1. The problem statement, all variables and given/known data

Express the beam energy loss in the accelerator in terms of the change in the beam momentum.

It is taken from one paper, where

$$\Delta T = \left(\frac{1+\gamma}{\gamma}\right)\frac{T_0 \Delta p}{p_0} \tag{1}$$

expression is used for transition from one equation to the next one.

Even though it does seem legit, I don't seem to find the way to actually show it mathematically.

Please help!

2. Relevant equations

Kinetic Energy:

$$T = mc^2(\gamma - 1) \tag{2}$$

Momentum:

$$p = \gamma m V \tag{3}$$

3. The attempt at a solution.

$$\begin{aligned} \Delta T = T - T_0 = mc^2(\gamma - \gamma_0) = \gamma_0 mc^2(\gamma/\gamma_0 - 1) = \\ = \frac{T_0}{p_0}(\gamma m V_0 - p_0) = \frac{T_0}{p_0}(\gamma m V_0 - \gamma_0 m V_0) = \end{aligned} \tag{4}$$

I have attempted different manipulations from here, but didn't get anywhere feasible. I have also tried the other way around, starting with the right part of the equation

$$\begin{aligned} \Delta p \left(\frac{\gamma+1}{\gamma}\right) = (p - p_0)\left(\frac{\gamma+1}{\gamma}\right) = \\ = \frac{\gamma^2 m V + \gamma m V - \gamma_0 m V_0 - \gamma\gamma_0 m V_0}{\gamma} = \\ = \gamma m V + mV - \gamma_0 m V_0/\gamma - \gamma_0 m V_0 \end{aligned} \tag{5}$$

It loooks like, I got only one term $\gamma_0 m V_0$, but I am missing something to finalize the other terms.