

## Moving IMU Steel

This procedure details the necessary steps required to move the Intermediate Muon Detectors (IMU) in the CDF Collision Hall. There are four 500-ton IMU detector assemblies that move in an east-west direction on a guided rail system in the collision hall. Each detector assembly is moved using a dedicated screw drive system that is capable of moving the assembly 120 inches in approximately 26 minutes. This motion is necessary to allow access to other detector systems in the collision hall. A checklist is included in this procedure that is to be used for every IMU move.

### Editorial Hand-Processed Changes Other Than Spelling Require CDF Operations Head Approval

HPC Number	Date	Section Number	Name
1.	<u>07-09-10</u>	<u>3.0 Checklist: Removed instructions regarding yellow muon fans</u>	<u>Phil Schlabach</u>
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____

### Approvals

\_\_\_\_\_  
(CDF Operations Head)

\_\_\_\_\_  
(Date)

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(CDF Department Head)

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Particle Physics Division Head)

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Accelerator Division Head)

\_\_\_\_\_  
(Date)

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**1.0 Controlled Copies of this procedure**

Two controlled copies of this procedure will exist.

One will be held in the CDF Operations Library.

The other will be on the CDF web page at

<http://www-cdf.fnal.gov/htbin/cdfproc/listProc>

All other copies will be marked, " INFORMATIONAL COPY ONLY "

## **2.0 The Procedure**

The IMUs shall be moved in accordance with the checklist provided in the next section. No other procedure is required for this move operation.

### **3.0 Checklist**

The next several pages contain the checklist for moving the IMU detectors in the CDF Collision Hall. The two IMU halves (either east or west) are intended to be moved together with the precautions listed. However, the following checklist also allows moving the IMUs into a split configuration for the case in which the interlocks/micro-switches are NOT defeated. If the IMU halves must be split such that the interlocks/micro-switches need to be defeated, this procedure may not be used. In this case a Job Hazard Analysis must be written and signed by the CDF Department Head or the CDF Operations Head.

A separate checklist is to be filled out for each IMU being moved and for each direction of movement. Completed checklists are to be placed in the binder marked "IMU Move Checklists" in the CDF control room.

## **Move IMUs *OUT* Checklist**

The minimum number of personnel required to conduct this operation is two, at least one of which must have been trained in the IMU move operation. A trained person is to act as the equipment operator, whose function is to operate the drive system controls and to watch for any problems at the back (away from the interaction region) of the IMU being moved. The other is to act as an observer, whose functions are to watch for any problems at the front (B0 side) and the bore of the IMU being moved. During the move operation, no other work is to be performed in the immediate area around the equipment being moved.

IMU(s) Being Moved OUT: \_\_\_\_\_ EAST \_\_\_\_\_ WEST

Date of Move Operation: \_\_\_\_\_

Printed Name of Equipment Operator: \_\_\_\_\_

Printed Name of Observers: \_\_\_\_\_

Printed Name of Person Completing This Checklist: \_\_\_\_\_

### **I. Preoperational Inspection**

#### **General Area**

- Verify all cabling is free from entanglement and out of the path of moving mechanical components.
- Verify that the upper shielding fin is in the operating (extended) position.
- Verify that the IMU rails are clear.
- Sweep top surface and edges of rails to remove any debris. Vacuum if necessary.
- Make sure no lifts or ladders are in the path of the IMU steel.
- Check IMU cable and pipe festoons are free and clear.

#### **IMU Steel**

- Check that the IMU platforms mounted on back of steel are clear (safety tie offs are NOT attached to it).

### **II. Preparation for Move**

- Move the lower fin to its open (non-extended) position. In this position, the lower fin limit switch will be made up and allow the IMUs to move.
- Plug in the motor controller boxes for the IMUs to be moved.
- Engage the disconnect switches and verify that power is supplied to the controllers for the IMUs to be moved.

**Move IMUs OUT Checklist (continued)**

**III. Move Operation**

Due to the presence of the shielding fin, the IMU move sequence is predetermined. The fin mounted IMU (either northeast or northwest) must be moved out 2” before the opposite IMU (either southeast or southwest) starts moving so as to preclude any contact with the shielding fin.

Note: During the move operation, the operator must remain in close proximity to the controller box so that the emergency stop button can be reached at any instant.

- A. Note and record the encoder readings before beginning this move operation.

North Side Closed Position Encoder reading (inches): \_\_\_\_\_

South Side Closed Position Encoder reading (inches): \_\_\_\_\_

- B. Begin moving the North side of the IMU. On the North motor controller box, press OUT. The move sequence will begin.
- C.(i). For normal IMU moves, the two halves of the IMU are moved together. In this case, begin moving the South side of the IMU after the North side is in motion and has moved OUT 2 inches. On the South motor controller box, press OUT. The move sequence will begin.
- C.(ii). If a split IMU configuration is required, the South IMU may remain stationary. If it is necessary to move the South OUT, begin moving the South side of the IMU after the North side is in motion and has moved OUT 2 inches. On the South motor controller box, press OUT. The move sequence will begin. Stop the South in its desired position. The North IMU is to be stopped after the South IMU is stopped and when its position allows the required work to be accomplished or it reaches the end of its travel.
- D. Note and record the motor current percent and the frequency of operation (displayed on the LCD display inside the controller box).

North Current % \_\_\_\_\_ Frequency \_\_\_\_\_

South Current % \_\_\_\_\_ Frequency \_\_\_\_\_

- E. The move operation will cease when the travel switch is contacted.
- F. Note and record the encoder readings when the movement is complete.

North Position (open): \_\_\_\_\_ Encoder reading (inches): \_\_\_\_\_

South Position (open): \_\_\_\_\_ Encoder reading (inches): \_\_\_\_\_

**Move IMUs *OUT* Checklist (continued)**

**IV. Secure from Move Operation**

- Disengage the disconnect switches.
- Unplug the motor controller box power cables, roll up cables, and secure.
- Verify IMU circulation fans (inside snout) are turned off with switch located on north IMU.
- Verify lights inside IMU are turned on.

## **Move IMUs *IN* Checklist**

The minimum number of personnel required to conduct this operation is two, at least one of which must have been trained in the IMU move operation. A trained person is to act as the equipment operator, whose function is to operate the drive system controls and to watch for any problems at the back (away from the interaction region) of the IMU being moved. The other is to act as an observer, whose functions are to watch for any problems at the front (B0 side) and the bore of the IMU being moved. During the move operation, no other work is to be performed in the immediate area around the equipment being moved.

IMU(s) Being Moved IN: \_\_\_\_\_ EAST \_\_\_\_\_ WEST

Date of Move Operation: \_\_\_\_\_

Printed Name of Equipment Operator: \_\_\_\_\_

Printed Name of Observers: \_\_\_\_\_

Printed Name of Person Completing This Checklist: \_\_\_\_\_

### **I. Preoperational Inspection**

#### **General Area**

- Verify all cabling is free from entanglement and out of the path of moving mechanical components.
- Verify that the upper shielding fin is in the operating (extended) position.
- Remove any Aluminum Plate Rail Covers that are installed.
- Sweep top surface and edges of rails to remove any debris. Vacuum if necessary.
- Inspect the bore of the IMU to be moved for any obstructions between the IMU and the low beta magnet/cradle assembly.
- Verify that all notch access equipment is removed or safely secured.

#### **Miniplug Region**

- Check that the miniplug "graboid" has been removed from IMU steel.
- Check that miniplug is secured via eye-bolts in the lower rail.
- Check the clearance between miniplug and solid beampipe in the miniplug bore.
- Check that the inner bore (CLC) plug platform is clear of equipment.
- Check that the BLM cables are dressed along the carbon fiber tube.

**Move IMUs IN Checklist (continued)**

**IMU Steel**

- Unplug lights mounted on IMU steel.
- Check that the IMU platforms mounted on back of steel are clear (safety tie offs are NOT attached to it).
- Check IMU cable and pipe festoons are free and clear.
- Verify that the scaffolding and the scaffolding mounting brackets located inside snout (for endplug crate access) are removed.
- Check that the IMU circulation fans (inside snout) are working.
- Check that the front faces of the IMUs are clear of obstructions and/or foreign objects.

**Endwall Region**

- Verify that the scaffolding mounted above shower max crates (curved ladders) is removed if desired. If this scaffolding is left installed, verify that it is clear.
- Verify that the CMX mini-skirt scaffolding (including unistrut supporting frame) is removed.
- Verify that all yellow access grating is installed and locked (search and secure has been completed under the detector).
- Verify that the CMX arches are pushed in.
- Verify that the plug relay racks are pushed all the way in.
- Check that cables to plug relay rack are inside the rack's profile.
- Secure water lines for plug racks to the side of the rack.
- Check that the cables to the CMX miniskirts are clear of the IMU rails.
- Check that protective plates on lower corners of CMX stands have been removed.

**II. Preparation for Move**

- Plug in the motor controller boxes for the IMUs to be moved.
- Engage the disconnect switches and verify that power is supplied to the controllers for the IMUs to be moved.

**Move IMUs IN Checklist (continued)**

**III. Move Operation**

Due to the presence of the shielding fin, the IMU move sequence is predetermined. The fin mounted IMU (either northeast or northwest) must be moved after the opposite IMU (either southeast or southwest) has moved in 2” so as to preclude any contact with the shielding fin.

Note: During the move operation, the operator must remain in close proximity to the controller box so that the emergency stop button can be reached at any instant.

- A. Begin moving the South side of the IMU. On the South motor controller box, press IN. The move sequence will begin.
- B.(i). For normal IMU moves, the two halves of the IMU are moved together. In this case, begin moving the North side of the IMU after the South side is in motion and has moved IN 2 inches. On the North motor controller box, press IN. The move sequence will begin.
- B.(ii). If a split IMU configuration is required, the North IMU will remain stationary until the work requiring the split configuration is complete. The South IMU can be stopped when its position allows the required work to be accomplished. When the work is complete, restart the South side motion IN. Then begin moving the North side of the IMU. On the North motor controller box, press IN. The move sequence will begin.
- C. Note and record the motor current percent and the frequency of operation (displayed on the LCD display inside the controller box).

North Current % \_\_\_\_\_ Frequency \_\_\_\_\_

South Current % \_\_\_\_\_ Frequency \_\_\_\_\_

- D. Verify that the IMU movement speed slows during the last inch of travel.
- E. The move operation will cease when the travel switch is contacted.
- F. Note and record the encoder readings when the movement is complete.

North Position (closed): \_\_\_\_\_ Encoder reading (inches): \_\_\_\_\_

South Position (closed): \_\_\_\_\_ Encoder reading (inches): \_\_\_\_\_

**IV. Secure from Move Operation**

- Disengage the disconnect switches.
- Unplug the motor controller box power cables, roll up cables, and secure.
- Verify IMU circulation fans (inside snout) are turned on with switch located on north IMU.
- Verify lights inside IMU are turned off.
- Assure that the Muon Dehumidifier is properly positioned, plugged in and operating. (The yellow Muon Cooling Fans are not currently being used).
- Move the lower fin to its operating (extended) position.

#### **4.0 Deviations from the Procedure**

All deviations from the above procedure must be approved by the CDF Department Head, after consultation with the CDF Operations Head or their Deputies.

**5.0 Required Training and Authorized Training Personnel**

The required training for this (CDF-II 414) procedure is in the form of “hands-on” experience gained while participating in an actual IMU move conducted by trained personnel. All personnel participating in this operation must be approved for CDF Supervised Access or CDF Controlled Access.

LIST OF AUTHORIZED TRAINING PERSONNEL FOR THIS PROCEDURE:

<u>Name (Last, First)</u>	<u>I.D.#</u>
Allen, Dervin	6220
Allspach, Del	7201
Lindgren, Michael	13974
Lukens, Pat	9382
Roser, Rob	11910

Either a procedure practice run led by an authorized trainer or a verbal discussion with an authorized trainer is the only required training. This choice depends on the specific procedure being performed and experience of the trainee.

**6.0 Training Materials**

A copy of this procedure.

**7.0 List of Trained People for this procedure**

The list of trained people for this procedure will exist in written form in the CDF Department copy of this procedure.

Dervin Allen  
Del Allspach  
Roberto Davila  
Jamie Grado  
Steve Hahn  
Mike Lindgren  
Pat Lukens  
Lew Morris  
Rob Roser  
Phil Schlabach  
Wayne Waldon  
Peter Wilson  
George Wyatt

**8.0 References and Supporting Documentation**

None