ahEnvironmentLight Version 3.0
for DAZ Studio
Version 3.0.1.139 and above

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Featured Highlights of Version 3.0

New features since Version 1.0 are in italic lettering, new features since 2.0 are in red lettering.

- ***Fully compatible with DAZ Studio 3.0 (PC and MAC)***

- ***A comprehensive Online Manual.***

- ***8 Render ready IBL scene presets including HDR Image light probes for immediate rendering with new matching preview light.***

- ***8 New render ready IBL Outdoor Presets including 8 new HDR Image light probes with linear intensity scaling for even better control of the lighting via the new gamma control of the IBL light and matching preview light.***

- ***Light Intensity setting ranging from 0 to 200% for compatibility with DAZ Studio lights.***

- ***Full rotation in X,Y axis for compatibility with DAZ Studio lights.***

- **Full Ambient Lighting support with** *new support for individual Ambient Color*.

- **Image Based Lighting** (IBL) with **HDR Image support** and c*ontrols for Brightness , Saturation and Gamma*

- ***Internal IBL image rotation in X and Y axis for matching the preview light with the IBL light for improved preview feedback.***

- **Ambient Occlusion** with *separate sample settings for transparent (e.g. Hair) and non transparent materials for better performance control and support for three different distribution methods*
- ***New AO algorithm with improved render speed***
- ***New AO Off Surface Switch to exclude surfaces from AO calculation at will***

- ***Specular Highlights calculation with full HDR Image support based on the settings for Specular Color, Strength and Glossiness of the surface materials.***

- ***Specular Occlusion calculation based on the settings of Specular Strength and Glossiness of the surface materials.***

- ***Uses one single IBL Image for calculating the diffuse, specular and reflection part of the lighting which is more accurate and saves considerably memory while rendering and also eliminating the need for preblurred IBL images.***

- **Controls** for **Irradiance Shadingrate** and **Irradiance Maximum Error** for optimizing quality versus render time

- Indirect Light Transport *(ILT) Light for adding diffuse and specular surface to surface light reflections and color bleeding to the scene.*
- ***New ILT algorithm with improved render speed.***

Quick Start

Where to find the various parts

Everything is grouped under the lights section in the `Content Tab` of DAZ Studio 3.0:

The folder `ah Lights` contains the loader script for the basic IBL/ILT Light. As it does not have any specific "render ready" settings. It is used as a starting point to work with your own IBL images and settings.

The folders beneath `ah Lights Presets` contains various scripts which will load complete light setups with matching IBL images and preview quality settings.
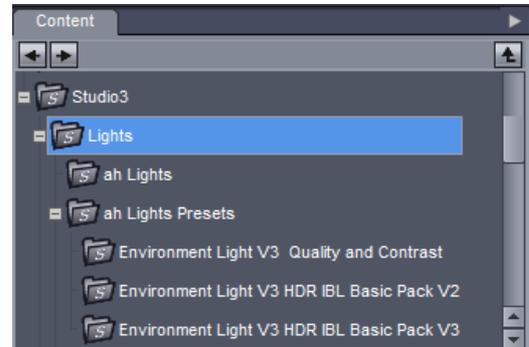
To use them just double click on one of the preset icons to load the specific IBL light preset.

Note:
If You want to preserve the lights in your scene press and hold the CTRL key while double clicking the loader script icon. It will bring up the scripts dialog which provides You with extra options how the new IBL Light should be loaded.

The folder `Environment Light V3 Quality and Contrast` contains a couple of helper scripts to quickly change the quality and the contrast of the IBL Light once it has been loaded into your scene.

To use them just select the IBL Light in the scene tree and double click on one of the preset icons.

Loading and rendering a scene with the IBL light

The basic steps are:

- o   Load or create your scene and pose your models
- o   Load one of the Light Presets
- o   Check your render settings
- o   Select Your favorite camera and render away!

As example I loaded a test scene of mine and used the preset:

`[ah] Outdoor 6`

from the new V3 Basic Pack folder.

The light probe image for this preset was taken shortly before sunset and gives us a very soft and starkly yellow light coming almost horizontally from the left.

The only adjustment I made was upping the AO Sample setting from 4 to 64 for cleaner, less noise shadows.
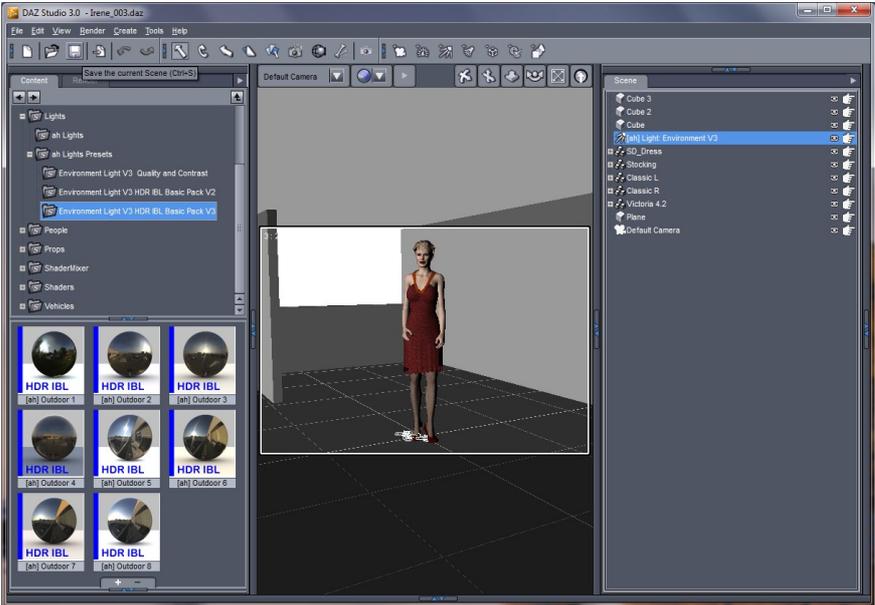
Next check your render settings !

This step is very important if you want to avoid your render time going through the roof.

As basic settings use the one shown on the right.

The most important settings are:

- Use Software: 3Delight
- Shading Rate: 1
- Max Ray Trace Depth: 1

After hitting Render and waiting for a good couple of minutes this was the result:
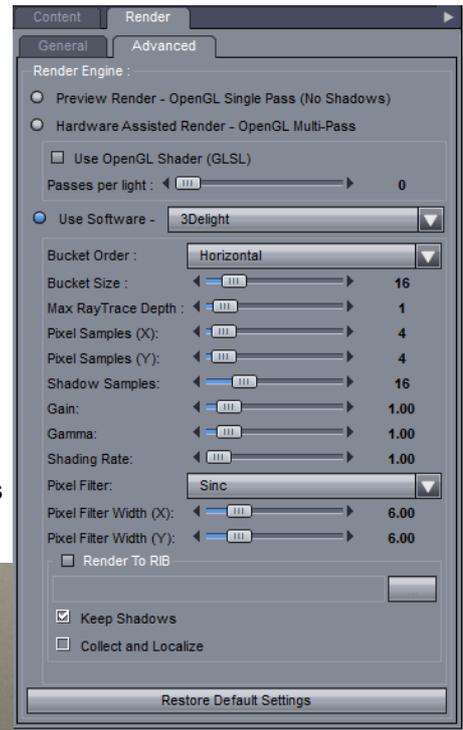
There are many things that can and should be tweaked, but considering a setup time of less than a minute the result is not bad at all.

New features concerning setup

Preview Light

One thing that was missing from all IBL Lights where the non intuitive setup procedure because there was now way in the preview window to determine from where the light is actually coming in the scene. Only after rendering an image we could see the effect of the IBL lights.

This is still the case, but with version 3 of the ahEnvironment Light we got a much better sense of the lights main directionality because of the new built in preview light.

Here is an example scene of mine after loading the IBL preset [ah] Indoor 1:
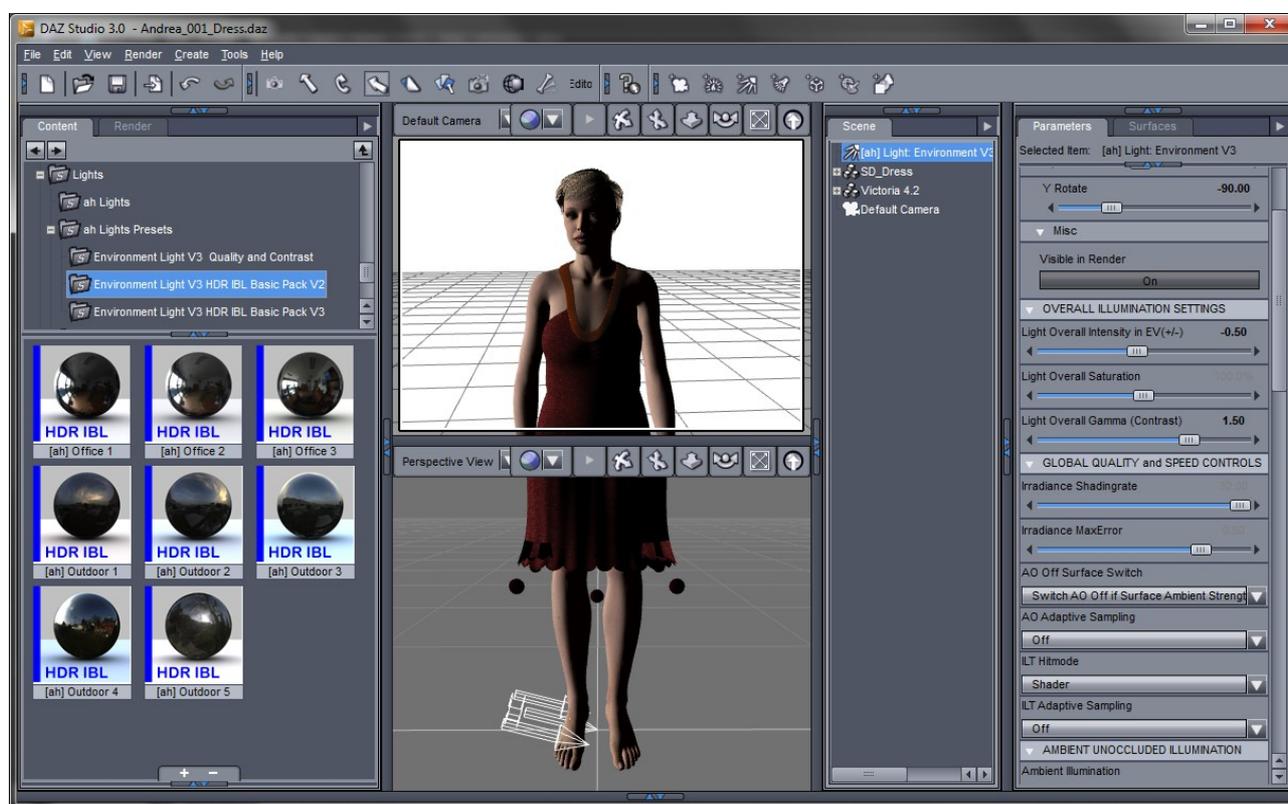
The preview lights arrows, as seen in the perspective view on the bottom half of the OpenGL view are pointing from the left and slightly from behind the figure. Also the surfaces of our figure is more brightly lit on the left side as can be in the camera view.

A quick render shows us that the general direction and brightness is matching our rendered result.

If we now rotate the light horizontally (Y-Rotate) we see that the lights preview arrows will rotate accordingly. Also we can switch to the lights preview window and see exactly what the light "sees".

Important Note:
Be careful not to use the rotate button attached to the lights preview window. Only use the sliders in the parameters tab! Reason for this is a rather inconvenient "feature" which under certain conditions will screw up the rotation axis of the light resulting that the preview will not be synced with the actual orientation.
If that happens just open the hidden parameters and correct all rotation axis values to 0.
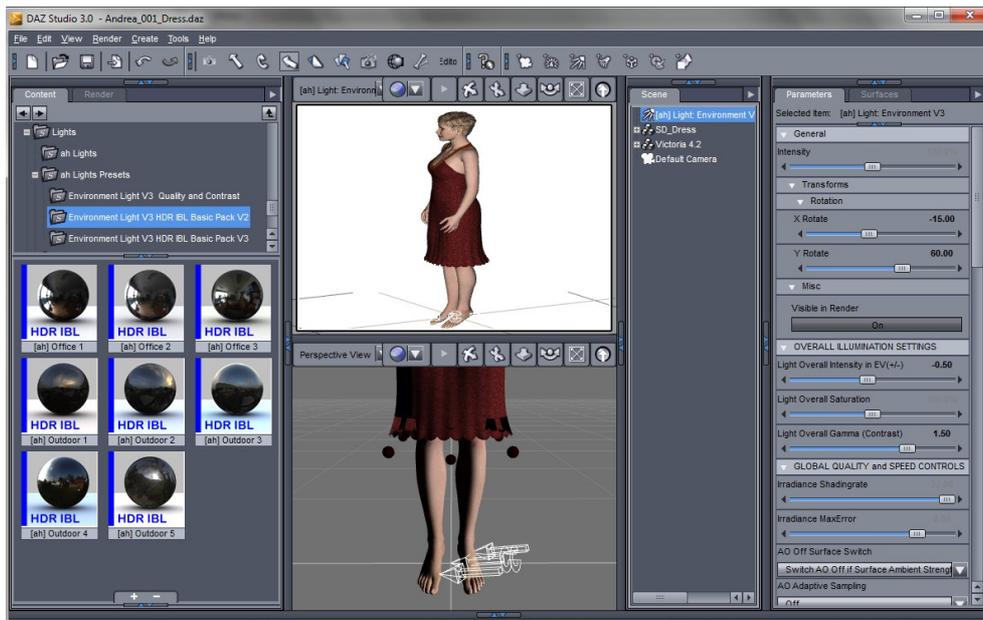
After adding a vaguely matching backdrop image the render looks like this:

As You can see, matching the lights direction with a background image is now a matter of seconds.

Internal IBL Image Rotation Parameters

As seen in the example above, the direction of the preview light is now matching the direction of the brightest region of the IBL image.

This is done by internally reorienting the IBL image to match the standard light vector of Studio, which is pointing North or in other words in negative z direction.
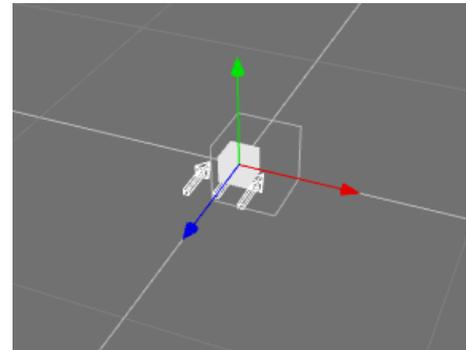
If we look closer to the IBL lights settings in the parameters tab, we can see that the light is originally set to -15 degrees in X and -90 degrees in Y.
This is done on purpose by the preset script to get the lights directionality the same as the day the light probe image was taken.
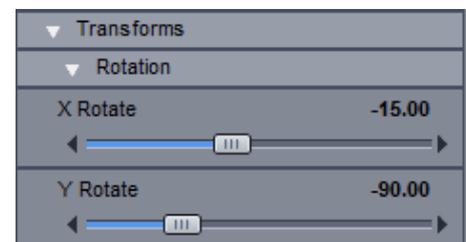
If we now have a look at the IBL Map Rotation controls we can see that they are set exactly the opposite. They are counteracting the original orientation of the light probe image.
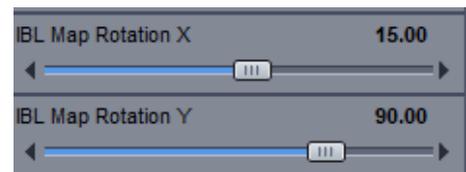
For the IBL images from this package the rotation is automatically set correctly by the loader scripts, but for light probes from other sources we are able to match the orientation the same way to get all the benefits of the preview light.

Overall Illumination Settings

While it is a lot easier now in DAZ Studio 3.0 to control the brightness and gamma of our rendered images, it is still necessary to get the light settings right to match the shaders and background plates used in the scene.

To ease this job the new Overall Illumination Settings are introduced in version 3 of the ahEnvironment Light.
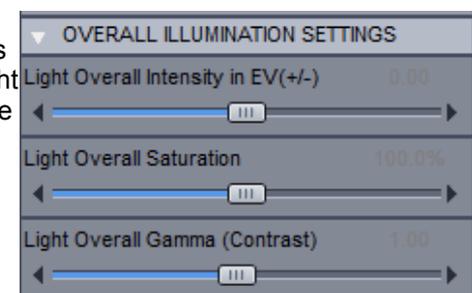
As the name suggests, this three controls will be applied after all the other settings like AO Gamma or IBL Map Brightness Scale for instance. The basic concept is, that all the other parameters are used to get the internal mix if the light right and after that we use the Overall Illumination Settings to match the light with our scene.

The presets in this package have their internal mix already balanced for general lighting condition and acting as sole lights in a scene. If we have other lights in the scene the overall settings are used to match the IBL light with them to achieve a homogenous look of the rendered image.

Ambient Unoccluded Illumination

This controls the constant ambient part of the light that is used to get at least a bit of light and color to every region of our scene.

That seems trivial but in fact it is considered good practice to avoid any black areas in an rendered image.

We can use this new controls to add a bit of constant light to every surface of our scene.
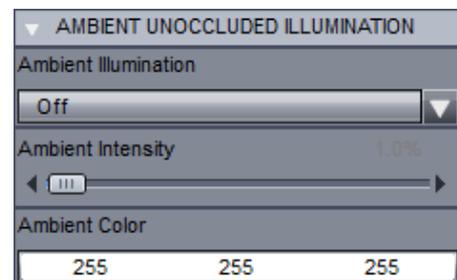
While this helps a lot to getting a better look, we have to be very careful not to overdo it. To much will wash out our shadows. I prefer something between 2-5% intensity and a bluish tint for outdoor scenes and 5-10% for indoor scenes with a matching tint to simulate the bounced light from the walls, the floor and the ceiling.

Here is an example: left without, right with 10% ambient illumination.
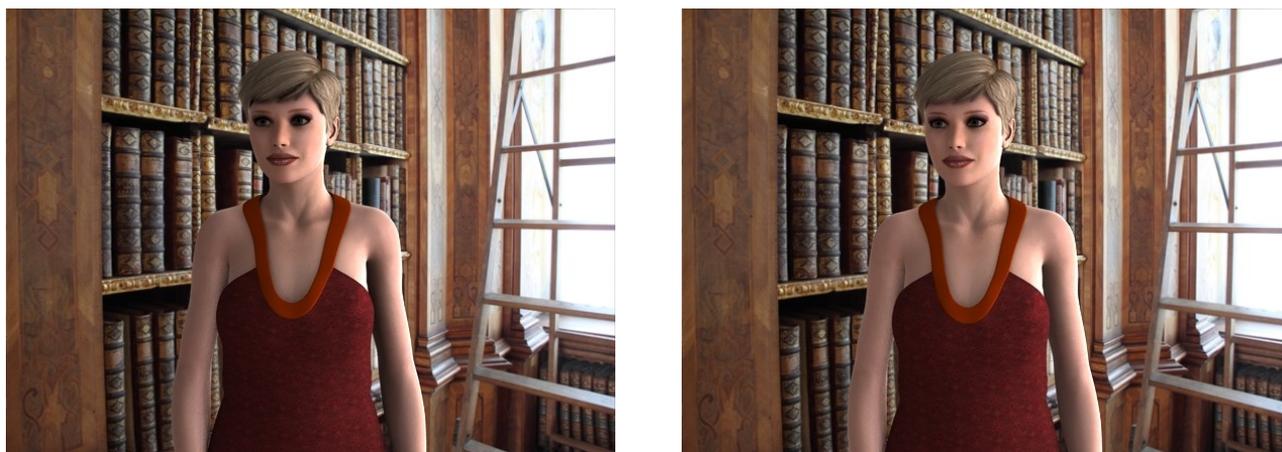
The difference is subtle but adds to a more natural lighting solution.
In a manner of speaking one can say that this is a poor mans bounce light simulation. If render and/or setup time is an issue this is the way to go. Otherwise we can use ILT which would calculate the bouncing light much more accurately at the cost of render time.

Built in ILT

Prior to this release the IBL and ILT light where two separated lights. Now they are merged into one HDRI IBL environment light. The reason for doing this was the opportunity to enhance the internal work flow of the light which resulted in greatly reduced render times.

The controls for the ILT light are now to find in the section ILT Illumination. The functionality and usage if the ILT light did not change.

If we want an ILT only light, all have to do is to switch all light sections off with exception of the ILT Illumination.

New features concerning render time

Some of the new features built in since the last version will help us bringing down render times significantly. Besides the parameters AO Samples and AO Samples for Transparent Materials and the quality switches like Irradiance Shadingrate and Irradiance Max Error which are still in our arsenal we have two more parameters for even better control:

- AO Hitmode
- AO Off Surface Switch
- ILT Hitmode

AO Hitmode Switch

To speed up the render time we can restrict AO calculation to only use the surface primitives, thus saving a lot of time by not being forced to read the surface shaders at all. In most rendered images this will have very little or no impact on the image.
Only surfaces that are shadowed by other surfaces which have a transparency map attached to them will suffer more or less.
I suggest to use the option "Primitive" first to see if there is a big enough impact on the image to justify the massive increase in render time when using the option "Shader".

AO Off Surface Switch

Prior to version 3 of the ahEnvironment Light there was no way to arbitrary exclude surfaces from the AO calculation. The only way we had to achieve that kind of control was to rely on AO built in the advanced surface shaders.
This required a lot of time to setup, because we had to exchange all standard surface shaders to the more advanced ones which in turn required a great deal of time to tweak each surface to give the same result as with the standard shaders. Well, this is over now!
With the AO Off Surface Switch we can exclude any surface from the AO calculation and it works with practically any surface shader.

The tricky part was figuring out a way to achieve this without having to rewrite or reinvent every surface shader written for Studio yet?

Well, I used two surface parameters common to every shader, namely Ambient and Diffuse Strength. Setting them to one specific value will exclude the surface from AO calculation. These "magic" values are:

- 0.1% for Ambient Strength and
- 99.9% for Diffuse Strength.

Either value will have very little if any effect on the resulting image, but gives the ahEnvironment Light the right hint to act accordingly.

Note:
Transparency mapped hair often looks much better without any AO shadows.
Mainly because hair, especially light colored hair, is supposed to be translucent which the standard surface shaders can not simulate.

ILT Hitmode Switch

Same as above, but used during ILT calculation.

Fine Tuning the Settings

Section: General

Intensity

This is the DAZ Studio compatible master light intensity control. It gives instant visual feedback and works exactly the same way as in any other DAZ Studio light.

Note:
There is also a intensity controls in the Overall Illumination Settings section, which are more precise but do not give instant visual feedback.
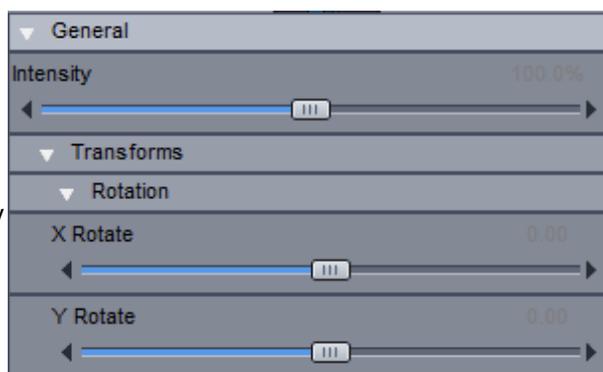
Transforms

Rotation

The settings X and Y Rotation behave exactly the same as the settings of the same name in the standard lights of DAZ Studio.

Rotating around x-axis results in rotating the light up and down while rotating around y-axis will rotate the light horizontally from left to right. The behavior is exactly as with any other DAZ Studio light.

Note
The exact effect of the IBL light on the scene can only be obtained from the IBL light probe during rendering. So we have to do a (low) resolution render to actually see the effects of the IBL Light.
See also section "Quality Presets" for changing from preview to final render quality.

But, (BIG BUT !) since version 3.0 the built in preview light gives us a fair approximation of the lights dominant direction. This is done by rotating the original IBL image so that it matches with the preview lights rotation settings.

For example:

In the image below the preset "Outdoor_004" from the basic pack was used.

In the image series above, we can see the effect of rotating the IBL Light.
From left to right: **Preview** (OGL view in DAZ Studio), rendered with **original orientation** and rendered with IBL light **rotated 150** degrees in y-direction - which means to rotate the IBL light horizontally.

We can see that in the original orientation most of the light comes from the left and slightly behind the figure. After rotating 150 degrees, the light comes from the front right direction. Note the change in brightness and specular reflections because the figure now gets much more direct light from the sun.

Section: Overall Illumination Settings

As the name suggests, this three controls will be applied after all the other settings like AO Gamma or IBL Map Brightness Scale for instance.
The basic concept is, that all the other parameters are used to get the internal mix if the light right and after that we use the Overall Illumination Settings to match the light with our scene.
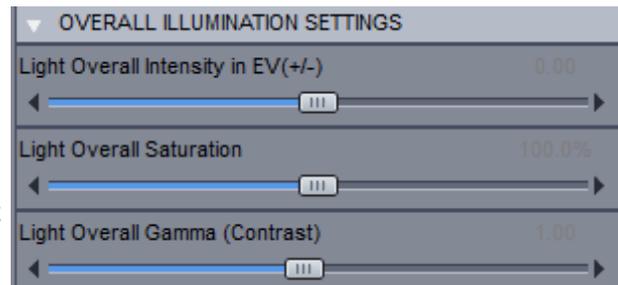
Light Overall Intensity in EV(+/-):

Controls the intensity in steps of EV (or f-stops).
A value of 0 is neutral, while -1 results in half the intensity and +1 in doubling it.
Contrary to the light intensity and exposure controls of DAZ Studio it works not in a linear fashion as for instance a value of +2 will quadruple the light intensity.
Photographers are familiar with this kind of scale, as it works like exactly as the exposure time settings of a real world (D)SLR camera.

Why not stick with linear? As the HDR IBL images we use to compute the lighting have a very broad range of values we need to scale them for our scene. For instance a good daylight HDR image must be scaled down at least 4 EV to match the light intensity of a standard light in DAZ Studio.

With a linear control we would enter 6.25% which is not very practical and must be calculated. Entering -4 EV is much more convenient and as said before is standard practice in both worlds, CGI and Photography.

Light Saturation:

Controls the color saturation of the light. A value of 0% will result in a white or gray light without any color tint.
A value of 1000% will result in the original color tint computed from the IBL image and the various color settings. Here are 3 images at 100%, 50% and 0% saturation with a stark yellow-red light probe:

Note:
Not the image saturation is altered by this setting, but the lights color saturation! If we want to alter the image saturation we have to do it outside of DAZ Studio or use surface shaders that have that option built in.

Light Overall Gamma:

Controls the gamma setting of the light. A value of 1 will result in a linear brightness scaling.
Values between 0.1 to 0.99 will increase the contrast while values of 1.01 to 2 will decrease contrast.

Note:
Contrast is not the right technical term, but avoiding the complexity of the whole gamma story it is the best I could find. People who want to know exactly whats behind that should google "gamma".

Her is a series of images rendered with gamma setting at 0.7, 1 and 1.4:

Note:
Not the image gamma is altered by this setting, but the lights gamma!
If we want to alter the image gamma we have to use the gamma settings in the advanced render settings of DAZ Studio which have by the way the same scaling.
As long as the IBL light is the only light source in the scene it makes no difference which setting we use.
But in conjunction with other lights we can use the gamma setting of the IBL light to match the contrast with the other lights of scene.

Section: Global Quality and Speed Controls

Irradiance Shadingrate

Irradiance Shadingrate controls how often AO ot ILT is calculated on a specific surface.
Setting it to a value of 1 instructs the render engine that AO or ILT should be determined at every shading point in the scene.
This is most often overkill and slows down rendering to a crawl. "Sane" values for most DAZ Studio scenes ranges from 1024 to 256 which will determine the values only every 1024th and 256th shading point respectively.

For very close shots or high image sizes, settings may have to be be lowered if the image starts to look blotchy – but it is recommended to try higher values and have a look on the outcome first.

Because the right setting is highly dependent on the scene, the resolution of the figures, and image size, it is very hard to give recommendations. But rough estimates for a V4 figure and an image size of 750x750 pixels are:

- For wide area shots: 1024   to 512   (a complete room for instance)
- For medium area shots: 512   to 256   (a human figure from the waist up for instance)
- For close up shots: 256   to 64   (a human single face for instance)

Note:
It is strongly recommended to try higher sampling rates for AO first before lowering the value for irradiance shadingrate. It is much cheaper in terms of render time. So try sampling rates of 128 samples or more first ,and then, as a last option consider lowering the irradiance shadingrate!

Irradiance Shadingrate

Controls the amount of interpolation between shading points on the shaded surface. Higher settings instructs the render engine to calculate interpolation more exactly – at the expense of some render time.
Setting it to values of 0.5 or 0.75 is recommended. A value of zero turns interpolation completely off which may lead to blotchy images.

AO Off Surface Switch

This controls switches the AO calculation on or off for a specific surface.

To exclude a specific surface a special value must be set in the surface tab for either Ambient Strength or Diffuse Strength. These "magic" values are:

- 0.1% for Ambient Strength or
- 99.9% for Diffuse Strength.

Either value will have very little if any effect on the resulting image, but gives the ahEnvironment Light the right hint to act accordingly.
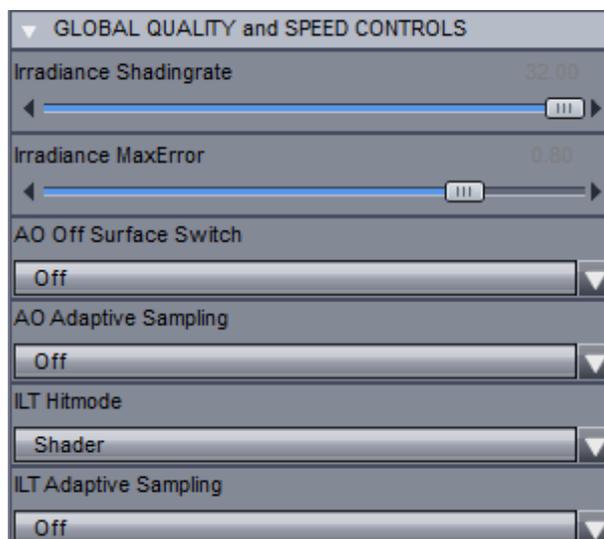
Note:
Transparency mapped hair often looks much better without any AO shadows.
Mainly because hair, especially light colored hair, is supposed to be translucent which the standard surface shaders can not simulate.

AO Adaptive Sampling

This controls if or of not adaptive sampling should be used by the render engine for calculating AO.
For scenes with big surfaces this has a positive impact on render speed. To determine if our scene is receptive to this speed increase must be tested for each scene.

Note: Best used for rendering animations, where we usually squeeze for every second of render time.

ILT Hitmode

Same as AO Hitmode – see there.

ILT Adaptive Sampling

This controls if or of not adaptive sampling should be used by the render engine for calculating ILT. See also AO Adaptive Sampling.

Section: Ambient Unoccluded Illumination

This controls the constant ambient part of the IBL light which is added to every surface in the scene.
As it is not effected by any shadowing effect it brightens up all areas if the image that are illuminated by the IBL light.

It is used to avoid black areas in the rendered image which would otherwise be not responsive to any gamma, color or contrast tweaking in or outside of DAZ Studio.
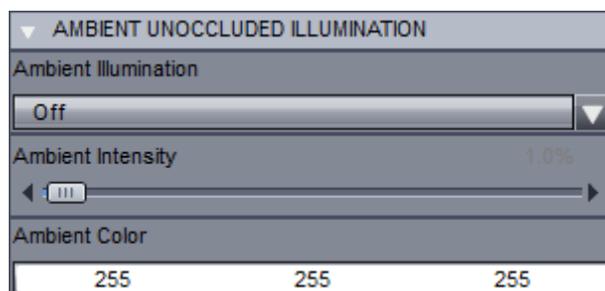
Ambient Illumination

Switches ambient illumination on or off.

Ambient Intensity

Usual settings range from 2 to 10% intensity to generate a more natural lighting.

Note:
Be careful not to use to high values, because it is prone to wash out the shadows of the image.

Ambient Color

The color of the ambient light in RGB notation.

Section: IBL Illumination

IBL Illumination

This control behaves exactly the same as in the
standard lights of DAZ Studio.
Possible settings are:

- On   Adds diffuse IBL and
             specular IBL to the
             scene.
- Diffuse Only Adds diffuse IBL to your
             scene.
- Specular Only Adds specular IBL to
             your scene.
- Off   Switches the light
             completely off.

Intensity and Specular Intensity

The Intensity setting behaves exactly as the setting of
the same name in the standard lights of DAZ Studio. It
controls the amount of light which the light should add
to the scene.
Reasonable values ranges from 0% - which is the
equivalent of switching the light off and 100% which
sets it to full intensity.
If you have additional lights in the scene the scene may get too bright. You should lower the intensity setting
for all the lights to correct for this.

The Specular Intensity setting controls the strength of the calculated specular highlights.
Because most surface shaders are set up to cope well with the standard Studio lights, this might cause
specular highlights under IBL lighting to be either calculated to weak or to strong compared to the original
DAZ Studio lights.

This is mainly caused by the fact that HDR IBL lighting has a much more "real" light intensity distribution and
is generally much more accurate with the actual geometry of the original light sources.
For instance, while the origin of a traditional DAZ Studio spot light is mathematically just a point in space the
same spot light in a IBL image has a real dimension thus will create a broader and more natural highlight.

To compensate for this, you can go either of two ways: Alter the surface shader settings to more "real world"
values or compensate in the light shader – exactly what the Specular Intensity setting is for.

Note:
The method to compensate in the IBL light shader is inferior to changing the settings of the surface shader.
So if the IBL light is the primary light source in your scene it is recommended to alter the surface shaders
settings for Glossiness and/or Specular Strength – it will get you closer to a natural look (if that is to be
desired for the image in the first place).

IBL Color Map

This is the actual IBL light probe image.
If the color setting is set to any other color than pure white (RGB 255,255,255) then this color is multiplied
with image color before it is used as IBL image. It can push an existing IBL image towards a certain hue.
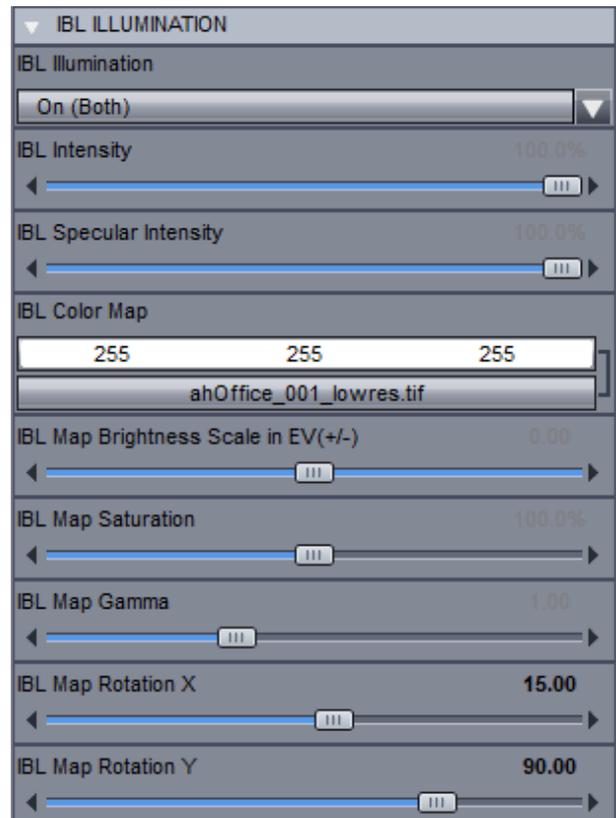
Note that the intensity is also changed, so you might have to compensate with the IBL Brightness Scale setting – see below.

Note:
It is not recommended to use blurred images with the IBL Light.
While other implementations are dependent on such external blurring for correct lighting calculation of the diffuse part the this light takes care of such things by itself. In doing so it is able to calculate a much better lighting solution and is able to use a single map for diffuse, specular and reflection calculation which saves considerably memory while rendering.

Note:
If no IBL image is given, the ahEnvironment Light simulates the IBL image by calculating a sphere around the scene of uniform color and intensity. In this way the ahEnvironment Light can be used without any image at all as a uniform fill light in combination with other lights.

Note:
If You use Your own IBL HDR images, or download some from the Net, then they may have to be properly prepared before they can be used as light probe. First they have to be in what is called Latitude/Longitude layout. Secondly, for the sake of Studio they also have to be in TIFF format. For HDR Images it should be a Floating Point TIFF image to preserve the full range of intensity values. See section "Preparing a Light Probe" for more information on that matter.

IBL Brightness Scale

Controls the intensity of the IBL image in steps of EV (or f-stops).
A value of 0 is neutral, while -1 results in half the intensity and +1 in doubling it.

Contrary to the light intensity and exposure controls of DAZ Studio it works not in a linear fashion as for instance a value of +2 will quadruple the light intensity.

Photographers are familiar with this kind of scale, as it works like exactly as the exposure time settings of a real world (D)SLR camera.

Every IBL image contains its own amount of light intensity values. So some of them would appear very dark or very bright in comparison with the standard lights of DAZ Studio.
In fact it depends heavily on the real light situation at the location they were taken and on the technique used to combine the single shots into an actual HDR image.

To counterbalance for that, every IBL image will be multiplied with the IBL Brightness Scale value before calculating the actual brightness of the light.

The actual values can range widely. Some images need values as low as -4 others a value of +5 or more. Unfortunately if the value is unknown the only way to get it is to experiment with a simple scene and trying various values.

Note:
The light presets included in this package will set the correct brightness scale values for their IBL images automatically.

IBL Map Saturation

IBL images, especially HDR images taken at real locations, tend to have very saturated lights and shadows. While this is scientifically correct it may not look that good in your rendered image.

For instance an HDR image taken on steel blue sunny afternoon on a green meadow will produce very bluish

shadows on surfaces pointing away from the sun and also very greenish shadows on the surfaces pointing towards the ground.
While the same effect can be seen in many real life photographs it is seldom desired. In fact professional photographers, if they choose to take a photograph on such a location, use white or even sometimes colored reflectors to compensate.

Fortunately in CGI we have much easier controls for such matters. The IBL Map Saturation setting will desaturate the image if needed and therefore colored shadows can be easily corrected.

A value of 1.0 it has no effect on the image while at 0.0 the image will be converted to black and white before being used as light probe.

In the image series below the effect of the saturation setting is shown. From left to right: 100%, 25% and 0% Saturation – For better comparison: The floor plane's surface color is set to a uniform light gray.

IBL Map Gamma

Controls the gamma setting of the IBL image. A value of 1 will result in a linear brightness scaling.
Values between 0.1 to 0.99 will increase the contrast while values of 1.01 to 2 will decrease contrast.

Note:
Contrast is not the right technical term, but avoiding the complexity of the whole gamma story it is the best I could find. People who want to know exactly whats behind that should google "gamma".

It is used in two ways:

a) To correct the gamma scale of an existing IBL image or
b) To control the contrast of the IBL image for artistic purposes

The difference to the same setting in the Overall Illumination Settings is, that it only influences the IBL image and not the whole light as the former. The contrast of say AO Shadows and ILT illumination will not be altered.

IBL Map Rotation

This controls the internal rotation of the IBL image. It is used to match the IBL image to DAZ Studios coordinate system and to match it to the built in preview light.

Here is a IBL light probe image taken on a late sunny afternoon:

The sun is the primary light source in that probe and should match the standard light vector of DAZ Studio which would point exactly to the center of the light probe image.

What we do is to set the x and y rotation values in a way to shift the sun to center of the light probe image which is usually where the camera is imaged in a mirrored ball setup.

This image illustrates how we can do that:
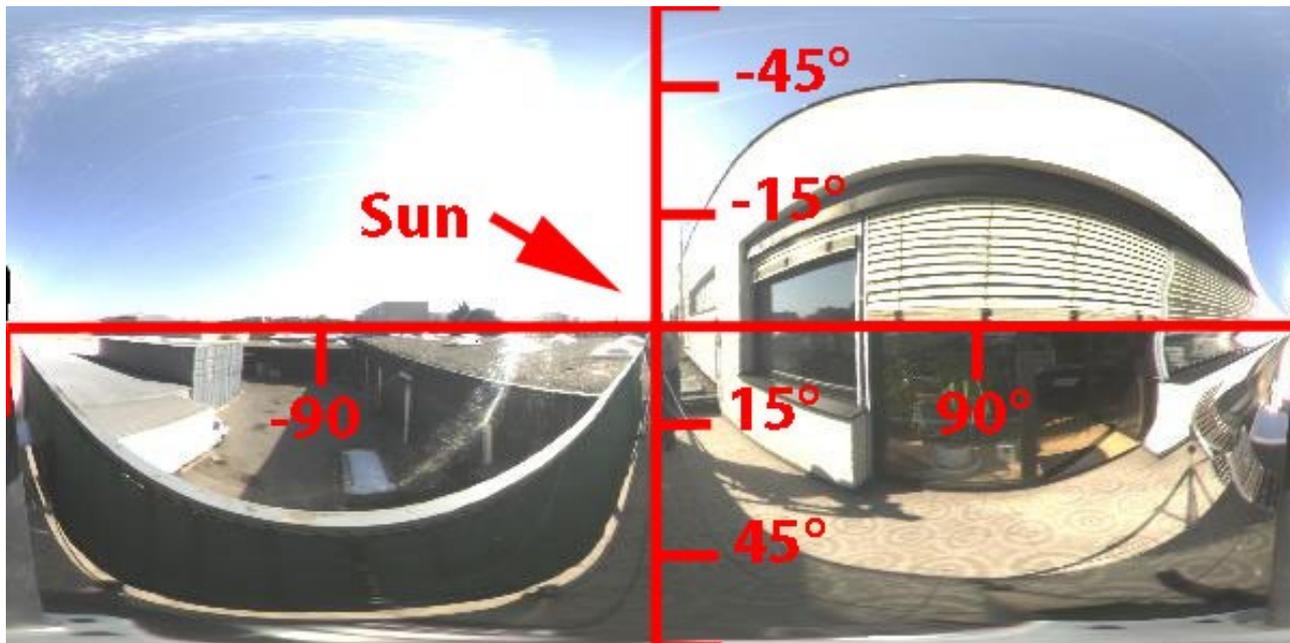
As we can see the sun in the original image (here in Lat/Long layout) is located at approximately 15° above the horizon and 45° east of our image center. This translates to -15° on the x-axis and -45° on the y-axis. To bring the sun into the center we have to shift (or rotate) 15 degrees down and 45 degrees to the right.

So our found values for x and y rotation are:

      IBL Map Rotation X: 15
      IBL Map Rotation Y: 45

Given this values the sun will be perfectly aligned with the vector of the preview light.

Note:
We must be careful of the axis orientation. From the origin (0,0) in the center the y-axis (horizontal) points to the right and the x-axis (vertical or elevation) points to the bottom of the image. Also the values on the x-axis are not linear but they are the sinus of x. So 45° down translates to sin(45) = 0.7 or 70 percent of the distance between the origin and the bottom of the image.

To conclude this matter: In most cases, approximating the position is sufficient to give enough feedback with the preview light.

Section: Ambient Occlusion

Ambient Occlusion (Diffuse Shadows)

Similarly to the standard lights from DAZ Studio,
the [ah] Environment Light has a shadow control setting.

However as the internal mechanics are different,
compared to the standard DAZ Studio lights, there is
only an "On" and "Off" value.

Specular Occlusion (Specular Shadows)

Similar to the above, but calculates the shadows for the
specular portion of the light.
Possible Settings are:

- **Off**   No Specular Occlusion is calculated.
- **use AO**   Uses the same shadow solution as for Ambient Occlusion, which is very crude but
                   sometimes a good enough approximation. The main advantage is that it does
                   not cost additional render time. *Note: Ambient Occlusion must be switched on.*
- **Advanced**   Calculates its own shadow solution depending on the specular settings of the
                   shaded surface material. This settings results in a much more accurate shadowing
                   at the cost of some additional render time.
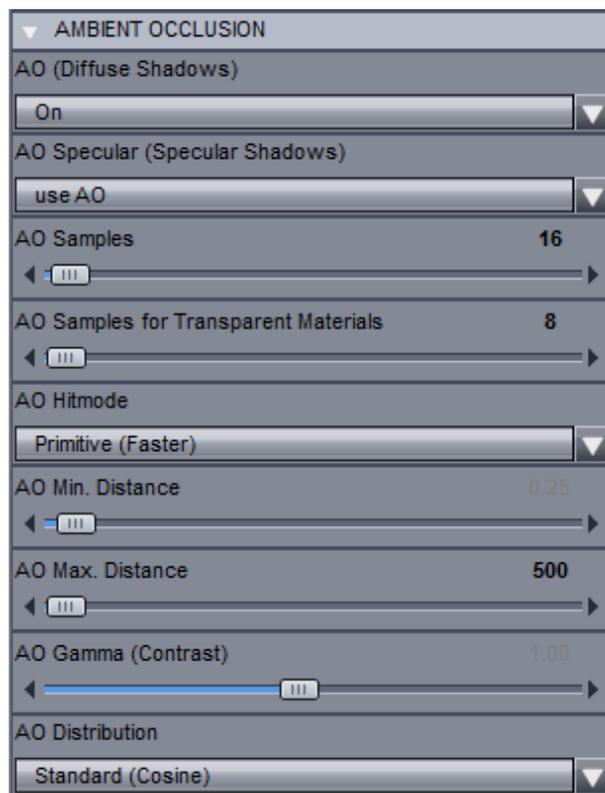
In the image series above, we can see small but distinctive differences in the three options. From left to right:
Specular Occlusion Off, use AO and Advanced.
Most noticeable is the difference on the sphere. In the first two images the reflection from the figure is mixed
with the reflection calculated from the IBL image. The color from the table is shining through. In the image on
the right the reflection is calculated correct – the areas from the figures reflection are now excluded from the
reflections calculated from the IBL image.

AO Samples and AO Samples for Transparent Materials

These settings control how many probing rays are cast to detect light blocking objects.

For test rendering the recommended settings are 8 or 4 samples. This will give You good enough shadows to determine the outcome of the final render.

For final rendering, settings up to 512 samples for non transparent materials are considered normal.

Because probing for transparent surfaces takes very long to render you may want to set the number of samples for transparent material to considerably lower values like 4 or 8.

Note:
The ahEnvironment Light recognizes transparent materials automatically while rendering. No special marking or tagging is required.

The image series below shows the effect of increasing the number of AO samples. From left to right: 8, 16, 64 AO Samples:

AO Hitmode

To speed up the render time we can restrict AO calculation to only use the surface primitives, thus saving a lot of time by not being forced to read the surface shaders at all. In most rendered images this will have very little or no impact on the image.
Only surfaces that are shadowed by other surfaces which have a transparency map attached to them will suffer more or less.
I suggest to use the option "Primitive" first to see if there is a big enough impact on the image to justify the massive increase in render time when using the option "Shader".

AO Minimum and Maximum Distance

These settings control at what distance the cast rays are starting and ending while probing the scene blocking objects.
In other words the rays will start at a point exactly the minimum distance above the surface being shaded and will end at exactly the distance given in the maximum distance setting. In DAZ Studio the unit for distances is set to centimeters.

A common way to use the Maximum Distance setting is to exclude bounding objects like walls or other

structures that should not shadow the surface.

Note:
If minimum distance is set too low the surface being shaded will cast its own shadow on itself. This is the so called self shadowing effect and may occur if the surface shader involves some kind of displacement or bump mapping.
In this case gradually increase the value of the minimum distance setting in very low steps until no more self shadowing occurs or set the bump or displacement strength to a lower value.

AO Gamma

AO Distribution

This setting controls how the probing rays are cast while probing the environment for blocking objects.

- The standard setting is "Standard(Cosine)" which will cast more of the probing rays in the direction in which the surface normal is oriented. This setting is also the one that needs the least number of rays cast (AO Samples) to produce even looking shadows.
- The "Uniform" setting will cast probing rays equally distributed in every direction resulting in a more accurate probing. But as more rays are cast to the edge of the probed area the overall density of the cast rays gets lower. So this settings sometimes needs a higher number of AO Samples to produce even shadows compared to the "Cosine" setting.
- The "IBL Map" setting tries to determine the most likely direction from which an occlusion occurs from the given IBL image and cast probing rays primarily in that direction. This results in stronger, more natural shadows – especially with IBL images that are taken in broad sunlight.

In the image series below the differences are very hard to detect – but they are there – most noticeable at the chest area. (From left to right: Cosine, Uniform, IBL Map)

Note:
The differences between the distribution settings are most likely only visible by direct comparison of the resulting images and are often hard to detect. General rule is, the higher the IBL image's dynamic range, the bigger the difference in the resulting shadows.
Also not all HDR IBL images are equally suitable for IBL Map distribution and some may even result in very strange shadows.

ILT Illumination (GI Bounce)

ILT Illumination

This control behaves exactly the same as in the standard
lights of DAZ Studio. Possible settings are:

- On   Adds diffuse ILT and
                        specular ILT to the
                        scene.
- Diffuse Only   Adds diffuse ILT to your
                        scene.
- Specular Only Adds specular ILT to
                        your scene.
- Off   Switches ILT completely off.
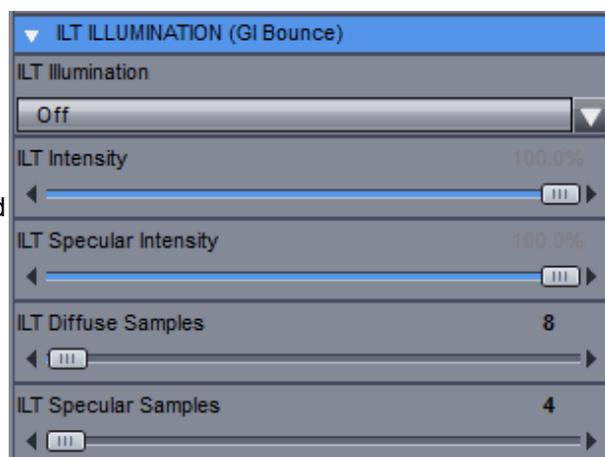
ILT Intensity

The overall intensity of the ILT part of the light.

ILT Diffuse and ILT Specular Intensity

Controls the diffuse and specular part independently. The sum of both will then be feed into the ILT Intensity
control for final mixing.

ILT Diffuse Samples and ILT Specular Samples

This setting controls how many probing rays are cast to detect light from other surfaces in the scene.

For test rendering the recommended setting is 4 or 8 samples. This will give a good enough approximation
to determine the outcome of the final render.

For final rendering settings up to 1024 samples are considered normal.

Note:
*For most purposes setting the samples for specular ILT to about half (or lower) the value as for diffuse ILT
sufficient.*

Appendix

Introduction to IBL, AO and ILT

IBL

In the CGI world abbreviations are very much common place – almost everything is shortened to two or three letter acronyms. CGI itself is an acronym and stands for **C**omputer **G**enerated **I**mage or sometimes **I**maging.

The techniques used in this shader pack are a subset of so called GI or Global Illumination techniques which began to evolve some twenty years ago mostly for the purpose of the film industry and their special effects departments.

A very common problem there is to integrate an CG object into real life footage. While creating and animating such an object is one problem, the other is how to blend it in so that the audience would not be able to tell. Unfortunately the human eye and brain are very good in detecting if something looks off in an image. Especially if there is something to compare the CG object to the image itself like the background or other objects nearby. Even very small variations in color or tone, inconsistent shadows or reflections or a dozens of other details can give a CG object away easily .

One of the most fundamental steps to get it right is to light the CG object exactly the same way as it would actually have been in the scene. There is a very elegant way to do just that. It is called **IBL** – yet another acronym for **I**mage **B**ased **L**ighting.

How does it work? Well, as the name suggests one would take an image of light from the original filming location to illuminate the CG object later on. Such an image is often called a light probe, because it is essentially an image of all light that would fall onto a object that would be put in exact the same spot as the camera that took that image.

Another common way to take such images is to photograph a mirrored sphere put in exactly the location where the CG objects should be placed in the scene.

Here is such an image:

If we wrap that image onto a cylinder we have a so called panoramic map with Latitude/Longitude layout,

which looks like this:

Now we can see that with a mirrored ball we can take an image of the complete surroundings in one single shot.

As the image contains light information for any given angle it can be used to determine the exact amount and color of light that a surface of the CG object would have received from that specific direction if it would actually have been in the same spot as the mirrored ball. And that is the "magic" of IBL.

Only one more thing. We said that we need only a single image of the mirrored ball. Well that is not exactly true. As a single image can only hold a rather small number of intensity values we have to take about 7 to 16 images ranging from very dark to very bright and combine them together to get an accurate light probe. This technique is called **HDRI** or **H**igh **D**ynamic **R**ange **I**maging.

Here is the exposure series which was used for this light probe image:

Combining both methods we get what is called **HDR IBL.** And that is what we use in the IBL light shader included in this package.

AO

Illuminating every surface of the CG object with the light determined from the light probe places a problem in our hands: What to do with surfaces that do not face the outside world imaged by the light probe? Or in other words would be shadowed by blocking objects in the scene?

Well, the IBL light probe can only provide us with the necessary lighting information for surfaces that are directly exposed to the surrounding – so we have to have another way to determine which surfaces are shadowed by other objects in our scene.

And that is what **AO** or **A**mbient **O**cclusion does. It looks for light blocking objects in our scene and uses the gathered information to exclude surfaces from receiving light from the IBL light probe.

It is like sitting on the shaded surface and literally poking around for objects with a long stick and bandaged eyes. Every time You hit something you know that from that direction the surface is not able to receive light.

This is exactly how AO works. It literally shoots rays in every direction to probe the environment for light blocking objects. The more rays it shoots the more accurate the probing is.

ILT

I**LT** stands for **I**ndirect **L**ight **T**ransport. It is another GI technique to illuminate surfaces. ILT determines how much light a particular surface is receiving from other surfaces in the scene. It simulates light that bounces from surface to surface in the scene – hence the indirect part in the name.

The technique behind it is somewhat similar to AO. The render engine probes the currently shaded surface surroundings for objects and determines how much light bounces back from them onto the shaded surface.

Take this sample scene for example:

The left image was rendered without ILT. The only light that illuminates the scene is a point light simulating the flame of the oil lamp. So all light emanates from that one point only. Every surface that does not directly "see" the oil lamp receives no light from it at all – hence they are rendered very, very dark or pitch black depending on their surface materials.

Well, that is not what would happen in a real room setup. Light would bounce from the walls, the ceiling or any other surface back into the room and then back on other surfaces and so forth.

Now look at the right image. Here we used ILT with one bounce only to simulate the indirect light from the surfaces. Now every surface has received light – some directly from the oil lamp, others only from surrounding surfaces. Look closely under the table or at the oil lamp itself – the lower part which is black on the left image now is illuminated from light that bounces back from the table.

Preparing an IBL HDRI Light Probe

Introduction

If we want to use images other those included as IBL light probes in this package we may have to prepare them first.

There are two important things:

- The map layout of the IBL image
- The file format of the image itself (like TIFF, JPG, PNG etc.)

There are various map layouts for IBL light probe images, the most commonly used ones are the **Mirrored Ball** and the **Latitude/Longitude** layout. In DAZ Studio we use the later one for environment mapping purposes which includes IBL, AO and reflection mapping.

A properly environment map in Latitude/Longitude layout would look like this:

This image indicates which sections of the light probe will illuminate objects in the scene as seen from the point of view of the camera. Imagine this wrapped on a giant sphere around the scene.

The **image file format** of the image itself, the way its pixel values are written into the image file, are another matter. As we strive to use the best images available for IBL, we use formats which can handle HDR pixel values.

There are two very common formats: *.HDR (Radiance File Format) and *.TIF (or *.TIFF on non Windows(r) machines).
While HDR can always handle HDR pixel values with **TIFF** we must be more careful. There are quite a few sub formats and **only one of them fits the bill** the so called **Floating Point TIFF** format.

So whenever converting a *.HDR image to *.TIF we have to make absolutely sure to use **Floating Point TIFF** as export format – using anything else and we would lose the High Dynamic Range.

> *Note:*
> We are using TIFF in DAZ Studio, because it is the only HDR format that the DAZ Studio GUI permits us to browse and load via its interface. But as we use Floating Point TIFF only we don't have to compromise on the quality of the HDR images.

Currently there are two software packages freely available on the net for generating and/or converting HDR images:

- **HDR Shop 1.0**   (available from : **http://www.debevec.com**) and

- **Picturenaut**   **(available from : http://www.hdrlabs.com/picturenaut)**

While HDR Shop 1.0 is free for non commercial usage, Picturenaut is without usage restriction at all.

Picturenaut and its plugins, is the more complex (and also more powerful) program of the two. But we will use HDR Shop 1.0 to demonstrate the steps for converting IBL images for DAZ Studio because it still is the easier program to use.

Using HDR Shop 1.0 for converting IBL Images

Steps for converting panoramic Radiance HDR (or most other image formats):

- Start HDR Shop 1.0
- Load the original image file
- Save the image in Floating Point TIF format for DAZ Studio

Open the File Menu and choose "Open" from the list.
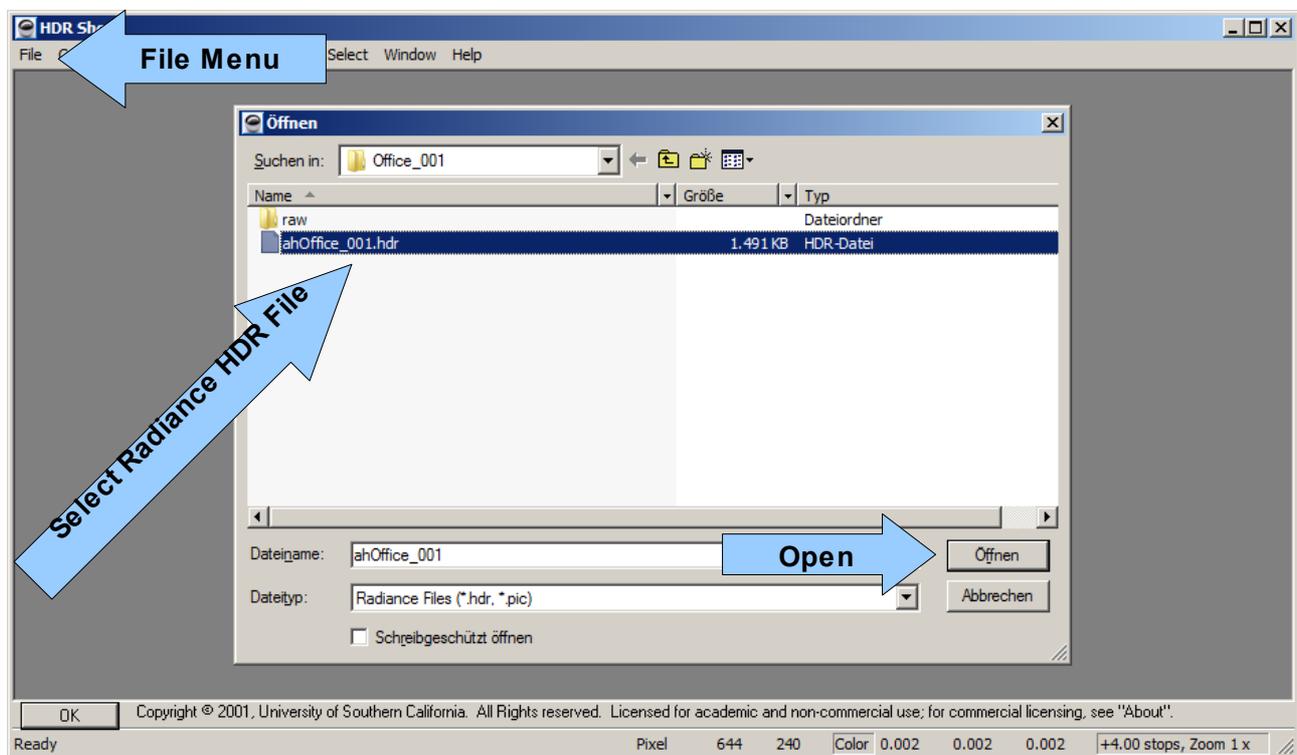
In above dialog choose the original image and click on the button Open.
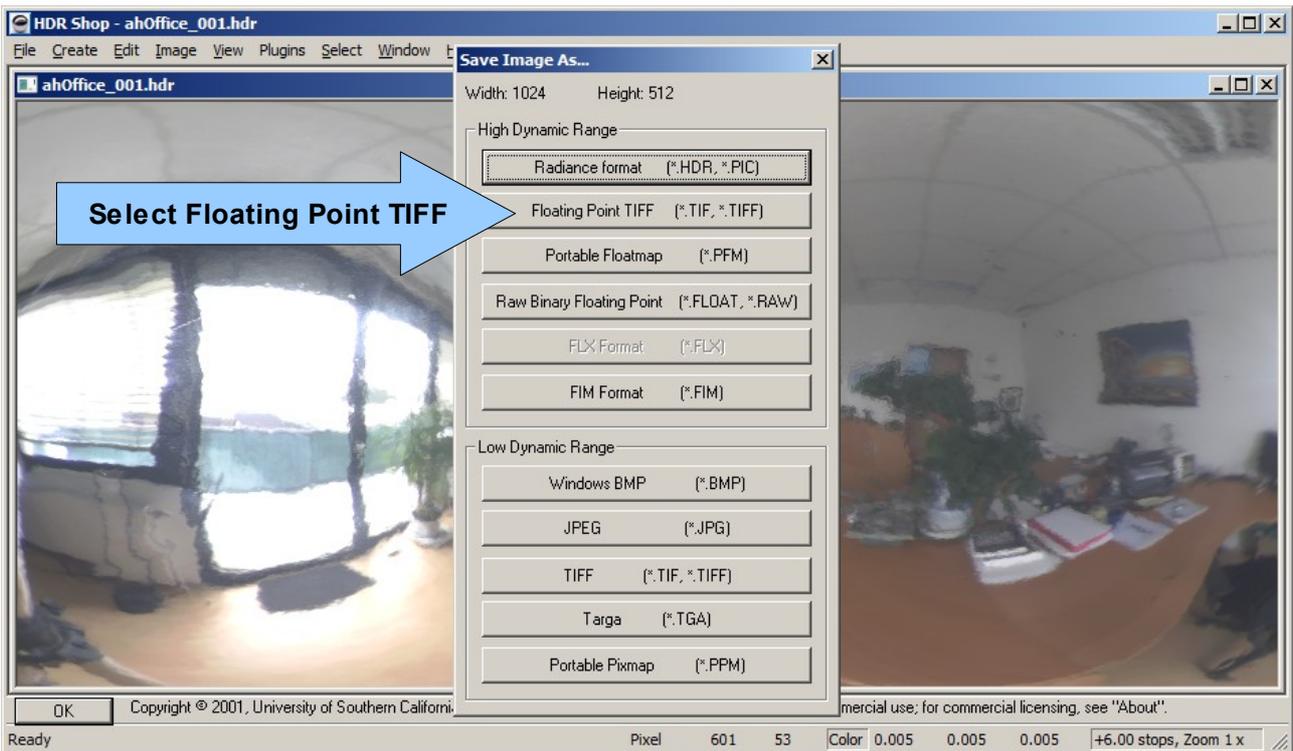
Open the File Menu and choose "Save" from the list. In the above dialog choose Floating Point TIFF – the save dialog opens.
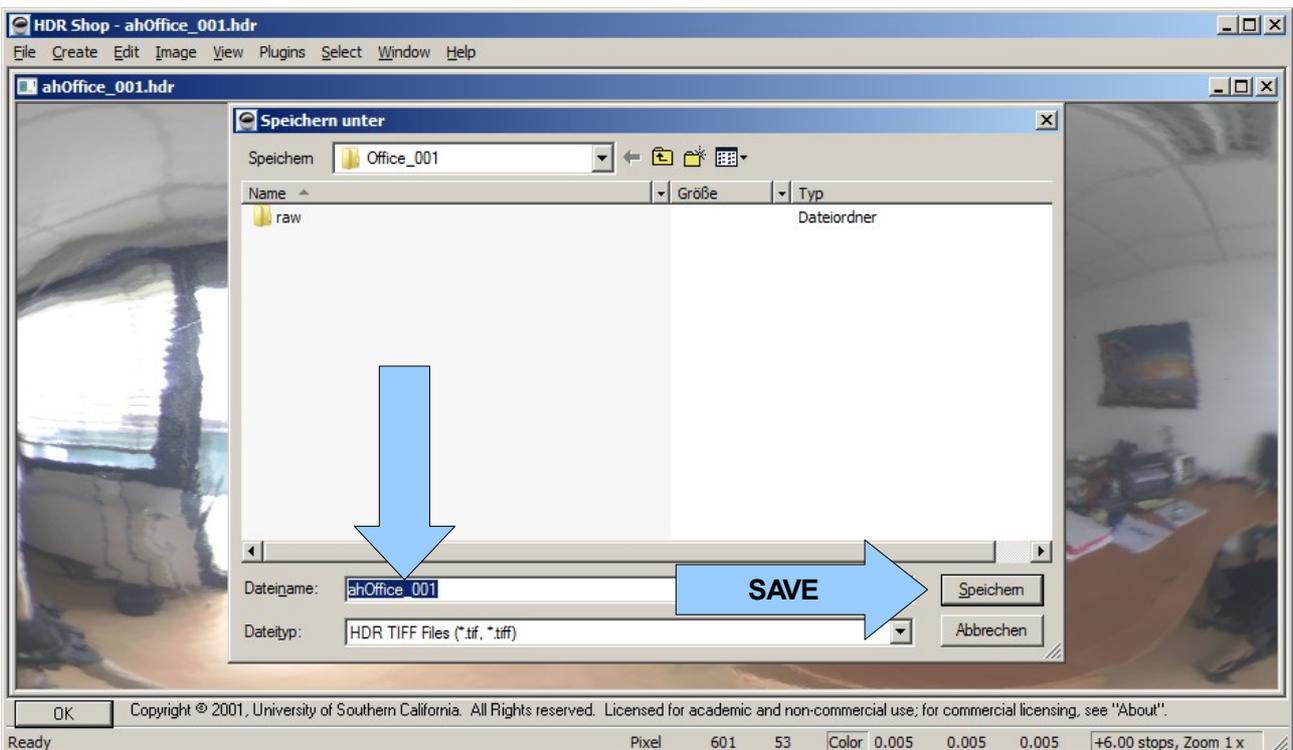
Save the image under a new file name with the ending .tif. (Option: HDR TIFF (*.tif, *.tiff)).

And that's it. Now we have saved the Radiance HDR image file to a Floating Point TIFF we can use in DAZ Studio.

FAQ

Can I use this package with DAZ Studio 2.3?

No, this version is specifically designed for DAZ Studio 3.0.138 and above.

Can I use the ahEnvironment Light with other lights e.g spot lights?

Yes, absolutely. Any combination with the DAZ Studio lights will work.

Can I use the ahEnvironment Light with other surface shaders?

Yes, absolutely. Any combination with the standard DAZ Studio shaders will work.

How can I achieve that reflecting sphere that can be seen in some of the promo images?

There is a little trick involved to get the standard Studio surfaces to reflect both the IBL image and the reflection. As the ahEnvironment Light shader only sees the specular part of the shader we have to set the surface parameters accordingly:
Set diffuse and specular color to white, diffuse strength to 1%, glossiness to 100%, specular strength to 10000%(!) and reflection strength to somewhere between 50-100%.
For optimal results choose the Advanced Specular Occlusion option in the ahEnvironment Light.

Can I use other images than the provided for IBL?

Yes, any image can be used provided it is in one of the following image formats: JPEG (8bit), PNG(8bit), TIFF(8bit) and HDR-TIFF (Floating Point).
For optimal results the image should be HDR and in Floating Point TIFF mapped to latitude/longitude layout. See section: Preparing a IBL HDRI Light Probe and Short Introduction to IBL,AO and ILT for more information.
There are plenty of sources on the net or You can create Your own. As starting point I recommend the following links:

- http://www.debevec.com
- http://www.debevec.org
- http://www.debevec.org/IBL2003/Vitz-HDRIBL-SIGGRAPH2003.pdf

Contacting the author

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