



## 26.2 Editors - Properties Editor - Render Properties Tab

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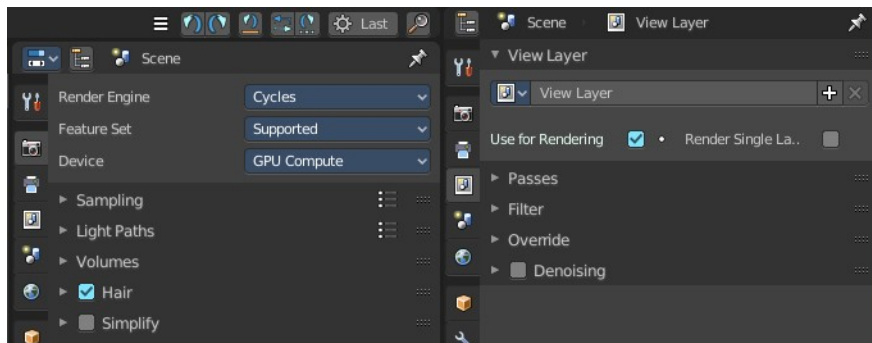
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## Render Tab

There are four different render engines available. Workbench, Eevee, Eevee (Legacy), and Cycles. This chapter has a focus on the Cycles render engine panels.

Cycles is a so called offline renderer. It is an unbiased physically correct renderer with some biased adjustments to make it usable for animations.

Cycles can render at the CPU or the GPU.

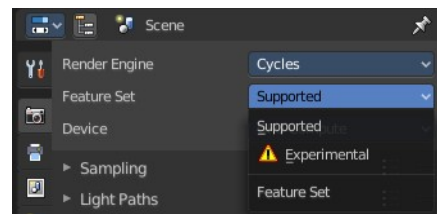


## Cycles Feature Set

When you choose Cycles then you will see a new drop down box called Feature set. Cycles has two feature set settings. Supported and Experimental.

Supported means you have all common Cycles settings available.

Experimental means that you have access to some further experimental features of Cycles, which are somehow functional, but are still experimental features. Like Adaptive subdivision. Those features may or may not work proper. Use at own risk!



## Cycles Device

When you turn on Cuda in the User Preferences then you will get a Device drop down box to choose if you want to render with the CPU or the GPU.

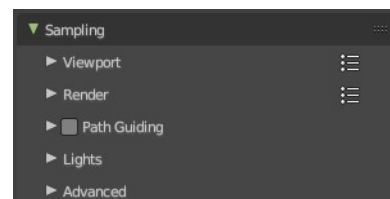


## Open Shading Language

When you render with Cycles at the CPU, then you can choose to use the Open Shading Language.

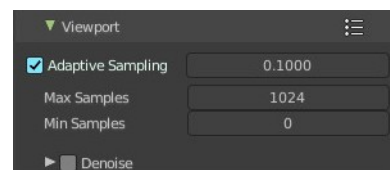
## Sampling panel

Adjust the samples for Cycles. And enable denoising.



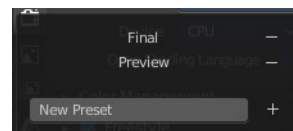
## Viewport subpanel

Sampling settings for the Viewport rendering.



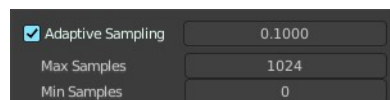
## Presets

In the header you will find a Presets menu to choose between presets and define your own presets.



## Adaptive Sampling

Automatically reduce the number of samples per pixel, based on estimated noise level.



### Adaptive sampling threshold

The noise level step to stop sampling at. Lower values reduce noise at the cost of render time. A value of zero means to use the automatic setting based on number of AA samples.

### Max Samples

Maximum samples for adaptive sampling.

### Min Samples

Minimum samples for adaptive sampling. A value of zero means to use the automatic setting based on number of AA samples.

## Samples

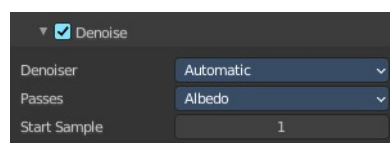
When Noise Threshold is off then you will see the Samples edit box. Number of samples to render.



## Denoise Sub Subpanel

### Use Denoising Checkbox

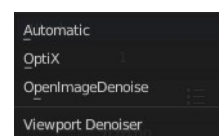
Activate Denoising.



### Denoiser

#### Automatic

Use the fastest denoiser that is available. If OptiX is available then OptiX. Otherwise OpenImageDenoiser.



#### OptiX

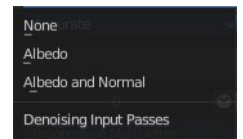
Use the OptiX Denoiser.

## OpenImageDenoiser

Use the OpenImageDenoiser.

## Passes

What input passes to use.

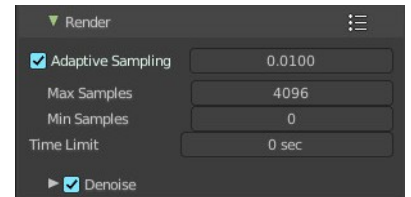


## Start Sample

The sample to start denoising at.

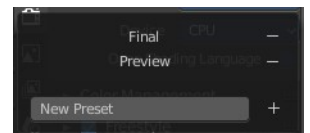
## Render subpanel

Sampling settings for the final rendering.



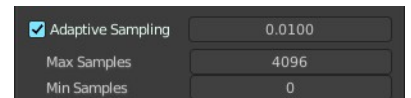
## Presets

In the header you will find a Presets menu to choose between presets and define your own presets.



## Adaptive Sampling

Automatically reduce the number of samples per pixel, based on estimated noise level.



### Adaptive sampling threshold

The noise level step to stop sampling at. Lower values reduces noise at the cost of render time. A value of zero means to use the automatic setting based on number of AA samples.

### Max Samples

Maximum samples for adaptive sampling.

### Min Samples

Minimum samples for adaptive sampling. A value of zero means to use the automatic setting based on number of AA samples.

## Samples

When Noise Threshold is off then you will see the Samples edit box. Number of samples to render.



## Time Limit

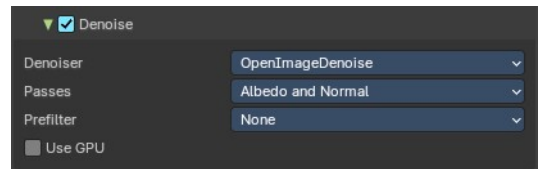
When Noise Threshold is off then you will see the Time Limit edit box. Limit the render time. This ends the rendering process after the given time. A value of zero disables the limit.



## Denoise Sub Subpanel

### Use Denoising Checkbox

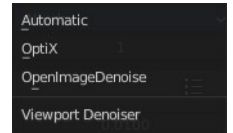
Activate Denoising.



### Denoiser

#### Automatic

Use the fastest denoiser that is available. If OptiX is available then OptiX. Otherwise OpenImageDenoiser.



#### OptiX

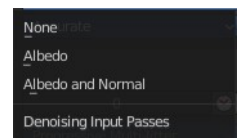
Use the OptiX Denoiser.

#### OpenImageDenoiser

Use the OpenImageDenoiser.

### Passes

What input passes to use.



### Start Sample

The sample to start denoising at.

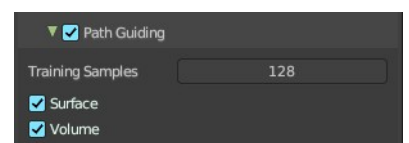
### Use GPU

Perform Denoising on the GPU.

This property is just visible when Cycles device uses GPU and the denoiser is OpenImage Denoise.

## Path Guiding subpanel

Use path guiding for sampling paths. Path guiding incrementally learns the light distribution of the scene. And guides path into directions with high direct and indirect light contributions.



### Training Samples

The maximum number of samples used for training path guiding. Higher values results in more accurate guiding at the cost of speed. A value of 0 will continue the training until the last sample.

### Surface

Use guiding at surfaces.

### Volume

Use guiding inside volumes.

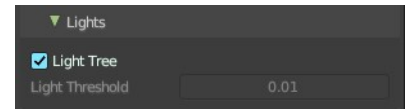
## Lights subpanel

### Light Tree

When ticked use existing light tree. This will sample multiple lights more efficiently.

### Light Threshold

When Light Tree is unticked Light Threshold becomes available. Terminate light samples below this value. This speeds up the rendering at the cost of noise. A value of zero will disable the test. Then all light value will be calculated.



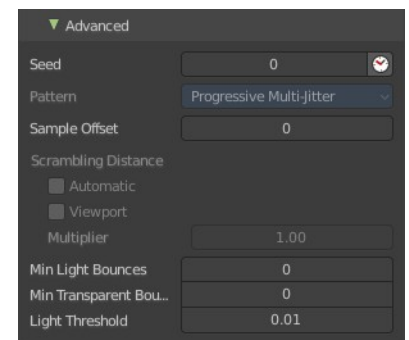
## Advanced subpanel

### Seed

Seed value for integrator to get different noise patterns.

### *Animate Seed*

The clock icon beside the Seed value. Enable it to get different seed values for animation. Without animated seed you will get visible patterns in animations.



### Pattern

Random sampling pattern used by the integrator. You need to turn off Noise Threshold in the Render panel to activate and use the Sampling Pattern.



### *Sobol*

Uses a Sobol pattern to decide the random sampling pattern used by the integrator.

### *Progressive Multi-Jitter*

Uses a progressive Multi-Jitter pattern to decide the random sampling pattern used by the integrator.

### Sample Offset

Number of samples to skip when starting the render.

## Scrambling Distance

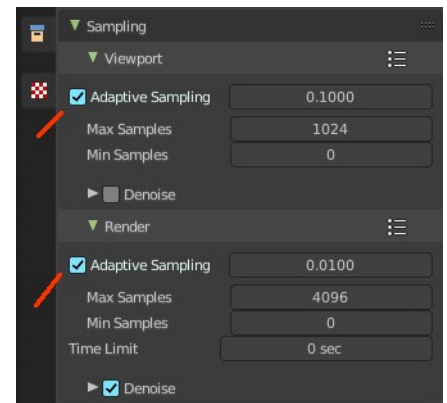
Speeds up the rendering times at the gpu at cost of possible artifacts. You need to turn off Adaptive Sampling in the Render or Viewport panel to activate and use the Scrambling Distance.

### Adaptive

Instead of a fixed scrambling distance you can use this adaptive method. It is based on the sample count.

### Viewport

Also use the scrambling distance in the viewport.



## Min Light Bounces

The minimum bounces of light rays.

## Min Transparent Bounces

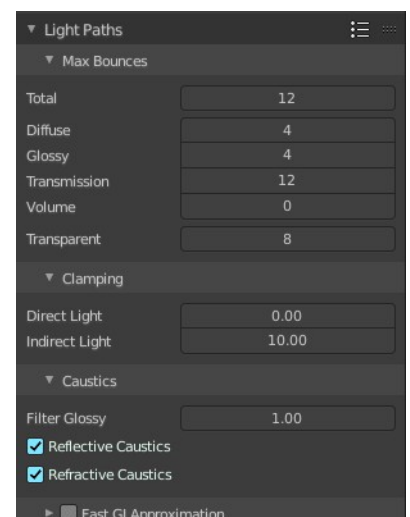
The minimum number of transparent bounces.

## Light Threshold

Terminates light samples when the light contribution is below this value. This gives more noise, but renders faster. Type in 0 to disable this feature.

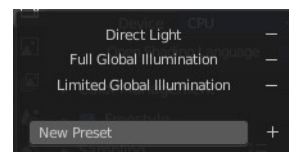
## Light Paths panel

Here you will find all settings regarding light paths.



## Presets

In the header you will find a Presets menu to choose between presets and define your own presets.



---

## Max Bounces

A sub menu with the Maximum Bounces settings.

### Total

Total maximum number of bounces.

### Diffuse

Maximum number of diffuse bounces.

### Glossy

Maximum number of glossy bounces.

### Transmission Bounces

Maximum number of transmission bounces.

### Volume

Maximum number of volume scattering bounces.

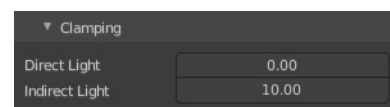
### Transparent

Maximum number of transparency bounces.

---

## Clamping

A sub menu with the Clamping settings. Clamping will reduce noise at the cost of accuracy.



### Direct Light

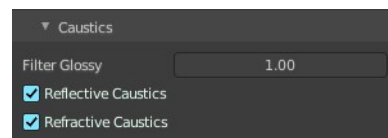
The maximum value for a direct sample. Zero means disabled.

### Indirect Light

The maximum value for an indirect sample. Zero means disabled.

## Caustics

A sub menu with caustics and filter glossy settings.



### Filter Glossy

When using a value higher than 0.0, this will blur glossy reflections after blurry bounces, to reduce noise at the cost of accuracy. 1.0 is a good starting value to tweak.

Some light paths have a low probability of being found while contributing much light to the pixel. As a result these light paths will be found in some pixels and not in others, causing fireflies. An example of such a difficult path might be a small light that is causing a small specular highlight on a sharp glossy material, which we are seeing through a rough glossy material. In fact in such a case we practically have a caustic.

With path tracing it is difficult to find the specular highlight, but if we increase the roughness on the material, the highlight gets bigger and softer, and so easier to find. Often this blurring will hardly be noticeable, because we are seeing it through a blurry material anyway, but there are also cases where this will lead to a loss of detail in lighting.

### Reflective Caustics

Disable reflective caustics. Path tracing supports rendering of caustics with a sufficient number of samples. But in practice it may be inefficient to the point that there is just too much noise.

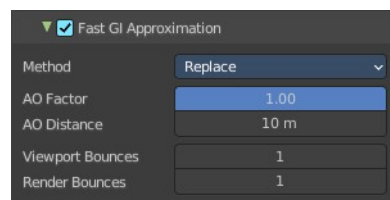
### Refractive Caustics

Disable refractive caustics. Path tracing supports rendering of caustics with a sufficient number of samples. But in practice it may be inefficient to the point that there is just too much noise.

## Fast GI approximation subpanel

Approximate diffuse indirect light with background tinted ambient occlusion.

This method provides a fast alternative to full global illumination, for interactive viewport rendering or final renderers with lower quality.

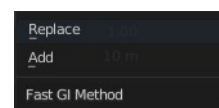


### Fast GI Approximation checkbox

The checkbox in the header activates the Fast GI Approximation.

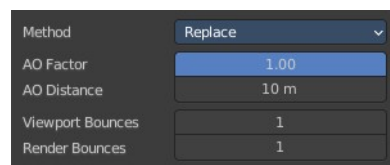
### Method

The fast gi method.



### Replace

Replace global illumination with ambient occlusion after a specified number of bounces.



### AO Factor

Factor of ambient occlusion blending.

## AO Distance

The length of the rays that are used for Ambient Occlusion. Defines how far any other faces gives the occlusion effect.

## Viewport Bounces

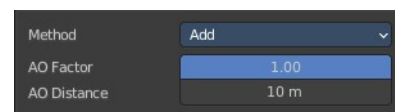
Use approximate global illumination after this number of light bounces in the viewport. A value of 0 deactivates the feature.

## Render Bounces

Use approximate global illumination after this number of light bounces in the rendering. A value of 0 deactivates the feature.

## Add

Add ambient occlusion to diffuse surfaces



## AO Factor

Factor of ambient occlusion blending.

## AO Distance

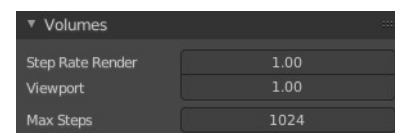
The length of the rays that are used for Ambient Occlusion. Defines how far any other faces gives the occlusion effect.

# Volumes panel

Adjust the volume sampling.

## Step Rate Render

Globally adjust detail for volume rendering for the final rendering. Lower values give more accurate and detailed results but also increased render time.



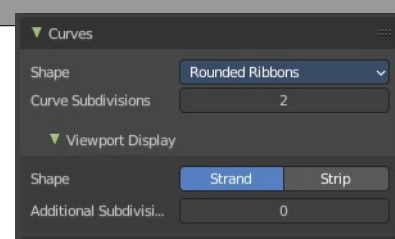
## Step Rate Viewport

Globally adjust detail for volume rendering for the viewport rendering. Lower values give more accurate and detailed results but also increased render time.

## Max Steps

Maximum number of steps through the volume before giving up, to protect from extremely long render times with big objects or small step sizes.

# Curves panel



Adjust the settings for Hair particles.

## Shape

Choose between the shape 3D Curves and Rounded Ribbon.



## Curve Subdivisions

Rounded Ribbons, the number of subdivisions at the curves.

## Viewport Display subpanel

How to display the hairs in the viewport.

## Shape

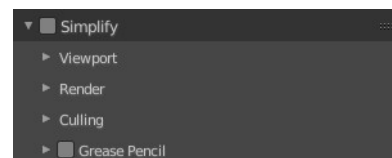
The hair shape type. Stand or Strip.

## Additional Subdiv

Additional subdivision along the hair.

## Simplify panel

Sometimes you want to simplify the rendering without to loose the already tweaked settings and adjustments. For test renderings for example. Simplify allows you to set global limits on subdivision, shadow samples and more.



## Enable

In the header is a checkbox to enable Simplify.

## Viewport

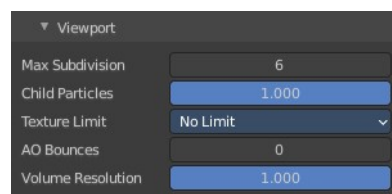
This section affects the rendering with cycles in the Viewport.

## Max Subdivisions

Limit the number of maximum subdivisions.

## Child Particles

Limit the number of child particles.



## Texture Limit

Automatically scales down textures to the chosen value.

## AO Bounces

Limit the number of Ambient Occlusion Bounces.

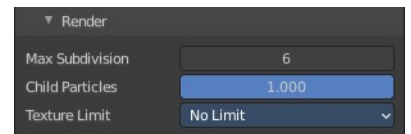
## Volume Resolution

Simplify volumes by adjusting volume percentage of volume objects in viewport.

---

## Render

This section affects the final rendering.



### Max Subdivisions

Limit the number of maximum subdivisions.

### Child Particles

Limit the number of child particles

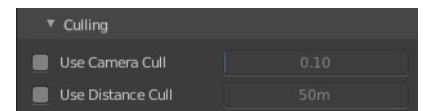
### Texture Limit

Automatically scales down textures to the chosen value.

---

## Culling

Contains Culling settings. Culling means that the affected geometry is excluded from calculation.



### Use Camera Cull

Allow objects to be culled based on the Camera Frustum. Frustum is the region of the 3D space that gets displayed by the camera, the field of view.

### *Camera cull margin*

The margin for the camera space culling.

---

### Use Distance Cull

Allow objects to be culled based on the distance to the camera.

### *Distance*

The distance after which the objects gets culled away.



## Grease Pencil

### Playback Only

Simplify the grease pencil strokes only during playback.

### Fill

Display Fill strokes in viewport.

### Modifiers

Display Modifiers.

### Shader Effects

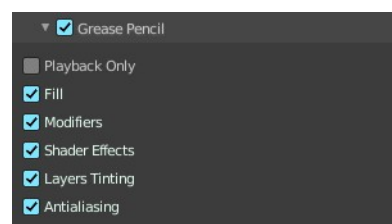
Display Shader effects.

### Layers Tinting

Display layer tint.

### Antialiasing

Use antialiasing to smooth stroke edges.



## Motion Blur panel

Enable Motion Blur and adjust the settings.

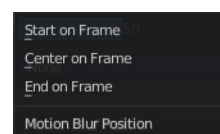
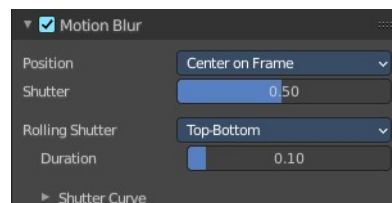
Each object has also its own settings to control motion blur. These options can be found in the corresponding Object tab of the Properties editor.

### Enable

In the header is a checkbox to enable Simplify.

### Position

Controls at what point the shutter opens in relation to the frame.

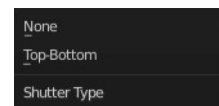


## Shutter

Time between frames over which motion blur is computed. Shutter time 1.0 blurs over the length of 1 frame, 2.0 over the length of two frames, from the previous to the next.

## Rolling Shutter

Enable Rolling Shutter.



## Duration

With method Top - Bottom only. Controls balance between pure rolling shutter effect and pure motion blur effect. With zero being no rolling shutter and one being all rolling shutter.

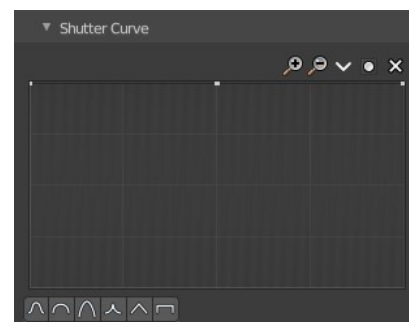
## Shutter Curve

Sutter curve is a sub menu wAdjust a curve for the shutter effect.

## Navigation elements



The navigation elements at the top are described from left to right.



## Zoom in and out

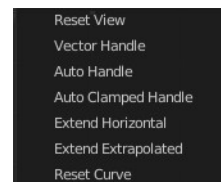
The two buttons with the magnifying glass at it zooms in and out in the curve window.

## Tools

Tools is a menu that contains some curve related tools.

### Reset View

Resets the curve windows zoom.



### Vector Handle

Set handle type to Vector.

### Auto Handle

Set handle type to Auto.

### Auto Clamped Handle

Set handle type to Auto Clamped.

### Extend Horizontal

Causes the curve to stay horizontal before the first point and after the last point.

### Extend Extrapolated

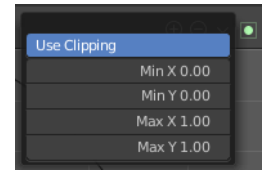
Causes the curve to extrapolate before the first point and after the last point, based on the shape of the curve.

## Reset Curve

Resets the curve to the initial shape.

## Use Clipping

Clipping options. Set up clipping for the stroke.



## Delete Points

Deletes selected curve points.

## X and Y values

The coordinates of the currently selected curve point.

## Presets

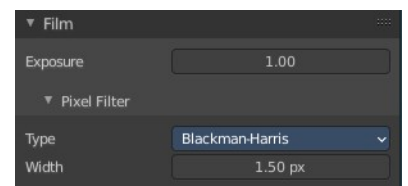
At the bottom you can find some curve presets.



# Film panel

## Exposure

Exposure can be used to change the brightness of an image. Different then the Exposure option found in the Color management panel this exposure option works is on the data while the Color management exposure is on the view.

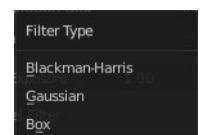


## Pixel Filter

The Pixel Filter randomly changes the coordinates of every sample with the given distribution. For example: When the Sobol Sampling Pattern samples near the edge of the pixel, the neighboring pixel might be lit instead with a rather high probability. Pixel filter is used to get rid of aliasing on the sharp edge of very bright objects, like mesh lights.

## Type

Choose the pixel filter type.

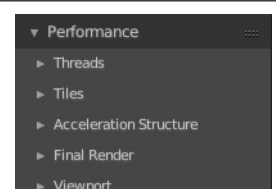


## Width

Adjust the pixel filter width.

# Performance panel

Settings to influence the render performance.



## Presets

Performance presets can be applied to quickly configure Cycles.

### **Default**

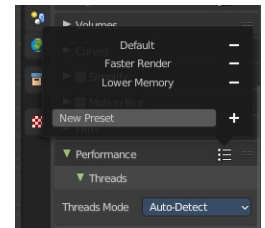
This preset are the default cycles settings.

### **Faster Rendering**

This preset is dedicated to speed with higher memory usage. This may be more unstable due to hardware limits.

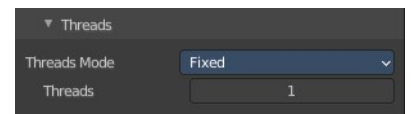
### **Lower Memory**

This preset is dedicated to lower memory. This may cause longer renders.



## Threads

With threads, you are able to to assign as many cores as you need from your CPU as dedicated resources. Default is Auto-Detect.



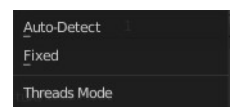
### **Mode**

#### **Auto-detect**

Automatically chooses the amount threads to match the number of logical processors on your computer.

#### **Fixed**

Manually choose the amount threads to use for rendering.



### **Threads**

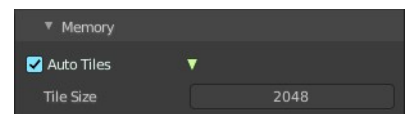
Just active when you choose Fixed. Number of threads that you want to use.

---

## Memory

### **Auto Tiles**

Automatically render high resolution images in tiles to reduce memory usage. Tiles are cached to disk while rendering, to save memory.



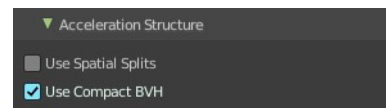
### **Tile Size**

The tile size for the tiles.

## Acceleration Structure

### Use Spatial Splits

Spatial splits improve rendering performance in scenes with a mix of large and small polygons. The downsides are longer BVH build times and slightly increased memory usage.



### With CPU rendering:

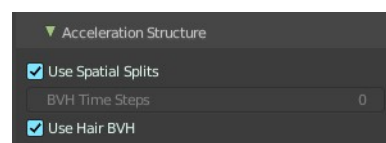
#### Use compact BVH

Use a compact BVH code structure that uses less ram. This option renders slower.

### With GPU rendering:

#### BVH Time Steps

Is just active when Spatial Splits is off. Split BVH Primitives by this number of time steps. This speeds up rendering, but requires more memory.



#### Use Hair BVH

Use a special type of BVH for rendering hair. The bounding boxes are not axis aligned allowing a spatially closer fit to the hair geometry. Disabling this option will reduce memory, at the cost of increasing hair render time.

## Final Render

### Persistent Data

Keep image data in memory after rendering, for faster re-renders at the cost of extra memory usage when performing other tasks in Blender.

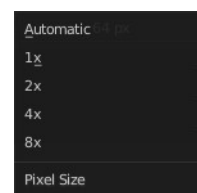
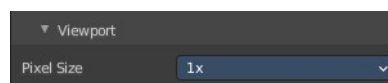


## Viewport

This settings is for rendering in the Viewport.

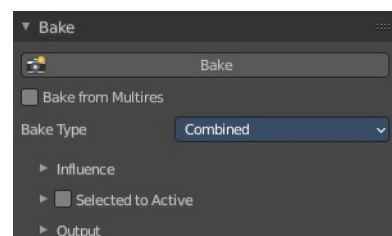
### Pixel Size

Pixel Size for Viewport Rendering.



## Bake panel

Texture baking is the process to bake specific informations from one object into the texture or the vertex colors of another object. Ambient Occlusion. Or a Normal Map for example.



**NOTE**

**Baking into textures requires to have a working UV mapping and a texture at the target object!**

How to use: Select the source object where you want to bake from, hold down Shift, select the target object where you want to bake to, so that both objects are selected. Adjust the settings to your needs. Then hit the Bake button.

**NOTE**

The Bake panel is visible in all Modes. But you have to bake in Object Mode.

## Settings for all Texture types

Most settings in the Bake panel are available for all texture types.

### Bake Button

Start the bake process.

### Bake from Multires

Bake directly from multi resolution object.

## Bake Type

Bake Mode is a drop-down box to choose what type of information you want to bake from the source object into the texture or the vertex colors of the target object.

You can bake Subsurface, Transmission, Glossy, Diffuse, Environment, Emit, UV, Normal, Shadow, Ambient Occlusion and Combined.

### ***Combined***

Bakes the full rendering, means materials, textures, lightning, into the texture of the target object. Except Specularity.

### ***Ambient Occlusion***

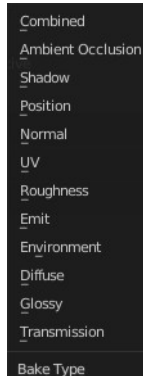
Bakes ambient occlusion as specified in the World panels. Ignores all lights in the scene.

### ***Shadow***

Bakes the Shadow into the texture of the target object.

### ***Position***

Bake out a position map. Position maps stores the distance from the floor. Which allows to add a dirtmap above



Combined  
Ambient Occlusion  
Shadow  
Position  
Normal  
UV  
Roughness  
Emit  
Environment  
Diffuse  
Glossy  
Transmission  
Bake Type

some ground for example.

### ***Normal***

Creates a Normal map by using the normals of the source object, and baking them as colors into the texture of the target object.

### ***UV***

Bakes colors of materials and textures only, without shading.

### ***Roughness***

Bakes the Roughness of a material into the texture of the target object.

### ***Emit***

Bakes the Emission or the glow color of a material into the texture of the target object.

### ***Environment***

Bakes the Environment texture into the texture of the target object. As seen from the center of the object.

### ***Diffuse***

Bake the diffuse texture of the source object into the texture of the target object.

### ***Glossy***

Bakes the Glossy Passes of a material into the texture of the target object.

### ***Transmission***

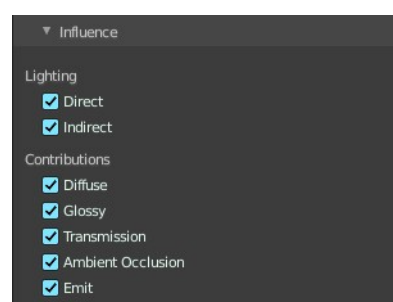
Bakes the transmission Passes of a material into the texture of the target object.

---

## **Influence Sub panel**

Adjust what data contributes to the bake process. The items are self explaining.

The content changes, dependent of what type you want to bake.



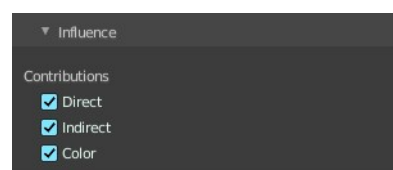
### ***Glossy, Diffuse***

#### **Direct**

Add direct Light.

#### **Indirect**

Add indirect Light.



## Color

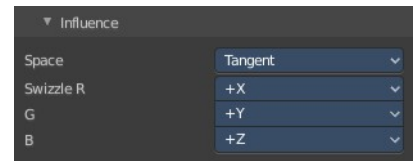
Add Color.

---

## Normal

### Space

A drop-down box to chooses the Normal Space to use.



### Swizzle

Axis to bake in red, green and blue channels.

---

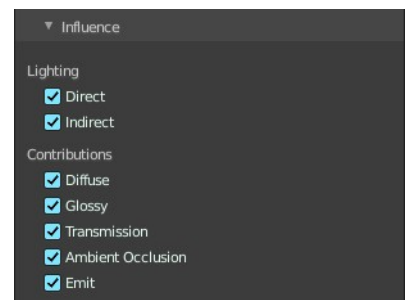
## Combined

### Direct

Bake directly from Multires mesh.

### Indirect

Normalizes without using material settings.



### Diffuse

Bake with Diffuse.

### Glossy

Bake with Glossy.

### Transmission

Bake with Transmission.

### Subsurface

Bake with Subsurface.

### AO

Bake with Ambient Occlusion.

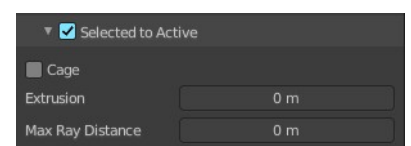
### Emit

Bake with Emit.

---

## Selected to Active

The usual way to bake is first select the Source Object, where you want to bake from, hold down Shift, select the target object where you want to bake to, so that both objects are selected. Then hit the Bake button. That's Selected to Active.



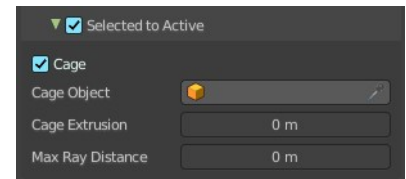


## ***Extrusion***

Inflate the active object by the specified distance for baking.

## ***Cage***

Cast Rays to active object from a cage. A value of zero means unlimited ray length.



## ***Cage Object***

Pick an object to use as a cage. Usually you create this cage object by duplicating the original object, and extrude out the faces along their normals until they fully include the original object.

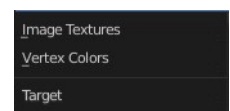
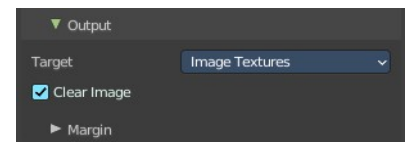
## ***Ray Distance***

Distance to use for the inward ray cast when using Selected to Active.

## **Output Sub panel**

### ***Target***

To what target to bake. You can bake to images or you can bake to the vertex colors of the mesh. Note that baking to vertex colors has no further options.

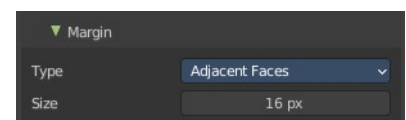


### ***Clear Image***

Clear clears the target image before baking.

### ***Margin sub subpanel***

Adjust the margin width.



### ***Type***

The margin type.

### ***Adjacent Faces***

Use pixels from adjacent faces across UV seams to create the margin.

### ***Extend***

Use the pixels at the inside of the border UV seams, and extend from there to create the margin.

### ***Size***

The size of the margin around the UV patches.

