

The Experimental DXR project is a Unity custom version with binaries based on the 2019.2a5 version of Unity, enhanced with DXR support and version 5.8.0 of HDRP enhanced with DXR support. It is a Windows only version with DX12 API.

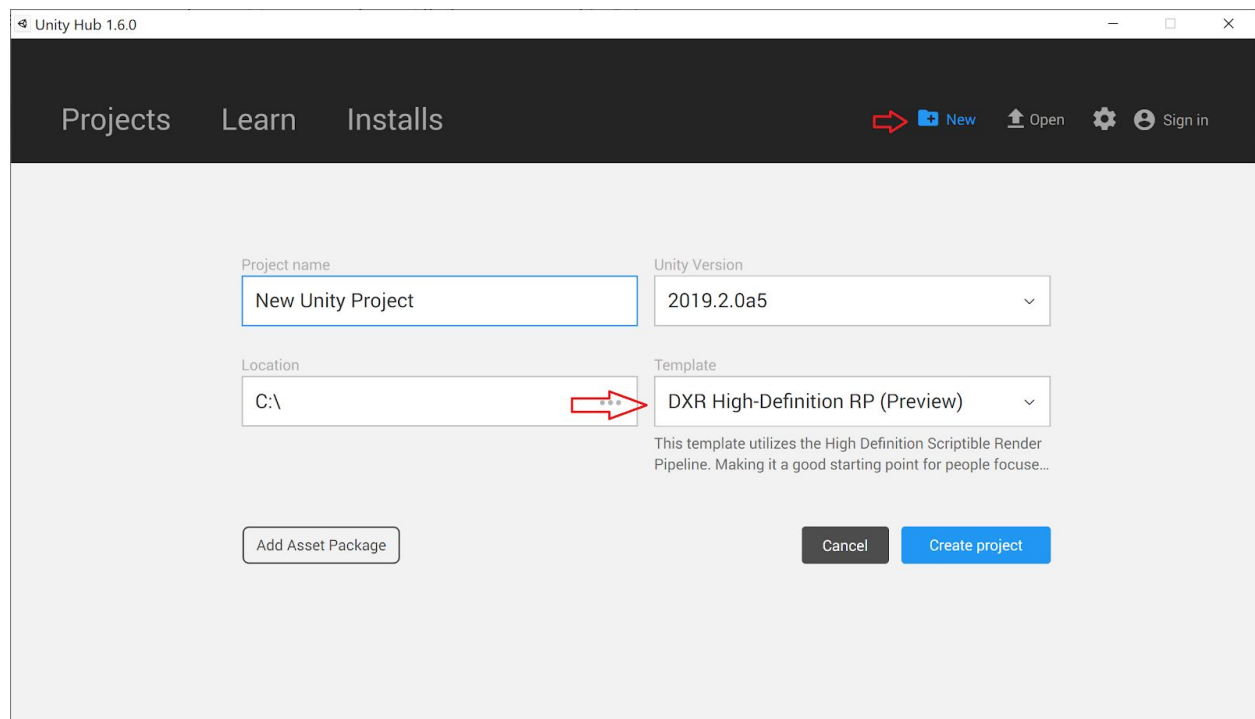
This project is a sandbox in which you can play with real time ray tracing features in Unity. This is a prototype and the final implementation of DXR will be different from this version. This project can not be used to do any production work.

Requirements:

- NVIDIA RTX series card
- Windows 10 RS5 (Build 1809) or later

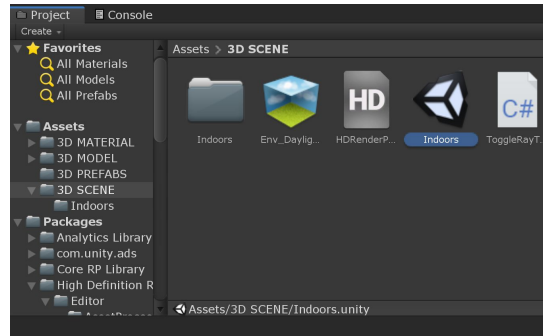
Install step:

- Download the project from Github in the release section, unzip.
- Launch Unity.exe
- Create a new project and select DXR High Definition RP (Preview)



This will setup the sandbox DXR project with the HDRP package.

- In 3D SCENE folder, open the scene indoors.unity

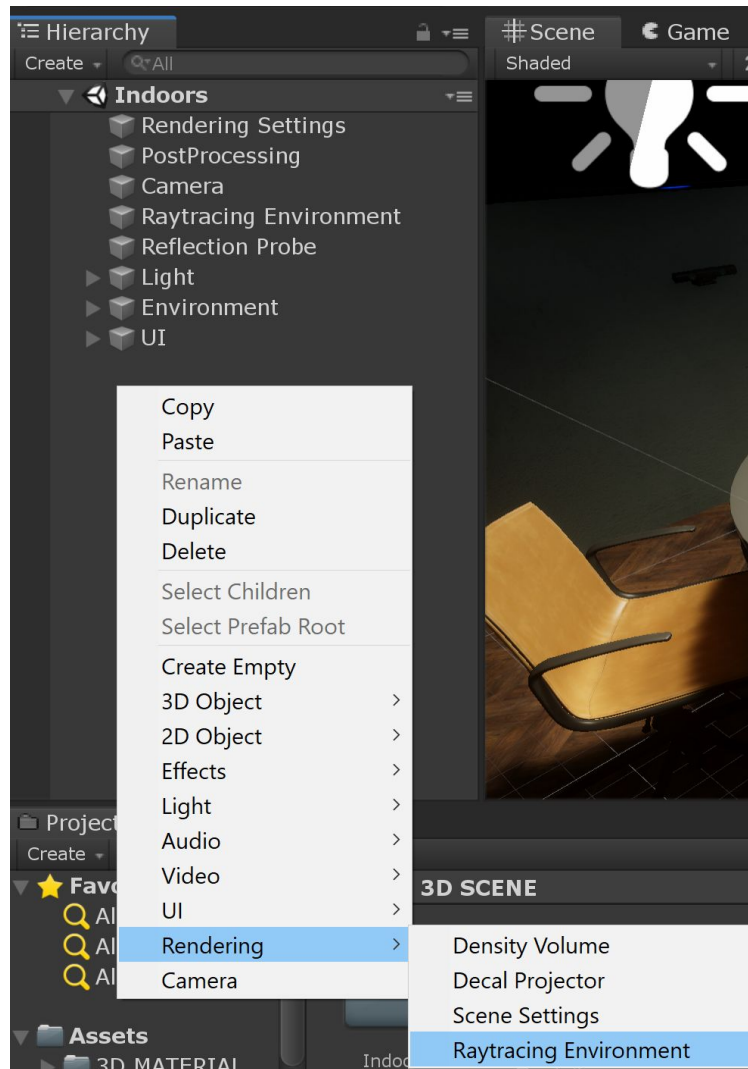


- Click play to see the scene, you can now enable/disable raytrace effects (Note: By default the ray tracing effects are only visible in game view).

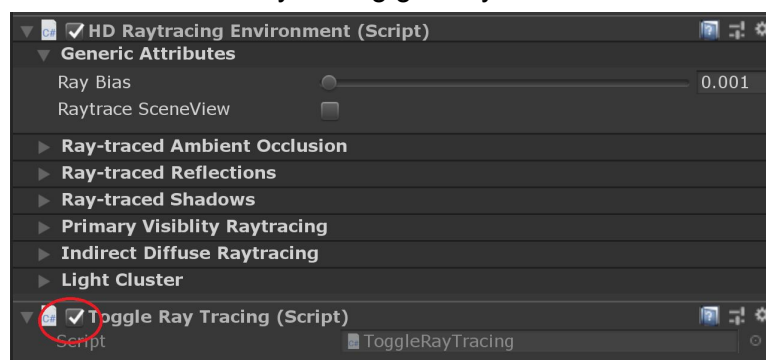


Ray Tracing configuration:

- To get access to ray tracing features you need to create a ray tracing environment (already created in the provided scene)



- The ray tracing environment inspector allows you to configure the various effect of ray tracing and to disable/enable ray tracing globally



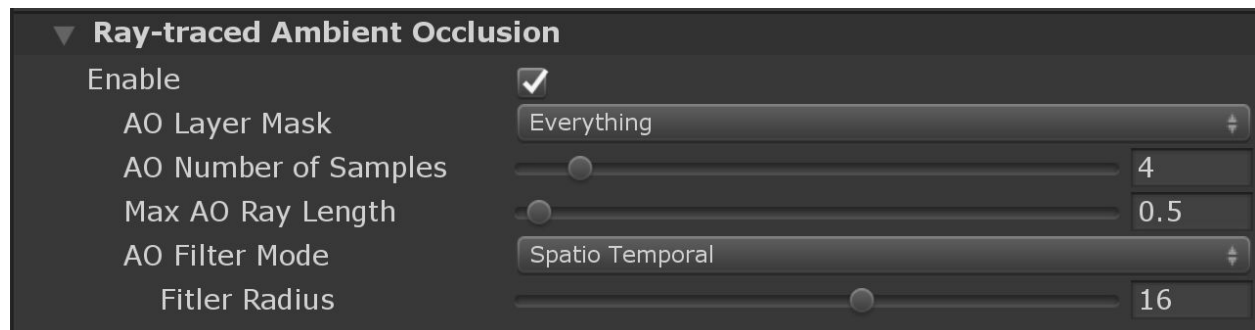
Ray Bias: Allows you to shift the start of a ray to avoid self intersection.

Raytrace SceneView: Allows you to enable ray tracing effect in the scene view, otherwise the ray tracing effects are only visible in the game view. It is often easier for artists to navigate in a scene without ray tracing, particularly when the ray traced scene is costly.

Other settings allow to configure each effect. In each of these effects there is a layer mask allowing to control which objects are taken into account for the effect. If an object isn't in the same layer than an effect, it has no impact on it.

Ray Tracing Effects

Ray Traced Ambient Occlusion



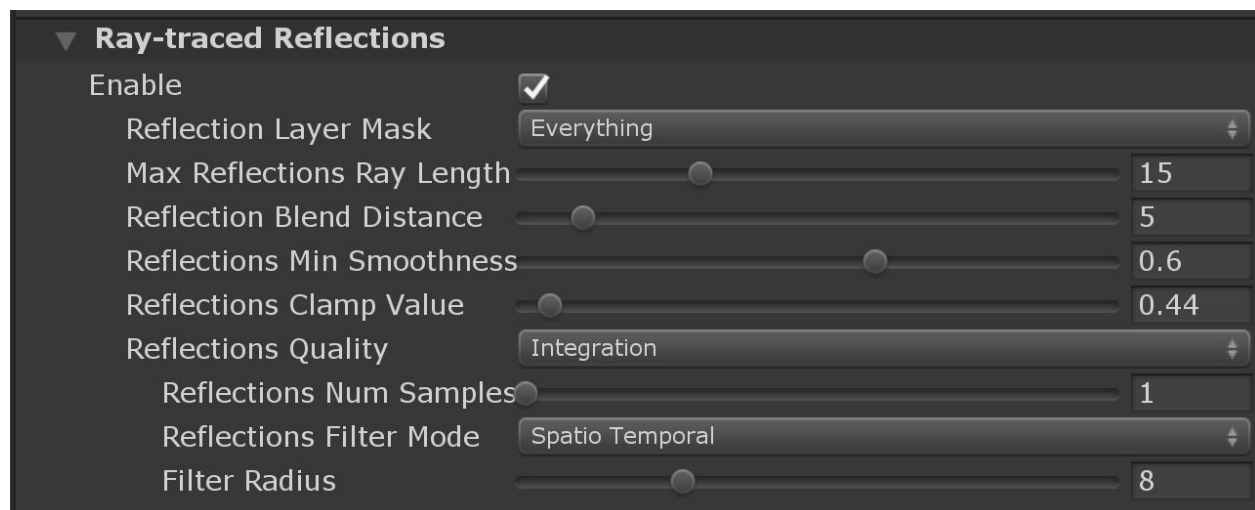
AO Layer Mask: Enables control of which objects are part of this effect

AO Number of Samples: A higher number of samples gives better quality but also increases cost. It is recommended to use 4 samples for real-time performance.

Max AO Ray Length: Allows control of the maximum length that a ray can travel before being considered as a miss. A low value allow to increase performance.

AO Filter Mode: Denoiser type: None, Spatio temporal or NVIDIA denoiser. The following settings depends on the chosen denoiser and allows you to control the quality of it at varying cost.

Ray Traced Reflection



This effect allows to add reflections to your scene and will replace screen space reflection if enabled.

Reflections Layer Mask: Allows control of which objects are part of this effect

Max Reflections Ray Length: Allows control of the maximum length that a ray can travel before being considered as a miss. A low value allow to increase performance.

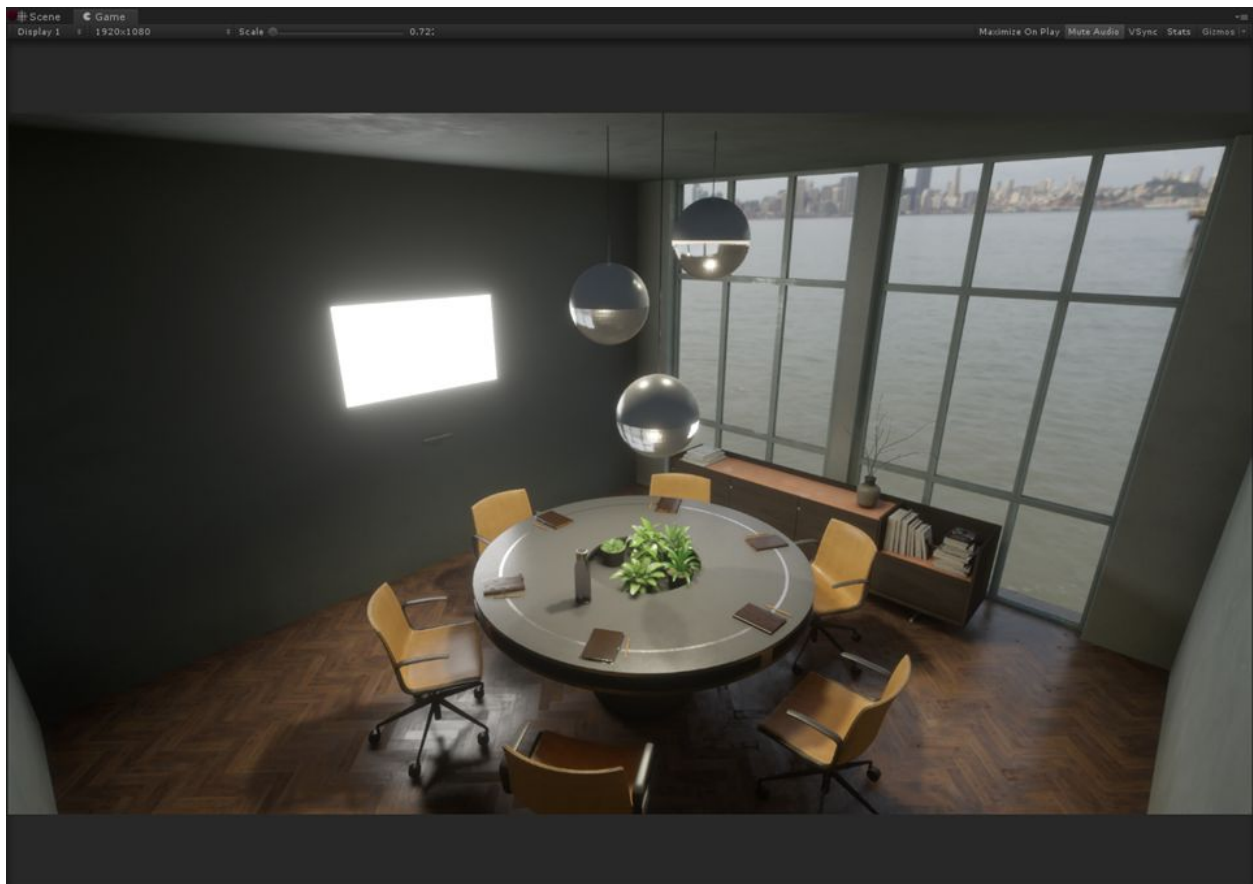
Reflections Blend Distance: Unused.

Reflections Min Smoothness: What is the minimum value of the smoothness required to used raytraced reflection, otherwise the pixel will use reflection probe or sky as a fallback.

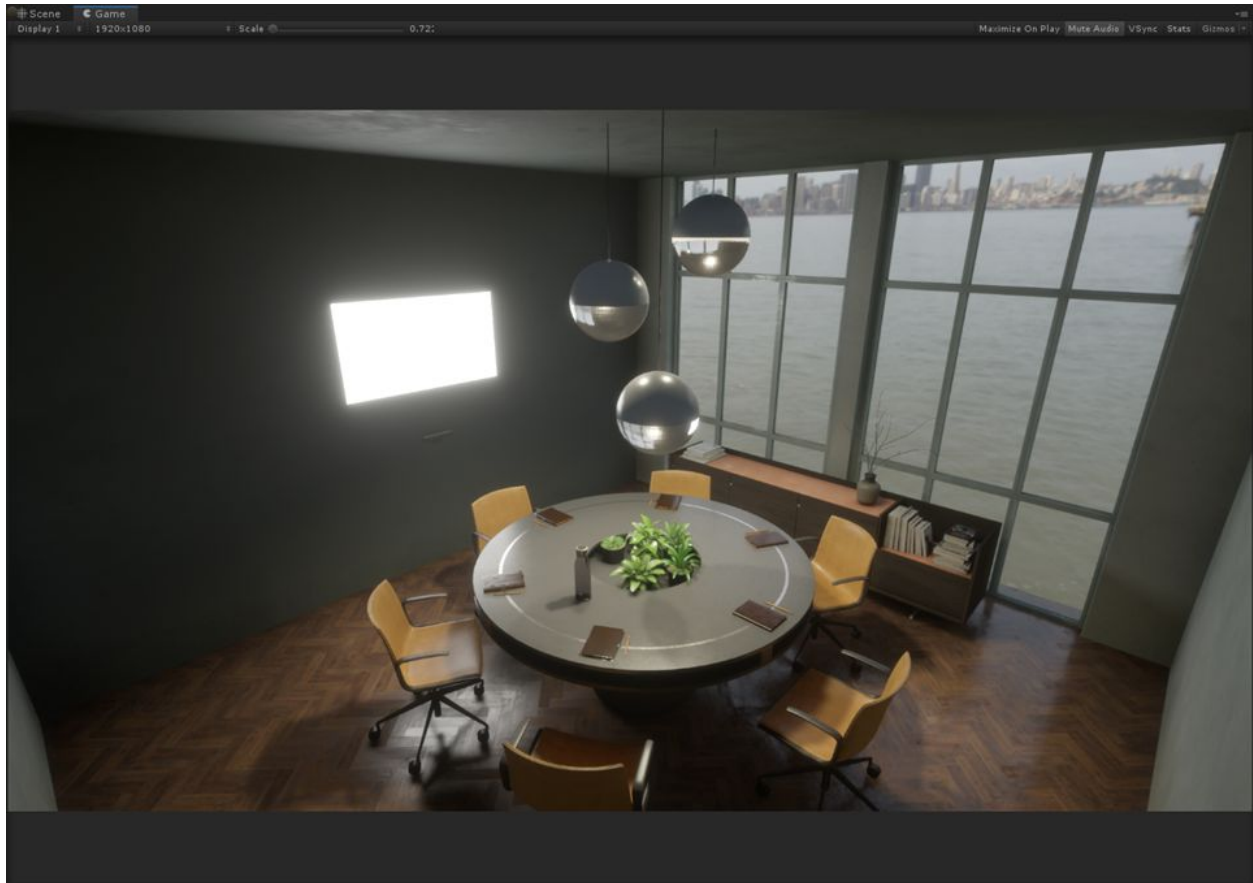
Reflections clamp values: Allows you to define in pre-expose space, a threshold to reduce fireflies. Try to keep value above 1 to keep bloom effect on intense value

Reflections quality: QuaterRes (Reflection is rendered with one sample per pixel (so $\frac{1}{4}$ for full screen) with temporal accumulation) or Integration (Reflection is render full screen with number of sample ray per pixel). In both cases, a denoiser is apply at the end with controllable filter radius. A bigger radius will increase cost.

Example of Integration (full resolution) result:



Example of quarter resolution result. Difference is barely noticeable for a good improvement in performance:



▼ **Light Cluster**

Cluster Cell Max Lights	<input type="range"/>	10
Cluster Range	<input type="range"/>	15.4

The reflections can reflect lights and objects outside of the viewing frustum. To deal with this limitation a light cluster is generated and forwarded to the ray traced shader. The light cluster is a voxel of 64x64x32 with a size defined by **Cluster Range** (Half Extent of Voxel around the camera center) and a maximum number of light per cell of **Cluster Cell Max Lights**.

Ray Traced Rectangular Area Light



These settings allow to enable raytraced area shadow for the textured rectangular area light.

Shadow Layer Mask: Enables control of which objects are part of this effect

Shadow Num Samples: A higher number of samples gives better quality but also increases cost. It is recommended to use 4 samples for real-time performance.

Max Num Shadows: Number of raytraced area shadows allowed into the scene. Once the maximum is reached, it fallback on no shadow for the extra lights.

Shadow Bilateral Radius: Control the size of the blur kernel used in the denoiser. Higher value help reduce noise but increase cost.

Split Integration: When enabled, all the shadow samples will be performed one after the other instead of all at the same time. This improves the performance with large area lights. Impact of this option should be measured to see if it is a win or not for current application. It doesn't change the quality.

Primary Visibility Raytracing



This effect allows to render object with ray tracing. Unlike other effects that rely on secondary ray (i.e the first ray is solve with rasterization). This effect is aiming at render smooth transparent objects even if it work on opaque objects. It only support smooth objects (no rough refraction).

Primary Visibility Layer Mask: Enables control of which objects are part of this effect

Raytracing Maximal Depth: Define the number of times a ray is allowed to trigger another ray when intersecting an objects. This allow to have recursive smooth reflection and refraction.

Example of 2 glass render with 1 for Maximal Depth



Example of 2 glass render with 5 for Maximal Depth

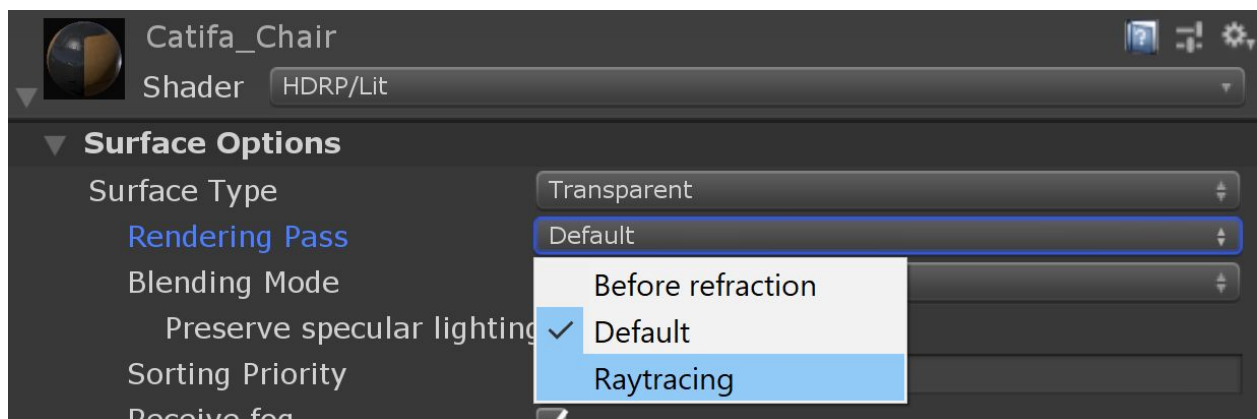


Example of 2 glass render with 7 for Maximal Depth



Raytracing Ray Length: Allows control of the maximum length that a ray can travel before being considered as a miss. A low value allow to increase performance.

To have an object rendered with Primary-Visibility effect when the effect is enabled, edit the material of the object and select Rendering Pass: Raytracing.



Indirect Diffuse Lighting



This effect allows to add one diffuse bounce lighting to your scene. This is very early and brute force implementation of this effect and this can't be used for real time purpose. It is more for reference.

Indirect Diffuse Layer Mask: Enables control of which objects are part of this effect

Indirect Diffuse Num Samples: A higher number of samples gives better quality but also increases cost. It is recommended to use at least 16 samples to get approximation of bounce lighting.

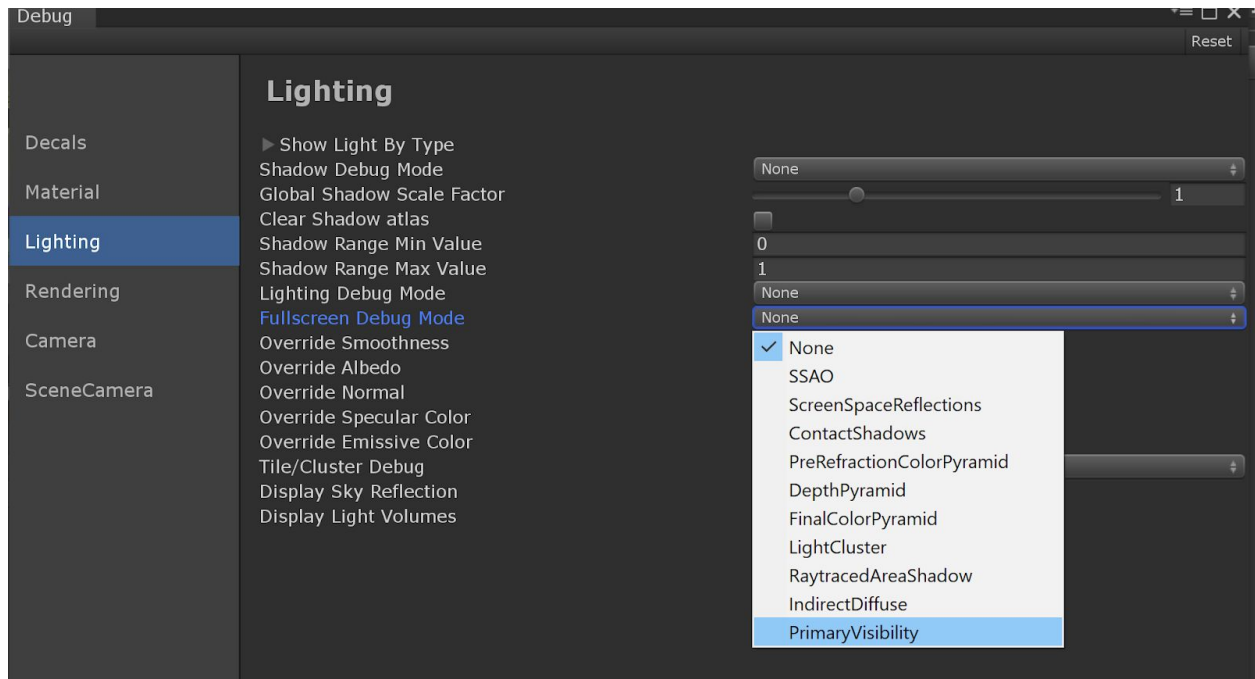
Indirect Diffuse Ray Length: Maximum distance a ray will travel before fallback on the sky lighting. Lower value increase performance.

Indirect Diffuse Ray clamp values: Allows you to define in pre-expose space, a threshold to reduce fireflies. Try to keep value above 1 to keep bloom effect on intense value

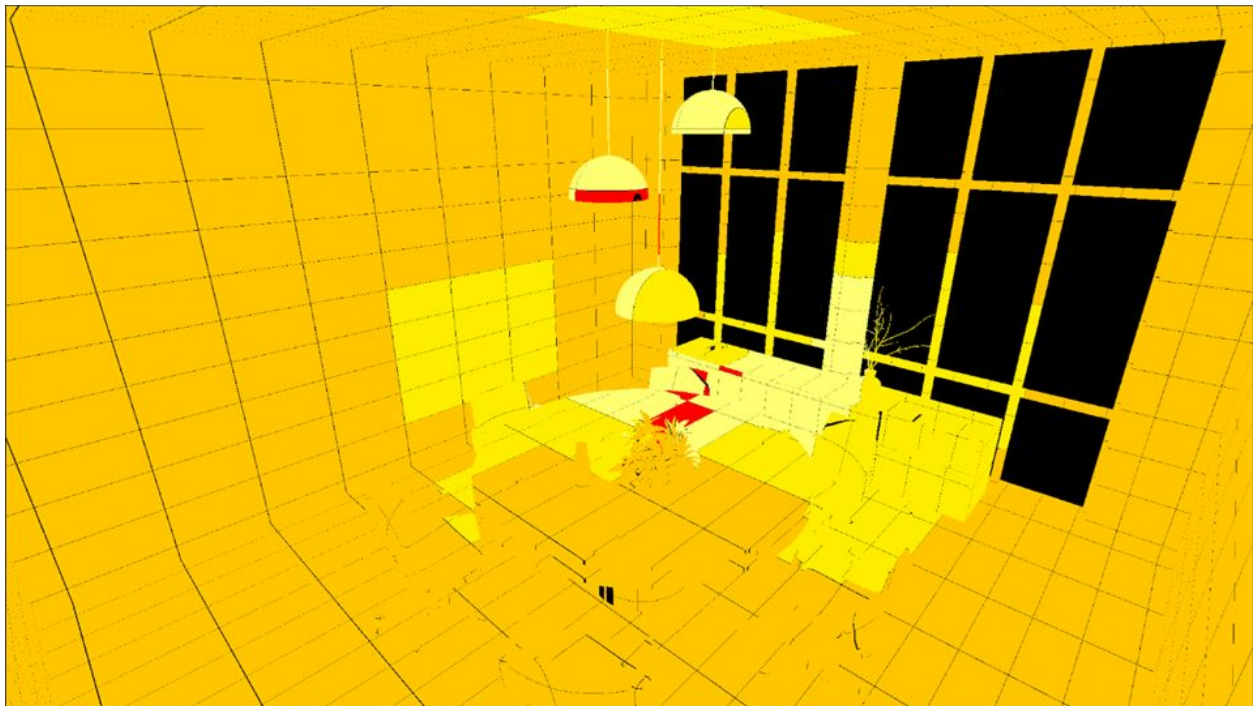
Indirect Diffuse Filter mode: Use spatio temporal filter to get noise free result.

Debugging

You can inspect the results of various effects with the debug menu. Windows -> Analysis -> Render Pipeline Debug. Select Lighting then choose one of the fullscreen debug modes:



- SSAO allow to see the ray trace AO effect
- ScreenSpaceReflections allow you to see the raytrace reflection effect
- Indirect diffuse allows you to see the indirect diffuse effect
- Primary visibility allows you to see the primary visibility mask
- Light cluster allow to see the light present in the light cluster



Light cluster: The color represents the # of lights <accumulation of yellow> hitting the area, Red displays the maximum budget for the lights

Material authoring

This experimental version only support Lit and Unlit Material for raytracing. And only the HDRP/Lit shader graph version is supported.

When using a Material for raytracing, currently no mipmap LOD are supported.

Only Lit Shader mode *Deferred Only* is supported in HDRP asset.

