

11ID-1 Beamline
Access Control and Interlock System (ACIS)
Verification and Validation Procedure
6.7.52.2 Rev. 8

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1.0 PURPOSE

The objective is to validate and verify the operation of the Access Control and Interlock System (ACIS) within specifications as outlined in “Booster/Storage Ring/Beamlines Access Control and Interlock System (ACIS) PLC Component Manual” [1].

2.0 BACKGROUND

The CLS has adopted a two-level redundant lock-up system for the beam line enclosures. The system consists of a hard-wired 24 Vdc system and a programmable logic controller (PLC) input-output system. Fundamentally, all lock-up areas operate in the same manner, each having its own emergency off switches, door switches as well as station push button switches. Refer to the component manual [1] for more information.

2.1 Testing Philosophy

The overriding approach to the methodology is a meticulous and exhaustive series of tests to ensure that the system operates as required. More detail is provided in the component manual [1].

3.0 APPLICATION REQUIREMENTS

3.1 Context

This document contains the testing procedure for the beamline ACIS.

3.2 Personnel Qualification

CLSI technical personnel not involved in the design and implementation shall conduct the validation of the system. The tests require two personnel (referred to hereinafter as Inspector 1 and Inspector 2). The validation will take place in Radiological Controlled Areas (RCA) and Industrial Controlled Areas (ICA). Inspectors must have received both the General Radiation Training (GRT) and General Industrial Training (GIT) as outlined in 8.7.1.1 “Canadian Light Source – Facility Access” [2] to enter these areas.

In cases where the radiation sources are being tested (i.e. BR/SR RF), appropriate personnel from Operations, Controls and Instrumentation or Engineering and Technical Services will be identified by managers of those groups to assist the inspection team with verifying system response as required.

3.3 Supervision and Verification

The Health, Safety and Environment (HSE) manager or designate will supervise the execution of the procedure, acting either as Inspector 1 or Inspector 2 or simply in a supervisory capacity.

3.4 General Precautions, Limitations and Constraints

This procedure involves an individual being present in a lockup area after it has been engaged. Further precautions will be noted in the procedure section.

3.5 Prerequisites

Verification may take place after the system has been turned over from design. The design verification includes Safety System Ring Out [3].

3.6 Personnel Protection Equipment

Personnel who enter designated construction zones during a validation procedure must wear all personal protective equipment (i.e. work boots, safety goggles, hard hats, hearing protection, etc) that apply. As noted in section 3.2, inspectors are expected to be familiar with precautions for entering these areas.

3.7 Equipment, Materials and Supplies

For most testing, at least two individuals are required and for the sake of convenience, wireless radio communications is recommended. A personal Thermo luminescent Dosimeter (TLD) must be worn at all times.

Other equipment includes:

- A voltmeter/continuity tester
- A timer, watch or stopwatch
- Pertinent drawings referenced in section 4.2, and
- Copies of the forms and checklists in section 6.0.
- An ethernet video camera
- Six foot step ladder

3.8 Termination Criteria

When a fault is detected, it is at the discretion of the HSE overseer to continue with the validation procedure. Any system fault, however, requires that the entire validation procedure be conducted from the beginning after the fault has been corrected before the system is considered validated. Procedural errors and those arising from typographical errors in drawings and other documentation, may or may not require another iteration of this procedure; again at the discretion of the HSE overseer.

4.0 REFERENCE MATERIAL

4.1 Glossary

The following terms appear in the verification procedures:

TBN-n (Description) is a terminal block. The point is tested either by measuring voltage from the point to ground or by measuring continuity between two points, indicated by a "V" or "C" in square brackets, respectively. In the latter case, TBN-n will indicate two points separated by a "/"; TB5-13/14 or TB1-4/TB9-2, for example. Either or both points could also be a relay terminal (see Knn, this section).

Information in round brackets is a brief, optional description of the device function.

Knn (Description) is a relay, part of the ACIS (see drawing "SGM/PGM 11ID-1 LOCK UP SYSTEM SCHEMATIC DIAGRAM 1 OF 2" [4]). Verification of device status at the panel is accomplished visually by observing an indicator light on the relay in question. An illuminated light denotes an energized relay represented as a 1 or "on". An inactive light denotes a de-energized relay shown as a 0 or "off".

In some instances it is necessary to specify a terminal on the relay to test. In such instances the terminal will be noted similar to a terminal block. For example, K3-A1+ means to test terminal "A1+" on relay 3.

Information in round brackets is a brief, optional description of the device function.

TN-n (Description) is a timer module, part of the ACIS (see drawing "SGM/PGM 11ID-1 LOCK UP SYSTEM SCHEMATIC DIAGRAM 1 OF 2" [4]). Verification of device status at the panel is accomplished visually by observing an indicator light on the device in question. An illuminated light denotes an energized timer, represented as a 1 or "on". An inactive light denotes a de-energized device shown as a 0 or "off".

In some instances it is necessary to specify a terminal on the timer to test. In such instances the terminal will be noted similar to a terminal block. For example, T2-B1 means to test terminal "B1" of timer 2.

Information in round brackets is a brief, optional description of the device function.

SWx (Description) is a test switch. These are typically normally-closed momentary pushbuttons that are used to simulate key events. In rare circumstances a normally-open contact is utilized. The information in round brackets is a brief, optional description of the device.

ALL CLEAR refers to the timed interval between search completion and before the area is considered secure in which the horns sound and strobes flash.

The following three labels refer to system components. In the context of this document it refers to whether or not the component can be operated or has been interlocked.

LINAC is the linear accelerator.

BR RF refers to the booster ring RF system.

SR RF refers to the storage ring RF system.

4.2 Supporting Documents

1. "Booster/Storage Ring/Beamlines – Access Control and Interlock System", 7.9.39.4, Rev 3.
2. "Canadian Light Source – Facility Access", 8.7.1.1, Rev. 0
3. "Safety System Ring Out Procedure", 7.7.52.1 Rev. 2
4. "SGM/PGM BEAMLINE 11ID-1 LOCK UP SYSTEM SCHEMATIC DIAGRAM 1 OF 2", 11ID-1\EE\PROT\LOCK\0102625, Rev. 7
5. "11ID POE Access Control Interlock System Lockup Procedure", 6.7.52.1, Rev. 1
6. "11ID FRONT END ENCLOSURE (FOE) ACCESS CONTROL SYSTEM (ACIS) GENERAL LAYOUT", RAD\0102500, Rev. 2
7. "Linac to LTB1 Lockup Procedure", 2.7.37.2, Rev.1B
8. "Booster Lockup Procedure", 3.7.37.1, Rev.1
9. "Storage Ring Lockup Procedure", 5.7.52.1, Rev 1
10. "BOOSTER/STORAGE RING TOP OF SHIELDING EQUIPMENT LAYOUT", /BLDG/EE/0050706, Rev. 18
11. "Non-Conformance Reporting and Tracking Procedure", 0.7.91.2, Rev. 0
12. "SGM PGM BEAMLINE FRONT END SAFETY SHUTTER WIRING DIAGRAM", 11ID-1\EE\MON\WIR\0099803, Rev. 1

5.0 PROCEDURE

Note - The following procedures make use of the 11ID POE Access Control Interlock System Lockup Procedure [5], drawing 0102500 [6], Linac, BR and SR Lockup Procedures [7] [8] [9] and the forms and checklists in section 6.0. Rack locations are shown on drawing 0050706 [10].

Note – For each failure, an incident is entered in to the automated problem tracking system [11] detailing the nature, cause and resolution of the failure. The incident number issued by the system is listed in the summary report of section 6.1.

5.1 Administrative Verification

Note – Do not proceed with subsequent sections until the following verification has been made.

5.1.1 Verification

- a) Inspector 1 or 2: VERIFY:
 - a. Safety System Ring Out Procedure [3], Rev: _____ has been performed for the system referred to in this document _____

5.2 Emergency Off Verification

5.2.1 Verification

- a) Inspector 1 or 2: PLACE a sign indicating ACIS testing in progress at zone 8 and 9 gates and OBTAIN one of the SR gate keys or D23 key.
- b) Inspector 2: RESET all EOSs.
- c) Inspector 2: VERIFY the following:
 - a. EOS1611.3-01 light is off _____
 - b. EOS1611.3-01 is installed and labeled correctly _____
 - c. EOS1611.3-02 light is off _____
 - d. EOS1611.3-02 is installed and labeled correctly _____
 - e. EOS1611.3-03 light is off _____
 - f. EOS1611.3-03 is installed and labeled correctly _____
 - g. EOS1611.3-04 light is off _____
 - h. EOS1611.3-04 is installed and labeled correctly _____
- d) Inspector 1: VERIFY:
 - a. K5, K6 and K57 are on _____
 - b. K20 is on _____
 - c. P1611.3-01 EOS indicator is off _____

- d. 24V between TB5-01 and TB1-GND _____
- e) Inspector 2: ACTIVATE EOS1611.3-01
- f) Inspector 2: VERIFY the following:
 - a. EOS1611.3-01 light is on _____
 - b. EOS1611.3-02 light is off _____
 - c. EOS1611.3-03 light is off _____
 - d. EOS1611.3-04 light is off _____
- g) Inspector 1: VERIFY:
 - a. K5, K6 and K57 are off _____
 - b. K20 is off _____
 - c. P1611.3-01 EOS indicator is on _____
 - d. < 1V between TB5-01 and TB1-GND _____
- h) Inspector 2: RESET EOS1611.3-01 and ACTIVATE EOS1611.3-02
- i) Inspector 2: VERIFY the following:
 - a. EOS1611.3-01 light is off _____
 - b. EOS1611.3-02 light is on _____
 - c. EOS1611.3-03 light is off _____
 - d. EOS1611.3-04 light is off _____
- j) Inspector 1: VERIFY:
 - a. K5, K6 and K57 are off _____
 - b. K20 is off _____
 - c. P1611.3-01 EOS indicator is on _____
 - d. < 1V between TB5-01 and TB1-GND _____
- k) Inspector 2: RESET EOS1611.3-02 and ACTIVATE EOS1611.3-03
- l) Inspector 2: VERIFY the following:
 - a. EOS1611.3-01 light is off _____
 - b. EOS1611.3-02 light is off _____
 - c. EOS1611.3-03 light is on _____
 - d. EOS1611.3-04 light is off _____
- m) Inspector 1: VERIFY:
 - a. K5, K6 and K57 are off _____
 - b. K20 is off _____
 - c. P1611.3-01 EOS indicator is on _____
 - d. < 1V between TB5-01 and TB1-GND _____
- n) Inspector 2: RESET EOS1611.1-03 and ACTIVATE EOS1611.3-04

- o) Inspector 2: VERIFY the following:
 - a. EOS1611.1-01 light is off _____
 - b. EOS1611.1-02 light is off _____
 - c. EOS1611.1-03 light is off _____
 - d. EOS1611.1-04 light is on _____
- p) Inspector 1: VERIFY:
 - a. K5, K6 and K57 are off _____
 - b. K20 is off _____
 - c. P1611.3-01 EOS indicator is on _____
 - d. < 1V between TB5-01 and TB1-GND _____
- q) Inspector 1 & 2: Print your names, date the checklist and initial where indicated.

Inspector: _____	Initials: _____
(Please print)	Date (dd-mm-yyyy): _____
Inspector: _____	Initials: _____
(Please print)	Date (dd-mm-yyyy): _____

5.3 Enclosure Doors

5.3.1 Verification.

- a) Inspector 1 or 2: PLACE a sign indicating ACIS testing in progress at zone 8 and 9 gates and OBTAIN one of the SR gate keys or D23 key.
- b) Inspector 2: OPEN door 1 and CLOSE door 2 and 3 and VERIFY:
 - a. SWDI1611.3-01 and SWDI1611.3-02 are installed correctly _____
- c) Inspector 2: TOGGLE SWDI1611.3-01
- d) Inspector 1: VERIFY the following at P1611.3-01:
 - a. K48 is toggled _____
 - b. Interrupts 24V between TB5-17 and TB1-GND _____
- e) Inspector 2: TOGGLE SWDI1611.3-02
- f) Inspector 1: VERIFY the following is being toggled at P1611.3-01:
 - a. Interrupts 24V between TB5-4 and TB2-GND _____
- g) Inspector 2: OPEN door 2 and CLOSE door 1 and VERIFY:
 - a. SWDI1611.3-03 and SWDI1611.3-04 are installed correctly _____
- h) Inspector 2: TOGGLE SWDI1611.3-03.
- i) Inspector 1: VERIFY the following at P1611.3-01:
 - a. K48 is toggled _____
 - b. Interrupts 24V between TB5-17 and TB1-GND _____
- j) Inspector 2: TOGGLE SWDI1611.3-04.
- k) Inspector 1: VERIFY the following is being toggled at P1611.3-01:
 - a. Interrupts 24V between TB5-8 and TB2-GND _____
- l) Inspector 2: CLOSE door 2 and OPEN door 3 and VERIFY:
 - a. SWDI1611.3-05 and SWDI1611.3-06 are installed correctly _____
- m) Inspector 2: TOGGLE SWDI1611.3-05
- n) Inspector 1: VERIFY the following at P1611.3-01:
 - a. K48 is toggled _____
 - b. Interrupts 24V between TB5-17 and TB1-GND _____
- o) Inspector 2: TOGGLE SWDI1611.3-06
- p) Inspector 1: VERIFY the following is being toggled at P1611.3-01:
 - a. Interrupts 24V between TB5-12 and TB2-GND _____
- q) Inspector 2: CLOSE door 3 and open door 4 and VERIFY:

- a. SWDI1611.3-07 and SWDI1611.3-08 are installed correctly _____
- r) Inspector 2: TOGGLE SWDI1611.3-07
- s) Inspector 1: VERIFY the following at P1611.3-01:
- a. Interrupts continuity between TB5-13 and K13-A1+ _____
- t) Inspector 2: TOGGLE SWDI1611.3-08
- u) Inspector 1: VERIFY the following is being toggled at P1611.3-01:
- a. Interrupts 24V between TB5-16 and TB2-GND _____
- b. Interrupts 24V between SW6-Return (white wire) and TB2-Common _____
- v) Inspector 2: CLOSE Door 4 and toggle an EOS in the enclosure.
- w) Inspector 1: VERIFY the following at P1611.3-01:
- a. K48 and K49 are toggled _____
- b. Interrupts 24V between TB5-17 and TB1-GND _____
- c. Interrupts 24V between TB5-58 and TB2 GND _____
- x) Inspector 2: TOGGLE SW1 of P1611.3-01
- y) Inspector 1: VERIFY the following at P1611.3-01:
- a. K48 is toggled _____
- b. Interrupts 24V between TB5-17 and TB1 ground _____
- z) Inspector 2: TOGGLE SW3 of P1611.3-01.
- aa) Inspector 1: VERIFY the following at P1611.3-01:
- a. Interrupts continuity between TB5-13 and K13-A1+ _____
- bb) Inspector 2: TOGGLE SW5 of P1611.3-01.
- cc) Inspector 1: VERIFY the following at P1611.3-01:
- a. Interrupts voltage between TB5-4 and TB2-GND _____
- b. Interrupts voltage between TB5-8 and TB2-GND _____
- c. Interrupts voltage between TB5-12 and TB2-GND _____
- dd) Inspector 2: TOGGLE SW6 of P1611.3-01.
- ee) Inspector 1: VERIFY the following at P1611.3-01:
- a. Interrupts 24V between SW6-Return (white wire) and TB2-Common _____
- ff) Inspectors 1 & 2: Print your names, date the checklist and initial where indicated.

Inspector: _____ Initials: _____

(Please print)

Date (dd-mm-yyyy): _____

Inspector: _____ Initials: _____

(Please print)

Date (dd-mm-yyyy): _____

5.4 Safety Shutters

Note – For SSH particulars refer to detail drawing [12].

WARNING – The safety shutters present a pinch hazard. Ensure personnel are clear of the shutters before operating.

5.4.1 Verification

- a) Inspector 1 or 2: PLACE a camera in SR1 for monitoring SSH1411-I00-01 and SSH1411-I00-02.
- b) Inspector 1 or 2: PLACE a sign indicating ACIS testing in progress at zone 8 and 9 gates and OBTAIN one of the SR gate keys or D23 key.
- c) Inspector 2: VERIFY:
 - a. SSHs and limit switches are installed correctly and labeled _____
 - b. SSHs have a “Pinch Hazard” sticker on each _____

WARNING – Do not open or attempt to open the safety shutters unless specifically directed for the duration of this test. Inspector 2 is advised to be alert for any movement of the shutters.

- d) Inspector 2: ACTIVATE the switches on the safety shutters as indicated in Table 1 and Table 2 using a device such as a screwdriver.

WARNING – PINCH HAZARD. DO NOT USE ANY PART OF YOUR BODY TO DEPRESS THE LIMIT SWITCHES.

- e) Inspector 1: VERIFY the status of the devices by placing a check in the corresponding box of the table.

LS1 (SSH1411-I00-01)	LS1 (SSH1411-I00-02)	K30	K31	K32	K33
OUT	OUT	0	1	0	1
OUT	IN	0	1	0	1
IN	OUT	0	1	0	1
IN	IN	1	1	0	1

Table 1: SSH Open Limits (H/W)

LS2 (SSH1411-I00-01)	LS2 (SSH1411-I00-02)	K30	K31	K32	K33
OUT	OUT	0	1	0	1
OUT	IN	0	1	0	1
IN	OUT	0	1	0	1
IN	IN	0	1	1	1

Table 2: Open Limits (PLC)

- f) Inspector 1 or 2: PERFORM the lockup procedure on the hutch [5].
- g) Inspector 1: OPEN the safety shutters from the panel.

WARNING – Do not close or attempt to close the safety shutters for the duration of this test. Inspector 2 is advised to be alert for any movement of the shutters.

- h) Inspector 2: ACTIVATE the switches on the safety shutters as indicated in Table 3 and Table 4 using a device such as a screwdriver.

WARNING – PINCH HAZARD. DO NOT USE ANY PART OF YOUR BODY TO DEPRESS THE LIMIT SWITCHES.

- i) Inspector 1: VERIFY the status of the devices by placing a check in the corresponding box of the table.

LS3 (SSH1411-I00-01)	LS3 (SSH1411-I00-02)	K30	K31	K32	K33
0	0	1	0	1	0
0	1	1	0	1	0
1	0	1	0	1	0
1	1	1	1	1	0

Table 3: Close Limit (H/W)

LS4 (SSH1411-I00-01)	LS4 (SSH1411-I00-02)	K30	K31	K32	K33
0	0	1	0	1	0
0	1	1	0	1	0
1	0	1	0	1	0
1	1	1	0	1	1

Table 4: Close Limits (PLC)

- j) Inspector 2: ACTIVATE SWx of P1611.3-01 as indicated in Table 5.
- k) Inspector 1: VERIFY the status of the devices by placing a check in the corresponding box of the table.

SW4	SW7	K30	K31	K32	K33
0	0	1	0	1	0
0	1	1	0	1	0
1	0	1	0	1	0
1	1	1	0	1	0

Table 5: Close Limit Test Switches (Shutters Open)

- l) Inspector 1 or 2: CLOSE the safety shutters.
- m) Inspector 2: ACTIVATE the switches P1611.3-01 as indicated in Table 6 and Table 7.
- n) Inspector 1: VERIFY the status of the devices by placing a check in the corresponding box of the table.

SW4	SW7	K30	K31	K32	K33
0	0	0	1	0	1
0	1	0	1	0	0
1	0	0	0	0	1
1	1	0	0	0	0

Table 6: Close Limit Test Switches (Shutters Closed)

SW4	SW7	K35, K42, K52, K53 & K70	K34, K62
0	0	1	0
0	1	0	0
1	0	0	0
1	1	0	0

Table 7: Close Limit Test Switches (Summing Chains)

- o) Inspector 1 & 2: Print your names, date the checklist and initial where indicated.

Inspector: _____ Initials: _____
 (Please print) Date (dd-mm-yyyy): _____

Inspector: _____ Initials: _____
 (Please print) Date (dd-mm-yyyy): _____

5.5 Normal Lockup

Note - Inspector 2 must be inside the enclosure when locked to verify some components and is to have appropriate hearing protection.

5.5.1 Verification

- a) Inspector 1 or 2: PLACE a camera in SR1 for monitoring SSH1411-I00-01 and SSH1411-I00-02.
- b) Inspector 1 or 2: PLACE a sign indicating ACIS testing in progress at zone 8 and 9 gates and OBTAIN one of the SR gate keys or D23 key.
- c) Inspector 1 or 2: OPEN all doors to the enclosure.
- d) Inspector 2: VERIFY:
 - a. LUS1611.3-01 LED is off _____
 - b. LUS1611.3-02 LED is off _____
 - c. HRN1611.3-01 and HRN1611.3-02 are off _____
 - d. ZLL1611.3-01 and ZLL1611.3-02 are off _____
- e) Inspector 1: VERIFY on P1611.3-01:
 - a. Perimeter Doors Locked Green LED is off _____
 - b. Perimeter Doors Locked Red LED is on _____
 - c. Enclosure Search Green LED is off _____
 - d. Enclosure Search Red LED is on _____
 - e. Enclosure Secure Green LED is off _____
 - f. Enclosure Search Red LED is on _____
 - g. Safety Shutter Green light off _____
 - h. Safety Shutter Red light is on _____
 - i. Safety Shutters can not be opened by panel OPEN button _____
- f) Inspector 2: CLOSE Door 1 and VERIFY:
 - a. LUS1611.3-01 LED is off _____
 - b. LUS1611.3-02 LED is off _____
 - c. HRN1611.3-01 and HRN1611.3-02 are off _____
 - d. ZLL1611.3-01 and ZLL1611.3-02 are off _____
- g) Inspector 1: VERIFY:
 - a. Perimeter Doors Locked Green LED is off _____
 - b. Perimeter Doors Locked Red LED is on _____
 - c. Enclosure Search Green LED is off _____

- d. Enclosure Search Red LED is on _____
 - e. Enclosure Secure Green LED is off _____
 - f. Enclosure Search Red LED is on _____
 - g. Safety Shutter Green light is off _____
 - h. Safety Shutter Red light is on _____
 - i. Safety Shutters can not be opened by panel OPEN button _____
- h) Inspector 2: CLOSE Door 2 and VERIFY:
- a. LUS1611.3-01 LED is off _____
 - b. LUS1611.3-02 LED is off _____
 - c. HRN1611.3-01 and HRN1611.3-02 are off _____
 - d. ZLL1611.3-01 and ZLL1611.3-02 are off _____
- i) Inspector 1: VERIFY:
- a. Perimeter Doors Locked Green LED is off _____
 - b. Perimeter Doors Locked Red LED is on _____
 - c. Enclosure Search Green LED is off _____
 - d. Enclosure Search Red LED is on _____
 - e. Enclosure Secure Green LED is off _____
 - f. Enclosure Search Red LED is on _____
 - g. Safety Shutter Green light is off _____
 - h. Safety Shutter Red light is on _____
 - j. Safety Shutters can not be opened by panel OPEN button _____
- j) Inspector 2: CLOSE Door 3 and VERIFY:
- a. LUS1611.3-01 LED is off _____
 - b. LUS1611.3-02 LED is off _____
 - c. HRN1611.3-01 and HRN1611.3-02 are off _____
 - d. ZLL1611.3-01 and ZLL1611.3-02 are off _____
- k) Inspector 1: VERIFY:
- a. Perimeter Doors Locked Green LED is on _____
 - b. Perimeter Doors Locked Red LED is off _____
 - c. Enclosure Search Green LED is off _____
 - d. Enclosure Search Red LED is on _____
 - e. Enclosure Secure Green LED is off _____
 - f. Enclosure Search Red LED is on _____
 - g. Safety Shutter Green light is off _____
 - h. Safety Shutter Red light is on _____

i. Safety Shutters can not be opened by panel OPEN button _____

l) Inspector 2: PRESS LUS1611.3-01 and VERIFY:

Note - The area or exit timers may expire while the various devices are being verified. In this case restart the area lockup from step l).

a. LUS1611.3-01 LED is on _____

b. LUS1611.3-02 LED is off _____

c. HRN1611.3-01 and HRN1611.3-02 are off _____

d. ZLL1611.3-01 and ZLL1611.3-02 are off _____

m) Inspector 1: VERIFY:

a. Perimeter Doors Locked Green LED is on _____

b. Perimeter Doors Locked Red LED is off _____

c. Enclosure Search Green LED is off _____

d. Enclosure Search Red LED is on _____

e. Enclosure Secure Green LED is off _____

f. Enclosure Search Red LED is on _____

g. Safety Shutter Green light is off _____

h. Safety Shutter Red light is on _____

i. Safety Shutters can not be opened by panel OPEN button _____

n) Inspector 2: PRESS LUS1611.3-02 and VERIFY:

a. LUS1611.3-01 LED is on _____

b. LUS1611.3-02 LED is on _____

c. HRN1611.3-01 and HRN1611.3-02 are off _____

d. ZLL1611.3-01 and ZLL1611.3-02 are off _____

o) Inspector 1: VERIFY:

j. Perimeter Doors Locked Green LED is on _____

k. Perimeter Doors Locked Red LED is off _____

l. Enclosure Search Green LED is off _____

m. Enclosure Search Red LED is on _____

n. Enclosure Secure Green LED is off _____

o. Enclosure Search Red LED is on _____

p. Safety Shutter Green light is off _____

q. Safety Shutter Red light is on _____

r. Safety Shutters can not be opened by panel OPEN button _____

p) Inspector 2: CLOSE Door 4 and VERIFY:

a. LUS1611.3-01 LED is on _____

- b. LUS1611.3-02 LED is on _____
 - c. HRN1611.3-01 and HRN1611.3-02 stay on for > 15s _____
 - d. ZLL1611.3-01 and ZLL1611.3-02 stay on for > 15s _____
- q) Inspector 1: VERIFY:
- a. Perimeter Doors Locked Green LED is on _____
 - b. Perimeter Doors Locked Red LED is off _____
 - c. Enclosure Search Green LED is on _____
 - d. Enclosure Search Red LED is off _____
 - e. Enclosure Secure LEDs switch from Red to Green > 15s _____
 - f. Safety Shutter Green light is off _____
 - g. Safety Shutter Red light is on _____
 - h. Safety Shutters can not be opened by panel OPEN button (before Enclosure Secure) _____
- r) Inspector 1: OPEN Safety Shutter and VERIFY:
- a. Safety shutters are open _____
 - b. Safety Shutters status lights switch from Red to Green _____
- s) Inspector 1: PRESS Main Door and Perimeter Door Unlock buttons and VERIFY:
- a. Door 1 is locked _____
 - b. Door 2 is locked _____
 - c. Door 3 is locked _____
 - d. Door 4 is closed _____
- t) Inspector 1: CLOSE safety shutters and PRESS Main Door unlock button and VERIFY:
- a. Door 1 is locked _____
 - b. Door 2 is locked _____
 - c. Door 3 is locked _____
 - d. Door 4 is opens _____
- u) Inspector 2: PRESS LUS1611.3-01 and VERIFY:
- a. LUS1611.3-01 goes off <= 45s _____
- v) Inspector 1: VERIFY:
- a. K21 switches off <= 45s _____
- w) Inspector 2: CLOSE Door 4 and VERIFY:
- a. LUS1611.3-01 LED is off _____
 - b. LUS1611.3-02 LED is off _____
 - c. HRN1611.3-01 and HRN1611.3-02 are off _____

d. ZLL1611.3-01 and ZLL1611.3-02 are off _____

x) Inspector 1: VERIFY:

a. Perimeter Doors Locked Green LED is on _____

b. Perimeter Doors Locked Red LED is off _____

c. Enclosure Search Green LED is off _____

d. Enclosure Search Red LED is on _____

e. Enclosure Secure green LED stays off after 30s _____

f. Enclosure Secure red LED stays on after 30s _____

g. Safety Shutter Green light is off _____

h. Safety Shutter Red light is on _____

i. Safety Shutters can not be opened by panel OPEN button _____

y) Inspector 1 & 2: Print your names, date the checklist and initial where indicated.

Inspector: _____

(Please print)

Initials: _____

Date (dd-mm-yyyy): _____

Inspector: _____

(Please print)

Initials: _____

Date (dd-mm-yyyy): _____

5.6 Lockup Compromise

Note - Inspector 2 must be inside the enclosure when locked to verify some components and is to have appropriate hearing protection.

5.6.1 Verification

- a) Inspector 1 or 2: PLACE a sign indicating ACIS testing in progress at zone 8 and 9 gates and OBTAIN one of the SR gate keys or D23 key.
- b) Inspector 2: CLOSE all doors to the enclosure ACTIVATE an EOS.
- c) Inspector 2: ACTIVATE LUS1611.3-01 and VERIFY:
 - a. LUS1611.3-01 light stays off _____
- d) Inspector 2: PERFORM a lockup [5] up to and including pressing LUS1611.3-01.
- e) Inspector 1: VERIFY
 - a. T1 switches on \leq 30s (from when LUS1611.3-01 was pressed)

 - b. K7 switches off \leq 30s (from when LUS1611.3-01 was pressed)

- f) Inspector 2: PERFORM a lockup [5] up to and including pressing LUS1611.3-02.
- g) Inspector 1: VERIFY:
 - a. T2 switches on \leq 15s (from when LUS1611.3-02 was pressed)

 - b. K7 switches off \leq 30s (from when LUS1611.3-01 was pressed)

- h) Inspector 2: PERFORM a lockup [5].
- i) Inspector 1: OPEN the safety shutters.
- j) Inspector 2: ACTIVATE an EOS.
- k) Inspector 1 VERIFY:
 - a. Enclosure Secure green LED is off _____
 - b. Enclosure Secure red LED is on _____
 - c. Safety shutters close _____
- l) Inspector 2: PERFORM a lockup [5].
- m) Inspector 1: OPEN the safety shutters.
- n) Inspector 2: PRESS EXB1611.3-01 after the All Clear.
- o) Inspector 1: VERIFY:
 - a. Enclosure Secure green LED is off _____

- b. Enclosure Secure red LED is on _____
 - c. Safety shutters close _____
- p) Inspector 2: PERFORM a lockup [5].
- q) Inspector 1: OPEN the safety shutters.
- r) Inspector 2: PRESS EXB1611.3-02 after the All Clear.
- s) Inspector 1: VERIFY:
 - a. Enclosure Secure green LED is off _____
 - b. Enclosure Secure red LED is on _____
 - c. Safety shutters close _____
- t) Inspector 2: PERFORM a lockup [5].
- u) Inspector 1: PRESS and RELEASE SW1 after the All Clear and VERIFY.
 - a. T1, T2, T3, K7, K8, K11, K12, K13, K14, K15, K16, K17, K18, K27 and K40 are off _____
 - b. Enclosure Search is red _____
 - c. Enclosure Secure is red _____
 - d. K21, K22, K23, K24, K25, K26, K28 and K29 are on _____
- v) Inspector 2: PERFORM a lockup [5].
- w) Inspector 1: PRESS and RELEASE SW3 after the All Clear and VERIFY:
 - a. T1, T2, T3, K7, K8, K11, K12, K13, K14, K15, K16, K17, K18, K27 and K40 are off _____
 - b. Enclosure Search is red _____
 - c. Enclosure Secure is red _____
 - d. K21, K22, K23, K24, K25, K26, K28 and K29 are on _____
- x) Inspector 2: PERFORM a lockup [5].
- y) Inspector 1: PRESS and RELEASE SW5 after the All Clear and VERIFY.
 - a. T1, T2, T3, K7, K8, K11, K12, K13, K14, K15, K16, K17, K18 and K27 are on _____
 - b. Enclosure Search is red _____
 - c. Enclosure Secure is red _____
 - d. K21, K22, K23, K24, K25, K26, K28, K29 and K40 are off _____
- z) Inspector 2: PERFORM a lockup [5].
- aa) Inspector 1: PRESS and RELEASE SW6 after the All Clear and VERIFY:
 - a. T1, T2, T3, K7, K8, K11, K12, K13, K14, K15, K16, K17, K18 and K27 are on _____
 - b. Enclosure Search is red _____
 - c. Enclosure Secure is red _____

- d. K21, K22, K23, K24, K25, K26, K28, K29 and K40 are off _____
- bb) Inspector 1 & 2: Print your names, date the checklist and initial where indicated.

Inspector: _____	Initials: _____
(Please print)	Date (dd-mm-yyyy): _____
Inspector: _____	Initials: _____
(Please print)	Date (dd-mm-yyyy): _____

5.7 Ready Chain

5.7.1 Verification

- a) Inspectors 1 and 2: ENSURE that all of zones 1-9 are locked [7] [8] [9] up to and including turning all gate keys in the control room and allowing the respective All Clear intervals to time out..
- b) Inspector 2: PERFORM a lockup [5] of the enclosure.
- c) Inspector 1: ENSURE Floor Coordinator permissive is enabled.
- d) Inspector 1: ENSURE CLS Enable is enabled.
- e) Inspector 1: ENSURE there is no Major Fault and open the safety shutters.
- f) Inspector 1: DISABLE Floor Coordinator permissive and VERIFY:
 - a. Safety shutters are closed _____
 - b. Ensure Safety Shutters can not be opened via panel OPEN pushbutton_____
- g) Inspector 1: ENABLE Floor Coordinator permissive and OPEN safety shutters.
- h) Inspector 2: DISABLE CLS Enable permissive.
- i) Inspector 1: VERIFY:
 - a. Safety shutters are closed _____
 - b. Ensure Safety Shutters can not be opened via panel OPEN pushbutton_____
- j) Inspector 2: ENABLE CLS Enable Permissive.
- k) Inspector 1: OPEN safety shutters
- l) Inspector 1: ACTIVATE SWx and VERIFY the status of the device(s) in Table 8.

DEVICE	SW1	SW3	SW5	SW6
Safety Shutters	0	0	0	0
Major Fault Light	1	1	1	1
K61, K63 and K64	0	0	0	0
K36	1	1	0	0

Table 8: Door Test Switches (SSH Open)

- m) Inspector 2: PERFORM a lockup [5] of the enclosure.
- n) Inspector 1: VERIFY device status in Table 9 after All Clear for SWx pressed in step m) above.

DEVICE	SW1	SW3	SW5	SW6
Safety Shutters cannot be opened via panel OPEN pushbutton.				

Table 9: SSH Major Fault Interlock (SSH Open)

- o) Inspector 1: RESET Major Fault.
- p) Inspectors 1 and 2: REPEAT steps K through O for remaining SWx columns in Table 8 and Table 9.
- q) Inspector 1: OPEN and CLOSE Safety Shutters and VERIFY:
 - a. Safety Shutters Open _____
 - b. Safety Shutters Close _____
- r) Inspector 1: ACTIVATE SWx and VERIFY the status of the components in Table 10.

DEVICE	SW1	SW3	SW5	SW6
Safety Shutters	0	0	0	0
Major Fault Light	0	0	0	0
K61, K63 and K64	1	1	1	1
K36	1	1	1	1
K17, K18 and K27	0	0	1	1
K28 and K29	1	1	0	0

Table 10: Door Test Switches (SSH Closed)

- s) Inspector 2: PERFORM a lockup [5] of the enclosure.
- t) Inspector 1: VERIFY after All Clear the status of device(s) in Table 11 for the SWx activated in r).

DEVICE	SW1	SW3	SW5	SW6
Safety Shutters can be opened by panel OPEN button				

Table 11: SSH Major Fault Interlock (SSH Closed)

- u) Inspector 1: CLOSE safety shutters.
- v) Inspectors 1 and 2: REPEAT steps R through U for remaining columns.
- w) Inspector 1 & 2: Print your names, date the checklist and initial where indicated.

Inspector: _____ Initials: _____

(Please print)
Inspector: _____
(Please print)

Date (dd-mm-yyyy): _____
Initials: _____
Date (dd-mm-yyyy): _____

5.8 Radiation Sources

5.8.1 Verification

- a) Inspectors 1 and 2: ENSURE that all of zones 1-9 are locked [7] [8] [9] up to and including turning all gate keys in the control room and allowing the respective All Clear intervals to time out.
- b) Inspector 1 or 2: OBTAIN the assistance of someone from CID, ETS or AOD as indicated in 3.2, hereinafter referred to as “Assistant”, as required.
- c) Inspector 1: CLOSE BST0003-01.
- d) Inspector 1: REFER to Table 12.
- e) Inspector 2: LOCKUP [5] the enclosure(s) as identified in the table, where 0=unlocked and 1= Enclosure Secure.
- f) Inspector 2: ENSURE all beamline enclosure Ready Chains are enabled.
- g) Inspector 1 and Assistant: VERIFY the status of the SOURCES for the given lockup combination under ENCLOSURES in SSH IN.
- h) Inspector 2: PRESS and HOLD SWx.
- i) Inspector 1 and Assistant: VERIFY source status for the column under SWx for the given lockup combination.
- j) Inspector s: RELEASE SWx,
- k) Inspector 1 and Assistant: RESET radiation sources as required.
- l) Inspector 2: RESET any Ready Chain interlocks as required.

ENCLOSURES POE-1	SOURCES	TESTS		
		SSH IN	SW4	SW7
1	LINAC	1	1	1
	BR RF	1	1	1
	SR RF	1	1	1
0	LINAC	1	1	1
	BR RF	1	0	0
	SR RF	1	0	0

Table 12: Beam Stop In

- m) Inspectors 1 & 2 and Assistant: Repeat steps D to L for remaining columns.
- n) Inspector 1: OPEN BST003-01.
- o) Inspectors 1 and 2: PERFORM steps D to L referring to Table 13.

ENCLOSURES POE-1	SOURCES	TESTS		
		SSH IN	SW4	SW7
1	LINAC	1	0	0
	BR RF	1	1	1
	SR RF	1	1	1
0	LINAC	1	0	0
	BR RF	1	0	0
	SR RF	1	0	0

Table 13: Beam Stop Out

p) Inspector 1 & 2 and Assistant: Print your names, date the checklist and initial where indicated.

Assistant: _____ Initials: _____

(Please print)

Date (dd-mm-yyyy): _____

Inspector: _____ Initials: _____

(Please print)

Date (dd-mm-yyyy): _____

Inspector: _____ Initials: _____

(Please print)

Date (dd-mm-yyyy): _____

