

PITCHvr™ Vision User's Manual



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Quick Start Guide for Steam Downloads

To start up with VIVE or INDEX

1. Turn on one controller.
2. Open Steam.
3. In Library, launch SteamVR.
4. Stay in Library and Launch PITCHvr™ Vision. A simple GUI will open on the desktop.
5. In the GUI, select headset from "Viewing Platform" drop down list. Select any other options you'd like to try in the PITCHvr™ Vision training / evaluation system (see user's manual for details).
6. When ready, click the "Run PITCHvr™" button on bottom right of GUI window.
7. Put on HMD and follow instructions on "hitter's eye" (scoreboard-like screen deep in the field).

To start up with Oculus

(note: Quest 2 requires a link cable attached and activated)

1. Open the Oculus app.
2. Open the Steam app.
3. In Steam Library, launch PITCHvr™ Vision (this can be run via SteamVR, but it usually runs smoother without)
4. A simple GUI will open on the desktop.
5. In the GUI, select the headset from the "Viewing Platform" drop down list. Select any other options you'd like to try in the PITCHvr™ Vision training / evaluation system (see user's manual for details).
6. When ready, click the "Run PITCHvr" button on the bottom right of the GUI window.
7. Put on the HMD and follow instructions on the "hitter's eye" (scoreboard-like screen deep in the field).

Introduction

PITCHvr™ Vision uses patented technology to train and evaluate serious baseball players in:

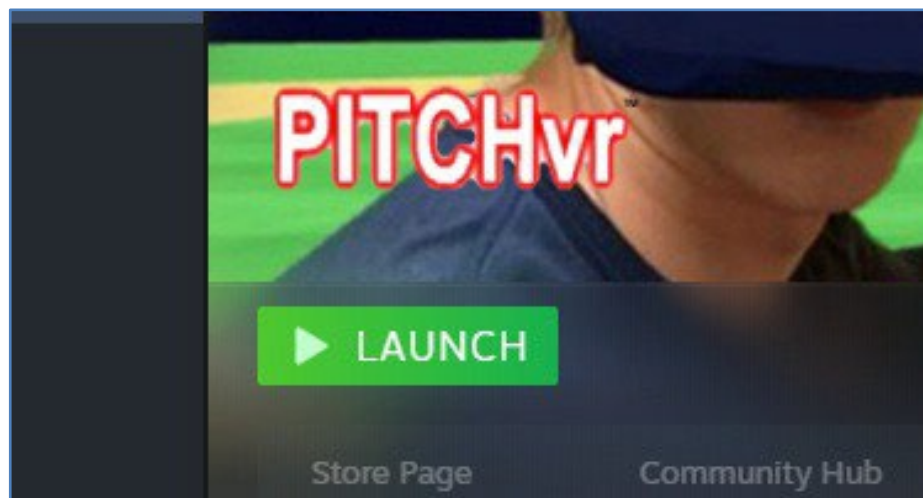
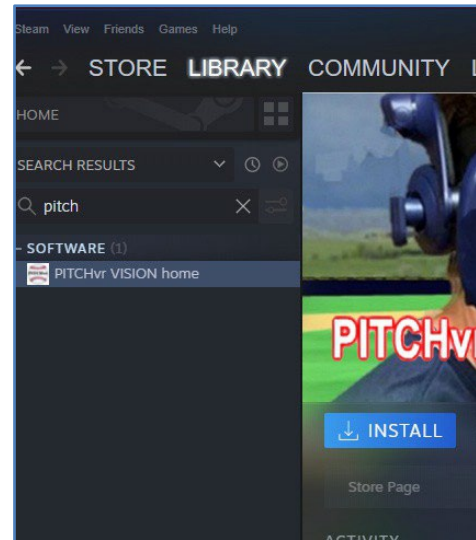
- Pitch type recognition
- Strike zone (K Zone) location recognition
- Pitch trajectory

Features

- Immersive training in a ballpark with realistic dimensions
- Staircase adaptive training -- the user selects the initial degree of difficulty, but the system adjusts to the player's actual performance level during the session
- Personalized strike zones, set by the user, accounting for height variability from player to player
- Bat length as selected by the player
- Player can bat left or right
- Three levels of pitching data sets are available: high school, college, and pro
- A realistic pitcher avatar that throws four types of pitches:
 - Fastball
 - Curveball
 - Slider
 - Change up
- Selection of left or right-handed pitcher
- Multiple pitch combinations based on spin-mirroring set by the user provide a unique Spin Perception™ training approach
- Animations show the pitcher's finger positions as the pitch is being released
- Training mode that employs 3D graphics to indicate pitch release point and tunnel zone
- User selections for type of baseball including:
 - size (standard 3-inch or more difficult 2-inch diameter)
 - color (denoting type of pitch)
 - seam thickness
 - graphics on the baseball to highlight spin rate and directions
- Patented Soundscapes™ technology, embedded in the animation, train the player's brain to assess speed, type, and position of the ball in-flight
- Eye-sync™ technology trains the user to better track the trajectory of the pitch and spin of the ball by allowing the user to repeatedly replay the pitch forward and backward
- Several techniques are employed in evaluation mode, including strobed pitches where the ball appears and disappears on the way to the plate
- Live Coach/Trainer's view on the computer monitor shows a split screen with the catcher's view and the pitcher's view of each pitch and swing
- After each pitch, the result is shown on the scoreboard behind the batter
- At the end of a session, an XLS (e.g., Excel) report file provides pitch by pitch reports on the batter's performance for player and trainer review
- Leaderboards (coming soon) help players keep track of their progress and compete against others

Downloading from Steam

1. After purchasing PITCHvr™ Vision from Steam, go to your Steam LIBRARY, select the app in the lefthand list, and click the blue INSTALL button.
2. Ensure your VR headset is connected to your PC.
3. Start PITCHvr™ Vision by clicking the green LAUNCH button.
4. Follow instructions within your VR headset to set up training sessions.



Launching PITCHvr™ Vision

1. Run your VR software (the SteamVR app if using with the Vive Pro 2 HMD, OR the Oculus app with the Oculus Link established if using Oculus Quest 2 or Rift S).
2. Turn on at least one controller if using the Vive Pro 2, or ensure the Oculus Link is active if using Oculus HMDs.
3. Click on the PITCHvr™ Vision app, either directly from Steam as above, or from the icon on your desktop.
4. Make sure your HMD is fitted securely to your head and adjusted properly for your use.
5. Follow the detailed instructions below to choose your type of session within the VR GUI.

Starting your PITCHvr™ Vision session

The GUI (graphical user interface) allows the user to set up a PITCHvr™ Vision Training session or an Evaluation session.

Open the PITCHvr™ Vision GUI by clicking on the **PLAY** icon.

Once the GUI program opens, click on the **User Settings** tab if it is not already activated. Enter your name or other identifier in the **User Name** or ID# input box.

For **Viewing Platform**, select your virtual reality (VR) head mounted display set (HMD) from the dropdown list. Available options include Oculus Rift S, Oculus Quest with a link cable, Oculus Quest 2 with a link cable, HTC Vive or Valve Index.

PITCHvr Vision User Settings

User Settings Training Evaluation

User Name or ID#: bharper

Viewing Platform
Quest 2

Pitch Data Sets

3/4 HS 3/4 COLL 3/4 PRO
 SA HS SA COLL SA PRO
 OT HS OT COLL OT PRO
 SUB HS SUB COLL SUB PRO

Mode
 Training Evaluation

Run PITCHvr

Perceptual Image Trainer for the Complete Hitter in the virtual realm
PITCHvr™
U.S. Patents
10,864,422
11,331,551

The user can also select from the available Pitch Data Sets purchased. The purchased, available choices are black and not grayed out. **HS** indicates the high school data set; **COLL** denotes the college level pitch data set and the **PRO** column is for the professional set. The other indicators include arm slots of **3/4**, **SA**, **OT** and **SUB**. The **3/4** slot is the most common delivery in today's game; it is released at an angle between 50 and 60 degrees from the top of the shoulder. **SA** indicates a side arm pitch. **OT** refers to a pitcher with an over-the-top arm motion. **SUB** is the submariner delivery where the pitch is delivered in a near underhand position, similar to a software pitch.

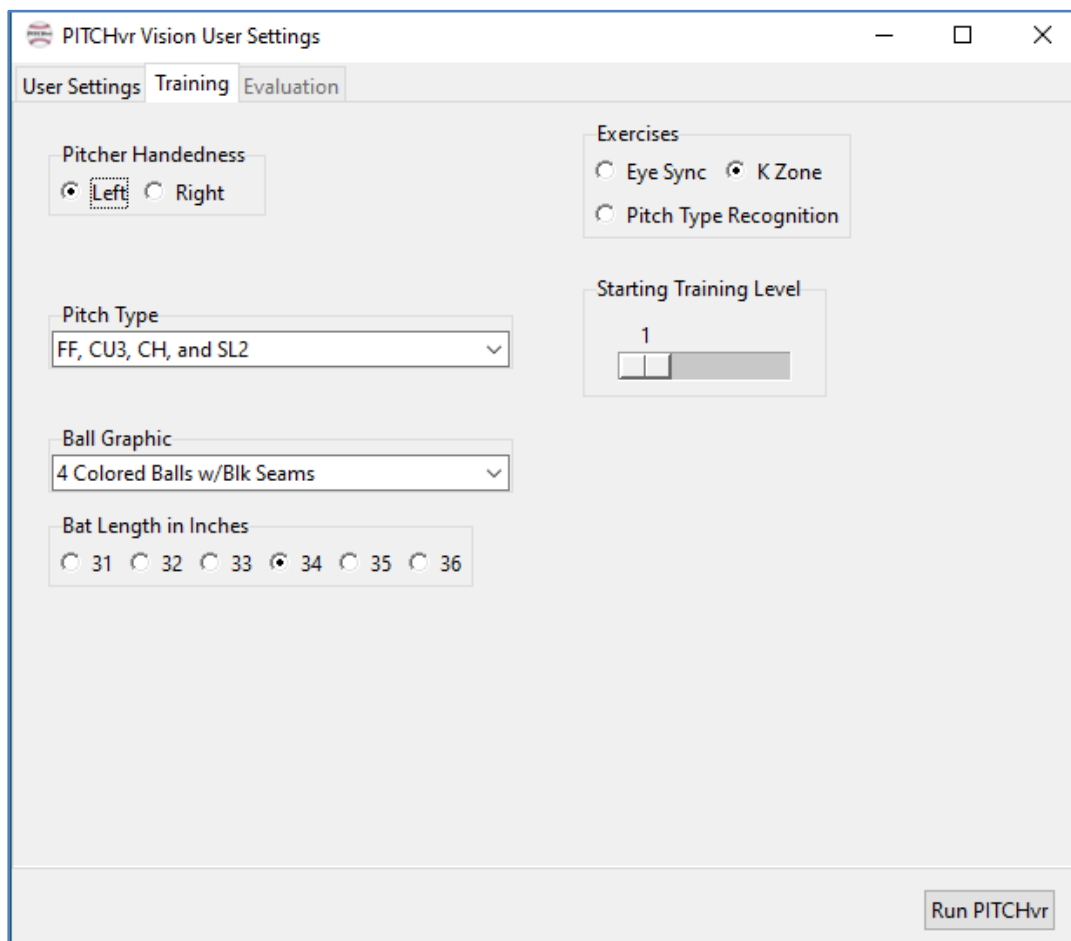
Using the GUI to set up a Training session

Training session options include Eye-sync™, K zone, and Pitch Recognition.

A number of training aids are automatically provided during all Training sessions. These include:

- A graphic in 3D space just above the pitcher's throwing arm to indicate the pitch release zone.
- A graphic in 3D space mid-way between the pitching mound and home plate to indicate the Tunnel Zone.
- Patented audio Soundscapes™ to train the hitter's brain to better recognize the type of pitch and the location of the ball as the pitch is on the way to the plate.
- Ability to select baseballs colored-coded for the type of pitch being thrown.

Click on the radio button for **Training** in the **Mode** section of the User Settings Window.



Click on the **Training** tab to select the specific session's options.

Select the desired **Pitcher Handedness** by clicking on either **Left** or **Right** radio button.

Select the desired pitch types to face during the training session from the **Pitch Type** dropdown selection.

Pitch type selections include:

- FC and FT (Eye Sync™ and K Zone Training only)
- FF and CU3
- FC and CH
- FS and SL1
- FS and CU1
- CH and SL2
- FT and CU2
- FF, CU3, and SL2
- FS, SL1, and CH
- FF, CU3, CH, and SL2

Select the desired **Ball Graphic** from the drop-down list.

The **Ball Graphic** selections include:

- Standard baseball with red seams - just like you would see in a ball game in the real world
- Baseballs with arrows printed on them to indicate spin
- 4 Colored Balls with black seams.
 - Red baseballs indicate a type of fastball (FC, FF, FS, FT)
 - Blue baseballs indicate a type of curve (CU1, CU2, CU3)
 - Green baseballs indicate a changeup
 - Yellow baseballs indicate a slider (SL1 and SL2)

Select the **Bat Length** in inches by clicking the radio button. Note: A standard bat image is not used in the training or evaluation. The player needs to focus on bringing the barrel of the bat to the ball. Select a bat length that the player would typically use in the real world. This bat image is properly scaled to take into account that the batter's top hand will be on the controller and the bottom hand will be below the controller. In VR systems where the handedness of the controller matters, a right-handed batter will typically use a right-handed controller, whereas a left-handed batter will use a left-handed controller. 3D-printed controller extensions can be used to keep the user's hands together while swinging.

Select the initial desired **Starting Training Level** by moving the slider. PITCHvr™ will automatically adjust the level of difficulty during the session as part of the training process.

Select one of the types of **Exercises** using the radio buttons. Available training sessions include **Eye Sync**, **K Zone**, and **Pitch Type Recognition**.

Click on the "Run PITCHvr™" button at the bottom right corner of the window to finalize the session selections and to start the virtual reality training session.

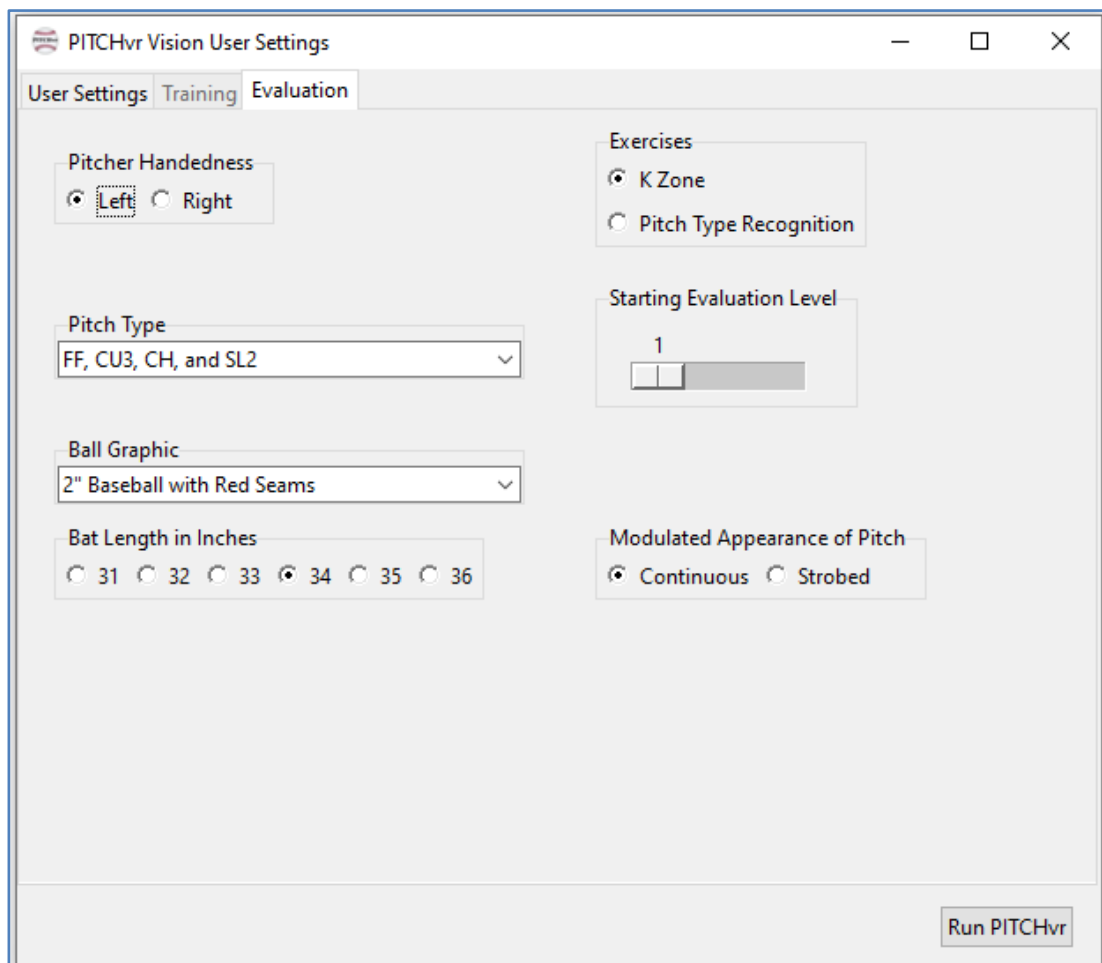
Using the GUI to set up an Evaluation session

An **evaluation** type of session is often set up by a coach or trainer but can be set up by the player to track progress.

Click on the radio button for **Evaluation** in the **Mode** section of the User Settings Window and select the **Evaluation** tab.

During evaluation sessions, training aids such as Pitch Release Point, Color Coded Baseballs, Soundscapes™, and Tunnel Zone graphics are not provided.

Evaluation sessions can be one of two **Exercises**, either **K Zone** or **Pitch Recognition**. One of the two are selected using the associated radio buttons.



Select the desired **Pitcher Handedness** by selecting either the **Left** or **Right** radio button.

Select the desired pitch types for the batter to face during the evaluation session from the **Pitch Type** dropdown selection.

Pitch Type selections include:

- FC and FT (K Zone Evaluation only)
- FF and CU3
- FC and CH
- FS and SL1
- FS and CU1
- CH and SL2
- FT and CU2
- FF, CU3, and SL2
- FS, SL1, and CH
- FF, CU3, CH, and SL2

The **Ball Graphic** selections include:

- Standard 3-inch baseball with red seams
- 2-inch baseballs with red seams

Select the desired **Bat Length** by selecting the appropriate radio button.

Select the initial desired **Starting Evaluation Level** using the slider control input. PITCHvr™ will automatically adjust the level of the session as part of the evaluation.

Select the desired type of **Evaluation** exercise session using the radio buttons. Available exercises are **Pitch Recognition** and **K Zone**.

Select the desired style for **Modulated Appearance of Pitch** -- either the radio button for **Continuous or Strobed**. In the **Continuous** mode, the pitched ball appears as it would in real world practice. In the **Strobed** mode, the pitch will appear and disappear on the way to the plate to challenge the batter's concentration and sharpen their instincts.

Click on the "Run PITCHvr™" button at the bottom right corner of the window to finalize the session selections and to start the virtual reality training session.

Entering the PITCHvr™ Vision virtual world

Follow the directions of the HMD manufacturer as you would to prepare for a VR session with their HMD. Follow all safety procedures and precautions.

Once you have set up the PITCHvr™ GUI, you are now ready to start a session in VR.

Setting homeplate orientation

Open PITCHvr™ Vision as you would any other VR application on your system.

Do not put on the HMD until you are standing in the location within your play space where you would like home plate to appear. Orient yourself as though you were standing right behind home plate and are looking at the pitcher.

If your space is safe for use--clear of objects, people, and pets -- put on your HMD.

At this point, the HMD should place you in a simple but geometrically accurate baseball park, with you standing right behind home plate.

NOTE: The PITCHvr™ ballpark is deliberately designed for training with minimal distractions. The baseball aspects are detailed, but there are no screaming fans, no flags waving in the outfield, no hot dog wrappers blowing around on the infield and no organist playing fight anthems. PITCHvr™ is not intended to be a game; it should be thought of as a serious training tool. Hopefully it is an enjoyable experience, but progress in hitting will only be achieved if the player focuses on the task at hand. PITCHvr™ demands serious concentration.

Entering a Training session

If you selected **Training** when you set up the GUI, you will be placed in an **Eye-sync™**, **Pitch Recognition**, or **K Zone** training session. Be prepared to focus!

In all the sessions, PITCHvr™ provides you with a number of training aids including a virtual **Pitch Release Point** graphic, a **Tunnel Zone** graphic, **Soundscapes™**, and the opportunity to select **Color Coded Balls**, and **Balls with Spin Arrows**.

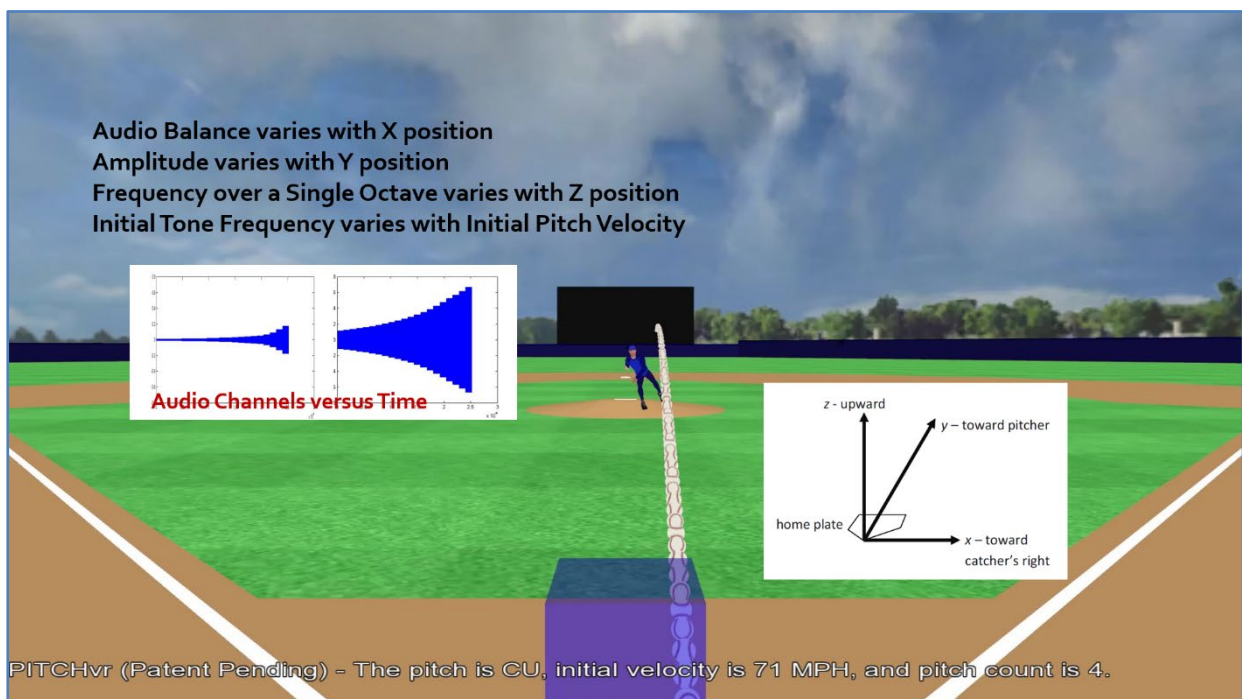
Pitch Release Point - checkerboard graphic in 3D virtual space to indicate the approximate zone where the pitcher releases the ball. The purpose is to help the batter focus on the very first moment the pitch is visible. The realistic PITCHvr™ pitcher avatar includes accurate finger positions that can indicate the particular pitch being thrown.



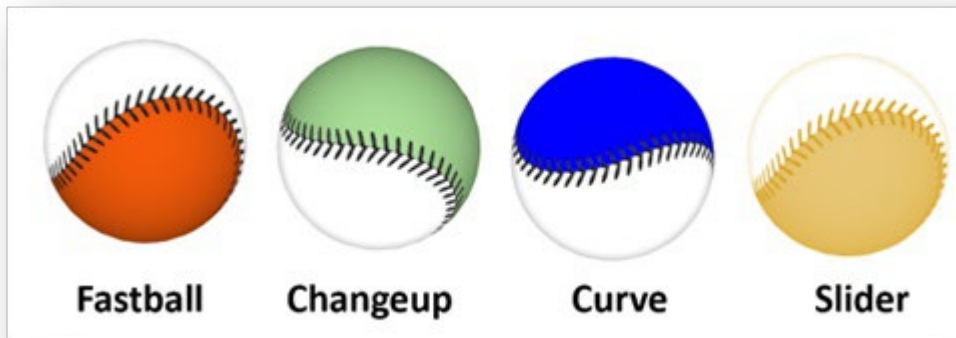
Tunnel Zone - A red and blue checkerboard graphic is positioned in 3D virtual space mid-way between the pitcher's mound and home plate. The purpose is to help the batter focus on the path of the ball in the "tunnel" as it approaches home plate.



Soundscapes™ . With most aspects of PITCHvr™ the player must deeply concentrate; however, the patented Soundscapes™ technology is an exception. With each thrown pitch, the Soundscapes™ feature produces a complex sound that represents the instantaneous speed, pitch type and location of the ball throughout its trajectory toward the plate. The soundscape begins slightly before pitch release to lead the hitter's eyes along the pitch path. The theory behind Soundscapes™ is that over time, after experiencing multiple pitches, the audio input will have helped reinforce the player's pitch recognition and the ability to track the pitch, since great hitters anticipate--rather than react to--a pitch's trajectory. This skill improvement is expected to persist, even when the Soundscapes™ are not present.



Color Coded Balls - When selected in the GUI for training, the color-coded balls are thrown by the pitcher to indicate the type of pitch being thrown. Red is used for fastballs; blue for curves; yellow for sliders, and green for changeups. These can be seen live as the pitch is headed toward the plate and are also shown in the pitch trajectory graphic after the pitch is thrown. In both the live view and the pitch trajectory view, the colors aid the batter by not only indicating the type of pitch, but by highlighting the spin of the pitch.



Spin Arrows - When selected in the GUI for training, balls with arrows printed on them are thrown by the pitcher to emphasize the spin the pitcher puts on the ball. The thick black arrows on the ball can be seen live as the pitch is headed toward the plate and are also shown after the live pitch in the pitch trajectory graphic.



Eye-sync™ warm up training exercise

Eye-sync™ is a warmup exercise where after the pitch is initially thrown, the baseball travels back and forth along the pitch path between the pitch release point and the front of home plate. Ten pitches are thrown in this warm-up exercise before exiting the VR software.

The purpose of the **Eye-sync™** sessions is to get the player's eyes to move back and forth along the pitch path to develop eye muscle memory for each pitch type.

Pitch Recognition Training Session

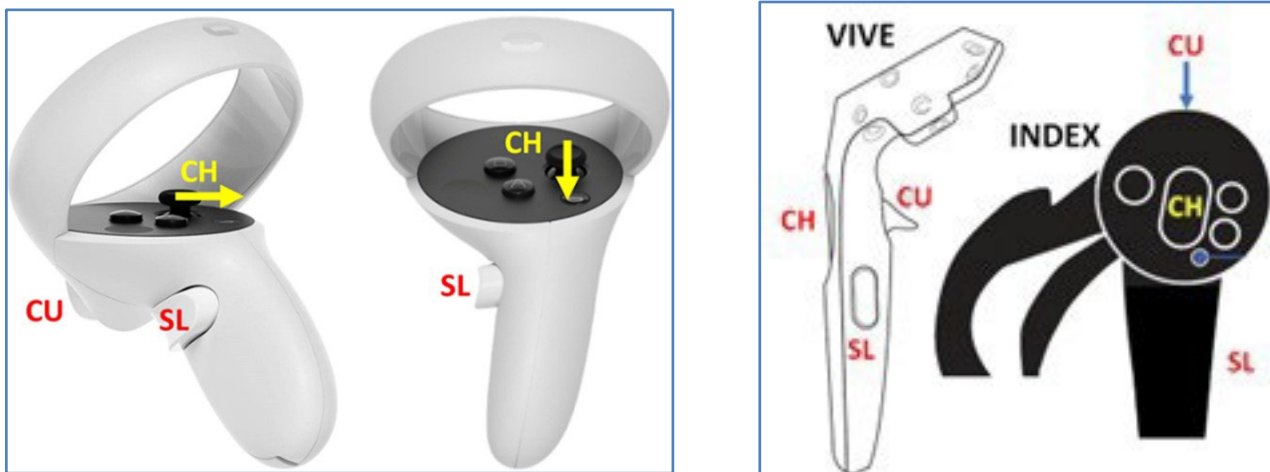
During the **Pitch Recognition** sessions, the batter is challenged to determine the type of pitch being thrown. The types of pitches the batter will face were chosen in the GUI. For example, if the user selected four seam fastballs (FF) and downward breaking curves (CU3), the pitcher will only throw those two types of pitches.

Note: Though up to four pitch types can be selected in the GUI, for training purposes it is recommended the player begins training with only two types at a time. As the player progresses, more than two pitch types can be used.

The pitcher will throw 20 pitches during a Pitch Recognition training session. After the 20th pitch, the program will close so that the player and trainers can review the performance spreadsheet detailing the results of the session.

With the HMD carefully in place to provide the clearest view of the PITCHvr™ pitcher and ballpark, step into the batter's box holding one of the controllers. You can bat right or left-handed as you prefer.

Look behind you for a graphic that shows how to use the controller to signal the type of pitch. The indicators for the Oculus/Meta and the SteamVR (Index) controllers are shown below.



For example, if you are using the Oculus / Meta controller do nothing if the pitch is a Fastball, pull the trigger for a Curveball, grip the handle for a Slider, or flick the joystick for a Change Up. Face the pitcher and follow the instructions as provided in the Batter's Eye (the large wall out in center field). Before you press the button to signal the pitcher to throw, note the **Pitch Release Point** graphic and the **Tunnel Zone** graphic. Most importantly, prepare to focus your concentration on the upcoming pitch. Don't let anything distract you.

As the pitch comes in, if you think it is a type of fastball - do nothing. If you think it is one of the other pitches, press the appropriate switch on the controller. Hitters are trained to gear up for a fastball and adjust against anything else. The rationale for controller use is the same here. If an off-speed pitch is thrown, then the user makes the adjustment by pressing one of the buttons.

Note: For non-fastballs, part of your score will be how quickly you made your decision (and pressed the proper switch on the controller.)

Once the pitch is thrown, you've made your decision and the ball has crossed the plate, look behind you to see the information panel that details data about the pitch and your reaction to it. This information will also be included in a session spreadsheet to be provided after 20 pitches.

Once you've reviewed the information panel, look back toward the pitcher and study the flight of the pitch. In addition to the path of the pitch, observe the spin and the location of the pitch relative to the tunnel graphic and the pitch release graphic.

If you predicted the pitch would not be a fastball, you should see a large white sphere on the pitch path. The location of the large ball is an indication of when you made your decision and clicked the controller indicating the type of pitch. Ideally, your decision will have been made somewhere on the pitch trajectory between the tunnel checkerboard and the pitch release point. If the large white sphere is closer to the plate, it may be considered late, and points will be deducted from your score.

If the trigger were pressed $\frac{1}{6}$ of a second before the pitch reached home plate, then the selection is deemed "on-time." Otherwise, if the trigger is pressed after this time but before the pitch has reached home plate, then the selection is deemed late. The $\frac{1}{6}$ of a second duration before the pitch reaches home plate has been chosen in this training analysis tool since elite hitters take $\frac{1}{6}$ of a second from the start of their swing until bat-ball impact occurs, so their swing decision must occur at least $\frac{1}{6}$ of a second before the pitch reaches home plate.

On-time correct selections are awarded 5 points, but late correct selections are awarded only 2.5 points. Incorrect selections are awarded 0 points. The training level (degree of difficulty) within the system progresses to higher levels if the user consistently has correct selections. Otherwise, the training level goes down if the user consistently has incorrect selections.

After 20 pitches, PITCHvr™ Vision will automatically exit. Normally, you would go to your customized report and review it - ideally with your coach or trainer. While doing this, take off the headset and refer to the PC.

PITCHvr™ will have created a spreadsheet detailing your session. To find it, open the reports folder and navigate to the correct report. Detailed instructions are found later in this manual (see page 16).

If you are not ready to review your session report, you can restart PITCHvr™ to repeat the training session with the same setting, or you can redesign a new session for Training or Evaluation in the already opened GUI window.

K Zone Recognition Session

During the **K Zone Recognition** sessions, the batter is challenged to determine if the pitch being thrown will be a ball or a strike. The types of pitches the batter will face were chosen in the GUI. For example, if the user selected four seam fastballs (FF) and 12 - 6 curves (CU3), the pitcher will only throw those two types of pitches.

With the HMD carefully in place to provide the clearest view of the PITCHvr™ pitcher and ballpark, step into the batter's box holding one of the controllers.

Before a pitch is thrown, the user must set up a personalized strike zone. Using the controller, place the controller at the bottom of one of your kneecaps and then pull the trigger on the controller to set the lower limit of the strike zone. You should see a green version of home plate when holding the trigger, just above the actual home plate. Raise or lower the controller to adjust the final location of the lower green plate to the desired lower limit if necessary. Release the trigger to set the lower strike zone limit.



Set the upper strike zone by placing the controller in the middle of your torso and then pulling the trigger to set the level of the upper strike zone limit. You should see a red version of home plate at this upper location. In major league baseball this upper limit is defined as being a height halfway between the player's shoulders and the top of the uniform pants waist.

To finalize the strike zone, follow the instructions provided on the Batter's Eye located in the deepest part of center field. Instructions will be provided to press a controller button to begin the session. Once this button is pressed, a blue graphic illustrating the user's strike zone will appear and the pitcher will take his place on the mound.

The pitcher will throw 20 pitches during this session. You may bat right or left-handed as you prefer. In this exercise you will have the option of going through the swinging motion or pressing the trigger button to indicated that the pitch is a strike. If you are planning on using the swinging technique, it is important to make sure your play area is clear of all objects including people. Hold your controller and your hands as though you are holding a bat and intend to swing it. For

Vive and Index controllers, the user's bottom hand can grip onto the bottom of the controller to maintain proper hand placement. For Oculus or Meta controllers, an optional controller extension can be purchased.

Now, face the pitcher and follow the instructions as provided in the Batter's Eye (the large wall out in center field). Note the **Pitch Release Point** graphic and the **Tunnel Zone** graphic. Most importantly, prepare to focus your concentration on the upcoming pitch. Don't let anything distract you.

Before each pitch is thrown, make sure to properly position yourself in the batter's box. If a strike is thrown, you will want to be in a position to "swing" the controller over and past the mid-point of home plate to indicate a strike.

TIP: with the HMD in place, look down at the ground. The "shadow disk" graphic in the virtual batter's box will indicate the shadow position of your head. This head shadow graphic, along with the depictions of the controller and bat images, will provide excellent indications of where your body exists in the virtual realm relative to the plate.

When the pitch is released:

- If you think the pitch will be a strike you must either press the trigger on the controller to indicate this or swing through the strike zone (the image of the bat must pass beyond the mid-point of home plate).
- If you believe the pitch will be a ball, do nothing. As you might in a real-life game, you may start your swing, but do not allow the controller to move past the mid-point of home plate. If you do, your response will be recorded as your prediction of a strike call.

Once the pitch is thrown and you've made your ball or strike decision, look behind you to see the information panel that details data about the pitch and your reaction to it. This information will also be included in a session spreadsheet to be provided at the end of the 20-pitch session.

After you've reviewed the information panel, look back toward the pitcher and study the flight of the pitch. In addition to the path of the pitch and how it crossed through or near the strike zone, observe the spin and the location of the pitch relative to the tunnel graphic and the pitch release graphic.

If you either initiated a swing or pressed the trigger button during the pitch, you should see a large white sphere on the pitch path indicating when you either started your swing or pressed the trigger button along the pitch path. If the large white sphere is too close to the plate, it may be considered late, and you will not get the full number of points for a correct decision.

After 20 pitches, PITCHvr™ Vision will automatically exit. Normally, you would go to your customized report and review it - ideally with your coach or trainer. Take off headset and refer to the PC. PITCHvr™ will have created a spreadsheet detailing your session. Please see detailed instructions on page 16 for how to access these reports.

If you are not ready to review your session report, you can restart PITCHvr™ to repeat the training or evaluation session with the same settings, or you can edit the settings in the GUI window and redesign a new session for **Training or Evaluation**.

Entering an Evaluation Session

Running **Evaluation** sessions for **Pitch Type** and **K Zone** is largely the same process as running the **Training** sessions except the training aids are removed (no **Soundscapes™**, no **Pitch Release Point** graphic, no **Tunnel Zone** graphic, no **balls with arrows**, and no **color-coded balls**.) The removal of the training aids simulates real life game time conditions. **Eye-sync™** is a not part of the evaluation process.

In addition to removing the training aids, new challenges can be chosen for the hitter via the GUI: the hitter may be asked to bat against standard 3-inch baseballs or 2-inch baseballs; the baseballs can also be modulated so will they appear and disappear as the pitch approaches the plate. The modulation masks some visual clues such as the rotation of the ball, challenging the hitter and helping the trainer in evaluation.



As with the **Pitch Recognition** and **K Zone** training exercises, 20 pitches are thrown per session; information regarding each pitch can be seen on the Information board behind the plate. Full reports are generated at the end of each session and placed in the reports folder.

The maximum score that can be achieved in evaluation sessions is dependent on the difficulty of the sessions as set by the GUI selections:

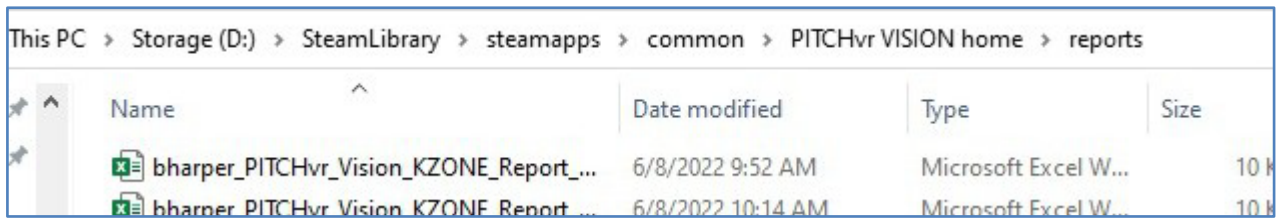
- 3" baseball, continuous motion (Max Score= 100)
- 2" baseball, continuous motion (Max Score= 133)
- 3" baseball, modulated motion (Max Score= 166)
- 2" baseball, modulated motion (Max Score= 200)

After 20 pitches, PITCHvr™ Vision will automatically exit. Take off the headset and refer to the PC. Normally, you would go to your customized report and review it- ideally with your coach or trainer.

PITCHvr™ will have created a spreadsheet detailing your session. Click the reports folder, then find the report to be examined and open it. If you are not ready to review your session report, you can restart PITCHvr™ to repeat the training session with the same settings, or you can edit the settings in the GUI and redesign a new session for Training or Evaluation.

Reports

PITCHvr™ places the session reports in a folder it created on the Windows computer when it first installed. Typically, this folder is called "reports" and is located in the PITCHvr™ Vision home folder, example shown below.

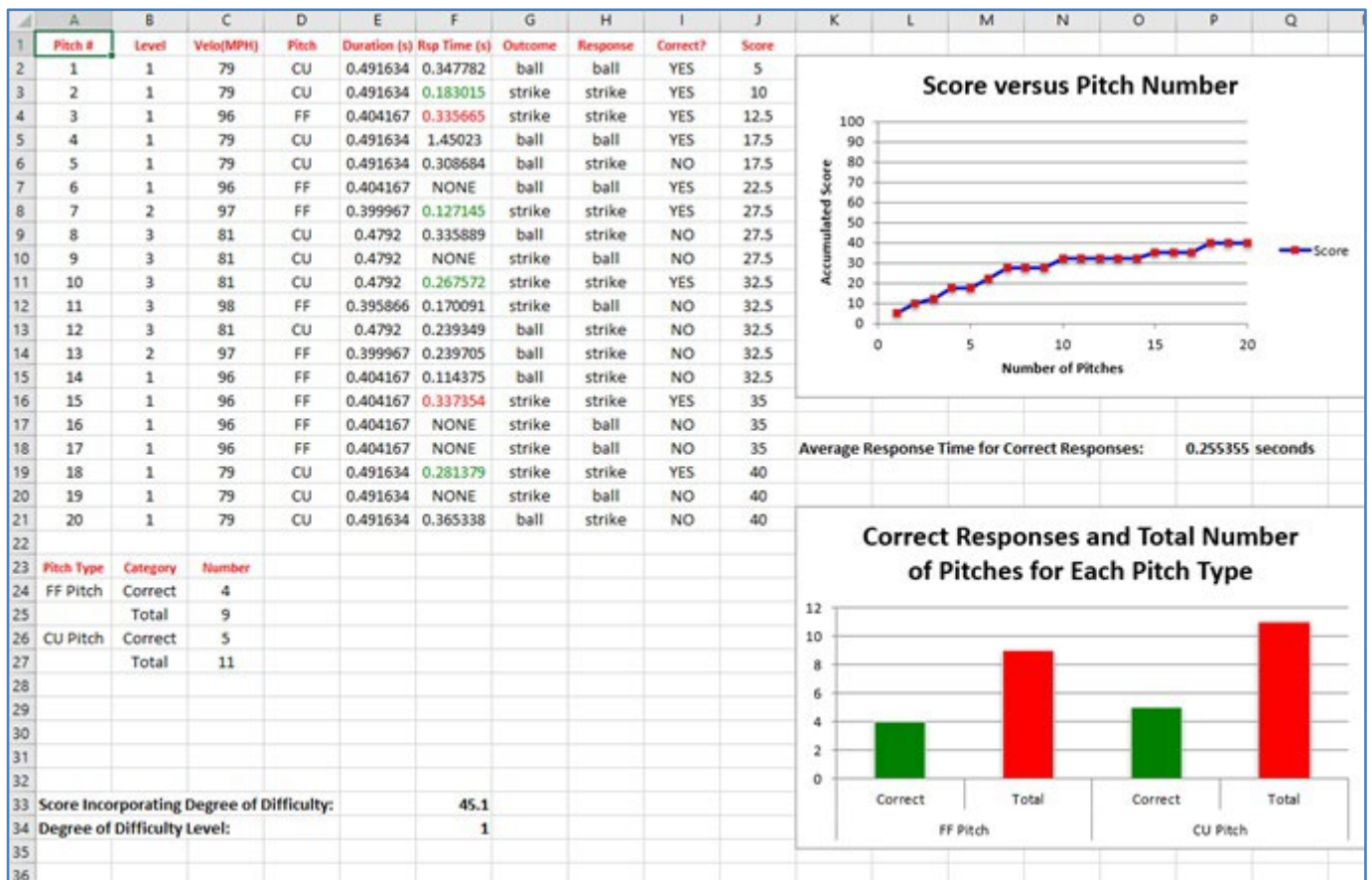


The reports are written as XLS files, meaning they can be read and displayed using standard spreadsheet software such as Microsoft Excel or OpenOffice's Calc.

The report files are named to help identify the user, the type, and the time of the report session. For example, the report file is named with the Player's Name or ID; "_PITCHvr_"; the type of exercise ("KZONE_" or "PITCH_TYPE_"); "Report_", followed by the date and time of the report.

Each report is customized with pitch-by-pitch entries and summaries. They include tables to help the player, coaches, and trainers evaluate the sessions.

An example of an evaluation session report for K Zone evaluation can be seen below:

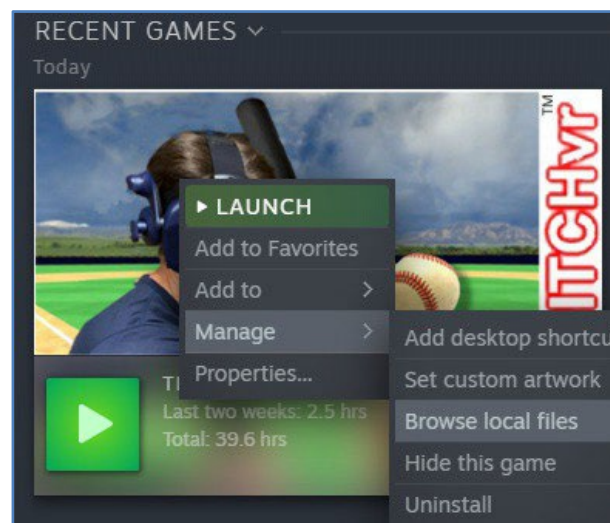


In the response time column (F), the response times in green show on-time responses and times in red show late responses when a correct response of a strike occurs. Time values in black note when the bat swing movement was initialized for either incorrect responses or when the correct response of a ball occurs. "NONE" denotes that no bat movement was detected.

Also, note that the pitch level (column B) increases after the first six pitches when the responses were mostly correct, stays at pitch level 3 for several pitches, but then the pitch level value starts to fall as more and more responses are incorrect. Consequently, the system will adjust to your performance level so that you can either properly train or be evaluated.

Finally, for an evaluation session, a Degree of Difficulty Score (45.1 is shown in F33) is also provided based on the level of difficulty chosen (1 is shown in F34) and the final performance score (40 is shown in J21). As the average value of the level in column B increases, a higher Degree of Difficulty Score will result.

Note: if you've downloaded PITCHvr™ from the STEAM Store, there is an alternate way to access your reports. While on STEAM, right click on the PITCHvr™ application icon, select "Manage" and "Browse Local Files", then follow the instructions as above.



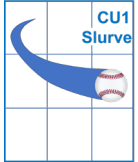
Pitch Types and Spin-Mirroring Combinations

The 10 different pitch types in PITCHvr™ Vision are shown below for a right-handed pitcher as seen from the catcher's perspective. The pitch paths for a left-handed pitcher would be the mirror image of the pitch paths shown below.



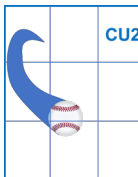
Change-up (CH)

One of the slowest pitches; it is thrown with a deceptive, nearly identical motion to that of a fastball & causes the batter to start their swing before the pitch arrives.



Curveball Slurve (CU1)

A slower pitch with more overall break than a slider; used to trick hitters who are expecting a fastball into swinging too early and over the top of the curveball. The CU1 has a more horizontal movement than the 12-6 curve.



Curveball Slurve / 12 -6 (CU2)

A slower pitch with more overall break than a slider; used to trick hitters who are expecting a fastball into swinging too early and over the top of the curveball. The CU2 has a more horizontal movement than the CU3, but not as much as a CU1.



Curveball 12 - 6 (CU3)

A slower pitch with more overall break than a slider; used to trick hitters who are expecting a fastball into swinging too early and over the top of the curveball. The 12-6 curveball breaks straight downward (from the 12 to the 6 clock positions).



Fastball - Cutter (FC)

A fastball that moves slightly away from the pitcher's arm-side as it reaches home plate. When thrown to an opposite-handed batter, the pitch will quickly move in towards the batter's hands, causing their swing to hit the ball on the smaller part of the bat (often breaking it).



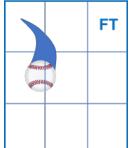
Fastball - Four Seam (FF)

The fastest and straightest fastball; it can overpower hitters, as it can get to the strike zone faster than the hitter can process it, creating a swung strike or a weak contact hit.



Fastball - Sinker or Split-Finger (FS)

A pitch thrown while the pitcher grips the ball with their two fingers split on opposite sides of the ball; this pitch drops sharply as it nears home plate. Designed to force the batter to swing early and with weak contact.



Fastball - Two Seam (FT)

Slightly slower than the FF, it has more movement, moving in the same direction as the pitch arm (rightward movement for a right-handed pitcher).



Slider (SL1)

A breaking pitch designed to deceive the hitter with spin and movement away from the pitcher's arm-side. The SL1 has more "run" (horizontal movement to the pitcher's arm-side) and less "depth" (vertical drop) than the SL2 pitch.



Slider (SL2)

A breaking pitch designed to deceive the hitter with spin and movement away from the pitcher's arm-side. The SL2 has less "run" (horizontal movement to the pitcher's arm-side) and more "depth" (vertical drop) than the SL1 pitch.

The pitch type combinations in PITCHvr™ Vision are set up to emphasize the training and evaluation of pitches that are "spin mirrors" of each other. More and more pitchers are being taught to throw combinations of pitches that come out of the same tunnel but move in opposite directions. To get pitched balls to move in opposite directions, the spin axis of one pitch is flipped compared to the spin axis of the other pitch. For example, a curveball has top spin whereas a fastball has back spin. Their spin axes lie in opposite directions parallel to the ground or are the "mirror" of each other.

Spin on a baseball produces a force known as the Magnus force; a curveball with top spin produces a downward force on the pitched ball while the back spin on a fastball produces an upward force. Consequently, a curveball drops more than it would due to gravity alone whereas the effect of gravity on a fastball is less, and the fastball drops less, since the Magnus force negates the effect of gravity to some degree.

The pitch combinations for the PITCHvr™ Vision system shown below emphasize the spin mirroring effect. This allows a hitter to train in the most efficient manner possible by training the brain to anticipate the pitch trajectory of spin-mirrored pitches.

- FC and FT
- FF and CU3
- FC and CH
- FS and SL1
- FS and CU1
- CH and SL2
- FT and CU2
- FF, CU3, and SL2
- FS, SL1, and CH
- FF, CU3, CH, and SL2

In the PITCHvr™ Vision system, training through the use of Soundscapes™ in tandem with the Spin Perception™ training approach along with the various visual graphics and assets creates a unique perceptual training experience offered by no other hitter training system.

Currently, there are three different pitch data sets available for a three-quarter release point pitcher. The speed ranges for each pitch in each data set are given in the table below. There are nine more pitch data sets planned, where three different pitch data sets will be created for each of the three additional release points. These pitch release points will be classified as over-the-top, side-arm, and submarine.

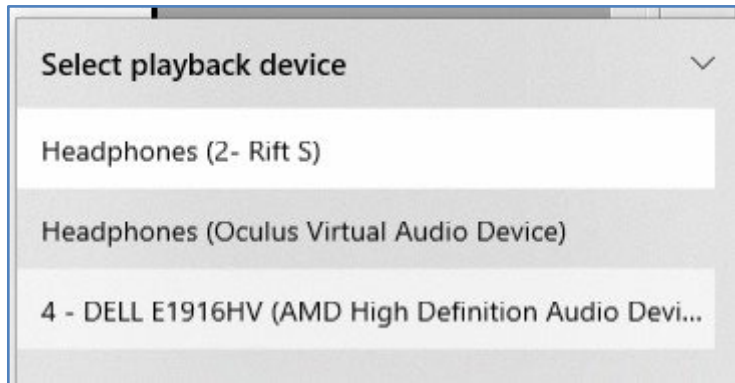
Pitch Type 3/4 release	HS	College	Pro
	(MPH)	(MPH)	(MPH)
Change up	70-74	79-83	86-90
Slurve	70-74	74-78	82-86
Hybrid between Slurve and 12-6	68-72	71-75	81-85
12 to 6 curve	66-70	69-73	79-83
Cutter	76-85	86-95	92-101
Four seam fastball	76-85	86-95	96-105
Split finger fastball	76-85	86-95	96-105
Two seam fastball	76-85	86-95	96-105
Slider with more run and less depth	74-78	77-81	88-92
Slider with less run and more depth	76-80	81-85	90-94

Finally, note that in pro baseball, there is a training philosophy which has been called "practice dirty, play clean." We have incorporated this philosophy into PITCHvr™ Vision so even the best hitters will be challenged by some pitches that are beyond the physical capabilities of the top pitchers. With the addition of using smaller balls and strobed pitch paths during evaluation, our software can even pick up nuances between elite players' abilities in determining type and location of pitches.

Appendix

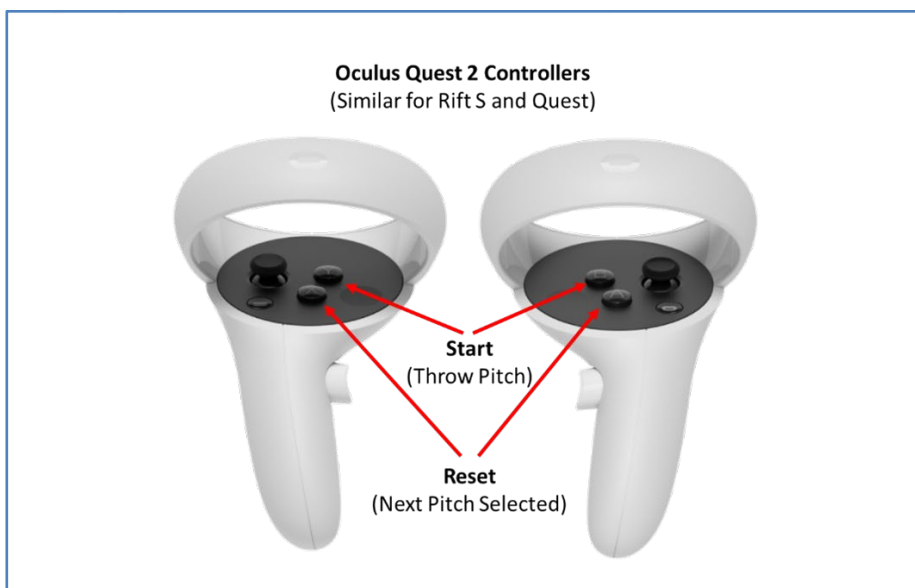
Regarding Soundscapes™

If you do not hear the **Soundscapes™**, make sure the computer is playing sounds through the HMD. For example, for Oculus using Windows 11, click on the speaker icon on the computer's desktop at the bottom right. A panel will appear; open the selector by clicking the v in the upper right corner of the popup. Then select Oculus Rift S (NOT the virtual device). Click anywhere on the desktop to exit the panel.



Controller Buttons Used During VR Training

With the Oculus, the **Y or B** buttons (depending on if you're using the left or right controller) on the controllers are used to trigger the pitcher to throw a pitch. The **X or A** buttons on the controllers are used to reset the system after a pitch has been thrown and the user's results have been displayed on a message board behind home plate.



Example Set Up: Using PITCHvr™ on the Oculus Rift S for the first time

(**Note:** The following description uses the Oculus Rift S HMD as an example. The procedure for other headsets is similar.)

Be sure to follow all of the safety precautions suggested by the manufacturer. Many of the notes below are simply a subset of the HMD manufacturer's instructions and are focused on the proper set up and use of PITCHvr™ Vision.

As with any HMD product, it is suggested that no one under the age of 13 use PITCHvr™.

It is very important the HMD and its lenses are adjusted properly for the user. For PITCHvr™ Vision to work effectively, the HMD must provide the user with the best VR experience possible. Vision is the key to baseball and PITCHvr™ training, so it is worth the time and thought needed to ensure the HMD is properly fitted for the user.

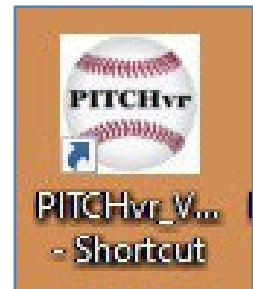
Open the Oculus software on your PC.

Following the instructions inside the Oculus application, set the floor level and a safe play space.

Using the Oculus software setting section, ensure the HMD and Controllers are connected to the computer and working properly. Add batteries to the controllers if needed.

Open PITCHvr™ Vision either from the Oculus Library or as you would any other Windows program.

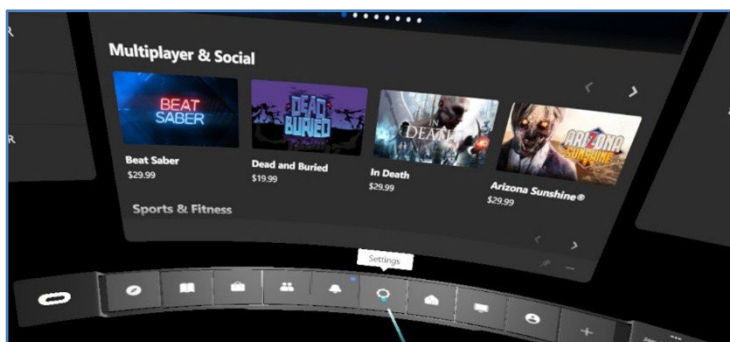
NOTE: The first time PITCHvr™ runs, Windows Defender or any other virus protection software may not recognize the software and attempt to block it. You will need to "allow" the PITCHvr™ program to run or to be excluded from being blocked.



If given a safety notice within the Oculus workspace, review it and, if satisfied, accept it.

If asked to allow access to data click "allow" using the controller.

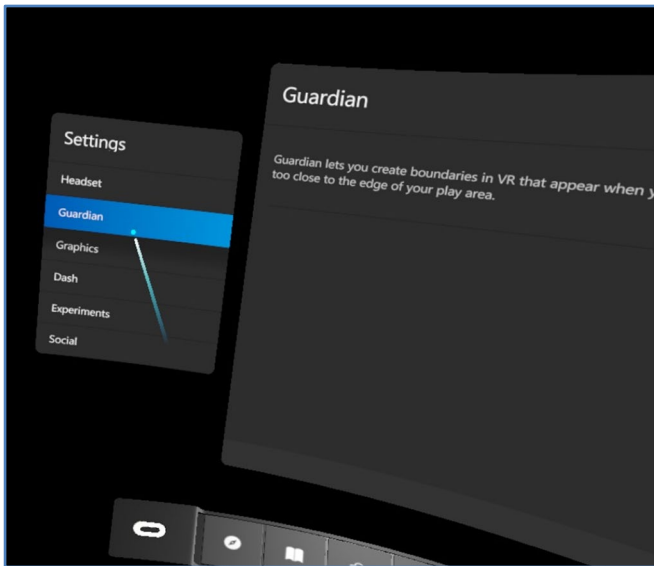
If asked about checking objects in area, be sure to do so.



If you've not set a boundary and floor level perform the following:

- Press the Oculus button on the right controller
- Select "Settings" from Oculus control panel

- Select "Guardian" from the "Settings" panel
- Choose "Set Up Guardian"



- Follow the in-Oculus instructions to set the floor level and the training area.
- Follow the instructions to set floor height by placing Controller on the ground. Select "Confirm" when satisfied.
- First time using PITCHvr™ on the Oculus Rift S? If so, go to the Oculus Library (book icon), select "Filters" and check "Hidden Apps."
- If not already defined, create a safe play area by following instructions and drawing the area using a controller. Select "Confirm" when satisfied.

IMPORTANT: Stand in the location within your play space where you would like home plate to appear. Orient yourself as though you were standing right behind home plate and are looking at the pitcher.

- Click the "Library" (book icon) on the Oculus control panel



- Click on the PITCHvr™ icon in the APPS panel

