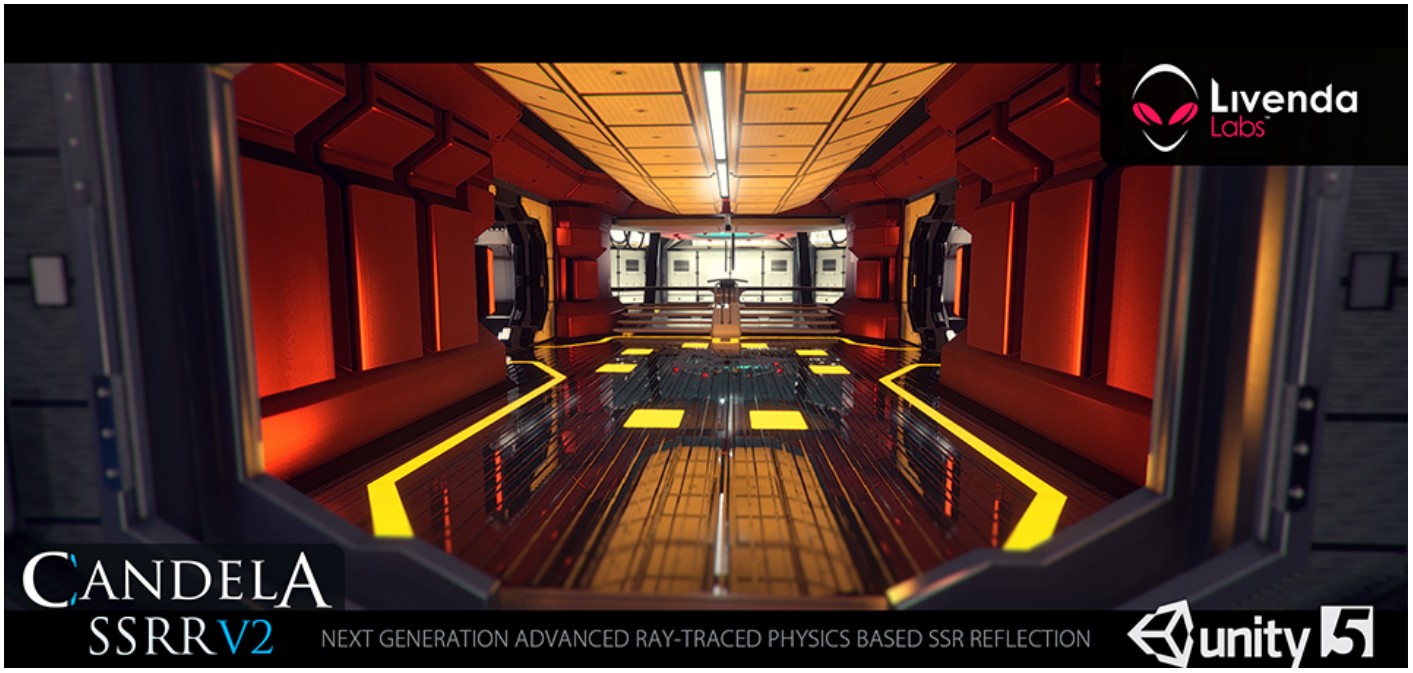
Livenda Labs



CANDELA SSRRV2

User Manual

unity 5

Introduction

Congratulations on your purchase of **Candela SSRR V2** which brings comprehensive Unity 5 compatibilty together with significant performance & quality enhancements! Your ability to add advanced ray-traced reflections to your Unity Project is now at your fingertips. 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!

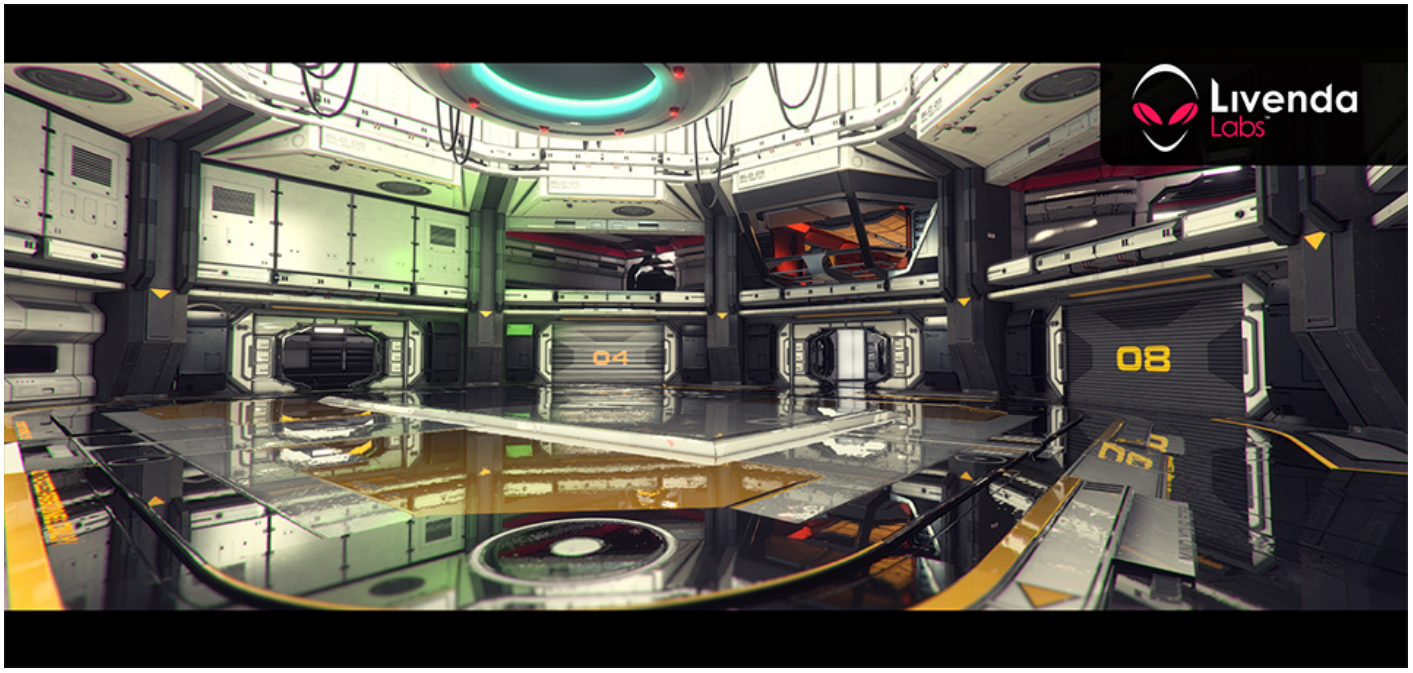
What's NEW in Candela SSRR V2

- Candela SSRR V2 is now completely Physically correct in all respects. Increasing quality and performance significantly while making it easier to integrate into your projects. The general work flow paradigm is now based on PBS principals regardless if you are using the New Unity 5 Standard shaders or the legacy shaders.
- Comprehensive & Complete support for Unity 5 Professional & Personal, which means it works with ALL Render Paths and Shaders, with support for almost all platforms. OpenGL, DirectX 9, DirectX 11. New Deferred Shading, Forward Rendering and Legacy Deferred Lighting.
- Across the board minimum 2 - 6X Times Performance Increase! now also possible to use with new Mobile platforms supporting OpenGLES 3.0
- New Physically correct Convolution - no more slow and incorrect Bilateral Blur! Very closely matching Unity 5 PBS / IBL and Reflection probe convolution for correct blending. Multiple performance options can now be easily selected suitable for your project withing the new Editor Inspector GUI.
- SSR Shimmer Reduction & Highlight Compression! i.e. Physically Based shading (PBS) such as the one utilized by Unity 5 is susceptible to high frequency highlight shimmer primarily caused by very high specular values. Screen Space Reflections can intensify this as sub-pixel motion increases. Also as roughness becomes high (more blurry), these sub-pixel highlights will cause distracting low - mid frequency shimmer during convolution. Candela V2 reduces this significantly.
- PBS Metallic & Specular Color now effect SSR reflection Color! Occlusion Chanel can also be used when activated in the standard (or standard specular) shader.
- New & much improved Physically Based Compose blend mode - Candela SSRR V2 uses a new cleaner 'Masking' Texture to compose SSR on top of the scene making it much more Physically plausible than just ' additive blend ' with the visible scene. Now, dark reflections or scene objects in shadow will reflect correctly. Specular highlights from shading can now be masked by reflected visibility (to a certain extend in screen-space).
- SSR Fresnel is now based on per-pixel Schlick & BRDF importance sampling
- Roughness values or textures correctly contribute to glossiness (roughness blur and grazing angle blur) i.e. Perfect mirror reflections are maintained at low roughness (which means no blur on contact reflections) and progressively increase glossiness as roughness increases (while respecting graze angles)
- Cleaner and leaner inspector UI which is much more intuitive with Performance & Quality target selections right at the top making it a breeze to use.
- When Using MSAA in Forward render mode, reflections while no longer need to be flipped

Candela SSRR V2 Platform Compatibility for Unity 5 Professional & Personal

This release is compatible with OpenGL, DirectX 9, DirectX 11 and supports the New Unity 5 Deferred Shading, Forward Rendering & Legacy Deferred Paths together with compatibility for all legacy shaders and the New Standard PBS shaders.

IMPORTANT: When using the new Unity 5 Deferred shading render path, you are free to use any available shader, this includes the new Standard & Standard Specular PBS shaders as well as all the other legacy shaders and the included Candela Helper shaders. However, if you are using the old legacy Deferred (light prepass) or the Forward render mode only the legacy shaders and the included Candela Helper shaders should be used.



What is Candela SSRR?

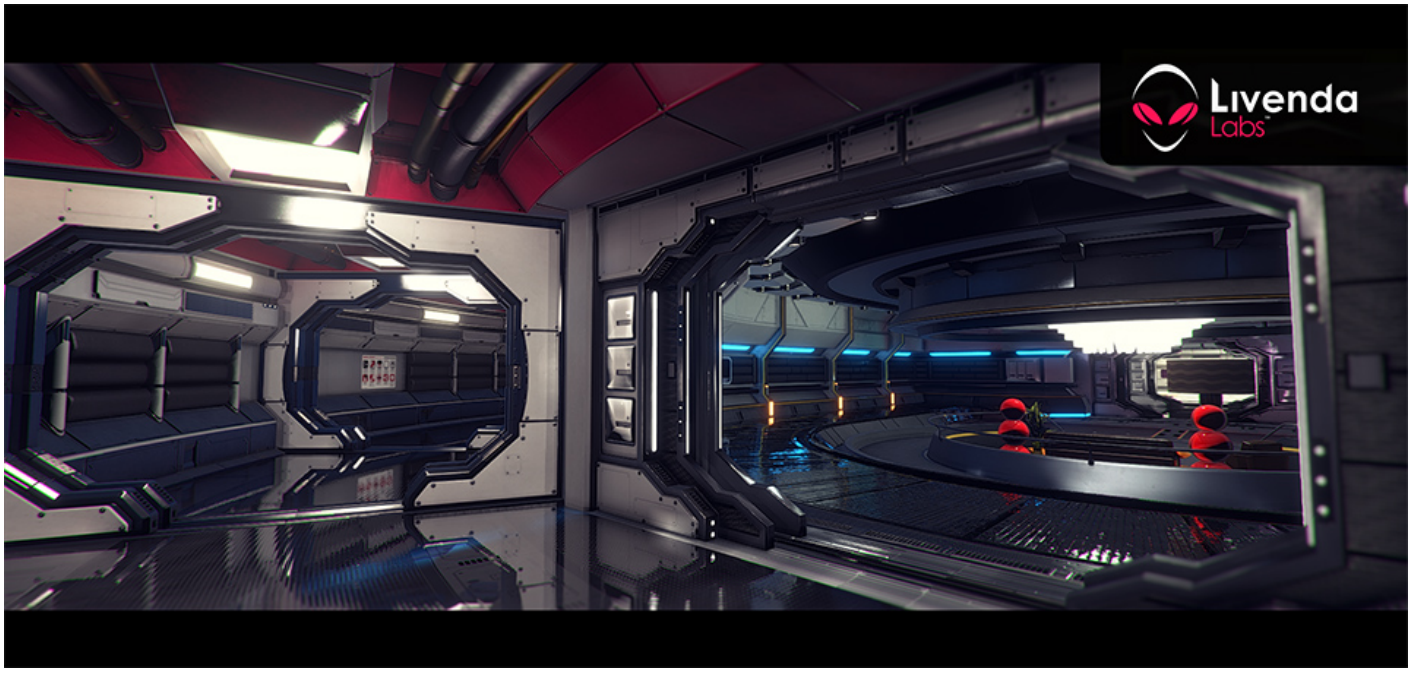
Candela SSRR is a complete and simple to use highly optimized screen space glossy reflection solution for Unity 5. It is implemented as a image post-processing effect which can be attached to a camera in your scene. This technique works with any potential reflective surface and every point of the scene 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 screens-pace 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, traditionally it has been computationally 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 V2 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

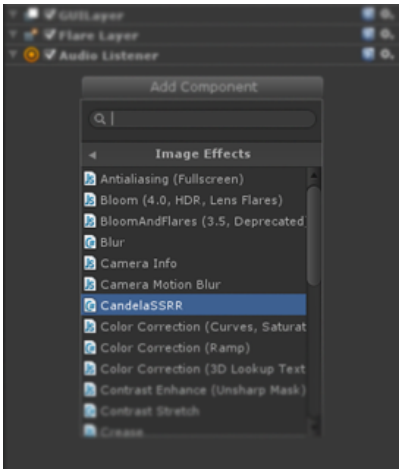


Getting Started

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!

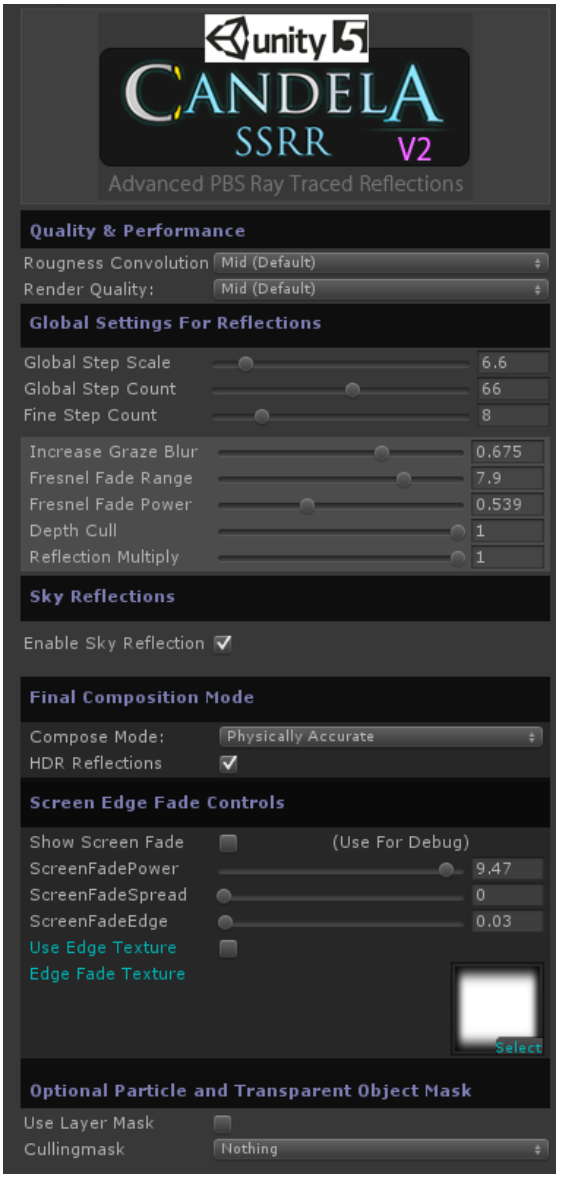
Candela SSRR being an Image Effect (post process) it must be applied to a Camera object. There are a number of ways to do this:-

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.



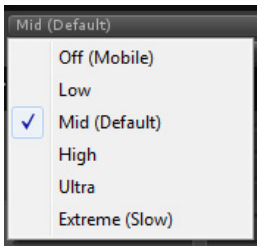
*Method **A** Example*

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 or high performance devices, your project might be a AAA game or a Turn Table Style Product Demonstration.



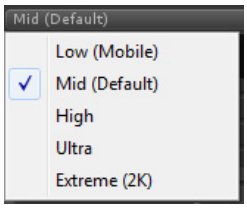
Candela SSRR V2 Inspector

Roughness Convolution: New Physically correct Convolution - (*Reflection Blur quality*) no more slow and incorrect Bilateral Blur! Very closely matching Unity 5 PBS / IBL and Reflection probe convolution for correct blending. Multiple performance options can now be easily selected suitable for your project withing the new Editor Inspector GUI.



Mid (Default) to *High* is ideal for most projects based on PC / Mac OS, Xbox ONE, PS4 (*Low* profile is also a great compromise). Performance impact is exponential as higher options are selected.

Render Quality: Internal Reflection resolution. *Mid* (Default) to *High* is ideal for most projects based on PC / Mac OS, Xbox ONE, PS4. Performance impact is exponential as higher options are selected.



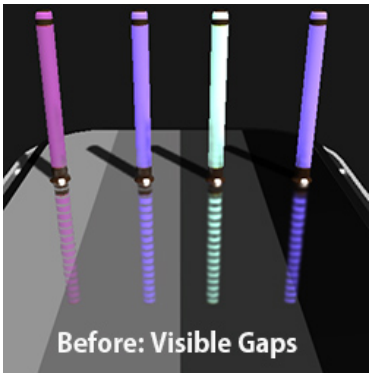
Mid - High for 1080P Devices is ideal, Ultra is for ~ 2K , Extreme for 2K and above. Performance impact is exponential as higher options are selected. Tip: Generally reflections look great and more then adequate for 2K and up displays even when *Mid* option is selected.

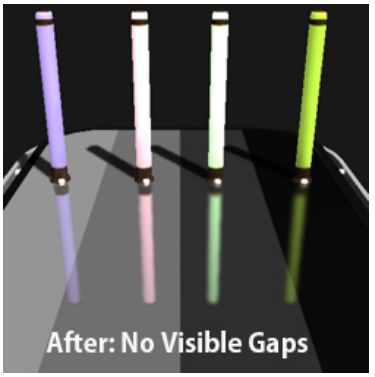
Global Step Scale: This is the step size in screen pixels the primary ray takes at each step count to see if the reflection ray has hit an object in the scene. Depending on your performance requirements you can adjust this to get better quality reflections if you make this value smaller. Smaller values 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.

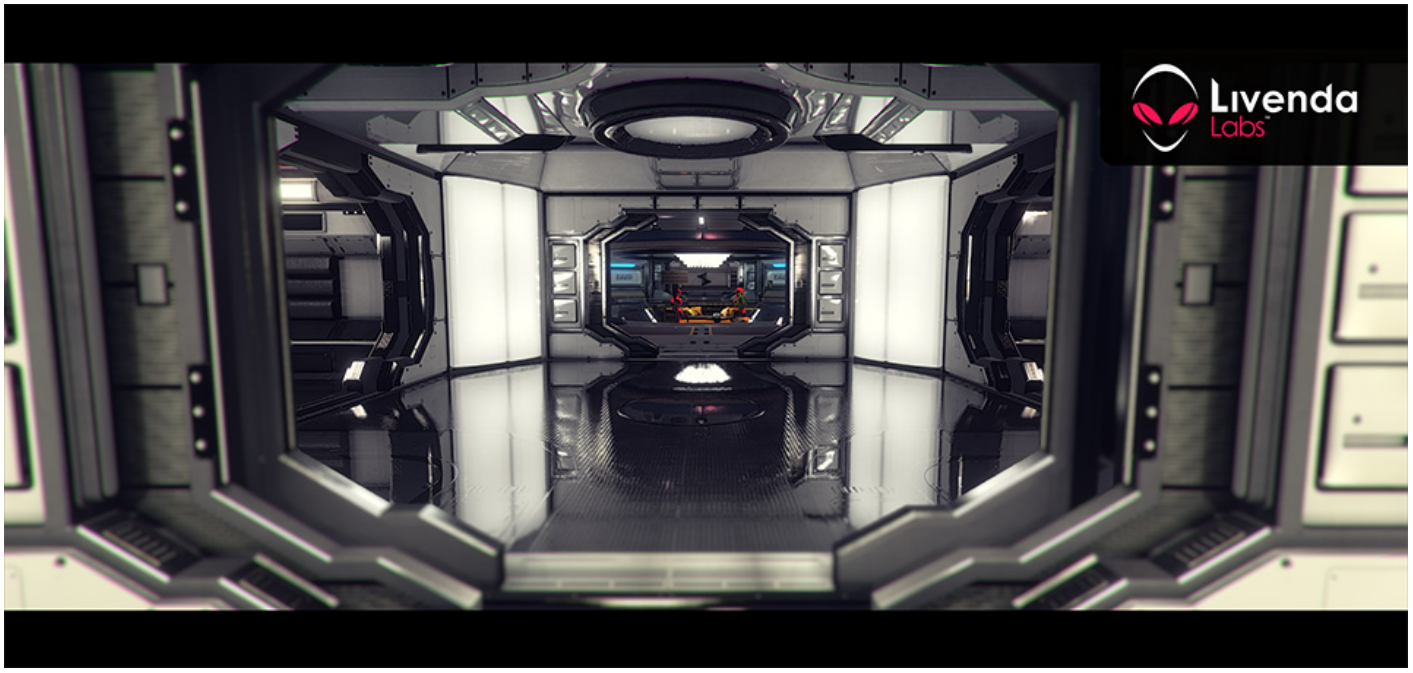
Tip**:** It is better (more performant) to Increase *Global Step Count* to achieve further reaching reflections then increasing the Fine Step Count





Increase Graze Blur: Adjust this value if you want 'increase' 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.

Tip: Candela SSRR V2 is Physically Based so there is always Grazing Blur depending on the roughness of the material, this value will increase this globally

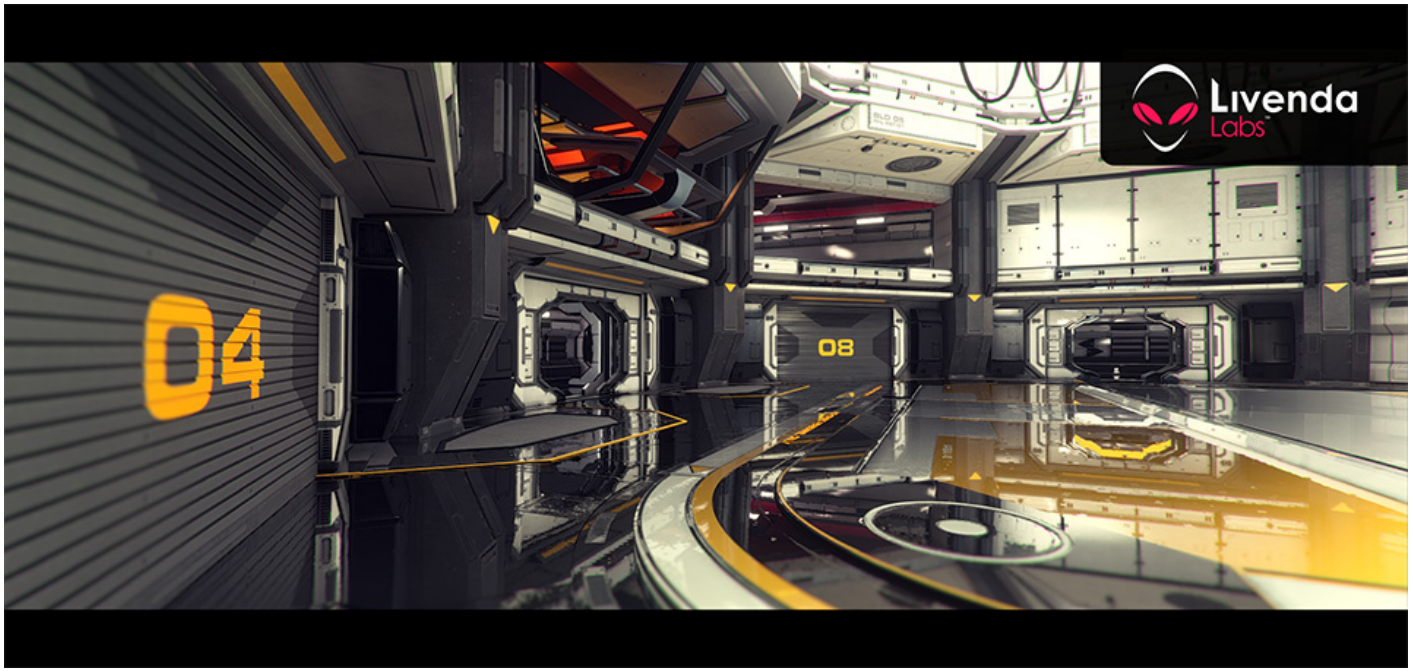


Fresnel Fade Range: SSR Fresnel is now based on per-pixel Schlick GGX approximation. This value will increase the effect to enable fading of reflections more suitable for your project.

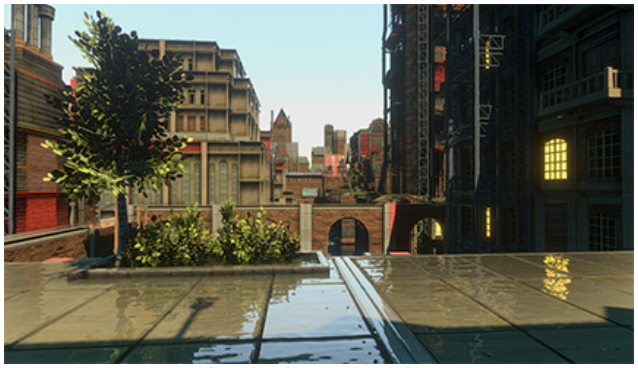
Fresnel Fade Power: This will tighten the Fade Range for smaller or longer falloff.

Depth Cull: Used to terminate reflections that are far away from the camera.

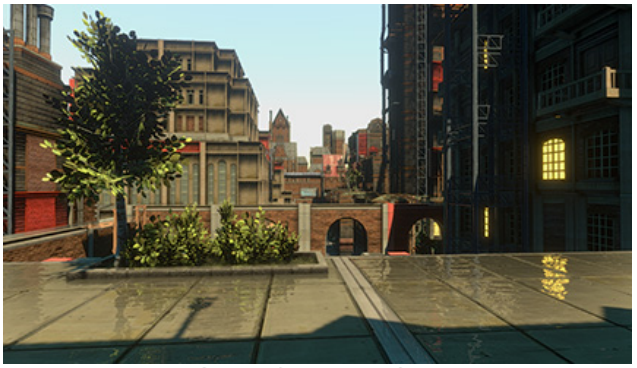
Reflection Multiply: Use this to adjust the intensity of reflections globally. Reflection intensity can also be adjusted on per-material basis, Being Physically accurate, just adjust the roughness value in the New standard shaders or the Specular power in all other shaders. Changing this value has no impact on performance.



Enable Sky Reflections: If enabled the Unity Sky (or any other custom sky object which is far away) will be reflected. It is also important to remember that being a screen-space reflection system, Candela SSRR will only reflect the sky when it is actually visible. SSR Sky reflections are more appropriate when used in conjunction with Cubemap reflections or Reflection Probes or the Unity 5 Skybox reflections.

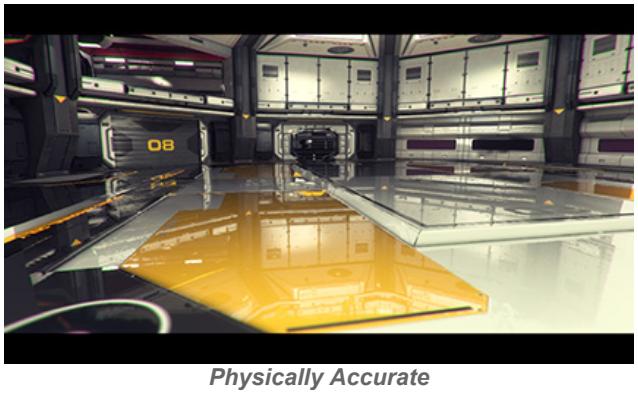


Sky Reflections - ON

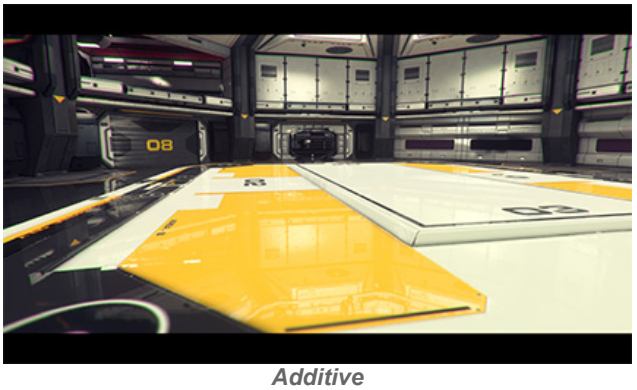


Sky Reflections - OFF

Compose Mode: New & much improved Physically Based Compose blend mode - Candela SSRR V2 uses a new cleaner 'Masking' Texture to compose SSR on top of the scene making it much more Physically plausible than just ' additive blend ' with the visible scene. Now, dark reflections or scene objects in shadow will reflect correctly. Specular highlights from shading can now be masked by reflected visibility (to a certain extend in screen-space). 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).



Physically Accurate



Additive

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.

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.

Use Layer Mask: Enable a layer to be excluded from reflections i.e. they will not cast reflections and *more importantly will not occlude reflections being cast by objects behind them*. It is important to realize that Candela Can *'Only'* Reflect objects on the scene and cannot reflect objects being occuled by another and this is commonly known as Depth Shadowing and is the nature of Screen Space based reflections. This option will enable all Transparent Shaded objects such as Particles/ Glass/ Windows etc. and any other object in the layer to be exuded

Culling Mask: Choose the layer you like to be included in the reflections, multiple layers can be selected

Materials And Shaders

Firstly, with Candela SSRR V2 it is possible to control a number of reflection properties such as Reflection Intensity or Glossy Reflections (Blurred Reflections) on Per Material basis. In order to provide and maintain a unified work flow within Unity and easy integration to your projects, Candela SSRR V2 is designed not to require any special or specific shaders.

More importantly you do not need to change your workflow, Candela SSRR V2 is designed to adhere to the new Unity 5 standards and more!

You can get started quickly by using the New standard Unity 5 default shaders (When using the new Deferred render path). Candela SSRR V2 package provides a number of *Helper Shaders (Listed Below)* which exposes the required texture slots that allow you to

control reflection properties on per-pixel basis. These work in all render paths in Unity 5.

PBS Metallic & Specular Color now effect SSR reflection Color! Occlusion Chanel can also be used when activated in the standard (or standard specular) shader.

When using any legacy shaders, the specular color will now modulate the reflection color accordingly based on PBS principals!

IMPORTANT: When using the new Unity 5 Deferred shading render path, you are free to use any available shader, this includes the new Standard & Standard Specular PBS shaders as well as all the other legacy shaders and the included Candela Helper shaders. However, if you are using the old legacy Deferred (light prepass) or the Forward render mode only the legacy shaders and the included Candela Helper shaders should be used.

Provided Helper Shaders

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

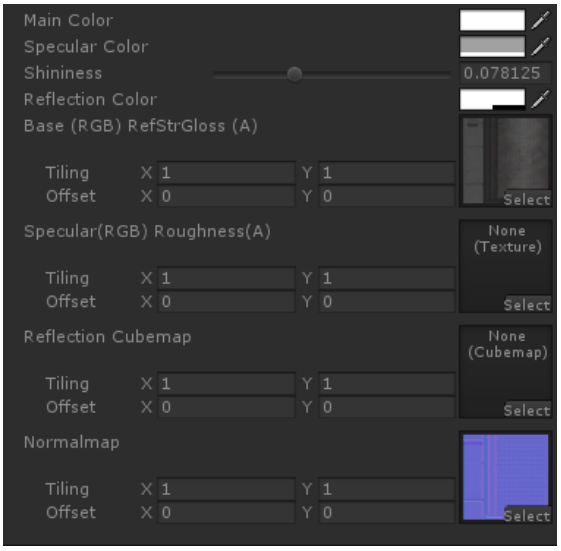
PBS (Physically Based Shader) - When **not** using the New Unity 5 Standard PBS shaders, these shaders provide a more Physically plausible method for material settings. The Shininess i.e. the Specularity value provided (either directly or via a texture or both) will modulate the reflection amount ' and ' Blurriness respectively.

IMPORTANT: When using the New Deferred Shading mode please use the New Unity 5 Standard PBS shaders.

Candela Specular Map PBS SSR
Candela Bumped Simple PBS SSR

Roughness (smoothness Map) Texture map generation
The roughness map - White is smooth/polished and Black is very rough. After importing to Unity, click on the texture and choose ' Alpha from Gray scale ' to modulate the roughness (this is a quick method and not the correct method). It is important to note that you adhere to Unity 5 PBS principles as much as possible for best results.

Candela Bumped Cubemap with SSR



IMPORTANT: It is best practice to choose your render path from the 'Camera' Drop-down menu rather then selecting 'use player settings'

For any other queries please visit our website Livenda.com

Happy Reflections!

END-USER LICENSE AGREEMENT FOR Candela-SSRR Script

IMPORTANT PLEASE READ THE TERMS AND CONDITIONS OF THIS LICENSE AGREEMENT CAREFULLY BEFORE CONTINUING WITH THIS PROGRAM INSTALL: LivendaLabs End-User License Agreement ("EULA") is a legal agreement between you (either an individual or a single entity) and LivendaLabs for the LivendaLabs software product(s) identified above which may include associated software components, media, printed materials, and "online" or electronic documentation ("Candela-SSRR Script"). By installing, copying, or otherwise using the Candela-SSRR Script, you agree to be bound by the terms of this EULA. This license agreement represents the entire agreement concerning the program between you and LivendaLabs, (referred to as "licenser"), and it supersedes any prior proposal, representation, or understanding between the parties. If you do not agree to the terms of this EULA, do not install or use the Candela-SSRR Script.

The Candela-SSRR Script is protected by copyright laws and international copyright treaties, as well as other intellectual property laws and treaties. The Candela-SSRR Script is licensed, not sold.

1. BUGS IN SOFTWARE
Candela-SSRR does not claim that the software has no bugs and does not guarantee that it will work in any environment.

2. GRANT OF LICENSE.
The SOFTWARE PRODUCT is licensed as follows:
(a) Installation and Use.
LivendaLabs grants you the right to install and use copies of the Candela-SSRR Script on your computer running a validly licensed copy of the operating system for which the Candela-SSRR Script was designed [e.g., Windows 95, Windows NT, Windows 98, Windows 2000, Windows 2003, Windows XP, Windows ME, Windows Vista, Windows 7, OSX].
(b) Backup Copies.
You may also make copies of the Candela-SSRR Script as may be necessary for backup and archival purposes.

3. DESCRIPTION OF OTHER RIGHTS AND LIMITATIONS.
(a) Maintenance of Copyright Notices.
You must not remove or alter any copyright notices on any and all copies of the Candela-SSRR Script.
(b) Distribution.
You may not distribute copies of the Candela-SSRR Script to third parties.
(c) Rental.

You may not rent, lease, or lend the Candela-SSRR Script.
(d) Support Services.
LivendaLabs may provide you with support services related to the Candela-SSRR Script ("Support Services"). Any supplemental software code provided to you as part of the Support Services shall be considered part of the Candela-SSRR Script and subject to the terms and conditions of this EULA.
(e) Compliance with Applicable Laws.
You must comply with all applicable laws regarding use of the Candela-SSRR Script.

4. TERMINATION
Without prejudice to any other rights, LivendaLabs may terminate this EULA if you fail to comply with the terms and conditions of this EULA. In such event, you must destroy all copies of the Candela-SSRR Script in your possession.

5. COPYRIGHT
All title, including but not limited to copyrights, in and to the Candela-SSRR Script and any copies thereof are owned by LivendaLabs. All title and intellectual property rights in and to the content which may be accessed through use of the Candela-SSRR Script is the property of the respective content owner and may be protected by applicable copyright or other intellectual property laws and treaties. This EULA grants you no rights to use such content. All rights not expressly granted are reserved by LivendaLabs.

6. NO WARRANTIES
LivendaLabs expressly disclaims any warranty for the Candela-SSRR Script. The Candela-SSRR Script is provided 'As Is' without any express or implied warranty of any kind, including but not limited to any warranties of merchantability, noninfringement, or fitness of a particular purpose. LivendaLabs does not warrant or assume responsibility for the accuracy or completeness of any information, text, graphics, links or other items contained within the Candela-SSRR Script. LivendaLabs makes no warranties respecting any harm that may be caused by the transmission of a computer virus, worm, time bomb, logic bomb, or other such computer program. LivendaLabs further expressly disclaims any warranty or representation to Authorized Users or to any third party.

7. LIMITATION OF LIABILITY
In no event shall LivendaLabs be liable for any damages (including, without limitation, lost profits, business interruption, or lost information) rising out of 'Authorized Users' use of or inability to use the Candela-SSRR Script, even if LivendaLabs has been advised of the possibility of such damages. In no event will LivendaLabs be liable for loss of data or for indirect, special, incidental, consequential (including lost profit), or other damages based in contract, tort or otherwise. LivendaLabs shall have no liability with respect to the content of the Candela-SSRR Script or any part thereof, including but not limited to errors or omissions contained therein, libel, infringements of rights of publicity, privacy, trademark rights, business interruption, personal injury, loss of privacy, moral rights or the disclosure of confidential information.