SPECIAL RELATIVITY
reviewed and corrected

Jean DAVID 2001

Time and space : dilation or contraction ?

Introduction

In my previous demonstrations, a beam of light has been emitted either perpendicularly to the direction of moving train, either slightly deviated ahead to compensate the movement of the target.

It is obvious, with the first experience, that an observer aboard the moving train will undoubtly see a deviation of the light beam to the back of this train, which deviation reveals to this observer his proper movement unlike what Galileo said. This deviation is confirmed by a well-known astronomical optical effect called "aberration" and which was used, in the 18th century, to deduct, you know what, the light speed ;-)

In my second document, I demonstrate that a moving target cannot be reached, in the conditions establised for the test because of the limit of the speed of light.

Now, let's do the same experience but with a light beam emitted in the axe of the moving train.

As usual, I'll expose first the different situations as Einstein would do which, I think, will certainly bring up some contradictions. Then, I will invite you to review them all by taking account the real trajectory of the beam just like in my previous demonstrations.

So now, Time and Space : dilation or contraction ? It's up to you !

But first, let's synchronize our clocks .....

Let's take the train once again ....

I propose you to look at these following situations :

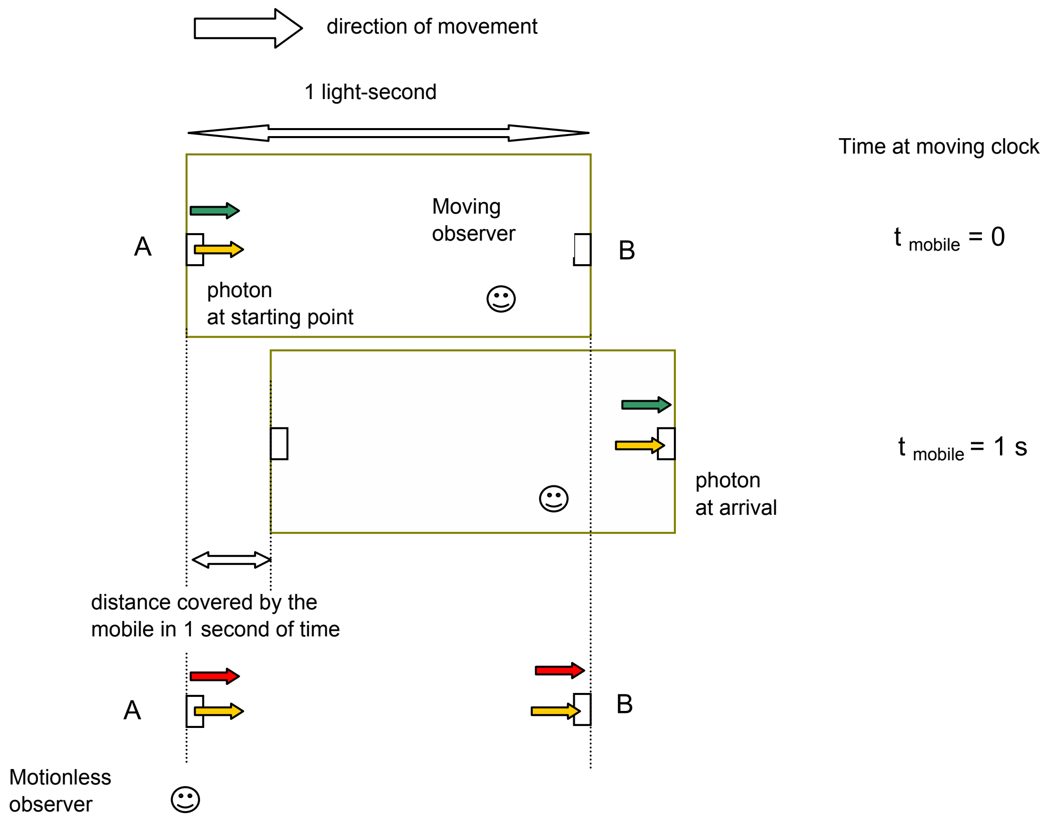
1) The light transmitter A and the target B are on board of the train.
2) The light transmitter A and the target B are in the motionless referential.

For each one of these situations, we will study the 2 cases where :

a) the beam is emitted from the rear to the head of the train
b) the beam is emitted from the head to the rear of the train

To simplify, just let's suppose that the train is one light-second long.

Because the vectors for speed and the beam of light (photon) are parallel, I shall adopt, in my drawings, a side offset for the displays of the mobile viewed at different times to make more clarity.



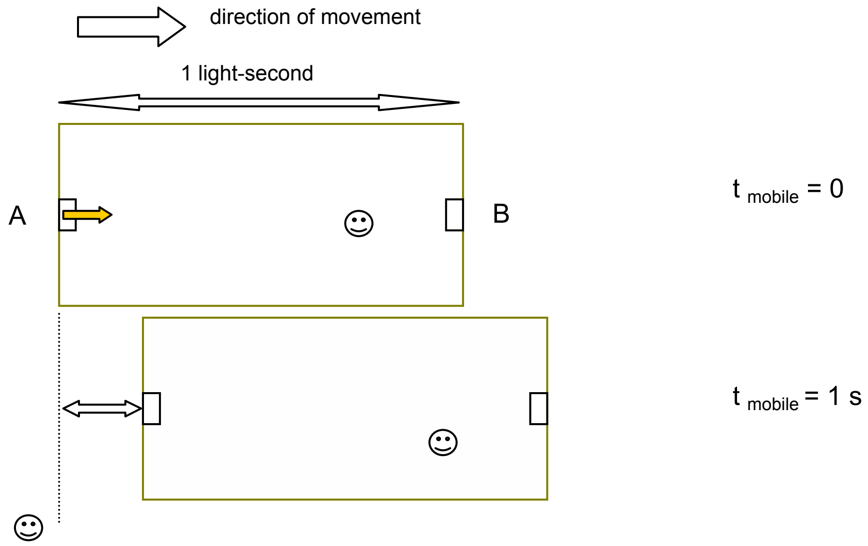
Photon "marks" (et) are placed in each referential. They will let us draw the "light vector" seen by each observer.

The reference clock will be specified for each situation. For more simplicity, I have chosen the clock of the referential where the transmitter and the target are.

Let's place now our 2 observers in their respective referential and let's start the tests.

Case #1a : transmitter and target on the mobile, the beam goes from rear to head

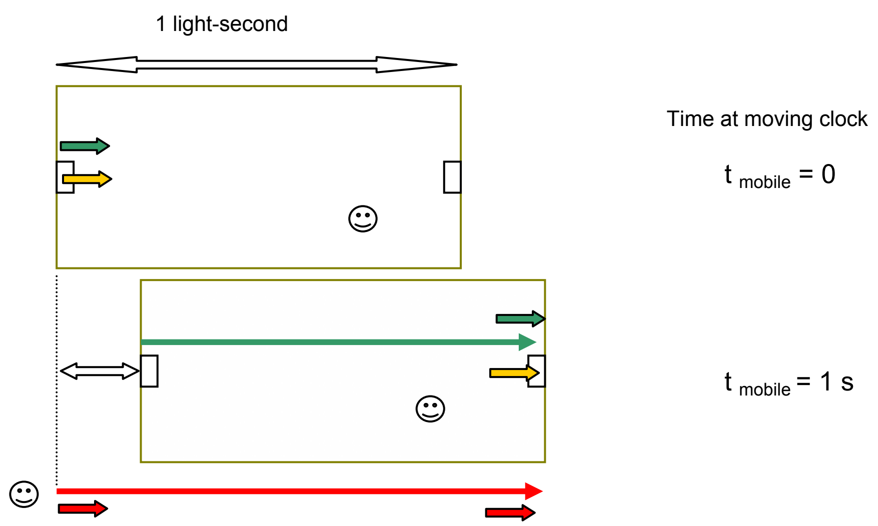
At time t=0, a beam is emitted from rear to head.



What do we "see" at time t =1s on the mobile clock ?

Einstein said, light has the same speed in any referential. As the train is one light-second long, at the instant t_{mobile}= 1s, for the moving observer, the photon must reach the target B at the head of the train.

Consequently, this moving observer will see the green light path. The motionless observer will see the red one.



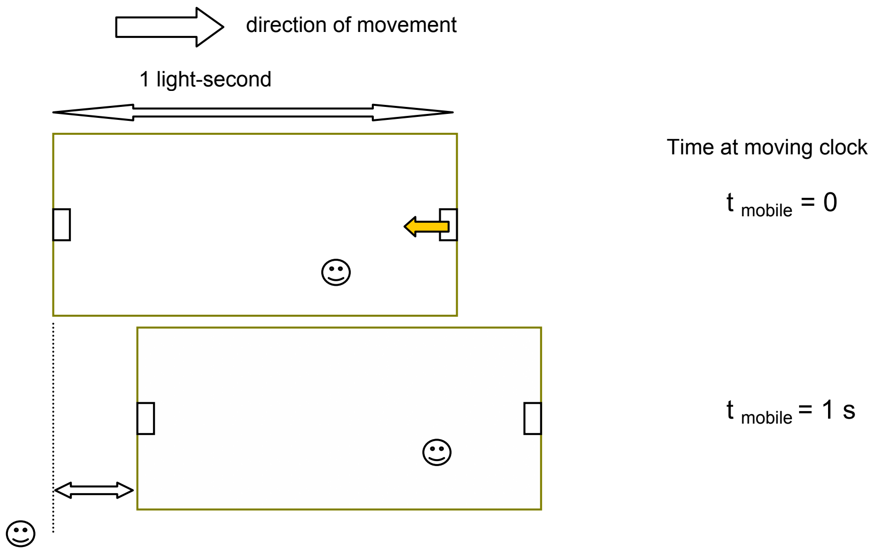
You can see, here, that the red trace is longer than the green one which is equal to the length of the train.

Einstein again said, longer trace, longer time, so there must be **DILATION** of time for the motionless referential.

$$t_{motionless} > t_{mobile}$$

Case # 1b : transmitter and target on the mobile, the beam goes from head to rear

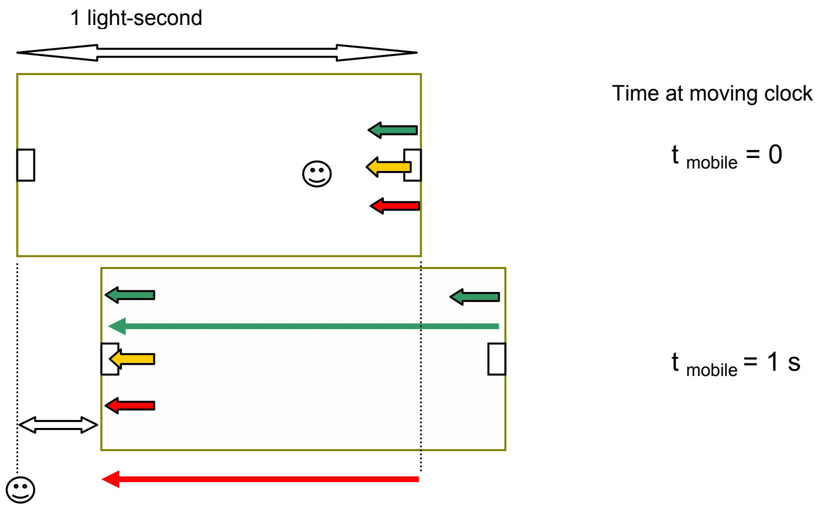
At time t=0, a photon departs from the head to the rear of the train.



What do we "see" at time t =1s on the mobile clock ?

As you know, **light has the same speed in any referential and in any direction it goes.**
Then at the instant t_{mobile} = 1s, the photon must reach the target placed at the rear of the train.

The moving observer will see the green trace. Nothing changes for him.
The motionless observer will see the red trace but here, something goes weird !



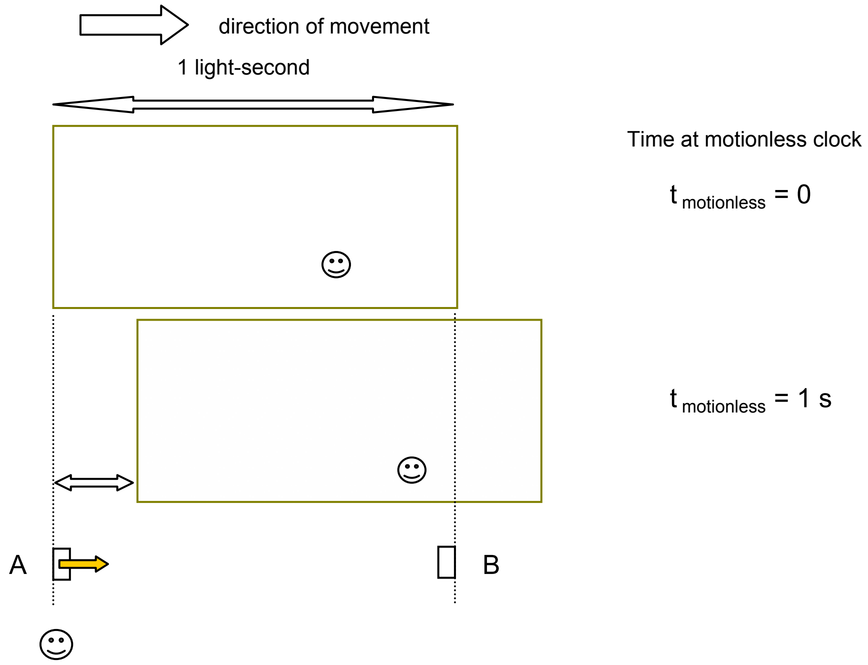
The red trace is now shorter than the green one while it was longer in the previous case. If you follow the same rules as before, we must have this time **CONTRACTION** of time for our motionless observer.

$$t_{motionless} < t_{mobile}$$

First contradiction : *When you reverse the way of propagation of light, the time relativity is not preserved.*

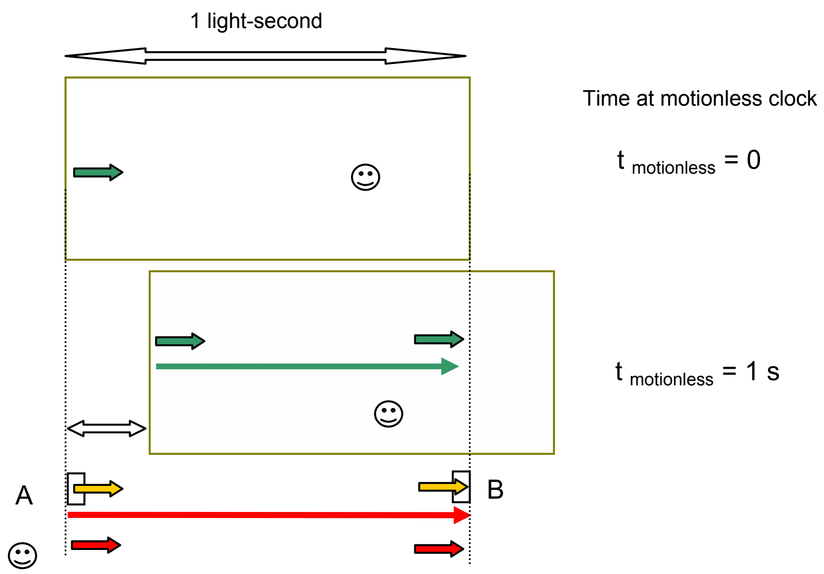
Case # 2a : motionless transmitter and target, photon from rear to head

Given 2 points, A et B, corresponding respectively to the rear and the head of the train at time t = 0. At this instant, a photon departs from A towards B.



What do we "see" at time $t_{motionless}$ =1s ? The distance AB est 1 light-second long, the photon from A at time $t_{motionless}$ = 0 must reach B à $t_{motionless}$ = 1s.

The moving observer sees the green vector (tail = rear of the train, head = B seen from his referential). The motionless observateur sees the red trace corresponding to the a distance of one light-second.

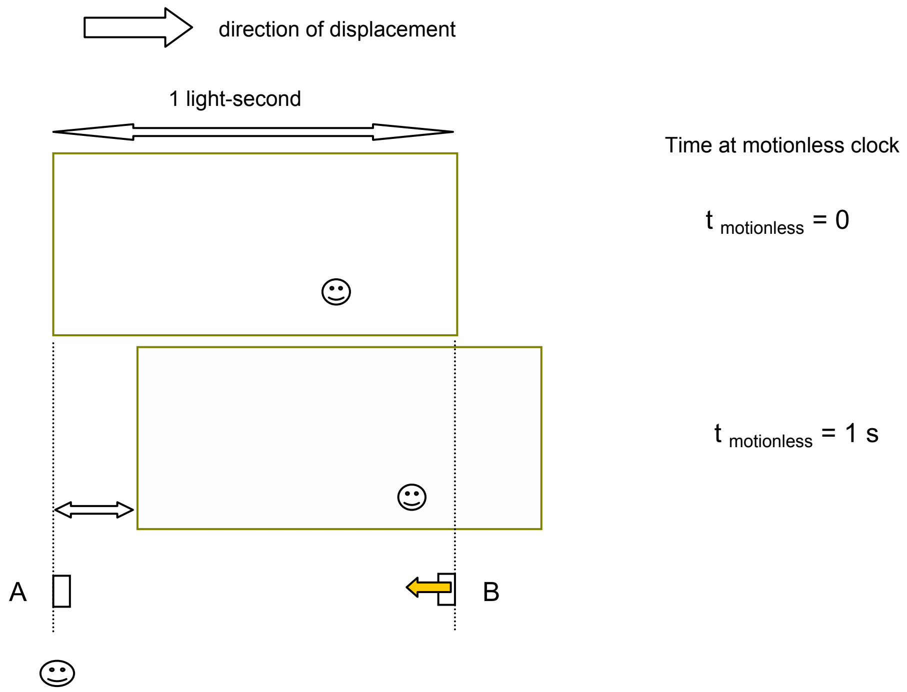


In this case, there is **CONTRACTION** of time for the moving referentiel. We have then :

$t_{motionless} > t_{mobile}$

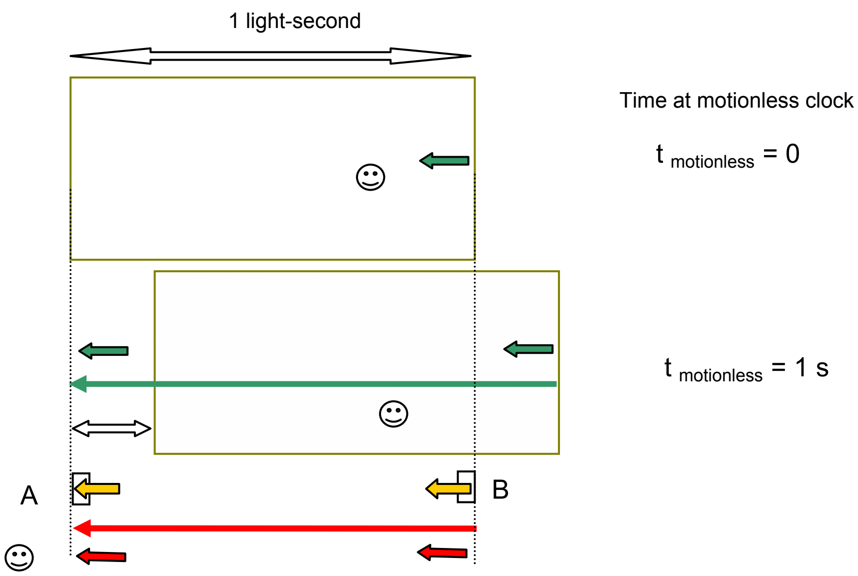
Case # 2b : motionless transmitter and target, photon from head to rear

At time t=0, a photon departs from B towards A in the opposite direction of the train displacement.



What do we "see" at time $t_{motionless}$ =1s at the motionless referential clock? The distance AB is equal to 1 light-second, the photon leaving A at time $t_{motionless}$= 0 must arrive at B at time $t_{motionless}$ = 1s.

The motionless observateur sees the red trace corresponding to the a distance of one light-second.
The moving observer sees the green vector (tail = head of the train, head = A seen from his referential).



In this case, there is now **DILATION** of time for the moving referntial.

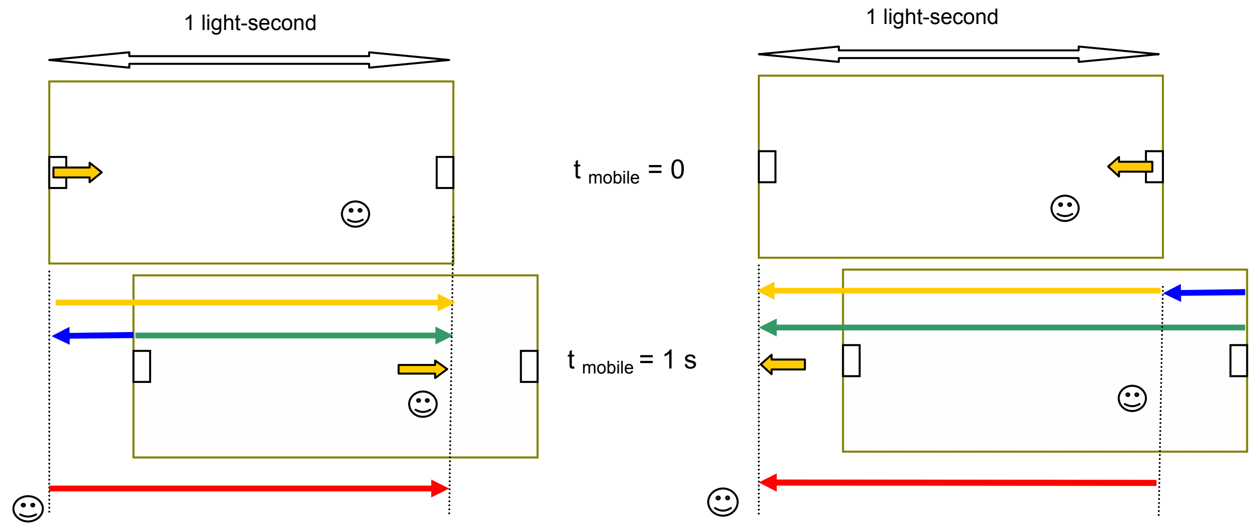
$$t_{motionless} < t_{mobile}$$

And now let's have another look ....

Let's see all the 4 previous cases with the "real" trajectory of the photon shown in yellow in the drawings below as well as the train displacement vector (in blue).

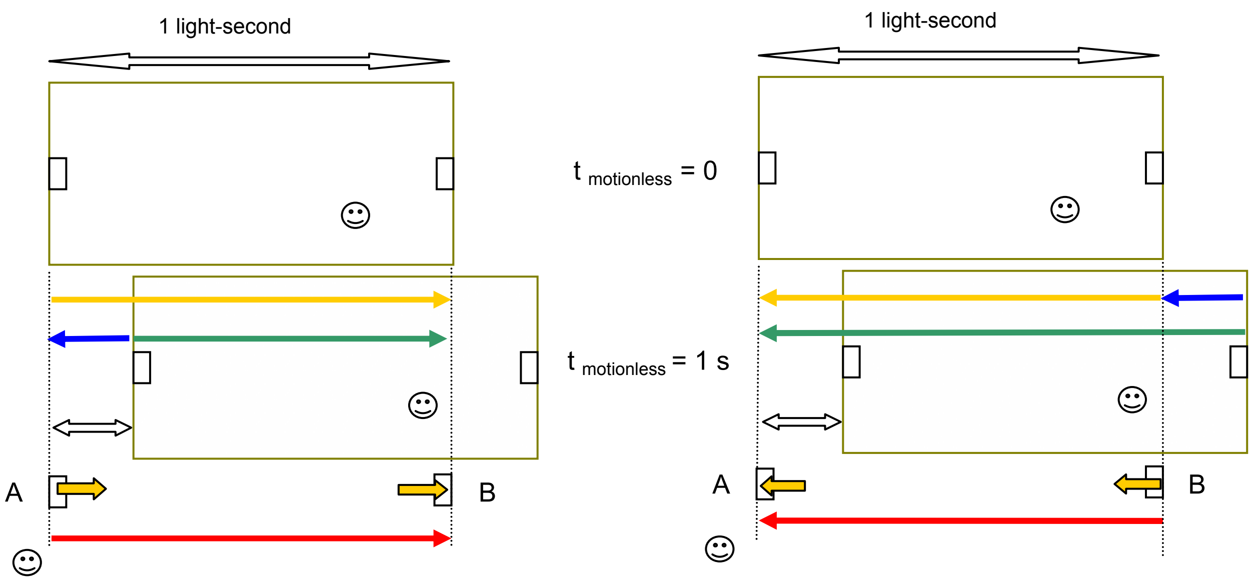
First, what about the cases where the transmitter and the receiver are aboard the train ?

Case 1a **Case 1b**



And when the photon is emitted and received in the "motionless" referential.

Case 2a **Case 2b**



The moving observer actually sees the green trace which is the galilean sum of the blue an yellow traces. In case 1a, the photon does not reach the target while in case 1b, it goes beyond.

For the motionless observer, the real trace (in yellow) falls in with what he sees (in red).

You will notice that cases 1a and 2a yield similar result (idem for 2a et 2b). Which confirms the real nature of light : independant of referentials.

CONCLUSION

By applying Einstein's relativity principles in the previous experiences, we are led out to some astonishing results :

1) According to the direction of light propagation (same way as the train or opposite way), time does not seem to yield up to the same relativity law.

2) There is, on the contrary, some coherence between the direction of light and the "modelling" of time (dilation or contraction), whatever the referential the test equipments and the clock are in :

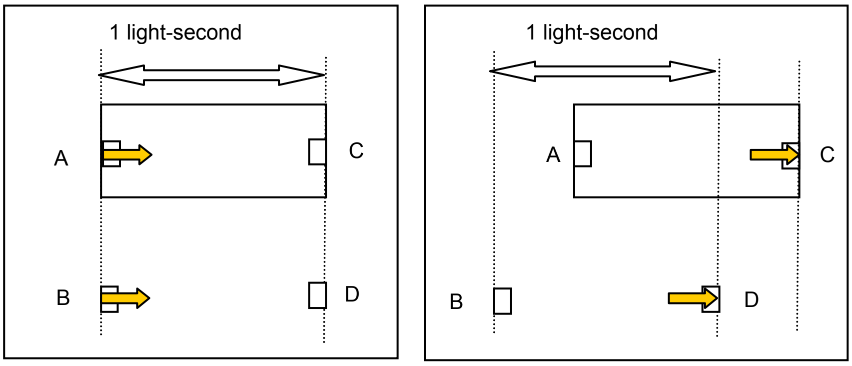
- time dilation for the motionless referential when the photon goes the same way as the train.
- time contraction when it goes the opposite way

3) The moving referential is not anymore the one to benefit by time contraction.

We can hardly admit that the Lorentz's formula of transformation has foreseen these two opposite effects which are subject to the direction of light propagation. There is no clock in a given referential that slows down and speeds up at the same time relative to another clock in another referential. I don't think that time easily falls in with this subtle mathematical modelling game.

As an ending, I submit you a last question :

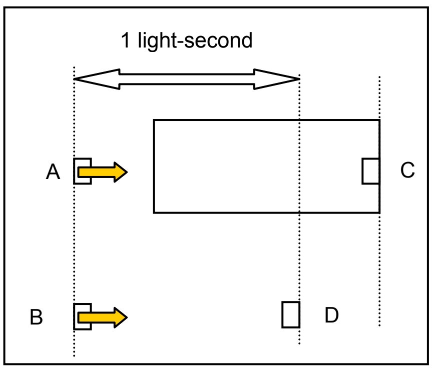
At time t=0, 2 photons depart from A, a moving source, and B, a motionless source.
According to Einstein, when the A photon reaches its target C, the B photon must also reach target D.



QUESTION :

Does the A photon reach the moving target C if the A transmitter is motionless like B?

To be continued …..



VERY IMPORTANT

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