CMA.

Not drawn to scale

L

W

Rectangle's rest frame

Not drawn to scale

$t = t_1$

$t = t_2$

kaboom!

laser

kaboom!

v
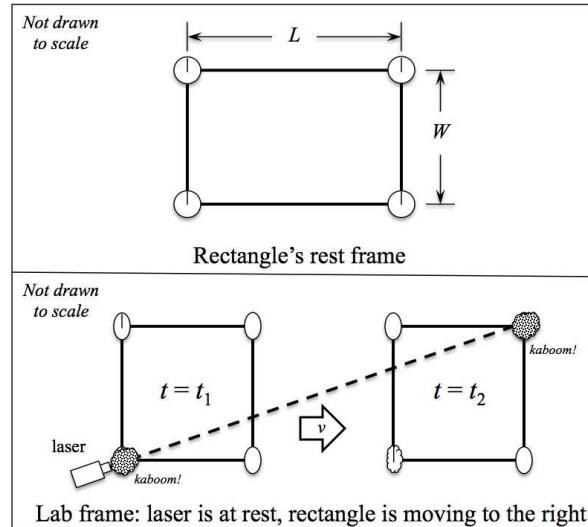
Lab frame: laser is at rest, rectangle is moving to the right

a) A rectangular structure carries clocks at its four corners. The clocks are synchronized in the structure's rest frame, in which it has length L =4ft and width $W = 3$ft (see figure). In our laboratory frame the rectangle is moving in the positive x direction at speed $v = 0.8c$. As the clock at the lower left corner of the rectangle flies past a laboratory laser, the laser fires once, freezing the clock display at zero nanoseconds. The same laser pulse then strikes the rectangle's upper right clock, disabling that clock too. Use the approximation that $c = 1$ foot per nanosecond to determine the reading on the upper right clock after it is disabled.

b) Technicians at a national laboratory use a device to accelerate pellets of mass m from rest to relativistic speeds. The device applies a time-dependent force so that the rate of change of the lab-frame magnitude of a pellet's 3-vector momentum is
$$dp/dt = bt,$$
where b is a positive constant. After a lab-frame time T has elapsed the force drops to zero, and stays zero. What is a pellet's Lorentz factor
$$\gamma = \frac{1}{\sqrt{1 - v^2/c^2}}$$
after the accelerating force drops to zero?