

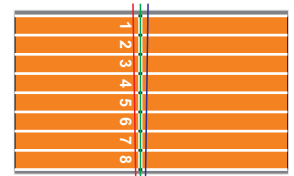
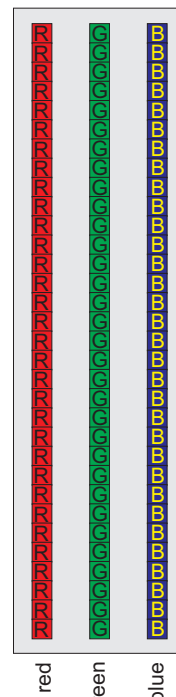
Introduction of the ALGE 3-Line-CCD System

The main reason for a good, precise, and sharp image is the resolution and scan rate of a system. If you have the double resolution for the same picture, it needs also the double scan rate. This means also that you have increased the picture information (pixels of the picture) for four times and the precision to the double. The main features for a high precision picture are the resolution and the scan rate.

How does the ALGE OPTIc2 Camera work:

ALGE uses a 3-line CCD sensor. This CCD-sensor has a separate sensor for the three ground colors (RGB), this means one for red, green, and blue. Since the three sensors are next to each other it means that only one sensor looks exactly at the finish line. We use the middle one, which means green. If the athletes come from the left they will pass first the red sensor, than green and finally blue. In order to get the picture correct, this means to get a color image, we have to put the three colors RGB on top of each other, e.g. we have to move the red sensor picture two pixel back, and we have to move the blue one two pixel forward. In case of a constant speed and the correct pixel movement we have now a perfect color image.

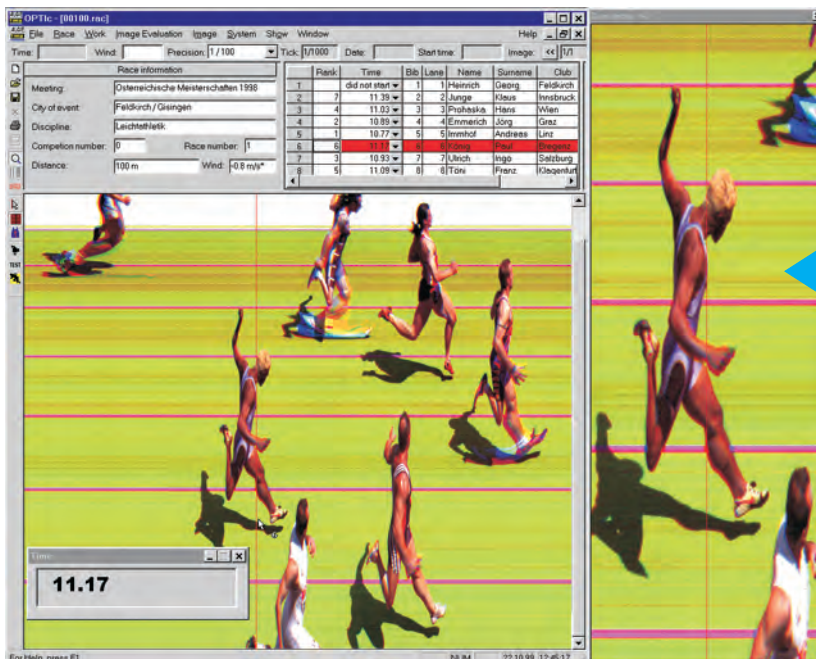
RGB-sensor



Lens

3-CCD-Sensor

RGB-sensor looking at the finish line of a athletic track



Why is the background green?

The background is green, because the green sensor sees in this example a white color (finish line), the red and blue sensor sees red (track before and after the finish line). If you mix this colors together, it has as a result green. The background color does not have anything to do with the accuracy of the system, since for the accuracy we use only the green array.

Why is it not the truth, if a competitor of ALGE says, that it is not possible to adjust a system with a 3-line CCD sensor accurate?

Because we use only one sensor to adjust the system. The red and blue sensor is turned off. The adjustment is made with the green sensor only as a black and white picture. If the green sensor is adjusted well to the finish line, it must show the finish line in white, and the lane marks in black.

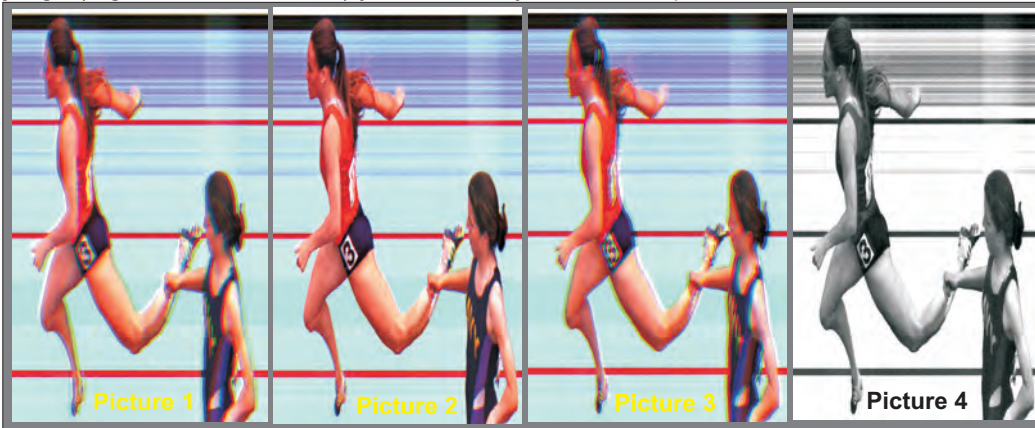
It is also possible for a referee to check before or after the race, if the adjustment was OK, since each picture you can see as well in black/white. If you change the color picture to black/white mode, it must show again the background of the finish in white and the lane boarder marks in black.



The OPTIc2 is of course recognized by the IAAF (International Athletic Amateur Federation) and was used in many international and national events. Further the OPTIc2 is approved by many national federations in athletic, like Germany, Switzerland, Austria, etc.

What happens if the speed of the object is slower or faster than expected?

We can correct the pixel lag before or after the race. This means we can correct the picture in a way, that the correct pixel cover each other and give the right color and a sharp image. This means the important part of the object that you have to judge (e.g. breast for athletic) you can always make sharp.



Picture 1 and 3:

The scan rate of the camera is too slow (picture 1) or too fast (picture 3). This means the three sensors for RGB do not cover. This is typical, if the speed is not adjusted well, or if the object goes slower or faster than expected through the finish. If this happens, it is possible to correct the picture by changing the pixel lag.

Picture 2:

The speed of the object is OK. This means that the speed (scan rate) is correct or the correction of the pixel lag is correct. It is possible to make out of the not sharp picture that you see in picture 1 or 3 a very sharp color image (picture 2).

Picture 4:

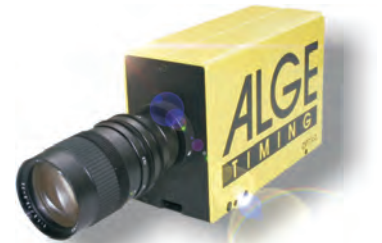
It does not matter which speed you use for recording. If you switch to the black and white mode, the picture is always sharp, since it is made only from the green sensor (middle sensor). Now you can also see, that the adjustment was correct, since the background is white, and the lane borders are black.

Why does ALGE use a 3-line CCD sensor?

The 3-line CCD sensor is mainly used for scanners. This is the reason for the high development and affordable price. This was also one of the reasons for ALGE to choose a 3-line CCD sensor. Another reason was that the way the sensor is built. While other sensors that have the RGB pixels in one line are much longer, the 3-line CCD sensor is very short. This has the advantage of using a standard C-Mount 2/3 lens like it is standard for video, and still have the very high resolution of 1360 pixel (of each array).

This means for ALGE customers:

- photo finish system at a reasonable price
- camera with high resolution (up to 1360 pixel (for every sensor, red, green, and blue))
- camera with a high scan rate (up to 3000 scans per second)
- true color picture (16 Million colors)
- standard C-Mount 2/3 lenses at reasonable prices



How does a 3-line CCD sensor work?

In a scanner or photocopy machine the 3-CCD-sensor moves always with a constant speed over the picture that you want to scan. This means it is no problem, if the sensors for red, green, and blue is passing the object at a different time. The software can correct this after the scan. This system has the advantage, that the pixel of each color are direct next to each other, and there is no space of in-between (e.g. for the other colors).

In sport at most times the object moves with a constant speed in front of the 3-CCD-sensor. In case this does not happen, we need a intelligent software that allows to correct not sharp coverage of the different colors for one point. In order to guarantee the precise times, we need to have one CCD array as the reference. ALGE uses the green array as time reference and does only move the scan of the red and blue array.

Why does ALGE has the possibility to switch from the color picture to the black/white picture?

In case that a picture is not sharp, because of different speeds of the objects on the finish line, it is possible to change to the black and white mode. In this mode, the camera works only with the green pixel array in black/white mode. Also a referee can check the setup of the system at any time, even after the event. In the black/white mode the athletic track must be white (bright), and the lane borders black (dark).

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