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C-A OPERATIONS PROCEDURES MANUAL

8.1.3 LINAC Beam Checkout for Booster

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Hand Processed Changes

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Approved: _____ *Signature on File* _____
 Collider-Accelerator Department Chairman Date

V. LoDestro

8.1.3 Linac Beam Checkout for Booster

1. Purpose

To provide instructions for Linac staff on how to do a full systems check of the Linac by accelerating beam through the Linac following turn of subsystems.

2. Responsibilities

This Linac checkout with beam shall be done by trained Linac staff. The Linac Operations Coordinator shall be consulted prior to operation of the Linac following a shutdown.

3. Prerequisites

- 3.1 The Linac Systems Turn On for Booster, [C-A-OPM 8.1.1](#), has been completed. All systems shall be set to their previous running values during their turn on.
- 3.2 The Linac LRM system must be operational; yearly checkout and calibration is part of Linac maintenance.
- 3.3 The beam current transformers must be operational yearly checkout and calibration is part of Linac maintenance.
- 3.4 Qualified and trained Linac staff.
- 3.5 MCR is manned.
- 3.6 Linac is operating on PPM Users 1, 2, 3 or 4 only.

4. Precautions

- 4.1 The Linac tunnel, HEBT, and BLIP must be secured prior to accelerating beam in the Linac.
- 4.2 The AGS ring must be secured unless a chipmunk monitor is placed at the HEBT door on the AGS ring side prior to Linac turn on.

5. Procedure

Note:

If the Linac is already delivering 200 MeV beam to BLIP, this procedure is not necessary.

- 5.1 Open all LEBT, tank, and HEBT vacuum valves. LEBT valves are controlled from the preinjector area. Tank and HEBT valves are controlled from the individual vacuum control panels along the lower equipment bay.
- 5.2 From the Linac Control Room (ICR), measure the beam current at the source output (L1) and the input to the RFQ (L2). If $L2/L1 < 65\%$, tune the 35 keV transport line using spreadsheet.
- 5.3 Check the rf power level in the RFQ to insure that it is handling the beam loading. Measure the current at the output of the RFQ (L3). If $L3/L2 < 65\%$, retune the 35 keV line.
- 5.4 Open the 0-9 beam stop (ICR rack F2). Check for beam on the L5 transformer. No beam should be seen on L5, indicating that the Fast Beam Interrupt (FBI) system is working properly. If beam is seen on L5 at this time, it must be investigated by a system expert. Proceeding without the FBI being operational would cause equipment damage.
- 5.5 Push the "Chopper Bypass" button in the ILCR rack F2. Beam should now be seen on the L5 current transformer. If $L5/L3 < 50\%$, retune the 750 keV line.
- 5.6 Check the power levels in the three bunchers, and verify that they are handling the beam loading.
- 5.7 In spreadsheet on User 5 PPM set the Linac beam pulse width to 50 msec, or less using the chopper timing command. Set the User 5 Rep Rate to 1PPS using the Linac Timing PC located in R3.
- 5.8 Open the Tank 1 beam stop. If no current is seen at the Tank 9 current transformer, check for an indication of a system malfunction and correct the malfunction. Beam should only be seen at Tank 9 at the 1PPS repetition rate. Once beam is seen at tank 9, check the rf power levels in the 9 tanks to see that all systems are handling beam loading.
- 5.9 Measure the T1 and T9 beam currents. If $T9/T1 < 95\%$ the tank amplitude and phase settings shall be checked. If $T9/L5 < 65\%$, the 750 keV transport line may need to be retuned. If the 750 keV quadrupoles and steerers are at their previous running values, it is likely that the phases of the RFQ and bunchers need to be adjusted.

- 5.10 Check that the Master Sample Pulse falls during the beam time. This is done by observing the T9 beam current on the scope in the LCR-C5 rack, and reducing the scope intensity until the marker dot can be seen. The dot (sample time) can be adjusted with the "AGS MSP" thumbwheel below the scope.
- 5.11 Check that the LRM's and transformer multiplex signals are on the lower scope in LCR-C6 rack. Selected with the LRM/BT button below the scope.
- 5.12 Open the High Energy beam stop (T9). Check that all LRM signals are below 1 V on the multiplex channels. All beam current transformer signals from T1 to H8 should be equal within 10% on the transformer multiplex display. The signal on the HEBT-VI multewire should be centered. If not, check that BM4 (address Lex. ND249_CuR), or Tank 9 phase (address LRF.TK9.PAS_INQ), are at their correct values. If the values are correct, but the beam is still not centered, the Tank 9 phase should be changed slightly to center the beam at HEBT-VI. (Note: if BLIP is running, changing the Tank 9 phase will affect their tune). If LRM levels are high in certain locations, tuning will be necessary.
- 5.13 If the beam position, currents, and radiation levels check out OK, the Linac is operational, and beam can be transported to the Booster. Inform MCR that the Linac turn on is complete. Linac studies User 5 and BM4 can be turned off. When the Booster is ready for beam, MCR must turn on DH1 and open the LTB 1 & 2 beam stops. Beam is initiated on PPM Users 1 through 5.

6. Documentation

- 6.1 Once the Linac is operational, any set points other than in the Source/LEBT area which differ from previous running values shall be recorded in the Linac Operations Logbook.
- 6.2 All beam transformer readings shall be recorded in the Linac Operations Logbook.
- 6.3 A set of HEBT SEM's shall be taken and put in the SEM notebook.
- 6.4 The Source, LEBT, and RFQ values shall be archived.
- 6.5 The on duty MCR OC shall be informed that the Linac is operational and note this in the MCR OC log.

7. **References**

7.1 Linac Systems Turn On for Booster, [C-A-OPM 8.1.1](#).

8. **Attachments**

None