

**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. Indicate N/A for departments that did not do any work on the system.

**SYSTEM BEING SIGNED OFF:** Linac NTF MuCOOL Booster 8-GeV/Main Injector/Recycler  
(Circle as Applicable) BNB NuMI Muon Switchyard Meson Primary MT MC NM  
FAST PXIE \_\_\_\_\_

<u>DEPARTMENT</u>	<u>DATE</u>	<u>SIGNATURE (Department Head/Designee)</u>
Controls	5/7/2016	[Signature]
Cryogenics	5/6/16	[Signature]
E/E Support	3/3/16	[Signature]
ES&H	5.10.2016	[Signature]
External Beamlines	5/10/16	[Signature]
Instrumentation	5/8/14	[Signature]
Main Injector	N/A	N/A
Mechanical Support	6 May 2014	[Signature]
Muon	N/A	N/A
Operations	5/10/16	[Signature]
Proton Source	N/A	[Signature]
RF	N/A	N/A
ENG Support	5-7-16	[Signature]
Target Systems	N/A	N/A

The MuCOOL radiation shielding meets the requirements documented in the

MuCool Facility Shielding Assessment, C. Johnstone, I. Rakhno, N. Mokhov, W. Higgins, November 1, 2010 shielding assessment.

Approved by [Signature] 5/10/2016  
Department Head Date

Comments and special conditions:

**FINAL APPROVALS**

Department Head [Signature] Date 5/10/2016  
Radiation Safety Officer [Signature] Date 5/10/16  
Accelerator Division Head [Signature] Date 5/10/16



Sergei Nagaitsev  
Headquarters  
Accelerator Division  
630.840.4397 (phone)  
630.840.4552 (fax)

## Memorandum

May 10, 2016

**To:** Dan Johnson

**From:** Sergei Nagaitsev

A handwritten signature in blue ink, appearing to read "S. Nagaitsev", with the date "11/2/91" written above it.

**Subject:** Permission to Restart MuCool Test Area (MTA)

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

cc:

J. Anderson  
G. Lauten  
R. Lewis  
C. Moore  
T. Kobilarcik  
M. Backfish  
File

## BEAM PERMIT

### MuCOOL Test Area (MTA) Accelerator Safety Envelope (ASE) Limit

The maximum hourly beam power transmitted to MTA is limited to:

**Emittance Mode and Experiment Mode:**  $1.59 \times 10^{18}$  protons at 400 MeV

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

### MTA Operating Limits

The maximum operational charge transmitted to MTA is limited to:

**Emittance Mode:**  $9.60 \times 10^{15}$  protons per hour at 400 MeV

**Experiment Mode:**  $9.60 \times 10^{14}$  protons per hour at 400 MeV

Examples:

**Emittance Mode:**

$1.6 \times 10^{13}$  protons/pulse to MTA for Emittance Mode @ 600 pulses/hour =  $9.60 \times 10^{15}$  protons/hour

**Experiment Mode:**

$1.6 \times 10^{13}$  protons/pulse to MTA for Experiment Mode @ 60 pulses/hour =  $9.60 \times 10^{14}$  protons/hour

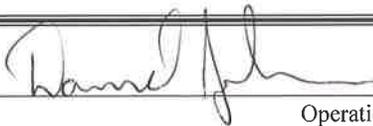
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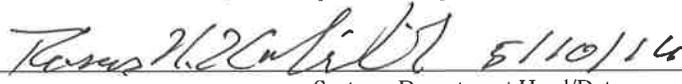
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Special conditions and comments:

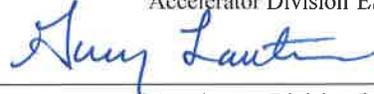
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Reviewed by  5/10/16  
Operations Department Head/Date

Reviewed by  5/10/16  
Systems Department Head/Date

Reviewed by  5.10.2016  
Accelerator Division ES&H Department Head/Date

Reviewed by  5/10/16  
Accelerator Division Radiation Safety Officer/Date

Approved by  5/10/16  
Accelerator Division Head/Date

# Running Condition

## MuCool Test Area (MTA)

May 10, 2016

R.S.O.

Gary Lauten

<b>Mode of Operation</b>	<b>Experiment Mode</b>
<b>ASE Limit</b>	1.59 E18 protons/hr at 400 MeV
<b>Operating Limit</b>	9.60 E14 protons/hr at 400 MeV
<b>Critical Devices</b>	<b>E:UHB03, E:UBS01</b>
<b>Enclosures Protected</b>	MuCOOL Test Area (MTA)

**Interlocked Radiation Detectors**

<u>Detector Type</u>	<u>Detector Trips</u>	<u>Demux</u>	<u>Location</u>
Chipmunk	E:UHB03, E:UBS01	2-045	MuCool Hatch on berm
Chipmunk	E:UHB03, E:UBS01	2-041	MTA Refrigerator Room

**Other Requirements**

**Special Interlocks:** The CDC Inputs required may be found on the Safety System Status pages. An interlocked rate limiter limits the maximum rate to 60 pulses per hour for Experiment Mode.

**Access Devices:** E:UHB03 and E:UBS01 must be disabled in order to access the MuCool Test Area (MTA).

**Special Concerns:** Work performed on Critical Devices requires RSO approval before re-establishing beam.

**Gates, Fencing, and Passive Shielding Requirements:**

The shield wall between the MTA and Linac Enclosure is required during operation. There is no access to radiologically fenced areas during beam operation without prior RSO approval.

## Operational Comments

Intensity is monitored via **E.UTR01**. The interlocked detectors are in the integrate mode. Interlocked detector trips require RSO approval to re-enable the area. Interlocked detector trips and the RSO approval to re-enable the area shall be documented in the MCR E-log.

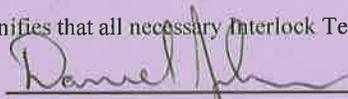
**Initial accesses require Rad Safety inclusion to confirm residual dose rate expectations.**

Intensity Limit Example:

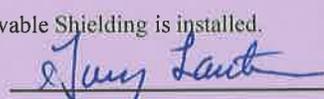
1.6 E13 protons/pulse at 60 pulses per hour --> 9.6 E14 protons/hour

R.S.O. approval also signifies that all necessary Interlock Tests have been completed and Removable Shielding is installed.

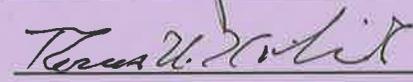
Ops. Dept. Head Approval



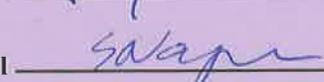
R.S.O. Approval



Sys. Dept. Head Approval



AD Head Approval



# Running Condition

## MuCool Test Area (MTA)

May 10, 2016

R.S.O.

Gary Lauten

**Mode of Operation**

**Emittance Mode**

ASE Limit

1.59 E18 protons/hr at 400 MeV

Operating Limit

9.60 E15 protons/hr at 400 MeV

Critical Devices

**E:UHB03, E:UBS01**

Enclosures Protected

MuCOOL Test Area (MTA)

**Interlocked Radiation Detectors**

**Detector Type**

**Detector Trips**

**Demux**

**Location**

Chipmunk

E:UHB03, E:UBS01

2-045

MuCool Hatch on berm

Chipmunk

E:UHB03, E:UBS01

2-041

MTA Refrigerator Room

**Other Requirements**

**Special Interlocks:** The CDC Inputs required may be found on the Safety System Status pages. An interlocked rate limiter limits the maximum rate to 600 pulses per hour for Emittance Mode.

**Access Devices:** E:UHB03 and E:UBS01 must be disabled in order to access the MuCool Test Area (MTA).

**Special Concerns:** Work performed on Critical Devices requires RSO approval before re-establishing beam.

**Gates, Fencing, and Passive Shielding Requirements:**

The shield wall between the MTA and Linac Enclosure is required during operation. There is no access to radiologically fenced areas during beam operation without prior RSO approval.

## Operational Comments

Intensity is monitored via **E:UTR01**. The interlocked detectors are in the integrate mode. Interlocked detector trips require RSO approval to re-enable the area. Interlocked detector trips and the RSO approval to re-enable the area shall be documented in the MCR E-log.

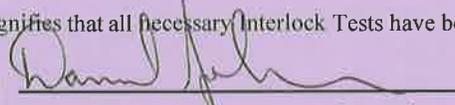
**Initial accesses require Rad Safety inclusion to confirm residual dose rate expectations.**

**Intensity Limit Example:**

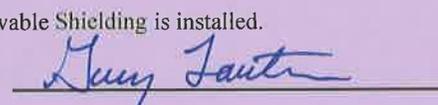
1.6 E13 protons/pulse at 600 pulses per hour --> 9.6 E15 protons/hour

R.S.O. approval also signifies that all necessary Interlock Tests have been completed and Removable Shielding is installed.

Ops. Dept. Head Approval



R.S.O. Approval



Sys. Dept. Head Approval



AD Head Approval

