

Photography courtesy of: Red Bull Diagnostics and Training Centre

GETTING SPECIFIC

It comes back to providing highly tailored solutions, Christian says. "In sports science there are all these principles about what you should do to, for example, become a good sprinter. But we've been measuring five different sprinters and they all have completely different movement patterns.

"So every athlete gets his or her unique suggestions and ideas. That's the fun part, but also the challenging part, combining that with known values. We calculate the mean angle for, for example, the knee [across all athletes performing a given movement]. That's important, because we know where the athlete is in terms of this norm." But, Christian goes on, that doesn't mean that an athlete outside that average is doing something wrong - the mean just provides a reference point from which to interpret the data.

Christian can give example after example of athletes his team has helped in this way.

One is a soccer player who had issues with knee stability. Christian's team was able to determine that the player had an imbalance between the muscle chains across his hip in the front and back. This created a large angular momentum causing the thigh to move forward and introduce the instability to the knee.

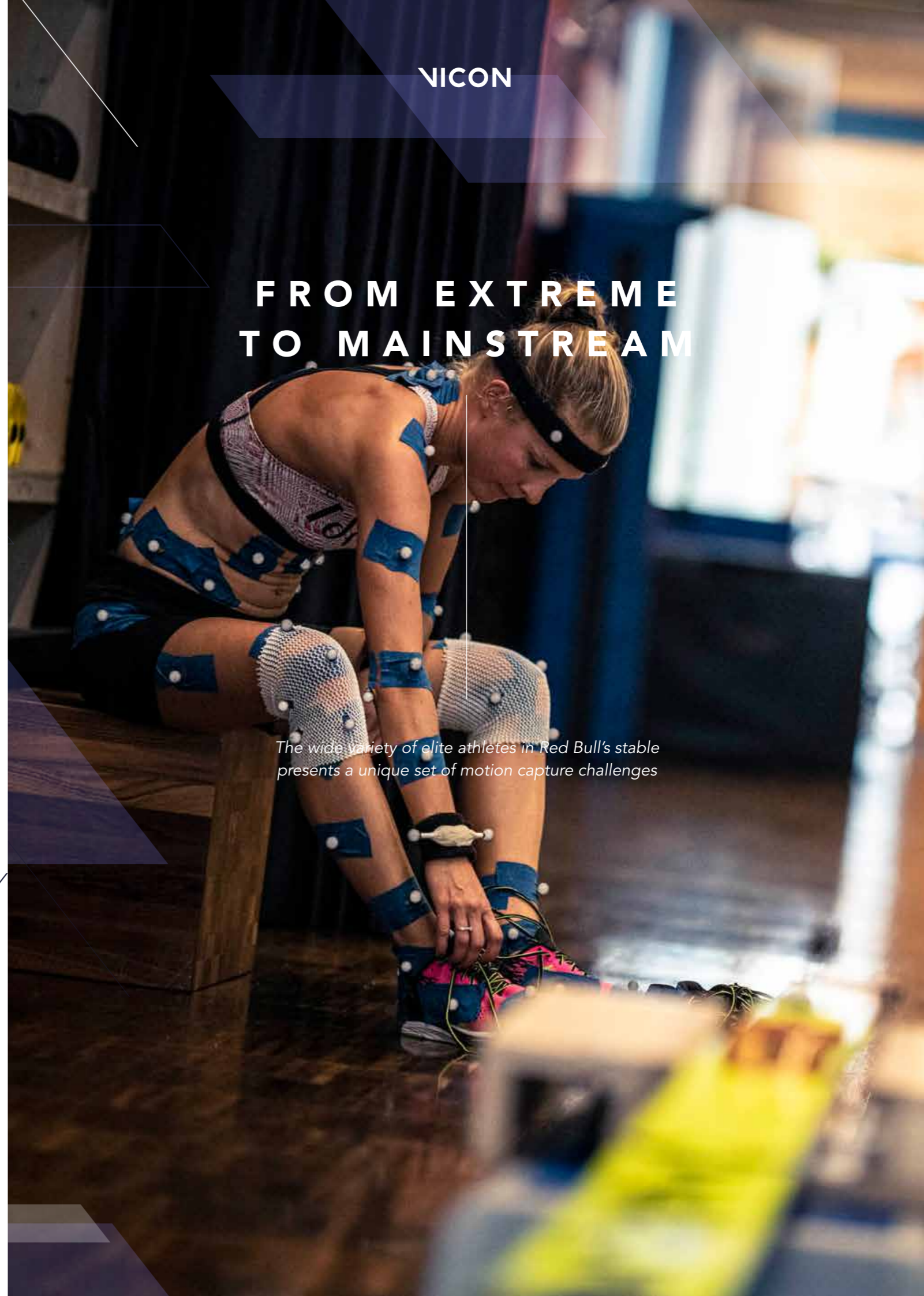
Another example is a distance runner who had an achilles problem - she had too much rotational momentum which she ended up compensating for with her achilles, though it could just as easily have been her knee.

In both cases the team was able to link the symptoms in one part of the body to a problem in another - insights that wouldn't have been possible without reliable, high fidelity data.

Building on that foundation, Christian is excited about where Red Bull can take these tools and insights in the future. He talks about the possibilities of full 3D modelling out in the wild, and of using inertial sensors to capture the movement of athletes half the world away.

Not satisfied with conquering the breadth of sporting achievement, Red Bull is intent on delving into the depths of human performance.

FROM EXTREME TO MAINSTREAM



The wide variety of elite athletes in Red Bull's stable presents a unique set of motion capture challenges

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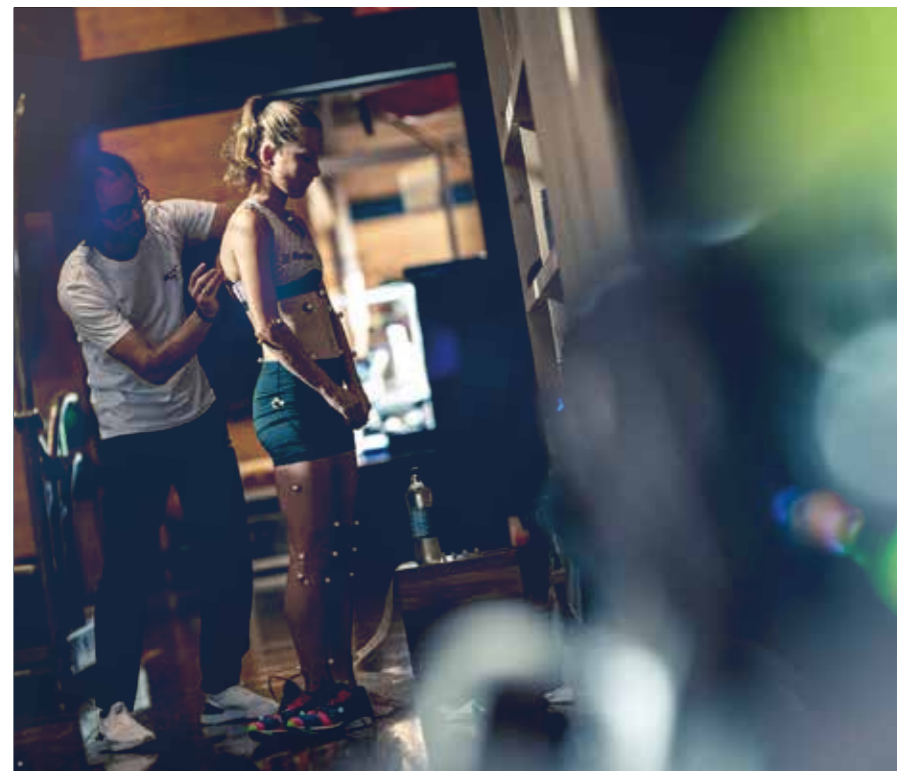
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The term 'Red Bull athlete' used to conjure images of daredevils throwing themselves out of planes or down mountains, but over the years Red Bull has evolved into a mainstream sporting dynasty. Its broad church of sponsored teams and athletes ranges from soccer to ultra running to kayaking to F1 to cliff diving. One thing unites them: they're performing at an elite level. That demands an elite level of care.



CHRISTIAN MAURER-GRUBINGER
Athlete Performance Centre
network's headquarters Austria

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THERE'S A HUGE VARIETY OF DIFFERENT MOVEMENTS. THE CHALLENGE IS TO FIND OPTIMAL MOVEMENT PATTERNS FOR A SPECIFIC PERSON"



Red Bull's Athlete Performance Centres, located around the world, rehabilitate and train the company's world-class athletes, helping them improve performance and return from injury. A key element of that project is gathering and utilising extremely precise kinematic data, something made possible by the centre's Vicon technology.

The challenge isn't only working in the broad range of disciplines covered by Red Bull, it's also working with athletes who have finely-tuned, highly singular biomechanical profiles.

"The movements are very individual - there's not a normal running pattern, a normal walking pattern, a normal jumping pattern," says Christian Maurer-Grubinger, PhD, from the Athlete Performance Centre network's headquarters in Austria. "There's a huge variety of different movements. The challenge is to find the optimal movement patterns for a specific person."

Red Bull's aim, then, is to take highly-focused insights into the minutiae of an athlete's movement and turn that into a highly-tailored programme that's specific to each individual.

When you're looking at that level of fine grain detail your data has to be bulletproof. There's already a certain amount of volatility in how people repeat movements, so it's crucial to have very low volatility in tracking so that Red Bull's biomechanists can be confident the data is accurate. To get that data, they use 12 Bonita 10 cameras and two Bonita 720c cameras in a setup that's combined with force plates and EMG instrumentation.

∥
ALL THE COMPUTING IS DONE ONBOARD THE CAMERA"



∥
WE CAN TRAIN THE COACHES TO UNDERSTAND THE DATA THEY RECORD AND IMMEDIATELY GIVE FEEDBACK TO THE ATHLETES."



CALL OF THE WILD

There's a further challenge, however. The team is working with athletes whose movements can't necessarily be captured in the lab. Christian gives the example of a snowboarder performing a jump in a halfpipe: it's not just about forces - it's about timing, momentum and psychological components. "The limit is not how high they can jump in the lab setting," he says. "There's a huge drive to go outside, into the field. But it always has to be with high quality data."

Recently, therefore, Red Bull has invested in an IMU inertial system using Vicon's Blue Trident sensors so that Christian and his colleagues can gather insights from out in the field.

By doing both optical and inertial capture through the Vicon ecosystem, says Christian, "we can combine two technologies."

He gives the example of Red Bull's runners. "We have the high precision of the running analysis on the treadmill with the markers, where based on the forces we measure we can calculate back to the joint movements etc.

But with IMU we can then better transfer the results from the more detailed lab capture sessions to the field."

Furthermore, with the forthcoming addition of IMU to their setup, Christian and his team can work more collaboratively with other Red Bull personnel. "We can train the coaches to understand the data they record and immediately give feedback to the athletes," he says.

The input of athletes and their coaches is critical, as they understand their performance with a depth that can only come from long periods in the field. "I can show them the technology, show what we usually do," says Christian. "But in the communication with the athletes and coaches we establish whether that's a fit or whether we need something different. For instance, for snowboarders we look a lot at rotation and how that works in comparison with rotating the pelvis and leaving the ground. It's fascinating - in every discussion with a coach or athlete we learn so much."