Magnet Errors –

Go back to

$$x'' - \frac{R+x}{R^2} + \frac{(\gamma\beta)'}{\gamma\beta}x' - \frac{x'^2}{R+x} =$$

$$= -\frac{qB_0}{\gamma\beta mc}\left(1+\frac{x}{R}\right)^2\left(1 + \frac{\Delta B_{0y}}{B_0} + \frac{B_{yx}+\Delta B_{yx}}{B_0}x + \frac{B_{yy}+\Delta B_{yy}}{B_0}y\right)$$

$$y'' + \frac{(\gamma\beta)'}{\gamma\beta}y' - \frac{x'y'}{R+x} = \frac{qB_0}{\gamma\beta mc}\left(1+\frac{x}{R}\right)^2 \times \left(\frac{\Delta B_{0x}}{B_0} + \frac{B_{xx}+\Delta B_{xx}}{B_0}x + \frac{B_{xy}+\Delta B_{xy}}{B_0}y\right)$$

$$\frac{qB_0}{\gamma\beta mc} = \frac{qB_0}{p} = \frac{qB_0}{p_0(1+\delta)} \approx \frac{1}{R}(1-\delta+\ldots)$$

$$B_{yx} + \Delta B_{yx} = B_{xy} + \Delta B_{xy} = B_N' + \Delta B_N'$$

$$B_{yy} + \Delta B_{yy} = -B_{xx} - \Delta B_{xx} = B_S' + \Delta B_S'$$

$$x'' - \frac{1}{R} - \frac{x}{R^2} + \frac{(\gamma\beta)'x'}{\gamma\beta} = -\frac{1}{R}(1-\delta)\left(1+2\frac{x}{R}\right) *$$

$$*\left(1 + \frac{\Delta B_{0y}}{B_0} + \frac{B_N'+\Delta B_N'}{B_0}x + \frac{B_S'+\Delta B_S'}{B_0}y\right)$$

$$y'' + \frac{(\gamma\beta)'}{\gamma\beta}y' = \frac{1}{R}(1-\delta)\left(1+\frac{2x}{R}\right)\left(\frac{\Delta B_{0x}}{B_0} - \frac{B_S'+\Delta B_S'}{B_0}x + \frac{B_N'+\Delta B_N'}{B_0}y\right)$$

$$x'' + \frac{(\gamma\beta)'x'}{\gamma\beta} - \frac{x}{R^2} - \frac{1}{R} = -\frac{1}{R} + \frac{\delta}{R} - (1-\delta)\frac{\Delta B_{0y}}{RB_0}$$

$$-(1-\delta)\left(\frac{2}{R^2} + \frac{B_N'}{RB_0} + \frac{2}{R^2}\frac{\Delta B_{0y}}{B_0} + \frac{\Delta B_N'}{RB_0}\right)x$$

$$-(1-\delta)\left(\frac{B_S'}{RB_0} + \frac{\Delta B_S'}{RB_0}\right)y$$

$$y'' + \frac{(\gamma\beta)'y'}{\gamma\beta} = (1-\delta)\frac{\Delta B_{0x}}{B_0} + (1-\delta)\left(\frac{B_N'}{RB_0} + \frac{\Delta B_N'}{RB_0}\right)y$$

$$-(1-\delta)\left(\frac{B_S'}{RB_0} + \frac{\Delta B_S'}{RB_0} - \frac{2\Delta B_{0x}}{R^2B_0}\right)x$$

$$K_x \equiv \frac{1}{R^2} + \frac{B_N'}{RB_0} \qquad K_{\delta x} \equiv \frac{2}{R^2} + \frac{B_N'}{RB_0}$$

$$= K_x + 1/R^2$$

$$K_y \equiv -\frac{B_N'}{RB_0} = -K_x + \frac{1}{R^2} \equiv K_{\delta y}$$

$$S \equiv \frac{B_S'}{RB_0}$$

Finally!

$$x'' + \frac{(\gamma\beta)'}{\gamma\beta} x' + (K_x - K_{\delta x}\delta)x + S(1-\delta)y =$$

$$= \frac{\delta}{R} - \frac{\Delta B_{0y}}{RB_0} - \left(\frac{2}{R^2}\frac{\Delta B_{0y}}{B_0} + \frac{\Delta B_N'}{RB_0}\right)x$$

$$- \frac{\Delta B_S'}{RB_0} y$$

$$y'' + \frac{(\gamma\beta)'}{\gamma\beta} y' + K_y(1-\delta)y + S(1-\delta)y =$$

$$= \frac{\Delta B_{0x}}{RB_0} + \frac{\Delta B_N'}{RB_0} y - \left(\frac{\Delta B_S'}{RB_0} - \frac{2\Delta B_{0x}}{R^2 B_0}\right)x$$