

wom_archlight
Version 1.0

User Manual

1. About the package

A collection of shaders to allow the usage of physically accurate lights, including IES light profiles and object area lights, in Softimage and Maya.

2. Installation

(a) Softimage

In Softimage, go to File -> Add-On -> Install. Browse to the wom_archlight.xsiaddon file, press Ok, then press Install. This package currently includes executables for Windows 64-bit and 32-bit and Linux 64-bit.

(b) Maya

Copy the files in the wom_archlight_maya folder to the respective folders in your Maya installation folder indicated below:

wom_archlight_maya\scripts\AETemplates	to	[Maya]\scripts\AETemplates
wom_archlight_maya\icons	to	[Maya]\icons
wom_archlight_maya\mentalray\include	to	[Maya]\mentalray\include
wom_archlight_maya\mentalray\lib-[platform]	to	[Maya]\mentalray\lib

For the mentalray\lib folder, please copy from the subfolder that applies to your platform. Thus, if you are using Windows 64 bit, copy the file in mentalray\lib-win64 to your [Maya]\mentalray\lib folder. Currently, this package supports Windows 64-bit and 32-bit, Linux 64-bit and Mac OSX.

In some older versions of Maya, you may also need to manually add the shader files to the maya.rayrc file in your [Maya]\mentalray folder. In this case, open the file with a text editor and add the lines:

```
link    "{MAYABASE}/lib/wom_archlight.{DSO}"
mi      "{MAYABASE}/include/wom_archlight.mi"
```

3. Using the shaders

(a) Overview

Neither Maya nor Softimage have direct support for light shaders that support real world lighting units. In addition, Softimage currently has no support for IES light profiles. The purpose of the wom_archlight collection of shaders is to enable the use of physically accurate lights in Softimage and Maya, which can be set using real-world lighting units, can use IES light profiles, and have some other helpful features for architectural lighting. The wom_archlight collection of shaders also includes a shader that allows the use of object lights in Maya and Softimage.

Wom_archlight includes several separate shaders, each of which are described in detail:

wom_archlight - light shader that is physically accurate and includes IES profile support

wom_lightprofile (Softimage only) - geometry shader to allow Softimage to use light profiles

wom_lightprofile_utility - texture shader to add light profile support to other shaders

wom_light_object - geometry shader to allow object lights

Softimage Note: To use IES light profiles, two shaders are required: a geometry shader (wom_lightprofile) and a light shader (wom_archlight). The two shaders work together, so both must be added to a scene for IES profiles to work properly.

(b) **wom_archlight**

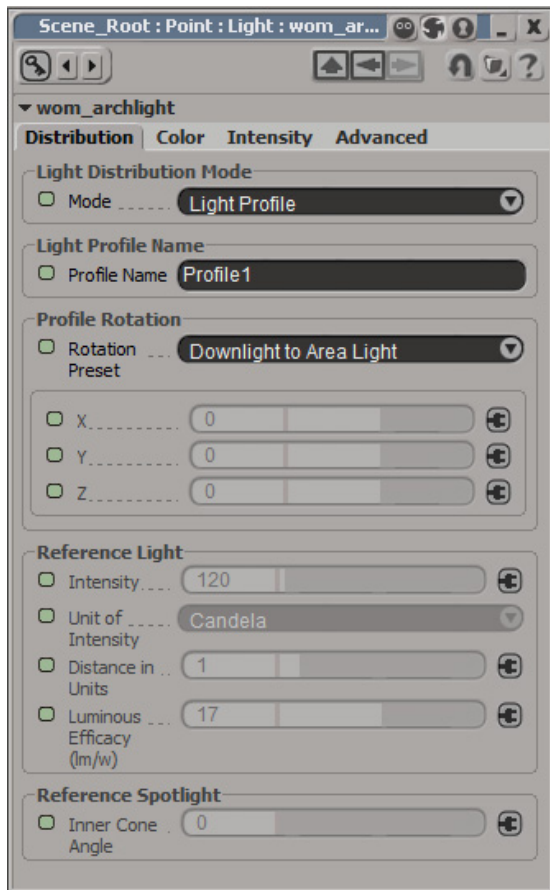
Softimage Note: If you plan to use light profiles, first add a light profile to the scene using wom_lightprofile, which is described below in Section 3(c).

To use wom_archlight, create a point or spot light and assign it the light shader wom_archlight. You can also assign the same wom_archlight as the photon shader to the light.

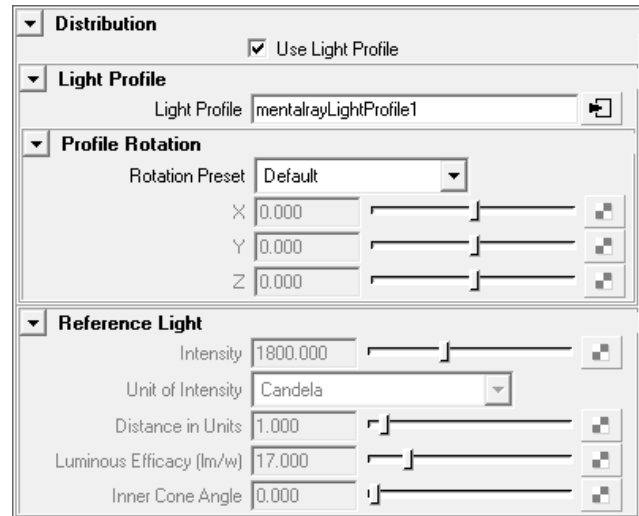
Note regarding light types: You can use wom_archlight with point lights or spotlights, and any of the area light types. However, when using spot lights or any of the directional area lights (rectangle, disc or cylinders) you may find that your light profile is not aligned with the direction of the light as represented in the Maya/Softimage interface. To fix this, use the Profile Rotation options, described below.

i. **DISTRIBUTION**

The wom_archlight shader controls are divided into several tabs/sets of controls. The first relates to the distribution of light from the shader:



Softimage



Maya

Light Distribution Mode or **Use Light Profile** sets which of two modes wom_archlight will run in: Light Profile or Reference Light. In Light Profile mode, the light distribution is determined by an IES or Eulumdat light profile. In Reference Light mode, wom_archlight acts like a regular Softimage or Maya light, except that the intensity can be set using physically accurate units. Reference Light mode is useful when you want a particular lighting level, but do not have a light profile file. Note: In Reference Light mode, wom_archlight uses the type of light (point or spot) and spot angle in the light parameters itself. Maya Note: When the Use Light Profile box is unticked, wom_archlight runs in Reference Light mode.

Profile Name (Softimage only) should be set to match the Profile Name of the wom_lightprofile shader with the light profile you want to use. You can have multiple lights

with the same Profile Name and they will all use the same light profile. Profile Name is only active in Light Profile mode.

Light Profile (Maya only) should contain the node of the light profile you want to use.

Rotation Preset under Profile Rotation allows control over the rotation of the light profile. The Profile Rotation controls are only active in Light Profile mode. There are six options for the profile rotation:

Default means that the light direction defined in the light profile itself will be used.

Custom enables the separate X, Y and Z controls, which allow you to choose the exact profile rotation in degrees.

Downlight to Spotlight should be selected if your light profile casts light downwards by default, and you want to match its direction to a spotlight in the Maya/Softimage UI.

Downlight to Area Light should be selected if your light profile casts light downwards by default, and you want to match its direction to one of the directional area lights (rectangle, disc, cylinder) in the Maya/Softimage UI.

Uplight to Spotlight is the same as Downlight to Spotlight, except for use with light profiles that cast light upwards by default.

Uplight to Area Light is the same as Downlight to Area Light, except for use with light profiles that cast light upwards by default.

Reference Light: Intensity sets the intensity of light when in Reference Light mode. All Reference Light controls are disabled in Light Profile mode. This control works in conjunction with the Unit of Intensity control to set the actual light intensity. For example, if Intensity is set to 1600 and Unit of Intensity is set to Lumen, then the light will emit 1600 Lumens.

Reference Light: Unit of Intensity determines what units the Intensity control uses in Reference Light mode. There are currently eight units of intensity (four photometric units and four equivalent radiometric units) that are available, which are described below. Note: when using any of the radiometric units (Watts, Watts/Steradian, Watts/M2), you must set the Luminous Efficacy of the light, which is set in Lumens per Watt. Incandescent lights typically have a Luminous Efficacy of approximately 17 lm/W, while a compact fluorescent bulb typically is approximately 60 lm/W.

Candela and Watts/Steradian are units that describe the amount of energy emitted by the light in a particular direction. If set to Candela or Watts/Steradian, the brightness of the light from a particular direction will not be affected by whether the light is a spotlight or a point light (or the angle of a spotlight). However, the total amount of energy emitted will vary dramatically. As a result, if using photons, a point light set to Candela or Watts/Steradian mode can be expected to brighten the scene much more than a spotlight. For a point light, approximately 120 candela or 7 watts/steradian is equivalent to regular 100 watt incandescent light bulb.

Lumen and Watts are units that describe the total amount of energy emitted by the light in all directions. If set to Lumen or Watts, the brightness of the light from a particular direction will change substantially depending on whether the light is a spotlight or a point light (or the angle of a spotlight). However, the total amount of energy emitted by a light set to Lumen or Watts will be fixed regardless of the type/angle of the light. For a point light, approximately 1700 lumen is equivalent to a regular 100 watt incandescent light bulb.

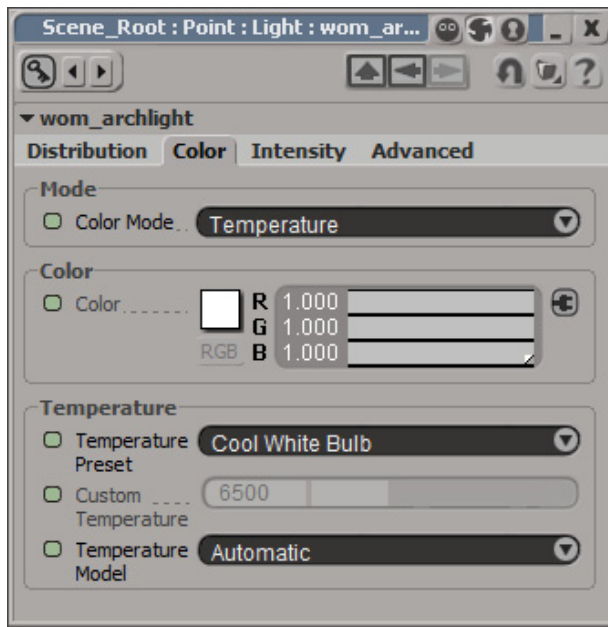
Lux at Set Distance and Watts/M2 at Set Distance describe the amount of light hitting a surface in square meters. The amount of light hitting the surface from a light source will depend on distance. As a result, enabling this unit will enable the Distance in Units control, and the Intensity and Distance in Units controls work together. For example, if the unit is Lux at Set Distance, Intensity set to 120 and distance is set to 10 units, the light will emit the amount of energy necessary to illuminate a surface at a distance of 10 units from the light to a brightness of 120 lux. A typical household room might be lit to 60 lux, while standard office lighting might be approximately 350 lux.

Lux at Spotlight Focus and Watts/M2 at Spotlight Focus operate identically to the prior units, except the distance is automatically calculated. In this mode, the shader casts a ray from the spotlight to the nearest surface. The length of this ray is then used as the distance to calculate the light level. Note: this mode ONLY works with spotlights. If used with other light types, no light will be emitted.

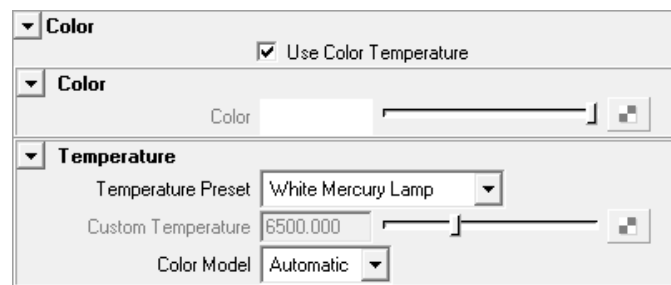
Reference Spotlight: Inner Cone Angle adjusts the falloff from the center of a spotlight to the edge of the spotlight beam. The higher the number, the more abruptly the intensity falls off at the edge of the spotlight beam. Note: this control has no effect unless the light is a spotlight.

ii. COLOR

The next set of controls allows you to set the color of the light emitted from the shader:



Softimage



Maya

Color Mode allows you to select whether the emitted light will be based on the Color parameter, or on a color temperature.

Color is how you set the color of the light when not in color temperature mode. This control is disabled in color temperature mode.

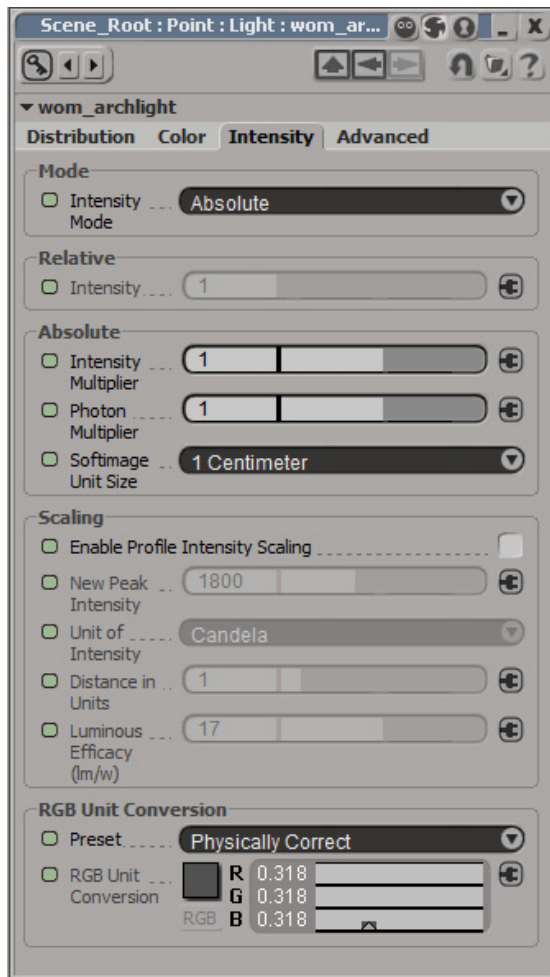
Temperature Preset allows you to choose a preset color temperature from the list. Alternatively, you can select "Custom" to manually set the exact color temperature using the Custom Temperature control below. The Temperature Preset control is only enabled if the Use Color Temperature box is ticked.

Custom Temperature is where you can set the exact color temperature to use when the Temperature Preset control is set to Custom.

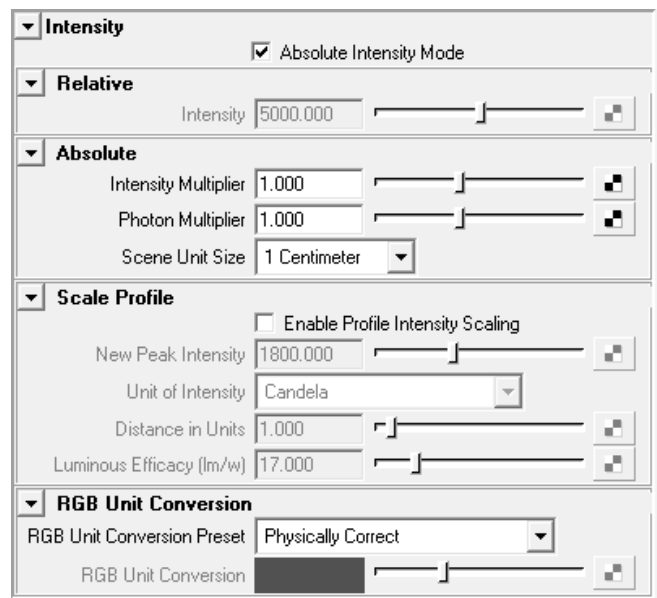
Temperature Model sets which algorithm the shader will use to determine the color temperature. The choices are cie_d, blackbody or Automatic. cie_d is more accurate, but only works in the temperature range 4000 - 25000 Kelvin, whereas blackbody works across all temperatures. If you select Automatic, the shader will choose cie_d when the color temperature is set between 4000 - 25000 Kelvin, and blackbody for all other temperatures.

iii. INTENSITY

The third set of controls adjusts the intensity of the light emitted from the wom_archlight shader:



Softimage



Maya

Intensity Mode or **Absolute Intensity Mode** sets which of two intensity modes the shader will operate in: Relative or Absolute. When in Relative mode, the light intensity is set using the Intensity control, which simply acts as a multiplier of the color value. When in Absolute mode, the raw candela values are read from the light profile and used directly in the shader. The idea is that a light profile for a 60 watt bulb should produce an intensity of light in your scene that you would expect from a 60 watt bulb. For this to work, however, the shader must know the scale of your scene, which is set using the Softimage/Scene Unit Size control. Maya Note: when Absolute Intensity Mode is unticked, wom_archlight runs in Relative mode.

Intensity sets the light intensity in Relative intensity mode. The control is disabled in Absolute intensity mode.

Intensity Multiplier allows some control over the light intensity when in Absolute intensity mode. When set to 1.0, the raw values in the light profile are used in the scene. By increasing or decreasing the value from 1.0, you can tweak the light level emitted.

Photon Multiplier allows control over the intensity of photons when in Absolute intensity mode, so you can adjust the amount of indirect v. direct lighting in the scene. When set to 1.0, the raw values in the light profile are used as the photon energy. Note: when in Relative intensity mode, the photon intensity is taken from the Intensity control on the Photon tab of the light source itself (not `wom_archlight`). When in Absolute mode, the Intensity control on the Photon tab of the light source is not used, as the intensity comes from the light profile.

Softimage Unit Size or **Scene Unit Size** is how you inform Softimage or Maya, respectively, of the scale of your scene when in Absolute intensity mode. Generally 1 Softimage Unit equals 10 centimeters, and in Maya the default unit size is 1 centimeter. If your scene uses a different scale, however, you must set the scale here for the profile intensity to be correct.

Enable Profile Intensity Scaling enables a mode that allows adjustment of the built-in intensity of a light profile to another real life unit. These controls operate almost identically to those described above for the Reference Light mode. Profile scaling operates by determining the peak intensity of the light profile, then adjusting all values in the profile such that the peak intensity matches the intensity you set.

New Peak Intensity operates identically to the Reference Light: Intensity control described above.

Unit of Intensity operates almost identically to the Reference Light: Unit of Intensity control described above. The exception is that profile scaling does not support the use of Lumen or Watts as the unit. This is because an accurate determination of Lumen and Watts requires knowing the beam angle of the light. Because mental ray does not make this information available, it is not possible at this time to accurately match a light profile to a set number of Lumen or Watts.

Distance in Units operates almost identically to the Reference Light: Distance in Units control described above.

RGB Unit Conversion Preset sets which RGB unit conversion that `wom_archlight` uses. The options are:

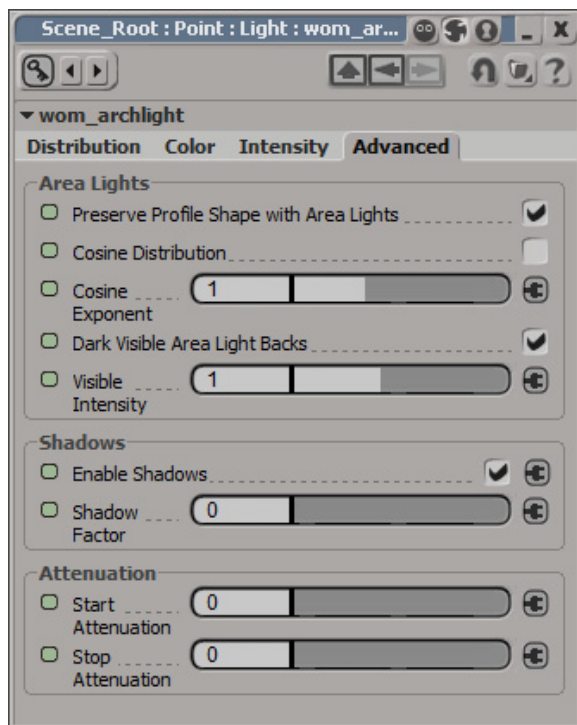
Physically Correct which is the default and highly recommended setting. When using this setting, RGB conversion is set to 0.318 for each of red, green and blue. This setting is suited for use with `mib_exposure_photographic` lens shader, with a `cm/2` setting of 1. When used in this way, the intensities of light should be correct, and the exposure settings should work as a real camera.

Physical Sun/Sky Default sets the RGB unit conversion to 0.001 (XSI) or 0.0001 (Maya), which is the default RGB setting for the Physical Sun and Sky shaders in mental ray. While this setting is not physically correct, it will cause `wom_archlight` to match the Sun/Sky intensity at default settings. The recommended approach, however, is to set `wom_archlight` to Physically Correct, then set the RGB Unit Conversion of Physical Sun/Sky to 0.318.

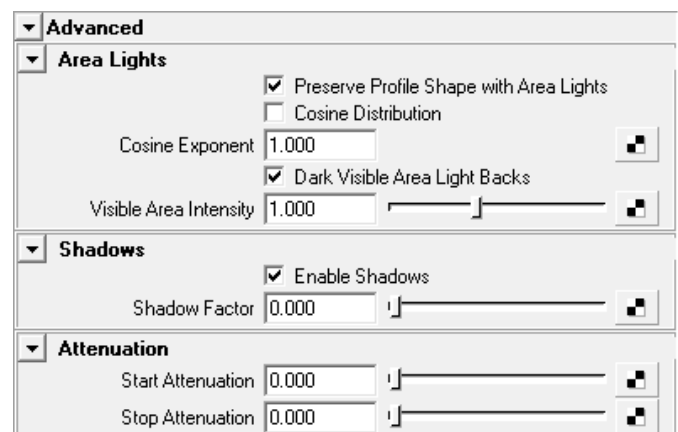
Custom allows you to set your own RGB Unit Conversion using the color control.

iv. ADVANCED

The final set of controls allows adjustment of various advanced (and likely rarely used) settings:



Softimage



Maya

Preserve Profile Shape with Area Lights keeps the shape and definition of light profiles intact when using area lights, at the expense of the accuracy of shadows. This allows soft shadows while still getting well defined light profiles. When disabled, light profiles may be blurry when

using area lights, but physical correctness between light and shadows improves. Background: In mental ray, light profiles are only accurate for point lights. When using area lights, mental ray attempts to work around this limitation by effectively "smearing" the profile, resulting in blurriness. By enabling the Preserve Profile Shape with Area Lights option, `wom_archlight` calculates the light profile as if the light was a point light, but calculates shadows as if the light was an area light. However, this introduces physical incorrectness between the light and shadows, particularly with large area lights. You may also notice a reduction in intensity in the light profile beam relative to a point light with large area lights. Thus, when using this option, try to minimize the size of the area light to ensure as much physical correctness as possible.

Cosine Distribution enables a cosine light distribution from the flat area lights (disc, rectangle), based on the method used by `physical_light`. With this setting enabled, the light is most intense in front of the area light, and drops off to zero perpendicular to the light direction. This approach is somewhat in conflict with the concept of light profiles, so it is disabled by default.

Cosine Exponent adjusts how quickly light falls off on a spotlight when using the Inner Cone Angle setting.

Dark Visible Area Light Backs sets whether the back of the flat area lights (disc, rectangle) is illuminated or dark when visible area lights are enabled.

Visible Intensity adjusts how bright a visible area light appears. This acts as a multiplier, so a setting of 1.0 is the default, while 2.0 is twice as bright. The main function of this setting is to match the intensity of a visible area light to the light output from a light profile.

Enable Shadows is self explanatory.

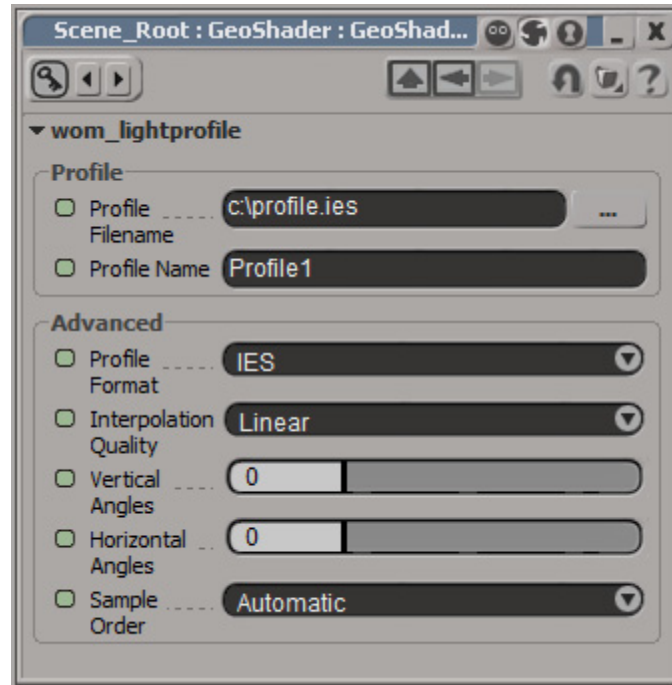
Shadow Factor allows light to penetrate shadow-producing objects. When set to 1, no shadows will appear.

Start Attenuation determines the distance at which the intensity of the light will begin to fade with distance. Thus, if set to 10.0, an object 11.0 units away from the light will be as bright as if it was 1.0 units away from the light.

Stop Attenuation determines the distance after which no light remains, if the attenuation controls are enabled. In order to enable Start and Stop Attenuation, two conditions must be met: (1) Stop Attenuation must be greater than 0.0, and (2) Stop Attenuation must be greater than Start Attenuation.

(c) *wom_lightprofile (Softimage only)*

The wom_lightprofile geometry shader allows Softimage to use light profiles. To create it, first create a Geometry Shader Primitive under Get->Primitive, and then add a wom_lightprofile shader to it.



Profile Filename should contain the filename of the light profile on disk. Note: if the profile cannot be found, try using two slashes instead of single slashes in the pathname.

Profile Name, which must be set to some unique name. It does not matter what name you choose, as long as no wom_lightprofiles have the same Profile Name. You should create a separate wom_lightprofile for each light profile you want to use in your scene.

Profile Format should identify the format of the light profile (IES or Eulumdat).

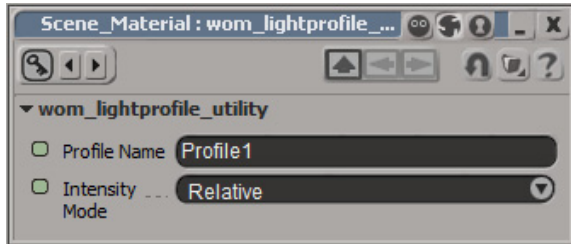
Interpolation Quality defines the degree of interpolation of the light profile. The choices are linear interpolation or cubic interpolation.

Vertical Angles and **Horizontal Angles** define the resolution of internal representation of the light profile that mental ray generates from the light profile. 0 is the default, which means that mental ray will use the resolution defined in the profile itself.

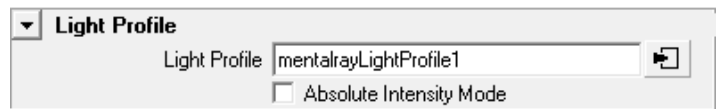
Sample Order defines whether the horizontal angles in the profile grow clockwise (1) or counterclockwise (2). If set to 0, the sample order in the profile is used.

(d) *wom_lightprofile_utility*

The package also includes a very simple texture shader that reads light profiles and outputs a scalar. This shader, *wom_lightprofile_utility* can be used in the Render Tree to create more complex shaders that use light profiles. The controls for *wom_lightprofile_utility* are extremely simple:



Softimage



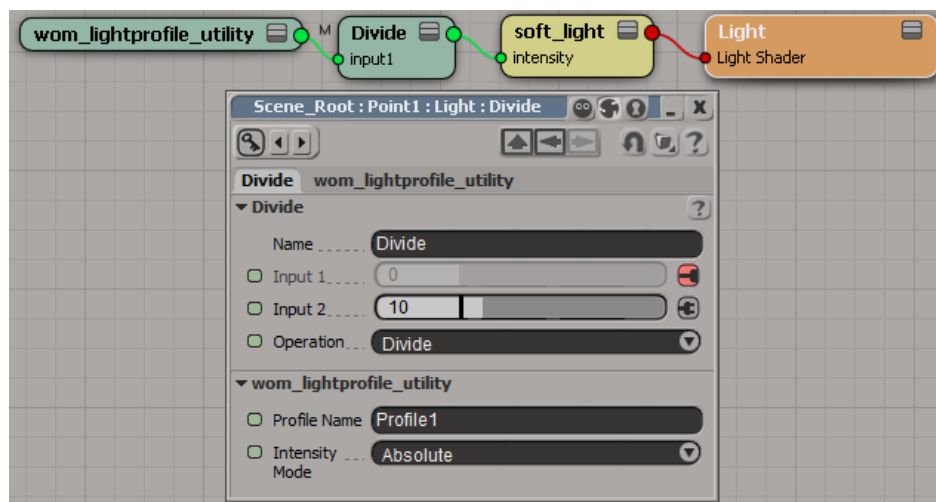
Maya

Profile Name (Softimage Only) is where you set the name of the light profile to be used. This has an identical function to what is described for *wom_archlight*, above.

Light Profile (Maya Only) is where you set the node of the light profile to be used. This has an identical function to what is described for *wom_archlight*, above.

Intensity Mode sets whether the scalar output from the shader is a normalized relative value (0..1) or the raw absolute values contained in the light profile.

Below is an example Render Tree from Softimage to show how the *wom_lightprofile_utility* shader could be used to add light profile support to the built-in *soft_light* shader:

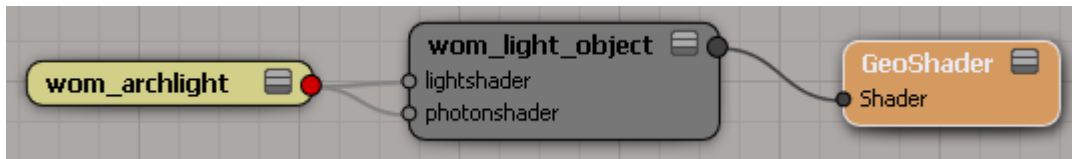


(e) *wom_light_object*

The package includes a geometry shader that enables the use of geometric objects as area light sources. To use the shader:

Softimage

1. Create a Geometry Shader Primitive and add *wom_light_object* to it.
2. In the *wom_light_object* properties, for the Source Object enter the name of the object (e.g., torus) with the shape you want to use for your area light. Do NOT put the name of the Geometry Shader Primitive.
3. With the geometry shader selected, open the Render Tree. Create light and/or photon shaders and connect them to the lightshader and/or photonshader inputs of *wom_light_object*:



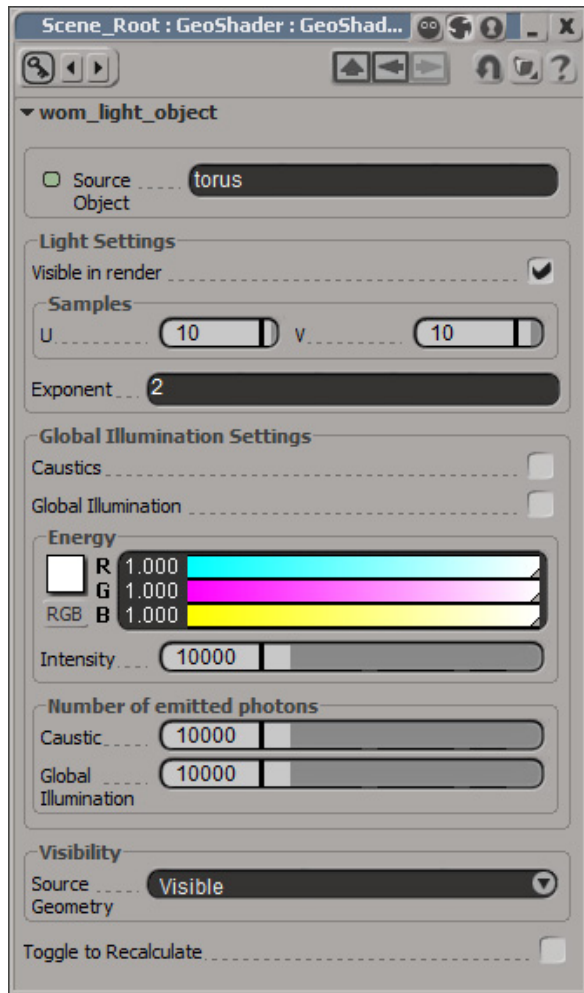
4. Ensure there is at least one regular light (e.g., not *wom_light_object*) in your scene. This light can have zero intensity and/or no shaders and/or no diffuse/specular contribution. If no regular light exists, Softimage assumes that no lights exists and renders nothing.
5. Everything should now work as expected. Render. **SEE IMPORTANT WARNING BELOW.**

Maya

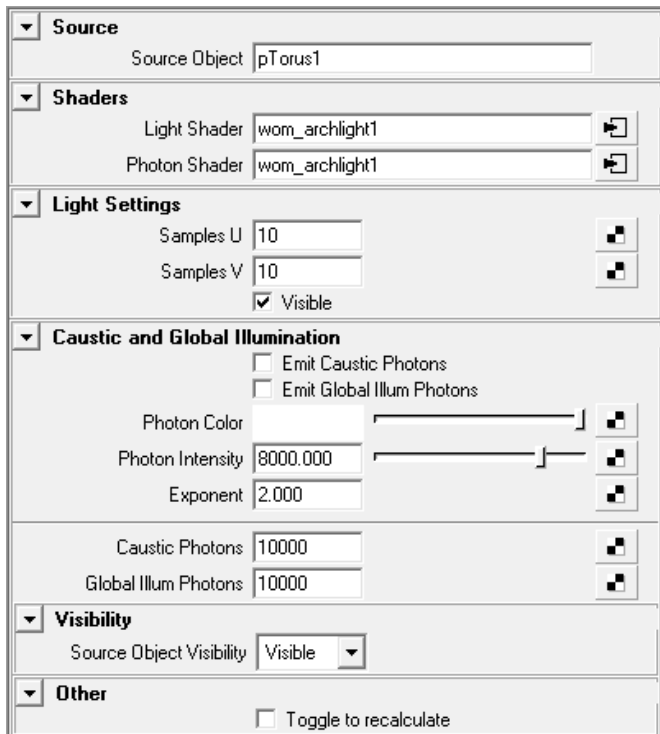
1. Create a dummy object of any type (for example, a polygon cube). It does not matter what type of object, as this will NOT be rendered.
2. Go to the transform node of the dummy object, and expand "mental ray".
3. Click Enable Geometry Shader and add *wom_light_object* to the Geometry Shader field.
4. In the *wom_light_object* properties, for the Source Object enter the name of the transform node of the object with the shape you want to use for your area light. Do NOT put the name of the dummy object.
5. Add a light and/or photon shader to the Light Shader and Photon Shader fields.
6. Everything should now work as expected. Render. **SEE IMPORTANT WARNING BELOW.**

IMPORTANT WARNING: Always toggle the Toggle to Recalculate checkbox before rendering after making ANY modifications to the Source Object's geometry, otherwise mental ray or Maya/Softimage may crash. For an explanation of this behavior, see the "Known Issues" section below.

Note: wom_light_object does **NOT** make the Source Object emit light. Rather, a copy of the object emits light from the location of the dummy object. The best way to think about this is that wom_light_object creates a new area light that uses another object as the shape (rather than a sphere, disc etc).



Softimage



Maya

The majority of the controls for this shader are identical to those for creating a regular light. Those controls will not be described here. The controls that are unique are described below. Also, note that many of the light settings, such as intensity of direct light, are set using the parameters of the light shader attached to wom_light_object.

Source Object is used to select the object that the geometry will be taken from. NOTE: this shader does **not** make the selected object into a light. Instead, it causes the geometry shader to emit light in the shape of the geometry.

Light Shader / Photon Shader (Maya Only) is where you attach a light and/or photon shader to the geometry shader. Note: Softimage has no equivalent control in its properties page. Instead, you connect a light or photon shader using the Render Tree.

Source Geometry Visibility sets whether the geometry on the Source Object is rendered or hidden. The choices are Visible or Invisible. Note: If you change the Source Object while it is set to Invisible, the original object is likely to remain invisible until you re-launch Maya/Softimage. In order to get the object to become visible again, either set the object to Visible and re-render before changing the Source Object. If you have already changed the Source Object, change it back to the original object, set it as Visible, re-render, then set the Source Object to the new object.

Toggle to Recalculate has no function other than to force a recalculation of the shader. Unlike regular shaders, geometry shaders are not automatically recalculated every render. Instead, they generally only get recalculated when a parameter changes. By using this checkbox, you can force a recalculation without changing any real settings of the shader.

4. **Known issues**

Modifications to geometry when using wom_light_object. If you modify the underlying geometry that is set as a light using wom_light_object, is HIGHLY recommended that you save your scene and use the Toggle to Recalculate checkbox to force the shader to recalculate before rendering. This is because, as a result of the modification, the link between the object light and the geometry object could get broken (technically speaking, the old miTag reference may no longer point to the new object). When wom_light_object recalculates it generates a new link to the object, but if it is not recalculated it may try to use an object that no longer exists. This will almost certainly result in the light object not being rendered at all, and may result in the application or mental ray crashing. There is no known fix for this at this time.

Duplicate profile names (Softimage version). Be sure that before you render that no two wom_lightprofiles have the same Profile Name. This is because the second will overwrite the first in the mental ray cache, which could cause some anomalies. If you do this accidentally, you will probably need to go back to the overwritten wom_lightprofile instance, adjust any parameter, and rerender in order to get mental ray to recalculate the geometry shader.

Physical accuracy and direct and photon intensity multipliers. Please note that the wom_archlight shader does **NOT** guarantee to be physically correct at this time, rather it attempts to produce a reasonable approximation of realistic lighting. When the direct and photon intensity multipliers are each set to 1.0 in absolute intensity mode, the relationship between direct and indirect lighting should be approximately correct. However, the shader has **NOT** been rigorously tested to ensure or confirm physical correctness, so some tweaking of the multipliers may be necessary. Also, bear in mind I am neither a scientist nor a mathematician, so take any claims of physical correctness with a grain of salt.

Eulumdat files. Technically, Eulumdat files are supposed to work with mental ray's light profile code. In practice, however, I have yet to encounter a Eulumdat file that does not crash mental ray. In addition, Eulumdat files use a different method of describing the intensity of light that wom_archlight is not yet designed for. As a result, Eulumdat files cannot currently use Absolute mode (if you can even get them to work).

5. *License and Warranty*

Portions of wom_archlight are based on code provided by mental images, which are subject to their own licensing. Please see the accompanying README.mental_images_code for information.

The license for all other portions is described below:

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6. *Credits*

- The people at XSIBase for helping to test the initial versions and for providing great ideas that have made their way into the shader.
- The people at CGTalk for helping to test the Maya version.
- Mental images, for making mental ray and providing the source code to the base shaders, upon which wom_archlight is built.
- Bart at mental images forums for finding the solutions to several problems along the way.
- Ctrl.studio for their shaders that were great inspiration.

7. *Version history*

- 1.0 "Final" 1.0 release. Minor bug fixes/internal changes. Added Preserve Profile Shape with Area Lights option. First release with source code.
- 0.95 Major revision to wom_light_object. Many internal changes/fixes. Public beta release.
- 0.92 First Maya version. (limited distribution)
- 0.91 Fixed bugs. Added support for radiometric units. Internal version.
- 0.9 Added support for reference lights, profile scaling, area light settings. Beta.
- 0.7 Added support for profile rotation. Added proper support for all area light types. minor internal changes. Release candidate 3.
- 0.62 Fixed incorrect absolute intensity for direct lights. Added wom_light_object. Minor internal changes. Experimental version.
- 0.61 Fixed light attenuation. Minor internal changes. Release candidate 2.
- 0.6 Second public release. Absolute intensity support, improved photon support and the addition of wom_lightprofile_utility. "Release Candidate" status.
- 0.5 Initial public release. Color temperature and basic photon support.
- 0.4 Initial release (limited distribution).