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APERTURE LIMITATIONS DUE TO NON-LINEAR COUPLING

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> G. PARZEN APRIL 2, 1986

HIGH ENERGY FACILITIES Brookhaven National Laboratory Upton, N.Y. 11973 The sextupoles for correcting chromaticity and the eddy current sextupole fields can drive the 2 $\nu_{\rm X}$ - 2 $\nu_{\rm y}$ = 0 coupling resonance.

y - motions that start at $y_0 = 27 \text{ mm}$ at QD, corresponding to $\varepsilon_y = 50 \times 10^{-6}$, will grow as large as 38mm, depending on the choice of v_x , v_y .

The next two graphs show the implications of this non-linear growth on the acceptable emittance.

Depending on one's assumptions, the acceptable emittance could be as low as ε_y = 38 x 10⁻⁶.

This non-linear effect could be avoided by moving v_x , v_y about .05 from the $v_x = v_y$ resonance. However this may not be desirable as this puts v_x , v_y in a region where there are many higher order resonance lines.

It is possible that this non-linear effect could be corrected by a system of octupole correctors, since octupoles can also excite the $2v_y - 2v_x = o$ resonance.

The first figure plots the maximum value of y at QD, y_{max} , against the initial value of χ at QF, χ_0 . If one assumes that the largest safe value of y_{max} is 30mm, then the largest allowed χ_0 is 23mm corresponding to $\varepsilon = 38 \times 10^{-6}$.

The second figure shows the effect of the v_X , v_y choice on the non-linear coupling. v_X is held constant at $v_X = 4.82$ while v_y is varied from 4.75 to 4.89. The largest coupling occurs at $v_X \cong v_y$ and the coupling is removed by going .05 away from the $v_X = v_y$ resonance. The coupling depends on the choice of the initial phase of χ , and two curves are shown for two different choices of χ_0 and χ'_0 .



