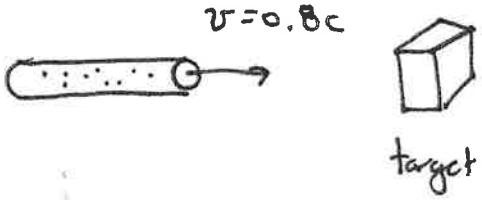
EX 31.1 (Invariant spacetime interval)



t_1 = time when front of cluster strikes target

t_2 = time " back " " " "

$\boxed{\Delta t_0 = t_2 - t_1 = 1.0\,ns.}$ according to K. K measure "proper time"

a) According to K, $\boxed{L = v \cdot \Delta t_0 = 24\,cm.}$

According to K', who is riding along with the cluster,

the (proper) length is $L_0 = L \cdot \gamma$

$= 24cm \cdot \frac{1}{\sqrt{1-(0.8)^2}} = 24cm \cdot \frac{10}{6}$

$\boxed{L_0 = 40\,cm}$

K & K' disagree on the length of the cluster.

also: $\Delta t = \gamma \Delta t_0$

$\boxed{\Delta t = \frac{10}{6} \cdot 1.0\,ns = 1\frac{2}{3}\,nseconds}$ (according to K')

b) According to K, $(\Delta s)^2 = 0^2 - c^2 \cdot \Delta t_0^2$

$(\Delta s)^2 = = -900\,cm^2$

According to K', $(\Delta s')^2 = L_0^2 - c^2 \Delta t^2 =$

$(\Delta s')^2 = -900\,cm^2$

$(\Delta s)^2 = (\Delta s')^2$