

BEAMS DIVISION ADMINISTRATIVE PROCEDURE

BDAP-11-0001

BEAM PERMITS, RUN CONDITIONS, and STARTUP

RESPONSIBLE DEPARTMENT : BDHQ

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1.0 PURPOSE AND SCOPE

One purpose of this procedure is to describe how the Beams Division complex is turned back on after extended shutdowns. An extended shutdown is typically greater than a month long, the Tevatron is warmed up to room temperature, extensive maintenance or improvement work has taken place, or a changeover between collider and fixed-target modes has been done. 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. Another purpose of this procedure is to generate Beam Permits and Running Conditions, and can be executed when it is deemed necessary to formally review a given startup.

1.1 POLICY

It is the Beams 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 safety envelope contained in the current Safety Assessment Document.

2.0 RESPONSIBILITIES

2.1 BD ES&H Department Head

The BD ES&H Department Head is responsible for preparing this document and updating it on an as-needed basis.

2.2 BD ASSOCIATE DIVISION HEAD FOR ENGINEERING

The BD Associate Division Head for Engineering is responsible for coordinating shutdown activities and assuring that necessary maintenance is carried out.

2.3 BD 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 affect startup the BD department heads are responsible for ensuring that the Division head or designee is informed. In addition the BD Department Heads (or their designees) have to sign off on the relevant restart sheets and checklists.

2.4 BD DIVISION HEAD

The BD Division Head is responsible for overseeing that the provisions of this procedure are carried out. The BD Division Head is responsible for sending the memos to the Operations Department Head to permit start or restart of the various systems.

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

2.5 BD RADIATION SAFETY OFFICER

The BD Radiation Safety Officer will review the Beam Permit, and the System Startup Sign-off for compliance with the current Fermilab Radiological Control Manual (see attachments 1 and 2, respectively).

3.0 STARTUP PROCEDURE

3.1 BEAMS DIVISION COMPLEX

The Beams Division Complex consists of the Proton Source, Antiproton Source, MainInjector, Tevatron, Switchyard, and fixed target systems.

3.2 BEAM PERMITS AND RUNNING CONDITIONS

Prior to the start of any accelerator or beamline, a Beam Permit and Run Condition shall be completed and placed in the Main Control Room,(Attachments 1 and 3). The Beam Permit and Running Condition identify beam power and operating parameters allowed for the appropriate system. The beam power limits are determined by the Division Head in consultation with the ES&H Department Head and the Head of Operations, and are contained within the Safety Envelope limits. In general the operational beam permit limit will be less than or equal to 95% of the Safety Envelope limit. "Beam Permits" are prepared by the BD Operations Department Head and the BD Systems Department Head for the system in question, reviewed by the BD Radiation Safety Officer, and the BD ES&H Department Head, and approved by the BD Division Head. "Running Conditions" are prepared and signed by the BD Radiation Safety Officer, and signed by the Operations Department Head, and BD 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 ALARA considerations.

The complete list of systems requiring Beam Permits and Running Conditions are:

- a. Linac
- b. NTF
- c. Booster
- d. Antiproton Source

- e. Main Injector
- f. Recycler
- g. Tevatron
- h. Switchyard
- h. Fixed Target (including only current operating beamlines)

3.3 SIGN-OFFS & CHECKLISTS

The complete list of sign-off and checklists needed for this procedure are

- a. Beams Division System Restart Sign-off Form (Attachment 2)
- b. BD Mechanical Support Department Procedure BDDP-ME-0101
"Mechanical Support Department Quality Assurance Sign-off for
Maintenance and Upgrade Tasks on the Accelerator Complex"
- c. BD Cryogenics Department Procedures
 - BDDP-CR-9203 "Cryogenic Checklist Following Cold Tevatron
Component Change Procedure"
 - BDDP-CR-9204 "Cryogenic Checklist Following Cold Proton
Bend Component Change Procedure"
 - BDDP-CR-9205 "Cryogenic Checklist Following Cold Muon Bend
Component Change Procedure"
 - BDDP-CR-9206 "Cryogenic Checklist Following Cold Meson
Bend Component Change Procedure"
- d. BD EE Support Department Procedures
 - BDDP-EE-4011 "TEV QPM End of Shutdown Start-up Procedure"
 - BDDP-EE-4013 "Low Beta QPM End of Shutdown Start-up
Procedure"
 - BDDP-EE-4014 "Low Beta 1 kA Quad End of Shutdown or End of
Repair Start-up Procedure"

3.3.1 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 BD Radiation Safety Officer signature indicates that the assessment is consistent with the current FRCM.

3.4 SYSTEM TURN-ON

3.4.1 Generic Conditions

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

System startup is initiated by a memo that is sent by the BD Division Head to the BD Operations Department Head indicating that it is ready for beam transport. The memo will also indicate the maximum beam power that can initially be run through the system. If this beam power is not that given in the system Beam Permit, the conditions that will have to be fulfilled before the Beam Permit becomes fully operational are included in the memo.

3.4.2 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 BDDP-ME-0101 and BDDP-CR-9203. After the walk-through, a meeting is convened that is attended by the BD Division Head (or designee), and the BD Cryogenics, Mechanical Support, and Tevatron Department Heads (or their respective designees), BD Operations Department Head and the ES&H Department Head. 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 BD Division Head to the BD Operations Department Head. The permission can be verbally transmitted by the BD Division Head, but has then to be followed by the written memo within seventy-two hours.
- b. The BD EE Support Department carries out an electrical walk-through inspection following BDDP-EE-4011, 4013, 4014. After the walk-through, a meeting is convened that is attended by the BD Division Head (or designee), and the Tevatron and EE Support Department Heads (or their respective designees), BD 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 BD Division Head to the BD Operations Department Head. The permission can be verbally transmitted by the BD Division Head, but has then to be followed by the written memo within seventy-two hours.

3.4.3 Switchyard

In addition to the generic conditions given above, the following specific conditions apply to the Switchyard.

The mechanical and cryogenics groups that work on the Switchyard do a walk-through following BDDP-ME-0101 and BDDP-CR-9204, 9205, 9206. After

After the walk-through, a meeting is convened that is attended by the BD Division Head (or designee), and the BD Cryogenics, Mechanical Support, Operations, ES&H, and External Beams 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 Switchyard cool down. This permission, including special conditions if necessary, is formally transmitted by a memo from the BD Division Head to the BD Operations Department Head. This permission can be verbally transmitted by the BD Division Head, but has then to be followed by the written memo within seventy-two hours.

- b. The BD EE Support Department carries out an electrical walk-through inspection. After the walk-through, a meeting is convened that is attended by the BD Division Head (or designee), and the Switchyard and EE Support Department Heads (or their respective designees), BD 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 Switchyard when it is cold. This permission, including special conditions if necessary, is formally transmitted by a memo from the BD Division Head to the BD Operations Department Head. This permission can be verbally transmitted by the BD Division Head, but has then to be followed by the written memo within seventy-two hours.

4.0 DOCUMENTATION

Copies of all Beam Permit authorization memos, "Running Conditions" System Restart Sign-off forms, Beam Power permit forms, and cool down forms will be retained by BD Headquarters for a period of four years. In addition the currently active Beam Power permit forms for all accelerator systems will be viewable in the Main Control Room.

5.0 EXTRA-DIVISION DISTRIBUTION

None.



BEAM PERMIT

EXAMPLE

Linac Beam Safety Envelope

The maximum beam transmitted through the Linac accelerator is limited to 3.54 E17 particles 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 E17 particles.

For calculation purposes, where the pulse length is constant, the number of particles per hour may be determined by the following formula:

$$\text{particles/hour} = \text{current (mA)} \times \text{pulse length } (\mu\text{sec}) \times \text{actual \# pulses in one hour} \times 6.25 \text{E9}$$

Examples:

#1 33 mA of beam with a pulse length of 30 microseconds at 15 pulses per second for 1 hour.

$$33 \text{ mA} \times 30 \mu\text{sec} \times 54000 \text{ pulses/hr} \times 6.25\text{E9} = 3.34 \text{ E17 particles/hour}$$

#2 50 mA of beam with a pulse length of 30 microseconds at 5 pulses per second for 1 hour.

$$50 \text{ mA} \times 30 \mu\text{sec} \times 18000 \text{ pulses/hr} \times 6.25\text{E9} = 1.69 \text{ E17 particles/hour}$$

Special conditions and comments:

Prepared by _____
Operations Department Head/Date and Proton Source Department Head/Date

Reviewed by _____
Beams Division ES&H Head /Date

Reviewed by _____
Beams Division Radiation Safety Officer/Date

Approved by _____
Beams Division Head/Date

Date: 8/21/98
Rev: 4.7.1



EXAMPLE

SYSTEM SIGN-OFF

The signatures below indicate that work done on the system since the last period of operation has been completed, and that the systems are ready for restart of beam operation. Signatures that are N/A should be initialed by the system Department Head.

SYSTEM BEING SIGNED OFF: Linac, Booster, Anti-Proton, Main Injector,
(Circle One) Recycler, Tevatron, Switchyard, Fixed Target

<u>DEPARTMENT</u>	<u>DATE</u>	<u>SIGNATURE (Department Head/Designee)</u>
CONTROLS	_____	_____
CRYOGENICS	_____	_____
EE SUPPORT	_____	_____
RF & INSTRUMENTATION	_____	_____
MECH. SUPPORT	_____	_____
ES&H	_____	_____
OPERATIONS	_____	_____

The _____ radiation shielding meets the requirements documented in the _____ shielding assessment.

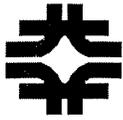
Approved by _____ Date _____
Department Head Date

=====
Comments and special conditions:

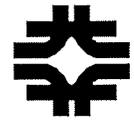
=====

FINAL APPROVALS

Department Head _____ Date _____
Radiation Safety Officer _____ Date _____
Beams Division Head _____ Date _____



Running Condition Main Injector



January 28, 1999

Michael A. Gerardi

R.S.O.

Mode Identifier Circulating Beam & Beam to the MI-40 Abort

Primary Intensity Limit 4.86 E15 protons/hour Exp. #

Additional Limit N/A N/A

Critical Devices **VBC1 & MP02**

Enclosures Protected MI-8, MI, TeV F-Sector, MI/TeV Crossovers, P-Bar Transport

Interlocked Radiation Detectors

<u>Detector Type</u>	<u>Detector Trips</u>	<u>Demux</u>	<u>Location</u>
Chipmunk	VBC1 & MP02	0-250	Booster West Tower/Berm
Chipmunk	VBC1 & MP02	0-251	Booster West Tower/Berm over MI-8
Chipmunk	VBC1 & MP02	0-252	Booster West Tower/MI-8 Line Berm
Chipmunk	VBC1 & MP02	Not Available	MI-8 Service Building Drop Area

DRAFT

Other Requirements

Special Interlocks:

The following CDC Inputs must be present in order to obtain a Main Injector Permit:

8 GeV ESS, 8 GeV Radiation Monitors, Main Injector ESS, MI/TeV Crossover ESS, P-Bar Transport ESS, and TeV F-Sector ESS.

All detectors are in the rate mode. See procedure for response to Main Injector detector trips in the Yellow Book.

Access Devices: VBC1 or MP02 must be disabled in order to access the 8 GeV Line, Main Injector, TeV F-Sector, P-Bar Transport, and MI/TeV Crossovers.

Special Concerns: Access to the MI-40 Absorber room requires **prior** RSO approval. 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"

The maximum charge transmitted through the Main Injector line is limited by the Beam Permit to 9.0 E15 protons/hour, however for initial commissioning via this "Running Condition" the limit is 4.86 E15 protons/hour. This is to minimize activation levels until such time as nominal tunes are better understood and documented. It is important during this commissioning phase that we minimize losses on the MI 40 abort lambertson. Operations is coordinating the monitoring of losses on the lambertson with an acknowledgable alarm. Bob Mau has generated a Note to the Operations Department explaining the requirements.

Intensity Limit Examples:

2 p/m at 4.05 E13 p/p --> 4.86 E15 p/h
4 p/m at 2.025 E13 p/p --> 4.86 E15 p/h
60 p/h at 8.1 E13 p/p --> 4.86 E15 p/h

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**