

# FEL Personnel Safety System Operator Training

# FEL PSS Operator Training

Feb 2011

## Table of Contents

Table of Contents	2
<b>Part 2 - PSS Modes and Procedures</b>	<b>4</b>
<b>FEL Operating Modes</b>	<b>5</b>
Restricted Access	6
Sweep	7
Controlled Access	8
Power Permit	9
Beam Permit	10
PSS Internal States	11
<b>Sweep Mode</b>	<b>12</b>
<b>SSO Duties for a Sweep:</b>	<b>15</b>
Prior to the Sweep:	15
At the start of the sweep:	16
During the Sweep:	17
At the end of the Sweep:	18
<b>Controlled Access Mode</b>	<b>19</b>
Notes on Controlled Access Mode:	21
<b>SSO Duties for a Controlled Access:</b>	<b>22</b>
Prior to the access:	22
<b>General Access</b>	<b>23</b>

# FEL PSS Operator Training

Feb 2011

<b>General Access</b>	24
<b>General Access</b>	25
<b>SSO Duties for a Controlled Access:</b>	26
<b>Laser Alignment Access</b>	26
<b>Laser Alignment Access</b>	27
<b>Laser Alignment Access</b>	28
<b>Laser Alignment Access</b>	29
<b>Beam State Change Procedures</b>	30
Switching from Restricted Access to Sweep	30
Switching from Sweep to Controlled Access	30
Switching from Controlled Access to Power Permit	31
Switching from Power Permit to Beam Permit	31
Switching from Beam Permit to Power Permit	32
Switching from Power Permit to Controlled Access	32
Switching from Controlled Access to Restricted Access	33

# FEL PSS Operator Training

Feb 2011

## Part 2 - PSS Modes and Procedures

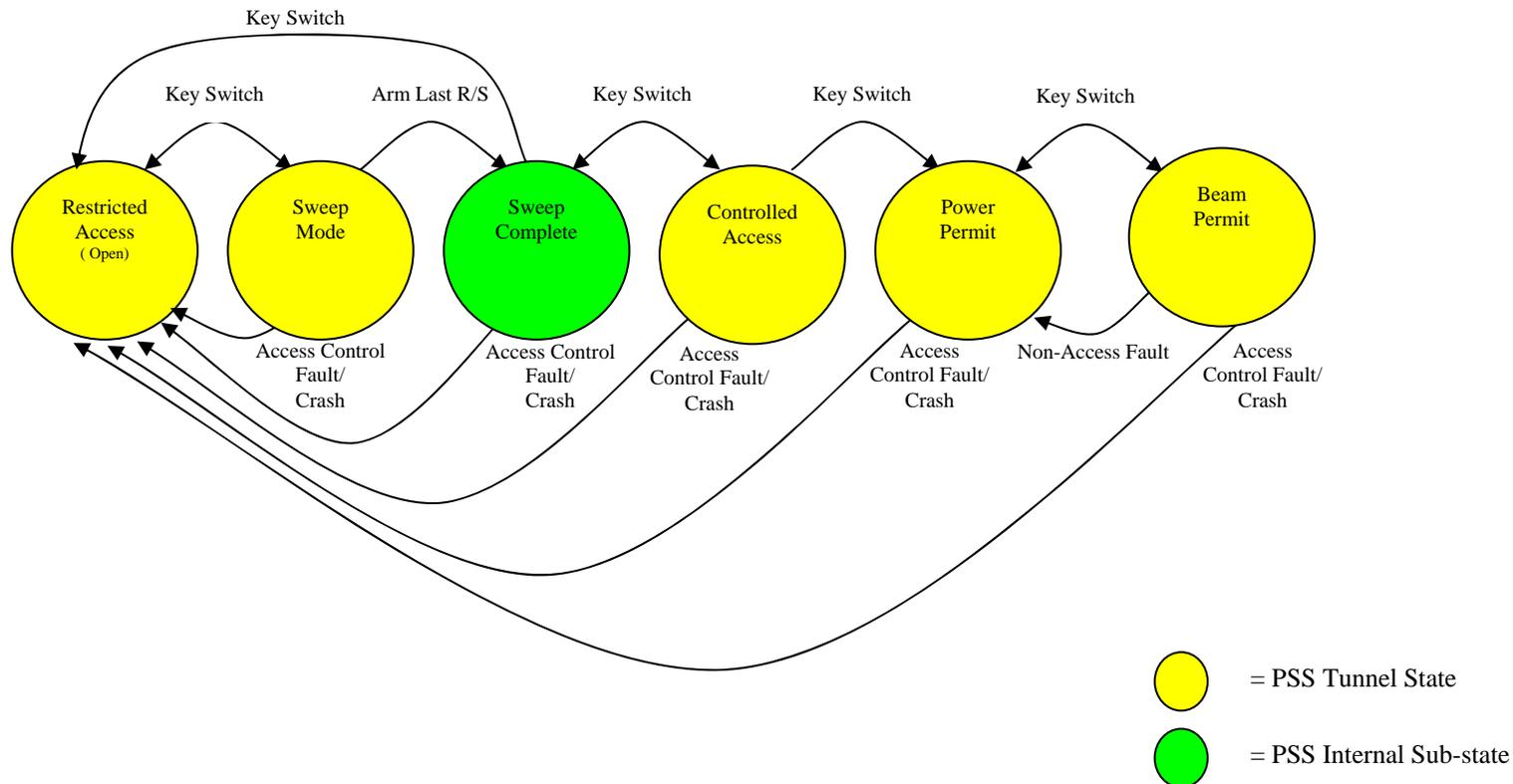
# FEL PSS Operator Training

Feb 2011

## FEL Operating Modes

The FEL is switched between modes using the Mode Control Key.

There are five tunnel access states used in the Safety System. Each mode is defined by the status of the PSS inputs, i.e. it is state driven.



PSS Logic - State Diagram

# FEL PSS Operator Training

Feb 2011

## Restricted Access

*Access State.* This is the lowest or safest state of operation as far as the PSS is concerned. All high voltage devices are OFF. The tunnel is open for access by anyone with appropriate training.

Inputs: Restricted Access key switch or a “Crash”

Outputs: All HV devices are off  
Run/Safe box "safe" lamp is ON

# FEL PSS Operator Training

Feb 2011

## Sweep

**Access State.** In Sweep mode all personnel should be out of the tunnel. Tunnel gates are automatically locked. A sweep team enters the tunnel and follows a preset sweep pattern. A guard is posted at points where someone could enter behind the sweep team and avoid detection.

Inputs: Sweep key switch  
All doors, gates, hatches are CLOSED  
Run/safe boxes can be armed in order  
Run Safe box crash button OK  
TOP STOP crash button OK  
All HV devices are OFF

Outputs: All HV devices OFF  
Run/Safe box "safe" lamp is ON  
Run/Safe box "operational" lamp is ON (when armed)  
Tunnel gates are LOCKED  
Magenta beacons are ON

# FEL PSS Operator Training

Feb 2011

## Controlled Access

**Access State.** Controlled access is used to allow limited entry into the tunnel under the direct supervision of a Safety System Operator. Personnel may not enter the tunnel until they have an exchange key, ODH training, and dosimetry. The absence of the Master Exchange Key in its normal slot inhibits any high voltage device in the area from operating. Until an Exchange Key is taken the inner door (D2) cannot be unlocked.

**Inputs:** Controlled Access key switch position  
All doors, gates, hatches are CLOSED  
All Run/safe boxes are ARMED (Sweep Complete)  
All Crash Buttons OK  
All HV devices are OFF

**Outputs:** All HV devices are OFF  
Run/Safe box "safe" and "operational" lamps lit  
Tunnel gates are LOCKED  
Magenta beacons are ON

# FEL PSS Operator Training

Feb 2011

## Power Permit

***Exclusion State.*** In Power Permit mode high voltage devices within the segment are permitted to operate.

Inputs: Power Permit Key Switch (latched)  
All doors, gates, hatches CLOSED  
All Run/Safe boxes are ARMED (Sweep Complete)  
All Crash Buttons OK  
All exchange keys are IN  
Interlock “Ready” (waveguide pressure) from RF HPAs

Outputs: Permissive to RF HPAs if interlocks are OK  
Permissive to Box Power Supplies, if appropriate  
Run/Safe box "Operational" and "Unsafe" lamps ON  
All doors with maglocks LOCKED  
Magenta beacons are ON  
30-second klaxon alarms start

# FEL PSS Operator Training

Feb 2011

## Beam Permit

*Exclusion State.* ALL protection devices within the segment are NOT faulted and the area is ready for beam. “Beam Permit” is always coincident with “Power Permit”.

Inputs: Any fault in a segment that is used to resolve “Gun Permit” will drop the Gun HV.

Outputs: This output is called “Gun Beam Permit” or “Gun Permit”

# FEL PSS Operator Training

Feb 2011

## **PSS Internal States**

In addition to the tunnel states the PSS logic has internal logic states that do not directly affect the status of devices outside the PSS. These states do not explicitly define exclusion or access modes. They define conditions of subsets of the safety interlock system. These conditions are then used in higher logic functions to determine if PSS controls may be actuated.

For example, if the tunnel is swept and ready, a condition called "Sweep Complete" exists. The Controlled Access, Power Permit, and Beam Permit logic all use this condition as a requirement for that state. As the name suggests, this sub-state is true when all Run/Safe boxes are armed and the sweep personnel have exited the tunnel. Sweep complete is used by all higher logic functions as one indication that the tunnel is secure.

# FEL PSS Operator Training

Feb 2011

## **Sweep Mode**

Run/Safe boxes are distributed throughout each tunnel segment. The boxes contain status lamps, an emergency crash switch, and a key switch used to arm the box.

The sweep pattern is preprogrammed in the PLC logic. Run/Safe boxes will not arm out of sequence.

The last Run/Safe box in the sweep pattern is always at the access room area. This forces the sweep team to double back in some areas.

If the sweeper leaves the line of sight of the last Run/Safe box a guard is posted to ensure that no one enters the area that has been swept.

## **Special Case:**

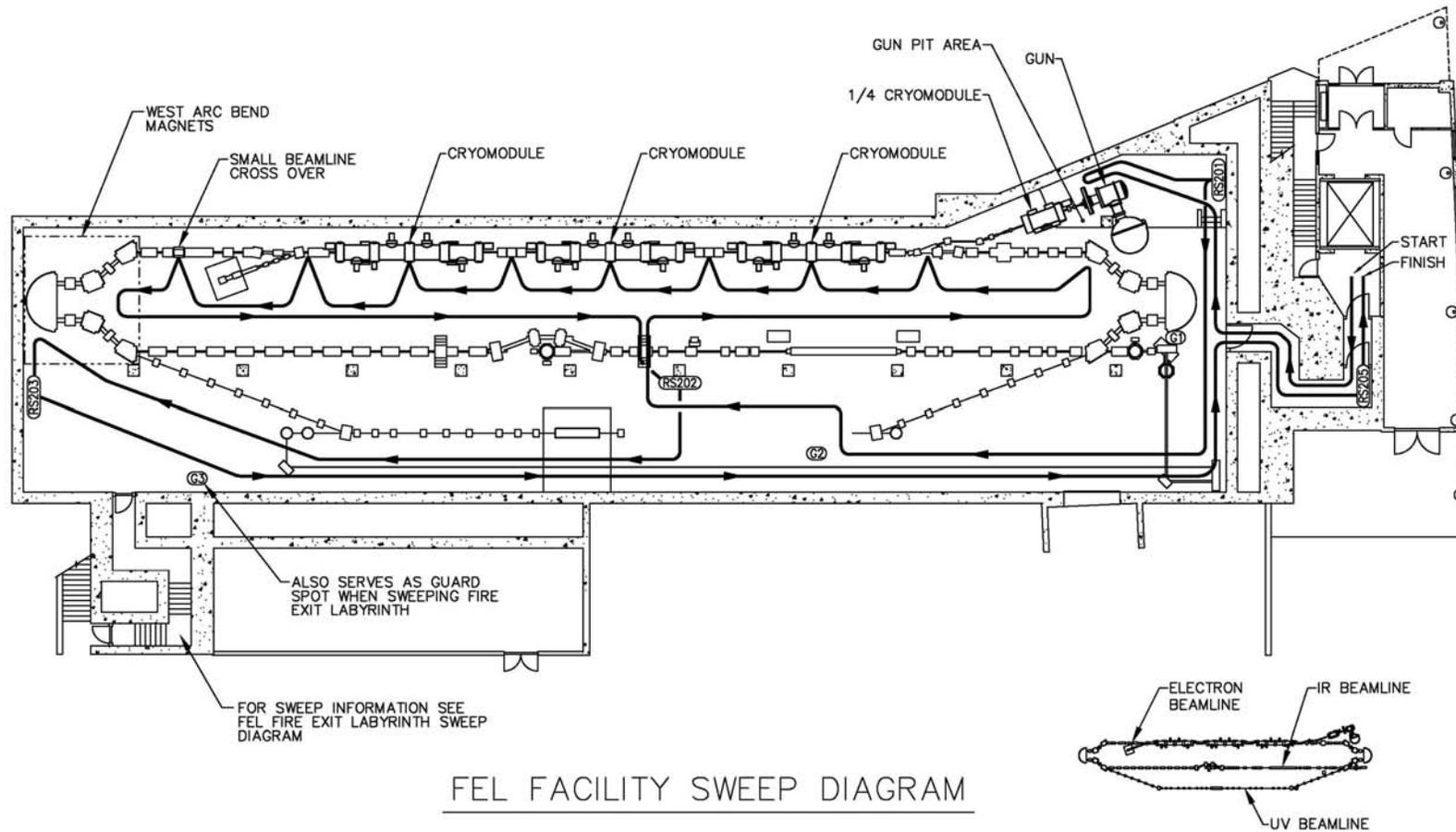
The Fire Exit Labyrinth may be swept separately from the main vault.

Once the Run/Safe Box (RS204) is armed you have 20 seconds to exit the area and close the door.

When the area is secure the green lamp next to the door should be ON.

# FEL PSS Operator Training

Feb 2011





# FEL PSS Operator Training

Feb 2011

## SSO Duties for a Sweep:

### **Prior to the Sweep:**

A “Sweep Log” stamp is provided for entering sweep data into the PSS logbook.

Make sure that the tunnel does not require a radiation survey. If it does require a survey then this must be done before the sweep. A full survey cannot be done during a sweep.

Assemble a sweep team.

Check to make sure that at least one of the sweepers is on the qualified sweeper list. A list of qualified lead sweepers is kept on the Safety System Group website. ([http://www.jlab.org/accel/ssg/Pss/qualified\\_sweeper.pdf](http://www.jlab.org/accel/ssg/Pss/qualified_sweeper.pdf))

Make sure that the exit door is closed.

Make sure that the roll-up door is closed.

Make an announcement 15 minutes before the beginning of the sweep...

**“Attention, Attention, a sweep of the FEL beam enclosure will take place in 15 minutes. Please exit the area immediately.” - repeat**

# FEL PSS Operator Training

Feb 2011

## At the start of the sweep:

Repeat the announcement at 5 minutes before the start of a sweep.

“Attention, Attention, a sweep of the FEL beam enclosure will take place in 5 minutes. Please exit the area immediately.”

Lock the access room magnetic door locks.

Give the lead sweeper the FEL access control key.

Unlock the outer access door (D1), allow the sweep team to enter.

Lock Door 1

Contact the sweep team using the phone.

Log the names of the sweepers

Verify proof of dosimetry.

Unlock door 2, allow the sweep team to enter.

Lock Door 2

# FEL PSS Operator Training

Feb 2011

## **During the Sweep:**

Monitor the progress of the sweep team.

Make sure the sweep is progressing. Contact the sweep team if there is an unusually long delay between arming Run/Safe boxes.

Make sure the boxes are being armed in the correct sequence.

Be ready to contact the sweep team at the end of the sweep.

Record the names of any personnel found in the tunnel during the sweep.

# FEL PSS Operator Training

Feb 2011

## **At the end of the Sweep:**

Establish contact with the sweep team before they arm the last box.

Tell the sweep team to arm the last Run/Safe box.

Unlock door 2, allow the sweep team to enter.

Confirm that door 2 is closed, then lock door 2

Unlock door 1, allow the sweep team to exit

Lock Door 1

Take the sweep key from the sweep team and place it in the Mode Control keyswitch.

Finish entering the required information into the PSS log.

At the discretion of the on-duty Crew Chief or the signed-in FEL Duty Officer, change the access state to “Controlled Access”.

# FEL PSS Operator Training

Feb 2011

## Controlled Access Mode

Controlled Access Mode is used to allow a limited number of personnel to access the tunnel. If it becomes necessary for large groups to make an access, then the machine should be taken to Restricted Access Mode.

In Controlled Access mode it is up to the Safety System Operator to ensure that all personnel are properly logged in and out of the tunnel.

The SSO must also make sure that each person entering the tunnel has current dosimetry and an exchange key.

The SSO will ask each entrant if they have current ODH.

As long as the Master Exchange Key is in the master socket, none of the exchange keys can be removed.

# FEL PSS Operator Training

Feb 2011

There are two types of Controlled Accesses to the FEL beam enclosure.

- General Controlled Access
- Drive Laser Alignment Controlled Access

A normal controlled access uses the same procedure as the CEBAF accelerator.

Qualified laser workers use the Drive Laser Alignment controlled access procedure for testing and aligning the gun photocathode drive laser. Only qualified and properly equipped personnel may enter the enclosure in Drive Laser Alignment controlled access mode.

**THE SSO SHALL ONLY ALLOW PERSONNEL WITH LASER SAFETY TRAINING IN THE ENCLOSURE DURING A LASER ALIGNMENT CONTROLLED ACCESS.**

# FEL PSS Operator Training

Feb 2011

## Notes on Controlled Access Mode:

Only 10 people are allowed entry into the beam enclosure during Controlled Access Mode.

The inner access room door (D2) will remain automatically locked until the Master Exchange Key is removed.

When in laser alignment mode the yellow laser warning beacons in the Access Room will remain flashing.

The laser shutter Bypass Key is located on the left wall of the drive laser clean room entrance area.

# FEL PSS Operator Training

Feb 2011

## SSO Duties for a Controlled Access:

### **Prior to the access:**

Determine if a radiation survey of the area is required. Before allowing general personnel into the hall, it must be surveyed for radiation hazards.

Determine if the Access is a general Controlled Access or for laser alignment.

Make sure that all HV devices are OFF. \*\*\*\* Failing to verify that all high voltage devices read “OFF/Safe” (**GREEN**) before switching to Controlled Access could result in dropping the tunnel to Restricted Access. \*\*\*

Make an announcement over the PA system that “the FEL will be switched to Controlled Access.”



# FEL PSS Operator Training

Feb 2011

## General Access

### During the access -

Verify that the Drive Laser Bypass is not bypassed (Green/OK)

Unlock door 1 (outer door) and allow personnel to enter.

Lock Door 1

Establish contact with the Controlled Access group using the phone.

Verify each person has dosimetry.

Ask each person if they have current ODH training.

Verify with the Controlled Access team that the laser shutter warning beacon IS NOT flashing (off).

# FEL PSS Operator Training

Feb 2011

## General Access

### During the access -

Release the Master Exchange Key.

Verify that each person takes an exchange key.

Enter the required information into the PSS log (i.e. names, training, etc.)

Unlock Door 2 and allow the group to enter.

Lock Door 2.

# FEL PSS Operator Training

Feb 2011

## General Access

### Processing personnel out of the tunnel -

Unlock Door 2 (inner door).

Allow personnel to enter access room.

Lock Door 2.

Establish contact with the Controlled Access group using the phone.

Allow personnel to return the exchange keys.

When the last person returns their exchange key, have them return the master key.

Finish entering the required information into the PSS log. \*\*\*\*\*

Open Door 1 (outer door) and allow the personnel to exit.

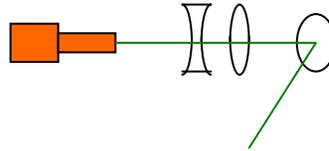
Lock Door 1.

# FEL PSS Operator Training

Feb 2011

## SSO Duties for a Controlled Access:

### Laser Alignment Access



#### During the access -

Unlock door 1 (outer door) and allow the group to enter.

Lock Door 1.

Establish contact with the Controlled Access group using the phone.

Verify each person has dosimetry.

Verify that each person entering has on a pair of laser safety goggles.



Ask each person if they have current laser safety training. Deny entry to anyone that does not.

# FEL PSS Operator Training

Feb 2011

## Laser Alignment Access

### During the access -

Ask each person if they have current ODH training.

Release the Master Exchange Key.

Ask each person entering to take an exchange key.

Verify that each person takes an exchange key.

# FEL PSS Operator Training

Feb 2011

## Laser Alignment Access

### During the access -

Ask the team to verify that the yellow laser warning beacon is ON. \*

Enter the required information into the PSS log (i.e. names, training, etc.)

Unlock Door 2 and allow the group to enter.

Lock Door 2.

\* As soon as the Master Exchange Key is released the yellow warning beacon will start flashing and the 30-second timer for the laser shutter permit delay will start. At the end of 30 seconds the PSS laser shutters will open.

# FEL PSS Operator Training

Feb 2011

## Laser Alignment Access

### Processing personnel out of the tunnel -

Unlock Door 2 (inner door).

Allow personnel to enter access room.

Lock Door 2.

Establish contact with the Controlled Access group using the phone.

Allow personnel to return the exchange keys.

When the last person returns their exchange key, have them return the master key.

Finish entering the required information into the PSS log. \*\*\*\*\*

Open Door 1 (outer door) and allow the personnel to exit.

Lock Door 1.

# FEL PSS Operator Training

Feb 2011

## Beam State Change Procedures

### **Switching from Restricted Access to Sweep**

Ensure all exit doors are closed

Ensure all OFF/SAFE, READY, and CRASH icons are GREEN

Lock access room doors 1 and 2

Switch the Mode Control key to SWEEP

### **Switching from Sweep to Controlled Access**

Ensure the sweep team is out of the enclosure

Verify that the “Sweep Complete” icon shows up on the PSS display

Ensure that access room doors 1 and 2 are locked

Insert the Mode Control Key into the right keyswitch

Switch the Mode Control key to CONTROLLED ACCESS

# FEL PSS Operator Training

Feb 2011

## **Switching from Controlled Access to Power Permit**

Announce over the Public Address System that "The FEL will be switched to POWER PERMIT."

Verify that the Master Exchange Key is in the master position (**GREEN**).

Ensure the access group is out of the enclosure

Switch the Mode Control key to POWER PERMIT

## **Switching from Power Permit to Beam Permit**

Verify that the Laser Shutter Bypass is in the "normal" position (not bypassed).

Announce over the Public Address System that "The FEL will be switched to BEAM PERMIT."

Verify that the "HV Delay Timer" = 30 seconds and indicates "Ready".

Switch the Mode Control Key to BEAM PERMIT.

# FEL PSS Operator Training

Feb 2011

## Switching from Beam Permit to Power Permit

Announce, “The FEL will be switched to POWER PERMIT.”  
Turn off the gun high voltage.  
Switch the Mode Control Key to POWER PERMIT.

## Switching from Power Permit to Controlled Access

Turn off all RF, Magnet, and Gun high voltage power supplies.  
Announce, “The FEL will be switched to CONTROLLED ACCESS.”  
Verify that all high voltage devices read “Off/Safe” (**GREEN**)  
Switch the Mode Control Key to CONTROLLED ACCESS.

**Failure to verify that all HV reads "Off/Safe" may result in dropping to RESTRICTED ACCESS.**

# FEL PSS Operator Training

Feb 2011

## **Switching from Controlled Access to Restricted Access**

Verify that the Master Exchange Key is in the master position (**GREEN**).

Announce that the "the FEL will be switched to RESTRICTED ACCESS."

Switch the Mode Control Key to SWEEP

Remove the Mode Control key from the right keyswitch

Insert the Mode Control key in the left keyswitch

Switch the left Mode Control Key to RESTRICTED ACCESS