

# Memorandum

Michael Lindgren  
Chief Accelerator Officer

**Accelerator Division**  
P.O. Box 500, MS 306  
Kirk Road and Pine Street  
Batavia, Illinois 60510-5011  
USA  
Office 630 840 8409  
[mlindgre@fnal.gov](mailto:mlindgre@fnal.gov)

**Date:** September 13, 2022  
**To:** Todd Sullivan      Michael Lindgren, Digitally signed by Michael Lindgren, UID mlindgre  
**From:** Michael Lindgren      UID:mlindgre Date: 2022.09.13 14:37:24 -0500  
**Re:** Approval for running beam to Linac

---

**Message:**

Safety documentation and procedures for restart of beam operations to the Linac are now complete and in place. Therefore, you are hereby authorized to deliver beam to Linac.

Cc: J. Compton  
P. Czarapata  
R. Lewis  
M. Quinn  
B. Russel  
M. Schoell  
C.Y. Tan  
A. Valishev

**RESCINDED**  
Date 8/1/2023 BR



### 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**

<u>DEPARTMENT</u>	<u>DATE</u>	<u>SIGNATURE (Department Head/Designee)</u>
1. Controls	9/12/22	Denise Finstrom, UID:finstrom <small>Digitally signed by Denise Finstrom, UID:finstrom Date: 2022.09.12.08.56.37 -05'00'</small>
2. Cryogenics		N/A
3. E/E Support	9/9/22	Chris Jensen <small>Digitally signed by Chns Jensen Date: 2022.09.09.12.23.46 -05'00'</small>
4. RPO Manager	9/13/22	Maddie Schoell, UID:maddiew <small>Digitally signed by Maddie Schoell, UID:maddiew Date: 2022.09.13.14.12.13 -05'00'</small>
5. LSO		Matthew Spaw, UID:mspaw <small>Digitally signed by Matthew Spaw, UID:mspaw Date: 2022.09.12.11.42.49 -05'00'</small>
6. External Beamlines	9/7/22	Thomas Kobilarcik, UID:kobilarc <small>Digitally signed by Thomas Kobilarcik, UID:kobilarc Date: 2022.09.07.13.51.06 -05'00'</small>
7. Instrumentation	9/6/22	Craig Drennan, UID:cdrennan <small>Digitally signed by Craig Drennan, UID:cdrennan Date: 2022.09.06.11.27.47 -05'00'</small>
8. Interlocks	9/7/22	Randy Zifko, UID:rmzifko <small>Digitally signed by Randy Zifko, UID:rmzifko Date: 2022.09.07.11.28.16 -05'00'</small>
9. Main Injector		N/A
10. Mechanical Support	9/7/22	Mayling Wong-Squires, UID:mlwong <small>Digitally signed by Mayling Wong-Squires, UID:mlwong Date: 2022.09.07.15.24.21 -05'00'</small>
11. Muon		N/A
12. Operations	9/13/22	Todd Sullivan <small>Digitally signed by Todd Sullivan Date: 2022.09.13.14.36.27 -05'00'</small>
13. Proton Source		Cheng-Yang Tan, UID:cytan <small>Digitally signed by Cheng-Yang Tan, UID:cytan Date: 2022.09.12.14.08.22 -05'00'</small>
14. RF		N/A
15. ENG Support		Paul C Czarapata <small>Digitally signed by Paul C Czarapata Date: 2022.09.07.13.13.46 -05'00'</small>
16. Target Systems		N/A
17. Shutdown Coordinator	9/12/22	Consolato Gattuso <small>Digitally signed by Consolato Gattuso Date: 2022.09.12.10.29.23 -05'00'</small>

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

LSO, Matt Spaw, x2973 - Laser Notcher requires LSO inspection prior to start up.

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	Cheng-Yang Tan, UID:cytan <small>Digitally signed by Cheng-Yang Tan, UID:cytan Date: 2022.09.13.14.44.26 -05'00'</small>	Date	_____
Assigned RSO	Maddie Schoell, UID:maddiew <small>Digitally signed by Maddie Schoell, UID:maddiew Date: 2022.09.13.14.12.28 -05'00'</small>	Date	9/13/22
AD Division Head	Michael Lindgren, UID:mlindgre <small>Digitally signed by Michael Lindgren, UID:mlindgre Date: 2022.09.13.14.49.35 -05'00'</small>	Date	9/13/22



**BEAM PERMIT**  
**9/13/2022**

**LINAC Accelerator Safety Envelope (ASE) Limit**

The maximum beam intensity transmitted through the LINAC Beamline is limited to:  
 $1.77 \times 10^{19}$  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:  
 $3.54 \times 10^{17}$  protons/hr at 400 MeV

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

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

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

---

Special conditions and comments:

---

Reviewed by	<b>Todd Sullivan</b>	Digitally signed by Todd Sullivan Date: 2022.09.13 14:37:04 -05'00'
	Operations Department Head	
Reviewed by	<b>Cheng-Yang Tan, UID:cytan</b>	Digitally signed by Cheng-Yang Tan, UID:cytan Date: 2022.09.13 14:45:17 -05'00'
	Systems Department Head	
Reviewed by	<b>Maddie Schoell, UID:maddiew</b>	Digitally signed by Maddie Schoell, UID:maddiew Date: 2022.09.13 14:14:06 -05'00'
	Assigned RSO	
Reviewed by	<b>Maddie Schoell, UID:maddiew</b>	Digitally signed by Maddie Schoell, UID:maddiew Date: 2022.09.13 14:14:13 -05'00'
	ES&H Radiation Physics Operations Department Head	
Approved by	<b>Michael Lindgren, UID:mlindgre</b>	Digitally signed by Michael Lindgren, UID:mlindgre Date: 2022.09.13 14:48:26 -05'00'
	Accelerator Division Head	

Operator Signatures

Crew Chiefs

Duff Olson 9/13/22 ✓  
Sony Spill 9/13/22 ✓  
Kurt McCoy 9/14/22 ✓  
Patricia Powell 9/14/22 ✓  
Matteo Piffa 9/14/22 ✓

Crew A

Jay Turkman 9-16-22 ✓  
Ando Pittman 9-28-22 ✓  
Kit 9-28-22 ✓  
Hayden Hoshman 10/22/22 ✓  
C. Valquez 3/13/23 ✓

Crew B

Troy Thayer 9-13-22 ✓  
George Williams 9/13/22 ✓  
Dave Brown 9/13/22 ✓  
Myrtle 9/13/22 ✓  
Alex Kellorose 2/23/23 ✓

Crew C

Casey McCall 9-13-22 ✓  
Keymont Butler 9/13/22 ✓  
Ake T. Hagan 9/13/22 ✓  
Eric Cook 9/13/22 ✓  
Linh Pham 9/23/22 ✓

Crew D

Janice 9/14/2022 ✓  
Jan Bae 9/14/22 ✓  
Ashley Getta 9/14/22 ✓  
Jagdeep Kheturi 9/14/22 ✓  
Matthew 2-23/23 ✓

Crew E

Phil 9/13/22 ✓  
Robert 9/14/22 ✓  
Conrad Myrman 9-14-22 ✓  
Cassandra Archer 9-16-22 ✓  
Colin Burnett 9/30/22 ✓

Other

14011W  
Tom 29 Sept 22 ✓

Keller 10/17/2022 ✓  
Max 10-18-22 ✓

# Running Condition Linac

September 13, 2022

Area RSO

Maddie Schoell

**Mode of Operation** Full Operation

<b>Beam Limits</b>	<b>Beam Energy</b> 400 MeV	<b>ASE Limit</b> 1.77 E19 protons/hr	<b>Operating Limit</b> 3.54 E17 protons/hr
--------------------	-------------------------------	---	---

**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.

**Tool 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.

**Dept. Head Approval** Todd Sullivan  
Digitally signed by Todd Sullivan  
Date: 2022.09.13 14:40:59 -0500'

**Sys. Dept. Head Approval** Cheng-Yang Tan,  
UID: cytan  
Digitally signed by Cheng-Yang Tan,  
UID: cytan  
Date: 2022.09.13 14:45:52 -0500'

**Assigned RSO Approval** Maddie Schoell,  
UID: maddiew  
Digitally signed by Maddie Schoell,  
UID: maddiew  
Date: 2022.09.13 14:14:41 -0500'

**AD Head Approval** Michael Lindgren,  
UID: mlindgre  
Digitally signed by Michael Lindgren,  
UID: mlindgre  
Date: 2022.09.13 14:48:55 -0500'

September 13, 2022

Area RSO

Maddie Schoell

---

## Operational Comments

---

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

---

## Instrument Information





September 13, 2022

Area RSO

Maddie Schoell

Operator Signatures

Crew Chiefs  
Dak [Signature] 9/13/22

[Signature] 9/13/22

Ken P. [Signature] 9/14/22

[Signature] 9/14/22

[Signature] 9/14/22

Crew B

[Signature] 9-13-22

George Williams 9/13/22

[Signature] 9/3/22

Daniel [Signature] 9/13/22

[Signature] 9/13/22

Crew D

[Signature] 9/14/22

[Signature] 9/14/22

Ashley [Signature] 9/14/22

[Signature] 9/14/22

[Signature] 2/23/23

[Signature] 14011N 29 Sept 22

Crew A

[Signature] 9-16-22

Andres [Signature] 9-28-22

[Signature] 9-28-22

[Signature] 10/22/22

C. [Signature] 3/13/23

Crew C

[Signature] 9-13-22

[Signature] 9/13/22

[Signature] 9/13/22

[Signature] 9/13/22

[Signature] 10/18/22

Crew E

[Signature] 9/13/22

[Signature] 9/14/22

[Signature] 9-14-22

[Signature] 9-16-22

Alex [Signature] 2-23-23

Other

[Signature] 10/17/2022

[Signature] 10-18-22

Mike Lindgren  
Chief Accelerator Officer

**Accelerator Division**  
P.O. Box 500, MS 306  
Kirk Road and Pine Street  
Batavia, Illinois 60510-5011  
USA  
Office: 630.840.8409  
[mlindgre@fnal.gov](mailto:mlindgre@fnal.gov)

**Date:** April 10, 2020  
**To:** Todd Sullivan & Joe Compton  
**From:** Mike Lindgren *Maddie Schoell*  
**Re:** Rescind Current Beam Permits and Run Conditions

---

**Message:**

Effective 0001 Sunday April 12, 2020, I am rescinding the following Beam Permits and Running Conditions:

- Linac
- NIF
- Booster
- 8 GeV (MI-8) Beamline
- Booster Neutrino
- Main Injector
- Recycler
- NuMI
- P1-P2 Beamline
- P3 – Switchyard 120
- Meson Primary
- Meson Test
  - Low Energy Pion Mode
  - Diffracted Proton Mode
  - High Energy Pion Mode
- Meson Center
- Muon Campus – off Target
- Muon Campus – on Target
- FAST
- IOTA

Please send rescinded Beam Permits and Running Conditions to Maddie Schoell. New Beam Permits and Running Conditions will be generated upon the conclusion of the current shutdown activities.

CC: Maddie Schoell

