Re: Light clocks question

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From: Tom Roberts (*tjroberts_at_lucent.com*)
Date: 01/13/05

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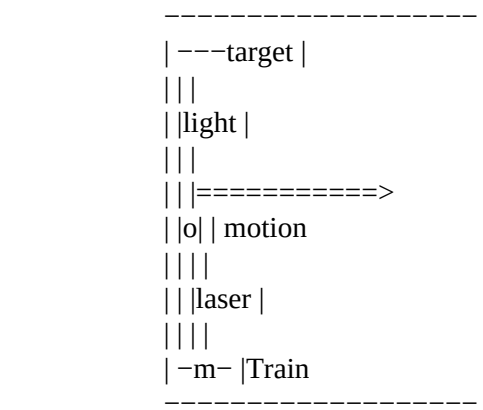
Stuart Gall wrote:
> *Say we have a sort of light clock with a laser at one end and a target*
> *at the other.*
>
> *Why does the observer on the embankment expect to see the light hitting*
> *the target at all? In order for it to hit the target the light must have*
> *had some perpendicular velocity component added to it (not possible by*
> *special relativity)*

I assume you are considering the light clock to be perpendicular to the relative velocity of train and embankment:



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Embankment (at rest in this drawing)

In the train frame, the light clock is constructed so the mirrors of the laser are perpendicular to the line from laser to target, and the light from the laser consequently hits the target. Note the laser has a small aperture at its top end (the 'o'), and any light emitted by the laser must exit this aperture; the laser also has a mirror at its bottom end (the 'm'). This is a simplified description of the laser....

In the embankment frame, consider the last reflection of light inside the laser from the mirror at the bottom. In order to get through the aperture, it must have a nonzero component of velocity to the right,

because by the time this light reaches the aperture the latter will have moved to the right. But that's OK, because the transform from train frame to embankment frame gives the light PRECISELY the correct component to the right to get it through the aperture. After all, the physical situation does not change depending on which frame one uses to describe it −− physically the light does emerge through that aperture.

Note the laser itself does not appear rotated to the embankment observer, nor does the clock consisting of laser plus target. But the