Motion Amplification® in Sports

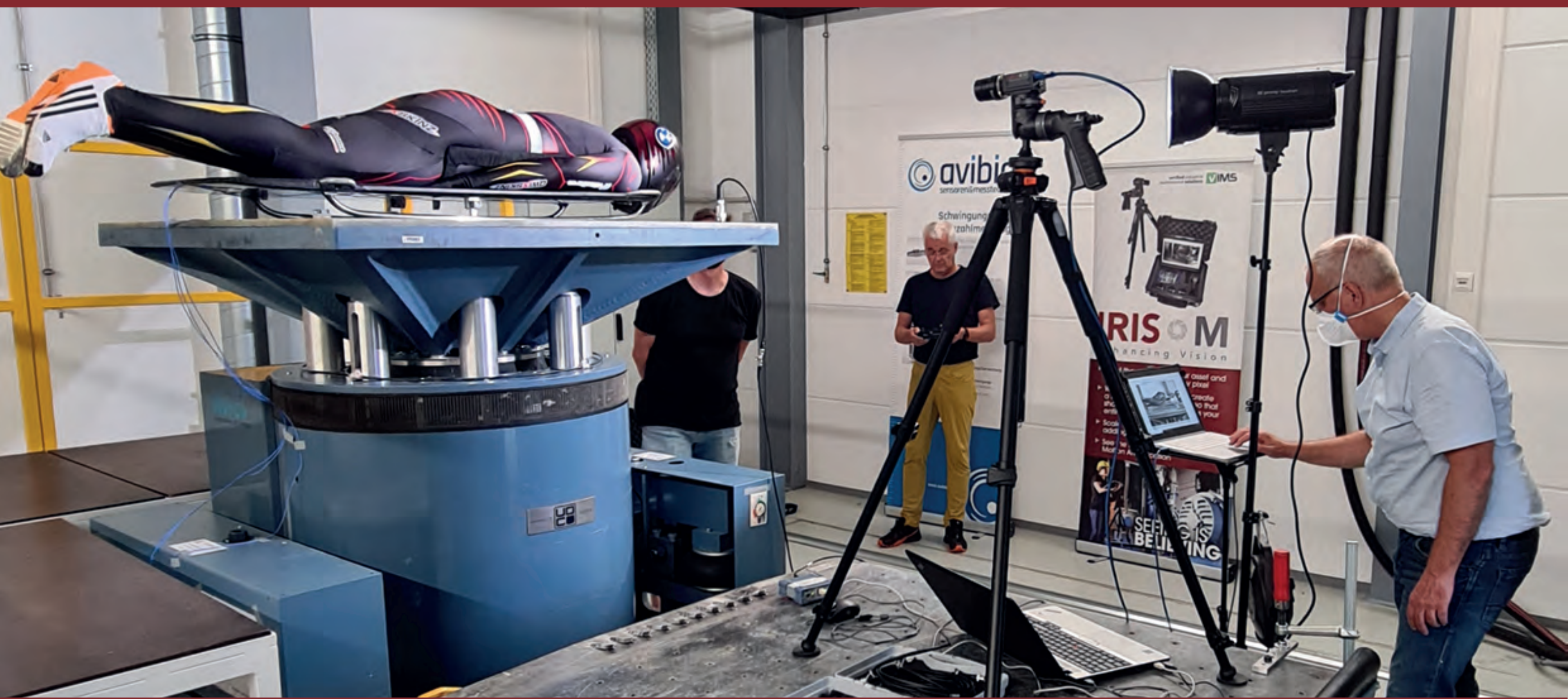
RDI Technologies worked with their international partner VIMS and Team Snowstorm to study a German luge team and a Belgian skeleton athlete as they prepared for the Olympics.

Motion Amplification® is the latest science in the field of vibration, measuring deflection, displacement, movement, and vibration not visible to the human eye. Using patented camera and software technology, Motion Amplification® turns every pixel into a sensor and measures non-contact vibration with incredible accuracy.

With the power of Motion Amplification®, the research team was able to visualize the sled and riders, as well as analyze the movement of the luge in a wind tunnel-like setup simulating actual riding conditions. Visualizing this motion enabled them to enhance the aerodynamic design and performance of the sled.

See Motion Amplification® in action and learn more about how this technology plays a critical role in many different industry apllications.

WATCH NOW



With Motion Amplification® software an ROI (region of interest) can be drawn anywhere in the image to extract vibration frequency and amplitude data.

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Skeleton Vibrations Visualized

Matthias Scherge, Team Snowstorm, 76316 Malsch

Instead of complicated diagrams, such as that of the power spectral density in [1], vibrations can also be made visible directly. For this purpose, a special video camera (RDI Technologies) was used, whose pixels of the CCD matrix act as individual sensors. An algorithm is integrated in the evaluation software, which detects and tracks distinctive points in the image, e.g. the runner. If the points move, the algorithm also recognizes this. Since the camera is able to determine the distance to the object, if the pixel size is known, the movement of the salient points can be quantified via the ray set. One holds a magnified representation of the vibration. Such representations are very intuitive for coach and athlete.

Vibration excitations were performed using the electrodynamic test system described in [1] with realistic values for amplitude and frequency. The camera system was used to focus on four points, three on the athlete, i.e., rear, center, and front, and one measurement point on the sled. The measuring point on the sled had only one degree of freedom, namely in vertical direction. All other measurement points had two degrees of freedom in the image plane, vertically and horizontally, which can be seen especially in the movement of the head. The vibration amplitudes moved in a range of ±10 mm. To analyze the vibration behavior, experiments were performed with different body tension at different bows and different position of the body on the sled. As expected, the damping decreases with larger bow. However, these changes are small compared to changes in body tension or the internal structure of the sled. Damping contributions introduced by the body are therefore particularly important, or as Chris Gorski put it: ”Someone once told me you want to vision you are a soft towel that is draped over the sled. It was a great visualization for me. So that means relax, stay soft, keep your head and shoulders down.”

[1] Vibrations in Skeleton Sports, M. Scherge, Gliding Short 2(2022)en