Render Elements

This page discusses render elements in general, with links to sub-groups of render elements.

Overview

Render Elements are a way to break out renders into their component parts such as diffuse color, reflections, shadows, mattes, etc. This gives fine control over the final image when using compositing or image editing applications to re-assemble the component elements. Render elements are also sometimes known as *render passes*.

Render elements appear in the V-Ray Frame Buffer (VFB) and can be viewed from the drop-down at the upper left corner of the VFB. They can also be saved out of the VFB as many common file formats.

Render elements are generated at render time based on the user's selection before rendering. Most render elements have parameters that can be customized to further assist the compositing process. These parameters are described on each render element's individual page, along with common uses and any notes on their generation and usage.

V-Ray supports the built-in Maya Render Elements User Interface. However, V-Ray provides its own render elements and does not support the standard render elements implemented in Maya. Therefore standard Maya render elements will not work with V-Ray, and vice-versa.
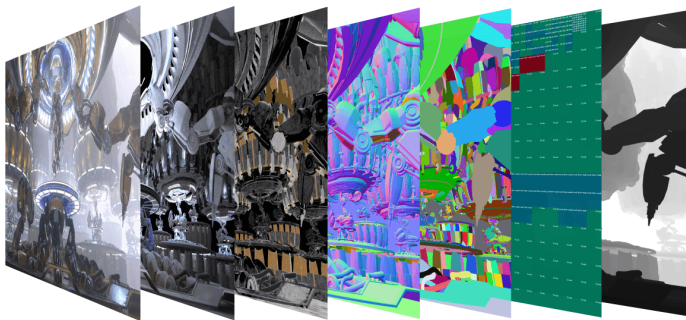
The list of render elements that are supported by V-Ray can be found on the List of Supported Render Elements section below. All render elements support native V-Ray materials. Some render elements also support standard Maya materials, and these are noted on the Supported Render Elements page as well.

When using the V-Ray frame buffer, V-Ray will write render elements only if you specify either one of the **V-Ray raw image file outputs** or the **Separate render channels** options. If you want to specify the render elements outputs using the Maya **Render Output** field or using the output options of the various render elements, then you have to disable the V-Ray frame buffer.
Since V-Ray Next Update 1, some of the render elements are rendered differently than before. The Lighting render element now contains all direct diffuse illumination and the GI element contains all indirect diffuse illumination. Similarly, all direct reflections of lights now go to the Specular element and all indirect reflections go to the Reflection element.

Previously this behavior depended on the sampling of the lights and not just on the type of the contribution. Some of the direct contributions that should be in the Lighting and Specular elements were written to the GI and Reflection elements instead. In both cases they compose back to Beauty correctly but the different types of contributions are now split between the elements more consistently.

This change makes the elements more consistent but it's also needed for preventing artifacts in these elements with the adaptive dome light (and possibly in the future with other adaptive lights).

The raw elements are affected only when the corresponding normal and filter elements are available, otherwise they're rendered as before. This is because the raw elements have to be derived internally from the corresponding normal elements in order to work with the consistent elements (e.g. VRayRawGlobalIllumination = VRayGlobalIllumination / DiffuseFilter).

There's an option to enable or disable the new behavior in the Rendering rollout under the Overrides tab in the Render Settings window. The consistent elements are automatically enabled when the scene contains an adaptive dome light so they don't have artifacts. They are also enabled by default for new scenes. For V-Ray GPU they are always enabled without an option to disable them.
UI Path: ||Display Render Settings button|| > Render Elements tab
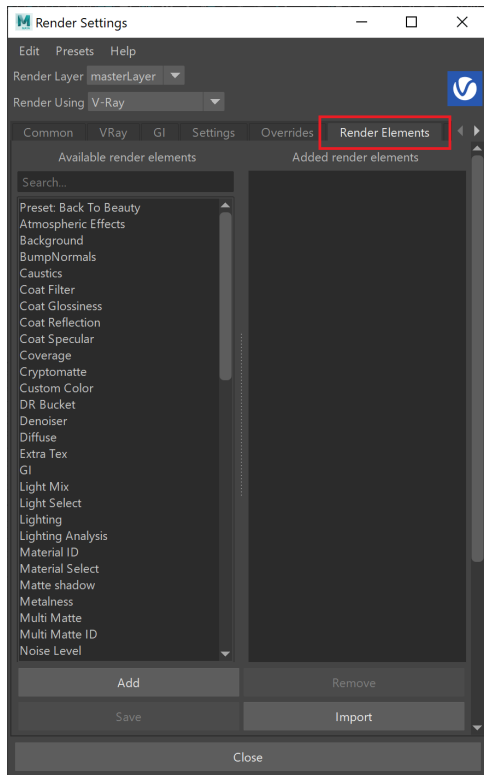
To use render elements, select from the Available render elements column and click the **Add** button to add the passes you wish to generate at render time. When you render the scene, the added render elements listed in the column on the right, will also render, which can be viewed from the VFB window's channel drop-down menu.

For more information on the parameters on this dialog, see the Render Elements tab page.
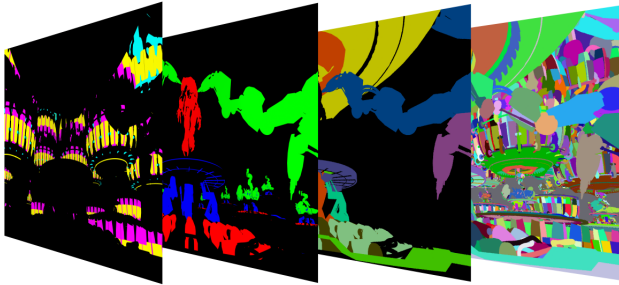
Render Elements Sub-groups

Render Elements in V-Ray break down into four major groups:

Beauty Render Elements
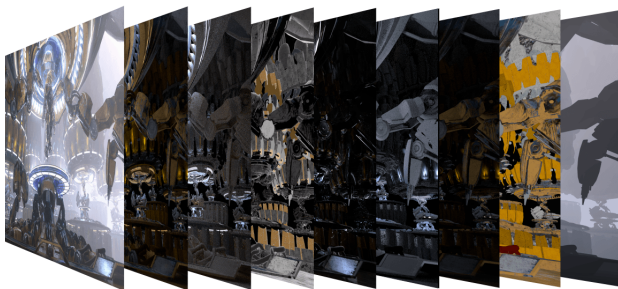
The Beauty Render Elements are the primary render elements that form V-Ray's
pre-composited final render pass known as Beauty or RGB Color.
These include the
Lighting, Global Illumination, Reflection, Refraction, Specular, etc.

Matte Render Elements

The Matte Render Elements aid selection masking in the compositing process.
These include the Material ID, Multi Matte, Object ID, and Render ID Render Elements.

Geometry Render Elements
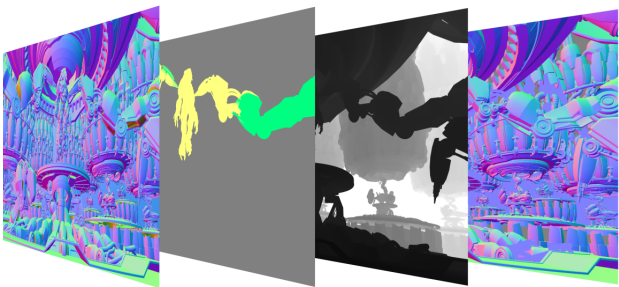
The Geometry Render Elements rely on geometry to generate geometry data for the compositing
process. These include the Velocity, Z-Depth, and Normals Render Elements.

Utility Render Elements
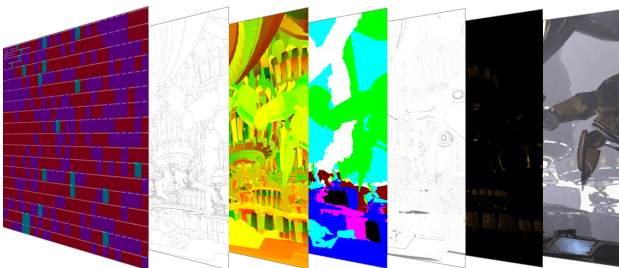
The Utility Render Elements give insight into how V-Ray is running and extra functionality for compositing.
These include the Distributed Render ID, Sample Rate, Denoiser, Extra texture, etc.

List of Supported Render Elements

The following render elements are supported by V-Ray. All render elements support native V-Ray materials while some render elements support standard Maya materials, as noted in the table below.

In order to render a correct **Raw** render pass, you need to also render the corresponding main element and filter. For example, **Raw Reflection** will require you to render **Reflection** and **Reflection filter**. For **Raw GI**, you need **GI** and **Diffuse**, etc.

Render element	Maya node name	Color Depth of EXR floating-point channels[*]	Description
Atmospheric Effects	vrayRE_Atmospheric_Effects	16bit/32bit	Atmospheric effects, such as Environment Fog.
Back to Beauty	–	16bit/32bit	Expands as all beauty elements for the actual rendering.
Background	vrayRE_Background	16bit/32bit	Image background, such as any Background Texture specified in the Environment overrides.
Bump Normals	vrayRE_BumpNormals	16bit/32bit	Normals generated by bump maps, in screen space (which is not the same as camera space). Use the VRaySamplerInfo utility texture node to get the normals in camera, world or object space.
Caustics	vrayRE_Caustics	16bit/32bit	The caustics on the material. These caustics are present only when the Caustics option of V-Ray is enabled. This channel does not include GI caustics.
Coat Specular	vrayRE_Coat	16bit/32bit	Direct surface specular highlights coming from the VRayMtl Coat layer used in the scene.
Coat Filter	vrayRE_Coat_Filter	16bit/32bit	Reflection filter for VRayMtl Coat layer.
Coat Glossiness	vrayRE_Coat_Glossiness	16bit/32bit	Returns a float value that corresponds with the Coat Glossiness value of the VRayMtl Coat layer.
Coat Reflection	vrayRE_Coat_Reflection	16bit/32bit	Indirect reflections coming from the Coat layers of VRayMtl used in the scene.
Coverage	vrayRE_Coverage	16bit/32bit	For each pixel, the final values for the render element are taken from the object that makes the largest contribution to that pixel.
Cryptomatte	vrayRE_Cryptomatte	forced 32bit (for multi-channel files)	Uses the Cryptomatte convention by Psypop to encode mattes into multichannel OpenEXRs.
Custom Color	vrayRE_Custom_Color	16bit/32bit	A generic render element container. Use the Alias value to specify which render element it should be used as.
DR Bucket	vrayRE_DR_Bucket	16bit/32bit	Identifies the render node responsible for rendering a bucket during distributed rendering.
Diffuse	vrayRE_Diffuse	16bit/32bit	Pure diffuse surface color.
Denoiser	vrayRE_Denoiser	16bit/32bit	Applies a denoising operation to the image after it is rendered (with the neccessary channels).
Extra Texture	vrayRE_Extra_Tex	forced 32bit (optional for multi-channel files)	Renders the entire scene with a single defined texture mapped on all objects.
Global Illumination (GI)	vrayRE_GI	16bit/32bit	The diffuse surface global illumination. Only present if Global illumination is enabled.
LightMix	vrayRE_Light_Mix	16bit/32bit	Adjusts intensity and color of lights and light emitting materials during and after render directly from the VFB.
Light Select	vrayRE_Light_Select	16bit/32bit	Extracts the contribution of a user-defined light or a set of lights in the scene as a separate render element.
Light Path Expressions	vrayRE_Light_Select	–	A tool for extracting specific lighting events from the scene to a separate channel.
Lighting	vrayRE_Lighting	16bit/32bit	Diffuse direct surface lighting.
Lightning Analysis	vrayRE_Lightning_Analysis	16bit/32bit	Provides visual representation of the lighting intensity within a rendered frame.
Material ID	vrayRE_Material_ID	–	Material ID of scene objects.
Material Select	vrayRE_Material_Select	16bit/32bit	Renders only the object(s) assigned to a user-specified V-Ray compatible material. The material can be a top-level material or a sub-material of a VRayBlendMtl.
Matte Shadow	vrayRE_Matte_shadow	16bit/32bit	Matte shadow part of the image.
Metalness	vrayRE_Metalness	16bit/32bit	Creates a black and white image, which can be used as a metalness mask when creating PBR shaders.
Multi Matte	vrayRE_Multi_Matte	16bit/32bit	Creates selection masks based on an object ID or material ID.

Multi Matte ID	vrayRE_Multi_Matte_ID	16bit/32bit	Returns an integer value in the image that corresponds to the value of the object's multiMatte ID #.
Noise Level	vrayRE_Noise_Level	16bit/32bit	Creates a monochromatic image showing the amount of noise in the render.
Normals	vrayRE_Normals	16bit/32bit	Surface normals in camera space. To output the normals in screen/object/world space, use Maya's Sampler Info utility texture node.
Object ID	vrayRE_Object_ID	–	Returns solid un-shaded colors to represent a numerical identifiers set through that object's Attributes, Object Property, or assigned material. Useful for selection masks. *EXR*s and *.vrimg* formats store as integer values.
Object Select	vrayRE_Object_select	16bit/32bit	Renders only the object(s) called out with a specific Object or Material ID. This effect is reversible to create a render element that excludes a particular object or objects according to Object or Material ID.
Raw Coat Filter	vrayRE_Raw_Coat_Filter	16bit/32bit	Creates a solid mask showing the areas of reflection in the Coat layer without being affected by Fresnel.
Raw Coat Reflection	vrayRE_Raw_Coat_Reflection	16bit/32bit	Pure surface indirect reflection from a VRayMtl Coat layer before it is multiplied by the reflection filter color.
Raw Diffuse Filter	vrayRE_Raw_Diffuse_Filter	16bit/32bit	A solid mask of raw diffuse surface color information not affected by fresnel falloff.
Raw GI	vrayRE_Raw_GI	16bit/32bit	Raw diffuse global illumination (not multiplied by the diffuse surface color). Only present if Global illumination is enabled.
Raw Light	vrayRE_Raw_Light	16bit/32bit	Raw diffuse direct illumination before it's multiplied by the diffuse surface color.
Raw Reflection	vrayRE_Raw_Reflection	16bit/32bit	Pure surface indirect reflection before it is multiplied by the reflection filter color.
Raw Reflection Filter	vrayRE_Raw_Reflection_Filter	16bit/32bit	A solid mask of raw reflection information not affected by fresnel falloff.
R a w Refraction	vrayRE_Raw_Refraction	16bit/32bit	Pure surface refraction before it is multiplied by the refraction filter color.
Raw Refraction Filter	vrayRE_Raw_Refraction_Filter	16bit/32bit	A solid mask of raw refraction information not affected by fresnel falloff.
Raw Shadow	vrayRE_Raw_Shadow	16bit/32bit	Raw light blocked by other objects.
Raw Sheen Filter	vrayRE_Raw_Sheen_Filter	16bit/32bit	Holds information similar to Sheen Filter RE, but without being affected by Fresnel.
Raw Sheen Reflection	vrayRE_Raw_Sheen_Reflection	16bit/32bit	Pure surface indirect reflection from a VRayMtl Sheen layer before it is multiplied by the reflection filter color.
Raw Total Light	vrayRE_Raw_Total_Light	16bit/32bit	Sum of all raw lighting, both direct and indirect.
Reflect IOR	vrayRE_Reflect_IOR	16bit/32bit	Stores floating-point information that corresponds to the Fresnel IOR values of scene objects' materials.
Reflection	vrayRE_Reflection	16bit/32bit	All indirect reflections from a surface.
Reflection Filter	vrayRE_Reflection_Filter	16bit/32bit	Reflection filter (the color by which the raw reflections are multiplied to give the final surface reflection). This may be considered an alpha channel for reflections.
Reflection Glossiness	vrayRE_Reflection_glossiness	16bit/32bit	Returns a float value that corresponds with the Reflection Glossiness value of an object's material.
Refraction	vrayRE_Refraction	16bit/32bit	Refractions through a surface.
Refraction Filter	vrayRE_Refraction_Filter	16bit/32bit	The refraction filter mitigates the raw refraction layer. This render element returns the color by which the raw refractions are multiplied to give the final surface refraction. This may be considered an alpha channel for refractions.
Refraction Glossiness	vrayRE_Refraction_glossiness	16bit/32bit	Returns a float value that corresponds to the Refraction Glossiness value of an object's material.
Render ID	vrayRE_Render_ID	–	Node render ID of the object that contributes most to the pixel value.
Render Time	vrayRE_Render_Time	16bit/32bit	Shows a floating-point number for each pixel's render time measured in milliseconds.
SSS	vrayRE_SSS	16bit/32bit	Renders just the subsurface part of the VRaySSS2 material on a separate layer.
Sample Rate	vrayRE_Sample_Rate	16bit/32bit	Shows an image where the pixel brightness is directly proportional to the number of samples taken at that pixel.

Sampler Info	vrayRE_Sampler_Info	forced 32bit (for multi-channel files)	Provides information about various aspects of the shaded points - position, normal, bump normal, reflection /refraction vectors and UVW coordinates. Can be used e.g. for world position passes or normal passes.
Self Illumination	vrayRE_Self_Illumination	16bit/32bit	Self-illumination of the surface.
Shadow	vrayRE_Shadow	16bit/32bit	Diffuse light that is blocked by other objects.
Sheen Specular	vrayRE_Sheen	16bit/32bit	Direct surface specular highlights coming from the VRayMtl Sheen layer used in the scene.
Sheen Filter	vrayRE_Sheen_Filter	16bit/32bit	Reflection filter for VRayMtl Sheen layer.
Sheen Glossiness	vrayRE_Sheen_Glossiness	16bit/32bit	Returns a float value that corresponds with the Sheen Glossiness value of the VRayMtl Sheen layer.
Sheen Reflection	vrayRE_Sheen_Reflection	16bit/32bit	Indirect reflections coming from the Sheen layer(s) of VRayMtl used in the scene.
Specular	vrayRE_Specular	16bit/32bit	All direct specular highlights coming from a surface.
Toon	vrayRE_Toon	16bit/32bit	Stores results of V-Ray Toon rendering effect.
Toon Specular	vrayRE_Toon_Specular	16bit/32bit	Stores Toon Specular reflection (highlights) information calculated from the VRayToonMtl.
Total Light	vrayRE_Total_Light	16bit/32bit	Total lighting in the scene, both direct and indirect.
Unclamped Color	vrayRE_Unclamped_Color	16bit/32bit	The unclamped or adjusted image color before Color Mapping settings are applied.
Velocity	vrayRE_Velocity	16bit/32bit	Surface velocity of an object. This render element is useful for generating motion blur in post-production.
Z-depth	vrayRE_Z_depth	forced 32bit (for multi-channel files)	Z-depth of surfaces in the scene.
VRScans Paint Mask	vrayRE_VRScans_Paint_Mask	16bit/32bit	Allows color changes to a V-Ray Scanned Material in compositing.
VRScans Zone Mask	vrayRE_VRScans_Zone_Mask	16bit/32bit	Shows the zone that is a map of the sub-materials. The rendered image is monochrome. The white color specifies the selected zone, whereas the black color specifies the other parts of the image.

* For all image formats except EXR the render elements depend on their respective channels' output settings.

Notes

- V-Ray always anti-aliases with respect to the RGB Color channel. Therefore, other channels may appear jagged or noisy in areas where V-Ray has placed fewer samples.
- Render elements will render in Distributed Rendering mode.
- Render elements require additional storage when rendering and thus increase the amount of RAM used during rendering. When rendering to the V-Ray VFB, you can reduce this by rendering directly to a *.vrimg* file on disk and not storing the final image in memory.
- Render elements may slow down the final image rendering a little bit, depending on the number of elements that are selected. They have no effect on GI/reflection, etc. calculations.
- Since V-Ray Next, the Reflection Hilight Glossiness has been removed from the UI as it can no longer be controlled separately from the Reflection Glossiness in VRayMtl. As there will be no difference between the Reflection Hilight Glossiness Render Element and the Reflection Glossiness one, the Reflection Hilight Glossiness Render Element is no longer available.
- When selecting the Affect All channels option of VRayMtl/VRayToonMtl, be aware that the information of the respective component will affect all render elements, therefore the Back to Beauty composition will not match the RGB result from the renderer.