnel will screen and collect data from crystals based on initial specifications from the program's participants.

All Proprietary requests will require contract agreements. LRL-CAT offers a Fee for Service or Long Term Program. For program details, contact us at: [us\\_lrlcat\\_guinfo@lilly.com](mailto:us_lrlcat_guinfo@lilly.com)

All Non-Proprietary requests for data collection at LRL-CAT are handled as rapid access proposals through the General User Program of the Advanced Photon Source. Proposals may be sent to the APS at any time. Once a proposal has been submitted and all safety documentation provided and approved by the APS and LRL-CAT staff, samples can be run quickly when the APS is operational. The turn-around for screening images and datasets is within 1-2 days. Although routinely, users get their data within 24-32 hours of shipment.

## 2. Getting Started

### 2.1. Review LRL-CAT Technical Capabilities

Before submitting a proposal, prospective users should review the technical capabilities and specifications of LRL-CAT. This review will ensure that the beamline facilities meet the user's requirements and that all needed equipment and instrumentation are available. The LRL-CAT technical specifications are as follows:

- Technique: Macromolecular crystallography
- Insertion Device: Undulator A
- Monochromator: Kohzu HLD-15 Double Crystal LN<sub>2</sub> Cryocooled
- Crystals: Silicon (111)
- Energy range (beamline, standard configuration): 5.0 - 22 keV (0.56 – 2.47 Å)
- Energy resolution: ~0.01% (FWHM)
- Focused beam size (H x V): ~140 μm x 50 μm
- Flux at sample position (Se K edge, 1st harmonic of undulator): ~5.2 x 10<sup>12</sup> (photons/sec, measured with Si pin diode)
- Detector: **Pilatus3 S 6M** Detector readout: 2 milliseconds, maximum frame rate 25 images per second | Click here for more detector information: <https://www.dectris.com/products/pilatus3/pilatus3-s-for-synchrotron/details/pilatus3-s-6m>

- Robotic Sample Changer: IRELEC CATS
- Robotic Sample Changer maximum capacity: 540 crystals
- Crystal centering: automated loop centering and manual
- Crystal Mount: EMBL SPINE (MD)
- Beamline Control Systems: Python, C, EPICS, spec (Certified Scientific Software) on Linux

## 2.2. Review Procedures for LRL-CAT Express Crystallography Program

LRL-CAT has a highly automated system for tracking samples and collecting data. The instructions must be followed in detail in order to maximize the quality of your results and smoothness of the whole procedure. (See [Section 3](#)).

**Proprietary Users can skip to Section 3.**

## 2.3. Acceptance of Requirements for Participating in the LRL-CAT General User Program

SUBMISSION TO THE APS OF A GENERAL USER PROPOSAL FOR LRL-CAT CONSTITUTES ACCEPTANCE OF THE CONDITIONS AND PROCEDURES LISTED IN APPENDIX A .

## 2.4. Submit General User Proposal to the APS

Submission of a General User Proposal at LRL-CAT is coordinated through the APS General User System. In most cases, beamtime will be allocated and data collected before your general user proposal is reviewed by the APS.

The APS provides information on access procedures via its online proposal system (see <https://www.aps.anl.gov/Users-Information/Getting-Started/User-Checklist>). Users can create, edit, and view proposals or request additional time for existing proposals. All beamtime requests at LRL-31-ID must be submitted as “mail-in” Rapid Access proposals.

As part of the proposal, the user includes a request for shifts of 8 hours. Users can estimate the number of shifts based on the following statistics: LRL-CAT can screen approximately 43 crystals each hour. A typical diffraction dataset of 180 degrees (900 frames at 0.2 degree / frame and 0.12 second / frame exposure requires ~3.2 minutes, including mounting and centering. Therefore, for standard crystals, we can collect up to ~18 datasets per hour, which includes crystal mounting, centering, and dataset collection. For well-diffracting crystals, LRL-CAT can collect up to 30-40 datasets per hour.

Each proposal is also required to have a current APS [Experimental Safety Assessment Form](#) (ESAF). The ESAF must be completed and approved by both the Advanced Photon Source and LRL-CAT prior to shipment of the dewar containing the user's samples.

## 3. LRL-CAT Express Crystallography Procedures

### 3.1. Contact Information

Each user will be assigned a unique contact identification number (Contact ID) that will be used for correspondence with LRL-CAT. Users only need to request a Contact ID during their first experiment at LRL-CAT. The identity of the user should be linked to the Principal Investigator. See [Section 5](#) below for the Contact ID request form and information to be submitted to LRL-CAT.

### 3.2. Sample Preparation

The LRL-CAT Express Crystallography Program relies on procedures for sample preparation and documentation that have been used at the beamline since the beginning of 2004. These procedures are designed to maximize the efficiency of beamtime utilization at LRL-CAT and the quality of communication between the users and LRL-CAT personnel. Users are strongly encouraged to follow the sample preparation instructions to the letter.

#### 3.2.1. Obtain Vials and Bar-coded Bases

All pins must be mounted in Molecular Dimension bases which are compatible with the IRELEC CATS cryo-sample changer in use at LRL-CAT. The bases can have the 2-D bar code option that can be used as part of the LRL-CAT sample tracking system. Order the Molecular Dimensions Cryo-caps with Data-Matrix ([MD7-401](#)) or without ([MD7-400](#)). These are sold in combination with cryo-vials ([MD7-402](#)), which are also required with the sample changer. Hampton bases and vials are NOT compatible with our data collection process!

**Please do not write on the underside of the base, over or near the 2-D bar code. Such markings can interfere with operation of the bar code scanner.**

#### 3.2.2. Use 18 mm Pins

The pins attached to the bases must be 18 mm in length. [Mounted cryo-loops](#) (constructed from nylon fiber whose diameter is ~20-100 microns) from Hampton are ideal for this purpose. The pins are scored to permit the creation of different lengths. Break the pin at the second score from the non-loop end to yield a pin that is 18 mm long.

Do NOT use loops whose fiber is 10 microns in diameter. These loops lack enough visual contrast to be recognized by the LRL-CAT automated loop-centering software. **Litho-type loops (such as those from Mitegen and Molecular Dimensions) are NOT compatible with our system.**

Be sure to glue the pin firmly into the base. In our experience, Superglue or equivalent works best. Epoxies do work but require greater care. If the pin is not held firmly to base, the crystal may not remain in the X-ray beam during your experiment or may cause a robot crash during mounting/unmounting of the sample.

Any deviation from these rules will cause our automated loop-centering program to fail and beamline staff will have to center the samples manually for screening and for data collection, thus significantly delaying beamline operations and increasing workload on beamline staff.

### 3.2.3. Obtain 1D Bar-code Labels from LRL-CAT

LRL tracks all samples with a triple barcode system, which employs the 2-D barcode on the underside of the pin base and **TWO UNIQUE, SINGLE USE 1-D barcodes provided by LRL-CAT.**

In the LRL-CAT tracking system, one (2 inch) 1-D bar code applied to the plastic cryo-vials in which the samples are shipped represents the primary crystal identifier. As the pin bases are typically re-used, the 2-D barcode can be associated with more than one crystal. The latter code therefore is used as a secondary identification system. The 2<sup>nd</sup> (1 inch) 1-D barcode will be used to identify the puck.

**It is crucial that the following directions be followed exactly.**

The (2 inch) bar codes are to be attached so that the long axis of the bar code is oriented along the length (height) of the cryo-vial (see figure below). In order that the barcodes remain attached to the vial throughout shipment, they must be applied at Room Temperature. **Do not cover the vent holes at the top of the vial.**



The (1-inch) barcodes should be mounted on the puck as shown below.



LRL-CAT will either mail the bar codes to the Users or ship them via [Federal Express®](#) if the User provides LRL-CAT with a FedEx account number.

### 3.2.4. Crystal Mounting

LRL-CAT will auto-center all samples in the X-ray beam using a robust, proprietary loop-centering algorithm developed by LRL-CAT. This algorithm requires that the submitted crystals are placed into loops that are commensurate with crystal size. The auto-centering system detects the cryo-loop within a video image of the loop. It does not attempt to find the crystal.

Crystals should not protrude significantly outside the loop. The irregular outline of the loop in such cases can cause the auto-centering algorithm to fail. This restriction is particularly important for rods or needles. The end of the crystal in this case must not extend past the end of the loop, since this makes it difficult to identify where the loop terminates.

The beam size at LRL-CAT is approximately  $120 \times 80 \mu\text{m}^2$ . Therefore, loops with a maximum dimension of  $\sim 70$  microns have the best chance of being centered correctly. If the crystal is significantly smaller than the loop or is not centered within the loop, it is possible that the crystal will not be in the beam during data collection. Beamline staff will try to resolve this issue manually but this will delay normal operations. For crystals larger than the size of the beam, larger loops may be used, provided that they are commensurate with crystal size.

Try to match the crystal to the size of the loop, if this cannot be accomplished, please place the crystal in the center of the loop.

The automated loop-centering system is very sensitive to anything that is not a loop (or does not look like a loop), please try to avoid:

- Extra threads/fibers on the loop, crystal or pin
- Loops that are too bent
- Ice/frost on the loop/sample or pin

Any deviation from these rules will cause our auto-centering program to fail and we will have to center the samples manually for screening and for data collection, thus significantly delaying beamline operations and increasing workload on beamline staff.

The centering images for each crystal are inspected manually. If beamline staff identifies crystals that were not properly centered automatically, these crystals are marked as manuals. These crystals are then re-screened manually, and then collected if they meet the resolution and quality cut-off.

### 3.2.5. Pucks

Samples will be shipped to the beamline already loaded in pucks. In order for the new data collection process to be as robust as possible, we are using EMBL pucks. These pucks are available from Molecular Dimensions ([MD7-510](#)). They also come in a starter kit ([MD7-500](#)) which is designed for local storage and transportation of samples. The additional items in the starter kit permit the pucks to be shipped in certain standard dewars.



Please send dewars with all **5 pucks** (either empty or full) and use the foam spacer provided in the MD Starter Kit to keep the vials from falling out of the pucks thus losing samples during shipment.

Allowing the pucks to move freely during transport can release the samples from the pucks and they can be annealed and lost.

### **3.2.6. Dewars**

The diameter of the interior of the dewar must match that of the support canister in the MD starter kit. The Taylor-Wharton standard dry shipper (CX100B-11M) is compatible with the EMBL equipment. Some dewars currently used to ship crystals have diameters that are too small to accept the pucks.

### **3.2.7. Data Transfer**

**DO NOT SEND SAMPLES TO LRL-CAT UNTIL YOUR SFTP SERVER IS RUNNING CORRECTLY AND HAS BEEN TESTED BY LRLCAT STAFF**

LRL-CAT provides direct transfer of data to the user through the internet. This approach will deliver data seamlessly to the user as soon as screening images and individual datasets are collected and processed. Data will appear as a zipped tar archive (\*.tar.gz) that will include all images and processing files.

To implement this approach, a Secure File Transfer Protocol (sftp) server at your location will be required. LRL-CAT will need an account on that server for the transfer.

Required server properties:

- The server has to accept file transfers larger than 1 GB
- The server has to allow us to check the size of the file once transferred
- The server has to have enough disk space for the amount of data requested
- 50 screening images ~ 1.1 GB (compressed)
- 1 dataset (900 frames or 180 degrees total angle range) and processing files ~3.6 GB (compressed)

Required server account information:

- server name (ex. sftp.server.edu)
- username
- password
- directory path (ex. /synchrotron\_data/user/lrlcat)

**To verify that the server works properly (check password, check disk space) is the SOLE responsibility of the USER.**

If you need more information, please contact LRL-CAT's Head of Operations: Jordi Benach ([benach\\_jordi@lilly.com](mailto:benach_jordi@lilly.com))

### **3.3. Sample Documentation**

#### **3.3.1. Standard Data Collection Conditions**

The Standard Data Collection Conditions used (unless otherwise specified by the user) at LRL-CAT are:

Screening:

- X-ray Energy: Selenium K absorption Edge (~12660 eV)
- Exposure: 0.6 seconds
- Oscillation: 1 degree
- Total Number of frames: 4
- Starting angles (degree): 0,45,90,135

Datasets:

- X-ray Energy: Selenium K absorption Edge (~12660 eV)
- Exposure: 0.12 seconds
- Oscillation: 0.2 degrees
- Total Number of frames: 900
- Total angle oscillation: 180 degrees

If no space group information is available and the indexing of the screening images shows a possibility for P1, then 360 degrees of data are collected. This is done by collecting 1800 frames at 0.2 degrees per frame and 0.12 seconds per frame.

The exposure can be reduced for crystals that are highly sensitive to radiation damage or good diffracting crystals. In this case, the exposure time is estimated by beamline software and can range from 0.04 s to 0.12 s per 0.2 degree frame.

#### **3.3.2. Instructions for Sample Submission Spreadsheet**

Screening images and diffraction datasets are collected according to the default parameters or the instructions provided by the user. These instructions are communicated to LRL-CAT through an Excel® Sample Submission Spreadsheet. The contents of this spreadsheet are loaded directly into the sample management database used by LRL-CAT. This procedure ensures the greatest accuracy in communication with beamline personnel. For this reason, it is imperative that all information in the spreadsheet be correct. Please take the time to double-check the spreadsheet before submitting it to LRL-CAT.

The system for communicating crystal data to the beamline can appear rather complicated. When users send crystals to LRL-CAT for the first time, some effort is required to learn the system. On subsequent shipments, however, our system is quite efficient and straightforward.

To request a copy of the Sample Submission Spreadsheet, please send an email to [us\\_lrlcat\\_gusamples@lilly.com](mailto:us_lrlcat_gusamples@lilly.com). Once complete, the spreadsheet should be emailed to the same address.

### **3.3.2.1. Rename the Spreadsheet**

The form of the name should be a combination of your last name, first initial, contact ID, the current date, and the standard extension for an Excel spreadsheet, ".xls". The format for the date is YYYYMMDD. For each spreadsheet submitted, please append "\_n" (n = 1, 2, 3...), which will differentiate the files when more than one spreadsheet is provided. The proper form for the file name is as follows: "Doe\_J\_10\_20100930\_1.xls".

### **3.3.2.2. Enter Information in the Spreadsheet**

These instructions refer to specific cells in the spreadsheet.

No special characters, such as – (hyphen), ?, >, <, () (parentheses), etc. may appear anywhere in the spreadsheet. When there is a choice of two values, for example when a specific protein construct crystallizes in two different space groups, enter only the most likely value. If a specific datum is unknown, leave the cell blank.

Only integer or real values are permitted for numeric values. Any restrictions are logical. For example, the number of frames must be an integer while the oscillation can be real or integer.

Some examples for entries are enclosed in quotation marks. Do not include these marks in the actual spreadsheet.

Each entry is listed as required, default, or optional. Those with default values will take those values if alternatives are not specified by the user. However, it is best to fill in the values, even when they are the same as the defaults, to ensure that LRL-CAT examines your crystals as desired.

### **3.3.2.3. Contact ID (cell B5) – Required**

In cell B5 enter your permanent contact identification number. This number was assigned through the Contact ID request form the first time you submitted samples to LRL-CAT. The contact ID is your primary identification for the LRL-CAT Express Crystallography Program.

### **3.3.2.4. Name & Email (cells B7, D7 & B9) – Required**

In cell B7 enter your first name. In cell D7 enter your last name. Be sure to use the same names each time you fill out this spreadsheet. Please use the legal form of your name (i.e. no nicknames). In cell B9 enter your email address. The email should be the same as that originally provided to LRL-CAT. Your name and email are used as a secondary verification after the Contact ID. If your name and/or email have changed, please update this information by communicating with [us\\_lrlcat\\_guinfo@lilly.com](mailto:us_lrlcat_guinfo@lilly.com) before submitting the spreadsheet.

### **3.3.2.5. GUP, BTR, & ESAF (cell B12, D12, & F12) – Required for Non-Proprietary Users only**

In cell B12 enter your 5 digit General User Proposal (GUP) number. In cell D12 enter your 6 digit Beam Time Request (BTR) number. In cell F12 enter your 6 digit Experiment Safety Approval Form (ESAF) number.

### **3.3.2.6. Crystal Information**

Beginning in row 18, enter the information for each crystal. These instructions describe a single crystal on row 18. For each subsequent crystal, use the following rows. Single blank rows between groups of related crystals or canes are permitted. Do not leave 2 or more consecutive empty rows.

### **3.3.2.7. Puck Barcode Label (cell A18) – Required**

In cell A18 enter the barcode that has been placed on the exterior of the puck. The entry here must exactly match that on the barcode. Capitalize all letters, include all zeros and do not add any spaces. (Example: APS12345)

### **3.3.2.8. Puck Position (cell B18) - Required**

In cell B18 enter the vial position in the puck. Puck positions are labeled 1 through 10. Each puck holds up to 10 vials.

### **3.3.2.9. Vial Barcode (cell C18) – Required**

In cell C18 enter the barcode that is on the outside of the cryo-vial. Capitalize all letters, include all zeros and do not add any spaces. (Example: APS98765)

### **3.3.2.10. Group Vial Barcode (cell D18) - Required**

In cell D18 enter the group vial barcode. This cell is used to identify common or duplicate crystals. Choose one vial barcode from a common set of crystals and enter it as the group vial barcode for all of the crystals within the set. When testing cryo-protectants, it makes sense to group crystals with similar protectants together. The same is true for crystals nominally identical in preparation. However, it is often appropriate to group different soaking conditions for ligands separately.

### **3.3.2.11. Cap 2-D Barcode (cell E18) – Optional**

In cell E18 enter the printed 2-D barcode located on the side of the base. PLEASE DO NOT WRITE ON THE CAPS.

### **3.3.2.12. Number Group Datasets (cell F18) - Required**

In cell F18 enter the integer number of datasets to be collected from the group. If the cell is blank, a value of 1 is assumed. Values greater than 3 will default to 3. Beamline staff will manually collect additional crystals of the same group if that is suggested from the screening images or after being discussed with the user.

Because of our thorough manual checks, the users will sometimes notice that we collect more datasets from those originally desired by the user. This is to ensure that the user gets the best data from each batch of crystals.

### **3.3.2.13. Protein (cell G18) – Required**

In cell G18 enter a descriptive name for your protein. This name will be used for any direct communication between LRL-CAT personnel and the user. Do not use spaces,

parentheses, hyphens, forward slashes or back slashes in the name. Underscores ( \_ ) may be used in place of these characters. The maximum length for protein name is 25 characters.

**3.3.2.14. Ligand (cell H18) – Optional**

In cell H18 enter the name of any ligand. As in the protein name, use underscores of non-alphanumeric characters. The ligand will appear in the name of the dataset. If no ligand is provided, dataset names will include the term “NONE”. The maximum length for ligand name is 25 characters.

**3.3.2.15. Space Group (cell I18) – Required if known**

Enter the space group in cell I18. Leave the cell blank if the space group is not known or the user is not completely sure about it.

Use the Hermann-Mauguin notation: use capital letters but do not use subscripts or parentheses. Example: use P212121 instead of P2(1)2(1)2(1) or P 21 21 21.

**3.3.2.16. Unit Cell (cells J18 to O18) – Required if known**

In cells J18 to O18 enter the unit cell dimensions and angles (a, b, c, alpha, beta, gamma) if known. Leave all of these cells blank if one or more dimensions are unknown. Units are angstroms and degrees. Do not include the units in the cells.

**3.3.2.17. Mosaicity (cell P18) – Optional**

Enter the estimated mosaicity in cell P18, if known. Otherwise, leave blank.

**3.3.2.18. Cut-off Resolution (cell Q18) - Required**

In cell Q18 enter the minimum acceptable resolution for data collection. If the crystal diffraction does not reach this resolution, the crystal will not be selected for dataset collection. The automatic systems at LRL-CAT will only select crystals for data collection that reach or exceed the cut-off resolution limit.

**3.3.2.19. Detector Resolution (cell R18) – Do Not Use**

Leave cell R18 blank.

**3.3.2.20. Single Wavelength (cell S18) - Required (if anomalous element is not present)**

In cell S18 enter “Yes” or “Y” if the crystal does not contain an anomalous element. All single wavelength collections will be done at the Selenium K edge. However, an affirmative answer here indicates that an alternative wavelength of similar X-ray energy may be used.

**3.3.2.21. Anomalous Element (cell T18) - Required (if anomalous element is present)**

In cell T18 enter the symbol from the periodic table of elements for the anomalous element present. For example, if the anomalous element is Platinum, enter "Pt". For mercury, enter "Hg". DO NOT SPELL OUT THE NAME OF THE ELEMENT. Do not include quotation marks in the cell. Use standard chemical symbol notation: "Pt ", not

"PT". If an anomalous element is not present or is not to be used in determining the appropriate X-ray energy, LEAVE THIS CELL BLANK.

When more than one potential element is present, such as with tantalum bromide, the user must choose only one element for the anomalous scatterer. Experience at LRL-CAT indicates that crystal decomposition prevents collection of diffraction data at two different X-ray wavelengths from the same crystal.

**3.3.2.22. Peak (cell U18) - Required (if anomalous element is present)**

If an anomalous element is present and listed in cell T18, "Yes" or "Y" should be entered here. For single wavelength samples, this cell should be left blank.

The requested measurement for a single crystal must be either a single wavelength or anomalous experiment. Therefore, only one of cells S18 (single wavelength) and cell U18 (peak) should be answered in the affirmative. LRL-CAT staff will use their best judgment if there is any ambiguity within these entries.

**3.3.2.23. Remote (cell V18) - Optional (only if anomalous element is present)**

If a dataset at a remote energy is required, enter "Yes". Otherwise enter "No" or leave blank. The remote energy will usually be 200 eV above or below the absorption edge of the anomalous element. Note, however, that LRL-CAT uses SAD almost exclusively for anomalous experiments and encourages users to do the same.

**3.3.2.24. Oscillation (cell W18) – Default**

In cell W18 enter the oscillation in angular degrees for a single image or frame. This value will be used for screening and for data collection. With our Pilatus 3 S 6M detector, thin-slicing or values between 0.1 - 0.3 degrees are recommended to provide the best data. If the cell is blank, an oscillation of 0.2 degree will be used. The allowed entries are integer or real numbers.

**3.3.2.25. Number of Frames (cell X18) - Default**

In cell X18 enter the number of frames required for the dataset. The default is 900 with an oscillation of 0.2 degrees per frame. For most experiments a data wedge of 180 degrees (frames times oscillation) should be used.

- For crystals known to be triclinic (P1) or for SAD anomalous experiments, 360 degrees of data will be collected (1800 frames at 0.2 degrees per frame). If the space group is not known, select at most 180 degrees of data, 360 degrees are preferred.
- If the space group is not known and the indexing of the screening images points to a possible P1, 360 degrees of data are collected automatically.
- If only 180 degrees have been collected and the final dataset symmetry (after merging/pointless analyses) turns out to be P1, a second wedge of data (usually 200 additional degrees) will be collected to increase completeness/multiplicity.

### **3.3.2.26. Maximum Exposure (cell Y18) – Optional**

Generally, this cell is left blank. It communicates information on the stability of the sample, if known. Enter a real number.

Typical exposures at LRL-CAT are 0.12 sec (at the Se K edge) or lower depending on energy/flux per 0.2 degree oscillation.

- For crystals that are known to decompose, smaller values should be used.
- LRL-CAT staff may reduce the exposure if obvious radiation damage is observed in equivalent crystals.
- The exposure will vary as well (usually shorter), if the energy is different to the standard Se K edge, as the flux at sample position varies significantly with energy.
- The minimum value is 0.04 seconds / frame.

### **3.3.2.27. Priority (cell Z18) - Do Not Use**

Leave cell Z18 blank

### **3.3.2.28. Notes (cell AA18) – Optional**

Enter any comments here as text. Brief comments are best. The comment should be entered in this cell only.

The comments are for informational purposes only. The data collection conditions are specified by other entries in the spreadsheet. Critical instructions (in addition to the information available in the cells in the spreadsheet) should be communicated in the text of the email when sending the completed spreadsheet.

## **3.3.3. Safety Documentation**

As noted in section 2.4, for General Users of the APS, a valid [Experimental Safety Assessment Form](#) (ESAF) is required. The ESAF must be completed and approved by both the Advanced Photon Source and LRL-CAT prior to shipment of the dewar containing the User's samples.

Samples submitted to LRL-CAT must be at Biosafety Level 1 (BSL-1) or lower. See <https://www.aps.anl.gov/Safety-and-Training/Safety/Experiment-Safety/Hazard-Classes> for a description of APS requirements for BSL-1 materials.

## **3.4. Sample Shipment**

### **3.4.1. Prepare Dewar for Shipping**

The User should ship crystals to LRL-CAT in standard dry shippers. The diameter of the interior of the dewar must match that of the support canister in the MD starter kit. The shippers (CX100B-11M) are available from Taylor-Wharton.

All shipments to LRL-CAT must comply with the regulations of the Department of Transportation (DOT), Department of Energy (DOE) and Argonne National Laboratory. Users are to follow [APS procedures for dry shippers](#).

Shipments must be non-hazardous. Accordingly, LRL-CAT **does not** accept crystals that have been frozen in propane or any other hazardous materials. In order to comply with [APS User Policies and Procedures for Hazmat Transport](#), **the User must remove all free-flowing liquid nitrogen prior to shipment.**

The APS and LRL-CAT require that conformance with safety policies, including those for shipments, be scrupulously observed. Therefore the following paragraph must be read and understood by the user.

**USERS ARE PROHIBITED FROM SENDING ANY DEWAR(S) THAT, EITHER DUE TO THE PRESENCE OF FREE-FLOWING LIQUID NITROGEN OR OTHER MATERIALS, WOULD BE CONSIDERED A HAZARDOUS SHIPMENT BY ARGONNE NATIONAL LABORATORY, THE U.S. DEPARTMENT OF ENERGY, THE U.S. DEPARTMENT OF TRANSPORTATION, AND/OR THE INTERNATIONAL AIR TRANSPORT ASSOCIATION. LRL-CAT ASSUMES NO LIABILITY FOR HAZARDOUS SHIPMENTS FROM THE USER.**

LRL-CAT is expected to inform the safety officers of the APS and the User of the failure to comply with existing regulations. Non-compliant shipments will be handled as directed by the APS.

### **3.4.2. Shipping Address**

Federal Express® and its drivers are familiar with shipping procedures at the APS. For this reason, LRL-CAT does not use other express carriers.

All shipments of crystals for the Express Crystallography Program are to be sent by Federal Express® to:

LRL-CAT  
Advanced Photon Source  
Argonne National Laboratory  
9700 S. Cass Ave, Building 438A, Sector 31  
Lemont, IL 60439

The receiving department of Argonne National Laboratory is closed on Saturday and Sunday, as well as most Federal Holidays and the week between December 25<sup>th</sup> and January 1<sup>st</sup>. All shipments should be delivered to the APS during the normal work week (Monday through Friday). A shipment sent on Friday should be designated for Monday delivery.

### **3.4.3. Notification of Dewar Shipment to LRL-CAT**

After shipping, send the tracking information to [us\\_lrlcat\\_guinfo@lilly.com](mailto:us_lrlcat_guinfo@lilly.com). The tracking number is also to be included in the sample submission form.



## **3.5. Screening Results and Data Collection**

Over the past several years, LRL-CAT has found that users obtain the best data when collection decisions are made by the LRL-CAT staff. LRL-CAT examines around 10,000 crystals per year and our staff has an excellent understanding of how to maximize the quality of your data collection. Provided the sftp server information is available and correct, screening images and collected datasets will be forwarded to the user as they are produced and processed. The whole process is quite fast and seamless for the user.

## **3.6. Return of Samples and Data**

### **3.6.1. Data and Dewar Returned to User**

Because most crystals degrade significantly after collection at the APS, LRL-CAT will return the crystals to the user at room temperature. The user should not expect to be able to subsequently re-use crystals exposed to X-rays at LRL-CAT.

The crystals will be returned in the original dewar. The cost for shipping the dewar will be charged to the User's account with [Federal Express®](#).

### **3.6.2. Deletion of Collected Data**

In order to ensure that the User's information is available solely to the user, all screening images and datasets will be deleted from LRL-CAT computers after the data have been transferred to the General User. The deletion will occur **7 days** after the Federal Express® tracking system indicates that the dewar, samples have been received at the User's institution.

Under this system, there is no long-term archival copy of the data resident at LRL-CAT. Therefore, the user is urged to verify the integrity of the data upon receipt. LRL-CAT cannot accept responsibility for archiving of your data.

### **3.6.3. User Account Information**

#### **3.6.3.1. With FedEx**

The User will provide LRL-CAT with a [Federal Express®](#) account number to charge for the return shipment of the sample dewar.

#### **3.6.3.2. With APS**

In the unlikely event that LRL-CAT must purchase miscellaneous materials or supplies as part of your data collection, the User must have an active [APS User Account](#) that LRL-CAT personnel are authorized to use.

## **3.7. Additional User Information**

### **3.7.1. Loss of Data Collection Capability**

If either the APS or the LRL-CAT beamline is not available due to a reason not related to APS equipment, LRL-CAT will endeavor to make up the lost beamtime as soon as possible. In cases where this type of problem occurs near or at the time of a long maintenance shutdown of the APS, it may be at least two months before LRL-CAT will be able to reattempt the requested experiments.

### **3.7.2. Publication Acknowledgments**

All publications that result from work at LRL-CAT must be properly acknowledged in accordance with standard APS Policies.

The following are the required acknowledgments for resources provided by Eli Lilly & Company, the LRL-CAT beamline and the Advanced Photon Source (APS). They MUST be included in all published reports of work undertaken by LRL-CAT (LRL-31ID-D), including journals, books, conference proceedings, or other printed technical media.

#### **3.7.2.1. APS Acknowledgment Statement**

This acknowledgment is required under the terms of all APS User Agreements.

“This research used resources of the Advanced Photon Source, a U.S. Department of Energy (DOE) Office of Science User Facility operated for the DOE Office of Science by Argonne National Laboratory under Contract No. DE-AC02-06CH11357.”

#### **3.7.2.2. LRL-CAT Acknowledgment Statement**

In addition to the APS Acknowledgment, the following should be included in publications that reference data obtained at LRL-CAT.

“Use of the Lilly Research Laboratories Collaborative Access Team (LRL-CAT) beamline at Sector 31 of the Advanced Photon Source was provided by Eli Lilly and Company, which operates the facility.”

### **3.7.3. Notification of Publications**

All users will provide a copy of any material submitted for publication that is based on work conducted at LRL-CAT beamline to: [us\\_lrlcat\\_guinfo@lilly.com](mailto:us_lrlcat_guinfo@lilly.com). The User is also required to provide similar information to the APS. Further APS publication information can be found [HERE](#).

## 4. Materials and Services

Sources for materials and services described above are as follows:

- For Loops and Pins: [Hampton Research](#)
- For Pucks, Bases and Vials: [Molecular Dimensions](#)
- For Dewars: Taylor-Wharton (CX100B-11M) Dry Shipper
  - [Cole Palmer](#)
  - [Cryodepot](#)
  - [Fisher Scientific](#)
- For Shipping: Federal Express®: <http://www.fedex.com/us/>

## 5. Contact ID Request Form

Enter the following contact information for both you and your organization. Please email to [us\\_lrlcat\\_guinfo@lilly.com](mailto:us_lrlcat_guinfo@lilly.com) or [morisco\\_laura@lilly.com](mailto:morisco_laura@lilly.com). A contact identification number will be assigned to you after your information has been submitted. The contact ID will be emailed to the address entered here. It is to be used for all sample spreadsheets that you submit to LRL-CAT.

**Required fields are indicated by an asterisk (\*).**

### Organization Information

Name:\* \_\_\_\_\_

Website: \_\_\_\_\_

General Phone: \_\_\_\_\_ Branch Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Address 1: \_\_\_\_\_

Address 2: \_\_\_\_\_

Address 3: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip / Postal Code: \_\_\_\_\_

Prov. / County / Etc.: \_\_\_\_\_ Country: \_\_\_\_\_

### Personal Information

Salutation:\* \_\_\_\_\_ First Name:\* \_\_\_\_\_ Middle Initial: \_\_\_\_\_

Last Name:\* \_\_\_\_\_

Title: \_\_\_\_\_

E-mail:\* \_\_\_\_\_ 2nd E-mail: \_\_\_\_\_

Work Phone:\* \_\_\_\_\_ Work Fax: \_\_\_\_\_

Cell Phone: \_\_\_\_\_ Home Phone: \_\_\_\_\_

Address 1:\* \_\_\_\_\_

Address 2: \_\_\_\_\_

Address 3: \_\_\_\_\_

City:\* \_\_\_\_\_ State:\* \_\_\_\_\_ Zip / Postal code:\* \_\_\_\_\_

Prov. / County / Etc.: \_\_\_\_\_ Country: \_\_\_\_\_

### SFTP/FTP account information:

Server name :\* \_\_\_\_\_

User name :\* \_\_\_\_\_

Password :\* \_\_\_\_\_

Directory path : \_\_\_\_\_

**FedEx Account Number:\*** \_\_\_\_\_

## 6. Express Crystallography Check List

The following is a Check List of all forms to complete and all materials to procure for successful use of the LRL-CAT Express Crystallography program.

### FORMS TO COMPLETE:

#### LRL-CAT:

- Complete the Contact Form (Section 5) and email to: [US\\_LRLCAT\\_GUINFO@LILLY.COM](mailto:US_LRLCAT_GUINFO@LILLY.COM)
- Obtain 1D barcode labels from LRL-CAT at: [US\\_LRLCAT\\_GUINFO@LILLY.COM](mailto:US_LRLCAT_GUINFO@LILLY.COM)
- Obtain and complete the Sample Spreadsheet (screening and data collection instructions) at: [US\\_LRLCAT\\_GUINFO@LILLY.COM](mailto:US_LRLCAT_GUINFO@LILLY.COM).
- Return the completed Sample Spreadsheet to: [US\\_LRLCAT\\_GUSAMPLES@LILLY.COM](mailto:US_LRLCAT_GUSAMPLES@LILLY.COM)
- Obtain the complete description of the Express Crystallography service and procedures at: <http://lrlcat.lilly.com>
- SAMPLE PREPARATION ([Section 3.2](#)) and DOCUMENTATION ([Section 3.3](#))
- **DATA TRANSFER: Before Sending Samples:** 1. Provide information to connect to a Secure File Transfer Protocol (SFTP) server. 2. Server must be tested by LRLCAT Staff. (See Section 3.2.7)

#### Advanced Photon Source (APS) | (For Non-Proprietary Users only)

- Register with the APS @ [Users-Information/Getting-Started/User-Checklist](#) to receive a badge number.
- Complete and submit a “Rapid Access” General User Proposal or request additional beam time at LRL-31-ID-D referencing your GU number at the [Submit a Proposal Login](#).
- Once we confirm receipt of your proposal and approve beam time, submit an (ESAF) at the [Complete an Experimental Safety Assessment Form Login](#).

### MATERIALS & EQUIPMENT NEEDED:

- Obtain Cryo-Caps and Magnetic Cryo-Vials: [Molecular Dimensions](#) (MD7-400, MD7-401 & MD7-402)
- Obtain Pucks (ESRF/EMBL Basket - 10 SPINE): [Molecular Dimensions](#) (MD7-510)
- Obtain complete Cryo-Kits: [Molecular Dimensions](#) (MD7-500)
- Obtain 18 mm Cryo-Loops from: [Hampton Research](#)
- Obtain Taylor-Wharton standard dry shipper (TW CX100B-11M) at: [Cole Palmer](#), [Cryodepot](#) & [Fisher Scientific](#)

# Appendix A

## 1. Legal Terms

“User Data” means all data and information generated by Eli Lilly & Company (Lilly) on User Materials in the performance of the Data Collection Services or provided to Lilly by User or User Institution.

“User Materials” means all biological or chemical materials provided by User or User Institution to Lilly, including User Crystals.

“Data Collection Services” refers to all activities undertaken by the personnel of LRL Collaborative Access Team (“LRL-CAT”) with User Materials in order to acquire User Data. These services are described in detail by this website and its associated documents.

## 2. Indemnification

User Institution shall indemnify, defend, and hold harmless Lilly, the directors, officers, and employees of Lilly and the successors and assigns of any of the foregoing (the “Lilly Indemnitee(s)”), from and against all claims, losses, costs, and liabilities (including, without limitation, payment of reasonable attorneys’ fees and other expenses of litigation), and shall pay any damages (including settlement amounts) finally awarded, with respect to any claim, suit or proceeding (any of the foregoing, a “Claim”) brought by Third Party against an Lilly Indemnitee, arising out of or relating to: (a) the use, handling, transfer or storage of the User Materials or User Data; or (b) a claim that the use by Lilly, User or User Institution of User Materials or User Data, infringes the intellectual property rights of a Third Party; except, in each case, to the extent caused by the gross negligence or willful misconduct of a Lilly Indemnitee and provided further that Lilly provides User Institution with prompt notice of any such claim and the exclusive ability to defend (with the reasonable cooperation of Lilly) or settle any such claim.

## 3. Limitation of Liability

No Lilly Indemnitee will be liable for any Claims incurred by User or User Institution as a result of Lilly’s performance of Data Collection Services, unless such Claim is due solely to Lilly’s gross negligence or willful misconduct. IN NO EVENT SHALL EITHER Lilly BE LIABLE FOR SPECIAL, CONSEQUENTIAL, INCIDENTAL, OR INDIRECT DAMAGES (INCLUDING WITHOUT LIMITATION LOSS OF PROFIT) WHETHER OR NOT USER INSTITUTION HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSS, HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, ARISING OUT OF THIS AGREEMENT. THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.

## 4. Warranty; Disclaimer

Lilly will use commercially reasonable efforts in performing Data Collection Services. User Institution acknowledges that the provision of Data Collection Services is subject to availability of the Advanced Photon Source. Lilly specifically disclaims any guarantee that the Data Collection Services will be successful, in whole or in part and that User

Data will be successfully obtained from User Crystals. EXCEPT AS OTHERWISE EXPRESSLY PROVIDED IN THIS AGREEMENT, Lilly MAKES NO REPRESENTATIONS AND EXTENDS NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE OF THE USER DATA, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THE INTELLECTUAL PROPERTY OR OTHER RIGHTS OF ANY THIRD PARTY.

#### **5. Force Majeure**

Lilly shall not be liable to the User or User Institution for damages or losses on account of failure of performance by the defaulting Party if the failure is occasioned by war, strike, acts of terrorism, fire, Act of God, earthquake, flood, lockout, embargo, governmental acts or orders or restrictions, failure of the Advanced Photon Source or any equipment, failure of suppliers (including, without limitation, energy suppliers), or any other reason where failure to perform is beyond the reasonable control and not caused by the negligence, intentional conduct or misconduct of Lilly and Lilly has exerted all reasonable efforts to avoid or remedy such force majeure; provided, however, that in no event shall Lilly be required to settle any labor dispute or disturbance.

#### **6. Acceptance of Terms and Conditions**

Submission to the APS of a General User Proposal for LRL-CAT by or on behalf of User shall constitute acceptance of the above terms and conditions by User and User's Institution.