

ACCELERATOR DIVISION ADMINISTRATIVE PROCEDURE

ADAP-11-0001

BEAM PERMITS, RUN CONDITIONS, and STARTUP

RESPONSIBLE DEPARTMENT : AD/ES&H

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Accelerator Division Head

REVISION NO. 4 REVISION DATE 1/27/09

**SUPERSEDED**

REVIEW AND CONCURRENCE RECORD

REVIEWED BY:  DATE: 2-19-09  
Operations Department Head

REVIEWED BY:  DATE: 2-2-09  
AD/ES&H Department Head

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## 1.0 PURPOSE AND SCOPE

One purpose of this procedure is to describe how the Accelerator Division complex is turned back on after an extended shutdown. An extended shutdown being defined as a shutdown that is typically greater than a month long. Another purpose is if the Tevatron is warmed up to room temperature, extensive maintenance or improvement work has taken place, or if a changeover between collider and fixed-target modes has been done. This procedure is also used as a driver to generate “Beam Permits” and “Running Conditions” that define operational parameters. This procedure can be executed whenever it is deemed necessary to formally review a given startup or operational change. This procedure does not address the shorter, controlled shutdowns that occur during the course of a run for maintenance and repair of specific components, or improvements to a few specific subsystems.

### 1.1 Policy

It is the Accelerator Division Policy that beam will not be introduced into any accelerator or beamline enclosure until:

- a. equipment and components are configured in a manner to safely allow beam transport.
- b. operational beam limits have been established consistent with the requirements of the Accelerator Safety Envelope (ASE), contained in the current applicable Safety Assessment Document.

## 2.0 RESPONSIBILITIES

### 2.1 AD ES&H Department Head

The AD ES&H Department Head is responsible for ensuring this document is prepared and updated on an as-needed basis.

### 2.2 AD Department Heads

All department heads are responsible for ensuring that the provisions relevant to their departments are carried out. In the event of a change in departmental procedure that affects startup, the AD department heads are responsible for ensuring that the Division head or designee is informed. In addition the AD Department Heads (or their designees) are required to sign off on the relevant System Start-Up Sign-Off sheets and checklists.

### 2.3 AD Division Head

The AD Division Head is responsible for overseeing that the provisions of this procedure are carried out. The AD Division Head is responsible for Approving the System Start-Up Sign-off, Beam Permit, and Run Condition documents, and for sending the appropriate memos to the Operations Department Head to allow for the start or restart of the various systems.

The AD Division Head is responsible for designating a major shutdown or initiating this procedure. Such a designation is accomplished by a memo to the AD Operations Department Head rescinding authorization to introduce, accelerate, or transport beam until re-authorized in writing as described in this procedure.

#### 2.4 AD Radiation Safety Officer

The AD Radiation Safety Officer will prepare and review the Beam Permit, Running Condition, and the System Start-Up Sign-off documents for compliance with the current Fermilab Radiological Control Manual (see attachments 1, 2, and 3, respectively).

### 3.0 STARTUP PROCEDURE

#### 3.1 Beam Permits and Running Conditions

Prior to the start of any accelerator beamline, or experimental area, a Beam Permit and Run Condition shall be generated and placed in the Main Control Room (Attachments 1 and 2). The Beam Permit and Running Condition identify beam power and operating parameters allowed for the appropriate system within the current Safety Envelope limits. The beam power limits are determined by the Division Head in consultation with the ES&H Department Head, the AD/Radiation Safety Officer, and the Head of Operations. In general the operational beam permit limit will be less than or equal to the "Beam Permit" limit. "Beam Permits" are prepared and reviewed by the AD Radiation Safety Officer to ensure compliance with the current appropriate system ASE, and are reviewed by the AD Operations Department Head, the AD Systems Department Head for the system in question, the AD ES&H Department Head, and approved by the AD Division Head. "Running Conditions" are prepared and signed by the AD Radiation Safety Officer, and signed by the AD/Operations Department Head, and AD/Division Head.

Run Conditions provide the Operations Department with the allowed or required safety related beamline parameters and configurations and any additional safety related restrictions on operating the beam. These limits may be the same as, or less than, the Beam Permit based on temporary or operational ALARA considerations. "Running Conditions" typically include:

- The Date Issued
- A Mode Identifier (some systems have multiple “Running Conditions”)
- The “Beam Permit” limit
- The “Operational Limit” (an operationally determined safety factor)
- The designated “Critical Devices” and enclosures protected
- Any Interlocked Radiation Detectors and monitoring channels (DEMUX)
- Any required special interlocks or setting types
- Devices or systems that must be disabled to allow access
- Any special concerns that require approval before re-enabling as system
- Associated Gates, Fences, or Passive Shielding Requirements
- Operational Comments such as what toroid monitors intensity
- Examples of Beam Permit and Operating Limit combinations with respect to Particles/Pulse, energy and repetition rate

Only the DEMUX channels of interlocked detectors and “Operational Comments” can be altered by the AD/RSO using initials on existing documents, any other changes require a new “Running Condition” be generated and approved.

### 3.2 Sign-Offs and Checklists

Each Department Head shall sign the System Startup Sign-Off form indicating that all work is completed and that to their knowledge the system is ready to accept beam. In addition, the signature of the department head responsible for a particular system indicates that the radiation shielding for the system is configured as described in the current shielding assessment, and the AD Radiation Safety Officer signature indicates that the assessment is consistent with the current FRCM.

### 3.3 System Turn-On

#### 3.3.1 Generic Conditions

A valid “Beam Permit”, “Running Condition” and System Start-Up Sign-off (see Attachments 1, 2, 3) are required to be completed before a given beamline system may accept and/or accelerate beam.

System operation is initiated by a memo that is sent by the AD Division Head to the AD Operations Department Head indicating that a system is ready for beam transport.

#### 3.3.2 Tevatron Cool Down and Power Up

In addition to the generic conditions given above, the following specific conditions apply to the Cool Down and Power Up of the Tevatron:

- a. The mechanical and cryogenics groups that work on the Tevatron complete a walk-through following specific procedures. After the walk-through, a meeting is convened that is attended by the AD Division Head (or designee), and the AD Cryogenics, Mechanical Support, and Tevatron Department Heads (or their respective designees). The walk-through data is examined to ensure that all of the work was done properly and everything has been restored properly. At this point, the walk-through procedure is signed off and permission can be given to initiate Tevatron cool down. This permission, with any conditions if necessary, is formally transmitted by a memo from the AD Division Head to the AD Operations Department Head. The permission can be verbally transmitted by the AD Division Head, but has then to be followed by the written memo within seventy-two hours.
  
- b. The AD EE Support Department carries out an electrical walk-through inspection following specific procedures. After the walk-through, a meeting is convened that is attended by the AD Division Head (or designee), and the Tevatron and EE Support Department Heads (or their respective designees), AD Operations Department Head and the ES&H Department Head. The walk-through checklists and data are examined to ensure all the work was done correctly and that everything has been restored properly. At this point, the walk-through procedure is signed off and permission can be given to power the Tevatron when it is cold. This permission, with any conditions if necessary, is formally transmitted by a memo from the AD Division Head to the AD Operations Department Head. The permission can be verbally transmitted by the AD Division Head, but has then to be followed by the written memo within seventy-two hours.

#### 4.0 DOCUMENTATION

Copies of all Beam Permits, Running Conditions, System Start-Up Sign-off forms, and cool down forms will be retained by AD Headquarters. In addition, the currently active Beam Permits and Running Conditions for all accelerator systems will be viewable in the Main Control Room.

5.0 DISTRIBUTION

An electronic controlled copy of this procedure is maintained on the ES&H Department web site at:

[Http://www-bdnew.fnal.gov/esh/adsp/index.html](http://www-bdnew.fnal.gov/esh/adsp/index.html)



**BEAM PERMIT**

Example

**Linac**

The maximum hourly beam power authorized through the Linac accelerator is limited to  $3.54 \times 10^{17}$  particles to 400 MeV in any one hour.

No accelerator or beam line will transmit beam without an operational beam interlock safety system.

**Linac Beam Operating Limits**

The operational limit for beam transmitted through the Linac in any one hour is  $3.34 \times 10^{17}$  particles.

Examples: Particles/hr = current (mA) x pulse length (μsec) x number of pulses/hr x  $6.25 \times 10^9$

#1 33 mA of beam with a pulse length of 30 μsec at 15 pulses/sec for one hour  
 $33 \text{ mA} \times 30 \text{ μsec} \times 54000 \text{ pulses/hr} \times 6.25 \times 10^9 = 3.34 \times 10^{17}$

#2 50 mA of beam with a pulse length of 30 μsec at 5 pulses/sec for one hour  
 $50 \text{ mA} \times 30 \text{ μsec} \times 18000 \text{ pulses/hr} \times 6.25 \times 10^9 = 1.69 \times 10^{17}$

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Special conditions and comments:

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Reviewed by \_\_\_\_\_  
Operations Department Head/Date

Reviewed by \_\_\_\_\_  
Proton Source Department Head/Date

Reviewed by \_\_\_\_\_  
Accelerator Division ES&H Dept Head/Date

Reviewed by \_\_\_\_\_  
Accelerator Division Radiation Safety Officer/Date

Approved by \_\_\_\_\_  
Accelerator Division Head/Date



R.S.O.

# Running Condition Switchyard 120

October 23, 2007  
Michael A. Gerardi



Example

<b>Mode Identifier</b>	Beam to the Switchyard Absorber/Meson, via P3		
<b>Beam Permit Limit</b>	7.5 E14 protons/hour		<u>Exp. #</u>
<b>Operational Limit</b>	6.7 E14 protons/hour		N/A
<b>Critical Devices</b>	<b>S:HP3US &amp; S:HP3DS</b>		
<b>Enclosures Protected</b>	Transfer Hall & Enclosures B,C,D,E		
	<u>Interlocked Radiation Detectors</u>		
	<u>Detector Trips</u>	<u>Demux</u>	<u>Location</u>
<u>Detector Type</u>			
Chipmunk	I:Lam52 & I:V701	2-009	A0 Ramp
Chipmunk	I:Lam52 & I:V701	2-010	Transfer Gallery Head House North
Chipmunk	I:Lam52 & I:V701	2-011	Transfer Gallery Head House South
Chipmunk	I:Lam52 & I:V701	2-246	F2 Cryo Building
Chipmunk	I:Lam52 & I:V701	2-247	F23 Kicker Building
Chipmunk	I:Lam52 & I:V701	2-250	F3 Cryo Building
Chipmunk	I:Lam52 & I:V701	2-252	F4 Cryo Building

### Other Requirements

**Special Interlocks:**

The "CDC" Inputs required to obtain a "Beam Permit" may be found on the "Safety System Status" pages.

**Info:** All interlocked Detectors are in the Integrate Mode and trip the P150 CDC.

**Access Devices:** S:HP3US or S:HP3DS must be disabled in order to access the enclosures protected

**Special Concerns:** Any work performed on Critical Devices requires RSO approval before re-establishing beam.

**Gates, Fencing, and Passive Shielding Requirements:**

There is no access to radiologically fenced areas during beam operation without prior RSO approval.

## "Operational Comments"

Intensity is monitored via **S:SYDINT (SEM)**.

It is also acceptable to transport beam to the switchyard absorber or Meson using single turn extraction.

**Intensity Limit Examples:**

5.4E11 protons/cycle @ 1241 cycles/hour = 6.7 E14 protons/hour

1.0E12 protons/cycle @ 670 cycles/hour = 6.7 E14 protons/hour

R.S.O. approval also signifies that all necessary Interlock Tests have been completed and Removable Shielding is installed.  
**Ops. Department Approval**                      **R.S.O. Approval**                      **Division Head Approval**



**Fermilab**

SYSTEM START-UP SIGN-OFF

Signatures indicate that work done on systems has been completed and are ready for the start of beam operation. N/A indications should be initialed by the respective system Department Head.

SYSTEM BEING SIGNED OFF: [Linac](#), [NTF](#), [MuCOOL](#), [Booster](#), [Main Injector](#), [Recycler](#), [Pelletron](#),  
(circle one) [MiniBooNE](#), [NuMI Anti-Proton](#), [Tevatron](#), [Switchyard](#), [Fixed Target](#),

<u>DEPARTMENT</u>	<u>DATE</u>	<u>SIGNATURE (Department Head/Designee)</u>
Antiproton Source	_____	_____
Controls	_____	_____
Cryogenics	_____	_____
Electrical Support	_____	_____
ES&H	_____	_____
External Beams	_____	_____
Instrumentation	_____	_____
Main Injector	_____	_____
Mechanical Support	_____	_____
Operations	_____	_____
Operations	_____	_____
Pelletron	_____	_____
Proton Source	_____	_____
Recycler	_____	_____
RF	_____	_____
Tev	_____	_____

The \_\_\_\_\_ radiation shielding meets the requirements documented in the \_\_\_\_\_ shielding assessment.

Comments and special conditions:

**FINAL APPROVALS**

Department Head \_\_\_\_\_ Date \_\_\_\_\_

Radiation Safety Officer \_\_\_\_\_ Date \_\_\_\_\_

Accelerator Division Head \_\_\_\_\_ Date \_\_\_\_\_