EXTERNAL BEAMLINES OJT

This OJT provides you with a checklist, guideline, and record of your Operator II External Beamlines training, and also introduces you to regular operational procedures as well as physical locations of equipment. **It is very important that you do not lose this document.** If you lose this document the training you have completed will have to be redone.

This training list has been successfully completed.

Department Head (Signature/Date)_____

Contents

Part 1: NuMI MCR

Trainer Date

1. Beamline Map

Draw a general map of the NuMI beamline, which should include the following:

____ MI ring

____ MI-62 service building

____ MI-65 service building

____ MI-65 target hall

____ Decay pipe

____ MINOS underground

Trainer Date

2. Beamline Power Supplies

Be familiar with the major components that form the NuMI beamline, including the following:

____ NuMI kicker

____ NuMI Lambertson

____ Main NuMI dipoles and quadrupoles

____ NuMI corrector power supplies

____ Know how to alter power supply ramps

____ Know the parameter naming convention for NuMI power supplies

Trainee Date

3. Experiments

Have a general understanding of the experiments that use the NuMI beam and their overall scientific goal. This knowledge should include a very basic description of the detectors, what they are designed to measure, and how they function. Sign yourself off when you are comfortable with this information.

____ NOvA

Trainer Date

4. MI-65 Target Hall Layout

Draw a diagram of the major devices in the MI-65 target hall. Know the purpose and function of each device, including the following:

____ Target

- ____ Composition
- ____ Target assembly cooling
- ____ Target chase cooling
- ____ Baffle collimator

____ Horns

- ____ Shape
- ____ Field shape and strength
- ____ RAW Cooling

____ Decay pipe

- ____ RAW Cooling

Trainer Date

5. MINOS Underground Layout

Draw a diagram of the major devices in the MINOS Underground. Know the purpose and function of each device, including the following:

____ Hadron monitor

____ Absorber

____ Muon monitors

____ NOvA detector

Trainer Date

6. NuMI Beam Permit System

Know the purpose and function of the NuMI beam permit system.

____ Know how to diagnose the cause of and reset a permit trip

____ Know how to use the beam permit trip log

____ Know what the eXpert file is

- ____ Check that the C204 limits match those of the file

Trainer Date

7. Events

____ Be familiar with the TCLK events associated with sending beam to NuMI

Trainer Date

8. NuMI Autotune Program

____ Understand the purpose and importance of the NuMI Autotune program

____ Know where it runs and how we interact with it

____ Be able to determine which devices it controls

____ Know how to tell, and what to do, if it is not working correctly

Trainer Date

9. RAW Systems

Know the following about the NuMI-related RAW systems:

____ Know the NuMI RAW systems, what they cool and how they heat-exchange

- ____ Target
- ____ Horn 1
- ____ Horn 2
- ____ Decay pipe cooling
- ____ Absorber

____ Know the requirements for access into MI-65 RAW utility room

____ Know what to do if a RAW system trips off, and who to call with any RAW-related problems

Trainer Date

10. Environmental Radiation Mitigation

Know the necessity and function of the target hall systems that reduce the amount of environmental radiation.

____ Know the role of the tritium mitigation systems

- ____ Target hall and chase air dehumidification systems
- ____ Evaporator controls
- ____ Autotune program
- ____ NuMI permit

____ Delayed ventilation of activated air and how it's vented to the atmosphere

Trainer Date

11. Instrumentation

Know the diagnostic instrumentation in the NuMI beamline, including how to use their associated applications. This includes:

____ Toroids

____ Beamline

____ Target

____ BPMs

____ Know the consequences of rebooting the NuMI BPMs

____ BLMs

____ TLMs

____ Profile monitors

____ Know when these are typically used

Trainer Date

12. NuMI MI-65 Turn Off and On

Understand how to turn MI-65 off and on before and after an access.

____ Know which devices are turned off or on via the sequencer

____ Know the appropriate CDC to manipulate

____ Know how to properly switch off MI-65 using the NuMI MI65 13.8KVAC Lockout/Tagout Procedure ADSP-05-1217

____ Know how to become qualified to perform this procedure

Trainer Date

13. MINOS Underground

Understand access procedures for the MINOS Underground areas.

____ Know which devices to turn on and off

____ Know which areas are interlocked

____ Know how to prepare these areas for access

____ Know how to exit in an emergency

Trainer Date

14. NuMI Access Hazards

Know the MI-65 target hall and MINOS Underground access hazards and how to identify the warning signs.

____ Know the hazards that may exist in supervised and controlled accesses

____ Airborne radiation monitor limitations for accesses

____ Required PPE for underground areas

Part 2: NuMI Walkaround

_____	
Trainer	Date

1. MI-8 Service Building

____ NuMI horn test area
- ____ Test cage
- ____ Horn power supply and interlocks
- ____ Stand-alone LCW system
- ____ CAMAC hardware

_____	
Trainer	Date

2. MI-60 Service Building South

____ NuMI critical device controller (CDC) chassis

____ NuMI permit hardware
- ____ Patch panel
- ____ CAMAC cards

____ Kicker power supply
- ____ Fluorinert skid

_____	
Trainer	Date

3. MI-60 Service Building North

____ Magnet power supplies
- ____ NuMI critical device power supplies
- ____ Dipoles
- ____ Quads
- ____ Correction elements

____ NuMI MIRF incomplete RFGE abort module

____ NuMI permit hardware
- ____ Patch panel
- ____ CAMAC cards

____ Lambertson vacuum hardware

____ Multiwire hardware

____ Toroid hardware

Trainer Date

4. MI-62 Service Building

____ Magnet power supplies
- ____ Dipoles
- ____ Quads

____ Stand-alone LCW system

____ NuMI permit hardware
- ____ Patch panel
- ____ CAMAC cards

____ NuMI beamline vacuum hardware

Trainer Date

5. MI-65 Service Building

____ Magnet power supplies
- ____ Dipoles
- ____ Quads
- ____ Correction elements

____ Elevator to MI-65 underground area

____ NuMI evaporator system
- ____ Holding Tank
- ____ Heaters

____ Profile monitor hardware

____ CAMAC hardware

____ NuMI permit hardware
- ____ Patch panel
- ____ CAMAC cards

____ MI-65 enclosure LOTO equipment
- ____ MI-65 Safety Lockout Chassis
- ____ Switch Controller Disconnect
- ____ 13.8 kV Disconnect Switch Cabinet

Trainer Date

6. MI-65 Underground

____ Horn power supply room

____ RAW cooling room

____ Know RSO permission is required to access

____ Entrance to NuMI target hall

____ Entrance to NuMI pre-target enclosure

Trainer Date

7. MINOS Service Building

____ NuMI CAMAC front end

____ MINOS timing hardware

____ CAMAC hardware

____ NuMI permit hardware

____ Patch panel

____ CAMAC cards

____ Elevator to MINOS Underground

Trainer Date

8. MINOS Underground

____ Absorber room entrance

____ Decay pipe emergency walkway entrance

____ Decay pipe RAW system

____ Hadron absorber RAW system

____ Muon alcoves

____ MINOS hall

____ NOvA cavern

____ NOvA detector

____ Understand that the experiment must be contacted prior to entry

Part 3: Switchyard MCR

3.1 General Layout

Trainer	Date

1. Switchyard Map

Draw a basic map of Switchyard that shows the following enclosures, their service buildings, and relevant injection and extraction devices:

____ P1, P2, and P3 Lines

____ F-Sector

____ Transfer Hall

____ Enclosure B

____ Enclosures C, D, and E

____ F-manholes

____ G2

____ Switchyard dump

____ Meson Line

- ____ MTest
- ____ MCenter

____ Neutrino Line

- ____ Neutrino Muon Line
- ____ Neutrino Muon detector building (KTeV)

Trainer	Date

2. Naming Convention

Know the naming convention for Switchyard service buildings, devices, and enclosures.

3.2 Tuning and Operations

Trainer	Date

1. General Tuning

Know how to tune Switchyard beamlines based on the needs of the various experiments.

____ Know where to find the Switchyard device map

____ Know how to monitor and minimize beam losses

____ Know how to stay within current run condition limits

- ____ Know that these limits are based on primary beam, not secondary beam, and that staying within these limits takes priority over experiment intensity

____ Know the process for establishing beam to each beamline

____ Know how to change the MTest energy mode

- ____ Know the beamline configuration differences in different energy modes
- ____ Know that placing the MT6 absorbers into the beam in pion mode results in giving the experiment muons
- ____ Know that placing the MT4 lead absorber into the beam in pion mode results in reducing electron/positron flux to the experiment

____ Know how to change the MCenter energy mode

- ____ Know the beamline configuration differences in different energy modes

____ Know how to troubleshoot when intensity or position is not ideal

____ Know how to tune beam when both Neutrino Muon and Meson beamlines are taking beam

Trainer	Date

2. Magnets and Devices

Know the function of various types of magnets and electrostatic devices used in Switchyard.

____ Know the use of the electrostatic septa and Lambertson combination to split beam

- ____ Locations of Switchyard Lambertsons
- ____ Locations of Switchyard electrostatic septa

____ Be aware of the different ways Switchyard magnets may be powered

- ____ Some large magnet strings use separate power supplies for voltage and current regulation
- ____ Some MTest magnets have a high-energy and low-energy power supply
- ____ Some power supplies use polarity switches for either negative charge particle selection or beamline design trajectory

____ Know the typical naming convention of magnet power supplies

3.3 Safety

Trainer Date

1. Critical Devices

Know how the Switchyard critical devices protect personnel.

____ Identify all of the critical devices and critical device controllers (CDCs) protecting Switchyard enclosures

____ Know the locations of the critical device power supplies

____ Know the role of the Switchyard rep rate monitor

____ Know the role of the MTest Mode Configuration Logic in the MTest CDC

Trainer Date

2. Enclosure Access

Know how to turn Switchyard enclosures off and on before and after an access.

____ Know how to prepare all Switchyard enclosures for access

- ____ What devices are turned off or on via the sequencers
- ____ The appropriate CDC to manipulate for a given enclosure

____ Know how to prepare Transfer Hall for access according to the HP3DS and QP3 13.8 kV Lockout/Tagout Procedure ADSP-05-1215

- ____ How to become qualified to perform this procedure

____ Know where to find keys to each enclosure

- ____ Which interlock reset keys are needed for each enclosure

____ Know the role of controlled access leaders (CALs) in remote experiment access

Trainer Date

3. Switchyard Access Hazards

Know the access hazards and how to identify the warning signs for the following enclosures:

____ F-Sector

____ Transfer Hall

____ Enclosures B, C, D, and E

____ Meson Line

- ____ ODH
- ____ Confined spaces

____ Neutrino Line

3.4 Utilities

Trainer Date

1. Water Systems

Be familiar with the nominal temperatures and pressures for the following LCW systems, as well as which enclosures are fed by each:

____ Remnant LCW system

____ Meson LCW systems

- ____ Purpose of the Meson RAW system
- ____ Who to notify about Meson RAW system issues
- ____ Know this is a closed loop system

____ Neutrino LCW systems

Trainer Date

2. Power Distribution

Know how power distribution systems affect Switchyard running.

____ Know what power supplies feed the P3 Line magnets

- ____ Which MOS at the Kautz Rd Substation feeds these power supplies

3.5 Vacuum Systems

Trainer Date

1. Vacuum Parameters

Know how to observe and diagnose possible vacuum problems in Switchyard.

____ Know the typical vacuum pressure in Switchyard

- ____ Know why this pressure is different from the accelerators

____ Know how to use the Switchyard vacuum page and be aware of the various vacuum systems

____ Know typical vacuum pressure inside electrostatic septa

- ____ Devices used to maintain this vacuum level
- ____ How septa vacuum pressures are different from the rest of the beam pipe and why

3.6 Instrumentation

Trainer Date

1. BLMs

____ Know how to use the BLMs to monitor losses in Switchyard and the transfer lines

Trainer Date

2. BPMs

Know how to use the BPMs to monitor positions in Switchyard and the transfer lines.

____ Know that the 52.8 MHz/2.5MHz BPMs do not work during slow spill

____ Know which BPMs do work in slow spill mode

Trainer Date

3. Wire Profile Monitors

____ Know how to view wire profile monitor data to observe beam in Switchyard

____ Be able to troubleshoot common wire monitor configuration issues

____ Be aware of the different types of wire profile monitors

Trainer Date

4. Intensity Monitoring

Know how beam intensity is monitored in Switchyard and the transfer lines.

____ Know the function of SEMs and Ion Chambers in Switchyard

____ Know the names and locations of Switchyard SEMs and Ion Chambers currently in use

____ Understand the differences between SEMs and Ion Chambers

____ Know the function of scintillation counters

____ Know the names and locations of commonly used scintillation counters

____ Know why toroids are not used for slow-spill beam

3.7 Controls

Trainer	Date

1. CAMAC Links

____ Be familiar with the CAMAC cards commonly used in Switchyard

____ Know which CAMAC link P3 Line elements are on

Trainer	Date

2. Events

____ Be familiar with the TCLK events associated with sending beam to Switchyard

Part 4: Switchyard Walkaround

Trainer Date

1. Cross Gallery Computer Room

____ Switchyard front end

Trainer Date

2. F3 Service Building

____ S:HP3US

Trainer Date

3. F4 Service Building

____ S:HP3DS
____ S:QP3

Trainer Date

4. Transfer Gallery

____ S:MLAM power supplies
____ S:MSEP power supply
____ Ion pump power supplies
____ MSEPTA front end
____ Corrector bulk supplies and regulators
____ Enclosure B entrance
____ Resonant BPMs
____ SWIC controllers
____ Switchyard rep rate monitor
____ Monitored power supply

Trainer Date

5. Switchyard Service Building (SSB)

____ Corrector bulk supplies and regulators
____ SWIC controllers
____ S:V204 power supply
____ S:MULAM power supply and interlock chassis
____ S:V100 power supply
____ Enclosures C, D, and E entrance

Trainer Date

6. G2 Service Building

____ S:FSEP power supply
____ Ion pump power supplies
____ Corrector bulk supplies and regulators
____ SWIC controllers
____ G2 enclosure entrance
____ F1 manhole entrance

Trainer Date

7. F Manholes

____ F2 manhole entrance
____ F3 manhole entrance

Trainer Date

8. MS1 Service Building

____ M01 enclosure entrances
____ Meson Primary CDC
____ F:MW1W power supply and interlock chassis
____ F:MC1D power supply and interlock chassis
____ MS1 RAW skid controller and wall breakers
____ MW1SEM hardware
____ SWIC controllers

Trainer Date

9. MS2 Service Building

____ MS2 LCW pumps and controller
____ M02 enclosure entrances
____ MTest Primary CDC
____ MCenter Primary CDC

Trainer Date

10. MS3 Service Building

____ M03 enclosure entrance
____ M04 enclosure entrance
____ M03 target and pinhole collimator motor controller

Trainer Date

11. Meson Detector Building (MDB)

____ MS4 service building
____ MT6-1 enclosure entrance and remote key tree
____ MT6-2 enclosure entrance and remote key tree
____ MC6 enclosure entrance
____ MC7 enclosure entrance
____ MTest control room
____ MCenter control room
____ Ion chamber hardware
____ Scintillator hardware

Trainer Date

12. NS1 Service Building

____ SWIC controllers
____ Magnet power supplies and interlock chassis
____ N01 enclosure access
____ NS1 LCW system

Trainer Date

13. NS2 Service Building

____ NS2 LCW system

Trainer Date

14. NS7 Service Building

____ F:NM3S power supply
____ F:NM4AN power supply
____ Neutrino CDC chassis
____ NM2 enclosure entrance

Trainer Date

15. Neutrino Muon Detector Building (KTeV)

____ NM4 enclosure entrances and remote key tree
____ NM3 enclosure entrance
____ NM3 RAW system controller

Trainer	Date

16. Training Center

____ Accelerator Division controls rack

- ____ Know how to access this area
- ____ Meson front end
- ____ Neutrino front end

Part 5: Booster Neutrino Beam MCR

Trainer Date

1. Beamline Layout

Draw the general layout of the BNB beamline. Your diagram should include:

____ MI ring

____ MI-12A and MI-12B enclosures

____ MI-10 and MI-12 service buildings

____ Decay region

____ Experiment detectors

Trainee Date

2. Experiments

Have a general understanding of the experiments that use the BNB, and their overall scientific goal. This knowledge should include a very basic description of the detector, what it is designed to measure, and how it functions. Sign yourself off when you are comfortable with this information.

____ ANNIE (SciBooNE Hall)

____ SBND (SBN ND)

____ MicroBooNE (LArTF)

____ MiniBooNE (MiniBooNE Hall)

____ ICARUS (SBN FD)

Trainer Date

3. MI-12 Target Hall

Draw a diagram of the major devices in the MI-12 target hall. Also, know the function and purpose of the target hall devices, including:

____ Target

- ____ Composition
- ____ Cooling

____ Horn

- ____ Shape
- ____ Field shape and strength
- ____ Power supply characteristics
- ____ Striplines and fan cooling units

____ Collimator

____ Decay region

____ Absorbers

Trainer Date

4. BNB Autotune Program

____ Understand the purpose and importance of the BNB Autotune program

____ Know where it runs and how we interact with it

____ Be able to determine which devices it controls

____ Know how to tell, and what to do, if it is not working correctly

Trainer Date

5. Instrumentation

Know the BNB-specific diagnostic instrumentation and their function, including:

____ E26 for BNB profile monitors

____ E27 for BNB BPMs and BLMs

____ Total loss monitors

____ MI-12B wall current monitor

____ Target 90° monitor

____ Absorber muon monitor

Trainer Date

6. BNB Water Cooling Systems

Have a general understanding of the water systems for BNB.

____ Know what the LCW cools

____ Know where the LCW comes from, and what it heat-exchanges with

____ Know the following about the BNB RAW system:

- ____ Its location
- ____ What it cools
- ____ What system it heat-exchanges with
- ____ Who must be informed of problems with this system

____ Be able to monitor LCW and RAW system parameters

Trainer Date

7. Turning MI-12A and MI-12B Off and On

Know how to turn MI-12A and MI-12B off and on before and after an access.

____ Know what devices are turned off or on via the sequencer

____ Know the appropriate CDC to manipulate

____ Know how to properly switch off at MI-12 using the MiniBoone MI-12A and MI-12B 480 Volt Lockout/Tagout Procedure ADSP-05-1216

____ How to become qualified to perform this procedure

____ Know how and why MI-12A access inhibits beam to the Main Injector

Trainer Date

8. MI-12A and MI-12B Access Hazards

Know the MI-12A and MI-12B access hazards and how to identify the warning signs.

____ Know whose permission is required for access

____ Know the purpose of the 1000 cfm fan system

____ How and when to manipulate it

____ Why it is interlocked to the CDC

____ Know the purpose of the 200 cfm fan system

____ When it is active

____ Why it is interlocked to the CDC

____ Know that a cooldown is required before access

____ Be able to look up the cooldown devices and the access threshold in the run condition

Part 6: Booster Neutrino Beam Walkaround

Trainer	Date

1. MI-8 Service Building

____ BNB permit patch panel

____ CAMAC hardware

Trainer	Date

2. MI-10 Service Building

____ Magnet power supplies

____ Dipoles

____ Quads

____ Correction elements and bulk power supply

____ MBEX switching magnet power supply

____ Critical device power supplies and CDC chassis

____ CAMAC hardware

____ BNB permit patch panel

____ CAMAC hardware

____ Vacuum hardware

____ Instrumentation hardware

____ SWIC

____ BPM

____ BLM

____ Toroid

____ LCW pump room that supplies MI-12

____ MI-12A enclosure entrance

Trainer Date

3. MI-12 Service Building

____ Magnet power supplies
- ____ Dipoles
- ____ Quads

____ RAW skid controls and readbacks

____ BNB de-watering tanks
- ____ De-watering well level readbacks

____ Airborne radiation monitors

____ Disconnect for MI-12 enclosure LOTO

____ BNB horn components
- ____ Power supply
- ____ Stripline
- ____ Controls
- ____ Interlocks

____ CAMAC hardware

____ BNB permit patch panel
- ____ CAMAC hardware

____ Instrumentation hardware
- ____ SWIC
- ____ Target BPM

____ Enclosure entrance to MI-12B

Trainer Date

4. MI-13 Enclosure

____ Access restrictions

Trainer Date

5. Detector Buildings

____ SciBooNE Hall (ANNIE)

____ SBN ND (SBND)

____ LArTF (MicroBooNE)

____ MiniBooNE Hall (MiniBooNE)

____ SBN FD (ICARUS)

Part 7: MTA MCR

Trainer Date

1. Beamline Components

Be familiar with the major components of the MTA beamline. Your knowledge should include:

____ E:UHB01 C-magnet

____ Critical Devices

____ E:UBS01

____ E:UHB03

Trainer Date

2. Hall Access

Be familiar with the hazards associated with accessing the MTA Hall.

Part 8: MeV Test Area Walkaround

_____
Trainer Date

1. Lower Linac Gallery Tech Shop

____ E:UHB03 power supply

_____
Trainer Date

2. South Linac Upper Gallery

____ Magnet power supplies
- ____ Dipoles
- ____ Quads
- ____ Correction elements

____ IRM and VME chassis

____ Toroid electronics

____ Beamline permit chassis

____ Rep rate monitor PLC

____ BPM and BLM hardware

_____
Trainer Date

3. Booster West Gallery 400 MeV Area

____ Ion pump power supplies

____ Vacuum gauge hardware

_____
Trainer Date

4. MTA Hall Enclosure

____ Potential hazards and safety monitoring equipment

____ Flammable gas shed