48. We interpret the given $10\,\text{GeV} = 10000\,\text{MeV}$ to be the kinetic energy of the proton. Using Table 38-3 and Eq. 38-49, we find

$$\gamma = \frac{K}{m_p c^2} + 1 = \frac{10000\,\text{MeV}}{938\,\text{MeV}} + 1 = 11.66 \ ,$$

and (from Eq. 38-8)

$$\beta = \sqrt{1 - \frac{1}{\gamma^2}} = 0.9963 \ .$$

Therefore, using the equation introduced in problem 46, we obtain

$$\begin{aligned} r &= \frac{\gamma m v}{qB} = \frac{\gamma m_p \beta c}{eB} \\ &= \frac{(11.66)\left(1.67 \times 10^{-27}\,\text{kg}\right)(0.9963)\left(2.998 \times 10^{8}\,\text{m/s}\right)}{(1.6 \times 10^{-19}\,\text{C})\,(55 \times 10^{-6}\,\text{T})} \\ &= 6.6 \times 10^{5}\ \text{m} \ . \end{aligned}$$