DESIGN OF THE TRISTAN INJECTION LINE

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Construction works are underway for a 350 m long beam transport line between the 2.5 GeV KEK Photon Factory Linac[1] and the TRISTAN accumulation ring (AR)[2]. A configuration of the beam transport magnets in the line is illustrated in Fig. 1. Main elements of the beam line are 47 quadrupoles and 26 horizontal bendings. A feature of the present design is that both electron and positron beams can be transported without changing the strength and polarity of the quadrupoles except for the strength of those for the emittance matching. A set of quadrupoles Q1 ∿ Q5 plays a role of matching the linac beam emittance to the acceptance of the following beam line. Two bending sections, B1 ∿ B6 and B7 ∿ B10, are designed so as to be achromatic for both electron and positron beams. Momentum analyses of the linac beam will be performed at the middle of the section Q8 ∿ Q9, where the dispersion function takes the maximum value.

The calculated betatron functions β_x, β_y and the dispersion function η_x are plotted in Fig. 2 and 3 for electron and positron beams, respectively. Assuming the following linac beam parameters, the transverse beam width has also been estimated as $w_{x,y} = \sqrt{\varepsilon_{x,y}\beta_{x,y} + (\eta_{x,y}\frac{\Delta p}{p})^2}$.

Emittance (2σ): 0.1 mm mr for electron, 0.5 mm mr for positron.
Momenturm spread (90%): ± 0.2 %

Fig. 4 and 5 shows an evolution of the electron and positron beam width in the beam line.

References

1) J. Tanaka et al.; "Design and Status of Photon Factory", 11th International Conference on High Energy Accelerators, (1980), 242.
2) KEK; "Abridged Description of TRISTAN Electron-Positron Colliding Beam Machine", Oct. 1981.

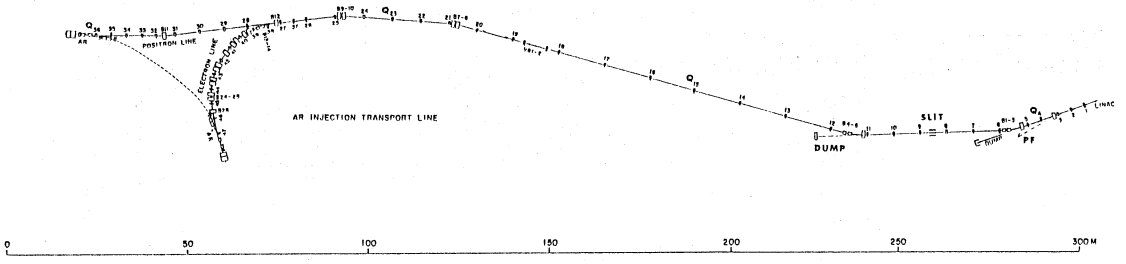

Fig.1 Layout of the injecton line

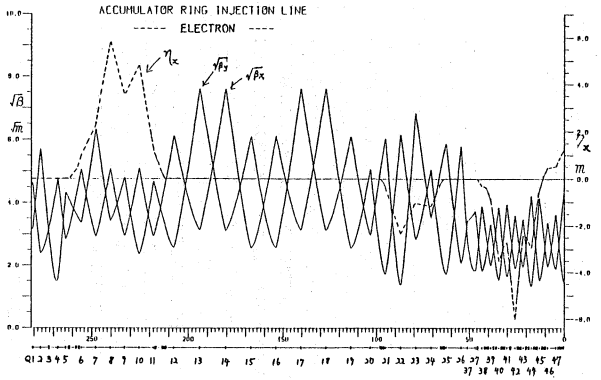

Fig.2 Amplitude and dispersion functions for the electron beam

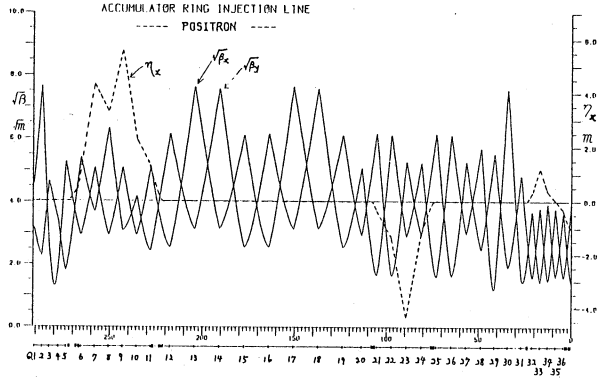

Fig.3 Amplitude and dispersion functions for the positron beam

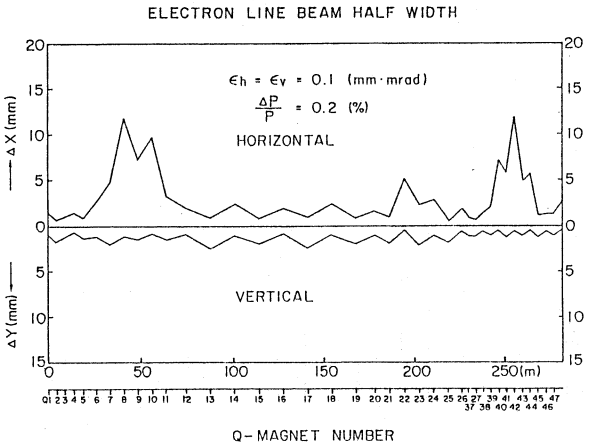

Fig.4 Beam half width for the electron beam.

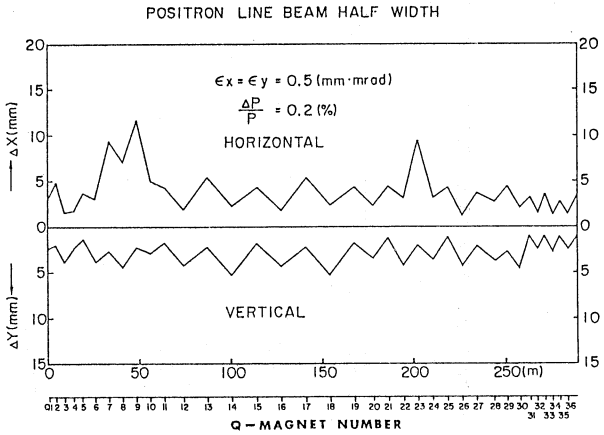

Fig.5 Beam half width for the positron beam