Opearation of SciFi Detector Motors

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Background

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 February and ending around March 10th. Positioning of the detectors will be done by Bogdan Wojtsekhowski (JLab), John Williamson (University of Glasgow), Edward 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 blue septum magnets. One of these units is shown below and the important components are outlined.

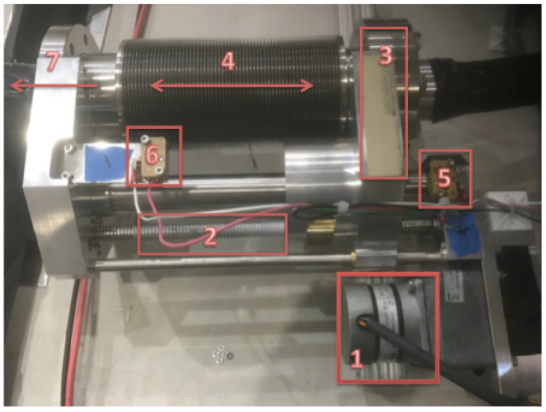

Figure 1: Important components of SciFi Detector. detector. Label 1 is the stepper motor. Label 2 is the axle shaft. Label 3 is the base flange is connected to the bellow flange. Label 4 is the bellow. Label 5 is a "Home" end-switch. Label 6 is "insert or Far" position end-switch.

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 axle. 400 steps equals 1 full revolution, so the highest achievable position resolution is $2.5x10^{-4}$ 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.

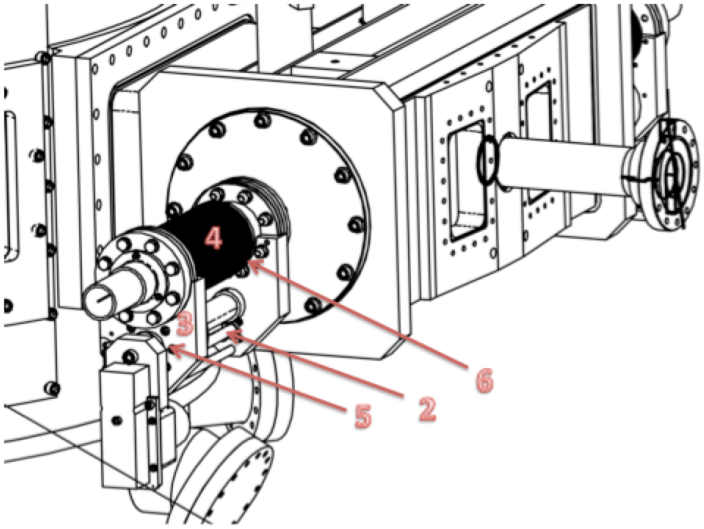

Figure 2: Side view diagram of installed Motor/LSM/Detector Unit. Here the 2 is an axle, label 3 is for a base flange, label 4 is for a bellow, label 5 is for a "Home" switch, label 6 is for a "Far" switch.

The limit switches are out of view from this angle, but sit outside of the chamber. The optical fibers from the detector head go through (4) and out of the end. The base (3) is attached to the head of the detector and will move back and forth along the axis (2). Shown below is a birds-eye view of the installed right motor/detector/LSM unit.

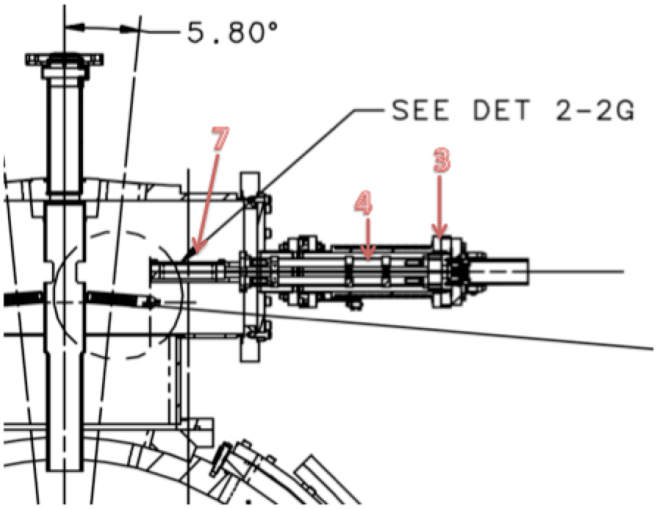

Figure 3: Birds eye view of installed unit. Here 7 is the active area of the detector, 4 is the bellow area, 3 is the base flange.

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 in and out of the optical area to gather calibration data for the HRS.

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

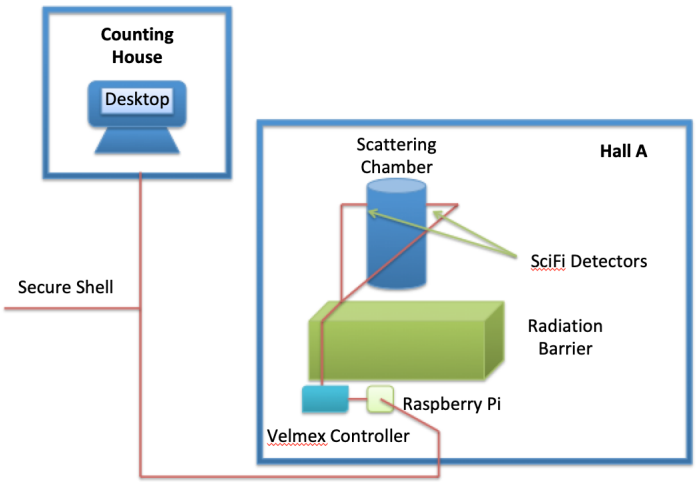

Figure 4: Diagram of the remote access setup

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, it can be reached using the "ssh" command from hapc3 in the hall A counting house. This software is available for all platforms. 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.

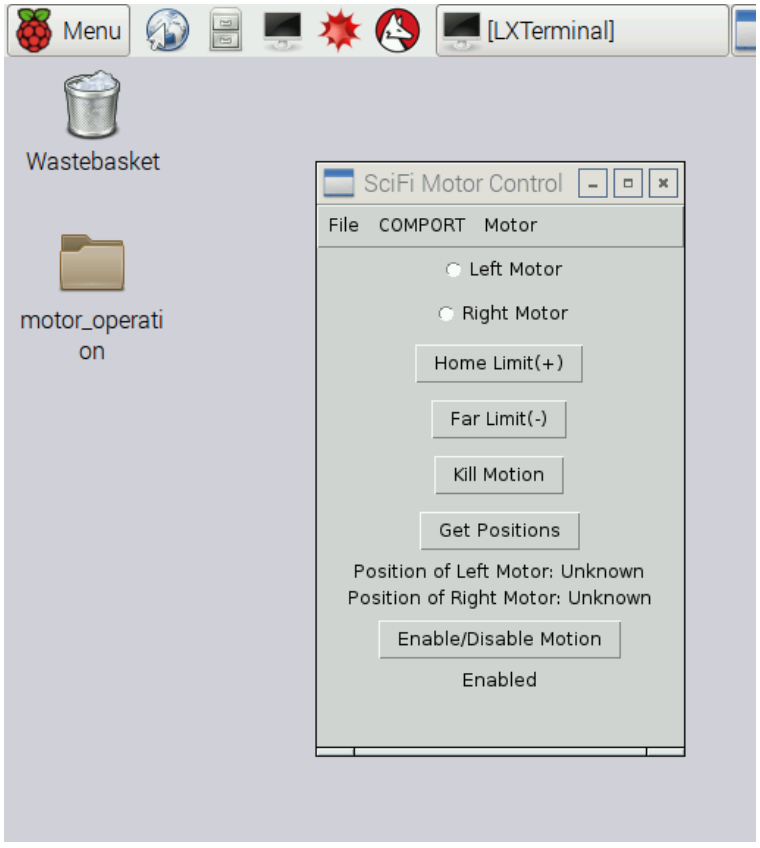

Figure 5: Screenshot of GUI

To access the GUI remotely:

1. Open a terminal on the adaq2 in the counting house
2. Enter the command "goscifi"
3. Type "python3 motor_control_GUI.py"

Upon opening, the program will automatically send the correct settings command to the controller.

The two most important positions for the detectors are at the home and far limits. To move them back and forth:

1. Select which motor you would like to move with the radio buttons
2. Press the Home Limit(+) or "Far limit (-)" button
3. Confirm that the motor is moving using the video cameras in the counting house and by the status in the bottom of the GUI

A few more imporant features are mentioned below.

- Movement will be disabled upon opening the program. Password is known by the operators. The position of the motors will still be displayed
- The GUI will freeze while the motor is in motion. If you need to kill the motion, just exit the GUI and restart it
- Only one motor can be moved at a time
- It takes approximately 8 minutes to move from one limit to the other