

Brookhaven National Laboratory/National Synchrotron Light Source			
Subject:	X21A1/A3 Radiological Interlock Test		
Number:	LS-PPS-0039	Revision:	B
		Effective:	04/05/2006
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[Revision Log](#)

Prepared By:	M. Buckley	Approved By:	S. Buda	Approved By:	
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*Approval signatures on file with master copy.

Test Reason:	Test Result:	<input type="checkbox"/> Passed	<input type="checkbox"/> Failed
	Test Type:	<input type="checkbox"/> Full	<input type="checkbox"/> Partial
Test Date:	Start Time:	Finish Time:	
Tester 1:	Assistant 1:		
Tester 2:	Assistant 2:		

PREPARATION:

- Inform control room operator that test will be done. _____
- Turn off 'Red Tag' switch on x-ray ring interlock, and apply LOTO to X-Ray Security system. _____
- Verify that vacuum valves and water interlocks are satisfied or connect user interlock test jumper. _____
- Obtain Spare transfer Kirk Key 19370. _____

[X21A1] (Downstream hatch):

1.
 - Break security in the X21A3 hatch. _____
 - Move beam stop downstream of X21A3 hatch to the "Out-of-Beam" position. _____
 - Ensure downstream removable beam pipe and beam pipe in the X21A3 hatch are in place. _____
 - Ensure RIA & RIB interlock connectors are plugged in for both removable beam pipes mentioned above. _____

2. **[Search Sequence]** Search the X21A1 hatch
 - The overhead lights go out _____
 - The red interior light comes on _____
 - The audible alarm sounds for 13 to 15 seconds minimum _____

 - The hatch interlock sign turns on _____

3. Open hatch door
 - The hatch interlock sign goes out _____

4. Press CS-1, close hatch door and wait.
 - Hutch interior lights come on in not more than 30 seconds. _____

 - Press CS-E.
 - Interlock does not activate _____

5. Press interior search buttons in order, close door, press CS-E, note that alarm comes on, open and close door, press CS-E again. (This must all be done in less than the timeout interval noted in step 4)
 - Interlock does not activate _____

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6. **[Shutter Enable]** Place latch device on door lock so key can be removed. Place switch holders on door switches. Search hutch, put door key in SRU and turn.
 The Safety Shutter "enable" light does not come on until the end of the warning interval _____

7. **[Opposite Hutch Inactive]** Search X21A1 hutch. Attempt to search X21A3 hutch.
 Cannot complete search _____

8. **[Emergency Stop]** Test the two Emergency Stops inside the X21A1 hutch.
 Press an Emergency Stop Button.

	<u>ES1</u>	<u>ES2</u>
The shutter "enable" light goes out	_____	_____
The ES indicator comes on	_____	_____
The ES latch cannot be reset unless the SOR key is turned	_____	_____

Search hutch and repeat step 8 for each ES button.

9. **[Hutch door switches]** Search hutch. Open safety shutter and photon shutter.
The "Beam On" sign turns ON _____

Door:			
1	2	3	4

Remove holder from switch 2.
 RIB latch light comes ON

	_____	_____	_____	_____
--	-------	-------	-------	-------

10. Replace holder on switch 2.
 RIB cannot be reset unless SOR key is turned.

	_____	_____	_____	_____
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11. Remove holder on switch 1.
 Safety shutter closes
 Photon shutter closes
 RIA latch light comes on
 Hutch interlock drops out
 "Beam On" sign goes out
 RIA can't be reset w/o SOR

	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____

Replace holder on switch 1. Search hutch and repeat for the remaining door switches.

12. **[Hutch SRU]** Replace holder on switch 1. Search hutch, leave shutter closed.
 Hutch Kirk key (KKH) cannot be removed from SRU unless button is pushed _____

13. Open safety shutter and photon shutter.
 KKH cannot be removed even if button is pushed _____

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14. Close shutters. Turn KKH and note where solenoid unit stops rotation. Push the button and turn key just beyond this point, but not far enough to actuate "key removed" switch. Release the button and leave key in this position. Open shutter(s), remove KKH, and replace.

RIA latch light comes on _____
 RIB latch light comes on _____
 The safety shutter closes _____
 The photon shutter closes _____

15. [**Beamline Transfer Key SRU**] With hutch interlocked, leave shutter(s) closed.
 Beam line transfer key can be removed only if
 button on SRU is pushed _____

Open safety shutter. (Photon shutter remains closed)
 Beam line transfer key can't be removed even if
 button is pushed _____

16. Close safety shutter.
 "Cheat" SRU as described in step 13. Open safety shutter, remove the key and replace.

RIA latch light comes on _____
 RIB latch light comes on _____
 The safety shutter closes _____
 SPA comes on _____
 SPA can't be reset w/o SOR _____

Reset RIA and RIB

17. [Beam pipe Transfer Key Bank] Obtain spare transfer key and, if applicable, beam pipe keys.

Open Safety & Photon Shutter
 Place spare transfer key in beam pipe key transfer bank and turn
 RIA latch light comes on _____
 RIB latch light comes on _____
 Safety shutter closes _____
 Photon shutter closes _____

Reset Faults

18. [**Emergency Stop**] Open photon and safety shutter. Press an emergency stop button inside X21A1 hutch.

RIA latch light comes on _____
 RIB latch light comes on _____
 Hutch interlock drops out _____
 ES indicator comes on _____
 Safety Shutter Closes _____
 Photon Shutter Closes _____

19. [**Photon Shutter Operation**] Observe the photon shutter while it is opened and closed.

The mechanism moves freely and without hesitation _____

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20. [**Beam pipe Test/Reach-Back**]

Complete test for both removable beam pipes.

Open Safety & Photon Shutter

Unplug **Upstream connector B**

RIB latch light comes on

RIBX latch light comes on

Safety Shutter enable light goes Out

Safety Shutter Closes

Replace connector

RIBX cannot be reset

Reset RIB

(20 cont.)

RIBX CAN be reset

Safety Shutter enable light comes On

Open Safety & Photon Shutter

Unplug **Downstream connector B**

RIB latch light comes on

RIBX latch light comes on

Safety Shutter enable light goes Out

Safety Shutter Closes

Replace connector

RIBX cannot be reset

Reset RIB

RIBX CAN be reset

Safety Shutter enable light comes On

Open Safety & Photon Shutter

Unplug **Upstream connector A**

RIA latch light comes on

RIAX latch light comes on

Safety shutter closes

Photon shutter closes

Replace connector.

RIAX cannot be reset

Reset RIA

RIAX CAN be reset

Photon Shutter enable light comes On

Open Safety & Photon Shutter

Unplug **Downstream connector A**

RIA latch light comes on

RIAX latch light comes on

Safety shutter closes

Photon shutter closes

Replace connector

RIAX cannot be reset

Reset RIA

RIAX CAN be reset

Photon Shutter enable light comes On

Up Stream Pipe
(inside X21A3 hutch)

Down Stream Pipe
(down-stream) X21A3 hutch

Up Stream Pipe
(inside X21A3 hutch)

Down Stream Pipe
(down-stream) X21A3 hutch

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21. **[Reach-Back – Door Switches]** One person goes to the x-ray equipment area and resets the indicators for RIAX and RIBX at SR100.

Open the safety shutter and photon shutter.

Remove switch holder from door switch number 2.

RIB latch light comes on _____

RIBX "Loop Enabled" indicator goes out _____

RIBX "Loop Disabled" indicator comes on _____

Replace switch holder.

RIBX cannot be reset _____

Reset RIB

RIBX CAN be reset

("Loop Enabled" indicator comes on) _____

22. Remove holder from door switch 1.

RIA latch light comes on _____

RIAX "Loop Enabled" indicator goes out _____

RIAX "Loop Disabled" indicator comes on _____

The safety shutter closes _____

The photon shutter closes _____

RIAX cannot be reset _____

Reset RIA

RIAX CAN be reset

("Loop Enabled" indicator comes on) _____

23. Remove the holders from the switches. Remove the latch device from the door lock(s). Stand inside the hutch and open and close the door.

All door switches operate freely and each makes a "click" when door is opened

(Complete test for each set of door switches)

Door:			
1	2	3	4

[X21A3] (Upstream hutch):

24. • Break security in the X21A1 hutch.
 • Ensure both removable beam pipes are out of place in the X21A3 hutch and/or disconnect beampipe interlock connectors at the upstream and downstream ends
 • Move beam stop downstream of X21A3 hutch to the "In-Beam" position.
 • Install Blank flange inside X21A3 hutch or place a latch device on flange
 ○ To remove key, transfer all applicable beamstop keys into transfer bank and place transfer key in L/O SRU along with L/O key and then turn.
 • Reset SOR. _____

25. **[Search Sequence]** Search the X21A3 hutch

The overhead lights go out _____

The red interior light comes on _____

The audible alarm sounds for 13 to 15 seconds minimum _____

The hutch interlock sign turns on _____

26. Open hutch door

The hutch interlock sign goes out _____

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27. Press CS-1, close hutch door and wait.
 Hutch interior lights come on in not more than 30 seconds. _____
 Press CS-E.
 Interlock does not activate _____
28. Press interior search buttons in order, close door, press CS-E, note that alarm comes on, open and close door, press CS-E again. (This must all be done in less than the timeout interval noted in step 26)
 Interlock does not activate _____
29. [**Shutter Enable**] Place latch device on door lock so key can be removed. Place switch holders on door switches. Search hutch, put door key in SRU and turn.
 The Safety Shutter "enable" light does not come on until the end of the warning interval _____
30. [**Opposite Hutch Inactive**] Search X21A3 hutch. Attempt to search X21A1 hutch.
 Cannot complete search _____
31. [**Emergency Stop**] Test the two Emergency Stops inside the X21A3 hutch
 The person inside presses an Emergency Stop Button. **ES1** **ES2**
 The shutter "enable" light goes out _____
 The ES indicator comes on _____
 The ES latch cannot be reset unless the SOR key is turned _____
 Search hutch and repeat step 31 for each ES button.
32. [**Hutch Door Switches**] Place latch device on door lock so key can be removed. Place switch holders on door switches. Search hutch, put door key in SRU and turn, open safety shutter and photon shutter.
 The "Beam On" sign turns ON _____
- | Door: | | | |
|-------|---|---|---|
| 1 | 2 | 3 | 4 |
- Remove holder from switch 2.
 RIB latch light comes ON _____
33. Replace holder on switch 2.
 RIB cannot be reset unless SOR key is turned. _____
34. Remove holder on switch 1.
 Safety shutter closes _____
 Photon shutter closes _____
 RIA latch light comes on _____
 Hutch interlock drops out _____
 "Beam On" sign goes out _____
 RIA can't be reset w/o SOR _____
 Replace holder on switch 1. Search hutch and repeat for the remaining door switches.

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35. [**Hutch SRU**] Search hutch, leave shutter closed.

Hutch Kirk key (KKH) cannot be removed from SRU unless button is pushed _____

36. Open safety shutter and photon shutter.

KKH cannot be removed even if button is pushed _____

37. Close shutters. Turn KKH and note where solenoid unit stops rotation. Push the button and turn key just beyond this point, but not far enough to actuate "key removed" switch. Release the button and leave key in this position. Open shutter(s), remove KKH, and replace.

RIA latch light comes on _____

RIB latch light comes on _____

The safety shutter closes _____

The photon shutter closes _____

38. [**Emergency Stop**] Open photon and safety shutter. Press an emergency stop button inside X21A3 hutch.

RIA latch light comes on _____

RIB latch light comes on _____

Hutch interlock drops out _____

ES indicator comes on _____

Safety Shutter Closes _____

Photon Shutter Closes _____

39. [**Shutter Enable Key**] Open the safety shutter. Remove the Control Room Shutter Enable Key for this beam line, and then replace the key.

The safety shutter closes _____

RIA latch light comes on _____

The "Control Room Shutter Enable" light goes out _____

The SPA latch comes on (after the key is back on) _____

The safety shutter cannot be opened _____

Reset RIA and SPA

40. [**Auto Open**] Open the Safety Shutter.

Turn "Auto Open" key to "ON".

At the Control Room Operator's Console, switch the shutter master enable to "Inhibit" and back to "Enable"

The safety shutter closes _____

And then re-opens _____

Turn "Auto Open" key to "OFF"

Switch the master enable to "Inhibit" and back to "Enable"

The safety shutter closes _____

And does NOT re-open _____

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41. **[Backstop/Reach-Back Test]**

Open Safety & Photon Shutter

The A3 back stop must be in place when the pipe is removed. Place a latch device on the back stop Kirk key to remove the key, place holders on the A and B back stop switches. Place the back stop key in the transfer unit and rotate. Search A3 hutch. Open photon and safety shutter.

Remove holder on the backstop "B" switch.

RIB latch light comes on

RIBX latch light comes on

Replace holder

RIBX cannot be reset

Reset RIB

RIBX can be reset

Remove holder on the backstop "A" switch.

RIA latch light comes on

RIAX latch light comes on

Safety shutter closes

Photon shutter closes

Replace holder

RIAX cannot be reset

Reset RIA

RIAX can be reset

42. Open Safety & Photon Shutter

Place spare transfer key in Backstop key transfer bank and turn

RIA latch light comes on

RIB latch light comes on

Safety shutter closes

Photon shutter closes

Reset RIA & RIB

43. **[Reach-Back]** One person goes to the x-ray equipment area and resets the indicators for RIAX and RIBX at SR100.

Open the safety shutter and photon shutter.

Remove switch holder from door switch number 2.

RIB latch light comes on

RIBX "Loop Enabled" indicator goes out

RIBX "Loop Disabled" indicator comes on

Replace switch holder.

RIBX cannot be reset

Reset RIB

RIBX CAN be reset

("Loop Enabled" indicator comes on)

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44. Remove holder from door switch 1.

- RIA latch light comes on _____
 - RIAX "Loop Enabled" indicator goes out _____
 - RIAX "Loop Disabled" indicator comes on _____
 - The safety shutter closes _____
 - The photon shutter closes _____
 - RIAX cannot be reset _____
- Reset RIA
- RIAX CAN be reset _____
 - ("Loop Enabled" indicator comes on) _____

45. Remove the holders from the switches. Remove the latch device from the door lock(s). Stand inside the hutch and open and close the door.

All door switches operate freely and each makes a "click" when door is opened

(Complete test for each set of door switches)

Door:			
1	2	3	4

46. [**Safety Shutter Operation**] Search the hutch. Locate the safety shutter associated with the beam line by tracing the beam pipe through the shield wall. Do not rely on labels on the shutter mechanism. Open the shutter.

- The correct shutter opens _____
 - No other shutter at that saw tooth opens or attempts to open _____
- Close the safety shutter.
- The mechanism moves freely and without hesitation _____

47. Remove user interlock test jumper (if applicable). _____

48. Remove latch device on blank flange (if applicable). _____

* * *