Multiple scattering in Inflector end coils

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Ring Acceptance

The effect of the multiple scattering in the inflector end coils is to distort the phase space of the muon distribution. The emittance is increased, and the effective β is decreased. The β_{inf} at the inflector exit is related to the peak β_{ring}^{max} in the ring according to

$$\beta_{ring-max} \sim \frac{{\beta_{match}}^2}{\beta_{inf}}$$

where β_{match} is the matching value of the β-function. Using

$$\begin{aligned} \epsilon &= \sigma'\sigma \\ \beta &= \frac{\sigma}{\sigma'} \\ \sigma &= = \sqrt{\epsilon\beta} \\ \beta_{ring-max} &\sim \frac{{\beta_{match}}^2}{\beta_{inf}} \end{aligned}$$

where σ is the beam width (height), σ' its divergence and ϵ the emittance. The effect of the multiple scattering is to increase the divergence with no change to the width.

$$\sigma'_f = \sqrt{\sigma'_i + \theta^2_{rms}}$$

where σ'_i and σ'_f are the divergence before and after the scattering. Then

$$\epsilon_f = \sigma'_f\sigma = \sigma\sqrt{\sigma'_i + \theta^2_{rms}}$$

and

$$\beta_f^{inf} = \frac{\beta_i^{inf}}{\sqrt{1 + \theta^2_{rms}/{\sigma'_i}^2}}$$

Finally, the maximum beam width(height) in the ring is

$$\sigma = \sqrt{\epsilon_f\beta_{ring-max}} = \sqrt{\epsilon_f\frac{\beta^2_{match}}{\beta_f^{inf}}}$$

And we can write σ in terms of the initial parameters ϵ_i,β_i^{inf}, $\beta_{ring-match}$ and θ_{rms}

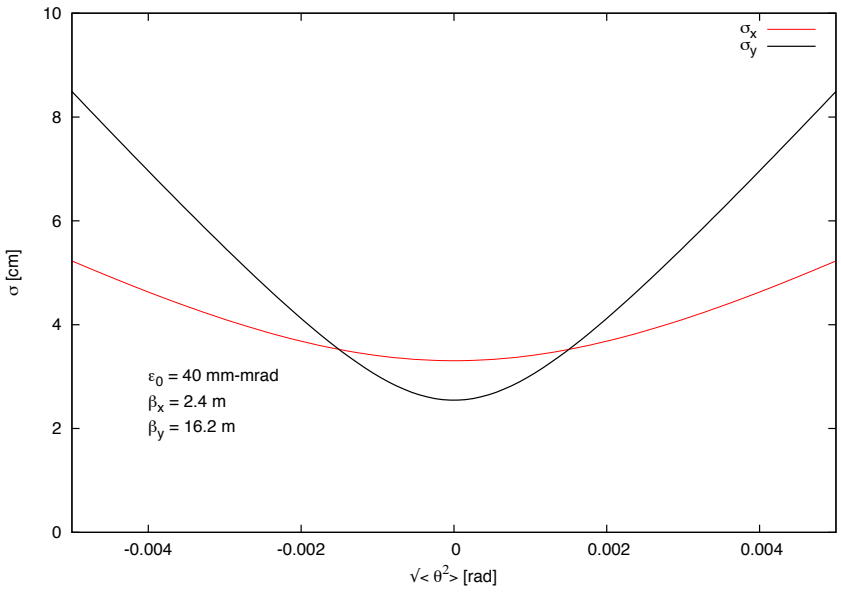

Figure 1: Dependence of maximum beam width(height) in muon storage ring on multiple scattering in inflector end coils