Radiation Safety Check-Off List for Operation of Booster with Ions from Tandem

(For operation beginning November 2006)

November 20, 2006

Prepared by: C.J. Gardner

Sign and Date: _____

Reviewed by: D.R. Beavis

Sign and Date: _____

Approved by: D.I. Lowenstein

Sign and Date: _____

Ions from Tandem may be injected and accelerated in Booster **only upon completion of this check-off list**. Completion of this list **does not allow** for the injection of protons from Linac. Before proceeding with the numbered check-off items, the **LTB** and **TTB** Beamstops must be **Inserted, Locked, and Tagged**. If necessary, equivalent devices and/or procedures may be substituted with appropriate LP and RSC approval. The Beamstop Locks and Tags are as follows:

1. _____ (LPB) LOTO Booster **LTB** Beamstop Enable Key (Building 914):

   Tag Number 6130

   Lock Number 10L240

   Person/Date: _____

2. _____ (LPB) LOTO Booster **TTB** Beamstop Enable Key (Building 914):

   Tag Number 6307

   Lock Number 10L222

   Person/Date: _____

Note: The Lock and Tag prohibiting **proton** injection from Linac may not be removed until a radiation safety checkoff list for **proton** operation is completed.

The following items are to be initialed as complete:

1 Tandem and TTB Line

1. _____ (LPT) TTB Radiation Safety Check-Off List Completed.

2 Security System

1. _____ (ACG) Functional Test of the Booster access control system complete.
2. _____ (ACG) Functional Test of Booster Extraction interlocks complete.
3. _____ (ACG) Functional Test of Booster-NSRL Penetration Stub interlocks complete. (These interlocks ensure that the stub region cannot be entered with beam in Booster.)
4. _____ (ACG) Functional Test of HEBT-TTB Cross-Over interlocks complete. (These interlocks ensure that this region cannot be entered with the TTB beamstops open.)
5. _____ (ACG) Booster Shutter to prevent long stored beam installed and operational. (The shutter is located in the B6 straight section downstream of the dump.)
6. _____ (ACG) B6 Dump cooling water flow-switch interlock operational. (This interlock closes the LTB and TTB beam stops if water flow ceases.)
7. _____ (ACG) D3 Septum Magnet cooling water flow-switch interlock operational. (This interlock closes the LTB and TTB beam stops if water flow ceases.)

3 Shielding

1. _____ (LE) Inspection of Booster berm shielding complete.
   _____ (LPB)
2. _____ (LPB) Booster F6 Septum shielding in place.
3. _____ (LE) Walk-through inspection of shielding inside Booster tunnel complete.
   _____ (LPB)
4. _____ (LPA) Shielding on AGS side of common boundry between Booster and AGS inspected.
5. _____ (LE) Shielding on the Linac side of the EBIS-Booster penetration in place.
   _____ (LPB)

4 Fencing and Posting

1. _____ (LE) Booster Perimeter Fence in place.
   _____ (LPB)
2. _____ (RCD) Booster Perimeter Fence posted as a "Radiation Area".
3. _____ (LE) Building 914 roof security fence in place.
4. _____ (RCD) Building 914 roof security fence posted as a "High Radiation Area".
5. _____ (LE) Structure covering the three pipes that come through the Booster berm over C1 is in place.
6. _____ (RCD) The structure over C1 is posted to prohibit entry.
7. _____ (RCD) Top of building 914 plug door posted as a "High Radiation Area".
8. _____ (RCD) Building 914 posted as a "Radiation Area".
9. _____ (LE) Vent pipe gratings in the Booster tunnel in Place.

10. _____ (RCD) In the AGS ring, the Booster/AGS labyrinth must be posted on top as follows, to prohibit personnel from working on top of the labyrinth:

    "WARNING! Working at shield top height prohibited, contact MCR if access is necessary."

11. _____ (RCD) Booster-NSRL penetration Stub posted.

12. _____ (RCD) NSRL Zone 2 posted.

13. _____ (LE) Fence in place to prevent entry onto the Booster berm from the new Linac exit and stairs.

    _____ (LPB)

14. _____ (RCD) This fence (above) posted as a "Radiation Area".

15. _____ (LE) Barrier on Linac side of EBIS-Booster penetration in place.

    _____ (LPB)

16. _____ (RCD) Barrier on Linac side of EBIS-Booster penetration posted to prohibit entry.

5 Chipmunks

1. _____ (ACG) Chipmunk NM060 on top of Building 914 plug door installed and checkout complete. (This chipmunk is set to alarm at 40 and interlock at 50 mr/hour.)

2. _____ (ACG) Chipmunk NM058 in "High Radiation Area" on Booster berm over F6 Septum installed and checkout complete. (This chipmunk is set to alarm at 40 and interlock at 50 mr/hour.)

3. _____ (ACG) Chipmunk NM059 in "High Radiation Area" on Booster berm over BTA DH2 & 3 installed and checkout complete. (This chipmunk is set to alarm at 40 and interlock at 50 mr/hour.)

4. _____ (ACG) Chipmunks NM133 and NM134 in the Booster-NSRL Penetration Stub are installed and checkout complete. The chipmunk at the penetration headwall (NM134) is set to alarm at 16 and interlock at 20 mr/hour. The chipmunk at the stub gate

(NM133) is set to alarm at 1.0 and interlock at 20 mr/hour. (Note that these chipmunks are disabled when extraction from Booster to NSRL is permitted.)

5. _____ (ACG) Chipmunks NM112 and NM113 on Linac side of EBIS-Booster Penetration installed and checkout complete. Chipmunk NM112 is located at beam height just outside the concrete block that shields the penetration pipe opening; it is set to alarm at 2.0 and interlock at 2.5 mr/hour. Chipmunk NM113 is located close to the penetration pipe opening in the area enclosed by the concrete shielding blocks. It is to be used as an area monitor and is connected to scalers for radiation measurements (it is not an alarming or interlocking chipmunk).

6. _____ (LPB) Location of above chipmunks checked.

6 Booster Extraction to AGS

1. _____ (ACG) A Radiation Security Orange Tag has been applied to the BTA QV5 power supply to ensure that the polarity of this quadrupole is not changed. (The quadrupole is wired to be vertically focussing).

2. _____ (RSC) Booster extraction critical device review complete or hazard considered acceptable pending further review.

Either Item 3 OR Item 4 must be completed:

3. _____ (LPA) The AGS Radiation Safety Check-Off List for operation with ions from Tandem is completed

OR

4. _____ (LPA) The Booster Extraction Enable Key is LOTO:

Tag No. _____

Lock No. _____

Person/Date: _____

7 Booster Extraction to NSRL

Either Item 1 OR Item 2 must be completed:

1. _____ (LPN) NSRL (R-line) is ready to accept beam.

   OR

2. _____ (LPN) Booster Extraction to NSRL is LOTO:

   Tag No. _____

   Lock No. _____

   Person/Date: _____

8 Verification and Permission

All of the above check-off items have been initialed as complete.

_____ (OC)

_____ (Date/Time)

The RS LOTO(s) that prevent Tandem Ion beams from entering Booster may be removed. The **TTB** beamstop remote enable key (in Bldg. 914) may be inserted and turned (or equivalent devices enabled) to allow beam enable from the MCR.

_____ (LPB)

_____ (Date/Time)

Abbreviations

LPT = Liaison Physicist Tandem (**James Alessi** or designee)

LPA = Liaison Physicist AGS (**Haixin Huang** or designee)

LPB = Liaison Physicist Booster (**Chris Gardner** or designee)

LPN = Liaison Physicist NSRL (**Adam Rusek** or designee)

LE = Liaison Engineer (**George Mahler** or designee)

CME = Chief Mechanical Engineer, ME (**Joe Tuozzolo** or designee)

RSC = Radiation Safety Committee (**Dana Beavis** or designee)

ACG = Access Control Group (**Jonathan Reich** or designee)

RCD = Radiation Control Division (**Paul Bergh** or designee)

MCR = Main Control Room

OC = Operations Coordinator