

Table 4.6: Apertures of Collimators

HMS	$d\Omega$ (msr)	Horizontal (mr)	Vertical (mr)	Shape
Large Collimator “Pion” Collimator	6.74	± 27.5 \pm	± 70.0 \pm	Octagonal, Flared Octagonal, Flared
SHMS Collimator	$d\Omega$ (msr)	Horizontal (mr)	Vertical (mr)	Shape
	4	± 24	± 40	Octagonal, Flared

If either spectrometer vacuum starts to deteriorate rapidly an expert should be notified. Vacuum system responsible personnel are listed in Table 4.3.

4.7 Spectrometer Slit Systems

4.7.1 HMS

The HMS slit system is installed on the gate valve housing mounted to the front face of Q1. It consists of a vacuum box with a slit ladder mounted into it. The slit ladder has space for three separate slits, which will typically be one sieve slit and two solid angle defining collimators. The slits are rectangular blocks of densimet (90% W and 10% Cu/Ni) with a density of 17 g/cm^3 . The collimators have an octagonal shaped opening machined into them; the sieve slit has many holes drilled into it.

The outer size of the collimators is 11.75” vertical by 8.25” horizontal. The outer size of the sieve slit is 10.00” vertical by 8.25” horizontal. Its vertical size is reduced w.r.t. 11.75” due to space constraints. The sieve slit always has to be installed at the bottom position of the ladder, so that we can use the shielding of the collimator above it to clearly distinguish the top row of holes. The central hole of the sieve slit has a smaller aperture, and two blocked holes exist to easily distinguish center and directions. The collimator thicknesses are 2.5”, while the sieve slit thickness is 1.25”. The dimensions and shape of the inner aperture of the present HMS collimators is denoted in Table 4.6.

The total depth of the slit box is close to 3.75”, which leaves enough space to later mount scintillators behind the collimators as an active veto counter (to prevent punch-through of hadrons) and/or to increase the collimator thickness. Two circular quick-connect flanges are added for feed-through of possible light guides.

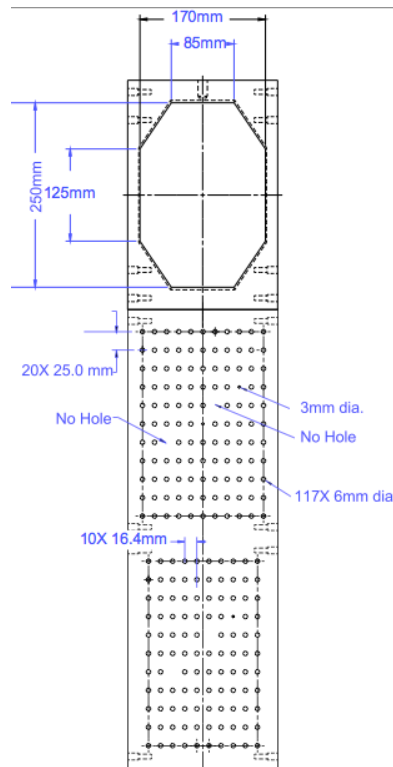


Figure 4.6: Geometry of the Main Collimator and the Sieve Slits in the SHMS

4.7.2 SHMS

A similar remotely-operated collimator box is installed on the SHMS between the HB and Q1 magnets. The collimator ladder assembly within this box may be positioned at three settings. The top position (accessed when the assembly is at its lowest position) is a stretched octagon with opening height 9.843" and width 6.693" on the upstream side. It is 2.5" thick. The lower two positions both present sieve holes in rectangular pattern with holes separated by 0.6457" horizontally and 0.9843" vertically. The sieve pattern at the middle ladder position has 11 columns of holes with the sixth column centered horizontally. The holes on the bottom sieve are in ten columns and are offset by one-half a column gap from those in the middle sieve. The sieve collimators are 1.25" thick. The geometry is illustrated in Fig. 4.6. Both sieves and octagonal collimator are made of Mi-Tech™ Tungsten HD-17 (Density 17 g/cc. 90% W, 6% Ni, 4% Cu).

Because the SHMS has both a horizontal bend (HB magnet) and a vertical bend (main Dipole magnet), a second sieve collimator is helpful for optics calibration and understanding the magnets. It is placed immediately upstream of the HB magnet entrance. Two options are provided: a conventional passive sieve collimator and the so-called *active sieve* which is a detector based on Gas Electron Multipliers (GEMs). A photo of the passive sieve options is shown in Fig. 4.7 and the dimensions and hole pattern are shown in Fig. 4.8.

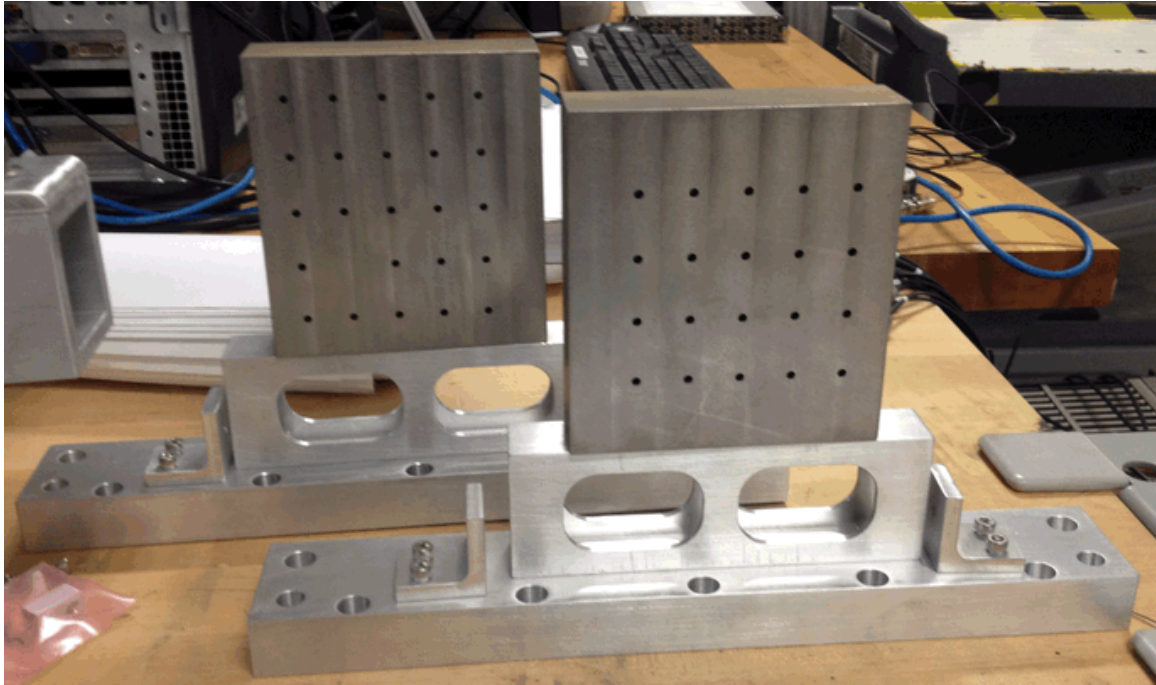


Figure 4.7: Upstream Sieve Slits that go on the front of the HB magnet of the SHMS

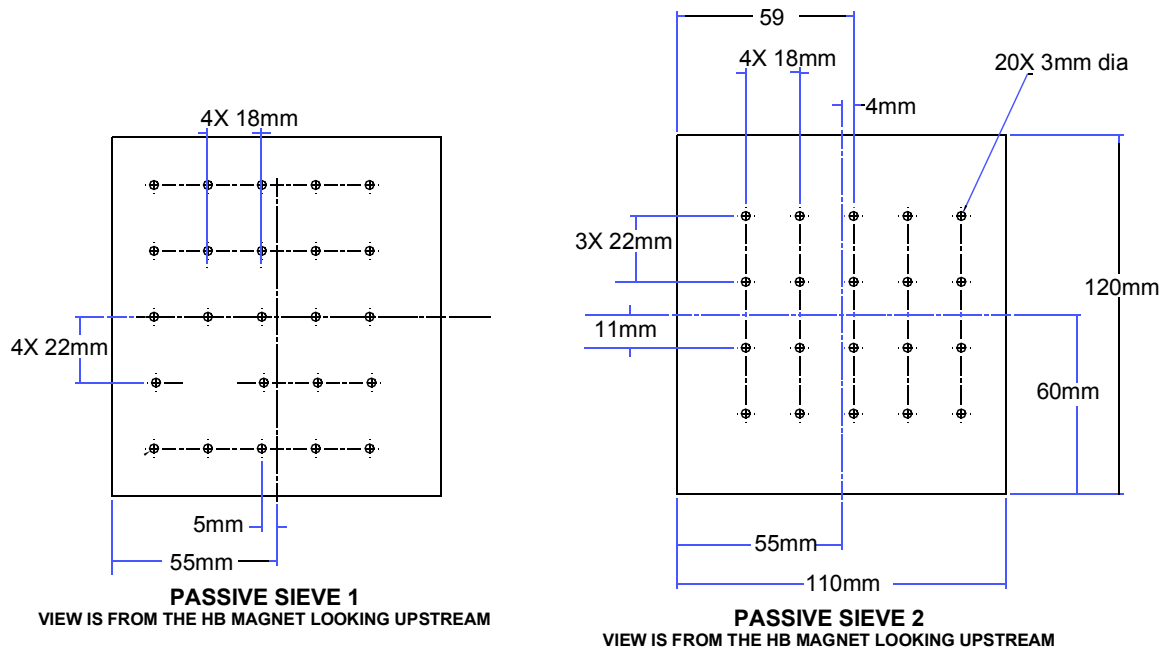


Figure 4.8: Upstream Sieve Slits that go on the front of the HB magnet of the SHMS

4.7.3 Operation of the Slit System

The HMS and SHMS slit systems are controlled by a remote control system consisting of motor/actuators that slide the slits in place. Resolvers specify the exact position of the slits. The resolver position of the slits is relative number of counts from the home position. The home position is set by a homing procedure that is programmed into the controller that sets the zero position by moving the slit to a position that activates the physical home switch. Once this homing procedure is complete, then the slits can be moved to surveyed positions that have been programmed. The home position for HMS and SHMS slit system does not mean that the slits are moved out of the way. For the HMS it is possible to move the slits so that they are out of the way (*All Out*), but for the SHMS there is no such position for the slits. EPICS drivers have been written for normal operation of the slits by users and non-experts and operation of the slits through the EPICS screens is described below. Upper and lower limit switches are on the slit system drive shaft to keep the slits from being moved too far in either direction. There are also software limits. The control box is located downstairs in Hall C. In the control box, there is a driver for the HMS and one for the SHMS. If power is lost to the control box, then the brake engages on the motor that drives the slits. On the front of the control box is a red emergency power shutoff button. The control box should only be opened by trained experts.

EPICS drivers have been written for normal operation of the slits by users and non-experts. The EPICS screens are accessed through the accelerator **jmenu**. Instructions for access the **jmenu** will be given in the Hall C How-tos. From the **jmenu**, the HMS and SHMS slit system EPICs controls can be accessed on The Hall C Operations Menu which is open from **jmenu** → **Standalone Menus** → **HallC**. On the Hall C Operations Menu under *Experiment Specific* are *HMS Coll. Motion Control* and *SHMS Coll. Motion Control*. Clicking the respective title will bring up the EPICS screens shown in Fig. 4.9. Fig. 4.9 shows the HMS and SHMS slit controls in normal operation. In normal operation, the homing procedure has been completed as indicated by the orange rectangles next to *Home position found/reference point point set* and *Home routine finished*. With the homing procedure completed, the user can moved to the other slit positions by clicking on the labeled button. For the HMS slit system, the slits can be moved so that they are out of the acceptance by clicking on the *All Out* button. It is not possible to move the SHMS slit out of the acceptance. In Fig. 4.10, the EPICS screens are show when the slits are moving. The velocity should be around 1000 rpm and the current less than 2 amps (typically the reading fluctuates between 0 and 1). If the current is above 2 amps, then click the *Stop Motion* button and contact the expert. The option of experts moving the slits to an arbitrary position is available for the EPICS screen. The conversion is 327680 counts is one mm. The mostly likely use for this option is during the taking of optics data when one wants data with the sieve slit moved by half the distance between holes to get more vertical angles.

The EPICS controls are done through an soft IOC called *iocsofthmsco* and *iocsoftshmsco*. If EPICS screens are white then the IOC needs to be rebooted. Another reason



Figure 4.9: HMS and SHMS slit system screens in normal operation.



Figure 4.10: HMS and SHMS slit system screens when the slits are moving.

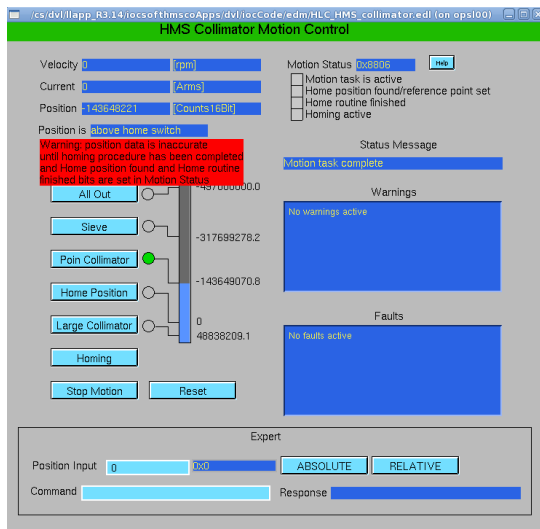


Figure 4.11: HMS EPICS screen when power restore but before the homing procedure as been executed.

that soft IOC would need to be reboot would be if the soft IOC has lost communication with the driver. In the case , the user could not move the slit and the text on the Warnings and Faults windows is in light grey color. Only the MCC operator can reset the soft IOCs by accessing **jmenu** → **Operations** → **Control Systems** → **Reboot** → **HallC**. The user can call MCC to reset the soft IOCs.

If there is a power outage, the brakes are engage in the motor that drives the slits. Once power is restored then the user needs to do the following steps to get the slit system back in normal operation mode.

1. Ask MCC to reboot the soft IOC for the HMS and SHMS, *iocsofthmsco* and *iocsoftshmsco*.
2. Access the HMS and SHMS EPICS screens.
3. On the EPICS screens, click on the *Reset* button. this runs an initialization program which loads parameters into the driver. The EPICS screen should look like Fig. 4.11. The red warning is to remind the user to execute the homing procedure.
4. On the EPICS screens, click on the *Homing* button. This executes the homing program which defines the home position and is needed before moving to other position.
5. When the homing procedure is successful then the rectangles next to *Home position found/reference point point set* and *Home routine finished* will be orange.
6. Click on button to move slit to desired position.