


$$\frac{d\vec{p}}{dt} = q \vec{E}$$

$$p_x = q E t$$

$$\vec{p} = \gamma m \vec{v}$$

$$\text{hence } v_x = \frac{p_x}{\frac{1}{\sqrt{1 - \left(\frac{v}{c}\right)^2}}}$$

$$= q E t \cdot \sqrt{1 - \left(\frac{q E t}{c}\right)^2}$$