

New findings for the shoeing of show jumpers

High-speed camera from Optronis also shines on live subjects



Show jumping assumes perfect teamwork between animal and human in which sequences of movements need to be precisely coordinated. The main effort here is made by the delicate hind legs and hind hoofs of the horse. But what do the movements and loads on the hind hoofs actually look like in precise detail when the horse lands from a jump? It was precisely this question that state-qualified farrier Jürgen Gotthardt, who studied equine biomechanics and the anatomical principles of movement in the UK, addressed in his degree thesis, “Movement analysis of the hind legs of show jumping horses”, when he compared the impact on the hoof of a conventional open hind leg horseshoe and a closed sports horseshoe when landing from a jump. To research his thesis, he visited a professional equestrian sports facility in Germany where six show jumpers and a professional rider were made available to him in order to capture the data he required.

Breathtaking shots with the Optronis CamRecord 600

A white, rectangular Optronis CamRecord 600 camera with a black lens. The camera has 'Optronis CamRecord' and 'High-Speed' printed on its side. It is shown from a three-quarter front view.

Analyzing the movement of the hind hoofs takes more than the human eye or a standard camera. In his research with equine scientists in the USA, Gotthardt established that camera systems with a frame rate of 200 to 300 frames per second are mostly used for movement analysis. However, he was able to go one better when a “Hightech - Made in Germany” product caught his eye. The farrier had found out about Optronis products on the internet, and in discussing his bespoke needs with Optronis it soon became clear that the CR 600 high-speed camera system represented the best system for the task. At a resolution of 1280 x 1024 pixels, the camera captures 500 frames per second. The camera is easy to set up with a standard lens and tripod and is operated on a standard laptop with the relevant camera software via a FireWire interface. Expensive interfaces and frame grabbers on the PC are therefore not required. The CR 600 is also the most light-sensitive high-speed camera in the Optronis range which makes child’s play of illumination. Another advantage is the camera’s large built-in image memory, which captures the data when recording and forwards it to the laptop for replay in slow motion.

Images of the hind hoof movement of horses landing from a jump had never been seen before!

After careful planning and a test run, the video recording started in October 2011. Gotthardt set the camera to operate with an even brighter resolution of 800 x 600, which delivered some 1,000 frames per second. The result was a series of breathtaking shots of anatomical movements that had yet to be seen in such detail. Optronis also supplied the compatible software for the task, which proved to be the perfect tailored solution for data backup. This enabled the camera to display continuously, and only when a usable jump appeared on the monitoring screen connected to the camera was the film sequence display triggered from the camera onto the PC. When it came to measuring the images accurately, Gotthardt used a software program specifically tailored to horses. Although he could have measured the movements with the software supplied by Optronis with the camera, the software he used was already programmed with a number of default values covering equine anatomy.

The perfect shoeing

The video recordings taken by Gotthardt show the precise loads applied to the hoofs, joints and legs of horses in show jumping. By measuring the images – the horizontal and vertical components of deceleration and acceleration in each case were measured at the hoof – an analysis can finally be made of the angle at which the hoof plunges into the ground and the rotation. For example, where a backward rotation is identified on

landing with an open horseshoe, a new shoeing would have to be considered straight away as this phenomenon carries a high risk of injury. The high-speed camera therefore helped to identify the perfect shoeing for the horse, which not only reduces the risk of injury but also actively supports the hoof in show jumping. A closed sports shoe minimizes the forces generated on landing – mainly, the torsional force and shear force. Due to this stabilizing effect, the load on the hind legs of the horse in show jumping is reduced, as many experts will confirm. Showjumper Denise Manns, who won the Grand Prix of Pirmasens with her horse Comtesse in July 2012, has had her horses shoed by Gotthardt since 2011 with the “sports bar shoe with frog support”. Even horses with injuries, such as ligament and sinew damage, can be confidently left in the skilful hands of Jürgen Gotthardt. Gotthardt develops special horseshoes for his four-legged patients which promote the healing process. With the use of its high-speed camera to supply the images for researching hoof movements in show jumping, Optronis has even made a contribution to equestrianism.



CamRecord CR600x2



Specifications

Resolution	1280 x 1024 pixel
Frame Rate @ Max. Resolution	500 fps
Image Sensor	Progressive Scan CMOS
Exposure Time	1 μ s - 1/Framerate
Active Area	17,92 mm x 14,34 mm
Sensor Diagonal Dimension	22,95 mm
Pixel Size	14 μ m x 14 μ m
A/D Conversion	10 Bit or 8 Bit
Dynamic	60 dB (90 dB optical)
Sensitivity	25 V/lux*s
Shutter	global electronic, >1 μ s exposure time
Trigger Signal	TTL, switch, open collector, rising or falling edge, on image content variation
Synchronization	internal, external
Interface	Gigabit Ethernet
Video Output	VGA
Power	12 VDC / 12 W
Lens Mount	Nikon F-Mount (optional C-Mount)