Jefferson Lab
Thomas Jefferson National Accelerator Facility

Accelerator Experiment Safety Assessment Document (ESAD)

(See ES&H Manual Chapter 3130 Appendix T1 Accelerator Science Experiment Safety Assessment Document –Instructions)

Click For Word Doc

Accelerator Experiment ID:	AE-19-001	(Assigned by appropriate leadership)

This form documents your experiment. The Experiment Lead Scientist completes ALL numbered questions (write "not applicable" or "none" where appropriate). If your experiment changes before the form expires, you must notify the accelerator Experiment Facility Leader. Most changes are easily accommodated and should not result in significant delay.

1. Location:	Building 18, LERF Vault (Once approved, this form is valid for two years.)	2. Expected Start Date:	October 1, 2019
3. Experiment Title:	Isotope Production R&D at Jefferson Lab's High-Power Electron Accelerators		
4. Document Owner(s) (Lead Scientist):	Andrew Hutton	4a. Contact Information:	andrew@jlab.org

5. List all Experimenters who will be working at the facility:

First & Last Name (Print)	Affiliation:	Phone:	E-Mail:
Andrew Hutton	JLab	(757) 269-7396	andrew@jlab.org
Kevin Jordan	JLab	(757) 269-7644	jordan@jlab.org
Stephen Benson	JLab	(757) 269-5026	felman@jlab.org
Joseph Gubeli	JLab	(757) 269-7862	gubeli@jlab.org
Gino Santistevan	NMT		geno.santistevan@student.nmt.edu
Robert Bentley	NMT		robert.bentley@student.nmt.edu

6. Name of People who completed this form:

First & Last Name (Print)	Affiliation:	Phone:	E-Mail:
Andrew Hutton	JLab	(757) 876-1770	andrew@jlab.org
Stephen Benson	JLab	(757) 269-5026	felman@jlab.org

Document History:

Revision:	Reason for revision or update:	Serial number of superseded document
N/A		

Distribution: Original: MCC Control Room, **Copies:** Lead Scientist, author(s), LERF Control room or UITF Control room, Division Safety Officer, ESH&Q Document Control, ESH&Q Liaison, Area Safety Warden
After expiration: Forward original and log sheet of trained personnel to ESH&Q Document Control.

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7. Experiment Overview

Provide a brief description of your planned activities. Include the approximate duration of the program.
Irradiate a boron nitride crucible containing pure gallium to produce Cu^{67}. Several irradiations are foreseen: ~1kw @ 25 MeV and 40 MeV; 5 kW @ 40 MeV. The crucible will be sealed prior to irradiation. It will be transferred to VCU following the irradiation, maintaining the seal intact until it is in the hot cell at VCU.

Does this experiment involve modification to the installed beam delivery system?	x	YES		NO
If YES describe the Modifications.				
Addition of a new target line behind the existing dump				

8. Task Hazard Analysis

Instructions: Answer the following questions. When answers indicate a hazard may exist – document the resolution(s) and hazard mitigation techniques.

General Conditions	Keywords	Yes	No	Mitigation
Will chemicals be used? Note: such use must meet the appropriate SDS requirements including Personal Protective Equipment (PPE).	acids, flammable gases and solvents, heavy metals (lead, etc.), respirator, gloves, aprons, face shield, safety glasses, working with flammables	X		Follow MSDS recommendation for the handling of gallium. Use crucible materials that are inert to gallium such as boron nitride and graphite.
Will you create dust, welding arcs, heat, excessive noise, ionizing or non-ionizing radiation, radioactive materials?	welding, grinding, painting, x-rays, respirator, gloves, RF, lasers, chemicals, epoxies	X		Coordinate with Radcon to work according to ALARA standards.
Are there any fire or explosive hazards associated with the work?	painting, welding, grinding, brazing, mixing chemicals, battery charging		X	
Could the work create headaches, breathing problems, or dizziness from odors, etc.?	Motor exhaust, painting, ozone, solvents, acids, bases, chemicals, portable heaters		X	
Will compressed or liquefied gasses be used?	cryogenics, nitrogen, helium, argon, carbon monoxide		X	
Does the task require work in areas or with materials subject to temperature extremes?	welding, soldering, brazing, cryogenics, resistive heating		X	
Does the work involve the use of hoists or robotics?	manlifts, subcontractors, rentals, slings, rigging	X		Rigging to be done by qualified riggers at JLab when necessary.

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Instructions: Answer the following questions. When answers indicate a hazard may exist – document the resolution(s) and hazard mitigation techniques.				
General Conditions	**Keywords**	**Yes**	**No**	**Mitigation**
Will powered hand tools be used?	drills, saws, PPE, GFCI, power activated tools	X		
Does the work involve the risk of electrical shock or other forms of hazardous energy?	LOTO, compressed gases, power supplies, pressure, cryogenics		X	
Does the task involve lifting, pulling, pushing, or carrying heavy objects, or repetitive motion?	posture, back injury, twisting	X		
Does the task involve work with pressurized or vacuum vessels?	resistive heaters, GFCI, pressure relief, tanks, containers		X	
Does the task require any permits?	welding, grinding, open flame soldering		X	
Does the task require specialized training?	Respirator		X	
Will waste products require special handling or disposal requirements?	chemicals, by products, discharges to sanitary sewer or air		X	
Any other hazards we may have overlooked with this list?		X		

9. Experimental Details

List all materials (and quantities) to be used in your experiment. List Target Material first and include all chemicals, gases, sample materials, etc.

~60 grams of liquid Gallium for each irradiation (expected to be less than 5 irradiations)

Describe any airborne contaminants that may be produced. Include the expected composition/decomposition; the method of exhaust; fixture description; and expected interaction with the optical beam.

Some ozone produced. Calculations show it to stay below allowed limits.

Describe the beam stop construction and its ability to handle power.

Target to be designed explicitly to handle the beam power for this experiment

List Personal Protective Equipment Required.

Standard PPE for work in the LERF

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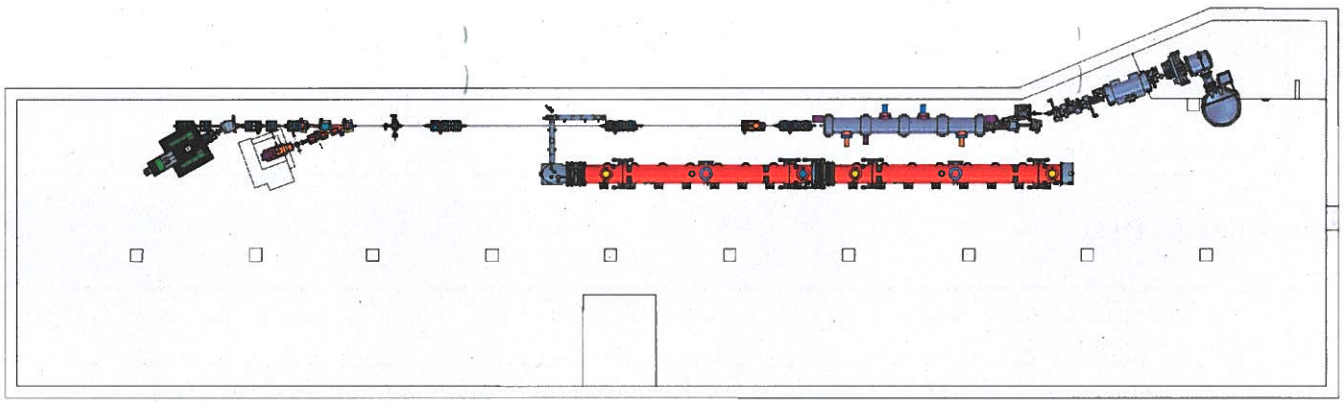
Additional Precautions (e.g. posting requirements, process restrictions, equipment limitations, laser beam containment, interlocks)
None

10. Additional Laser Usage

Describe any additional lasers to be used in the experiment. (Use of additional Class 3b and above lasers will require a separate, additional Laser Operational Safety Procedure (LOSP).)
None

11. Outline Experiment Procedure

Layout of equipment and room (e.g. a brief description of any special requirements, overhead floor plan.)



The target will be on the new 1X beamline downstream of the energy recovery dump. The target itself will be in a shielded enclosure on a sliding table that can allow one to access the target and retrieve the target crucible. Details of the transport line are shown below.

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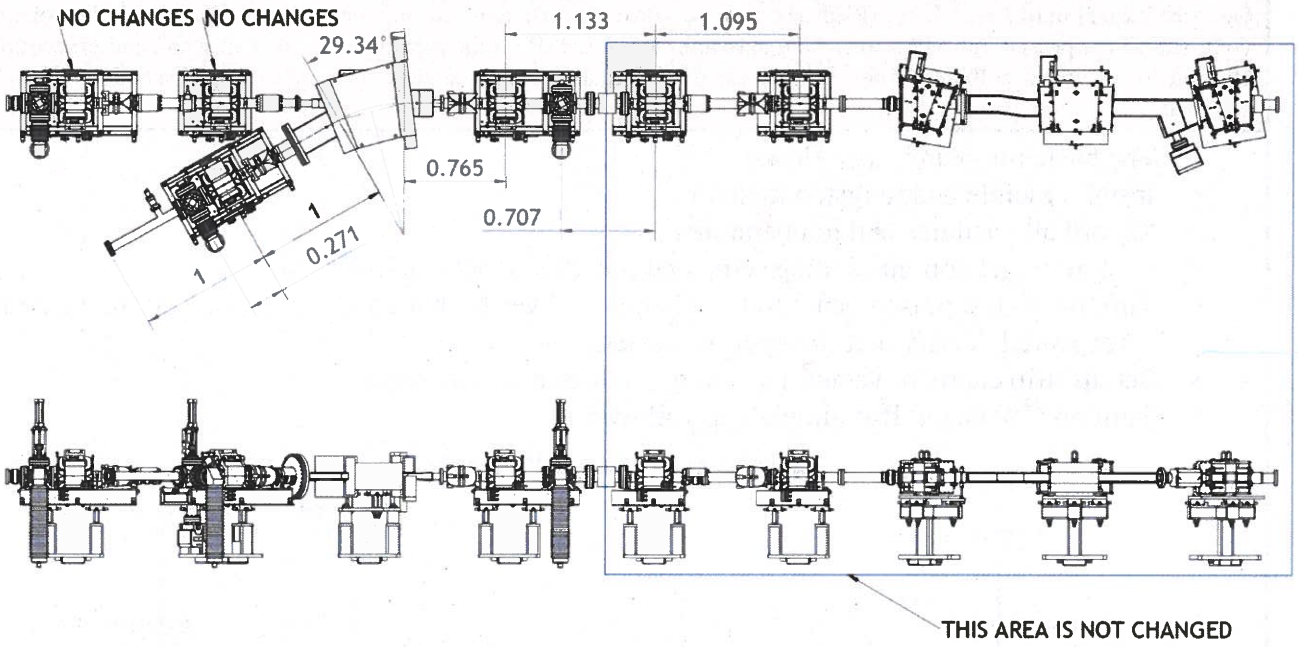

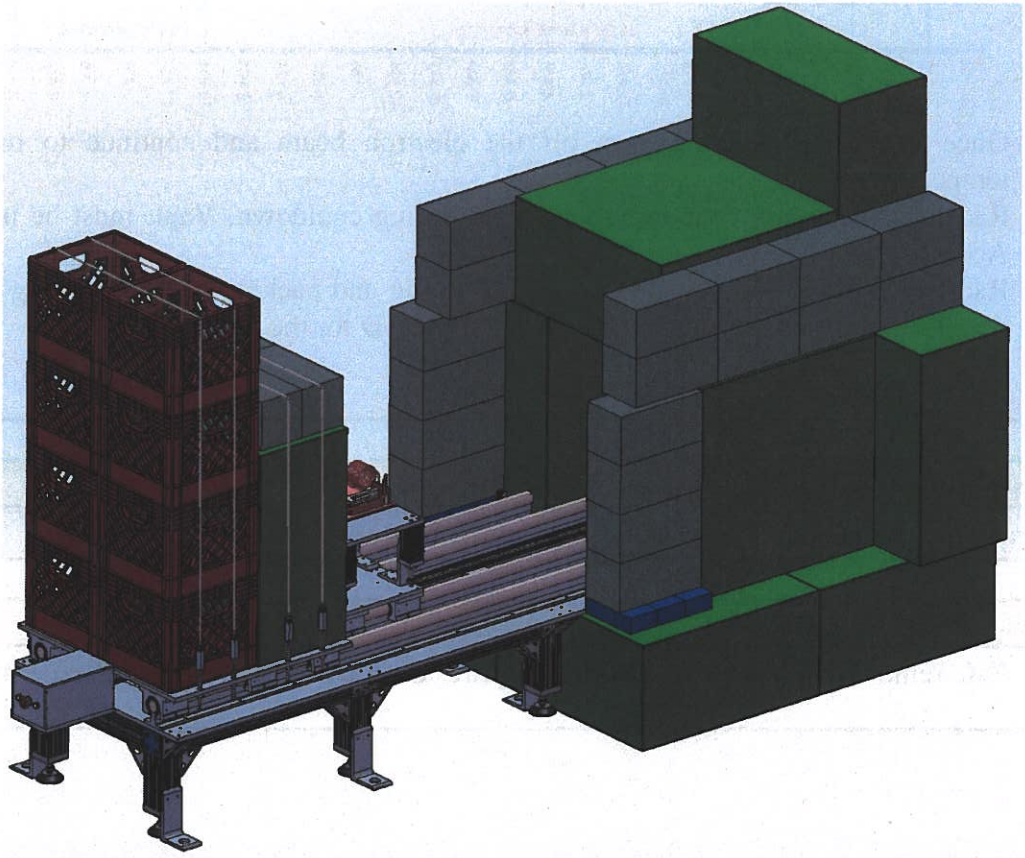

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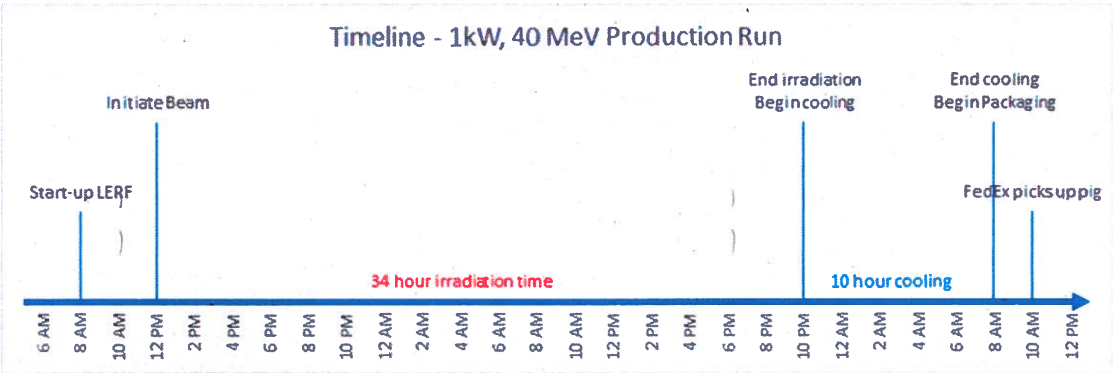
General Experiment Procedures (Please be concise. Provide sufficient information to illustrate what will be done, who will do it, and where procedures will occur. You may refer to the LOSP for the particular lab, its hardware, and procedures. However a specific Test Plan will be filed on a separate form after technical and safety approval and scheduling have been assigned.

The basic run plan is as follows:

- Install crucible and tungsten radiator.
- Record all vacuums and temperatures.
- Restore target commissioning setup and put all magnets on hysteresis.
- Turn on 40 μA pulsed beam to the 1X line and verify that zone 2 is phase and the beam trajectory is recovered. Verify that transport is lossless.
- Set up strip charts of vacuum and temperatures near the target.
- Turn on CW beam. Run timeline as follows:



- Once irradiation is done, turn off the electron beam and continue to monitor vacuum and temperatures.
- RadCon will monitor the radiation levels during cooldown. Vault must be in at least Controlled Access.
- RadCon to supervise transfer of crucible to pig and packing of the shipping container. For more details on the packing and shipment see the RSAD for the this project.

Residual Hazards (Contaminants, Disposal, Safe Disassembly, …)

The irradiation will result in radioactive Gallium to be shipped out of the lab

Any Other Safety Considerations

Safe removal of the irradiated target requires detailed study (part of the experiment).

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12. Regulatory Requirements

Regulatory Requirements		
[ ] Yes [x] No	Does the proposed experiment utilize viruses, viable bacteria, or material presenting a biological hazard at the lab facility? Certain biological hazards require notification to agencies outside Jefferson Lab.	
[x] Yes [ ] No	Does the proposed experiment require any radioactive materials or radiation producing equipment? Experiment will produce radioactive materials (that is the goal of the experiment).	
[x] Yes [ ] No	Does the proposed experiment require any industrial chemicals to be brought or shipped to Jefferson Lab? All chemicals must include a SDS for each material shipped. Pure Gallium will be purchased for the experiment.	
[x] Yes [ ] No	Does the proposed experiment create any chemical hazards? Gallium is corrosive. It will be handled in a fume hood and remain encapsulated in an inert boron nitride crucible.	

13. Environmental Management Information

(See EMP-04 Project/Activity/Experiment Environmental Review)

Is this a Water-Based Project?	[x] YES	[ ] NO
If YES provide details:		
Source of the Water and estimated quantity.	Existing LCW source - <5 gpm	
How is water to be discharged or disposed of:	Existing drains	
Sanitary Sewer		
Special Sanitary Sewer Discharge		
Surface Water		

Will the Experiment Generate Waste?	[ ] YES	[x] NO
If YES list all wastes including anticipated quantities and disposal approach for each type.		
Anticipated Air Emissions		
Other Waste Water		
Hazardous Waste		

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Solid Waste (landfill or recycling)	
Power/Natural Resource Consumption Expected	

14. Decommissioning/Shutdown Procedure (if necessary):

How will you ensure the lab is left in a safe and clean state after the experiment? Provide guidelines or process steps which outline closeout actions. Think about what needs to be done and plan enough time to do it:

Gallium will be shipped to VCU for processing	Hazardous material to be removed from the lab.	Target will be removed. Target beamline will remain, including shielding, for future experiments	User provided equipment to be removed.	LERF will be in a better state after re-installation of the beamlines. It will be left like that.	Lab to be left in a clean and orderly state.		

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(When form is complete submit it DSO for review and approvals)

This part to be completed by Jefferson Lab

SUPPLEMENTAL TECHNICAL VALIDATIONS

Subject Matter Expert Review and Acceptance

Hazard Reviewed (per ES&H Manual 2410-T1):	Print	Signature	Date:
[Enter Hazards]			
[Enter Hazards]			
[Enter Hazards]			

APPROVALS

	Print	Signature	Date:
Division Safety Officer	Harry Fanning	Harry W Fanning	7-JAN-2020
Accelerator Experiment Facility Leader:	Stephen Benson	Stephen Benson	8-Jan-2020
Laser System Supervisor:	NA		

15. Revision Summary

Revision 2.0 – 9/24/19 – Formerly titled FEL Experiment Safety Approval Form Instructions; rewritten to reflect current laboratory operations

Revision 1.0 – 11/23/10 – Updated to reflect current laboratory operations

ISSUING AUTHORITY	TECHNICAL POINT-OF-CONTACT	APPROVAL DATE	REVIEW DATE	REV.	
ESH&Q Division	Harry Fanning	9/25/19	9/25/22	2.0	

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