Table of Contents

1 Introduction
   U-RENDER Early Access 4
   Demo Version 4
   Main Features 4
      Improvements Planned for the Near Future 4
   Feedback 5
   Real-Time Rendering 6

2 System Requirements
   Cinema 4D Requirements 8
   Graphics Processor Requirements 8
   Tested Graphics Cards 8

3 Setup and Installation
   Installation of U-RENDER Application 9
   Installation of Cinema 4D Plug-in 9
      Quick Guide 9
      Detailed Installation Steps 9
   Activating the License 10
   Choosing the GPU on Multi-GPU Systems 12

4 Quick Start Guide - First Steps 14

5 Live Mode
   Features 20
   Dashboard 20
      Live Updates 21
      Live View 22
   Limitations 22

6 Render Settings
   Basic 24
      General 24
      Shaders 25
      Anti-Aliasing 25
      Displacement 27
   Environment 27
      Background 27
      Environment Map 28
   Reflectance 29
   Shadows 31
## Effects

- Motion Blur 31
- Depth of Field (Experimental) 32
- Ambient Occlusion 33
- Hemisphere Ambient Occlusion 34
- Ground-Truth Ambient Occlusion 35
- Bloom 37
- Fog 38

### Tone Mapping / Gamma
- Tone Mapping Settings 40

### Post Processing
- Chromatic Aberration 41
- Vignette 42
- Gamma 43

### Multi Pass
- Matte 44
- Lighting 44
- Material 45
- Advanced 45
- Compositing in After Effects 45
- Compositing in Fusion 46

## Materials

### Texture Projections (Procedural UVs)

### Cinema 4D Shader support

### General Texture Adjustments

### Color

### Emissive

### Transparency

### Clear Coat

### Reflectance
- Environment 57
- Fresnel Reflectance 58
- Glossiness/Roughness 59
- Screen Space Reflections 60

### Bump

### Normal

### Displacement

### Mask

### Material Id Color

## Lights

### Default Light

### U-RENDER Light Tag Settings
Introduction

Thank you for downloading U-RENDER. If you need further assistance or have suggestions or features requests please visit our user forums at http://talk.u-render.com or contact us at help@u-render.com.

U-RENDER Early Access

U-RENDER Early Access provides a very cost effective version to establish high quality realtime rendering in production pipelines.

Early Access is a bridge between the beta version and a later, proven version “1.x”. The intention is to smooth over typical “Version 1.0” issues. You are still able to adopt and establish new workflows and services earlier, increasing their lead on competitors by using U-RENDER for high quality real-time rendering.

Demo Version

We provide download links through our website and the U-RENDER Forum where you can download the latest version. Without a valid license installed, U-RENDER will run in “Demo” mode and show a visible watermark over rendered images.

Main Features

- Physically Based Material System (specular and metallic workflow)
- Lights and Shadows
- Image Based Lighting (IBL)
- Support for UV-less workflows using texture projections
- Geometry Displacement
- Linear Workflow
- Post Processing (Tone Mapping, Ambient Occlusion, Bloom and preliminary Depth of Field)
- Support for Cloners / Instances
- Screen-Space Reflections
- Rendering of Transparent Objects
- Live Mode (real-time feedback for materials, lights and limited scene changes. Live sync of scenes is still under development)

Improvements Planned for the Near Future

- Improved Animation Rendering Support including Motion Blur and Live Mode
- General Improvements for Live Mode
- Tighter integration with Cinema 4D and improved Scene Parsing
- We have a long list of planned features for future versions. We will prioritize development depending on your feedback.
Feedback

We are always happy to receive your feedback. We are particularly interested in these areas:

- usability
- stability
- fitness for use in production
- workflow issues
- issues with parsing scene data
- Improvements and missing features
Real-Time Rendering

U-RENDER’s approach to rendering is to use advanced methods of real-time rendering. From a technical point of view this is closely related to the methods that are used in modern video games. In contrast to CPU and GPU renderer, U-RENDER does not use methods like ray-tracing or path-tracing. This allows us to render images within milliseconds, opening new venues for rendering, supporting the creative workflow and drastically reducing turnaround times and costs.

U-RENDER fits naturally between video games and traditional renderers. We can use methods that allow higher image quality than in video games as there is no strict limit to render times (usually 16 to 33 milliseconds in games).

![Image Quality and Rendering Features Diagram]

Real-time rendering brings its own set of limitations though. The possibilities are limited by hardware implementations. Using modern GPUs, these limitations are less and less strict and allow for increasingly elaborate algorithms to be implemented but there are still some boundaries that remain. For once, we cannot easily and quickly cross over to CPU memory and use algorithms for materials that run on the CPU. Transferring data between RAM and the GPU also slows down the process considerably.

There is a long list of desirable features that have the potential to make U-RENDER the go-to choice for any rendering task. We are actively researching solutions how to implement those in the context of real-time rendering.

Areas of research for future features are:

- Support for Cinema 4D’s Shaders (partially supported in current version using texture baking)
- Extended Material Options like Procedural Shaders
- Advanced Material Effects like Subsurface Scattering, Flakes, Thin-film
- Extensive Particle Rendering Support
- Volumetric Rendering
- Real-time Global Illumination
- Procedural Animation Systems that run on the GPU

Implementing these features with real-time feedback are challenging. Right now we are focused on getting the first version production ready. We have to cut these advanced features for now to get a solid foundation in your hands now and then start building on that for the future.
System Requirements

- 64-bit Intel or AMD x64-based processor, 2 GHz or faster
- 8 GB or more of RAM
- 64-bit Windows 10 (version 1607 or later)
- 1 GB of available hard-disk space for 64-bit installation. Additional free space required during installation and for optional, additional materials
- at least 1920x1080 display resolution with 32-bit color

U-RENDER is available in English only

In addition to the U-RENDER standalone you also need the U-RENDER host plug-in for Cinema 4D.

Cinema 4D Requirements

U-RENDER currently supports Cinema 4D R16 to R20.

Please make sure you have the latest update for Cinema 4D installed. These are the latest version as of writing of the documentation:

- Cinema 4D R16.051
- Cinema 4D R17.055 (SP3.5)
- Cinema 4D R18.057 (SP3)
- Cinema 4D R19.068
- Cinema 4D R20.059

Graphics Processor Requirements

- AMD or NVIDIA GPU
- OpenGL 4.5 capable
- 3 GB or more of graphics VRAM (8 GB or more recommended)
- Multi-GPU setups (NVIDIA SLI, AMD Crossfire) are untested and therefore not supported

Tested Graphics Cards

- AMD Radeon RX 480 with 8 GB VRAM
- AMD Vega 64 with 8 GB VRAM
- NVIDIA GeForce 1060 GTX mobile with 6 GB VRAM
- NVIDIA GeForce 1060 GTX with 6 GB VRAM
- NVIDIA GeForce 1080 GTX with 8 GB VRAM
- NVIDIA GeForce 2080 RTX with 8 GB VRAM

We cannot test all cards in a timely manner. If your card is not listed above, but meets the Graphics Processor Requirements, chances are high that it will work with the latest version of U-RENDER.
Setup and Installation

U-RENDER consists of two components:

- The host application plug-in for Cinema 4D
- The standalone rendering application

The Cinema 4D plug-in works with R16 or later. Make sure you install the matching plug-in according to your Cinema 4D release version.

Installation of U-RENDER Application

To Install the U-RENDER Application, run the Setup and follow the on-screen instructions.

On Systems with several GPUs - especially on notebooks with integrated graphics and dedicated GPU - you need to choose which GPU U-RENDER will use. Please see the chapter “Choosing the GPU on Multi-GPU Systems” for details.

Installation of Cinema 4D Plug-in

Quick Guide

The ZIP File you downloaded contains a plug-in folder and a doc folder where you found a ReadMe containing these installation steps. Close the Cinema 4D application and copy the content of the plug-in folder into your Cinema 4D’s plug-ins folder. Make sure that you install the plug-in that matches your Cinema 4D version, e.g. install the R19 plug-in when you are using Cinema 4D R19. Now start Cinema 4D again.

Detailed Installation Steps

1. **Unpack the downloaded ZIP file** into a temporary location of your choice (e.g. your Desktop). Inside the ZIP file you find a plug-in folder that contains all the files that need to be copied to your Cinema 4D installation.

2. **Find Cinema 4D’s plug-in folder**: To find the folder where Cinema 4D expects 3rd party plug-ins start Cinema 4D and go to the preferences (from the Edit > Preferences menu). You can see the path to the preferences folder at the bottom of the dialog. There is also a button to open the folder in the File Explorer / Finder. Click the Open Preferences Folder... button. The path on Microsoft Windows is typically something like: C:\Users\Name\AppData\Roaming\MAXON\CINEMA 4D R16_12345678\.

3. **Close the Cinema 4D Application**.

4. **Copy the plug-in files**: In the preferences folder you see a folder named plug-ins. Now copy all the files from the downloaded plug-in folder into Cinema 4D’s plug-ins folder.
Make sure you are installing the plug-in version that matches your Cinema 4D Release. So, for example, copy the R19 plug-in into the plug-in folder of Cinema 4D R19.

5. **Start Cinema 4D** again.

6. **Now U-RENDER should be installed and working within Cinema 4D.** To make sure everything went fine you can check the Console in Cinema 4D. Use the Script / Console... menu to open the Console. You should find a message showing that the plug-in has been loaded, including the version number of U-RENDER. You find U-RENDER In the Cinema 4D Plugins menu and can choose U-RENDER as renderer in the Render Settings.

### Activating the License

When you purchased U-RENDER you received an Activation Key for your license. Please make sure that you store that key safely. Please do not share the Activation Key with others as it will prevent you from activating your license for yourself.

Install and start the U-RENDER standalone renderer on the computer that you will continue to use U-RENDER on. The License will be bound to this computer upon activation.

From the menu choose Help - Activate License.

![U-RENDER](image)

In the License Activation dialog, enter your Activation Key into the designated field and click on the “Activate” button.

![License Activation](image)

License Activation will retrieve a license from the activation server and install it on your computer. This will take a few moments. You will see a message that confirms the successful activation.
Once activated successfully, the license is permanently installed on your computer.

The license file is saved to your local application settings folder (%LOCALAPPDATA% which is typically C:\users\<user name>\AppData\Local)

With a valid license installed, scenes are rendered without a visible watermark overlay.
Choosing the GPU on Multi-GPU Systems

On Systems with several GPUs - especially on notebooks with integrated graphics and dedicated GPU - you need to choose which GPU U-RENDER will use.

To select the GPU you need to find U-Render.exe (usually in C:\Program Files\U-Render), right-click for the context menu and select the GPU from the “Run with graphics processor” menu.

We strongly recommend to use the “Change default graphics processor…” option to permanently configure which GPU U-RENDER uses.

Note: “Run with graphics processor” is only available on systems with more than one GPU.
If “Run with graphics processor” is missing from your context menu, you can set it the default in your GPU Settings (either Nvidia or Radeon Settings).

The fastest way to access your GPU settings is from your Windows Desktop. Right-click on an empty area of your desktop to get to the GPU settings.
Quick Start Guide - First Steps

This is a step by step quick start guide how to set up a scene from scratch and should give a main idea of the workflow. Every resource files and steps as C4D files can be found in the Quick_Start_Guide folder. Download the content from https://u-render.com/get/downloads/

Step 1 - Preparing U-RENDER view

After installing U-RENDER launch Cinema 4D and start U-Render.exe. The U-RENDER view appears.

If you go to menu View, you can check/uncheck Always-On-Top. That prevents other program windows overlapping the U-RENDER view window.
The bottom bar also shows basic information like render resolution, render time, Graphics Card, used VRAM and Port Number.

Step 2 - Load Quickstart scene

Load the quickstart scene:
\Quick_Start_Guide\ur_quickstart_step02_v001.c4d or create some props.

The quickstart scene contains a nice material probe that is very suitable for testing the appearance of materials.

Step 3 - Setting up U-RENDER
Go to render settings, set the output resolution you want (we choose a squared aspect ratio) and set U-RENDER as Renderer. Leave default settings for now. Render to Picture Viewer or render the current view. The rendering appears in the Picture viewer or current view as well as in the U-RENDER view.

**Step 4 - Creating and Assigning Materials**

Create U-RENDER Materials for Sphere, Floor, Base/Symbol and assign them to the objects. Leave the default Material Settings.

Note, as long "Live" is not activated (activation in step 5), you see the currently created Material in the U-RENDER view.

**Step 5 - Creating Spotlights and Light Tags**

Create some Spotlights and align them as you like. In this example there are 3 Spotlights created. Assign a U-RENDER light Tag on every light source, leave defaults.

**Activate U-RENDER Live mode: Plugins - U-RENDER - LIVE Mode**

The scene appears in U-RENDER view
**Step 6 - Tweaking in Real-time with LIVE Mode: Lights**

With activated Live Mode (Step 5), adjust your Lights position, color, intensity in the U-RENDER Light Tags.

The most important settings that should be adjusted are:

- **Attenuation:** inverse Square
- **Radius Decay** (depends how far away is your spotlight)
- **Outer Angle** (cone size of the Spotlight)
- **Shadow Mode:** Soft Edges
- **Shadow Map Size** (can be set for each light separately)
- **Sample Radius** (defines the softness of the shadows)
- **Absolute Bias, Slope Bias** (shadow contact and artefact optimization)

(U-RENDER Light Tag settings for the 3 Spotlights)
Step 7 - Tweaking in Real-time with LIVE Mode: Materials

Make sure that Live mode is active (Step 5).

For the wood material:

- put 04_wood_scotch_pine_diffuse.jpg into the Color texture slot
- set Brightness between 5%-8%
- put 04_wood_scotch_pine_glossiness.jpg into the Glossiness texture slot
- put 04_wood_scotch_pine_normal.jpg into the Normal texture slot with strength about 15%

Adjust the other created and assigned materials as you like. (if something goes wrong in the U-RENDER view and it doesn’t update, just deactivate and activate Live mode)

The scene contains bright single colored Materials with Brightness ~5% and Glossiness ~70%.

⚠ Note, that the material preview thumbnails are not updated, when Live mode is active. To update them, deactivate Live mode and double click on the thumbnail or select “Render All Materials” in the “Function” menu of the material manager.

Step 8 - Setting up IBL and Environment in Real-time with LIVE Mode

Using an HDR environment map is one of the most efficient ways to get very nice reflections and diffuse lighting with just a few clicks for the cost of very less performance.

Go to Render Settings - Environment and put a HDR image into the Global Environment Map slot: wood_03_010_2k.hdr. Note that the map has to be equirectangular mapped.

You also should activate Diffuse IBL. This generates very nice ambient light by calculating spherical harmonics based on the used HDR image. Adjust the Exposure values as well as the Azimuthal Rotation as you like.
Step 9 - Further Improvements

You may have recognized, that some areas of our scene are burned out because of the brightness of the lights and bright materials. In this case it is a good idea to activate tone mapping in the Render Settings. In this scene Reinhard does a very good job with a White Point value ~2

Also activate Ambient Occlusion to get more details for ambient diffuse dimming. When using bloom in a subtle way it gives a nice color bleeding like effect. Chromatic Aberration and Vignette gives the rendering some kind of photo like appearance.

Step 10 - Final Steps

Finally it's time to get rid of the pixelated corners and aliasing effects. Go to Render Settings - Basic and activate FXAA. This is a very fast anti aliasing algorithm that also can be turned on when working in LIVE mode in real-time. For final quality that may be not enough and Multi-Frame Sampling should be activated too. Note that the performance decreases but it does a very good job.
Render your Scene in the Picture Viewer with final settings and save your work.

Congratulations! You have mastered your first project with U-RENDER!
Live Mode

You can enable Live Mode by activating the “Live Mode” Command from the menu. We suggest, that you place the icon for the command somewhere in your UI layout where it will be easily accessible.

When you activate Live Mode the current state of the scene is synchronized in the background. Once all data has been transferred Live Mode goes active. Now you can make changes to your scene and see the updates of supported properties in real-time.

Features

The main purpose of Live Mode is to allow for real-time updates in the rendered image while you make adjustments to your materials and lights. Live Mode allows you to immediately see the effect of your changes. There is also limited support for updates of matrices, i.e. the position and orientation of objects. This allows to intuitively work on scene layout with real-time feedback on shadows, shading and reflections.

What Live Mode essentially tries to achieve is to provide instant feedback using high quality real-time rendering.

Currently, these changes are synchronized:

- Light Settings (for best results, use the U-RENDER Light Tag)
- Material Settings
- Object positions and orientations for the currently selected object

Dashboard

The Dashboard gives you better control over what kind of data is going to be updated when LIVE- Mode is active. Adjustments in this settings can be useful to increase the playback performance.

⚠ Deleting objects is synchronized always no matter if the update settings are turned on or off.

⚠ Creating objects is only synchronized when “Update Geometry” is turned on.
**Live Updates**

- **Transforms ON / OFF**
  Enables synchronisation of position, rotation and scale of objects.

- **Camera ON / OFF**
  Enables Camera updates in LIVE-Mode. Useful when using a single view panel and the scene has to be tweaked for a specific camera view. If enabling this option, the current view is updated automatically.

- **Lights ON / OFF**
  Enables Light updates in LIVE-Mode. Especially a high amount of point lights with high resolution shadow maps can cause longer render times.

- **Materials ON / OFF**
  Enables Material updates in LIVE-Mode.

- **Geometry ON / OFF**
  Enables Meshes updates in LIVE-Mode. Concerns mesh deformation based on point level animation or skinned meshes as well as modelling operations. Updating those types costs a lot performance. Also needs to turned on when creating new objects should be synchronized.

  ° Note that scaling a mesh in "Model mode" modifies vertex positions. Scaling a mesh in "Object mode" does change its transformation matrix and is a lot quicker to update.

- **Instances ON / OFF**
  Enables Render-Instance updates in LIVE-Mode.
Render Settings ON / OFF

Enables Render-Setting updates in LIVE-Mode.

Live View

Refresh Scene

Available when Live Mode is active. Deletes and resends the scene. Useful if the scene is not updated correctly.

Live Resolution

1. Viewport: Viewport mode is set by default. The U-RENDER Live View Window is using the resolution of the active viewport. If the size of the active viewport is changed, the U-RENDER Live View Window changes as well.
2. Output: Uses the render resolution that is set in the render settings for the U-RENDER Live View resolution.
3. Custom: a custom resolution can be set for the U-RENDER Live View resolution

Scale

Influences all Live Resolution Modes: The scale lets you fastly adjust the size of the U-RENDER Live View resolution.

Limitations

There are a couple of limitations to Live Mode as U-RENDER needs to parse the Cinema 4D scene to update the rendering. Most of these limitations are due to performance constraints. Parsing the whole scene, including meshes for all objects, would take too long to still have real-time feedback. So we limit updates to immediate changes that are quick to parse.

These are the most significant limitations:

- Mesh deformations and geometry changes are only updated when enabled in the Dashboard
- Scaling: In Model Mode scaling changes vertex positions. The changes are only updated when geometry updates are on (see the Dashboard).
In Object Mode, scaling changes the object transformation (scaling) parameters. The scale is updated when transform updates are on (see the Dashboard).

We are looking into ways to add more features to Live Mode and to increase its performance.
Render Settings

Basic

General

✦ Default Light

The U-RENDER default light is parented to the position of the active render camera. If a light source is created in the scene, the default light is deactivated automatically and doesn’t influence the render result. It doesn’t need to be turned off manually in the render settings.

✦ Autostart U-RENDER for Rendering/Material Previews

This option lets U-RENDER start automatically and render the Material Previews, Render View, Picture viewer and U-RENDER Live without starting the application manually. Note that you have to set the executable path of the application in the global preferences (Edit - Preferences - U-RENDER)

✦ Render-Resolution Overscan

Renders a larger image but keeps the resolution that is set in the render settings output or live view resolution. This can help to prevent screen space effects like Ambient Occlusion or Screen Space Reflections from fading out too early.

Note that the use of Render-Resolution Overscan results in longer render times.

(Render-Resolution Overscan: xy=0%, xy=50%)
In the following example the output resolution is set to 1920x1080. Render-Resolution Overscan x and y is set to 25%. So U-RENDER renders the image in 2400x1350 but the output of the render result is 1920x1080. You can see both resolution values in the bottom bar of the U-RENDER Live View window:

Shaders

➧ Render Resolutions
Sets the resolution of low/medium/high setting Cinema 4D shaders are rendered in picture viewer. Also see chapter "Materials - Cinema 4D Shader support"

➧ Preview Resolutions
Sets the resolution of Cinema 4D shaders for Material Preview and Live-Mode. See also chapter "Materials - Cinema 4D Shader support"

Anti-Aliasing

➧ Anti-Aliasing Mode FXAA
Simple mode that work very fast and gives a basic amount of antialiasing. Can be combined with Multi-Frame Sampling.
Enable Multi-Frame Sampling

Enables/disables Multi-Frame Sampling. This method gives a high quality result of aliasing but also costs render time with increasing passes. It’s good for final quality rendering.

Samples

⚠ Sets the samples n². A value of 2 means 4 x samples.

Filter Size

Adjusts the area that is sampled. A higher value gives a softer result but has a better chance to reduce aliasing artefacts.
Displacement

❖ Enable Displacement

Enables/disables the geometry displacement. Enable if displacement maps are set in U-RENDER materials.

❖ Limit Displacement Steps/Maximum Displacement Steps

Limits the maximum subdivision level of U-RENDER materials for the entire scene by setting maximum displacement steps. It limits the Subdivision Level of the displacement setting in the material.

Environment

Background

❖ Background Color

You can set a background color that appears in the U-RENDER view instead of the black default environment. The background color does not influence the appearance of the scene lighting at all. If tone mapping is used, note that you can enable or disable the effect of tone mapping by checking “Apply on Background” on/off in Render Settings - Tone Mapping/Gamma - Tone Mapping Settings. This is useful if you need a certain color as background that is not influenced by tone mapping.

❖ Ambient Light Color

Sets a global ambient light that influences the entire scene. It’s black by default and calculated additionally to the Diffuse IBL settings. Using the Ambient Light is the simplest way to give the impression of indirect illumination.

(Ambient light: black / grey / bluish color)
Environment Map

Image Based Lighting (IBL) is based on spherical harmonics and provides a very efficient and fast way of diffuse and specular ambient illumination of objects or entire scenes based on an equirectangular image. For best results use a high dynamic range image.

1. Select an equirectangular environment map as global environment map (32-bit float *.hdr recommended). Specular IBL is activated automatically. (needs material with Reflectance Channel turned on)
2. Enable diffuse image based lighting by activating "Enable Diffuse IBL" (needs material with diffuse Color brighter than black)

(IBL image based lighting: off / on / the used HDR environment map)

Global Environment Map

Select an equirectangular environment map for setting a global environment map. (32-bit float *.hdr recommended).

Exposure

Adjusts the brightness of the image and the strength the HDR is affecting the specular reflection of materials. The amount of this value depends of the dynamic range and general exposure of the used environment map.

⚠ The exposure doesn’t influence the behaviour of the diffuse IBL.

Azimuthal Rotation

Due to the calculation of the IBL based on the environment map, you can use the Azimuthal Rotation to adjust the horizontal orientation. This also affects the Diffuse IBL as well.

Use As Background

When activated, the environment map is displayed as background image in the U-RENDER view. Check the tone mapping render settings if you want to have tone mapping affecting the background or not.

Blur Factor
The Blur Factor gives some control about blurriness of the environment when used as background. That blurriness does not influence the blurriness of the specular or diffuse IBL calculation.

- **Enable Diffuse IBL**

  Turns the diffuse image based lighting on or off and depends on the global environment map. Diffuse IBL is based on spherical harmonics and provides a very efficient and fast way of diffuse ambient illumination.

- **Exposure**

  Adjusts the strength the environment map is affecting the diffuse illumination of materials. The amount of this value depends on the dynamic range and exposure of the used environment map. It does not influence the strength of the specular IBL. Use the Azimuthal Rotation to adjust the orientation.

  ![IBL: off / 0.2 / 0.5 / 1.0 / 2.0](image)

- **Occlusion**

  IBL Occlusion is depending on the Screen Space Ambient Occlusion (SSAO) (Render Settings - Effects - Ambient Occlusion). Set IBL Occlusion value to 0% if you don't want extra calculation of ambient occlusion on IBL illuminated geometry/areas. 100% IBL Occlusion uses the SSAO settings to decrease ambient illumination on self shadowing areas of nearby geometry.

- **Samples**

  Defines the number of samples used to calculate IBL. In most cases the default value of 10,000 should work fast with good quality.

**Reflectance**

This option allows to adjust global settings of the the screen space reflections. Note, that they also have to be activated for each material in the material reflectance settings. In the current version the result may be slightly different between rendering in live mode and picture viewer.

- **Enable Screen Space Reflections**

  Check on to enable the SSR.

- **Ray Trace Iterations**
Increase the iterations to include larger distances that should be reflected.

(iterations: 100 / 500 / 1000)

✧ **Jitter**

Defines the density of the Screen Space Reflections and can be used if the Screen Space Ray Trace Iterations has to be very low.

(Jitter: 1 / 100 / 200)

✧ **Screen Fade Start/End, Distance Fade Start/End**

This values adjust the amount of fade in general and screen space.

(different fade start/end examples)
Shadows

✦ Default Shadow Map Size

This is the default Shadow Map Size that is used, if in the U-RENDER Light tag is no specific shadow map size defined. (See U-RENDER Light Tag - Shadows chapter for shadow examples)

✦ Shadow Map Size Limit

No Lightsource can have a higher Shadow Map Size larger than the Limit Size. Check Use Limit to activate. It is a good way to increase the FPS in LIVE mode without adjusting every single Light source.

✦ Use Limit

Enables the Shadow Map Size Limit and overwrites the U-RENDER Light Tag Shadow Map settings.

Effects

Motion Blur

Supported Motion Blur: Camera Motion Blur and Object Motion Blur. In the current Release of U-RENDER, object deformation is not supported by Motion Blur.

⚠ Note, that Motion Blur is deactivated in LIVE-Mode. Render a sequence in Picture Viewer to get the render result with Motion Blur.

⚠ When scaling objects be sure that you use Object Mode and not Model Mode.

Use the Shutter Speed or Shutter Angle of the camera to adjust the strength of the Motion Blur. Smaller Shutter Speed/Shutter Angle values provides less Motion Blur.

(Shutter Speed: 1/125s, 1/30s, 1/8s)
Reconstruction Dithering

This value gives control over the Motion Blurs Dithering. Higher values produces smoother Motion Blur.

⚠ If Motion Blur is needed for a single still frame, you have to render an image sequence of at least two frames to get a proper result.

Depth of Field (Experimental)

Depth of Field refers to the range of distance that appears acceptably sharp. It depends on the distance between camera and objects and the camera settings. Depth of field settings are available in the U-RENDER Camera Tag.
Enable Depth of Field

Enables/disables Depth of Field for the entire scene.

Sample Count

Adjusts the amount of samples that are used to calculate Depth of Field.

Ambient Occlusion

Ambient Occlusion defines if a point is lit by ambient light.

You can choose between Hemisphere AO and Ground-Truth AO.

(Ambient Occlusion off / Hemisphere-AO / Ground-Truth-AO)

⚠ Note, if there is no ambient light set, there are also no occluded areas. If lighting a scene with spots/omnis/direct lights without ambient light you will not see any kind of ambient occlusion at all, because this light sources cause diffuse light and not ambient
light. In order to have ambient occlusion effect set an ambient light in Render Settings - Background - Ambient Light Color or/and Render Settings - Environment - Environment Map and Enable Diffuse IBL.

⚠ Ambient Occlusion can cause artefacts in the render result. To fix them, adjust the near and far clipping values in the U-RENDER Camera Tag. You also can try to raise the Hemisphere Offset value when using Hemisphere AO method.

Hemisphere Ambient Occlusion

This Ambient Occlusion method is very fast and the result is smoother than the Ground-Truth Ambient Occlusion.

❖ Radius

Defines the distance geometry occludes nearby areas. Note that the units are [cm].

(Hemisphere-AO radius: 2 / 8 / 32)

❖ Power

Defines the strength of darkening of the occluded areas.

(Hemisphere-AO power: 1 / 4 / 8)

❖ Samples

Sets the samples that are used for calculation. High amounts causes more render time.
Hemisphere Offset

Small amounts gives detailed results if objects are very close to each other. Otherwise small amounts can cause unwanted occlusion on faces that are bend very slightly and nearly flat.

⚠ Note that the units of the Hemisphere Offset are [cm].

Ground-Truth Ambient Occlusion

This method is more advanced than Hemisphere AO. It is good when there are fine details needed. When increasing the values it can cost more render time compared to Hemisphere AO.

⚠ Note, when using Spherical Camera use the Hemisphere AO. The Ground-Truth AO method can produce unwanted seams and wrong shading.

Radius

Defines the distance geometry occludes nearby areas. Note that the units are [cm].
Max. Range

Limits the visible range of the Ground-Truth-AO of the set radius.

Sample-Steps

Increased Sample-Steps provides smoother results.

Power

Defines the strength of darkening of the occluded areas.
Use fast preview-filter in Live-Mode

Activating this option when working in Live-Mode can greatly increase the performance. Note, that there may occur flickering artefacts that are caused by the Ambient Occlusion, so deactivate this option when rendering the final image.

Enable Depth-Peeling

This option uses depth peels to "look" behind objects and prevents halos that can occur on foreground objects when there are other object close behind them.

Include Backfaces (option for Depth-Peeling)

Only active if Depth-Peeling is enabled. Includes backfaces for calculating the Ground-Truth Ambient Occlusion.

Depth-Layers Count (option for Depth-Peeling)

Only active if Depth-Peeling is enabled. Increase the layer count if there are still halos visible when Depth-Peeling is enabled. High values costs render time.

Bloom

Bloom simulates the artifact effect of camera lenses that cause bright light to fade outside from bright areas.
Firefly Reduction can help to reduce flickering of the Bloom effect when there are small but bright spots ("fireflies") in your image that change over time. Firefly Reduction limits the luminance of the image when calculating the bloom. This will result in a reduction of the bloom intensity but also helps to get rid of flickers.

Intensity

Adjusts the intensity of bloom. Higher values mean brighter bloom.

![Image showing the effect of varying intensity settings](image)

*bloom intensity: 0.1 / 1.0 / 3.0*

Inner Weight

Inner weight controls the intensity of the bloom on the “inside”, i.e. close to the bright area.

Outer Weight

Outer Weight controls the intensity of the bloom on the “outside”, i.e. further away from the bright area. Reduce the Outer Weight to decrease the radius of the bloom.

![Image showing the effect of varying inner and outer weight settings](image)

*Weights: Inner 1.0, Outer 1.0 / Inner 2.0, Outer 0.5 / Inner 5.0, Outer 0.5*

Fog

Fog sets the obscurance of objects that are far away. This effect is a post effect and doesn’t interact with light sources and objects in the scene. It can be used for basic ground fog as well as distance haze.

![Image showing the effect of fog](image)
Fog Color

Sets the fog color that also can be used to darkening the scene in distance when using a dark color.

(fog color white / light orange / black)

Falloff Type/Density/Distance

This settings controls the density of the fog starting from the camera along the view direction.

(fog: off / density 0.5, distance 600 / density 2.0, distance 600)

Height Falloff/Height

The height falloff lets the fog fade also in +Y direction, starting from scene point 0,0,0.

(exponential falloff, height 25 / linear falloff, height 100 / exponential falloff, height 100)
Tone Mapping / Gamma

Tone Mapping Settings

❖ Enable Tone Mapping

Enables/Disables tone mapping. Prevents the render result from clipping to white.

(tone mapping: off / Reinhard white point 1.5 / Reinhard white point 5.0)

(tone mapping: off / Exponential white point 1.5 / Exponential white point 5.0)

❖ Affect Background

Use this option if you want to have your background tonemapped or not. It influences background color as well as environment map, if it’s set for use as background.
Tone Mapping Mode

Sets the tone mapping mode Linear, Exponential or Reinhard. In most cases Reinhard does a very good job.

Use HSV colorspace

When working with high reflective materials, there can be unwanted hue shifts in the specular highlights. In this cases use HSV colorspace for compensation.

Exposure

Increasing the exposure increases the brightness of the render result but clipping in bright areas can occur.

Black Point

Increasing the Black Point makes the rendering darker without touching the highlights.

White Point

White Point adjusts the amount how strong the highlights are shifted into visible dynamic range. This will be the most important setting for tone mapping.

Post Processing

Chromatic Aberration

Simulates the different refraction indices of different wavelengths of lenses. As result high contrast areas like edges are blurred with specific colors. This effect increases the closer the distance to the image border.

Enable Chromatic Aberration

Enables/Disables Chromatic Aberration.

Strength
High values cause more blur with increasing amount to the borders of the image.

(strength 0 / 10 / 20)

**Vignette**

Vignetting reduces the brightness of the image at the image border. It can be used to emphasize and draw attention to the image center.

🔹 Enable Vignette

Enables/Disables Vignette.

🔹 Radius

(radius 20 / 40 / 60)

🔹 Softness
Gamma

Output Color Profile

Choose the according output color profile to adjust the gamma value for your image.

Available options are:

- **Use Output Format**: Use this setting to make sure the gamma matches what Cinema 4D is expecting. The gamma is adjusted according to the Image Color Profile selected in the "Save" tab of the render settings. Right now, U-RENDER only understands sRGB and Linear color profiles. "Use Output Format" also makes sure to automatically change the color space to Linear for Multi-Pass rendering.
- **sRGB**: The image will be gamma corrected for sRGB (a gamma of roughly 2.4)
- **Linear**: The image will be kept in linear space (gamma 1.0). Use this if you want to continue to work in linear light for compositing.
- **Custom Gamma**: Custom Gamma allows you to set any gamma value you need.

Gamma

Define your custom output gamma here. This field is only available when “Custom Gamma” is selected in the Output Color Profile.
Multi Pass

Multipass rendering allows you to have control over many aspects of the render result by rendering a single frame splitted into various files called multi passes.

Note that enabling the Multi Pass option takes longer render time. Also the file format and type of compression strongly influences the render time. In general, higher compression causes longer render time but smaller file size and vice versa.

Multi Pass render time/filesize examples:

<table>
<thead>
<tr>
<th>Fileformat</th>
<th>Compression</th>
<th>Render time [mm:ss]</th>
<th>File size [GB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OpenEXR 32 bit float</td>
<td>none</td>
<td>01:59</td>
<td>7,7</td>
</tr>
<tr>
<td>OpenEXR 32 bit float</td>
<td>Zip in blocks of 16 scan lines</td>
<td>05:25</td>
<td>1,3</td>
</tr>
<tr>
<td>OpenEXR 32 bit half float</td>
<td>none</td>
<td>01:54</td>
<td>3,9</td>
</tr>
<tr>
<td>TIFF 32 bit</td>
<td>Compression pack bit</td>
<td>02:02</td>
<td>5,4</td>
</tr>
<tr>
<td>TIFF 32 bit</td>
<td>LZW compression</td>
<td>02:40</td>
<td>2,3</td>
</tr>
</tbody>
</table>

Matte

These special passes need additional Multi Passes that have to be created with the Multi-Pass option in the render settings:

❖ Object Id

Create an “Object Buffer” in Multi Pass with corresponding Group ID that matches the Compositing Tag on your object. The result is a black/white pass that can be used for masking an object. Use Cinema 4D Documentation for more information about Object Buffer. Also activate the “Object Id” multipass.

❖ Material Id

Create a “Post Effect” in the Multi Passes and check if your Materials have assigned a Material ID Color in the Material Editor. The result is a multicolored pass where every material has a specific color that can be used for masking/keying in your compositing software. Note that you have to apply “Post Effects” in C4D Multi-Pass menu.

Lighting

Except of the RGBA Image pass, all the passes of this group are necessary to get the correct render result.

Available Passes:

❖ RGBA Image
● Ambient
● Diffuse
● Specular
● Reflection
● Refraction
● Ambient Occlusion

Material

All passes in this group are necessary to get the correct render result.

Available Passes:

● Material Diffuse
● Material Specular
● Material Emissive

Advanced

This are additional passes that can be very useful to make additional effects in your compositing application. Note, that for the Depth pass you need to activate near and far clipping settings in the U-RENDER Camera Tag.

Available Passes:

● Material Normal
● Material UVW
● Depth

Compositing in After Effects

We recommend OpenEXR 32-bit float/half float file format for the multipasses. In this case it is important to use 32-bit float compositions and make following Project Settings:

In the Color Settings tab use “32-bits per channel (float)” as depth and use “sRGB IEC61966-2.1” as working space.

Also activate “Linearize Working Space”
Use following compositing approach to get the same result as the single pass render result:

Tip: If you don’t have a tone mapping plug-in installed in After effects, the built in “HDR highlight compression” effect assigned on an adjustment layer on top does a good job to bring values higher than 1 into a visible range.

Compositing in Fusion
Note that following effects are currently not included in the multi passes and have to be done in your compositing software:

- Tonemapping
- Vignette
- Chromatic Aberration
- Depth of Field
- Bloom
- Anti Aliasing
Materials

The U-RENDER Material focuses on easy and fast adjusting and creating physically based materials. If you don’t see the material previews in the Material Editor or the Material Manager be sure that U-RENDER is set in the Render Settings and refresh the Material thumbnail by double clicking on it in the Material Editor.

Texture Projections (Procedural UVs)

One major benefit of U-RENDER is the ability to use texture projections in addition to uv texture coordinates. This can be a major time saver as there is no need to create uv-maps for each models.
These texture projections are supported:

- Spherical
- Cylindrical
- Flat
- Cubic
- Frontal
- Spatial
- UV
- Shrink Wrapping
- Camera Projection

In addition to the projection types, tiling, repetition and offsets are supported as well.

**Cinema 4D Shader support**

It is possible to use a wide range of Cinema 4D shaders for U-RENDER Materials. Not every C4D shader is supported at the moment. In general, all color correcting (filter, colorizer, posterizer) layering (layer, fusion) and shaders that produce textures (noises, surfaces) are supported well. Shader that rely on render-time ray-tracing information will not work correctly.

⚠ We recommend to use C4D Shaders sparingly because texture baking can be time consuming!

⚠ If a C4D Shader is used as grayscale value for a material the gamma value for the texture has to be 2.2 that a grayscale value of RGB 128/128/128 corresponds to 50%. You can use the gamma slider for this adjustment.

Note that you set the number of CPU threads that should be used for texture baking in the global U-RENDER preferences (Menu: Edit / Preferences).

**Cinema 4D Shader baking resolution**

You can set three resolution settings for every Cinema Shader that needs to be baked separately. The specific resolution can be set in the “Render Settings - Basic - Shaders” tab. Because U-RENDER needs to bake the shaders, this process takes some time. To get a good performance we implemented separate resolution settings for U-RENDER live view and picture viewer renderings.

- If you want to adjust the entire scene/baking performance in LIVE mode, just set the resolution the Render settings.
- The settings in the Material Editor gives you control over specific materials that needs resolution adjustments.

**Animated**

Set this option active if using animated textures, noises, image sequences or movie clips as texture.
Resolution

There are three quality settings low/medium/high. This setting affects the resolution the shaders are baked and rendered in LIVE mode as well as in picture viewer. The default value is “medium”. When activating low or high, the resolution is set one step lower or higher. In this example lower would be 128x128 and higher 512x512.

The output resolution that is used for the picture viewer is set in the “Render Settings - Basic - Shaders - Render Resolutions” menu.

The Preview resolution for LIVE mode medium setting is set in the “Render Settings - Shaders - Preview Resolutions.”
General Texture Adjustments

All textures (normal map texture with restrictions) can be modified with several parameters to adjust brightness/contrast and other effects.

They also can be mixed with color or values by using blend modes (except normal map and emissive texture).

- **Mix Mode / Mix Strength**
  
  Possibility to blend the color/value with a texture (blend, add, multiply).
  
  For using a texture without mixing with color/value set blend mode to "blend" and the mix strength to 100%.

  (mix mode blend, mix strength 25 / 50 / 75)

- **Brightness**
  
  Adjusts the brightness of a texture from black (-100%) to white (+100%). Note that the brightness slider doesn't avoid clipping to black or white.

  (brightness 85 / 50 / -50 / -85)

- **Contrast**
  
  Adjusts the contrast of a texture from grey (-100%) to black/white (+100%). Note that the contrast slider doesn't avoid clipping.
 Gamma

Adjusts the gamma of a texture. Due to the nonlinear behavior of gamma, it avoids clipping to black or white.

 Invert

Inverts the entire texture.

Color

 Color

Defines the diffuse color of the material. Use dark color for metals.

 Texture

Loads a texture as diffuse color. Use any common file-format 8/16/32 bit. All textures in the U-RENDER Material (except normal map) have basic color correction sliders for Adjustment.

 Brightness/Contrast/Gamma/Invert

See: General Texture Adjustments
Emissive

❖ Color

Defines the color of the emission.

❖ Brightness

The brightness value allows you to tune the emission amount without the need to change the color. It acts as a multiplier for the emissive color as well as textures.

(solid emissive color color, emissive brightness: 0 / 250 / 500)

❖ Texture

You can use a texture for the emissive color.

(emissive texture)

❖ Brightness/Contrast/Gamma/Invert

See: “General Texture Adjustments”
Transparency

The Transparency channel enables the possibility to create transparent materials like glass, water etc. Note that you can set the specular reflection separately by using the reflectance channel.

Rendering of transparent objects are a challenge for real-time rendering. Either is is really slow or it compromises on quality. Right now U-RENDER uses “order independent transparencies”. This approach does not require to sort all polygons before rendering - which is good for the rendering speed. It has a couple of limitations though. First, the algorithm does not know which object is in front of the other. This can lead to "wrong" looking results with objects that are more opaque. As all transparent objects are drawn in one pass they also cannot refract and blur each other.

![Examples of materials with transparency](image)

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Opacity

Opacity affects diffuse and emissive properties of the material. Following example shows the effect of different opacity values and the material color set to white.

![Opacity](image)

Refraction

The IOR values for most materials is between 1,0 and 3,0. Refraction are a screen space effect. That means, other than with ray-tracing, only what is visible on the screen already can be seen (refracted) through transparent objects.
Transmission

To create a colored transparent object, use a transmission color other than white. The transmission color defines what color (wavelengths) are passing through the object. It is effectively the inverse of the absorption color. For example, a green transmission color makes the object appear green as it will absorb red and blue colors that are passing through the object.

Blurriness

This value simulates the diffusion of transmitted light and can be used for frosted glass effects. Blurriness does not affect other transparent objects. Note that the glossiness of reflectance is not affected by the transparency blurriness. You have full control of reflection glossiness in the reflectance channel of the material.
**Clear Coat**

Clear Coat is an additional layer with Reflectance and Glossiness/Roughness that can be used for car paint materials for example. In the current release of U-RENDER it is possible to use textures to define the Glossiness/Roughness. The use of separate Normal/Bump map is planned for future releases.

**Strength**

Defines the amount how strong the Clear Coat will appear. Note that the Material is still energy conserving when using Clear Coat, so it also influences Reflectance Channel as well as Diffuse Channel.

(Strength 0% / 50% / 100%)

**Glossiness/Roughness**

The Glossiness/Roughness defines the scattering of the specularity if the Clear Coat looks rough or glossy.

(Glossiness 50% / 80% / 100%)

**Normal**

The Clear Coat can have its own normal map and also be blended with the global Normal/Bump Channel.
1. Left: No Clearcoat Normal at all: Blend with Base Layer 0% and Strength 0%
2. Middle: Blend with Base Layer 100% and Strength 0%
3. Right: Blend with Base Layer 50% and Strength 40% ⚠ Note: If you set the Blend with Base Layer value to 100% the global Normal/Bump Channel is completely overwritten.

Reflectance

*examples of specular and glossiness textures*

Environment

🔹 Apply Global Environment Map

When active the global environment map from the Render Settings is used. Using an environment map greatly improves the appearance of the material. When you disable the environment, the reflectance only considers light sources for specular reflections.

🔹 Exposure

Works as an exposure multiplier for the global environment map. It affects the specular environment reflections but not the diffuse image based lighting (IBL). Use the exposure to increase or decrease the environment reflectance of specific materials to fine-tune their appearance. Typically, you do not need to adjust it though.
Fresnel Reflectance

➤ Workflow: Metallic

The reflectance of the metallic workflow depends on the base color of the color channel. Because of that, there is a metalness value instead of a color to define the appearance of the material. The higher the metalness value the more of the base color is used for the color of the specular reflection.

⚠ Note that nonmetal materials like plastic, stone, wood etc. have a very low metalness value (4%-8%) and metal materials like chrome, copper, gold etc. have very bright metalness value (80%-100%).

If a colored texture is used for “Metalness”, you can select which RGBA channel should be used for calculation. Default value is “Luminance” and is calculated from the combined RGB values.

➤ Dielectric F0

This value lets you tweak the fresnel factor independently from the metalness value. Note that this adjustments are more noticeable when working with nonmetal materials.

➤ Workflow: Specular

The reflectance of the specular workflow uses a specular RGB texture to define the appearance of the material.
⚠ Note that nonmetal materials like plastic, stone, wood etc. have a very dark brightness value (4%-8%) and metal materials like chrome, copper, gold etc. have a bright brightness value (80%-100%). Also the color of the reflectance depends specular color and texture.

_workflow: Hybrid

The hybrid workflow lets you combine the metallic and the specular workflow to get even more control of the appearance of the material. It uses Metalness texture as well as Specular texture.

Glossiness/Roughness

The glossiness/roughness defines the scattering of the specularity if the material looks rough or glossy.

It’s a good way to set the overall glossiness/roughness with the slider and then blend it with a texture to get very versatile appealing results. Note that you can use glossiness or roughness workflow for metallic, specular and hybrid materials. You also can use a glossiness texture as roughness texture if the invert option is active and vise versa.

⚠ Note that Glossiness/Roughness are very important material settings that influences the appearance very much. To get very soft, rough materials just decrease the Glossiness value or increase Roughness value.

_workflow Glossiness/Roughness

Defines how glossy or rough a material appears. 100% glossiness means that it is not rough at all and behaves like a mirror vise versa. The glossiness/roughness slider conforms a grayscale value: 0% = black and 100% = white.
Texture

Use a grayscale image to define the glossiness/roughness of the material. When a colored texture is put into the Glossiness/Roughness channel the luminance values are used for calculation.

Brightness/Contrast/Gamma/Invert

See: General Texture Adjustments

Screen Space Reflections

Screen space reflections allows objects to reflect each other in the scene. Check the Render Settings for global SSR settings.

Enable

Turns screen space reflections on/off for the material. The appearance of the reflections depends on the Specular Brightness and Glossiness/Roughness of the material.

Exposure

With the Exposure value you can make the Screens Space Reflections brighter or darker.

(SSR: off / on / increased exposure value)
Bump

Bump mapping is an efficient way to get additional structures on surfaces based on a grayscale map (height map). Bright areas of the map define bulges and dark areas define notches. Due to the mesh geometry is not deformed by bump maps they are generally used to fake microstructures and smaller details on surfaces.

You can use bump and normal map together, they are added.

Strength

Strength adjusts the amount of bumpiness according to a grayscale texture (heightmap). Set a negative value to switch bulges with notches.

Texture

Use a grayscale image (heightmap) that defines the bump appearance. If a colored texture is used, the color information is ignored and only the values are used for calculation.

(bump: off / strength 40 / strength 80)

Brightness/Contrast/Gamma/Invert

See: General Texture Adjustments
Normal

Normal mapping is an efficient way to get additional structures on surfaces based on a colored map where defined colors defines XYZ alignment and how the normals of the surfaces are modified. Due to the mesh geometry is not deformed by normal maps they are generally used to fake microstructures and smaller details on surfaces.

⚠ Note that there are two kind of normal maps with an important difference: OpenGL normal maps uses green color for surfaces that are facing upside (+Y) and DirectX normal maps uses green color for surfaces that are facing downside (-Y).

You can use bump and normal map together, they are added.

✦ Flip X (Red)

Activate this option if red color in your normal map defines surfaces that are facing negative X direction. When using standard OpenGL or DirectX maps this should be deactivated.

✦ Flip Y (Green)

Activate this option if you are using a DirectX normal map. (green color defines surface facing down)

✦ Strength

Sets the amount the normal map texture influences the surface. Set a negative value to switch bulges with notches.

✦ Texture

Use an OpenGL(+Y) or DirectX(-Y) normal map. The usage of grayscale images may produce weird artefacts.

(normal: off / strength 50 / strength 200)
Displacement

Displacement uses a heightmap to deform the geometry. The higher the subdivision levels are set in the material as well as in the render settings the more detailed information can be used for tessellation and displacement.

⚠ Note that displacements mapping has to be activated in the Render Settings - Basic - Displacement - Enable Displacement to have an effect.

✦ Strength

Strength adjusts the amount of displacement according a grayscale texture (heightmap) and height value. Set a negative value to switch bulges with notches.

✦ Height

This value is used to set the maximum displacement height/depth. Fine adjustment can be done with strength slider.

✦ Subdivision Level

Sets how often the polygons on the mesh are divided by the GPU. Note that there can be set a limit in the render settings Render Settings - Basic - Displacement - Limit Displacement Steps. If you set a limit for displacement steps, the subdivision level in the material is limited by this value. Also note, that the maximum subdivision level is limited by the used GPU.

(displacement: off / subdivision level 1 / subdivision level 64)

✦ Smoothing

This value adjusts the smoothness of the displacement shading / normals interpolation. It doesn’t change the displaced geometry itself. In many cases, lower values suit better for hard surface displacement and higher ones for organic shapes. It also can be useful for tweaking noisy height maps or to reduce compression artefacts if using low quality jpegs for displacement.
Choose one of the following displacement types:

- **Intensity** needs a grayscale heightmap and displaces the geometry outside the existing geometry.
- **Intensity (centered)** needs a grayscale heightmap and displaces the geometry outside as well as inside the existing geometry.
- **RGB (XYZ Tangent/Object/World)** needs a colored vector displacement map.

**Texture**

Load the displacement map and set the according type to work properly.

**Brightness/Contrast/Gamma/Invert**

See: General Texture Adjustments

**Assignment**

If this material is assigned to objects, they are all listed here. If entries are deleted manually, only the material tag disappears on the objects.
Mask

As a quick alternative to transparencies, materials support a mask (stencil) texture. You can select the threshold when the object should be masked (i.e. be invisible). This can be used to render leaves, fences, grids etc. without the need for slower transparencies. Masked parts of the object are clipped / invisible.

➤ Threshold

Choose a threshold at which the object should be clipped. The default value of 0.5 usually works well. As soon as the mask value is smaller than this threshold, the object will be invisible.

➤ Channel

Choose the channel which should be evaluated for the threshold.

Options are:

- Red - the red texture channel will be evaluated
- Green - the green texture channel will be evaluated
- Blue - the blue texture channel will be evaluated
- Alpha - the alpha channel of the texture will be evaluated. Make sure the texture used actually has an alpha channel. You can for example use the same texture as for the diffuse color.
- Lumiance - the overall texture luminance (RGB) will be evaluated

➤ Texture

The texture that will be used to evaluate for visibility. You can use for example the diffuse texture if that has an alpha channel. You can also use shaders like Noise in the texture slot.

Material Id Color

The Material Id Color is useful if rendering multi-pass frames to achieve a multi-colored render pass that can be used to masking/keying out materials.
Lights

U-RENDER supports a range of light types to calculate diffuse and specular light contributions:

- point/omni lights
- spot light
- infinite lights
- area lights (disc, rectangle and sphere shapes)

Real-time shadows rely on the calculation of shadow maps. We are still investigating other methods of shadows that could exceed the current limitations of shadow maps.

Supported shadow types are:

- None
- Hard Shadow Maps
- Soft Shadow Maps

U-RENDER tries to match the behaviour of Cinema 4D’s light sources as closely as possible. So lights without light tags work to a certain extend. Note, that not all parameters that Cinema 4D light objects offers are supported by U-RENDER though.

We recommended to apply a U-RENDER Light Tag on your light sources to get quick access to all supported light features.

Default Light

U-RENDER uses a default light when there is no light source in your scene. As soon as there is a light in your scene, the default light is disabled.

You can disable this default light in the Render Settings.

U-RENDER Light Tag Settings

General

- Color
  Defines the light of the color. You can adjust the color in the U-RENDER Light Tag as well as in the light object Basic tab, the values are parented.

- Intensity
  Sets the brightness of the light and works as multiplier for the light color.

- Type: Omni / Spot / Infinite / Area
  Sets the light type and makes light specific parameter available or unavailable.
Attenuation

Sets the attenuation of the light source. Use Inverse Square (photometric light intensity) falloff to have an physically correct falloff. Other falloff types are supported as well and may give you a result that matches your idea more closely. If you want to fake sunlight use an infinite light type and set the attenuation to “none”.

Options are:

- None - useful for very distant light sources which attenuation does not change over the range of the scene (e.g. sunlight)
- Linear
- Inverse Square
- Inverse Square Limited
- Step

Radius/Decay

Defines the distance where the falloff of the light starts.

Near Clip

Sets near clipping values with an from/to fall-off. All objects that are out of the clipping setting are unlit.

Far Clip

Sets far clipping values with an from/to fall-off. All objects that are out of the clipping setting are unlit.

Inner Angle

Only available for spot lights. Defines the inner spotlight angle until which the light retains maximum intensity.

Outer Angle

Only available for spot lights. This outer angle defines where the intensity drops to zero.
Area Shape (Area Lights Only)

Select the shape of the area light. Available options are:

- Rectangle
- Disc
- Sphere

Size X, Y, Z (Area Lights Only)

Define the size of the area light.

Show in Render (Area Lights only)

Enable this option to make the area light visible in the rendering.

Single Sided

Light is only emitted on one side, in direction of the positive z-direction. This matches Cinema 4D light’s “Z Direction Only” setting.

Diffuse

If active, the light creates diffuse lighting. Default value is active.

Specular

If active, the light creates specular lighting. Default value is active.

Shadows

Shadow Mode

U-RENDER provides several shadow modes: None, Hard, Soft Edges. Every mode has specific abilities.
Sets the shadow color. In reality shadows only exists at the absence of light and have no color. The effect of a colored shadow can occur when light is hitting transparent materials. We see green glass if all wavelengths are absorbed by the object except parts of the green ones that are transmitted. There are also parts of green light passing through the glass and the casted shadow seems green. Also atmospheric effects can cause the impression of bluish colored shadows the more the distance increases, as well as other participating media effects.

(shadow color black / blue / brown)

❖ Shadow Map Size

It is possible to define the shadow map size for every single light source in the scene. Smaller map sizes render faster and influences the precision and appearance of the shadows. Note that it is possible to set the default shadow map size in the Render Settings, as well as set up the maximum shadow map size a light source can have. In that case, the Light Tag Shadow Map Size is overwritten.

(shadow map size hard shadows 256 / 1024 / 4096)
Absolute Bias

Available for all shadow modes. This value tweaks the contact shadow behavior. Small amounts produce accurate shadows without offset between tangent objects and reduces the impression of floating. Otherwise small amounts can produce artefacts on larger scene scales. In order to have the best result, this value has to be tweaked for all light sources.

Slope Bias

This value tweaks shadow artefacts that can occur when the angle between light, surface and camera is very flat. Also good for optimizing in cases where the Absolute Bias has to be very low. Most artefacts occur when using point lights and hard shadows.

Shadow Sample Radius

Available for Soft Edges shadow mode. Adjusts the softness of the shadows. Note that higher values produce softer shadows but longer render times.
(sample radius 1 / 5 / 10)
Cameras

U-RENDER Camera Tag Settings

Clipping

Near Plane
Sets the near plane distance of the camera. There is no rendering of objects between camera and near plane distance. Also important when rendering Depth multipass to adjust the beginning of the grayscale depth gradient.

Far Plane
Sets the far plane distance of the camera. There is no rendering of objects behind the far plane distance. Also important when rendering Depth multipass to adjust the ending of the grayscale depth gradient.

Depth of field

To enable Depth of field has to be turned on in the Render Settings - Effects.

Focus Distance
Defines the distance that is rendered sharp. Depending if the F-Stop and scene scale, foreground and background gets more and more blurry.

F-Stop
Sets the F-Stop of the camera. The smaller the f-stop number, the blurrier the foreground and background is rendered.
Spherical Rendering

To enable Spherical Rendering, goto the Spherical Tab and select “Enable”. U-RENDER supports all features Cinema 4D provides.

For the Mapping Types choose the following Aspect Ratios:

- Lat-Long: 2:1, e.g. 4096x2048
- Cube Map (Cross): 4:3, e.g. 4096x3072
- Cube Map (3x2): 3:2, e.g. 3072x2048
- Cube Map (String): 6:1, e.g. 3072*512

⚠️ Post Effects like Vignette and Chromatic Aberration can cause unwanted artefacts. When using spherical rendering it’s better to turn them off.

⚠️ Use the Hemisphere Ambient Occlusion method instead of the Ground-Truth AO. The Ground-Truth-AO may cause unwanted seams.

⚠️ Slightly increasing the Render-Resolution Overscan (Render Settings - Basic) can prevent visible seams.
Object Tag

Settings

- Backface Culling

This option activates backface culling on/off. If active, the backside of faces is not visible/rendered.
U-RENDER Commands

After installing U-RENDER you can find additional commands in the Plugins - U-RENDER menu. We recommend to pin the menu bar into your UI to have fast access to the U-RENDER features.

LIVE Mode

When activated, U-RENDER updates the scene in real-time (depending on your hardware and scene complexity) in a separate U-RENDER view. You can navigate in your scene as usual, change lights, materials, position of objects and see the result updated in real-time in the U-RENDER standalone.

Dashboard

Opens the Dashboard. The Dashboard gives you better control over what kind of data is going to be updated when LIVE- Mode is active. Adjustments in this settings can be useful to increase the playback performance.

Material Converter

The material converter converts existing U-RENDER materials into Cinema materials and vice versa. Note that there are not all features supplied, but it is a good starting point that saves a lot of time compared to replacing and assigning materials and textures completely by hand. The converter doesn’t delete the materials after replacing them, they are still available in the material manager.

Create U-RENDER Materials

All Cinema materials in the scene are converted into corresponding U-RENDER materials. The material tags on each object are replaced automatically.

Create U-RENDER Materials from Selection

All selected Cinema materials are converted into corresponding U-RENDER materials. The material tags on each object are replaced automatically.

Create U-RENDER Material

This command creates a new U-RENDER material. We have added this command as an option that allows you to bind a keyboard shortcut to it or place it as icon in your layout. No more Create → Shader menu wrangling.
Check for Updates
The update window appears and shows the latest version available as well as the current installed version.

Clear Scene
When rendering a scene for first time, it’s entirely send to the GPU of the computer. This sending process may take more or less depending on the complexity of the scene. After changing minor things in the scene, like moving an object or adjusting a light source, U-RENDER checks what data has to be send for the next render process because of changes. All other data that is still on the GPU and unchanged will not be send again to the GPU. That can save enormous render time. In some cases there may occur wrong synchronisation behavior. That can cause that objects are missing in the render result or placed at wrong position etc. In that case use the clear scene option. That forces U-RENDER to send the whole scene again.

Scene Debug Info
This option prints scene debug information into the console window. (menu Script - Console)

System Information
Opens a window with basic information about your system that can be copied to clipboard or saved as *.txt file.
U-RENDER Preferences

The global U-RENDER preferences can be found under Edit - Preferences - U-RENDER.

Communication

➤ Port

The network port which the Cinema 4D plug-in uses to communicate with the standalone application. Typically leave this at the default value of 65056. In case another program already uses that port, you need to change the network port to an available number. Try ports in the range of 65000 to 65500. Make sure you configure the U-RENDER Standalone to use the matching port.

To find out the network port that the standalone application uses start the application and have a look at the window title. The used port shows right after the version.

➤ Live Update Interval [ms]

The Live Update Interval limits the number of updates that are sent to the standalone application.

If you have the LIVE mode enabled and - for example - move the camera, these changes are sent to U-RENDER. If too many updates are send there is the chance that the previous update is still being processed. This might lead to a situation where the updates are happening more frequently than U-RENDER can process them. To avoid this you can limit the rate of updates with this setting.

Values for the Live Update Interval range from 16 ms to 100 ms:

- 16 ms - sending a maximum of 60 updates per second
- 100 ms - sending a maximum of 10 updates per second

Updates

➤ Check for Updates

Turn on if U-RENDER should check updates automatically.

➤ Time Interval

Sets the time interval if U-RENDER should check for updates on Cinema startup, daily, weekly or monthly.
Type of Update

Lets you set if only stable, beta/unstable or alpha/nightly versions should be checked for update.

Material System

Material Preview Size

Sets the size the material previews are rendered in the U-RENDER view, if LIVE mode is not activated.

Shader Render-Thread Count

You can assign how many render threads are used for Cinema 4D shader baking that is used if you use Cinema Filters, Surfaces, Shaders etc. for your Materials. Initially there are not all available threads assigned to ensure that shader baking doesn't interrupt your working process.

Debug Options

Clear Scene Before Rendering

The Scene is deleted from the GPU before U-RENDER starts do render the image.
U-RENDER Standalone

U-RENDER Manual - 2019.06.02

Menu Options

➔ Edit - Preferences

Fast access to change the Communication Port. Also, update checking for new U-RENDER versions and the time interval can be set here. This can also be set in the C4D Preferences.

➔ View - Scene Information

Lists basic scene information of containing objects like Lights, Meshes, Instances and Materials. Also, used vertices and number of triangles are listed.

➔ View - V-Sync

Activated V-Sync caps the U-RENDER frame rate to your Monitor’s refresh rate (typically 60 FPS). Deactivating V-Sync can cause issues when navigating in the scene at very high frame rates.

➔ View - Always-On-Top

If you right click on the U-RENDER view title bar or left click directly on the U-RENDER icon, you can check/uncheck Always-On-Top. That prevents other program windows from overlapping the U-RENDER view.
Standalone and Plug-in Communication

The Cinema 4D plug-in communicates with U-RENDER using a local TCP/IP connection. Data is transferred using a HTTP based REST API.

For the communication to work, the U-RENDER standalone application needs the permission to listen on a network port. The default port is 65056 but can be configured. U-RENDER acts as a server.

The host plug-in acts as a client. It establishes the connection to the U-RENDER server.

The REST API is still in development and will change over time.

Configuring the TCP/IP Port of the U-RENDER Standalone

The U-RENDER Standalone is listening on a TCP/IP port (default port 65056). You might need to configure your Windows firewall to allow this.

U-RENDER is running on your local machine (localhost) and does not make connections to other servers on the internet or your local network. The Cinema 4D plug-in is making a connection to the U-RENDER standalone through a TCP/IP connection. As this connection is established only on your own machine (localhost) it does not make use of a proxy.

When the default port 65056 is already used by a different application, you can change the port by specifying it on the command line of the U-RENDER standalone (e.g. -port 65066) or by changing the settings.json file in your installation folder by adding or changing the "NetworkListeningPort" setting.

For example, add this entry to the settings.json:

```
"NetworkListeningPort" : 65055
```

Now restart the U-RENDER standalone. It should be listening on port 65055 now.

You also need to change the settings for the communication port in the Cinema 4D Preferences for U-RENDER.

We are looking into making this more user friendly in the future!
Troubleshooting

**U-RENDER seems to be offline**

Check if the U-RENDER standalone is running and could connect on the configured port. You can see the port configuration of the U-RENDER standalone in the window title. It shows the TCP/IP port it uses to listen for commands.

When the U-RENDER standalone could not use the configured port, it shows an error in the window title as well. There are several reasons why the connection on the configured port could fail:

- The Windows firewall or other security software is preventing U-RENDER to connect to the port
- The configured port is already used by another software

Make sure you have allowed U-RENDER to make the TCP/IP connection by checking your firewall and security settings.

Change the configured port if another software is already using the TCP/IP port. See the chapter “Standalone and Plug-in Communication” for details.

**Debug Log**

Both the Cinema 4D plug-in and the standalone application write debug level logs. These logs are written to the “U-Render” folder within the system temporary folder. There you can find URenderStandalone.g3log.###.log and URenderC4DBridge.g3log.###.log (with ### being the date and time when the log has been started).

A quick method to open the temporary folder is to open the Windows File Explorer and enter %TEMP% in the location field (shortcut: F4 or Ctrl-L).

The Cinema 4D plug-in also writes debug information to the Cinema 4D Console (menu: Script - Console, shortcut: Shift-F10).

**Scene Debug Info**

The Scene Debug Info menu command logs the current state of the scene into the Cinema 4D Console and into the log file. This technical scene info can be helpful in finding issues with parsing and synchronization.
Limitations and Known Issues

Known Issues

- Negative object scaling produces shading errors due to inverted normals
- Camera Projection Types: When setting parallel projection, avoid putting this camera in a parent object with rotation values. This can cause jittering in movement.
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C++ REST SDK (Casablanca)

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Dear ImGui

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Mesa 3-D graphics library
Version: 7.0

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OpenGL Mathematics (GLM)

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A Phenomenological Scattering Model for Order-Independent Transparency

Portions of transparency rendering are based on "A Phenomenological Scatter Model for Order-Independent Transparency" by Morgan MacGuire and Michael Mara.


http://graphics.cs.williams.edu/papers/TransparencyI3D16/

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Efficient GPU Screen-Space Ray Tracing

Portions of screen space ray-traced reflections are based on “Efficient GPU Screen-Space Ray Tracing” by Morgan McGuire and Michael Mara. Their example implementation was provided under a BSD 2-clause license.

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Documentation Changes

2018.12.01
- Added information about Early Access
- How to use license activation
- Added documentation of motion blur settings

2018.10.07
- Added description of Materials Clear Coat parameters

2019.01.15
- Added Ground Truth Ambient Occlusion

2019.03.01
- Added Dashboard

2019.06.02
- Added Render-Resolution Overscan
- Updated Screenshot Quick Start Guide
- Added Dashboard Live View
- Added U-RENDER Standalone menu options: Scene Information, Preferences
- Added Clearcoat Normal Map
- Added Spherical Rendering