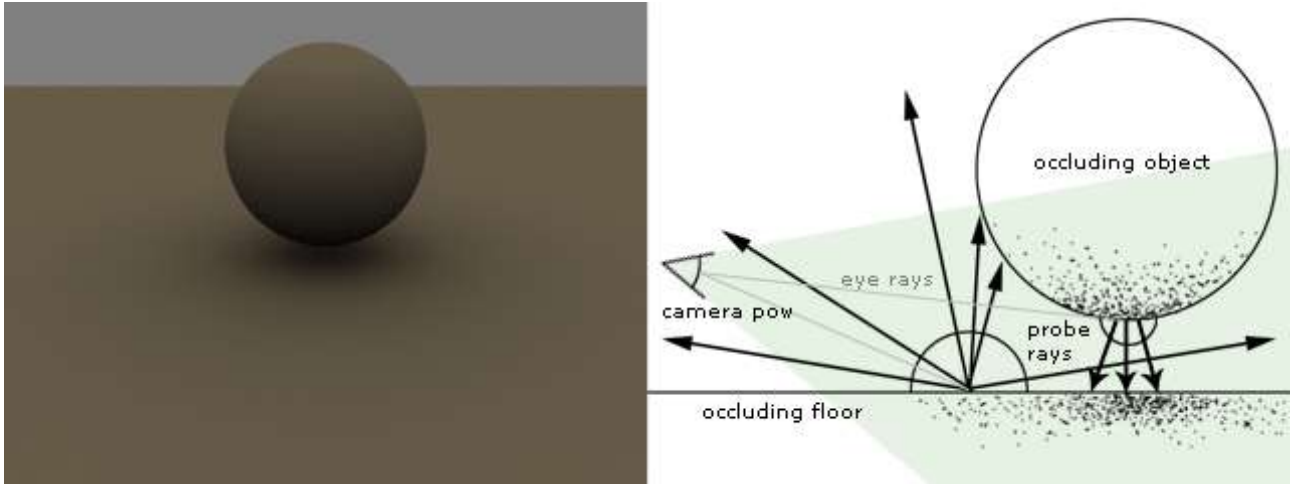


1. Mental Images Shaders

1.1 Occlusion Shader Set

What is Occlusion ? Occlusion is the extent with the area above a point is covered by other geometry and is generally used as a simplified method to « simulate » Global Illumination.

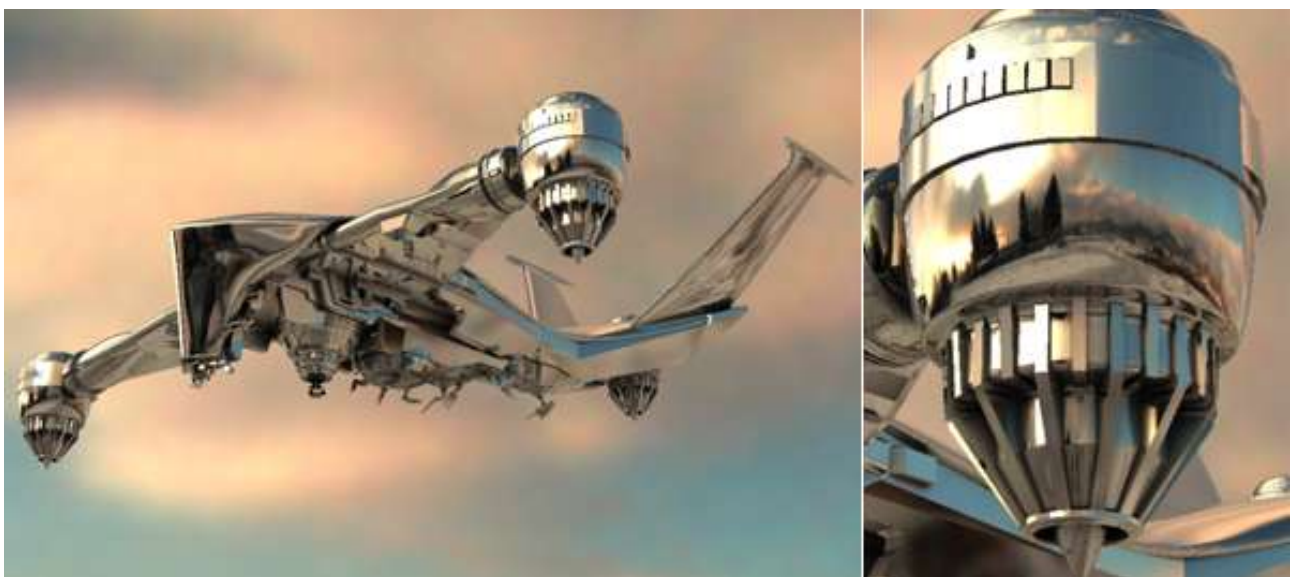
In Mental ray we have a set of 3 occlusion shaders that can work together.



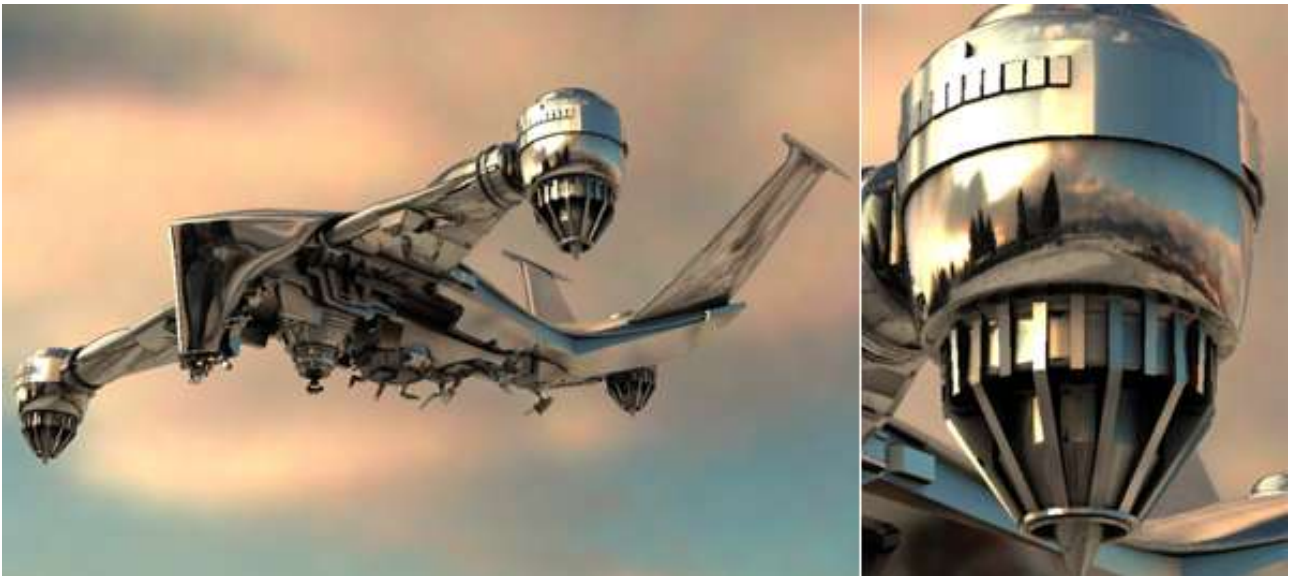
- Mib_amb_occlusion (the one provided with Xsi)

This is the occlusion itself, which handles all computation. It can be used to scale down the contribution of ambient light. For this use the shader works well when assigned to the ambient parameter of material.

This shader can also handle reflection occlusion that allows the shader to scale down the contribution from an environment reflection. In this way it can simulate raytraced reflection with a simple environment reflection.



output mode = 0, reflective = off
reflective occlusion (around surface normal)



output mode = 0, reflective = off
 reflective occlusion (around the reflection direction of eye ray)

So if you apply a reflection map it will show reflections EVERYWHERE on the object, even in areas where the object in reality would self-reflect. With a reflective OCCLUSION map, the reflection map gets attenuated in these areas where the objects reflection is blocked (by itself or other object).

Finally the shader can output 'bent normals'. Bent normals are expressed as a RGB encoded file where X are represented by Red, Y by Green and Blue by Z. Bent normal pass encode the direction vector to look up the ambient environment. The primary purpose of 'bent normals' is to delay the ambient lightning to later stage. Later may be either in a later rendering pass within XSI (having rendered to a texture and performing the lookup with mib_bent_normal_env) or in an external compositing application like the Fxtree.

- Mib_fg_occlusion.

This utility shader return occlusion with the help of Final gathering algorithm. You need for that to activate the FG in Xsi to it working. We have all the advantage of Final Gathering such as file caching (Fgmap) and support of transparent object.



For the same quality the standard AO takes about 11 min to render while FG one takes about 7 min.

- Mib_bent_normal_env.

This is a shader to be used after lightmapping/rendermapping (a.k.a. 'texture baking'). We will discuss it later in outdoors exemple.

1.2 Physical Light shader set

Here we have a set of 2 shaders who can work together : `mib_cie_d` and `physical_light`. The light shader `physical_light` models physically correct light sources. As for ideal point light, the light intensity falls off with the inverse square of the distance. In other word you have a nice very cool light falloff you just have to care about light intensity. By default in Xsi light have not any falloff. They light until infinity. However you can specify a falloff but you may not be physically accurate.

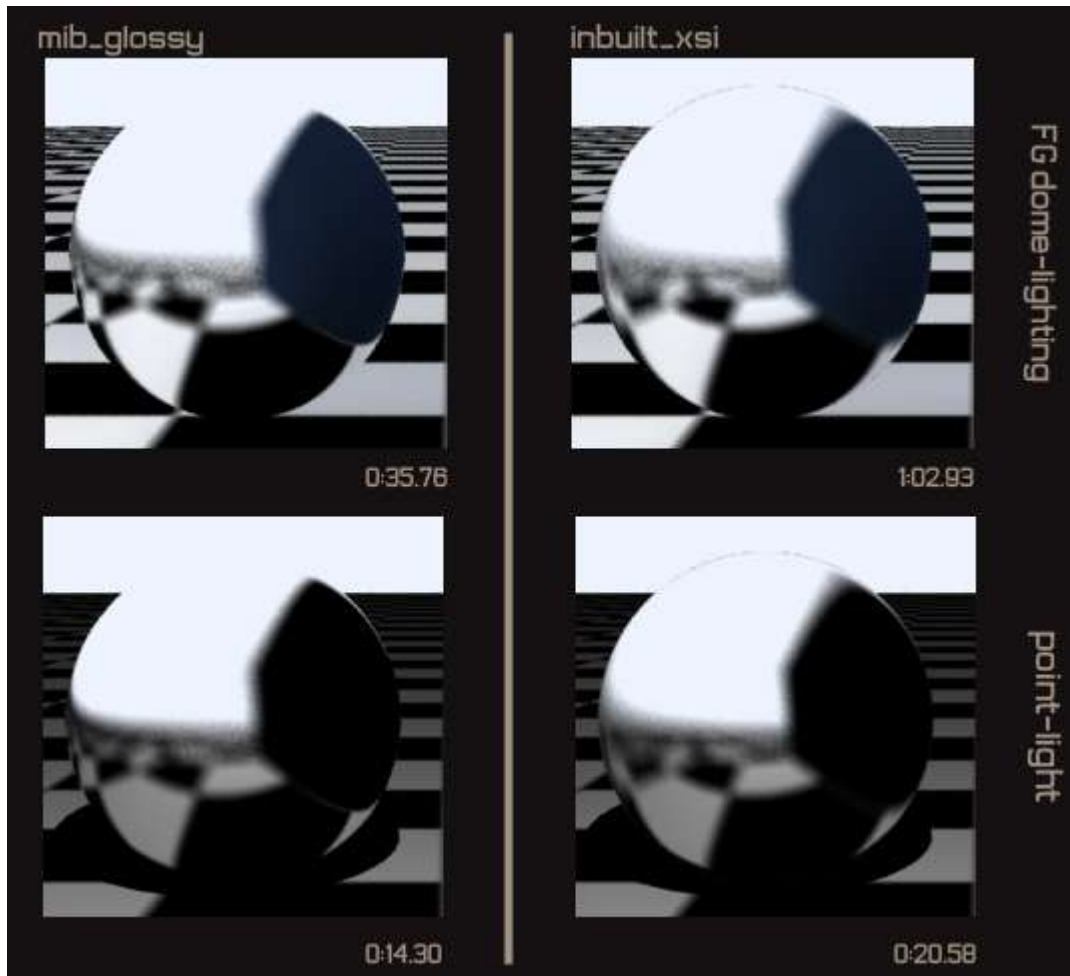
`mib_cie_d` shader return a color according a given temperature and intensity. Temperature are expressed in Kelvin. 6500 K is considered as the white point by the Commission Internationale de l'Eclairage (CIE). Above 6500 `mib_cie_d` will return a cold color while under 6500 return warm color.

Degrees Kelvin	Type of Light Source	Indoor (3200k) Color Balance	Outdoor (5500k) Color Balance
1700-1800K	Match Flame		
1850-1930K	Candle Flame		
2000-3000K	Sun: At Sunrise or Sunset		
2500-2900K	Household Tungsten Bulbs		
3000K	Tungsten lamp 500W-1k		
3200-3500K	Quartz Lights		
3200-7500K	Fluorescent Lights		
3275K	Tungsten Lamp 2k		
3380K	Tungsten Lamp 5k, 10k		
5000-5400K	Sun: Direct at Noon		
5500-6500K	Daylight (Sun + Sky)		
5500-6500K	Sun: through clouds/haze		
6000-7500K	Sky: Overcast		
6500K	RGB Monitor (White Pt.)		
7000-8000K	Outdoor Shade Areas		
8000-10000K	Sky: Partly Cloudy		

Based on information from the book [digital] Lighting & Rendering
Chart and colors (c)2003 Jeremy Birn for www.3dRender.com

1.3 mib_glossy_reflection/refraction

Xsi features mental ray 3.4. That mean that give us access to the new glossy materials, faster the one provided with XSI.



1.4 How to get them ?

We have a bunch of new supra cool shader but how to get them ? Fortunately the libraries are provided with XSI 5.0 only SPDL (graphic user interface) are missing. We have just to create these SPDL to get them in XSI.

Case studie the mib_cie_d.

Go to :

C:\softimage\XSI_5.0\Application\phenolib\include

Here you have all mental ray shader definition. Open the base.mi

Go to mib_cie_d (line 840)

we have :

```
declare shader  
color "mib_cie_d" (  
    scalar          "temperature",  
    scalar          "intensity"  
)  
version 1  
apply light  
end declare
```

The shader mib_cie_d is driven by 2 scalar parameters : temperature and intensity. And it s a light shader. What we need is to create the spdl with the same definition. We will use the shader wizzard to do this.

In Xsi :

Go to the plugins manger and on the Spdl tab create a new shader :

Call the new shader mib_cie_d the names are really important because they are the identity of each parameters. A bad name can lead to crash. So spell check them.

Add the two parameters as scalar.

Give a default value of 6500 to the temperature and 1 to the intensity.

Make sure that the version shader is filled by 1.

Then Generate the project.

The wizzard will generate a C template and the spdl. We don't need the C template. Edit the Spdl file directly.

Replace each *FileName = "mib_cie_d"* by *FileName = "base"*.

Go to C:\softimage\XSI_5.0\Application\bin\nt-x86-vc71 and copy the base.dll where you spdl was generated.

Go to the plugins manager and install your spdl. Make sure that Xsi can find the library.

2. Outdoors Scenes.

When it comes to light a outdoor scene everyone think about finalgathering and HDR images. Here we will compare two approaches. The Finalgathering approach and the ambient occlusion approach.

2.1 FG vs AO (Speed/Quality comparaison).

I will kill the suspense. Both are valid. Let's do a quick comparaison. We have a scene with a car (500K polygons). One light to simulate the sun and an Hdri as an environnement.

Not both maps arent optimised yet.



FG contribution

Settings :

AA 0/2 threshold 0,047 Gauss 3/3

FG 128 accuracy min 1 max 10 Presampling 3

Falloff min 1 max 10.

FG time : 0:02:37 Rendering time : 0:03:58

Total time : 0:06:35



AO contribution

Settings :

AA 0/2 Treshold 0,047 Gauss 3/3

Amb_Occlusion sample : 64

Rendering 0:06:12

FG and AO look pretty similar and the render time are almost same. So what is the difference between AO and FG?

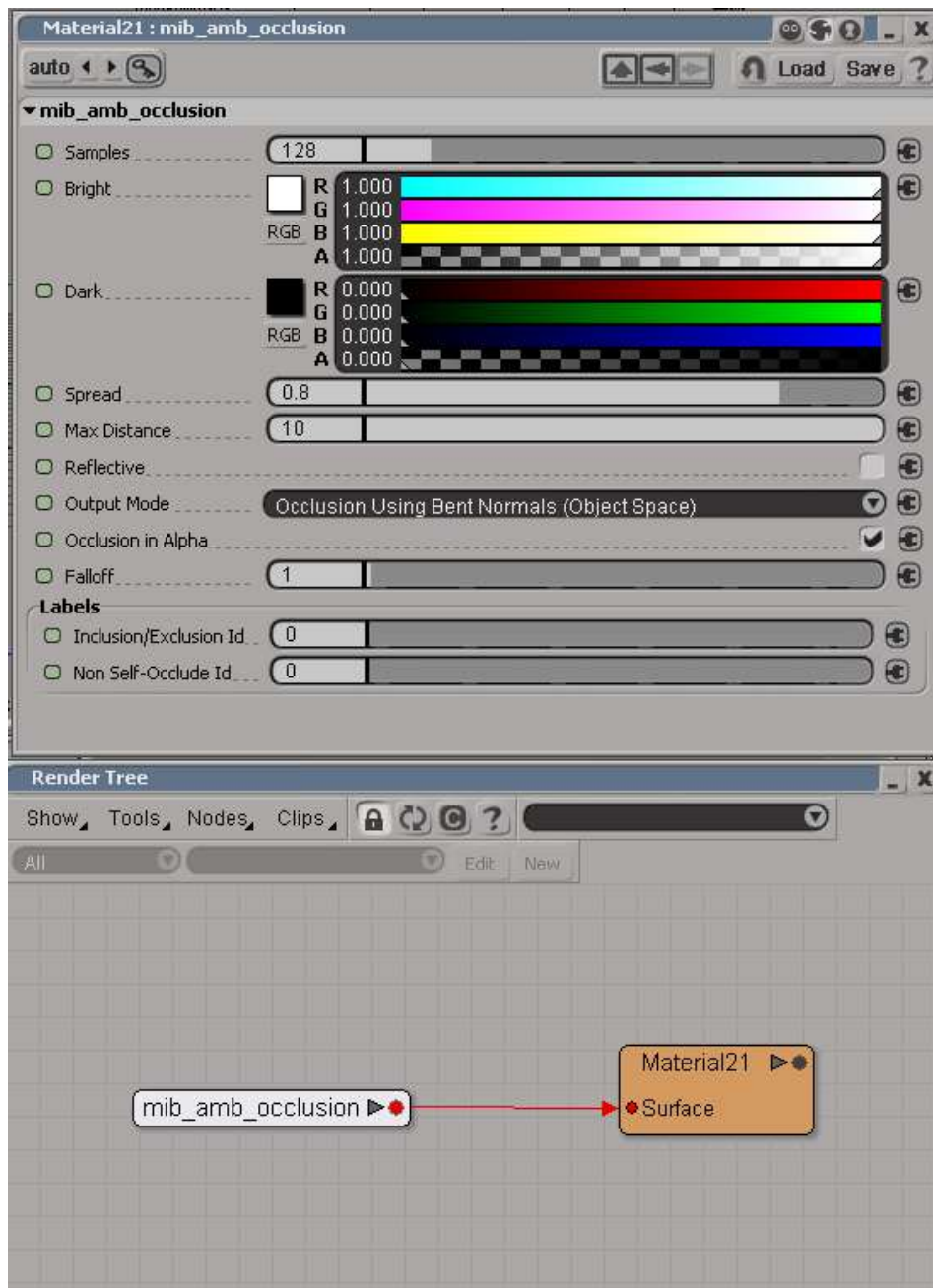
FG is concerned with bounced light and multibounce transparency, reflection, refraction and diffuse rays, whereas AO is more concerned with the absence of light, simulating the bounced light with an assumed omnipresent 'environnement light' (generally coming from diffuse environnement map or a sold color) and letting occluding geometry block light.

The output of mib_amb_occlusion is not filtered and hence is never as smooth as FG but instead any filker is never larger than a sample (less than a pixel). There is no risk in losing small surface details.

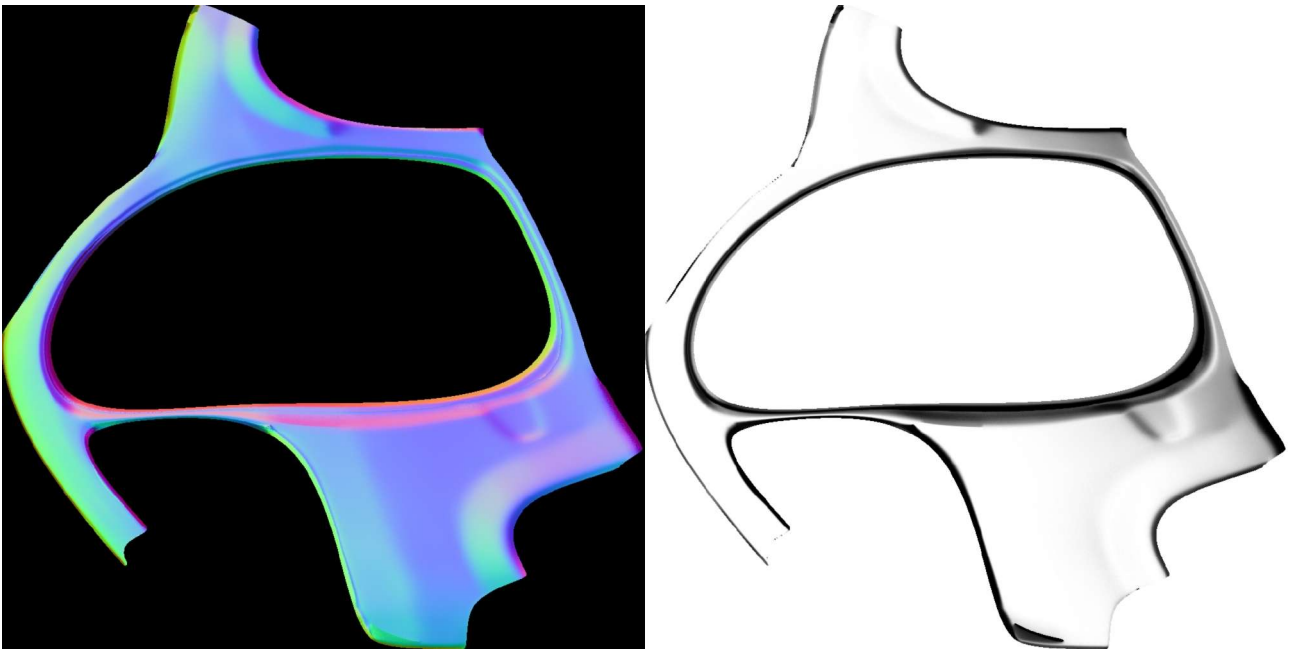
2.2 Optimising AO Render

We will need `amb_occlusion_shader` and the `mib_env_bent_normal`. The idea is to bake the occlusion contribution on a map and the result to sample the environment.

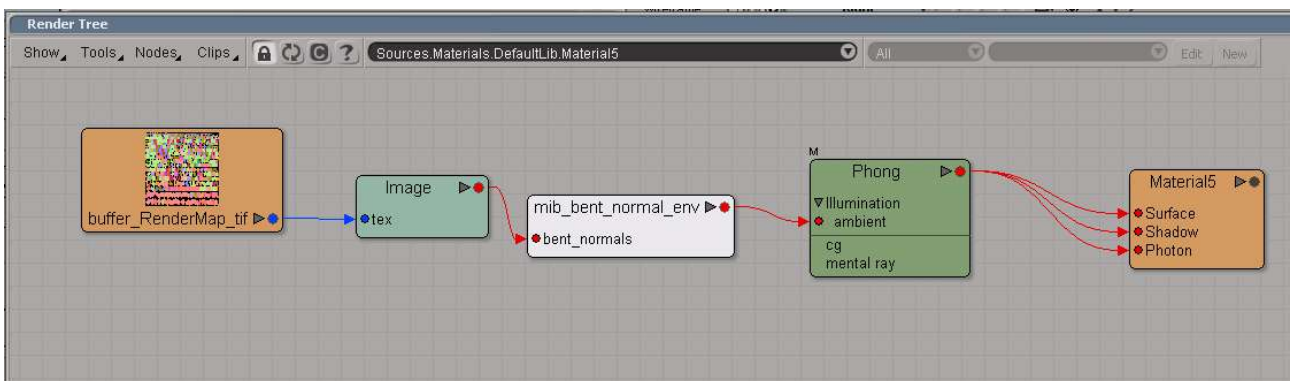
- Apply an `amb_occlusion_shader` to all object (Use the pass system of XSI).
- You can add more sample (since we will generate it only once).
- Switch the Output mode to 'Occlusion Using Bents Normals (Object Space)'. It's really important to choose object space. The bent vectors are localized to the object that mean that you are allowed to move, rotate, scale your object before the environment sampling. If you choose 'world space' the direction of the vectors looking environment would be frozen. In others word you can't move your object because the environment contribution will be not correct. The 'raster space' is useful for compositing application because vectors are relatives to camera.
- Check Occlusion in Alpha box. It will compute occlusion itself and store the result in alpha. Very important make sure that you set the color clipping in Raw mode in the render global options.



We are ready to rendermap all objects. Make sure you are rendering in a float 32 bits formats.
Avoid overlapped UV !!!!!



- Once you have rendered all object you need to connect in the ambient slot the mib_bent_normal with the rendermapped texture.



Note that the slider of the global ambience of Xsi will control the contribution of environnement on your objects.

Note also that you can use this technique only on rigid objects.

Rendering time after optimisation is about 0:02:04



2.3 FG strategies.

When objects don't move (eg. A city or a set) use FG maps to cache the irradiance.

- To cache FG points, switch to 'Append generated FG points to file'
- Take multiple point of view to accumulate enough sample.
- Then switch in 'Generate Only if file doesn't exist' (frozen maps)

Fg computation will be skipped and Fgmap is read to render irradiance.

When doing IBL (Image based Lighning as known as HDR render). Blur and scale down the image to something like 64 pixels wide.

Use ray_type node and open FG port . Connect the average color of your material or a simplified network. It will speed up a lot the FG processing.

Bake the into maps like AO . In case of reflective object (read with specular and/or reflection/refraction) bake the diffuse only. Re do a new shader network where you calculate only the specular and reflection. Switch off Finalgather.

Once the optimisation done the render went down to :

FG Computation : 0:38.71

Rendering : 0:01:30.47

Total time : 0:02:08



2.4 FG vs AO conclusion

With Ambient Occlusion probe rays provide a 1-bounce-only illumination effect while Finalgather in mental ray can provide diffuse multibounce illumination (since XSI 5.0). Furthermore, the Final gathering algorithm in the last release of Xsi is very much enhanced compared to earlier versions and resolves many issues related to potential animation flickering and detail loss, closing the gap ever further between Ambient occlusion and Final gathering, making it more an artistic and/or pipeline-architectural choice which method is employed.