

HTC VIVE Wrist Tracker Developer Guidelines Ver. 1.1

Version Control

Version Number	Version Date	Version Reason
1.0	2022.01.13	Initial version
1.1	2022.03.30	Content update

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Introduction

This document provides development guidelines for VR accessory makers and content developers interested in VIVE Wrist Tracker. These guidelines describe how to use VIVE Wrist Tracker for position tracking and data transmission.

When paired with VIVE Focus 3, VIVE Wrist Tracker transmits tracking data wirelessly from the tracker to the VIVE Focus 3 headset.

VIVE Wrist Tracker can also be attached to a peripheral accessory for object tracking. When used for object tracking, VIVE Wrist Tracker transmits tracking data just as it does when used to assist hand tracking. In addition, the accessory can also be connected to VIVE Wrist tracker through its USB interface to obtain additional data from the accessory, which can then transmit the additional data to VIVE Focus 3 along with the tracking data.

Use cases

There are three use cases for VIVE Wrist Tracker.

Use case 1: VIVE Wrist Tracker is attached to the wrist to assist hand tracking in VR. In this scenario, VIVE Wrist Tracker is paired wirelessly with VIVE Focus 3 to transmit tracking data.

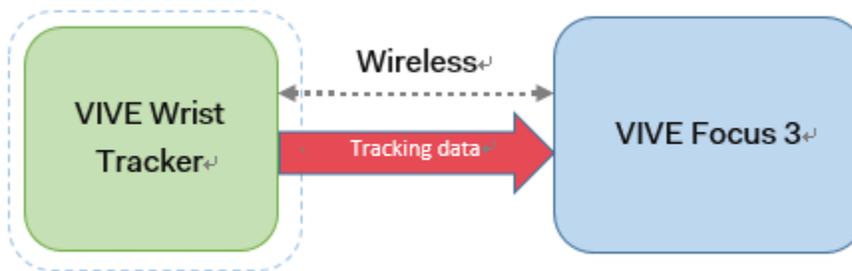


Figure: Use case 1

Use case 2: VIVE Wrist Tracker is attached to an accessory for object tracking. As with the first use case, in this scenario, VIVE Wrist Tracker is paired wirelessly with VIVE Focus 3 to transmit tracking data.

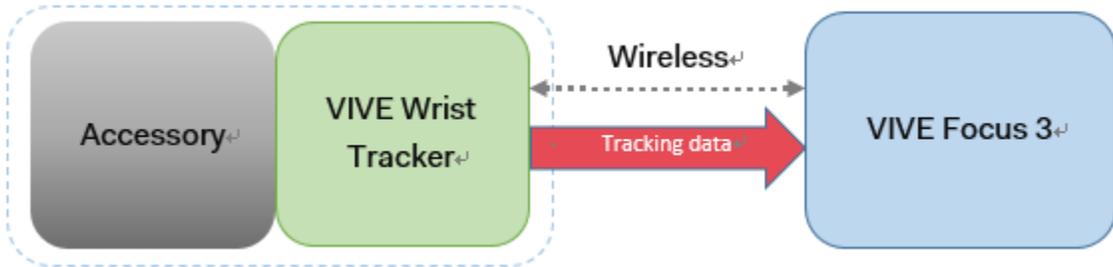


Figure: Use case 2

Use case 3: VIVE Wrist Tracker is attached to an accessory for object tracking. In addition, in this scenario, the accessory is also connected to VIVE Wrist Tracker via USB, allowing the accessory to send additional data to VIVE Wrist Tracker, which can then transmit the additional data to VIVE Focus 3 along with the tracking data.

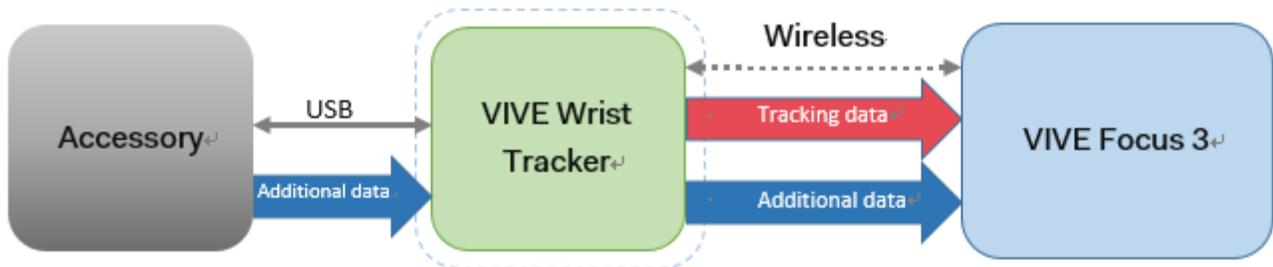


Figure: Use case 3

Hardware requirements

This section describes the hardware requirements for accessories used with VIVE Wrist Tracker.

Accessories must meet specific requirements to ensure that VIVE Wrist Tracker can generate accurate tracking data for the accessory and to ensure that any additional data provided by the accessory is compatible with VIVE Focus 3.

Interface

1. USB Type-C port: USB 2.0 Full-Speed (client)
2. Buttons:
 - Power button: Powers the tracker on and off
 - App button: Defined by developer

Radio frequency (RF)

To ensure the stability of the wireless connection between VIVE Wrist Tracker and VIVE Focus 3, the OTA performance of the tracker must not degrade by more than 3 dB an accessory is attached.

Please adhere to the following recommendations to maximize RF performance.

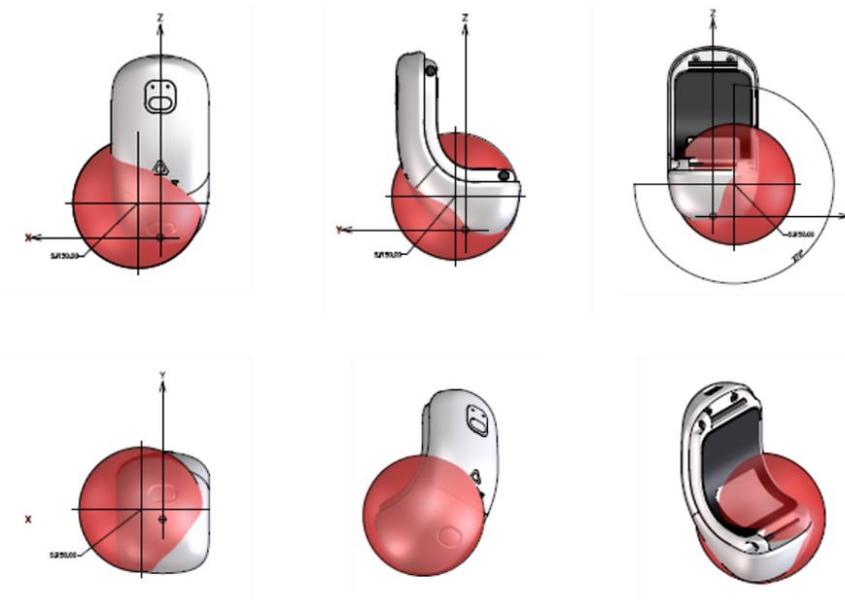


Figure: Spherical radius of the tracker antenna. Metal parts in this area may cause RF interference. (Spherical radius = 30 mm, with the center being the antenna feed point.)

For optimal OTA performance, the tracker antenna should be at least 30 mm away from any metal parts.

Power

- USB Type-C port voltage requirement: 5V \pm 5%; > 200 mA
- Maximum required charging time: 2 hours

Optics

VIVE Wrist Tracker has an asymmetrical shape. Therefore, its FOV is also asymmetrical. In addition, VIVE Focus 3 uses inside-out tracking, so the FOV of the tracker depends on the position of the headset relative to the orientation of the tracker. The following figures illustrate the FOV of VIVE Wrist Tracker in relation to VIVE Focus 3 when the headset is about 50 cm away from the tracker's geometric center.

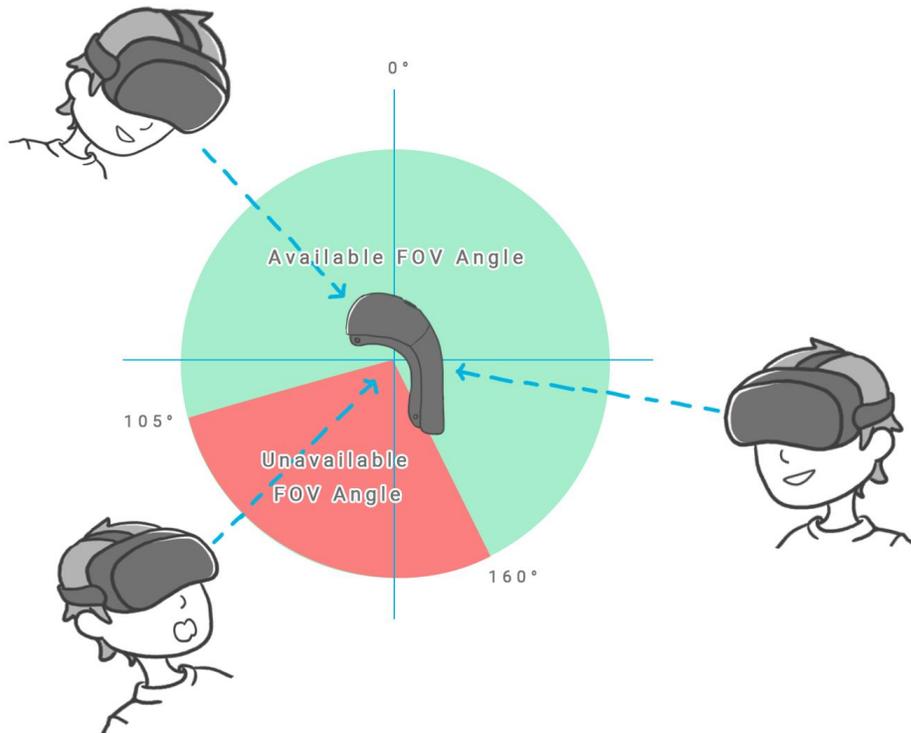


Figure: Tracker FOV relative to headset position along the sagittal plane

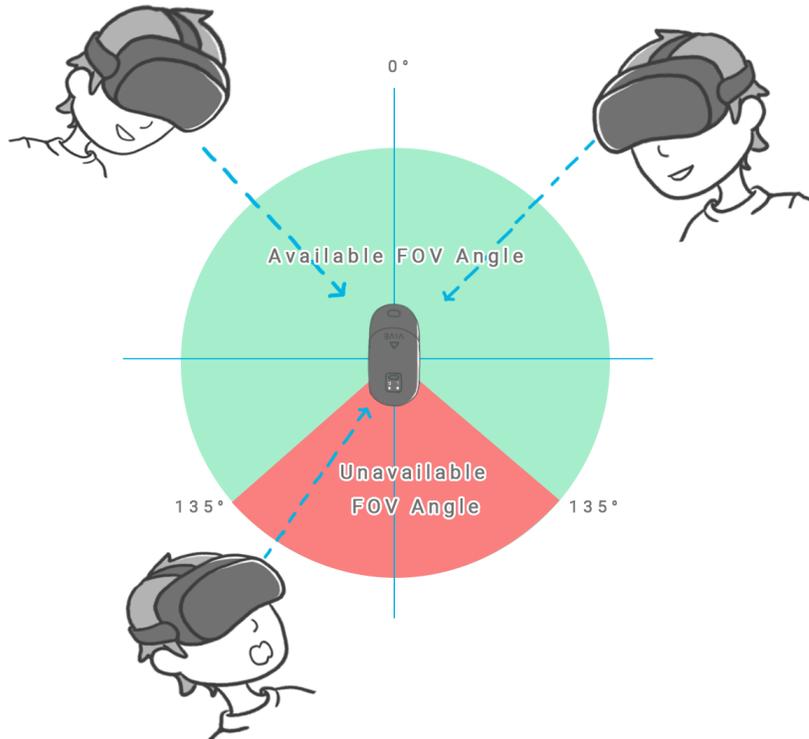


Figure: Tracker FOV relative to headset position along the transverse plane

The headset must stay within the FOV of the tracker during operation. In addition, make sure there aren't any objects between the tracker and the headset, as this will interfere with object detection.

The following illustration shows the FOV of VIVE Wrist Tracker when attached to a VR gaming peripheral, in this case an imitation firearm. If the mounting base extends beyond the recommended placement area, the tracker's FOV will be blocked by the body of the accessory.

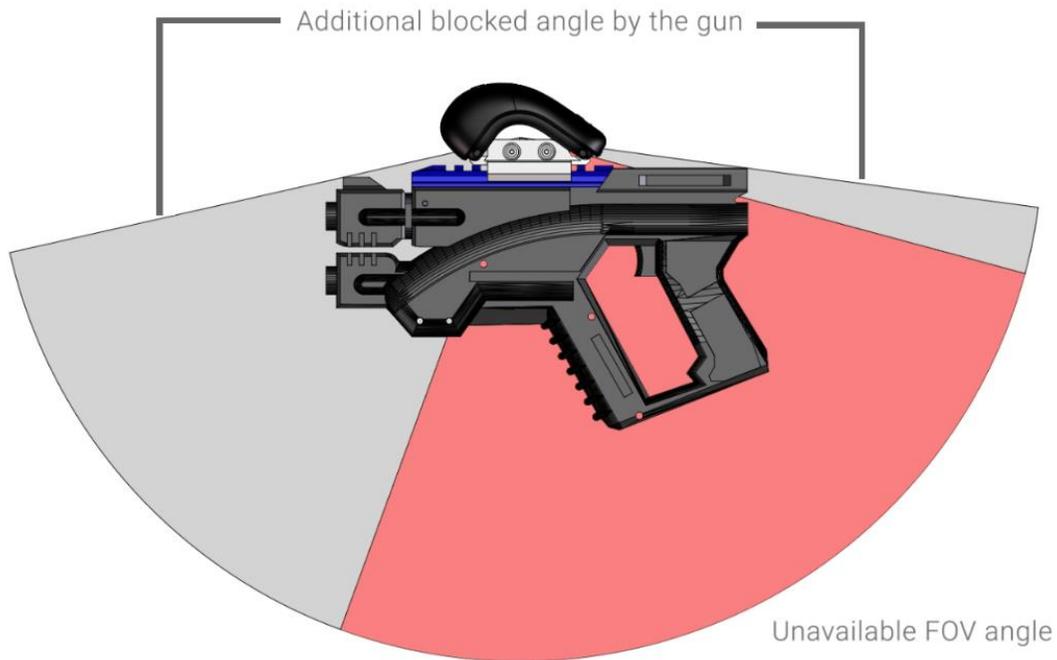


Figure: Mounting base extends beyond recommended placement area

For optimal tracking performance, we recommend attaching the tracker to the accessory so that the Power button faces the headset.

To maintain optimal tracking performance, make sure the gray area illustrated in the following figure remains exposed during operation. Do not attach objects to it or cover it with any materials.

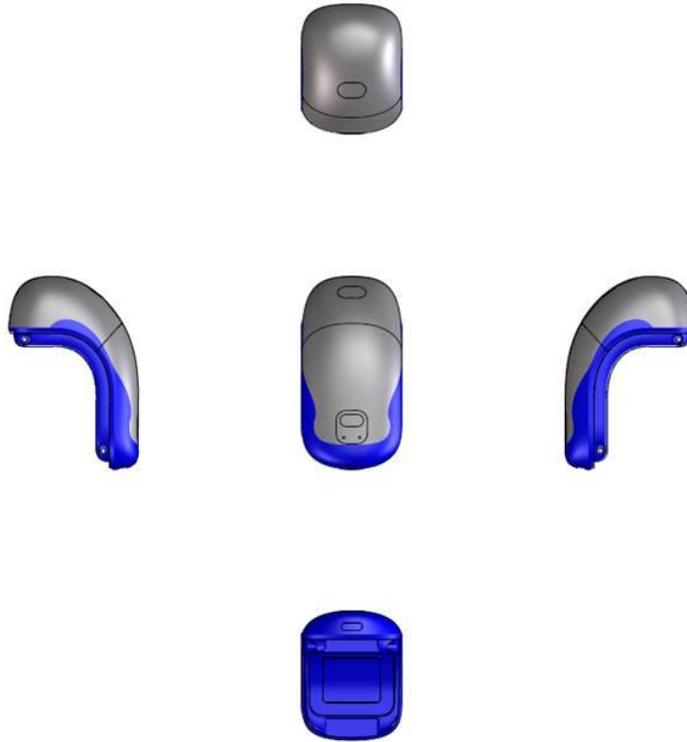


Figure: Exposed area (gray) and contact area of VIVE Wrist Tracker when attached to an accessory (blue)

Mounting

Adhere to the following guidelines to ensure your safety when using VIVE Wrist Tracker with an accessory.

- a. The specifications of the accessory's mounting interface must match those of the mounting base attached to the tracker.
- b. The tracker should be easy to attach and detach with two hands (that is, with one hand holding the tracker and the other holding the accessory.)
- c. The user should not be at risk of physical harm while attaching or detaching the tracker.
- d. Attaching or detaching the tracker should not cause the user any discomfort.
- e. To prevent unintended damage to the tracker, the tracker should not come into contact with any external objects during operation.
- f. To ensure optimal tracking performance, the accessory or its components should not be in the tracker's FOV.

Example mounting interfaces

Attaching VIVE Wrist Tracker to VR peripherals is simple and straightforward. The following CAD drawings show examples of how VIVE Wrist Tracker can be mounted to accessories such as imitation gaming weapons and safety equipment. The imitation gaming firearms depicted are equipped with a Picatinny rail, which can be used as a mounting interface.

VIVE Tracker can be mounted to a Picatinny rail using a rail mount-type mounting base. CAD drawings of the VIVE Tracker rail mount are available to developers. Contact us for more information.

Imitation firearms (mounting interface: Picatinny rail)



Figure: Toy like gun with VIVE Wrist Tracker and rail mount-type mounting base

The following two figures show the schematics for the accessory mounting rail (Picatinny rail).

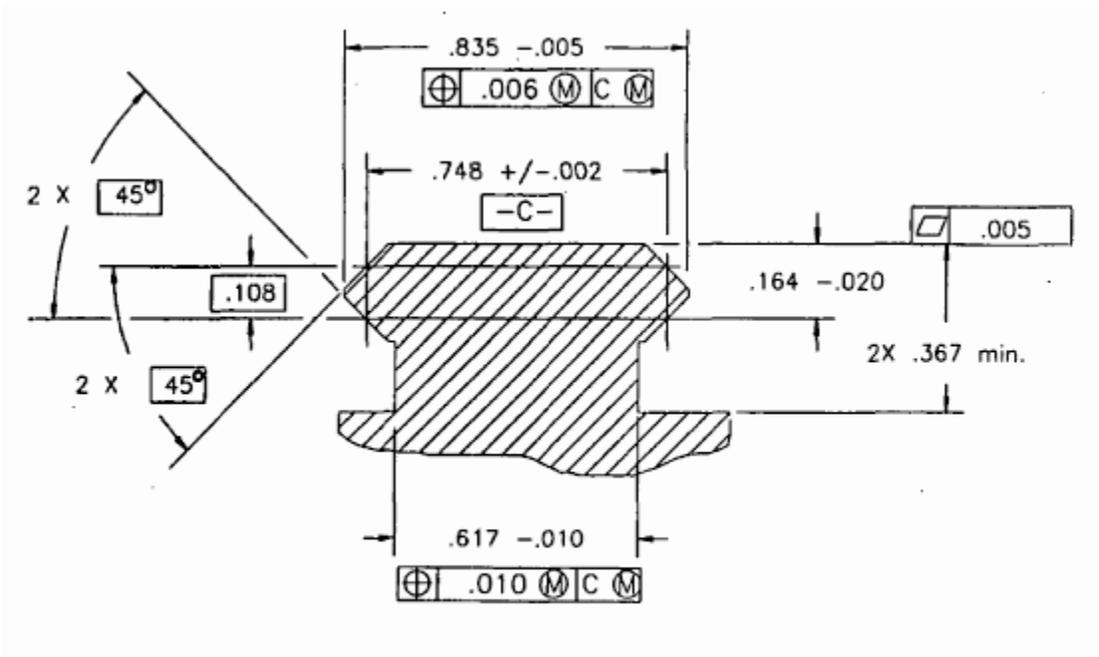
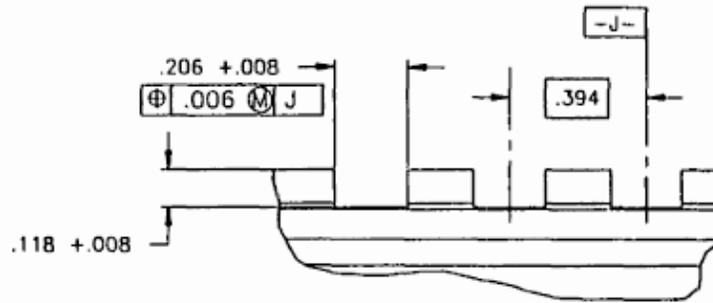


FIGURE 1. Accessory mounting rail profile



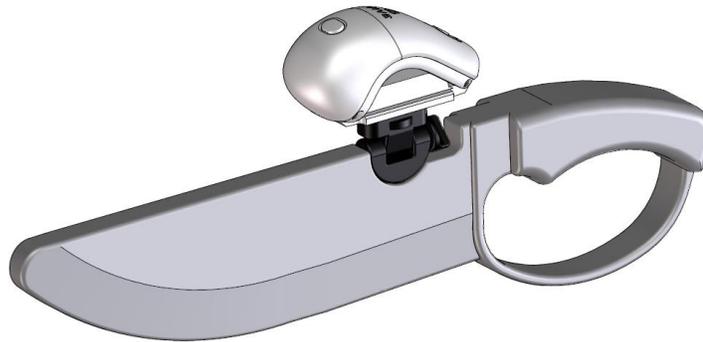
Note

1. Groove dimensions apply to all grooves. The number of grooves are dependant on application.
2. Center to center dimension applies between adjacent grooves.

FIGURE 2. Recoil groove

Imitation edged gaming weapons

The mounting interface should be as close as possible to the grip area of an edged gaming weapon. The length of the gaming weapon should be defined in the VR program.



Fire extinguisher

When VIVE Wrist Tracker is attached directly to a grip, the tracker's FOV must be free from your hands and other objects during operation.



Mechanical specifications

The following specifications may be useful for determining the compatibility of VIVE Wrist Tracker with various accessories.



Figure: VIVE Wrist Tracker

Dimensions and weight

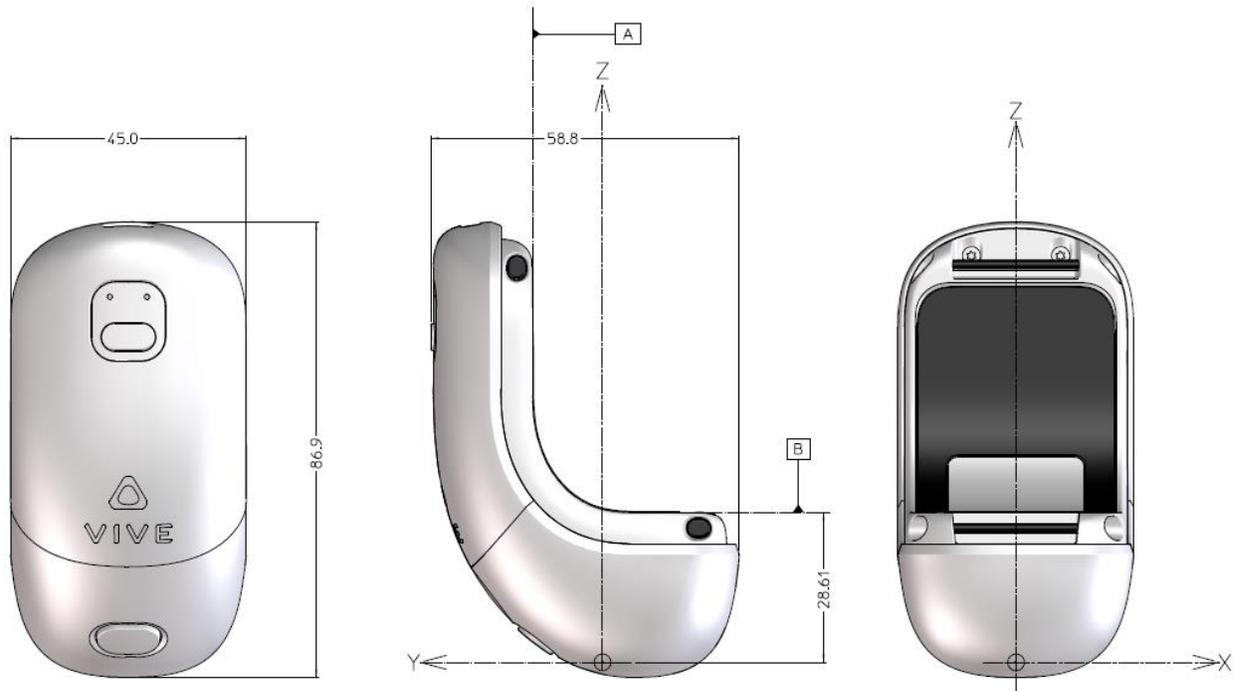


Figure: Front, side, and back views of VIVE Wrist Tracker

The tracker measures 86.9 mm (L) × 45.0 mm (W) × 58.8mm (H) and weighs 48.1 g.

Components

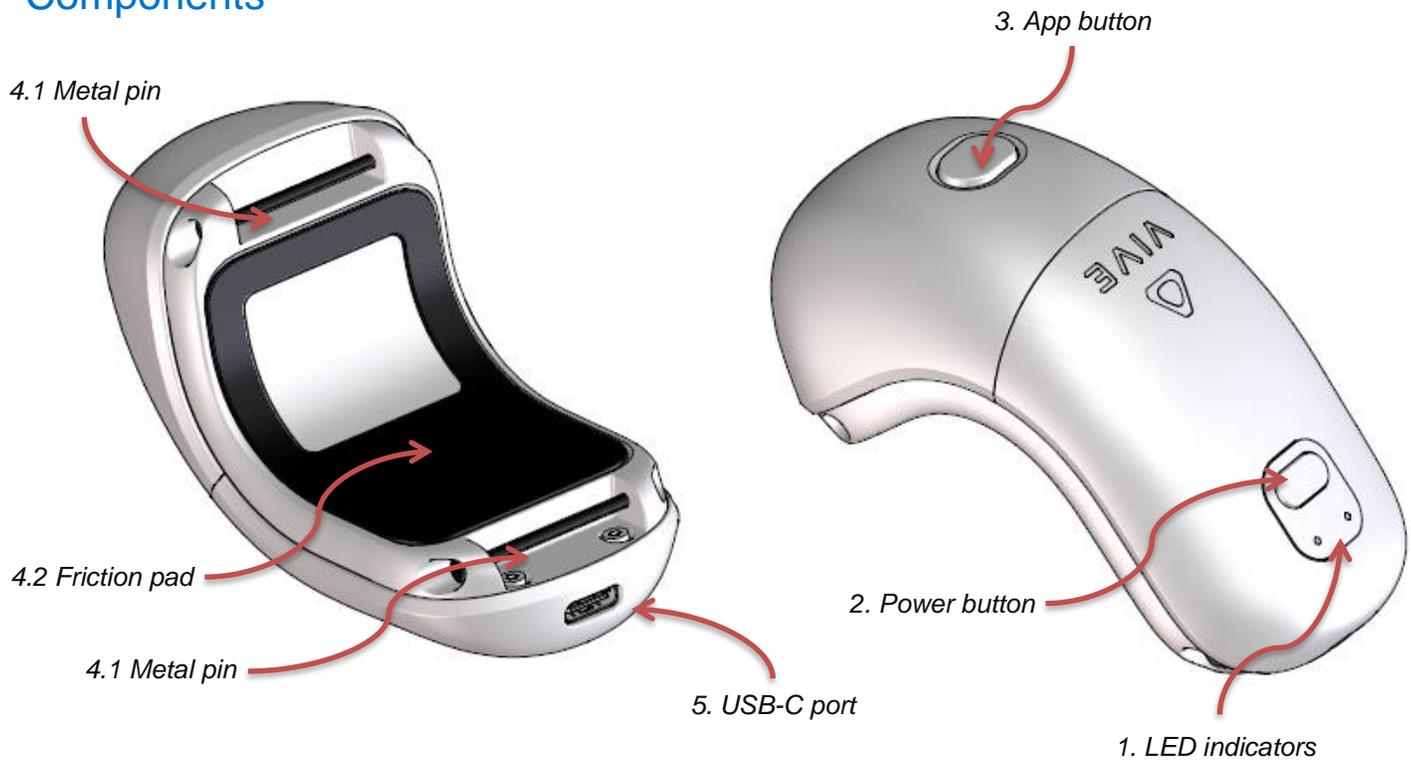


Figure: Components

1. **LED indicators:** Indicate pairing status
2. **Power button:** For powering the tracker on and off
3. **App button:** Defined by content
4. **Mounting mechanism:**
 - 4.1 Metal pin for fastening accessories
 - 4.2 Friction pad for preventing slippage between the tracker and an accessory
5. **USB-C port:** For connecting the tracker to an accessory

Mounting base assembly

The following drawing illustrates how to attach a mounting base to VIVE Wrist Tracker. CAD files for the mounting base are available to developers. Contact us for more information.

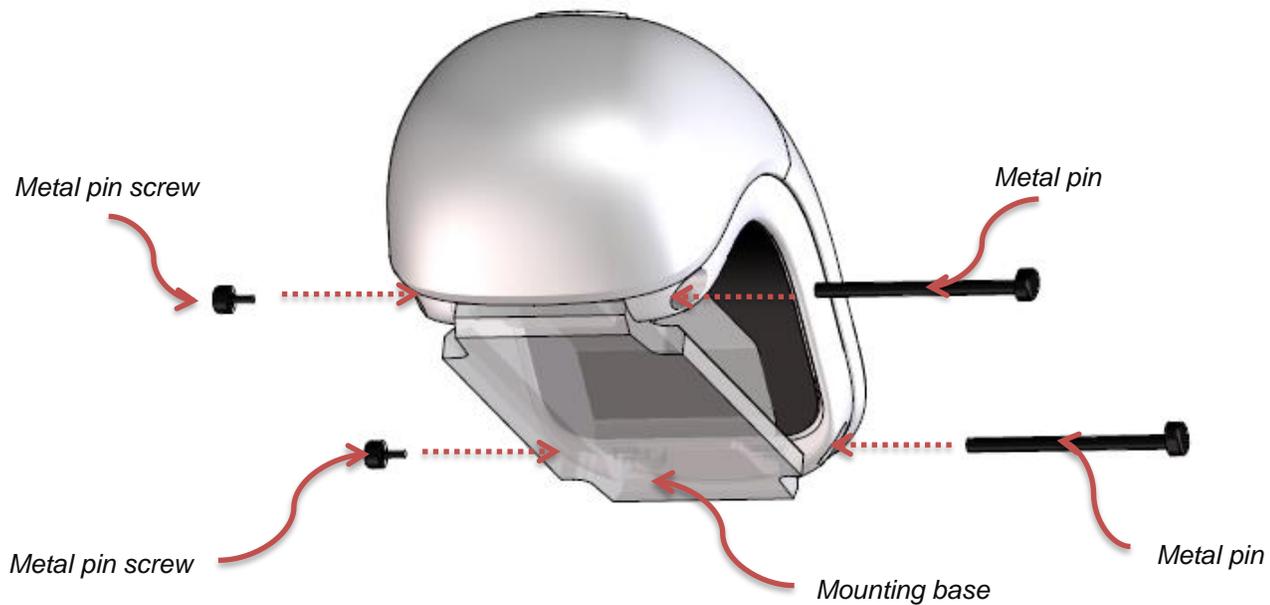
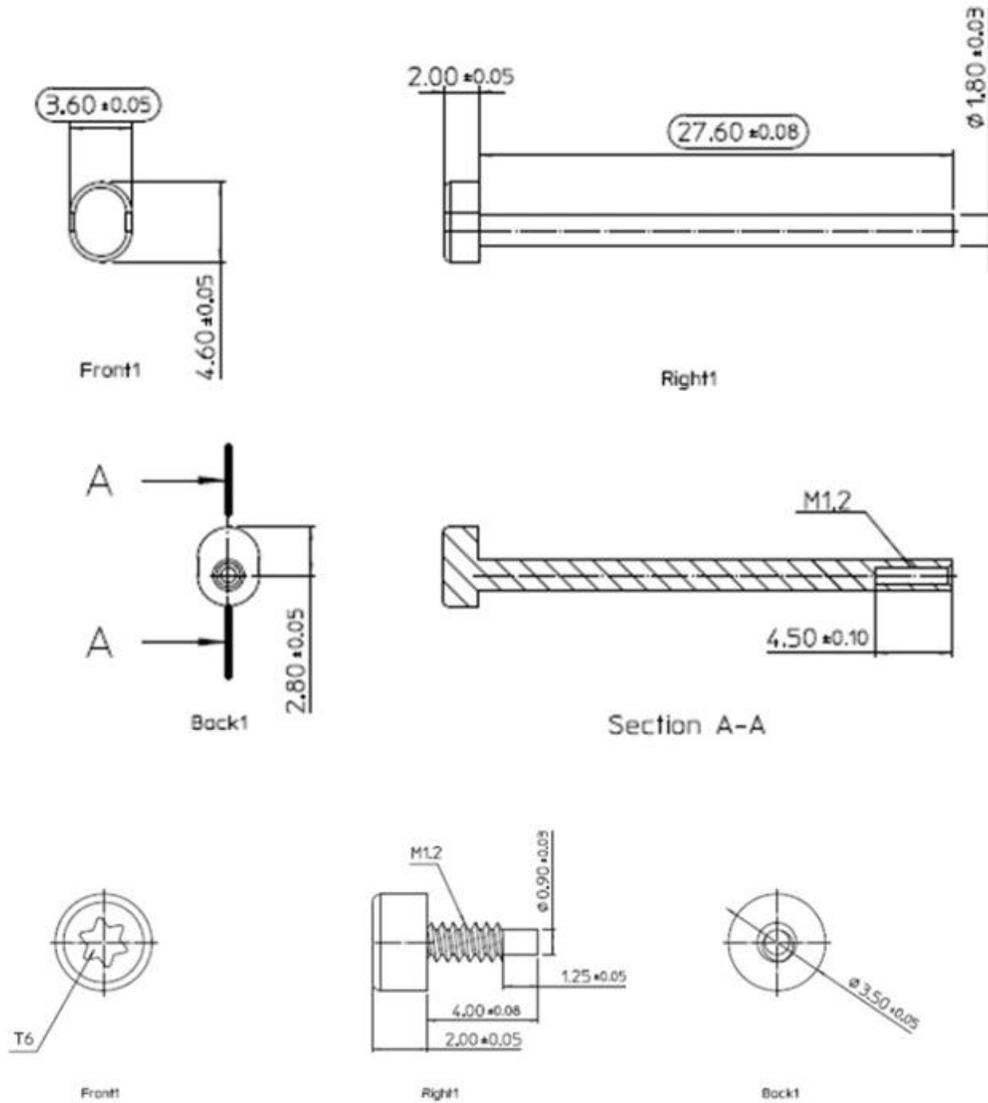


Figure: Mounting base assembly

Make sure to install the mounting base on VIVE Wrist Tracker before attaching the tracker to the mounting interface on the accessory.

Metal pin dimensions

The following schematic shows the dimensions of the metal pins. (Unit: mm)



Software

This section describes how software can be used to adapt accessories and develop content for VIVE Wrist Tracker.

In addition to transmitting tracking data, the VIVE Wrist Tracker can transmit additional data to VIVE Focus 3 USB from an attached accessory through the tracker's USB Type-C interface.

Accessory makers can utilize this feature when adapting accessories for VIVE Wrist Tracker. For details on the data formats that can be transferred between an accessory and VIVE Wrist Tracker, see the [Data Formats](#) section.

Content developers can also take advantage of this feature when designing VR content for accessories attached to VIVE Wrist Tracker. For details on the types of software applications that can be used for development, see the [Accessory integration](#) and [Unity integration](#).

Accessory integration

This section provides information on position transformation between an accessory and VIVE Wrist Tracker. Content developers can determine the correct rotation and translation result of the content developed for the accessory in a game engine such as Unity.

The local coordinate system of the accessory is assumed to be front-facing on the *z-axis* (left-handed coordinate system) with VIVE Wrist Tracker attached to the accessory as illustrated below. The rotation degree and translation distance of an accessory in relation to VIVE Wrist Tracker are described in terms of roll, yaw, and pitch, as well as D_x , D_y , and D_z , respectively, during integration.

After the center of an accessory has been determined during the design process, the rotation degree and translation distance can be measured according to the conditions of integration.

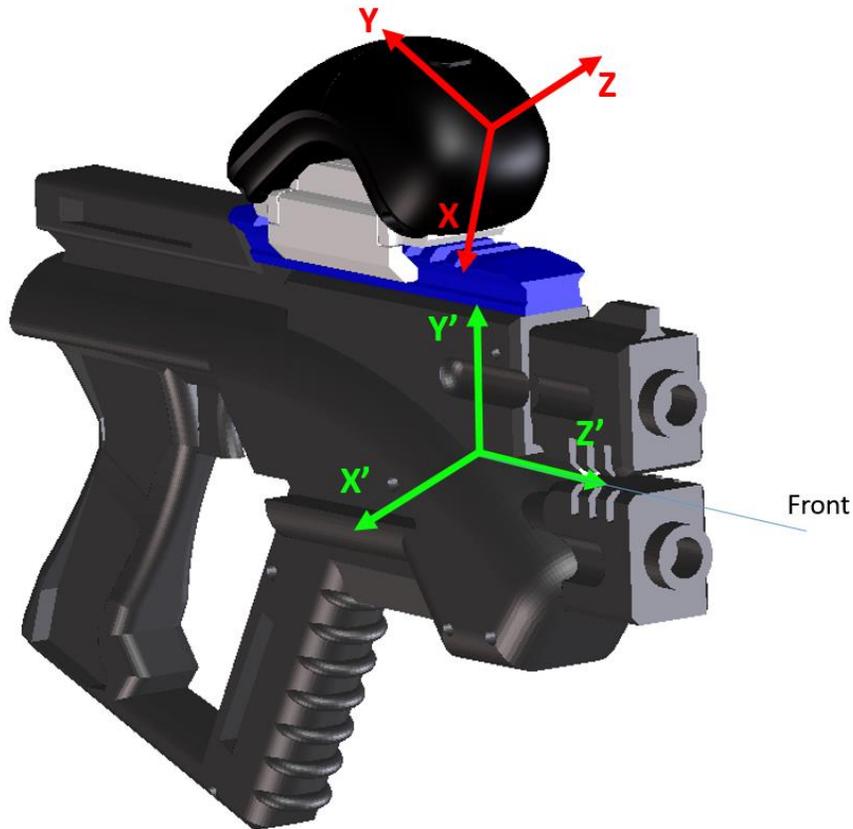


Figure: Example accessory integration of a toy like gun

Pitch: Angle of rotation around the *x-axis*

Yaw: Angle of rotation around the *y-axis*

Roll: Angle of rotation around the *z-axis*

Dx : Distance between the center of the accessory and tracker along the *x-axis*

Dy : Distance between the center of the accessory and tracker along the *y-axis*

Dz : Distance between the center of the accessory and tracker along the *z-axis*

Content developers can use these parameters to transform the tracker pose into an accessory pose with the following equations:

Assuming the tracker rotation matrix is $R_{Tracker}$, the accessory rotation matrix is $R_{Accessory} = R_{Pitch_Yaw_Roll} * R_{Tracker}$.

For the accessory position, $V_{Accessory} = V_{Tracker} + R_{Accessory} * Distance$.

System requirements

To test hardware accessories or VR content with VIVE Wrist Tracker, you'll need a VIVE Focus 3 in addition to the hardware and software required for your accessory or content. For more information, visit www.vive.com.

For accessory makers:

Hardware accessories designed to send additional data to VIVE Focus 3 through VIVE Wrist Tracker must support USB 2.0 Full-Speed as well as USB host and Human Interface Device (HID) specifications.

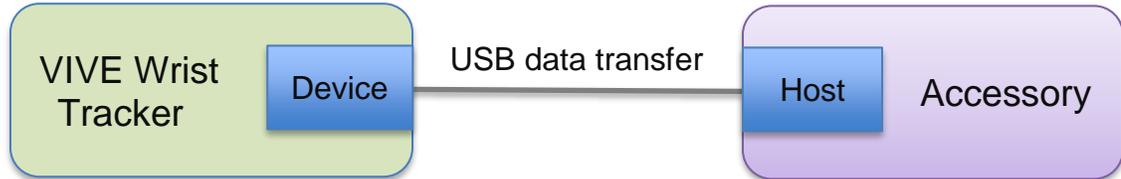


Figure: USB data transfer architecture

Data formats

Hardware accessories must be able to send data to VIVE Wrist Tracker via the HID protocol. As an HID device, the hardware accessory will send the data to the tracker through a USB HID Feature Report, the tracker will use to interpret the data. The data transfer interval should be longer than 10 ms.

To learn more about USB HID specifications, visit <https://www.usb.org/hid>.

In addition, the VID/PID USB combination for VIVE Wrist Tracker is **0BB4/09EA**. The accessory will use this ID combination to find the drivers for the USB device.

The following code samples outline the USB command flow between the accessory and VIVE Wrist Tracker. The maximum data payload is 12 bytes.

For VIVE Focus 3 content developers:

SetFeature 0xB4 data format:

[0xB4] [Data size N] [Raw Data 1] [Raw Data 2] [Raw Data N] (Max N = 12)

Code samples

The following code samples can be used to send the setFeature command to VIVE Wrist Tracker. However, your system must be able to reference the correct API in order to send the USB setFeature command.

Visual Studio:

```
byte buffer[65] = {0};

buffer[0] = 0x00; //Report ID
buffer[1] = 0xB4;
buffer[2] = 0x07; //USB Payload Length = Raw Data Length +3
buffer[3] = 0x04; //Raw Data Length
buffer[4] = 0x01; //Raw Byte 0
buffer[5] = 0x01; //Raw Byte 1
buffer[6] = 0x01; //Raw Byte 2
buffer[7] = 0x01; //Raw Byte 3

if(!HidD_SetFeature(m_hDevice, buffer, FeatureReportLength)){
```

Java:

```
// Take 0xB4 command for example
data1[0] = 0; //Report ID
data1[1] = (byte)180; //0xB4
data1[2] = 7; //USB payload length = Raw Data Length +3
data1[3] = 4; // Raw Data Length
data1[4] = 1; //Raw Byte 0
data1[5] = 1; // Raw Byte 1
data1[6] = 1; // Raw Byte 2
data1[7] = 1; // Raw Byte 3

int result = mDeviceConn.controlTransfer(0x21, 0x09, 0x0300, 2, data1, data1.length, 0);
```

For PC VR developers who work with VIVE Business Streaming:

SetFeature 0xB4 data format:

Byte Index	Data	Remark
0	Tag Index	Indicates the version of the data being sent out. In this version, the default value is zero.
1	Button	TRIGGER 0x01 BUMPER 0x02 MENU 0x04 STEAM 0x08 PAD 0x10 PAD_FINGERDOWN 0x20 Reserved 0x40 Reserved 0x80
2	Pad X value	-32768 to 32767 BYTE 2 is LSB
3		
4	Pad Y value	-32768 to 32767 BYTE 4 is LSB
5		
6	Trigger Raw	Value: 0 to 65535 BYTE 6 is LSB
7		
8		Reserved
9		Reserved
10		Reserved
11		Reserved

Table: VIVE Wrist Tracker accessory for work with VIVE Business Streaming data format

Unity integration

This section describes how to use the Unity game engine to integrate VIVE Wrist Tracker when developing VR content.

First, you need to pair VIVE Wrist Tracker with VIVE Focus 3.

After pairing, the input type icon on the VIVE Focus 3 system dashboard will indicate that VIVE Wrist Tracker is connected.

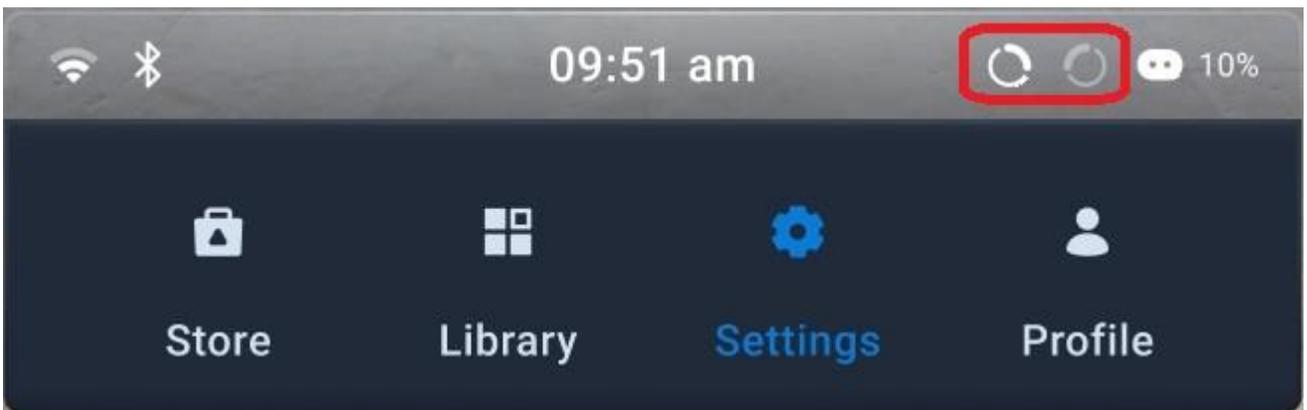


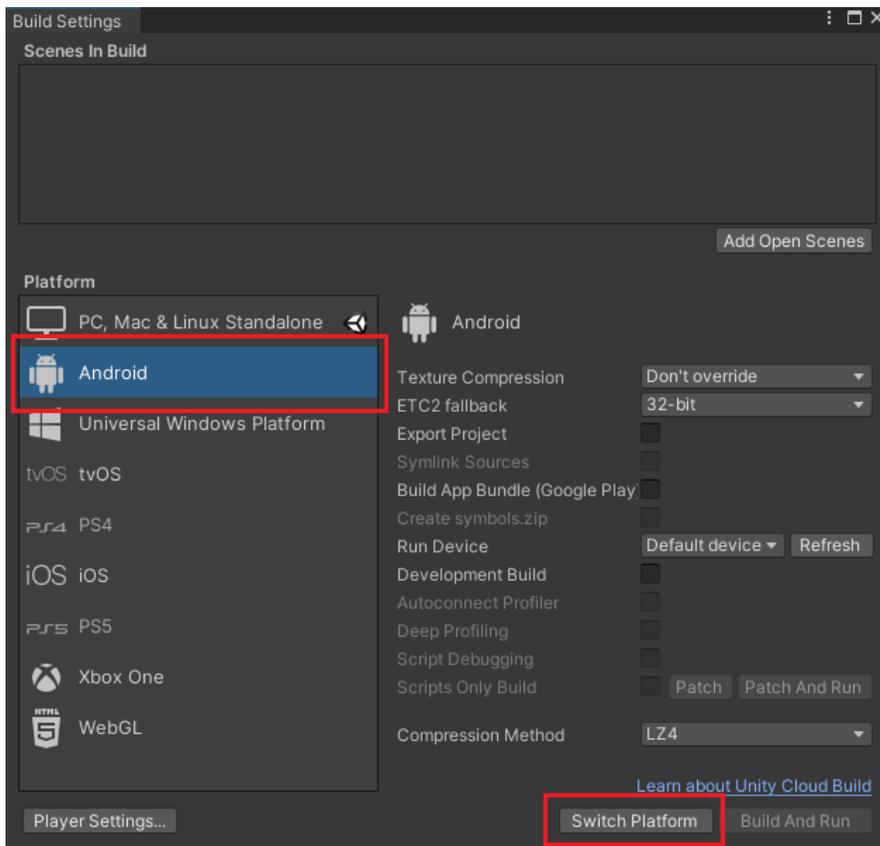
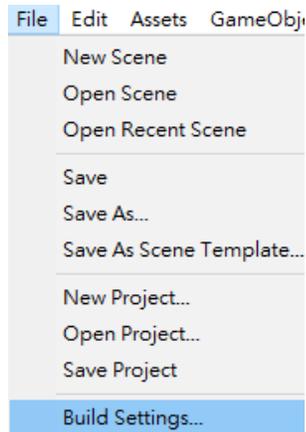
Figure: VIVE Wrist Tracker is added in VIVE Focus 3

We recommended using use Unity 2019.4.3 or later. You can download it at <https://unity3d.com/get-unity/download>.

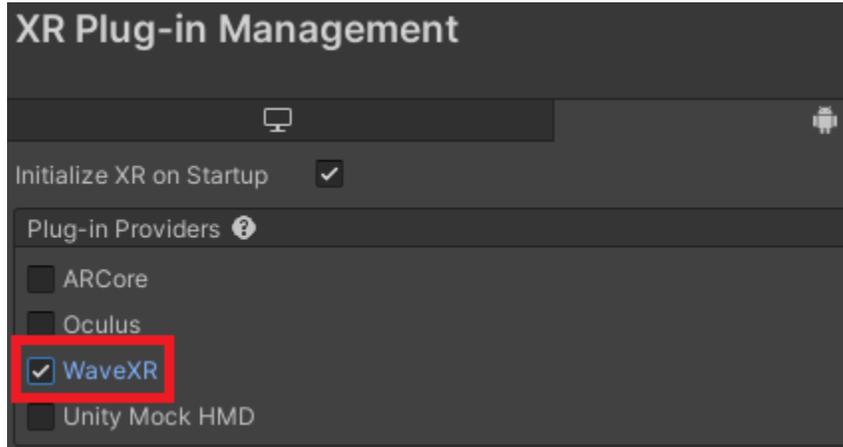
Setting up Unity for content creation

Perform the following steps to start creating content for VIVE Wrist Tracker in Unity.

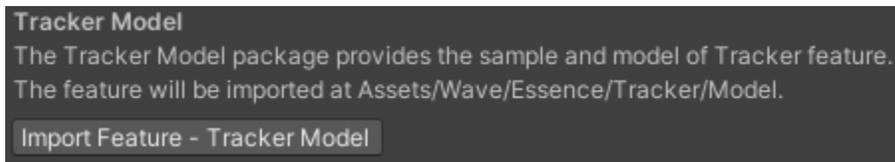
1. Configure your Build Settings.
 - a. Go to **File > Build Settings...**, and then select **Switch Platform**.
 - b. Select **Android**.



2. Configure your Project Settings.
 - a. Go to **Edit > Project Settings**.
 - b. Under **XR Plug-in Management**, click the **Android** tab.
 - c. Under **Plug-in Providers**, select **Wave XR**.



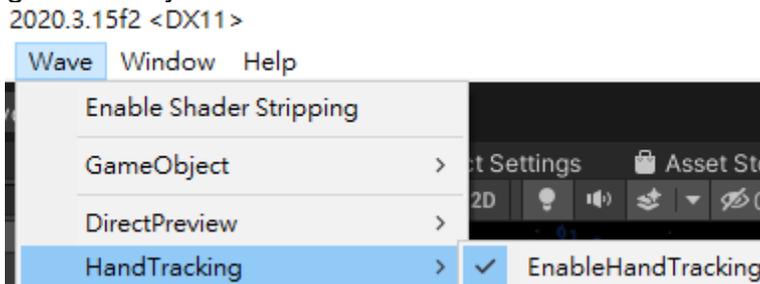
- d. Under **Wave XR > Essence**, click **Import Feature - Tracker Model**.



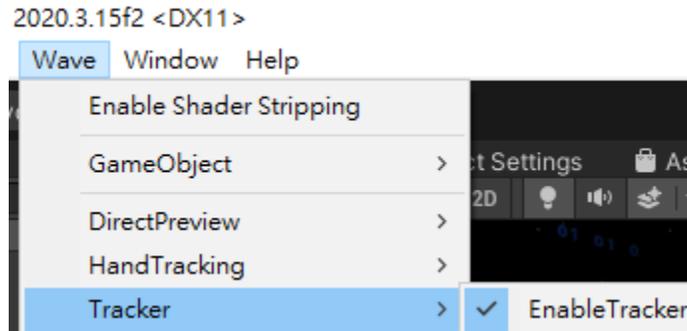
- e. Under **Player > Other Settings > Identification**, set the API level.



3. Add *AndroidManifest.xml* to your configuration.
 - a. Go to **Wave > HandTracking** and confirm that **EnableHandTracking** is selected. This setting will modify *AndroidManifest.xml*.



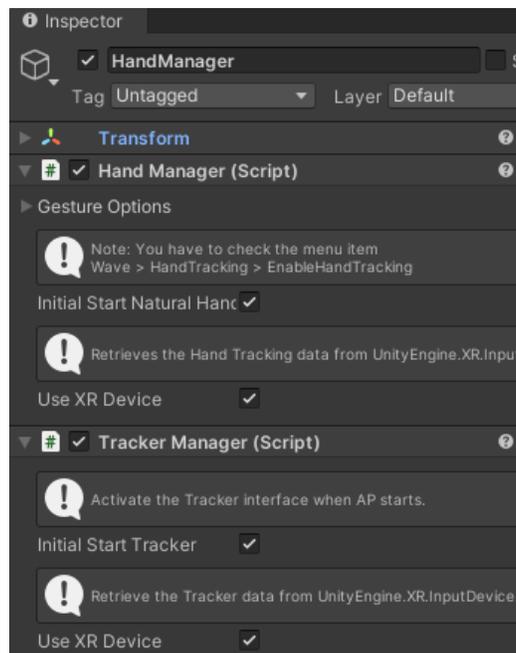
- b. **Wave > Tracker** and confirm that **EnableTracker** is selected. This setting will also modify *AndroidManifest.xml*.



Note: If you're using a custom *AndroidManifest.xml* file and the file could not be configured, you'll need to add the following configurations manually:

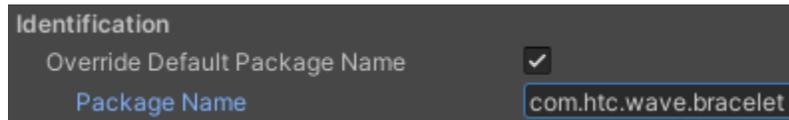
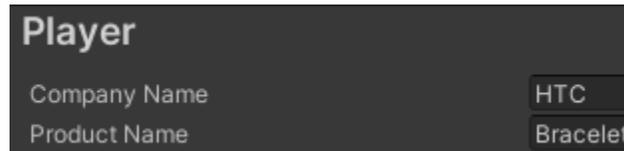
```
<uses-feature android:name="wave.feature.tracker" android:required="true" />
<uses-feature android:name="wave.feature.handtracking" android:required="true" />
```

- 4. Enable scripts for your scene.
 - a. Go to **Assets > Wave > Essence > Tracker > Model > 4.2.90-preview.2 > Demo > Bracelet**.
 - b. Make sure **Hand Manager (Script)** and **Tracker Manager (Script)** are selected for the **HandManager** object.

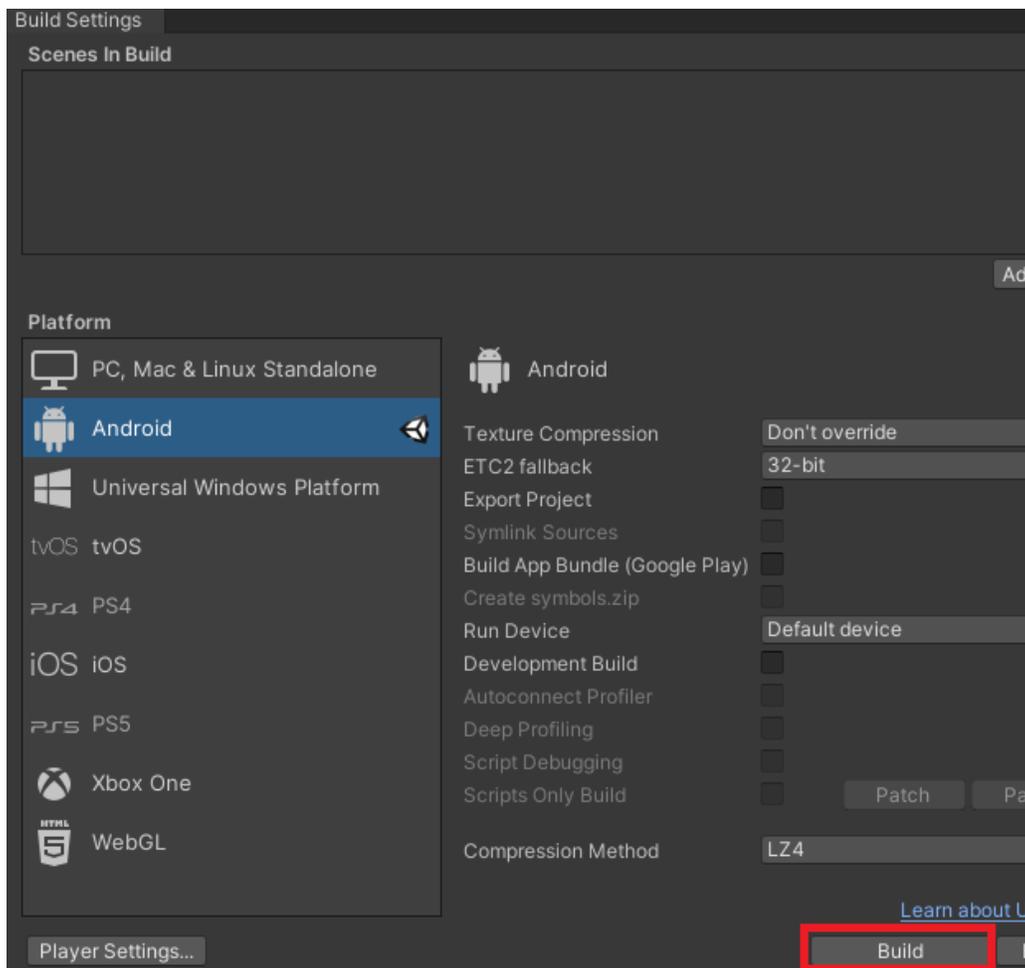


Note: If you need to use hand tracking or the tracker for your scene, you'll need to add the Hand Manager and Tracker Manager scripts manually.

5. Build the Android APK.
 - a. Go to **Edit > Project Settings > Player**, set the **Product Name** and **Other Settings > Identification > Override Default Package Name > Package Name**.



- b. Under **File > Build Settings**, click **Build**.

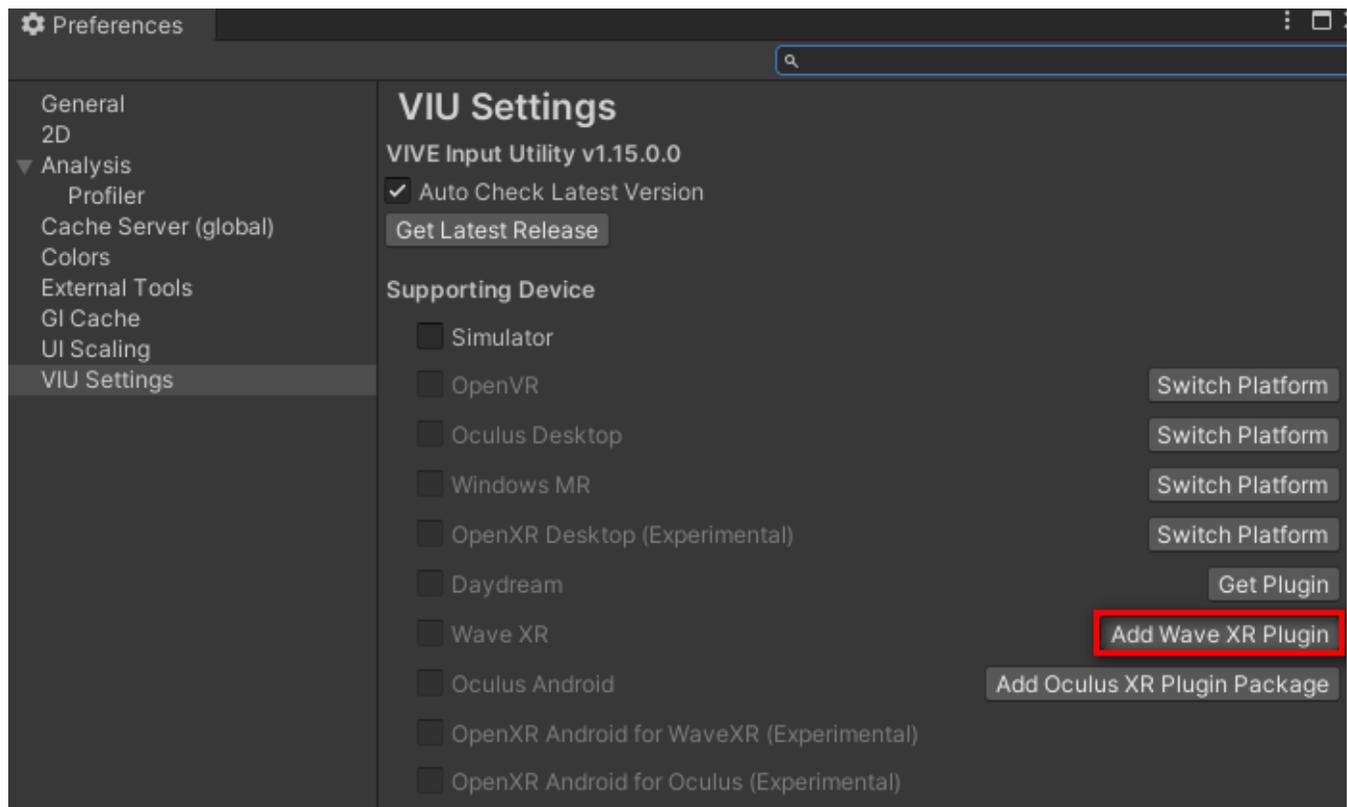


Configuring the VIVE Input Utility (VIU)

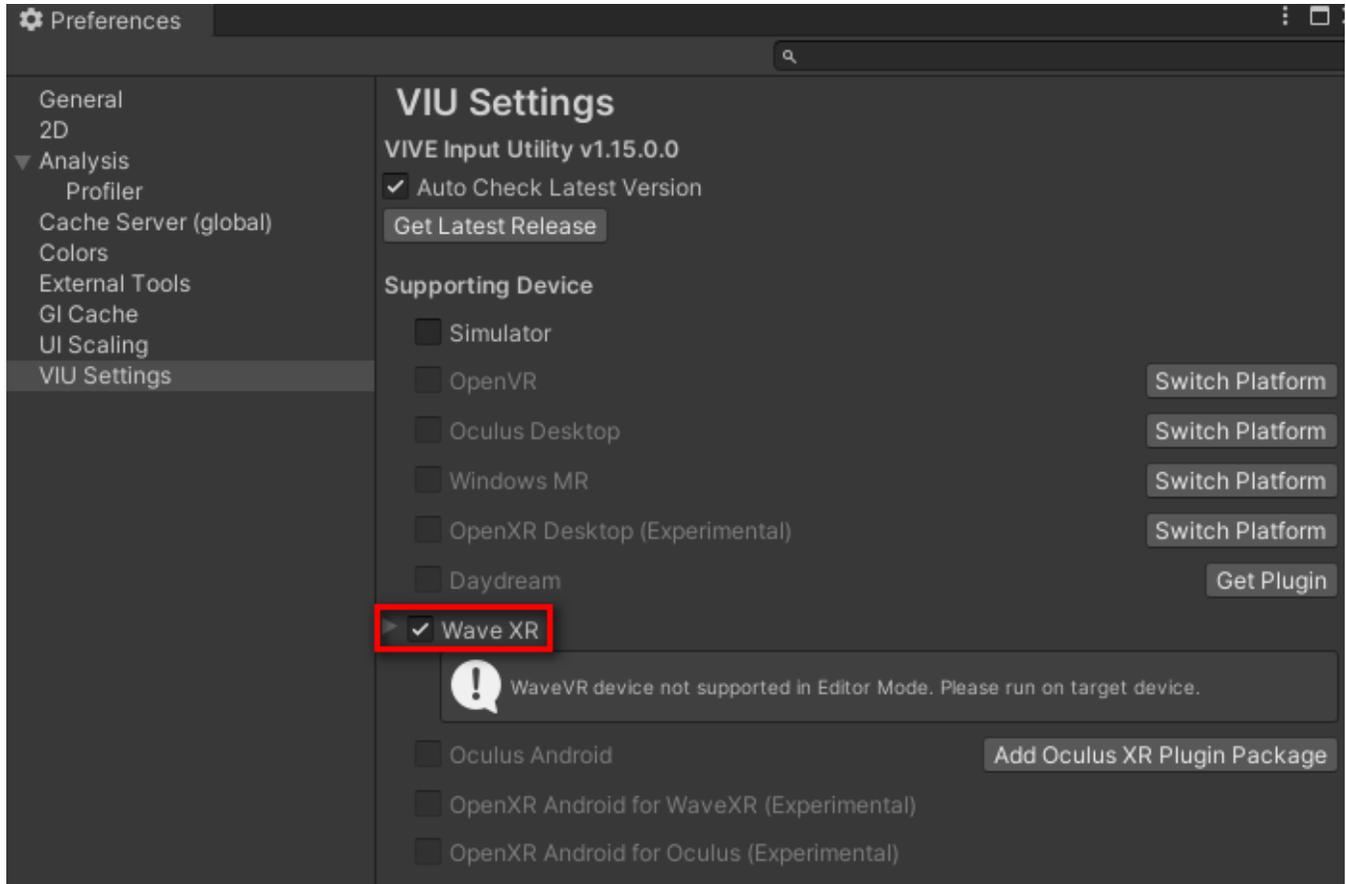
Perform the following steps to configure the VIVE Input Utility (VIU) plugin for your project.

1. Configure VIU settings.
 - a. Go to **Edit > Preferences**, and then click **Add Wave XR Plugin**.

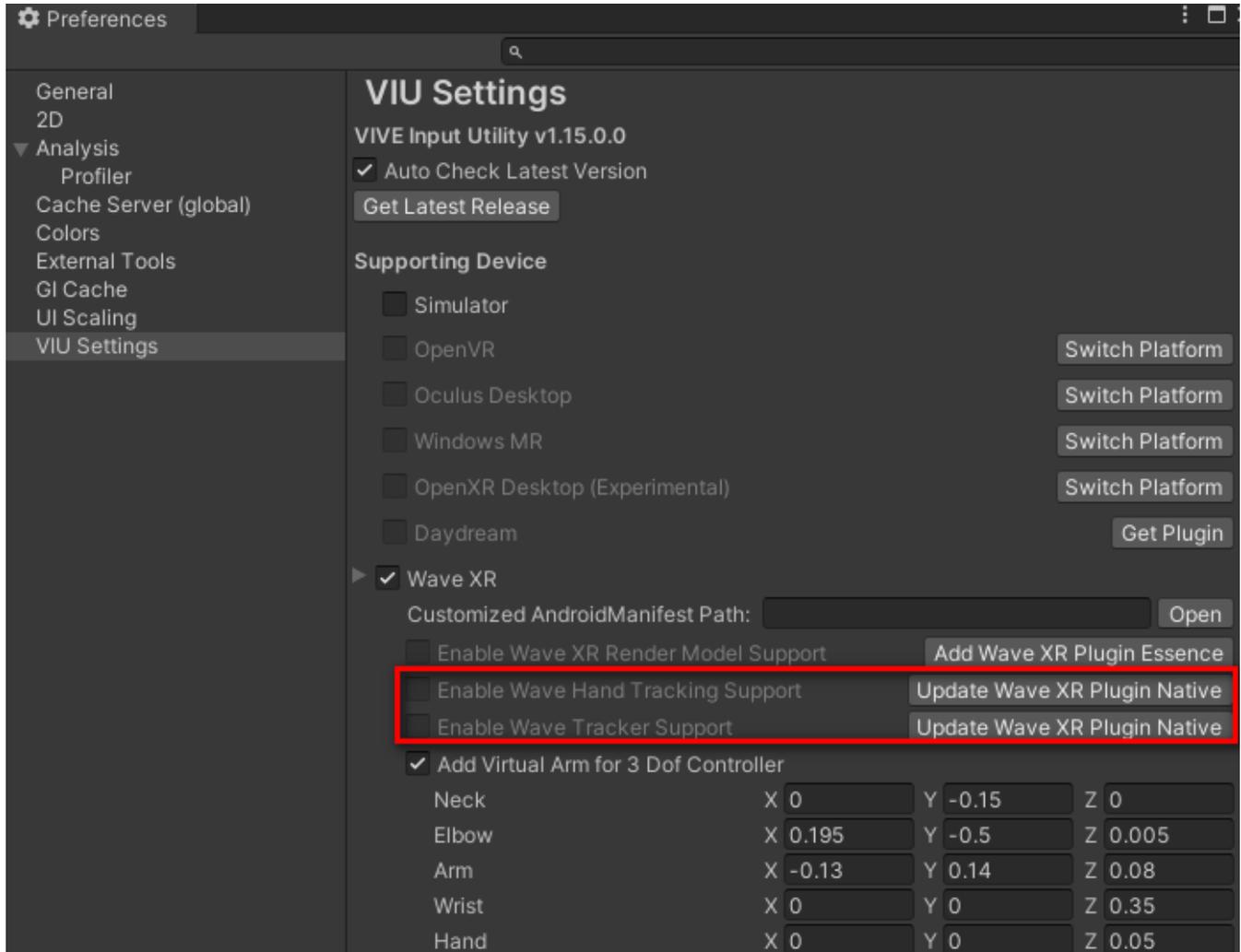
Note: If the platform is not set to **Android**, click **Switch Platform**.



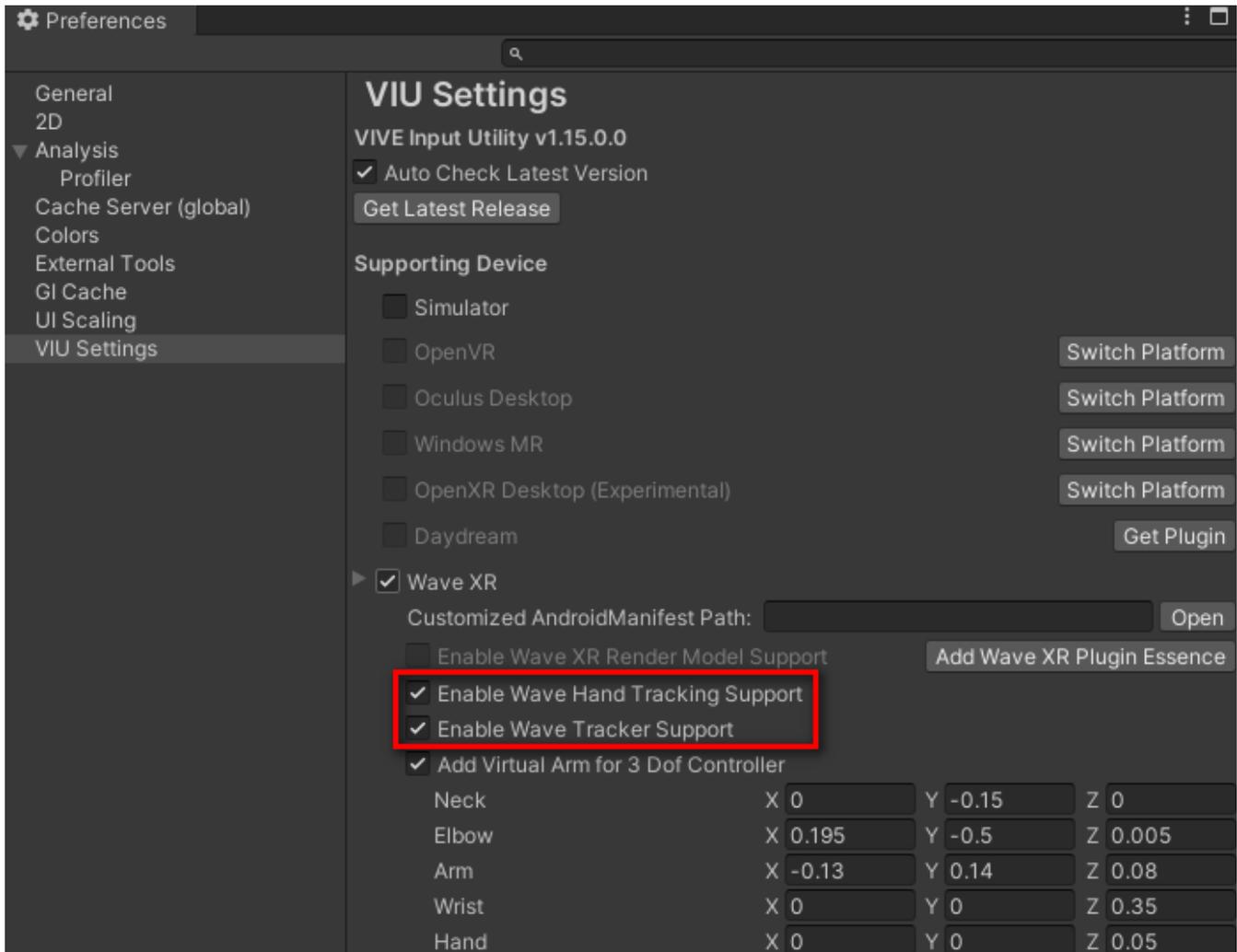
b. Select **Wave XR**.



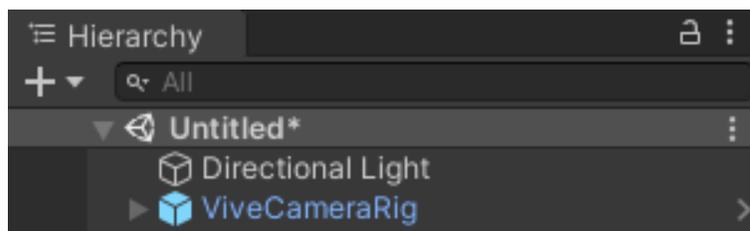
c. Select **Update Wave XR Plugin Native**.



Note: Make sure both **Enable Wave Hand Tracking Support** and **Enable Wave Tracker Support** are selected.

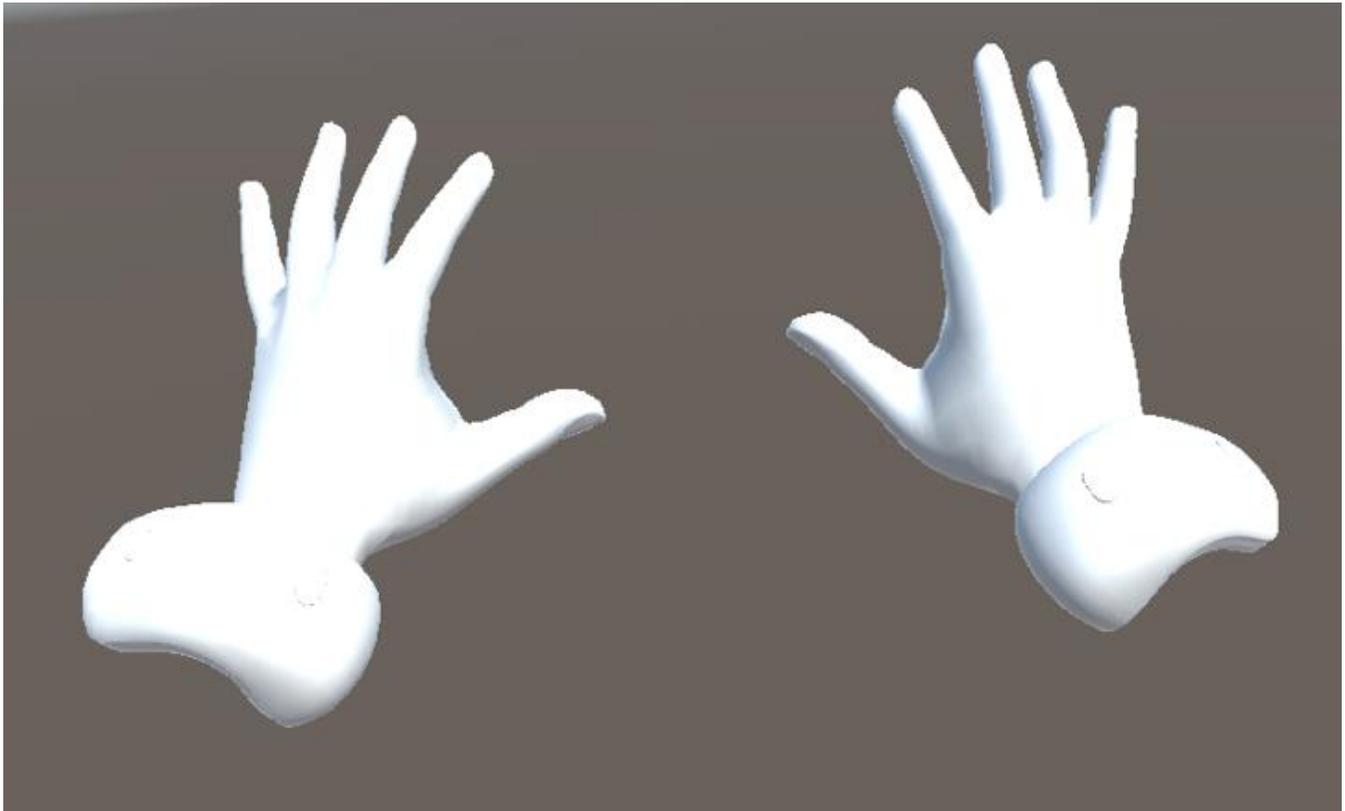


2. Configure your scene.
 - a. Go to **File > New Scene**.
 - b. Add the **ViveCameraRig** prefab to your scene, and then remove **Main Camera**.
ViveCameraRig will be added to *Assets\HTC.UnityPlugin\ViveInputUtility\Prefabs*.



Your hands and the wrist trackers will now be visible in VR.

Note: The default hand and tracker VR models for VIU will appear white.



FAQs

Type	No.	Question	Answer
General	1	How do I check the tracker's battery level?	When in VR, you can check the tracker's battery level from the Lobby or the VIVE Menu. When the battery is low, a flashing red dot will appear next to the tracker icon.
	2	How do I pair VIVE Wrist Tracker with VIVE Focus 3?	To pair VIVE Wrist Tracker, go to Settings > Connectivity > Controller , and select the input type icon in the upper right. Follow the on-screen instructions to pair the wrist trackers.
	3	What does the status LED on VIVE Wrist Tracker mean?	The status LEDs indicate the status of the tracker and which side it's paired on. <ul style="list-style-type: none"> • Solid green: Tracker is paired • Blinking red: Battery is low • Blinking blue: Tracker being paired with the headset • Solid blue: The tracker is connecting to the headset • Solid orange: Charging
	4	How do I update VIVE Wrist Tracker?	If a firmware update for VIVE Wrist Tracker is available, the Update firmware button will appear on the Controller screen. Select the button to start the firmware update. Note: Do not power off the tracker before the firmware update is finished. Doing so could result in a firmware error.
	5	Why does VIVE Wrist Tracker automatically turn off?	VIVE Wrist Tracker automatically turns off when the battery is drained or when the headset enters Standby mode or powers off.
	6	Why can't I switch to VIVE Wrist Tracker in VIVE Focus 3?	If you can't see the input type button in the upper right of the Controller screen, check that your VIVE Focus 3 is updated to the latest version.



VIVE Wrist Tracker

HTC Corporation

Developer Guidelines

v1.1
2022/3/24

Type	No.	Question	Answer
SDK	1	Where can I download the latest VIVE Wave SDK and support documentation?	You can download the VIVE Wave SDK at https://developer.vive.com/resources/vive-wave/download/latest/ . VIVE Wave SDK support documentation is available at https://hub.vive.com/storage/app/doc/en-us/UnityXR/UnityXRTutorials.html .
	2	How can I use VIVE Wrist Tracker with content created for the VIVE Focus 3 controller?	You or a content developer will need to apply new coordinate settings to VIVE Wrist Tracker according to the original coordinate settings of the controllers. If the coordinate settings are different, VIVE Wrist Tracker will need to be recalibrated.
	3	Do the VIVE Wrist Tracker hardware buttons correspond to any VIVE Focus 3 controller buttons?	The Power button corresponds to the VIVE/Menu buttons, and the App button corresponds to the A/X buttons.

Type	No.	Question	Answer
Hardware	1	What is included in the VIVE Wrist Tracker CAD files?	The compressed CAD file package contains STP files for VIVE Wrist Tracker, Rail mount, and Mounting base. You can use these files for reference when designing hardware accessories for VIVE Wrist Tracker. Download the CAD file from below links: VIVE Wrist Tracker surface CAD: https://dl.vive.com/3d-files/vive_wrist_tracker_surface_3d.zip Rail mount CAD: https://dl.vive.com/3d-files/vive_wrist_tracker_picatinny_rail_mount_3d.zip Mounting base CAD: https://dl.vive.com/3d-files/vive_wrist_tracker_mounting_base_3d.zip