Memorandum

Michael Lindgren
Division Head

Accelerator Division
P.O. Box 500, MS 306
Kirk Road and Pine Street
Batavia, Illinois 60510-5011
USA
Office: 630.840.8409
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Date: October 11, 2019

To: Todd Sullivan

From: Michael Lindgren

Re: Approval for Running Booster

Safety documentation and procedures for restart of Booster operation are now complete and in place. Therefore, you are hereby authorized to run beam to the Booster.

cc: N. Chelidze
S. McGimpsey
E. McHugh
C.Y. Tan

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ADAP-11-0001
REV. 8

SYSTEM START-UP SIGN-OFF

The signatures below, unless noted in the comments section, indicate that the relevant systems are ready for the restart of beam operation. Indicate in the comments section any remaining work that would affect the restart of beam operations. Indicate N/A for departments that did not do any work on the system.

SYSTEM BEING SIGNED OFF: (Circle as Applicable)
Linac NIF MTA Booster [8-GeV Line-MI-10 Region] [MI-20-MI-62/Recycler] BNB NuMI P1-P2 Muon P3-Switchyard Meson Primary MT MC NM FAST PIP-II _____

DEPARTMENT	DATE	SIGNATURE (Department Head/Designee)
1. Controls	10-4-19	Amy L Vogel for J. Patrick
2. Cryogenics	N/A	
3. E/E Support	10-4-19	
4. RPO Manager	10/11/2019	Madelyn Schoell
5. LSO	N/A	
6. External Beamlines	N/A	
7. Instrumentation	10/4/2019	
8. Interlocks	10/4/2019	
9. Main Injector	10/4/19	Daniel Capestany
10. Mechanical Support	9 Oct 2019	M Wong-Squires
11. Muon	N/A	
12. Operations	10/11/19	
13. Proton Source	10-4-19	for Tom
14. RF	10-11-19	John Reid
15. ENG Support	10-4-19	Paul C Gerspach
16. Target Systems	N/A	
17. Shutdown Coordinator	10-11-19	

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Comments and special conditions (please mark comment with department # to connect comment with appropriate department):

#8: NOTE: We are locked in the Dump Mode. The MI half of the Booster Logic Module has not been tested.
Note: 8-GeV ESS has been tested.

#4: AN RSO LOCK IS IN PLACE KEEPING BOOSTER IN DUMP MODE

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The BOOSTER radiation shielding meets the requirements documented in the 2017 "BOOSTER SHIELDING ASSESSMENT" shielding assessment.

FINAL APPROVALS

System Department Head _____ Date 11 OCT '19
Assigned RSO _____ Date 10/11/19
AD Division Head _____ Date 10/11/2019

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BEAM PERMIT

10/11/2019

Booster Accelerator Safety Envelope (ASE) Limit

The maximum hourly beam power transmitted through the Booster accelerator is limited to:
1.80×10^{19} protons per hr at 8 GeV.

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

Booster Operating Limit

The maximum charge transmitted through the Booster is limited to:
2.70×10^{17} protons per hour at 8 GeV.

Examples: Charge/hr = number of pulses/hr x number of protons/pulse

#1 54,000 pulses per hour (15 Hz) at 5.00×10^{12} protons per pulse = 2.70×10^{17} protons per hour.

#2 36,000 pulses per hour (10 Hz) at 7.50×10^{12} protons per pulse = 2.70×10^{17} protons per hour.

Special conditions and comments:

Reviewed by Todd Sullivan 7092 10/11/19
Operations Department Head

Reviewed by Chris Yaretzky 11876 11 OCT 19
Systems Department Head

Reviewed by [signature] 10/11/19
Assigned RSO

Reviewed by Madelyn Schoell 10/11/2019
ESH&Q Radiation Physics Operations Department Head

Approved by [signature] 10/11/2019
Accelerator Division Head

Operator Signatures

Crew Chiefs

2019-10-11

10/11/2019

10-11-19

14011N 12OCT19

10/16/19

Crew A

10-11-19

10/11/19

10/11/19

10/14/19

Crew B

10-11-19

10/16/19

10/16/19

Crew C

10/11/19

10-11-19

10-11-19

10-12-19

Crew D

10/11/19

10/11/19

10/11/19

10/22/19

Crew E

10/2/19

10/12/19

10/12/19

10-12-19

Other

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Running Condition
Booster

October 11, 2019

Area RSO Sue McGimpsey

Mode of Operation Booster Operation

Beam Limits

Beam Energy	ASE Limit	Operating Limit
8 GeV	1.80 E19 protons/hr	2.70 E17 protons/hr

Critical Devices B:MH1 & B:LAM

Enclosures Protected Booster, 8 GeV Line

Preferred Monitoring Devices* Booster intensity is monitored via B:CHGBBM
Booster Absorber intensity is monitored via B:BBMDMP

*Other methods of monitoring intensity may be used.

Requirements

Access Devices B:MH1 and B:LAM must be disabled in order to access Booster, or the 8 GeV enclosures.

Cool Off Period none

Special Interlocks The CDC Inputs including failure mode devices may all be found on the Safety System Status pages.

Special Concerns Any work performed on critical devices or obtaining a critical device key requires prior RSO approval.

There are two operating modes for Booster: Extraction to 8 GeV line and beam to the Dump (Absorber). In order to change modes from sending beam to the dump (absorber) to extracting beam to areas downstream, the Booster permit should be disabled, otherwise the interlock system may interpret the change as a failure.

Gates, Fencing and Passive Shielding Requirements There is no access to radiologically fenced areas without prior RSO approval.
Shielding, fencing and posting are in accordance with the 2017 "Booster shielding assessment".

Assigned RSO approval also signifies that all necessary Interlock Tests have been completed and Removable Shielding is installed.

Ops. Dept. Head Approval _____ **Assigned RSO Approval** _____

Sys. Dept. Head Approval _____ **AD Head Approval** _____

Operational Comments

Booster is able to run in two modes: MI-10 (MI) Mode and Dump Mode
B:BS809 is OUT for MI-10 Mode, and IN for the Dump Mode.

Based on thermal considerations, the repetition rate is limited to 7 Hz when sending beam to the absorber.

MCR must be appropriately staffed according to the Accelerator Safety Envelope.

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Instrument Information

Interlocked detectors (i.e., Chipmunk, FOX, Scarecrow, TLM, etc.) in "Integrate" mode that trip will not allow a safety system reset until sufficient time has passed to keep the hourly dose rate equal to or below the trip point setting. Interlocked detectors in "Integrate" mode that trip may be reset as the safety system allows. If there are more than ten trips by an interlocked detector in "Integrate" mode in one hour, RSO approval is required before reset.

Intersect

MUX	Type	Location	QF	R/I Mode	Trip Level	CDC	Device(s) Tripped
0-203	Chipmunk	Booster East Fan Room (Short 12)	5	Integrate	5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-227	Chipmunk	Booster Crossover at CUB (Short 19)	5	Integrate	5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-232	Chipmunk	Booster/Linac W Gal Inersect (Long 22)	5	Integrate	2.5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-239	Chipmunk	Booster Per 1 Exit Stairwell (Short 1)	5	Integrate	5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-250	Chipmunk	MI-8 Line in WBT (12' US of Buttress)	5	Integrate	0.4 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-251	Chipmunk	MI-8 Line on Berm (WBT)	5	Integrate	5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
2-024	TLM	BSTR TLM1 Per 23, 24, 1		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-252	TLM	BSTR TLM2 Per 2, 3, 4		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-253	TLM	BSTR TLM3 Per 5, 6		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-205	TLM	BSTR TLM4 Per 8, 9, 10		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-206	TLM	BSTR TLM5 Per 11, 12, 13		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-220	TLM	BSTR TLM6 Per 14, 15, 16		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-221	TLM	BSTR TLM7 Per 17, 18, 19		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
2-025	TLM	BSTR TLM8 Per 20, 21, 22		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-254	TLM	BSTR TLM3a Per 6, 7		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM

Note: QF only included for chipmmunks

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Operator Signatures

Crew Chiefs

2019-10-11

10/11/2019

10-11-19

10/11/19

10/16/19

Crew A

10-11-19

10/11/19

10/11/19

10/17/19

Crew B

10-11-19

10/16/19

10/16/19

Crew C

10/11/19

10-11-19

10-11-19

10-12-19

Crew D

10/11/19

10/11/19

10/11/19

10/22/19

Crew E

10/12/19

10/12/19

10/12/19

10-12-19

Other

ADAP-11-0001