



## 8.1.4 Linac Beam Checkout For BLIP

### 1. Purpose

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

### 2. Responsibilities

The Linac checkout for BLIP shall be done by trained Linac staff.

### 3. Prerequisites

3.1 The Linac Systems Turn On for BLIP, [C-A-OPM 8.1.2](#), has been completed. All systems should have been 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 The Linac Operations Coordinator shall be consulted prior to operation of the Linac following a shutdown.

3.6 MCR is manned.

3.7 Linac is operating on PPM User 6.

### 4. Precautions

4.1 The Linac tunnel, HEFT, and BLIP must be secured prior to accelerating beam in the Linac.

### 5. Procedure

(Note: if the Linac is already delivering beam for the Booster, open the BLIP vacuum valve, then do steps 5.7, 5.8 and 5.10-5.13.

5.1 Open all LEBT, tank, and BLIP vacuum valves. LEBT valves are controlled from the preinjector area. Tank and BLIP valves are controlled from the individual 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 spread sheet.
- 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 ICR 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 Check the "DAS Ready" light in LCR rack F7. If it is on, BLIP is not requesting beam, and beam can not be tuned further until they are ready.
- 5.8 In spread sheet on User 6 PPM, set the Linac beam width to 50  $\mu$ sec or less, using the chopper timing command. Set the User 6 Rep Rate to 6-2/3 PPS using the Linac timing PC located in R3. 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. 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 should 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 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 "BLIP MSP" thumbwheel below the scope.
- 5.11 The upper scope in rack C6 should always be displaying the signal from the multiwire after BM1 in the BLIP line. The beam should now be centered horizontally on this multiwire by adjusting the BM1 dipole current, spread sheet Lex.PD19\_Cur. The multiwire before the BLIP target is displayed on the lower scope in C6. The beam should be centered on this multiwire horizontally by adjusting the BM2 dipole, spread sheet address Lex.PD49\_Cur.

- 5.12 Call up the LRMs and transformer multiplex signals on the lower scope in LCR-C6 rack. (Selected with the LRM/BT button below the scope). Check that all LRM signals are below 1 V on the multiplex channels. (The map showing the location of each LRM channel is in LCR rack F1). All beam current transformer signals from T1 to T9, and the B3 and B4 transformers, should be equal within 10% on the transformer multiplex display. Individual transformer signals can be displayed on the scope in rack C5 by selecting the appropriate button in the same rack. If LRM levels are high in certain locations, or there is excessive beam loss, tuning will be necessary.
- 5.13 If the beam position, currents, and radiation levels check out OK, the "Beam Width" can be slowly increased to 500  $\mu$ s, using the chopper control in spread sheet, keeping an eye on BLIP Vacuum.. The T9 beam width should now be approximately 500  $\mu$ s, unless a system malfunction is limiting the beam width. Beam loading should be rechecked on the tank rf systems. At this point the Linac is operational, and beam is transported to the BLIP target. Inform MCR that the Linac is now operational for BLIP.

## 6. **Documentation**

- 6.1 Once the Linac is operational, any setpoints 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 The Source, LEBT, and RFQ values shall be archived in the Apollo.

## 7. **References**

- 7.1 [C-A-OPM 8.1.2, "Linac Systems Turn On for BLIP"](#).

## 8. **Attachments**

None