

## Solenoid Power-On Access to DØ Collision Hall for Solenoid Fringe Field Survey

### Revision Log

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1.2	5/2/05	All	Initial Issue

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# **1 INTRODUCTION**

## **1.1 Purpose**

This procedure describes the steps to be followed during mapping of the fringe fields of the D0 Solenoid in the DØ Collision Hall, which requires that the DØ solenoid magnet power supply is on during the collision hall access. The Electrical Engineer responsible for D0 support, or designee, is responsible for executing this procedure.

## **1.2 Scope and Applicability**

This procedure addresses the actions necessary to safely enter the Collision Hall and survey the magnetic fields while the solenoid is powered. It is done under controlled access conditions, with additional restrictions placed on entry, as described in this procedure. Only personnel authorized by the DØ Run Coordinator, or designee, and the Electrical Engineer responsible for DØ support, or designee, are permitted to enter the Collision Hall during this solenoid power on survey.

# **2 PRECAUTIONS AND LIMITATIONS**

A. Those involved in this survey must be aware that the solenoid fringe fields have not been surveyed with the detector in its final configuration, and there is potential for substantial magnetic fields. No individuals with cardiac pacemakers or other such medical implants or active sickle cell anemia may be involved in this survey.

## **2.1 Documents**

- [1] Obtain an informational copy of this procedure to use as a checklist.
- [2] Verify that the approval date and version number of the informational copy is the same as the posted controlled version.

## 2.2 Special equipment, tools, parts, and supplies

- [1] Obtain a portable magnetic field mapping instrument, and verify that the calibration of that device is properly understood.
- [2] Select a small ferrous object, such as a screwdriver, to empirically verify magnetic forces encountered during access.

## 2.3 Special approvals

- [1] Enter the name of the Electrical Engineer or designee responsible for executing this procedure:  
Name \_\_\_\_\_ I.D. # \_\_\_\_\_
- [2] Obtain PPD SSO approval on the "Accelerator Division Safety System Power Supply Jumper Request" form.
- [3] Submit the signed "Jumper Request" form to the Accelerator Division Senior Safety Officer for approval. Whenever possible, this form must be submitted at least 24 hours in advance.

## 2.4 Special training

- [1] Familiarization with toroid and solenoid operating procedures and hazards; training provided by Electrical Engineer responsible for DØ support.
- [2] Familiarization with [FESHM 5062.2 "Static Magnetic Fields"](#)
- [3] Controlled-access training.
- [4] Familiarization with the Controlled-access procedures, which will be adhered to in their entirety with the exception that the DØ Operator will not turn off and lock out the solenoid as specified in step 4.1 of [DØ-SAFETY-BLDG-003](#) v1.1.

# 3 PROCEDURE

## 3.1 Documenting those involved

**NOTE**        *The team performing this survey must consist of at least two people (a*

*mapper, who will perform the field measurements, and a verifier) and must have at least one escort. The escort cannot be part of the party performing the work.*

- [1] The personnel involved in the access should sign below, indicating that they have read and understand the procedures in this document:

	Name	I.D.#
DØ Controlled-access Coordinator	_____	_____
DØ Operator	_____	_____
Escort 1	_____	_____
Escort 2 (as needed)	_____	_____
Access Worker 1 - mapper	_____	_____
Access Worker 2 – verifier	_____	_____
Access Worker 3	_____	_____
Access Worker 4	_____	_____

- [2] Provide the DØ Controlled-access Coordinator with the names and ID numbers of those participating in this controlled access.
- [3] Remind the DØ Controlled-access Coordinator that only the people on the list can sign out a Collision Hall controlled access key while this procedure is in progress.
- [4] Enter the name of the Accelerator Division Safety Officer, or designee below.  
Name \_\_\_\_\_ I.D. # \_\_\_\_\_

### 3.2 Preparing the collision hall

- [1] Verify with the DØ Controlled-access Coordinator that the Collision Hall is currently secure and that there is no controlled access in progress.
- [2] Verify that the Collision Hall entrance is posted with the standard magnetic field warning sign that states "Danger - Magnetic Field Hazard - No persons with cardiac pacemakers when magnet energized".

- [3] Request that the DØ Operator power down the toroid and lock out the toroid power supply using a DØ Operations configuration control lock.
- [4] Verify that the toroid current is zero.
- [5] Request that the DØ Operator ramp down the solenoid power supply and lock out the solenoid power supply with the standard configuration control lock.

**NOTE**        *The solenoid takes approximately 15 minutes to ramp down to zero amps.*

- [6] Verify that the solenoid current is zero.
- [7] Confirm with the DØ Operator that both the toroid and solenoid power supplies have been locked off.
- [8] Disable the accelerator permit interlock connection to the solenoid power supply.

### 3.3 Testing the solenoid power supply crash button

**NOTE**        *Perform the following steps ONLY for the solenoid magnet power supply.*

- [1] The Electrical Engineer or designee performs the following operations related to the solenoid power supply:
  - [a] Verify that the solenoid power supply is set to 0 amps from the Controls Console.
  - [b] Manually switch the power supply to local.
  - [c] Manually set the internal reference control to 0 amps.
  - [d] Turn ON the main circuit breakers (utility room) and front panel circuit breakers (on power supply) for the solenoid power supply.
  - [e] Manually reset the power supply interlocks.
  - [f] Manually reset the power supply and press the ON button.
- [2] Verify that the red magnet status lamps mounted on the wall of the collision hall entrance show the proper magnet power supply status (by looking through the window on the door to the collision hall).
- [3] At least two members of the team that is scheduled to perform the solenoid fringe field measurement should make a controlled access to test the power supply crash button in the Collision Hall. Note that all controlled access procedures documented in DØ-SAFETY-BLDG-003 v1.1 are to be followed as usual

EXCEPT that the solenoid power supply is to be on (in contrast to statements made in section 4.1 of that document).

- [4] Verify that the red magnet status lamps mounted on the west wall of the collision hall show the proper status.
- [5] Press and then manually retract the Solenoid/Toroid magnet power supply crash button located in the Collision Hall entrance.
- [6] Verify that the red magnet status lamps show the proper status.
- [7] Ask the DØ Operator if the solenoid magnet power supply has tripped off. IF it did not, THEN discontinue the test until the crash button is repaired and works properly.
- [8] When the crash button test is successfully completed, the team exits the collision hall.
- [9] Instruct the DØ Operator to do the following:
  - [a] Reset the power supply interlocks.
  - [b] Reset the solenoid power supply.
  - [c] Place the solenoid power supply into remote mode.
  - [d] Proceed to energize the solenoid magnet to 4550 amps.
- [10] The fringe field survey team should now perform the survey (as per procedures specified in the following sections).

### **3.4 Performing survey in collision hall**

- [1] Record solenoid magnet current and polarity for the survey below.
  - [a] Solenoid \_\_\_\_\_ amps (control system readback)
  - [b] Solenoid Polarity \_\_\_\_ FWD \_\_\_\_ REV (control system readback)
- [2] Verify that the toroid is still powered down.
- [3] The escort(s) are to remain in visual and audible contact with the personnel performing the survey and check in with the DØ Controlled-access Coordinator at least once per hour to let them know that the survey is proceeding safely. Two-way radios may be used for contact.

- [4] All personnel entering the collision hall during this controlled access must be aware of the following information:
  - [a] Exit the collision hall if any unusual or dangerous situation develops.
  - [b] Large metal objects (e.g., ladders, pipes) must not be carried while the solenoid power supply is on.
  - [c] Always work with another person. Take brief work breaks at least every two hours to avoid fatigue.
  - [d] Inform the escort if you need the solenoid magnet to be de-energized.
- [5] Survey team and escort enter the Collision Hall, ensuring that each has a controlled access key.
- [6] Document the results of the fringe field survey, marking measurements on a map of the detector.
- [7] Areas to be surveyed include:
  - [a] Accessible stairways and ladders
  - [b] Accessible ventilation platforms
  - [c] Sidewalks
  - [d] North and south walkways
  - [e] Pit and platform areas (north, central and south)
  - [f] Cryo corner
  - [g] All accessible muon trusses
- [8] One member of each survey team (verifier) should firmly carry a small ferrous object, such as a screwdriver, and maintain a safe distance behind the person (mapper) using the portable field mapping instrument, while the mapper performs the survey. The verifier should use the small ferrous object to perform an independent empirical verification that no large magnetic forces are detected in readily accessible areas. Document any locations where significant forces are observed.

### **3.5 Securing from solenoid power-on access**

- [1] Once the survey is complete, verify that all people have exited the Collision Hall.

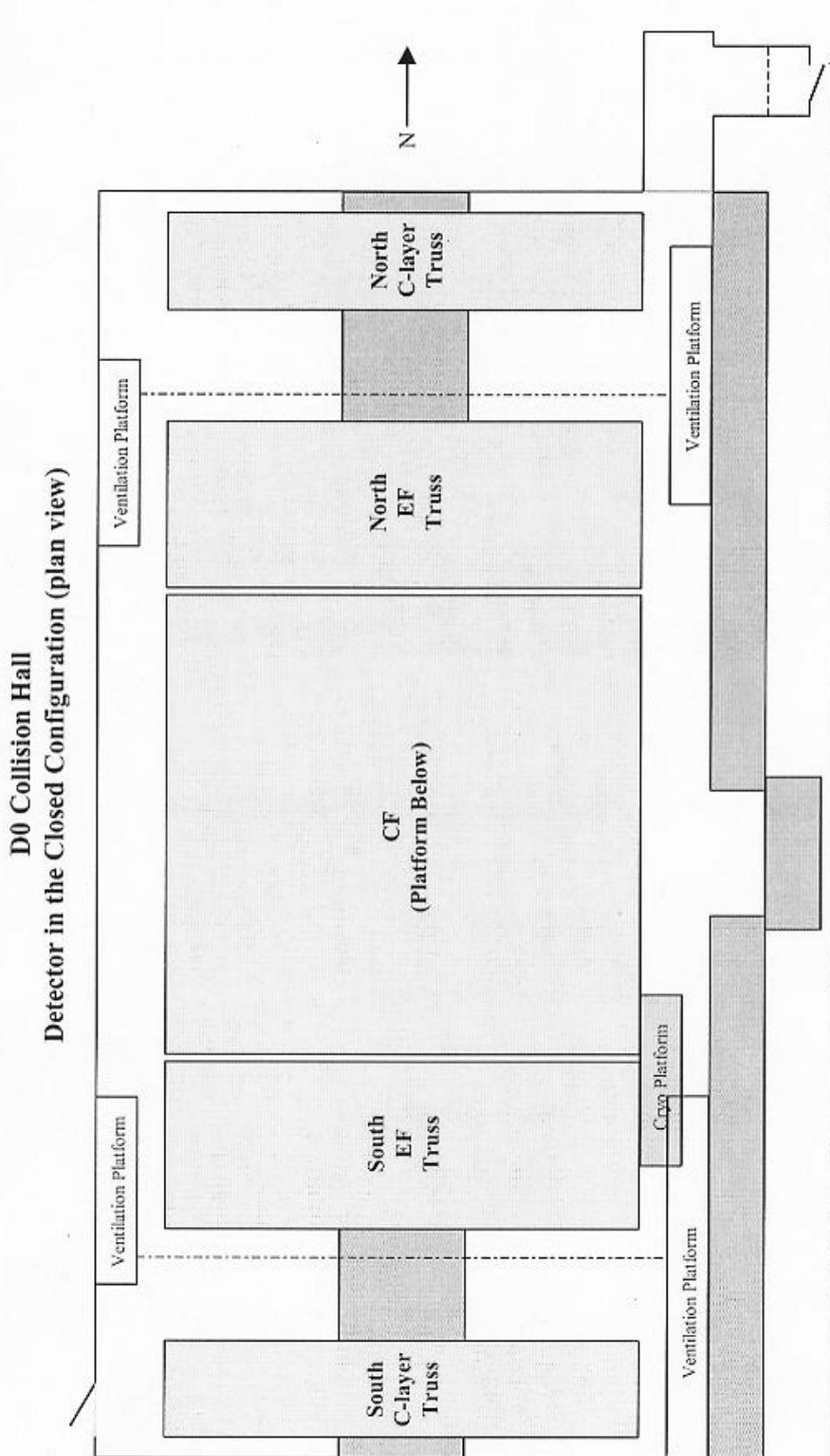
- [2] The DØ Controlled-access Coordinator should return all keys to the remote keytree.
- [3] Check whether all fringe field readings in regions that are readily accessible are below action levels of 300 Gauss for head or torso and 3000 Gauss for extremities. If so, then it may be possible to make future controlled accesses with the solenoid power on without additional restrictions. If not, it may be necessary to further restrict access to high field regions, and post appropriate signs.
- [4] Inform the Accelerator Division Senior Safety Officer, or designee, that the survey is complete.
- [5] Check with Accelerator Division Senior Safety Officer to determine whether the accelerator permit interlock for the solenoid power supply can be left disabled (based upon the results of the solenoid fringe field survey).
- [6] IF the fringe fields in readily accessible regions are below the action levels of 300 Gauss for the head or Torso and 3000 Gauss for the extremities, and the Accelerator Division Senior Safety Officer consents, then there is no need to discharge the solenoid to re-enable the accelerator permit interlock to the solenoid power supply.
- [7] IF the accelerator permit interlock to the solenoid power supply must be re-enabled:
  - [a] Instruct the DØ Operator to set the solenoid power supply to 0 amps and turn it off.
  - [b] The Electrical Engineer will re-enable the accelerator interlock to the solenoid power supply.
  - [c] Once the interlock has been re-enabled, verify that the "Accelerator Permit" is "Not Ok" on both the solenoid and toroid interlock status indicators.
- [8] Summarize the activity in the DØ Electronic Log Book.

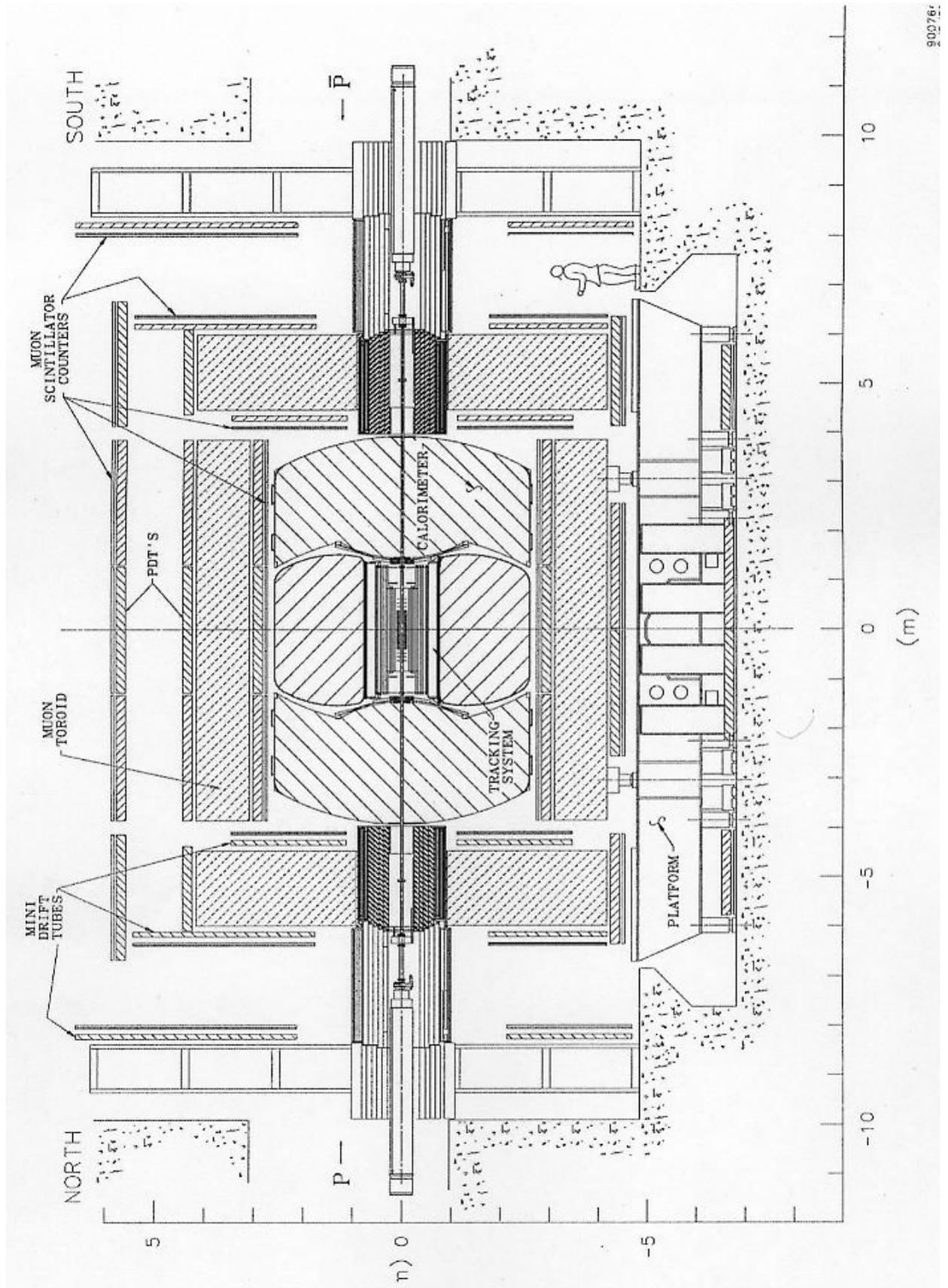
## 4 REFERENCES

- B. [Accelerator Division Procedure ADSP-10-002](#), "Safety System Interlock Bypass Procedure"
- C. Beams Division Safety System Power Supply Jumper Request Form
- D. [FESHM 5062.2, "Static Magnetic Fields"](#)
- E. [FESHM 5044, "Protection Against Exposed Electrical Bus"](#)
- F. DØ Controlled Access Procedure, [DØ-SAFETY-BLDG-003](#)
- G. DØ Electronic Log Book

## 5 APPENDICES

- Plan View of the DØ Collision Hall
- Elevation View of the DØ Detector in the Collision Hall (Note that the this view has North on the bottom of the page, as opposed to the plan view of the Collision Hall which has North on the top of the page.) Two copies of elevation view provided to facilitate documentation of fringe field measurements on east and west sides of detector.





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