Test Facilities Experiment Review

Please read the following regulations for experiments performed in the Test Facilities and fill in the Experiment Review form which is found at the end of this document. Test Facilities staff will use the information that you provide to initiate a formal SLAC Project Review of your experiment.

All hazards and mitigations associated with your experiment need to be documented on this form. All experiments need to pass a review prior to their installation and implementation at the Test Facilities and this form provides the basis for the review. If the experiment changes and new hazards arise, notify your Test Facilities contact immediately for additional guidance and review.

It is your responsibility to make sure the information provided is complete and accurate or else there could be delays in performing your experiment in the Test Facilities.

Make every effort to provide engineering solutions to your experiment's hazards.

Your Responsibilities for Safety

SLAC is committed to protecting the health and safety of our staff, the community, and the environment as we carry out our scientific mission. You share responsibility for ensuring a safe work environment at SLAC.

You:

- are responsible for satisfying all parties that the experiment is safe to operate and that there are no radiation concerns. The form included in this document is the first step in communicating the hazards of your experiment.
- are responsible for developing safety documentation and sharing it with the Test Facilities staff.
- are responsible for informing the Test Facilities staff of any changes to the experiment (apparatus or procedures) that affect safety.
- are responsible for ensuring that any requests from SLAC for the purpose of increased safety are implemented.
- are responsible for providing enough people to operate the experiment in a safe manner.

You may designate someone to act on your behalf.

Electrical

Please note that any electronic equipment must be approved for the intended use by a Nationally Recognized Testing Laboratory (NRTL) (http://www.osha.gov/dts/otpca/nrtl/). Examples of some acceptable NRTL marks are shown below. Equipment that does not meet these criteria must be inspected and approved for use by a SLAC EEIP electrical equipment inspector prior to use. Please indicate any equipment that needs to be EEIP-ed on the Review Form.

Note: the European CE conformity marking does not satisfy the US NRTL requirement.

Note: Equipment that is battery operated or is powered by a separate NRTL-approved power supply operating at less than 50 volts is generally allowed without an EEIP inspection.

Lockout / Tagout – Control of Hazardous Energy

Any process capable of causing injury due to unanticipated operation or energy release must be locked out following the SLAC Control or Hazardous Energy (CoHE) program. All equipment is expected to incorporate covers, shields or guards to protect against incidental exposure to a hazard. Equipment interlock systems may not be used in lieu of a CoHE lockout. The CoHE program applies when covers or other protective measures are removed for maintenance, repair or adjustments.

Examples of hazards which generally require control through the lockout program include:

- Electrical systems operating at greater than 50 volts or with more than 10 joules of stored energy
- Pressurized gas or liquid systems operating at greater than 50 psi with flexible lines or greater than 150 psi with rigid lines
- Spring-loaded or gravity-based hazards capable of causing injury
- Devices with motors or air movers capable of causing injury

Energy sources which do not generally require application of SLAC CoHE include:

- Exposure to electrical sources intrinsically limited to less than 5 mA.
- Equipment which can be unplugged – providing that the power cord remains within the direct control of the person working on the equipment.

Training and qualification for application of CoHE equipment lockout is not frequently offered. Users are strongly encouraged to design equipment with connectors that can allow potentially hazardous electrical sources to be isolated from the experimental equipment.

The CoHE program is rigorously applied at SLAC.

List these hazards on the Review Form and indicate how the design removes the need for control through the lockout program if this is the case.

If there is any doubt regarding the experimental equipment and the lockout requirements, please indicate this on the Review Form.

Weight

Equipment may be carried down staircases if can easily be carried. As a general rule, objects that may qualify as airline carry-on baggage may be carried on the staircase. Objects that are unusually shaped or exceed approximately 40 pounds will require special arrangements for transport. Please indicate such items on the Review Form.

Experiments must be designed to avoid the necessity of lifting or manually holding any heavy or awkward object in place. For example, a large vacuum flange with attached instrumentation may require the incorporation of a lifting device or retention bracket to allow routine adjustments. Please indicate this requirement on the Review Form.

Compressed gas

Nitrogen gas is available for purging of chambers during work in vacuum vessels. Helium is available for leak checking. Please list any compressed gas requirements on the Review Form.

Vacuum Viewports

Glass vacuum viewports may be at risk of being damaged. We usually require that viewports greater than two inches in diameter are covered or otherwise protected against damage when not in use. Simple plexiglass or plastic covers with retaining clips may be used to satisfy this requirement. Please indicate location, type and number of viewports on the Review Form so we may assess whether this is required. There may also be laser safety requirements to cover the viewport depending on its location.

Lead Shielding

Lead shielding blocks are available for local shielding upon request. Typical lead blocks are 2" by 4" by 8" in size and weigh 26 pounds. The experimental tables have load restrictions so it is important to know in advance the shielding you need. Please evaluate how much shielding you require and where it needs to be position and state this on the Review Form.

Lasers

Lasers must be approved prior to use at SLAC. Low power alignment lasers will not present unusual difficulties. These must be inspected before use for correct labelling by the FACET & Test Facilities Safety Officer or designee. The use of Class 3-b or Class 4 lasers is permitted under a laser safety program with approval of the SLAC Laser Safety Officer.

Please indicate any lasers you intend to bring with you and use at SLAC on the Review Form. Please state their working parameters. Please also state the parameters for any use of lasers provided by the facility such that we may check whether this is within the currently permitted safety envelope.

Radioactive Equipment

Equipment which is radioactive (has a count rate above natural background) requires advance authorization and must be shipped through special procedures. Any equipment that has been exposed to accelerator-produced particle beam or used in fission or fusion studies may need to be checked for removable radioactive contamination – even if the equipment was released as non-radioactive. Please indicate any equipment that falls in the above categories on the Review Form.

Non-Ionizing Radiation

Radiation from medium and high power RF systems operating between 3 kHz and 300 GHz (including induction heater installations) must not exceed the Maximum Permitted Exposure (MPE) levels as defined in recognized consensus standards. Please indicate any RF systems on the Review Form.

Chemicals

Most chemicals used at SLAC are obtained through the SLAC Chemical Management System. If the required chemical is not in the SLAC Chemical Catalog, delays of several weeks beyond a normal acquisition time should be anticipated. This requirement includes the use of common items obtained at the local hardware store such as Loktite adhesive, solder, silicone RTV adhesive, etc.

Chemical samples and specialized chemicals associated with the experiment must be identified well in advance. Pre-approval and a safety analysis are required. Transport of specialized chemicals is controlled by SLAC policy and, in general, will require transportation by a commercial carrier. Please put details on the Review Form.

Note: SLAC has ample supplies of laboratory grade propyl alcohol (isopropyl alcohol) and ethyl alcohol for incidental cleaning of samples and vacuum equipment.

Chemicals in the Accelerator Enclosure

Small containers of Alcohol may be brought into the accelerator enclosure for use during periods of installation.

All other chemicals (including greases, oils, and gases) must be evaluated on a case-by-case basis. Please indicate these on the Review Form.

Hazardous materials, biological materials, etc…

Please inform your Test Facilities contact of any hazardous or biological material that is a part of your experiment.

A hazardous material is defined as any chemical or material that, due to its physical or chemical properties poses a risk to the health or safety of humans, environment, or the laboratory. This includes, but is not limited to, chemicals/materials (including gases) that are FLAMMABLE, CORROSIVE, REACTIVE, TOXIC, CARCINOGENIC, RADIOACTIVE, materials that are BIOHAZARDOUS and NANOMATERIALS – defined as having at least one dimension between 1 and 100 nanometers.

Material Safety Data Sheets (MSDS) must accompany all hazardous materials that come to SLAC.

Data acquisition equipment and computers

Any devices or computers connected to the SLAC internal computer network must be approved prior to connection. Please describe each device, its operating system (including software version) and what function it is serving in the experimental program.

Tool kits

Many tools are available here for Test Facilities Users. However, Users may wish to bring specialized tools.

Experiment Review Form

Please fill this in as completely as you can. The main aim is to identify hazards and their mitigations. We also aim to understand how best to integrate your experiment into the FACET infrastructure.

Sections that are not applicable can be left blank. Figures can be approximate if they do not impact safety. Please return this form as soon as possible to your Test Facilities contact.

This form will be the basis for follow-up discussions and a Safety Review of your experiment.

Attach further pages as required.

Part One: Information

Experiment Title:

Date:

Contact Name for Further Information:

Telephone:

Email:

Description of Experiment: *Please aim this at someone not in your field but with reasonable scientific knowledge. Keep this brief- "abstract-length"*

Description of Experimental Procedure:

Part Two: Apparatus

You must provide us with drawings and, if possible, computer models.

Dimensions of apparatus: *Include any support equipment such as vacuum pumps, electronics, etc.*

Weight (especially note if any item cannot be carried safely down stairs):

Lead Shielding Requirements:

Description of mechanical controls:

Description of electronic controls:

Cabling requirements:

Part Three: Computing

Description of controls software:

Description of data acquisition systems or computers:

Networked resources or software you need access to:

Part Four: Radiation

List <u>All</u> materials and devices that will be in the accelerator tunnel during beam operation:

List all samples or other materials that are directly in the beam or could feasibly be in the beam from a beam mis-steer or misalignment of samples. *(Include diagnostic screens and devices, sample materials including any supporting substrate, brackets or carriers. State material and length):*

Please complete the checklist and comment on any "yes" below or on a separate sheet:

Yes	No	**Experiment contains:**
☐	☐	We will use radiological sources
☐	☐	We will bring radioactive materials on site (please describe items, history of use and current radiological status)
☐	☐	We will bring equipment on site that has previously been exposed to a particle beam, fission or fusion experiments, or may be radiologically activated or contaminated (please describe items, history of use and current radiological status)
☐	☐	We will need to take radiologically active materials off site e.g.: samples exposed to the beam (please provide contact details for the radiation safety officer who will receive the materials)
☐	☐	We will need to take *potentially* activated materials off site, including cameras and other instrumentation that has been in the beam tunnel during beam operation. (please provide contact details for the radiation safety officer who will receive the materials)
☐	☐	We will use Non-Ionizing Radiation (RF) systems – State frequency and the maximum possible peak and average power. Do not list radiation from normal instrumentation and logic (e.g.: TTL) sources.

Comments:

Part Five: Lasers

Will you use a laser as part of your experiment or during the installation of your experiment? If so, state class and type of laser.

If you are using Class 3B or Class 4 lasers, please state laser parameters (energy, intensity, pulse duration).

You must provide drawings for the layout of the laser beam path with approximate dimensions and descriptions of the optics used.

Part Six: Electrical Hazards

List Electrical Equipment that will need to be EEIP tested on arrival at SLAC:

Please complete the following table (examples are given to help you):

Potential Electrical Hazards (e.g.: heater leads, high voltage vacuum feedthroughs)

Item	Hazard	Mitigation
Heater Leads	*Shock hazard - Heaters operate at 150 Volts*	*Heater leads are covered when in use. Heater plugs into a nearby connector – avoiding lockout requirement.*
Vacuum feedthrough	*Bias voltage for detector – 100 volts*	*Bias current is limited by a resistor to 1 mA*

Part Seven: Gas, Chemical and Material Hazards

Yes	No	**Experiment contains:**
☐	☐	Hazardous Materials. List any material considered hazardous by the State of California
☐	☐	Specialized Chemicals. List any chemicals used in the experiment or support equipment. Include pump oils, vacuum greases used on o-rings, etc.
☐	☐	Flammable materials. (Materials that can ignite and burn easily at room temperature.)
☐	☐	Compressed Gases
☐	☐	Potentially pressurized system (Greater than 15 psig.)
☐	☐	Cryogens
☐	☐	Nano-scale Materials
☐	☐	Biological Materials

Comments:

Please complete the following table (examples are given to help you):

Pinch Hazards (for example from moving parts):

Item	Hazard	Mitigation
OTR screen	*Vacuum actuator can pinch personnel*	*Actuator is covered*

Part Eight: Experiment Failure Mitigations

Please complete the following tables (examples are given to help you):

Identify all potential failure modes of experimental equipment. Include failure modes that are mitigated by engineering or administrative controls.

Item	Hazard	Mitigation
Helium pressure regulator failure	*High pressure helium can pressurize vacuum chamber*	*Pressure relief valve installed on low pressure line limits pressure to less than 15 psi*
OTR screen holder can be hit by beam	*Damage to cameras by beam shower*	*Screen mover interlocked to machine protection system to turn off beam during screen motion*

In your Experimental Procedure, what mistakes can be made? *(i.e. what are the failure modes and consequences)*

Item	Hazard	Mitigation
Dielectric wakefield device can be moved into beam	*Beam shower, destruction of experiment*	*Procedure requires experimenter to monitor secondary electron detector when inserting device*

The information above is a truthful account of the experimental apparatus and procedures. I agree to provide further information as needed for the experimental safety review. Any changes to the experimental program will be conveyed to the Test Facilities staff using a revised version of this form.

Signed:

Name:

Date: