

APERTURE LIMITATIONS DUE TO NON-LINEAR COUPLING

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April 1986

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U.S. Department of Energy

USDOE Office of Science (SC)

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Booster Technical Note

No. 24

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APRIL 2, 1986

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The sextupoles for correcting chromaticity and the eddy current sextupole fields can drive the $2\nu_x - 2\nu_y = 0$ coupling resonance.

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

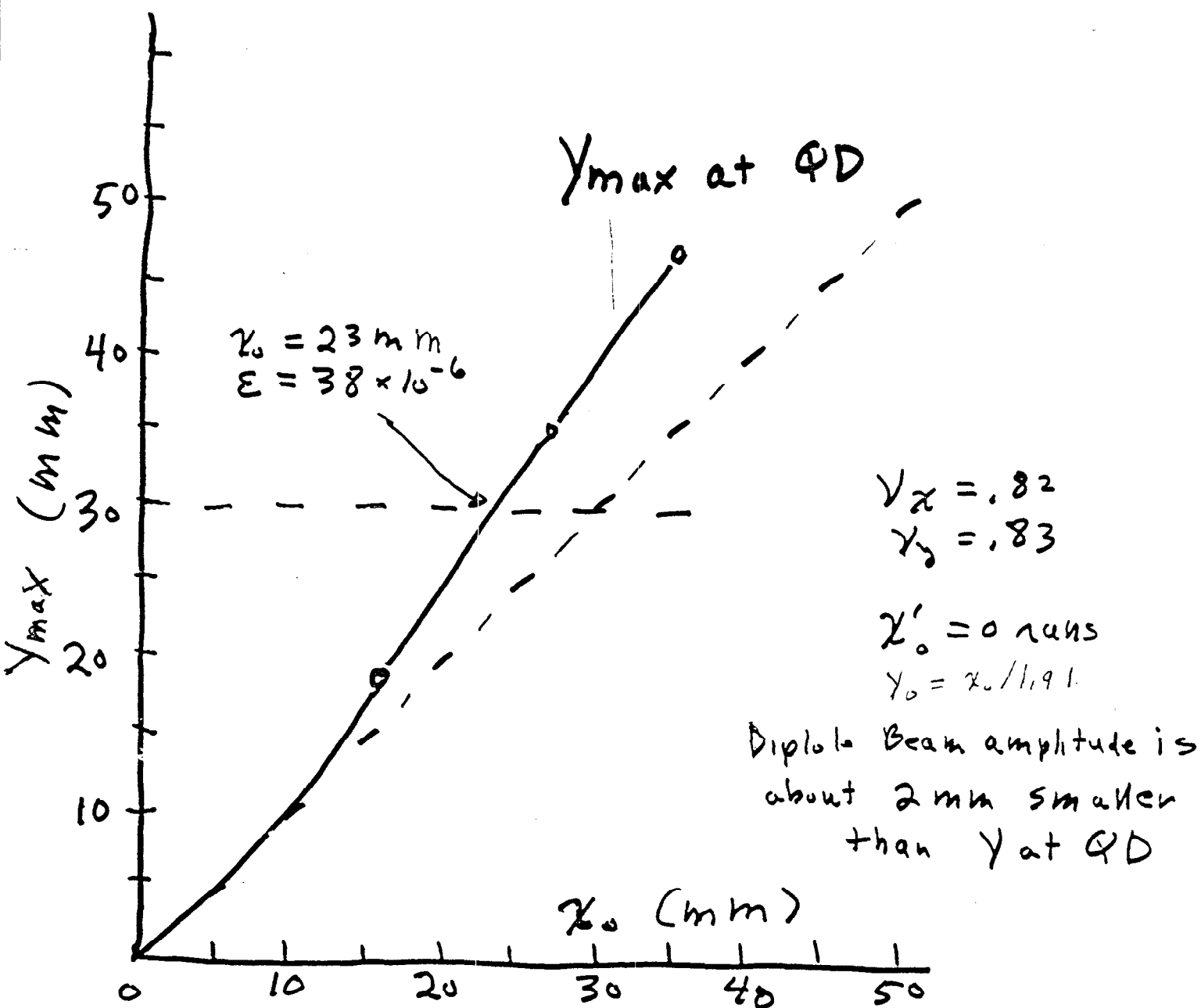
This non-linear effect could be avoided by moving ν_x, ν_y about .05 from the $\nu_x = \nu_y$ resonance. However this may not be desirable as this puts ν_x, ν_y in a region where there are many higher order resonance lines.

It is possible that this non-linear effect could be corrected by a system of octupole correctors, since octupoles can also excite the $2\nu_y - 2\nu_x = 0$ 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 $\epsilon = 38 \times 10^{-6}$.

The second figure shows the effect of the ν_x , ν_y choice on the non-linear coupling. ν_x is held constant at $\nu_x = 4.82$ while ν_y is varied from 4.75 to 4.89. The largest coupling occurs at $\nu_x \approx \nu_y$ and the coupling is removed by going .05 away from the $\nu_x = \nu_y$ 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 .

Non-Linear γ -growth



Non-Linear Coupling

