THE SAMPLING TAB

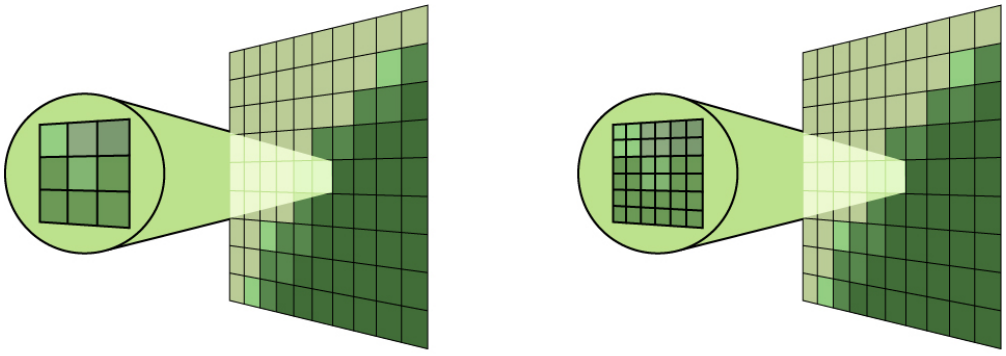
The Sampling Tab can be found under the Rendering Tab on the Mantra Node.

The parameters found on this tab control the amount of sampling performed by Mantra while generating an image. Adjusting these parameters will have a dramatic effect on the quality and clarity of your images as well as the amount of time it takes to render them. Changing these values should be done carefully to avoid over-sampling and extended render times.

For an explanation of how sampling works, see the "Sampling and Noise" section.

Pixel Samples

This parameter controls the number of primary rays Mantra will use to sample your scene per pixel. The two numbers represent an arrangement of samples in the X and Y axis and are generally the same number. However, for non-square pixels it may be necessary to use different values in X and Y. Multiplying these two values together will give you the number of primary rays per pixel.



Pixel Samples: 3 x 3 Pixel Samples: 6 x 6

Increasing Pixel Samples will result in a cleaner, higher quality image. However, since **all other sampling values are multiplied by the number of Pixel Samples**, they should only be increased when necessary. For more details on when to increase Pixel Samples, see the "Removing Noise" section.

Ray Variance Antialiasing

When enabled, this parameter will cause Mantra to use ray variance antialiasing when determining the number of Secondary Rays to send for every Primary Ray.

This means that rather than using a specific number of rays, Mantra will first send out a small number of rays and use this sample set to evaluate the Variance. Depending on the amount of various, Mantra will continue to send more rays up to the Max Ray Samples value. Ray Variance Antialiasing is useful for optimizing your render by sending more rays only in the areas they are needed.

In cases where the minimum number of rays to remove noise is equal to the maximum number of rays, you may save a small amount of render time by disabling Ray Variance Antialiasing.

Min Ray Samples

This value is the **minimum number of secondary rays** to use when generating an image. When Ray Variance Antialiasing is disabled, this number represents the number of secondary rays to send regardless of the noise level.

Remember, this number is multiplied by the current number of Pixel Samples.

Max Ray Samples

When Ray Variance Antialiasing is enabled, this parameter represents the **maximum number of secondary rays** allowed even if the Noise Level is never reached. This parameter, along with Min Ray Samples, essentially allows you to create a range of acceptable sampling for your image. Carefully controlling the total number of potential rays is the best way to optimize your renders.

Remember, this number is multiplied by the current number of Pixel Samples.

For more details on when to increase Max Ray Samples, see the “Removing Noise” section.

Noise Level

This parameter represents a threshold in the **amount of variance allowed before mantra will send more secondary rays**. Variance essentially represents how “spread out” the values in a set of samples are. For instance, a set of samples that were all the same would have a variance of 0. It is generally a good idea to keep this value as high as possible so that rays are sent only into those areas where an unacceptable amount of noise is present.

Adding “direct samples” and “indirect samples” image planes can help you track how many samples are being sent and to which parts of the image. For more information about sampling, see the “Sampling and Noise” section.

If you find that certain objects in your scene require substantially more samples than other parts of your image and you are unable to “target” those objects using the Noise Level

parameter, it may be a better idea to add per-object sampling parameters to the problem areas. See the “Removing Noise” section for more details.

Diffuse Quality

This parameter controls the quality of Indirect Diffuse sampling. (For more information regarding the difference between Direct and Indirect rays, see the section on Sampling and Noise)

Often, indirect sources of light will be a significant cause of noise in your renders. This quality slider allows you to adjust the amount of secondary rays sent to help resolve this type of noise. Keep in mind that indirect sources of light can be the **surfaces of other objects** in your scene **as well as light scattered inside of a volume**.

Essentially, the Diffuse Quality parameter acts as a **multiplier** on the “Max Ray Samples” while also acting as a **divisor** for “Noise Level”. For instance, let’s say you have set “May Ray Samples” to 8 and your Noise Level to 0.1. If you then set your “Diffuse Quality” parameter to 2, Mantra will send up to 16 secondary ray samples based on a Noise Level of 0.05. It is important to remember that these numbers apply only to the indirect samples, your original values will be used for all direct sampling.

To find out how much noise is present in your indirect diffuse component, it can be useful to add the “Indirect Lighting (per-component)” image plane in the “Extra Image Planes” tab. This will allow to you investigate each indirect component in isolation.

If you find that increasing the “Diffuse Quality” does not improve the amount of noise in your Indirect Diffuse Component, it may be because your Noise Level is set too low and the variance threshold is being met before more indirect samples can be sent. Try slowly lowering the Noise Level amount until you begin to see a noticeable difference in your indirect noise.

SSS Quality

This parameter controls the quality of Indirect sampling sent to materials with Sub Surface Scattering enabled.

Materials with Sub Surface Scattering enabled can exhibit a large amount of noise, especially when the Sub Surface Distance is set to a high value. This quality slider allows you to adjust the amount of secondary rays sent to help resolve this type of noise.

Essentially, the SSS Quality parameter acts as a **multiplier** on the “Max Ray Samples” while also acting as a **divisor** for “Noise Level”. For instance, let’s say you have set “May Ray Samples” to 8 and your Noise Level to 0.1. If you then set your “Diffuse Quality” parameter to 2, Mantra will

send up to 16 secondary ray samples based on a Noise Level of 0.05. It is important to remember that these numbers apply only to the indirect samples, your original values will be used for all direct sampling.

To find out how much noise is present in your Indirect SSS component, it can be useful to add the “Indirect Lighting (per-component)” image plane in the “Extra Image Planes” tab. This will allow to you investigate each indirect component in isolation

If you find that increasing the “SSS Quality” does not improve the amount of noise in your Indirect Diffuse Component, it may be because your Noise Level is set too low and the variance threshold is being met before more indirect samples can be sent. Try slowly lowering the Noise Level amount until you begin to see a noticeable difference in your indirect noise.

Reflection Quality

This parameter controls the quality of Indirect Reflection sampling. (For more information regarding the difference between Direct and Indirect rays, see the section on Sampling and Noise)

Indirect Reflections, which are reflections of other objects in your scene, can sometimes be the source of noise in your scene. This quality slider allows you to adjust the amount of secondary rays sent to help resolve this type of noise.

Essentially, the Reflection Quality parameter acts as a **multiplier** on the “Max Ray Samples” while also acting as a **divisor** for “Noise Level”. For instance, let’s say you have set “May Ray Samples” to 8 and your Noise Level to 0.1. If you then set your “Reflection Quality” parameter to 2, Mantra will send up to 16 secondary ray samples based on a Noise Level of 0.05. It is important to remember that these numbers apply only to the indirect samples, your original values will be used for all direct sampling.

To find out how much noise is present in your indirect reflection component, it can be useful to add the “Indirect Lighting (per-component)” image plane in the “Extra Image Planes” tab. This will allow to you investigate each indirect component in isolation.

If you find that increasing the “Reflection Quality” does not improve the amount of noise in your Indirect Reflection Component, it may be because your Noise Level is set too low and the variance threshold is being met before more indirect samples can be sent. Try slowly lowering the Noise Level amount until you begin to see a noticeable difference in your indirect noise.

Refraction Quality

This parameter controls the quality of Indirect Refraction sampling. (For more information regarding the difference between Direct and Indirect rays, see the section on Sampling and Noise)

Indirect Refractions, which are the refracted images of other objects in your scene, can sometimes be the source of noise in your scene, especially when using blurry refractions. This quality slider allows you to adjust the amount of secondary rays sent to help resolve this type of noise.

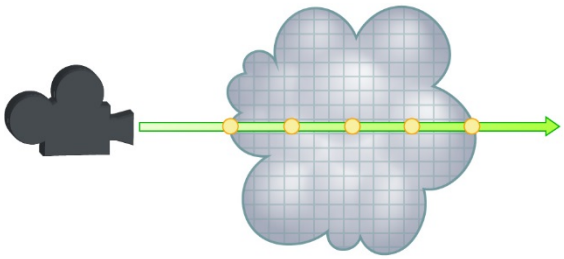
Essentially, the Refraction Quality parameter acts as a **multiplier** on the "Max Ray Samples" while also acting as a **divisor** for "Noise Level". For instance, let's say you have set "May Ray Samples" to 8 and your Noise Level to 0.1. If you then set your "Refraction Quality" parameter to 2, Mantra will send up to 16 secondary ray samples based on a Noise Level of 0.05. It is important to remember that these numbers apply only to the indirect samples, your original values will be used for all direct sampling.

To find out how much noise is present in your indirect refraction component, it can be useful to add the "Indirect Lighting (per-component)" image plane in the "Extra Image Planes" tab. This will allow to you investigate each indirect component in isolation.

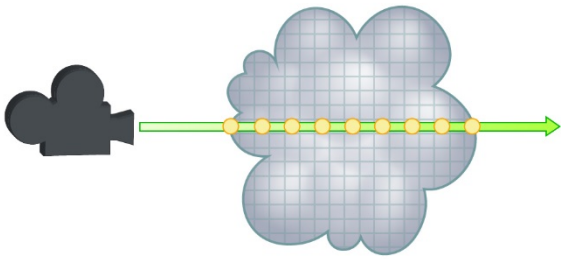
If you find that increasing the "Refraction Quality" does not improve the amount of noise in your Indirect Refraction Component, it may be because your Noise Level is set too low and the variance threshold is being met before more indirect samples can be sent. Try slowly lowering the Noise Level amount until you begin to see a noticeable difference in your indirect noise.

Volume Quality

This parameter controls how finely or coarsely a volume is sampled as a ray travels through it. Volumetric objects are made up of 3d structures called Voxels, the value of this parameter represents the number of voxels a ray will travel through before performing another sample.



Volume Quality : 0.25



Volume Quality : 0.5

The default value is 0.25, which means that every one of every four voxels will be sampled. A value of 1 would mean that all voxels are sampled and a value of 2 would mean that all voxels are sampled twice. This means that the volume quality value behaves in a similar way to pixel samples, acting as a multiplier on the total number of samples for volumetric objects.

For volumes that aren't voxel based, like CVEX procedural volumes, Mantra will divide the bounding box of the volume into roughly 100 "virtual" voxels. In these cases, setting the Volume Quality correctly is essential to maintaining the correct level of detail.

Keep in mind that increasing the volume quality can dramatically increase render times, so it should only be adjusted when necessary. Also, while increasing the default from 0.25 can reduce volumetric noise, increasing the value beyond 1 will rarely see similar results.

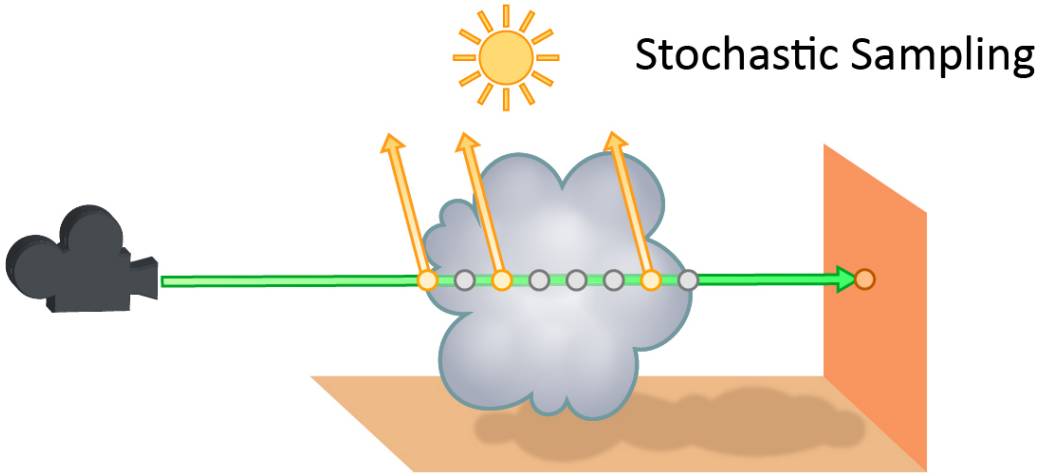
For more information about volume sampling, see the "Sampling and Noise" section.

Stochastic Transparency

Enabling this parameter will activate a Raytracing optimization for translucent objects (Volumes, Sprites, Transparent surfaces). Essentially, while the accumulation of density, or opacity, will occur at every step, the shading will occur randomly along the ray. This means less sampling is performed overall, speeding up renders. This parameter defaults to "on" because it is usually much faster than performing shading samples at every step but without a significant loss in visual quality.

For more information about stochastic transparency and volume sampling in general see "Sampling and Noise".

Stochastic Samples



This parameter controls the number of transparent samples to be shaded as a ray travels through translucent objects. Increasing this value will result in less noise in translucent objects and is generally less costly than increasing Pixel samples, Volume Quality, or Min and Max ray samples. Stochastic Sampling will not have any effect on noise from Indirect Sources however.

Sample Lock

Sampling generally occurs in random patterns which change on every frame of an animation. This can cause a distracting “buzz” when there is a significant amount of noise in your images which can make evaluation of other aspects of the scene difficult. Enabling this parameter will “lock” the sampling patterns so that the noise remains the same on every frame.

Also, in some cases where the final rendered images will be sent through a post-render de-noise process, it can be useful to have the noise remain constant frame to frame. Consistent sampling patterns can help when analyzing the noise.

It defaults to “off” because it is generally unacceptable to have a locked sampling pattern for final sequences.

Random Seed

Adjusting this parameter will cause the pixel sampling patterns used by Mantra to be regenerated in different configurations. By default, the patterns change on every frame, so manually changing this value is not necessary.

Allow Image Motion Blur

This parameter is related to the motion blur parameters which are available only when Motion Blur is enabled. Disabling this option will cause motion blur to be removed from the final

rendered image, however the blurred Position will still be calculated, allowing for custom motion vector image planes to be created. For more information, see the section on “Motion Blur”.

Adaptive Sampling

This toggle will enable **Adaptive Sampling**.

Adaptive sampling allows mantra to redistribute its sampling pattern in order to address noise in areas of the scene where radiance is changing quickly.

Essentially, mantra will perform some subset of the Max Ray Samples and compare their intensities. In areas where this group of samples show high contrast, the remaining samples will be redistributed to have a higher chance of resolving the noise. It behaves in a similar fashion to the Noise Level parameter; however, rather than dictating the number of samples to be sent into the scene it dictates how those samples are distributed.

Adaptive Sampling Threshold

This parameter controls how sensitive the adaptive sampling is to changes in radiance. Larger values mean that the current set of samples being examined would need to have a large difference in intensity before the redistribution of samples would occur. Smaller values mean that the samples would only need to vary a small amount before triggering the redistribution of samples.

In general, the default value of 0.1 will give reasonable results for most scenes.