Jefferson Lab
Thomas Jefferson National Accelerator Facility

Operational Safety Procedure Review and Approval Form # 81812
(See ES&H Manual Chapter 3310 Appendix T1 Operational Safety Procedure (OSP) and Temporary OSP Procedure for Instructions)

Type:	**TOSP** Click for OSP/TOSP Procedure Form Click for LOSP Procedure Form
Serial Number:	**ENP-19-81812-TOSP**
Issue Date:	**1/24/2019**
Expiration Date:	**3/24/2019**
Title:	**SciFi motion mechanism and controls**
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) **Extension box downstream of the scattering chamber**

Risk Classification: (See ES&H Manual Chapter 3210 Appendix T3 Risk Code Assignment)	Without mitigation measures (3 or 4):	**2**
	With mitigation measures in place (N, 1, or 2):	**1**

Reason:	This document is written to mitigate hazard issues that are : **Not Applicable**
Owning Organization:	**PHALLA**
Document Owner(s):	**Wojtsekhowski, Bogdan (bogdanw@jlab.org)** Primary

Supplemental Technical Validations ▣

Radiological Controlled Area   *(David Hamlette, Keith Welch)*

Other Hazards:
data quality reduction   *(Bogdan Wojtsekhowski)*

Document History ▣

Revision ▣	Reason for revision or update ▣	Serial number of superseded document ▣

Comments for reviewers/approvers: ▣

Attachments ▣

Procedure: **SciFi_Operation_WriteUp.pdf**
THA: **THA_SciFi.pdf**

	Additional Files:

Review Signatures	
Additional Authorization : Physics ES&H Liaison	**Signed** on 1/22/2019 12:34:58 PM by Bert Manzlak (manzlak@jlab.org) .
Person : Subject Matter Expert : data quality reduction	**Signed** on 1/22/2019 11:35:06 AM by Bogdan Wojtsekhowski (bogdanw@jlab.org) .
Subject Matter Expert : Radiation - Ionizing->Radiological Controlled Area	**Signed** on 1/23/2019 9:58:45 AM by Keith Welch (welch@jlab.org) .

Approval Signatures	
Division Safety Officer : PHALLA	**Signed** on 1/23/2019 10:39:22 AM by Ed Folts (folts@jlab.org) .
Org Manager : PHALLA	**Signed** on 1/24/2019 10:15:08 AM by Cynthia (Thia) Keppel (keppel@jlab.org) .
Safety Warden : Experimental Hall A - A100	**Signed** on 1/24/2019 11:04:39 AM by Jessie Butler (jbutler@jlab.org) .

Operation of SciFi Detector Controls

Andrew Moyer

January 19, 2019

Introduction

The following is a brief description of operating the motors that position the SciFi detectors. These detectors will be installed and used for the APEX experiment, starting in January and ending around March 10th.

Task hazard

Placing of the SciFi detector in the HRS aperture during the sieve slit optics data taking or the production data taking would lead to data quality reduction due to scattering of the particles in the SciFi detector material. To avoid this problem, the location of the SciFi must be at "home" position during the regimes above (sieve slit optics and production). Mitigation is achieved by limiting the operating personnel and coordination of the SciFi operation with the experiment run coordinator.

Personnel

Positioning of the detectors will be done only by Bogdan Wojtsekhowski (JLab), John Williamson (University of Glasgow), and Ed Brash and Andrew Moyer (Christopher Newport University.)

Hardware and Set Up

There will be two units installed on the left and right sides of the compartment between the scattering chamber and the blue (septum) magnet (see the figure below). One of these units is shown below and the important components are outlined.
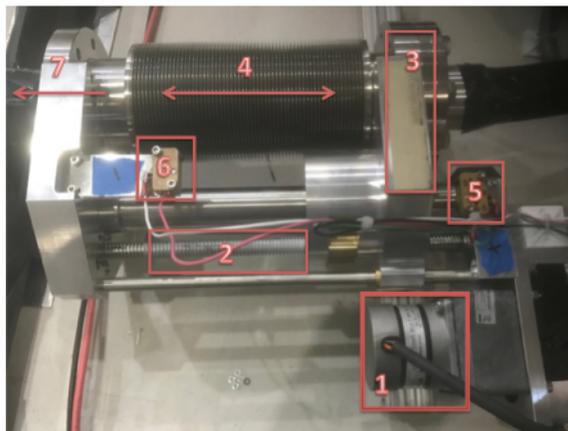

Figure 1: Important components of the SciFi detector. Label 1 is the stepper motor. Label 2 is the axle shaft. Label 3 is the base flange connected to the bellow flange. Label 4 is the bellow. Label 5 is a "Home" end-switch. Label 6 is an "Insert" or "Far" position end-switch.

At position one is a McLennan Stepper motor (1). This is installed onto the entire unit, which is a linear shift mechanism (LSM) made by UHV design. The motor rotates the axle (2) clockwise or counter clockwise. There is a pitch of 0.1 inches between the grooves on this axel. 400 steps equals 1 full revolution, so 400 steps would move the head of the detector 0.1 inches. The base of LSM (3) will move adjacent to the axle (2) and compress/decompress the chamber (4) surrounding the optical fibers. This chamber is under vacuum pressure with the rest of the scattering chamber. The base (3) can run into the limits (5 and 6). Position (5) is the "+" or "Home" limit and this corresponds with the position furthest from the beamline. Position (6) is the (-) or "Far" limit and this corresponds to the postion closest to the beam, without actually being in the beam. These limit switches are sitting on metal plates that are machined precisely to pick the limiting positions. Not shown is the head of the detector (7), which will move with the base of the LSM. It is also important to note that besides the far limit, there is an additional pipe surrounding the beam which will prevent the motor from putting the detector head in the beam. Shown below is a diagram of this unit installed.
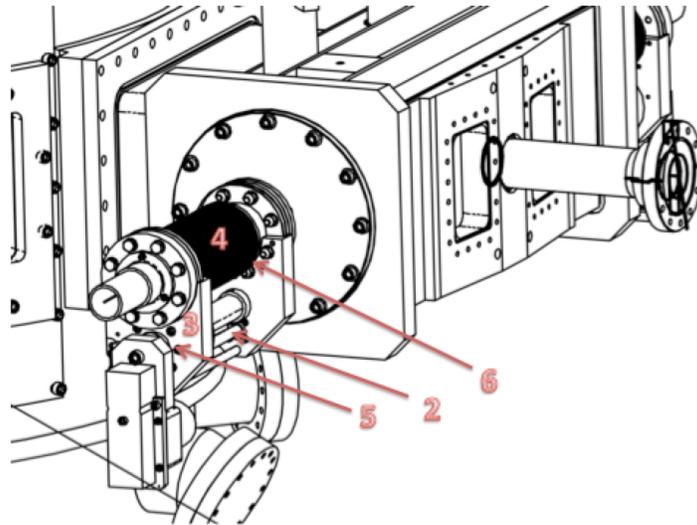

Figure 2: Diagram of Installed Motor/LSM/Detector Unit. Here, 2 is an axle, label 3 is for a base flange, label 4 is for a bellow, label 5 is for a "Home" switch, label 6 is for a "Far" switch.

The l limit s witches are out of view f rom t his angle, but s it outside of the chamber. The optical fibers from t he detector head go t hrough (4) and out of t he end. The base (3) i s attached t o t he head of t he detector and will move back and f orth along t he axis (2). Shown below i s a birds-eye view of t he installed r ight motor/detector/LSM unit.
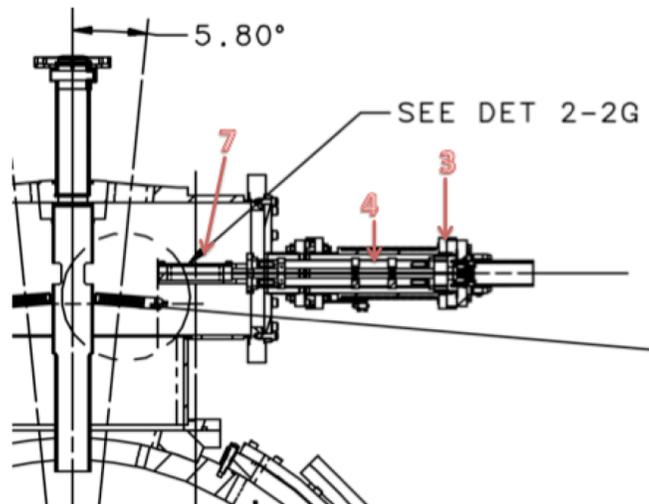
Figure 3: Top view of the SciFi area of the vacuum system. Here 7 is the active area of the detector, 4 is the bellow area, 3 is the base flange.

The most important thing to note is the circle in the diagram. This circle encompasses the optical area. The head of the detector will move back and forth across the optical area to gather calibration data for the HRS.

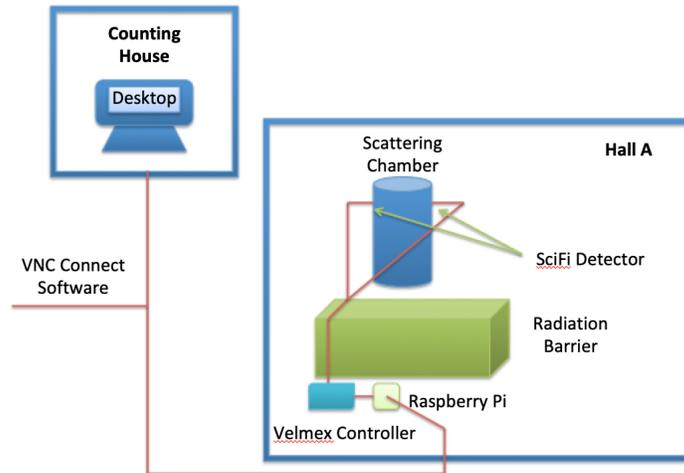Figure 4 shows how the motors will be accessed from the counting house.

Figure 4: Diagram of the remote control setup.

The motor control graphical user interface (GUI) will be on the Raspberry Pi in hall A. It will be placed behind the green radiation barrier. To access it remotely, VNC connect software will allow access from the counting house. This software is available for all platforms. Unlike the secure shell command, VNC connect will give access to the full desktop on the Raspberry Pi. In order to do this, the Raspberry Pi must be set up on the Jlab network with it's own IP address. Not shown in the diagram is a usb to serial converter in between the Raspberry Pi and the velmex controller. This allows access to the controllers serial port. Using the software, commands to move the motor will be sent to the controller. The controller will in turn send commands to the two motors attached to the detectors.

Operation of the Motor via Control GUI

Below is a screenshot of the GUI opened on the Raspberry Pi.

Figure 5: Screen shot of the GUI window.

Before attempting to operate motor, two simple steps must be followed. One must connect to the Velmex controller and update the settings.

1. Select "COMPORT" from the menu bar and click "Connect COM port"

2. Select "Motor" from the menu bar and click "Set Motor/Limits/Velocity"

If no errors are displayed in the terminal, the GUI should be ready to use. The basic procedure for setting the position of the detector is as follows.

1. Select which motor you would like to move with the radio buttons

2. Send it to the positive home limit by pressing the button. It will continuously output an erroneous position, so ignore it. The process may take a while, depending on the current position. Just watch the progress in the bottom of the GUI.

3. Set the current position to zero by clicking "Zero Position." This should be instantaneous.

4. Enter how far in millimeters you would like to move the head into the direction of the beam. To do this, enter the number in the text box and put a negative sign in front of it (towards far limit). Then press move. The GUI will freeze again, but the position and limit status will be updated every second or so.

As a check, the home limit should show "engaged" when you zero the position and "disengaged" when it starts to move in the direction of the far limit. If anything goes wrong select "File" from the menu bar and click "Exit." Then restart the process. These procedures may be slightly modified as the software is completed.

Task Hazard Analysis (THA) Worksheet

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

Click For Word

Author:	Bogdan Wojtsekhowski	Date:	January 21, 2019	Task #: If applicable	N/A

Complete all information. Use as many sheets as necessary

Task Title:	SciFi motion mechanism and controls			Task Location:	
Division:	Physics	Department:	Hall A	Frequency of use:	N/A
Lead Worker:	B. Wojtsekhowski				

Mitigation already in place:
Standard Protecting Measures
Work Control Documents

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
	Motion of the SciFi detector could result in of 50 mg/cm2 material in the HRS aperture which lead to reduction of the data quality. No risk for personal.	L	L	2	Follow procedure/limit persons allowed to operate.	TOSP for SCiFi motion.	

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

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.)

For questions or comments regarding this form contact the Technical Point-of-Contact Harry Fanning
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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-19-81812-TOSP

Title: SciFi motion mechanism and controls

Name	Signature	Date