

### [mex209] Pion decay in accelerator

Pions in their rest frame  $S'$  decay according to the empirical law,

$$\frac{N(t')}{N_0} = 2^{-t'/T},$$

where  $T \simeq 1.8 \times 10^{-8}$ s is the half-life for these particles. Researchers at Fermilab create high-energy pulses of pions and observe that two thirds of these particles reach a detector at a distance  $\ell = 35$ m (in the lab frame  $S$ ) from the point where they were created (target).

- (a) Find the velocity  $v$  of the pions in units of  $c$ .
- (b) Find the distance  $\ell'$  between target and detector in the rest frame of the particles.

**Solution:**