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|  | **Operational Safety Procedure Form**  **(See** [**ES&H Manual Chapter 3310 Appendix T1 Operational Safety Procedure (OSP) and Temporary OSP Procedure**](http://www.jlab.org/ehs/ehsmanual/3310T1.htm) **for instructions.)** |
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| Serial Number: | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | |  | |
| (Assigned by [ESH&Q Document Control](mailto:mbailey@jlab.org?subject=Operational%20Safety%20Procedure%20Number%20Needed) x7277) | | | | | | | | | | | | | | | | |  | |
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|  | | **OSP**  X | | | | | **TOSP** | | | | | | | | **This document is written to mitigate** [**hazard issues**](http://wwwold.jlab.org/ehs/ehsmanual/Glossary.htm#HazardIssue) **that are (check all that apply):**  Unable to comply with ES&H Manual requirements as written.  New/anticipated/previously unrecognized.  Determined to have an unmitigated [Risk Code](https://www.jlab.org/ehs/ehsmanual/Glossary.htm#RCDef) of 3 or 4. | | | | | | | | | | | | | | | | |  | | |
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|  | | Issue Date: | | | |  | | | | | | | | | | | | | | Expiration Date: | | | |  | | | | | | | | | |  |
|  | | (No more than three years from Issue Date except TOSP which is three months from Issue Date) | | | | | | | | | | | | | | | | | | | | | |  |
|  | | Title: | **Operation of Polarized Target for g2p** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |  |
|  | | Location: | | | Hall A | | | | | | | | | | | | | | | | | | | | | | | | | | | | |  |
|  | | Risk classification  (See [*ESH&Q Manual Chapter 3210 Appendix T3 Risk Code Assignment*](http://www.jlab.org/ehs/ehsmanual/3210T3.htm).) | | | | | | | | | | | | | | | | | | | | | Without mitigation measures (3 or 4): | | | | | | | | 3 | | |  |
|  | | With mitigation measures in place (0, 1, or 2): | | | | | | | | 1 | | |  |
|  | | Document Owner(s): | | | | | | | Christopher Keith | | | | | | | | | | | | | | | | Date: | | 1/10/12 | | | | | | |  |
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| Supplemental Technical Validations: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Hazard Reviewed (per [ES&H Manual 2410-T1](https://www.jlab.org/ehs/ehsmanual/2410T1.htm)): | | | | | | | | | | | | | | | | | | | Subject Matter Experts Signature: | | | | | | | | | | | Date: | | | | |
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| Approval Signatures: | | | | | | | | | | | | | | Print Signature | | | | | | | | | | | | | | | | | Date: | | | |
|  | | Division Safety Officer: | | | | | | | | Javier Gomez | | | | | | | | | | | | | | | | | | |  | |  | | |  |
|  | | Department or Group Head: | | | | | | | | | | | Robert Michaels | | | | | | | | | | | | | | | |  | |  | | |  |
|  | | **Safety Warden of Area:** | | | | | | | | | Ed Folts | | | | | | | | | | | | | | | | | |  | |  | | |  |
|  | | Other Approval(s): | | | | | |  | | | | | | | | | | | | | | | | | | | | |  | |  | | |  |
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| Document History: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | Revision: | | | Reason for revision or update: | | | | | | | | | | | | | | | | | | | | | | Serial number of superseded document | | | | | | | |  |
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**Distribution:** Copies to: affected area, authors, Division Safety Officer, ESH&Q Document Control

**After expiration:** Forward original and log sheet of trained personnel to ESH&Q Document Control.

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|  | 1. **Purpose of the Procedure** | |  |
| Operation Safety Procedure for the polarized target in Hall A for g2p/gep. | |
| 1. **Scope –** include operations, people, and/or areas where procedure applies | |
| To describe the day-to-day operation of the g2p polarized target. It pertains to trained target operators working near the target. | |
| 1. **Description of the Facility: (**include floor plans and layout of a typical experiment or operation) | |
| CAD drawing and top view of the target system in Hall A. The target is on the Hall A beamline, at the pivot point between the two high resolution spectrometers.  A brief description of the target can be found here:  http://www.jlab.org/~pzhu/report/Polarized\_Proton\_Target.pdf  For more detailed information see the article published in Nucl. Instrum. And Meth. by TO Averett et al: http://www.sciencedirect.com/science/article/pii/S0168900298014314 | |
| 1. **Authority and Responsibility:** | |
|  | **4.1 Who has authority to implement/terminate** |
| Chris Keith  Dave Meekins  Josh Pierce | |
|  | **4.2 Who is responsible for key tasks** |
| Target installation and repair: JLab Target Group  Day-to-day target operation and monitoring: g2p/gep experimental collaboration https://hallaweb.jlab.org/wiki/index.php/Solid\_Polarized\_Target | |
| 1. **Who analyzes the special or unusual hazards (See** [**ES&H Manual Chapter 3210 Appendix T1 Work Planning, Control, and Authorization Procedure**](http://www.jlab.org/ehs/ehsmanual/3210T1.htm)**)** | |
| **Fall hazard**: access to the target is via the upper and lower decks. Both decks are greater than four feet above the hall floor, and a fall from either could result in injury.  **Hazard mitigation:** Handrails are used on both the upper and lower platform, as well as on the  stairs leading to them.  **Thin Window Hazard**: The scattering chamber has multiple thin vacuum windows of varying size and shape. Rupture of these windows could result in a vacuum implosion that could cause hearing damage to nearby personnel.  **Hazard Mitigation:** This hazard only exists to personnel working on the lower deck. Access to the lower deck shall locked whenever the scattering chamber is under vacuum, shall be limited to authorized personnel, will require hearing and eye protection, and appropriate signage will be in place. Thin polycarbonate window covers will be in place whenever the scattering chamber is under vacuum and access to the lower platform is required.  **Magnetic Field Hazard:** The target utilizes a superconducting magnet with a maximum field strength of 5.1 Tesla.  -- This field issufficient to pull magnetic objects through the thin vacuum windows incorporated in the scattering chamber.  -- The field can interfere with surgical implants (pacemakers, aneurism clips, etc), and magnetic storage devices (credit cards, hard drives etc).  -- Loss of magnet operation while beam is being delivered to the hall, and the target is polarized transversely would result in a significant mis-steering of the electron beam.  **Hazard Mitigation:**  -- Before the magnet is energized a sweep of the immediate area is required. The purpose of this sweep is to eliminate any loose objects that might be moved by the magnetic field. Access near the thin vacuum windows will not be permitted when the magnet is energized.  -- The area around the magnet has been posted with signs and emergency lights that indicate the presence of the field and warn wearers of medical implants of the potential hazard. The 5 gauss contour will be delimited by a chained barrier. Interlocked gates are positioned at all stairway entrances to both the upper and lower platforms.  -- A gauss probe will be located near the magnet and will activate flashing warning signs indicating that the magnet is energized. The probe shall also be interlocked with the FSD system in Hall A to shut down the beam in the event of sudden loss of field.  -- The target shall be manned by a trained target operator, either in the Hall A counting house or in Hall A proper, whenever the magnet is energized.  **Magnet Power Supply Hazard**: A 125 amp, 10 V DC power supply is used to energize the superconducting magnet. During a quench, higher voltages may develop at the magnet leads.  **Hazard Mitigation**: All exposed leads shall be covered by appropriate insulating covers.  **Microwave Hazard:** The target material is polarized by exposure to 140 Hz microwave irradiation, with a power level of a few Watts.  -- The frequency range is far beyond the current region of microwave hazards defined by existing standards. In this frequency range minor, localized heating effects are assumed to be the only hazard encountered.  -- The microwave source is powered by a high voltage supply circuit.  **Hazard Mitigation:**  -- The microwave radiation is completely contained within appropriately-sized metal waveguides.  -- There are no exposed high voltage leads on the microwave system. The high voltage supply circuit has a protective interlock system which prevents accidental contact with high voltage. The interface box between the microwave source and the power supply is sealed and has an interlock system such that if opened the high voltage is tripped off.  -- Water cooling is used to maintain an appropriate temperature of the microwave source. The power supply is interlocked on both temperature (40 C) and water flow. | |
| 1. **Personal and environmental hazard controls including:** | |
|  | **6.1 Shielding** |
| n.a. | |
|  | **6.2 Interlocks** |
| Magnetic field is interlocked to FSD.  Microwave source is interlocked on both temperature and water cooling flow. | |
|  | * 1. **Other** |
| Protective covers, hearing protection, and safety glasses for thin vacuum windows when working on lower platform.  Access to upper and lower target platforms interlocked and restricted to trained target personnel and ARMS.  Radiation conditions on upper platform may require RAD II training. To be determined.  Appropriate signage will be in place for all Hazards listed in Section 5. | |
| 1. **Monitoring systems** | |
| Magnetic Hall probe near superconducting magnet. | |
| 1. **Ventilation** | |
| n.a. | |
| 1. **List of safety equipment (i.e: personal protective equipment or special tools)** | |
| In addition to items listed in Section 6.3, cryogenic gloves and full face shields will be on hand. | |
| 1. **Associated administrative procedures** | |
| The target will be attended by a trained operator or expert, either in the Hall A counting house or in Hall A, whenever the superconducting magnet is energized. | |
| 1. **Operating guidelines** | |
| A list of operational procedures can be found on the g2p target wiki:  https://hallaweb.jlab.org/wiki/index.php/Solid\_Polarized\_Target | |
| 1. **Notification of Affected Personnel (How and Who)** | |
| A list of qualified target operators will be maintained by the g2p collaboration. A list of and contact info for Target Experts (e.g. Chris Keith, Dave Meekins, Josh Pierce, Don Crabb, and James Maxwell) will be on display in the Hall C counting house. The JLab Target Group will provide an expert to act as liaison for day-to-day operations. | |
| 1. **List of steps required to execute the procedure from start to finish.** | |
| Evacuate scattering chamber.  Cool magnet to 4.2 K.  Cool refrigerator to 1 K.  Insert target material.  Energize magnet.  Perform thermal equilibrium calibration of target polarization.  Energize microwaves to dynamically polarize target. | |
| 1. **Back out procedures, i.e., steps necessary to restore the equipment/area to a safe level.** | |
| De-energize magnet.  De-energize microwaves. | |
| 1. **Special environmental control requirements:** | |
| n.a. | |
| 1. **Environmental Impacts (See** [**EMP-04 Project/Activity/Experiment Environmental Review**](https://jlabdoc.jlab.org/docushare/dsweb/View/Collection-1349) | |
| n.a. | |
| 1. **Abatement Steps – Secondary Containment, or Special Packaging requirements** | |
| n.a. | |
| 1. **Training requirements** | |
| Specialized training will be required for Target Operators. This includes required online reading, passage of an online quiz, and a practicum administered by a Target Expert.  https://hallaweb.jlab.org/wiki/index.php/Solid\_Polarized\_Target#Training\_Materials | |
| 1. **Unusual/Emergency procedures e.g., Injury, Fire, Loss of power** | |
| n.a. | |
| 1. **Instrument calibration requirements, e.g., safety system/device recertification, RF probe calibration** | |
| n.a. | |
| 1. **Inspection schedules** | |
| n.a. | |
| 1. **References/Associated Documentation** | |
| https://hallaweb.jlab.org/wiki/index.php/Solid\_Polarized\_Target | |
| 1. **List of Records Generated (Include Location / Review and Approved procedure)** | |
| [Design Criteria for Polarized Target Vacuum Dewar, Oxford Instruments, 1991](https://poltar.jlab.org/drupal/filebrowser/download/648)  [Relief Analysis of Hall C Polarized Target](https://poltar.jlab.org/drupal/filebrowser/download/648)  [Relief Analysis of Hall B Polarized Target](https://poltar.jlab.org/drupal/filebrowser/download/650)  [Hall B Magnet Refit Calculations (under review)](http://www.example.com) | |
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**Authorized/Trained Individuals:**

| **Print Name/Signature** | **Date** |
| --- | --- |
| Christopher D. Keith (gatekeeper) |  |
| Josh Pierce (gatekeeper) |  |
| Dave Meekins (gatekeeper) |  |
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| **Form Revision Summary**  **Revision 1 – 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** | **EXPIRATION DATE** | **REV.** |  | |  | ESH&Q Division | [Harry Fanning](mailto:fanning@jlab.org?subject=ESH%20Manual%203310%20Appendix%20T1%20Operational%20Safety%20Procedure%20Form) | 12/01/11 | 12/01/14 | 1 |  |   ***This document is controlled as an on line file. It may be printed but the print copy is not a controlled document. It is the user’s responsibility to ensure that the document is the same revision as the current on line file. This copy was printed on 1/13/2012.*** |