

# Memorandum

Michael Lindgren  
Chief Accelerator Officer

**Accelerator Division**  
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**Date:** November 18, 2020

**To:** Todd Sullivan

**From:** Michael Lindgren, Michael Lindgren, UID:mlindgre  
Digitally signed by Michael Lindgren, UID:mlindgre  
Date: 2020.11.18 12:35:58 -08'00'

**Re:** Approval for Running Beam to MI/Recycler

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

cc: G. Annala  
D. Capista  
M. Convery  
P. Czarapata  
S. McGimpsey  
D. Morris  
M. Schoell



**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	11/11/20	James Patrick <small>Digitally signed by James Patrick Date: 2020.11.11 14:53:41 -06'00'</small>
2. Cryogenics	N/A	
3. E/E Support	11/14/20	Chris Jensen <small>Digitally signed by Chris Jensen DN: cn=Chris Jensen, o= Fermilab, email=cjensen@fnal.gov, c=US Date: 2020.11.19 11:29:12 -06'00'</small>
4. RPO Manager	11/18/20	Madelyn Schoell, UID:maddiew <small>Digitally signed by Madelyn Schoell, UID:maddiew Date: 2020.11.18 11:26:59 -06'00'</small>
5. LSO	N/A	
6. External Beamlines		Gerald Annala <small>Digitally signed by Gerald Annala Date: 2020.11.10 08:11:34 -06'00'</small>
7. Instrumentation	11/16/20	Craig Drennan <small>Digitally signed by Craig Drennan Date: 2020.11.16 16:36:35 -06'00'</small>
8. Interlocks	11/10/20	Randy Zifko, UID:rmzifko <small>Digitally signed by Randy Zifko, UID:rmzifko Date: 2020.11.10 13:19:58 -06'00'</small>
9. Main Injector	11/16/20	Ioanis Kourbanis, UID:ioanis <small>Digitally signed by Ioanis Kourbanis, UID:ioanis Date: 2020.11.16 17:11:57 -06'00'</small>
10. Mechanical Support	11/13/20	<i>[Handwritten Signature]</i>
11. Muon	N/A	
12. Operations	11/04/20	<i>[Handwritten Signature]</i>
13. Proton Source	N/A	
14. RF	11/11/20	John Reid, UID:jsreid <small>Digitally signed by John Reid, UID:jsreid Date: 2020.11.11 21:57:57 -06'00'</small>
15. ENG Support	11/29/20	<i>[Handwritten Signature]</i>
16. Target Systems	N/A	
17. Shutdown Coordinator	11/10/20	Consolato Gattuso <small>Digitally signed by Consolato Gattuso Date: 2020.11.10 10:28:39 -06'00'</small>

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

MSD is ready for operations once the ion pump changeout in the MI-30 area is completed this weekend. -MWS 13 Nov 2020

EES there are some minor issues with the fluorinert skid R:K1COOL which will need a 30 minute downtime to fix when parts come in. Cables for new RR sextapole magnets are booted inside corrector power supply rack.

The above items have been closed. IK 11/18/20

The MAIN INJECTOR + RECYCLER radiation shielding meets the requirements documented in the 2018 "MAIN INJECTOR ISDOKW INCREMENTAL SHIELDING ASSESSMENT AND 2012 "RECYCLER RING INCREMENTAL:  $2.25 \times 10^{13}$  PROTONS" shielding assessment. *[Handwritten Signature]*

**FINAL APPROVALS**

System Department Head	Ioanis Kourbanis, UID:ioanis <small>Digitally signed by Ioanis Kourbanis, UID:ioanis Date: 2020.11.18 12:38:56 -06'00'</small>	Date	_____
Assigned RSO	Susan McGimpsey <small>Digitally signed by Susan McGimpsey Date: 2020.11.18 12:49:44 -06'00'</small>	Date	_____
AD Division Head	Michael Lindgren, UID:mlindgre <small>Digitally signed by Michael Lindgren, UID:mlindgre Date: 2020.11.18 12:52:54 -06'00'</small>	Date	11/18/20



**BEAM PERMIT**  
**11/18/2020**

### Main Injector Accelerator Safety Envelope (ASE) Limit

The maximum beam intensity transmitted through the Main Injector Beamline is limited to:

- 7.45 x 10<sup>17</sup> protons/hour at 8 GeV
- 7.45 x 10<sup>17</sup> protons/hour at 120 GeV
- 6.23 x 10<sup>17</sup> protons/hour at 150 GeV

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

### Main Injector Beamline Operating Limits

The maximum beam intensity transmitted through the Main Injector Beamline is limited to:

- 2.93 x 10<sup>17</sup> protons/hour at 8 GeV
- 2.93 x 10<sup>17</sup> protons/hour at 120 GeV
- 2.34 x 10<sup>17</sup> protons/hour at 150 GeV

Examples:

- #1 1,200 pulses/hour at 2.44 x 10<sup>14</sup> protons/pulse = 2.93 x 10<sup>17</sup> protons/hour at 8 GeV
- #2 2,700 pulses/hour at 1.08 x 10<sup>14</sup> protons/pulse = 2.93 x 10<sup>17</sup> protons/hour at 120 GeV
- #3 2,400 pulses/hour at 9.75 x 10<sup>13</sup> protons/pulse = 2.34 x 10<sup>17</sup> protons/hour at 150 GeV

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Special conditions and comments:

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Reviewed by	<b>Todd Sullivan</b>	Digitally signed by Todd Sullivan Date: 2020.11.18 13:10:53 -06'00'
	Operations Department Head	
Reviewed by	<b>Ioanis Kourbanis, UID:ioanis</b>	Digitally signed by Ioanis Kourbanis, UID:ioanis Date: 2020.11.18 12:49:26 -06'00'
	Systems Department Head	
Reviewed by	<b>Susan McGimpsey</b>	Digitally signed by Susan McGimpsey Date: 2020.11.18 12:51:47 -06'00'
	Assigned RSO	
Reviewed by	<b>Madelyn Schoell, UID:maddiew</b>	Digitally signed by Madelyn Schoell, UID:maddiew Date: 2020.11.18 13:02:56 -06'00'
	ES&H Radiation Physics Operations Department Head	
Approved by	<b>Michael Lindgren, UID:mlindgre</b>	Digitally signed by Michael Lindgren, UID:mlindgre Date: 2020.11.18 13:32:50 -06'00'
	Accelerator Division Head	

Operator Signatures

Crew Chiefs

Michael Czerniak 11/18/20  
Kell 11/18/20  
Michael J. O'Neil 11/19/20  
Dell 11/19/20  
John 21 Nov 20

Crew B

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\_\_\_\_\_  
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Crew D

Kurt McConry 11/19/20  
Tyr 11-19-20  
Jacob Schaeffer 19 Nov 2020  
Mia 11/19/20

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\_\_\_\_\_

Other

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Crew A

Jay Johnson 11-21-20  
Andy Peterson 11-21-20  
Chad 11/21/20  
Scott Genda 11/21/20  
James Makela 11-22-20

Crew C

Seaton Merrill 11/18/20  
Nate Ruffalo 11/18/20  
Shelly Pez 11/18/2020  
John T. Hooper 11/20/20

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Crew E

Abby Baker 11/19/20  
Cenzy J. Brattberg 19 Nov 2020  
Sander Schellert 11/19/20  
Harlan Hoescher 11/19/2020

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# Running Condition Main Injector

November 18, 2020

Sue McGimpsey

Area RSO

**Mode of Operation** Full Operation

Beam Limits	Beam Energy	ASE Limit	Operating Limit
	8 GeV*	7.45 E17 protons/hr	2.93 E17 protons/hr
	120 GeV	7.45 E17 protons/hr	2.93 E17 protons/hr
	150 GeV**	6.23 E17 protons/hr	2.34 E17 protons/hr

\* Although energy scaling of 8 GeV intensity could be substantially higher, there is no need for higher intensity at 8 GeV and the limit is chosen to match the 120 GeV intensity limit.  
 \*\* 150 GeV beam operation is for MI studies only. Beam aborted to MI-40 Abort.

**Critical Devices** I:LAM10 & BS10  
 Coasting beam critical devices are I:BV619 & I:BV622 which are open to achieve coasting beam

**Enclosures Protected** MI-20--MI-62, TeV F Sector, MI/TeV Crossovers

**Preferred Monitoring Devices\*** Intensity is monitored via I:TOR852 via \$10 for Booster to MI, and R:TOR905 via \$F3 for RR to MI.  
 \*Other methods of monitoring intensity may be used.

## Requirements

**Access Devices** I:LAM10 and BS10 must be disabled in order to access the enclosures protected. Access is also dependent on Recycler critical devices.

**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.  
 Access to MI-40 Absorber room requires prior RSO approval. RCTs may obtain MI-40 Absorber room key without prior RSO approval.

**Gates, Fencing and Passive Shielding Requirements** There is no access to radiologically fenced areas without prior RSO approval.  
 The A150 & P150 ODH barrier gates have been locked in the open position since the shielding physically provides the barrier and isolates the Tevatron from the Main Injector. Shielding, fencing and posting is in accordance with 2018 "Main Injector 1500 kW incremental shielding assessment."

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

Ops. Dept. Head Approval

**Todd Sullivan**

Digitally signed by Todd Sullivan  
Date: 2020.11.18 13:08:41 -06'00'

Ioanis Kourbanis,  
UID:ioanis

Digitally signed by Ioanis Kourbanis, UID:ioanis  
Date: 2020.11.18 12:40:13 -06'00'

Assigned RSO Approval

**Susan McGimpsey**

Digitally signed by Susan McGimpsey  
Date: 2020.11.18 12:50:28 -06'00'

Michael Lindgren,  
UID:mlindgre

Digitally signed by Michael Lindgren, UID:mlindgre  
Date: 2020.11.18 13:33:22 -06'00'

Sys. Dept. Head Approval

AD Head Approval

## Operational Comments

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

### Defense-in-Depth Controls

The Main Injector and Recycler rings utilize defense-in-depth controls to reduce the probability, duration, and likelihood of beam loss accident conditions. These consist of Beam Loss Monitors, Vacuum Interlocks and Power Supply Regulation and Permit Interlocks connected to the Beam Permit System, LCW radiation monitors, Beam Switch Sum Box (BSSB), Time Line Generator (TLG), Main Injector/Recycler Transfer Permit, Main Injector/Recycler Orbit Controls and software Alarms and Limits.

The Beam Permit System, Beam Switch Sum Box (BSSB), Time Line Generator (TLG), Main Injector/Recycler Transfer Permit and the LCW Chipmunk Detectors are required to be operational when the Main Injector or Recycler rings are transporting or accelerating beam.

Individual inputs to the beam permit system from the Beam Loss Monitors, Vacuum Interlocks and Power Supply Regulation and Permit Interlock may be masked on an as needed basis under the direction of the MI Department. Any inputs masked from these three systems and any administrative controls directed by the MI Department are required to be logged in the MCR E-log.



Running Condition  
Main Injector

November 18, 2020

Area RSO

Sue McGimpsey

Operator Signatures

*Michael Czyszynski* Crew Chiefs 11/18/20

*Kell* 11/19/20

*Michael J. O'Neil* 11/19/20

*Del J. Blum* 11/19/20

*John* 21 Nov 20

Crew B

Crew A

*Greg Johannson* 11-21-20

*Alex Petten* 11-21-20

*Chaf* 11/21/20

*Peter Gauder* 11/21/2020

*Jodyes Johnson* 11-22-20

Crew C

*Jacques Niel* 11/18/20

*Nitin P. P. K.* 11/18/20

*Gilberto Perez* 11/18/2020

*John T. Homan* 11/20/20

Crew D

*Ken P. McDonald* 11/19/20

*Greg* 11-19-20

*Jacob Schaeffer* 19 Nov 2020

*Amari* 11/19/20

Crew E

*Anthony L. L.* 11/19/20

*Ventz J. Watkins* 19 Nov 2020

*James Schellera* 11/19/20

*Hydun Hoshorn* 11/19/20 20

Other

*Open 2* 2020-1-15