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National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
Title: Beamline 8-BM Radiological Interlock Test			Technical

Reviewed by:		
7/7/2016	7/12/2016	7/8/2016
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USI Screening/Resolution	Procedure Validation*
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### VERSION HISTORY LOG

VERSION	DESCRIPTION	DATE
1	First Issue.	08Jul2016

### ACRONYMS

ABM	Authorization Basis Manager	Neg	Negative
ASE	Accelerator Safety Envelope	NSLS-II	National Synchrotron Light Source II
BM	Bending Magnet	P	Pendant
BNL	Brookhaven National Laboratory	Pos	Positive
ES	Emergency Stop	PS	Power Supply
ESH	Environment, Safety and Health	PPS	Personnel Protection System
FE	Front End	R	Right
FOE	First Optical Enclosure	RF	Radio Frequency
HMI	Human Machine Interface	SAF	Safety Approval Form
HVPS	High Voltage Power Supply	SB	Search Button
I/O	Input/Output	SBE	Search Button External
KK	Kirk Key	SBMS	Standards-Based Management System
L	Left	SR	Storage Ring
LED	Light Emitting Diode	SRU	Solenoid Release Unit
LOTO	Lockout/Tagout	SS	Safety Shutter
MCR	Main Control Room	V	Volts

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## 1 PURPOSE AND SCOPE

The purpose of this procedure is to provide instructions for testing and certifying the radiological interlock system for the BNL NSLS-II Beamline 8-BM. The system will be re-tested every six months, in accordance with the SBMS Program Description: *Radiological Control Manual* and SBMS Subject Area, *Interlock Safety for High Risk Hazards*. Certification shall be completed sometime during, but no later than, the last day of the calendar month in which it is due. Any beamline PPS system going beyond the last day of the month in which it is due will be disabled by ESH Staff using Centrally Controlled LOTO until certification is complete. Testing will also be required after a change in wiring, components or programming in accordance with PS-ESH-PRM-3.4.1, *Procedure for Safety System Work Permits* and the guidelines for certification specified in PS-C-ASD-SPC-SR-PPS-001, *Storage Ring Personnel Protection System (SPPS) Design Description* and PS-C-XFD-SPC-PPS-001, *Beamline Personnel Protection System (BLPPS) and Front End Personnel Protection System Design Description*. Changes to the system shall be performed in accordance with PS-C-ASD-PRC-057, *NSLS-II PPS Configuration Management*.

## 2 DEFINITIONS

None.

## 3 RESPONSIBILITIES

### 3.1 Testers

- 3.1.1 Coordinate and perform radiological interlock certification testing.
- 3.1.2 Delegate radiological interlock testing step actions to personnel acting as Assistants.
- 3.1.3 Complete attached test checklist as required.

### 3.2 Assistants

- 3.2.1 Assist the Tester in performing the interlock test step actions when directed by the Tester.
- 3.2.2 Report all radiological interlock test observations to the Tester.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
Title: Beamline 8-BM Radiological Interlock Test			Technical

### 3.3 Accelerator Safety Systems Engineers and Technicians

3.3.1 Provide technical support throughout testing.

### 3.4 Primary Authorized Employees

3.4.1 Apply LOTO in accordance with this procedure.

### 3.5 Configuration Management Specialist

3.5.1 Posts completed test checklists on the NSLS-II SharePoint Document Center.

## 4 PREREQUISITES

4.1 At least one Tester shall be ESH Staff.

4.2 Assistants shall be designated by the Testers.

4.3 A Mechanical Engineering Review has been completed for all hutch door switches to ensure proper positioning.

## 5 PRECAUTIONS AND LIMITATIONS

5.1 All steps in this procedure that require LOTO of systems/equipment for servicing and maintenance activities shall be performed in accordance with SBMS Subject Area, *Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance*.

5.2 All steps in this procedure that require LOTO for any purpose other than servicing and maintenance shall be performed in accordance with PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*.

5.3 Mufflers shall be used to reduce noise during testing by placing them on the sounders.

5.4 The radiological interlock systems for the facility are a credited control in accordance with the ASE. Any deviation or discrepancy from an expected test result may be a violation of the ASE and shall be reported to the ABM as soon as practical.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
Title: Beamline 8-BM Radiological Interlock Test			Technical

- 5.5 All steps in the test checklist that require a beamline search shall be performed in accordance with PS-C-XFD-PRC-010, *Beamline Enclosure Search and Secure and Breaking Security Procedure*.
- 5.6 All configuration control checklists, commissioning approval forms and SAFs for Beamline 8-BM shall be voided prior to the start of certification testing.

## 6 PROCEDURE

### 6.1 Test and Certify Radiological Interlocks

**Note:** Two Testers are required to test and certify Beamline 8-BM radiological interlocks.

- 6.1.1 Testers notify the Lead Operator and the Lead Beamline Scientist that a test of the Beamline 8-BM radiological interlocks will be performed.
- 6.1.2 Testers obtain the Beamline 8-BM enable key and Beamline PPS reset key from the Control Room.

**Note:** LOTO may be applied to other pieces of equipment such as: injection shutters, bending magnet power supplies, linac PPS enable switch, booster PPS enable switch or SR PPS enable switches that offer an equivalent amount of protection. Live testing will require the LOTO listed in 6.1.3 and 6.1.4.

6.1.3 Primary Authorized Employee applies LOTO to the following:

- Gun HVPS output cable connector in accordance with SBMS Subject Area, *Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance* to ensure no signal output to the electron gun cage
- Three linac modulator power supply line cords OR Booster Dipole F Power Supply in accordance with SBMS Subject Area, *Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance*
- Booster RF HVPS OR Booster low level RF drive termination in accordance with PS-C-ASD-PRC-047, *NSLS-II Booster Ring Radio Frequency System High Voltage Power Supply (BR-HVPS) Lockout/Tagout (LOTO)*
- SR System "C" low level RF drive termination OR SR System "C" RF output connection to cavity in accordance with SBMS Subject Area,

National Synchrotron Light Source II, Brookhaven National Laboratory			
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Title: <b>Beamline 8-BM Radiological Interlock Test</b>			<b>Technical</b>

*Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance*

- SR System “D” low level RF drive termination OR SR System “D” RF output connection to cavity in accordance with SBMS Subject Area, *Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance*

6.1.4 Tester applies LOTO to each of the following in accordance with PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*:

- Gun HVPS output cable connector
- Three linac modulator power supply line cords OR Booster Dipole F Power Supply
- Booster RF HVPS OR Booster low level RF drive termination
- SR System “C” low level RF drive termination OR SR System “C” RF output connection to cavity
- SR System “D” low level RF drive termination OR SR System “D” RF output connection to cavity

**Note:** With the exception of LOTO checklist items, checklist items (i.e., tests) specified in Attachment A, *NSLS-II Beamline 8-BM Radiological Interlock Test Checklist* may be performed without all of the specified checklist items (i.e., partial radiological interlock test).

6.1.5 Testers use Attachment A, *NSLS-II Beamline 8-BM Radiological Interlock Test Checklist* to test and certify the radiological interlocks.

- IF the correct corresponding observation has been made, THEN make a checkmark (✓) for each step.
- IF any step results in an undesired event or outcome, THEN contact the Accelerator Safety Systems Engineer and/or Technician.
- IF the undesired outcome or event requires a change to wiring, components or programming, THEN make a checkmark (✓) in the Test Result “Failed” box at the top of the checklist.
- IF the checklist is fully completed with desirable outcomes, THEN make a checkmark (✓) in the Test Result “Passed” box at the top of the checklist.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
Title: <b>Beamline 8-BM Radiological Interlock Test</b>			<b>Technical</b>

- 6.1.6 Testers notify the Lead Operator that the test of the NSLS-II Beamline 8-BM radiological interlocks is completed and the resulting outcome (i.e., Passed or Failed).
- 6.1.7 Testers remove LOTO from each of the following in accordance with PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*:
- Gun HVPS output cable connector
  - Three linac modulator power supply line cords OR Booster Dipole F Power Supply
  - Booster RF HVPS OR Booster low level RF drive termination
  - SR System “C” low level RF drive termination OR SR System “C” RF output connection to cavity
  - SR System “D” low level RF drive termination OR SR System “D” RF output connection to cavity
- 6.1.8 Testers ensure all Beamline PPS cabinets are secure and locked.
- 6.1.9 Testers return the Beamline 8-BM enable key and the Beamline PPS reset key to the Control Room.
- 6.1.10 Testers notify Primary Authorized Employees for each of the following systems that interlock testing is complete AND removal of LOTO may be performed:
- Gun HVPS output cable connector
  - Three linac modulator power supply line cords OR Booster Dipole F Power Supply
  - Booster RF HVPS OR Booster low level RF drive termination
  - SR System “C” low level RF drive termination OR SR System “C” RF output connection to cavity
  - SR System “D” low level RF drive termination OR SR System “D” RF output connection to cavity
- 6.1.11 Testers provide the completed test checklist to the Configuration Management Specialist for posting on the NSLS-II SharePoint Document Center.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
Title: Beamline 8-BM Radiological Interlock Test			Technical

## 7 REFERENCES

- 7.1 PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*
- 7.2 PS-C-ASD-PRC-047, *NSLS-II Booster Ring Radio Frequency System High Voltage Power Supply (BR-HVPS) Lockout/Tagout (LOTO)*
- 7.3 PS-C-ASD-PRC-057, *NSLS-II PPS Configuration Management*
- 7.4 PS-ESH-PRM-3.4.1, *Procedure for Safety System Work Permits*
- 7.5 PS-C-XFD-PRC-010, *Beamline Enclosure Search and Secure and Breaking Security Procedure*
- 7.6 SBMS Program Description: *Radiological Control Manual*
- 7.7 SBMS Subject Area, *Interlock Safety for High Risk Hazards*
- 7.8 SBMS Subject Area, *Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance*
- 7.9 PS-C-CMD-PRC-002, *Records Management Procedure*
- 7.10 PS-C-ASD-SPC-SR-PPS-001, *Storage Ring Personnel Protection System (SPPS) Design Description*
- 7.11 PS-C-XFD-SPC-PPS-001, *Beamline Personnel Protection System (BLPPS) and Front End Personnel Protection System Design Description*

## 8 ATTACHMENTS

Attachment A, *NSLS-II Beamline 8-BM Radiological Interlock Test Checklist*

Attachment B, *NSLS-II 8-BM Beamline PPS Equipment Photos*

## 9 DOCUMENTATION

The following document is generated as a result of this procedure, and shall be maintained in accordance with PS-C-CMD-PRC-002, *Records Management Procedure*:

- Completed NSLS-II Beamline 8-BM Radiological Interlock Test Checklists

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Title: Beamline 8-BM Radiological Interlock Test			Technical

## Attachment A

### NSLS-II Beamline 8-BM Radiological Interlock Test Checklist

Test Reason:	Test Result: <input type="checkbox"/> Passed <input type="checkbox"/> Failed		
	Test Type:	<input type="checkbox"/> Pre-Certification	<input type="checkbox"/> Certification <input type="checkbox"/> Partial
Test Date:	Start Time:	Finish Time:	
Tester 1:	Assistant 1:		
Tester 2:	Assistant 2:		
Tester 1 Signature:	Tester 2 Signature:		
*Reviewer 1:	Reviewer 1 sig.:		
Reviewer 2:	Reviewer 2 sig.:		
** Safety Signature 8-BM (Beamline HMI)	Previous 8-BM SS#	Date: / /	
A Chain:                      B Chain:	A Chain:	B Chain:	
** Safety Signature Pentant 3 Beamline (SR HMI)	Previous Pentant 3 SS#	Date: / /	
A Chain:                      B Chain:	A Chain:	B Chain:	

\* A review by an Accelerator Safety Systems Engineer and a designated specialist (Reviewer 2) is only required upon a Test failure.  
 \*\*If Current Safety Signature number (found in top left corner on HMI) is different from previous number, contact the Accelerator Safety Systems Cognizant Engineer.

#### PREPARATION:

I. All hutch door switches have been evaluated by Mechanical Engineering for proper positioning	
II. Inform Control Room Lead Operator that testing will be done	
III. Obtain Beamline enable and PPS reset keys from Control Room	
IV. Verify that beamline vacuum and water interlocks are satisfied	
V. Place muffler on beam imminent sounder	
VI. Request Lead Operator enable Master shutters	

#### A1 **Verify System Lockouts**

- Gun HVPS output cable connector \_\_\_\_\_
- Linac modulator line cords (3) OR Booster Dipole F PS 480 V \_\_\_\_\_
- Booster RF HVPS 480 V OR Booster low level RF drive termination \_\_\_\_\_
- SR System C low level RF drive termination OR SR System C RF output connection to cavity \_\_\_\_\_
- SR System D low level RF drive termination OR SR System D RF output connection to cavity \_\_\_\_\_

#### A2 **Verify Search and Time Beam Imminent Alarm**

Verify that search path is free from obstacles and line of sight is clear in search mirrors in accordance with PS-C-XFD-PRC-010, *Beamline Enclosure Search and Secure and Breaking Security Procedure* \_\_\_\_\_

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**A**

*Close the Right door*

“Entry Permitted” sign is ON

*Using the keypad, lock the closed doors*

*Press SB1*

SB1 illuminates

Search sounder sounds

Search yellow beacon flashing

*Press SB2*

SB2 illuminates

*Exit hutch and close main door*

*Press SBE and **begin timing***

Beam imminent alarm sounds for 30 seconds

After warning, FOE Interlocked A and B ON (**green**), HMI

“Interlocked” sign is ON

Maglock A and B ON, HMI

*Press the SBE/Access Button*

“Interlocked” sign OFF, “Entry Permitted” sign is ON

FOE Interlocked A and B OFF, HMI

Maglock A OFF

*Open door*

Door opens, Maglock B OFF

A3 ***Out of Sequence Search in the FOE (A Hutch)***

**A**

*Press SB2*

SB2 does not illuminate

*Press SB1*

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	SB1 illuminates		_____
	<i>Close hutch door and press SBE</i>		_____
	Hutch does NOT secure		_____
A4	<b>Search Timeout</b>		<b>A</b>
	<i>Press first search button and <b>begin timing</b></i>		_____
	<i>Complete search <b>without pressing Final Search button</b></i>		_____
	Search sounders off in 2 minutes		_____
	<i>Press Final Search button</i>		_____
	Search does not complete		_____
A5	<b>Shutter Enable</b>		
	Place actuators on FOE door switches and attach Maglock devices		_____
		Beamline Online A and B OFF	_____
	Enable beamline with key and perform a reset	Beamline Online A and B ON ( <b>green</b> )	_____
	Search the FOE	FE Shutter Permits A and B ON <i>after</i> Beam Imminent Warning	_____
	Open FE shutters	FE Shutters A and B indicate open ( <b>green</b> )	_____
		“Beam On” sign is ON	_____
	Close FE shutters	FE Shutters A and B indicate closed ( <b>red</b> )	_____
A6	<b>Emergency Stops (ES) FOE (A Hutch)</b>		
	For each ES search hutch	<b>ES1</b>	<b>ES2</b>
	<i>Open FE Shutters from keypad</i>	_____	_____
	FE Shutters A and B open ( <b>green</b> )	_____	_____
	FOE Interlocked A and B ON ( <b>green</b> )	_____	_____
	FE Shutter Permit A and B ON ( <b>green</b> )	_____	_____
	FE Critical Device Permits A and B ON	_____	_____
	Right Maglock A ON ( <b>green</b> )	_____	_____
	Left Maglock A ON ( <b>green</b> )	_____	_____
	<i>Press ES</i>	_____	_____
	FE Shutters A and B closed ( <b>red</b> )	_____	_____
	FOE Interlocked A and B OFF	_____	_____

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Title: <b>Beamline 8-BM Radiological Interlock Test</b>			<b>Technical</b>

FE Shutter Permit A and B OFF	_____	_____	_____
FE Critical Device Permits A and B OFF	_____	_____	_____
Right Maglock A OFF	_____	_____	_____
Left Maglock A OFF	_____	_____	_____
<i>Pull out ES</i>	_____	_____	_____
ES Sum Latch OFF	_____	_____	_____
<i>Reset fault</i>	_____	_____	_____
ES Sum Latch ON ( <b>green</b> )	_____	_____	_____

**A7 FOE Right Door Switches**

Place actuators on the door switches and Maglock. \_\_\_\_\_

Check the corresponding Permits for each switch tested (e.g., A Permit for switch A1).

	<u><b>A</b></u>	<u><b>B</b></u>	<u><b>Reed</b></u>
<i>Search hutch</i>	_____	_____	_____
<i>Open FE Shutters from keypad</i>	_____	_____	_____
FE Shutters A and B open ( <b>green</b> )	_____	_____	_____
FOE Interlocked A and B ON ( <b>green</b> )	_____	_____	_____
FE Shutter Permit A and B ON ( <b>green</b> )	_____	_____	_____
FOE Door Switch Sum A and B ON ( <b>green</b> )	_____	_____	_____
FE Critical Device Permits A and B ON	_____	_____	_____
<i>Remove one switch actuator</i>	_____	_____	_____
FE Shutters A and B closed ( <b>red</b> )	_____	_____	_____
FOE Interlocked OFF	_____	_____	_____
FE Shutter Permit OFF	_____	_____	_____
FOE Door Switch Sum OFF	_____	_____	_____
FE Critical Device Permits A and B OFF	_____	_____	_____
<i>Replace switch actuator and reset fault</i>	_____	_____	_____

Remove actuators and close door \_\_\_\_\_

**A8 FOE Left Door Switches**

Place actuators on the door switches and Maglock. \_\_\_\_\_

Check the corresponding Permits for each switch tested (e.g., A Permit for switch A).

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	<u>A</u>	<u>B</u>	<u>Reed</u>
<i>Search hutch</i>	_____	_____	_____
<i>Open FE Shutters from keypad</i>	_____	_____	_____
FE Shutters A and B open ( <b>green</b> )	_____	_____	_____
FOE Interlocked A and B ON ( <b>green</b> )	_____	_____	_____
FE Shutter Permit A and B ON ( <b>green</b> )	_____	_____	_____
FOE Door Switch Sum A and B ON ( <b>green</b> )	_____	_____	_____
FE Critical Device Permits A and B ON	_____	_____	_____
<i>Remove one switch actuator</i>	_____	_____	_____
FE Shutters A and B closed ( <b>red</b> )	_____	_____	_____
FOE Interlocked OFF	_____	_____	_____
FE Shutter Permit OFF	_____	_____	_____
FOE Door Switch Sum OFF	_____	_____	_____
FE Critical Device Permits A and B OFF	_____	_____	_____
<i>Replace switch actuator and reset fault</i>	_____	_____	_____
Remove actuators and close door			_____
<b>A9</b> <b>Experimental Enclosure Switches and Kirk Key</b>			
Place actuators on the enclosure door switches and place latch device on Kirk Key (KK) assembly			_____
Remove KK and cycle into SRU			_____
Attempt to remove KK without pressing button			_____
Key cannot be removed			_____
Check the corresponding Permits for each switch tested (e.g., A Permit for switch A). KK drops both chains			
	<u>A</u>	<u>B</u>	<u>KK</u>
<i>Open FE and LIS1 Shutters from keypad</i>	_____	_____	_____
FE Shutters A and B open ( <b>green</b> )	_____	_____	_____
LIS1 Shutter A and B open ( <b>green</b> )	_____	_____	_____
LIS1 Shutter Permit A and B ON ( <b>green</b> )	_____	_____	_____
FE Critical Device Permits A and B ON	_____	_____	_____
<i>Remove one switch actuator/Cycle "cheated" KK</i>	_____	_____	_____
LIS1 Shutter A and B Closed ( <b>red</b> )	_____	_____	_____

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L1S1 Shutter Permit OFF

\_\_\_\_\_

FE Critical Device Permits A and B OFF

\_\_\_\_\_

*Replace switch actuator and reset fault*

\_\_\_\_\_

Remove actuators and latch device, close door and cycle KK in place

\_\_\_\_\_

**A10 Magnetic Lock Test (FOE)**

Connect the FOE test box (Attachment B Figure B4) to the PPS cabinet (Attachment B Figure B7). Use the box to turn ON the Maglocks (set switches to "Normal").

\_\_\_\_\_

Repeat steps for each door: Right (R), Left (L)

**R**      **L**

*Search hutch*

\_\_\_\_\_

FOE Interlocked A and B ON (**green**)

\_\_\_\_\_

FE Shutter Permit A and B ON (**green**)

\_\_\_\_\_

Door Maglock A and B ON (**green**)

\_\_\_\_\_

*Open FE Shutters*

\_\_\_\_\_

FE Shutters open (**green**)

\_\_\_\_\_

*Using FOE test box, turn OFF Maglock*

\_\_\_\_\_

Door Maglock A OFF

\_\_\_\_\_

FE Shutters closed (**red**)

\_\_\_\_\_

FOE Interlocked A OFF

\_\_\_\_\_

FE Shutter Permit A OFF

\_\_\_\_\_

*Turn On Maglock and reset fault*

\_\_\_\_\_

*Search hutch*

\_\_\_\_\_

*Using FE Shutter test fixture, Open FE Shutters*

\_\_\_\_\_

FE Critical Device Permits A and B ON

\_\_\_\_\_

*Using FOE test box, turn OFF Maglock*

\_\_\_\_\_

*Within 3 seconds:* FE Critical Devices Permits A Chain OFF

\_\_\_\_\_

Disconnect the FOE test box and reset fault

\_\_\_\_\_

**A11 Observe Beamline Photon Shutter Operation**

*Close Beamline Photon Shutter*

\_\_\_\_\_

Shutter indicates closed A and B (**red**), HMI

\_\_\_\_\_

*Open Beamline Photon Shutter*

\_\_\_\_\_

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
Title: Beamline 8-BM Radiological Interlock Test			Technical

	Shutter opens smoothly without hesitation	_____
	Shutter indicates open A and B ( <b>green</b> ), HMI	_____
	<i>Close Beamline Photon Shutter</i>	_____
A12	<b>Observe FE Safety Shutter(s) Operation</b>	
	With Maintenance Door open, connect FE Shutter test fixture (Attachment B Figure B5).	_____
	Shutters are in the closed (down) position	_____
	FE Shutter Closed A and B ( <b>red</b> ), HMI	_____
	<i>Turn the "Air" switch ON</i>	_____
	<i>Open FE Photon Shutter and SSs A and B</i>	_____
	Shutters open freely without hesitation	_____
	Shutters are in the open (up) position	_____
	FE Shutter Open A and B ( <b>green</b> ), HMI	_____
	<i>Actuate Shutters closed</i>	_____
	FE Shutter Closed A and B ( <b>red</b> ), HMI	_____
A13	<b>FE Safety Shutters can only be Closed if FE Photon Shutter is Closed</b>	
	<i>Search hutch</i>	_____
	FOE Interlocked A and B ON ( <b>green</b> ), HMI	_____
	FE Critical Devices Permits A and B ON ( <b>green</b> ), HMI	_____
	<i>Open FE SSA</i>	_____
	SSA Open	_____
	<i>Open FE Photon Shutter</i>	_____
	FE Critical Devices Permits A and B OFF, HMI	_____
	<i>Close Shutters</i>	_____
	<i>Reset fault</i>	_____
	FE Critical Devices Permits A and B ON ( <b>green</b> ), HMI	_____
	<i>Open FE SSB</i>	_____
	SSB Open	_____
	<i>Open FE Photon Shutter</i>	_____
	FE Critical Devices Permits A and B OFF, HMI	_____
	<i>Close Shutters</i>	_____
	<i>Reset fault</i>	_____
	FE Critical Devices Permits A and B ON ( <b>green</b> ), HMI	_____
A14	<b>Beamline Enable Key (Opening Hhutter without Key Trips SR RF and Dipole PS)</b>	
	<i>Remove beamline enable key</i>	_____
	Beamline Online A and B OFF	_____
	<i>Search FOE</i>	_____
	FOE Interlocked A and B ON ( <b>green</b> ), HMI	_____
	FE Critical Devices Permits A and B ON ( <b>green</b> ), HMI	_____
	<i>Using FE Shutter test fixture, Open FE Shutters</i>	_____
	FE Critical Devices Permits A and B OFF	_____
	<i>Replace beamline enable key and reset faults</i>	_____
	Beamline Online A and B ON ( <b>green</b> )	_____

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
Title: Beamline 8-BM Radiological Interlock Test			Technical

**Live Testing**

**A15 Reach Back FOE Door Switches**

<i>Secure P1 through P5</i>	SR Secure, A and B chain, SR HMI	_____
<i>Place actuators on FOE hutch downstream left door switches and Maglock</i>		_____
<i>Search hutch</i>	FOE Interlocked A and B ON ( <b>green</b> ), HMI	_____
	FE Critical Devices Permits A and B ON ( <b>green</b> ), HMI	_____
<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permit A and B ON ( <b>green</b> ), SR HMI	_____
<i>Check I/O Box 8BM Beamline Enable Panel</i>	FE Critical Devices Permits A and B LEDs ON	_____
<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Critical Device Permit Sum A and B LEDs ON	_____
	FE Shutters Closed A and B LEDs ON	_____
<i>Check Dipole PS (positive) Beamline Interface</i>	A and B Permits ON, Dipole PS Pos. Interface	_____
<i>Check Dipole PS (negative) Beamline Interface</i>	A and B Permits ON, Dipole PS Neg. Interface	_____
<i>Check SR RF System C HVPS Beamline Interface</i>	A and B Permits ON, SR RF System C HVPS Interface	_____
<i>Check SR RF System D HVPS Beamline Interface</i>	A and B Permits ON, SR RF System D HVPS Interface	_____
<i>Operator enables SR Dipole PS</i>	SR Dipole PS is ON	_____
<i>Operator enables SR RF System C HVPS</i>	SR RF System C HVPS is ON	_____
<i>Operator enables SR RF System D HVPS</i>	SR RF System D HVPS is ON	_____
<i>Using FE Shutter test fixture, open the FE Shutters (SSA, SSB and Photon)</i>		_____
	FE Shutters Open	_____
<i>Remove an "A chain" door switch actuator from beamline hutch door</i>		_____
	FOE Interlocked A OFF, HMI	_____
	FE Critical Devices Permits A chain OFF, HMI	_____
<i>Check I/O Box 8BM Beamline Enable Panel</i>	FE Critical Devices Permit A LED OFF	_____
<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Critical Device Permit Sum A LED OFF	_____
<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permit A OFF ( <b>red</b> ), SR HMI	_____
<i>Check SR RF System C HVPS Beamline Interface</i>	A Permits OFF, SR RF System C HVPS Interface	_____
<i>Check SR RF System D HVPS Beamline Interface</i>	A Permits OFF, SR RF System D HVPS Interface	_____
<i>Check Dipole PS (positive) Beamline Interface</i>	A Permits OFF, Dipole PS Pos. Interface	_____
<i>Check Dipole PS (negative) Beamline Interface</i>	A Permits OFF, Dipole PS Neg. Interface	_____

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Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
Title: <b>Beamline 8-BM Radiological Interlock Test</b>			<b>Technical</b>

	SR RF System C HVPS is OFF	_____
	SR RF System D HVPS is OFF	_____
	SR Dipole PS is OFF	_____
<i>Close Shutters</i>	Shutters closed	_____
Replace " <b>A chain</b> " door switch actuator and reset fault(s)		_____
<i>Search hutch</i>		_____
	FOE Interlocked A and B ON ( <b>green</b> ), HMI	_____
	FE Critical Devices Permits A and B ON ( <b>green</b> ), HMI	_____
<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permit A and B ON ( <b>green</b> ), SR HMI	_____
<i>Check I/O Box 8BM Beamline Enable Panel</i>	FE Critical Devices Permits A and B LEDs ON	_____
<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Critical Device Permit Sum A and B LEDs ON	_____
	FE Shutters Closed A and B LEDs ON	_____
<i>Check Dipole PS (positive) Beamline Interface</i>	A and B Permits ON, Dipole PS Pos. Interface	_____
<i>Check Dipole PS (negative) Beamline Interface</i>	A and B Permits ON, Dipole PS Neg. Interface	_____
<i>Check SR RF System C HVPS Beamline Interface</i>	A and B Permits ON, SR RF System C HVPS Interface	_____
<i>Check SR RF System D HVPS Beamline Interface</i>	A and B Permits ON, SR RF System D HVPS Interface	_____
<i>Operator enables SR Dipole PS</i>	SR Dipole PS is ON	_____
<i>Operator enables SR RF System C HVPS</i>	SR RF System C HVPS is ON	_____
<i>Operator enables SR RF System D HVPS</i>	SR RF System D HVPS is ON	_____
<i>Using FE Shutter test fixture, open the FE Shutters (SSA, SSB and Photon)</i>		_____
	FE Shutters Open	_____
Remove a " <b>B chain</b> " door switch actuator	FOE Interlocked B OFF, HMI	_____
	FE Critical Devices Permits B chain OFF, HMI	_____
<i>Check I/O Box 8BM Beamline Enable Panel</i>	FE Critical Devices Permit B LED OFF	_____
<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permit B OFF ( <b>red</b> ), SR HMI	_____
<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Critical Device Permit Sum B LED OFF	_____
<i>Check SR RF System C HVPS Beamline Interface</i>	B Permits OFF, SR RF System C HVPS Interface	_____
<i>Check SR RF System D HVPS Beamline Interface</i>	B Permits OFF, SR RF System D HVPS Interface	_____
<i>Check Dipole PS (positive) Beamline Interface</i>	B Permits OFF, Dipole PS Pos. Interface	_____
<i>Check Dipole PS (negative) Beamline Interface</i>	B Permits OFF, Dipole PS Neg. Interface	_____

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SR Dipole PS is OFF \_\_\_\_\_

SR RF System C HVPS is OFF \_\_\_\_\_

SR RF System D HVPS is OFF \_\_\_\_\_

*Close FE Shutters with test fixture* \_\_\_\_\_

*Remove hutch switch and Maglock actuators* \_\_\_\_\_

**A16 Observe All Shutters Closed Sum**

*Check I/O Box 28 Beamline Enable Panel* FE Shutters closed A chain light ON \_\_\_\_\_

FE Shutters closed B chain light ON \_\_\_\_\_

*Using FE Shutter test fixture open both FE SSs and then Photon Shutter* \_\_\_\_\_

FE Shutters open (**green**), HMI \_\_\_\_\_

*Check I/O Box 28 Beamline Enable Panel* FE Shutters closed A chain light OFF \_\_\_\_\_

FE Shutters closed B chain light OFF \_\_\_\_\_

*Close FE Shutters and remove FE Shutter test fixture* \_\_\_\_\_

**A17 Test Completion**

Inspect all hutch doors and labyrinths to ensure all PPS switch and Maglock actuators have been removed \_\_\_\_\_

Return Beamline enable key and Beamline PPS reset key to the Control Room \_\_\_\_\_

Remove muffler from beam imminent sounder \_\_\_\_\_

Ensure PPS cabinets are secure and locked; challenge locks \_\_\_\_\_

Remove all LOTO \_\_\_\_\_

Inform Lead Operator that testing is complete \_\_\_\_\_

**- END ATTACHMENT A -**

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Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
Title: Beamline 8-BM Radiological Interlock Test			Technical

## Attachment B - NSLS-II 8-BM Beamline PPS Equipment Photos



**Figure B1:** NSLS-II Beamline Enable Panel (Mounted on Mezzanine I/O Box)



**Figure B2:** FE Safety Shutters B and A

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Doc No. PS-C-XFD-PRC-060	Author: T. McDonald	Effective Date: 08Jul2016 Review Frequency: 3 yrs	Version 1
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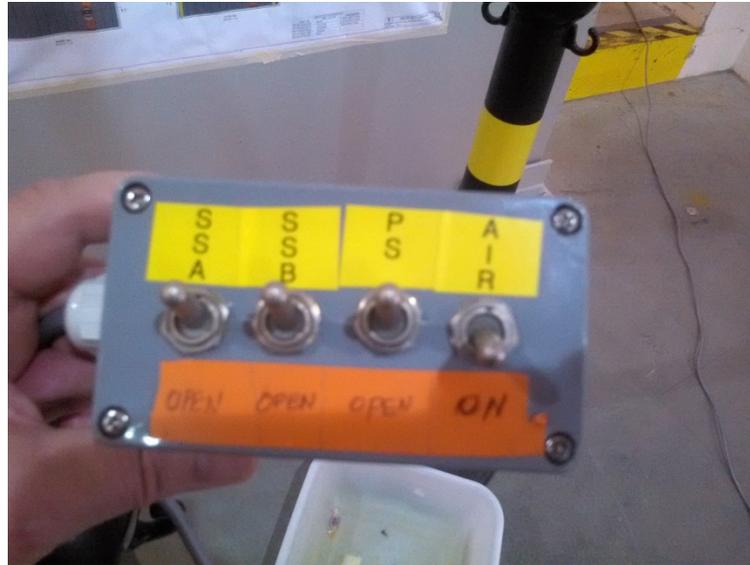
**Figure B3:** FE BM Photon Shutter ( in closed position)



**Figure B4:** FOE Test Box

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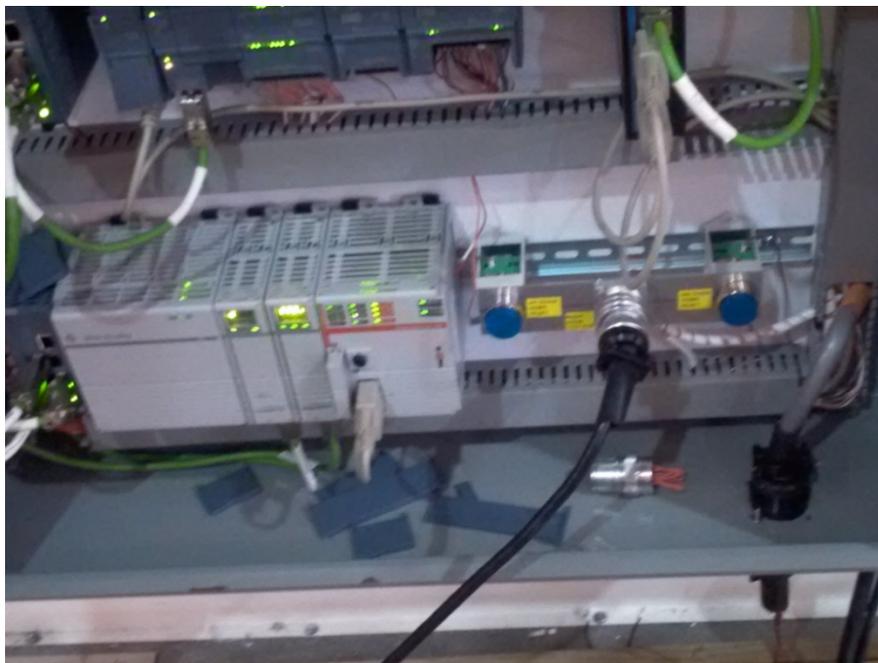
**Figure B5:** FE Shutter Test Fixture



**Figure B6:** FE Shutter Junction Boxes (inside SR)

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**Figure B7:** FOE Test Box Connection inside PPS Cabinet

**-END-**