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8V

Design Parmaeters for an 8 Sector F.F.A.G. Mark Ib Model

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Below is a listing of the parameters of the F.F.A.G. Mark Ib electron betatron model. The magnetic fields along equilibrium orbits are equal and opposite in successive magnets except for fringing effects near straight sections. The geometry is given in Figure 1. The magnetic field fall off is produced by distributed pole face windings on the magnets. The magnets are constructed with a larger aperture at the high field region so that fringing effects scale with the radius.

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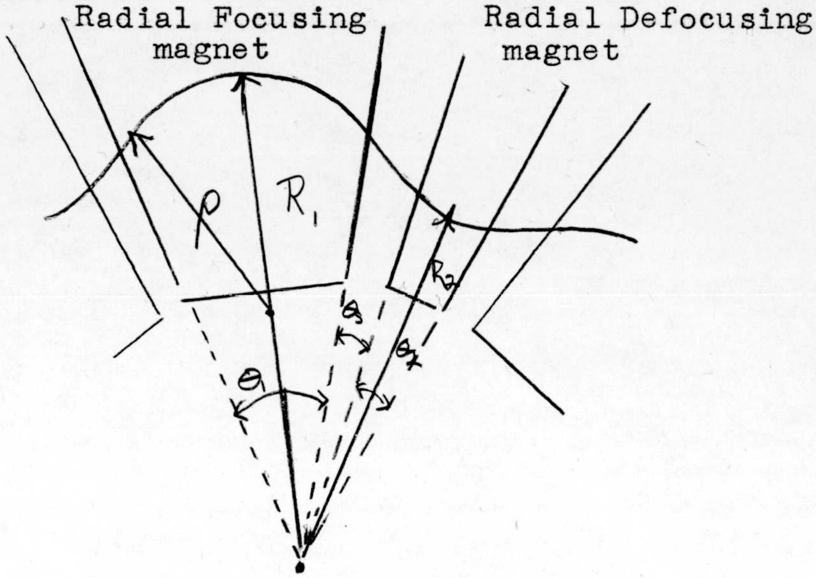

Figure 1.

$N = 8$, the number of magnet pairs.

$\frac{R_1}{\rho} = 2.85$, $\frac{R_2}{\rho} = 2.59$ — The ratio of the orbit radius to the radius of curvature at the centers of plus and minus magnets.

$n_1 = \frac{\rho}{H}\frac{dH}{dr} = 1.18$, at center of a plus magnet.

$k = \frac{R}{H}\frac{dH}{dr} = 3.36$, at every point in the machine.

$\nu_x = 2.80$, the number of radial betatron oscillations per revolution.

$\nu_z = 1.81$, the number of vertical betatron oscillations per revolution.

$\theta_1 = 25^\circ\, 42'$, the angle subtended by plus magnets.

$\theta_2 = 10^\circ\, 26'$, the angle subtended by minus magnets.

$\theta_s = 4^\circ\, 26'$, the angle subtended by straight sections.

$R_i = 32$ cm, $R_o = 54$ cm — the inner and outer radii of the inside of the vacuum tank (donut).

$G_i = 4.0$ cm, the magnet gap at the 32 cm radius.

$\frac{G}{R} =$ constant for all R across the useful aperture.

$Z = 2.41$ cm, the inside vertical aperture of the vacuum tank.

$E_i \cong 25$ kev, the approximate electron energy at injection.

$E_o \cong 360$ kev, the approximate electron energy at ejection.

$\Delta V = 40$ volts, the betatron core accelerating volts per turn.

Repetition Rate = 500 cycles per second.

$H_i \cong 40$ gauss, the magnetic field at injection.

$H_o \cong 130$ gauss, the magnetic field at ejection.

Details of calculations of orbits and ν's are given in MURA reports by Cole and Kerst. Work with the model will proceed in three stages:

Stage 1 - Measurement of ν's with constant voltage "point" source injector, no acceleration.

Stage 2 - Acceleration using a pulsed injector.

Stage 3 - Acceleration using a constant voltage injector.

The magnets have been assembled and field measurements made at Purdue, and the model is being assembled and tested at Michigan.