

# Movement analysis helps coach and athlete to evaluate the pole-vault technique

*Examining speed and timing data for better pole-vaulting results*

*Sittard (Netherlands), 29 may 2008* - Sprinting speed and timing mainly determine the height of a pole-vault jump. RSscan set up a pilot study to analyze these parameters for two competition pole-vaulters (Rens Blom and Wout van Wengerden). To measure speed and timing, two time ports and a Footscan pressure measurement plate were used. The results can help coach and athlete to evaluate technique and improve training efficiency.

**Table 1: Tested pole-vaulters**

	Wout	Rens
Age	21	31
Length	1m??	1m??
Weight	78kg	78kg
Competition level	??	??



Two gate ports measured the maximum sprinting speed between 30m and 40m from the starting position during normal sprinting. The jumping speed was measured 16m and 3m before the pole-vault box.

The foot contact-time was measured using a footscan pressure platform (RSscan International, 1m x 0.4m, 16 384 conductive polymer sensors of size 7mm to 5mm, 500 Hz, linear calibration, sensor by sensor). The platform was mounted into a EVA running track, in the middle for running and at the end for pole-vault jumping, just on the propulsion place.



The two pole-vaulters performed 25 jumps over a jumping height of 4m90. They sprinted 10-12 passes towards the pole-vault box before jumping. The running speed was categorized in three modes: slow, average and fast.

Image 1 shows a last foot-contact (with spikes) on the pressure platform just before take off. What you see is a footscan image of the last total foot-contact before take off. The footscan software measures foot contact-time and propulsion.

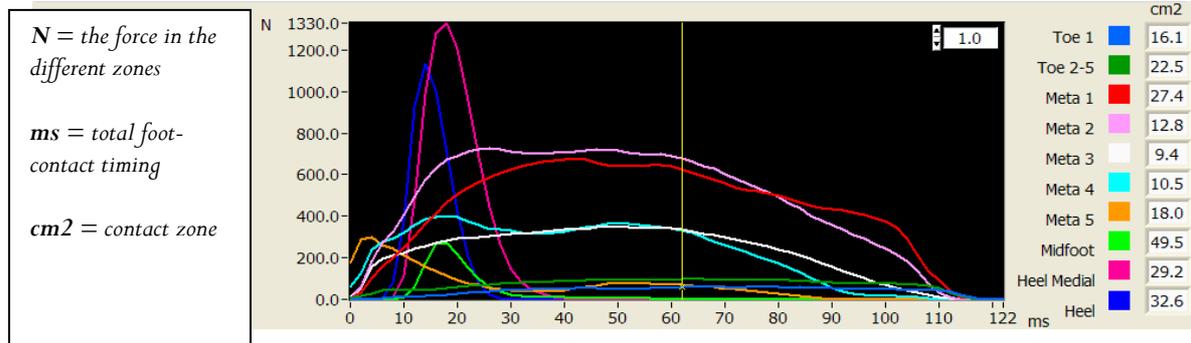
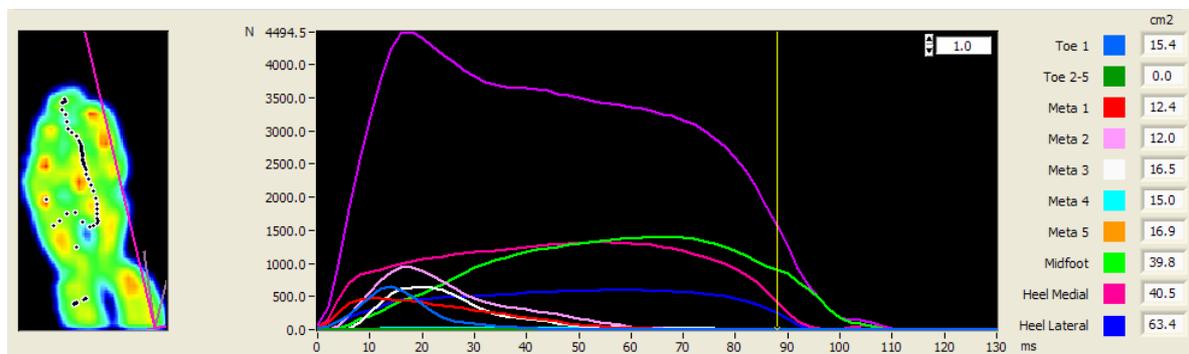
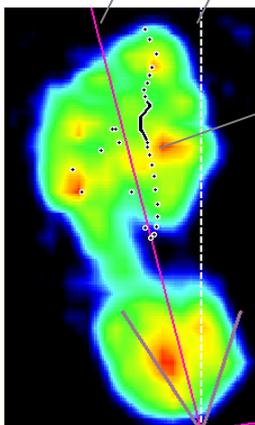


Image 1: Footscan image of Wout (above) and Rens (under)



**Foot-axis running direction**



Centre of pressure (COP) is the middle point of pressure at one frame (dot). The different dots show the (baan) of the COP during one foot-contact.

The total foot-contact is from initial foot contact (first pressure one platform) to last forefoot contact.

Propulsion is the movement of the COP back to the front of the foot, after it moved backwards following the initial foot-contact.

The results of the two jumpers were analyzed individually and compared to each other (table 2). The sprinting and jumping data were different for Wout and Rens. Wout takes off on 3.95m from the Pole vault box, Rens on 3.63m. Wout has a grip height of 3.85m and Rens 3.80m. The average step length of Wout is 1.84m for the total 12 steps, for Rens it is 1.87m. Interesting is that Rens sprints faster, has a shorter foot contact-time and also is jumping off more consistent on the same correct place. Yet he performed weaker then Wout at the beginning of the athletic season 2008.

**Table 2: Speed and timing data**

Wout van Wengerden					
Running speed	Total foot-contact	Propulsion	Running speed last 5 steps	Step length	take off (before box)
Average	122 ms	109 ms	7.59 m/sec	1.84 m	3.95 m
Fast	118 ms	106 ms	7.83 m/sec	1.85 m	3.75 m
Slow	126 ms	114 ms	7.30 m/sec	1.82 m	4.2 m

Rens Blom					
Running speed	Total foot-contact	Propulsion	Running speed last 5 steps	Step length	take off (before box)
Average	109 ms	92 ms	7.64 m/sec	1.87 m	3.63 m
Fast	106 ms	88 ms	7.88 m/sec	1.88 m	3.55 m
Slow	114 ms	100 ms	7.47 m/sec	1.86 m	3.8 m



3,95 3,70 3,55

Take-off position (propulsion point).  
The average is 3.7m from Pole-vault box, middle hole.

Rens takes off closer to the pole vault box than Wout. This take-off position gives him extra tension on the body and probably results in a lower jumping height.

The jumping and sprinting variables were compared (table 3). For Wout, running at average speed, the total foot-contact while jumping was 8,43% shorter in comparison to sprinting. The top running speed was 17,42% slower during jumping. The speed of these pole-vault athletes, on the last 6 steps, is about 17 to 18 % slower with pole-vault compared to normal full speed sprinting. So, sprint-training with pole is probably more useful than normal full speed sprinting.

**Table 3: Comparison of jumping and sprinting variables**

	Wout		Rens	
Running speed	Total foot-contact	Top speed running	Total foot-contact	Top speed running
Average	8,43 %	17,42 %	9,86 %	17,31 %
Fast	6,78 %	15,42 %	13,21 %	18,06 %
Slow	9,52 %	20,40 %	8,78 %	14,08 %

All jumping tests were made after 10 to 12 steps. During competition-jumps these athletes use 18 steps. Moreover, the stress of the competition can have a major influence on performance. So it's possible that there is a little difference between test and competition situation.

The speed and timing information that was measured with this pilot study protocol can help coaches to evaluate pole-vault techniques. It gives athlete and coach more information about small errors in the jumping or sprinting technique. In the future, this protocol has to be used to analyze sprinting and jumping of more pole-vaulters. More data of foot-contact, step-length and sprinting-speed, focused on the last 6 steps before take-off are necessary to find a more exact correlation between take-off position and sprinting speed.