

Fault studies for the LTB-ETB Region

Purpose of the fault studies was to produce proton beam loss in the LTB line close to the penetration in linac-booster wall where the LTB line crosses the ETB (EBIS to Booster) line and measure the resulting prompt radiation on the linac side. (See Figure 1)

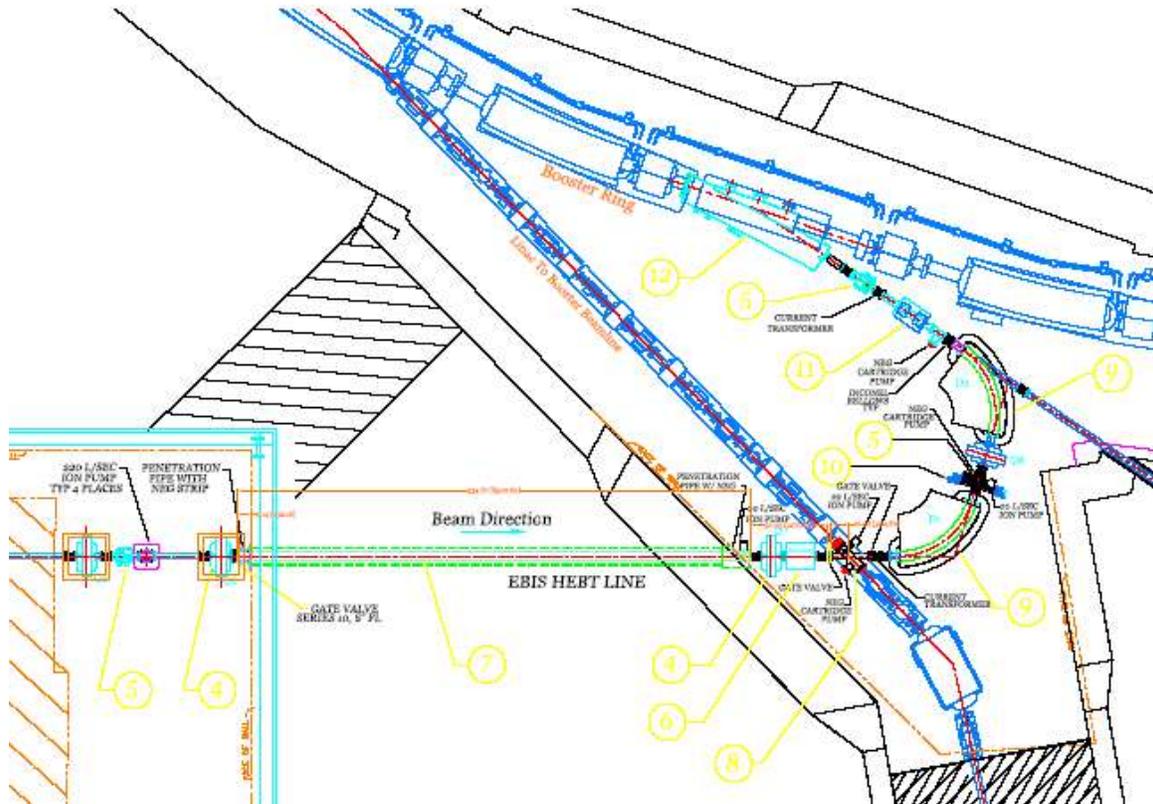


Figure 1: layout of LTB and ETB lines showing cross over.

Calculations:

Calculations were made to see if the single loss can be produce near the LTB and ETB line cross over.

Fault Study I:

There is a gate valve 25 cm down stream of LTB-ETB cross over (see figure 2) Beam from polarized source (5×10^{11} PPP) was dumped o this gate valve and prompt radiation were measured on the linac side of the penetration. NO radiation was measured. Explanation was given as follows: since the thickness of gate valve is to small to produce measurable radiation on the linac side of the wall.

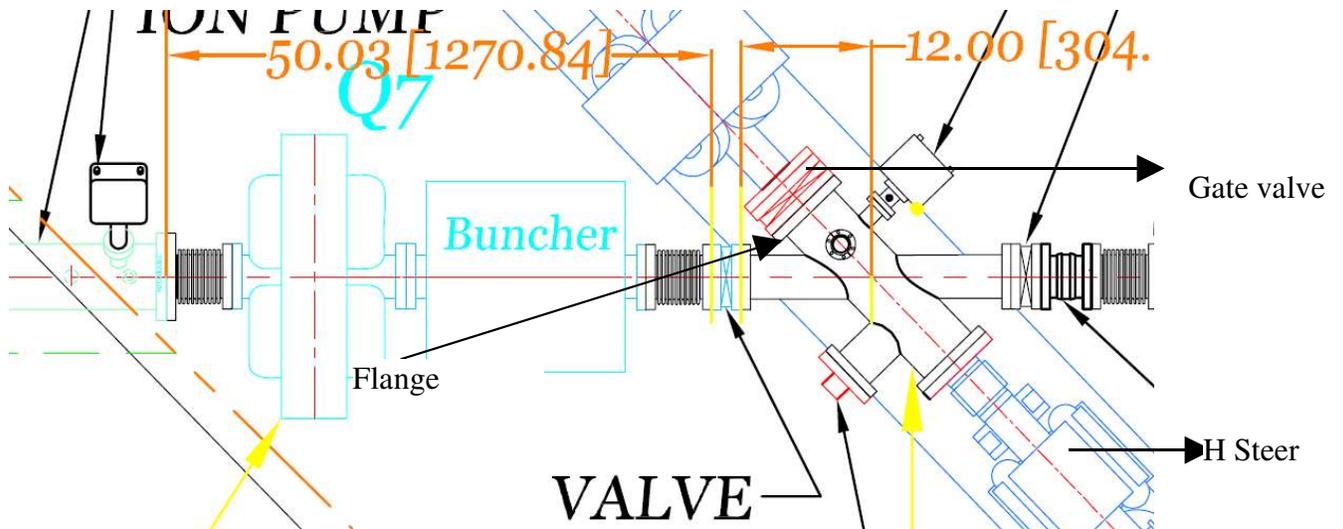


Figure 2: LTB-ETB cross over, showing gate valve.

Fault Study II

It was thought, if the full beam could be dump on the flanges down stream end of LTB-ETB-cross chamber, which are much thicker than the gate valve than one could see the prompt radiation on the linac side of the wall.

The ID of the flange is 6 inches (15.24 cm) and the beam size at this location is approximately 1.1 cm, $\beta_x=0.9051$ m, $\eta_x=-3.6$ m, $\epsilon_x=15 \pi$ mm mrad (95%, un-normalized), $\Delta p/p=\pm 0.1\%$ (95%). If the full beam has to hit the flange, this implies that central orbit has to move it this location about 8.72 cm.

There is H steerer about 91 cm upstream of the flange. To produce deflection at the flange 8.72, this steerer has to give a horizontal kick of about 97 mrad (5.6 degrees). This steerer cannot produce this kick.

Other idea was to use D2 to D5 magnet to produce the beam loss at the flange. The ID of the line is 3.455 inches (4.38 cm radius). Transport calculation shows that if central orbit is moved by 8.72 cm at the flange, then it also move ~4.4 cm at exit of QH7 (which is before DH5). Figure 3 shows the central orbit displacement along the LTB line to move central orbit by 8.72 cm at the flange.

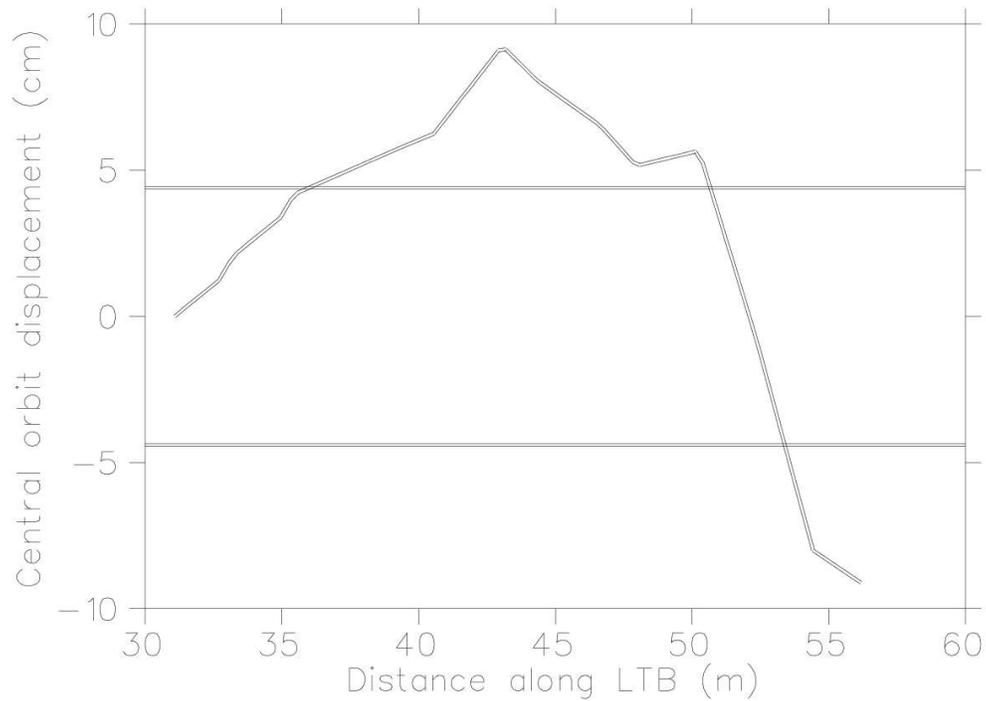


Figure 3: Central orbit displacement along the LTB line to produce the displacement at the flange about 8.72 cm. Flange location is 42.62 meter in this figure. Horizontal solid line showing the aperture in the LTB line except at LTB-ETB cross chamber (42.12 to 42.62 m) where the ID is 6 inches.

This shows that one cannot produce single loss point at flange down stream of LTB-ETB cross over using D2-D5 dipoles.