NSLS-II Beamline 7-ID Radiological Interlock Test Checklist

<table>
<thead>
<tr>
<th>Test Reason:</th>
<th>Test Result:</th>
<th>Passed</th>
<th>Failed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Test</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Date:</th>
<th>Start Time:</th>
<th>Finish Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>11/6/2018</td>
<td></td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Tester 1:</th>
<th>Assistant 1:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Thomas McDonald</td>
<td>Accelerator Operations Staff</td>
<td></td>
</tr>
<tr>
<td>Gabrielle Stueck</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tester 2:</th>
<th>Assistant 2:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert Connel</td>
<td></td>
</tr>
<tr>
<td>Brian Harnad</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tester 1 Signature:</th>
<th>Tester 2 Signature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thomas McDonald</td>
<td>R. Connel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>*Reviewer 1:</th>
<th>Reviewer 2 Signature:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>**Safety Signature 7-ID (Beamline HMI)</th>
<th>Previous 7-ID SS#</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Chain: 7740-4487 B Chain: 4657-4981</td>
<td>Date: /</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>**Safety Signature Pantent 3 Beamline (SR HMI)</th>
<th>Previous Pantent 3 SS#</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Chain: EXPA 2A17 B Chain: D981 F28E</td>
<td>Date: /</td>
</tr>
</tbody>
</table>

* 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 NSLS-II 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. 7-ID Beamline Staff close isolation vacuum valves in preparation for vacuum sensor test steps ✓
VI. Place muffler on beam imminent sounder ✓
VII. Request Lead Operator enable Master Shutters ✓

A1 Verify System Lockouts

Gun HVPS Enable Switch ✓
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 ✓
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 (green), all doors, HMI

Press the SBE/Access Button

“Interlocked” sign is OFF, “Entry Permitted” sign is ON
FOE Interlocked A and B OFF, HMI
Maglock A OFF (may require opening Maglock on keypad)

Open door

Door opens, Maglock B OFF

Out of Sequence Search in the FOE (A Hutch)

Press SB2

SB2 does not illuminate

Press SB1

SB1 illuminates

Close hutch door and press SBE

Hutch does NOT secure
A4 **Search Timeout**

*Press first search button and begin timing*

*Complete search without pressing Final Search button*
  - Search sounders off in 2 minutes

*Press Final Search button*
  - Search does not complete

A5 **Shutter Enable**

Place actuators on FOE door switches and attach Maglock devices.

- Enable beamline with key and perform a reset
  - Beamline Online A and B OFF

- Search the FOE
  - Beamline Online A and B ON (green)
  - FE Shutter Permits A and B ON after Beam
  - Imminent Warning

- Open FE Shutter
  - FE Shutters A and B indicate open (green)
  - 2 “Beam On” signs are ON

- Close FE Shutters
  - FE Shutters A and B indicate closed (red)
  - 2 “Beam On” signs are OFF

- Attempt to Open Shutter 1 from keypad
  - Shutter 1 A and B closed (red)

- Cycle Line 1 Beamline key in place
  - Shutter 1 Permit A and B ON (green)

- Open Shutter 1 from keypad
  - Shutter 1 A and B open (green)

- Cycle Line 1 Beamline key out of place
  - Shutter 1 Permit A and B OFF
  - Shutter 1 A and B closed (red)

- Attempt to Open Shutter 4 from keypad
  - Shutter 4 A and B closed (red)

- Cycle Line 2 Beamline key in place
  - Shutter 4 Permit A and B ON (green)

- Open Shutter 4 from keypad
  - Shutter 4 A and B open (green)

- Cycle Line 2 Beamline key out of place
  - Shutter 4 A and B closed (red)
  - Shutter 4 Permit A and B OFF

- Rotate keys in place to enable both lines
  - Shutter 1 and 4 Permits A and B ON (green)
A6  **Emergency Stops (ES) FOE (A Hutch)**

For each ES search FOE hutch.

**Open FE Shutters from keypad**

- FE Shutters A and B open (green)
- FOE Interlocked A and B ON (green)
- FE Shutter Permits A and B ON (green)
- FE Critical Device Permits A and B ON
- Right Maglock A and B ON (green)
- Left Maglock A and B ON (green)

**Press ES**

- FE Shutters A and B closed (red)
- FOE Interlocked A and B OFF
- FE Shutter Permits A and B OFF
- FE Critical Device Permits A and B OFF
- Right Maglock A OFF
- Left Maglock A OFF

**Pull out ES**

- ES Sum Latch OFF

**Reset fault**

- ES Sum Latch ON (green)

A7  **FOE Labyrinth I Switches and Latches**

Place actuators on the door switches and Maglock.

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

**Search hutch**

**Open FE Shutters from keypad**

- FE Shutters A and B open (green)
- FOE Interlocked A and B ON (green)
- FE Shutter Permits A and B ON (green)
- Cable Lab 1 Switches/Latch A and B ON (green)
- FE Critical Device Permits A and B ON

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>Latch</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✔</td>
</tr>
</tbody>
</table>
### NSLS-II Beamline 7-ID Radiological Interlock Test Checklist

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**Remove one switch actuator**

- FE Shutter A and B closed (red)  
- FOE Interlocked OFF  
- FE Shutter Permit OFF  
- Cable Lab 1 Switch/Latch Permit OFF  
- FE Critical Device Permits A and B OFF

**Replace switch actuator and reset fault**

Remove labyrinth actuators and close labyrinth door

---

**A8 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).

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>Reed</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

**Search hutch**

**Open FE Shutters from keypad**

- FE Shutters A and B open (green)  
- FOE Interlocked A and B ON (green)  
- FE Shutter Permits A and B ON (green)  
- FOE Door Switch Sum A and B ON (green)  
- FE Critical Device Permits A and B ON

**Remove one switch actuator**

- FE Shutter A and B closed (red)  
- FOE Interlocked OFF  
- FE Shutter Permit OFF  
- FOE Door Switch Sum OFF  
- FE Critical Device Permits A and B OFF

**Replace switch actuator and reset fault**

Remove actuators and close door

---

**A9 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 A1).
### Search hutch

**Open FE Shutters from keypad**
- FE Shutters A and B open (green)
- FOE Interlocked A and B ON (green)
- FE Shutter Permits A and B ON (green)
- FOE Door Switch Sum A and B ON (green)
- FE Critical Device Permits A and B ON

**Remove one switch actuator**
- FE Shutters A and B closed (red)
- FOE Interlocked OFF
- FE Shutter Permit OFF
- FOE Door Switch Sum OFF
- FE Critical Device Permits A and B OFF

**Replace switch actuator and reset fault**
- Remove actuators and close door

---

### A10 Magnetic Lock Test (FOE)

Connect the FOE test box to the PPS cabinet. Use the box to turn ON the Maglocks (set switches to “Normal”).

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

**Search hutch**
- FOE Interlocked A and B ON (green)
- FE Shutter Permits 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 Device Permit A Chain OFF

Close FE Shutters and reset fault

Disconnect FOE test box

A11 Vacuum Sensors Beamline SW3

Qualified Beamline Staff will perform vacuum venting.

Note: Shutter 6 to be installed in 2018.*

Vacuum sensor SW A and B ON (green)
Shutter 3 Permits A and B ON (green)
*Shutter 6 Permits A and B ON (green)

*Open Beamline Photon Shutters 3 and 6
   Shutter 3 open (green)
   *Shutter 6 open (green)

Beamline Staff vents up section
   Vacuum sensor SW A and B OFF
   Shutter 3 closed
   *Shutter 6 closed
   Shutter 3 Permits A and B OFF
   *Shutter 6 Permits A and B OFF
   FE Critical Device Permits A and B ON

Open All upstream Shutters from Shutter 3 with test devices
   All upstream Shutters open
   FE Critical Device Permits A and B OFF

Close All Shutters and reset FE Critical Devices Fault
   FE Critical Device Permits A and B ON

*Open All upstream Shutters from Shutter 6 with test devices
   *All upstream Shutters open
   *FE Critical Device Permits A and B OFF

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Close All Shutters and reset FE Critical Devices Fault
FE Critical Device Permits A and B ON

Beamline Staff returns vacuum
Vacuum sensor SW A and B ON (green)
Shutter 3 Permits A and B OFF
*Shutter 6 Permits A and B OFF

Reset fault
Shutter 3 Permits A and B ON (green)
*Shutter 6 Permits A and B ON (green)

A12 Vacuum Sensors Beamline SW2
Qualified Beamline Staff will perform vacuum venting.

Vacuum sensor SW A and B ON (green)
Shutter 2 Permits A and B ON (green)
Shutter 5 Permits A and B ON (green)

Open Beamline Photon Shutters 2 and 5
Shutter 2 open (green)
Shutter 5 open (green)

Beamline Staff vents up section
Vacuum sensor SW A and B OFF
Shutter 2 closed
Shutter 5 closed
Shutter 2 Permits A and B OFF
Shutter 5 Permits A and B OFF
FE Critical Device Permits A and B ON

Open All upstream Shutters from Shutter 2 with test devices
All upstream Shutters open
FE Critical Device Permits A and B OFF

Close All Shutters and reset FE Critical Devices Fault
FE Critical Device Permits A and B ON

Open All upstream and FE Shutters with test devices
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| All upstream Shutters open                      | ✓ |
| FE Critical Device Permits A and B OFF          | ✓ |
| Close All Shutters and reset FE Critical Devices Fault | ✓ |
| FE Critical Device Permits A and B ON           | ✓ |
| Beamline Staff returns vacuum                   | ✓ |
| Vacuum sensor SW A and B ON (green)             | ✓ |
| Shutter 2 Permits A and B OFF                   | ✓ |
| Shutter 5 Permits A and B OFF                   | ✓ |
| Reset fault                                     | ✓ |
| Shutter 2 Permits A and B ON (green)            | ✓ |
| Shutter 5 Permits A and B ON (green)            | ✓ |

A13 **Vacuum Sensors Beamline SW1 and SW8**

Qualified Beamline Staff will perform vacuum venting.

Repeat steps for each vacuum switch.

| Vacuum sensor SW A and B ON (green) | ✓ | ✓ |
| Shutter 1 Permits A and B ON (green) | ✓ | ✓ |

Open Beamline Photon Shutter 1

Shutter 1 open (green)  

Beamline Staff vents up section

| Vacuum sensor SW A and B OFF | ✓ | ✓ |
| Shutter 1 closed            | ✓ | ✓ |
| Shutter 1 Permits A and B OFF | ✓ | ✓ |
| FE Critical Device Permits A and B ON | ✓ | ✓ |

Open Shutter 1 and FE Shutters with test devices

| Shutter 1 and FE Shutters open | ✓ | ✓ |

Close All Shutters and reset FE Critical Devices Fault

| FE Critical Device Permits A and B ON | ✓ | ✓ |

Beamline Staff returns vacuum

| Vacuum sensor SW A and B ON (green) | ✓ | ✓ |
| Shutter 1 Permits A and B OFF       | ✓ | ✓ |
Reset fault
Shutter 1 Permits A and B ON (green)

A14 *Vacuum Sensors Beamline SW7*
Qualified Beamline Staff will perform vacuum venting.

Vacuum sensor SW A and B ON (green)
Shutter 9 Permits A and B ON (green)
Open Beamline Photon Shutter 9
Shutter 9 open (green)
Beamline Staff vents up section
Vacuum sensor SW A and B OFF
Shutter 9 closed
Shutter 9 Permits A and B OFF
FE Critical Device Permits A and B ON
Open All upstream and FE Shutters with test devices
All upstream Shutters open
FE Critical Device Permits A and B OFF
Close All Shutters and reset FE Critical Devices Fault
FE Critical Device Permits A and B ON
Beamline Staff returns vacuum
Vacuum sensor SW A and B ON (green)
Shutter 9 Permits A and B OFF
Reset fault
Shutter 9 Permits A and B ON (green)

A15 *Vacuum Sensors Beamline SW6*
Qualified Beamline Staff will perform vacuum venting.

Vacuum sensor SW A and B ON (green)
Shutter 8 Permits A and B ON (green)
Open Beamline Photon Shutter 8
Shutter 8 open (green)
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**Beamline Staff vents up section**

- Vacuum sensor SW A and B OFF
- Shutter 8 closed
- Shutter 8 Permits A and B OFF
- FE Critical Device Permits A and B ON

**Open All upstream and FE Shutters with test devices**

- All upstream Shutters open
- FE Critical Device Permits A and B OFF

**Close All Shutters and reset FE Critical Devices Fault**

- FE Critical Device Permits A and B ON

**Beamline Staff returns vacuum**

- Vacuum sensor SW A and B ON (green)
- Shutter 8 Permits A and B OFF

**Reset fault**

- Shutter 8 Permits A and B ON (green)

---

**A16 Vacuum Sensors Beamline SW11 and SW5**

Qualified Beamline Staff will perform vacuum venting.

Repeat steps for each vacuum switch.

- Vacuum sensor SW A and B ON (green)
- Shutter 7 Permits A and B ON (green)

**Open Beamline Photon Shutter 7**

- Shutter 7 open (green)

**Beamline Staff vents up section**

- Vacuum sensor SW A and B OFF
- Shutter 7 closed
- Shutter 7 Permits A and B OFF
- FE Critical Device Permits A and B ON

**Open All upstream and FE Shutters with test devices**

- All upstream Shutters open
- FE Critical Device Permits A and B OFF
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| National Synchrotron Light Source II, Brookhaven National Laboratory |
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### Close All Shutters and reset FE Critical Devices Fault
- FE Critical Device Permits A and B ON

### Beamline Staff returns vacuum
- Vacuum sensor SW A and B ON (green)
- Shutter 7 Permits A and B OFF

### Reset fault
- Shutter 7 Permits A and B ON (green)

### Vacuum Sensors Beamline SW4 and SW9
- Qualified Beamline Staff will perform vacuum venting.
- Repeat steps for each vacuum switch.
  - Vacuum sensor SW A and B ON (green)
  - Shutter 4 Permits A and B ON (green)
- Open Beamline Photon Shutter 4
  - Shutter 4 open (green)
- Beamline Staff vents up section
  - Vacuum sensor SW A and B OFF
  - Shutter 4 closed
  - Shutter 4 Permits A and B OFF
  - FE Critical Device Permits A and B ON
- Open Shutter 4 and FE Shutters with test devices
  - Shutter 4 and FE Shutters open
  - FE Critical Device Permits A and B OFF
- Close All Shutters and reset FE Critical Devices Fault
  - FE Critical Device Permits A and B ON

### Beamline Staff returns vacuum
- Vacuum sensor SW A and B ON (green)
- Shutter 4 Permits A and B OFF

### Reset fault
- Shutter 4 Permits A and B ON (green)
A18 **FOE Water Interlock**

FOE Water flow meters for the PPS are located on top of the hutch.

The PPS FOE Water Safety Test Amplifiers (STA) are located in the cabinet to the upper right of the meters on top of the hutch.

<table>
<thead>
<tr>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Current STA A</th>
<th>Current STA B</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 = 1.77</td>
<td>B1 = 0.64</td>
<td>A STA1 = 1.73</td>
<td>B STA1 = 1.76</td>
</tr>
<tr>
<td>A2 = 1.82</td>
<td>B2 = 0.64</td>
<td>A STA2 = 0.63</td>
<td>B STA2 = 0.64</td>
</tr>
</tbody>
</table>

The current programmed trip settings for the amplifiers are in column 1. The STA readouts for each tested A and B chain STAs will be recorded in columns 3 and 4. These recordings should be within 15% of the programmed trip point (column 2).

<table>
<thead>
<tr>
<th>Trip Points</th>
<th>Trip Points (-15 %)</th>
<th>Recorded A Trip</th>
<th>Recorded B Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPS 1: 1.3 GPM</td>
<td>1.1 GPM</td>
<td>A STA1 = 1.3</td>
<td>B STA1 = 1.3</td>
</tr>
<tr>
<td>PPS 2: 0.5 GPM</td>
<td>0.43 GPM</td>
<td>A STA2 = 0.5</td>
<td>B STA2 = 0.5</td>
</tr>
</tbody>
</table>

Repeat each step for all water flow meters

**Open FE Shutters**

- FE Shutters A and B open (green)
- FOE Water Permits A and B ON (green), HMI
- FE Shutter Permits A and B ON (green), HMI

**Using the valve, lower water flow to trip point**

- FE Shutters A and B closed (red)
- In 5 seconds: FE Shutter Permits A and B OFF, HMI
- FOE Water Permits A and B OFF, HMI
- Recorded STA A and B levels above; within 15%

**Return water flow to pretest values**

- FOE Water Permits A and B remain OFF, HMI

**Reset fault at PPS cabinet**

- FOE Water Permits A and B ON (green), HMI
- FE Shutter Permits A and B ON (green), HMI
A19  **FOE Water Safety Test Amplifier Faults**

Repeat each step for all water flow meters.

**Open FE Shutters with keypad**

- FE Shutters A and B open (green)
- FOE Water Permits A and B ON (green), HMI
- FE Shutter Permits A and B ON (green), HMI

**Press A chain fault/reset button**

- FE Shutters A and B closed (red)
- FOE Water Permit A OFF, HMI

In 5 seconds: FE Shutter Permit A OFF, HMI

**Reset fault**

**Open FE Shutters with keypad**

- FE Shutters A and B open (green)
- FOE Water Permits A and B ON (green), HMI
- FE Shutter Permits A and B ON (green), HMI

**Press B chain fault/reset button**

- FE Shutters A and B closed (red)
- FOE Water Permit B OFF, HMI

In 5 seconds: FE Shutter Permit B OFF, HMI

**Reset fault**

A20  **Auxiliary Water Interlock**

Auxiliary water flow meters for the PPS are located downstream of the FOE.

The Auxiliary PPS Water Safety Test Amplifiers (STA) are located in the cabinet located downstream of the FOE.

<table>
<thead>
<tr>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Current STA A</th>
<th>Current STA B</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1= 0.6 GPM</td>
<td>B1= 0.7 GPM</td>
<td>STA1= 0.6 GPM</td>
<td>STA1= 0.7 GPM</td>
</tr>
<tr>
<td>A2= 0.5 GPM</td>
<td>B2= 0.8 GPM</td>
<td>STA2= 0.8 GPM</td>
<td>STA2= 0.8 GPM</td>
</tr>
</tbody>
</table>

The current programmed trip settings for the amplifiers are in column 1. The STA readouts for each tested A and B chain STAs will be recorded in columns 3 and 4. These recordings should be within 15% of the programmed trip point (column 2).

<table>
<thead>
<tr>
<th>Trip Points</th>
<th>Trip Points (- 15 %)</th>
<th>Recorded A Trip</th>
<th>Recorded B Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUX 1: 0.6 GPM</td>
<td>0.51 GPM</td>
<td>STA1= 0.6 GPM</td>
<td>STA1= 0.6 GPM</td>
</tr>
<tr>
<td>AUX 2: 0.5 GPM</td>
<td>0.43 GPM</td>
<td>STA2= 0.5 GPM</td>
<td>STA2= 0.5 GPM</td>
</tr>
</tbody>
</table>
Repeat each step for all water flow meters.

Open Photon Shutter 1 for AUX1, Shutter 4 for AUX2

- Shuttles A and B open (green)  
- AUX Water Permits A and B ON (green), HMI  
- Shutter Permits A and B ON (green), HMI

Using the valve, lower water flow to trip point

- Shuttles A and B closed (red)  
- Shutter Permits A and B OFF, HMI  
- AUX Water Permits A and B OFF, HMI

Recorded STA A and B levels above; within 15%

Return water flow to pretest values

- AUX Water Permits A and B remain OFF, HMI

Reset fault at PPS cabinet

- AUX Water Permits A and B ON (green), HMI  
- Shutter Permits A and B ON (green), HMI

A21 Auxiliary Water Safety Test Amplifier Faults

Repeat each step for all water flow meters.

Open Photon Shutter 1 for AUX1, Shutter 4 for AUX2

- Shuttles A and B open (green)  
- AUX Water Permits A and B ON (green), HMI  
- Shutter Permits A and B ON (green), HMI

Press A chain fault/reset button

- Shuttles A and B closed (red)  
- AUX Water Permit A OFF, HMI  
- Shutter Permit A OFF, HMI

Reset fault

Open FE Shutters with keypad

- Shuttles A and B open (green)  
- AUX Water Permits A and B ON (green), HMI  
- Shutter Permits A and B ON (green), HMI

Press B chain fault/reset button

- Shuttles A and B closed (red)
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AUX Water Permit B OFF, HMI
Shutter Permit B OFF, HMI
Reset fault

A22 PPS Aperture

The PPS Aperture Transmitter meters are located inside the FOE. The STAs are located in the PPS cabinet outside of the FOE. Note: PPS Aperture device not yet installed 7M1/6/18

Record the Transmitter meter readings (absolute pressure).

<table>
<thead>
<tr>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Current STA A</th>
<th>Current STA B</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 = 19.0</td>
<td>B1 = 19.0</td>
<td>A STA1 = 19.0</td>
<td>B STA1 = 19.0</td>
</tr>
</tbody>
</table>

Qualified Beamline Staff will adjust the valve to lower the absolute pressure (trip point at 18 psia).

Open FE Shutters

- FE Shutters A and B open (green) ✓
- Aperture Low Press. A and B ON (green), HMI ✓
- FE Critical Device Permits A and B ON (green), HMI ✓

Using the valve, lower pressure to below trip point at 18 psia

- Both A and B chains trip within 5% of 18 psia (>17.1) ✓
- FE Shutters A and B closed (red) ✓
- FE Critical Device Permits A and B OFF, HMI ✓
- Aperture Low Press. A and B OFF, HMI ✓

Qualified Beamline Staff return pressure to pretest values

- Aperture Low Press. A and B ON (green), HMI ✓

Reset fault at I/O Box

- FE Critical Device Permits A and B ON (green), HMI

A23 PPS Aperture (Module Fault)

Repeat for A and B chain STAs.

Open FE Shutters

- FE Shutters A and B open (green) ✓
- Aperture Module Fault A and B ON (green), HMI ✓
- FE Critical Device Permits A and B ON (green), HMI ✓

Generate a trip amplifier fault

- FE Shutters A and B closed (red) ✓
FE Critical Device Permits A and B OFF, HMI
Aperture Module Fault OFF (red), HMI

*Return trip amplifier to operating condition*
Aperture Module Fault A and B ON (green), HMI

*Reset fault at I/O box*
FE Critical Device Permits A and B ON (green), HMI

**A24 Observe Beamline Photon Shutter Operation**

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

*Open Beamline Photon Shutter*
Shutter opens smoothly without hesitation
Shutter indicates open A and B (green), HMI

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

*Note: Shutter 6 to be installed in 2018.*

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

*Open Beamline Photon Shutter*
Shutter opens smoothly without hesitation
Shutter indicates open A and B (green), HMI

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

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

*Open Beamline Photon Shutter*
Shutter opens smoothly without hesitation
Shutter indicates open A and B (green), HMI

*Close Beamline Photon Shutter*
Shutter indicates closed A and B (red), HMI
A25 **Observe FE Safety Shutter(s) Operation**

With Maintenance Door open, connect FE Shutter test fixture.

- Shutter(s) are in the closed (down) position ✔
- FE Shutters A and B closed (red), HMI ✔

**Turn the "Air" switch ON**

- Shutter(s) are in the open (up) position ✔
- FE Shutters A and B open (green), HMI ✔

- Actuate Shutters closed ✔
- FE Shutters A and B closed (red), HMI ✔

A26 **FE Safety Shutters can only be Closed if FE Photon Shutter is Closed**

- Search hutch
  - FOE Interlocked A and B ON (green), HMI ✔
  - FE Critical Device Permits A and B ON (green), HMI ✔
- Open FE SSA
  - SSA Open ✔
- Open FE Photon Shutter
  - FE Critical Device Permits A and B OFF, HMI ✔
- Close Shutters ✔
- Reset fault
  - FE Critical Device Permits A and B ON (green), HMI ✔
- Open FE SSB
  - SSB Open ✔
- Open FE Photon Shutter
  - FE Critical Device Permits A and B OFF, HMI ✔
- Close Shutters ✔
- Reset fault
  - FE Critical Device Permits A and B ON (green), HMI ✔

A27 **Beamline Enable Key (Opening Shutter Without Key Trips SR RF and Dipole PS)**

- Remove beamline enable key
  - Beamline Online A and B OFF ✔
- Search FOE
  - FOE Interlocked A and B ON (green), HMI ✔
  - FE Critical Device Permits A and B ON (green), HMI ✔
- Using FE Shutter test fixture, Open FE Shutters
  - FE Critical Device Permits A and B OFF ✔
- Using FE Shutter test fixture, Close FE Shutters ✔
- Replace beamline enable key and reset faults
  - Beamline Online A and B ON (green) ✔
  - FE Critical Device Permits A and B ON (green), HMI ✔
**Live Testing**

**A28 Reach Back FOE Door Switches**

Secure P1 through P5

Place actuators on FOE hutch door switches and Maglock.

Search hutch

Check Control Room SR HMI (MCR beamline 1)

Check I/O Box 7 Beamline Enable Panel

Check I/O Box 28 Beamline Enable Panel

Check Dipole PS (positive) Beamline Interface

Check Dipole PS (negative) Beamline Interface

Check SR RF System C HVPS Beamline Interface

Check SR RF System D HVPS Beamline Interface

Operator enables SR Dipole PS

Operator enables SR RF System C HVPS

Operator enables SR RF System D HVPS

Using FE Shutter test fixture, open the FE Shutters (SSA, SSB and Photon)

Remove an "A chain" door switch actuator from beamline hutch door

Operator enables SR RF System

Operator enables SR RF System

Using FE Shutter test fixture, open the FE Shutters (SSA, SSB and Photon)

Remove an "A chain" door switch actuator from beamline hutch door

FOE Interlocked A OFF, HMI

FE Critical Device Permit A chain OFF, HMI

FE Critical Device Permit A LED OFF

FE Critical Device Permit Sum A LED OFF

FE Critical Device Permit A OFF (red), SR HMI

A Permit OFF, SR RF System C HVPS Interface

A Permit OFF, SR RF System D HVPS Interface

A Permit OFF, Dipole PS Pos. Interface

A Permit OFF, Dipole PS Neg. Interface

SR RF System C HVPS is OFF

SR RF System D HVPS is OFF

SR RF System C HVPS is OFF

SR RF System D HVPS is OFF

SR RF System C HVPS is OFF

SR RF System D HVPS is OFF
<table>
<thead>
<tr>
<th>Subject:</th>
<th>NSLS-II Beamline 7-ID Radiological Interlock Test Checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number:</td>
<td>NSLSII-7ID-CHK-001</td>
</tr>
</tbody>
</table>

- SR Dipole PS is OFF

- Close FE Shutter with FE Shutter test fixture
  - FE Shutters closed

- Replace “A chain” door switch actuator and reset fault(s)

- Search hutch
  - FOE Interlocked A and B ON (green), HMI
  - FE Critical Device Permits A and B ON (green), HMI

- Check Control Room SR HMI (MCR beamline 1)
  - FE Critical Device Permit A and B ON (green), SR HMI

- Check I/O Box 7 Beamline Enable Panel
  - FE Critical Device Permits A and B LEDs ON

- Check I/O Box 28 Beamline Enable Panel
  - FE Critical Device Permit Sum A and B LEDs ON

- Check Dipole PS (positive) Beamline Interface
  - A and B Permits ON, Dipole PS Pos. Interface

- Check Dipole PS (negative) Beamline Interface
  - A and B Permits ON, Dipole PS Neg. Interface

- Check SR RF System C HVPS Beamline Interface
  - A and B Permits ON, SR RF System C HVPS Interface

- Check SR RF System D HVPS Beamline Interface
  - A and B Permits ON, SR RF System D HVPS Interface

- Operator enables SR Dipole PS
  - SR Dipole PS is ON

- Operator enables SR RF System C HVPS
  - SR RF System C HVPS is ON

- Operator enables SR RF System D HVPS
  - SR RF System D HVPS is ON

- Using FE Shutter test fixture, open the FE Shutters (SSA, SSB and Photon)
  - FE Shutters open

- Remove “B chain” switch actuator
  - FOE Interlocked B OFF, HMI
  - FE Critical Device Permit B chain OFF, HMI

- Check I/O Box 7 Beamline Enable Panel
  - FE Critical Device Permit B LED OFF

- Check Control Room SR HMI (MCR beamline 1)
  - FE Critical Device Permit B OFF (red), SR HMI

- Check I/O Box 28 Beamline Enable Panel
  - FE Critical Device Permit Sum B LED OFF

- Check SR RF System C HVPS Beamline Interface
  - B Permit OFF, SR RF System C HVPS Interface

- Check SR RF System D HVPS Beamline Interface
  - B Permit OFF, SR RF System D HVPS Interface

- Check Dipole PS (positive) Beamline Interface
  - B Permit OFF, Dipole PS Pos. Interface

- Check Dipole PS (negative) Beamline Interface
  - B Permit OFF, Dipole PS Neg. Interface

- SR Dipole PS is OFF
  - SR RF System C HVPS is OFF
  - SR RF System D HVPS is OFF
### NSLS-II Beamline 7-ID Radiological Interlock Test Checklist

<table>
<thead>
<tr>
<th>Subject:</th>
<th>NSLS-II Beamline 7-ID Radiological Interlock Test Checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number:</td>
<td>NSLSII-7ID-Chk-001</td>
</tr>
<tr>
<td>Revision:</td>
<td>1</td>
</tr>
<tr>
<td>Effective:</td>
<td>12JAN2018</td>
</tr>
<tr>
<td>Page:</td>
<td>21 of 23</td>
</tr>
</tbody>
</table>

- **Close FE Shutters with FE Shutter test fixture**  
  FE Shutters closed
- **Remove beamline hutch switch actuators and Maglock actuator**  
  

#### A29 Water Interlock (Live)

- **Search FOE**  
  FOE Interlocked A and B ON (green), HMI
- **Check I/O Box 7 Beamline Enable Panel**  
  FE Critical Device Permits A and B ON (green), HMI
- **Check I/O Box 28 Beamline Enable Panel**  
  FE Critical Device Permit Sum A and B LEDs ON
- **Check Control Room SR HMI (MCR beamline 1)**  
  FE Critical Device Permit A and B ON (green), SR HMI
- **Check Dipole PS (positive) Beamline Interface**  
  A and B Permits ON, Dipole PS Pos. Interface
- **Check Dipole PS (negative) Beamline Interface**  
  A and B Permits ON, Dipole PS Neg. Interface
- **Check SR RF System C HVPS Beamline Interface**  
  A and B Permits ON, SR RF System C HVPS Interface
- **Check SR RF System D HVPS Beamline Interface**  
  A and B Permits ON, SR RF System D HVPS Interface
- **Operator enables SR Dipole PS**  
  SR Dipole PS is ON
- **Operator enables SR RF System C HVPS**  
  SR RF System C HVPS is ON
- **Operator enables SR RF System D HVPS**  
  SR RF System D HVPS is ON
- **Using FE Shutter test fixture, turn on air and open Photon then SSs**  
  FE Shutters indicate open (green), HMI

**Using water trip points in Step A18, lower flow to one meter**  
Water Permits A and B OFF, HMI
- **Within 5 seconds**  
  FE Critical Device Permits A and B OFF, HMI
- **Check I/O Box 7 Beamline Enable Panel**  
  FE Critical Device Permits A and B LEDs OFF
- **Check I/O Box 28 Beamline Enable Panel**  
  FE Critical Device Permit Sum A and B LEDs OFF
- **Check Control Room SR HMI (MCR beamline 1)**  
  FE Critical Device Permit A and B OFF, SR HMI
- **Check SR RF System C HVPS Beamline Interface**  
  A and B Permits OFF, SR RF System C HVPS Interface
- **Check SR RF System D HVPS Beamline Interface**  
  A and B Permits OFF, SR RF System D HVPS Interface
- **Check Dipole PS (positive) Beamline Interface**  
  A and B Permits OFF, Dipole PS Pos. Interface
- **Check Dipole PS (negative) Beamline Interface**  
  A and B Permits OFF, Dipole PS Neg. Interface

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A30 **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 SSSs 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**

A31 **FOE Area Radiation Monitor**

Refer to PS-C-ASD-PRC-008, *NSLS-II Area Radiation Monitor PPS Test and complete Attachment D, NSLS-II Beamline (FOE) Area Radiation Monitor Checklist.*

FRM 7-ID Test Checklist Completed ✔

A32 **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 D

### NSLS-II Beamline (FOE) Area Radiation Monitor Checklist

**Note:** Signatures below indicate that the test has been completed.

<table>
<thead>
<tr>
<th>Monitor #</th>
<th>ID #</th>
<th>Beamline:</th>
<th>Test Reason:</th>
<th>Test Date:</th>
<th>Test Result</th>
<th>Tester:</th>
<th>RCD:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRH ID 7</td>
<td>INO 7650</td>
<td>7-ID</td>
<td>[☐] Beamline Certification</td>
<td>1/16/18</td>
<td>[☐] Passed</td>
<td>Thomas McDonald</td>
<td>[☐] Failed</td>
</tr>
</tbody>
</table>

**Fail Alarm:** Place checkmark (✓) in checkbox (☐) for each correct response.

<table>
<thead>
<tr>
<th>Local Expected Observation</th>
<th>HMI/CR Expected Observation</th>
<th>Linac HMI</th>
<th>CR HMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator turns on Gun</td>
<td>Gun HVPS is ON</td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>RCD Disables Monitor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silence CR Alarm</td>
<td></td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Gun turns OFF</td>
<td>Gun HVPS is OFF</td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Return monitor to normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RCD ensures ARM is locked</td>
<td></td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
</tbody>
</table>

**Low Alarm:** Place checkmark (✓) in checkbox (☐) for each correct response.

<table>
<thead>
<tr>
<th>Local Expected Observation</th>
<th>HMI/CR Expected Observation</th>
<th>Beaml ine HMI</th>
<th>CR HMI/EPICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opens FE shutter (w/keypad)</td>
<td>FE Shutters open</td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Apply source until low alarm</td>
<td>Yellow light on Monitor</td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Return monitor to normal</td>
<td></td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Apply source until low alarm</td>
<td>FE Critical Device Permit A chain OFF</td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Return monitor to normal</td>
<td></td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
</tbody>
</table>

**High Alarm:** Place checkmark (✓) in checkbox (☐) for each correct response.

<table>
<thead>
<tr>
<th>Local Expected Observation</th>
<th>HMI/CR Expected Observation</th>
<th>Linac HMI</th>
<th>CR HMI/EPICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator turns on Gun</td>
<td>Gun HVPS is ON</td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Apply source until high alarm</td>
<td>Red light on Monitor</td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Silence Alarm</td>
<td>Monitor alarm sounds</td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Gun turns OFF</td>
<td>Gun HVPS is OFF</td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
<tr>
<td>Return monitor to normal</td>
<td></td>
<td>[✓]</td>
<td>[✓]</td>
</tr>
</tbody>
</table>

### Description of Test Failures (if any):

D1