

Memorandum

Michael Lindgren
Division Head

Accelerator Division
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USA
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Date: September 27, 2019
To: Todd Sullivan
From: Michael Lindgren 
Re: Approval for Running LINAC

Message:

Safety documentation and procedures for running LINAC are now complete and in place. Therefore, you are hereby authorized for beam operation in Linac.

cc: Mary Convery
Sue McGimpsey
Eric McHugh
Maddie Schoell
CY Tan

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

<u>DEPARTMENT</u>	<u>DATE</u>	<u>SIGNATURE (Department Head/Designee)</u>
1. Controls	9/12/2019	<i>Janet Patrick</i>
2. Cryogenics	N/A	
3. E/E Support	9/10/2019	<i>[Signature]</i>
4. RPO Manager	9/27/2019	<i>Madeira Schrell</i>
5. LSO	9/20/19	<i>West</i>
6. External Beamlines	N/A	
7. Instrumentation	9/13/2019	<i>[Signature]</i>
8. Interlocks	9/12/2019	<i>Russ m. 3/Ko</i>
9. Main Injector	N/A	
10. Mechanical Support	9/12/2019	<i>MMong - Squires</i>
11. Muon	N/A	
12. Operations	09/27/19	<i>Todd Miller</i>
13. Proton Source	9-27-19	<i>[Signature]</i>
14. RF	N/A	
15. ENG Support	9/12/2019	<i>[Signature]</i>
16. Target Systems	N/A	
17. Shutdown Coordinator	9/16/19	<i>[Signature]</i>

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

N/A

The LINAC radiation shielding meets the requirements documented in the 1993 "RADIATION SHIELDING ASSESSMENT OF LINAC HIGH ENERGY ENCLOSURE FOLLOWING THE 1993 UPGRADE INSTALLATION + LOW INTENSITY COMMISSIONING" shielding assessment.

FINAL APPROVALS

System Department Head *[Signature]* Date 9/27/19
Assigned RSO *Madeira Schrell* for Sue McGimpsey Date 9/27/2019
AD Division Head *[Signature]* Date 9/27/2019

BEAM PERMIT**09/27/2019****LINAC Accelerator Safety Envelope (ASE) Limit**

The maximum beam intensity transmitted through the LINAC Beamline is limited to:
 1.77×10^{19} protons/hr at 400 MeV

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

LINAC Beamline Operating Limits

The maximum beam intensity transmitted through the LINAC Beamline is limited to:
 3.54×10^{17} protons/hr at 400 MeV

Examples: Particles/hr = current (mA) x pulse length (μ sec) x number of pulses/hr x 6.25×10^9

#1 35 mA of beam with a pulse length of 30 μ sec at 15 Hz for one hour yields 3.54×10^{17} protons/hour
($35 \text{ mA} \times 30 \text{ } \mu\text{sec} \times 54,000 \text{ pulses/hr} \times 6.25 \times 10^9 = 3.54 \times 10^{17} \text{ protons/hour}$)

#2 50 mA of beam with a pulse length of 30 μ sec at 5 Hz for one hour yields 1.69×10^{17} protons/hour
($50 \text{ mA} \times 30 \text{ } \mu\text{sec} \times 18,000 \text{ pulses/hr} \times 6.25 \times 10^9 = 1.69 \times 10^{17} \text{ protons/hour}$)

Special conditions and comments:

Reviewed by



Operations Department Head

Reviewed by



Systems Department Head

Reviewed by

Madelyn Schoell for see McGimpsey

Assigned RSO

Reviewed by



ESH&Q Radiation Physics Operations Department Head

Approved by



Accelerator Division Head

Operator Signatures

Crew Chiefs

Michael Van 2019-09-28 ✓
14011N
Douglas Th 28 Sep 19 ✓
Dylan 9/30/19 ✓
Michael 10/02/2019 ✓
Gregory 10-5-19 ✓

Crew B

Pat Doudle 9/30/19 ✓
Logan 9-30-19 ✓
Kell 10/1/19 ✓

Crew D

Stephan 9/28/19 ✓
Walter 9/28/19 ✓
Hayden 9-28-19 ✓
Jolyne 9-28-19 ✓

Crew A

Michael 9/28/19 ✓
Spencer 9/28/19 ✓
Cristy 9-28-19 ✓
Clare 9/29/19 ✓

Crew C

Greg 9-28-19 ✓
Raymond 9/28/19 ✓
Ken 9/28/19 ✓
Jacob 9/28/19 ✓

Crew E

Gilbert 9-30-19 ✓
Alan 9/30/19 ✓
Antez 9/30/2019 ✓
George 9/30/2019 ✓

Other

September 27, 2019

Sue McGimpsey

Area RSO

Mode of Operation Full Operation

Beam Limits	Beam Energy 400 MeV	ASE Limit 1.77 E19 protons/hr	Operating Limit 3.54 E17 protons/hr
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Critical Devices L:LVV and RFQ Low Level RF
L:LVV is a Vacuum Gate Valve

Enclosures Protected Linac and all areas downstream

Preferred Monitoring Devices* Intensity is monitored via L:RF3INT

*Other methods of monitoring intensity may be used.

Requirements

Access Devices L:LVV must be closed and RFQ Low Level RF must be OFF to access Linac.

Cool Off Period none

Special Interlocks The CDC Inputs including failure mode devices may all be found on the Safety System Status pages. No access to the Linac enclosure while the high energy (Klystron) and Marx modulator gradients are energized. Back-up devices are the ion source extractor PS AC Contactor L:AEXTSV AND L:BEXTSV The status of the RFQ low level RF is monitored in L:RFQDS1

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

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 1993 "Radiation shielding assessment of the Linac high energy enclosure following the 1993 upgrade installation and low energy commissioning". The RFQ, ion source, (and former I- Cockroft-Walton) area directly north of the Linac enclosure is posted as a Radiation Area and is locked/posted to prevent access by non-Radiological Worker trained personnel. Routine access to this Radiation Area by Radiological Worker trained personnel is permitted during beam operations. Lower Level penetrations (27) must be locked with a LIN C cored padlock prior to operation. Penetrations (8) on top of the Linac Berm must be locked with PAD 118 and LIN E cored padlocks. The downstream portion of the Booster Chute (on the Booster side) must be covered and locked with a PAD 118 and LIN C cored padlocks.

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

Ops. Dept. Head Approval <u>Todd Sullivan</u>	Assigned RSO Approval <u>Madelyn Schaeff</u>
Sys. Dept. Head Approval <u>Sue McGimpsey</u>	AD Head Approval <u>[Signature]</u>

September 27, 2019

Area RSO

Sue McGimpsey

Operational Comments

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

September 27, 2019

Area RSO

Sue McGimpsey

Operator Signatures

Crew Chiefs

[Signature] 2019-09-28

[Signature] 28 Sep 19

[Signature] 9/30/19

[Signature] 10/02/2019

[Signature] 10-5-19

Crew B

[Signature] 9-30-19

[Signature] 9/30/19

[Signature] 10/1/19

Crew D

[Signature] 9/28/19

[Signature] 9/28/19

[Signature] 9-28-19

[Signature]

Crew A

[Signature] 9/28/19

[Signature] 9/28/19

[Signature] 9-28-19

[Signature] 9/29/19

Crew C

[Signature]

[Signature]

[Signature]

[Signature]

Crew E

[Signature] 9-30-19

[Signature] 9/30/19

[Signature] 9/30/2019

[Signature] 11/19/19

Other

Memorandum

Maddie Schoell
RPO Department Head

ES&H Section
P.O. Box 500, MS 371
Kirk Road and Pine Street
Batavia, Illinois 60510-5011
USA
Office: 630.840.4807
Mobile: 574.229.0659
maddiew@fnal.gov

Date: September 27, 2019
To: Matt Quinn, Senior Radiation Safety Officer (SRSO)
From: Maddie Schoell, Radiation Physics Operations (RPO) Department Head
Re: SRSO Approval for Exemption from FRCM Article 236, Table 2-6 Requirement
Due to Egress Concerns

Message:

The area immediately north of the Linac enclosure, known as the Pre-Acc, is a posted Radiation Area. Access to this space include:

- Grey access door on the source level, east side
- Sliding plexiglass door on source level, east side next to the Linac laser notcher
- Door on the ground level, east side going to the bridge going over the source to the west side
- Door on the pit level, east side

Dose rate measurements taken in 2013 showed dose rates immediately outside of the Linac enclosure east gate reaching 6.24 mrem/hr, and the area outside of the sliding plexiglass door reached 1.32 mrem/hr.

FRCM Article 231 requires at least one method of control to radiological areas. All four access points for the Pre-Acc have rigid barriers and "Caution: Radiation Area" signage so satisfy the "signs and barricades" option. Additionally, an RWP has been generated for this space, placed on the grey access door, indicating requirement for entry. The other three access points have signs stating "STOP! RWP Required. You must read and sign the RWP before going past this point. RWP is located on the grey access door." However, FRCM Article 236, Table 2-6, requires barriers to be locked for dose rates between 5-100 mrem/hr due to prompt radiation under normal operating conditions. Since areas within the Pre-Acc can be above 5 mrem/hr during normal operation, the barriers should be locked. Three of the four access points meet this requirement:

- The grey access door is locked with a keypad access.
- The ground level door is locked, currently with an AC-4 lock.
- The pit level door is locked, currently with an AC-20 lock.

Note: The type of key/core locks does not matter for this situation. The doors are locked and the RWP notes the required training needed for access, so there is no need for the keys to be issued from the MCR and tied to any specific training.

Placing a lock on the sliding plexiglass door causes egress issues for individuals exiting the Linac enclosure through the north east gate.

I am requesting SRSO approval for an exemption to FRCM Table 2-6 requirement to have the sliding plexiglass door be locked due to this egress concern, with the stated controls remaining in place. This solution satisfies the entry control requirements of 10 CFR 835.501.c.

Approval: _____

Matt Quinn, Senior Radiation Safety Officer (SRSO)

Date: _____

9/27/19