Jefferson Lab
Thomas Jefferson National Accelerator Facility

TITLE: **ES&H Manual**

DOCUMENT ID: **3310 Appendix T2**
Operational Safety Procedure Form

Click for OSP/TOSP Instructions

Serial Number: [Enter Serial Number] PHY-11-034-TOSP / PHY-11-010-TOSP
(Assigned by ESH&Q Document Control x7277)

[ ] **OSP** [X] **TOSP**

***Attach the Task Hazard Analysis (THA) related to this procedure**

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Issue Date:	11/22/11	**Expiration Date:**	2/22/12
(No more than three years from Issue Date except TOSP which is three months from issue date)			
Title:	Commissioning beamline, detector and DAQ systems with straight-through beam for g2p		
Location:	Hall A		
Risk classification (See *ESH&Q Manual Chapter 3210 Appendix T3 Risk Code Assignment*.)	**Without mitigation measures (3 or 4):**	2	
	With mitigation measures in place (0, 1, or 2):	0	
Document Owner(s):	Jian-ping Chen	**Date:**	11/22/2011

Supplemental Technical Validations:

Hazard Reviewed (per ES&H Manual 2410-T1):	Subject Matter Experts Signature:	Date:
Operation	Arne Freyberger *(signature)*	11/29/2011
Radiation	Keith Welch *(signature)*	11/30/11
General	Bert Manzlak *(signature: Bert Manzlak)*	11/29/11

Approval Signatures:	Print	Signature	Date:
Division Safety Officer:	Javier Gomez	*(signature)*	12/5/11
Department or Group Head:	Robert Michaels	*(signature: Robert Michaels)*	11/29/11
Safety Warden of Area:	Ed Folts	Jack Segal (Alternate)	11/29/11
Other Approval(s):	Tim Michalski	*(signature: Timothy J Michalski)*	11/29/11

Document History:

Revision:	Reason for revision or update:	Serial number of superseded document
[Rev]	[Enter Reason]	[Previous Rev]

Distribution: Copies to: affected area, authors, Division Safety Officer, ESH&Q Document Control
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1. Purpose of the Procedure

To commissioning and check out available new beam line components, detector and data acquisition systems with beam.

2. Scope – include operations, people, and/or areas where procedure applies

Beamline commissioning including the new BCM, Tungsten Calorimeter, BPM, super-harp, slow raster, readout and data acquisition systems, and Moller polarimeter.
Detector check out including HRS and 3rd arm detectors and data acquisition systems.
Operations will be executed jointly by the accelerator operation group/CASA (Yves Roblin responsible), engineering groups and users.
The procedure will be taking place in Hall A.
(Note: Polarized target, chicane and local beam dump will not be commissioned.)

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

No polarized target.
A 64" long pipe will replace the target scattering chamber to connect the upstream beam line to the downstream beam line. It is a 2.5" PVC pipe with ¼" thickness. It will be filled with slightly over-pressured helium gas to minimize material in the beam path. A 0.010" thick 12C foil will be inserted for the 2nd part of the commissioning (detector/DAQ checkout).
The beamline chicane magnets will be in straight-through position and magnets will be off.
Hall A beam line components and detectors will be checked out without beam first before this procedure. The beamline commissioning plan is attached (Eric Forman's procedure). The detector/DAQ check out plan is attached (Karl Slifer's run plan).

4. Authority and Responsibility:

4.1 Who has authority to implement/terminate

Arne Freyberger, Robert Michaels, Jian-ping Chen.

4.2 Who is responsible for key tasks

Tim Michalski is responsible for the beam line components be ready.
Yves Roblin is responsible for the beam line commissioning.
Jian-ping Chen/Karl Slifer are responsible for the detector/DAQ checkout.
A run coordinator will coordinate the commissioning activities with guidance from the above people.

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

The radiation hazard is analyzed by Keith Welch and as an attachment to this document will include a Radiation Safety Assessment Document (RSAD)
The safety of each sub-systems is analyzed by system owners and OSPs and procedures are attached (Septum magnets and power supply OSP, Tungsten Calorimeter test procedure).

6. Personal and environmental hazard controls including:

6.1 Shielding

N/A

6.2 Interlocks

PSS interlocks, including target and dump ion chambers, septum power supplies and a special one on the pressure gauge for the PVC beam pipe will be used.

6.3 Other

N/A

7. Monitoring systems

Beam viewer before the pivot, dump viewer, BPM (with SEE if the new readout not ready) and BCM.

8. Ventilation

Helium gas will be vented through the standard vent line.

9. List of safety equipment (i.e: personal protective equipment or special tools)

Standard Hall A experimental safety procedure applies

10. Associated administrative procedures

See all attached procedures (as discussed in 2 and 5)

11. Operating guidelines

Have all sub-systems checkout before beam. Following the beamline commissioning plan for the 1st part. Following the detector/DAQ checkout plan for the 2nd part.

12. Notification of Affected Personnel (How and Who)

A run coordinator will be coordinating the commissioning activities and notify all affected personnel (PD, run coordinators of other two halls, spokespersons, Hall A leader).

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13. List of steps required to execute the procedure from start to finish.

See attached beamline commissioning procedure and the detector/DAQ checkout plan.

14. Back out procedures, i.e., steps necessary to restore the equipment/area to a safe level.

The PVC pipe will be de-installed after radiation cool-down and RADCON check.

15. Special environmental control requirements:

16. Environmental Impacts (See EMP-04 Project/Activity/Experiment Environmental Review

N/A

17. Abatement Steps – Secondary Containment, or Special Packaging requirements

N/A

18. Training requirements

All personnel working in Hall A need to satisfy the standard training requirements (RAD work I, Hall A safety walk through, ODH).

19. Unusual/Emergency procedures e.g., Injury, Fire, Loss of power

In emergency, stop beam operation, notify MCC operator, notify run coordinator. Follow standard emergency procedure (call 911 if fire).

20. Instrument calibration requirements, e.g., safety system/device recertification, RF probe calibration

All beam line and detector/DAQ components will be checked out before the beam commissioning procedure.

21. Inspection schedules

All components will be inspected before the procedure.

22. References/Associated Documentation

See attached procedures and Hall A OSP.

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

All records will be kept in JLab archive. Data will be recorded on disk/tape. Other commissioning information in Hall A electronic log (HALog).

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Authorized/Trained Individuals

Print Name/Signature	Date
All shift works should read and sign this documents:	

ISSUING AUTHORITY	APPENDIX AUTHOR	APPROVAL DATE	EFFECTIVE DATE	EXPIRATION DATE	REV.	Page 5 of 5
ESH&Q Division	Harry Fanning	10/05/09	01/01/10	10/05012	0	

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3210Appendix T2
Task Hazard Analysis (THA) Worksheet

Click For Word Doc

Author:	Jian-ping Chen				
Date:	11/23/11	**Task #:** If applicable		**Frequency of use:**	
Complete all information. Use as many sheets as necessary					
Task Location:	Hall A	**Task Title:**	G2p beam commissioning		
Division:	Physics	**Department:**	Hall A		
Lead Worker:	Jian-ping Chen				
Mitigation already in place: Standard Protecting Measures Work Control Documents	TOSP for the g2p beam commissioning				

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
	Beam delivery/Hit PVC pipe	L	M	2	Ion chamber and pressure gauge Interlock to FSD		0
	Highest Risk Code before Mitigation:		2			**Highest Risk Code after Mitigation:**	0

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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3210Appendix T2
Task Hazard Analysis (THA) Worksheet

ISSUING AUTHORITY	FORM TECHNICAL POINT-OF-CONTACT	APPROVAL DATE	EFFECTIVE DATE	EXPIRATION DATE	REV.
ESH&Q Division	Harry Fanning	10/05/09	01/01/09	10/05/12	0

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Initial beam delivery into Hall A.

Establishing beam to dump, estimate of 3 hours

Commissioning low current BPMS, one shift (8 hours)

Reference the BPM offsets relative to the HARPS (1 hour)

Set the match from pre-determined values obtained at 1C05. (2 hours)

Commission the rasters to produce the required beam size (3 hours)

1) Conditions are that :
    a. Compton chicane in OFF position (we go straight-thru)
    b. Current limited to 2 microamps CW. Initial spin up in tune
    c. Measurements for matching to 1C has been done with hall A dumplette in (quad 1C05/HARP 1C05)
    d. FZ1 and FZ2 magnets OFF and degaussed. Current Interlocks disabled.
    e. Target empty, target field ZERO
    f. Silver calorimeter retracted

ESTABLISHING BEAM TO HALLA DUMP

2) Establish beam in tune mode until visible on ITV1H05
    a. Steer front of beamline to arrive centered on that viewer. (20 minutes)
    b. Take a HARP scans at IHA1H04 , IHA1H05A and IHA1H05B (10 minutes)
    c. From these scans, establish a 3 point fit for centroid in X and Y (10 minutes)
    d. Adjusting correctors MBD1H04V/MBD1H04H as needed, zero the incoming angles in order to (10 minutes) have all three harps give the same centroid within errors. You can estimate what corrector strengths are needed as follows:

    from the fit of centroid versus HARP S position, take the slope which gives the angle in radians. (it should be in the few microradians range)
    (I will put the S positions of the HARPS in there perhaps and make a table to show how it should be done, even thought I likely will be in control room to do it)
    The corrector kick will be 7.528E6 * angle(radians)= G.cm (for 2.257 GeV/c beam). For the Y

plane, flip the angle sign. (we want to apply opposite angle with corrector). Do not flip sign for X plane because the X bpm position already has an extra sign in it.

e. Iterate c,d,e as needed. (assume 3 iterations)

3) Establish DUMP location (30 minutes)
   a. Go to CW. Slowly raise current up to the maximum limit of 2 microamps (is it?)
   b. Check to see if it is visible on the dump viewer. If not, consult move to next step.
   c. Check to see if ion chambers are sensitive to it by moving the beam horizontally with MBD1H04H and recording the readings of the left and right ion chambers.
   d. Set MBD1H04H to put the beam where the readings are minimized and roughly the same on both ion chambers

END OF PROCEDURE TO ESTABLISH BEAM AT DUMP

DIAGNOSTICS COMMISSIONING (12 hours)

4) Commission the low current BPMS
   a. Follow J. Musson Test Plan/ATLIS (about one shift= 8hours)
5) Adjust the BPM offsets relative to the HARPS
   a. Check IPM1H05A and IPM1H05B readings. If not zero, adjust the SOFF offset to make them zero (5 minutes)
6) Commission the SILVER CALORIMETER (test plan from Mahmoud Ahmad)

RASTERS COMMISSIONING

Prerequisite: The Moller quadrupoles are powered. They are part of the Optics and should always be on.

Commission SLOW raster settings

a. With beam established to dump as per the procedure above, go in tune mode.
b. Measure beam size at harp IHA1H05A and IHA1H05B.
c. Turn on SLOW Raster X and set at BL=4kG.cm (controls are in HALLA , not OPS)
d. Take a harp SCAN at IHA1H05A and IHA1H05B, extrapolate size at target.
e. Adjust Raster X until its 2cm
f. Turn on SLOW Raster Y and set at BL=5.9 kG
g. Take a harp SCAN at IHA1H05A and IHA1H05B, extrapolate size at target
h. Adjust Raster Y until its 2cm

Commission FAST raster settings

a. Turn on FAST raster (from OPS controls) and select a 4x4 mm size.
b. Take a HARP scan at IHA1H05A and IHA1H05B.
c. Extrapolate sizes to target, adjust raster until desired size is reached

Note that instead of using the Harps, one can use the hall A data acquisition and spot++ as they usually do. It will depend whether or not we can put beam on a target to do that.

November 30, 2011

E08-027/E08-007 Commissioning Runplan

Task	Estimated date	Shifts	Activity
I	Dec. 12-14	9	Initial Delivery of Beam to Hall A. (Testplan of Yves Roblin). -Establish beam to dump -Commission BPMs -BPM/Harp calibration -Match to values at 1C05 -Slow/Fast Raster Commissioning
II	Dec. 15	1	Moller Commissioning.
III	Dec. 15-18	13	HRS/Detector Checkout
IV	Dec. 19	3	Carbon Inelastic Spectrum & False Asymmetry
V	Dec. 20	2	Optics Commissioning

Goal

Commission the beamline diagnostics (BCM, BPM, tungsten calorimeter, super-harp slow and fast rasters, Moller polarimeter), the septa magnets, the spectrometer detector stack, the 3^{rd} arm detector and all associated control/DAQ systems for E08-027 and E08-007. The polarized target, local dump and FZ chicane magnets will not be commissioned at this time.

I : Initial Delivery (9 shifts)

The initial delivery of beam to Hall A will be directed by Accelerator Ops. with assistance from the Hall A shift crew. This includes delivery of beam to the dump, commissioning of the BPMs, calibration with the Harp and power up of the rasters. Full details are provided in the test plan of Y. Roblin, and summarized in the table above.

Start up configuration

Three pass beam, E0 =1.721 GeV, polarized, no raster.

Current: Initially pulsed up to 8μA pulsed, then up to 5 μA CW.

Spectrometers at 12.5°, P_0 = 1.720 MeV (carbon elastic).

Carbon Target: OUT.

Sieve slits : OUT.

Septa settings: 5.66°

Compton chicane: OFF (straigt-thru).

Polarized Target chicane : OFF and degaussed. (straigt-thru).

Tungsten Calorimeter : Retracted.

Collab responsibilities:

Request slow raster radius : 1 cm. Fast raster : 1 x 1 mm^2.

Checkout Happex BPM crate. (**Resp:** A. Camsonne, P. Zhu)

Slow energy lock. Fast feedback (possible?). Happex asymmetry feedback.

Confirm final beam energy for delivery.

Shift will need to run spot++. Start Detector checkout parasitically using scattering from ^{4}He flowing in the target chamber.

II : Moller Commissioning (1 shift)

Test plan of Sasha Glamazdin for Moller measurement at three-pass beam.

1. Moller settings. HV adjusment - 2 hours
2. The first Moller quad scan - 1 hour
3. The third Moller quad scan - 1 hour
4. Moller target scan - 30 min
5. New DAQ dead time test - 2 hours
6. Restore the beam parameters - 30 min

Hall A Shift Responsibilities:

Check consistency with other hall's Moller measurements.

Determine absolute beam helicity signs in Hall A. Large asymmetry run.

Record beam half-wave plate IN/OUT changes during data taking.

Verify that Wien filter angle and beam half-wave plate status are in EPICS data stream.

III: HRS/Detector Checkout

Some of these tasks can be performed parasitically to previous tests. There should be some usuable rate coming from the helium in the PVC pipe.
Hall A Shift Responsibilities:

1. Verify that FZ1 and FZ2 chicane magnets are configured for no deflection ('straight-thru' mode).
2. Remove HRS vacuum window covers? (necessary/possible with septa?)
3. Insert 10 mil carbon foil target. Responsible person? Procedure? Masking needed? Any survey or simpler method of location? 2 hours.
4. Test Quad and Septa cycling. 3 hours.
5. Set momentum to carbon elastic setting. $P_0 = 1720$ MeV.
6. Request CW beam at 1 μA. No raster.
7. Adjust prescalers to obtain deadtime less than 10%. Verify DAQ rate is greate than xx kHz.
8. Continuos online replay. Take 2 M good events per run. but atleast 15 mins for each run. No run longer than 1 hour.
9. Large Charge Asymmetry runs. 1 shift.
10. High rate DAQ tests. 1 shift.

11. Septum current scan. 1 shift.

12. Trigger Checkout. (**Resp:** Alex. Vince. Ryan).

    (a) Check deadtime scalers.
    (b) Timing and PID thresholds.
    (c) Verify that all scalers are incrementing.
    (d) Check for doule pulsing.

13. 3rd Arm checkout(**Resp:** Kalyan. Chao. Jixie). Prior to beam perform Hall probe measurement of magnetic fields at PMT location. and Mu-metal shield optimization.

    (a) Removable shield in place?
    (b) HV gain adjustment.
    (c) Threshold adjustment.
    (d) Trigger.

14. HRS Detectors (**Resp:** Alex. Vince. Melissa. Ryan) : 6 shifts.

    (a) On-line scripts operational. Beginning-of-run script and End-of-run script. Automatic entry to Halog. Mantain the official version of g2p analyzer. Software setup. update and backup files. Online instructions. Establish standard spectrums for online shift workers. Standard online data quality cuts and keep track the number of good events. (**Resp:** Toby)
    (b) Set Raw data file size limit.
    (c) Online data disk spaces
    (d) Scripts for copying raw data file to silo and verify that no recorded data get lost. (**Resp:** Toby).
    (e) Survey of detector positions? Offsets updated in analyzer.
    (f) DC
        i. Gas shed checkout procedure (**Resp:** Jack?)
        ii. Test drift chamber HV controls.
        iii. Verify voltages (anything else?) are recorded in Epics data stream.
        iv. Take long run. Identify any hot or dead wires. Check against replay database. Update if necessary.
    (g) Gas Cerenkov (**Resp:** Melissa)
        i. Gas shed checkout procedure (**Resp:** Jack?)
        ii. PMT HV gain-matched.
        iii. All ADC and TDC channels have signal?
        iv. Compare NPE to old short tank results.
    (h) Pion rejector / Calorimeter (**Resp:** Melissa. Ryan).
        i. PMT HV gain-matched.
        ii. All ADC and TDC channels have signal?
    (i) Scintillator
        i. Beam RF timing signal readout.
        ii. Timing offset of S1 S2M.
        iii. Initial time-of-flight corrections.
    (j) Scalers working and Scaler display working in the counting house (**Resp:** Ryan).
    (k) Online dead time calculation make sense from the scalers. Minimize DAQ readout time. reduce deadtime.
    (l) EPICS variables into the data stream.
    (m) What other conditions need to be satisfied before moving into production?

Carbon Inelastic Spectrum and False Asymmetry

(Resp: Karl. ...)

1. Acceptance scan. Sequentially shift momentum setting by factor 1/3. 1 shift.
2. Take full spectrum of carbon. covering the elastic and accessible inelastic region. See Table 1 for kinematic settings. Take 2M good events per setting. with a minimum time spent on each point of one hour.

E_0	P_0	W	Minimum Time (hr)
1.72	1.556	1.07	1
1.72	1.431	1.17	1
1.72	1.317	1.26	1
1.72	1.211	1.34	1
1.72	1.115	1.40	1
1.72	1.025	1.46	1
1.72	0.943	1.51	1
1.72	0.868	1.56	1
1.72	0.798	1.60	1
1.72	0.735	1.64	1
1.72	0.676	1.67	1
1.72	0.622	1.70	1
1.72	0.572	1.73	1
1.72	0.526	1.75	1
1.72	0.484	1.77	1
1.72	0.445	1.79	1
1.72	0.410	1.81	1

Table 1: Carbon Inelastic Scan.

IV: Optics Commissioning : 2 shifts

(Resp: Jixie Zhang. Min. Chao). This will be a limited commissioning of the spectrometer and septa optics. To be performed only if time available.

1. Sieve slit surveyed. in position. Reproducible. 1 shifts.
2. Beam cross scan (OPs will steer with correctors and quads) 1 shift.
3. Verify initial optics database. iterate.

Radiological Safety Analysis Document

This Radiological Safety Analysis Document (RSAD) identifies the radiation budget for the experiment, the verification process for the radiation budget, and controls with regard to production, movement, or import of radioactive materials.

I. Description

This document covers the radiological safety aspects of pre-run commissioning of beamline, diagnostics, dump and detector systems in Hall A for the E08-027 (g2p) and E08-007 experiments using low-current beam for the period from approximately December 12 to December 22, 2011. The experimental target, local dump and target chicane magnet systems will not be commissioned. No polarized target will be installed. A length of PVC tubing will replace the polarized target system. Beam will go only to the straight-ahead high-power dump in Hall A.

A full description of the test setup, beam parameters and restrictions can be found in TOSP No. PHY-11-034-TOSP. Operations beyond the scope of that TOSP must be approved by the RadCon department head. Part of the commissioning will involve use of a thin ^{12}C foil (0.010"). Nominal beam conditions will be 1.7 GeV and ~1 μA. Commissioning of the dump viewer may require several μA or more in order to see the beam spot (up to 10 μA for this purpose is approved under this RSAD).

II. Summary and Conclusions

The commissioning run is not expected to contribute any significant dose at the Jefferson Lab boundary given the low beam power, lack of target, and duration of run. No manual manipulations of the carbon foil target are to be made without RadCon approval. Site boundary doses will be monitored by RadCon to ensure that the site boundary goal is not exceeded. The experiment may cause Radiation Areas in the Hall. High Radiation Areas are not expected, but could occur in the event of poor beam quality or beam loss issues. **Adherence to this RSAD is vital.**

III. Calculations of Radiation Dose at Site Boundary

The radiation budget for a given experiment is the amount of radiation that is expected at site boundary as a result of a given set of experimental conditions. This budget may be specified in terms of mrem at site boundary or as a percentage of the Jefferson Lab design goal for dose to the public, which is 10 mrem per year. The Jefferson Lab design goal is 10% of the DOE annual dose limit to the public, and cannot be exceeded without prior written consent from the Radiation Control Department Head and the Director of Jefferson Lab. Site boundary doses were not formally calculated for this commissioning run. Historical data and scaling to present conditions suggests boundary radiation levels will be negligible. This expectation will be verified during the run by use of the installed active boundary monitors. Any unusual radiation levels will be investigated immediately by RadCon and appropriate actions taken to mitigate the conditions.

IV. Radiation Hazards

The following controls shall be used to prevent the unnecessary exposure of personnel and to comply with Federal, State, and local regulations, as well as with Jefferson Lab and the Experimenter's home institution policies.

A. From Beam in the Hall

When the Hall status is Beam Permit, there are potentially lethal conditions present. Therefore, prior to going to Beam Permit, several actions will occur. Announcements will be made over the intercom system notifying personnel of a change in status from Restricted Access (free access to the Hall is allowed, with appropriate dosimetry and training) to Sweep Mode. All magnetic locks on exit doors will be activated. Persons trained to sweep the area will enter by keyed access (Controlled Access) and search in all areas of the Hall to check for personnel.

After the sweep, another announcement will be made, indicating a change to Power Permit, followed by Beam Permit. The Run-Safe boxes will indicate "OPERATIONAL" and "UNSAFE". IF YOU ARE IN THE HALL AT ANY TIME THAT THE RUN-SAFE BOXES INDICATE "UNSAFE", IMMEDIATELY PRESS THE "PUSH TO SAFE" BUTTON ON THE BOX.

Controlled Area Radiation Monitors (CARMs) are located in strategic areas around the Hall and the Counting House to ensure that unsafe conditions do not occur in occupiable areas. This experiment may create regions of increased radiation outside the hall in areas not normally controlled for radiological purposes. The RadCon Department will monitor the CARMs and make surveys as necessary to assess the impact of the experiment on radiation levels around the hall.

B. From Activation of Target and Beamline Components and Other Materials in the Hall

1. **The Radiation Control Department shall be consulted for all movement of used targets, collimators, and shields.** The Radiation Control Department will assess the radiation exposure conditions and will implement controls as necessary based on the radiological hazards.

2. **There shall be no local manipulation of activated target configurations without direct supervision by the Radiation Control Department.** Remote movement of target configurations is permitted using appropriately reviewed and approved methods.

3. **No work is to be performed on beamline components, which could result in dispersal of radioactive material** (e.g., drilling, cutting, welding, etc.). Such activities must be conducted only with specific permission and control by the Radiation Control Department.

4. **The PVC beamline insert and associated downstream beamline are expected to become activated.** There is some potential for local surface contamination on this section of the beamline. **No work on this portion of the beamline is to be conducted without RCD review.**

5. **A radiation area may develop near the target/beamline area.** Less likely, but possible high radiation areas could occur in this area and near the beam dump tunnel entrance. If these conditions occur, work in these areas will be governed by specific RWPs.

NOTE:

Work planning for all radiological work shall be coordinated through the hall work coordinator (E. Folts) using the ATLis work planning tool.

6. This experiment is not expected to produce levels of airborne radioactivity high enough to significantly impact environmental effluent standards. However, airborne radioactivity concentration in the hall is measured continuously. **If airborne radioactivity concentration as monitored by the AMS-4 air monitor in the experimental hall exceeds an average of 1.0E-6 μCi/cc for a period of greater than 5 consecutive days,** the Radiation Control Department (RCD) will investigate to

determine if the experimental conditions are accurate, and to assess what actions may reduce the airborne radioactivity levels to ensure that Jefferson Lab dose to the public from release of airborne radioactivity limits are not exceeded.

C. Other Sources

1. **All radioactive materials brought to Jefferson Lab shall be identified to the Radiation Control Department.** These materials include, but are not limited to radioactive check sources (of any activity, exempt or nonexempt), previously used targets or radioactive beamline components, previously used shielding or collimators, or He-3 containers. The RCD inventories and tracks all radioactive materials onsite. The Radiation Control Department may survey the experimental setup before experiments begin as a baseline for future measurements if significant residual activity levels are present.

2. **Tanks or cylinders of He-3 containing more than 10 mCi of tritium (H-3) shall not be stored or used in an experimental hall without the express, written permission of the RadCon manager. Any containers of He-3 brought on site shall be assessed for the tritium content before use.** Additionally, He-3 containers should not be stored in the experimental hall when not in use.

V. Incremental Shielding or Other Measures to be Taken to Reduce Radiation Hazards

No additional shielding is planned for this experiment. It is up to Physics Division management to consider the potential dose from this experiment and its impact on the annual dose budget.

The RCD Head will notify the Hall Leader and Physics Division Safety Officer of any identified trends which might impact access to the hall or create conditions requiring broad changes to radiological working standards (i.e. General Access RWP revision). The RCD head will recommend engineered or other controls considered necessary to prevent significant degradation of the radiological conditions in the hall.

VI. Operations Procedures

1. **All experimenters must comply with experiment-specific administrative controls.** These controls begin with the measures outlined in the experiment's Conduct of Operations Document, and also include, but are not limited to, Radiation Work Permits, Temporary Operational Safety Procedures, and Operational Safety Procedures, or any verbal instructions from the Radiation Control Department. A general access RWP governing access to the Halls and the accelerator enclosure must be read and followed by all participants in the experiment. This RWP can be read and electronically signed online at:
   http://www.jlab.org/accel/RadCon/pdf_forms/Gen%20Acc%20RWP.pdf

2. Any individual with a need to handle radioactive material at Jefferson Lab shall first complete Radiation Worker (RW-I) training.

3. **There shall be adequate communication between the experimenter(s) and the Accelerator Crew Chief and/or Program Deputy** to ensure that all power restrictions on the target are well known. Exceeding these power restrictions may lead to excessive and unnecessary contamination, activation, and personnel exposure.

4. **No beamline component may be altered** outside the scope of this RSAD without formal Radiation Control Department review. Alteration of these components (including the exit beamline itself) may result in increased radiation production from the Hall and a resultant increase in site boundary dose.

5. **Any requested changes outside of the experimental parameters submitted for radiation safety assessment (i.e., current, energy, target material, target thickness, run time)** for this experiment shall require a formal review by the Radiation Control Department, and a new revision to the RSAD.

VII. Decommissioning and Decontamination of Radioactive Components

Experimenters shall retain all targets and experimental equipment brought to Jefferson Lab for temporary use during the experiment. After sufficient decay of the radioactive target configurations, they shall be delivered to the experimenter's home institution for final disposition. All transportation shall be done in accordance with United States Department of Transportation Regulations (Title 49, Code of Federal Regulations) or International Civil Aviation Organization (ICAO) regulations. In the event that the experimenter's home institution cannot accept the radioactive material due to licensing requirements, the experimenter shall arrange for appropriate funds transfers for disposal of the material. Jefferson Lab cannot store indefinitely any radioactive targets or experimental equipment.

The Radiation Control Department may be reached at any time through the Accelerator Crew Chief (269-7045) or directly by calling the RadCon Cell Phone (876-1743). On Weekends, Swing Shift, and Owl Shift, requests for RadCon support should be made through the Crew Chief. This will ensure that there is prompt response with no duplication of effort.

Approvals:

[signature] 12/2/2011

Radiation Control Department Head   Date