

HDRI – Creating Environment Maps for Houdini

THIS GUIDE LOOKS AT THE GENERATION OF HDRI ENVIRONMENT MAPS FOR HOUDINI. THIS PROCESS VARIES DEPENDING UPON THE TYPE OF LIGHT DATA CREATED AT ACQUISITION STAGE. THIS GUIDE COVERS LIGHT DATA CREATED USING A 12-24 WIDE ANGLE LENS, AND A 180 DEGREE FISH EYE LENS. THE PROCESSES DEMONSTRATED CAN ALSO BE APPLIED TO CHROME BALL LIGHT DATA, AS WELL AS FULL FRAME FISH EYE LENS DATA. THIS GUIDE ONLY COVERS STRAIGHT CONVERSION OF LIGHT DATA TO AN ENVIRONMENT MAP. IT DOES NOT COVER ASPECTS SUCH AS SKY REPLACEMENTS OR EXTENSIONS.

TIPS FOR USING ENVIRONMENT MAPS IN HOUDINI ARE ALSO GIVEN AT THE END OF THIS GUIDE...

THE CONVERSION PROCESS IS DEPENDANT UPON THE TYPE OF LIGHT DATA SOURCED; HOWEVER IN A NUTSHELL ADOBE PHOTOSHOP IS USED TO AUTOMATE THE CREATION OF HDR IMAGES AND THEIR CONVERSION INTO AN ENVIRONMENT MAP PANORAMA.

THE FISH EYE LENS EXAMPLE ALSO USES NUKE TO TRANSFORM THE BASE HDR IMAGES BEFORE THEY ARE CONVERTED INTO A PANORAMA USING PHOTOSHOP. BOTH PHOTOSHOP AND NUKE CAN BE FOUND ON THE APPLE MULTIMEDIA MACHINES IN W101; AS WELL AS THESE EXAMPLE FILES.

USE THESE EXAMPLE FILES TO PRACTICE ON BEFORE YOUR PROJECT FILMING COMMENCES... THIS WILL HELP YOU UNDERSTAND WHAT YOU NEED TO DO WHEN FILMING.

12-24 WIDE ANGLE LENS

This example will look at the creation of an Environment Map for Houdini with Acquisition Images generated by a 12-24 Wide Angle Lens. A Canon 5D was used with auto-bracketing activated. This feature automatically generates 3 images per shot; bright, mid and dark.



_MG_0001.CR2



_MG_0002.CR2



_MG_0003.CR2

NOTE: for a wider dynamic range, more base exposure images can be sourced; however, although limited to 3 images the auto-bracketing feature of the Canon 5D does mean a rapid generation of files, which can be useful in changing lighting conditions

A total of 9 different angles were photographed in this way to create a full panorama of the location. Each of these images are stored in the native raw format for the Canon 5D.

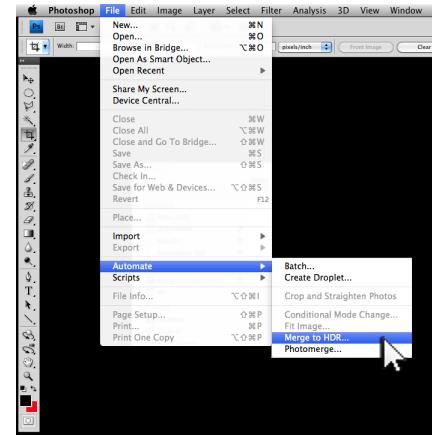
HDRI – Creating Environment Maps for Houdini

Step 1 – Organizing the Files

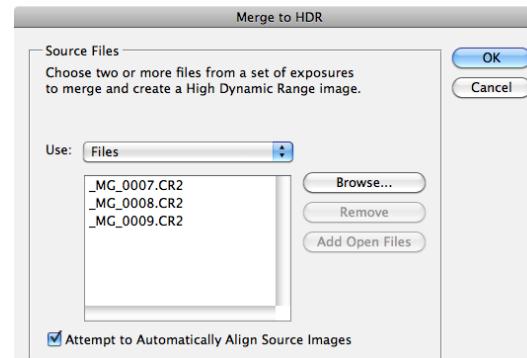
When these base images have been copied to disk, they need to be separated out into folders representing each photographed angle.

1		Today, 13:38	--
	_MG_0001.CR2	Today, 10:24	24.2 MB
	_MG_0002.CR2	Today, 10:24	23.6 MB
	_MG_0003.CR2	Today, 10:24	27.7 MB
2		Today, 13:38	--
	_MG_0004.CR2	Today, 10:24	24.3 MB
	_MG_0005.CR2	Today, 10:24	23.6 MB
	_MG_0006.CR2	Today, 10:24	28 MB
3		Today, 13:38	--
	_MG_0007.CR2	Today, 10:24	25 MB
	_MG_0008.CR2	Today, 10:25	23.9 MB
	_MG_0009.CR2	Today, 10:25	28.6 MB
4		Today, 13:38	--
	_MG_0010.CR2	Today, 10:25	25.4 MB
	_MG_0011.CR2	Today, 10:25	24.2 MB
	_MG_0012.CR2	Today, 10:25	28.5 MB
5		Today, 13:38	--
	_MG_0013.CR2	Today, 10:25	25.2 MB
	_MG_0014.CR2	Today, 10:25	24.3 MB
	_MG_0015.CR2	Today, 10:25	27.3 MB
6		Today, 13:38	--
	_MG_0016.CR2	Today, 10:25	24.6 MB
	_MG_0017.CR2	Today, 10:25	23.7 MB
	_MG_0018.CR2	Today, 10:25	27.2 MB
7		Today, 13:38	--
	_MG_0019.CR2	Today, 10:25	24.9 MB
	_MG_0020.CR2	Today, 10:25	23.8 MB
	_MG_0021.CR2	Today, 10:25	28.4 MB
8		Today, 13:38	--
	_MG_0022.CR2	Today, 10:26	24.6 MB
	_MG_0023.CR2	Today, 10:26	23.7 MB
	_MG_0024.CR2	Today, 10:26	27.9 MB
9		Today, 13:38	--
	_MG_0025.CR2	Today, 10:26	24.2 MB
	_MG_0026.CR2	Today, 10:26	23.5 MB
	_MG_0027.CR2	Today, 10:26	27.6 MB

Each folder contains the bright, mid and dark raw images for each angle photographed. **Adobe Photoshop** can then be used to compile these raw images into the hdr format.

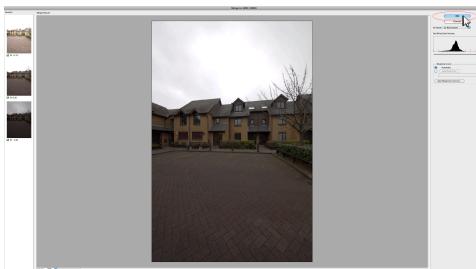


From the **File > Automate Menu**, choose **Merge to HDR...**



From the resulting dialog window, **Browse** for the raw images found in the first data folder. When the HDR image has been compiled, a HDR preview window will appear. Press **OK** to complete the HDR Merge process.

HDRI – Creating Environment Maps for Houdini



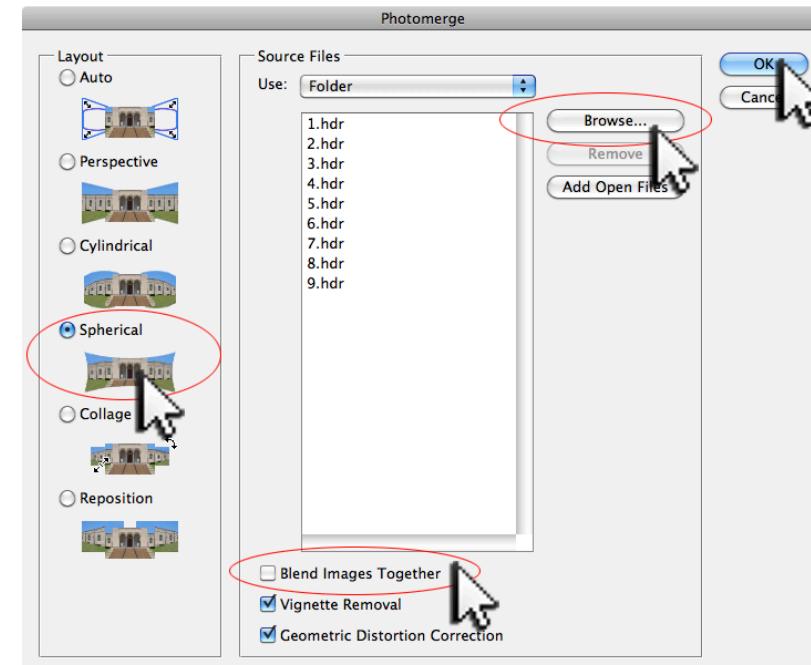
When the final HDR Image appears in Photoshop, **Save it as a .hdr (Radiance Image) into a separate directory**. From the **Image > Image Size Menu**, reduce the size of the HDR Image to **10%**, and **resave** the image to **another separate directory**.

8		Today, 13:38	--	Folder
9		Today, 13:38	--	Folder
hdr_base_images		Today, 13:38	--	Folder
1.hdr		Today, 13:29	64.3 MB	Radiance
2.hdr		Today, 13:30	64.4 MB	Radiance
3.hdr		Today, 13:31	64.6 MB	Radiance
4.hdr		Today, 13:32	64.7 MB	Radiance
5.hdr		Today, 13:33	64.6 MB	Radiance
6.hdr		Today, 13:34	64.4 MB	Radiance
7.hdr		Today, 13:35	64.7 MB	Radiance
8.hdr		Today, 13:36	64.6 MB	Radiance
9.hdr		Today, 13:37	64.3 MB	Radiance
hdi_tenpercent		Today, 14:00	--	Folder
1.hdr		Today, 13:55	754 KB	Radiance
2.hdr		Today, 13:56	754 KB	Radiance
3.hdr		Today, 13:57	762 KB	Radiance
4.hdr		Today, 13:57	754 KB	Radiance
5.hdr		Today, 13:58	745 KB	Radiance
6.hdr		Today, 13:58	729 KB	Radiance
7.hdr		Today, 13:59	745 KB	Radiance
8.hdr		Today, 13:59	758 KB	Radiance
9.hdr		Today, 14:00	741 KB	Radiance

Repeat this process for all the camera angles photographed. The scaled down HDR Images will be used to generate the environment map, with the non-scaled HDR Images kept as a back-up in case alternate sizes are required.

Step 2 - Creating the Panorama

From the **File > Automate Menu**, choose **Photomerge...**

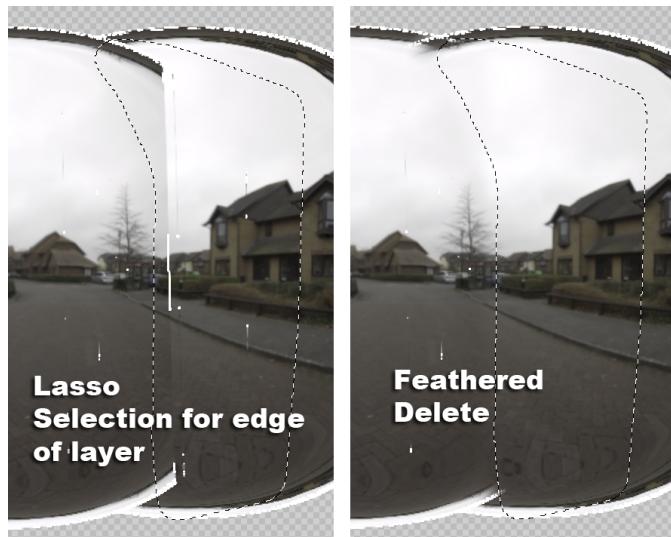


Specify a **Layout of Spherical**, and **Browse** for the **scaled down HDR Images**. **Deactivate** the **Blend Images Together** option, and **if desired activate** the **Vignette Removal** and **Geometric Distortion Correction** options. Press **OK** to complete the Photomerge process. The Photomerge panorama will appear as a series of Photoshop Layers aligned relative to each other.

HDRI – Creating Environment Maps for Houdini



NOTE: The white boundaries for each layer can be removed in Photoshop by Lasso selecting them; feathering the resulting selection and pressing the Delete (or backspace) key. Similarly, the overlap regions can also be blended using this method.

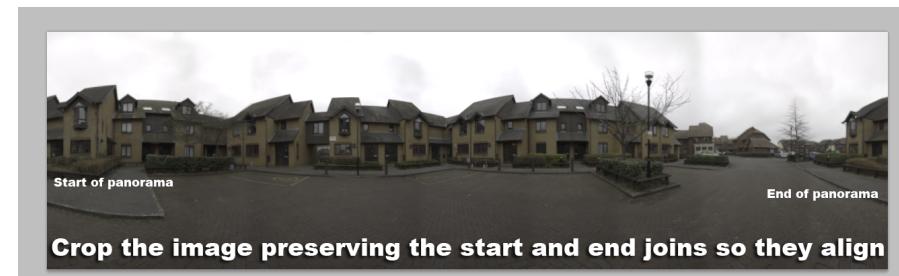


With the initial clean up completed, the **Layers can be flattened**, and the **Clone Tool** used to **repair any holes** in the panorama.



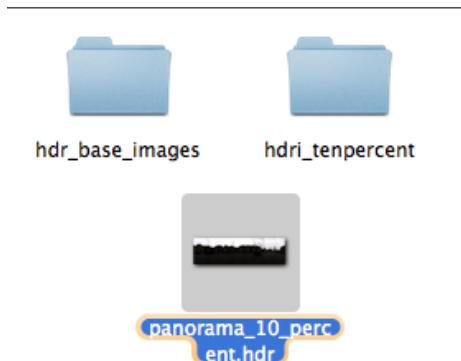
The **Clone Tool** can also be used to **soften any vignette striping** evident on the image.

As a final step, **Crop** the panorama as closely as possible to **the image boundaries**, ensuring that the **start** and **end** of the panorama create an **alignment to each other**.

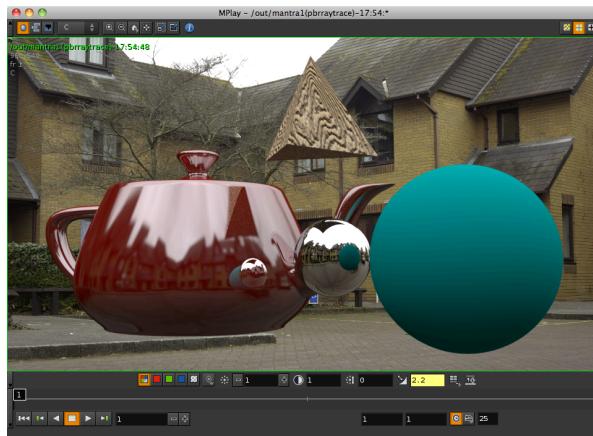


HDRI – Creating Environment Maps for Houdini

The file can then be saved out to disk as a new HDR Image file.



This file can now be used in Houdini as an Environment Map on an Environment Light.



8MM FISH EYE LENS

This example will look at the creation of an Environment Map for Houdini with Acquisition Images generated by a 8mm Fish Eye Lens. A Canon 5D was used with auto-bracketing activated. This feature automatically generates 3 images per shot; bright, mid and dark.



NOTE: for a wider dynamic range, more base exposure images can be sourced; however, although limited to 3 images the auto-bracketing feature of the Canon 5D does mean a rapid generation of files, which can be useful in changing lighting conditions

A total of 7 different angles were photographed in this way to create a full panorama of the location. Each of these images are stored in the native raw format for the Canon 5D.

IMPORTANT NOTE: In this example, we did not source quite enough angles to create the full panorama. We should have sourced 8+ angles instead of 7.

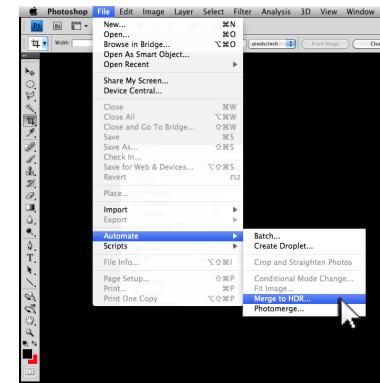
HDRI – Creating Environment Maps for Houdini

Step 1 – Organizing the Files

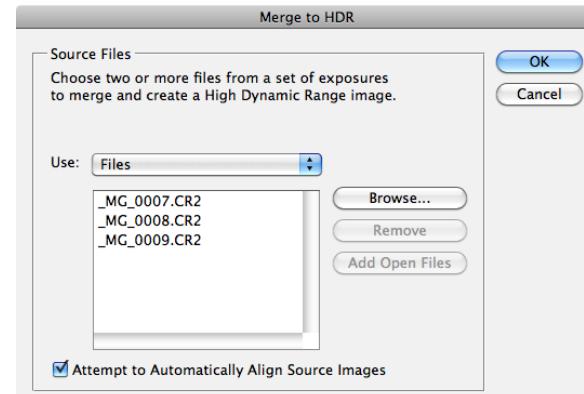
When these base images have been copied to disk, they need to be separated out into folders representing each photographed angle.

1		Yesterday, 10:57	--	Folder
	_MG_0028.CR2	Yesterday, 10:27	22.6 MB	Canon...aw file
	_MG_0029.CR2	Yesterday, 10:27	21.7 MB	Canon...aw file
	_MG_0030.CR2	Yesterday, 10:28	24.5 MB	Canon...aw file
2		Yesterday, 10:57	--	Folder
	_MG_0031.CR2	Yesterday, 10:28	22.9 MB	Canon...aw file
	_MG_0032.CR2	Yesterday, 10:28	21.9 MB	Canon...aw file
	_MG_0033.CR2	Yesterday, 10:28	24.9 MB	Canon...aw file
3		Yesterday, 10:57	--	Folder
	_MG_0034.CR2	Yesterday, 10:28	23.1 MB	Canon...aw file
	_MG_0035.CR2	Yesterday, 10:28	22.1 MB	Canon...aw file
	_MG_0036.CR2	Yesterday, 10:28	25.1 MB	Canon...aw file
4		Yesterday, 10:57	--	Folder
	_MG_0037.CR2	Yesterday, 10:28	23 MB	Canon...aw file
	_MG_0038.CR2	Yesterday, 10:28	22.2 MB	Canon...aw file
	_MG_0039.CR2	Yesterday, 10:28	25.1 MB	Canon...aw file
5		Yesterday, 10:58	--	Folder
	_MG_0040.CR2	Yesterday, 10:28	22.9 MB	Canon...aw file
	_MG_0041.CR2	Yesterday, 10:28	22.1 MB	Canon...aw file
	_MG_0042.CR2	Yesterday, 10:28	25.2 MB	Canon...aw file
6		Yesterday, 10:58	--	Folder
	_MG_0043.CR2	Yesterday, 10:29	22.7 MB	Canon...aw file
	_MG_0044.CR2	Yesterday, 10:29	21.9 MB	Canon...aw file
	_MG_0045.CR2	Yesterday, 10:29	25.1 MB	Canon...aw file
7		Yesterday, 10:58	--	Folder
	_MG_0046.CR2	Yesterday, 10:29	22.7 MB	Canon...aw file
	_MG_0047.CR2	Yesterday, 10:29	21.9 MB	Canon...aw file
	_MG_0048.CR2	Yesterday, 10:29	24.9 MB	Canon...aw file

Each folder contains the bright, mid and dark raw images for each angle photographed. **Adobe Photoshop** can then be used to compile these raw images as a HDRI however this needs to be saved in the **exr format** for additional processing using Nuke.



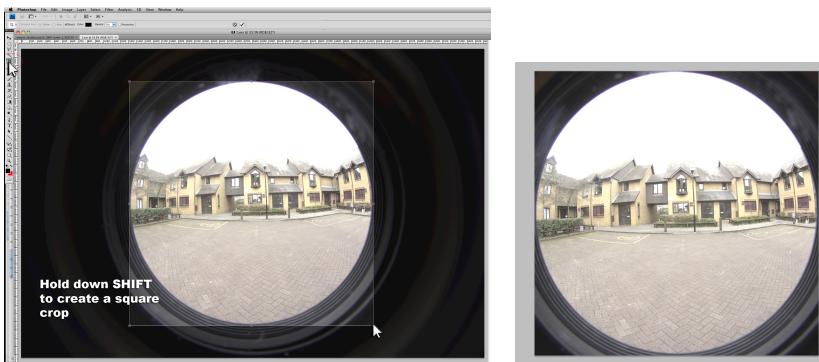
From the **File > Automate Menu**, choose **Merge to HDR...**



From the resulting dialog window, **Browse** for the raw images found in the first data folder. When the HDR image has been compiled, a HDR preview window will appear. Press **OK** to complete the HDR Merge process.

HDRI – Creating Environment Maps for Houdini

When the final HDR Image appears in Photoshop, use the **Crop Tool** to create a **square crop** tightly surrounding the fish eye lens image. Hold down **SHIFT** to ensure a square crop.



Save the cropped HDRI as an **.exr** (OpenEXR Image) into a separate directory.

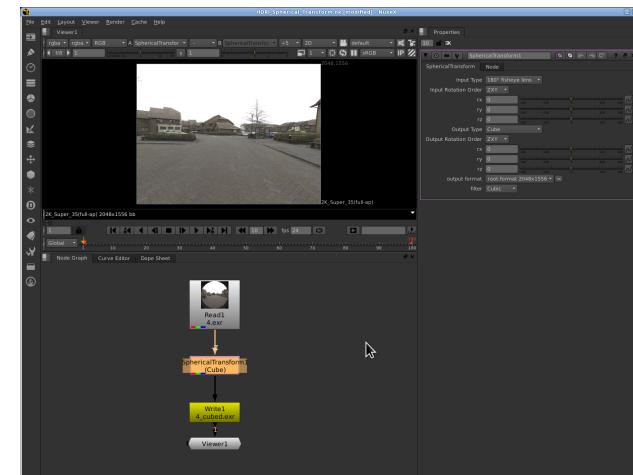
Repeat this process for all of the 7 fish eye lens sets of images.

►	1	Yesterday, 10:57	--	Folder
►	2	Yesterday, 10:57	--	Folder
►	3	Yesterday, 10:57	--	Folder
►	4	Yesterday, 10:57	--	Folder
►	5	Yesterday, 10:58	--	Folder
►	6	Yesterday, 10:58	--	Folder
►	7	Yesterday, 10:58	--	Folder
▼	hdr_base_images	Today, 12:25	--	Folder
	1.exr	Today, 11:00	26.9 MB	OpenE...image
	2.exr	Today, 11:22	27.4 MB	OpenE...image
	3.exr	Today, 11:24	27.5 MB	OpenE...image
	4.exr	Today, 11:26	27.3 MB	OpenE...image
	5.exr	Today, 12:22	27.2 MB	OpenE...image
	6.exr	Today, 12:24	27.3 MB	OpenE...image
	7.exr	Today, 12:25	27.2 MB	OpenE...image

Open Nuke and using a **Read** node, import the **first exr file**. Append a **Spherical Transform** node to the **Read Node**. In its **parameters** specify:

Input Type	Fish Eye Lens
Output Type	Cube

NOTE: The Spherical Transform Node also has options for Mirror Ball input and output types if a chrome sphere has been used instead of a fish eye lens.

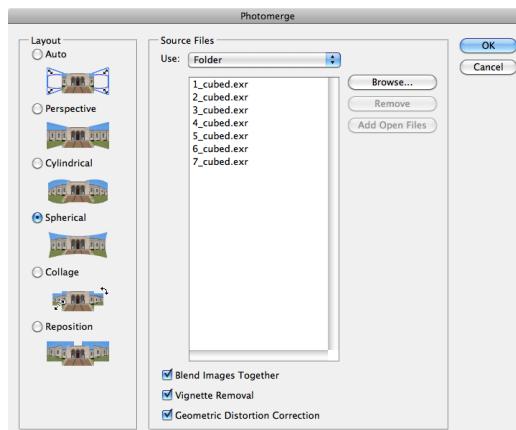


This will convert the spherical image into one that can be stitched together as a panorama. Use a **Write** node to save the image back out to disk as a **new image in a new directory**.

HDRI – Creating Environment Maps for Houdini

hdr_base_images		Today, 12:25	-- Folder
1.exr		Today, 11:00	26.9 MB OpenE...image
2.exr		Today, 11:22	27.4 MB OpenE...image
3.exr		Today, 11:24	27.5 MB OpenE...image
4.exr		Today, 11:26	27.3 MB OpenE...image
5.exr		Today, 12:22	27.2 MB OpenE...image
6.exr		Today, 12:24	27.3 MB OpenE...image
7.exr		Today, 12:25	27.2 MB OpenE...image
hdr_cubed		Today, 12:54	-- Folder
1_cubed.exr		Today, 12:32	10.4 MB OpenE...image
2_cubed.exr		Today, 12:33	10.9 MB OpenE...image
3_cubed.exr		Today, 12:33	11.2 MB OpenE...image
4_cubed.exr		Today, 12:36	9.7 MB OpenE...image
5_cubed.exr		Today, 12:35	10.7 MB OpenE...image
6_cubed.exr		Today, 12:35	10.6 MB OpenE...image
7_cubed.exr		Today, 12:35	10.5 MB OpenE...image

Re-open Photoshop, and from the **File > Automate Menu**, choose **Photomerge...**



In the **Photomerge options**, specify a **Spherical Layout** and Browse for the Nuke exr images just created. Activate the **Blend Images Together**, **Vignette Removal** and **Geometric Distortion Correction** options and press **OK** to start the Photomerge operation.

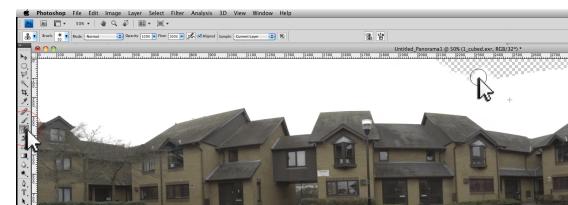


The resulting panorama will appear in Photoshop. **NOTE:** Converting the images via Nuke means that the Blend Images Together option in the Photomerge settings will instantly work, without need for further clean up.

IMPORTANT NOTE: In this example, we did not source quite enough angles to create the full panorama. We should have sourced 8 angles instead of 7.



With the panorama created, the image can be cropped down to create the final environment map. **Merge all the visible layers** (don't flatten the image yet). **The Clone Tool** can then be used to extend the sky region for the cropped image.

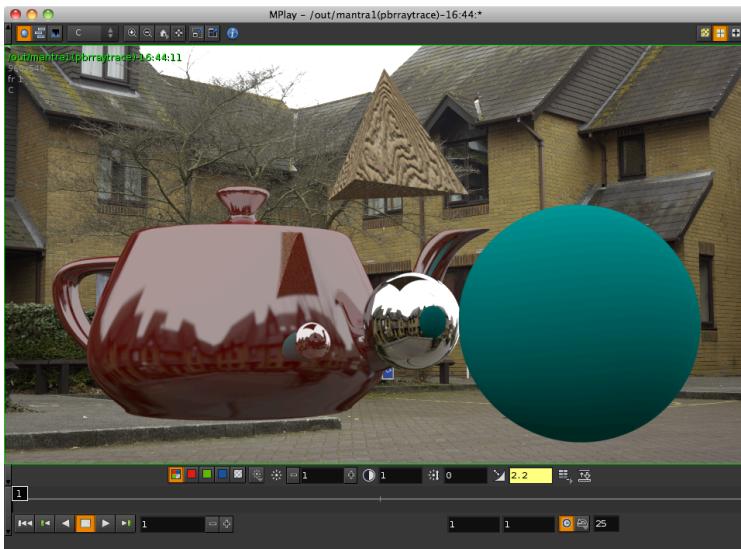


HDRI – Creating Environment Maps for Houdini

With the clean up complete, the image can be flattened and saved to disk as a .hdr file for use in Houdini.



NOTE: If required this final image can be resized smaller for processing speed, and a sky extension / replacement can also be created.



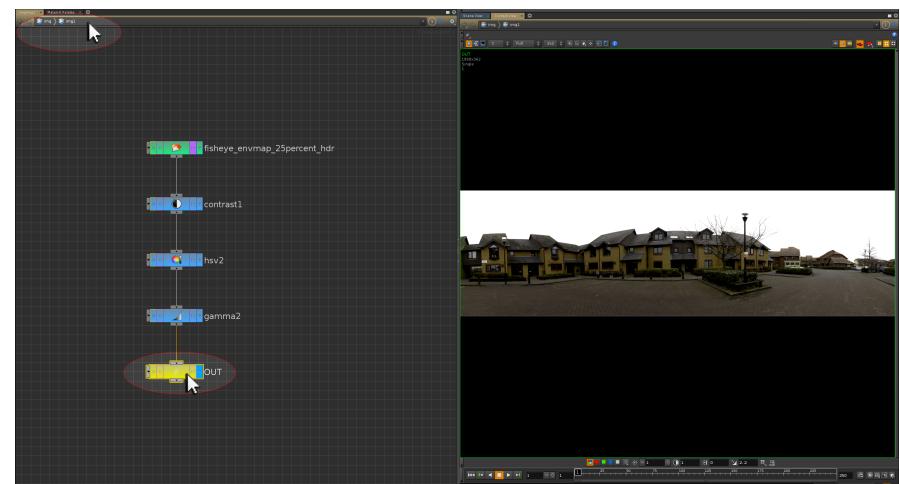
TIPS FOR USING HDR ENVIRONMENT MAPS IN HOUDINI

The Chrome Sphere Test

Creating a simple sphere object with a Chrome Material assigned can be a useful way to check the success of the environment map. Doing this will reveal any striping problems still evident on the map. It can also be used to check the resolution and quality of reflections relative to the final production render resolution.

HDRI Environment Maps and COPS

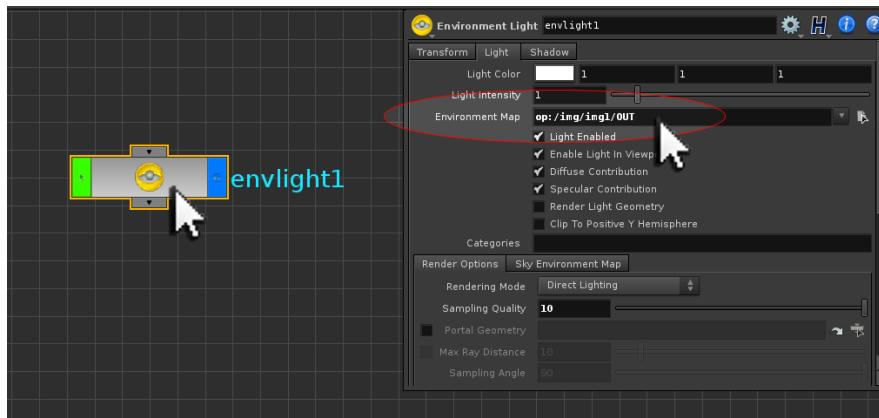
HDR Images can be read into **COPS (/img)**, the **compositing level of Houdini**. This can allow for further adjustment to the HDR Image to create a strong light match. The **File COP** can be used read in the environment map. A **Gamma COP** can be used to adjust its exposure. A **Bright COP** and **Contrast COP** can adjust brightness and contrast. A **HSV COP** can be used to adjust saturation values.



HDRI – Creating Environment Maps for Houdini

The HDR Image can also be activated as a ‘live’ environment map by using a **Null COP** to denote the end of the composite network chain. This Null COP can then be called in the **Environment Map** parameter of the **Environment Light** by using the **op: command**. For example:

Environment Map **op:/img/img1/OUT**



This allows for render tests to be generated relative to this ‘live’ compositing network, giving HDRI flexibility as the light match is being established. Once the light match has been achieved, the **Null COP network** can be rendered out to disk as a **.rat file** for final renders.

Orientating Environment Maps

On Linux, a large preview sphere of the environment map should appear in the Houdini Viewer when an environment map is loaded into an Environment Light.

This preview can be used to rotate the environment light so it aligns with the background plate.

If this preview is not present in the Viewer, an alternative is to use a textured NURBS sphere (activated with XY Polar UV coordinates, and textured with a constant material). The rotation of the preview sphere can then be channel referenced into the rotation parameter of the Environment Light to facilitate its orientation.