

# Advanced Photon Source

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## APS Policy on Control of Radiation Safety System Bypasses

### Section where used:

Advanced Photon Source (APS) personnel responsible for bypassing, via physical jumper, force, override, etc., Radiation Safety Systems (RSS) design input(s) or output(s) to Access Control Interlock System (ACIS) and Personnel Safety Systems (PSS).

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## APS Control of Bypasses

### 1. INTRODUCTION

This PSC policy implements section 3.2.2 step 4 of Laboratory Wide Argonne Procedure [LMS-PROC 143, Radiation Safety Interlock Systems](#). It captures a graded approach to bypasses of design inputs and outputs to specified systems, similar to other processes within PSC. The policy evaluates the risk and consequence of the bypasses and assigns a corresponding method to control the bypass including installation, consequence of the bypass installation, periodic audit, and subsequent removal with associated consequence/guidance for operations following removal. The policy requires review and a graded approach of approval for active bypasses prior to operation for Access Control Interlock System (ACIS) and Radiation Safety Systems (RSS) interlocks including those defined in the Accelerator Functional Requirements Document (FReD) (APSU\_1695659), and Personnel Safety Systems (PSS).

#### 1.1. Purpose

Provide a method to review and mitigate the risk for bypasses of RSS design inputs and outputs to/from ACIS, and PSS while ensuring the proper reviews, approval, and rigor are applied to control bypasses of these systems. The policy also provides a method of easily identifying the bypasses and for auditing bypasses in use.

#### 1.2. Scope

This policy:

- Defines the process to evaluate bypasses for ACIS and PSS to determine adequacy in meeting performance, safety, and operational objectives.
- Provides a grading rubric to determine the appropriate scope, level of formality and approval for a bypass and associated guidance while operating with the bypass in place.
- Defines the bypass log use, requirements, and auditing guidance.
- Defines different types of bypasses, see [Appendix A](#).

#### 1.3. Applicability

Applies to bypasses (physical jumpers, simulators, software forces, overrides, jumper plugs) that bypass a design input or output for ACIS and PSS OR requires a bypass to systems that are inputs or outputs to ACIS and PSS. Bypasses are only allowed for one run cycle, not to exceed 120 days, if following the run cycle or nearing the 120 days, the bypass shall be reapproved. During the APS dark period, bypasses are allowed until the completion of test and checkout.

This procedure covers Radiation Safety Systems (RSS) which have the highest level of consequence and risk and equipment protection systems with lower consequence and risk, as such a graded approach will be applied.

Radiation Safety Systems covered in this procedure:

- Access Control Interlocks Systems (ACIS)
  - Including Booster Extraction Fast Interlock, booster to storage ring (BTS) BeamShut Off Current Monitor (BESOCM) and Stored Beam Monitor Interlock – see Accelerator FReD (APSU\_1695659), section 2.14 for details and the APS Safety Assessment Document Revision 6 (APS\_1188832) Tables 3-6 and 3-7.
- Personnel Safety Systems (PSS)

Exemption: Engineered software or hardware bypasses that are reviewed and approved during a design review inserted with an approved procedure.

## 1.4. Definitions

See [Appendix A](#) for a list of definitions.

## 1.5. References

See [Appendix B](#) for a list of references.

## 2. BACKGROUND

Bypasses are temporarily utilized to circumvent or provide desired inputs and outputs to equipment to provide a needed signal to the equipment that a certain condition is met to allow for testing or operation, due to a device malfunction or other criteria.

## 3. PROCEDURE

### *Control of Radiation Safety System Bypasses During Accelerator Operations:*

1. An issue is identified that requires the bypass of a design input or output to ACIS, or PSS OR requires a bypass that affects ACIS, or PSS.
2. Inform the Main Control Room, the Facility manager/custodian (PSC directorate safety manager (DSM)), AND the MCR Group Leader (for accelerator bypass) or the on-shift floor coordinator (for beamline bypass) promptly of the following conditions:
  - a. Failures of interlock system or components that compromise the level of safety of the system.
3. The Deputy ALD for Operations or designee will direct a review of the implications of the bypass and measures to be instituted to mitigate identified risks. Consider the below as bypass options and implications are reviewed.
  - a. Software and hardware bypassing of any interlock component is allowed only under strict controls and only if alternate controls provides equivalent safety or the hazard that the interlock protects was positively locked out according to [LMS-MNL-4, Hazardous Energy Control Manual](#).
  - b. If this bypass would be better addressed with an engineered modification, if so, follow APS WPC and Design Review procedures to implement the engineered modification.
4. If the bypass includes bypassing a safety function of a Credited Control, the Deputy ALD for Operations advises the PSC Safety Manager of potential unreviewed safety issue (USI). As appropriate, a USI Determination will be completed per Advanced Photon Source Procedure [APS\\_1185831, Unreviewed Safety Issue Determination](#), and Argonne Procedure LMS [Procedure 383, Facility-Specific Implementation of Unreviewed Safety Issue](#) with the review. The PSC Radiation Safety Committee (PRSC) can advise on conformance to APS shielding standards and potential safety impacts of the designs as applicable.
5. The Deputy ALD for Operations will approve the instituted measures and duration.
6. Enter the bypass into the bypass logbook in the Main Control Room using Appendix C as a guide, controlled by the Safety Interlocks (SI) team.
7. Application of use of a bypass for any interlock system requiring bypasses requires a work request in the [APS Work Request System](#), a Configuration Control Work Permit in accordance with [APS\\_1192930](#) and an approved procedure.
  - a. Install the bypass according to the work control document(s) and following this policy, see Appendix C for details. **Note: Two person verification is required for bypass installation. The first person should install the bypass using the appropriate procedure(s) and drawing(s) and the second person should independently verify that the bypass is properly installed using the appropriate procedure(s) and drawing(s).**
8. Inform the Deputy ALD for Operations, applicable Division Director, Group Leader AND the MCR Group Leader (accelerator bypass), and the on-shift floor coordinator (if applicable) that the bypass is installed.
9. Remove the bypass.

- a. Determine corrective action to remove bypass.
  - b. Remove the bypass following a procedure, remove from the bypass logbook, and close out the configuration control work permit (CCWP) (if necessary) with approval from the Deputy ALD for Operations.
  - c. With the bypass removed, test the system to verify proper functioning of the circuit, the component, and the safety function (check for expected system response to verify proper removal of the bypass) using an approved procedure.
10. Inform the Deputy ALD for Operations, applicable Division Director, Group Leader AND the MCR Group Leader (accelerator bypass), and the on-shift floor coordinator (if applicable) that the bypass is removed and system response verified.

### ***Control of Radiation Safety System Bypasses While Shutdown:***

1. A bypass of a design input or output to ACIS, or PSS OR a bypass that affects ACIS, or PSS is needed to perform maintenance, testing, troubleshooting, fault, etc.
2. Inform the cognizant system Engineer/SME and Group Leader.
3. Enter the bypass into the bypass logbook in the Main Control Room using Appendix C as a guide, controlled by the Safety Interlocks (SI) team.
4. Application or use of a bypass for any interlock system requiring bypasses requires a work request in the [APS Work Request System](#), a Configuration Control Work Permit in accordance with [APS 1192930](#) and an approved procedure.
  - a. Install the bypass according to the work control document(s) and following this policy, see Appendix C for details. ***Note: Two person verification is required for bypass installation. The first person should install the bypass using the appropriate procedure(s) and drawing(s) and the second person should independently verify that the bypass is properly installed using the appropriate procedure(s) and drawing(s).***
5. Inform the cognizant system Engineer/SME and Group Leader the bypass is installed.
6. Perform maintenance, testing, troubleshooting, fault, etc.
7. Remove the bypass.
  - a. Determine corrective action to remove bypass.
  - b. Remove the bypass following a procedure, remove from the bypass logbook, and close out the configuration control work permit (CCWP) (if necessary).
  - c. With the bypass removed, test the system to verify proper functioning of the circuit, the component, and the safety function (check for expected system response to verify proper removal of the bypass) using an approved procedure.
8. ***IF the bypass will remain in place during accelerator operations, proceed as described below:***
  - a. Inform the Main Control Room, the Facility manager/custodian (PSC directorate safety manager (DSM)), AND the MCR Group Leader (accelerator bypass) or the on-shift floor coordinator (beamline bypass).
  - b. The Deputy ALD for Operations or designee will direct a review of the implications of the bypass and measures to be instituted to mitigate identified risks. Consider the below as bypass options and implications are reviewed.

- i. Software and hardware bypassing of any interlock component is allowed only under strict controls and only if alternate controls provides equivalent safety or the hazard that the interlock protects was positively locked out according to [LMS-MNL-4, Hazardous Energy Control Manual](#).
    - ii. If this bypass would be better addressed with an engineered modification, if so, follow APS WPC and Design Review procedures to implement the engineered modification.
  - c. If the bypass includes bypassing a safety function of a Credited Control, the Deputy ALD for Operations advises the PSC Safety Manager of potential unreviewed safety issue (USI). As appropriate, a USI Determination will be completed per Advanced Photon Source Procedure [APS 1185831, Unreviewed Safety Issue Determination](#), and Argonne Procedure LMS [Procedure 383, Facility-Specific Implementation of Unreviewed Safety Issue](#) with the review. The PSC Radiation Safety Committee (PRSC) can advise on conformance to APS shielding standards and potential safety impacts of the designs as applicable.
  - d. The Deputy ALD for Operations will approve the instituted measures and duration.
  - e. Remove the bypass.
    - i. Determine corrective action to remove bypass.
    - ii. Remove the bypass following a procedure, remove from the bypass logbook, and close out the configuration control work permit (CCWP) (if necessary) with approval from the Deputy ALD for Operations.
    - iii. With the bypass removed, test the system to verify proper functioning of the circuit, the component, and the safety function (check for expected system response to verify proper removal of the bypass) using an approved procedure.
  - f. Inform the Deputy ALD for Operations, applicable Division Director, Group Leader AND the MCR Group Leader (accelerator bypass), and the on-shift floor coordinator (if applicable) that the bypass is removed and system response verified.

## Auditing the Bypass Log and Duration of Bypasses

1. The log should be audited by the SI Group Leader and MCR Group Leader or their designee prior to “delivering beam” (machine startup) following extended machine maintenance shutdowns greater than 1 week to validate any bypasses that are installed are appropriately approved as described above and any special operating conditions associated with the bypass is documented.
  - a. The SI Group Leader and MCR Group Leader will report their audit findings to the Deputy ALD for Operations including any active bypasses which will be reviewed.
  - b. The report of the audit will be filed in ICMS.
2. Further, the log should be audited annually by the SI Group Leader and MCR Group Leader or their designee following the December/January maintenance shutdown to

physically verify any bypasses listed in the log are present, this audit should be directed by the APS Main Control Room personnel and completed by someone other than the person who installed or second checked the bypass but is from the appropriate group.

- a. The SI Group Leader and MCR Group Leader will report their audit findings to the Deputy ALD for Operations including any active bypasses which will be reviewed.
  - b. The report of the audit will be filed in ICMS.
3. Duration of bypass
- a. Bypasses are only allowed for one run cycle, not to exceed 120 days, if following the run cycle or nearing the 120 days, the bypass shall be reapproved by the Deputy ALD for Operations. During the APS dark period, bypasses are allowed until the completion of test and checkout.

## Bypass Log

An ACIS and PSS [Bypass log](#) is used to maintain a list of active bypasses of ACIS and PSS design inputs/outputs. The log should be filled out by the person initiating the installation of the bypass with guidance from their GL, CAM, Engineer, SME, or Project Lead.

See [Appendix C](#) for detailed Bypass log instructions.

## 4. CLOSEOUT OR POST-PERFORMANCE ACTIVITY

Following removal of a bypass(es), complete one of the following as appropriate:

- a. Closeout the ACIS/PSS Bypass Log entry for the bypass(es) removed.
- b. Complete the procedure for removal of the bypass.
- c. Closeout the CCWP.

## 5. DOCUMENTS/RECORDS CREATED BY THIS PROCEDURE

The documents/records listed below will be created in the execution of this procedure and must be retained as indicated.

Description of Document/Record (include ID number, if applicable)	Custodian	Storage Location and Medium	Retention Requirement
ACIS/ PSS Log	SI Group Leader	MCR	5 years



## 6. TRAINING REQUIRED

None.

## 7. Feedback and Improvement

If you are using this procedure and have comments or suggested improvements for it, please go to the [APS Policies and Procedures Comment Form](#)\* to submit your input to a Procedure Administrator. If you are reviewing this procedure in workflow, your input must be entered in the comment box when you approve or reject the procedure.

Instructions for execution-time modifications to a policy/procedure can be found in the following document: Field Modification of APS Policy/Procedure ([APS 1408152](#)).

<https://www.aps.anl.gov/Document-Central/APS-Policies-and-Procedures-Comment-Form>

## APPENDIX A – DEFINITIONS

### Forces

Forces are provided as part of the PLC firmware that allows one to override the “on” or “off” state of input devices to the PLC (regardless of their actual state), thus providing the PLC logic program any desired state for any input at any time. Forces can also be applied to PLC outputs, overriding the PLC logic program, forcing physical devices “on or off”, regardless of the action of the PLC’s program. For obvious reasons forces must be carefully controlled and are rarely used during routine operations. **NOTE: FORCES are not an option for ACIS after the ACIS Upgrade in CY23. PSS allows forces and those should be tracked per this procedure.**

### Bypasses

Engineered bypass – Software or hardware bypasses that are reviewed and approved during a design review.

Example 1: PSS permit override key switch used during PSS validations performed when the FES shutter air supply is locked out and tagged out (LOTOd) and there is no beam in the Storage Ring.

Example 2: ACIS Test mode where all outputs to beam generating or beam accelerating equipment is not connected to ACIS enable signals and ACIS can override radiation monitors input when these monitors have probes removed for calibration.

### Equipment Simulator Switches (test toggles).

- Equipment may include simulator switches that bypass design inputs/outputs.
- These switches are typically built into the equipment and are part of the design.

### Hardwire Jumpers

- For safety systems, hardwire jumpers can represent a potentially dangerous mode of operation if they override safety function inputs or outputs.
- Hardware jumpers, typically wires/leads, physically bypass an input or output to/from a system that affects operation of the system.
- A jumper usually eliminates/removes the input or output, whereas test plugs, test devices, or simulators typically provide a “simulated” input or output to the system.

## APPENDIX B – REFERENCES

### Requirements and reference documents:

- LMS [Procedure 143](#), Radiation Safety Interlock Systems
- LMS [Procedure 188, Rev 3](#), Accelerator Safety Management
- LMS [Procedure 383](#), Facility-Specific Implementation of Unreviewed Safety Issue
- LMS [Policy 35](#), Radiological, Nuclear and Accelerator Safety
- [Argonne Radiation Protection Program](#)
- DOE Order, [O420.2D](#), Safety of Accelerator Facilities
- DOE Guide, [G420.2-1A](#), Accelerator Facility Safety Implementation Guide
- [Accelerator Functional Requirements Document \(FReD\)](#) (APSU\_1695659)

### PSC Policies, practices, and procedures:

- [APS Design Reviews, APS\\_000031](#)
- [Configuration Control Work Permit](#) (CCWP)
- [CCWP Template](#)
- [APS Configuration Control for Personnel Radiation Protection Shielding](#)
- ACIS-Interfaced Equipment Readiness Checklists (Multiple)

### Safety Interlocks group policies, practices, and example procedures:

- [ACIS – PSS Front End Shutter Jumper Procedure](#)
- [ACIS Use of forces, bypasses, simulator switches, and hardwired jumpers](#)
- Safety Interlocks Group Beamline Readiness Checklist

### Supplemental documents:

- LMS [Manual 20](#), Design Manual
- [ANL 496](#), Lockout/Tagout (LOTO) Logbook example

## APPENDIX C – BYPASS and BYPASS LOG INSTRUCTIONS

### *Bypass instructions*

1. Obtain approval to insert the bypass.
  - a. Includes approved CCWP, Work Request and procedure.
2. Enter the bypass into the bypass log including the following: Bypass number/tag color, approval, date put into place, type, system, impact, action required to remove.
3. Insert the bypass using an approved procedure.
  - a. Conspicuously label each jumper for ease of identification and to prevent confusion between jumpers in the same location.
    - i. Example of Jumper label: ACIS Jumper 01-2023, PSS Jumper Rack 7 TB12-TB14, etc. Cross reference the Bypass Log sequence number with the local jumper label.
    - ii. Two person verification is required for bypass installation. The first person should install the bypass using the appropriate procedure(s) and drawing(s) and the second person should independently verify that the bypass is properly installed using the appropriate procedure(s) and drawing(s).
    - iii. For electronic or software forces, ensure the software conspicuously informs operators, engineers and technicians that the force is active.
4. During accelerator operations - inform the Deputy ALD for Operations, applicable Division Director, Group Leader AND the MCR Group Leader (accelerator bypass), and the on-shift floor coordinator (if applicable) that the bypass is installed.
5. During a maintenance shutdown – inform the cognizant system Engineer/SME and Group Leader.
6. Complete the action needed to remove the bypass and inform the appropriate personnel from step 4 or 5 above.
7. Update the bypass log.

### *Bypass log instructions*

1. Bypass number/tag color – enter next sequential number for the calendar year, example, first entry of 2023 is 2022-1, second entry is 2023-2.
2. Approval – enter appropriate role that approved bypass, any necessary procedures to put bypass in place.
3. Date put in place – enter date installed.
4. Type – select from: physical jumper, force, override, plug or other. If other selected, include in notes the type of jumper.
5. System – enter the applicable system for the bypass.
6. Impact of bypass – detail impact to the design and operation of the system.
7. Action required to remove bypass: enter details for step that need to be taken before the bypass can be removed.
8. Date removed – enter date bypass removed.

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9. Expiration date: enter the date as approved. This date should meet the requirement that “Bypasses are only allowed for one run cycle, not to exceed 120 days, if following the run cycle or nearing the 120 days, the bypass shall be reapproved. During the APS dark period, bypasses are allowed until the completion of test and checkout.”