

Brookhaven National Laboratory National Synchrotron Light Source		Number: LS-PPS-0015	Revision: G
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Subject: <u>SDL Laser Interlock Test</u>			
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*Approval signatures on file with master copy.

[Revision/ Log](#)

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:		

Required Preparation/Prerequisites:

- Inform the experimenter that a test of the laser interlock is being performed.
 - A qualified SDL laser operator must be available to assist in placing Safeguards (Beam-Dumps) at the output of each laser system as indicated below and to place the laser systems in a "Ready-Mode" where the power supplies will be on with no laser output. Refer to [SDL Laser Interlock System LOTO](#).
 - Obtain system reset key (F-300) and wear shoe covers when entering the laser room.
- Refer to [Appendix A](#) for reference photos of SDL Laser Interlock Components.

[Laser Room Search & Access]

1. Press the Start Search button located on the East wall of the laser room.
 - LED comes ON the button box _____
 - Press CS-2 located on the North wall. _____
 - LED comes ON the button box _____
 - Exit the laser room and press the Complete Search Button. _____
 - Observe the audible warning on Internal Sonalert is a minimum of 15 seconds. _____ Sec.
 - Observe the audible warning on External Sonalert is a minimum of 15 seconds. _____ Sec.
 - Laser Interlocked sign is illuminated _____

2. Press the Laser Power Trip reset button.
 - Laser Room secure light is illuminated on the main control box. _____
 - "Doors" light is not illuminated. _____
 - Laser Power Trip light out. _____

3. Open the outside door and observe:
 - Interlocked sign goes out. _____
 - "Laser Interlocked" light goes out. _____
 - A Chain Fault is illuminated. _____
 - Laser Power Trip light is illuminated. _____
 - Intermittent audible alarm sounds for 5 sec. _____ Sec.

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- 4. Press the Start Search button (Start Timing).
Press CS2. Exit the hutch.
The check station pilot light stays on for no more than 1 minute.
Press Complete Search (CS-E)
Interlock does not activate
Press CS-2
The LED on button box does not illuminate
Exit the laser room.
- 5. Press Complete Search Button
LED on button box does illuminate
The interlock does not secure
Press the Start Search button located on the East wall of the laser room.
Press CS-2 located on the North wall.
Exit the laser room.
Press the Complete Search Button.
Open the door and close the door within the time-out period and press the Complete Search Button,
The interlock does not secure
- 6. **[Lockout Switch]**
Secure the laser room. Power Supply remains OFF.
Switch from "ON" mode to "OFF".
Observe that panel indicators turn OFF
Attempt to secure hutch
Laser hutch security will not activate
Switch to "ON" mode.
- 7. **[Pass Through]**
Secure the Laser room.
Press the Access/Reset button located on the main control box.
Door Bypass #1 light illuminates.
Open the outside door to the laser room
The interlock remains active
- 8. Enter the vestibule and close the door.
Press the Access/Reset #1 button.
The led goes out.
- 9. Press the Access/Reset #2 button.
The LED on the button box lights.
The Door Bypass #2 light on the main box illuminates
Open the inside door and enter the laser room.
Press the Access/Reset button inside the laser room.
The LED on the button box goes out.

10. Reverse steps 8 & 9 to exit the laser room.
The interlock is maintained. _____

11. From the outside of the Laser Room press the Access/Reset button located on the main control box.
Open the door and hold open noting the time from when the button was pressed.
Interlock dumps within a maximum of 20 seconds. _____ Sec.

12. Secure the laser room and enter the vestibule using the buttons.
Once inside the vestibule press the Access/Reset button #2 and open the door. Hold open noting the time from when the button was pressed.
Interlock dumps within a maximum of 20 seconds. _____ Sec.

[Door Switches]

13. Verify faults are cleared on the following laser supplies are ON:
Faults are cleared on the two Yag power supplies _____
Faults are cleared on Ti Saphire power supply _____

Reset Laser Power Trip

Place latch devices on the inner and outer door switches.
Search laser room. Remove holder from switch #1.

	<u>Main Inner</u>	<u>Main Outer</u>	<u>Aux Inner</u>	<u>Aux Outer</u>
Interlock drops out.	_____	_____	_____	_____
The A Chain Fault light is illuminated,	_____	_____	_____	_____
Two Yag power supplies trip OFF	_____	_____	_____	_____
Ti Saphire power supply trips OFF	_____	_____	_____	_____
Laser Power Trip Fault	_____	_____	_____	_____

Replace switch holder and reset Laser power trip fault
Enable Power supplies

14. Search the Laser Room.
Press the Interlock Off button, open the Inner door, and then repeat for outer door.
The interlock sign goes out when the button is pressed.
There is no audible warning when the door is opened. _____

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		Laser Emergency Stop				
		<u>ES-1</u>	<u>ES-2</u>	<u>ES-3</u>	<u>ES-4</u>	<u>ES-5 (Op Console)</u>
15.	<p>[Emergency Stop]</p> <p>Search the laser room and Reset Laser Power Trip. Press an emergency stop</p> <p style="padding-left: 40px;">The interlock drops out. The Yag/Ti-Sapphire laser power is removed. E-Stop light is out A Chain Fault B Chain Fault 5 sec audible alarm</p> <p>Reset emergency stop fault and repeat step for remaining switches.</p>	_____	_____	_____	_____	_____
16.	<p>With one emergency stop button pressed in, press the start search button then CS-2. Exit the room and press the complete search button. The interlock does not activate.</p> <p>Reset the emergency stop button. Break Gun Security.</p>	_____	_____	_____	_____	_____
17.	<p>[Gun Hutch – Search and Exit Hutch]</p> <p>Search the Main Laser Room. Press the Start Search button located inside of the Gun Hutch. LED lights come on the button box.</p> <p>Exit the hutch, close the door, and press the Complete Search button. The audible warning is a minimum of 15 seconds. Gun Hutch Secure light is illuminated. A Chain Fault and B Chain Fault lights are out. “Laser Interlocked” sign is On</p>	_____	_____	_____	_____	_____
18.	<p>Open the Gun Hutch door. Gun Hutch Secure light goes out. A-chain fault light comes on B-chain fault light comes on The audible warning is a minimum of 5 sec. “Laser Interlocked” sign is Off</p>	_____	_____	_____	_____	_____
19.	<p>Press the start search button and close door (w/assistant inside) or place jumper on door switches The check station pilot light stays on for no more than 1 minute. Press Complete Search (CS-E). Interlock does not activate</p>	_____	_____	_____	_____	_____

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- Remove switch holders if applicable.
20. Press interior search buttons in order in the Gun hutch, close the 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 19)
 Interlock does not activate _____
21. **[Gun Hutch – Internal Search]**
 Enter the Gun Hutch and Close the door.
 Press the Start Search button.
 LED lights come on the button box. _____
 Press the Complete Search button.
 The audible warning is a minimum of 15 seconds. _____ Sec.
 Gun Hutch Secure light is illuminated. _____
 A Chain Fault and B Chain Fault lights are out. _____
22. Open the Gun Hutch door.
 Gun Hutch Secure light goes out. _____
 A-chain fault light comes on _____
 B-chain fault light comes on _____
 The audible warning is a minimum of 5 sec. _____ Sec.
23. Press the Start Search button and close the door remaining inside.
 The check station pilot light stays on for no more than 1 minute. _____ Sec.
 Press Complete Search (CS-E) inside Gun Hutch.
 Interlock does not activate _____
24. Press interior Start Search button, close door and remain inside. Press Complete Search inside hutch. Note that alarm comes on, open and close door, press Complete Search inside hutch again. (This must all be done in less than the timeout interval noted in step 19)
 Interlock does not activate _____
25. Attempt to open the Gun shutter with the Gun Hutch not secured,
 The shutter does not open. _____
26. Secure the Gun Hutch and secure the laser room.
 Open the Gun shutter and reset the laser power.
 Open the Gun Hutch door.
 Laser power trips _____
 Yag power supply trips off _____
 Ti-Sapphire power supply trips off _____
 The warning sonolert sounds for five seconds. _____ Sec.
 Gun Shutter Closes _____

27. Secure the gun hutch, secure the Laser room, reset the laser power, and open the Gun Hutch door. Gun shutter remains closed.
 The laser power does not trip
 Warning sonalert sounds for five seconds
28. Place switch holders on the gun hutch doors
 Secure the gun hutch.
 Open the Gun shutter and press an emergency stop in GUN hutch
- | | Inside
ES-15 | Outside
ES-14 |
|---|-----------------|------------------|
| The shutter closes. | | |
| The Gun security drops out. | | |
| Laser power trip light is on | | |
| E-Stop light cannot be reset w/o SOR key. | | |
| Gun hutch cannot be secured. | | |
- Reset Emergency stop at Laser Control Panel.

- | | Door | | | |
|---|------|---|---|---|
| | 1 | 2 | 3 | 4 |
| B Chain Fault light illuminates. | | | | |
| Shutter closes | | | | |
| Laser PWR does not trip.
(Trip light is OFF) | | | | |
| Reset 'B' Chain fault using "Complete Search" button. | | | | |
| A Chain Fault light illuminates. | | | | |
| Shutter closes. | | | | |
| Laser PWR trip light comes ON | | | | |
| 5 sec audible alarm | | | | |
- Reset Laser Power Trip

[Gun Shutter – Operation]

- Open the Gun Shutter and observe
 Shutter Opens smoothly with no hesitation
- Close the Gun Shutter and observe
 Shutter Closes smoothly with no hesitation

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35. Press the laser door guard button, Open door #1, exit and close door #1, and press LCS-E.
 The “Laser Interlocked” sign does not activate. _____
 The CS-E light does not come on. _____
 The Warning siren does not sound. _____
36. With door #2 closed and door #1 closed press the laser door guard button from inside the LINAC area.
 The light on the laser door guard box lights _____
 Press LCS-4
 The light on LCS-4 does not latch. _____
 Press LCS-3
 The light on LCS-3 does not latch. _____
 Press LCS2 then LCS-1.
 Observe the light on LCS-2 does not latch. _____
 Observe the light on LCS-1 lights and latches. _____
 Press the door guard button.
 Open door #1 exit and close door #1, and press LCS-E.
 The “Laser Interlocked” light does not activate. _____
 The LCS-E light does not stay on. _____
 The Warning siren does not sound. _____
37. Leave door #1 open and press the laser door guard button.
 The door guard light does not light. _____
 Press LCS-1
 The LCS-1 light does not latch. _____
 Press LCS-2
 The LCS-2 light does not latch _____
 Press the LCS-3 Button
 The light on LCS-3 does not latch. _____
 Press LCS-4
 The light on LCS-4 does not stay lit _____
 Press the laser door guard button. Exit and close door #1. Press LCS-E.
 The “Laser Interlocked” light does not activate. _____
 The LCS-E light does not latch. _____
 The Warning siren does not sound. _____
 Press the Laser Interlock Off Button and open door #1
38. Press LDG, LCS-1, LCS-2, LCS-3, LCS-4, and LDG. Exit LINAC and close door.
 Press LCS-E. Open the door and close the door within the time-out period and
 press LCS-E.
 The Interlock does not activate _____
 Alarm sounds for 5 sec. _____ **Sec.**

39.	<i>[Light Curtain]</i>		<u>Upper Beam</u>	<u>Lower Beam</u>
		Complete this step by first tripping the Upper laser light curtain beam and then repeating the step and tripping the lower laser light curtain beam.		
		Close door #1 and press the laser door guard button		
		The door guard light on the box lights		
		Press LCS-1.		
		The light on the LCS-1 box lights.		
		Press LCS-2		
		The light on the LCS-2 box lights		
		Press LCS-3		
		The light on LCS-3 box lights.		
		Break the appropriate light curtain beam.		
		The light on LCS-3 goes out.		
		Press LCS-4		
		The light on LCS-4 does latch.		
		Press LCS-3		
		The light on LCS-3 does not come ON		
		Observe the laser door guard light is Off.		
		Press the door guard button.		
		Open door #1 exit and close door #1. Press LCS-E.		
		The "Laser Interlocked" sign does not activate.		
		The CS-E light does not stay on.		
		The Warning siren does not sound.		
		Press the Laser Interlock Off button and repeat for the other light beam.		
40.	<i>[Gun to LINAC (GTL) Laser Shutter]</i>			
		<i>Conduct this step using both control panels.</i>		
		Search LINAC.		
		Press the GTL laser shutter Open button and observe shutter position	<u>Internal Panel</u>	<u>External Panel</u>
		Open indicator comes ON		
		Shutter is in Open position		
		Press the GTL laser shutter closed button and observe shutter position		
		Closed indicator comes ON		
		Shutter is in Closed position		
41.	Open the GTL laser shutter			
		The shutter opens		
		A short audible sound followed by a 2-second audible signal is heard		
				Sec.

45. Open the GTL laser shutter and Gun laser shutter
 Press the External PASS-Through button and begin timing.
 GTL shutter remains Open _____
 Gun shutter remains Open _____

Open the main door #1.
 After no more than 20 seconds the following occurs: _____ seconds

- An audible warning sounds for 5 seconds _____
- GTL laser shutter closes _____
- Gun laser shutter closes _____
- LINAC Interlock drops out _____
- Two Yag power supplies trip OFF _____
- Ti Saphire power supply trips OFF _____
- Main Laser Hutch Remains Secure _____

46. **[Emergency Stop]**
 Secure LINAC for Laser Operation
 Open GTL & Gun laser shutter.
 Verify faults are cleared on the following laser power supplies:
 Faults are cleared on the two Yag power supplies _____

Faults are cleared on Ti Saphire power supply _____

Press the Emergency Stop Button (ES-16) on the Radiological logic box.
 The LINAC Interlocked light goes out. _____
 LINAC Area Laser Emergency Stops light comes ON. _____
 Two Yag power supplies trip OFF _____

- Ti Saphire power supply trips OFF _____
- GTL & Gun laser shutter CLOSES _____

Pull the Emergency Stop button out.
 The Emergency Stop light remains on. _____

Reset fault using the SOR key at the Main Laser Control Panel.
 The Emergency Stop Fault light goes out at the
 Laser logic box. _____

47. Press the other 14 Emergency stops (ES1 - ES14) located in the LINAC area one at a time. The
 Emergency Stop Fault light comes on. Reset the fault each time.

ES	Gun Hutch													
1	2	3	4	5	6	7	8	9	10	11	12	13	ES14	ES14
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

48. Press the Emergency Stop (ES-17) located on the LINAC Security control panel.
 The Emergency Stop Fault light comes on. _____

Reset ES fault. _____

Appendix A:

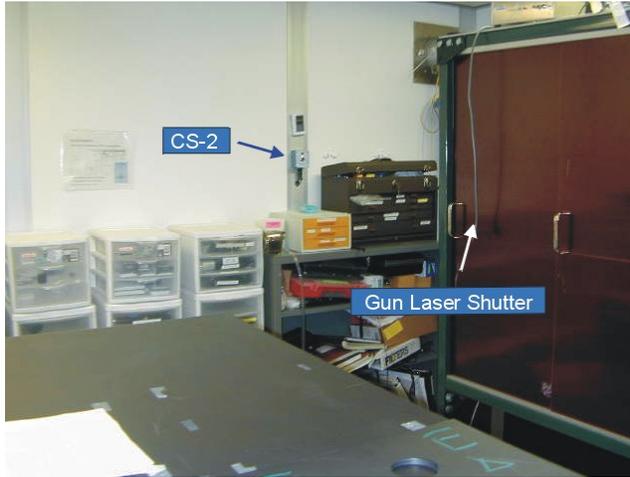


Figure 1: GUN Laser Shutter Location

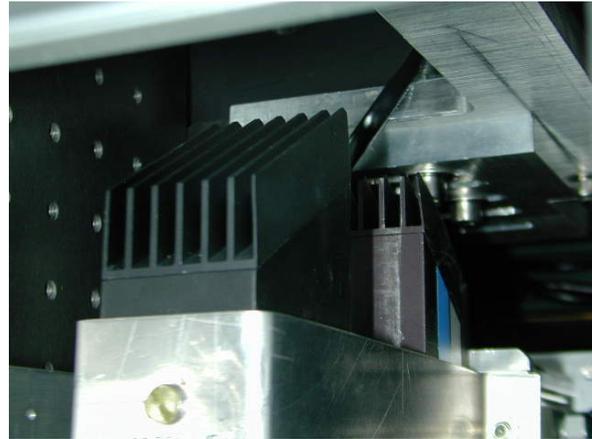


Figure 2: Gun Laser Shutter (front view of block)



Figure 3: Gun Laser Shutter (rear view)



Figure 4: Main Laser Hutch Entrance and Laser Logic Panel



Figure 5: YAG 150 Laser Control Panel



Figure 6: YAG 170 Laser Control Panel



Figure 7: Ti-Sapphire Laser Display Panel



Figure 8: Main Laser Hutch Internal Control Panel



Figure 9: Laser Logic Panel



Figure 10: YAGS Power Supplies

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Figure 11: GTL Location (Upstream inside Gun Hutch)

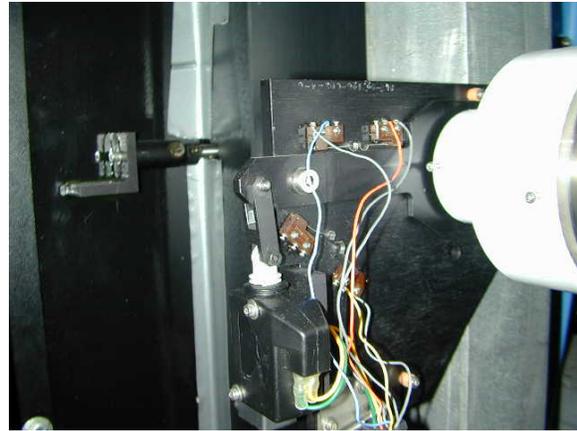


Figure 12: Gun To LINAC (GTL) Laser Shutter

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