Advanced Screen Space Ray-Traced Glossy Reflections Plugin for Unity® software

CANDELA SSRR

Introduction

Congratulations on your purchase of Candela SSRR! Your ability to add advanced raytraced reflections to your Unity Project is now at your fingertips. Please note that this is a simplified manual designed to get you started quickly with Candela SSRR and make it simple for you to add reflections to your scene. For more complete and up to date docs as well as tutorial videos please visit the web site www.livenda.com
so lets get started!

What is Candela SSRR?

Candela SSRR is a complete and simple to use highly optimized screen space glossy reflection solution for Unity. It is implemented as a image postprocessing effect which can be attached to a camera in your scene. This technique works with any potential reflective surface and every point of the scene in fact becomes potentially reflective which can be controlled via the use of applied materials.

Being a screen space based post effect also means only surfaces that are visible to the camera are able to be reflected. It is advisable to use screenspace reflections together with localized and global cubemaps as a way to achieve a general-purpose and robust solution for indirect specular and glossy reflectivity.

That being said screenspace reflections can easily enhance the look of your scene or game, making objects more grounded and attached to the environment. In the real world reflections are everywhere, traditionaly it has been computationaly quite costly to compute using methods such as true ray-tracing, SSRR on the other hand does not require almost any CPU cost and potentially long setup of additional render passes, it is performance friendly and independent of scene complexity. Every object and material can be reflected at zero cost as shading has already been evaluated.

With Candela SSRR it is possible to achieve multiple types of reflective surfaces. The categories below describe some of the reflection types.

Polished - A Polished Reflection is an undisturbed reflection, like a mirror or chrome.
Blurry - A Blurry Reflection means that tiny random bumps on the surface of the material cause the reflection to be blurry
Metallic - A reflection is Metallic if the highlights and reflections retain the color of the reflective object
Glossy - This term can be misused. Sometimes it is a setting which is the opposite of Blurry. (When "Glossiness" has a low value, the reflection is blurry.) However, some people use the term "Glossy Reflection" as a synonym for "Blurred Reflection." Glossy used in the context of Candela SSRR means that the reflection is actually blurred, so Glossy and/or Blurry reflections mean the same thing

Candela SSRR Platform Compatibility

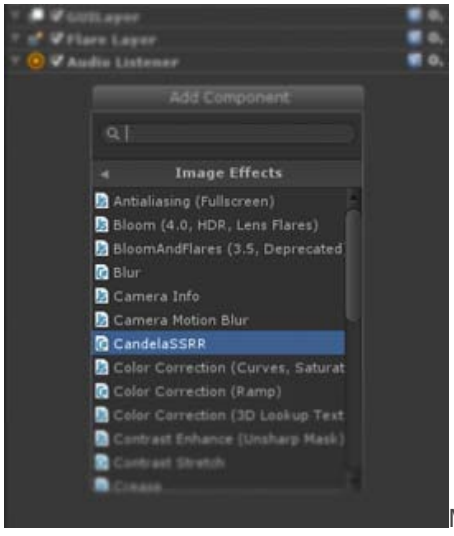
This release is compatible with OpenGL, DirectX 9, DirectX 11 and supports both Deferred and Forward Rendering Paths in Unity.

Getting Started

It is trivial to integrate Candela SSRR into your development pipeline. Firstly, Import the CandelaSSRR package file into your Unity project through the asset store window. A “CandelaSSRR” folder will be created in your project, containing everything you need including shaders, editor scripts and some demo scene files. Feel free to move this folder anywhere in your project but make sure to keep the internal structure intact. Do not delete anything from the resources or editor folder. Candela SSRR is now ready to use!

Candela SSRR being an Image Effect (post process) it must be applied to a Camera object. There are a number of ways to do this:-

Method A: Select the relevant Camera (Main Camera) from the Hierarchy view then click 'Add Component' on the inspector window. Now select the Image Effects Component and you will see CandelaSSRR, click on it and you're done.
Method B: Select the relevant Camera (Main Camera) from the Hierarchy view then select Component from the Unity menu bar then select Image Effects, now choose CandelaSSRR.
Method C: Click on the “CandelaSSRR” folder, the relevant script is CandelaSSRR.cs click and drag this script to your Camera.



Method A Example

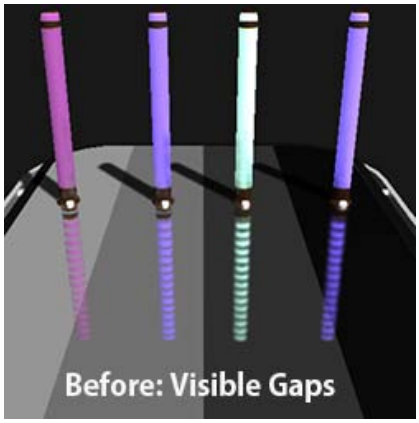
Now that you have CandelaSSRR applied to your Camera, lets go over the parameter controls available to you. (Please note that we will be looking at how to actually modify your materials to achieve different reflection types such as Polished or Glossy reflections per object basis in the Materials And Shaders Section of this manual) If you now run your scene you will see reflections, but wait there is more! There are many parameters available to you to get the exact desired reflection effect you're looking for while considering the performance requirements of your project. CandelaSSRR is designed to work with low-end hardware such as mobile devices or high performance devices, your project might be a AAA game or a Turn Table Style Product Demonstration.

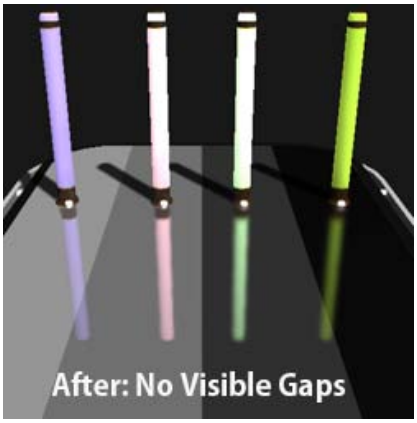
Candela SSRR Inspector

Global Step Scale: This is the step size in screen pixels the primary ray takes at each step count to see if the reflection ray has hit an object in the scene. Depending on your performance requirements you can adjust this to get better quality reflections if you make this value smaller. Smaller values mean the ray will not travel as much so you might want to increase the Global Step Count for further reaching reflections.

Global Step Count: This is the maximum number of times the primary reflection ray will travel in increments of Global Step Scale until it hits an object, Increase this value to get further reaching reflections. Higher quality reflections can be achieved with low Global Step Scale and High Global Step Count. Higher Global Step Count will have an impact on performance.

Fine Step Count: If the primary reflection ray has a hit it will than start searching with a smaller step scale to get a more refined reflection, increase this value to just fill in the gaps within the reflection. (If you start seeing gaps within your reflections increase this value to when it just disappears, don't go any higher as it is a waste of performance.





Global Bias: Small offset value used for comparing for ray collision, adjust this value to minimize reflection artifacts. If you change the camera's far clip distance, global bias may need to be changed.

Global Fade: This value controls how the reflections are faded away as they reach further. This is a global setting that effects all reflections.

Depth Cull: Used to terminate reflections that are far away from the camera, low values will give better performance.

Reflection Multiply: Use this to adjust the intensity of reflections globally. Reflection intensity can also be adjusted per-material basis, you can learn more about that in Materials And Shaders section of this manual. Changing this value has no impact on performance.

Global Blur Radius: To achieve glossy reflections, computed reflections will have to be blurred before they are modulated with the scene, this value determines or caps the maximum blur possible with glossy materials. This value effects both standard blur and High Quality blur utilized by Candela SSRR. Changing this value has no impact on performance.

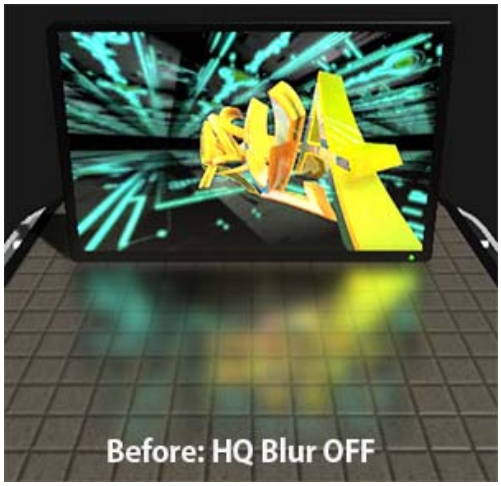
Blur Iterations: Increase this value if you require higher level of globally blurred reflections, values such as 2 or 3 are recommended, but you can go higher. Higher values will have more impact on performance.

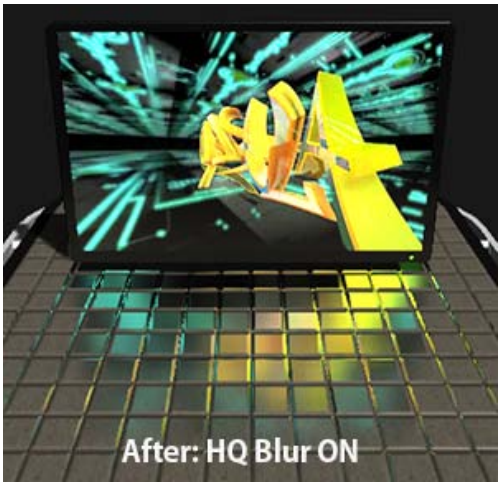
Distance Blur Radius: Adjust this value if you want reflections to be more blurry as they reach further from the reflecting object. Please not this is a global parameter and will effect all reflections in the scene. Changing this value has no impact on performance.

Distance Blur Start: This value is only important if your *Distance Blur Radius* is greater then Zero. This value sets where the Blurring will begin from the reflecting object/s . Higher values will cause the reflections to be more sharper closer to the reflecting object and become more blurry as the reflection reaches a further distance.

Graze Blur Power: Adjust this value if you want reflections to be more blurry as the grazing angle from the camera to the reflecting surface becomes small. Certain materials such as a sheet of paper at very *grazing angles* will show a visible *glossy reflection*, this can be a general case for most materials. A small graze blur power will show more realistic result, this is a global value for all reflections and changing this will not impact performance.

High Quality Blur: Enable this if you require more accurate blur modulation with the scene. This is more costly interms of performance compared to default blur, however it produces a much more consistent composition. HQ Blur becomes more important if your scene requires highly glossy reflections. Modulating highly blurred reflections with the scene becomes possible with HQ Blur as it is edge aware of the objects. The image below demonstrates the importance of HQ Blur especially when using Normal Maps.





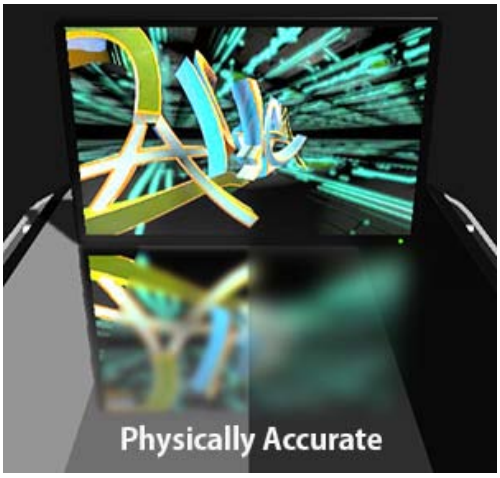
HQ Depth Sensitivity and HQ Normal Sensitivity: These values are to detect spatial differences in the scene and used to work out where to blur before reflections are modulated, adjust these values if you see undesirable leaking of glossy reflections between objects. Changing this value has no impact on performance.

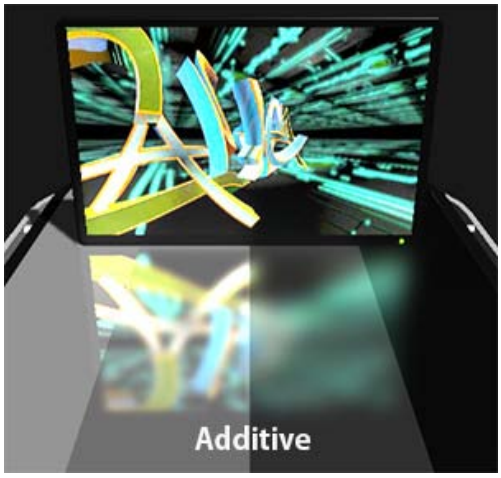
Screen Edge Fade Controls: Reflections are faded out as they reach to edge of the screen in order to minimize the popping effect that might occur as the camera moves around, the related parameters will allow you to control this fade shape and its impact. You can visually see the fade shape being used if you enable 'Show Screen Fade', this may be useful to easily adjust for a desired result. For performance reasons Candela SSRR utilizes two methods for screen fade, if 'Use Edge Texture' is enabled, a gray scale image must be provided which defines the intensity and shape of the screen fade. Using an Edge Texture is more friendly on performance in relation to the default procedural method but it's shape cannot be adjusted dynamically. The default method is where the screen fade is computed procedurally, it produces more of an oval shape , 'ScreenFadePower', 'ScreenFadeSpread', 'ScreenFadeEdge' can be adjusted to get the desired shape.

Resolution Optimized: Enable this if overall performance is important to your project, such as using Candela SSRR with mobile devices. Enabling this effectively makes all the reflection computations at half the current screen resolution, this gives a performance boost however may impact the quality of reflections.

High Precision Depth: By default Candela SSRR makes use of a high precision custom depth map in order to resolve reflections more accurately across all supported platforms. Disabling this mode will revert Candela SSRR to use the depth map generated by unity in deffered render mode which may introduce some artifacts to the reflections. Please note in forward render mode Candela SSRR will always use this High Precision Depth. Enabling High Precision Depth will have a small impact on rendering performance, however will produce higher quality reflections.

Compose Mode: In this version of Candela SSRR there are two methods provided for final scene composition, *Physically Accurate* and *Additive*. They both produce different results depending on your scene requirements. Physically Accurate mode will modulate(mix) the reflections generated by Candela SSRR with the scene by utilizing a specially generated mask which results in a more realistic composition as bright pixels are occluded (For example A Dark Object Reflecting On A Bright Surface). Additive mode as the name suggests simply adds the reflections on top of the scene, which may be a more desirable effect depending again on your scene requirements. In general, additive mode will produce brighter scene reflections which can be compensated by changing '*Reflection Multiply*' (Global Parameter) or by modifying the per material property for reflection intensity (In Candela This is linked to Diffuse Alpha).





HDR Reflections: Enabling this mode will write reflections to a High Dynamic Range(HDR) Render Texture. This is important for overly bright sections of your scene which are reflected prior to composition. Enabling this mode will make sure the HDR rendering pipeline is preserved with your project.

Materials And Shaders

Firstly, with Candela SSRR it is possible to control a number of reflection properties such as Reflection Intensity or Glossy Reflections (Blurred Reflections) with Per Material basis. In order to provide and maintain a unified work flow within Unity and easy integration to your projects, Candela SSRR is designed not to require any special or specific shaders.

On per material basis, the *Reflection Intensity* is modulated either via the ' Alpha ' Value of the Main Color or ' Alpha ' Channel of the base Texture provided or both. Like wise, the *Roughness or Glossy* amount is modulated either by the Shininess Value in a Specular based shader or the Alpha Channel of the Specular Texture provided or both.

You can get started quickly by using the standard Unity default shaders, however the standard shaders do not expose some of these textures by default, for example a Specular map which for Candela SSRR would modulate Glossy reflections. With the Candela SSRR package we have provided a number of *Helper Shaders (Listed Below)* which exposes the required texture slots that allow you to control reflection properties on per-pixel basis. More Helper Shaders will be included in future updates or versions.

Helper Shaders Provided

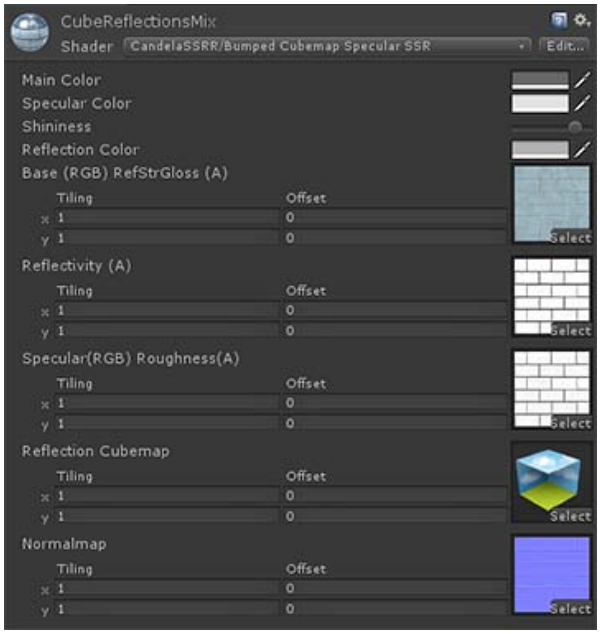
Candela Specular Map
Candela Bumped Specular
Candela Cubemap with SSR
Candela Bumped Cubemap with SSR

PBS (Physically Based Shader) - These shaders provide a more Physically plausible method for material settings. The Shininess i.e. the Specularity value provided (either directly or via a texture or both) will modulate the reflection amount ' and ' Blurriness respectively.

Candela Specular Map PBS SSR
Candela Bumped Simple PBS SSR

Roughness and Reflectivity Texture map generation

Candela Bumped Cubemap with SSR



The roughness map - White is smooth/polished and Black is very rough. When generating this textures make sure there is no pure black in the texture. After completing your roughness texture you can make sure of this by increasing the overall brightness a small amount. After importing to Unity, click on the texture and choose ' Alpha from Grayscale '

The Reflectivity map - Lighter colors more reflection, Dark colors less reflection. After importing to Unity, click on the texture and choose ' Alpha from Grayscale '

For any other queries please visit our website Livenda.com

Happy Reflections!

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