

## Vantage Gives Boost To Life Sciences at Roehampton University

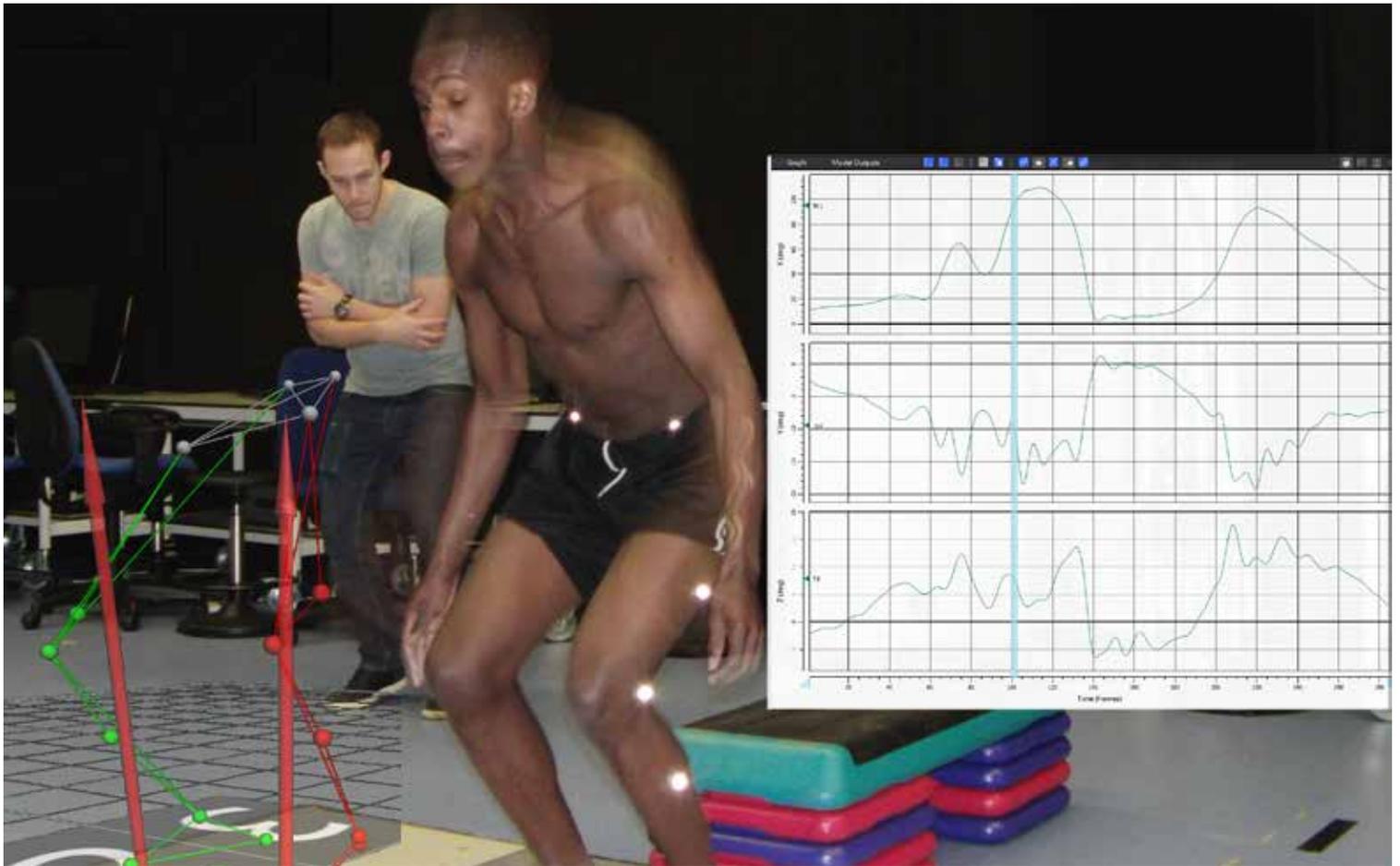


Image courtesy of Northumbria University

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**Alison Carlisle, Specialist Technician, Sport and Exercise Sciences, Department of Life Sciences at Roehampton.**

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Gait Analysis



Vantage Camera



Marker Placement

Ranked the UK's most research-intensive modern university, Roehampton has seen its biomechanics and life science research accelerate by leaps and bounds after upgrading to the Vicon Vantage V5 system with Nexus 2 software.

Named 'Best Modern University' in the Complete University Guide 2015, Sunday Times Good University Guide 2015 and Guardian University Guide 2016, the University of Roehampton purchased its first Vicon system for biomechanics in 1996.

Vicon motion capture technology has been at the heart of the multifunctional laboratory at Roehampton ever since. Widely used for teaching and research purposes, the system is used predominantly by the Sports and Exercise Science faculty and within the Biomechanics courses. Many PhD students go on to use the Vicon system in their dissertations; current studies include the injury risks from cricket bowling, golf swings and cutting manoeuvres in football.

Roehampton's staff are also able to make great use of the Vicon facility for research. Much research has focused on people with lower limb amputations, concentrating on factors such as back pain, movement, exercise intervention to improve daily tasks and gait retraining. Based on results from the Research Excellence Framework (REF)

2014, the institute won acclaim as the Most Research Intensive University in the UK.

It was this award that enabled Roehampton to upgrade from a dozen well-used Vicon motion capture cameras to a new 12-unit Vicon Vantage V5 system this year. The V5 is the fastest camera in Vicon's Vantage range and significantly outperforms similar motion capture cameras in both resolution and speed. Able to capture 420fps at 5MP, it's ideal for capturing high-speed movements in a golf swing or the nuances of gait analysis.

Although the system was only installed over the 2016 Easter break, considerable benefits for both staff and students are already evident. "The new improved workflow is making a massive difference to staff with their research, and students for their dissertations and their projects," says Alison Carlisle, Specialist Technician, Sport and Exercise Sciences, Department of Life Sciences at Roehampton. "The really big improvements I've seen are in the field of view, the quality of data, the resolution and the software."

Step up in quality  
The Vicon system at Roehampton uses models such as Plug-in-Gait for gait analysis, which is based upon the Helen Hayes marker set.

"We usually use lower body markers to look

at kinematics and kinetics - joint angles, joint moments, joint powers, as well as things like hopping," explains Carlisle. "They're 14mm retroreflective balls, with 16 markers in all for the lower body. It's very powerful. You can get intra-spatial parameters like hop distance, step length, or stride length, out of it really quickly."

Based on the research that was entered into the REF, two students are conducting a study on prosthetic 'blades' designed for forward propulsion and jogging. "The research is about how the prosthetic responds to lateral movement, for example to see if the side movement could allow amputees to play tennis. The stiffness can be changed on the blade, so they're looking at the effects of that. This will all feed into the design of the blades."

The marker system has to be very precise. "We're always striving to minimise errors," says Carlisle. "The new Vantage system offers increased resolution, and Nexus 2 introduces new marker detection algorithms, which together enable greater accuracy. We place markers all over the prosthetic limb and some of them are quite closely placed. The older system sometimes couldn't tell them apart, but this new system finds it really easy."

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Another task for the department has been processing the motion data for students below Masters level. While third-year students are taught about processing, they don't do it themselves.

"It would be fraught with problems because they're new users," says Carlisle. "It's quite complicated and the students wouldn't even know that they had gaps because they're just not experienced enough. They have very high expectations - they haven't gone through the onerous frame-by-frame workflow of older biomechanists. It's amazing how it has come forward in leaps and bounds. Nexus 2.3 offers a really wonderfully improved workflow, from my point of view, in that there's automatic gap filling."

The new Nexus system also features Range of Motion (ROM) calibration, an enhancement on the method available in the first version of Nexus.

"We used to just have a static subject calibration process, but now there's also one for a range of movements all around the joints," enthuses Carlisle. "That's a huge improvement to the automation of a process, which can be very time consuming."

"I used to have to spend a lot of time with students processing the results," she says. "Processing and data collection is much smoother. It gives more accurate data because there are fewer gaps. Vicon has also developed software capabilities to improve labelling. I'm delighted that students are getting much better results with Vicon Vantage, which frees me up to do more work on research."

## Taking a wider view

The Vantage system is mounted 3.5m high on a rig, providing significantly more coverage in the lab.

"With the larger area, we get more walking or running strides, which is really important for both students and research," adds the specialist technician. "We do a lot of research on running, looking at gait retraining, and other injury reduction ideas, such as retraining people to run with a greater stride length."

Carlisle states that in combination with the increased volume, there's also a much better field of view. "That's a huge plus in my eyes," she says. "It enhances the sport work we do, because if you're capturing running you need to have a certain amount of space to get good, quality data. We've got a long enough lab to get enough velocity up."

It's not just running. A current example of research is a golf intervention study for a movement therapist who works with coaches for PGA-level golfers. "The idea of the intervention is to increase stability to the lower body," explains Carlisle. "It's to reduce the chance of getting injured from the golf swing movement and allow the body to move in a freer fashion."

"We have a big net, so people don't bowl a cricket ball or hit a golf ball into the cameras," says Carlisle. "We can take the sampling rate right up, which is very important for this kind of work, and it's now easier to get really good data at higher sampling rates."

The Vicon system works in conjunction with three Kistler force plates mounted in the

floor of the lab, which are used to measure ground reaction forces in three dimensions. Gap filling improvements in the Vicon system result in improved reconstruction algorithms which, according to Carlisle, benefit their jumping studies.

"Jumping has traditionally been quite challenging," she explains. "Now with the Vantage system we are really able to capture and analyse these movements. Greater capabilities in the Nexus software, linked to the new cameras, are really benefitting the data for studies of jumping."

## Rapid response

Over the past 20 years, Roehampton has enjoyed a long and successful working relationship with Vicon. "We've had excellent support, and Vicon actually took our old system away as a part exchange," reveals Carlisle. "I've been a technician for a long time and worked with different companies. Sometimes the slowness of the response is very frustrating. We've always found Vicon to be really amazing in their response to get problems fixed."

"This is very high tech," she concedes. "It's complex and there are a lot of things that can go wrong, but Vicon continue to work on ways to improve it. The new Vantage workflow is making a massive difference. There's much greater accuracy, greater usability, and we get cleaner data with Vantage. I didn't really know, until we got it, how great it would be."

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