8. From Eq. 38-49, the Lorentz factor is

$$\gamma = 1 + \frac{K}{mc^2} = 1 + \frac{80\,\text{MeV}}{135\,\text{MeV}} = 1.59 \; .$$

Solving Eq. 38-8 for the speed, we find

$$\gamma = \frac{1}{\sqrt{1-(v/c)^2}} \quad \Longrightarrow \quad v = c\sqrt{1-\frac{1}{\gamma^2}}$$

which yields $v = 0.778c$ or $v = 2.33 \times 10^8$ m/s. Now, in the reference frame of the laboratory, the lifetime of the pion is not the given τ value but is "dilated." Using Eq. 38-9, the time in the lab is

$$t = \gamma\tau = (1.59)\left(8.3 \times 10^{-17}\,\text{s}\right) = 1.3 \times 10^{-16}\;\text{s} \; .$$

Finally, using Eq. 38-10, we find the distance in the lab to be

$$x = vt = \left(2.33 \times 10^8\,\text{m/s}\right)\left(1.3 \times 10^{-16}\,\text{s}\right) = 3.1 \times 10^{-8}\;\text{m} \; .$$