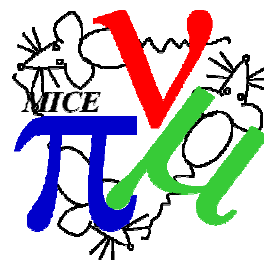


# MICE Beamstop – User’s Guide

J.J. Nebrensky (Brunel University, Uxbridge UB8 3PH, UK)  
G. Barber (Imperial College, London SW7 2AZ, UK)



## 1 Introduction

This document describes operation and basic troubleshooting of the MICE moving beamstop. *Pre-requisites for beamstop operation are NOT covered.*

The MICE moving beamstop assembly (fig. 1) consists of a cast concrete and steel barrier, faced with borated polyethylene (Borotron HM050), which covers an opening in the DSA wall, such that radiation within the DSA is blocked from entering the main part of the MICE Hall. A movable plug can be lowered from the casing, exposing the aperture by which the muon beam enters the Hall. The moving beamstop is supported on a scissor lifting table powered by two independent hydraulic power packs.

To prevent accidental operation or exposure of the Hall after a power failure, the motion of the scissor table can be blocked by a removable metal frame secured by padlocks – sometimes referred to as the “mechanical beamstop”.

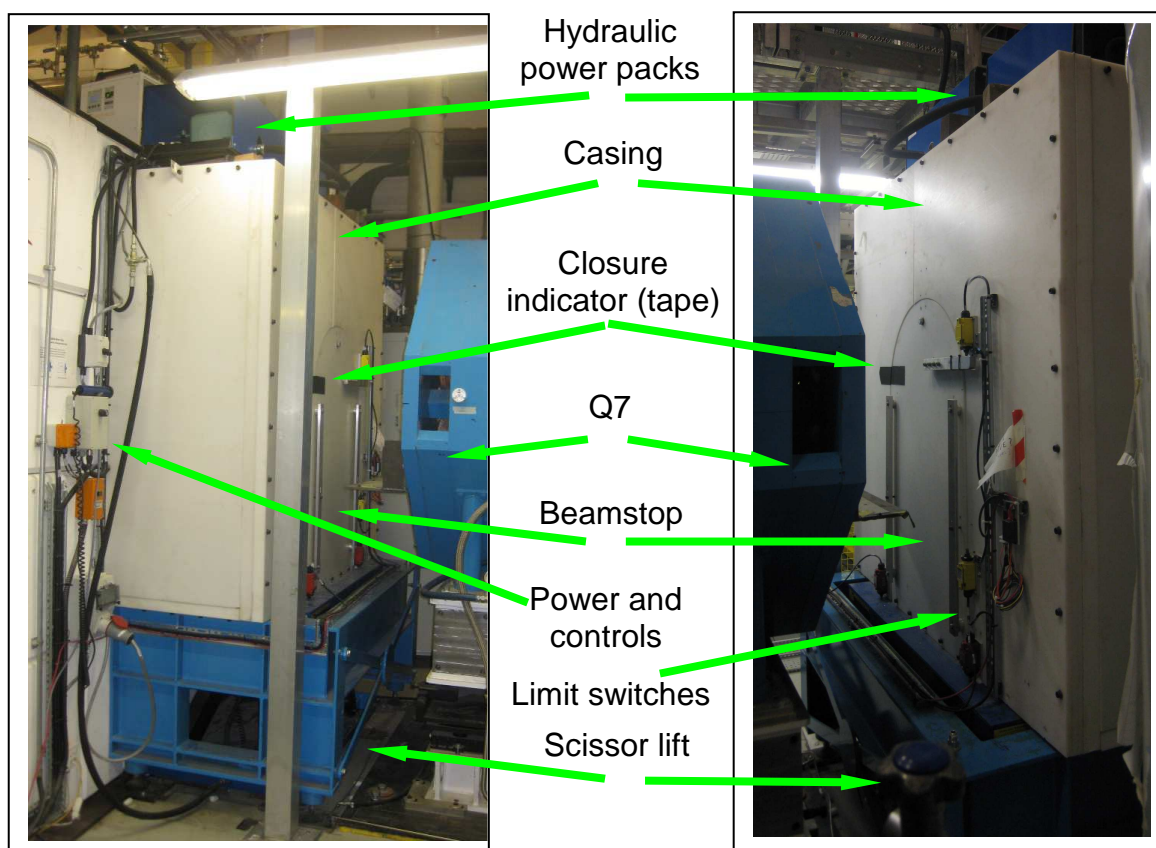


Figure 1: MICE Moving Beamstop

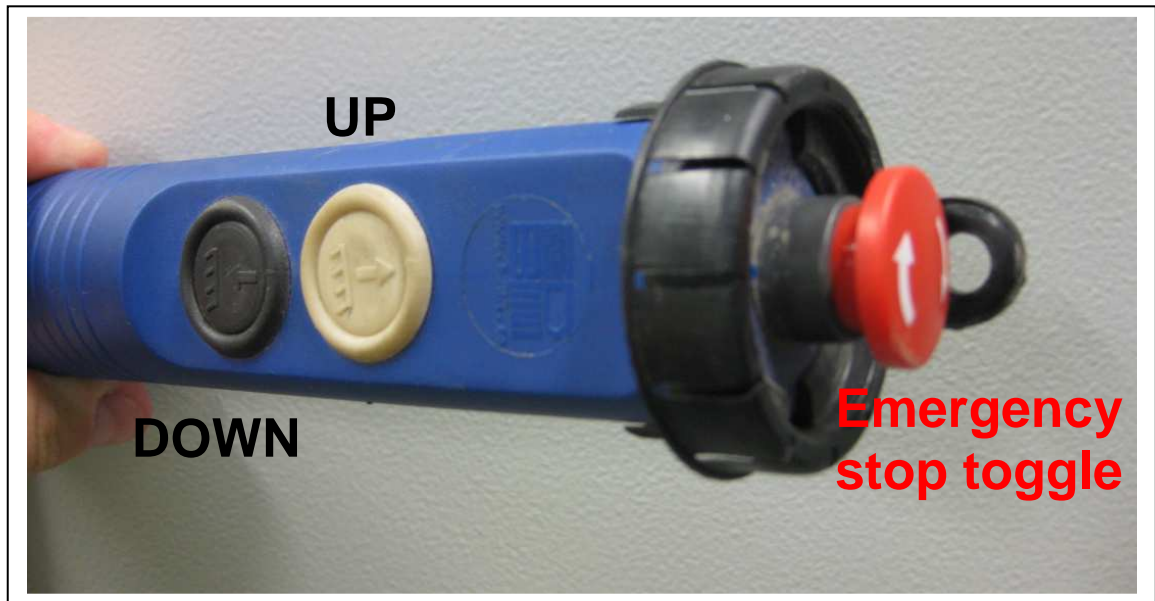


Figure 2: Moving Beamstop Hand Control Unit

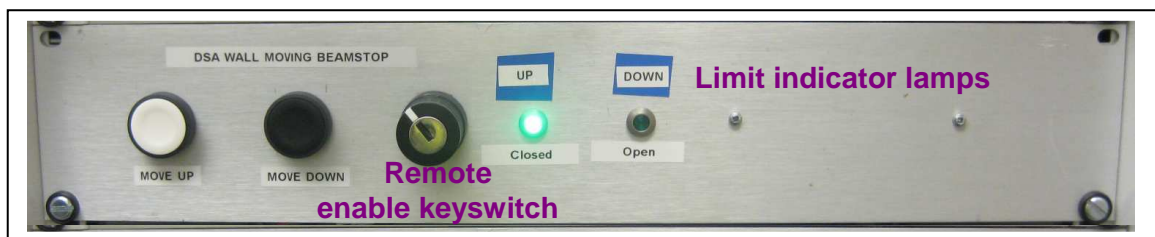


Figure 3: Moving Beamstop Remote Control Panel

The beamstop can be operated either locally using a hand control unit, fig. 2, or remotely from the control panel in the Rack Room (rack DAQ-01), fig. 3. This is decided by turning the beamstop enable key in the appropriate keyswitch. The local enable key switch is mounted on the DSA wall, while the remote enable keyswitch is on the control panel.

The beamstop must be left in the fully raised state. This can be confirmed visually – the edges of the black tape should line up. A webcam is provided to view this from outside the MICE Hall. Beamstop status is also indicated on the “Beamline Summary” Controls & Monitoring display, on the Alarm Handler, and PPS crates (C9/22/4 is “Muon Beamstop Shut”).

The state of the beamstop is monitored by the PPS, which may take action when the beamstop is opened or closed – consult the PPS User Guide for details. However, the beamstop is not *controlled* by the PPS – it can be opened or closed at any time, so procedural controls regarding pre-requisites and operation must be followed.

## 2 Installation/Cold Starting

*The moving beamstop must be left in the fully raised state. If it has been left partly or fully open, seek advice from the Duty Co-ordinator in the first instance.*

Check that the scissor lift area is clear and free from any obstructions.

Check that the mechanical beamstop spanner (17 mm) and tommy bar are present (right).



Power to the beamstop power packs is provided from the adjacent three-phase socket – ensure this is switched on. The “UP” limit indicator lamp on the control panel in the Rack Room will illuminate.

If there is a specific reason for concern, attempt to raise the beamstop even further (even though it cannot move) using the local hand-control (see below): it should be possible to hear the hydraulic power pack energise.

## 3 Preparation for shift

### 3.1 Warm Start

*The moving beamstop must be left in the fully raised state. If it has been left partly or fully open, seek advice from the Duty Co-ordinator in the first instance.*

Check that the “UP” limit indicator lamp on the control panel in the Rack Room is lit.

Get Beamstop Enable key and two small padlock keys from MOM.

#### 3.1.1 Energise power pack

- Insert and rotate the enable key in the local keyswitch on the DSA wall (fig. 7).
- Turn the red stop toggle on the hand control clockwise and pull it out.
- Push the white “up” button to make sure the beamstop is all the way up. It should be possible to hear the hydraulic power pack energise.
- When sure, push red stop toggle back in. The beamstop now cannot be moved.
- Turn key anti-clockwise and remove it from keyswitch.

This process builds up the hydraulic pressure in the system, and ensures that the scissor table is not pushing on the mechanical beamstop frame.

#### 3.1.2 Remove Mechanical Beamstop Frame

The “mechanical beamstop” is a metal frame that prevents motion of the scissor table. It is secured to the base of the table assembly by the main pair of M10 (17 mm) bolts (fig. 4). A second pair of studs carries a crossbar that is held in place by a pair of padlocks to prevent unauthorised removal of the restraint (fig. 5).

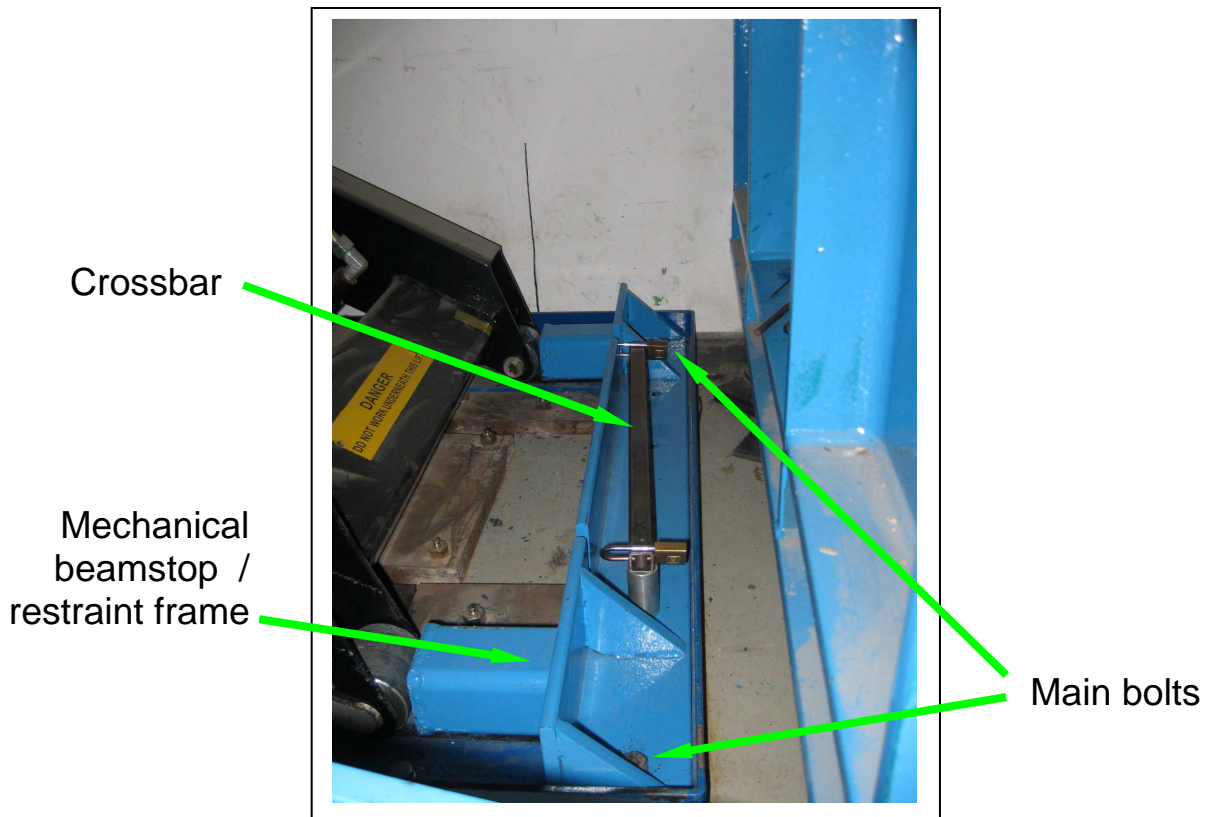


Figure 4: Mechanical beamstop frame and layout.  
 Note that the crossbar is mounted deeper in at the far (right-hand) end

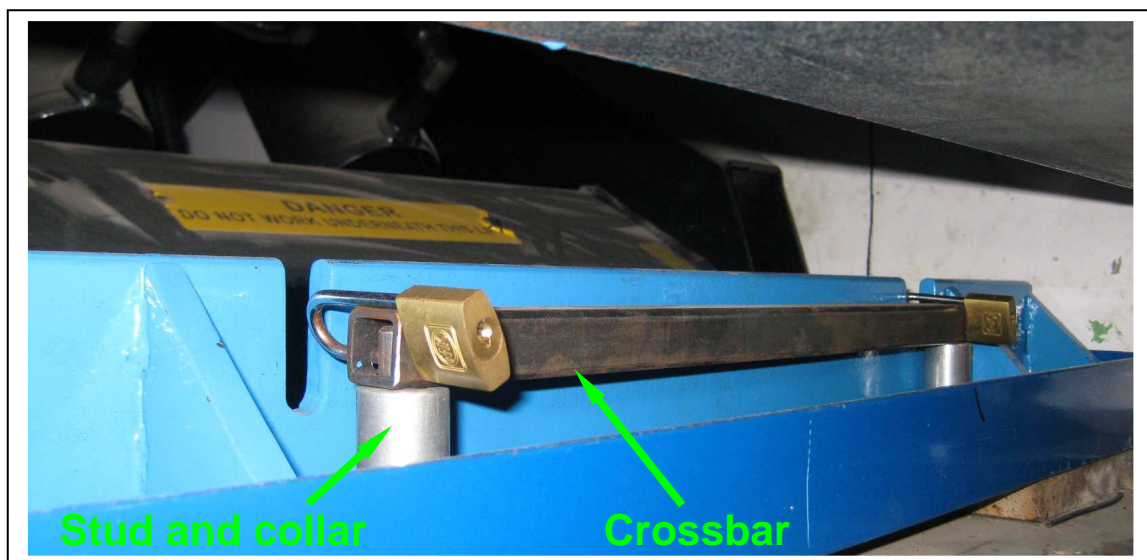


Figure 5: Mechanical beamstop crossbar.

As the mechanical beamstop is disassembled the parts should be carefully set aside such that it is clear which side they came from. Keep all parts from the left together and separate from the parts from the right. *They are not the same and are not interchangeable.* The niches in the support frame are convenient for storage.

**All components (including washers, etc.) must be accounted for!**

*They may become a hazard when the superconducting magnets are active!*

*As you will be working with your hands beneath a heavy movable object, a second person should be present.*

Remove the mechanical beamstop as follows:

- Unlock and remove the padlocks from the crossbar.
- Remove the crossbar – note that it has a top and bottom side.
- Remove the studs and collars – use the tommy bar provided to turn the stud by the hole used for the padlock. Note which mounting holes the studs were in.
- Remove the main M10 bolts, using the box spanner provided. Note which mounting holes the bolts were in. The silver bolt goes at the left end and the black bolt on the right.
- Lift out the restraining frame – having the second person pull it out the side (towards Q7) is easiest.
- Once finished, turn the red stop toggle on the hand control clockwise and pull it out, otherwise remote operation is not possible.

The beamstop is now free to move and can be operated subject to inserting the beamstop enable key into the appropriate keyswitch.

### **3.2 Function Test**

The only real test is to open and close the beamstop: this would normally be left until the appropriate point in the shift.

## **4 Running Instructions**

### **4.1 To lower the beamstop remotely**

- (If there are people in the Hall, ensure everyone is clear of the moving parts!)
- Check that the beamstop is in the fully raised position – the UP lamp on the remote control panel in the Rack Room (fig. 3) should be lit.
- Insert the beamstop enable key into the keyswitch on the remote control panel and turn it.
- Briefly push the “MOVE UP” button, to clear any internal interlocks, then press and hold “MOVE DOWN”.
- The UP lamp will go out (as the beamstop is no longer fully raised) and the Alarm Handler will trigger if it is running.
- After about 30 s the beamstop will reach the lowered position and the “DOWN” lamp will illuminate.
- Confirm on webcam or C&M display that the beamstop has lowered as expected. Acknowledge Alarm Handler if necessary.

## 4.2 To raise the beamstop remotely

- (If there are people in the Hall, ensure everyone is clear of the moving parts!)
- Press and hold the “MOVE UP” button on the remote control panel.
- The DOWN lamp will go out (as the beamstop is no longer fully lowered) and the Alarm Handler will trigger if running.
- After about 30 s the beamstop will reach the raised position and the “UP” lamp will illuminate.
- Confirm on webcam or C&M display that the beamstop has closed as expected. Acknowledge Alarm Handler if necessary.
- Remove the beamstop enable key from the keyswitch on the remote control panel.

## 5 End of Shift

*The moving beamstop must be left in the fully raised state. If it has been left partly or fully open, seek advice from the Duty Co-ordinator in the first instance.*

At the end of a shift you should close the beamstop (section 4.2) and return keys to the MOM. Prior to leaving the MICE Hall in “Free Access” you should also replace the restraint frame.

### 5.1 Replace Mechanical Beamstop Frame

Replacing the restraint frame is the reverse of the process of removal (section 3.1.2).

**All components (including washers, etc.) must be accounted for!**

*They may become a hazard when the superconducting magnets are active!*

*As you will be working with your hands beneath a heavy movable object, a second person should be present.*

- Raise the beamstop, as per section 4.2 or by hand if needed.
- Push in the red stop toggle on the hand control.
- Remove beamstop enable key from keyswitch.
- Replace the restraint frame – ensure it is sitting level on the table base.
- Replace the main bolts – making sure to use the correct holes – leaving them loose. **The silver bolt goes at the left end and the black bolt on the right.**
- Replace the crossbar studs in the correct holes. It can be useful to rattle the frame to get the holes to line up.
- Tighten the main bolts with the spanner, and then do up the studs leaving the top hole aligned perpendicular to the MICE beam (see fig. 5).

- Replace the collars and the crossbar (with the padlock holes on the lower side) and replace the padlocks, with the lock bodies towards you.

Return beamstop keys to MOM or Duty Co-ordinator.

## 6 Shutdown

*Prior to leaving the MICE Hall in the “Free Access” state, the beamstop must be fully raised and the mechanical restraint frame put in place.*

Power to the beamstop is left on permanently.

## 7 Emergency Shutdown

If you need to shut off the system because it has a fault:

- Remove beamstop enable key from any keyswitch
- Shut off power to beamstop system at the 3-phase power socket (fig. 7)

If you need to stop it while it is in motion:

- Release control button!
- If using hand control, push the red stop toggle
- Remove beamstop enable key from any keyswitch
- Trip the scissor lift proximity sensors (fig. 6)

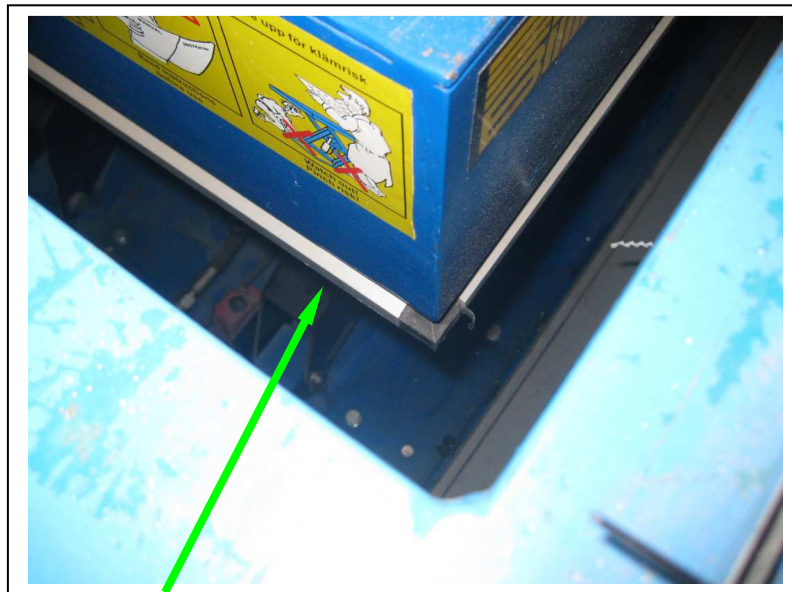
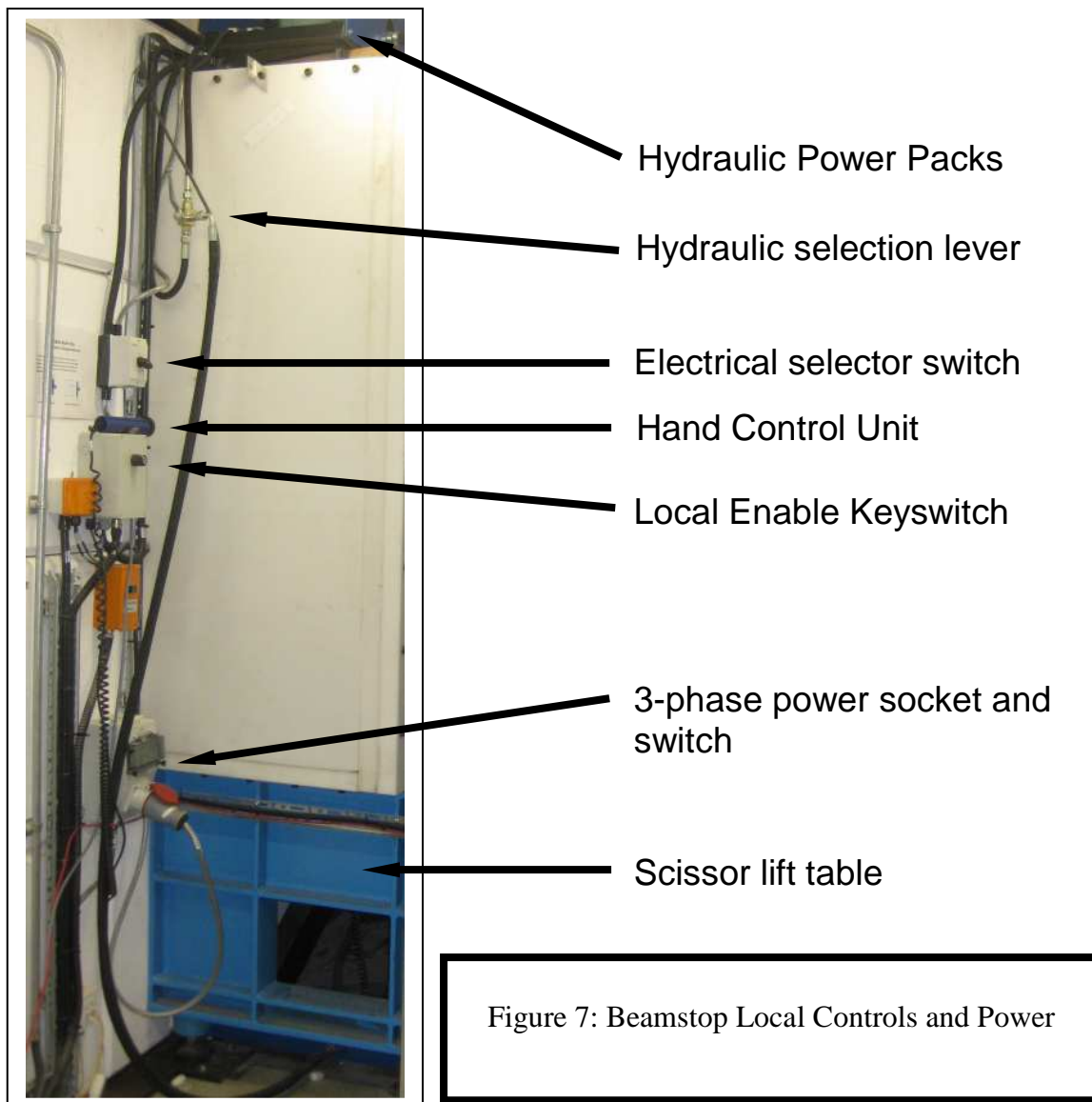


Figure 6: The silver bars are the proximity switches around the scissor-lift table platform.

The scissor lift is fitted with proximity switches around the lower edge of the moving table (fig. 6) – they are the long silver-coloured bars along each edge, which stop the beamstop movement if they are pushed *upward* (i.e. towards the concrete plug).

## 8 Troubleshooting

If no lamps are lit on the remote control panel but the beamstop is fully raised (or lowered), then the power is off – check the 3-phase mains plug and switch (fig. 7).



If the beamstop doesn't move when a control button is pushed:

- Is the stop toggle on the hand control unit still pushed in?
- Has the beamstop enable key been turned in the appropriate key switch?
- Is the power on? The plug must be in, the socket on, and the electrical selector switch on either position **1** or position **2** (not on 0!)
- Is the hydraulic power pack energising? It should be audible from the local control area. If not, ask the BLOC to switch to the backup power pack.

If the beamstop won't lower:

- Ensure the space around the lifting table is clear from obstructions and the proximity sensors are free
- Try to drive upward for a moment



The proximity sensors around the table edge will prevent the beamstop from being lowered further until the trip has been reset – this is done simply by *raising* the table momentarily, which can be done remotely. Thus, you should check that the area is clear first, rather than repeatedly driving the beamstop down on to the same obstruction!

If problems persist, contact the Hall Manager and/or Geoff Barber.

### 8.1 How to Switch to the Backup Power Pack (BLOC)

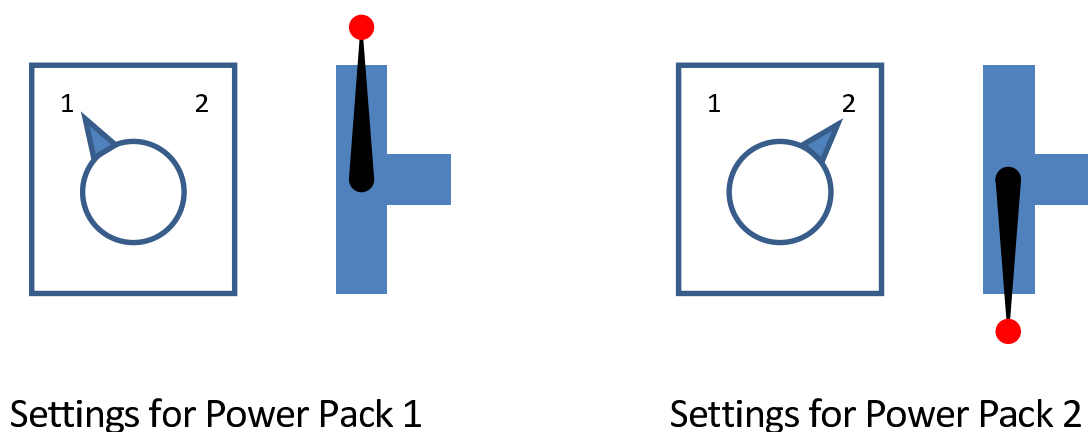


Figure 8: Switching the hydraulic power pack

In normal running mode the electrical selector switch will be set to **1** and the hydraulic selector lever will be at **12 o'clock**. To switch to the backup power pack the electrical switch needs to be set to **2** and the hydraulic lever put to **6 o'clock**.

## 9 Documented Procedures

Operation of beamstop is covered by MICE RA/MS templates Manual Handling 009.

The status of the beamstop aperture is an input to the MICE Hall PPS (C9/22/4) and is included in the latter's annual Functional Tests.

Removal and replacement of the mechanical beamstop / restraint frame is governed by a formal agreement (MICE-ISIS Safety Management Meeting 40 – 27<sup>th</sup> January 2016): <http://micewww.pp.rl.ac.uk/documents/169>