

A young boy is captured in a martial arts stance, likely Taekwondo, within a motion capture studio. He is shirtless and wearing dark blue shorts with a small logo on the left leg. He has several small black motion capture markers placed on his head, neck, chest, arms, and legs. He is standing on a dark mat with green and white lines. The background is dark blue with a large, semi-transparent orange triangle overlaid on the scene. The text "BEYOND MOTION" is centered in white, bold, sans-serif font.

**BEYOND MOTION**



- 3 Introduction
- 4 Who is Nexus for?
- 6 Benefits
- 8 CGM variations
- 14 What can you do with Nexus
- 16 What's new with Nexus
- 18 Valkyrie comes to Nexus
- 20 Shortcuts

## THE MOST TRUSTED MOTION CAPTURE ECOSYSTEM, INSPIRED BY YOU

Nexus is the most powerful all-inclusive modeling and processing tool for movement analysis on the market. Created specifically for the whole life sciences community, Nexus delivers precise, repeatable and clinically validated data.

With more than 90% of our product enhancements driven by customer feedback, Nexus 2 is the latest version of our most trusted motion capture software.

Learn more about the new features and benefits of Nexus 2, together with some insights from Dr. Fabien LeBoeuf (Nantes Hospital, France and Research associate, University of Salford, UK) on the latest developments in Conventional Gait Modeling.

### nexus

*noun*

1. a connection or series of connections linking two or more things.  
"the nexus between industry and political power"
2. a central or focal point.

# WHO IS NEXUS FOR?



## GAIT ANALYSIS & REHABILITATION



- Doctors & surgeons
- Military
- Physiotherapists
- Clinical scientists
- Postgrad research
- Undergrad teaching

## ANIMAL SCIENCE



- Veterinary doctors
- Researchers
- Trainers
- Postgrad research
- Undergrad teaching

## NEUROSCIENCE & MOTOR CONTROL



- Clinical scientists
- Doctors & surgeons
- Postgrad research
- Undergrad teaching
- Physiotherapists

## SPORTS PERFORMANCE & BIOMECHANICS



- Performance analysts
- Commercial research
- Strength & conditioning
- Postgrad research
- Undergrad teaching
- Physiotherapists
- Coaches or trainers

Nexus sets a standard for motion capture. With a host of new automated features, intelligent processing, flexible controls, and Vicon IMU integration; Nexus enables you to focus on the research, not the software.



### SAVE TIME WITH HIGHLY CUSTOMIZABLE YET SIMPLE PROCESSING PIPELINES

Often when a system becomes so advanced, it can be difficult and time-consuming to use. Nexus may be Vicon's most advanced data capture software, but that doesn't mean it is complicated to use.

- Customize your workflow to save time by automating common processing tasks.
- Create a series of steps with the Biomechanics Workflow Builder to combine data collection and offline processing, making it simple to get started with the SCoRE and SARA Functional Calibration.
- Use offline Python/MATLAB capabilities.
- Review labeling quality and automatically detect and fill gaps.
- Manage your data via Vicon's database management tool, ProEclipse.



### TRUSTED TO DELIVER CLINICALLY VALIDATED MODEL OUTPUTS

Poor quality, inconsistent data can have a severe impact on decision-making. You need precise and repeatable results from high-quality, clinically validated data.

- Four times more research papers on CGM than any other model\*
- Precise and repeatable data capture
- Camera calibration feedback helps to achieve consistent calibrations in the lab, to maintain data standards.



### POWERFUL ANALYSIS AND MODELING OF DATA

Capturing the data is just the first step. Modeling is where the real analysis can begin. Modeling should be intelligent and advanced, designed specifically for life sciences.

- Powerful native and compatible modeling, you can process data using scripts created in Vicon BodyBuilder, Python, MATLAB, and Vicon ProCalc.
- Automated labeling
- Real-time calibration feedback
- Native PiG and CGM2 – can run concurrently to compare datasets

**90%**

of our life sciences software enhancements are from customer feedback

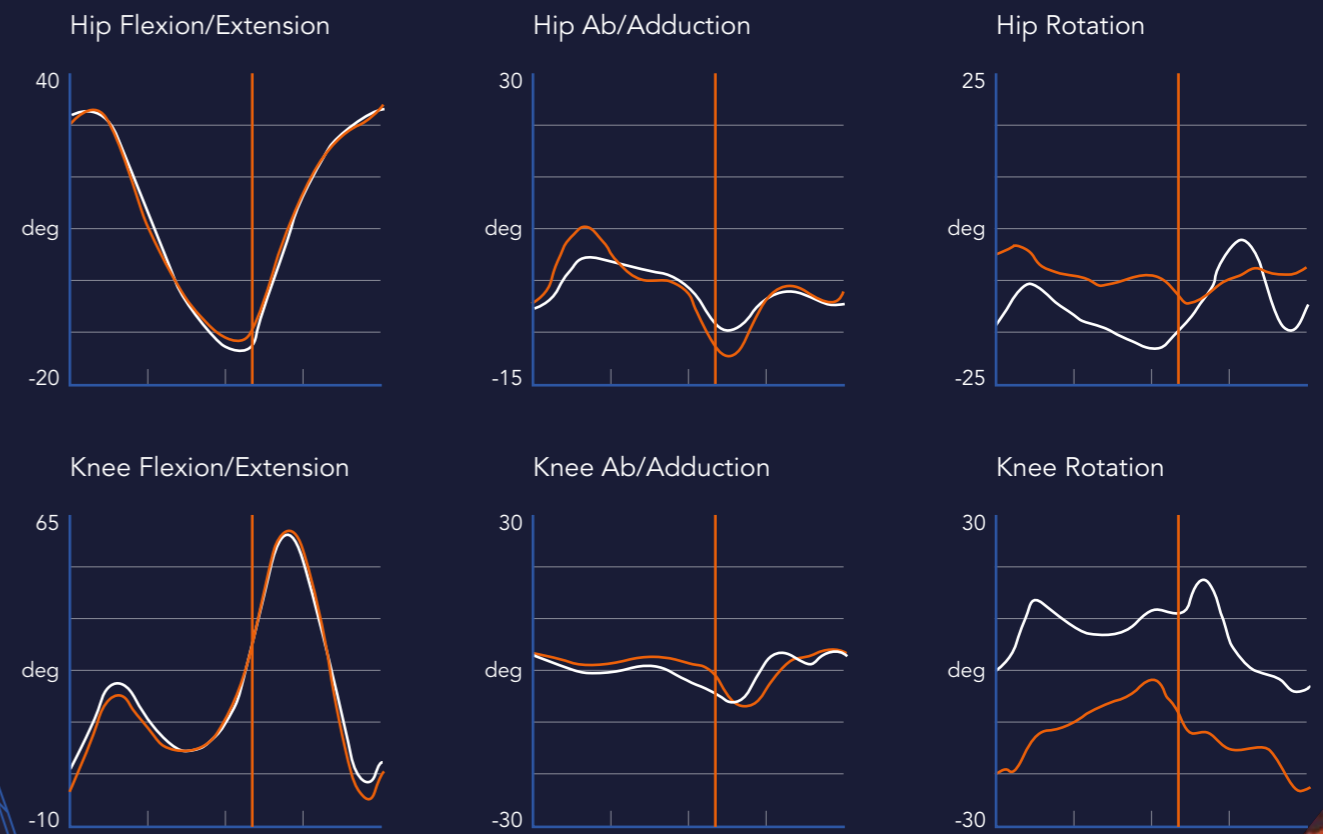
\* Google Scholar, Feb 2019

# UPDATING THE CONVENTIONAL GAIT MODEL FOR THE MODERN WORLD

"The CGM2 project aims to address the limitations of the CGM while maintaining its strengths"

Dr. Fabien LeBoeuf

Plug-in Gait v CGM2 Kinematics (Left context only displayed)



PLUG-IN GAIT

CGM2

CGM VARIATIONS

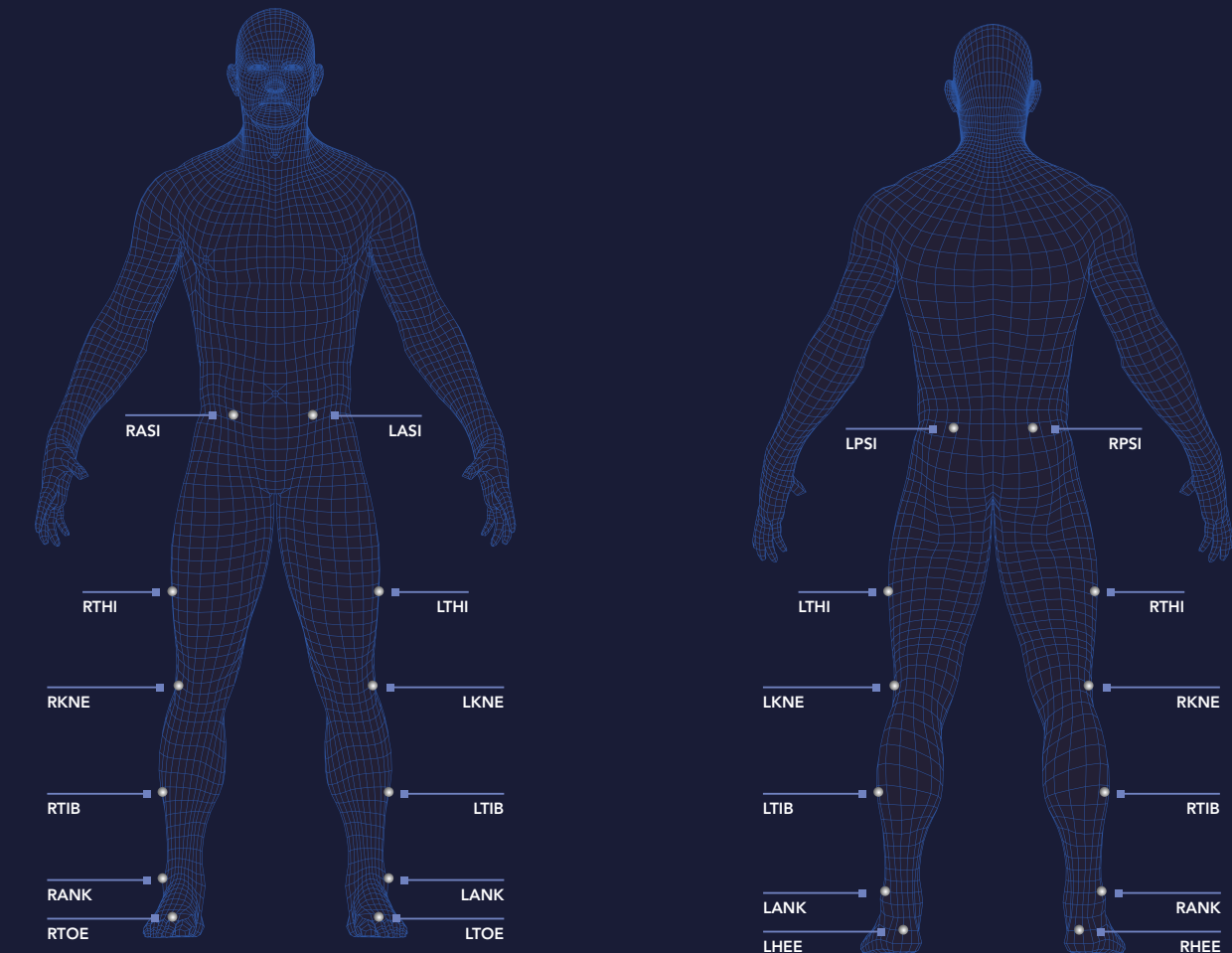
THE CONVENTIONAL GAIT MODEL 2 – CGM2 – IS AN OPEN SOURCE IMPLEMENTATION THAT REPRODUCES THE PAST, BUT PREPARES FOR THE FUTURE.

The CGM2 project updates the Conventional Gait Model for the modern world. Developed in a series of iterations, the project develops and validates an evolution of the CGM, which maintains its strengths and corrects its limitations.

Vicon has been privileged to work on this project with Dr Fabien LeBoeuf together with the staff at the Hugh Williamson Gait Analysis Laboratory at the Royal Children’s Hospital in Melbourne, who helped collect the data for the study.

The project’s findings have led to the creation of CGM2 – a combination of Vicon PiG and CGM features – to create a complete upper and lower body gait analysis model.

CGM 1.0 / 1.1



OPEN SOURCE FOR GREATER CONTROL

Dr. LeBoeuf’s research concentrated on extensive investigations on the localization of the hip joint center (HJC) in order to evaluate its impact on kinematics and kinetic CGM outputs.

Previously, no study had investigated the effect of HJC mislocation, because the CGM had been implemented in a proprietary commercial package that could not be modified.

CGM2 allows you to modify either the geometry of CGM or its kinematic and kinetic processing.

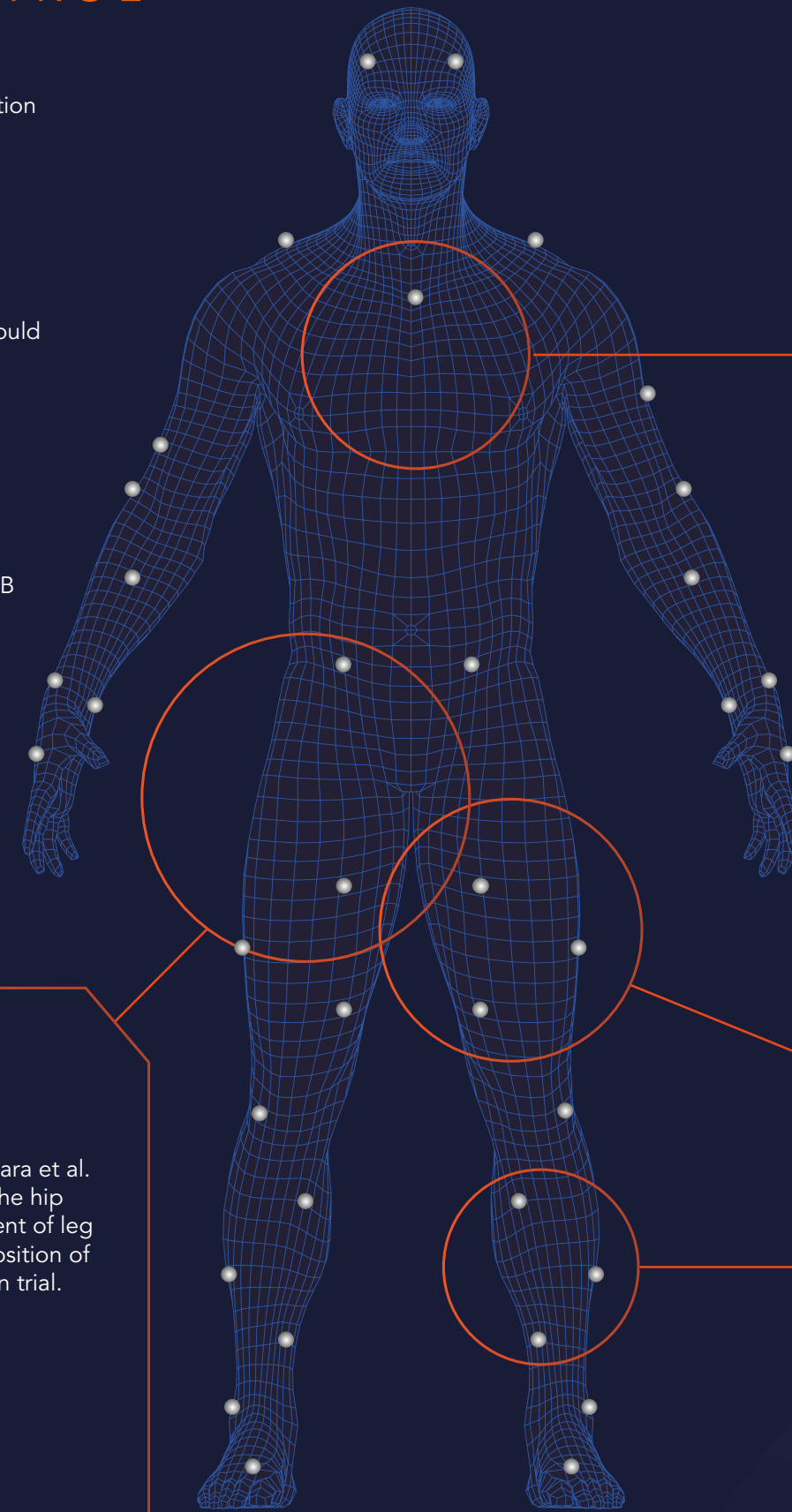
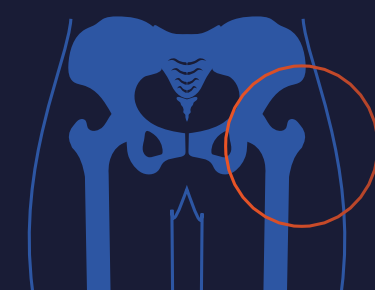
Nexus provides direct native pipeline integration to process your CGM2 data using scripts created in Python, MATLAB and Vicon ProCalc.

Nexus meets the modeling needs to enable the comprehensive integration of research pipelines and is equally suitable for quick in-class tuition.

It is the most robust, repeatable and reliable real-time labeling and skeletal solving solution available for biomechanics.

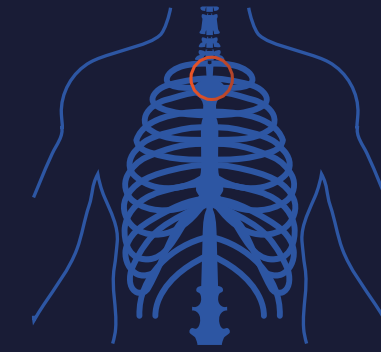
CGM2.1 HIP JOINT CENTER ACCURACY

Uses the regression equations of Hara et al. (2016) to estimate the position of the hip joint center based on a measurement of leg length taken from the measured position of markers during the static calibration trial.



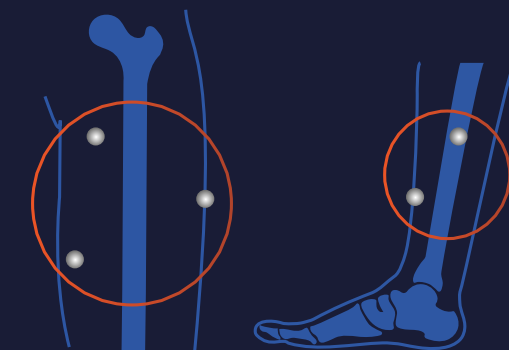
CGM2.5 UPPER BODY MODEL

Marker sets for upper thorax model.



CGM2.3 SKIN CLUSTERS

Removes thigh and tibia wand markers and replaces these with a small number of tracking markers (skin clusters) placed over the femur and shank segments.



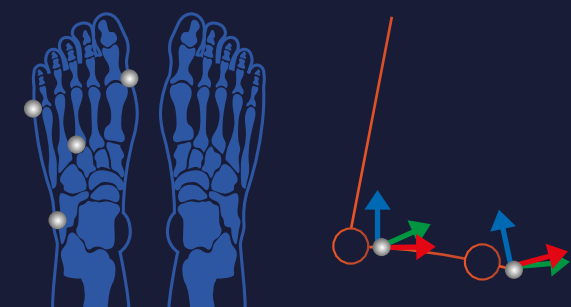
CGM2.2 INVERSE KINEMATICS

Calibrates a rigid segment model to the data captured during a static trial and then uses inverse kinematics to track marker trajectories captured during the walking trial.



CGM2.4 EXTENDED FOOT MODEL

Introduces a two-segment foot model, where the rear foot model is an adaptation of the CGM foot segment, and a new, additional forefoot segment is added.

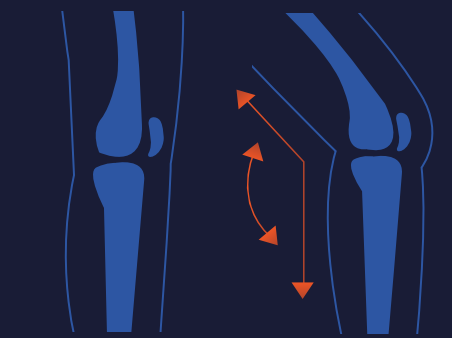


“The CGM2.1 project is an open source implementation that reproduces the past, but prepares for the future.”

Dr. Fabien Leboeuf

CGM2.6 KNEE CALIBRATION

Incorporates functional calibration of the knee joint based on a dynamic functional calibration test conducted after static calibration but before fitting the model to walking trials.



# WHAT CAN YOU DO WITH NEXUS?

## MANAGE & PREPARE YOUR SYSTEM

Easily calibrate and configure the system. Seamlessly connect mobile devices via the Vicon Control app. Prepare subjects by creating subject templates, calibrating labeling skeleton templates, creating pipelines, to increase the speed and accuracy of processing data.

The data-processing engine automatically initializes the labeling of your subject, removing the need to label manually. Nexus can automatically detect gaps and display information about labeling quality, enabling quick data correction if needed.

Nexus enables you to capture muscle activity and movement, review trials, assess foot strikes and review data quality. The system identifies events and fills gaps in your data.

Perform modeling, using PiG or CGM2 to derive kinematics and kinetics, or Oxford Foot Model for kinematics. Input subject measurements for PiG or full body analysis. Incorporate EMG and force plates into your session easily. Working with inertial sensors, you can capture, manage, import and export IMU data. Process digital video files and export trial data with 3D video overlay, ASCII or C3D.

## CAPTURE & REVIEW MOVEMENT



## AUTOMATE PROCESSING OPERATIONS

Save time with highly customizable, automated processing operations. You can review your processing history and quickly pull off reports. Create custom pipelines for common processing tasks.

With direct native pipeline integration, you can process data using scripts created in Vicon BodyBuilder, Python, MATLAB and Vicon ProCalc.



# MAIN FEATURES & BENEFITS OF NEXUS

## NEXUS 2.10 ONWARDS SEAMLESS INTEGRATION

Nexus 2.10 can seamlessly integrate with Vicon's market-leading IMU, Blue Trident, via its wireless network device, Beacon. By adding inertial sensors into the optical world, you can collect synchronized optical and inertial data in one platform.

## HARD SYNC

Precise timing of inertial to optical data.

## QUATERNIONS

When combining Blue Trident with Nexus you can describe global joint angles with three-dimensional orientation and rotation.

## TOBII EYE TRACKER INTEGRATION

Tobii's latest eye tracker is integrated into Nexus 2.10, enabling streaming of synchronized eye-gaze tracking with optical data.

## OPEN SOUND CONTROL INTEGRATION

Open Sound Control is the protocol for communication among computer and sound synthesizers for networking technology. Nexus now provides options for streaming data in OSC format, enabling live synchronized or offline. Data can be accessed by any platform that supports OSC for real-time control of sound and other media processing.





# VALKYRIE COMES TO NEXUS

## LEGENDARY PERFORMANCE

Nexus 2.15 incorporates Valkyrie, the world's most powerful motion capture camera, into Vicon's best-in-class life sciences ecosystem.

## CONFIDENCE IN HIGH-FIDELITY CAPTURE

Valkyrie pushes the boundaries of motion capture in the life sciences with unbeatable range, speed and field of view.

Valkyrie offers unprecedented levels of detail with pixel counts of up to 26MP, capturing complex structures with extraordinary fidelity. Capture speeds of up to 2000FPS enable users to track incredibly fast-moving subjects such as athletes.

The camera's unique, custom-designed varifocal lens optimizes performance, no matter the application. Its wide, center and narrow field of view options can be combined within your setup to ensure the best possible coverage for your data capture. The combination of Valkyrie's IP65 rating and incredible range makes capturing subjects in their natural environments easier than ever.

## FREE UP YOUR VALUABLE TIME

Valkyrie is engineered from the ground up to minimize its demands on your time. That means you can focus on what matters: your data and your subjects.

Even if you need to move your system for a project based out in the field, you can begin your session quickly. Valkyrie's 30fps full video preview mode makes camera aiming fast and accurate, no matter the environment.

Once you're set up, the robustness of Valkyrie's tracking and calibration combines with clear display features to allow you to focus on your project.

After your trial, the high quality data combined with Valkyrie's internal camera intelligence minimizes cleanup time and processing. Partnered with Nexus's trusted ecosystem, your motion capture experience will be streamlined and efficient.



## BESPOKE MOTION CAPTURE LENS

Valkyrie includes a new, custom-built varifocal lens to increase range and precision.



## INCREDIBLE SPEEDS

Valkyrie's native speeds go up to 500FPS, and as high as 2000FPS when using windowing techniques.



## MARKET-LEADING RESOLUTION

With a resolution of 26MP Valkyrie offers unparalleled clarity.



## INTUITIVE OPERATION

At 30fps, Valkyrie's full video preview mode is Vicon's smoothest yet for easier camera monitoring.



## A CAMERA FOR ANY ENVIRONMENT

With Valkyrie, you can capture any movement in any environment, safe in the knowledge that your camera is IP65-rated.

For more information visit our website or contact us.

[www.vicon.com/lifesciences](http://www.vicon.com/lifesciences)

[www.vicon.com/nexus](http://www.vicon.com/nexus)



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NEXUS SHORTCUTS

<b>F1</b>	Vicon Nexus help
<b>F2</b>	Data management
<b>F4</b>	Quick Reports window
<b>F5</b>	Full screen
<b>F6</b>	Sounds dialog box
<b>F7</b>	Options dialog box
<b>F8</b>	System Preparations Tools pane
<b>F9</b>	Subject Preparation Tools pane
<b>F10</b>	Capture tools pane
<b>F11</b>	Label/Edit Tools pane
<b>F12</b>	Pipeline Tools pane

NEXUS HOTKEYS

<b>Ctrl+Enter</b>	Start / stop capture
<b>Ctrl+Tab</b>	Switch live / offline mode
<b>Ctrl+Space</b>	Display/Hide marker labels
<b>Ctrl+ ←</b>	Move to previous event
<b>Ctrl+ →</b>	Move to next event
<b>Ctrl+Z</b>	Undo
<b>Ctrl+Y</b>	Redo
<b>Ctrl+S</b>	Save trial
<b>Ctrl+R</b>	Reset core processor
<b>Space</b>	Pause / restart real-time data streaming
<b>Space</b>	Play / stop offline data
<b>Esc</b>	Exit current mode (labeling, etc.)

MOUSE ACTIONS

<b>Right-click and drag</b>	Zoom 3D space
<b>Left-click and drag</b>	Rotate 3D space
<b>Left and right-click and drag</b>	Move 3D space
<b>Left-click</b>	Select individual item
<b>Ctrl + click</b>	Select several items
<b>Alt + click and drag</b>	Select individual item