How does Photo Timing Work?

This document is for Track & Field Officials (and spectators) so they can have some understanding of Photo Timing.

Photo timing has been used in Track & Field for many decades. It started out by using a digital camera that took photos on a film that used Polaroid type technology to produce the picture. This picture had times at the bottom of the photo and when the photo was put in a reading device the photo official could time athletes. This was a very time consuming process, often taking a couple hours to post results, and limited to only 8 athletes on one photo .

In the late 1980's, several companies developed digital cameras that connected to computers to take photos at the finish line. This new technology had several advantages. The one advantage that convinced many meets to change over was cost, each photo around $4.00, as of the mid 90's. The other advantage was rapid access to results, within 10 minutes of the end of the race.

In the early 1990's, BC clubs started using the Finish Lynx system. At first people used the camera just like the film camera was used, printing results from the Finish Lynx computer and then manually inputting them into the results computer. In the mid 1990's, start lists and results began to be shared electronically between the two computers without manual input, speeding up access to results.

In this document, I will explain some of the technical aspects of the current photo timing system, keeping it simple and trying to avoiding "techy" talk.

The first thing to understand is how the camera works. The important things you'll need to know about how the camera works are:

- The camera is digital, and most cameras in BC are made by Finish Lynx, supplied in different speeds, meaning "frames per second", usually up to 2,000 frames per second. These are NOT movie cameras but are cameras that take one picture at a time. (More on this later.)
- The camera has an internal clock with an elapsed time associated with each frame.
- The lens on the camera produces a picture that is very thin and long. Think of it as holding the edges of 2 pieces of paper a couple millimetres or 1/16" apart and looking through the opening.

Finish Lynx software in the computer serves as the brains of the outfit, connecting with the camera, setting it up so the software can receive pictures from the camera, as well as connecting with the wind gauge, score boards, bib camera and the meet program computer which is either HiTec Meet Manager or MeetPro. The Finish Lynx software sends and receives information to all these components through a networking system.

Proper camera setup is very important to producing correct times. The most important factor in setting up the camera is that it MUST be ON the front edge of the finish line. Once photo officials have set up the equipment a couple hundred times this becomes fairly simple. However, I'll try to explain it easily so you can visualize what needs to be done.

- Pull a string from lane 4 across the front of the finish line, (the part closest to the start line) and into the infield to where the camera stand is going to be located.
- Set the middle of the camera stand on the string and then put a plumb bob on the lens of the camera.
- Move the camera up to the desired height, point it at the finish line and adjust the stand so the plumb bob from the lens comes to rest over the string.

How does Photo Timing Work?

- With some adjustments from the software you now have the camera looking down at the finish line as if there was a vertical line rising from the track surface. When each athlete crosses the finish line the camera will see him or her the instant part of the athlete crosses the line.
- What the camera actually sees at this point is a 2cm. wide vertical strip of the front of the finish line and all 8 lanes.

Once all the rest of the equipment is set up (wind gauge, display clocks etc.) the meet can begin.

The photo official uploads the first event from the results computer, which will show the athletes' names, bib numbers, lanes, etc. The official will then signal the starters assistant that the finish line is ready to go.

The starters assistant then signals the starter that the finish line is ready and he/she can start the race, and the starter will then start the race by firing a gun near a piece of equipment called the "Start Transducer." The transducer is very integral to the whole system. You'll see the starter hauling this all over the track to different start lines. Without it there would be no times.

- The transducer is usually set up about 20cm. away from the gun.
- The transducer works from the sound wave from the gunshot, which goes into the transducer and causes the contacts to come together thus sending to the camera an electronic signal that the gun has fired and the race has started.
- The camera has an internal clock that starts once the signal from the transducer is received.

Once the race has started, the photo official will need to be aware of when the first athletes are finishing. In sprints, this isn't very hard but with some of the distance races it can be difficult without accurate lap counters. The software is designed so that when the official chooses "Auto Capture" when an athlete crosses the line, the system will "Capture" the image of the athlete. When I say "Capture" the image, you'll have to remember some of the features of the camera I mentioned before. Now comes the techy part (bear with me).

- When the athlete crosses the finish line the camera is taking pictures rapidly (imagine 1000 pictures every second; remember it's not a movie camera). So, when the nose crosses the line a picture is taken, then the cheek and so on until all the body is captured in long narrow pictures.
- The camera automatically associates an elapsed time with every one of those long narrow pictures. Each long narrow picture will be 1/1000 of a second. This is faster than a blink .
- After all the athletes have crossed the line, the official will start to read the pictures. The software has taken all those long narrow body parts and put them together so they actually resemble a human being from the side. This is what the photo official sees on the computer monitor.

There are two ways to time an athlete, one is using the lanes and the other is using bib numbers.
- With laned events, the official will put the mouse cursor in the lane of the athlete that's being timed and then click the mouse button. A vertical line will come up on the screen and the official will move that line with the mouse to the first part of the athlete's torso that crosses the finish line.

How does Photo Timing Work?

- Remember all those long narrow pictures with the time associated with each picture. The vertical line will be on the first picture showing the torso crossing the finish line and the time will be entered for that athlete by simply hitting the enter key. Then it's on to the next athlete/lane.
- For non-laned events, the official will still bring the vertical line to the athlete's torso but will have to type in the bib number. This will be supplied by either a bib camera or the finish line judges.
- Some other things that can happen at this time are;
    - The results can be sent to a display clock for spectators to see the times.
    - The wind gauge will send the wind readings to the software automatically.
- Once all the athletes have been timed, the race is saved and the results computer can pull up the results from the Finish Lynx computer. The photo official will then click next event, download the file for the next race, and the process starts all over again. In the meantime, the competition secretary is printing a hard copy of the results for posting and in some cases posting the results to the web.

Parents, athletes, and coaches are often curious about how the photofinish system works. Here are some useful tidbits about photo timing that may help you explain some questions.
- In most track events the "Torso" is what is timed. Often you must be careful as to what is the torso and what is a shoulder or where does the neck end and the torso begin? If you take and cut a person off at the belt line, lop off the head even with the shoulders and pull the arms off, then you throw what's left over the finish line, whatever part crosses first is what you bring the vertical line up to. The only change to what is timed is for wheelchairs. To time wheelchairs, the vertical line is placed on the first part of the hub/axle or the center of the front wheel.
- When results come out, they are posted in 1/100 of a second, which means 2 decimal places. However, the camera can time to 1/1000 of a second or 3 decimal places.
- When some results come out, 2 athletes may have times that are the same but are placed 1st and 2nd. People will ask why one came in second when they had the same time. To the naked eye, it appears these two athletes crossed the line at the same time, but when looking at the photofinish image (remember in 1/1000 of a second intervals), it is EASY for the photofinish official to see the difference. It's only when it gets down to 1 or 2/1000 of a second that it gets a little tougher. However, the photo operator can zoom in on the monitor to place the vertical line on the first pixel showing the torso on the finish line so the chances of a mistake in this circumstance are very slim.
- The most common mistakes made by photo officials are usually in the laned events. After 6 or 7 hours of reading pictures the official's eyes get a little wonky and he/she may put the cursor in the wrong lane thus giving the time to the wrong athlete. This is a very easy fix and when athletes/parents/coaches **POLITELY** point out the mistake, the photo official will fix it and the results will be re-posted.
- What more often happens is that parents/coaches think someone got little Johnny's time wrong when the coach/parent is watching the finish from down the track and hopes little Johnny did better than he did or they have a video on their phone that appears to show that little Johnny finished first. However, remember that the photo finish camera that's been setup right on the finish line sees the finish better because it has a precisely perpendicular angle to the finish line.
- Spectators often want to see the photo image in the finish line tent, but if the photo judge were to show everybody the photo the meet would get horribly behind and little Johnny would still be in second place.

How does Photo Timing Work?

I hope the previous 3 pages have helped you understand what photo timing is about. These are the very basics and being a photo official is very challenging yet satisfying. Usually there isn't very much down time so the day goes by fairly quickly.   As you can appreciate, despite the high degree of automation and expensive electronics and camera gear, this is a labour- intensive task and the officials are working very hard while staring at the screen. They don't need extra distractions.

See you on the track,
Respectfully submitted,
Kevin Kydd
Old Photo Judge