exr Trader

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IP Acknowledgements

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This plugin uses zlib:

zlib general purpose compression library

version 1.2.3, July 18th, 2005

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This plugin uses LightWrap++, a C++ wrapper for LightWave

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This piece of software is dedicated to Zareh and Mike.

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We would also like to thank the teams at NewTek-Europe and gadget for their kind support.

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Table of Contents

Introduction

Quoted from www.openexr.com:

OpenEXR is a high dynamic-range (HDR) image file format developed by Industrial Light & Magic for use in computer imaging applications.

OpenEXR's features include:

- Higher dynamic range and color precision than existing 8- and 10-bit image file formats.

- Support for 16-bit floating-point, 32-bit floating-point, and 32-bit integer pixels. The 16-bit floating-point format, called "half", is compatible with the half data type in NVIDIA's Cg graphics language and is supported natively on their new GeForce FX and Quadro FX 3D graphics solutions.

- Multiple lossless image compression algorithms. Some of the included codecs can achieve 2:1 lossless compression ratios on images with film grain.

- Extensibility. New compression codecs and image types can easily be added by extending the C++ classes included in the OpenEXR software distribution. New image attributes (strings, vectors, integers, etc.) can be added to OpenEXR image headers without affecting backward compatibility with existing OpenEXR applications.

exrTrader makes the OpenEXR file format available for users of LightWave 3D, providing basic image loading and saving as well as supporting the advanced features of OpenEXR, such as multiple buffers stored in a single image file.

This manual covers the usage of exrTrader only.

We are planning on publishing further tutorials of how to use OpenEXR in various pipelines in the future though, please check www.exrtrader.com for updates.

The capabilites of OpenEXR itself are explained extremely well at www.openexr.com. The "Technical Introduction to OpenEXR" available for download as a PDF is well worth a read.

Buffers & Channels – a Basic Introduction

Let's start with some definitions:

A **Channel** is a single image component, such as the red channel of an image.

A **Buffer** consist of one or more channels, for example:

Final Render is a buffer consisting of the red, green and glue channels.

Depth is a buffer consisting of one channel: Z

Motion is a buffer with two channels, X and Y (this is velocity in pixels)

OpenEXR is quite a complex, extensible image format, and many compositing applications only support a subset of its features, such as the following basic channels:

R	Red
B	Blue
G	Green
A	Alpha
Y	Luminosity
Z	Depth

Fusion 5 for example expects the following channel names by default (fortunately this can be changed in the Fusion 5 image loader):

R, G, B, A, Z, pixelCover, objectID, materialID, U, V, NX, NY, NZ, velX, velY

This is why we decided to include a preset system to cater for the needs of different applications and pipelines.

If the buffers are saved to a single file they are named as follows:

"BaseName.ChannelName"

Either the base or the channel name may be empty (in that case the "." is omitted) - but never both of them. You cannot have duplicate channel names within the same file.

The "Review Settings..." option tries to catch as many errors and omissions as possible.

If your application only supports the most basic channels you can use the option to save a buffer to an individual image file.

In that case the Base Name is omitted from the channel name, but is used as part of the file name. Make sure that the channel names are R,G,B (or Y in the case of a single channel image), otherwise more limited applications that expect the default channel names won't be able to read the image!

Some OpenEXR savvy applications, such as Nuke, can group the channels by their base name, so they see "BaseName" as a group of channels (or a layer).

The appendix contains a list of applications and their support for OpenEXR.

Compatibility

exrTrader V1.1 is based on OpenEXR 1.6.0.

exrTrader is compatible with LightWave3D 7.5 up to LightWave 9.3 – and very likely with future versions of LightWave 3D as well.

It currently runs with the Windows 32bit, Windows 64bit, Mac OSX CFM and Mac OSX UB versions of LightWave. It has been tested with Windows 2000, the 32bit and 64bit versions of Windows XP as well as Mac OSX. This is why you will see screenshots of both the OSX and the Windows ports in this manual.

Upon demand we can also port a Linux render node version.

Please visit www.exrtrader.com for more up to date information.

Features

exrTrader has been thoroughly tested in production by us and our trusty beta testers. The main features of exrTrader are:

- standard LightWave Loader supporting RGBA.
- standard LightWave Savers, supporting all saveable image types except for palletized images.
- a scene type master plugin for setting the image saver options, which are saved in the scene file.
- a dummy saver to enable network render managers to find saved files for success checks.
- an image filter plugin that allows to save arbitrary buffers to a single OpenEXR file that:
    - either uses a custom output file, or the RGB output file defined in the render globals.
    - mimics LightWave's name formatting scheme.
    - supports all compression schemes defined by OpenEXR.
    - supports all output buffers generated by LightWave and exposed through the SDK.
    - supports buffers that may consist of one (i.e. Depth), two (i.e. Motion), three (i.e. RGB) or more channels.
    - offers separate naming options for channels and buffers in the OpenEXR file, this will translate to buffer.channel as defined in the OpenEXR specs. Either may be blank.
    - supports different pixel types per channel.
    - offers the processing of buffers (invert, min, max, scale, offset).
    - supports OpenEXR metadata, including aspect ratio, comments, previews.
    - has data window support (for limited region renders).
    - uses VIPER to preview buffers.
- network rendering support.
- plugins consist of one file per platform.
- basic OpenEXR functionality is provided for free.
- free point upgrades, free support, free beer[1].

**1**   O.k., so we're still joking about the beer...

Setting up exrTrader

Installation

The download contains ZIP compressed files for all platforms supported by exrTrader. Extract the appropriate ZIP file for your platform.

The *exrTrader.p* file can be copied to any directory where you keep your plugins. We recommend using a manually created plugin directory to separate third party plugins from plugins shipped with LightWave 3D. This will simplify upgrades of LightWave 3D.

Now use the **Edit Plug-ins** panel (alt-F11) of the **Add Plugins** menu item to add the plugin file **exrTrader.***p* to LightWave 3D. LightWave will prompt you that it found 9 plugins in one file (Lightwave 9.0)[2].
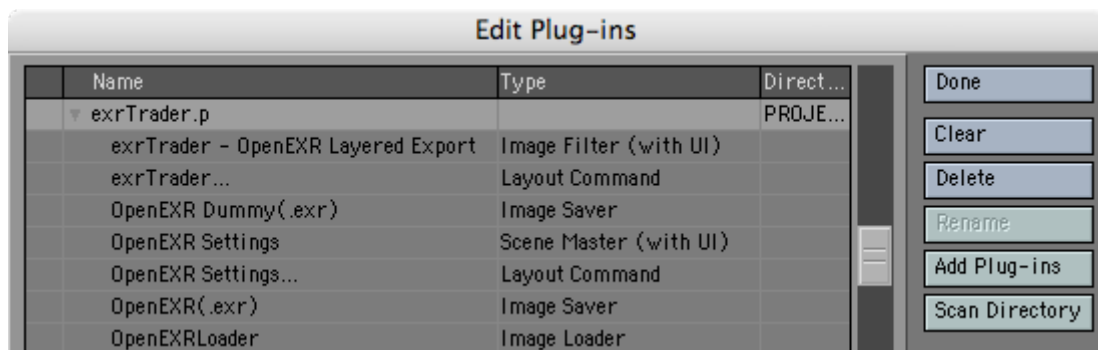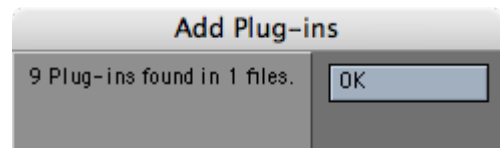
The seven plugins added are:

exrTrader – OpenEXR Layered Export

OpenEXR Settings

exrTraderLoader

OpenEXR(.exr)

OpenEXR Dummy(.exr)

exrTrader...

OpenEXR Settings...

To be able to use the exrTrader Layered Export you will need to register and activate it with the activation code we will send you.
The basic loaders and savers are fully functional without registering.

The last two plugins are convenience tools you can assign to a shortcut, or add to a menu, to quickly apply the respective plugins and open their user interface.

---

2   Actually, there are only 7 plugins, LightWave 3D 9.0 counts the user interfaces for two of these extra though. LightWave 3D 8.0 correctly reports 7 plugins.

Registration

Once you've installed the plugin, apply the **exrTrader – OpenEXR Layered Export** image filter plugin to your scene, and the registration window will automatically open.

Enter your full name, company name (if applicable) and e-mail address. Export the registration and attach it to an e-mail to **registration@exrtrader.com**. We will mail you an activation code within 24 hours after payment is received, depending on the time difference[3].

You can now either import the keyfile attached to the activation e-mail, or copy and paste the activation key into the registration panel (please make sure that the personal information is identical to the one submitted to us for the registration).

Your registration is now complete and you will see the interface of exrTrader, allowing you to use it.

The registration file is stored in the same folder where LightWave 3D is installed[4], the license file is named exrTrader.key. If you use multiple licenses of LightWave 3D from a single network share, the registration manager will only append/edit licenses locked to the dongle installed on the host machine. It will however manage multiple licenses allowing for a single registration file on your network share.

Included Plugins

exrTrader is actually a suite of plugins for LightWave 3D. Currently it consists of the following plugins (these are the plugin names as displayed in the Edit Plug-ins window by LightWave):

- exrTrader – OpenEXR Layered Export
- OpenEXR Settings
- exrTraderLoader
- OpenEXR(.exr)
- OpenEXR Dummy(.exr)
- exrTrader...
- OpenEXR Settings...

---

3   Our key generator needs some sleep every now and then ;)
4   Please back up your license file if you install a new version of LightWave into the same directory, especially on OSX when installing the UB of LightWave.

exrTrader – OpenEXR Layered Export

This is the flagship plugin. It allows you to export any of the render buffers provided by LightWave into a single, or multiple OpenEXR files.

OpenEXR is a quite complex image file format. The user interface of exrTrader provides full access to the options provided by the image format.

From the top to the bottom it is basically divided into three areas.

The top covers basic workflow options, as well as global options for the exported image files.

The middle section, starting with the "Buffers" tab, contains the controls for the individual buffers.

The "Metadata" tab contains options for metadata stored with the image files, such as a preview image, or a comment.

The bottom section includes the "About..." button to quickly check the version number and "Review Settings..." which gives you a quick overview of the applied settings and also highlights potential problems with the applied settings.
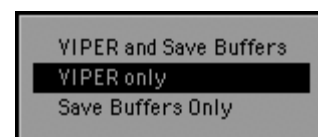
The individual controls will be explained in the following sections:
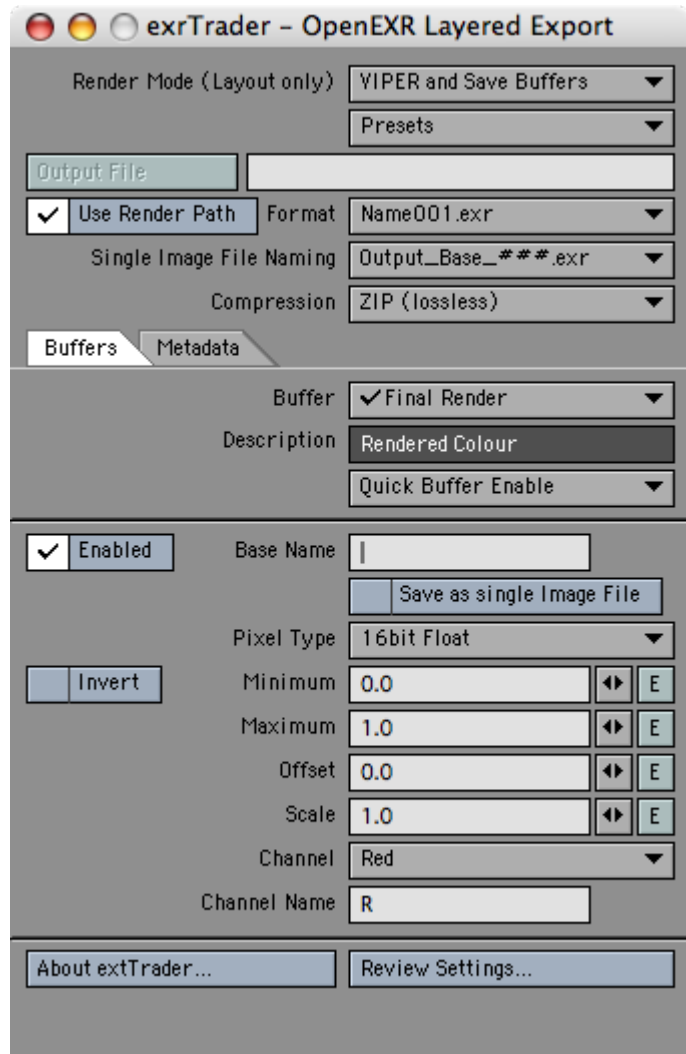
Render Mode

The Render Mode defines how exrTrader will handle the buffers when rendering in Layout.

exrTrader can display all buffers using VIPER after an initial render with exrTrader applied to the scene, this requires up to 42MB of memory.

VIPER and Save Buffers

This will save the buffers to disk, and also store a scaled down version in memory to be used in conjunction with VIPER.

VIPER only

This will only store the buffers in memory but not save them to disk.

Save Buffers Only

This option only saves the buffers to disk, but will not store them in memory for VIPER previews.

Note: the **Render Mode** setting is only relevant when rendering in Layout. When rendering using lwsn/ScreamerNet, the network renderer of LightWave 3D, exrTrader will **always** save the buffers, and **never** store them in memory for VIPER[5].
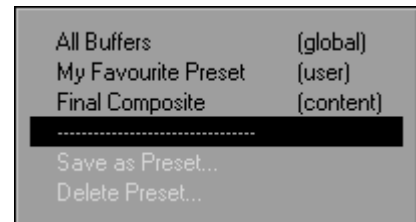
Presets

Using the Presets pop-up you can apply any of your presets, save your current settings as a preset or delete existing presets.

exrTrader has its own system to manage presets. The main reason for developing a custom system was to differentiate between user, global and project (content directory) specific settings.

user presets are stored in the same directory where your LightWave3D configuration files are stored, in a subdirectory called "SimplePresets".

global presets are stored in the installation directory of LightWave3D.

**content** presets are stored in the current content directory.

Save as Preset...

This option allows you to save the current exrTrader settings to a preset. Choose any of the three types and enter a name for the preset. You can also use the small pop-up to select any of the currently available preset names.
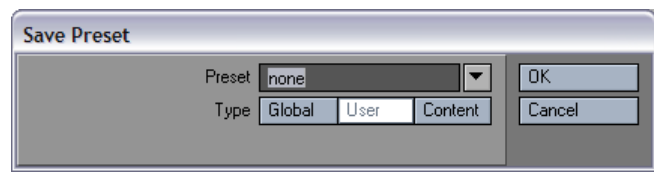
Delete Preset...

This allows you to select and of the available presets and delete them from the hard drive.
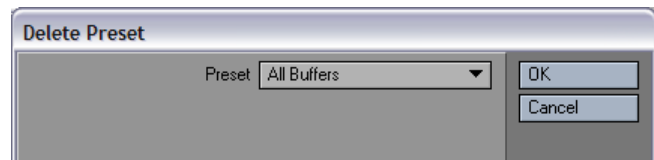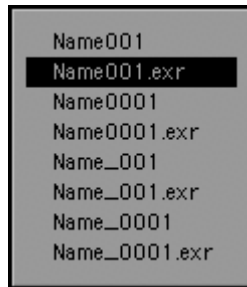
Output File

This control allows you to select an output file for the buffer saver to write to. Any extension and frame numbers of the selected file will be automatically removed. You can only select an output file if "Use Render Path" is not activated.

Use Render Path

If you select this option, exrTrader will use the output file defined in the Lightwave3D render globals.

This option is quite important if used across a render farm in conjunction with the OpenEXR Dummy Saver, described later in this manual.

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5   Obviously, since there is no VIPER in the network renderer.

Format

This settings defines how exrTrader will append the frame number and file extension to the Output File. These settings are identical to the settings in the Lightwave3D render globals.

Single File Naming

exrTrader by default saves all buffers into a single OpenEXR image file. You may optionally save single buffers into a separate image file.

This option defines how these separate image files will be named.

Output is the file name, as defined by the Output File control, or the render global in Lightwave3D if "Use Render Path" is active.

Base is the base name of the selected buffer, as described below in the documentation.

is the frame number, the amount of digits is defined by the Format option.

_ The underscores are only added if the Format option contains underscores as well.

.exr The file extension is added only if the Format option contains the file extension.
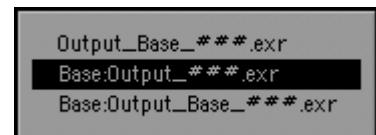
Output_Base_###.exr

This will save the buffer image files into the same directory as the Output File, and append the "Base" name to the file name.

Base/Output_###.exr

This will create a subdirectory named after the "Base" name where the Output File is written, and write the buffer image into that subdirectory.

Base/Output_Base_###.exr

This will create a subdirectory named after the "Base" name where the Output File is written, and write the buffer image into that subdirectory appending the "Base" name to the file name.

Example

To hopefully make this a bit easier to understand, here is an example of how these options work.

Let's assume we're rendering out to "images/Ninja.exr" as the Output File. The Format we're using is "Name_0001.exr".

We want to save the Reflection buffer as a separate image file, the "Base" name of it is "Specular".

These will be the buffer image file written at frame 60, depending on the Single File Naming option:

Output_Base_###.exr   images/Ninja_Specular_0060.exr
Base/Output_###.exr   images/Specular/Ninja_0060.exr
Base/Output_Base_###.exr   images/Specular/Ninja_Specular_0060.exr

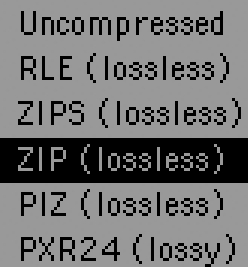The main file saved will in all cases be the same: images/Ninja_0060.exr

Compression

All compression options are lossless, except for PXR24, which is lossy when saving 32bit float image data (it cuts of the lower 8bit, effectively cutting the precision to 24bits).

exrTrader V1.1has been compiled to support OpenEXR Version 1.6, which includes the following compression modes:

```
Uncompressed
RLE (lossless)
ZIPS (lossless)
ZIP (lossless)
PIZ (lossless)
PXR24 (lossy)
```

- **Uncompressed**
  Doesn't compress the data at all, recommended for highest speeds (if the hard drive is fast) - but also uses the most storage space.

- **RLE (lossless)**
  Compresses the difference between adjacent pixels. Fast to compress and decompress, but in general only works well for images with large areas of solid colour.

- **ZIPS (lossless) -** *default*
  This uses a ZIP type compression scheme to compress one scanline at a time. Slow to compress, fast to decompress and also offers a fairly high compression ratio.

- **ZIP (lossless)**
  Just like ZIPS, except that it compresses 16 scanlines in one go. This results in a slightly better compression compared to ZIPS, but also slows down reading single scanlines from an image (as some compositing packages might do in proxy or ROI/DOD mode).

- **PIZ (lossless)**
  This is a wavelet based compression scheme that has a compression ratio that is comparable to ZIP(S), but is faster to compress ... on the other hand it is slower to decompress.

- **PXR24 (lossy)**
  A wavelet based compression scheme similar to PIZ, 32bit float numbers are cut off to 24bit, loosing 8 bits of precision.

- **B44 (lossy)**
  A compression scheme designed for the real-time playback of OpenEXR images with a constant compression ratio.

- **B44A (lossy)**
  Just like B44, but solid areas (such as alpha channels) have a better compression ratio.

These are explained in more detail in the Technical Introduction to OpenEXR, available as a PDF at www.openexr.com.[6]

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[6] I admit it, I didn't want to copy and paste the section over from the OpenEXR website. The document is highly recommended to understand the capabilities of OpenEXR.
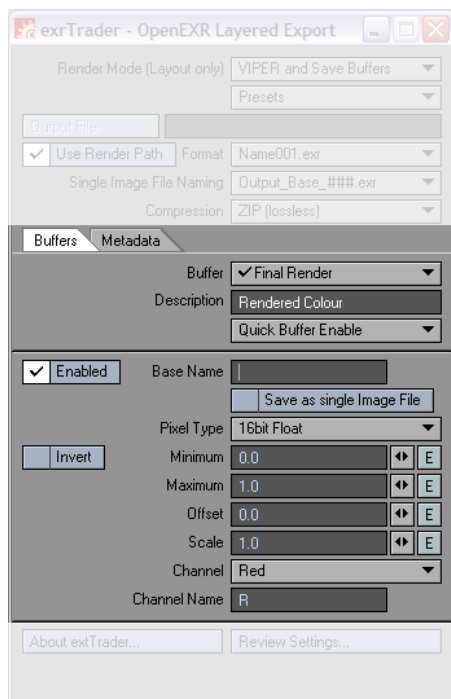
Buffers

This section of the interface allows you to individually select and edit buffers for exporting.

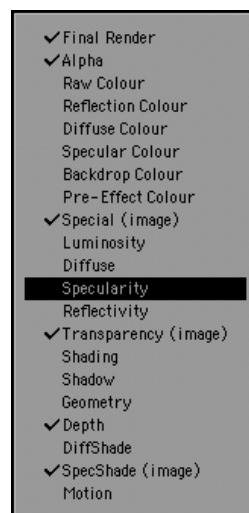The section above the dividing line allows you to select the available buffers.

The section below the dividing line contains the individual settings for the selected buffer.

Buffer

This pop-up displays all buffers currently available to exrTrader via the Lightwave3D SDK.

Buffers that are enabled for export have a check mark in front of them, Buffers that are written to a single file have the text "(image)" behind them.

**Note:** We think a couple of important buffers are missing from this list, especially the coverage data, object and surface Ids as well as normal and UV data. Unfortunately the current SDK for LightWave3D provides no access to these.

Description

A short description of the currently selected buffer is displayed here.

Quick Buffer Enable

This pop-up allows you to quickly enable/disable some of the more commonly used buffers.
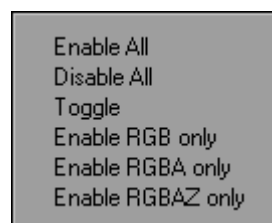
Individual Settings for Buffers

The following settings are per buffer, and define how a buffer will be processed by exrTrader.

Here you can also name the buffers, specify their pixel type and save them as single image files.
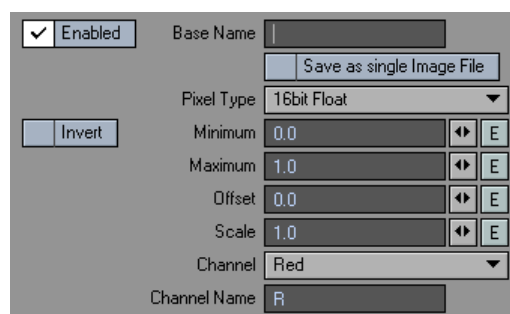
Enabled

This check box enables the buffer for saving.

Base Name

This is the base name for the current buffer.

If the buffer is saved as a channel in the main output file, the channels will include this base name as a prefix, i.e. "Specular.Red".

If the buffer is saved as a single image file, the base name will be a part of the image file name as explained in the **Single File Naming** section.

Save as single Image File

If this option is selected, the buffer will be saved into its own image file, instead of being a part of the main output file.

The name of the image file will be determined by the **Base Name** and the **Single File Naming** option.

Pixel Type

This option allows you to define how the pixels of the current buffer will be saved in the OpenEXR file. OpenEXR allows for all pixel types to co-exist in a single image file.

The Float pixel types allow for HDR buffers to be stored.

Integer is currently of little use with the available buffers. It is designed to be used with precise, discrete values such as object or surface Ids.

We recommend to use 16bit Float for all buffers, except for the Depth buffer which profits greatly from saving it at 32bit Float.

For more colour precision in compositing you can always switch buffers to 32bit float.

Invert

This option will invert the current buffer.

Minimum / Maximum

These two options allow you to change the range of the data saved in the buffer.

For most buffers, the Minimum and the Maximum define the range of values written out that correspond to the range of 0 .. 1.0 the the buffer as passed by LW (or "raw" buffer).

For the Depth buffer, these are handled differently, the Minimum and Maximum defined the distances in metres from the camera that correspond to the 0 .. 1.0 range in the written buffer.

Expressed mathematically:

*output = Minimum + buffer * (Maximum – Minimum)* for all a buffers except Depth

output = (buffer – Minimum) / (Maximum – Minimum) for the Depth buffer

Offset / Scale

Offset and Scale allow further tweaking of the buffer values.

Offset is just added to the buffer values, Scale scales the range of values in the buffer by the entered amount.

Channel / Channel Name

Since OpenEXR allows for the naming of every channel saved in the file, you can use the **Channel** control to pick a channel, and **Channel Name** to give it a new name.

This option is only available for buffers with more than one channel, buffers with only one channel will ignore this setting and only use the base name.

A buffer with one channel, saved as a single image, will only contain the channel name "Y" which, as far as the OpenEXR specifications go, should be interpreted as a grey scale image by the reading application.

Metadata

The metadata section of the interface allows you to store some additional information within your images.

Please feel free to contact us at *support@db-w.com* if you require other metadata to be stored with your OpenEXR files.

In addition to the metadata exposed by the user interface, exrTrader will also save the following information as metadata in your image files:

ComputerName   name of the computer that rendered the image (currently not available on OSX)

capDate   Time and date when the image was created

utcOffset   offset of capDate from UTC.

LightWaveScene   name of the LightWave scene that was used to render the image

**LightWaveBuild**   the Build number of LightWave used to render the scene
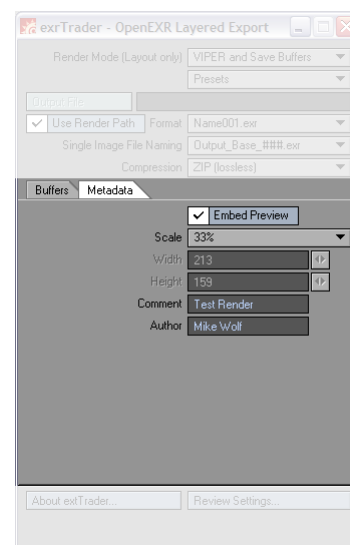
Embed Preview

Select this option to save a small preview image within the OpenEXR image files. These will be saved as 8bit data.

Scale / Width / Height

This option defines that scale of the preview image.

You may select any of the pre-defined percentages, or select Custom Size to be able to enter a **Height** and **Width** for the preview image.
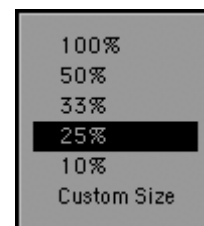
Comment

Here you can enter a comment that will be stored within the OpenEXR files saved by exrTrader

Author

You can use this control to enter the name of the person that created the images rendered with exrTrader in this scene. The name will be stored in the image files as the "owner".

Review Settings...

This option will show you a window with a summary of all buffers that are being saved out. Any potential errors will be highlighted in red.

Review Settings tries to cover all potential issues when saving an image. It may not succeed in all cases, though.

If it reports no error, and you still have problems saving, please create a preset of the settings and mail them to us at support@db-w.com, we will update Review Settings to catch those issues as well.
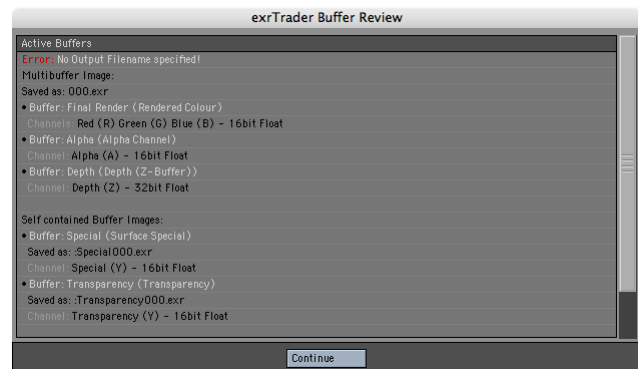
About exrTrader...

This shows the about box of exrTrader, including the version you are using.
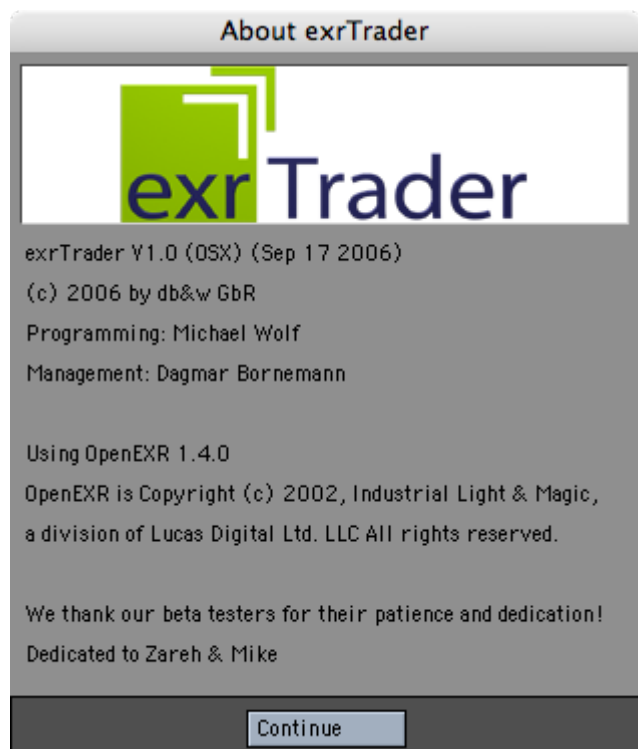
exrTrader and VIPER

exrTrader is unique in supporting VIPER to preview buffers prior to saving them out to disk. It even previews the effects of the editing settings applied to the buffers.

To use VIPER, make sure the **Render Mode** is set to either "VIPER and Save Buffers" or "VIPER only" and render a single frame of your scene. The buffers stored in memory will use up at most 42 MB of RAM.

You can now open VIPER and select any of the buffers in the exrTrader interface. The title of the VIPER window will read "VIPER : exrTrader Buffers" if it can display the exrTrader Buffers.

Adjustments to the buffer settings will be displayed immediately.

VIPER also provides Preview Options that control how the preview is displayed:

*blue_red_ninja.lws by William Vaughan*

Preview Options

VIPER can either display the **Raw Buffer** (the buffer as rendered by Lightwave3D) or the **Processed Buffer** (as processed by exrTrader using the editing settings, and as finally saved to disk).

These can also be displayed as a **normalized** preview. In this case exrTrader will display all values into the buffer in the range between 0 and 1.0 (black and white), effectively making the complete range of values in a buffer visible.
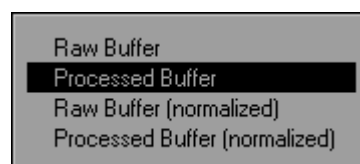
Below: Raw Buffer display vs. normalized display of the Depth-Buffer of the Ninja Scene.
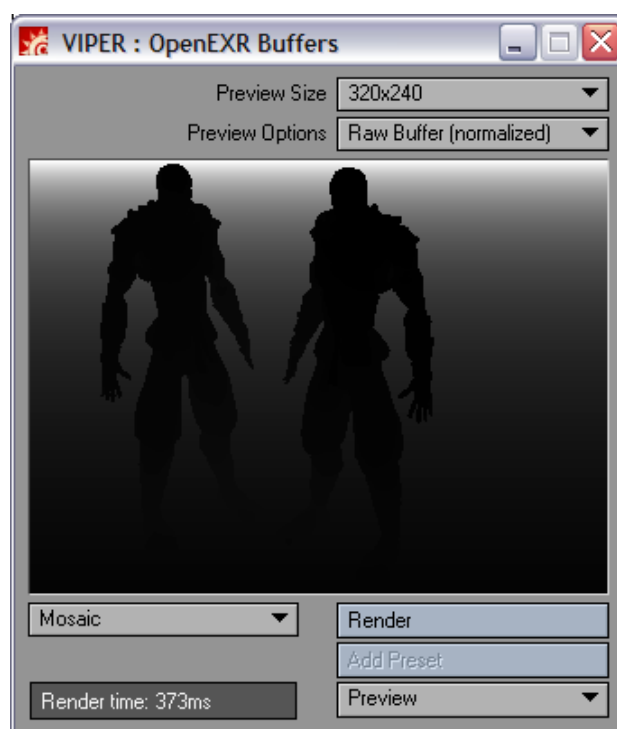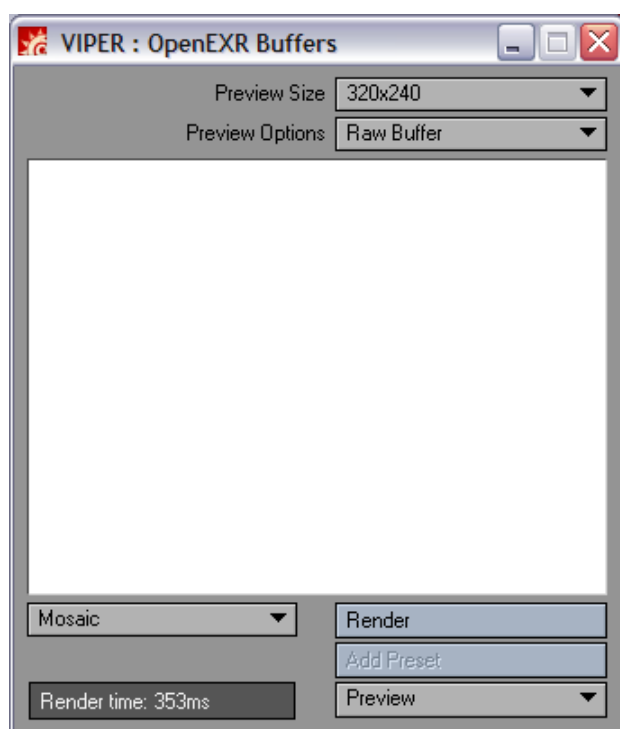
Basic OpenEXR Loader and Saver Plugins

exrTrader includes basic LightWave image loader and saver plugins that allow you to load and save OpenEXR images in any part of LightWave that loads and saves images.

These are included in exrTrader for free, and may be used freely without registering exrTrader.

To change the settings for the OpenEXR Saver, we've included a Layout Master plugin that can be saved with any scene to change the saving options.
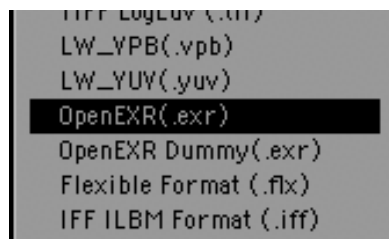
OpenEXR Settings
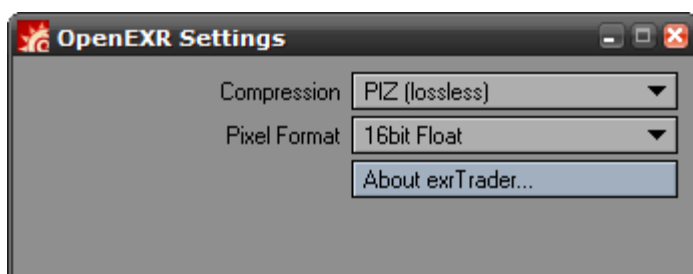
OpenEXR Settings is a Scene Master plugin that gets saved with a Lightwave3D scene.

It allows you to control the settings used by the OpenEXR saver, since a Lightwave3D image saver does not have a way to display an options panel.

The available settings are:

Compression

This defines the compression method used by the saver. Please refer to the previous section on this subject for details.
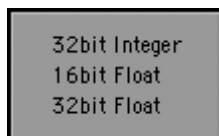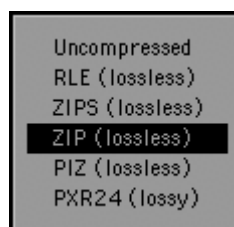
Pixel Format

The defines the pixel format for saving. Again, please refer to the previous Pixel Format documentation for details.

Special Plugins

OpenEXR Dummy Saver

The dummy saver has been designed to be used in conjunction with the exrTrader Buffer saver and third party render controllers that check render jobs for successfully rendered frames.

It doesn't save any image data, but allows a render controller to retrieve the output file path and extension from a Lightwave3D scene. If the scene only saves image data from the exrTrader Layered Export the render controller will still be able to check for rendered frames.

To use it, use the OpenEXR Dummy(.exr) image saver as the RGB Files saver in the render globals, make sure that "Use Render Path" is activated in exrTrader, and that the Format option of exrTrader matches the Format option in the Lightwave3D render globals.
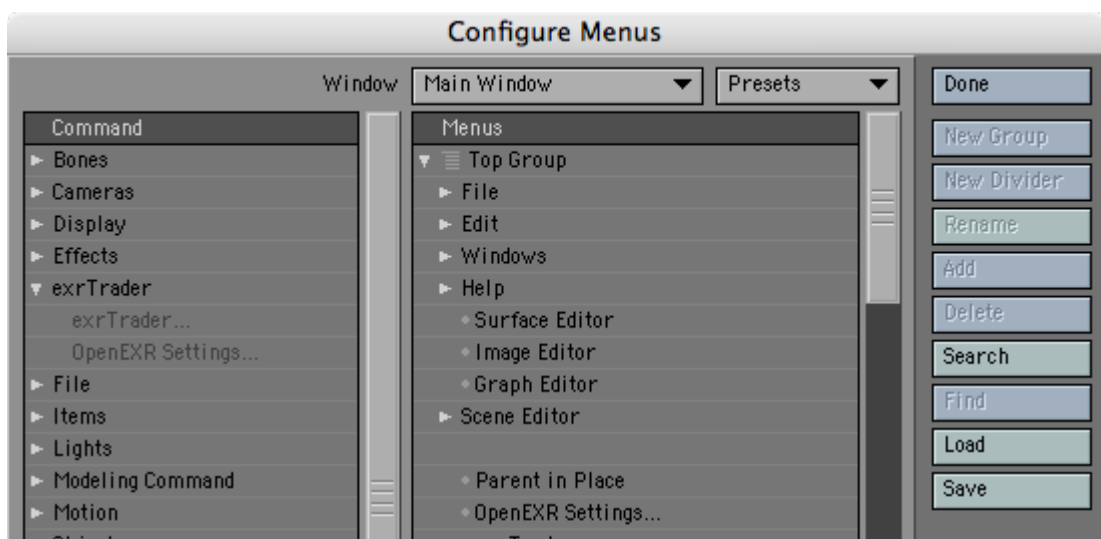
exrTrader...

This is a Generic Layout Plugin that has been designed to be assigned to a short cut, or added to a menu.

It will first check if exrTrader Layered Export is assigned to the current scene as an Image Filter. If not, exrTrader will be added.

Then it will open the user interface of the exrTrader Layered Export attached to the current scene.

OpenEXR Settings...

This is a Generic Layout Plugin that has been designed to be assigned to a short cut, or added to a menu.

It will first check if OpenEXR Settings is assigned to the current scene as a Scene Master. If not, OpenEXR Settings will be added.

Then it will open the user interface of the OpenEXR Settings attached to the current scene.

Appendices

Network Rendering

exrTrader is ScreamerNet compatible and allows for network renders. You can install the plugin on any render node and it will render as expected. It has been tested with a variety of third party render controllers, including Butterfly NetRender and Spider.

The OpenEXR Dummy Saver has been designed to allow render controllers to check for saved frames from rendered scenes, even if only the exrTrader Layered Export is actually writing frames.

OpenEXRsupport in third party applications

Here is a short list of third party applications, mainly compositing applications, and a summary of their ability to read OpenEXR:

Digital Fusion 4	Reads RGBA only.
Fusion 5	Reads RGBA and "deep" channels, R, G, B, A, Z, pixelCover, objectID, materialID, U, V, NX, NY, NZ, velX, velY Any channel of the file may be assigned to any of the deep channels used by Fusion 5, a channel may only be assigned once (a known bug in Fusion 5.01)
Shake 4	As far as we're aware it only reads RGBA, but allows the user to define which channels of the source file to use
After Effects 7-CS3	Basic RGBA support Advanced support for OpenEXR is available from http://www.fnordware.com/OpenEXR/
Combustion 4	Basic RGBA support
Nuke	Extended OpenEXR support, reads up to 64 arbitrary channels of an OpenEXR file, supports layers/grouped channels
PhotoShop CS2	Uses the same loader as After Effects 7, so basic RGBA support only. Advanced support for OpenEXR is available from http://www.fnordware.com/ProEXR/

LScript

The following commands can be issued from LScript or as a LightWave command:

Generic_Open_exrTrader – Applies the exrTrader Image Filter (if needed) and opens the user interface

Generic_Open_OpenEXRSettings - Applies the OpenEXR Settings Master Handler (if needed) and opens the user interface

Recommended Reading

The OpenEXR website at www.openexr.com is packed with information about the OpenEXR image file format.

We recommend downloading the "Technical Introduction to OpenEXR" PDF and at least having a quick look at it. We believe it explains some of the reasoning behind the design of exrTrader, and also give a great introduction to the capabilities of the image file format.