

# Physically-Based Compositing

 Images to be added.

With *Physically-Based Compositing (PBC)* we refer to the process of outputting individual lighting components from the renderer in a *global illumination* context to be then summed in compositing safely.

Let's first review the two ways of reconstructing and tweaking a global illumination image in compositing:

	Classic Compositing	Physically-Based Compositing
Global Illumination	Yes	Yes
Image Layer Type	Shading Components	Individual Lights Components
Image Layer Examples	diffuse, specular, indirect_diffuse, indirect_specular, subsurface	lights, light groups, incandescence, environment
Compositing Operation	Sum	Sum
Affects all light paths	No	Yes

In a **Classic Compositing** scenario where *shading components* are being output as image layers, the artist will be adding them up to "reconstruct" the beauty image:

```
beauty_color = diffuse
               + specular
               + indirect_diffuse
               + indirect_specular
               + subsurface
```

However, due to the presence of *Global Illumination*, light bounces everywhere in the scene, therefore any coloring operation in a directly lit component, such as grading (**G**) the diffuse, would require secondary operation to compensate its effect in the indirectly lit components:

```
beauty_color = diffuse(G)
               + specular
               + indirect_diffuse(G)
               + indirect_specular
               + subsurface(G)
```

A real world scenario would be more complex since typically indirect diffuse is further split into the contribution from the environment (environment diffuse) and in the surface-to-surface light transport (color bleed) while the indirect specular component is split into environment reflections, surface-to-surface reflections and refractions.

It should appear evident that in such case more relationship-tweaking between the individual components would be necessary in compositing when doing a simple operation such as grading.

In the **Physically-Based Compositing** scenario however a grading operation would not require any further relationship-tweaking since by outputting *Individual Light Components* (see [Multi-Lights rendering in 3Delight](#)) we *always* operate on all light paths, for each light, group of lights, for the environment and for incandescent geometry. Given a setup with many lights, he artist will be adding the image layers to "reconstruct" the beauty image:

```
beauty_color = light_1
               + light_2
```

```
+ light_group_A
+ light_Group_B
+ incandescence
+ environment
```

A grading operation **(G)** on light\_2 in compositing will not require any further relationship-tweaking for any other image layer since we already carry all light paths (direct and indirect) in the light\_2 image layer :

```
beauty_color = light_1
+ light_2(G)
+ light_group_A
+ light_Group_B
+ incandescence
+ environment
```



In 3Delight, output of light and light groups are mutually exclusive: a light put in group1 cannot be added to another group and cannot be output independently to ensure a correct compositing.

Physically-Based Compositing simplifies compositing process for the modern global illumination productions, it is not error-prone and ultimately results in physically plausible results that can be produced and iterated in a fraction of the time.