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Operational Safety Procedure Review and Approval Form # 63923
(See [ES&H Manual Chapter 3310 Appendix T1 Operational Safety Procedure \(OSP\) and Temporary OSP Procedure](#) for Instructions)

Type:

OSP [Click for OSP/TOSP Procedure Form](#)
[Click for LOSP Procedure Form](#)

Serial Number:

ACC-16-63923-OSP

Issue Date:

12/7/2016

Expiration Date:

11/7/2019

Title:

LERF Gun Test Stand (GTS)

Location:
(where work is being performed)

[Building Floor Plans](#)

Low Energy Recirculator Facility (LERF) - 109A

Location
Detail:
(specifics about
where in the
selected location(s)
the work is being
performed)

**Gun Test
Stand,
west side
of LERF.**

Risk Classification:

(See [ES&H Manual Chapter 3210 Appendix T3 Risk Code Assignment](#))

Without mitigation measures (3 or 4):

3

With mitigation measures in place (N, 1, or 2):

1

Reason:

This document is written to mitigate hazard issues that are :
Determined to have an unmitigated Risk code of 3 or 4

Owning Organization:

ACCCIS

Document Owner(s):

Hernandez-Garcia, Carlos (chgarcia@jlab.org) Primary

Supplemental Technical Validations ☒

Lasers Class 3B or 4 (Ultraviolet, Infrared, and Visible Light) (Bert Manzlak, Jennifer Williams)
ODH 0 and 1 (Bob May, Jennifer Williams)
Pinch Points (Bert Manzlak, Paul Collins)
Controlled Area (David Hamlette, Keith Welch)

Document History ☒

Revision
☒

Reason for revision or update ☒

Serial number of superseded
document ☒

5

***New gun configuration and addition of a 3200 Gauss
solenoid coil***

[FEL-14-34782-OSP](#)

Comments for
reviewers/approvers: ☐

Both THA and OSP have been updated with clarifying comments from J. Williams regarding normal and non-routine cathode solenoid magnet operations

Attachments ☐

Procedure: ***GTS OSP for 2017 renewal review 01.pdf***

THA: ***GTS THA for 2017 renewal review 01.pdf***

Additional Files:

[Convert to PDF](#)

Review Signatures

Subject Matter Expert : Lasers Class 3B or 4 (Ultraviolet-> Infrared-> and Visible Light) **Signed** on 11/14/2016 4:10:19 PM by Bert Manzlak (manzlak@jlab.org)

Subject Matter Expert : Oxygen Deficiency Hazards (ODH)->ODH 0 and 1 **Signed** on 12/1/2016 8:51:13 AM by Jennifer Williams (jennifer@jlab.org)

Subject Matter Expert : Pinch Points **Signed** on 11/14/2016 4:10:29 PM by Bert Manzlak (manzlak@jlab.org)

Subject Matter Expert : Radiation - Ionizing->Controlled Area **Signed** on 11/30/2016 2:06:30 PM by David Hamlette (hamlette@jlab.org)

Approval Signatures

Division Safety Officer : ACCCIS **Signed** on 12/7/2016 9:03:29 AM by Harry Fanning (fanning@jlab.org)

Org Manager : ACCCIS **Signed** on 12/1/2016 2:50:24 PM by Matthew Poelker (poelker@jlab.org)

Safety Warden : Low Energy Recirculator Facility (LERF) - 109A **Signed** on 12/1/2016 11:06:01 AM by Omar Garza (garza@jlab.org)

Operational Safety Procedure Form

(See [ES&H Manual Chapter 3310 Appendix T1](#)
[Operational Safety Procedure \(OSP\)](#) and
[Temporary OSP Procedure](#) for instructions.)

Click
—

DEFINE THE SCOPE OF WORK

Title:	LERF Gun Test stand (GTS)		
Location:	LERF Building 18, room 217 (GTS control room) and room 109A (GTS enclosure).	Type:	<input checked="" type="checkbox"/> OSP <input type="checkbox"/> TOSP
Risk Classification (per Task Hazard Analysis attached) (See ESH&Q Manual Chapter 3210 Appendix T3 Risk Code Assignment.)		Highest Risk Code Before Mitigation (3 or 4):	3
		Highest Risk Code after Mitigation (N, 1, or 2):	1
Owning Organization:	ACCCIS	Date:	November 14, 2016
Document Owner(s):	Carlos Hernandez-Garcia		
Document History (Optional)			
Revision:	Reason for revision or update:	Serial number of superseded document	
	Renewal and updates related to electron gun configuration and beam line.	FEL-14-34782-OSP	

ANALYZE THE HAZARDS

1. Purpose of the Procedure – Describe in detail the reason for the procedure (what is being done and why).

The purpose of this OSP is to describe in detail safe operating procedures for conducting photocathode gun and electron beam studies in the Gun Test Stand (GTS) at LERF.

The GTS consists of a DC electron gun and a beam line, it is considered in the FSAD* to be an accelerator component test stand and does not contain accelerating cavities or components designed to impart energy to the electrons beyond the voltage potential across the gun; a few hundred-kilo electron-Volts (keV). Its principal use is to test photocathode material performance and electron gun configurations.

* Final Safety Assessment Document Rev 7a: <https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-4440>

2. Scope – include all operations, people, and/or areas that the procedure will affect.

The GTS is not considered an accelerator; it is not a user facility and does not conduct nuclear physics experiments.

GTS operations & maintenance are conducted by the Center for Injectors and Sources (CIS) personnel.

This operating procedure applies to the area known as the Gun Test Stand (GTS). The GTS is located in the west side of the LERF, Building 18. Room 217 is the control room, Room 109A is the shielded enclosure that is under room 217 and also adjacent to the LERF vault.

Nominal operations are limited to the following modes:

- Tune-up beam (AKA viewer limited) at either 350 kV or 250 kV, administratively limited to less than 100

micro-Amps average current.

- 350 kV at 5 mA CW max limited by the power supply
- 250 kV at 32 mA CW max limited by the power supply

The gun high voltage power supplies, the laser hutch doors and the laser power units are interlocked to the GTS Personal Safety System (PSS). The cathode solenoid coil is not part of the PSS but it interlocked to the sliding concrete door, which is interlocked to the PSS.

3. Description of the Facility – include floor plans and layout of a typical experiment or operation.

The Gun Test Stand is located on the west side of the LERF (Building 18) and consists of a control room (Bldg 18, room 217) and an enclosure (Bldg 18, room 109A) with concrete shield walls that is under room 217 and is adjacent to the LERF vault. See Figure 1.

The GTS has a ceiling-mounted hutch with two lasers that can illuminate the photocathode: a Nd:YLF regenerative amplifier class 3B generating 0.5 mJ, 50 pico-seconds full width of the beam at half its maximum intensity (FWHM) pulses at 532 nm and at 15 Hz repetition rate, and a Coherent 10 Watts (W) CW laser operating at 532 nm wavelength. Only one laser can be utilized at a time to illuminate the photocathode.

In addition to the lasers, the GTS houses two types of high voltage power supplies: a 600 kV, 5 mA DC gas-insulated, and a 250 kV, 32 mA DC oil-insulated. Only one power supply can be connected at a time to the electron gun. At the moment, only the 600kV, 5 mA DC is connected to the electron gun.

A cathode solenoid coil for studying magnetized beam has been recently installed between the gun and the beam line, providing a magnetic field of about 1400 Gauss at the photocathode with a maximum operational current of 400 A and operational voltage of 77 V. The magnet power supply is interlocked to the sliding concrete shield door to prevent access to the magnet when it is energized. When personnel is required to work on the magnet while energized, that work will be conducted under a separate OSP, in which all personnel accessing the 600 Gauss area around the magnet will also be trained to remove ferromagnetic objects from themselves including wallet. The magnet is shown in yellow in Figure 2.

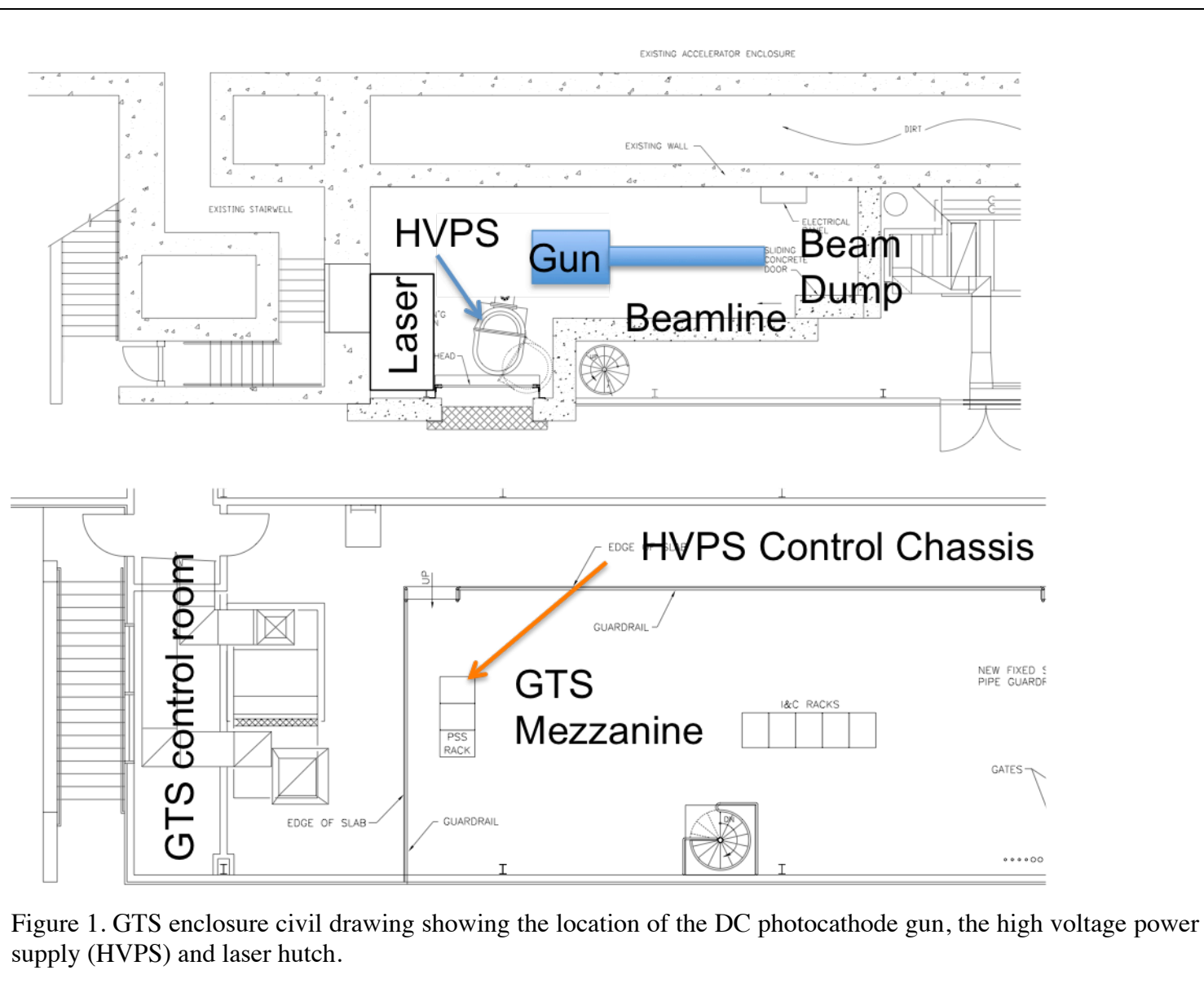


Figure 1. GTS enclosure civil drawing showing the location of the DC photocathode gun, the high voltage power supply (HVPS) and laser hutch.

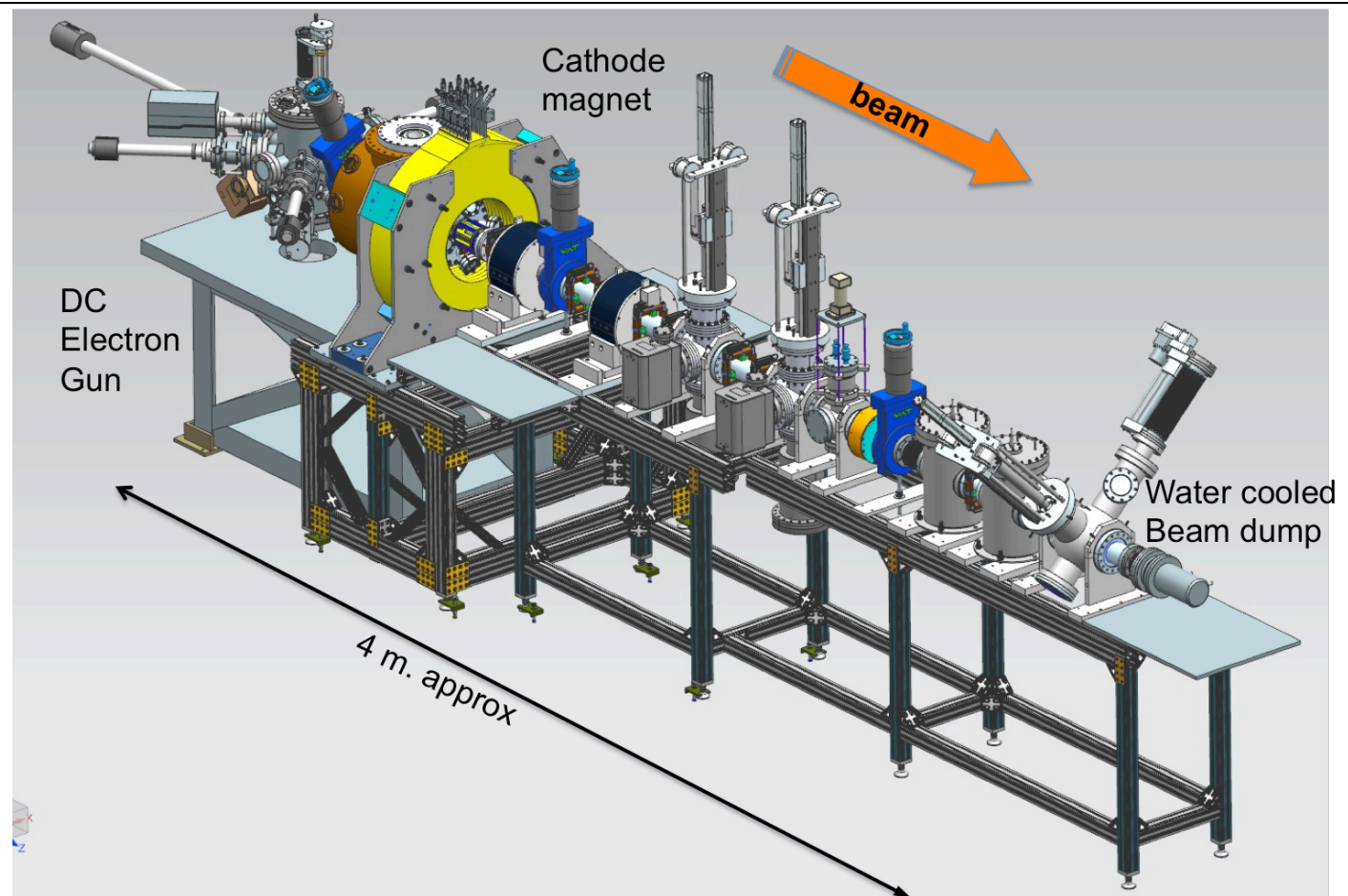


Figure 2. Isometric view sketch of the GTS beam line.

In normal operating conditions, the only access to the GTS enclosure is via the sliding concrete shield door (shown near the beam dump location in figure 1). Behind the concrete shield door, a sliding steel door is part of the LPSS to block any laser non-ionizing radiation. During installation periods, a metal overhead roll-up door is used for access to move equipment in and out such as the electron gun or the High Voltage Power Supply. The roll-up door is located at the opposite end of the room and is locked from the inside with a chain. This roll-up door IS NOT AN EXIT during normal GTS operating conditions. Concrete shield blocks are placed outside the roll-up door, therefore no access is possible through this door. Since the GTS is the plenum for the LERF vault HVAC, there is a vent between the LERF emergency exit staircase and the GTS. See figures 4 and 5.

4. Authority and Responsibility:

4.1 Who has authority to implement/terminate

Matt Poelker and/or Carlos Hernandez-Garcia.

4.2 Who is responsible for key tasks

Carlos Hernandez-Garcia is responsible for training GTS operators, for ensuring safe operation of the Gun Test Stand (GTS) and for leading the R&D program.

4.3 Who analyzes the special or unusual hazards (See [ES&H Manual Chapter 3210 Appendix T1 Work Planning, Control, and Authorization Procedure](#))

Ionizing Radiation - V. Vylet
 Oxygen Deficiency Hazards – J. Williams
 Safety Officer – O. Garza.

4.4 What are the Training Requirements (See http://www.jlab.org/div_dept/train/poc.pdf)

For safe operations of any of those systems, GTS operators must receive the following training:.

- The concrete shield door operation is part of this OSP.
- The PSS/LPSS user manual is part of this OSP. The Safety Systems Group in coordination with the CIS group keeps its certification up-to-date.
- The Laser system is covered under a separate ACC-16-001-LSOP.
- The High Voltage Power Supply is covered *ACC-16-63317-OSP*
- The cathode magnet coil is covered under a separate OSP.
- Training on operational procedures for the DC photocathode gun and for Drive Laser will be given by Carlos Hernandez-Garcia (gun) and Shukui Zhang (laser) to personnel participating in GTS studies and experiment on as-needed basis.
- SAF100 ES&H Orientation
- SAF103 Oxygen Deficiency Hazard
- SAF104 Lock, Tag and Try
- SAF143kd FEL Safety awareness
- This document

5. Personal and Environmental Hazard Controls Including:

5.1 Shielding

The prompt ionizing radiation hazard is due to x-ray emission caused by electrons impinging on a material, typically vacuum chambers and beam lines. Normal beam operations will be at 350keV and up to 5 mA DC, the physical limit of the HVPS. However, the physical limit of the power supply is 600 kV.

A series of surveys were conducted in June 2016 around the GTS area while current was generated in the gun and terminated in the beam dump. Surveys were performed with current varying in steps of 100 uA from 100 uA to 980 uA. At each step radiation measurements were performed around the facility, concentrating especially on the penetrations through the roof of the GTS-II enclosure. Detailed results can be found in the survey report at https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-123883/2016_06_17-GTS%20surveys-75072.pdf. The results at 980 uA are included in figure 3.

It should be noted that the only radiation levels above background were detected a) with CARM probes located inside the GTS enclosure, and b) immediately above the roof penetrations, where levels at waist level did not exceed the RCA limit of 50 urem. A close look at signal from CARM probes outside the enclosure, in particular the one near the stairs leading to the exit door on the west side of the building, indicates that no radiation above background was detected. The area above the mezzanine penetrations has been marked as RCA.

Operational Safety Procedure Form

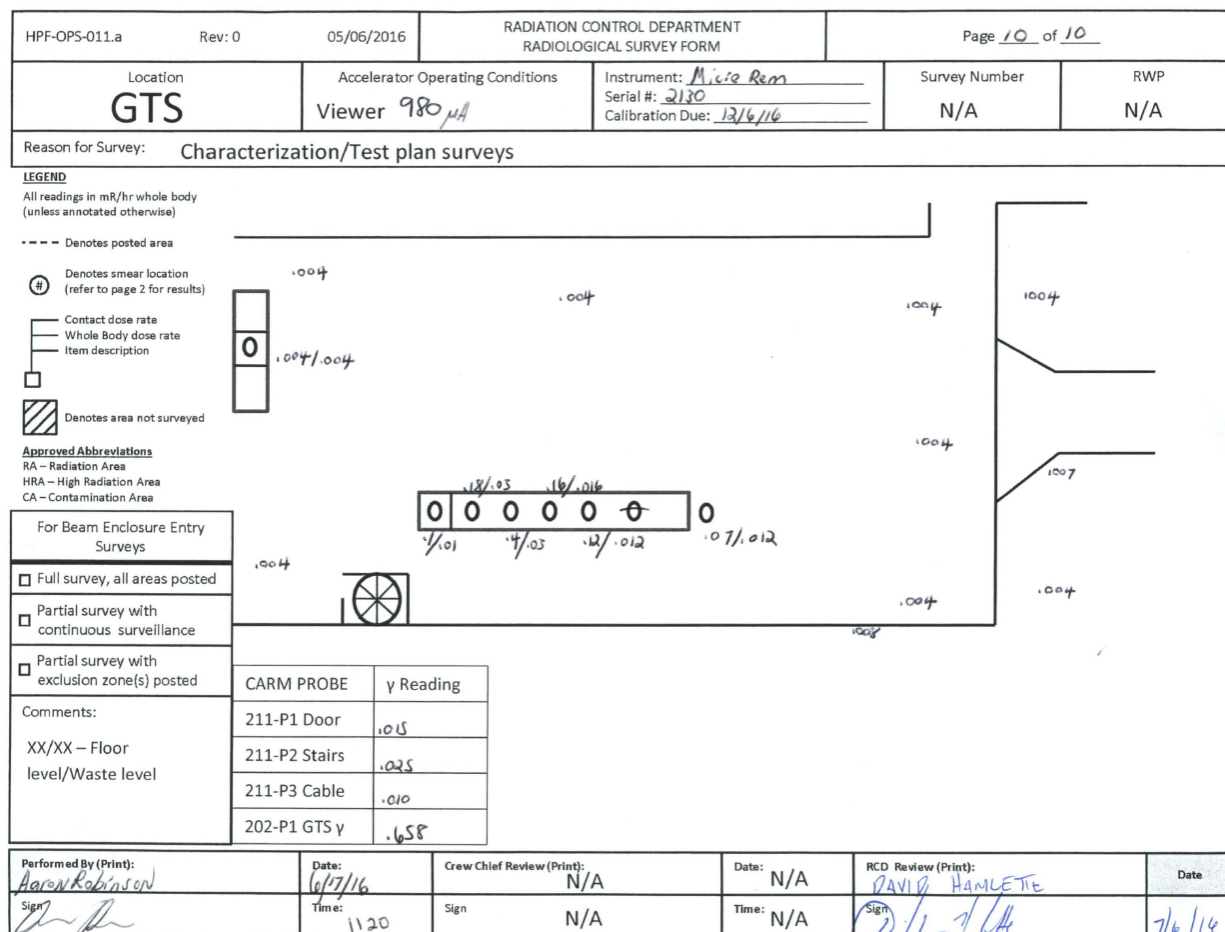


Figure 3. Radiation survey results.

Maximum Credible Accident: The high voltage power supply physical limits are 600 kV at 5 mA. Accidental beam losses at these values will result in loss of vacuum in the beam line, and subsequently in the electron gun where the photocathode emission is severely affected by vacuum conditions, therefore electron emission should cease within one minute. Due to the uncertainty of the source term, we estimate that the total dose accumulated over 2 minutes could be below ~500 mrem per occurrence, which complies with the new accident limit scenario, defined as mis-steering or loss of control of the electron beam under conditions corresponding to the upper limit of the beam power possible in a specific area. Under such conditions the integrated equivalent dose per occurrence shall not exceed 150 mSv (15 rem, ES&H Manual (6310-T2: Prompt Radiation Control Policy)).

Summary: Current shielding of the GTS has been deemed satisfactory and compliant with applicable JLab policies by the Radiation Control Group via surveys performed for currents up to ~1 mA. When all systems become ready to operate beyond 1mA, CIS staff will coordinate with the Radiation Control Group to perform more radiation surveys every time the current is increased beyond that for which radiation surveys were performed. Additional measures (posting and shielding) may be necessary depending on radiation survey results at higher current.

Note: All the shielding is the same as when first installed in Dec 2007 and verified in August 2016.

5.2 Interlocks

The Safety Systems Group has written a complete Personal Safety System User Guide (Revision 1.0 January 10 2008) that is part of this OSP. Important PSS information and related sweep procedures taken from that document follow.

The GTS personnel safety system (PSS) is an engineered interlock system to help protect personnel from exposure to prompt ionizing radiation (PIR) that results from operation of the electron gun. The GTS is composed of a concrete enclosure (vault) Room 109A, and a control room above the enclosure in the mezzanine Room 217 (Fig. 1). There are two personnel doors, a sliding concrete door and a sliding steel door. A rollup over-head door is only used for loading large pieces of equipment. This door is interlocked and is blocked by concrete shield blocks during operations. See Figure 4.

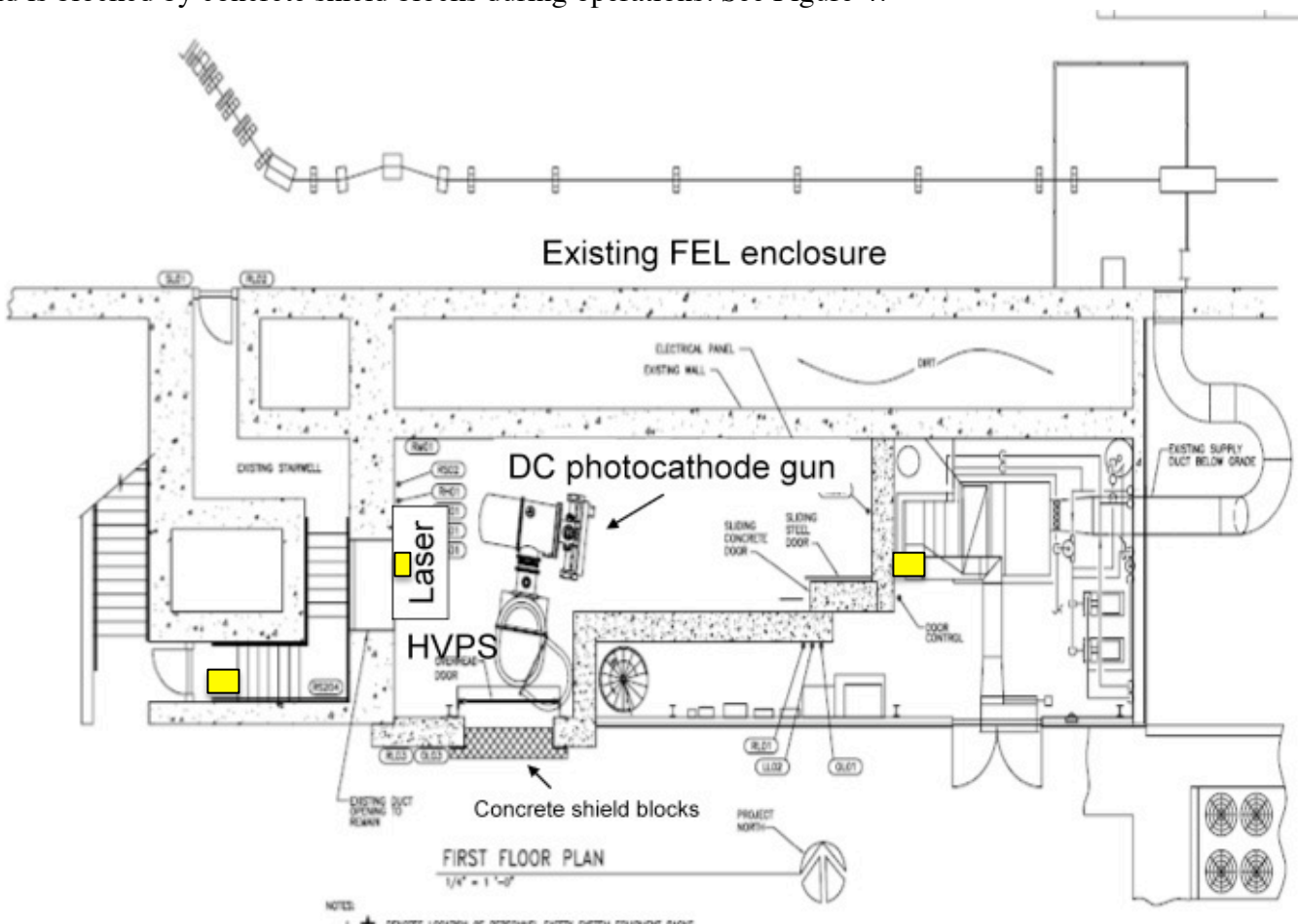


Figure 4. GTS enclosure civil layout showing the locations of doors and major pieces of equipment. The yellow squares indicate positions of the gamma probes. Two additional gamma probes are located above the penetrations in the mezzanine shown in this figure 3.

Figure 5 shows the concrete sliding door and the steel sliding door.

The concrete sliding door can only be closed from the outside, but it can always be opened from the inside by pushing the CRASH button. In case of power loss, the door can be opened from the inside with provided manual red winch.

THE SYSTEM IS DESIGNED TO PREVENT ANYONE BEING INSIDE WITH THE CONCRETE SLIDING DOOR CLOSED

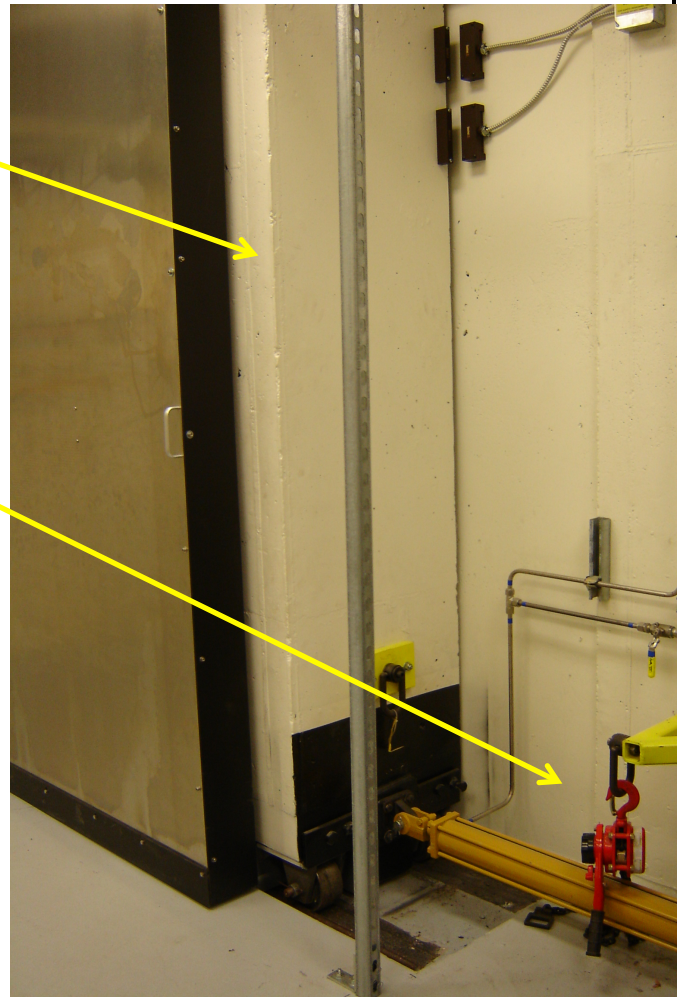


Figure 5. Detail showing the sliding concrete door and the sliding steel door from within the GTS enclosure.

The PSS is interlocked to the gun High Voltage Power Supply (HVPS) and to the Drive Laser Power Unit. It is the job of the PSS logic to determine the status of the GTS enclosure and, if a fault is detected, both the gun HVPS and the laser power unit are de-energized.

The cathode magnet is interlocked to the sliding concrete door interlock preventing access to the GTS enclosure when the magnet is energized. However, there will be a sliding concrete door interlock bypass key to be able to enter GTS with the magnet ON for specific measurements and studies. When the sliding concrete door interlock is bypassed, to prevent personnel with surgical implants and bioelectric devices from entering the 5 Gauss boundary, strobe light indicators are installed on the top of power supply and at the access sliding concrete door to show that the solenoid is energized. In addition, flashing red beacons and personnel barricades are installed at the actual 5 Gauss contour. A 5 Gauss boundary sign is posted at the GTS by the sliding concrete door entrance and a 600 Gauss boundary is posted near the solenoid.

An interlock between the nitrogen source and the air-handling unit has been installed and is operational as an engineered control. The interlock is a fail-closed solenoid valve up-stream of the nitrogen manifold and mounted outside of the GTS enclosure that closes when the air handling unit is not off.

5.3 Monitoring systems

The GTS enclosure has one Radiation Alarming Monitor (CARM) connected to the LERF radiation monitoring system to alert personnel working in the GTS enclosure in the event of LERF electron beam loss (one gamma probe is located behind the laser table attached to the air vent, one neutron probe is located also inside the GTS to one side of the laser table in the upper-left corner).

The GTS enclosure has its own CARM radiation monitoring system consisting of one gamma probe located next to the concrete shield door controls outside the enclosure, one more gamma probe is located in the LERF exit staircase, another gamma probe is located in the GTS control room 217 on top of the PSS rack (Fig. 6), which is above the mezzanine penetration above the laser hutch (Fig. 4), and finally one more gamma probe is located on the cable track which is above the penetrations in the GTS mezzanine. ODH sensors are inside the GTS enclosure, in the rear stair well, and at collection points in the LERF vault. The Safety System Group electronics continuously monitor the ODH sensor.

5.4 Ventilation

The GTS enclosure is part of the air conditioning system of the LERF vault. When the air conditioning system is operational, any SF₆ spill or leak off the high voltage power supply would be quickly dispersed due to the high flow rate of the air conditioning system. When the air conditioning system is off, any SF₆ would drain out of the GTS vault through the air conditioning recovery port and into the rear stair well of the LERF vault and then into the LERF vault.

The GTS enclosure is designed as an ODH 0 area.

The ODH assessment is addressed under a separate document **JLAB-TN-07-082** and also in the high voltage power supply **ACC-16-63317-OSP**. The floor area of room 109A was measured as 606.5 square feet with a 10-foot ceiling (6065 cubic feet). At one end of the room is an intake duct to the air-handling unit that supplies heated or cooled air mixed with fresh air to the LERF accelerator room. At the other end of the room is a hole in the wall that is open to the accelerator room and is covered with steel screen. Therefore, the GTS enclosure room 109A is considered a plenum. There is one roll up door, normally closed, and a concrete door, normally open. The concrete doorway has plastic panels to eliminate airflow through the doorway. In accordance with Appendix 6500-T3, reliable ventilation may be considered a relevant factor in this ODH assessment if the volume of air in the room is replaced with fresh air at a minimum of once an hour. The ventilation for this room comes from an air-handling unit. This unit operates 24 hours a day and 7 days a week. Because this room is a plenum, the air changes are larger than 50 air changes an hour.

5.5 Other (Electrical, ODH, Trip, Ladder) (Attach related Temporary Work Permits or Safety Reviews as appropriate.)

The following hazards are detailed in attached Task Hazard Analysis.

- ODH
- Magnetic DC fields
- Exposure to ionizing radiation
- Exposure to non-ionizing (laser) radiation
- Potential to crushing of limbs by operation of the concrete shield door.
- Potential to tripping off while stepping over the concrete shield door trench.

6. List of Safety Equipment:

6.1 List of Safety Equipment:

Laser safety goggles are located next to the PSS/LPSS console in the GTS control room 217. Inside the GTS enclosure, the PPE cabinet contains leather gloves and safety glasses.

6.2 Special Tools:

A grounding stick is attached to the high voltage power supply tank in the GTS enclosure. Ground sticks are required when disconnecting the high voltage cable from the gun or from the HVPS. Lock-Tag & Try personal lock(s), labels and a hasp to be used in the HVPS disconnect are located inside a toolbox just below the HVPS disconnect in the GTS mezzanine room 217. These activities are covered under the GTS 600kV HVPS OSP, and are not part of normal GTS operations.

DEVELOP THE PROCEDURE

1. Associated Administrative Controls

The configuration of the gun and laser systems is highly dependent on administrative procedures and configuration control. There are several assumptions concerning HVPS system configuration that form part of this logic.

- Safety Systems Group staff is responsible for:
 - LPSS engineered controls
 - PSS administrative and engineered controls
- Center for Injectors and Sources (CIS) staff is responsible for:
 - LPSS administrative controls
 - SF₆ Gas insulated HVPS administrative and engineered controls
 - Cathode magnet administrative and engineered controls

*Administrative controls includes: Authority/responsibility, Procedures, Postings, and PPE

- CIS GTS personnel are responsible for safe operation of the GTS facility. This includes limiting beam power to fall within the identified operations and safety parameters.
- LERF vault PSS logic manages the LERF exit labyrinth door switches and Run/Safe Box 204 to provide an "Area Secure" signal to the GTS PSS logic
- The GTS enclosure is currently rated ODH 0
 - Since SF₆ is heavier than air, one active ODH sensor is installed under the HVPS tank and will set the off the alarm in the event of SF₆ leakage
- The Glassman HVPS control unit is interlocked to the PSS, it cannot be energized unless the PSS is in "Run" mode, attained after the GTS enclosure has been swept.
- The cathode magnet is interlocked to the sliding concrete door interlock preventing access to the GTS enclosure when the magnet is energized but is not part of the PSS.
- The laser power unit is interlocked to the GTS PSS/LPSS.
- The CARMs/radiation probes are interlocked to the PSS.
- Fixed and removable shielding - i.e. concrete and steel walls, doors, vents and blocks - are adequate to meet all safety requirements that are not protected by functions of the PSS or LPSS.
- The door/gate in the LERF vault leading to the west side labyrinth exit is interlocked to the PSS. This is the area where the run safe box # 204 is located, and shared by the LERF PSS and the GTS PSS.

2. Operating Guidelines

The GTS is operated under this Operational Safety Procedure, which addresses hazards associated with maintenance and operation and their mitigations through engineered and administrative controls. Fault conditions in the GTS can produce only local work area impacts.

Staffing

The GTS can be operated by either a single trained and authorized user (typically the personnel conducting gun and/or beam studies), or in multiple unattended shifts. See:

Final Safety Assessment Document Rev 7a: <https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-4440>

GTS Operation

Prior to beam operation, the GTS must be placed in a personnel safe mode using the Personnel Safety System (PSS) and/or the Laser Personnel Safety System (LPSS). These involve using the proper door configuration, sweep and mode procedures, and securing of the GTS test cave and LERF exit staircase area described later in this document.

Once the GTS PSS is in “Run” mode, the operator uses computer terminals in the GTS control room to generate and monitor electron beam.

GTS Operator Requirements

Additionally to the training listed in section 4.4, the GTS operator must:

1. Read and understand this OSP that includes PSS sweep procedures,
2. Receive the practical training on this OSP and on Gun operational procedures from system owner (Carlos Hernandez-Garcia) or designee and,
3. Perform walkthrough of the following areas: GTS control room, mezzanine, spiral staircase, and enclosure.

3. Notification of Affected Personnel (who, how, and when)

Safety: GTS Safety Warden, Omar Garza 269-7257

GTS system owner: Carlos Hernandez-Garcia, office 269-6862, cel. 757-926-9133

ODH, Fire: CEBAF Crew Chief: 269-7045, cel. 757-630-7050.

Emergency: Guard gate 269-5822

4. List the Steps Required to Execute the Procedure: from start to finish.

The GTS enclosure can operate in two modes: a) Laser Alignment and b) Run mode. Laser Alignment mode is utilized for laser work only and no high voltage operations are permitted by LPSS/PSS. The enclosure is shielded from non-ionizing laser radiation to the outside by a sliding steel door interlocked to the LPSS/PSS. In case of emergency, this door can be manually slide open from the inside or outside. If the door is opened while in Laser Alignment mode permit, it will crash the LPSS and therefore close laser shutters and cut power to the laser.

In Run mode, the PSS gives “Gun Permit” which allows high voltage operations and Laser operations. A sliding concrete door in front of the steel sliding door shields the outside of the enclosure from prompt ionizing radiation during high voltage and beam operations. Procedures to operate the sliding concrete shield door are described at the end of this section.

The PSS/LPSS console is located in the GTS control room. Figure 6 shows a picture of the console (left), and a picture of the PSS/LPSS rack in the GTS Mezzanine (right).



Figure 6. Left, the PSS console is located in the GTS control room. Right, the PSS rack is located in the GTS mezzanine alongside racks housing IOCs, controls and monitoring equipment.

SSI Status

The Safety System Interface (SSI) status lamps display the active permits to the Gun, Drive Laser, and future RF systems.

"Gun Permit" will light when the gun HVPS has a PSS permit.

"Laser Permit" will light when the Drive Laser shutters receive a permit from the LPSS.

Door Status

The Door Status lamps in the PSS console indicate the important positions of the doors.

The sliding concrete door is the standard personnel door.

Note: this door will automatically open when any PSS/LPSS crash switch is pushed.

The sliding steel door is used to minimize laser light emanating from the enclosure during Laser Alignment mode. *This door must also be closed during and after a PSS sweep, as it is interlocked to this system.*

The roll-up door is only used to install large pieces of equipment. See figures

The LERF exit staircase door in the west side of the LERF vault is interlocked to the GTS PSS. It is normally

closed but can be pushed open in case of emergency. When pushed open, it will crash the GTS PSS. Figure 7 shows a picture of the LERF exit staircase door. The green beacon flashes once the Run/Safe box # 204 in the staircase has been armed.



Figure 7. Picture of the LERF exit staircase door located in the west side of the LERF vault (next to the SF6 blue bladder).

Keyswitch Controls

The keyswitch controls are used to change the state of the PSS and LPSS operating modes and reset non-access control faults. See Figure 6, left.

The colored LEDs indicate the status of the PSS operating mode. For the PSS there are two keyswitches and one key used in the operation of the GTS. The left hand keyswitch is used to switch between OPEN mode and SWEEP mode. The key can only be removed when in the “Sweep” position. The same key is used for the sweep so that the GTS cannot be accidentally switched to RUN while a sweep team is in the test cave. When a sweep is completed the key is returned to the right hand key switch and used to set the operating mode to RUN.

If a non-access control fault occurs, such as a radiation monitor trip, the key must be cycled from RUN to SWEEP then back to RUN in order to reset the PSS system.

Note: Switching the keyswitch from Sweep to RUN starts a timer. The gun HVPS and Laser shutters may not be operated until the timer has reached 30 seconds.

For LPSS Laser Alignment there are two keyswitches with a shared key. The keyswitch on the panel is used to switch between RUN mode and ALIGNMENT mode. The key can only be removed when in the “Alignment” position. The same key is used in the Laser permit status box in the cave so that the GTS cannot be accidentally switched to RUN while laser qualified staff are performing tests. The keyswitch in the cave is used to switch the shutter permits to ALIGNMENT mode. When testing is complete, the key is returned to the control room panel keyswitch and used to set the operating mode to RUN.

Note: Switching the cave keyswitch to ALIGNMENT starts a timer. The Laser shutters will not operate until the timer has reached 30 seconds.

Safety Crash

The Safety Crash is used to shutdown all GTS systems in an emergency.

This crash switch will remove permits to all high voltage power sources and the laser shutters. It will also crash the sweep and force the concrete door to open.

Door Configurations

Gun Operations

In this mode, the sliding concrete door, the sliding steel door, the roll-up door and the LERF exit staircase door must be closed completely.

Laser Alignment Operations

In this mode the sliding concrete door must be fully open, the sliding steel door, the roll-up door and the LERF exit staircase must be closed completely.

PSS Operational Modes

Pre-operational Checks:

In order to avoid having to re-sweep, the following preoperational checks should be made:

- Confirm that the LERF exit staircase located in the west side of the LERF vault is secure.
- Door operation
 - Check that the roll-up door is closed
 - Check that there are no obstacles blocking the moving concrete and sliding steel doors

Open Mode

Open mode is the default state for the PSS. In this mode all Run/Safe boxes are not armed and the gun HVPS and laser shutter permits are OFF. This mode can be reached by turning the sweep keyswitch to OPEN or by pushing any PSS/LPSS crash switch.

Conditions:

- No Gun HVPS permitted
- Laser Power Supply permitted when Class 1 enclosure is secure
- Roll-up door may be open
- LERF exit staircase area can be in any state

Note: The sliding concrete door must be fully open to meet other safety requirements.

- **Sweep Mode**

Prior to beginning operations, the GTS enclosure and the LERF exit staircase must be searched to ensure all personnel leaves those areas.

*Note: See **Section 8.0** of this user's guide for instructions that describe the proper sweep procedures and patterns.*

Conditions:

- No Gun HVPS permitted
- Laser Power Supply permitted when Class 1 enclosure is secure
- Roll-up door must be closed
- LERF exit staircase door must be closed to arm Run/Safe box #204. This area must be swept and the Run/Safe box armed BEFORE sweeping the GTS enclosure
- Sliding steel door must be fully closed before, during, and after sweep
- Sliding concrete door must be fully open before and during sweep, and fully closed when sweep is complete

• Ready Mode

“Ready Mode” is an internal PSS mode. It serves as a mode that the PSS will drop to when there is a non-access control fault, such as a radiation monitor.

• Run Mode

In order to enter and remain in RUN mode, all PSS interlocks must be OK.

Conditions:

- LERF exit staircase area swept and Run/Safe box #204 armed
- GTS enclosure must be swept and secured
- Sliding concrete door closed
- Sliding steel door closed
- Roll-up door closed
- Crash buttons active
- Audible warnings (for 30 seconds)
- Visible warnings (continuous)
- PSS shutters open (30 second delay)
- CARMs active
- Sweep Key in RUN position
- Laser Alignment Key in RUN position (Run Mode excludes Laser Alignment mode)
- Gun HVPS permitted (30 second delay)
- Laser Power Unit permitted

Note: If a CARM trips the PSS, turn the key from RUN back to Sweep, then back to RUN in order to reset the fault.

What happens if someone is in the test cave when it is switched to RUN Mode? The concrete sliding door cannot physically be closed from the inside, ensuring that no personnel is inside the GTS enclosure when the PSS interlocks acknowledge concrete sliding door as closed.

- In the LERF exit staircase and in the GTS enclosure the Run/Safe box lamps switch to “Unsafe”
- An alarm klaxon sounds for 30 seconds before the gun is enabled.
- Personnel should immediately exit the enclosure by hitting the nearest crash switch to open the sliding concrete door.

If someone is present in the enclosure after a sweep is complete, it will be a DOE reportable incident. All operations must cease at once and assistance given to any injured personnel, if required. The Principle Investigator must write down the names of all personnel on shift and that of the person(s) that were in the enclosure. The Principle Investigator must then contact the accelerator division safety officer and the radiation control group leader for further instructions.

- **Returning to Open Mode**

- Turn off the gun HVPS
- Switch the PSS key to “Sweep” mode
- Remove key and insert in left hand key switch
- Switch the PSS to “OPEN” mode

- **LPSS Operational Modes**

Pre-operational Checks:

- The LERF Exit staircase may be open.
- Door operation
 - Check that the roll-up door is closed
 - Check that there are no obstacles blocking the sliding steel door
 - Moving concrete door must be fully open to meet personnel safety requirements

- **Open Mode**

Open mode is the default state for the LPSS. This mode can be reached by turning the PSS sweep keyswitch to OPEN or by pushing any PSS/LPSS crash switch.

Conditions:

- No Gun HVPS permitted
- Laser Power Supply permitted when Class 1 enclosure is secure
- Roll-up door may be open
- LERF Exit staircase may be open

- **Laser Alignment Mode**

In order to enter and remain in Laser Alignment mode, all LPSS interlocks must be OK

Conditions:

- PSS Keyswitch is in the “OPEN” position
- Sliding concrete door must be fully open
- Roll-up door must be closed
- Sliding steel door must be closed
- PSS shutters open (30 sec. delay)
- Audible warnings (for 30 seconds)
- Visible warnings (continuous)
- Crash buttons active
- Administrative “sweep” of room

- Laser Alignment Keyswitch set (Laser Alignment Mode excludes Run mode)
- No Gun HVPS permitted
- Laser Power Supply permitted
- Class 4 laser operations permitted with proper LPE
- **Returning to Open Mode**
 - If open, close the covers of the laser hutch
 - Turn the Laser keyswitch in the cave counter-clockwise and remove
 - Open the sliding steel door
 - Return to the control room
 - Insert the Laser keyswitch and turn clockwise to “RUN” mode to allow for gun operations

Sweep Procedures

General Duties of the Sweep Team

Prior to sweeping, the sweepers must go to the GTS enclosure and ask personnel to leave the enclosure. In addition, the presence of the cathode magnet now requires an additional pre-sweep check: The strong magnetic field will attract loose ferromagnetic objects, possibly injuring body parts or striking fragile components. Prior to energizing the magnet, a sweep of cordoned area around the magnet will be performed for any loose magnetic objects such as tools, bolts, etc. All personnel accessing the 600 Gauss area around the magnet will also be trained to remove ferromagnetic objects from themselves including wallet.

Afterwards, the sweepers should ensure that all of the appropriate doors are closed. Confirm that the PSS panel or screens indicates that the doors are closed and the PSS panel LEDs read “Sweep Mode” for both system A and B.

It is the duty of the sweep team to thoroughly search the GTS enclosure for personnel. During the sweep, the team members must assume that there may be personnel who did not hear announcements or are incapacitated.

The sweepers should not perform any other tasks when doing an area sweep. Once the sweep starts, a 2-minute timer also starts. If the sweep is not completed within 2 minutes, the sweep will drop and will have to be re-swept.

At least one of the sweepers shall be a qualified lead sweeper. This is someone who is familiar with the sweep procedures for the GTS and for the LERF, and has swept the area at least once.

If anyone is found in the enclosure during a sweep, the person(s) must accompany the sweep team back to the GTS control room, and the sweep process must be re-initiated.

GTS Sweep Procedure for Gun Operations

Identify two qualified personnel as the sweep team.

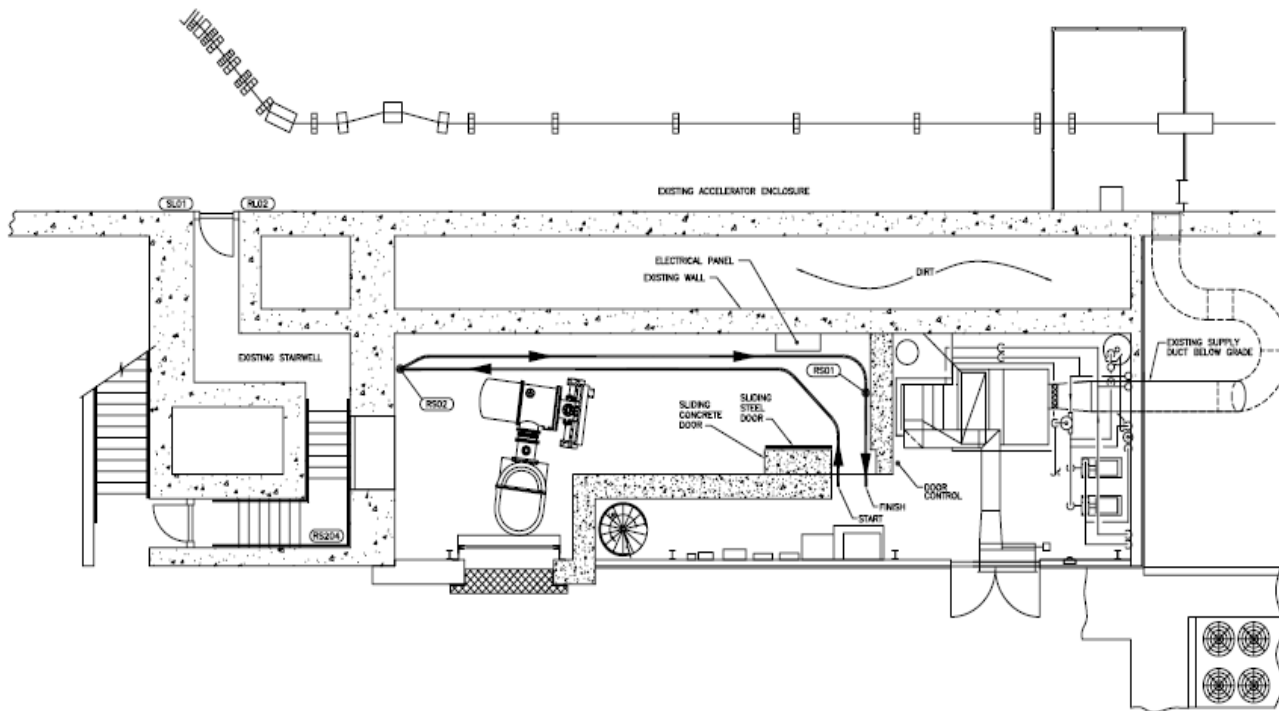
Walk through the GTS enclosure

- Ask any personnel in the cave to leave immediately
- Confirm that the roll-up door is closed
- Confirm that no magnetic objects are laying in the cordoned area around the cathode magnet
- Confirm that the sliding concrete door is fully open
- Return to the control room ensuring that the slide steel door is fully closed
- Look at the PSS console
 - Verify that the doors indicates their proper positions
 - Verify that the all system permits are OFF
 - Verify that the LERF exit staircase lamp is ON. If not, proceed to sweeping this area (see LERF exit staircase area sweep procedure below).
- Switch the PSS left hand keyswitch to Sweep mode and remove the sweep key
 - Verify that the PSS changes to Sweep mode
 - Take a copy of the sweep map if desired

Two sweepers exit the control room area. One is posted at the entrance of the test cave while the other enters through the concrete door.

- Open the sliding steel door, enter the GTS enclosure and close the sliding steel door behind you ensuring it closes completely
- Do a search for any personnel
- Arm the first Run/Safe box on the west wall to the right of the plenum vent
 - Verify that the Yellow “Operational” indicator is lit
- Arm the second Run/Safe box on the east wall near the exit
 - Verify that the Yellow “Operational” indicator is lit
- Turn the lights off, the switch is near the exit
- Exit the test enclosure ensuring the sliding steel door is fully closed upon exiting
- Close the sliding concrete door using the push buttons located next to the door on the right hand side. It must close within 60 seconds in order to maintain the sweep
- Return to the control room
- Place the sweep key in the right hand keyswitch and switch it to “Run” mode to begin operations

Note: Once the sweep is complete, the sweepers have exited the test cave and closed the concrete door,, the PSS will automatically go to “Ready” mode.



FEL GTS SWEEP DIAGRAM

GTS Sweep Procedure for Laser Alignment

Note: The detailed Sweep requirements for Laser Alignment mode are explained in the GTS LSOP.

LERF exit staircase area must be secured prior to start of GTS cave sweep.

Walk through the GTS enclosure

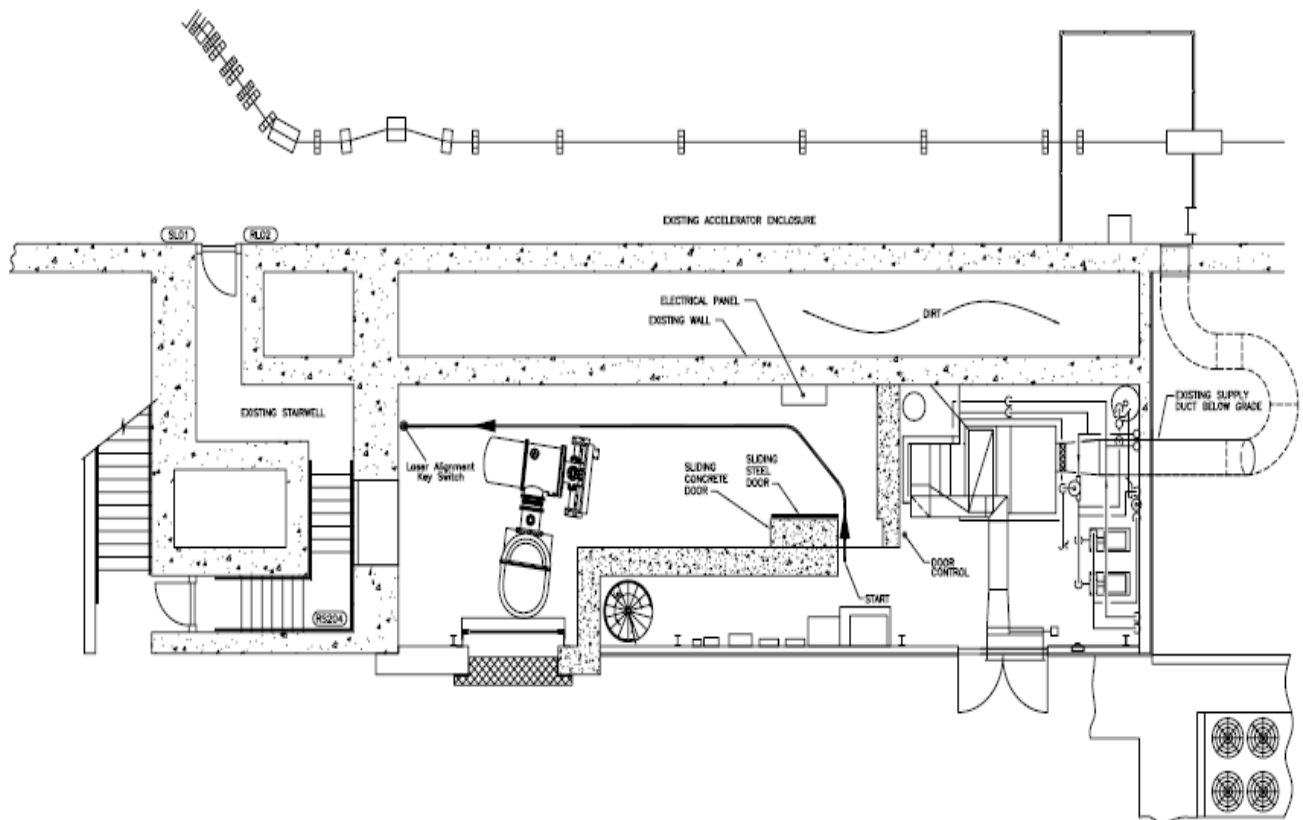
- Ask any personnel in the enclosure to leave
- Confirm that the roll-up door is closed
- Confirm that the concrete door is fully open
- Ensure that the sliding steel door is closed behind you

Return to the control room

- Look at the PSS panel.
 - Verify that the doors indicates their proper positions
 - Verify that the all system permits are OFF
- Switch the Laser keyswitch to Alignment mode and remove the key

The sweeper exits the control room area and enters the GTS enclosure. The sliding concrete door remains open at all times. The steel sliding door is closed during laser alignment mode

- Open the sliding steel door and close it behind you after entering the enclosure
- Check for any remaining personnel, if found ask them to leave
- Use appropriate LPE
- Insert the key into Laser permit status box in the cave and turn it clockwise to the "Alignment" position to begin tests
 - The Laser warning horn on the Laser permit status box in the cave will sound for 30 seconds
 - Once the 30 second timer is complete, the LPSS will provide a "Shutter Permit"
 - The yellow strobe outside the door will start flash
 - The yellow lamp on the Laser permit status box in the cave will light
 - The LPSS will automatically open the laser shutters



FEL GTS ALIGNMENT SWEEP DIAGRAM

LERF-exit staircase Area Sweep Procedure

LERF exit staircase area must be secured prior to sweeping the GTS enclosure.

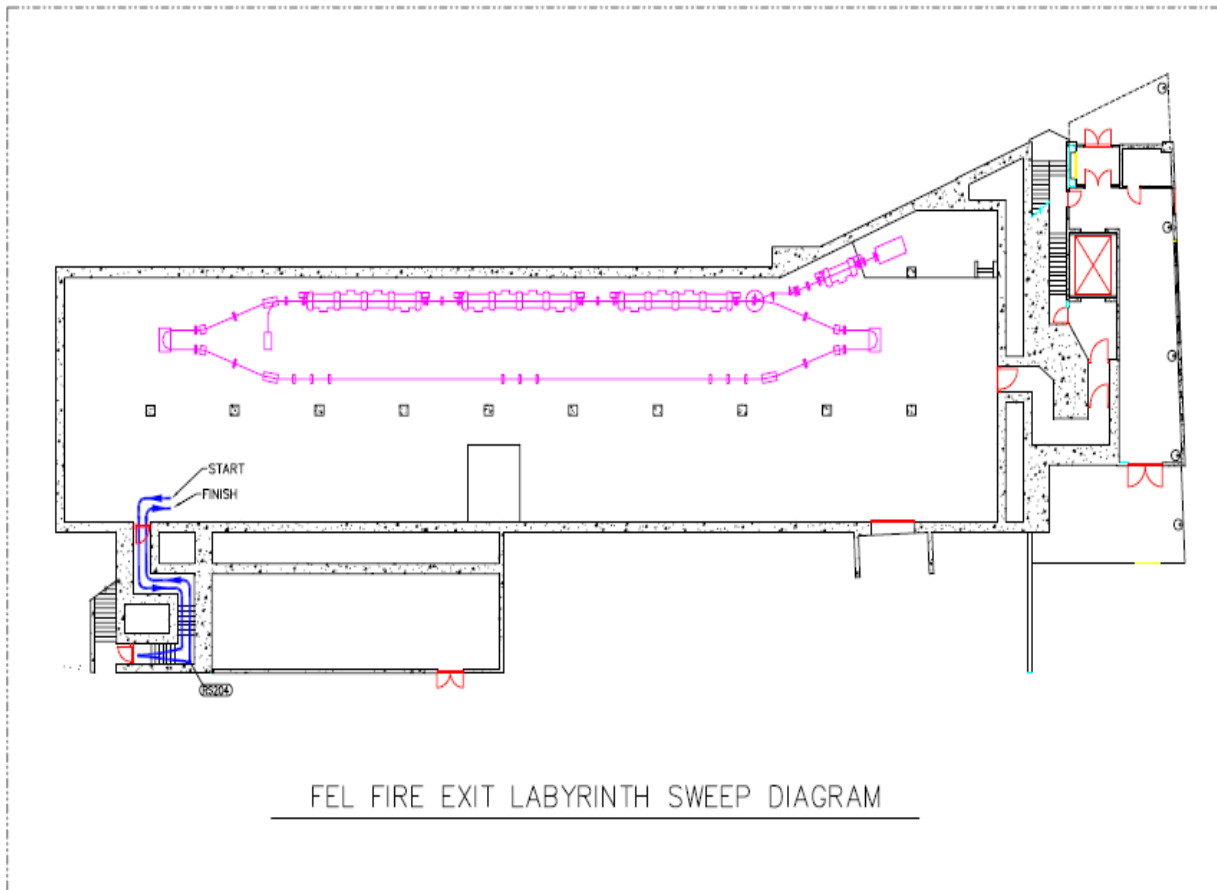
Identify two qualified personnel as the sweep team.

- Go to the MCC and request/access the special sweep key from the Keywatcher panel
- Look at the LERF screen on the PSS computer.
 - Verify that the exit area doors are closed

Two sweepers enter the LERF vault. One is posted at the entrance of the exit staircase while the other enters through the wire door, see figure 4.

- Close the wire door behind you
- Go to the fire door and confirm that it is completely closed and locked
- Arm the Run/Safe box (RS204) on the south wall
 - Verify that the Yellow "Operational" indicator is lit
- Exit the area closing the wire door completely upon exiting
- Check that the "Area Secure" light on the wall outside of the door is lit
- Return to the key to the MCC Keywatcher panel

Note: Once the sweep is complete, the PSS will send an "area secure" signal to both the FEL and GTS.



Concrete sliding door normal operating procedures:

To Close sliding concrete door: -

- a. Remove the trench plate using plate-pulling tool. The plate-pulling plate is on a hook affixed to

the wall inside the GTS enclosure next to the sliding door.

- b. Press door close button and keep it held in for the door to move. There will be a few seconds delay before the door starts to move due to the pre-set time delay switch to allow pump to come up to speed. The door will stop moving when it reaches the limit switch, at this point the close button can be released. **A red flashing light with a high volume buzzer will go off each time the door is actuated.**
- c. Monitor the space between the door and the jam to ensure that no one enters while the door is in motion. The door will move slowly, it will take approximately 45 seconds for the door to travel from the fully open to closed.

To Open sliding concrete door: -

- a. Press open button and keep it hold in for the door to move, there will be a few seconds delay before the door starts to move due to the pre-set time delay switch to allow pump to come up to speed. The door will stop moving when it reaches the limit switch, at this point the open button can be released. **A red flashing light with a high volume buzzer will go off each time the door is actuated.**
- b. Once to door is fully open, set the trench cover plate in the trench to prevent tripping.

Note: - The control buttons must be kept depressed to move the door. When the door reaches the open or close limit switches, it will stop moving and the button can be released. It is necessary for the door to reach the limit switch in open or close position to activate the PSS interlocks.

5. Back Out Procedure(s) i.e. steps necessary to restore the equipment/area to a safe level.

At any time during GTS operations, the PSS can be brought to OPEN or safe mode, in case there is a need for accessing the enclosure or to conclude high voltage operations.

Returning the PSS to Open Mode in normal operating conditions

- Turn off the gun HVPS from the EPICS control screen
- Proceed to the PSS console and switch the key to "Sweep" mode
- Remove key and insert in left hand key switch
- Switch the key to "OPEN" mode
- Proceed to the GTS enclosure entrance and open the sliding concrete door following procedure described above.

6. Special environmental control requirements:

6.1 Environmental impacts (See [EMP-04 Project/Activity/Experiment Environmental Review](#))

SF6 is used as an electrical insulating gas inside the pressurized (10 psi) high voltage power supply. SF6 is a green house gas that must be re-used to avoid releasing it into the atmosphere when there is a need to open the tanks, i.e. high voltage power supply maintenance. See High Voltage Power Supply *ACC-16-63317-OSP* for details on gas transferring operations. SF6 is a powerful green house gas, 23,900 times worse than CO2.

6.2 Abatement steps (secondary containment or special packaging requirements)

To prevent the escape of this gas we have installed a SF6 recovery system. This system passes the gas back and forth between a flexible storage bag, located outside, and the high voltage power supply. The system is also equipped with a vacuum pump to ensure near complete SF6 gas recovery.

7. Unusual/Emergency Procedures (e.g., loss of power, spills, fire, etc.)

Returning the PSS to Open Mode in case of emergency or any other abnormal conditions

At any moment the PSS Safety Crash buttons can be depressed. This action will cut off the gun high voltage power supply and will close the laser shutter if those systems are operational. It will also crash the sweep and will force open the sliding concrete shield door.

Since ionizing radiation is present in the enclosure only when the gun is at high voltage, depressing any of the PSS Safety Crash buttons will restore the area to a safe level.

The following is a list of currently installed alarms:

1. ODH (blue strobe + buzzer)
2. Fire (white strobe + high pitch)

The expected response to any of the alarms is to evacuate the GTS enclosure immediately, proceed to LERF muster point located at the LERF front door, and notify the crew chief.

Return to normal operations occurs when alarms are cleared by the following personnel:

1. ODH cleared by MCC Crew Chief
2. Fire cleared by Facilities Management

Other emergency procedures not covered by alarms are:

- a) Ventilation failure. Expected Response is to evacuate area immediately and convene at muster point.
- b) Personnel inside GTS enclosure AND sliding concrete door closed. **NOTE: This event should never occur if proper sweep procedures are followed.** Expected response is to proceed to the sliding concrete door exit and press the crash button. This will open the door.
- c) Electrical Power failure AND sliding concrete door closed. **NOTE: This event should never occur if proper sweep procedures are followed.** In case of power failure and personnel trapped inside GTS with the concrete shield door closed:
 1. Proceed to the sliding door and open the two manual hydraulic by-pass valves located on the wall behind the ram and shown in the figure below



2. Attach the big red winch hook to the pull point on the door edge.
3. Set chain winch to lift and operate lever to tighten the chain. This will pull the door open.
NOTE: It should not take a great deal of force to open the door.
4. If excessive force is required on the chain hoist lever: a) Set the hoist to lower, b) Release the chain tension, c) Check to ensure the manual by-pass valves are open, d) Re-try opening door. If still excessive force is needed call the Guard Gate at 269-5822 for help.

8. Instrument Calibration Requirements (e.g., safety system/device recertification, RF probe calibration)

ODH heads are maintained and continuously monitored by the Safety Systems Group.
CARMS are maintained by the Radiation Control group.
Both groups are responsible for calibrations and maintenance of their systems.

9. Inspection Schedules

PSS certifications are performed every six months by the Safety Systems Group in coordination with CIS personnel.

10. References/Associated Documentation

- Laser **ACC-16-001-LSOP**

- High Voltage Power Supply *ACC-16-63317-OSP*
- Cathode magnet OSP
- PSS/LPSS User guide Revision 1.0 January 10, 2008
- ODH Assessment JLAB-TN-07-082

11. List of Records Generated (Include Location / Review and Approved procedure)

[Click](#)
To Submit OSP
for Electronic Signatures

Distribution: Copies to: affected area, authors, Division Safety Officer

Expiration: Forward to ESH&Q Document Control

Form Revision Summary

Revision 1.3 – 11/27/13 – Added “Owning Organization” to more accurately reflect laboratory operations.

Revision 1.2 – 09/15/12 – Update form to conform to electronic review.

Revision 1.1 – 04/03/12 – Risk Code 0 switched to N to be consistent with [3210 T3 Risk Code Assignment](#).

Revision 1.0 – 12/01/11 – Added reasoning for OSP to aid in appropriate review determination.

Revision 0 – 10/05/09 – Updated to reflect current laboratory operations

ISSUING AUTHORITY	FORM TECHNICAL POINT-OF-CONTACT	APPROVAL DATE	REVIEW REQUIRED DATE	REV.
ESH&Q Division	Harry Fanning	12/01/11	12/01/14	1.3

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Task Hazard Analysis (THA) Worksheet

(See [ES&H Manual Chapter 3210 Appendix T1](#)
[Work Planning, Control, and Authorization Procedure](#))

Click
For Word

Author:	C. Hernandez-Garcia	Date:	November 8, 2016	Task #: If applicable	
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Complete all information. Use as many sheets as necessary

Task Title:	LERF Gun Test Stand (GTS) operations			Task Location:	LERF Bldg 18, room 217 and room 109A	
Division:	Accelerator	Department:	Center for Injectors and Sources		Frequency of use:	
Lead Worker:	C. Hernandez-Garcia					

Mitigation already in place: Standard Protecting Measures Work Control Documents	Ionizing Radiation Engineered Controls <ul style="list-style-type: none"> Concrete shielding at least 24" thick surrounds the GTS except in the vent to the FEL exit staircase Concrete shield blocks are permanently installed outside roll-up door. Concrete shield sliding door (only access to GTS enclosure) is interlocked to the PSS so that opening it will drop the HVPS permit. Two baffle steel plates are permanently installed in the vent to the FEL exit staircase and are sufficient to mitigate radiation hazards (See Appendix B). The high voltage power supply contactor is made up only when the PSS allows it.
	Exposure to Laser non-ionizing Radiation Drive Laser hazards are mitigated through use of Class 1 laser enclosures (hutch and laser beam line transport) and via redundant laser shutters interlocked to the Laser Personnel Safety System (LPSS). For laser alignment mode when a person needs to be in the enclosure with the laser turned on, administrative procedures require use of laser goggles, training and sliding steel entrance door interlocked to the LPSS. Laser hazards and procedures are fully covered under a separate document ACC-16-001-LSOP.
	Oxygen Deficiency Hazard The GTS enclosure is designed as an ODH 0 area. The ODH assessment for Nitrogen is addressed under a separate document JLAB-TN-07-082. The ODH assessment for SF6 is covered in the High Voltage Power Supply #FEL-07-002-SOP.
	An interlock between the nitrogen source and the air-handling unit has been installed and is operational as an engineered control. The interlock is a fail-closed solenoid valve up-stream of the nitrogen manifold and mounted outside of the GTS enclosure that closes when the air handling unit is not working.

	Oxygen Deficiency Hazard (continued) There is one active ODH sensor installed under the HVPS tank. This ODH alarm will go off in the event of SF6 leakage. Two ODH sensor mounts
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Task Hazard Analysis (THA) Worksheet

(See [ES&H Manual Chapter 3210 Appendix T1](#)
[Work Planning, Control, and Authorization Procedure](#))

have been installed in the north wall of the GTS enclosure, one close to the floor and one close to the ceiling for future use in case Liquid Helium is ever used.

Crushing during Sliding Concrete Shield Door operation, Engineered controls

1. Location of controls has been set to provide clear line of sight of the doorway.
2. Activation button must be kept depressed to move the door.
3. System pressure shall be set at minimum required to move the door

Sequence of Task Steps	Task Steps/Potential Hazards	Consequence Level	Probability Level	Risk Code (before mitigation)	Proposed Mitigation (Required for Risk Code >2)	Safety Procedures/ Practices/Controls/Training	Risk Code (after mitigation)
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Task Hazard Analysis (THA) Worksheet

(See [ES&H Manual Chapter 3210 Appendix T1](#)
[Work Planning, Control, and Authorization Procedure](#))

Sequence of Task Steps	Task Steps/Potential Hazards	Consequence Level	Probability Level	Risk Code (before mitigation)	Proposed Mitigation (Required for Risk Code >2)	Safety Procedures/ Practices/Controls/Training	Risk Code (after mitigation)
1	Gun operation / Exposure to Ionizing Radiation	M	M	3	See Mitigations already in place	<p>A Personnel Safety System (PSS) has been designed and implemented to protect individuals from ionizing radiation during high voltage and electron beam operations. The system has 3 Alarming Radiation Monitors (CARM) plus one more CARM linked to the LERF PSS system. A red flashing light will automatically be turned on in the GTS enclosure when the HVPS permit is allowed by the PSS. A sign just below the read flashing light is displayed indicating to exit immediately by pressing the concrete shield door crash button. The concrete shield door cannot be physically closed from the inside.</p> <p>Two-person sweep will be done prior to closing the GTS concrete shield door following procedures referenced in the GTS OSP.</p> <p>Magenta beacons are activated when high voltage interlocks are armed, indicating potential for ionizing radiation inside the GTS enclosure.</p>	1
2	Laser operation / Exposure to non-ionizing laser radiation	M	M	3	See Mitigations already in place	Use of Class 1 laser enclosures (hutch) interlocked to the LPSS, use of laser goggles, training and LPSS laser shutters interlocked secured access during alignment	1

Task Hazard Analysis (THA) Worksheet

(See [ES&H Manual Chapter 3210 Appendix T1](#)
[Work Planning, Control, and Authorization Procedure](#))

Sequence of Task Steps	Task Steps/Potential Hazards	Consequence Level	Probability Level	Risk Code (before mitigation)	Proposed Mitigation (Required for Risk Code >2)	Safety Procedures/ Practices/Controls/Training	Risk Code (after mitigation)
3	Magnet coil operation / Magnetic Field Hazard	M	M	3	A sliding concrete shield door Interlocked to the magnet power supply will prevent access to the magnet when it is energized.	A 5 Gauss boundary sign is posted at the GTS enclosure door and a 600 Gauss boundary is posted near the solenoid. Strong magnetic field will attract loose ferromagnetic objects, possibly injuring body parts or striking fragile components. Prior to energizing the magnet, a sweep of cordoned area will be performed for any loose magnetic objects. <u>When personnel is required to work on the magnet while energized, that work will be conducted under a separate OSP, in which all personnel entering the 600 Gauss area will also be trained to remove ferromagnetic objects from themselves including wallet.</u>	1
4	Enclosure occupancy / Oxygen Deficiency Hazard/SF ₆ exposure	L	EL	1	See Mitigations already in place	In case of ventilation loss due to HVAC failure (noticed by the sudden absence of ambient noise and air flow in the enclosure) personnel must leave area immediately and proceed to muster point located in the FEL building main entrance.	1
5	Sliding Concrete Shield door operation/ Crushing	M	M	3	See Mitigations already in place	GTS OSP requiring operators be trained in the operation of the door and associated risks	1

Task Hazard Analysis (THA) Worksheet

(See [ES&H Manual Chapter 3210 Appendix T1](#)
[Work Planning, Control, and Authorization Procedure](#))

Sequence of Task Steps	Task Steps/Potential Hazards	Consequence Level	Probability Level	Risk Code (before mitigation)	Proposed Mitigation (Required for Risk Code >2)	Safety Procedures/ Practices/Controls/Training	Risk Code (after mitigation)
6	Sliding Concrete Shield door operation/ Trip	L	M	2	A steel trench cover plate is already used	GTS OSP requires installing trench cover plate prior to entering and removal prior to closing.	1

Highest Risk Code before Mitigation:	3	Highest Risk Code after Mitigation:	1
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When completed, if the analysis indicates that the [Risk Code](#) before mitigation for any steps is “medium” or higher ($RC \geq 3$), then a formal [Work Control Document](#) (WCD) is developed for the task. Attach this completed Task Hazard Analysis Worksheet. Have the package reviewed and approved prior to beginning work. (See [ES&H Manual Chapter 3310 Operational Safety Procedure Program](#).)

Task Hazard Analysis (THA) Worksheet

(See [ES&H Manual Chapter 3210 Appendix T1](#)
[Work Planning, Control, and Authorization Procedure](#))

Form Revision Summary

Periodic Review – 08/13/15 – No changes per TPOC

Revision 0.1 – 06/19/12 - Triennial Review. Update to format.

Revision 0.0 – 10/05/09 – Written to document current laboratory operational procedure.

ISSUING AUTHORITY	TECHNICAL POINT-OF-CONTACT	APPROVAL DATE	REVIEW DATE	REV.
ESH&Q Division	Harry Fanning	08/13/15	08/13/18	0.1

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By signing this page, you testify that you have read, understand, and agree to abide by the procedure specified in the above referenced work control document:

Serial Number: ACC-16-63923-OSP

Title: LERF Gun Test Stand (GTS)

Name

Signature

Date _____

[illegible]