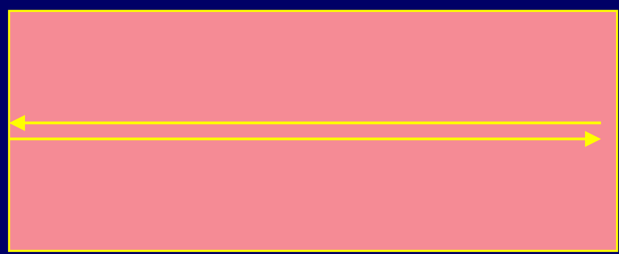
(i) Aboard train



send photon to end of train and back

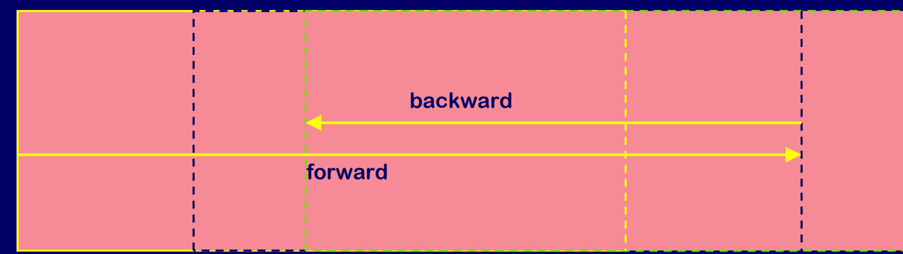
$$\Delta t_0 = 2\,\Delta x_0 / c$$

where

Δt_0 = time for light to travel to front and back of train for the <u>observer on the train.</u>

Δx_0 = length of train according to the <u>observer on the train.</u>

(ii) Train traveling to right with speed v



the observer <u>on the ground</u> sees :

$$\Delta t_{forward} = (\Delta x + v\,\Delta t_{forward})/c \quad = \Delta x/(c-v)$$

$$\Delta t_{backward} = (\Delta x - v\,\Delta t_{backward})/c \quad = \Delta x/(c+v)$$

$$\Delta t_{total} = \Delta t_{forward} + \Delta t_{backward} = (2\,\Delta x/c)\,\gamma^2 = \Delta t_0\,\gamma$$

– where we have used time dilation: $\Delta t_{total} = \Delta t_0\,\gamma$

$$2\,\Delta x_0 = c\,\Delta t_0 = 2\,\Delta x\,\gamma$$

$\Delta x = \Delta x_0/\gamma$ the length of the moving train is contracted!

note: see D. Griffiths' <u>Introduction to Electrodynamics</u>