



NEUTRINO LABORATORY RADIATION AND
ELECTRICAL SECURITY SYSTEM

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Several levels of radiation and electrical security are encountered in connection with the operation of the Neutrino Laboratory:

- (1) radiation coupled to operation into the main beam dump:
Manholes G1, G2, G3.
- (2) radiation coupled to energizing G-line pitching magnets in Enclosure C:
Neutrino Target Hall, Meson Decay Pipe Manhole,
Enclosure 100.
- (3) radiation from secondary beams:
Enclosures 101-115, Experimental Halls.
- (4) exposed electrical busswork
Neutrino Target Hall, Enclosures 100-106, 108-109,
112-115.

Level (1) enclosures, with radiation coupled to the Main Accelerator extraction system, are the responsibility of Accelerator Section, both for security and search and secure. They are incorporated into the Accelerator interlock system.

Level (2) enclosures can be uncoupled from the Accelerator system by locking out the G-line pitching magnets



in Enclosure C, with a mechanical beam plug as a backup. For Neutrino Laboratory personnel to carry out tasks in these areas safely with respect to radiation, they must have assurance against the proton beam being brought up into the area. It is the responsibility of the Neutrino Laboratory operations officer to search and secure the area to make sure his people are out before he gives beam permit to the Accelerator to allow pitching magnets to be energized and the beam plug to be removed.

Level (3) is similar to existing secondary beam lines at other accelerators since particle intensities are of the same order ($\sim 10^6$) and ionization loss is essentially independent of energy above a few hundred MeV. As at those installations, the vacuum pipe itself serves as a radiation fence to keep personnel out of the beam. Locking off appropriate magnets in Enclosure 100 will inhibit either of the secondary beam lines if there is need to work in the beam itself.

Level (4), which overlaps Levels (2) and (3) is potentially the worst hazard in the area. Standard operating procedure requires that there always be two people in an enclosure with live buss. Responsibility for all these enclosures rests with the Neutrino Laboratory operations officer.

The security system to implement the requirements is due to Rich Parry in consultation with Harry Howe and is modelled on the Main Ring system (see attached). In every enclosure an interlock loop must be made up before beam may be brought into the Area and/or power may be turned on. Entrance

into Level (2) enclosures - Neutrino Target Hall, Decay Pipe Manhole, Enclosure 100 - always drops out the pitching magnets and closes the beam stopper in the "G" line. A controlled access with d.c. power in the buss can be made by using two keys obtained from the Neutrino Laboratory Operations Officer in Building A. A single-key entry into these enclosures drops out the power supplies for that enclosure. These keys must be returned to the key tree before the Operations Officer can give a master reset to allow Main Control to bring up the proton beam.

Level (4)-only keys - Encl. 101-106, 108-109, 112-115 are also held in a key tree in Neulab Operations, but not interlocked to enclosures. These keys are identical with Level (3)-only keys - Encl. 107, 110, 111.

To ensure safety in those enclosures where power supplies are inside the magnet enclosure, the interlock reset box is located outside the enclosure. A power-on type entry, requiring two men, must be made after reset to actually turn on the supplies and energize the magnets.

Interlock and power status indicator lights are to be installed over the doors of each enclosure. A proton beam status box will be installed outside Level (2) enclosures.

Enclosure status information for all enclosures will be available to the Operations Officer through the control system.

NEUTRINO LABORATORY SECURITY SYSTEM KEYING

Richard Parry

A new keying series will be set up for the Neutrino Laboratory beam lines. There will be 7 (seven) keys.

1. Control key - black tag (1).
2. Crew chief key - red tag (1).
3. Power on keys for Encl. 101-115 - green tag (3).
4. Power on keys for vHall and Encl. 100 - blue tag (3).
5. Key tree keys for vHall - white tag (8).
6. Key tree keys for Encl. 100 - yellow tag (8).
7. Key to open interlock boxes - brown tag (1).

I. Control Key

There shall be one, and only one, control key. This key will be locked in a cabinet and will be the responsibility of the Neutrino Laboratory Section Head. The function of this key is to remove and insert the cores of the locks. This key need only be used during the construction phase of the safety system.

II. Crew Chief Key

This key shall be the responsibility of the crew chief in Lab A. The crew chief will be responsible for decisions concerning safety and operation of the neutrino line on his shift. This key will release the power on keys for Enclosures 101 through 115. It will also release the power on keys for vHall and Enclosure 100. A module will exist in Lab A which will

indicate the status of the neutrino line and other related safety information. The crew chief key will operate the master reset on this module. This reset will allow the main control room to bring beam into the Neutrino line. In each enclosure there will be a large junction box where all cables will be terminated, the junction box will be locked and opened only with the crew chief key.

III. Power on Key for Enclosures 101-115.

There shall be a total of 3 of these keys which will reside in Lab A. These keys will not be interlocked, but cannot be removed without permission from crew chief. The crew chief must unlock a key box to remove these. Any two of these keys will operate the controlled (power on) access boxes inside and outside Enclosures 101-115.

Any one of these keys will also be used to search and secure Enclosures 101-115.

All doors in Enclosures 101-115 shall be locked and opened only by these keys.

IV. Power on Keys for ν Hall and Enclosure 100.

There shall be a total of 3 of these keys. These keys will be interlocked to the extended proton beam via the pitching magnets and will reside in Lab A. These keys cannot be removed without permission of the crew chief. The crew chief must unlock a key box to remove these.

Any one of these keys will be used to S & S ν Hall and Enclosure 100.

Any one of these keys will operate the master reset module in each of these enclosures.

Any two of these keys will operate the controlled (power off, beam off) access.

Any two of these keys will enable a controlled (power on, beam off) access.

These keys will operate all interlocked doors in these two enclosures.

These keys open the key tree in each enclosure (v Hall and 100).

V. Key Tree Keys for v Hall.

There shall be a total of 8 of these keys. The keys will reside in a locked key tree outside v Hall. These keys will be interlocked and will insure beam off, power off access when removed.

These keys will open all interlocked doors in v Hall.

These keys can be used for controlled (power off, beam off) access via the boxes on either side of the gate.

VI. Key Tree Keys for Enclosure 100.

There shall be a total of 8 of these keys. The keys will reside in a locked key tree outside Enclosure 100. These keys will be interlocked and will insure beam off, power off access.

These keys will open all interlocked doors in Enclosure 100.

These keys can be used for controlled (power off, beam off) access via the boxes on either side of the gate.

VII. Key to Open Interlock Boxes.

This key of which there should be one and only one will be the responsibility of the director of the neutrino line. This is the key that opens all interlock boxes and need only be used during construction and maintenance of the system.

	Keys Needed	Keys Ordered	Cores Needed	Cores Ordered	Tag/Type
I. CONTROL KEY					
REMOVES AND INSERTS CORES	1	2	-	-	Black
II. CREW CHIEF KEY					
1. Releases power on 101-115 keys	1	2	1	-) Red
2. Releases power vHall 100 keys			1		
3. Grand master reset			1) Nu-1
4. Open junction boxes			13	25	
III. Power on Keys 101-115	3	5	3) Green
1. Operate pow. on C.A. 101-115			22)
2. Open doors 101-115			24) Nu-2
3. S & S 101-115			37	100)
IV. Power on vHall & 100	3	5	3) Blue
1. S & S vHall & 100			10)
2. Master Reset			2)
3. Control. Acc. Pow. On			4) Nu-3
4. Open key trees			2)
5. Open door vHall & 100			7	35)
V. Key Tree Keys vHall	8	10	8	10) White
VI. Key Tree Keys 100	8	10	8	10	Yellow N-5
VII. Open Doors and C.A. Power Off vHall	-	--	-	12	Nu3-4
VIII. Open Door and C.A. Power Off 100	-	--	-	12	Nu3-5
IX. Interlock Box Keys	1	4	-	-	Brown