25 minutes Practice Quiz for Week #8

Work with p.16 of lecture notes #11 in hand.

Lorentz invariants (part III)

In Tevatron's main interaction area a long awaited new particle of *rest mass* m_0 is born. The particle's momentum and energy (4-momentum) as seen in Tevatron's control room are $\vec{p}$ and E.

- (1) Write down the equation relating $\vec{p}, E$ and m_0.
- (2) Transform $\vec{p}, E$ and m_0 to an inertial frame moving (the "moving frame") at velocity v long the x-axis of the laboratory frame.
- (3) From now on treat p_y and p_z as fixed in the laboratory frame (i.e., $dp_y = dp_z = 0$). Will they be fixed in the "moving frame" too?
- (4) Using the equation in (1), show that $c^2 p_x dp_x = E dE$.
- (5) Using the equations in (2) and your result from (4), show that $\frac{dp_x}{E} = \frac{dp'_x}{E'}$ where the primed quantities refer to the ones measured in the "moving frame".
- (6) Congratulations, you have just proven one of the most fundamental Lorentz invariants of High Energy Physics!