

NEUTRINO AREA RADIATION AND
ELECTRICAL SECURITY SYSTEM

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I. RATIONALE

T.E.Toohig

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

- (1) radiation coupled to operation into the main beam dump:
Manholes G1, G2.
- (2) radiation coupled to energizing G-line pitching magnets
in Enclosure C:
Manhole G3.
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. Although not Level (1), G3 Manhole which is Accelerator Division responsibility is also in 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 Section 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 Area crew chief to search and secure the area to make sure his people are out before he gives beam permit to the Accelerator to allow the beam plug to be removed and pitching magnets to be energized.

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 Area crew chief.

The security system to implement the requirements is due to Rich Parry in consultation with Harry Howe and is modeled 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

*Targetting for the N-3/N-5 hadron beam line in Enclosure 100 can cause very high radiation levels in Enclosure 101, so Enclosure 101 is treated as a special case as noted below.

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 Area crew chief at the beam operations center. 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 crew chief key can be released to give an Area reset.

Level (4) - only keys - Enclosures 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 - Enclosures 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 installed over the doors of each enclosure. A proton beam status box is installed outside Level (2) enclosures.

Enclosure status information for all enclosures will be available to the crew chief through the control system.

II. NEUTRINO AREA SECURITY SYSTEM KEYING

Richard Parry

A new keying series will be set up for the Neutrino Area beam lines. There will be 8 (eight) keys.

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

1. 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 Area Section Head. The function of this key is to remove and insert the cores of the locks.

2. Master Radiation Reset Key

The Master Radiation Reset Key releases the Blue keys which control access to Neutrino Target Hall, Decay Pipe Manhole and Enclosure 100. When the Area is made up the Red key resets the G-1 collimator and MV-100. A reset from the Operations Center locks the Master Radiation Reset Key into its tumbler.

3. Crew Chief Key

This key shall be the responsibility of the crew chief. The crew chief is 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. A module will exist in Lab A which will indicate the status of the Neutrino Area and other related safety information.

4. Power on Key for Enclosures 101-115

There shall be a total of 4 of these keys which will reside at the Neutrino key station. These keys will not be interlocked, but cannot be removed without permission from crew chief. The crew chief must unlock the Kirk keylock 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.

5. Power on Keys for vHall and Enclosure 100

There shall be a total of 4 of these keys. These keys will reside at the Neutrino key station. These keys cannot be removed without permission of the crew chief. The crew chief must unlock the Kirk keylock to remove these.

Any one of these keys will be used to search and secure vHall 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 (vHall and 100).

6. Key Tree Keys for vHall

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

These keys will open all interlocked doors in vHall.

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

7. 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.

8. Key to Open Interlock Boxes

This key of which there should be one and only one will be the responsibility of the Neutrino Section Head. This is the key that opens

all interlock boxes and need only be used during construction and maintenance of the system. It also is used to open the padlocks on the main interlock junction boxes located in each enclosure.

	Keys Needed	Keys Ordered	Cores Needed	Cores Ordered	Tag/Type
1. CONTROL KEY a. Removes & inserts cores	1	2	-	-	Black
2. MASTER RADIATION RESET KEY	1	2	2		Red
3. CREW CHIEF KEY a. Releases power-on 101-115 keys	1	2	1	-	Orange Nu-1
4. POWER ON KEYS 101-115 a. Operate power on CA 101-115 b. Open doors 101-115 c. Search & secure 101-115	4	5	4 22 24 37	100	Green Nu-2
5. POWER ON - vHALL & 100 a. Search & secure vHall & 100 b. Master Enclosure reset c. Control Access Power on d. Open key trees e. Open door vHall & 100	4	5	4 10 2 4 2 7	35	Blue Nu-3
6. KEY TREE KEYS - vHALL a. Open doors & CA power off vHall	8	10	8	12	White Nu-4
7. KEY TREE KEYS - ENCLOSURE 100 a. Open door & CA Power off 100	8	10	8	12	Yellow Nu-5
8. INTERLOCK BOX AND INTERLOCK JUNCTION BOX KEYS a. Open junction boxes	1	4	- 13	-	Brown



SUBJECT

SCHMATIC - EXTRACTED BEAM INTERLOCK

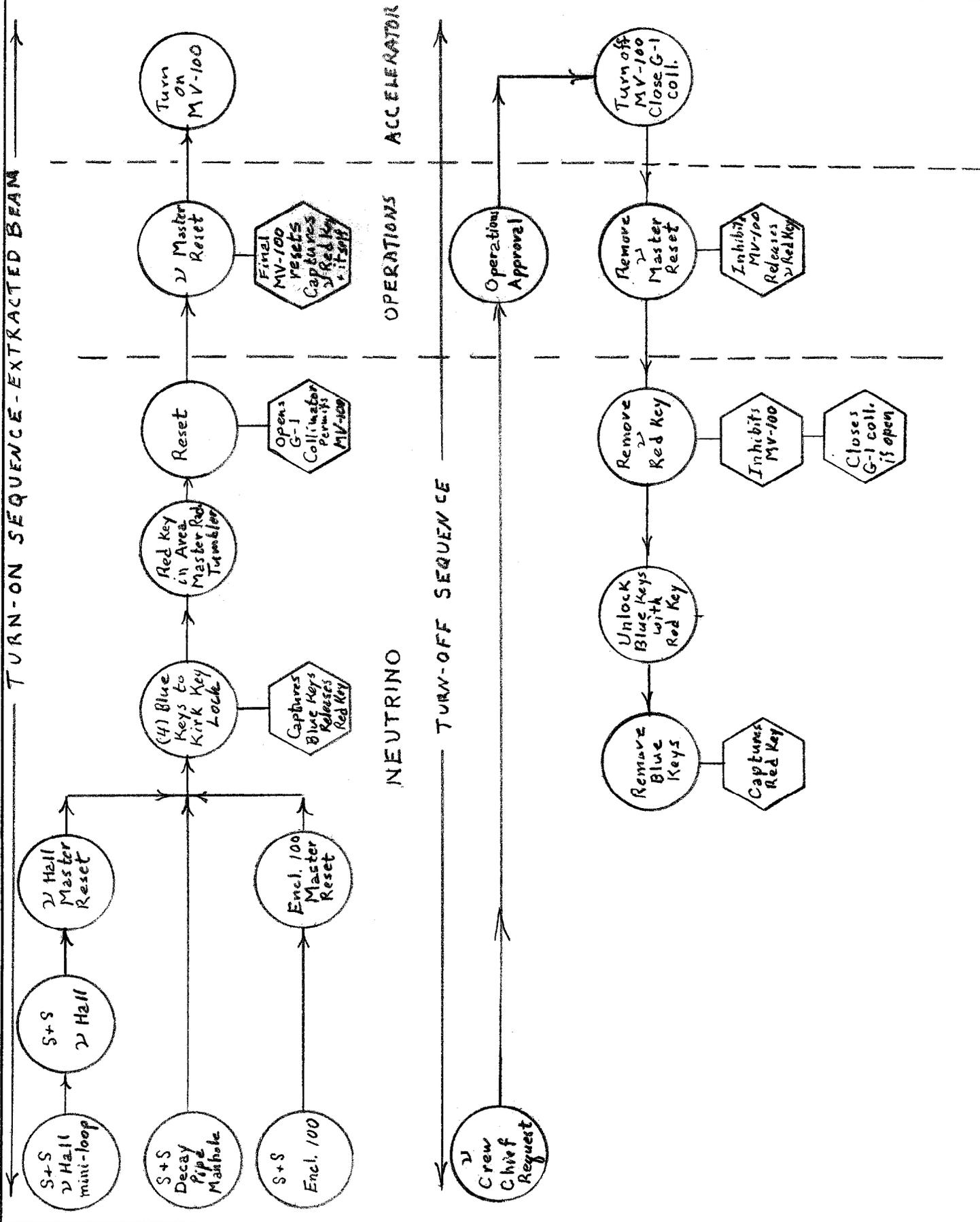
NAME

T. E. Tooby

DATE

12/21/73

REVISION DATE



III. NEUTRINO KEY-LOCK, INTERLOCK SYSTEM

E. Woods

The following is a description of the revised key-lock system for the Neutrino Area. (Neutrino Area key station = site 49.)

1.0 OPERATIONS (Bill Williams/Crew Chief)

1.1 Operational sequence.

- 1.1.1 Lock all doors and perform search and secure for all green keyed enclosures and interlocks.
- 1.1.2 Lock all doors and perform search and secure for all blue keyed enclosures and interlocks.
- 1.1.3 Insert all green keys into master Kirk key lock and lock them in with NEW lock-in key.
 - 1.1.3.1 This provides NO electrical interlock, but serves to isolate green keys, provide a central location for green keys, assigns the crew chief the responsibility of carrying and keeping track of only one key, and inhibits green key assignment without prior knowledge of the crew chief.
- 1.1.4 Remove NEW lock-in key. (Lock-in key can only be removed with all green keys in place.)
- 1.1.5 Crew chief retains possession of NEW lock-in key while Neutrino Area is in operation.
- 1.1.6 Insert all BLUE keys into master Kirk key lock and lock them in place with RED lock-in key.
- 1.1.7 Remove red key. (Red key can only be removed with all blue keys in place.)
- 1.1.8 Insert red key in "Accelerated Beam Permit" and rotate to locked position.
- 1.1.9 Call Accelerator MCR and inform them of ready condition of Neutrino Area.

- 1.1.10 MCR will initiate "beam on status" by instituting the following:
 - 1.1.10.1 Electrically lock Neutrino Area red key in the locked position.
 - 1.1.10.2 Perform preliminary beam extraction procedures.
 - 1.1.10.3 Open collimator in G-1 manhole. (Local status of collimator will be available at the Neutrino Area key station.)
 - 1.1.10.4 Turn on and set up MV-100. (Local status of MV-100 will be available at the Neutrino Area key station.)
 - 1.1.10.5 Extract beam to Neutrino Area.
- 1.1.11 Neutrino Area is now operational and experimental studies begin.
 - 1.1.11.1 Green key access is now available by:
 - 1.1.11.1.1 Single key with interlock and power supply interruption.
 - 1.1.11.1.2 Double key with power on accessibility.
 - 1.1.11.2 No blue key access is available without:
 - 1.1.11.2.1 Notifying MCR to release red key for blue key access in which case:
 - 1.1.11.2.1.1 Beam will be turned off,
 - 1.1.11.2.1.2 MV-100 will be turned off, and
 - 1.1.11.2.1.3 Collimator in G-1 will be closed.

- 2.0 FABRICATION (Completion date January 30, 1974)
- 2.1 Present red key reset in N-1 will be converted to blue key.
(R.Parry)
 - 2.2 Kirk key assemblies (2) will be provided by Neutrino Section.
 - 2.3 Cabling will be done by the Neutrino Section as per R.Parry. (L.Beverly)
 - 2.4 19-inch rack panel containing electric red key lock, visual displays, Kirk locks, and Best cores shall be fabricated for Neutrino Section. (R.Parry)
 - 2.5 An additional rack shall be installed at the Neutrino Area key station. (L.Beverly)
 - 2.6 Check out and operation shall be done by Neutrino Section.
(W.Williams)
 - 2.7 NEW lock-in key shall be supplied to Neutrino Section.
(R.Parry)