DESIGN OF INJECTION SYSTEM FOR THE IPCR SSC (II)

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Abstract

The preliminary design of the inejection system done with the computer program TRANSPORT is reported. The numeric orbit calculations, which we are going to adopt ultimately in place of TRANSPORT, were also used to examine the optical properties of the beam in the model bending magnet and compared to those with TRANSPORT.

In order to obtain the good orbit separation and beam quality in the SSC, it is important to inject the beam with the following conditions. One is to guide the particles with different momenta pararelly onto the entrance positions of the 1st equilibrium orbits which correspond to each momenta (dispersion matching) and another is to match the beam emittance with the acceptance of the SSC. According to these conditions has been done the design of the injection system, the layout of which is shown in Fig. 1 of "Design of Injection (I)". The computer program TRANSPORT[1] was used to transform the phase ellipse backward from the middle of the EIC through each element and up to the entrance of the BM3 starting with the upright phase ellipse. The characteristics of each element are listed in Table 1 of (I). In Fig. 1 is shown the beam envelope in these elements.

It is necessary to trace the beam at injection with the numeric orbit calculations, so we have developed the program which calculates the motion of charged particles in electromagnetic fields with time as the independent variable. These calculations can take account of the fringe field effect automatically. First of all we examined the optical properties of the beam in the measured fields of the model bending magnet. As a result it was found that the positions of the effective edges hardly change from that of the pole edge irrespective of excitations of 7, 12, 15 and 17 kG and that the phase ellipse transformations were also almost all the same at those excitations. In Fig. 2 is shown the comparison between the phase ellipse transformations calculated with the numerical integrations and TRANSPORT. The field strength, the bending angle, the face angle of the edges and initial phase ellipse are 12 kG, 90°, 0° and 5 x 5 π mm·mrad, respectively. The phase ellipse pairs shown are calculated a) at the initial point (far away from the magnet), b) at the middle of the magnet and c) at the exit of the magnet. As can be seen they gradually differ from each other especially in the z-z' plane , because the focusing or defocusing effect in the z direction cannot be taken into account at all by TRANSPORT in this case.

We will use the numeric orbit calculations ultimately for the design of the injection system.

Reference

1) K.L. Brown et al., SLAC-91(1974)

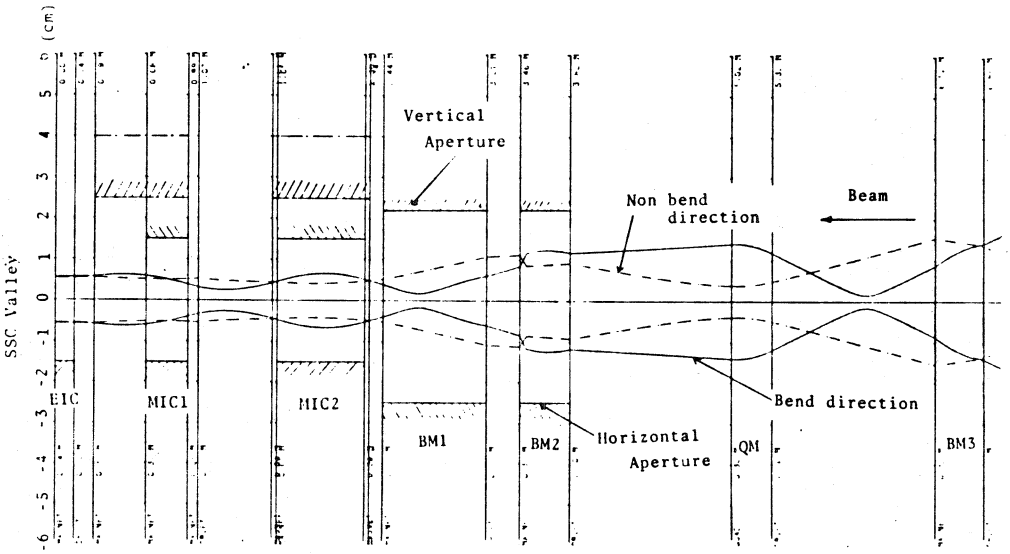

Fig.1 Beam envelope at injection calculated with TRANSPORT.

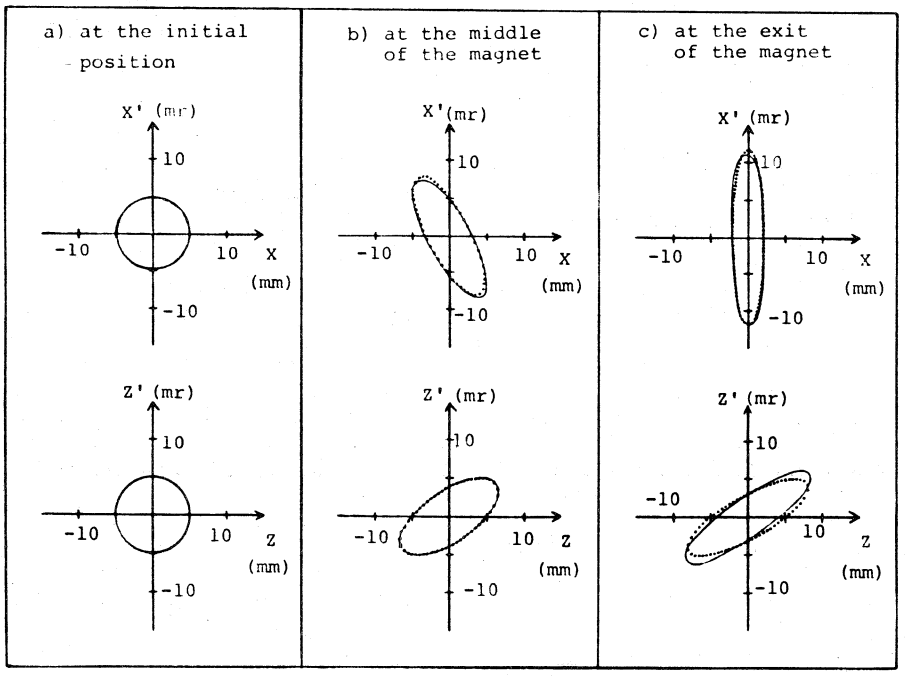

Fig.2 Comparison between phase ellipse transformations calculated with the numerical integrations (solid lines) and TRANSPORT (dotted lines).