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Jefferson Lab
Thomas Jefferson National Accelerator Facility

Operational Safety Procedure Review and Approval Form # 80652
(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:	***ENP-19-80652-OSP***		
Issue Date:	***1/18/2019***		
Expiration Date:	***11/18/2020***		
Title:	***The APEX Target OSP in Hall A***		
Location: (where work is being performed) Building Floor Plans	***101 - Experimental Hall A - A100***	Location Detail: (specifics about where in the selected location(s) the work is being performed)	***The target will be located 105.38 cm upstream of the Hall A target pivot.***
Risk Classification: (See ES&H Manual Chapter 3210 Appendix T3 Risk Code Assignment)	Without mitigation measures (3 or 4): With mitigation measures in place (N, 1, or 2):	***2*** ***1***	
Reason:	This document is written to mitigate hazard issues that are : ***Not Applicable***		
Owning Organization:	***PHALLA***		
Document Owner(s):	***Covrig Dusa, Silviu (covrig@jlab.org)*** Primary ***Butler, Jessie (jbutler@jlab.org)***		

Supplemental Technical Validations

Radiological Controlled Area (David Hamlette, Keith Welch)
Radiologically Contaminated Area (David Hamlette, Keith Welch)
Storage & Handling of Radioactive Materials (David Hamlette, Keith Welch)
Ladders (Bert Manzlak, George Perry)

Document History

Revision	Reason for revision or update	Serial number of superseded document
2	***Added language to paragraphs 5.2 and 9.1 to clarify the requirements for shift workers to operate the APEX target.***	

Comments for reviewers/approvers:

Attachments

Procedure: ***Target_OSP_v2.pdf***

THA: ***APEX_THA_rev1_jan2019.pdf***

Additional Files:

Review Signatures	
Additional Authorization : Physics ES&H Liaison	**Signed** on 1/16/2019 11:54:46 AM by Bert Manzlak (manzlak@jlab.org)
Subject Matter Expert : Radiation - Ionizing->Radiological Controlled Area	**Signed** on 1/16/2019 9:59:37 AM by David Hamlette (hamlette@jlab.org)
Subject Matter Expert : Radiation - Ionizing->Radiologically Contaminated Area	**Signed** on 1/16/2019 9:59:22 AM by David Hamlette (hamlette@jlab.org)
Subject Matter Expert : Radiation - Ionizing->Storage & Handling of Radioactive Materials	**Signed** on 1/16/2019 9:59:53 AM by David Hamlette (hamlette@jlab.org)
Subject Matter Expert : Working at Elevations->Ladders	**Signed** on 1/14/2019 9:42:32 AM by Bert Manzlak (manzlak@jlab.org)

Approval Signatures	
Division Safety Officer : PHALLA	**Signed** on 1/16/2019 12:16:51 PM by Ed Folts (folts@jlab.org)
Org Manager : PHALLA	**Signed** on 1/18/2019 11:35:05 AM by Cynthia (Thia) Keppel (keppel@jlab.org)
Safety Warden : Experimental Hall A - A100	**Signed** on 1/16/2019 12:20:11 PM by Jessie Butler (jbutler@jlab.org)

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Operational Safety Procedure Form

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

Click For Word Doc

Title:	APEX Target		
Location:	Hall A	**Type:**	☒OSP ☐TOSP
Risk Classification (per Task Hazard Analysis attached) (See *ESH&Q Manual Chapter 3210 Appendix T3 Risk Code Assignment*.)		**Highest Risk Code Before Mitigation**	2
		Highest Risk Code after Mitigation (N, 1, or 2):	1
Owning Organization:	Physics Division	**Date:**	11.28.2018
Document Owner(s):	Silviu Covrig Dusa, Jessie Butler		

DEFINE THE SCOPE OF WORK

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

A Prime Experiment (APEX) solid target OSP.

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

This document includes the operation of the APEX target in Hall A for the duration of the APEX measurement. The APEX target does not require a dedicated target operator during beam time operations.

3. Description of the Facility – include building, floor plans and layout of the experiment or operation.

The APEX target is located 105.38 cm upstream of the Hall A standard pivot. The target concept is described in the original APEX 2010 proposal https://hallaweb.jlab.org/collab/PAC/PAC37/E12-10-009-APEX.pdf and updated in 2016 for the APEX ERR in https://hallaweb.jlab.org/experiment/APEX/ERR/APEXtgt_ERR_6apr2016.pdf, which is updated in Figure 1 from Nov 2018. The target ladder from Figure 1 will be installed on the beam line. The target ladder has vertical motion only. The target ladder attaches to a six degrees of freedom alignment mechanism and the mechanism is fixed on a vertical pipe that attaches to the top plate of the target scattering chamber. A vacuum bellows on the top flange of the scattering chamber accommodates the vertical motion. An Anaheim Automation stepper motor of size 34K moves the target. The target is made of solid parts only and requires no coolant. The target is spread along the beam line over 50 cm. Starting at the top there are two Al made alignment holes 2 mm by 2 mm displaced vertically which will be used to check the alignment of the beam upstream and beam downstream ends of the target. There are three positions in beam for graphite foils that will be used for optics studies. There is one position for seven tungsten wires, four staggered vertically and three staggered horizontally. Each wire is 100 microns in diameter. There is a HOME position, which is a straight shot for the beam to the Hall A dump and there are two production target rows. The first row holds ten graphite foils displaced along the beam line and the second row holds ten tungsten foils displaced along the beam line. The production graphite is nominally 0.53% radiation lengths (RL) while the production tungsten foils are 2.8% RL. There will be four RTD temperature sensors installed on the Al frames of the first and last tungsten foils along the beam line.

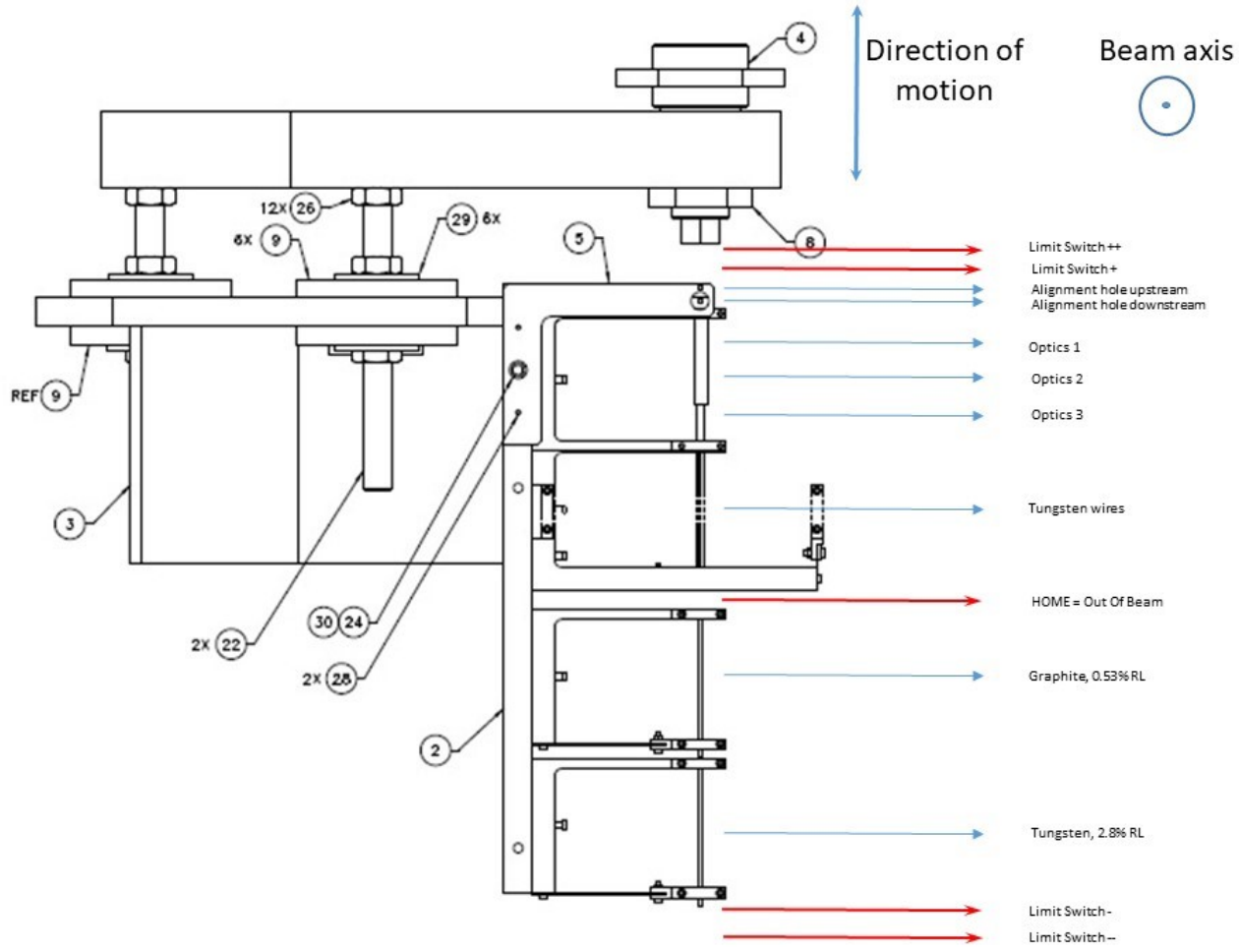

Figure 1. The APEX target ladder that will be installed on the beam line

ANALYZE THE HAZARDS and IMPLEMENT CONTROLS

4. Hazards identified on written Task Hazard Analysis

5. Authority and Responsibility:

5.1 Who has authority to implement/terminate

Silviu Covrig Dusa, Sandesh Gopinath, Jessie Butler, the Hall A Work Coordinator, Cynthia Keppel, the Halls A/C leader

5.2 Who is responsible for key tasks

Hall A technicians will install the scattering chamber. Silviu Covrig Dusa and Sandesh Gopinath are responsible for the installation, alignment and instrumentation of the target ladder with help from Jessie Butler and Hall A technicians. During beam operations the target will be monitored and operated by APEX/Hall A collaboration shift workers. Silviu will train shift workers on target operational procedures and keep a list of target trained personnel at

https://hallaweb.jlab.org/experiment/APEX/

5.3 Who analyzes the special or unusual hazards including elevated work, chemicals, gases, fire or sparks (See ES&H Manual Chapter 3210 Appendix T1 Work Planning, Control, and Authorization Procedure)

There are no unusual hazards related to this target.

6.

6.1 Shielding

As required by the APEX experiment configuration in Hall A.

6.2 Barriers (magnetic, hearing, elevated or crane work, etc.)

No special barriers required by the target.

6.3 Interlocks

The target motion is interlocked to the FSD system. Activating the limit switches (LS) + or – will stop the target motion motor and inhibit motion in that direction respectively while motion in the opposite direction to the LS+ or LS- will be allowed. Activating the LS++ or LS-- will cut power to the motor controller and activate the motor brake. Resetting an activated LS++ or LS-- will not be possible from the Hall A Counting House and it will require a Hall access.
The target relies on a functioning FSD for the fast beam raster magnets currents.
There are gate valves (GV) on the beam line across the scattering chamber. The GV upstream of the scattering chamber is interlocked with the FSD system but the GV downstream is not. MCC has remote control of all GVs on the beam line.

6.4 Monitoring systems

The target monitoring will be done in EPICS-EDM. The only target parameters will be four temperature sensors, target position in beam, motor brake, scattering chamber vacuum, beam current and beam raster size. The signals from the target will go into an IOC in the Hall, which will route them to a monitoring and control computer in the Hall A Counting House. The target temperature sensors and scattering chamber vacuum will be implemented in an Alarm Handler. Aside from the LSs the target is instrumented with positioning switches for the production targets (graphite and tungsten, see Figure 1) and HOME position. The positioning switches will not be used for precision positioning but rather as an indication of position. Precision positioning will be done in motor steps and read back from the motor controller. We are also implementing a string potentiometer that will provide the target position independent of the motor controller. The potentiometer will provide the target position if the motor controller were to lose step counts for whatever reason, eg. power loss.

6.5 Ventilation

There is no ventilation required for this target.

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

None.

7. List of Safety Equipment:

7.1 List of Safety Equipment:

No special PPE is required. Work on the target after beam activation may require a job-specific RWP. This determination will be done by RadCon.

7.2 Special Tools:

None.

8. Associated Administrative Controls

Operational restrictions on the beam current and raster size for each target are at http://opweb.acc.jlab.org/internal/ops/ops_webpage/restrictions/ops_restrictions.html

9. Training

9.1 What are the Training Requirements (See List of Training Skills)

Minimal training will be required to operate the APEX target. The only target procedures will be to move from one position to another, check if the beam current and raster size are appropriate for the target position in beam, check the scattering chamber vacuum and monitor the target temperature sensors. It is planned that this training need not be formalized, but that a list of designated shift workers allowed to perform target operations will be maintained at https://hallaweb.jlab.org/experiment/APEX/ by Silviu Covrig Dusa based on his verification that appropriate guidance has been provided to each individual on the list.

DEVELOP THE PROCEDURE

10. Operating Guidelines

This is a room temperature target with no cooling and no other moving parts outside of its lifter. Although it is expected that the center of the tungsten foils will reach temperatures over 2000 K with beam on target it is also expected for the tungsten foils Al frames to remain below 350 K at equilibrium with only radiative thermal heating/cooling. The tungsten foils target was designed to withstand beam currents up to 120 μA rastered over an area 1.5 mm horizontally by 5 mm vertically.

11. Notification of Affected Personnel (who, how, and when include building manager, safety warden, and area coordinator)

An expert will be on call to address issues related to the target motion system during beam operations. The target motion experts are: Silviu Covrig Dusa, Sandesh Gopinath, Jessie Butler, Jack Segal.

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

1. Target installation in the Hall
2. Survey and alignment
3. Beam operations and monitoring
4. RadCon survey
5. Target dismantling and storage

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

See RSAD.

14. Special environmental control requirements:

14.1 List materials, chemicals, gasses that could impact the environment (ensure these are considered when choosing Subject Mater Experts) and explore EMP-04 Project/Activity/Experiment Environmental Review below

None.

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

None.

14.3 Abatement steps (secondary containment or special packaging requirements)

See RSAD.

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

1. Loss of power to the target monitoring computer in the Counting House: in this situation the shift worker will just have to switch to a working computer in the Counting House, if no computer will have power the shift worker will have to wait until power returns, boot up a monitoring computer, establish the link with the target IOC and restart the main target gui and the striptool charts.
2. Loss of power in the Hall: the target IOC will be on UPS and operational for several minutes after a power line loss. If the power loss happens during a target move, the operator will stop the target motion and resume operation once power is restored.
3. Loss of power to the motor breakout box: the motor breakout box will be on UPS and should be operational in the event of a power loss for several minutes. If the power is lost while the target is moving, though, then the brake will come ON. Once the power is back then the target operator will execute a HOME-ing routine: in this routing the target is moved in a direction until either LS+ or LS- is hit, and then moved a number of steps to reach the HOME position (see Figure 1).
4. Network communication loss between the target IOC in the Hall and the target monitoring computer in the Counting House: this could be an issue if it happens during a target motion procedure only. The range of motion is protected by two sets of limit switches (LS), the inner ones stop the motor motion and the outer ones cut power to its controller and put the motor brake ON. The inner LSs are connected into the motor controller, while the outer LSs are not connected to the motor controller, and so are independent of it. If a motion command is issued and the communication between the target IOC in the Hall and the monitoring computer in the Counting House gets broken before the motion is completed it is expected that only the updated position of the target on the monitoring computer will be missing, the target IOC will go through the motion sequence and complete it. Once the network communication is restored, the operator will see the updated position of the target on the monitoring computer.
5. If, for whatever reason, the LS++ or LS-- are hit the power to the target motion motor controller will be cut and the motor brake will be put ON. In this situation, an access to the Hall will be required, as we will not instrument a by-pass in the Counting House. An APEX target motion expert will to go into the Hall and assess the situation. If it will be determined that the target is safe to move the expert will execute a HOME-ing routine by bypassing the LS++ or LS-- relay.
6. Non-target fire in the Hall: sound the fire alarm, evacuate Hall A, call 911, 4444 and MCC.

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

None.

17. Inspection Schedules

This OSP serves the function of the final safety approval of the APEX target.

18. References/Associated/Relevant Documentation

These have been referenced above when mentioned.

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

During beam operations, the shift worker will be required to post a logbook entry whenever the target changes position, whenever anything unusual happens with the target and once a shift a snapshot of the target control/monitoring main gui and stripcharts into the Hall A elog.

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 1.5 – 04/11/18 – Training section moved from section 5 Authority and Responsibility to section 9 Training
Revision 1.4 – 06/20/16 – Repositioned "Scope of Work" to clarify processes
Qualifying Periodic Review – 02/19/14 – No substantive changes required
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 0.0 – 10/05/09 – Updated to reflect current laboratory operations

ISSUING AUTHORITY	FORM TECHNICAL POINT-OF-CONTACT	APPROVAL DATE	REVIEW DATE	REV.
ESH&Q Division	Harry Fanning	04/11/18	04/11/21	1.5

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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:	Jessie Butler	**Date:**	30November2018	**Task #:** If applicable	

Complete all information. Use as many sheets as necessary

Task Title:	APEX Target			**Task Location:**	Inside Hall A
Division:	Physics	**Department:**	Hall A	**Frequency of use:**	As Needed
Lead Worker:	Silviu Covrig Dusa & Jessie Butler				
Mitigation already in place: Standard Protecting Measures Work Control Documents	Associated OSP and having specific training requirements to enter Hall A (SAF103, SAF110 & SAF801C)				

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	Exposure to Radiation	L	M	2	Limited access for non-essential personnel	• RAD worker trained • Use proper PPE • Follow associated OSP	1
2	Electric Shock	M	L	2	Limited access for non-essential personnel	• Ensure septum magnet is de-energized and off prior to entering pivot area • Follow associated OSP	1
3	Exposure to Loud Noise	L	L	1	Limited access for non-essential personnel	• Wear proper hearing protection within 10ft of pivot area	N

Highest Risk Code before Mitigation:	2	**Highest Risk Code after Mitigation:**	1

Task Hazard Analysis (THA) Worksheet

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

When completed, if the analysis indicates that the Risk Code before mitigation for any steps is "medium" or higher (RC≥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.)

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Task Hazard Analysis (THA) Worksheet

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

Form Revision Summary

Periodic Review – 08/29/18 – No changes per TPOC
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	08/29/18	08/29/21	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: ENP-19-80652-OSP

Title: The APEX Target OSP in Hall A

Name	Signature	Date