Modo VR Technical Preview User Guide

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Introduction

This document is intended for the setup and use of the Modo VR technical preview version. This version of Modo allows the use of a Virtual Reality (VR) Head Mounted Display (HMD) as the output that controls the Modo viewport. It is assumed the reader is already familiar with using Modo.

> Warning: This version of Modo VR is a standalone build of Modo that is only supplied as a technical demo of the VR feature set. Any Modo files saved with this version of Modo VR are not guaranteed to work with any other build of Modo.

Specifications, Installation, and Setup

Machine Specifications

VR is a performance demanding operation when done correctly. Due to this, there is a much higher minimum machine specification required than is needed to run the default installation of Modo. The following are the machine specifications that we recommend:

- Windows 10
- Intel i7 or Xeon, 3.5 GHz or higher CPU
- 8 GB DDR4 Memory
- NVIDIA GeForce 1080 or Quadro M6000 Graphics card
- HTC Vive or Oculus Rift HMD with Oculus Touch controllers

Other machine specifications are possible but only the above is officially tested for the Modo VR technical preview version. Alternate hardware options have been tried and should work, including AMD graphics cards. If any issues for any machine configurations are found, please, report the details as listed in the Feedback section.

Installing

Modo VR

Download and install the Modo VR files provided by Foundry.

If you do not have a valid Modo license on your machine, a Licensing dialog appears at start-up. Follow the licensing instructions supplied with your version of Modo VR.

SteamVR

Modo VR can use the SteamVR (or OpenVR) system to talk with your supported HMD. This requires Steam to be setup and installed on your system, using a Steam account. For more information, see SteamVR Support.

Oculus Home

Modo VR can use the Oculus Home system to talk with your Oculus HMD. This requires the Oculus Home system to be setup and installed on your system. For more information, see Oculus Setup. Once installed and running, click **Settings** > **General** and enable **Unknown Sources**.

Note: If you see paragraphs in this document that start with **Oculus:**, it means they concern functionalities that are only available using Oculus Touch controllers and Oculus Home.

Note: For all HMDs, please make sure the installation is working correctly in the SteamVR or Oculus Home applications before trying to use Modo VR.

Running and Setup

To start and use Modo VR with an HMD, do the following:

1. Start the SteamVR or Oculus Home application.
   Tip: Type SteamVR in the Windows Start search menu to locate the application or run it from within the Steam client.
   Tip: Type **Oculus** in the Windows Start search menu to locate the application.
2. Start the Modo VR application. Double-click the "Modo VR" shortcut on your desktop.
3. Click the **VR** layout tab in the switcher bar directly below Modo's menu bar.
   You should now see a single viewport with no side panels and a split left/right view.
   If you lift and move the HMD around, the view in the viewport should change.
4. Move the mouse over the 3D viewport and click in the view to ensure the application has focus.
5. Put on the HMD and activate the controllers.
   In the HMD, you should see an empty scene and a ground grid.

This **VR** layout can be switched to or from at anytime to allow you to review or edit your loaded Modo scene.

Tip: Modo VR will favor Oculus Home over SteamVR, if detected. If this is an issue, run Modo VR with **-nooculus** on the command line to stop Oculus Home from being used. Conversely, use **-noopenvr** on the command line to stop SteamVR from being used.

Options, Scenes, and Performance

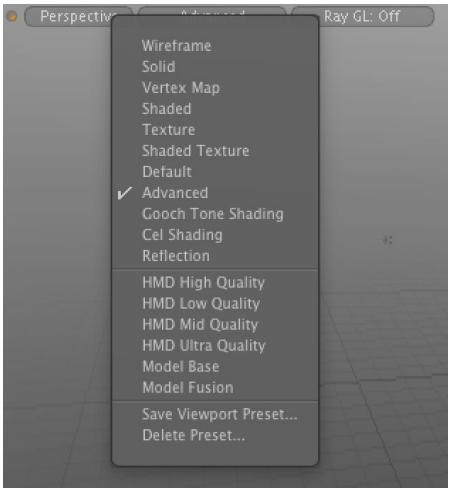
VR requires a much higher resolution and a higher frame rate for rendering than a normal Modo viewport session. This makes it easy to push Modo beyond the minimum required performance for an acceptable VR experience. To help control Modo's performance, there are a number of HMD Quality display setting presets that are predefined in Modo VR to allow you to configure your display.

Selecting an HMD Preset

Modo VR provides a number of predefined HMD Quality display settings.

To select an HMD Quality Preset:

1. In the top-left corner of the viewport, click the second capsule next to the Thumb to open a dropdown menu.



2. Select a preset you would like to try. The following predefined HMD Quality display settings are available:
    - HMD High Quality
    - HMD Low Quality
    - HMD Mid Quality
    - HMD Ultra Quality

If you would like to adjust the display settings manually, either use the gear settings icon on the top-right corner of the viewport or press the 'o' key when the cursor is over the viewport. The 3D Viewport Properties dialog is displayed. Open the **Advanced Options** tab to customize the display of elements within a viewport. For more information, see the **Viewport Options** topic in the Online Help.

New settings on the 3D Viewport Properties **Advanced Options** tab:

Setting	Description

Shadows	Controls the quality of the shadows. The following shadow options are available: ● CSM - Specifies if and how many levels of Cascade Shadow Maps are used for some light sources. Lower values render faster but produce less shadow detail. ● Size - Specifies the resolution of the Shadow Maps. ● Filter - Specifies if the shadows have a post process blur applied. Reduces jagged shadow edges.
Materials	Controls the type of shaders used to render the shader tree data. The following options are available: ● Simple - Very basic Blinn-Phong with no shadows, hardwired lights, and no environment lighting. ● Basic - Simplified Blinn-Phong that supports all light types, with shadows, and environment lighting. Viewport renders using this option will not match the Preview or Render windows but should produce higher frame rates. ● Full - Slowest but closest rendering to the Preview and Render windows.
Line Antialiasing	Controls how antialiased lines are rendered, which can improve visual quality. The following options are available: ● Off - Hard aliased lines. Fastest rendering. ● System - Hardware rendered anti-aliased lines, if the present graphics driver supports them. ● Full - Shader rendered anti-aliased lines. This is the slowest rendering but highest quality option.
Multisampling	Controls to render materials using hardware supported multi-sampled antialiasing (MSAA). The available option is the number of samples the hardware is to use for rendering. 1 is the default, upto a maximum supported value for your present GPU.
Anisotropic Filtering	Controls how material textures are rendered with filtering. The following options are available: ● Off - Use trilinear texture filtering. ● Max - Use anisotropic texture filtering, using the maximum GPU possible quality. Note: When changing this option you will need to restart Modo.
Stereo Mode	Controls if the viewport uses the HMD or not. The following options are available: ● Mono - Normal viewport mode. ● HMD - Use OpenVR to output to the connected HMD.
HMD Foveated Count	Controls how many sections make up a single eye's render. More sections save on pixel rate at the extra cost of CPU overhead.
HMD Resolution Scale	Controls how much to shrink the suggested rendering resolution to improve performance. Note: This option can produce inconsistent performance in the HMD. To resolve this issue, change the setting to obtain the desired performance and then restart Modo.

HMD Mirror	Controls if the HMD view is displayed in the viewport. This saves on performance.
Threaded Rendering	Renders the HMD view on a background thread, allowing the HMD to be constantly updated and to improve frame rates. Note: Some drivers will ignore this setting due to instabilities.

If using the presets or manually adjusting the display settings does not produce adequate performance, try the following:

- Hide objects and lights in the scene that you are not presently interest in.
- Make sure Modo has focus while using the HMD.
- Make sure there are no other applications that are producing high GPU or CPU loads.

Using Modo VR

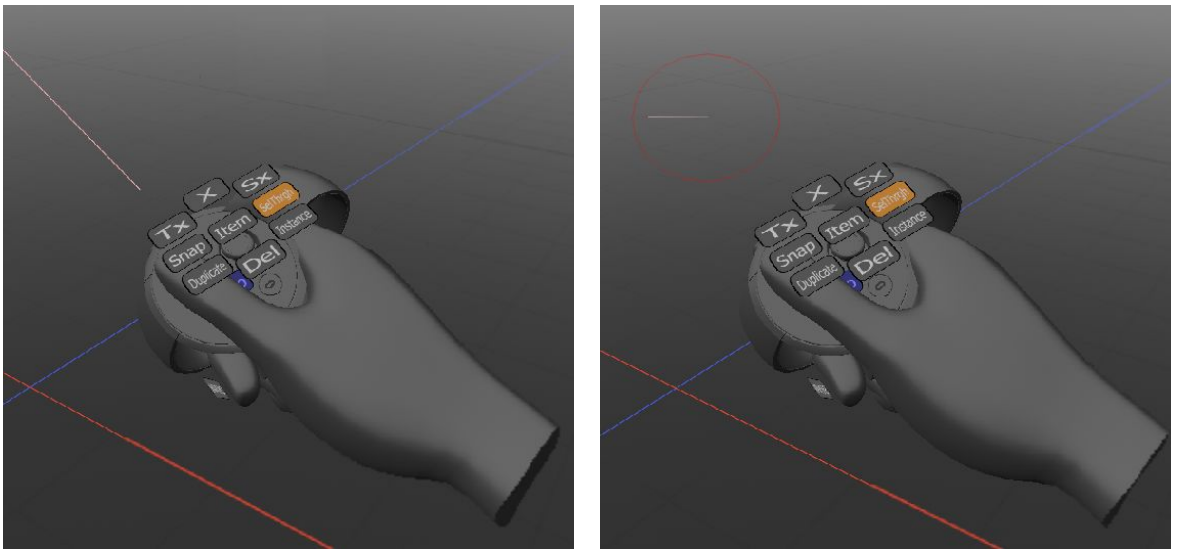
Controllers

The main way to interact with Modo VR is through hand controllers. When wearing the HMD you should see the two controllers (if they are missing, make sure they have not powered down). Each of them should look slightly different. One will have a laser line emitted from the front. This is the Pointer controller and is used as the master controller. Each controller has a trigger on the underside that works like the left or right mouse button to activate tools or selection using the laser pointer. Any buttons with actions assigned will have labels on them. If the button is touch sensitive, the label will change color when touched (blue) and again when pressed (orange). This is most noticeable when a controller has a touchpad or joystick that is segmented into button regions, the label highlights and vibrates when you move your finger or thumb into that button's region, letting you know that clicking at that point activates that action.

Note: The touchpad or joystick on a controller can be used without having to look at it. When your finger moves over a button the controller will vibrate to let you know a new button is active and ready to be clicked. Buttons on diagonals can be easily found by first moving your finger in a vertical or horizontal motion and then sliding around the touchpad or joystick until you feel the next vibration.

Laser Pointer and Target Modes

The laser pointer has two modes of operation: Pointer and Target; which you can switch between using the Laser Mode options.



Pointer Mode Target Mode

The pointer mode is the default mode of operation and can be seen as a line that emanates from the controller and points in the controller's forward direction. Point the laser line at the items you would like to interact with, like you would a laser pointer on a screen.

The target mode is shown as a circle with a small line within it. This works by looking through the line in the circle at the items you would like to interact with. There is still a laser line involved (the short line you can see inside the circle) but it always points in your head's direction. This method is harder to learn, but improves on some of the issue that affect the Pointer mode. (Like hand shake).

Selection

The default mode for the controllers is a selection mode. If you point the laser pointer at an object, its wireframe will change color (blue) to show it is highlighted. If you then use the pointer's trigger, the object will be selected (yellow).

Tool Handles

When tool handles are active you can use the laser pointer to highlight and drag different parts to perform operations. Pointing at a part of the tool handle will highlight it, changing its color (yellow). While highlighted, you can then hold the trigger and move the controller to drag the tool handle. For example, highlighting and dragging one of the transform tool handles' arrows will move the selection on that axis. For a full description of what the different tool handles do, see the Online Help. Use the **Drop** button to deactivate a tool handle and go back to **Selection** mode.

Teleport and Goto

There are two main ways to teleport yourself around a large scene: Teleport tool and Goto action. The Goto action works by pointing the laser pointer at a location and pressing the **Goto** button. You are then moved to the new location. This will work while any other tool mode is active without deactivating that tool mode. Pressing the **Teleport** button activates the Teleport tool. This changes the pointer from its previous mode (most likely Selection tool) to the Teleport mode. Pointing the laser line at a location now shows you an indication of where you will appear once teleportation has happened. To perform a teleport, use the trigger button. Once you have finished with the Teleport tool, use the Drop button to go back to the default tool.

Pinch to Navigate

An alternative to the Teleport and Goto options is the Pinch to Navigate (P2N). This involves holding down the navigation buttons on each controller (Note: For the HTC Vive

controllers, these are the grip buttons on the underside of the controllers. There is also a label on both sides of each controller. Only one button per controller has to be held down). Once held down, the scene around you can be translated, rotated, and scaled by moving both controllers:

- Moving the controllers closer together or further apart scales the scene.
- Moving the controllers around a center point rotates the scene around the point.
- Moving the controllers in the same direction translates the scene.

P2N needs some initial practice to get used to as it is easy to lose track of the present scale of the scene.

To help with scale, there is a UI element that appears between the controllers when P2N is activated. It represents the present absolute scaling of the scene. By default the scaling is x1, which is shown by the single white marker on the UI. For every 4 marks, the scale goes up or down by a factor of x10. Use this UI element to check that you are only changing the scene scale when you intend to.

Note: The menu item P2N Reset will place you back at the origin with a normal scale.

Oculus: When using Oculus Touch controllers it is possible to translate and rotate using a single hand. To activate this mode use the grab action (touch the A+B+Trigger and press the Grip button) , the controllers will vanish leaving just the hands. Either hand can be used.

Button Sets

Some of the buttons on the non-pointer controller and menu items will change the actions assigned to the buttons on the pointer controller. These are called Button Sets and represent different groups of actions. Once activated you will see the labels on the pointer controller change.

The available sets are:

Name	Description
Options	Display options for tweaking performance from within the HMD.
Anim	Animation controls.
Annotations	Annotation creation tools and UI.
Items	Item move tool handles, duplication and deleting.
Lights	Light creation and move tool handles.
LocTrack	Locator Tracking controls.

Menus

The non-pointer controller has a number of floating labels, over your wrist area. These are the Menu system. Use the pointer controller to point at and highlight an item and use the trigger to click on it. The first couple of rows of items are the top menu and will not change. Clicking these will change the menu items farther down to show sub-menus tailored for different workflows. Items with an orange background show a selected state.

Note: The controller button labeled Menu will toggle this menu on and off.

Top Menu Items

Name	Description
Anim	Show Animation sub-menu.
Button Sets	Show Buttons Sets sub-menu.
Rendering	Show Rendering options sub-menu.
Annotation	Show Annotations sub-menu.
LocTrack	Show Locator Tracking sub-menu.
Items	Show Item creation and manipulation sub-menu.
Layout	Show Item advanced manipulation sub-menu.
Misc	Show miscellaneous sub-menu.

Common Menu Items

Name	Description
Undo	Undo operation.
Redo	Redo operation.
Drop	Drop present tool, and return to selection mode.
Item	Item selection mode.
SelThrgh	Toggle Select Through state.
Duplicate	Create duplicates of selected items.
Instance	Create instances of selected items.

Hide	Hide selected items.
Hide Invert	Invert hidden items.
UnHide All	Unhide all items.
Tx	Transform tool.
Rx	Rotation tool.
Sx	Scale tool.
X	Transform, Rotation and Scale tool.

Layout Menu Items

Name	Description
Snap	Toggle snapping on/off. Start of snapping options.
Grid	Toggle grid snapping.
1 cm	Set grid snapping to 0.01 meter.
10 cm	Set grid snapping to 0.1 meter.
1 m	Set grid snapping to 1 meter.
Action Center	Start of Action Center options.
Automatic	Action Center mode.
Selection	Action Center mode.
Sel Border	Action Center mode.
Sel Auto	Action Center mode.
Element	Action Center mode.
Screen	Action Center mode.
Origin	Action Center mode.
Local	Action Center mode.
Pivot	Action Center mode.
Auto	Action Center element mode Auto.
Autoc	Action Center element mode Auto Center.
V	Vertex snapping or action centers.

E	Edge snapping or action centers.
Ec	Edge Center snapping or action centers.
P	Polygon snapping or action centers.
Pc	Polygon Center snapping or action centers.

Rendering Menu Items

Name	Description
HMD Low	Use HMD Low Quality viewport preset.
HMD Mid	Use HMD Mid Quality viewport preset.
HMD High	Use HMD High Quality viewport preset.
Simple	Set material mode to Simple.
Basic	Set material mode to Basic.
Full	Set material mode to Full.
Bump	Toggle bump mapping on/off.
Shadows	Toggle shadows on/off.
Wire	Cycle through Wireframe combination: ● Wireframe on all meshes. ● Wireframe only on select meshes. ● No wireframes.
Mirror	Toggle mirroring the HMD view in the viewport on/off.
Res Up	Increase resolution rendered for HMD.
Res Down	Decrease resolution rendered for HMD.
MSAA Up	Increase Multisample value.
MSAA Down	Decrease Multisample value.

Misc Menu Items

Name	Description
Menu	Toggle the menu on/off.
UI	Toggle UI elements, like Annotations, on/off.

Move UI	Toggle which controller the UI elements appear on.
Swap Hands	Switch which hand is the pointer and non-pointer controller.
Laser	Toggle the laser pointer on/off.
LaserCone	Show the laser's collision cone.
LaserNarrow	Make the laser's collision cone angle narrower than default.
LaserMid	Make the laser's collision cone angle the default size.
LaserWide	Make the laser's collision code angle wider than default.
Laser Mode	Toggle between laser pointer and laser target modes.
Laser Tilt	Cycle through the laser pointer tilt angles.
P2N Reset	Move the user back the center of the environment with a normal scale.
Menu Gaze	Toggle between 'point controller at menu' and 'look at menu' interaction modes. The 'look at' mode requires you to look at[1] the menu item you are interested in instead of pointing at it with your hands.

Indicators

The pointer controller can have a number of labels above the buttons. These are temporary indicators for user information, akin to status bar icons. The appearance of an indicator will vibrate the controller to call your attention to it. Any simple modal dialogs that Modo produces will show up here for a limited time, i.e. "Out of Undo - Ok" or "Nothing to Save - Ok" dialogs.

Name	Description
Lost Focus	The Modo application has lost focus to another application. This can happen due to notifications, new applications starting, or any number of other triggers. When this happens Modo VR will not respond until it has been made the active application again.
Threading Disabled[2]	Modo VR ideally uses a background thread to render the HMD view. This can be disabled by the user. The performance and interaction penalty for doing this is severe, this indicator is to remind you it is disabled and to re-enable it.
GPU Slow	The rendering of the HMD view is slower than is needed for a

[1] At present, eye tracking is not supported, so looking at the menu items requires you to move your head until the menu item is in the center of your view.
[2] There is also a 'Threading Not Supported' indicator that can be seen in some situations. See Known Issues.

	comfortable VR experience. There are many reason why this will happen. Some reasons are external like another application in your system is slowing your computer down, but the main course is your GPU is not fast enough to render the present scene or point of view, in this case try turning down the rendering options or hiding parts of the scene you are not concerned with at present. Some of the other indicator are hints[3] as to why you are seeing bad performance and will alway be in combination with this indicator.
Reduce Shadows	GPU Slow Hint: Calculating the shadows is taking too long. Try disabling the shadows.
Reduce Geometry	GPU Slow Hint: Rendering the geometry is taking too long. Try turning down the Multisampling, drawing less objects or drawing less vertices.
Simplify Pixels	GPU Slow Hint: Rendering the materials is taking too long. Try turning down the Multisampling, reducing the resolution, disabling bump-mapping or disabling shadows.

[3] The GPU Slow hints are only guesses at why your rendering is slower than normal. There are many issues that can contribute to slow rendering, and a hint might not be the best reason, but a good place to start looking for a solution.

Features

Annotations

Annotations are a way of leaving temporary notes in a Modo scene for later action.
The main items are:

- Sketched meshes.
- Snapshot cameras. These can contain a sub-mesh to hold sketched meshes.

Sketch Annotations

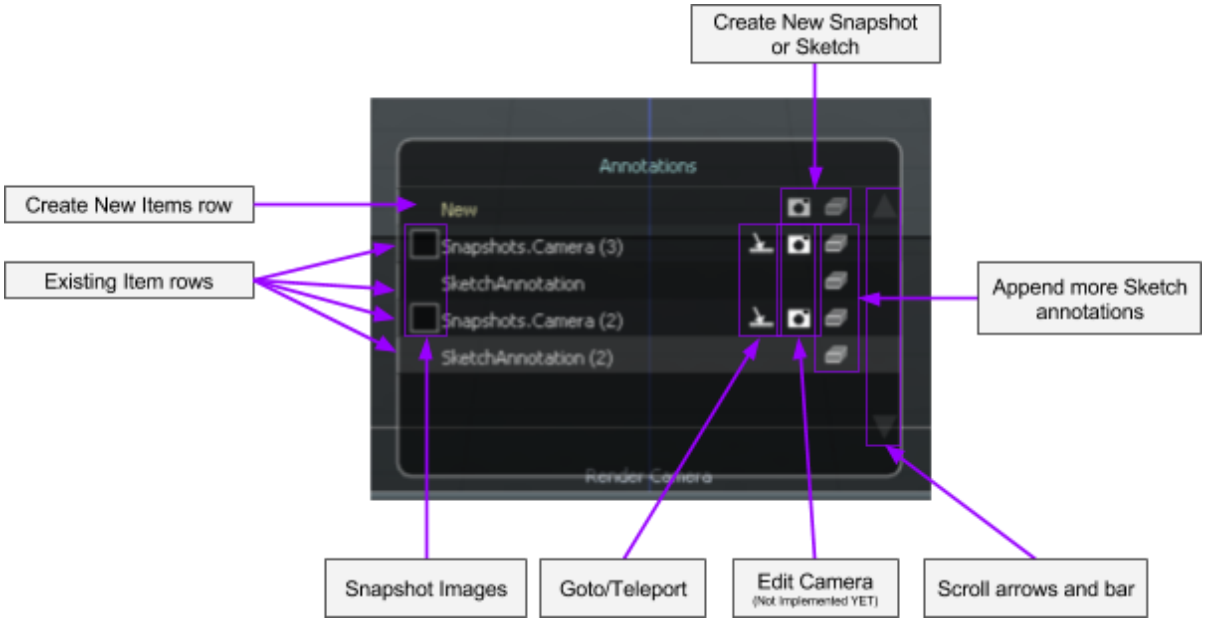
When in HMD mode it is not so easy to use the keyboard. So to allow notes to be taken the sketch tool has been used to allow sub meshes to be added for leaving notes. The sketch tool will leave a trail behind when the trigger is held down and the controller moved around. This can be used to place arrows, highlights, or even badly written text in the 3D scene.

Snapshots

Snapshots are cameras that can be placed down in the scene to allow for notes to be made for different viewpoints.

Annotations UI

The purpose of this UI is to allow you to create, find, navigate, and amend annotations in the scene.



Interactive parts of the UI are:

Control	Description
Scrollbar	Scrolls through the list of items when the list is larger than the panel space.
New Row Icons	Clicking these creates one of the following: ● New camera Snapshot annotation. Creates a camera at the present location. ● New Sketch annotation. Immediately goes into Sketch mode, holding the trigger to leave the sketch trail.
Teleport Icon	Teleports you to the location of the item/camera.
Mesh Icon	For the item on that row, adds/appends more sketched annotation. Immediately goes into sketch mode.

Select these by pointing the other controller at the UI and using its trigger to activate.

Locator Tracking

Locator Tracking allows your Modo scene to be affected by your current hand and head positions. This is done by placing named items into your scene and then rigging them to other parts of the scene.

To do this:

- Create an item in the root of the Item Tree, preferably a Locator.
- Rename the item to one of the designated names. See the table below.
- Go to the LocTrack button set on the hand controllers.
- Use the corresponding button to toggle the desired item to actively track. See the table below.

Item Name	Button Name	Description
LocatorHMDControllerLeft	Secondary	Position of the Secondary controller
LocatorHMDHead	HMD	Position of your Head
LocatorHMDControllerRight	Pointer	Position of the Pointer controller

Multi-GPU Support

Machines capable of NVIDIA SLI or AMD Crossfire are supported. This allows multiple GPUs to be used together for faster VR rendering.

To use this feature you have to:

- Install multiple SLI or CrossFire compatible graphic cards into a compatible system.
- Install a graphics card driver that supports SLI or CrossFire in OpenGL.[4]
- Enable SLI or CrossFire in your graphics cards settings.[5]
- Run Modo using -gpumulticast on the command line.

Note: It is not suggested that you enable SLI or CrossFire without also enabling it in Modo VR. Performance degradation has been observed in VR modes. However, due to the complexity of graphics cards, graphics drivers and system specifications, this might not always be the case and should be evaluated for your own system.

[4] The OpenGL driver must expose either GL_NV_gpu_multicast or GL_NVX_linked_gpu_multicast extensions. Some drivers only support SLI or CrossFire in DirectX and not OpenGL.
[5] Instruction for enabling SLI or CrossFire can be obtained from your graphics driver supplier. This is different for each vendor and can change between driver versions.

Feedback and Contacting Us

All questions and feedback on Modo VR should be directed to the Foundry's Public Modo VR forum or Private Modo VR forum, depending on which version of Modo VR you are using.

Known Issues

User Interface

- Modal dialogs pause the HMD. The user has to remove the HMD and proceed to deal with the dialog via the desktop, in the normal manner.
- Most of the buttons or menu items do not show the present state of the tool, menu or property they control.
- Normal viewport pop-ups and panels can steal focus from the HMD Controllers. Having a panel, like the “3D Display Properties”, open or pinned can stop Modo responding to the controllers properly.

Performance

- Moving or rotating the default directional lights in the HMD can cause poor performance. Disconnect the directional light from the environment Shader Tree, deleting it, or disable Environment lighting in the “3D Viewport Properties” “Advanced” tab should improve performance.
- “Threading Not Supported” indicator is permanently on. Some graphics card drivers have issues when running Modo VR in threaded mode and have to have the feature disabled.

Change List

Build 485365

- Changed glMeter to show frame times as a panel on the secondary controller.
- Changed glMeter to show GPU measured frame times for shadows, geometry and deferred rendering.
- Enabled FP16/Half maths in GLSL. For AMD and NVIDIA drivers.
- Optimised Unreal, Unity, glTF and Principles GLSL shaders.
- Changed hand, controller and UI rendering to reduce Harryhausen effect.
- Moved status indicators from on screen panels to indicators on the pointer controller.
- Added full support for Shader Tree group processing and masking.
- Updated application to match Modo11.2v3.

Build 479039

- New MSI based installer.
- Added support for Anisotropic Texture filtering. (Requires restart)
- Updated application to match Modo11.2v1.

Build 477757

- Added support for Aggregated MSAA on opaque materials.
- Added support for Action Centers.
- Added support for Snapping.

Build 468809

- Enabled simple button menu systems.
- Enabled alternate pointer mode, targets through a point off the end of the pointer.
- Enabled control of the pointer's cone casting angle.
- Widened pointer's default cone casting angle to allow for better interactions with wireframes.
- Fixed issues when background compiling of shaders pauses HMD updates.
- Disabled Screen Space Ambient Occlusion and Reflection in HMD modes.
- Changed texture manager to use bindless textures.
- Moved Annotations and other UI items to the secondary hand from the pointer hand.

Build 466010

- Fixed Goto breaking view on empty scenes.
- Fixed Controller meshes disappearing when switching between layouts.
- Fixed Unreal Opacity not being used when in Basic material mode.
- Moved Annotations panel to secondary controller.
- Added preference to control GPU material data table sizes.

Build 459968

- Fixed crash when viewport display options are open.
- Fixed Occlusion amount to Basic material mode.
- Fixed z-fighting on RollOver highing.
- Added locator tracking feature and button set.

Build 456594

- Added button set for Item selection and transformation.
- Added button set for Light creation and transformation.
- Improved selection behavior between wireframes, like lights and camera, and meshes.
- Updated application to match Modo 11.1.
- Changed Annotation sketches from lines to curves.
- Changed simple pop-up dialog messages to HMD indicators.

Build 453583

- Added native support for Oculus Rift and Touch.
- Added support for SLI/CrossFire multi-GPU systems.
- Updated application to match Modo 11.0.
- Relaxed the performance level for the Modo Slow overlay indicator to appear.
- Moved overlay indicators into the center of the view from the center of the render.

Build 139750

- Fixed support for OpenVR reprojection.
- Fixed support for Oculus Rift via SteamVR. (Helps to turn off SteamVR Reprojections)
- Fixed changing the resolution scaling option.
- Fixed Goto and Teleport to leave the user facing in that direction.
- Improved rendering CPU usage.
- Improved GPU shader usage.
- Moved the start of the laser line forward so it does not start inside the controller.
- Added controller button set for controlling key display options.
- Added controller button set for Annotations.

- Added Annotations UI.
- Added overlay indicators for:
    - Application loss of focus.
    - HMD frame too low.
    - Modo is busy doing something.