Inertial Motion Capture System FOHEART·X Manual

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GENERAL NOTES

Manual Application

Suitable products for this manual are inertial motion capture system FOHEART·X and software MotionVenus.

As the software MotionVenus is constantly being upgraded, if your software version has different functions, this manual is written according to MotionVenus1.4.8, please upgrade the latest version of the software.

2

The PART Ⅰ   Hardware

1   Attitude Sensor

1.1 Parameter

No.	Parameter		Note
0	Attitude accuracy	Dynamic accuracy Roll/Pitch≤0.5deg , Pitch≤1deg(RMS)	Measurement accuracy will be different under different circumstances.
		Static accuracy Roll/Pitch≤0.2deg , Pitch≤0.5deg(RMS)	
1	Weight	20g	_____
2	Acceleration range	±8g/±16g	_____
3	Angular velocity range	±2000dps	_____
4	Angular measurement resolution	0.02deg	_____
5	Attitude measurement range	triaxial 360deg	_____

6	Maximum update rate	200fps	_____
7	Sensor working time	3-4 hours	_____
8	Sensor wireless data transmission frequency band	2.4GHz	_____
9	Size	Diameter :44mm, height: 16mm	

1.2 Attitude Sensor OFF/ON

ON：Short press (<1 second) switch button;

OFF：Long press the switch button for more than 2 seconds and release the button.

2 Router

2.1 Parameter

No.	Parameter		Note
0	Weight	87g	_____
1	Size	Diameter :100mm, height: 23mm	_____
2	Connection mode with sensor	Wireless 2.4 G	_____

| 3 | Connection mode with computer | USB | ——————— |

2.2 For further communication distance, connect the external high-gain antenna.

3   Charge

3.1 Parameter

NO.	Parameter		Note
0	Weight	670g	———————
1	Size	Diameter:230mm, height: 37mm	———————

3.2 About the charge

Insert the sensor into the insert row and press the circular switch.

The PART Ⅱ   Quick use equipment

1   The connection

1.1 Connect router

Insert one end of the USB cable into the computer and the other end into the USB port of the

4

router.

1.2 Downlaod Software frome office website www.foheart.com.

2   Wear

2.1 Wearing diagram
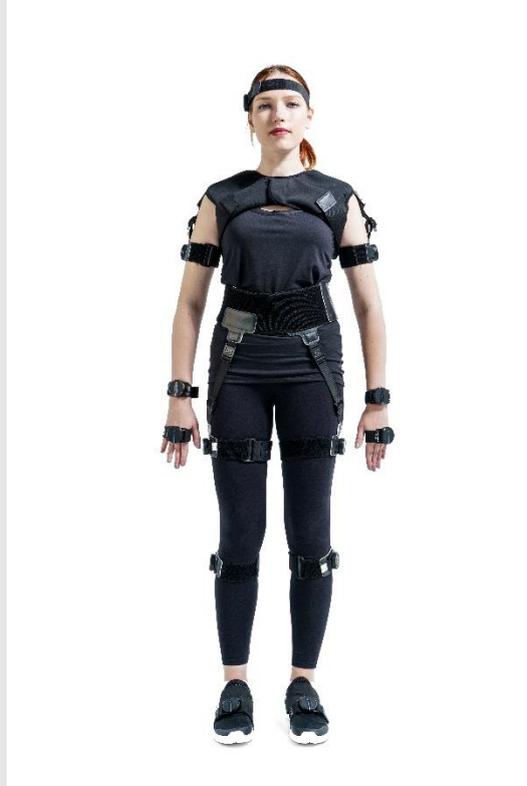
Note：

2.1.1 The light guide is pointing straight ahead.

The light guide is pointing straight ahead.

2.1.2 Other sensors are unlimited, but must correspond to the body part on the sensor label.
2.1.3 Sensor mounting base
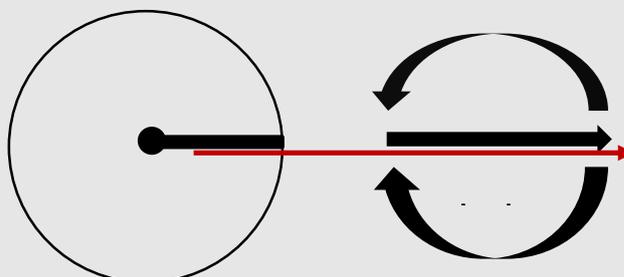
When the sensor node is installed, the light guide column (the direction of the red arrow in the figure above) is placed in the same direction as the arrow on the base. Then, the sensor can be fixed by rotating clockwise, and the sensor can be removed by rotating counterclockwise.

The PART Ⅲ   About Software

【Introduction】

MotionVenus is the PC client software with the FOHEART ·X inertial motion capture suite.

Its main function is to record motion capture data and export the data into BVH, FBX and other commonly used data formats in the animation industry. In addition, it can also send real-time (or offline) data streams of the performers' movements to 3D game engines such as Unity3D or Unreal Engine 4 to drive any virtual animated characters.

【Software download】

a.Software download site www.foheart.com/en/

b.Note:www.foheart.com and https://github.com/foheart is the only Is the only download site so far.

Software version description		
No.	**Version**	**Description**
1	V1.0.1	_____
2	V1.2.1	_____
3	V1.2.6	_____
4	V1.2.8	_____
5	V1.3.0	1. The network transmission of offline data is added, which supports up to five groups, and multiple offline data streams can be played in Unity3D and UE4.2. Modify network data transmission to be automatically forwarded to the background.3, added the details page of RAW file, can view the internal information of the file.4. Added the setting of euler Angle rotation sequence in the drawing area, supporting all six rotation sequences.5, added a multi-language switch, now supports English.6. Interactive help function is added. Click the question mark button in the upper right corner of each component to get the network help document related to this component.7. The Biped BVH format directly exported to 3Ds Max is added.8. Node calibration video is added.9. Fully support the selection of frame rate for all movie and TV playback and export, and add support for PAL, NTSC and other formats.10. Bug fixes for other details.

6	V.1.3.4	1. Increase the obvious visual prompt after the node suffers from serious magnetic interference.2. Add automatic monitoring function for recorded folders, and the list will be updated automatically after adding or deleting files.3. Fixed a problem that detected incorrect number of routers and charging bases.4. Added automatic software update function, please check whether there is a new version in help-> check update.5. Corrected the slight difference of displacement data in network data stream (which would affect unity3d.ue4 and MotionVenusSDK).6. The node calibration interface adds a button for individual calibration for each node.7. Optimized the algorithm and improved the speed and success rate of node calibration.8. Fixed non-integer frame rate bug.9. Modified quaternion in UDP sending configuration. Invalid rotation order of euler Angle.10. Dozens of bugs and details optimization.
7	V1.3.6	1. Fixed incorrect frame number of BVH exported data.2. Built-in Unroll and Gimble repair mechanism to directly export the correct FBX without any need to fix it in the MotionBuilder.3. Added the use of the game engine to control MotionVenus function, see the technical blog: http://blog.foheart.com/?P = 664. Bug and detail optimization.
8	V1.3.8	1. Attitude solution can automatically handle most of the up and down jumping, sliding and other problems.2. Added the file packaging function, which is convenient to copy the moving capture file to any location quickly.3. Added the function of raw data export, as detailed in blog http://blog.foheart.com/4. Bug and detail optimization.
9	V1.4.0	1. Optimization of attitude solution performance.2. Software homepage optimization.3. User configuration reservation function.4. Customize animation library path /.raw file association and other functions.5. Bug and detail optimization.
10	V1.4.2	1. UDP protocol adds support for extended data (acceleration, magnetometer, gyroscope).2. Corrected UDP protocol string type accuracy.3. Modify. CSV file format, and add bone, joint, gravity data support.4. Optimize the stability of USB device connection.5. Some bugs and details optimization.
11	V1.4.4	_____
12	V1.4.6	_____
13	V1.4.8	1. Added driver free mode support for receiver, compatible with win7/8/10; This mode requires new hardware support. **But this version of the software is compatible with all inertial motion capture systems of FOHEART.** 2. Bug and detail optimization.
Annotation		**For more information, please visit our website.**

【Software functional】

1 Sensor field calibration

When you open the software for the first time, the following screen will be displayed:

You can click "next" to see the instructions before calibration.

Current Model : Actor1 (Live)

Help Video

Nodes in horizontal, vertical view

Node upright, vertical view

Node upright, vertical view

Step 1: node in horizontal, above 4 turns in the same direction.

Step 2: node upright, face node positive, more than 4 turns in the same direction.

Step 3: node upright, face node profile, more than 4 turns in the same direction.

	Hip	Spine	Head	L Shoulde	Upper Ar	L Forearm	L Hand	R Shoulde	Upper Ar	R Foream	R Hand	Upper Le	L Leg	L Foot	Upper Le	R Leg	R Foot
Progress																	
Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate	Calibrate
Progress	0%	0%	0%	0%	0%	0%	0%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%

In order to ensure the accuracy of the node calibration, please keep away from magnetic disturbance.
Click calibrate button to calibrate all sensors.

✓ Complete   ✗ Not complete   Strong magnetic disturb

Calibrate

Previous   Next   Close

Choose one of the following calibration actions:

Calibration action 1:

frame1.png frame2.png frame3.png frame4.png frame5.png frame6.png frame7.png frame8.png frame9.png frame10.png frame11.png frame12.png

frame13.png frame14.png frame15.png frame16.png frame17.png frame18.png frame19.png frame20.png frame21.png frame22.png frame23.png frame24.png

frame25.png frame26.png frame27.png frame28.png frame29.png frame30.png frame31.png frame32.png frame33.png frame34.png frame35.png frame36.png

frame37.png frame38.png frame39.png frame40.png frame41.png frame42.png frame43.png frame44.png frame45.png frame46.png frame47.png frame48.png

frame49.png frame50.png frame51.png frame52.png frame53.png frame54.png frame55.png frame56.png frame57.png frame58.png frame59.png frame60.png

frame61.png frame62.png frame63.png frame64.png frame65.png frame66.png frame67.png frame68.png frame69.png frame70.png frame71.png frame72.png

frame73.png frame74.png frame75.png frame76.png frame77.png frame78.png frame79.png frame80.png frame81.png frame82.png frame83.png

Calibration method 2:

Hand - held nodes draw figure 8 in the air.

Repeat 3 to 4 times.

When the position of "calibration status" is shown as "√" successively, it means that the calibration of this sensor is completed.

You can click the "finish" button in the lower right corner to complete the sensor calibration process.

Special note: when the magnetic field of the sensor is not affected by the interference of the surrounding environment, there is no need to recalibrate the sensor every time it is turned on.

Be sure to recalibrate the sensor when changing locations (such as taking the sensor to another city for use).

When the sensor using the environment magnetic field interference especially serious, you can open the calibration box, check to see if the corresponding calibration status of the is in a state of "x" or "M", when to display "x", would you please to calibration of the sensor, when the show is "M", please stay away from strong magnetic interference around (what is the magnetic interference and how to avoid?

Recalibrate the sensor in this area.

2 Device list bar
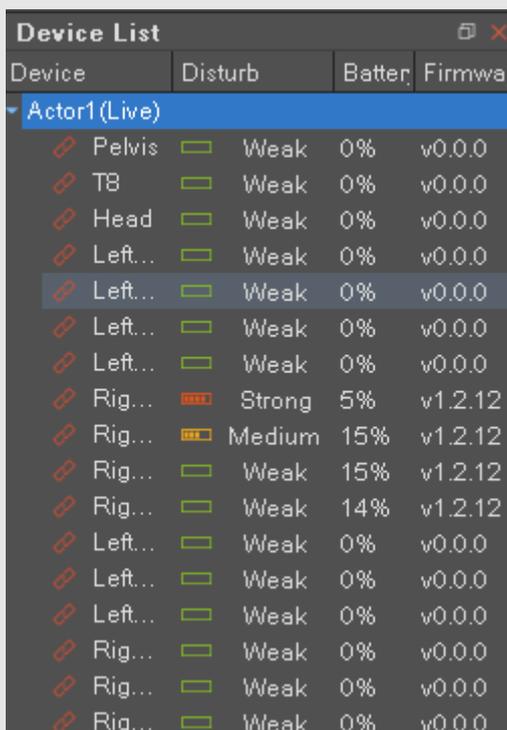
Each device connected to the computer terminal is loaded into a tree list, which shows the connection status, magnetic interference status and remaining power of each Sensor in detail.

The files opened in the library form are displayed here. The difference is that the playback files cannot display the device information, only the word "RePlay" is displayed in the charge column.

Serial number	Body part name
0	Pelvis
1	T8（On the back）
2	Head
3	LeftShoulder
4	LeftUpperArm

5	LeftForeArm
6	LeftHand
7	RightShoulder
8	RightUpperArm
9	RightForeArm
10	RightHand
11	LeftUpperLeg
12	LeftLowerLeg
13	LeftFoot
14	RightUpperLeg
15	RightLowerLeg
16	RightFoot

2.1 When MotionVenus is connected to multiple sets of devices simultaneously, the system automatically Numbers the devices, such as: Actor1(Live), Actor2(Live), Actor3(Live)...
, under each list are all nodes of this set;

You can click "Actor1(Live)" in the head of the list, and click it to indicate that this set of equipment is currently selected. The following operations (calibration, etc.) are carried out for the selected set of equipment.

2.1.1 "Pelvis……" refers to the body part corresponding to the sensor node of this set of equipment.

2.1.2 When connected is , the sensor in this part **is not connected** with the software. Please check whether the sensor is normally opened, and when connected is , the sensor in this part is normally connected.

2.1.2 "magnetic interference" : when displayed in the column of magnetic interference, it means that the sensor at this position is not subject to magnetic interference from the surrounding environment; when displayed in the column of magnetic interference, it means that it is subject to magnetic interference from the surrounding environment;

2.1.3 When close to the magnetic interference, the software will have a visual hint of magnetic interference, so that even at a distance from the software, you can see some parts of the magnetic interference.

2.2 "battery" shows the electric quantity of the sensor at the corresponding position, which is refreshed every 10 seconds.

2.3

2.3.1 Right-click on the device name and "Power off" to turn off all sensors.

2.3.2 "Copy" means to Copy the current name, such as "Actor1(Live)".
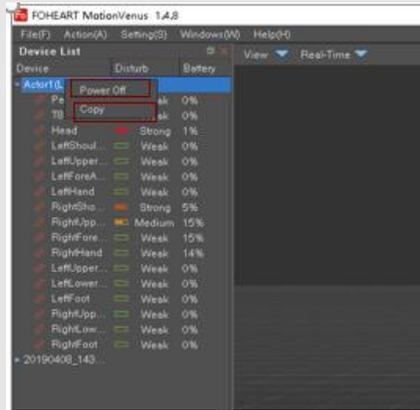
Note: in the process of use, since the feet are most vulnerable to magnetic interference, when the "magnetic interference" column shows abnormality, check whether there is a strong magnetic interference source around. If there is, keep away from it. When the magnetic interference is away from it, the foot Sensor can automatically return to the normal state.

3 3D character display windows 3D
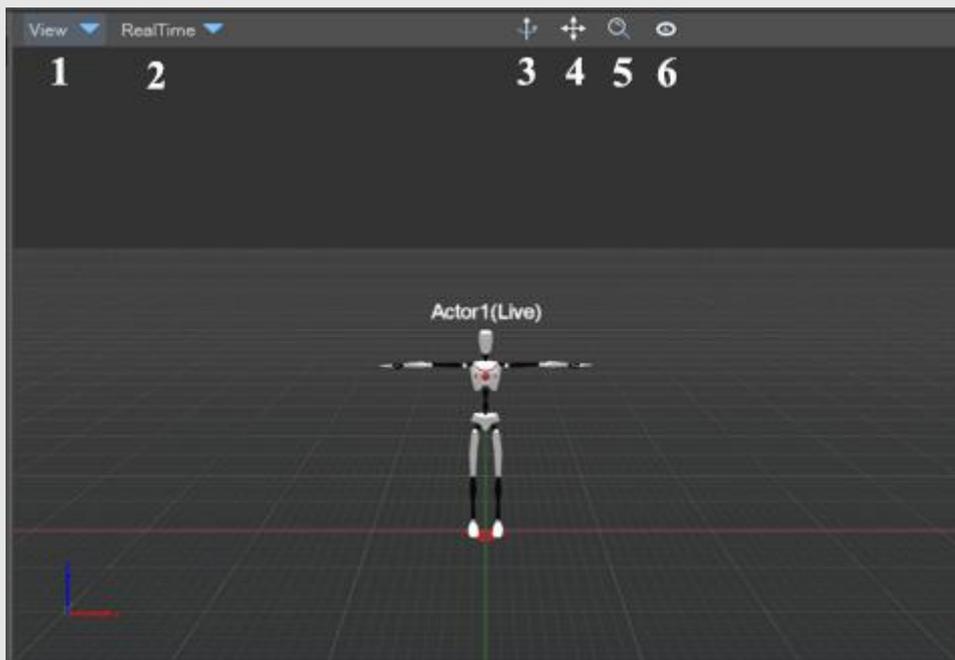
3.1 Click the "view" button in the figure to display "main view", "four View", "full screen" and "Ground" successively. By default, the state displayed is "Main View" and "ground plane".
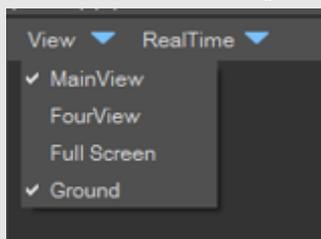
3.2 When four views are selected, the front, top, and side views of the avatar are displayed.
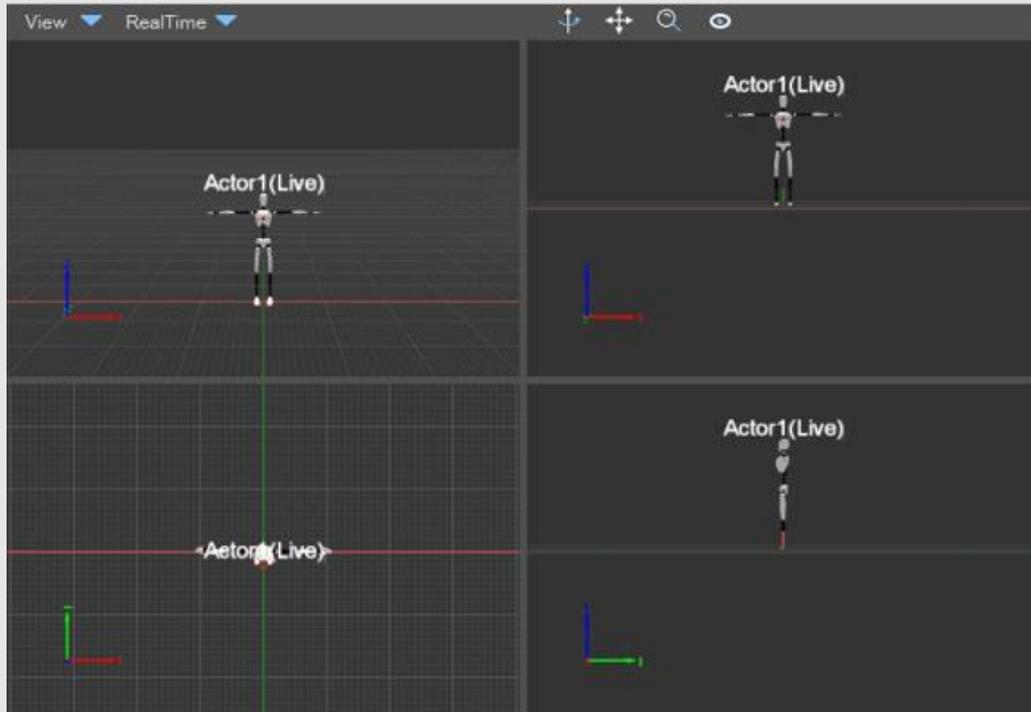
"Full screen" shows the currently selected view in full screen. You can press "Esc" to exit the full screen state.

3.3 "real-time mode" and "playback mode" are shown in the figure below. Virtual characters in the real-time mode are synchronized with those wearing motion capture devices for real-time performance;

When a recorded data file is opened for playback, it is in "playback mode". Click here to switch from "playback mode" to "real-time mode".
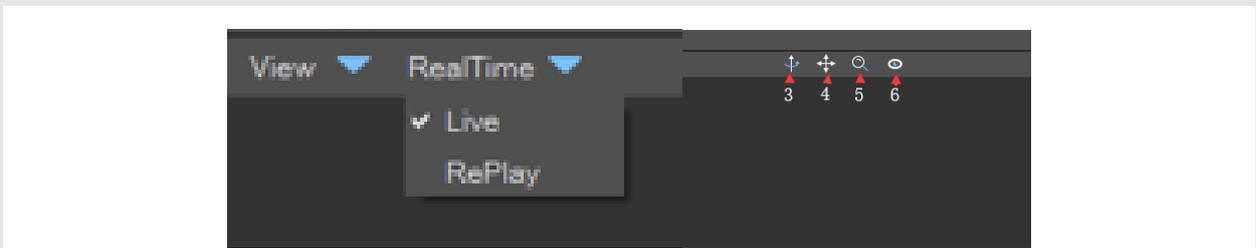
3.3.1 Hold down and drag the icon 3 to rotate the scene 360 degrees to view the 3D character model from multiple angles.

3.3.2 Hold down icon 4 and drag, then you can pan and drag the scene in four directions.

3.3.3 Hold down icon 5 and drag to zoom in or out.

3.3.4 Icon 6 is "character follow". Click the button to make the camera follow the 3D character.

4   Calibration management

14
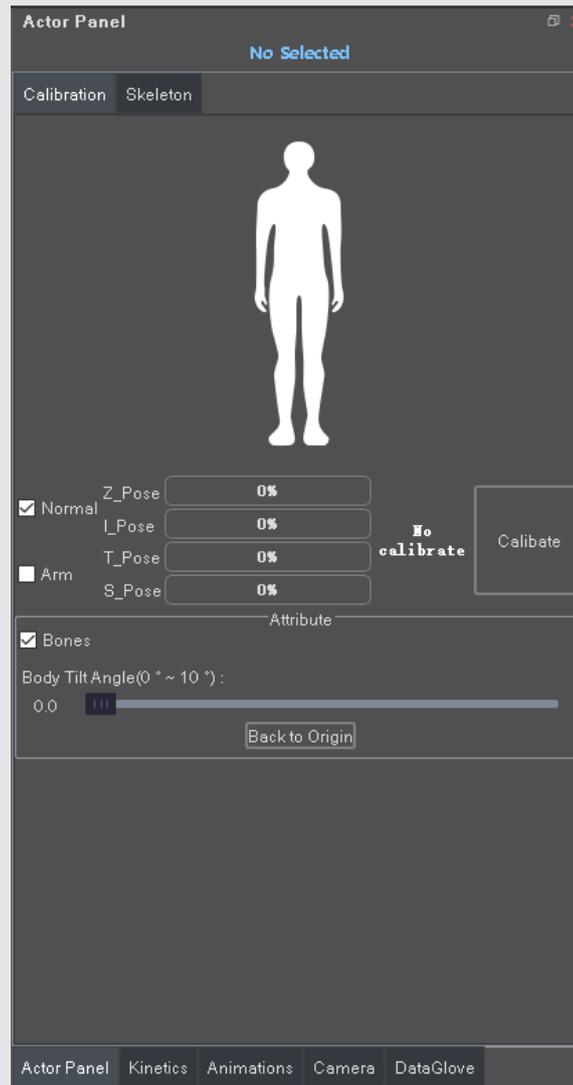
4.1 When the motion capture device is worn, human body calibration can be started.

The aim of calibration is to eliminate the wearing errors of motion capture nodes on different human bodies.There are four calibration methods: "Z_Pose", "I_Pose", "T_Pose" and "S_Pose".To calibrate the upper body parts separately, check the selection box in front of the "arm".Click "start calibration" and you can watch the above pictures of people and make corresponding actions. The default time of each calibration action is 3 seconds. You can customize the calibration interval time by clicking "Settings" and "options" in the software menu bar.

4.1.1 Z-Pose

15

4.1.2 I-Pose
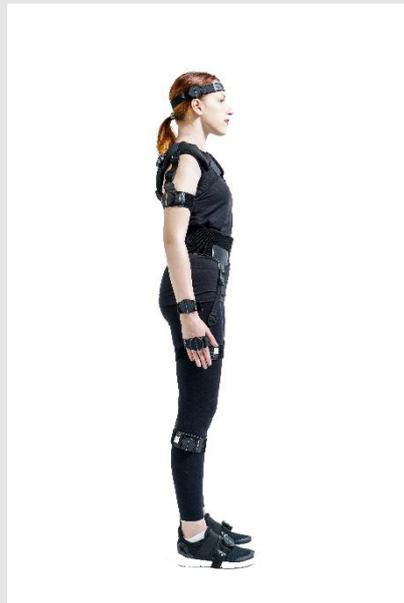
4.1.3 T-Pose arms to the sides, making sure they are straight.
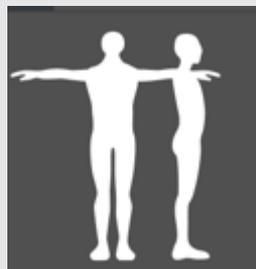
4.1.4 S-pose your arms in front of you, making sure they are straight.
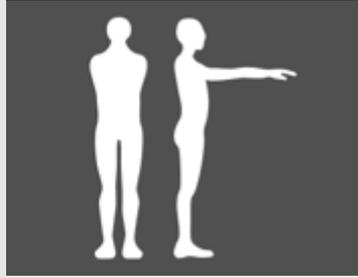
4.1.5 All calibration motion must be parallel to the feet.
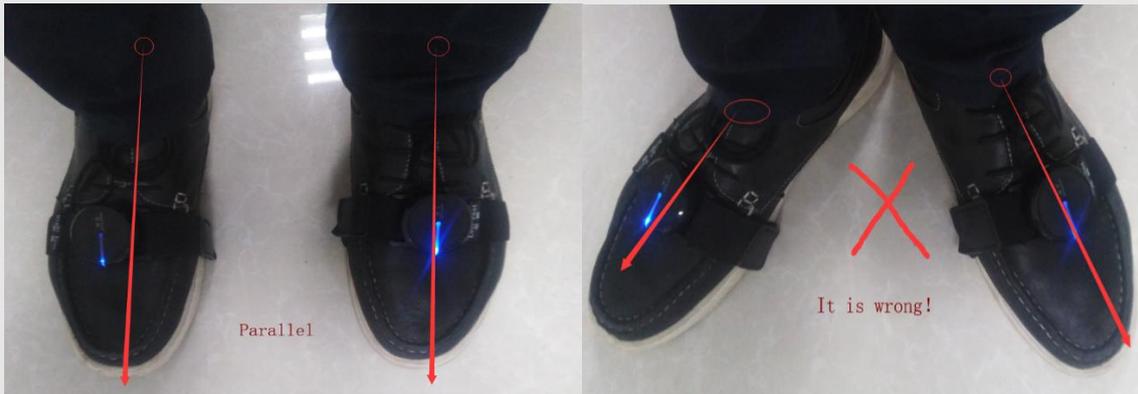
5 Body parameter Settings
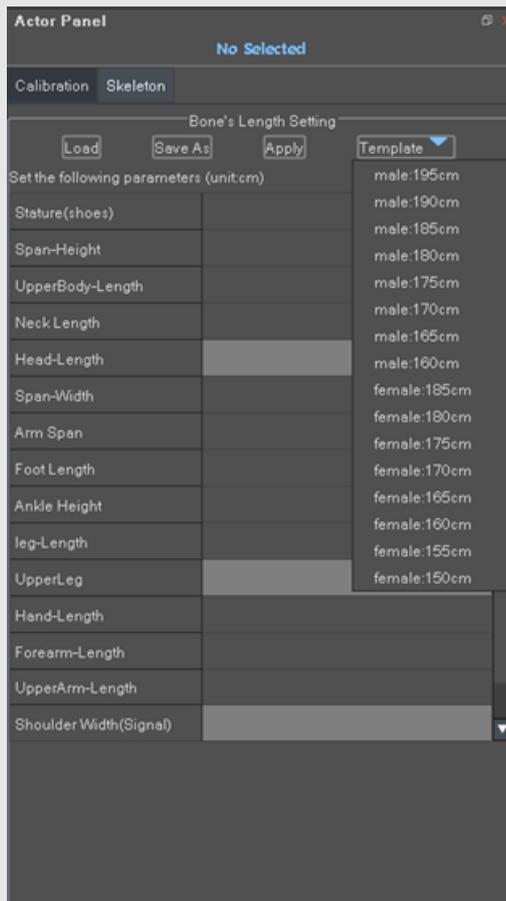
In the "bones" form, here you can choose the bone length template suitable for your height.Or precisely measure and set bone lengths.You can click to view the Settings of your actual height, bone length, make the virtual character model body parameters with you.Correct body parameter Settings can make your movements more accurate. For example, for the two-handed gesture, you need to set the correct upper and lower arms as well as the length of the hand, otherwise, the virtual character's hands cannot be folded or his arms can be crossed.After selecting the template, you must click the "apply" button to make sure you use it.If you are using a self-changing bone length, be sure to click save as to save the current configuration so you can manually choose to load your custom bone length next time.

6 Dynamics/kinetics
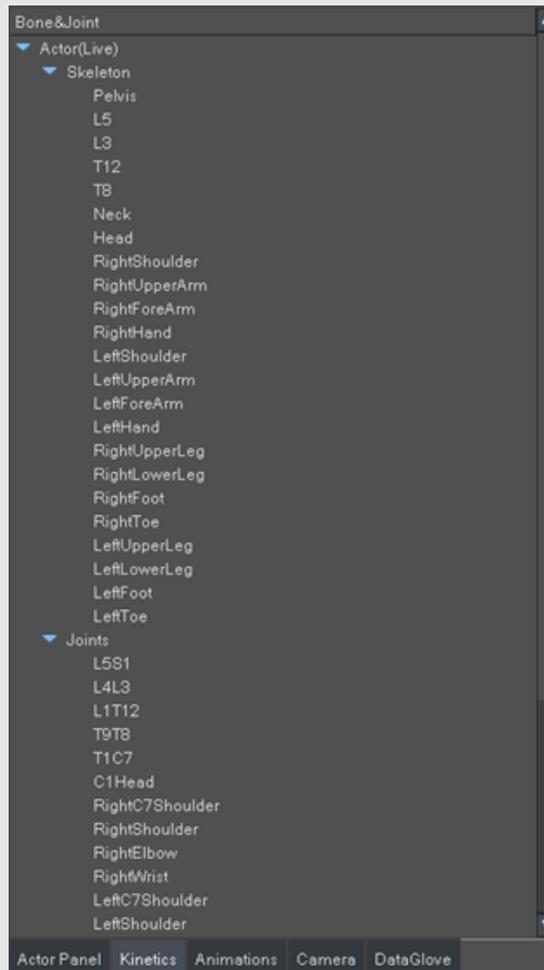
Right click on each bone or joint to view euler Angle data of the bone or joint, such as "right shoulder", or click on the bone or joint and drag it to the drawing window.Here we can view the bone or joint Angle change information we are interested in separately, and simultaneously monitor (up to four segments) the bone or joint Angle change information.

7 Drawing

Data from the euler Angle in the dynamics window are shown in the mapping area below the software, which monitors the angular changes of four bones or joints at the same time.There are six rotation order of angles, XYZ, XZY, YXZ, YZX, ZXY, ZYX, which can be selected from the drop-down box.Select the arrangement of display areas in the drop-down box at the top left of the drawing module.Halt/Resume: pause or Resume drawing a curve. After pausing, you can drag the data of each drawing area to see the historical data. You can also use the mouse wheel to scale the data displayed.
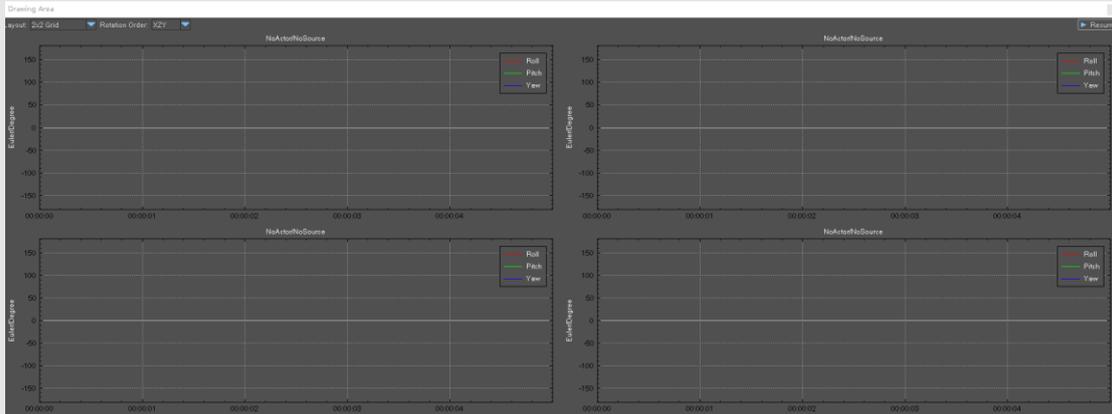
The bone or joint in the dynamic window is supported by a mouse drag and drop that can be placed directly into the drawing window.
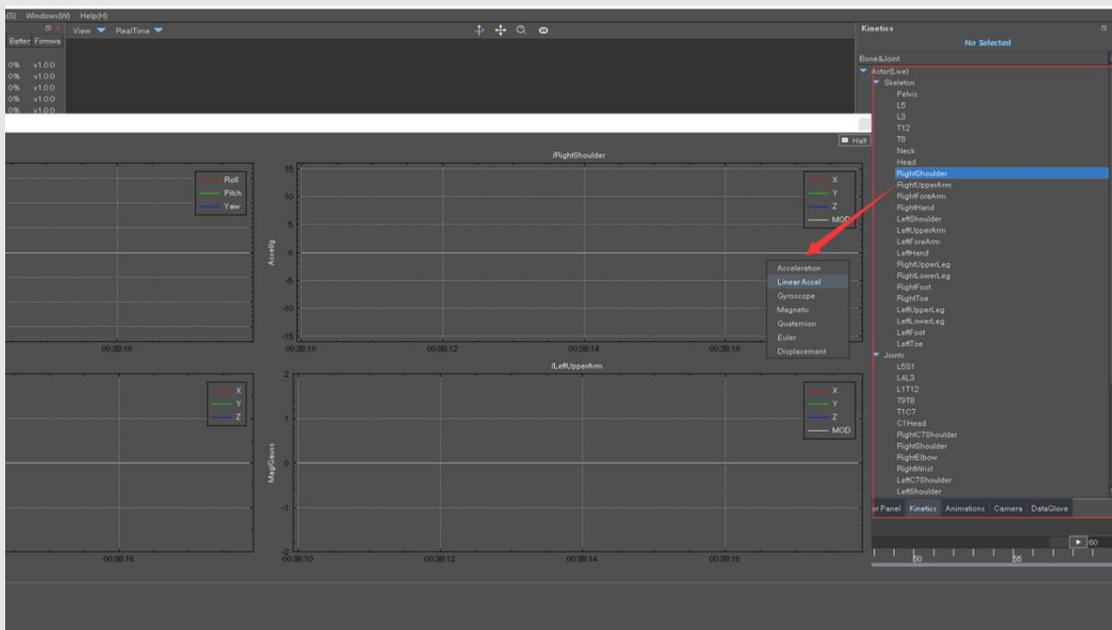
You can turn on the sensor data inside the device.
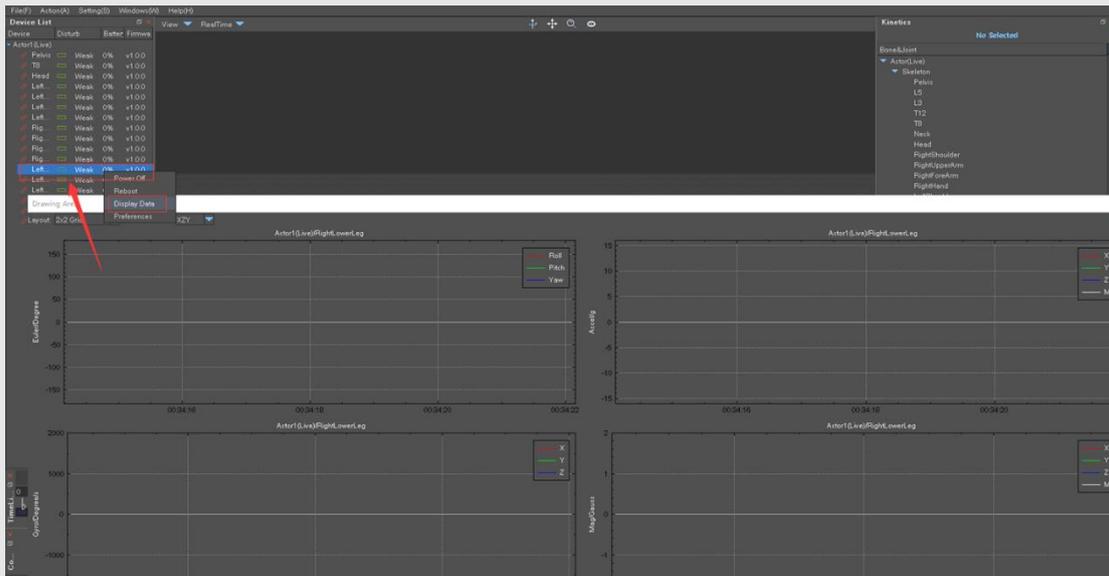
8   The timeline

The timeline bar is used to manage the recording, playback, fast and slow playback of real-time data, and modify data with the frame data modification module.
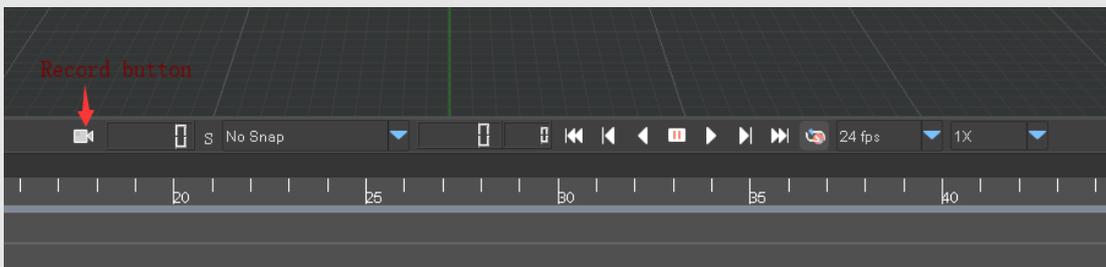
8.1 Click the record button to record the real-time data flow, and the completed data flow will be displayed in the record file management module.The main window will be marked red with a red border during recording:
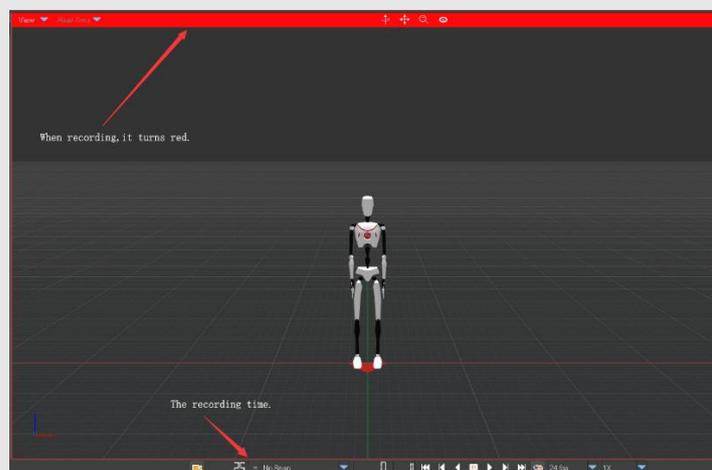
Note: while recording, you cannot play back the file at the same time. If you switch to playback mode, the recording will be blank.

8.2 Playback frame rate can be changed to preview the actual effect of exporting this frame rate as BVH or FBX.Frame rate selection supports multiple standard frame rates.

Frame	Meaning
PAL	25 fps
NTSC Full	29.97 fps
NTSC Drop	29.97 fps

8.3 The left and right sliders in the middle are used to control the display area of the timeline.You can directly double-click the slider to input frame number to achieve fast jump.
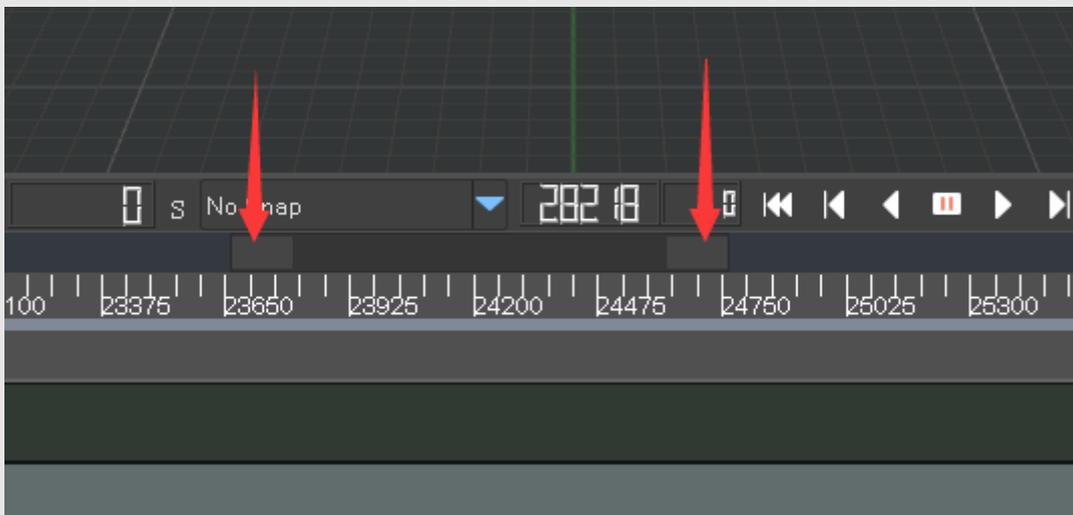
8.4 There are four playback modes:"Normal play";When "drag by frame" is played as the drag timeline slider, the minimum interval is one frame;"Play by frame" means the minimum interval is one frame when playing;When "drag to play" is played and dragged, the minimum interval is one frame.

9 The database

9.1 Function overview

Library module is mainly responsible for:

9.1. 1 Store, manage and play back recorded motion capture files;

9.1.2 Export action files into BVH, FBX and other common formats;

File naming rules: record date + time + role name.

For example, 20170713_172853_Actor1(Live), 20170713 represents the recording time on July 13, 2017, _172853 represents the recording time at 17:28:53, _Actor1(Live) represents the role name;
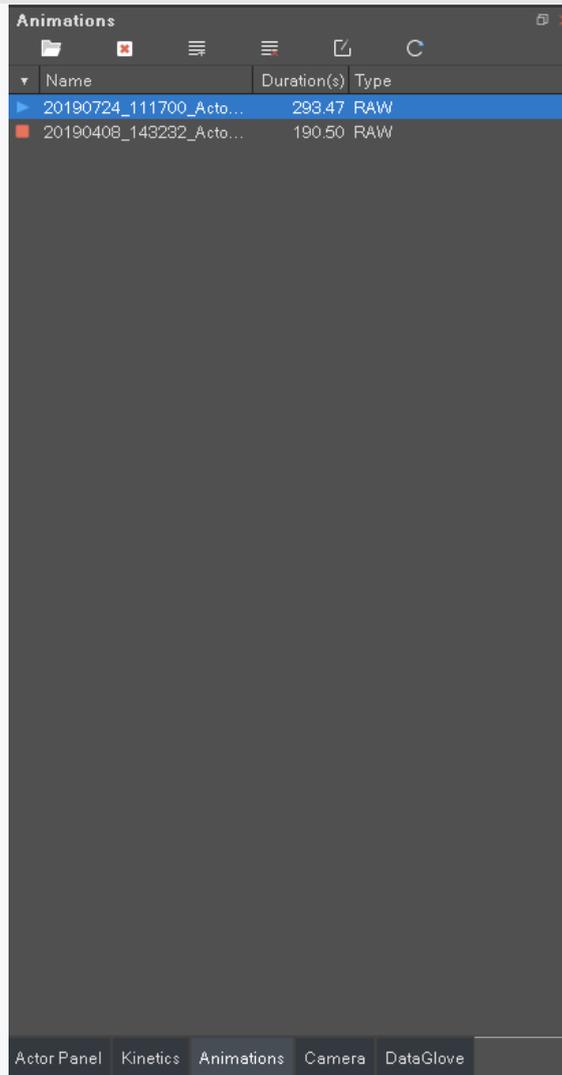
9.2 Data export

Right-click the opened file and select "export data within the range of timeline" from the pop-up menu. The exported data is the range determined by the two sliders in the middle of the timeline module.
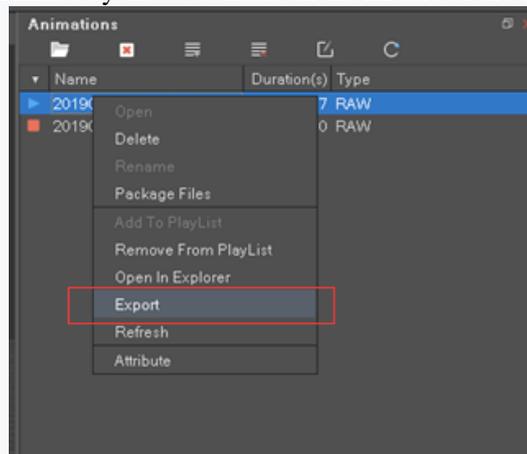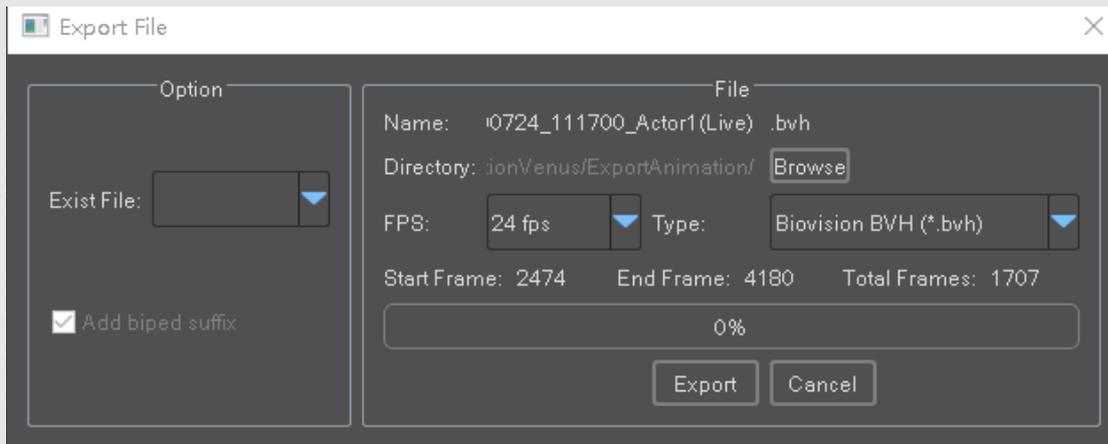
9.2.1 Export options

There are three options for handling files of the same name:

Automatic rename: the "_1" suffix is automatically added to the same named file.

Overwrite: automatically overwrites duplicate files.

Ask: each time a dialog box pops up asking if it is overwritten.

When the exported file is 3Ds Max Biped BVH, the _biped suffix is automatically added to the end of the file.

9.2.2 Frame rate selection

Frame rate selection supports multiple standard frame rates.

Frame	Meaning
PAL	25 fps
NTSC Full	29.97 fps
NTSC Drop	29.97 fps

10   3D Max Biped BVH
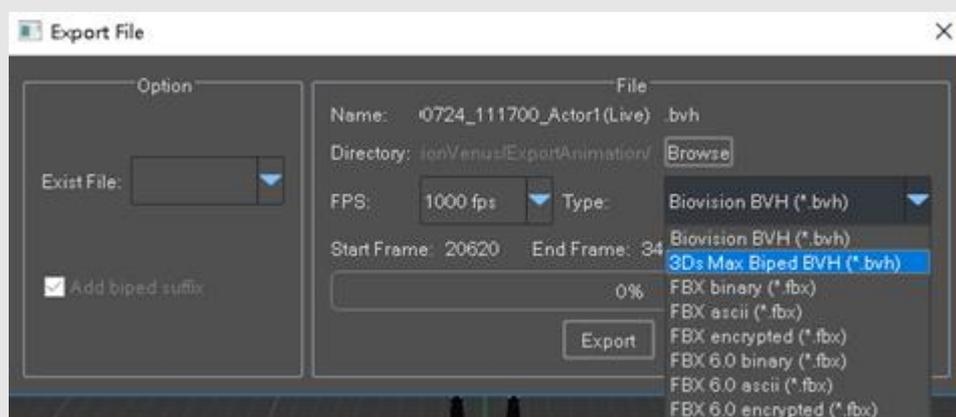
Import of this file format can be directly supported in 3Ds Max by:

First drag and drop in the scene to create a default Biped model,

And then Load Motion Capture File
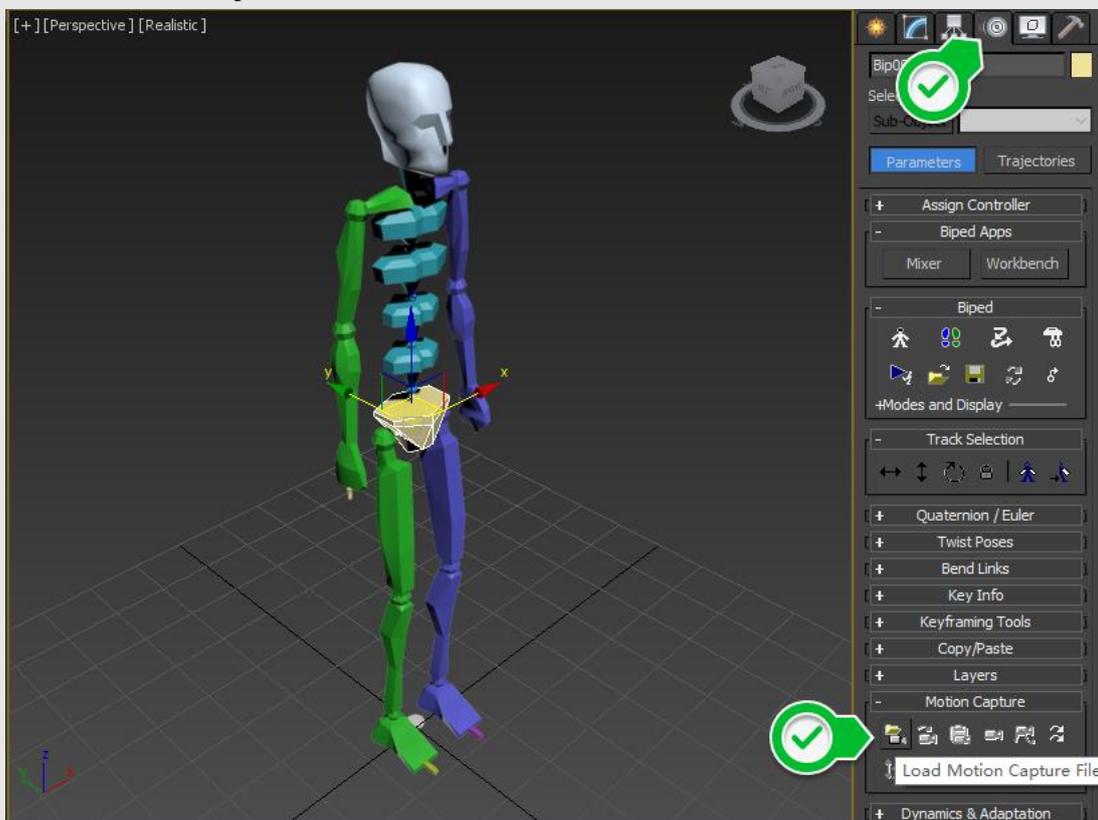
Select the exported ActorM_biped. BVH, and the final display is as follows:
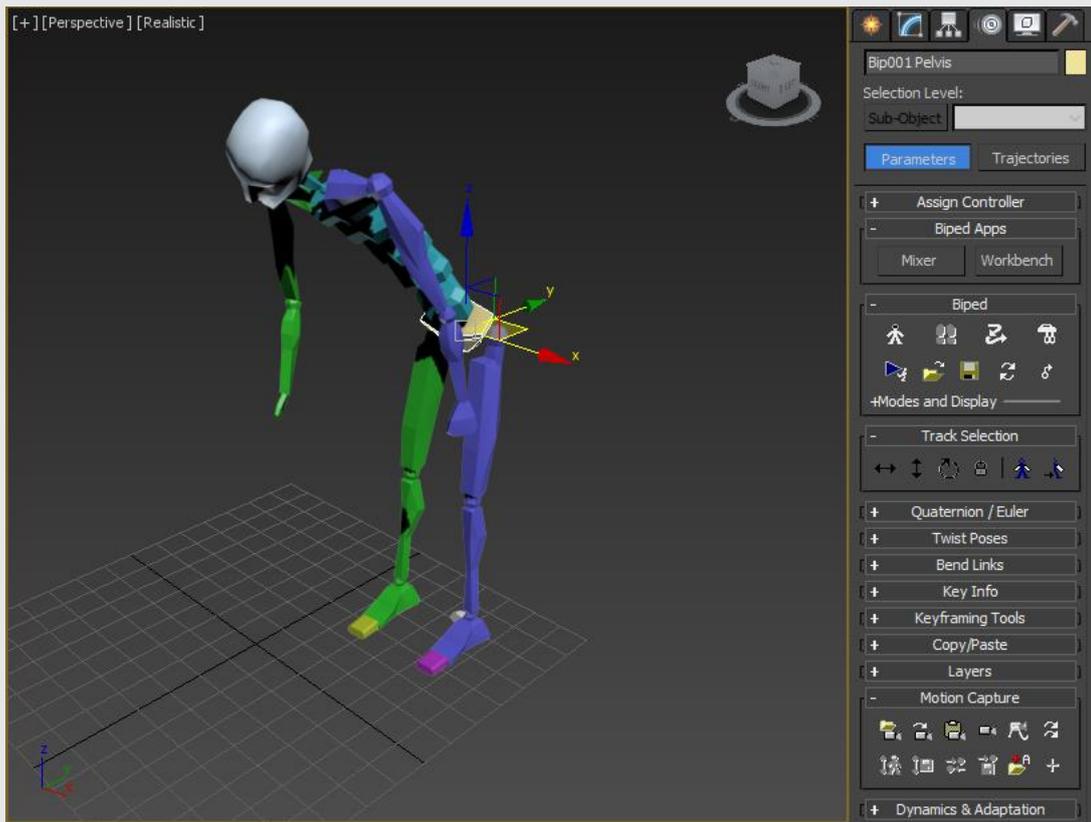
11   FBX Export

The export steps of FBX and BVH are exactly the same. Select:

11. 1 Start and end frames.

11.2. Export frame rate.

11.3 Click export.

12   Document information

Right click properties to view the details of the recorded file, including the hardware package used, total frame number, bone length and other information.
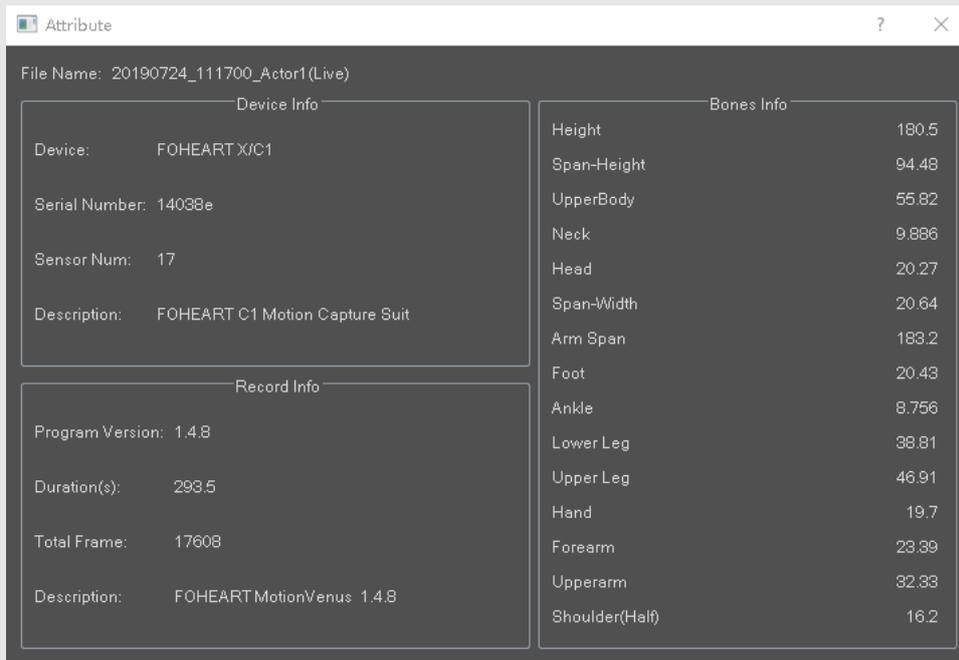
13 Playlist

Right click to add to the play queue, which means to add the current file to the playback stream. All files in the playlist will be forwarded to the network port in the background (for example, sent to Unity3D, Unreal Engine 4 and other third-party software or engines).
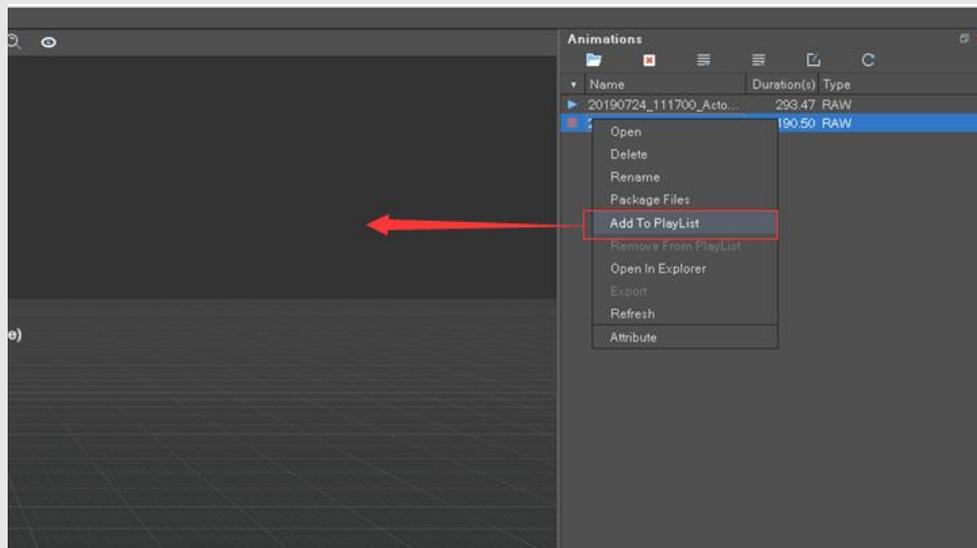
14 Document packing

When motion capture files need to be moved in different storage locations, for ease of operation, you can use MotionVenus' built-in file packaging function to quickly compress the current file and all related files to the specified storage location.In the "library" dock bar, select the file to be operated, right click "package file",

and the following menu will pop up:
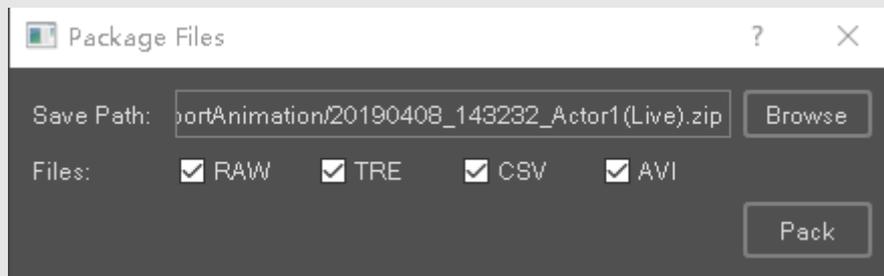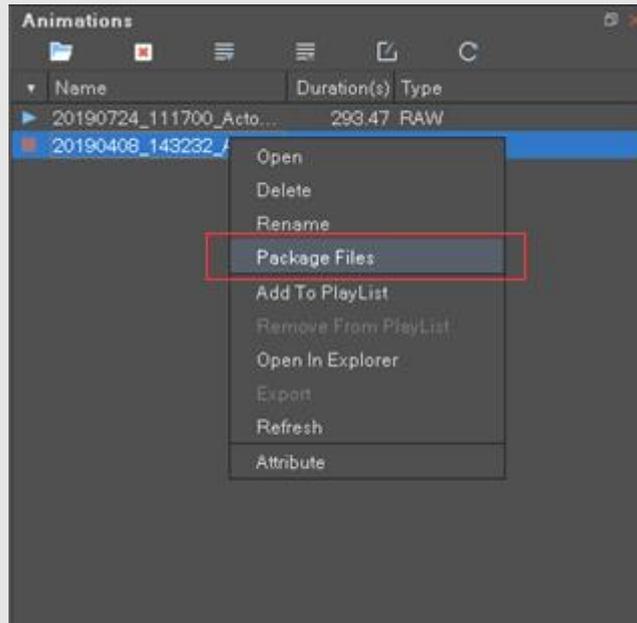
RAW: RAW file for motion capture data.

TRE file. If you have edited a contact point, check this.

CSV file: saves the original data (quaternion, euler Angle, acceleration, angular velocity, magnetic force value) information of the Sensor. If the option of exporting original data is turned on during recording, this file will be generated.

AVI file: saves the synchronized video video. If the camera capture function is used in the motion capture process, the synchronized video file will be generated.

After compression, a. Zip file named after the file name is generated.

If you need to use the packaged motion capture file, you need to unzip it to the library folder root of MotionVenus.

15 Contactpoint Editing

This module is used to correct accidental errors during motion capture, such as slippage, jitter, etc.
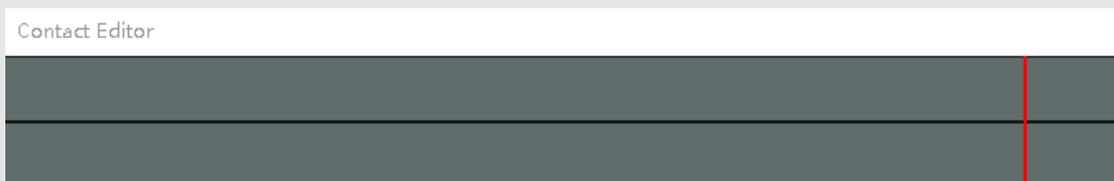
Operation process: there are two data frame states displayed in the frame data modification window. "LFoot"

at the top represents the state correction of the left foot, and "RFoot" at the bottom represents the state correction of the right foot.After loading the recorded data file, determine the animation scope to be modified, take the right click position as the starting point, drag to the designated position and lift as the end point, and then the following menu will be available for algorithm modification.

15.1 Select "touchdown", and the algorithm will execute the selected data segment according to the currently selected "LFoot" or "RFoot" to calculate the location state algorithm, and then re-calculate the data state.

15.2 Select "do not touch the ground", and the algorithm will implement the "LFoot" or "RFoot" of the selected data segment as the non-touching location operation state algorithm, and then re-settle the data state.

15.3 Select "default", and the algorithm will restore the selected data segment to the original state of unmodified data, and re-calculate.After editing, select save from the file menu.

16   Synchronize Video Capture

Function overviewMotionVenus can use USB camera to record video stream synchronously. Video stream and motion capture data can be synchronized at frame level (16.67ms).

16.1 Preparation for use:

16.1. 1 USB camera compatible with the system.

16.1.2 Make sure the camera driver is installed correctly.In the dock bar in the right side of MotionVenus, select camera capture and click the refresh button to get the connected camera.If there are multiple cameras in the system, you can select the camera device you want to use from the drop-down list.If there is an open USB camera device, the background will synchronize recording video stream from the camera by default when clicking the recording motion capture file. After recording, video will be saved as a video file with the same name as. Avi.When playing back video, if there is a video file with the same name, it automatically plays back the video file synchronously in the video window.

16.2   Video recording parameters:

16.2.1. Resolution: 640 x480px

16.2.2 Frame rate: 30fps
16.2.3 The number of video recorded at the same time: 1

17 Frequently Asked Questions

Software Usage Problems

Q: Why is the animation recording function not available?
A: If the installation directory of MotionVenus is on the system disk C, you need to run in administrator mode. Otherwise, data recording cannot be performed. This problem does not exist if the software is installed on a non-system disk.

Q: When multiple devices are used at the same time, only one device can display motion animation?
A: When multiple sets of equipment are used at the same time, each set of equipment should be calibrated separately. Click to select the root node of the device in the left list, and click the calibration button on the right to perform N-Pose, T-Pose and other calibration processes.

Q: When installing the driver, it always prompts "Installation failed"?
A: It may be that the installation has been successful, but the status is not updated; please be sure to put the device driver in the English path; after installing the driver, try to restart the computer or re-plug the FOHEART X/C1 router.

Q: Can the calibration of a single Sensor be performed in the game engine?
A: No. At this stage, the game engine only supports human body level initial motion calibration.

Q: If you use the game engine to control character calibration, can MotionVenus not run?
A: No. MotionVenus needs to be run to solve human motion.

Q: Why is there no response on the MotionVenus side after clicking the calibration on the Unity side?
A: Please check if the name of the Unity is correct. Check if the UDP_Target_IP and UDP_Target_Port on the Unity side are filled in correctly.

18 Device Usage Problems

Q: Magnetic interference and how to avoid it?
If there is a problem with the node angle display, or if magnetic interference is still present near the interferer, calibrate the node according to Section 3 of this manual.
A: When the node is calibrated and used, it should be away from magnetic interference, for example:
(1) Electronic devices such as mobile phones and watches, and key coins;
(2) magnets such as iron, cobalt, nickel, and alloys thereof;
(3) Within a few meters around the working of high-power substations, wireless base stations, air-conditioning cabinets, or high-power motors;
For the above-mentioned (1) (2) type of interference, a distance of 20 cm or more is required, and for the type (3) type of interference, the distance is required to be at least 1 m.

Q: How many sets of devices can the FOHEART X/C1 support at the same time?

A: You can support four sets of devices in one software at the same time.

Q: Feet jitter during use?

A: Keep away from severe magnetic field interference; adjust the "body tilt angle value" below the calibration bar (from the default value of 6° gradually increase), gradually increase or decrease to find the angle that suits you. (Because the angles of the legs of different human bodies are not the same, it is best to adjust manually)

Q: During the use of the software, the nodes are suddenly dropped.

A: The PC is replaced with another USB port. Replace the USB cable. In addition, it may be that a USB hub is used, and the device is dropped due to insufficient power supply from the USB hub. Make sure that the USB hub you are using can supply at least 350mA of supply current or use a USB hub with independent power supply.

Q: Can the router/receiver or charging dock not be connected after the system is updated?

A: Usually occurs above the WIN10 system. This is a phenomenon caused by the driver problem. Please refer to section 1.4 of the link for operation.

Q: How does magnetic interference affect motion capture?

A: The FOHEART motion capture system node has built-in magnetic interference shielding algorithm, which can block sudden magnetic interference, such as suddenly holding the mobile phone; the shielding process lasts for 30 seconds. If it can't get rid of magnetic interference within 30 seconds, it will cause the final result. Obviously poor influence.

Q: What is the rate at which the hardware Sensor uploads data?

A: 24~96fps, default 96fps.

Q: Is the data rate of MotionVenus forwarding data to Unity3D or Unreal Engine?

A: 60fps.

Q: What data does the MotionVenus forward data stream contain?

A: Euler angle of 23 segments of bone; Quaternion of 23 segments of bone; Local coordinates of 23 segments of bone; Gobal coordinates of 23 segments of bone; Accelerometer original value of 17 Sensors; Gyroscope original value of 17 Sensors; The original value of the magnetometer of 17 Sensors; (the original value is not output from the factory setting)

Q: What is the optional format for MotionVenus to forward data streams?

A: binary stream (the smallest packet in this way); readable string; Json format;

19 Precautions

— Do not use or store motion capture sensors near heat sources such as fire or heaters;

— Please use the original charging stand to charge;

— Do not put the motion capture sensor into the water or get it wet;

— Do not heat the motion capture sensor;

- prohibiting impact, throwing or subjecting the motion capture sensor to mechanical shock;

- prohibiting hammer or pedal movement capture sensors;

– disassembly of the motion capture sensor in any way;

– prohibit charging the motion capture sensor under fire or extreme heat;

• Use the original adapter to power the charging dock. Poor quality adapters may cause damage to the motion capture sensor battery.

20 Others

20.1 Definition of coordinate system

20.1.1 definition of hardware coordinate system

Hardware refers to the attitude sensor, and its coordinate system is defined as follows:
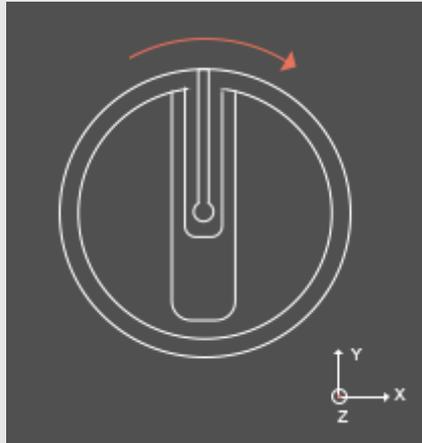
The light guide points to the y axis, the right side points to the x axis, and the z axis points directly above the Sensor.

Output value consistent with the coordinate system:17 Sensor acceleration values and angular velocity values.

20.1.2 definition of quaternion and euler Angle coordinate system

It conforms to the definition of east (X) north (Y) day (Z) coordinate system.Output value consistent with the coordinate system:Drag a Sensor in the device list directly to the drawing area window in MotionVenus to display the real-time curve value.

20.1.3 definition of MotionVenus bone coordinate system

It fits the right hand definition.
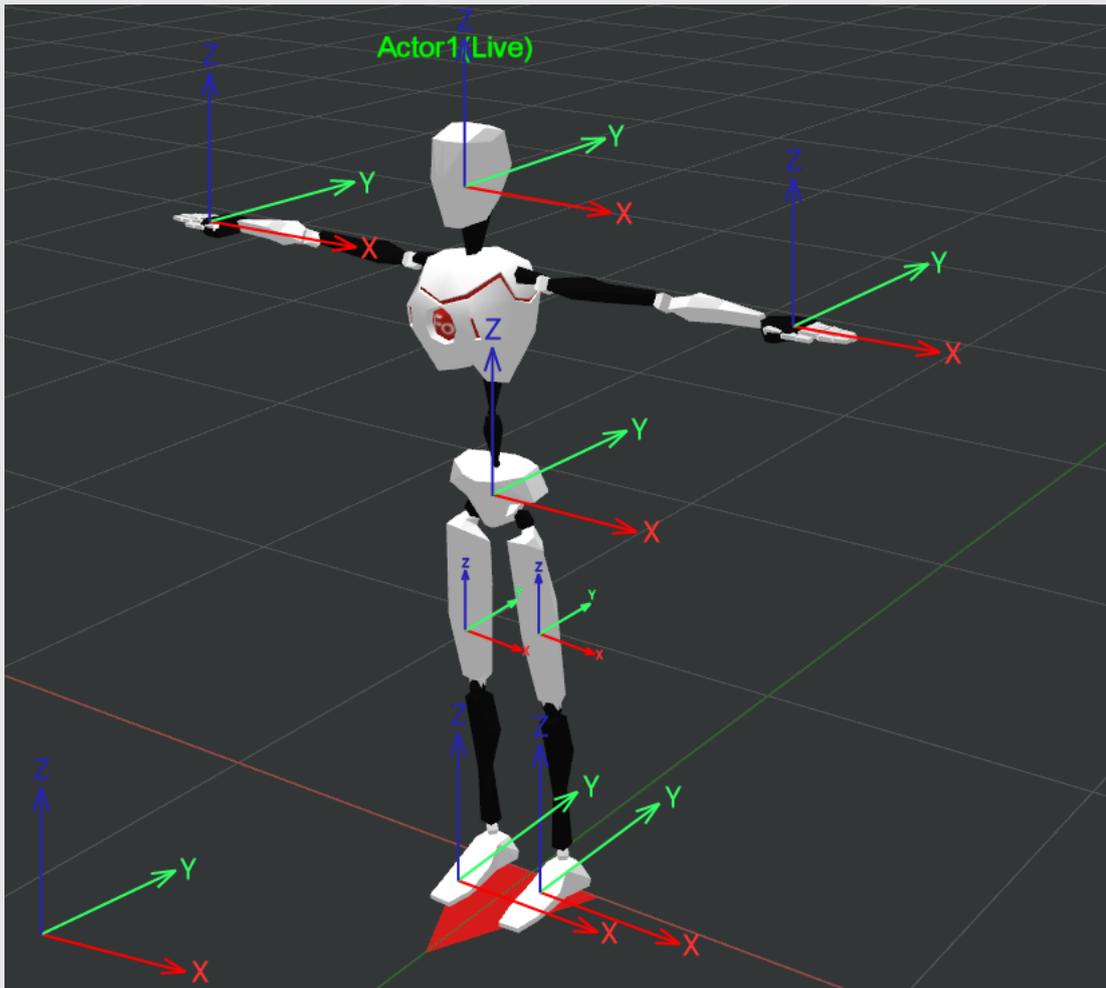
As shown in the figure above, the world coordinate system is the right-handed coordinate system. When t-pose, the local and global coordinate systems of each segment of skeleton are also the right-handed coordinate system. The angles of each segment of bone are defined as (0,0,0) in the t-pose. You can output Local or Global rotation values for each segment of bone. Output value consistent with the coordinate system:23 segments of bone rotation Angle, 22 joints rotation Angle.

20.2 Unity3D coordinate system
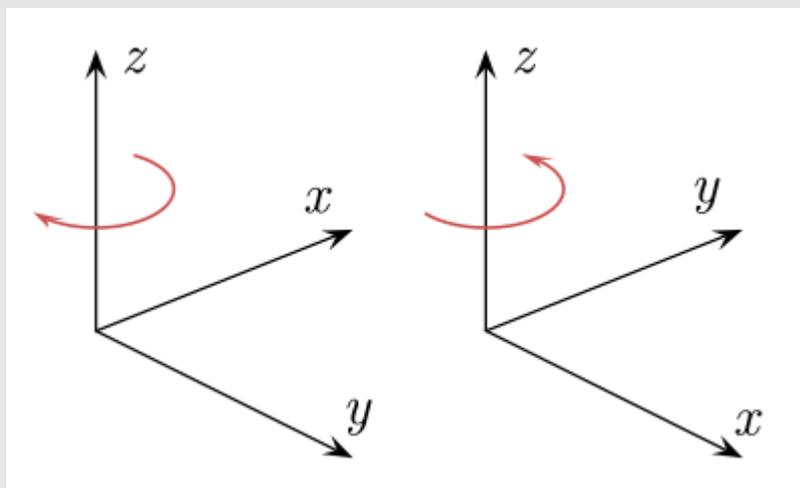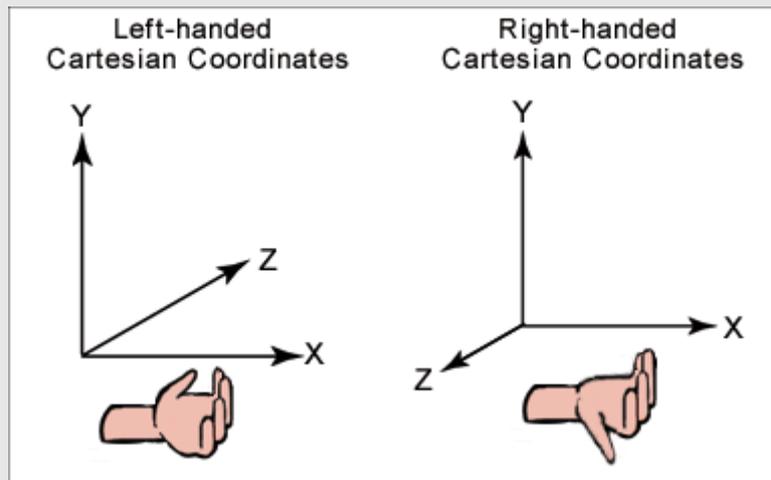
3D coordinate system is the basic concept of 3D game development.Generally, 3D software USES cartesian coordinate system to describe the coordinate information of objects.Cartesian coordinate system is divided into left-handed coordinate system and right-handed coordinate system:The left hand coordinate system is Y pointing up, X pointing to the right, and Z pointing forward.The right hand coordinate system is Y pointing up, X pointing to the right, and Z pointing back.In Unity3D, the left hand coordinate system is used, where X axis represents the horizontal direction, Y axis represents the vertical direction, and Z axis represents the depth.In MotionVenus, the right-handed coordinate system is used, where the X-axis represents the horizontal direction, the z-axis represents the vertical direction, and the Y-axis represents the depth.

21   MotionVenus SDK

Download address: https://github.com/FOHEART/MotionVenusSDK

SDK and Demo program all parts are provided with source code.
The SDK part USES c language development, the Demo program USES c ++ development.
The project was packaged using Visual Studio 2013.

21.1 function description

21.1.1 Receive real-time data streams from one or more MotionVenus clients via UDP.
21.1.2 Real-time spatial position and rotation of human bones in 23 segments.

33

21.1.3 SDK has been packaged as a DLL library to support multithreading.
21.1.4 Equipped with DEMO program.

21.2 system of data type units

Name	Units
Location	meter
Euler Angle	angle

21.3 bone correspondence
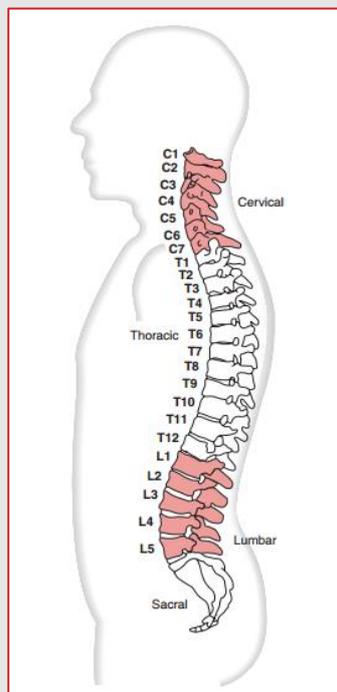
No.	Name	Paraphrase
0	Spine or Hips	The root node of the humanoid model controls the displacement of the whole human body and the rotation of the root node
1	Spine1	It is equivalent to human L3-L5 bones
2	Spine2	It is equivalent to human T12-L2 bones
3	Spine3	It is equivalent to human T8-T11 bones
4	Spine4	It is equivalent to human T1-T7 bones
5	Neck	Neck

6	Head	Head
7	RightShoulder	RightShoulder
8	RightArm	RightArm
9	RightForeArm	RightForeArm
10	RightHand	RightHand
11	LeftShoulder	LeftShoulder
12	LeftArm	LeftArm
13	LeftForeArm	LeftForeArm
14	LeftHand	LeftHand
15	RightUpLeg	RightUpLeg
16	RightLeg	RightLeg
17	RightFoot	RightFoot
18	RightToeBase	RightToeBase
19	LeftUpLeg	LeftUpLeg
20	LeftLeg	LeftLeg
21	LeftFoot	LeftFoot
22	LeftToeBase	LeftToeBase

21.4 method of use

21.4.1. Extract or clone to any location of the local hard disk.
21.4.2 Set MotionVenusSDK_Test project as the initiator.
21.4.3 Compile and run.
21.4.4 usage scenarios

21.5   Usage Scenarios

This SDK provides a 23-segment skeleton model based on human dynamics, and gives the rotation and spatial position of each segment of skeleton, which can be applied to:
21.5.1   Medical applications, such as elbow and shoulder joint motion analysis, spinal curvature analysis, leg dynamics analysis and so on.
21.5.2   Sports analysis, such as the chain action analysis of hand, forearm and forearm in throwing;Impact analysis of feet, thighs and calves during landing [note 1], etc.

21.5.3 Prop mapping. For example, the hand node can be fixed to the gun prop, and the prop will have space 360° rotation and displacement information;Or place the node on any object that needs to measure rotation information to obtain real-time rotation information of the object.

21.5.4 Third-party software integration. This SDK can be used to integrate with any third-party software to quickly obtain standard human dynamics data.

Note 1: this analysis requires both accelerometer and gyroscope underlying data. Please contact us for the underlying interface.

END