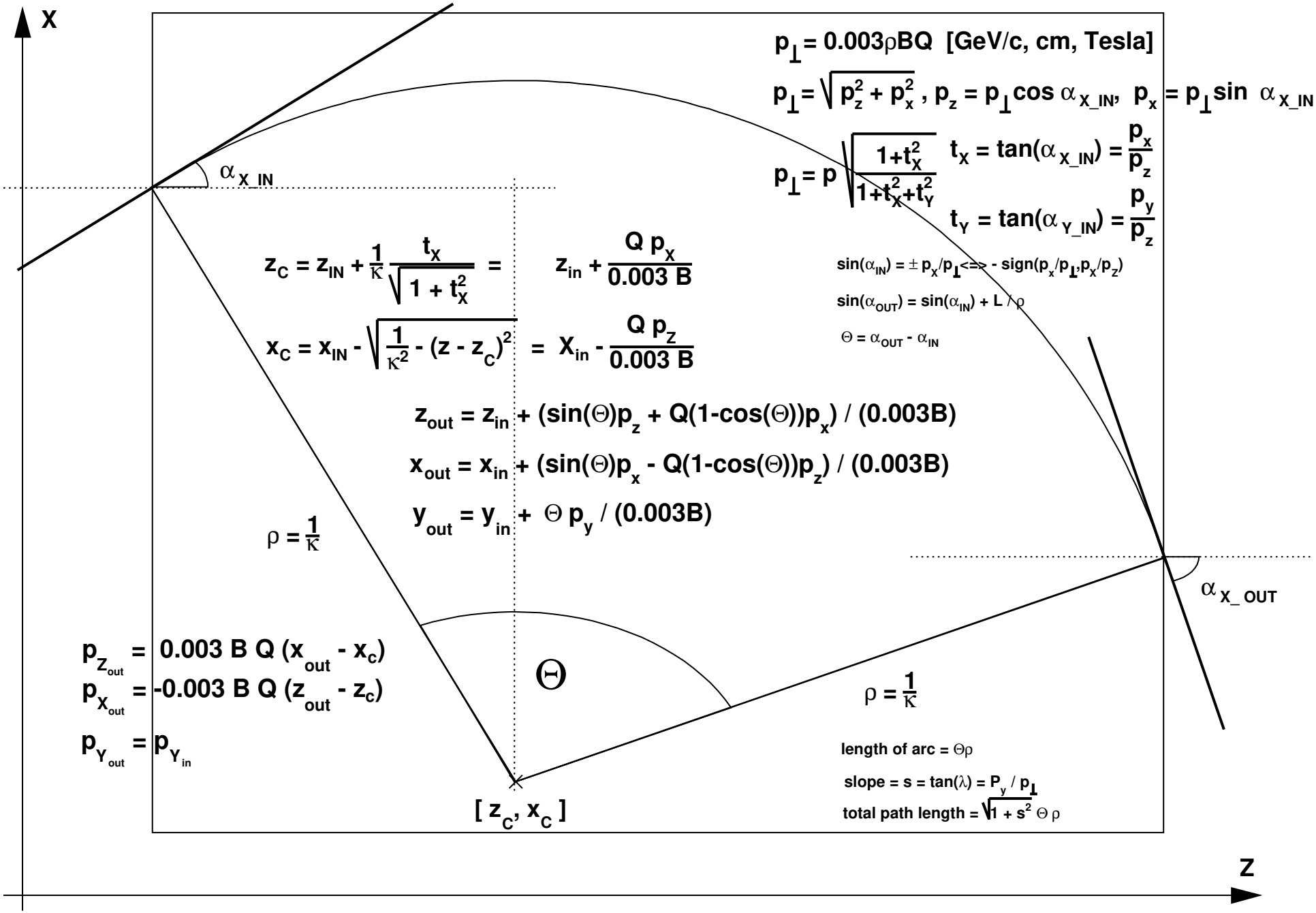

$$p_\perp = 0.003\rho BQ \quad \text{[GeV/c, cm, Tesla]}$$

$$p_\perp = \sqrt{p_z^2 + p_x^2}, \quad p_z = p_\perp \cos\alpha_{X_IN}, \quad p_x = p_\perp \sin\alpha_{X_IN}$$

$$p_\perp = p\sqrt{\frac{1+t_X^2}{1+t_X^2+t_Y^2}} \qquad t_X = \tan(\alpha_{X_IN}) = \frac{p_x}{p_z}$$

$$t_Y = \tan(\alpha_{Y_IN}) = \frac{p_y}{p_z}$$

$$z_C = z_{IN} + \frac{1}{\kappa}\frac{t_X}{\sqrt{1+t_X^2}} = z_{in} + \frac{Q\,p_X}{0.003\,B}$$

$$x_C = x_{IN} - \sqrt{\frac{1}{\kappa^2} - (z - z_C)^2} = X_{in} - \frac{Q\,p_Z}{0.003\,B}$$

$$\sin(\alpha_{IN}) = \pm p_x/p_\perp \Leftrightarrow -\mathrm{sign}(p_x/p_\perp, p_x/p_z)$$

$$\sin(\alpha_{OUT}) = \sin(\alpha_{IN}) + L/\rho$$

$$\Theta = \alpha_{OUT} - \alpha_{IN}$$

$$z_{out} = z_{in} + (\sin(\Theta)p_z + Q(1-\cos(\Theta))p_x) / (0.003B)$$

$$x_{out} = x_{in} + (\sin(\Theta)p_x - Q(1-\cos(\Theta))p_z) / (0.003B)$$

$$y_{out} = y_{in} + \Theta\, p_y / (0.003B)$$

$$p_{Z_{out}} = 0.003\,B\,Q\,(x_{out} - x_c)$$

$$p_{X_{out}} = -0.003\,B\,Q\,(z_{out} - z_c)$$

$$p_{Y_{out}} = p_{Y_{in}}$$

length of arc = $\Theta\rho$

slope = $s = \tan(\lambda) = P_y / p_\perp$

total path length = $\sqrt{1+s^2}\,\Theta\rho$