KEK PF STORAGE RING INJECTION

Ken Takayama

National Laboratory for High Energy Physics

Abstract

(A) The transport line from the linac to the storage ring was designed on the conditions that it shall have dispersion more than 5 m at the momentum slit to reduce the energy spread, and have total bending angle 35° in the horizontal direction. Besides this line must have a vertical translation section, since the height of the floor of storage ring is different from that of 2.5 GeV linac.

In designing this transport line, the conventional procedures, that is, posioning, dispersion matching, optics matching were taken. Practically total line was devided into five sections. Each section have some functions by that the previous purpose can be achieved. For example, the last section is one for optics matching to the beam in the 2.5 GeV storage ring. In Figure 1, the out line of the transport line is shown.

(B) The injection of electron beams into the 2.5 GeV storage ring is performed by the aid of four kicker magnets and tow septum magnets as illustrated schematically in Figure 2.

By means of two septum magnets located in the straight section S, electrons are deflected almost parallel to the equilibrium orbit of the storage ring. Since they are not injected on the equilibrium orbit, however, their resulting trajectories execute the coherent betatron oscillations. In order to minimize the amplitudes of oscillations, the equilibrium orbit is deformed at S toward septum magnets to form a local orbit bump by four pulsed bending magnets (kicker magnets) which are located upstream and downstream of S. If the exciting currents of kicker magnets are kept constant after finishing injection, the injected particles are inevitably lost by colliding with the septum within several turns, the number depending on the horizontal betatron number of storage ring. Therefore, the deformed orbit must be restored to zero by de-energizing kicker magnets within a few turns. The decay time of kicker magnets must be less than 2 μsec, since the time elapsed for a complet turn is 595 nsec in the present case.

After the completion of inejction, the oscillation of amplitudes around the equlibrium orbit decreases to an equlibrium value (prescribed by the orbit parameters) by favor of the radiaiton damping. The time required to reach equilibrium is called the radiation damping time, and it is 7 msec in the present case. The equlibirum value of betatron oscillation is much smaller than the amplitude of the coherent betatron oscillation existing during injection process. Therefore, already stored electrons are not lost by the deformation of the equlibrium orbit explained above. So, the next injection process can be made in the same manner.

The possible maximum injection rate is 50 Hz which is determined by the repetition rate of the linac, since the radiation damping time is small enough to accept this rate. However, in the view point of the septum magnet design and from the necessity of beam loading compensation for the rf cavities, the injection rate of 1 Hz has been nominally adopted in the present design.

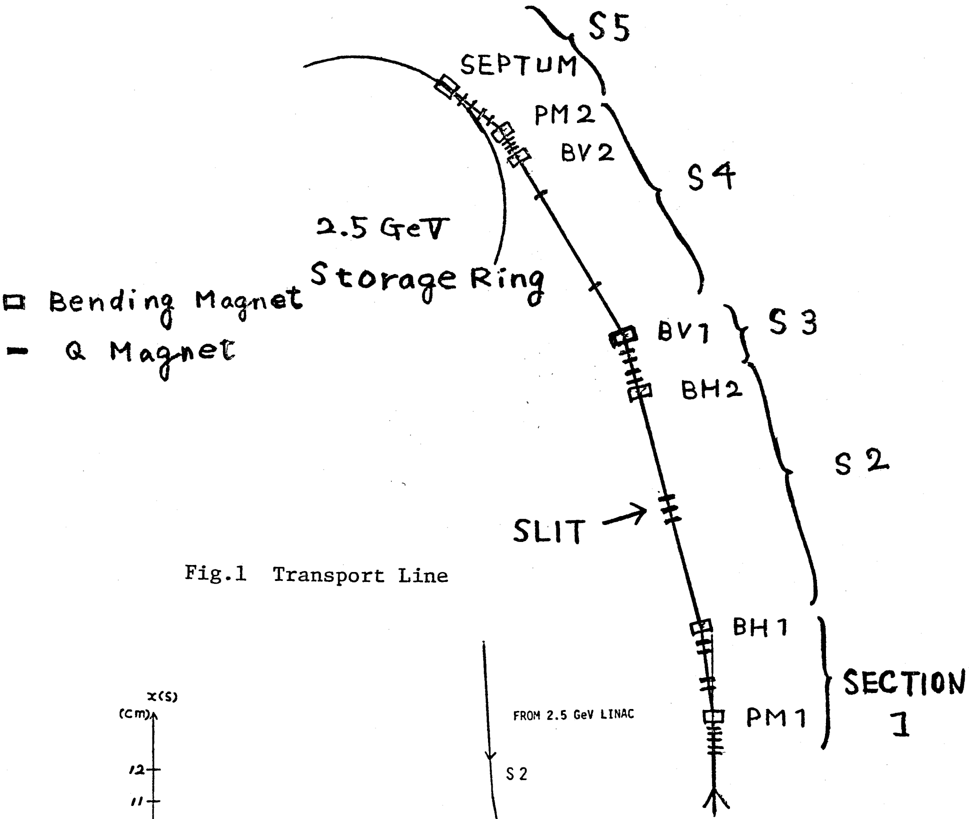

Fig.1 Transport Line

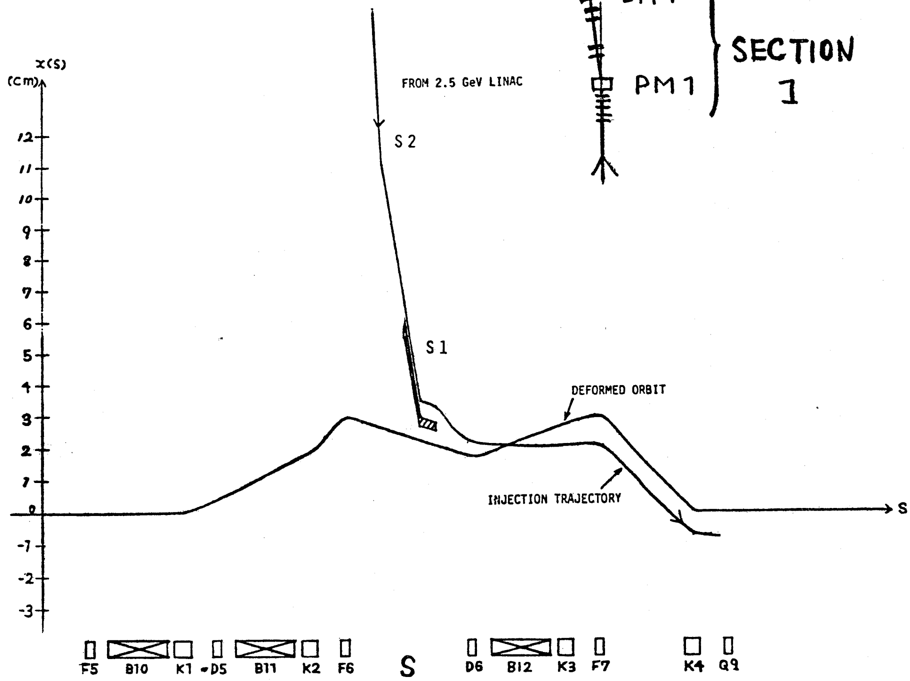

Fig.2 Trajectory of Injected Beam and Orbit Bump