

## DØ Silicon Detector Radiation Protection

### Revision Log

Version Number	Date Approved	Pages Affected	Description of Revisions
1.0	2/23/01	All	Initial Issue
1.1	3/5/01	5,6,7	Adjustment of integral value limits for C:D0BRUT to be done by collider sequencer.
1.2	5/15/02	See sidebars in text	Substantial revision to Appendix A-Table of Abort and Alarm Thresholds; various changes in text to reflect changes in Appendix A.

### Approvals

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## 1 INTRODUCTION

### 1.1 Purpose

This procedure describes the steps to be taken by the DØ Shift Crew and Main Control Room personnel with respect to the initiation of and recovery from Tevatron alarms and aborts caused by the DØ silicon detector radiation protection system.

### 1.2 Scope and Applicability

This procedure governs *alarms* and both manual and automated *aborts* of the Tevatron beam. The *alarm* condition is a preliminary indication of radiation levels that may cause significant damage to the SMT detector. The *abort* condition actually aborts the Tevatron beam to protect the SMT. Automated aborts are generated when the radiation-protection systems CAMAC electronics removes the Tevatron 5V enable/permit, causing the beam to be removed from the Tevatron without human intervention. Manual aborts are initiated by MCR shift personnel when certain integrated dose thresholds are exceeded.

## 2 PRECAUTIONS AND LIMITATIONS

The suggested levels for both *alarm* and *abort* are outlined in Appendix A. These levels may need to be adjusted during the collider run. The levels can be adjusted only by mutual agreement among the following:

- Beams Division Collider Run Coordinator
- DØ Run Coordinator
- DØ SMT Radiation Damage Control Officer (RDCO).

Changes to the agreed upon alarm and abort levels must be entered into the DØ SMT Rad Log by the DØ Run Coordinator.

### **3 PREREQUISITE ACTIONS**

#### **3.1 Documents**

[1] None

#### **3.2 Special equipment, tools, parts, and supplies**

[1] None

#### **3.3 Special approvals**

[1] None

#### **3.4 Special training**

[1] The following people must be trained in this procedure:

- DØ Run Coordinator and potential designees
- DØ Radiation Damage Control Officer (RDCO) and potential designees
- DØ Shift Captains
- Main Control Room Crew Chiefs

[2] Receive a copy of section 4 of this procedure and review it.

[3] Obtain familiarization lecture and a tour of the relevant parts of the system in the DØ Control Room and MCH3 from a system expert prior to being authorized to carry out this procedure. Current system experts are:

- Naeem Ahmed
- Ron Lipton

[4] The tour should include stops at:

- SMT radiation protection CAMAC crate
- SMT abort acknowledge switch
- SMT applications pages in ACNET

## 4 PROCEDURE

### 4.1 Manual Aborts

#### 4.1.1 Manual Abort During Shots

**NOTE** *This section covers the period from the start of shot setup until the end of scraping.*

##### MCR Crew Chief

- [1] Verify that the integral value of C:D0BRUT has been reset to zero by the collider sequencer at the start of shot setup.
- [2] Verify that the alarm level and alarm status of C:D0BRUT have been set by the collider sequencer so that it will alarm when it increases by the Manual Shot Alarm value (Appendix A, item 3).
- [3] If contacted by the DØ Shift Captain because of a manual shot alarm, do the following:
  - [a] Attempt to understand the nature of the problem and correct it.
  - [b] Call Tevatron experts, if necessary.
  - [c] Call the Collider Run Coordinator at the earliest convenient time.
- [4] IF C:D0BRUT increases by more than the MCR Manual Shot Abort value (Appendix A, item 4) THEN abort the beam.

##### DØ Shift Captain

**CAUTION** *The ultimate responsibility for the monitoring and protection of the DØ silicon detector resides with the DØ experiment.*

- [1] Instruct a DØ shift worker to monitor C:D0BRXX.
- [2] Startup page E35 on the Accelerator Console and verify that the abort modules are enabled (*en*).
- [3] IF C:D0BRXX exceeds the Manual Shot Alarm value (Appendix A, item 3), THEN inform the MCR crew chief and ask that the problem be investigated and corrected.

#### 4.1.1 Manual Abort During Shots (continued)

- [4] IF C:DØBRXX increases by more than the DØ Manual Shot Abort value (Appendix A, item 5) AND the MCR crew chief fails to abort the beam, THEN abort the beam.

#### 4.1.2 Manual Abort During Stores

**NOTE** *This procedure covers the period after scraping is complete.*

##### MCR Crew Chief

- [1] Verify that the integral value of C:DØBRUT has been reset to zero by the collider sequencer at the start of a store, after scraping is complete.
- [2] Verify that the alarm level and alarm status of C:DØBRUT have been set by the collider sequencer so that it will alarm when it increases by the Manual Store Alarm value (Appendix A, item 8).
- [3] If contacted by the DØ Shift Captain because of a Manual Store Alarm, do the following:
  - [a] Attempt to understand the nature of the problem and correct it.
  - [b] Call Tevatron experts, if necessary.
  - [c] Call the Collider Run Coordinator at the earliest convenient time.
- [4] IF C:DØBRUT increases by more than the MCR Manual Store Abort value (Appendix A, item 9) THEN abort the beam.

##### DØ Shift Captain

**CAUTION** *The ultimate responsibility for the monitoring and protection of the DØ silicon detector resides with the DØ experiment.*

- [1] Instruct a DØ shift worker to monitor C:DØBRXX.
- [2] Startup page E35 on the Accelerator Console and verify that the abort modules are enabled (*en*).
- [3] IF C:DØBRXX exceeds the Manual Store Alarm value (Appendix A, item 8), THEN inform the MCR crew chief and ask that the problem be investigated and corrected.

#### 4.1.2 Manual Abort During Stores (continued)

- [4] IF C:DØBRXX increases by more than the DØ Manual Store Abort value (Appendix A, item 10) AND the MCR crew chief fails to abort the beam, THEN abort the beam.

#### 4.1.3 Manual Abort During Studies

**NOTE** *This procedure covers collider study periods, or any other time when beam is injected into the Tevatron, except for shot or store conditions.*

##### MCR Crew Chief

- [1] Reset the integral value in rads of C:DØBRUT at the beginning of each 8-hour shift.
- [2] Adjust the limit and alarm status of C:DØBRUT so that it will alarm when it increases by the Manual Studies Alarm value (Appendix A, item 13).
- [3] If contacted by the DØ Shift Captain because of a Manual Studies Alarm, do the following:
  - [a] Attempt to understand the nature of the problem and correct it.
  - [b] Call Tevatron experts, if necessary.
  - [c] Call the Collider Run Coordinator at the earliest convenient time.
- [4] IF C:DØBRUT increases by more than the MCR Manual Studies Abort value (Appendix A, line 14) THEN abort the beam.

##### DØ Shift Captain

**CAUTION** *The ultimate responsibility for the monitoring and protection of the DØ silicon detector resides with the DØ experiment.*

- [1] Instruct a DØ shift worker to monitor C:DØBRXX.
- [2] Startup page E35 on the Accelerator Console and verify that the abort modules are enabled (*en*).
- [3] IF C:DØBRXX exceeds the Manual Studies Alarm value (Appendix A, item 13), THEN inform the MCR crew chief and ask that the problem be investigated and corrected.

#### 4.1.3 Manual Abort During Studies (continued)

- [4] IF C:DØBRXX increases by more than the DØ Manual Studies Abort value (Appendix A, item 15) AND the MCR crew chief fails to abort the beam, THEN abort the beam.

#### 4.1.4 Response to SMT Manual Abort

**NOTE** *Only the DØ Run Coordinator (or designee) can authorize the reset of the SMT Abort. The decision to reset will be made by the DØ Run Coordinator in consultation with the DØ SMT Radiation Damage Control Officer (RDCO) and Accelerator Operations. This consultation will consider data from the SMT Radiation Monitors (SRM), and other TeV diagnostics.*

- [1] IF the Tevatron problem is curable and understood by the DØ Run Coordinator, THEN the DØ Shift Captain will reset the abort by toggling the SMT ABORT RESET switch following a software reset of the abort system. Operations may then resume.
- [2] IF the Tevatron problem is not curable, or is recurring, or is not understood by the DØ Run Coordinator, THEN the DØ Run Coordinator may elect to consult a DØ Spokesperson (or his designee) before the ABORT is reset.
- [3] IF the problem is believed to put the SMT at serious risk, THEN the DØ Run Coordinator or DØ Spokesperson may elect to delay resetting the abort until appropriate discussions have taken place among DØ, Particle Physics Division, and Beams Division personnel, and, if necessary, the Directorate.
- [4] Record conclusions in the SMT Rad Log.

## 4.2 Automated Aborts and Alarms

**NOTE** *Only the DØ Run Coordinator (or designee) can authorize the reset of the SMT Abort. The decision to reset will be made by the DØ Run Coordinator in consultation with the DØ SMT Radiation Damage Control Officer (RDCO) and Accelerator Operations. This consultation will consider data from the SMT Radiation Monitors (SRM), and other Tevatron diagnostics. Conclusions will be logged in SMT Rad Log.*

### 4.2.1 Response To Valid Automated Aborts

**NOTE** *IF the measured dose at DØ was actually above the SMT threshold, THEN the abort is considered to be valid.*

- [1] IF the Tevatron problem is curable and understood by the DØ Run Coordinator, THEN reset the abort by toggling the SMT ABORT RESET switch following a software reset of the abort system. Operations may then resume.
- [2] IF the Tevatron problem is not curable, or is recurring, or is not understood by the DØ Run Coordinator, THEN the DØ Run Coordinator may elect to consult a DØ Spokesperson (or his designee) before the ABORT is reset.
- [3] IF the problem is believed to put the SMT at serious risk, THEN the DØ Run Coordinator or DØ Spokesperson may elect to delay resetting the abort until appropriate discussions have taken place among DØ, Particle Physics Division, and Beams Division personnel, and, if necessary, the Directorate.
- [4] Record conclusions in the SMT Rad Log

### 4.2.2 Response To Invalid Automated Aborts

**NOTE** *IF the measured dose at DØ is below the SMT abort threshold, THEN the abort is considered to be invalid.*

#### SMT Radiation Damage Control Officer

- [1] Trouble-shoot the cause of the invalid abort.
- [2] Minimize the time to the next store. Swap suspect modules, if necessary.
- [3] When the problem is corrected, reset the abort by toggling the SMT ABORT RESET switch following a software reset of the abort system. Operations may then resume.

#### 4.2.2 Response To Invalid Automated Aborts (continued)

- [4] Record the occurrence and conclusions in the SMT Rad Log.

#### 4.2.3 Response to Automated Alarms

##### DØ Shift Captain

- [1] Consult with the SMT Radiation Damage Control Officer and the Accelerator Main Control Room to understand the reasons for the observed losses.
- [2] IF the dose at DØ is above the alarm threshold, THEN request that the accelerator MCR investigate to determine the source of the problem.
- [3] Record the occurrence and conclusions in the SMT Rad Log.

##### SMT RDCO

- [1] IF the dose at DØ is below the Alarm Threshold, THEN trouble-shoot the cause of the false alarm.
- [2] Report the cause to the Shift Captain.

#### 4.3 On Abnormal Termination Of Store But Dose Below Abort Threshold

##### DØ Shift Captain

- [1] Assign a shift member to interpret dose data.
- [2] IF losses at DØ are unusually large, THEN consult with SMT RDCO.

##### SMT RDCO

- [1] Consult with DØ Run Coordinator, if necessary.

#### 4.4 Monitoring

##### DØ Shift Crew

- [1] Monitor data from the radiation dose detectors.
- [2] IF losses at DØ are unusually large, THEN consult with SMT RDCO (or designee).

##### SMT RDCO

- [1] Consult with DØ Run Coordinator, if necessary.

## **5 REFERENCES**

- A. DØ Note 3803, "What do we know about radiation damage in silicon detectors?"
- B. DØ Note 3837, "DØ RunIIa Beam Loss Monitors"

## **6 APPENDICES**

- A. Abort and Alarm Thresholds For DØ SMT Radiation Protection System

## APPENDIX A

### Abort and Alarm Thresholds For DØ SMT Radiation Protection System

Item	Period	Location	Alarm/Abort	Type	Level	Device	Setting	Units	Comments
1	<b>Shot Setup</b>	CAMAC	Alarm	Rate	6.37 rad/sec	DØBLXX	169	counts	OR of 8 devices
2		CAMAC	Abort	Rate	12.6 rad/sec	DØBTXX	188	counts	OR of 8 devices
3		CAMAC	Alarm	Integral	1 Krad	DØBRUT	1000	rads	single device
4		MCR	Man Abort	Integral	2 Krad	DØBRUT	-		single device
5		DØ	Man Abort	Integral	3 Krad	DØBRXX	-		Any one of 8 devices
6	<b>Store</b>	CAMAC	Alarm	Rate	6.37 rad/sec	DØBLXX	169	counts	OR of 8 devices
7		CAMAC	Abort	Rate	12.6 rad/sec	DØBTXX	188	counts	OR of 8 devices
8		CAMAC	Alarm	Integral	3 Krad	DØBRUT	3000	rads	single device
9		MCR	Man Abort	Integral	4 Krad	DØBRUT	-		single device
10		DØ	Man Abort	Integral	5 Krad	DØBRXX	-		Any one of 8 devices
11	<b>Studies</b>	CAMAC	Alarm	Rate	6.37 rad/sec	DØBLXX	169	counts	OR of 8 devices
12		CAMAC	Abort	Rate	12.6 rad/sec	DØBTXX	188	counts	OR of 8 devices
13		CAMAC	Alarm	Integral	4 Krad	DØBRUT	4000	rads	single device
14		MCR	Man Abort	Integral	5 Krad	DØBRUT	-		single device
15		DØ	Man Abort	Integral	6 Krad	DØBRXX	-		Any one of 8 devices