Dual-Fisheye Still Image

By using plug-in technology, you can improve the user experience for your customers. One example is to reduce the time between still image shots. The RICOH THETA S requires approximately 8 seconds between shots. The RICOH THETA V reduced this time to 4 seconds. The dual-fisheye plug-in reduces the time between shots to less than a second.
The reduction in time is achieved by delaying the process of converting dual-fisheye images into a single equirectangular image inside the camera.
This is useful for the following applications:

1. HDR - High Definition Range - photography technique for greater luminosity
2. Timelapse
3. High volume pictures such as taking 1,000 images at a large construction site
4. Factory or workflow optimization (Taking pictures of an assembly line or other process involving people moving items)
5. Computer graphics 3D model scenes to get lighting information

Concepts Covered

- Image stitching control
- Permission setting to access storage and camera
- Post-production workflow
- Conversion of dual-fisheye to equirectangular
- High Dynamic Range Images

Install apk from Source

Requirements

- Tested with THETA V firmware 2.40.2

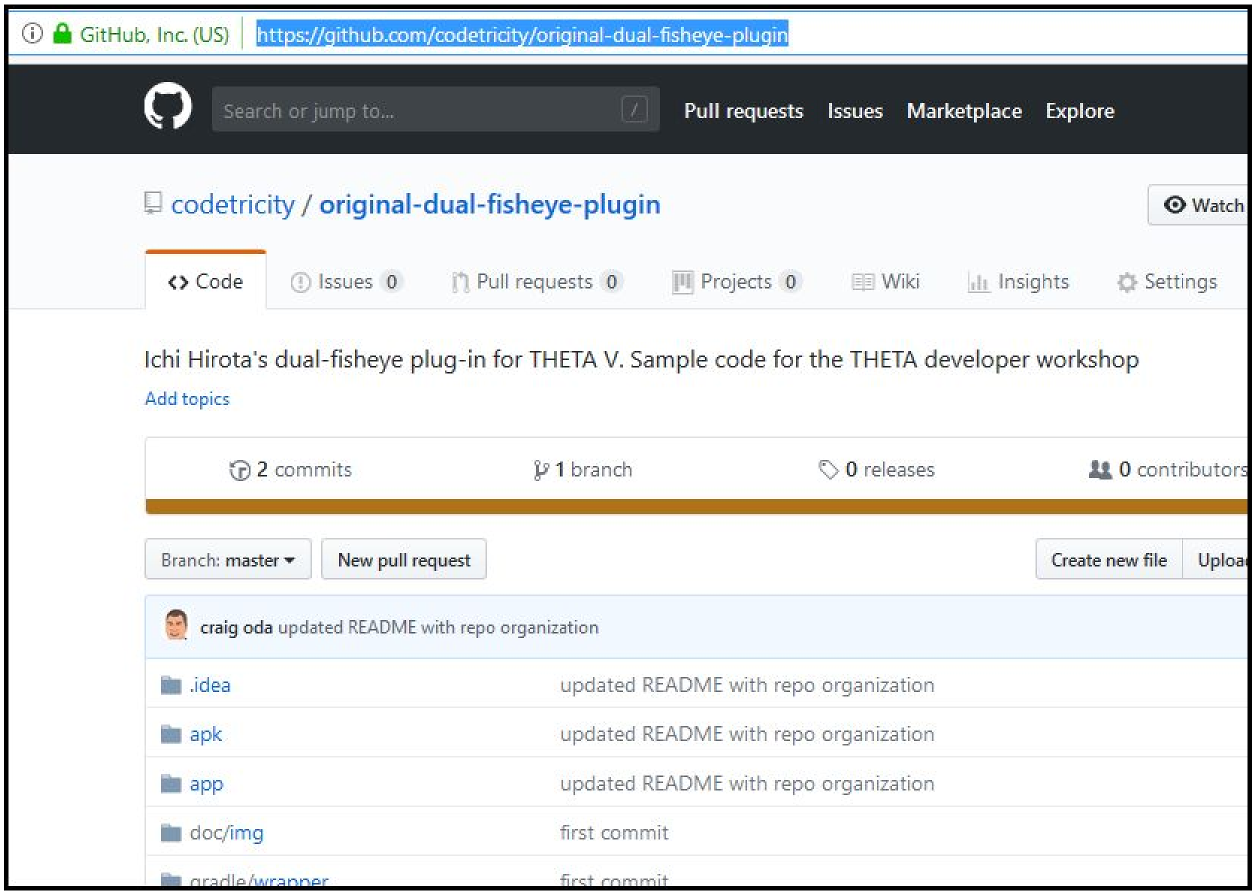
Known Issues

This is a simplified plug-in example with limited error checking. This example is sensitive to the duration of button presses.

- If you press the plug-in mode button for too long or too short, the plug-in may crash
- If you press the Wi-Fi button for too long to change from single to multi-shot mode, the application may crash
- If you press the shutter button for too long when you take the picture or pictures, the application may crash

Download GitHub Repository

Clone or download the GitHub repository for this tutorial.



Ichi Hirota's dual-fisheye plug-in for THETA V. Sample code for the THETA developer workshop

craig oda updated README with repo organization

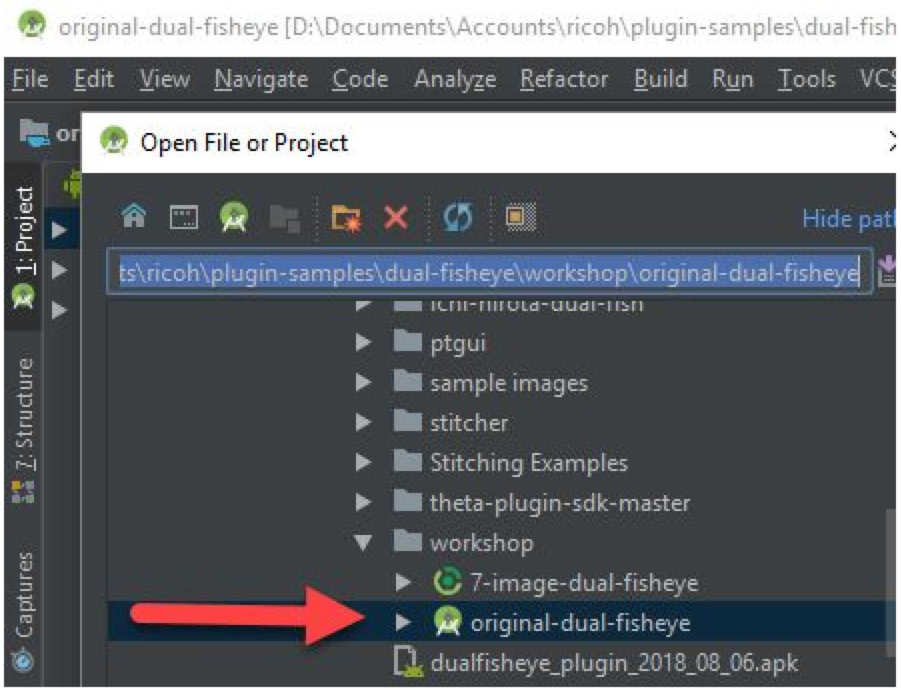
.idea	updated README with repo organization
apk	updated README with repo organization
app	updated README with repo organization
doc/img	first commit
gradle/wrapper	first commit

Repository Organization
/apk/app-debug.apk - binary to install in the RICOH THETA V
/tools/stitcher/MiSphereConverter_for_THETAV.apk - mobile stitching application for your Android phone
/app/src/main/java/com/theta360/pluginapplication/MainActivity.java - main plug-in source code

TIP: If you want to use the plug-in first and do not want to download the source, an updated apk was released on August 6, 2018. You can download the apk only. This version is not the same as the apk in the GitHub repository.

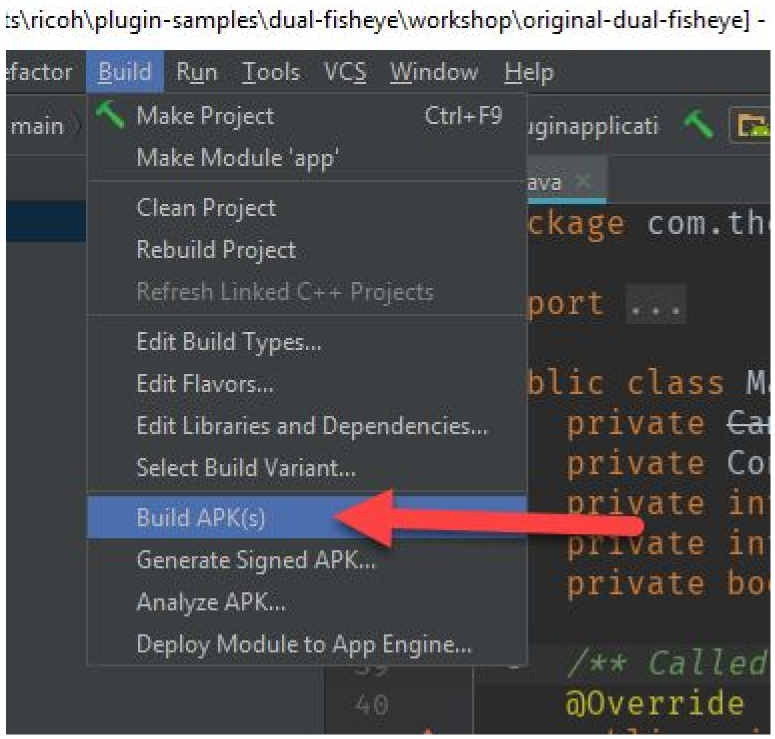
Open Android Project

File -> Open


original-dual-fisheye [D:\Documents\Accounts\ricoh\plugin-samples\dual-fish
File Edit View Navigate Code Analyze Refactor Build Run Tools VCS
Open File or Project
Hide path
ts\ricoh\plugin-samples\dual-fisheye\workshop\original-dual-fisheye
ptgui
sample images
stitcher
Stitching Examples
theta-plugin-sdk-master
workshop
7-image-dual-fisheye
original-dual-fisheye
dualfisheye_plugin_2018_08_06.apk
1: Project
7: Structure
Captures

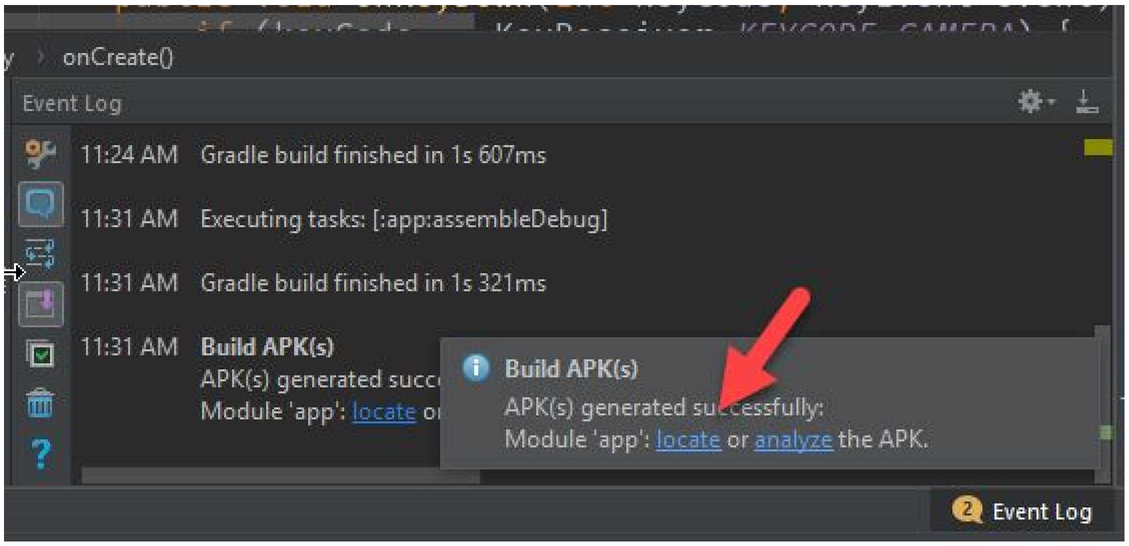
Build apk

Build -> Build APK(s)


ts\ricoh\plugin-samples\dual-fisheye\workshop\original-dual-fisheye] -
efactor Build Run Tools VCS Window Help
Make Project Ctrl+F9
Make Module 'app'
Clean Project
Rebuild Project
Refresh Linked C++ Projects
Edit Build Types...
Edit Flavors...
Edit Libraries and Dependencies...
Select Build Variant...
Build APK(s)
Generate Signed APK...
Analyze APK...
Deploy Module to App Engine...

NOTE: If the build fails, you can continue with the tutorial using the binary apk provided

Locate apk



```
11:24 AM   Gradle build finished in 1s 607ms
11:31 AM   Executing tasks: [:app:assembleDebug]
11:31 AM   Gradle build finished in 1s 321ms
11:31 AM   Build APK(s)
           APK(s) generated successfully:
           Module 'app': locate or analyze the APK.
```

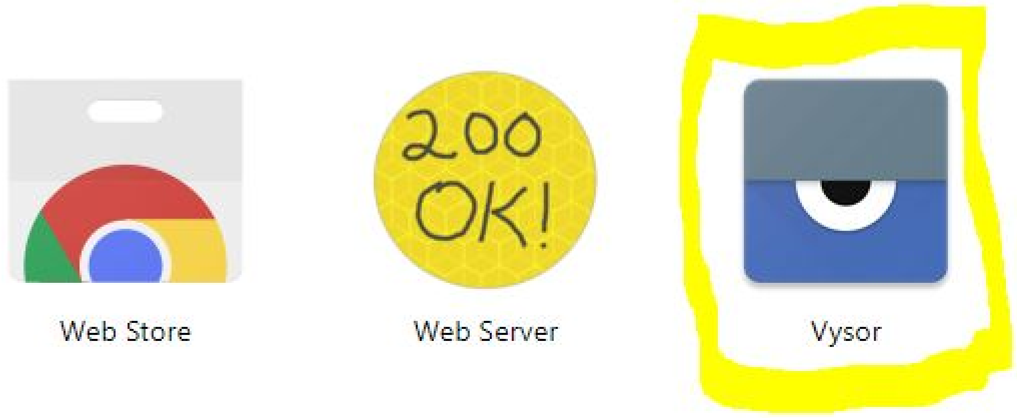
Use adb to install apk

Connect your THETA V to your workstation with a USB cable.
cd into the directory that your apk is in.
adb install -r app-debug.apk

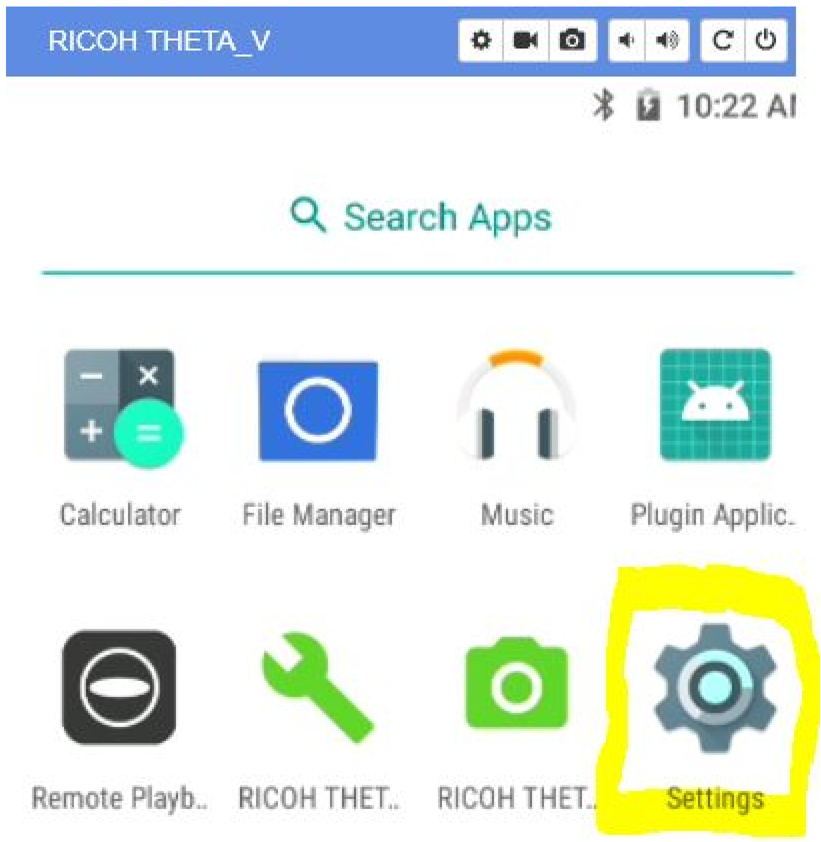
NOTE: If you've previously installed the THETA Plug-in SDK apk, you must first uninstall the SDK plug-in from the THETA. If adb does not detect your camera, unplug the camera and plug it back in. If the camera is still not detected, verify that your camera is unlocked. You must join the partner program to unlock your camera.

Use Vysor to set apk permissions

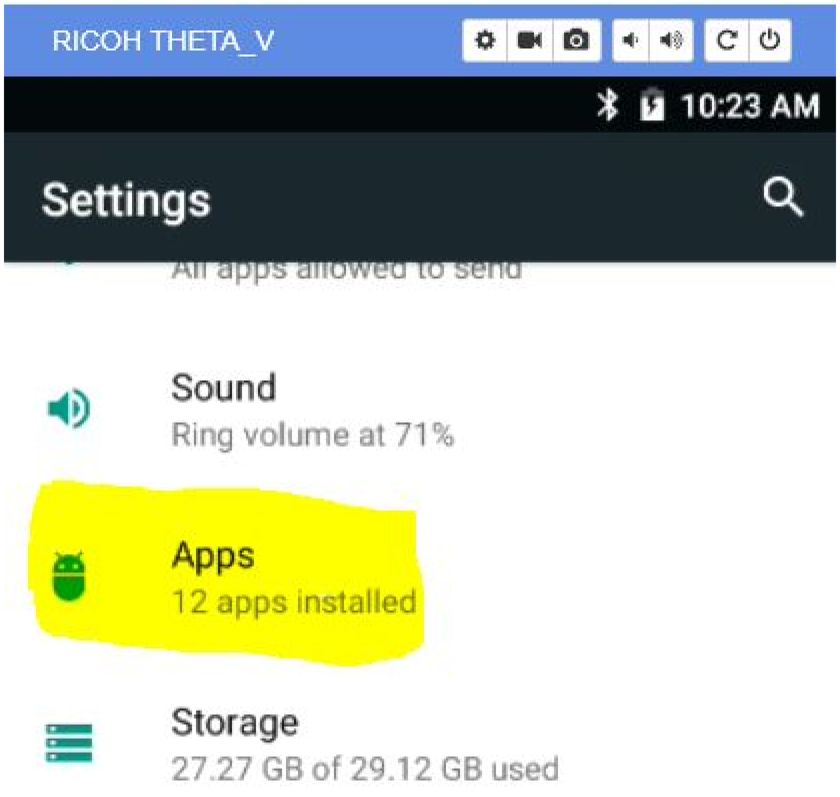
Start Vysor



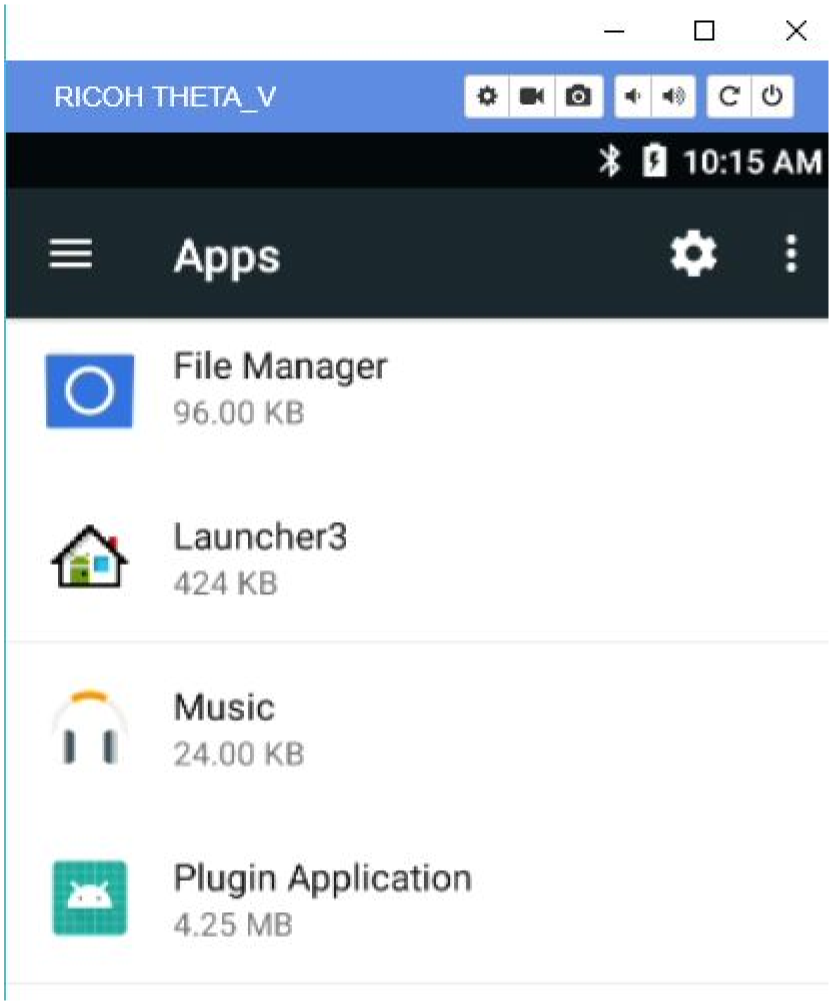
Select Apps in Settings



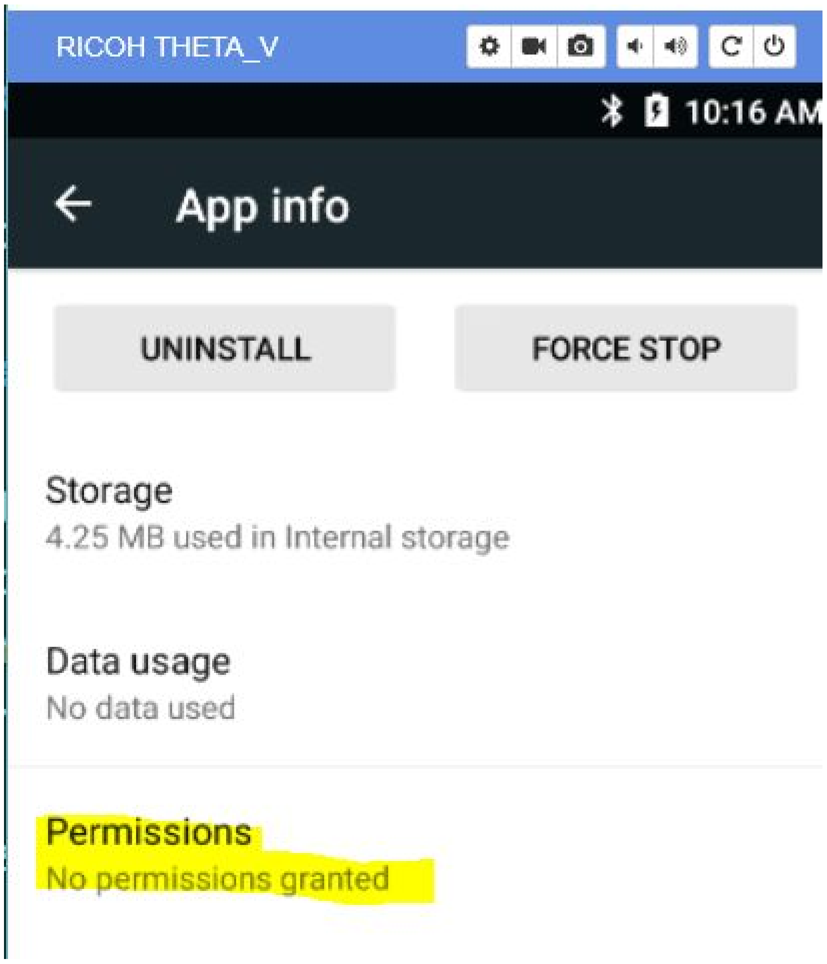
Scroll down until you see apps.



Select *Plugin Application*



In App Info select Permissions



RICOH THETA_V

10:16 AM

App info

UNINSTALL

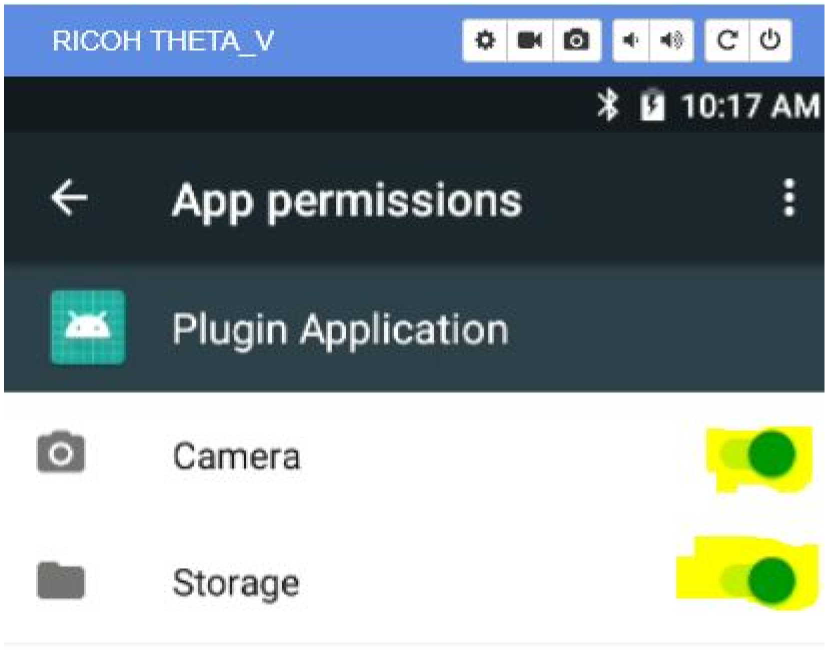
FORCE STOP

Storage
4.25 MB used in Internal storage

Data usage
No data used

Permissions
No permissions granted

Enable Camera and Storage



RICOH THETA_V

10:17 AM

App permissions

Plugin Application

Camera

Storage

Reboot Camera and Put Into Plug-in Mode

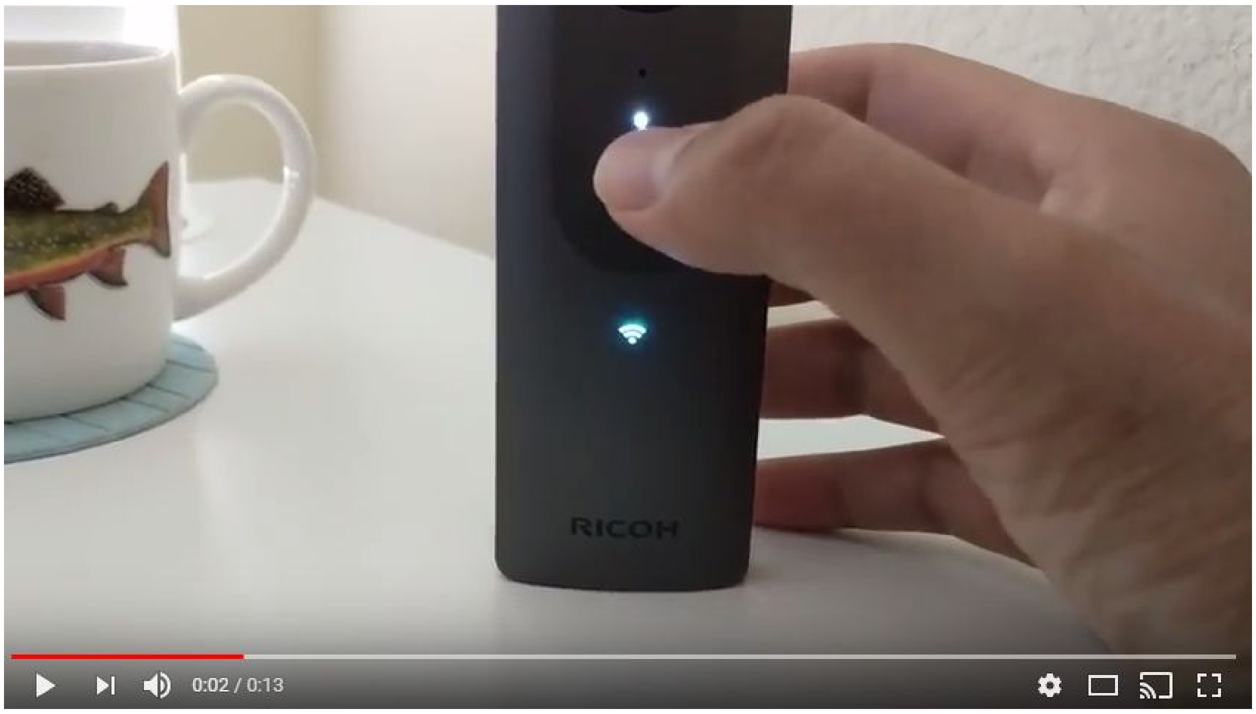
- Unplug camera
- Hold power button for 8 seconds
- Turn camera back on
- Hold Mode button for 2 seconds or longer
- Confirm that that the LED above the shutter button is white
- Wi-Fi LED below shutter will be aqua color and flashing

Taking Pictures

The camera has two modes by default. It can either take a single dual-fisheye image or take three dual-fisheye pictures in rapid succession for bracketing. You can switch between single image and bracketing mode by pressing the Wi-Fi button on the side of the camera. This must be a short press of less than 2 seconds.

Single Image

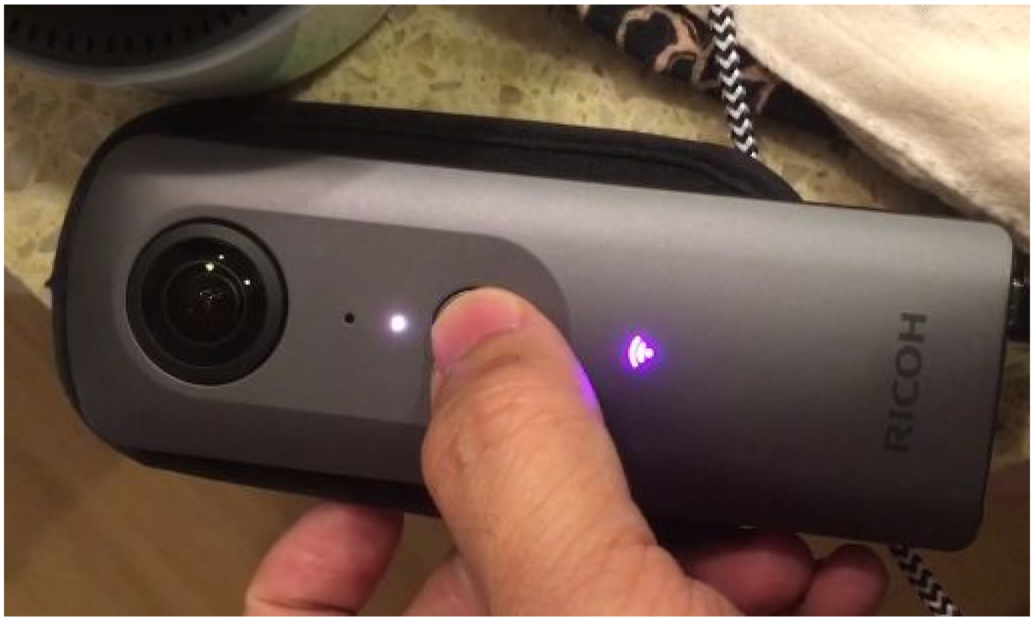
In single image mode. the Wi-Fi LED will be aqua and flashing.



3 Shot Mode

Press the Wi-Fi button on the side of the camera to get the camera into 3 shot mode. **WARNING: If you press the Wi-Fi button for more than a second, the plug-in may not work properly. Press the Wi-Fi button on the side of the camera firmly and release it quickly.**

In 3 shot mode, the Wi-Fi LED will be magenta and flashing faster compared to when the camera is in still image mode.

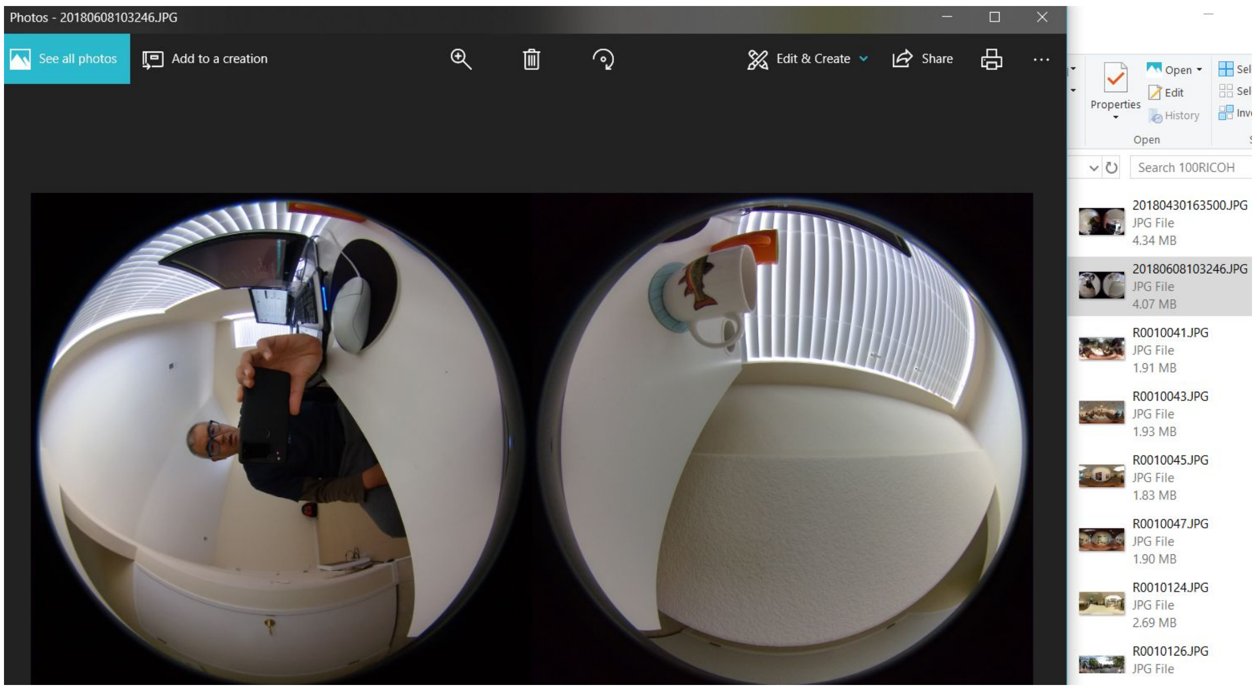


The gif below was contributed by community member @juantonto.

For 3 shot mode, you need to stabilize the camera for the duration of the three shots. Place the camera on tripod or stand it up on a table.
Press the shutter button. This must be a short press of less than 2 seconds.
Refer to the video above for the expected behavior of the camera, including LED and audio feedback.

Confirm pictures were taken

Connect camera to your computer with a USB cable.
In a file browser such as File Explorer, click into RICOH THETA V in the same process you use for a normal camera or storage device. Go into DCIM/100RICOH. You will see the dual-fisheye images with filenames that contain a date and time stamp.



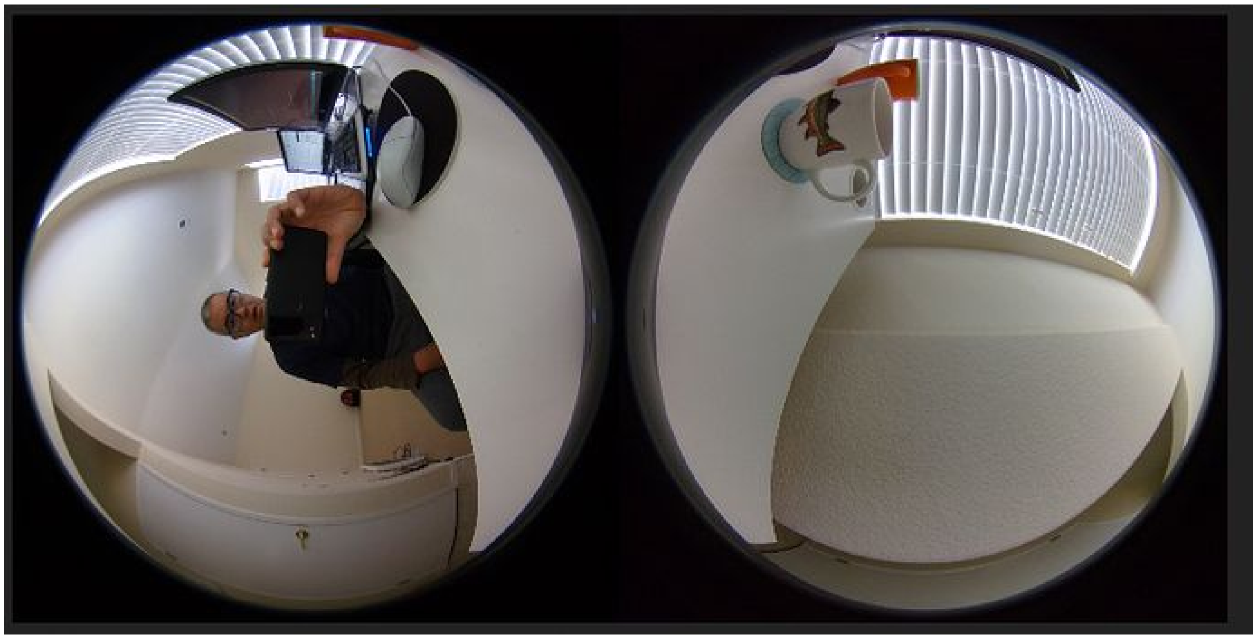
Stitching Dual-fisheye Images Into Equirectangular

For most applications, you will need to stitch the images in post-production processing using your own stitching library. For this tutorial, we will use a few commercial products to stitch the dual-fisheye image into equirectangular. Third-party stitching libraries do not have the lens parameter information from Ricoh and thus require manual callibration for each camera. Ricoh does not make the lens parameter information available.

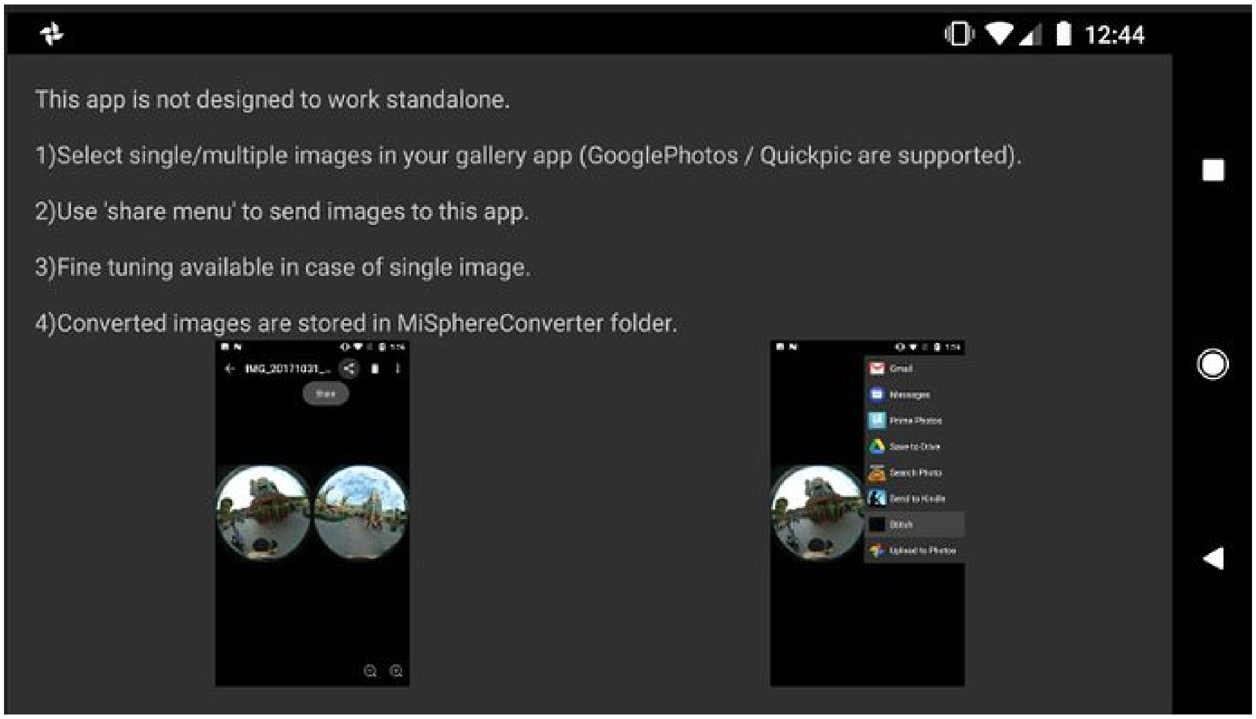
Android Phone Stitching Application

Ichi Hirota has produced a stitching library and Android mobile phone app that requires a one-time callibration for each camera. A trial version of the mobile app apk is available in the GitHub repository you downloaded for this tutorial. It is under the directory tools/stitcher. This trial version of the app has a watermark.
You can commercially license Ichi's stitching library and Android application. For more information on licensing Ichi's stitching library and Android application, please contact Jesse Casman at jcasman@oppkey.com.
If you prefer to use a desktop application, you can use PTGui. The guide to use PTGui to stitch the image is provided at the end of this article.

Original Dual-fisheye Image



Callibration Application



This app is not designed to work standalone.

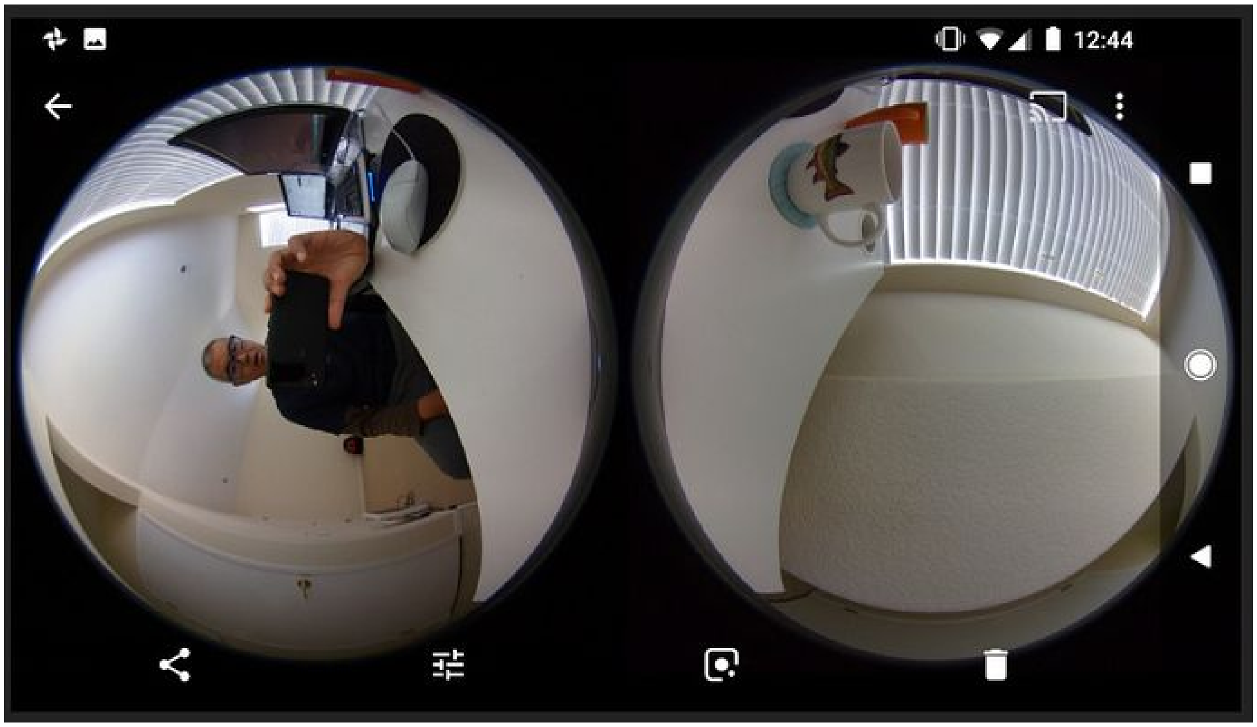
1)Select single/multiple images in your gallery app (GooglePhotos / Quickpic are supported).

2)Use 'share menu' to send images to this app.

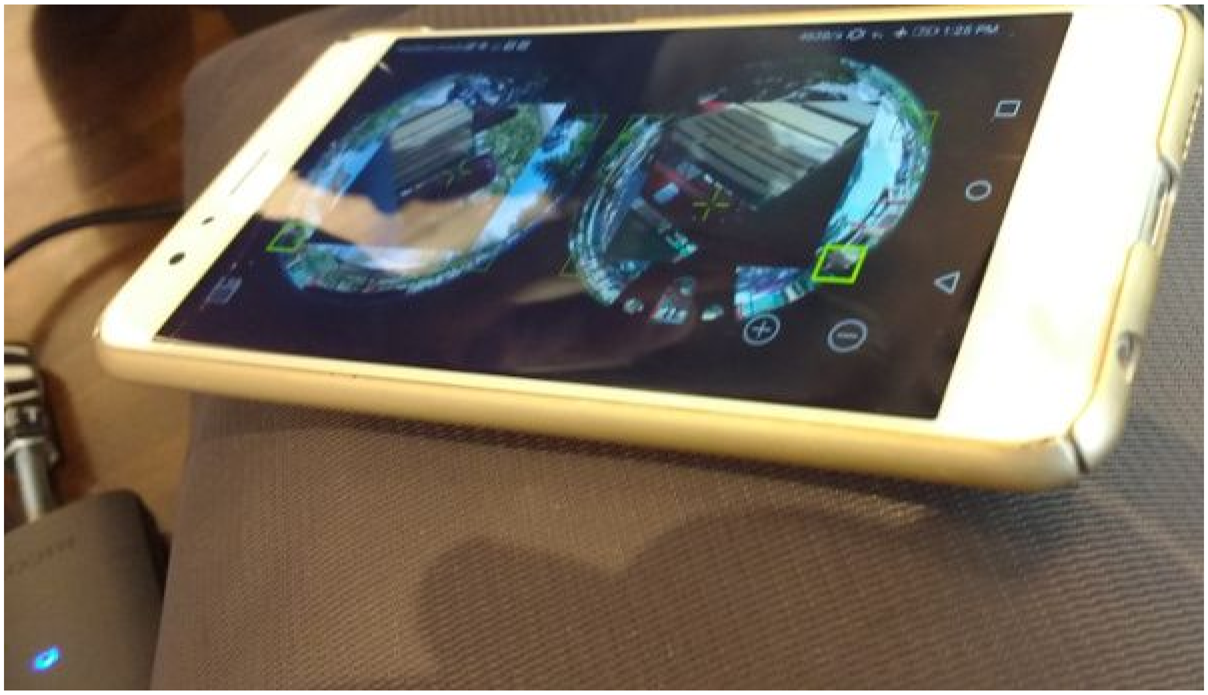
3)Fine tuning available in case of single image.

4)Converted images are stored in MiSphereConverter folder.

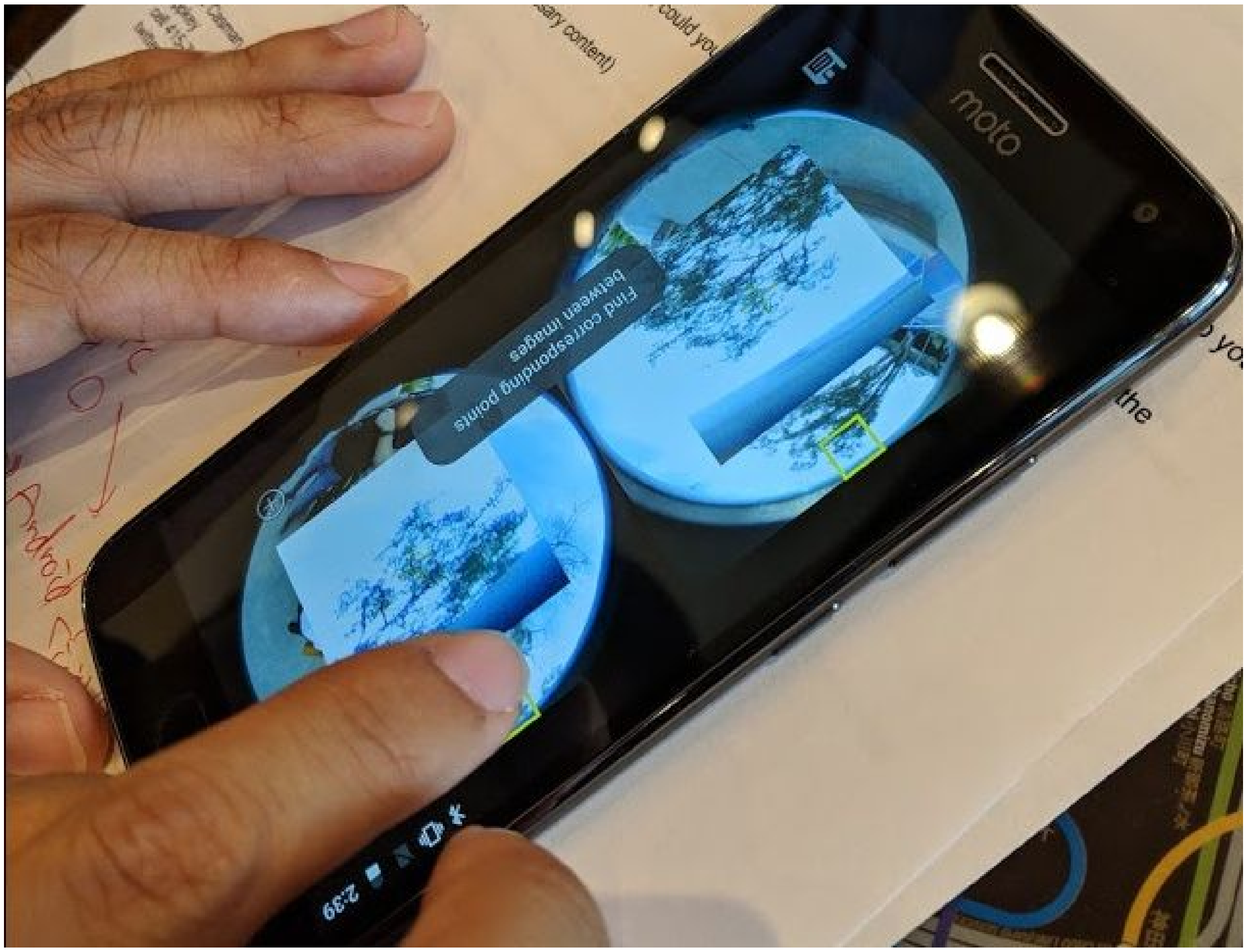
Dual-fisheye image loaded into callibration app.



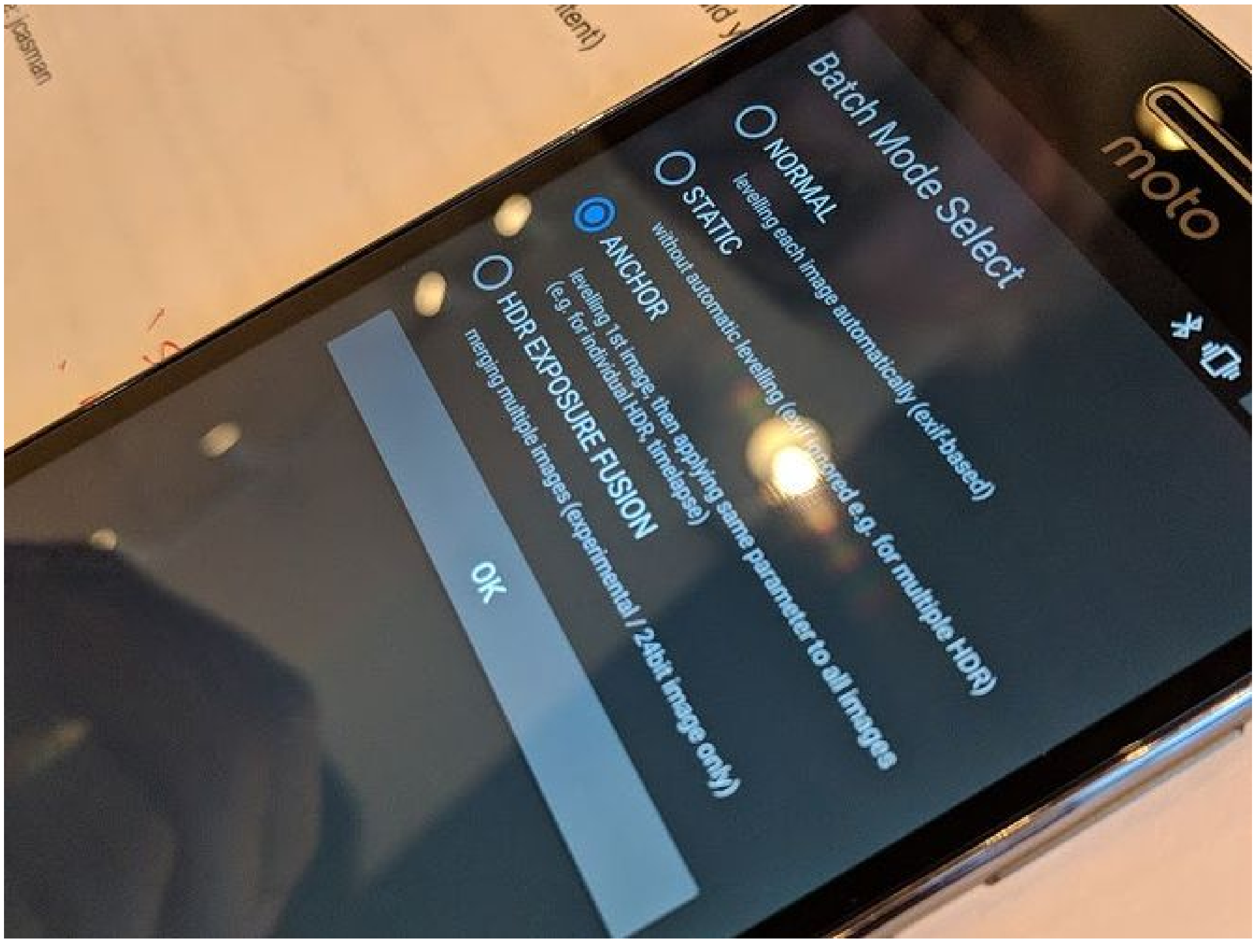
The lens distortion is compensated for by selecting points on the edges of the spheres. This is a one time process. The lens distortion information is then stored in the mobile app.



When you select the points of overlap, the callibration app will present a zoom view so that you can precisely select the overlap. In the view below, we're using the tree branch as the callibration point.



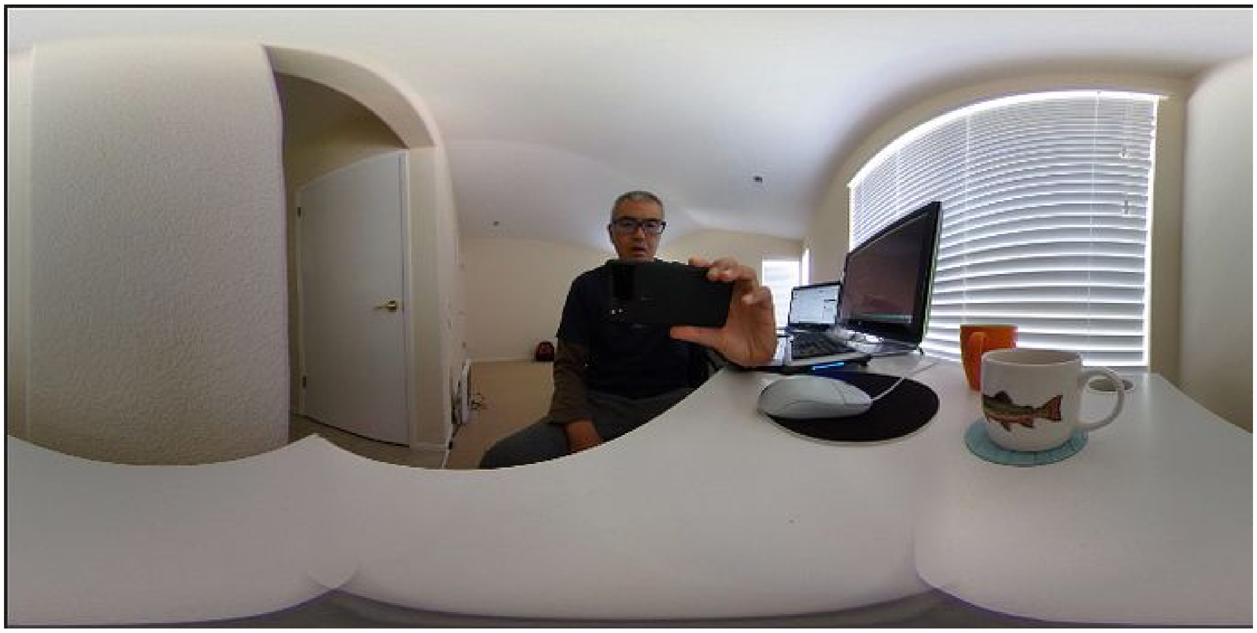
HDR is handled by the application.



Batch Mode Select

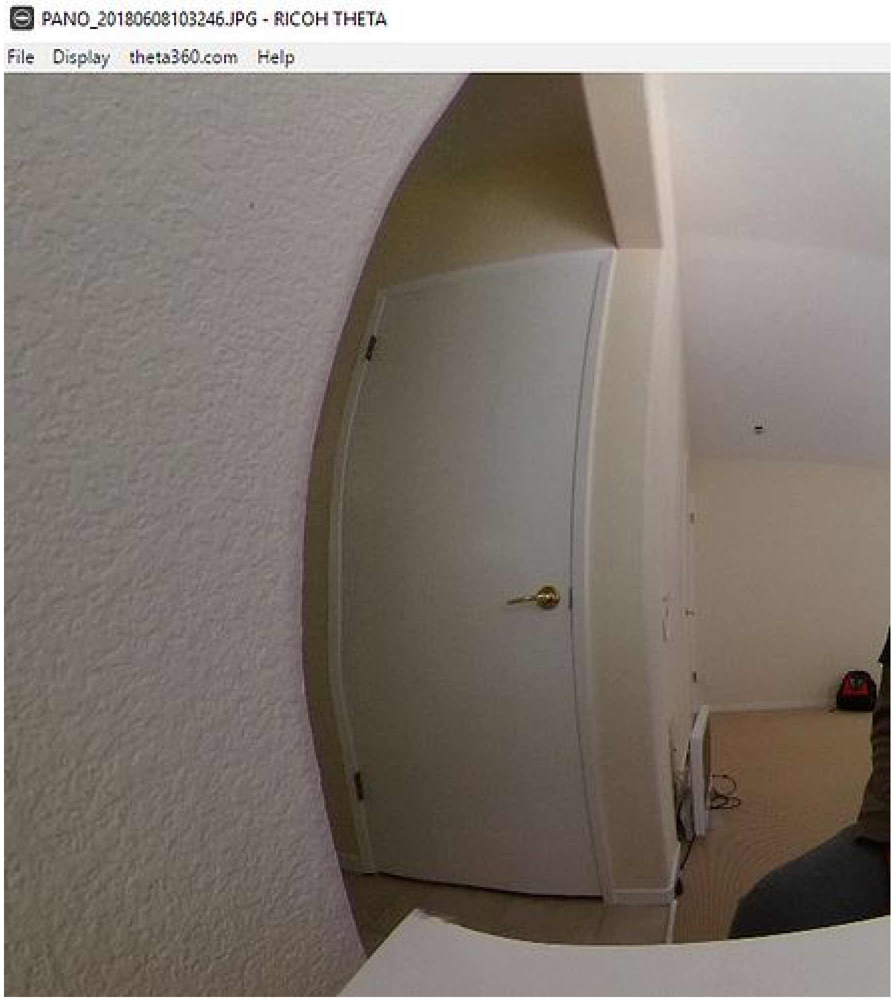
- NORMAL
  levelling each image automatically (exif-based)
- STATIC
  without automatic levelling (exif ignored e.g. for multiple HDR)
- [✓ ANCHOR]
  levelling 1st image, then applying same parameter to all images
  (e.g. for individual HDR, timelapse)
- HDR EXPOSURE FUSION
  merging multiple images (experimental / 24bit image only)

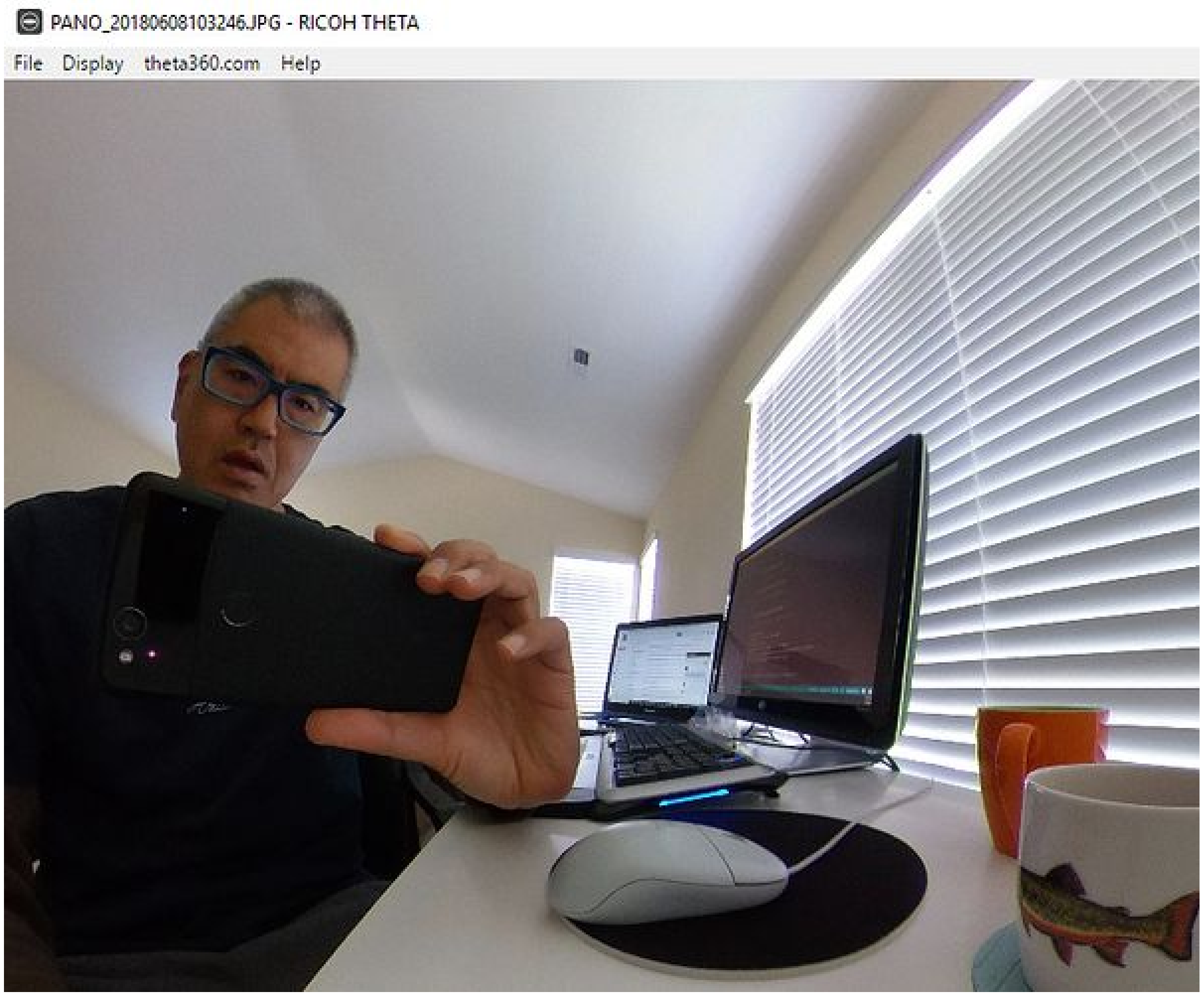
Stitching Results

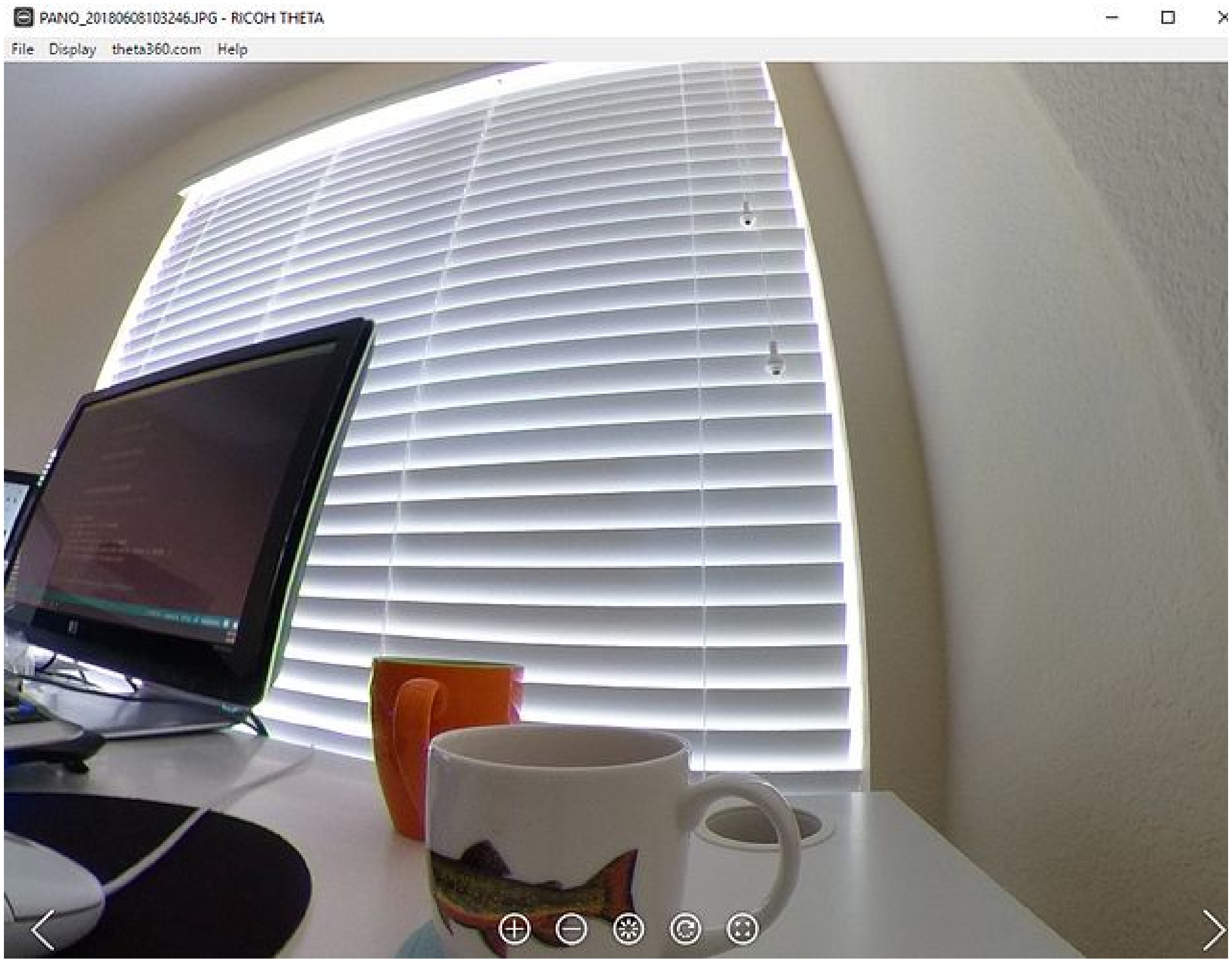


Close-Up on Stitch Line

Viewed using the Ricoh Desktop Appplication

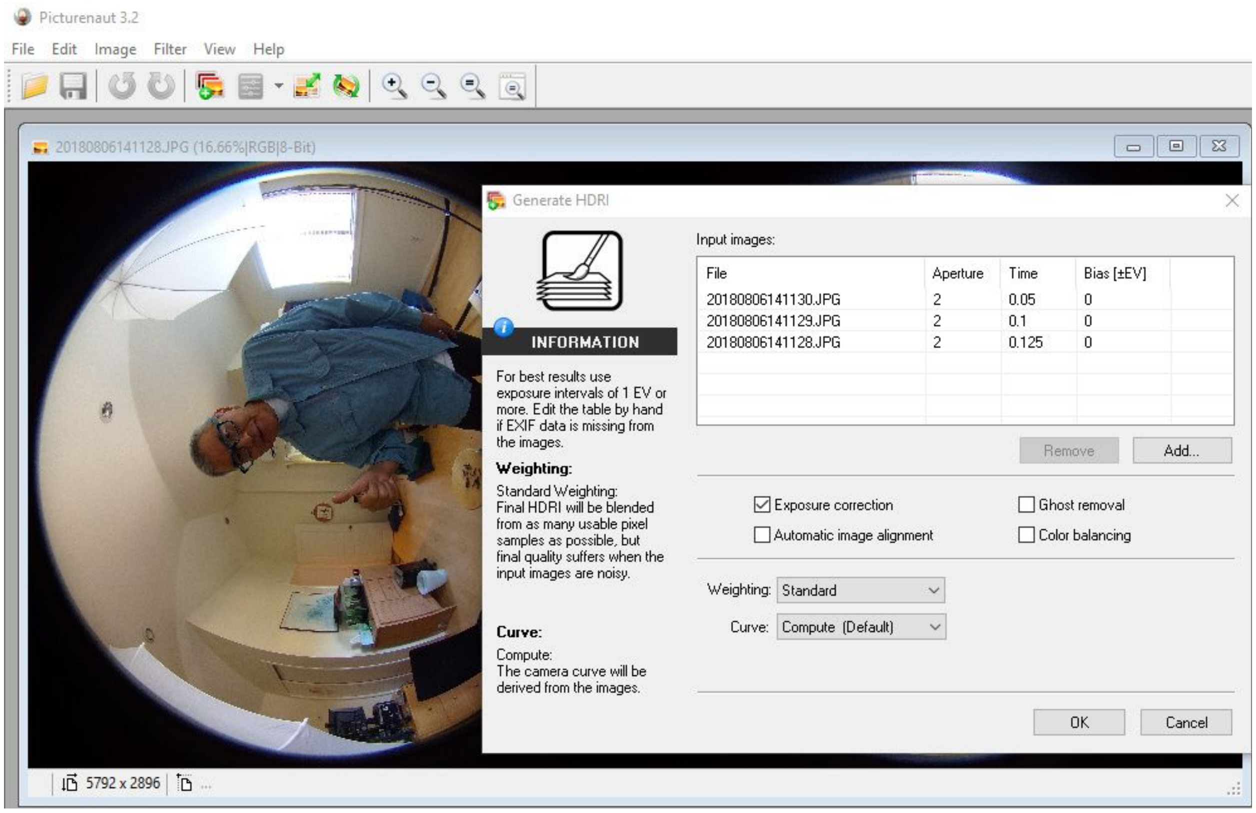



PANO_20180608103246.JPG - RICOH THETA
File
Display
theta360.com
Help



HDR - Blending 3 Shots into Single Image

You can use Picturenaut from HDR Labs to combine the 3 images into a single image.



For best results use exposure intervals of 1 EV or more. Edit the table by hand if EXIF data is missing from the images.

Weighting:

Standard Weighting:
Final HDRI will be blended from as many usable pixel samples as possible, but final quality suffers when the input images are noisy.

Curve:

Compute:
The camera curve will be derived from the images.

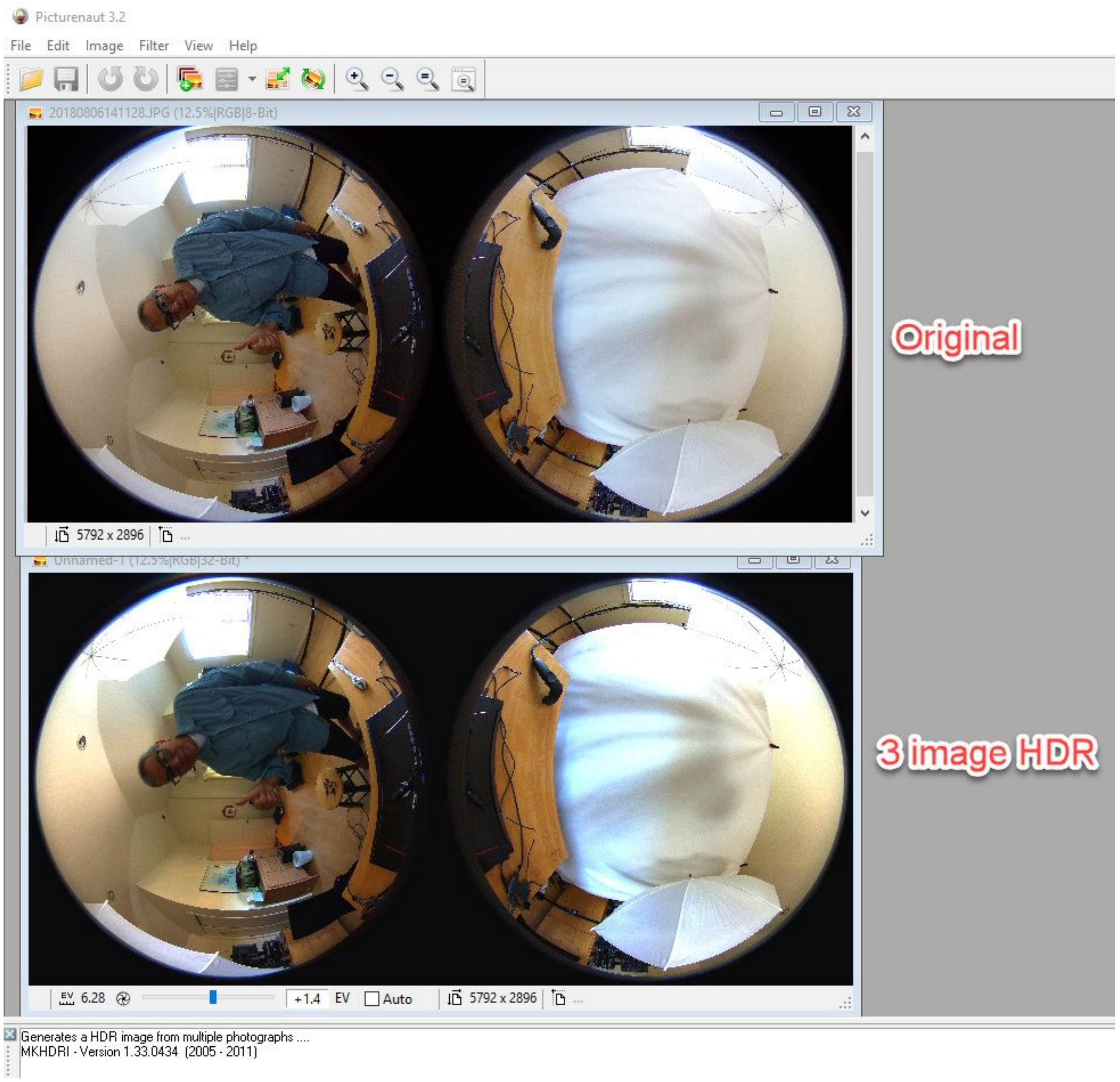
Input images:

File	Aperture	Time	Bias [±EV]
20180806141130.JPG	2	0.05	0
20180806141129.JPG	2	0.1	0
20180806141128.JPG	2	0.125	0

[✓] Exposure correction
[ ] Ghost removal
[ ] Automatic image alignment
[ ] Color balancing

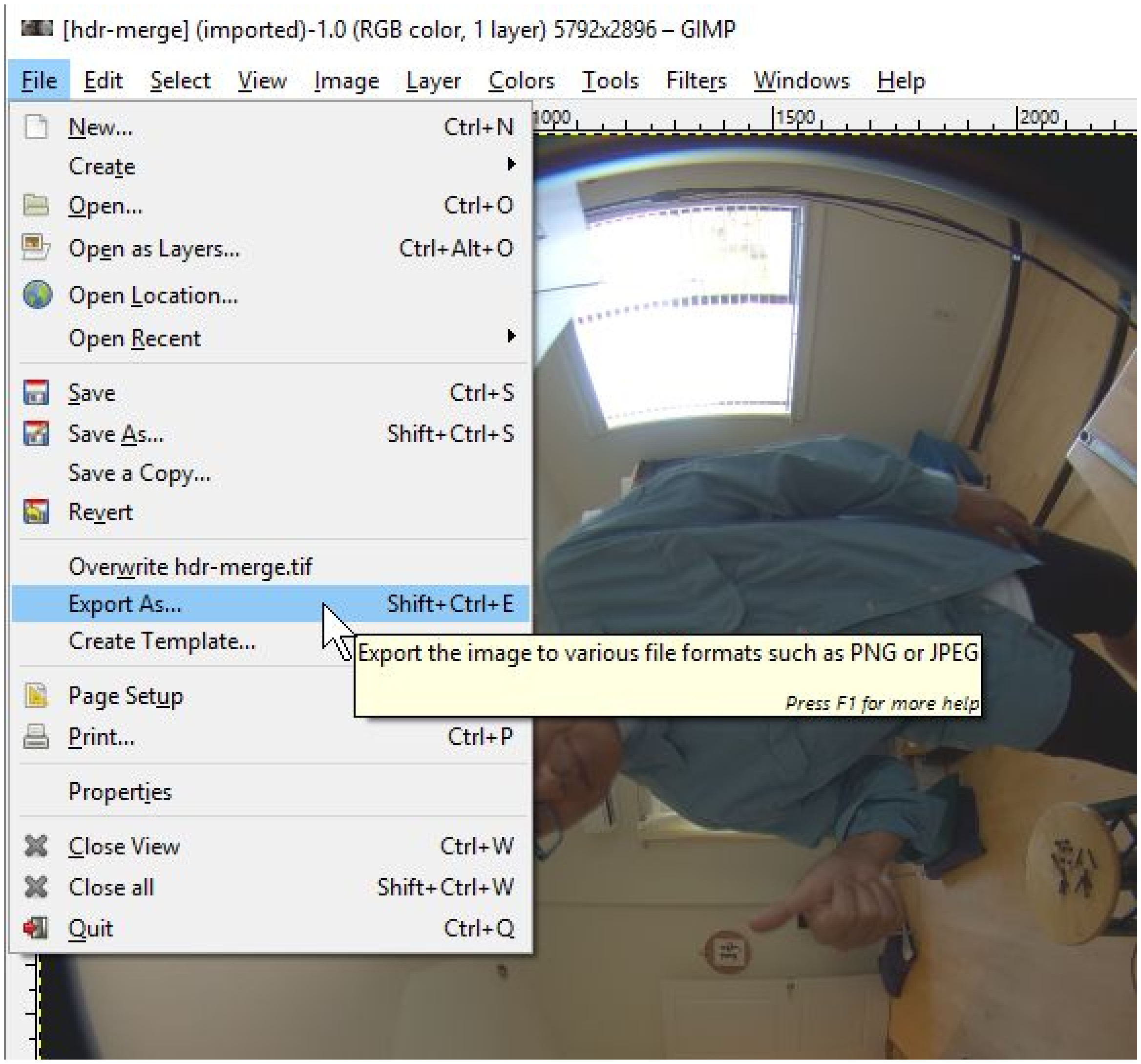
Weighting: Standard

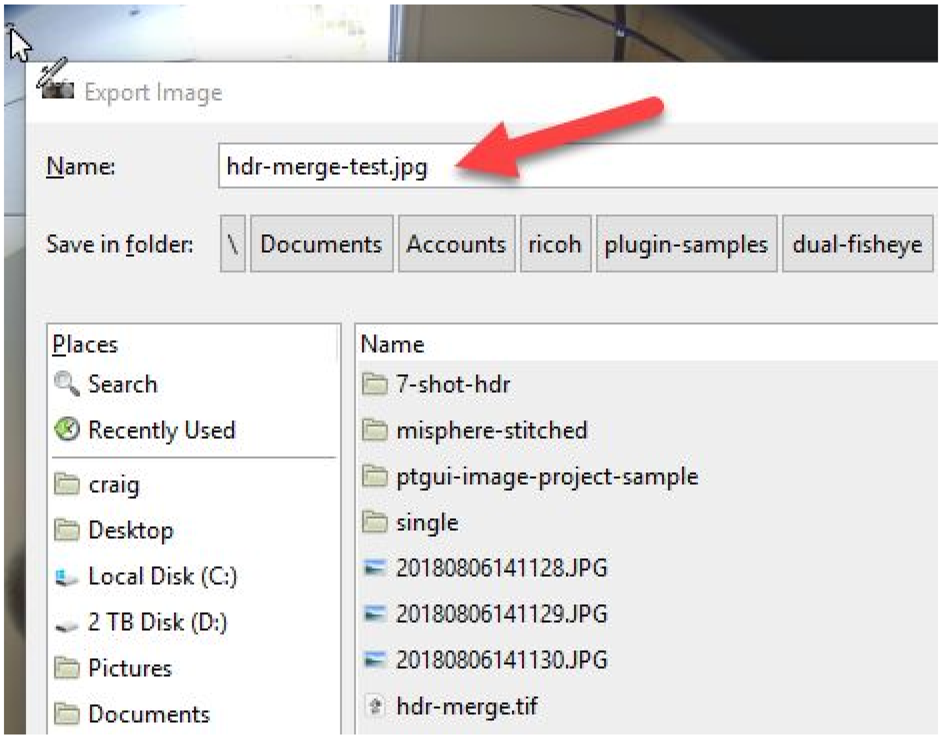
Curve: Compute (Default)


Picturenaut 3.2
File Edit Image Filter View Help
20180806141128.JPG (12.5%|RGB|8-Bit)
5792 x 2896
Original
Unnamed-1 (12.5%|RGB|32-Bit) *
6.28
+1.4 EV
Auto
5792 x 2896
3 image HDR

Generates a HDR image from multiple photographs ....
MKHDRI - Version 1.33.0434 (2005 - 2011)

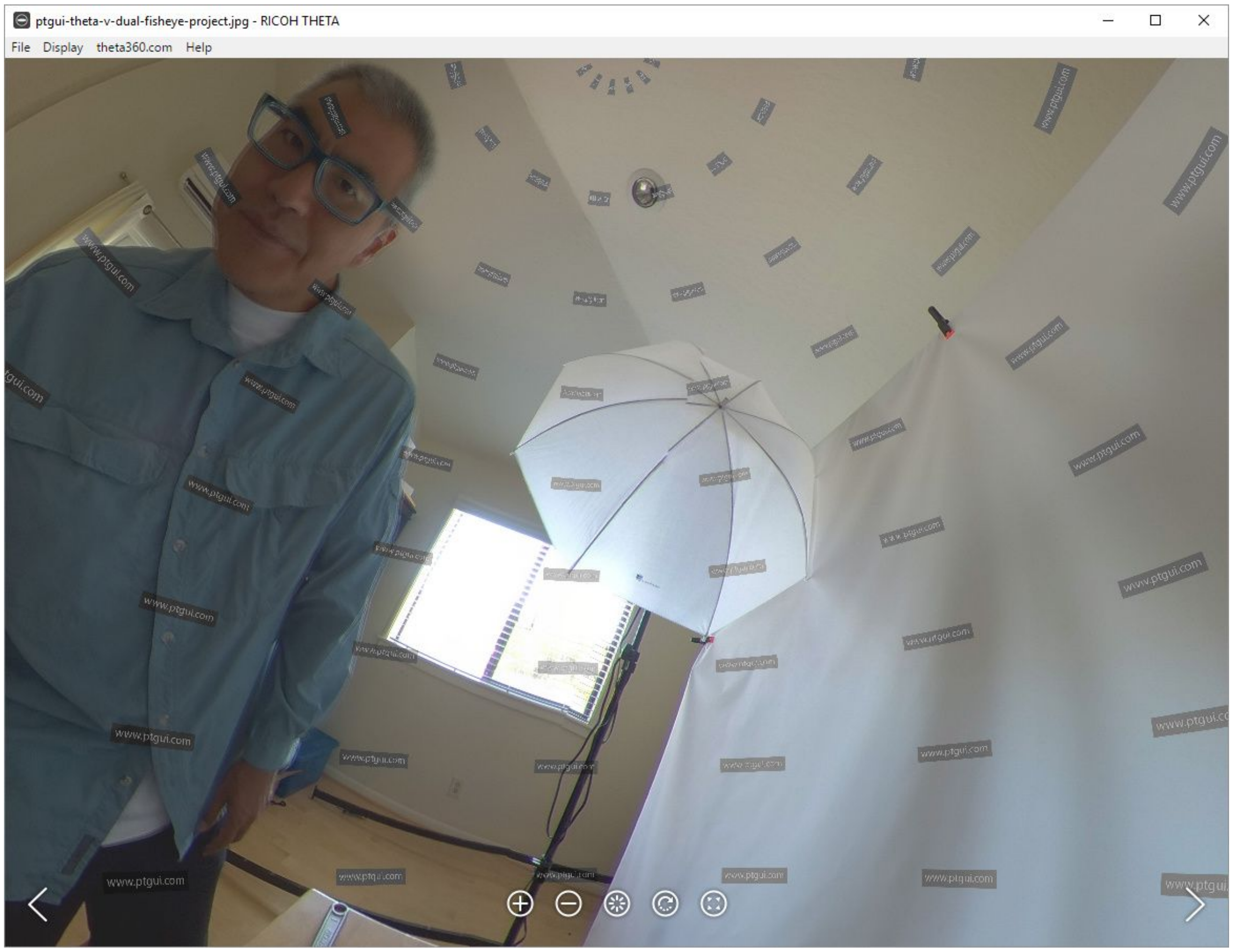
Picturenaut outputs a TIFF file. I converted this to jpeg using another graphics program called GIMP.

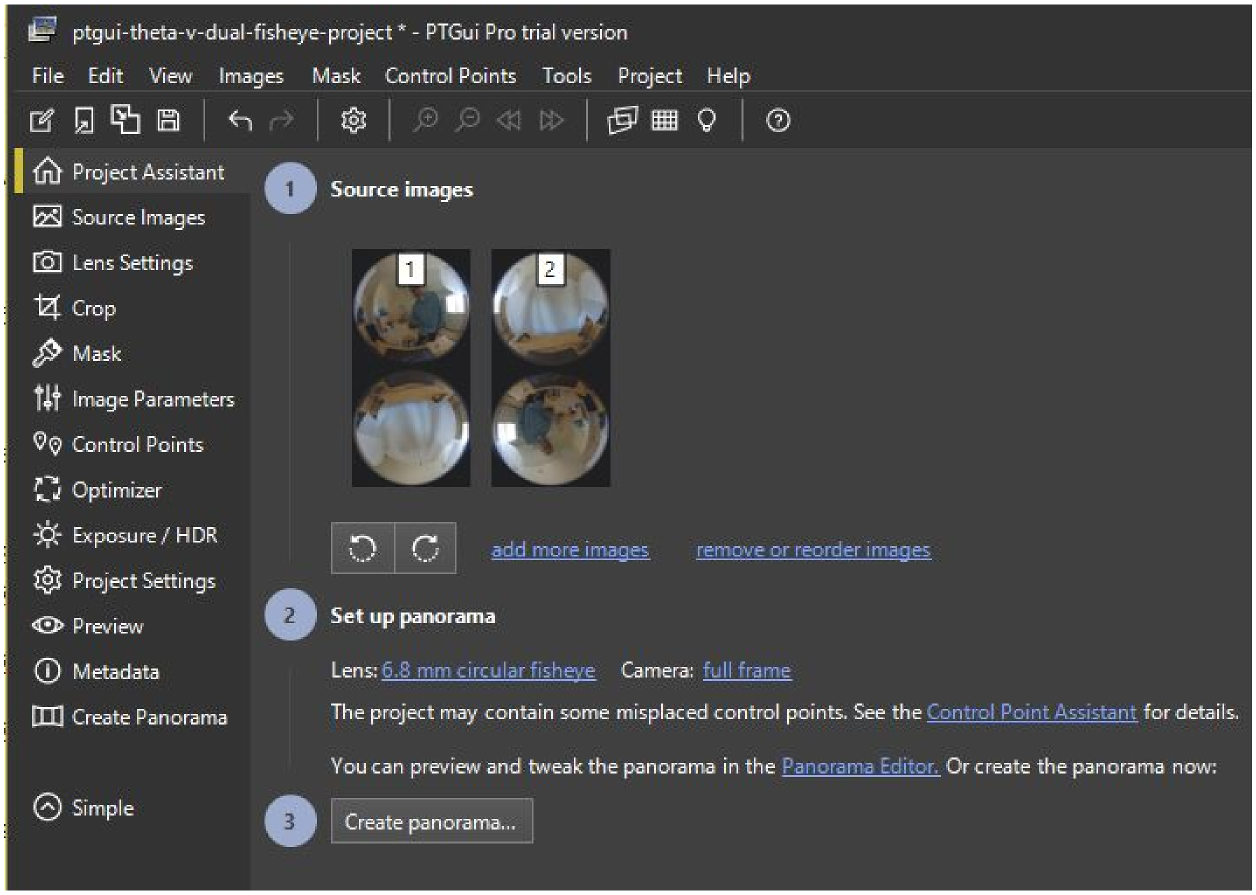

[hdr-merge] (imported)-1.0 (RGB color, 1 layer) 5792x2896 – GIMP
File
Edit
Select
View
Image
Layer
Colors
Tools
Filters
Windows
Help
New... Ctrl+N
Create
Open... Ctrl+O
Open as Layers... Ctrl+Alt+O
Open Location...
Open Recent
Save Ctrl+S
Save As... Shift+Ctrl+S
Save a Copy...
Revert
Overwrite hdr-merge.tif
Export As... Shift+Ctrl+E
Create Template...
Page Setup
Print... Ctrl+P
Properties
Close View Ctrl+W
Close all Shift+Ctrl+W
Quit Ctrl+Q
Export the image to various file formats such as PNG or JPEG
Press F1 for more help



Name: hdr-merge-test.jpg

I then used PTGui to stitch the dual-fisheye to equirectangular.


ptgui-theta-v-dual-fisheye-project.jpg - RICOH THETA
File
Display
theta360.com
Help
www.ptgui.com



1 Source images

2 Set up panorama

Lens: 6.8 mm circular fisheye Camera: full frame

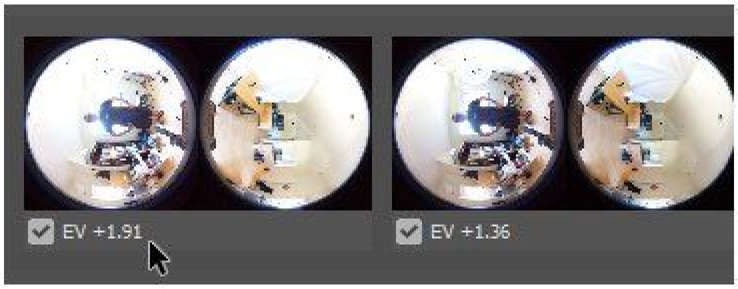
The project may contain some misplaced control points. See the Control Point Assistant for details.

You can preview and tweak the panorama in the Panorama Editor. Or create the panorama now:

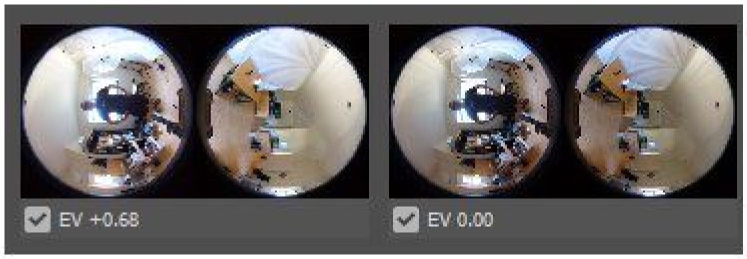
3 Create panorama...

Modify Code to Take 7 Images

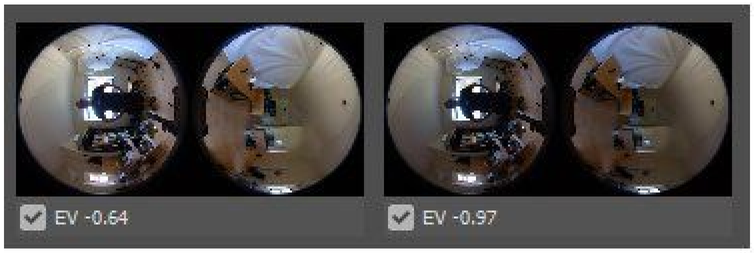
Let's modify the code to take 7 pictures with 7 different exposure compensation values:
-2.0, -1.3, -0.7, 0.0, 0.7, 1.3, 2.0
Here is an example output:



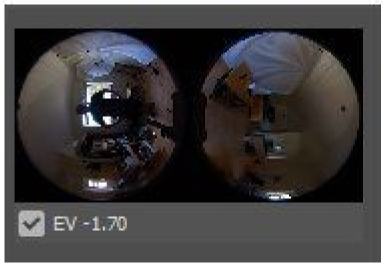
+1.92 +1.36



+0.68 0.00



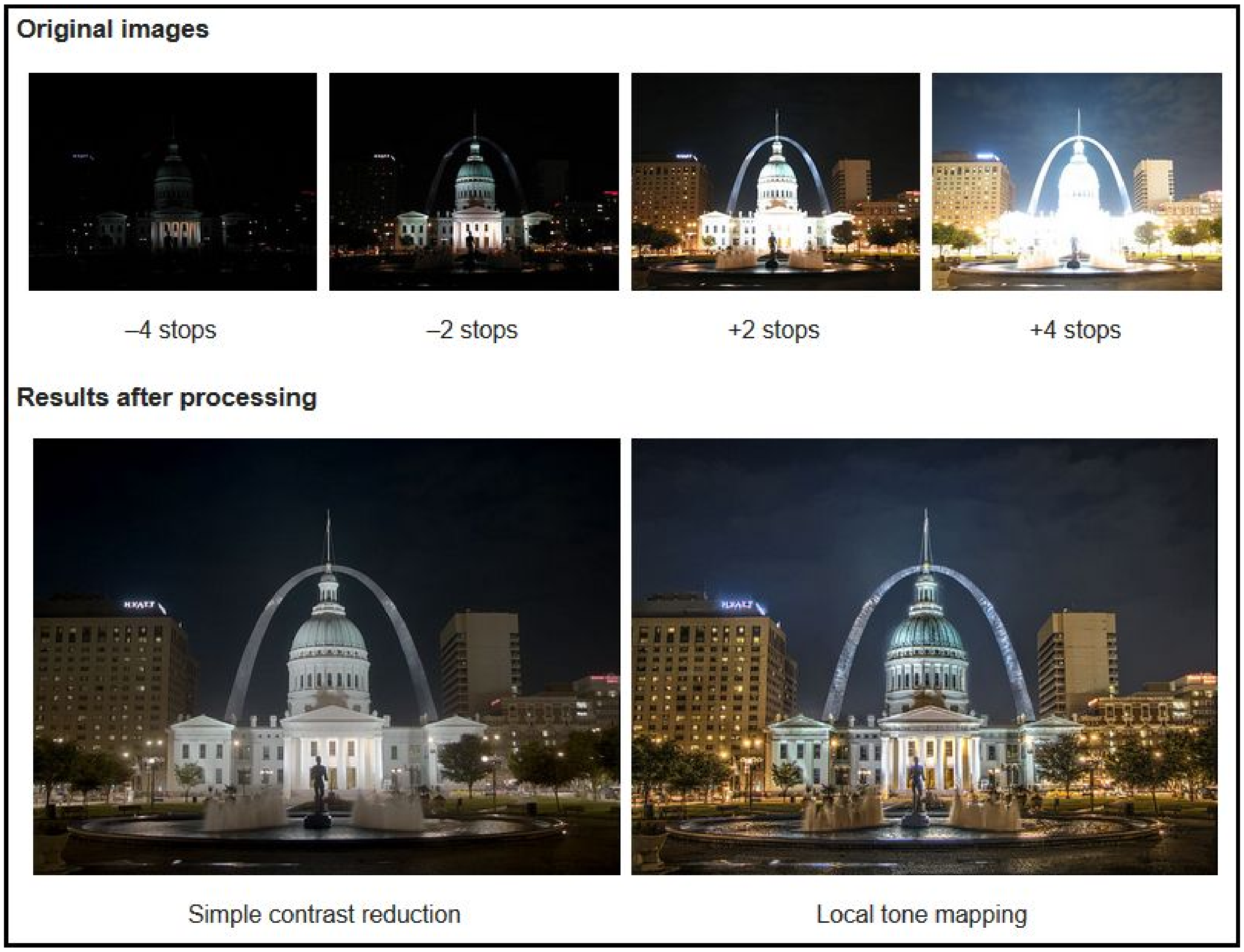
-0.64 -0.97



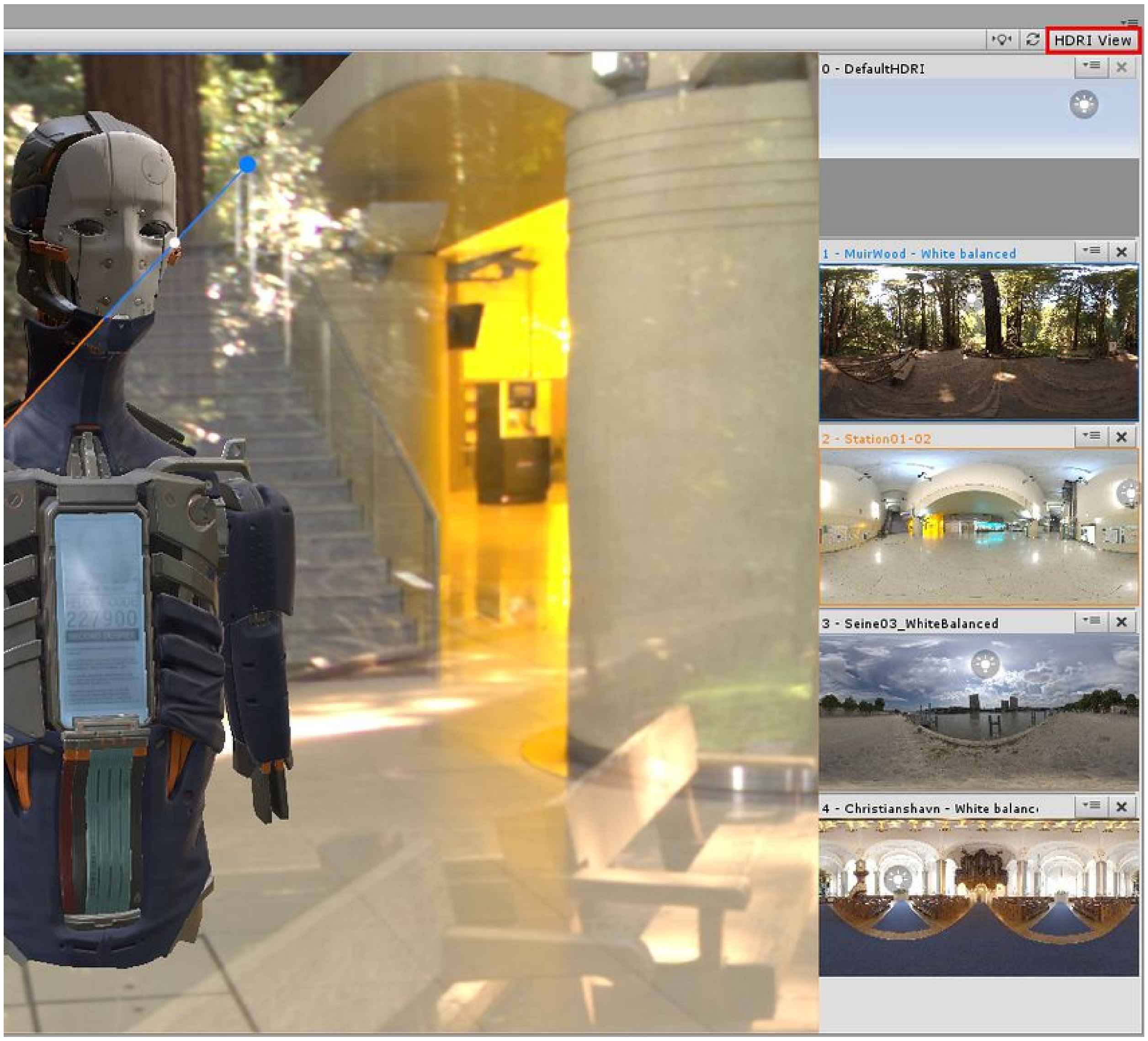
-1.70

Benefits

Basic information on High Dynamic Range Imaging (HDRi) is available on Wikipedia.
This image shows some of the benefits.



HDRi is also commonly used in the digital graphics industry. The graphic below from the Unity HDRI view documentation will give you a feel for how HDRI can help with lighting and perspective.

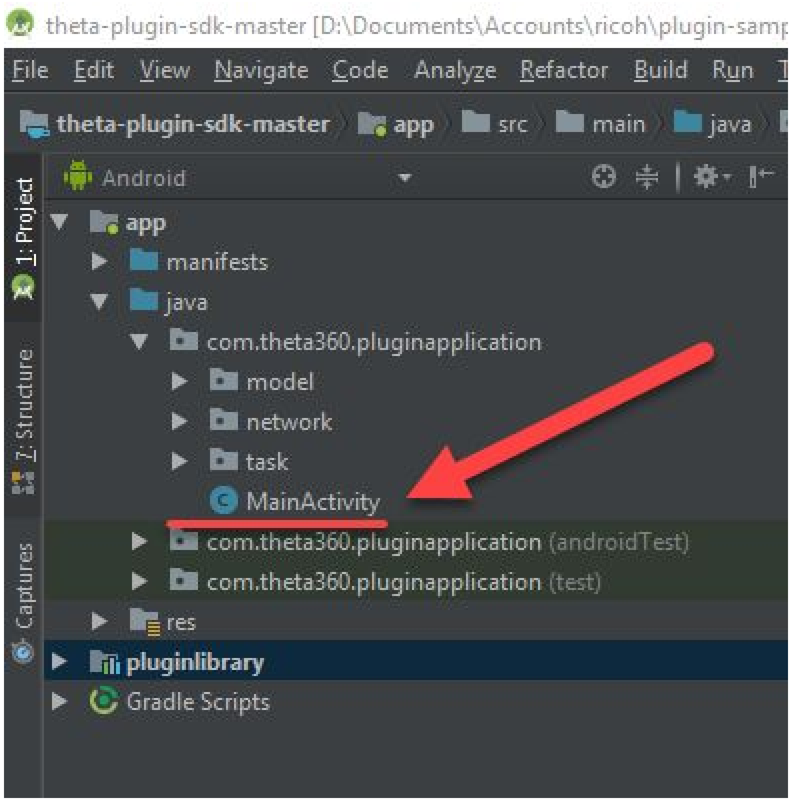

HDRI View
0 - DefaultHDRI
1 - MuirWood - White balanced
2 - Station01-02
3 - Seine03_WhiteBalanced
4 - Christianshavn - White balanc

Steps

If you prefer to read through the modifications and follow along, the modified code is in the 7-image branch of the repository.

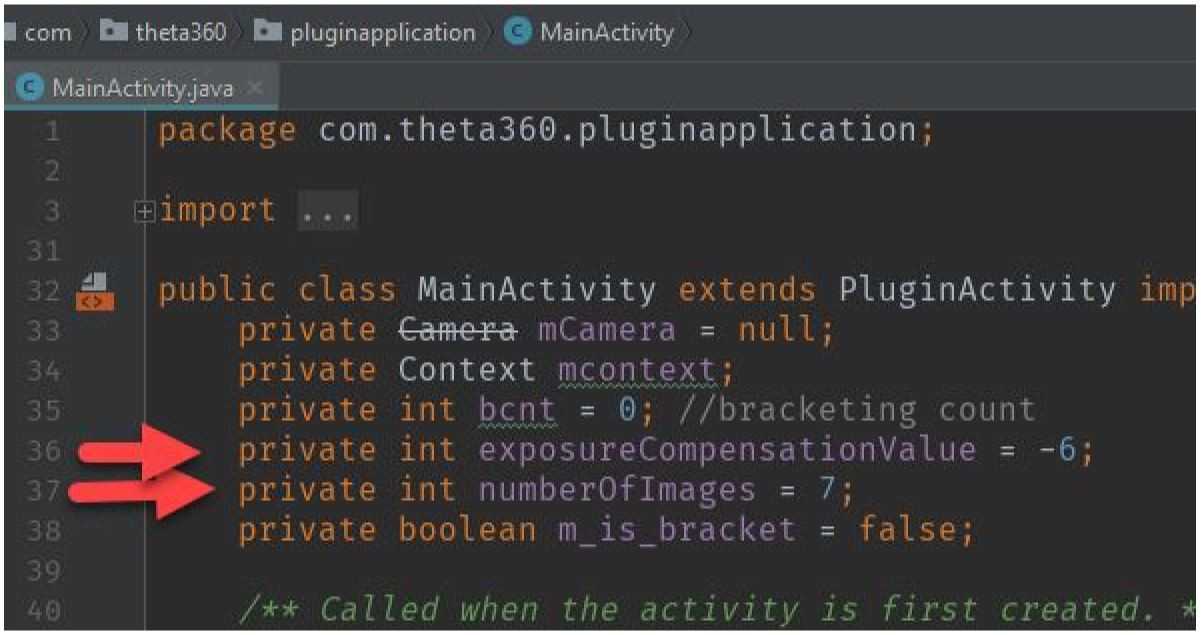
1. Open MainActivity.java

Under app/java/com.theta360.pluginapplication, locate MainActivity.


theta-plugin-sdk-master [D:\Documents\Accounts\ricoh\plugin-samp
File Edit View Navigate Code Analyze Refactor Build Run
theta-plugin-sdk-master app src main java
Android
app
manifests
java
com.theta360.pluginapplication
model
network
task
MainActivity
com.theta360.pluginapplication (androidTest)
com.theta360.pluginapplication (test)
res
pluginlibrary
Gradle Scripts
1: Project
7: Structure
Captures

2. Add Variables for NumberOfImages and for ExposureCompensationValue

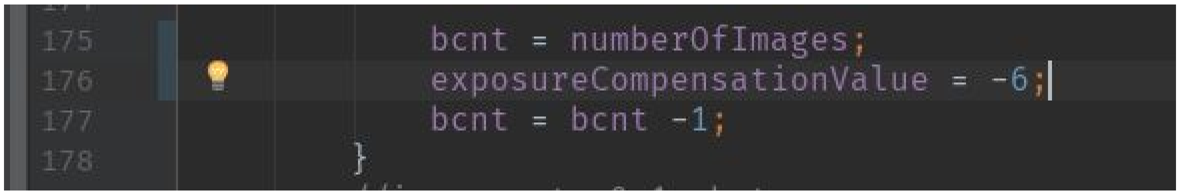
In MainActivity.java, add an integer variable called numberOfImages and set the value to 7. Add a second variable for ExposureCompensationValue and set the value to -6. Later in the tutorial, we will use this variable to move the exposure compensation from -6 to +6.



```
package com.theta360.pluginapplication;

import ...

public class MainActivity extends PluginActivity imp
    private ~~Camera~~ mCamera = null;
    private Context mcontext;
    private int bcnt = 0; //bracketing count
    private int exposureCompensationValue = -6;
    private int numberOfImages = 7;
    private boolean m_is_bracket = false;

    /** Called when the activity is first created. *
```

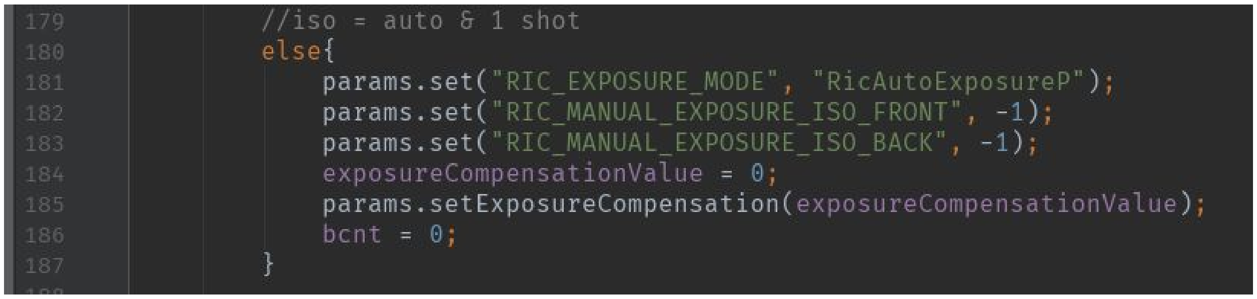
3. Reset Bracket Count and exposureCompensationValue

At roughly line 175, reset the variable bcnt to the numberOfImages.
Set exposureCompensationValue to -6. Set bcnt to numberOfImages.



```
175             bcnt = numberOfImages;
176             exposureCompensationValue = -6;
177             bcnt = bcnt -1;
178         }
```

Note that in the example above, RIC_EXPOSURE_MODE is set to RicAutoExposureP for the EV compensation to take effect. The current Camera API documentation indicates that only *RicAutoExposureT*, *RicAutoExposureP*, or *RicAutoExposureWDR* can set exposure compensation.
In single shot mode, the exposureCompensation will be zero.

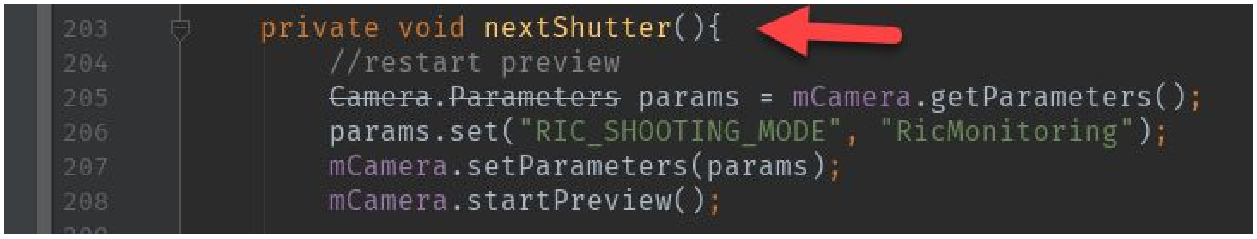


```
179         //iso = auto & 1 shot
180         else{
181             params.set("RIC_EXPOSURE_MODE", "RicAutoExposureP");
182             params.set("RIC_MANUAL_EXPOSURE_ISO_FRONT", -1);
183             params.set("RIC_MANUAL_EXPOSURE_ISO_BACK", -1);
184             exposureCompensationValue = 0;
185             params.setExposureCompensation(exposureCompensationValue);
186             bcnt = 0;
187         }
```

If you have any problems following this example, you can also copy and paste the relevant sections from the completed file on GitHub, 7-image branch.

4. Locate nextShutter()

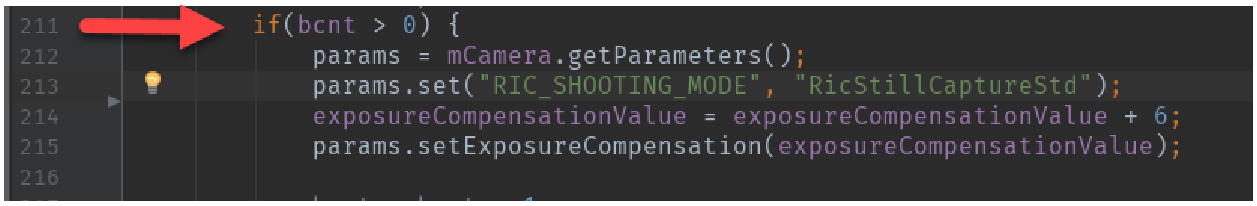
At roughly line 203, identify the section for nextShutter()



```
203     private void nextShutter(){
204         //restart preview
205         ~~Camera.Parameters~~ params = mCamera.getParameters();
206         params.set("RIC_SHOOTING_MODE", "RicMonitoring");
207         mCamera.setParameters(params);
208         mCamera.startPreview();
```

5. Locate bracket section

At roughly line 211, look for the line if(bcnt > 0).

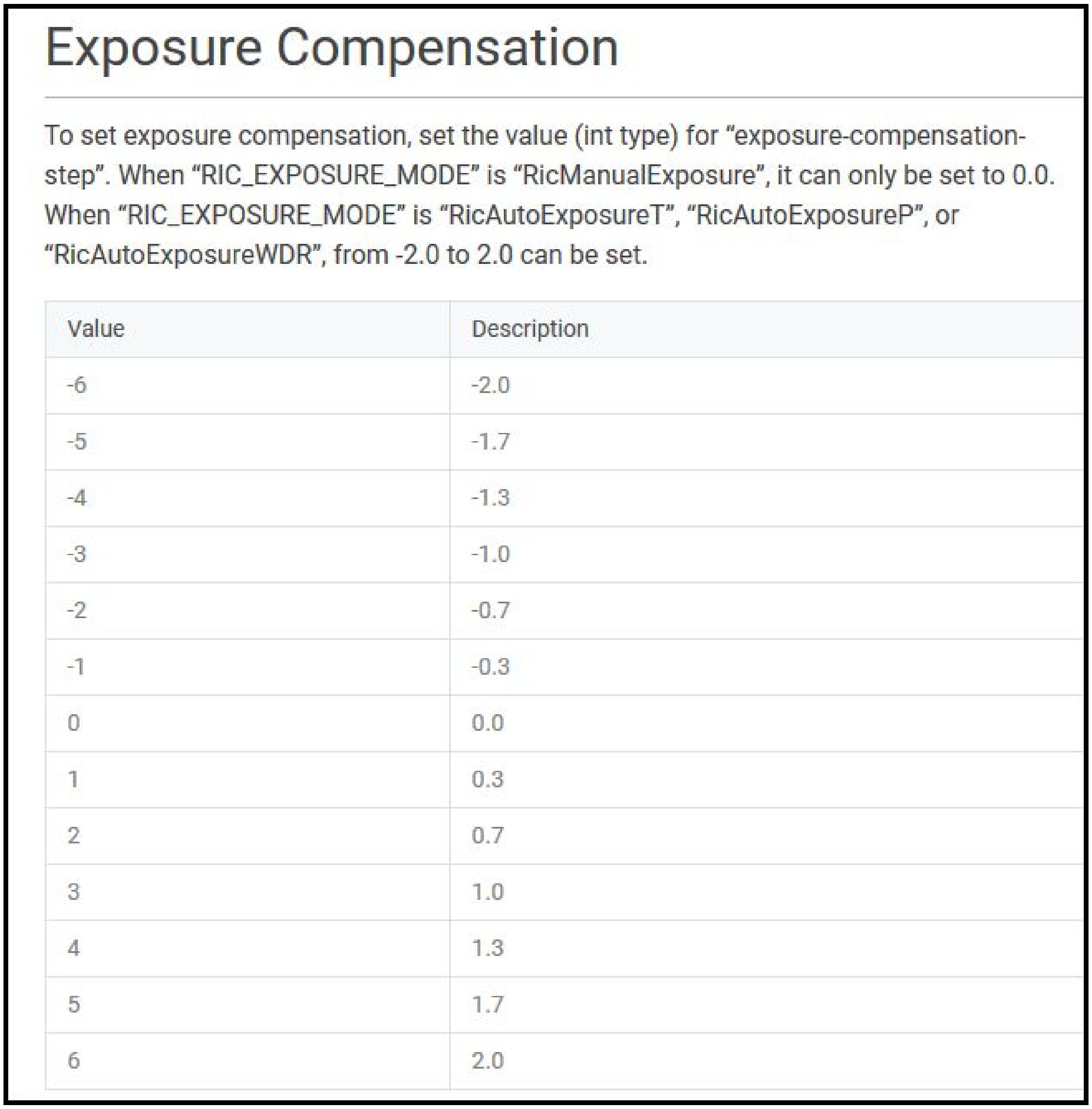


```
211     if(bcnt > 0) {
212         params = mCamera.getParameters();
213         params.set("RIC_SHOOTING_MODE", "RicStillCaptureStd");
214         exposureCompensationValue = exposureCompensationValue + 6;
215         params.setExposureCompensation(exposureCompensationValue);
216
```

The code after the else statement handles single shot mode.

6. Review Exposure Compensation API

We will adjust the exposure compensation value for every image in our 7 image set. Before modifying the code, let's look at the options the API provides for adjustment.
RICOH Camera API for exposure compensation is available at:
https://api.ricoh/docs/theta-plugin-reference/camera-api/



Exposure Compensation

To set exposure compensation, set the value (int type) for “exposure-compensation-step”. When “RIC_EXPOSURE_MODE” is “RicManualExposure”, it can only be set to 0.0. When “RIC_EXPOSURE_MODE” is “RicAutoExposureT”, “RicAutoExposureP”, or “RicAutoExposureWDR”, from -2.0 to 2.0 can be set.

Value	Description
-6	-2.0
-5	-1.7
-4	-1.3
-3	-1.0
-2	-0.7
-1	-0.3
0	0.0
1	0.3
2	0.7
3	1.0
4	1.3
5	1.7
6	2.0

7. Adjust Exposure Compensation

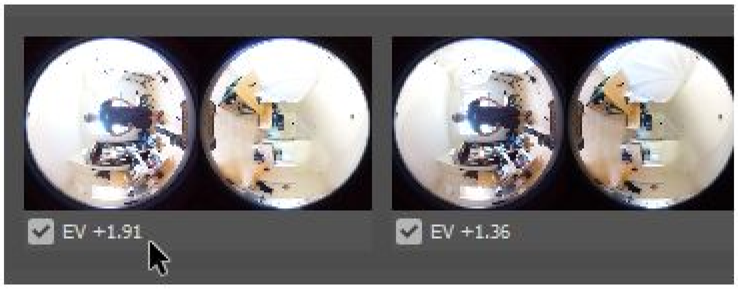
We will start the exposure compensation value at -6 and adjust it up by 2 for each image. With 7 images, this value will be changed with these values for each image: -6, -4, -2, 0, 2, 4, 6.

At the top of the code, we set the variable ExposureCompensationValue to -6 in step 2 of this tutorial. The first time through the loop, the line params.setExposureCompensation(ExposureCompensationValue) will pass the value -6, which corresponds to to a -2 adjustment. We increment ExposureCompensationValue by 2. The next time through the loop, ExposureCompensationValue will be -4, which corresponds to an adjustment of -1.3.

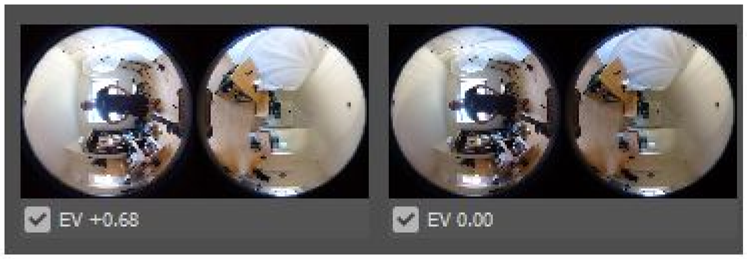
The code for setting exposure compensation is shown below.

```
if(bcnt > 0) {
    params = mCamera.getParameters();
    params.set("RIC_SHOOTING_MODE", "RicStillCaptureStd");
    exposureCompensationValue = exposureCompensationValue + 2;
    params.setExposureCompensation(exposureCompensationValue);

    bcnt = bcnt - 1;
    mCamera.setParameters(params);
    Intent intent = new Intent("com.theta360.plugin.ACTION_AUDIO_SHUTTER");
    sendBroadcast(intent);
    mCamera.takePicture(null, null, null, pictureListener);
}
else{
```

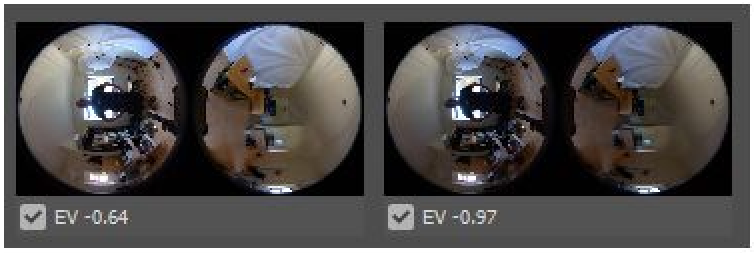
The EV of the images can be seen in this screenshot from Photoshop HDR Pro:



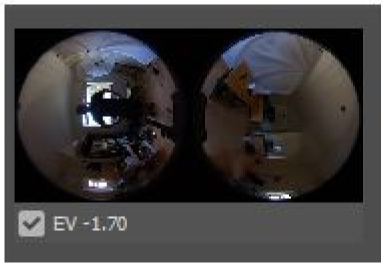
+1.92 +1.36



+0.68 0.00



-0.64 -0.97



-1.70

8. Build and Install

Build the apk. Before installing the apk, you must manually delete the existing Plugin Application from your camera.

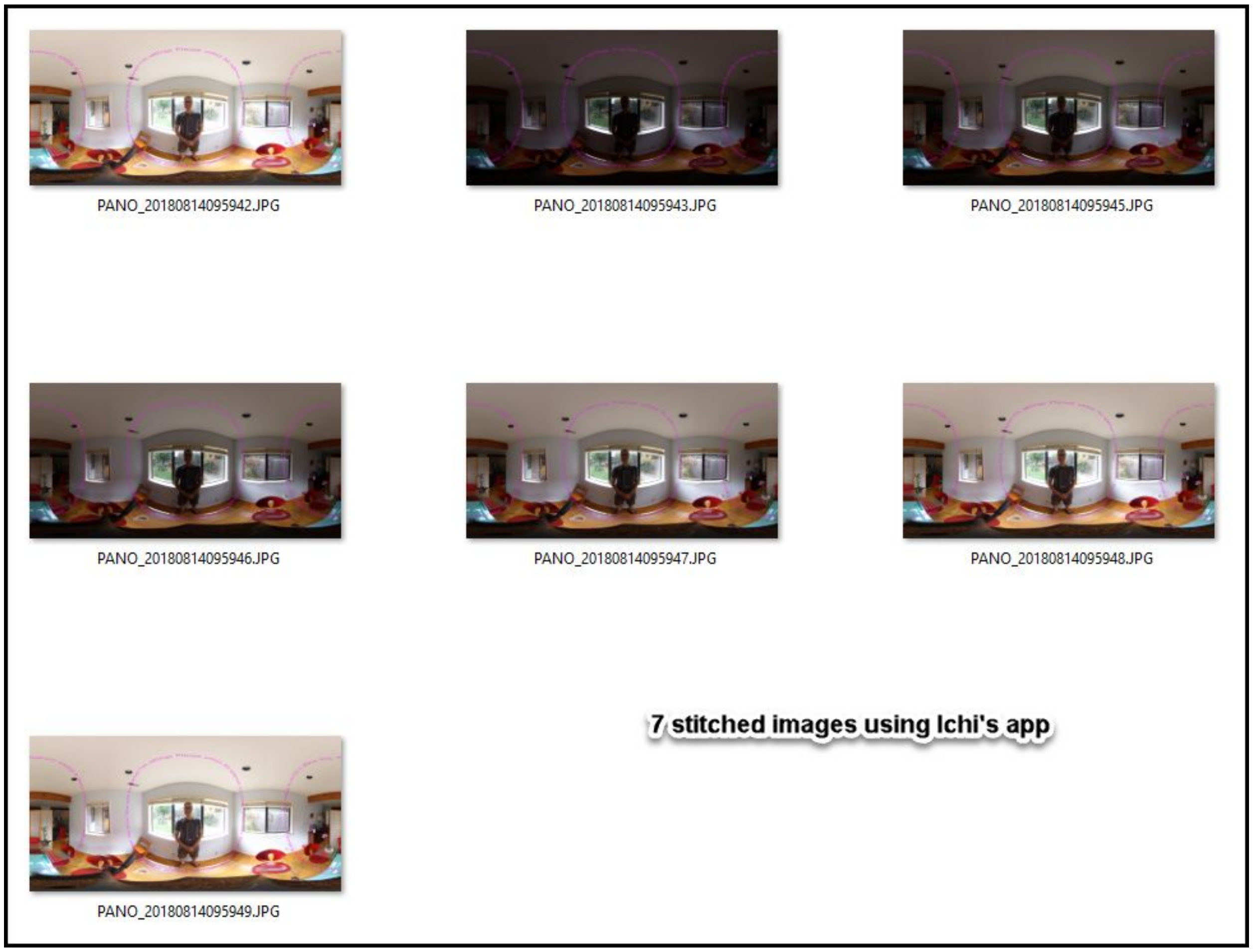
Follow this process:

1. Build apk in Android Studio
2. Use Vysor or the Ricoh desktop app to uninstall the existing plug-in application
3. Use adb install -r app-debug.apk to install the new apk you just built

9. Stitch Dual-fisheye Images into Equirectangular

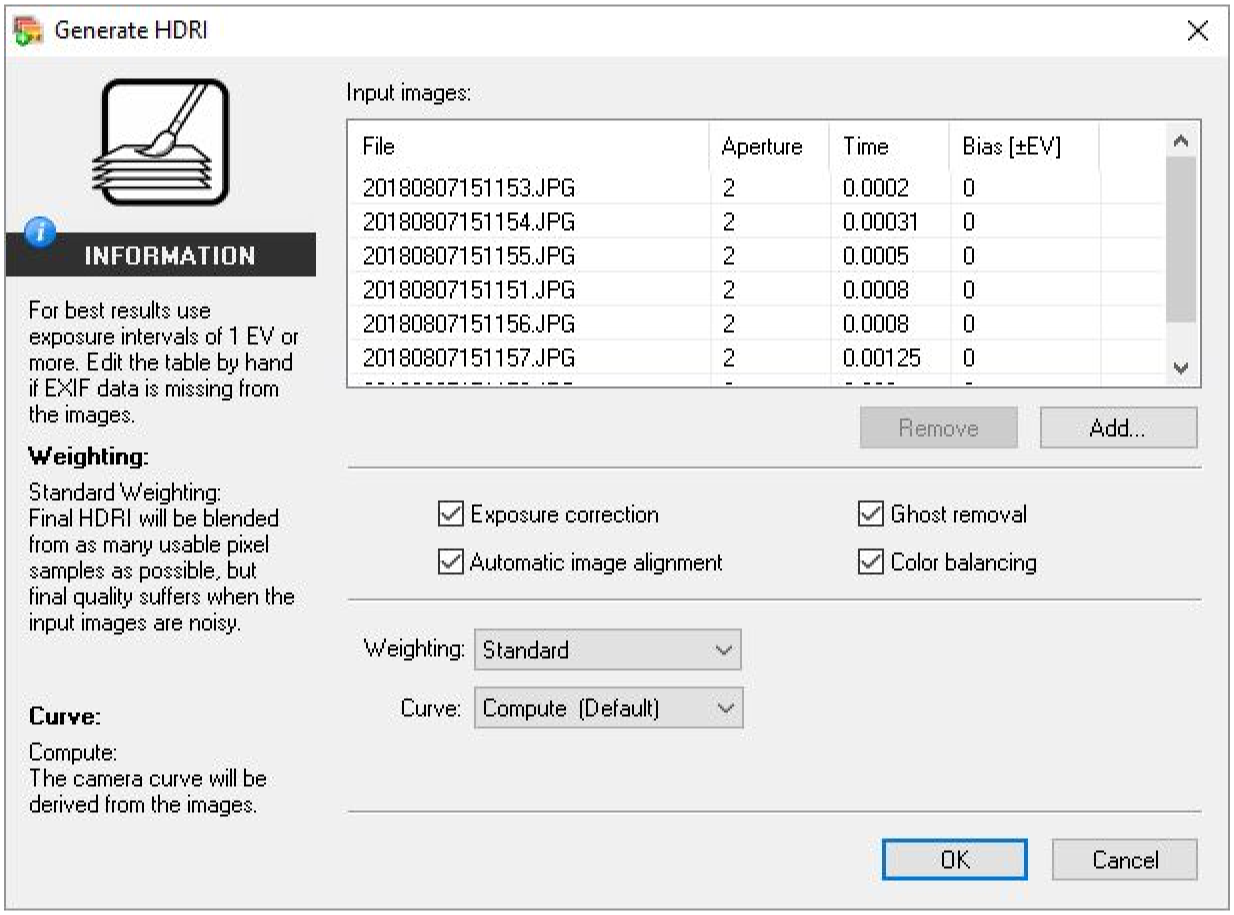
Use Ichi Hirota's mobile app for the stitching. The app can batch process all 7 images with a single command. After you process them on your Android phone, you need to transfer the files to your desktop computer using a USB cable.

If you do not have an Android phone, use PTGui on a Windows or Mac laptop. Information on using PTGui is included at the end of this tutorial in the reference section.



10. Create Single HDR Image

Use Picturenaut to merge the 7 images into a single HDR image.



Generate HDRI

INFORMATION

For best results use exposure intervals of 1 EV or more. Edit the table by hand if EXIF data is missing from the images.

Weighting:

Standard Weighting:
Final HDRI will be blended from as many usable pixel samples as possible, but final quality suffers when the input images are noisy.

Curve:

Compute:
The camera curve will be derived from the images.

Input images:

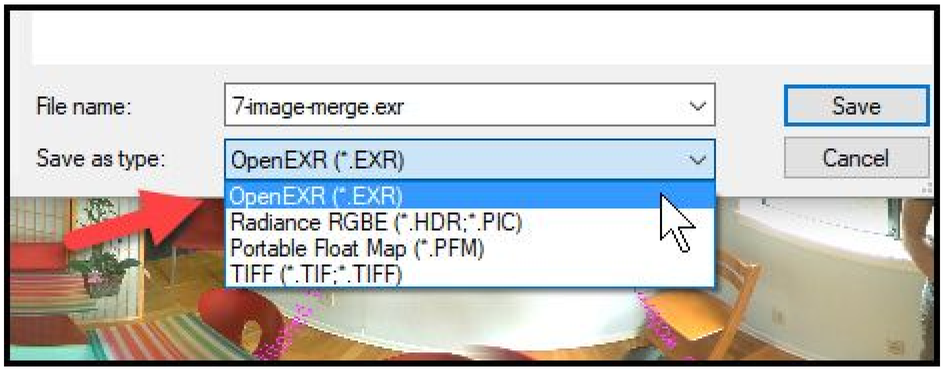
File	Aperture	Time	Bias [±EV]
20180807151153.JPG	2	0.0002	0
20180807151154.JPG	2	0.00031	0
20180807151155.JPG	2	0.0005	0
20180807151151.JPG	2	0.0008	0
20180807151156.JPG	2	0.0008	0
20180807151157.JPG	2	0.00125	0

☑ Exposure correction ☑ Ghost removal
☑ Automatic image alignment ☑ Color balancing

Weighting: Standard

Curve: Compute (Default)

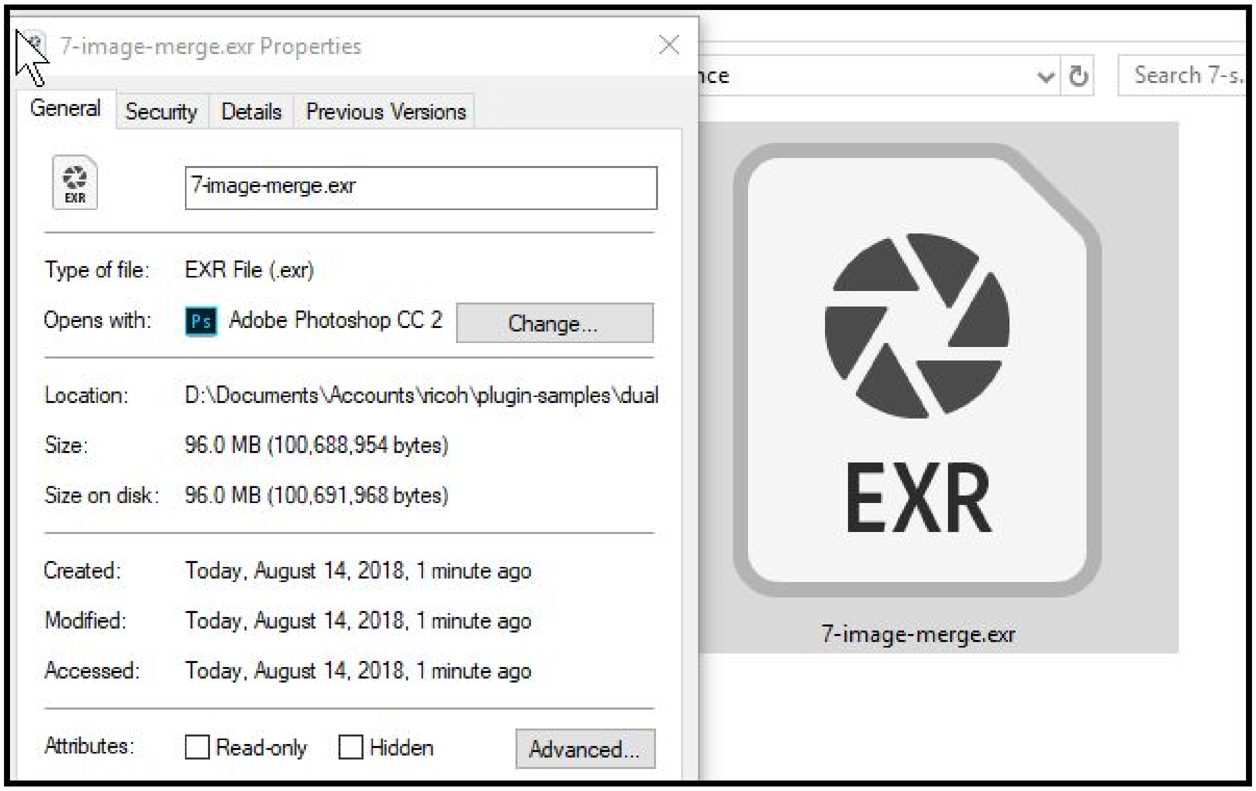
HDRi files are stored in one of three formats: Radiance RGBE, OpenEXR, or Floating point TIFF/PSD.



File name: 7-image-merge.exr

Save as type: OpenEXR (*.EXR)

The file is 96 MB.


7-image-merge.exr Properties

General | Security | Details | Previous Versions

7-image-merge.exr

Type of file: EXR File (.exr)
Opens with: Adobe Photoshop CC 2
Location: D:\Documents\Accounts\ricoh\plugin-samples\dual
Size: 96.0 MB (100,688,954 bytes)
Size on disk: 96.0 MB (100,691,968 bytes)
Created: Today, August 14, 2018, 1 minute ago
Modified: Today, August 14, 2018, 1 minute ago
Accessed: Today, August 14, 2018, 1 minute ago
Attributes: Read-only Hidden

If you have Photoshop, you can also use HDR Pro to create HDRI files.
Congratulations! You've completed the dual-fisheye tutorial!

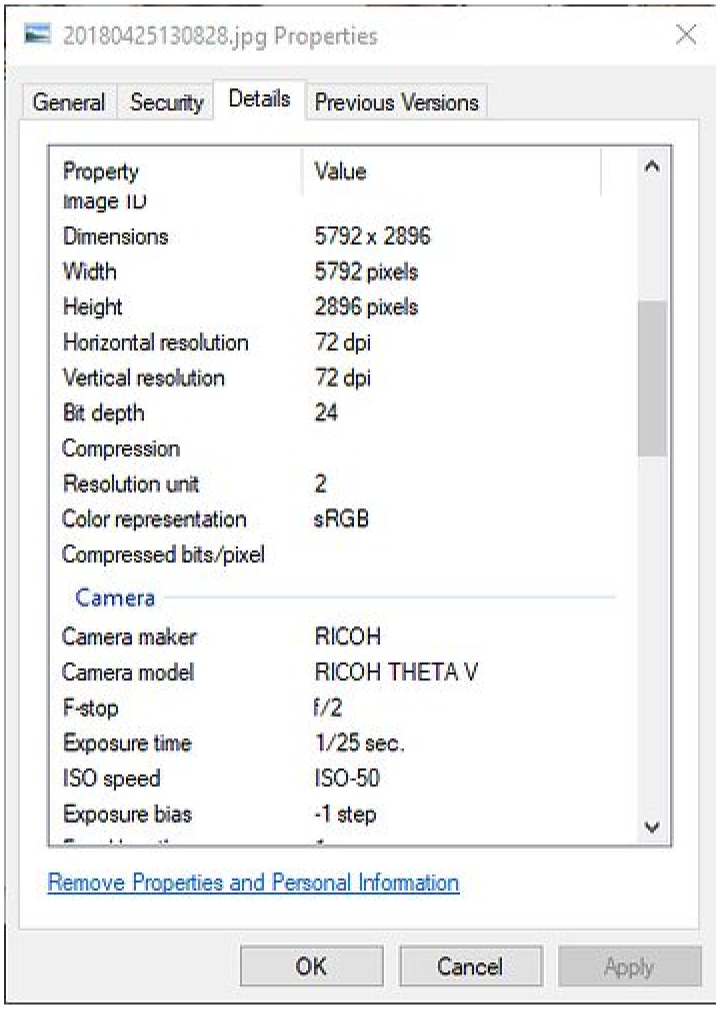
References and Resources

Turning off THETA V Stitching

Still images can be saved as dual-fisheye by adjusting the stitching parameter.
mParameters.set("RIC_PROC_STITCHING_TYPE", "RicNonStitching");

The size of the dual-fish image is 5792x2896. Use the command below:
mParameters.setPictureSize(5792, 2896);

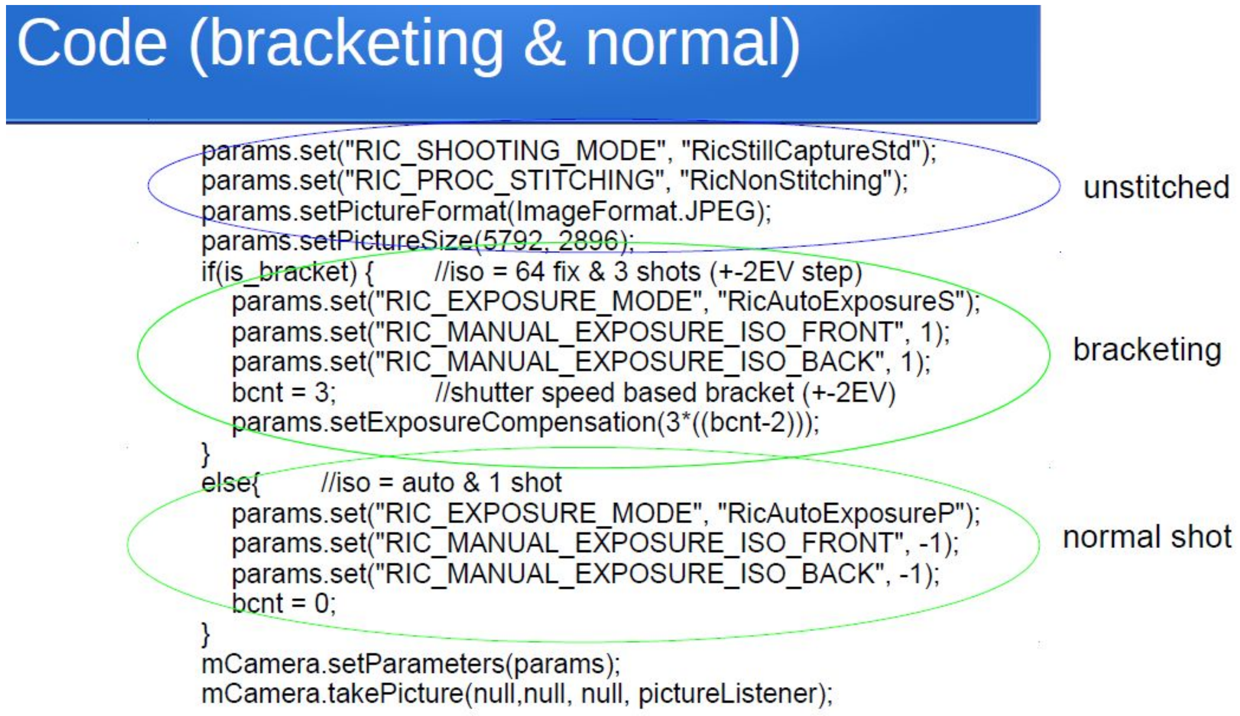
The picture below is from Ichi Hirota.


20180425130828.jpg Properties

Property	Value
Image ID	
Dimensions	5792 x 2896
Width	5792 pixels
Height	2896 pixels
Horizontal resolution	72 dpi
Vertical resolution	72 dpi
Bit depth	24
Compression	
Resolution unit	2
Color representation	sRGB
Compressed bits/pixel	
Camera	
Camera maker	RICOH
Camera model	RICOH THETA V
F-stop	f/2
Exposure time	1/25 sec.
ISO speed	ISO-50
Exposure bias	-1 step

This article provides more information on a plug-in built by community developer Ichi Hirota.

Here's example code from Ichi Hirota.



Code (bracketing & normal)

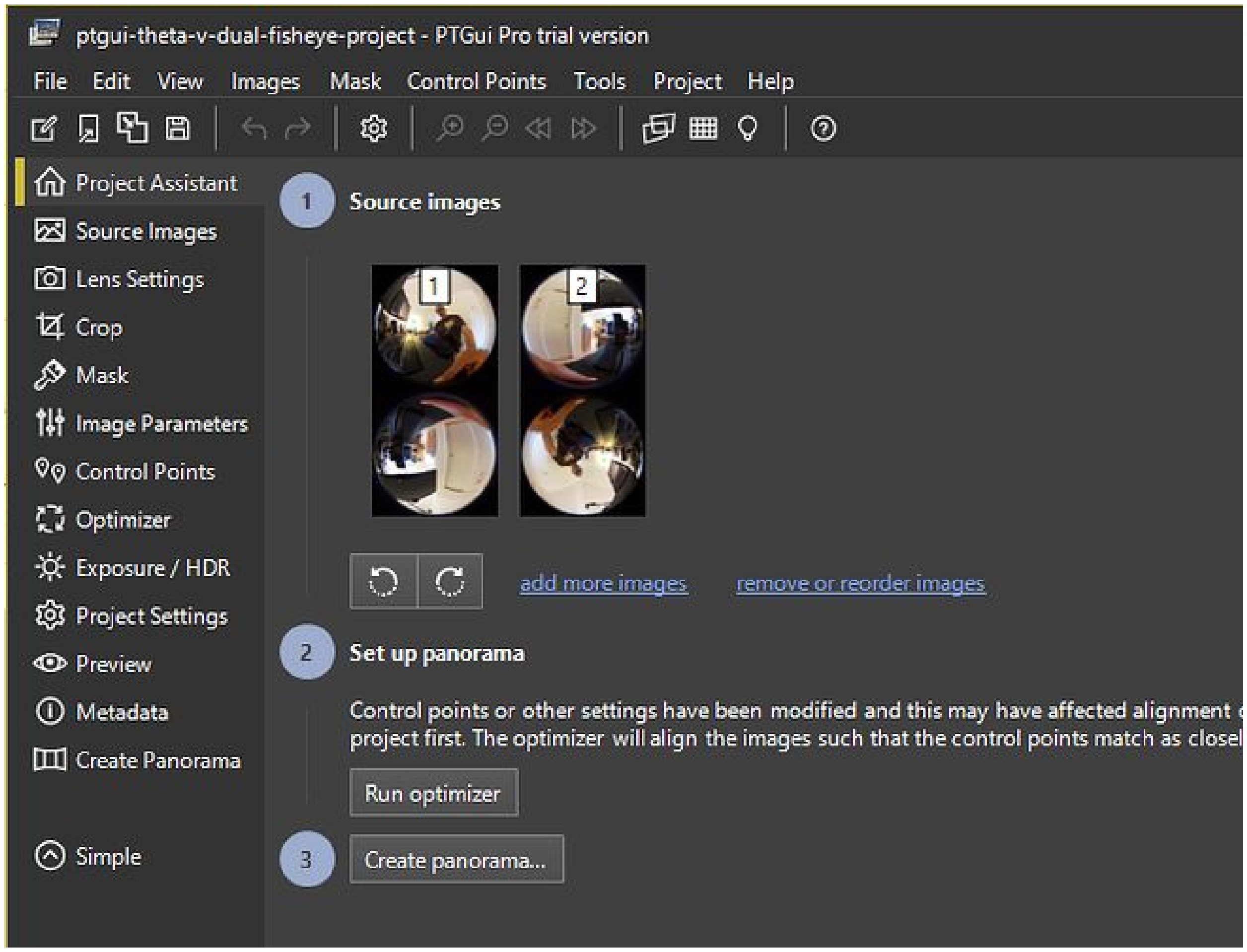
```
params.set("RIC_SHOOTING_MODE", "RicStillCaptureStd");
params.set("RIC_PROC_STITCHING", "RicNonStitching");
params.setPictureFormat(ImageFormat.JPEG);
params.setPictureSize(5792, 2896);
if(is_bracket) {        //iso = 64 fix & 3 shots (+-2EV step)
    params.set("RIC_EXPOSURE_MODE", "RicAutoExposureS");
    params.set("RIC_MANUAL_EXPOSURE_ISO_FRONT", 1);
    params.set("RIC_MANUAL_EXPOSURE_ISO_BACK", 1);
    bcnt = 3;           //shutter speed based bracket (+-2EV)
    params.setExposureCompensation(3*((bcnt-2)));
}
else{       //iso = auto & 1 shot
    params.set("RIC_EXPOSURE_MODE", "RicAutoExposureP");
    params.set("RIC_MANUAL_EXPOSURE_ISO_FRONT", -1);
    params.set("RIC_MANUAL_EXPOSURE_ISO_BACK", -1);
    bcnt = 0;
}
mCamera.setParameters(params);
mCamera.takePicture(null,null, null, pictureListener);
```

Stitching with Post-Shoot Tools

Instead of stitching the dual-fisheye image inside of the camera, you will need to use tools on your PC to convert the dual-fisheye image into equirectangular.

PTGui

Community member Svendus has reported success stitching hundreds of spheres on PC and Mac using PTGui 11.2. A free trial version is available.
This project file bundle has both a preset for THETA images as well as an example image.


ptgui-theta-v-dual-fisheye-project - PTGui Pro trial version

File Edit View Images Mask Control Points Tools Project Help

Project Assistant
Source Images
Lens Settings
Crop
Mask
Image Parameters
Control Points
Optimizer
Exposure / HDR
Project Settings
Preview
Metadata
Create Panorama

Simple

1 Source images

add more images remove or reorder images

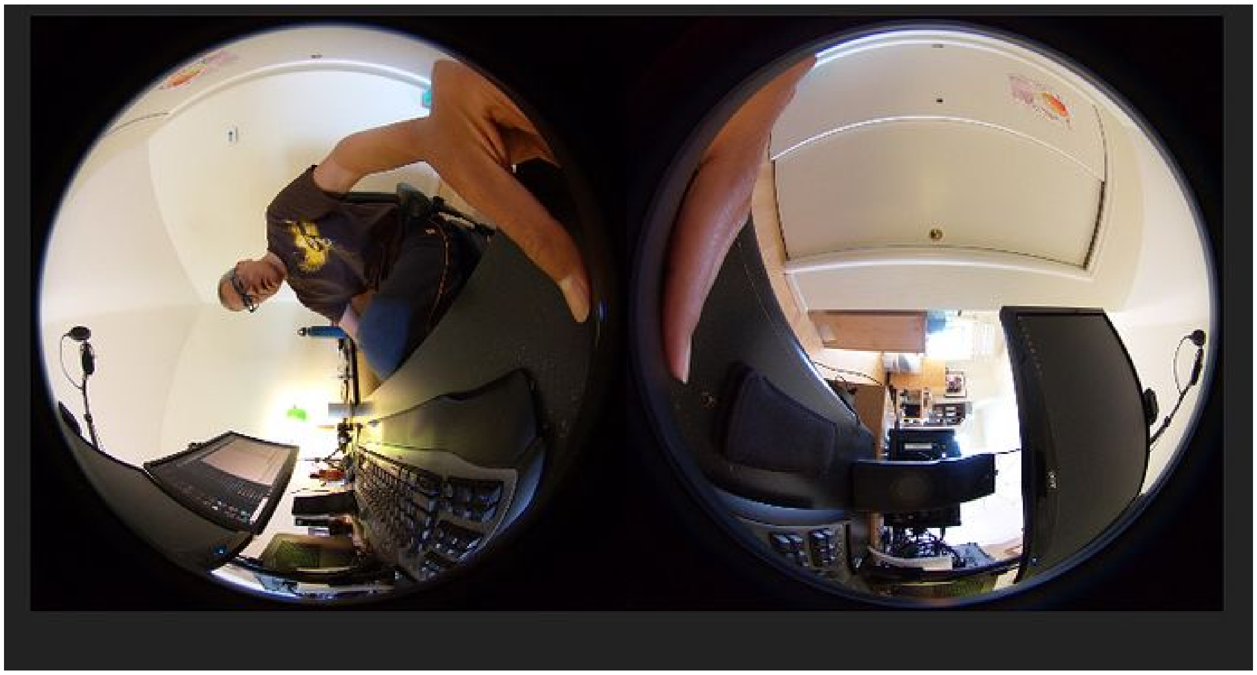
2 Set up panorama

Control points or other settings have been modified and this may have affected alignment
project first. The optimizer will align the images such that the control points match as closel

Run optimizer

3 Create panorama...

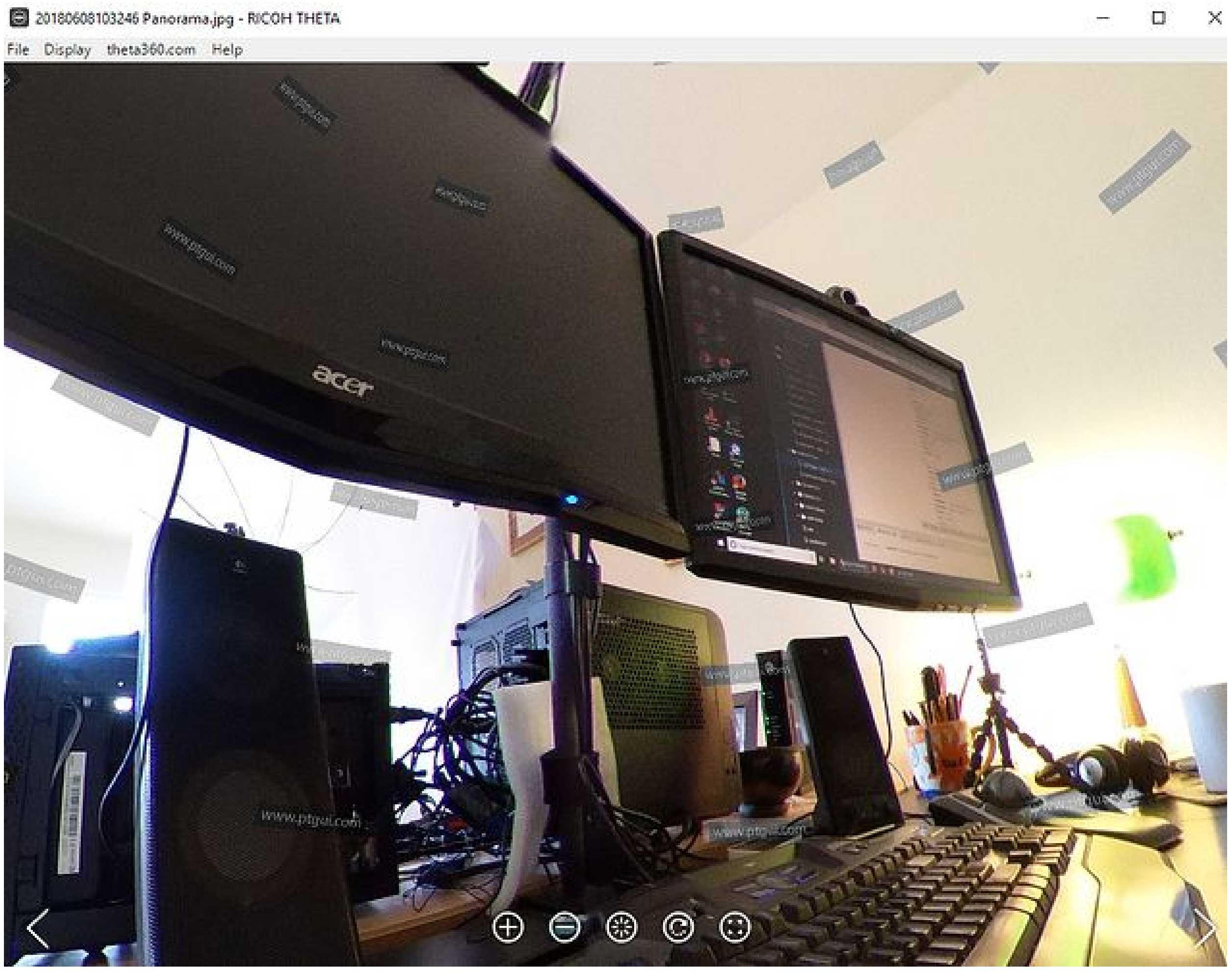
Original Image



Stitched Image

Close-up Image

Using the THETA Desktop Application to view the stitched image.

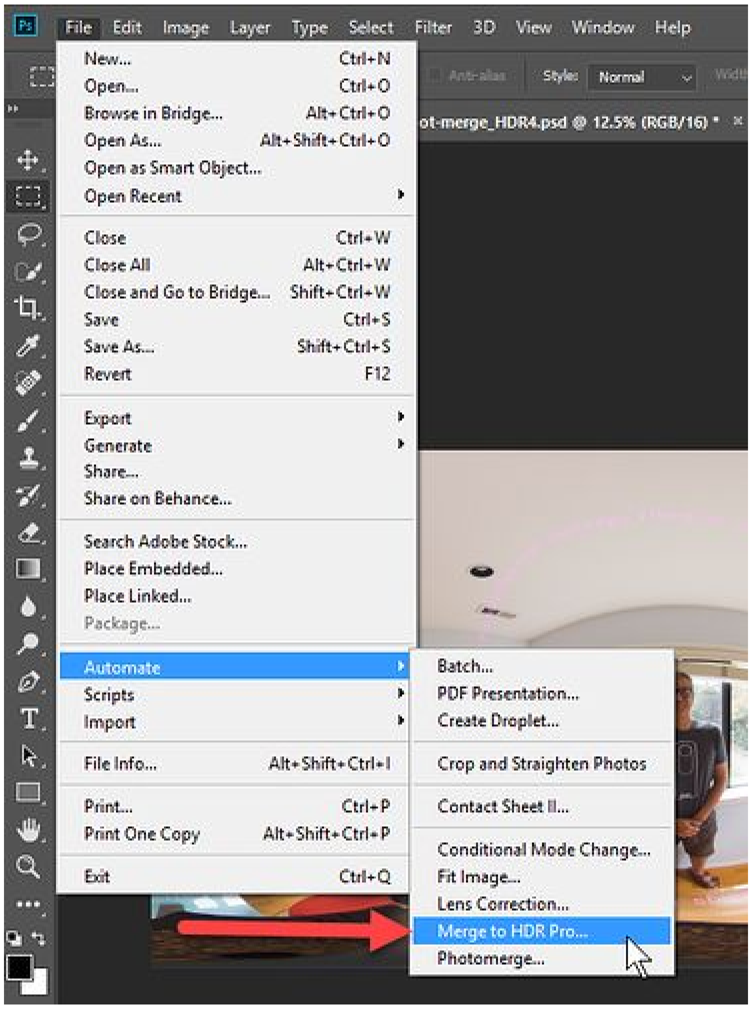


Other Stitching Solutions

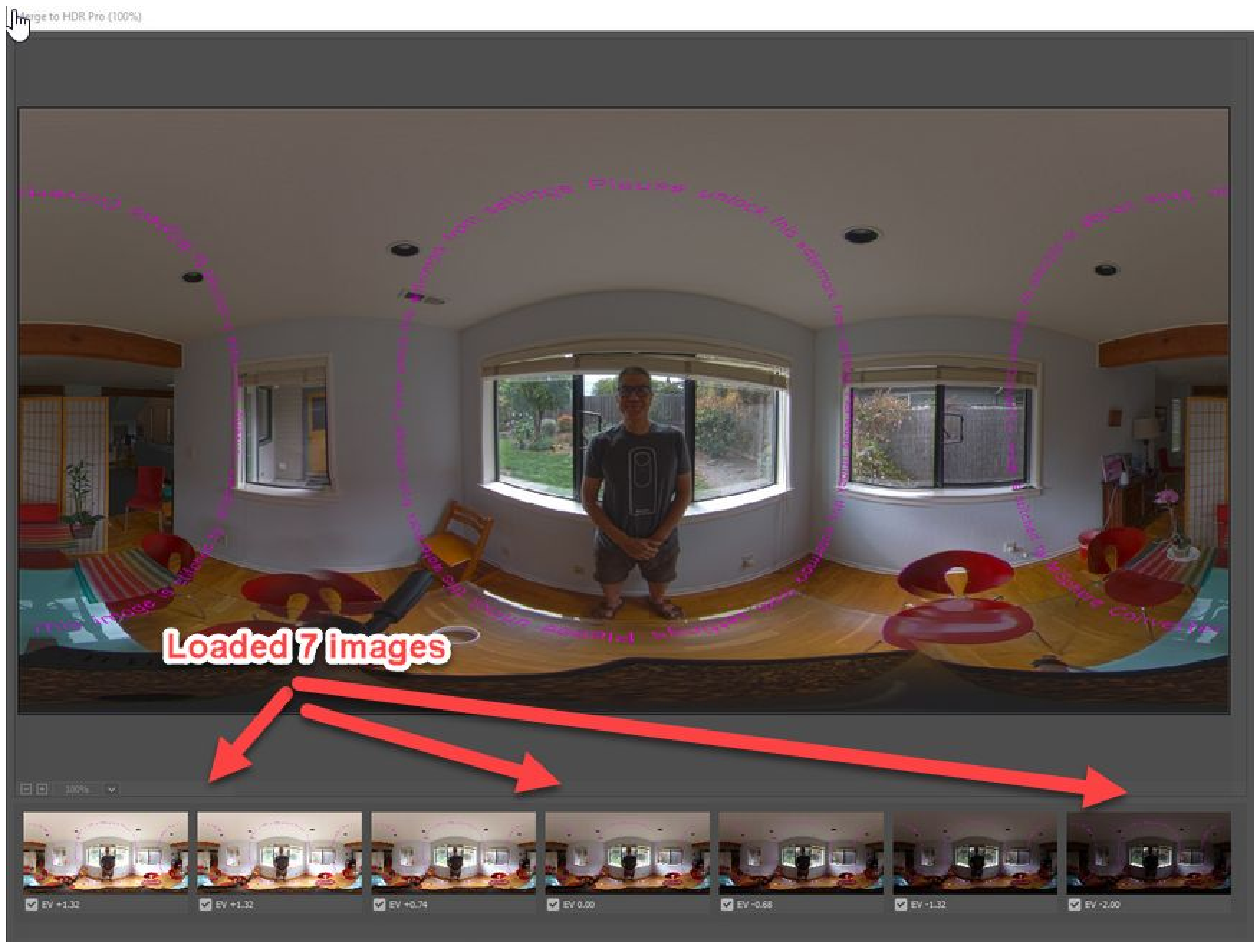
Community member @squizard360 is experimenting with Hugin and the dualfisheye2equirectangular_ffmpeg_remap project from evertvorster.

HDR with Photoshop

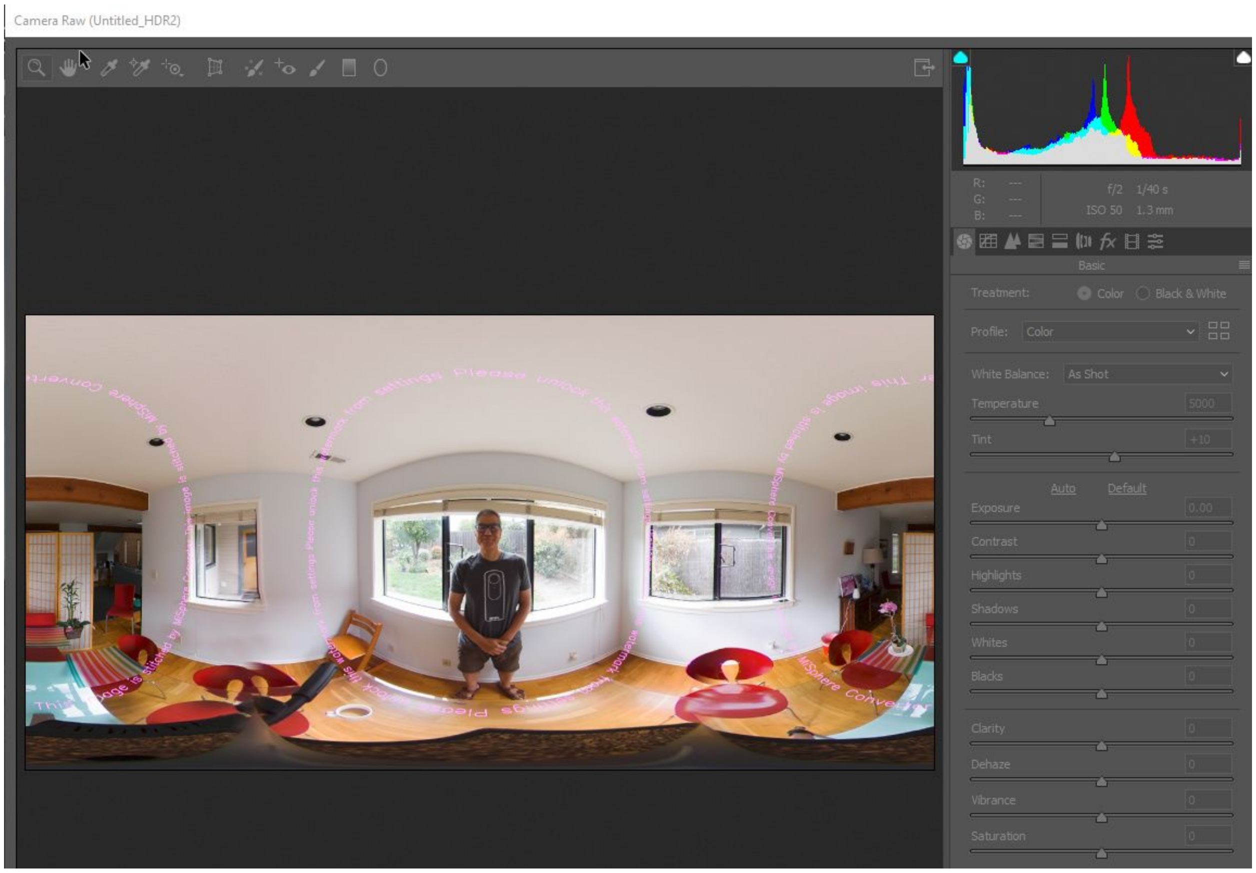
Photoshop can input all 7 images and create HDR images with HDR Pro.
With all 7 stitched images in a folder, go to *File -> Automate -> Merge to HDR Pro...*.



Select the folder. All 7 images will load. Each image will retain different EV values.



There are different ways to edit the image. In the example below, I am using Adobe Camera Raw (ACR) in 32 bit format.



Camera Raw (Untitled_HDR2)

R: ---
G: ---
B: ---

f/2 1/40 s
ISO 50 1.3 mm

Basic

Treatment: [✓ Color] Black & White

Profile: Color

White Balance: As Shot

Temperature 5000

Tint +10

Auto Default

Exposure 0.00

Contrast 0

Highlights 0

Shadows 0

Whites 0

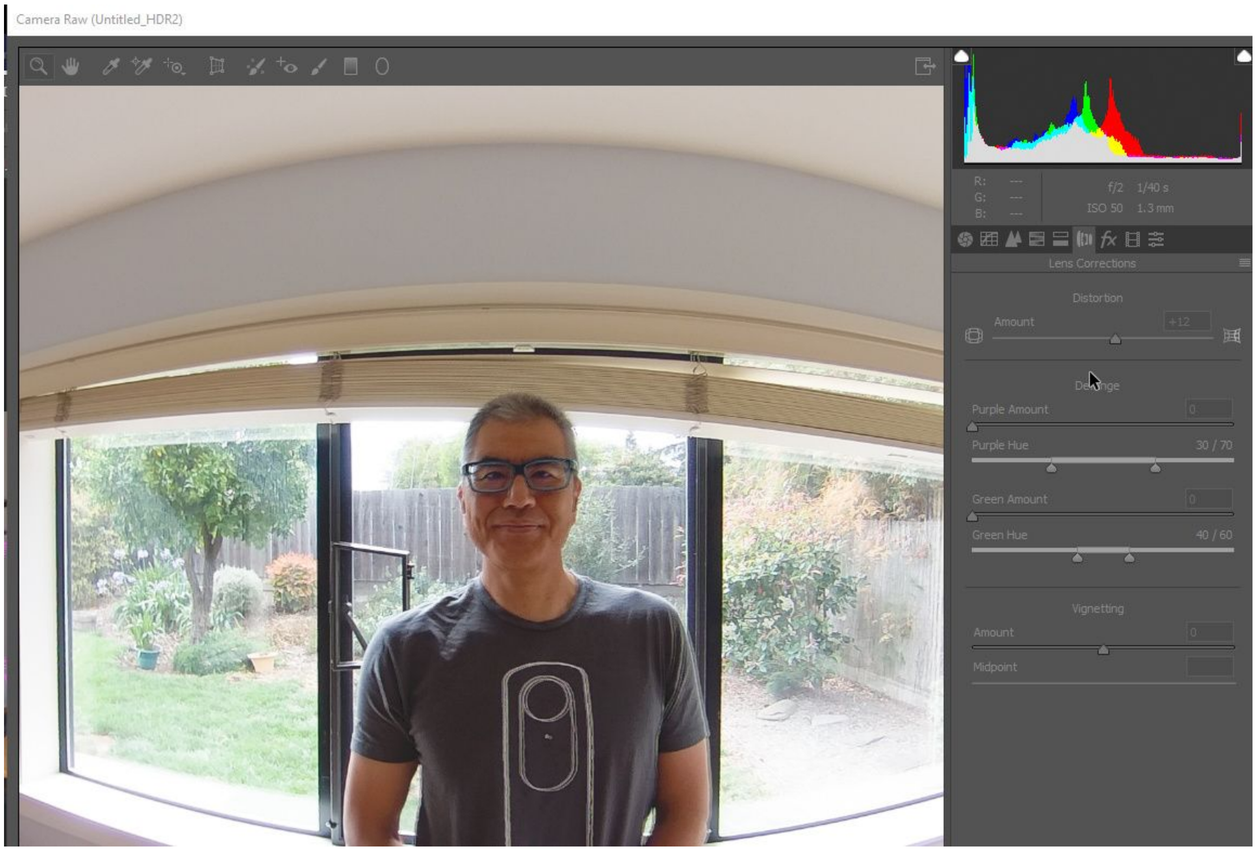
Blacks 0

Clarity 0

Dehaze 0

Vibrance 0

Saturation 0


Camera Raw (Untitled_HDR2)

R: ---
G: ---
B: ---

f/2 1/40 s
ISO 50 1.3 mm

Lens Corrections

Distortion

Amount +12

Defringe

Purple Amount 0

Purple Hue 30 / 70

Green Amount 0

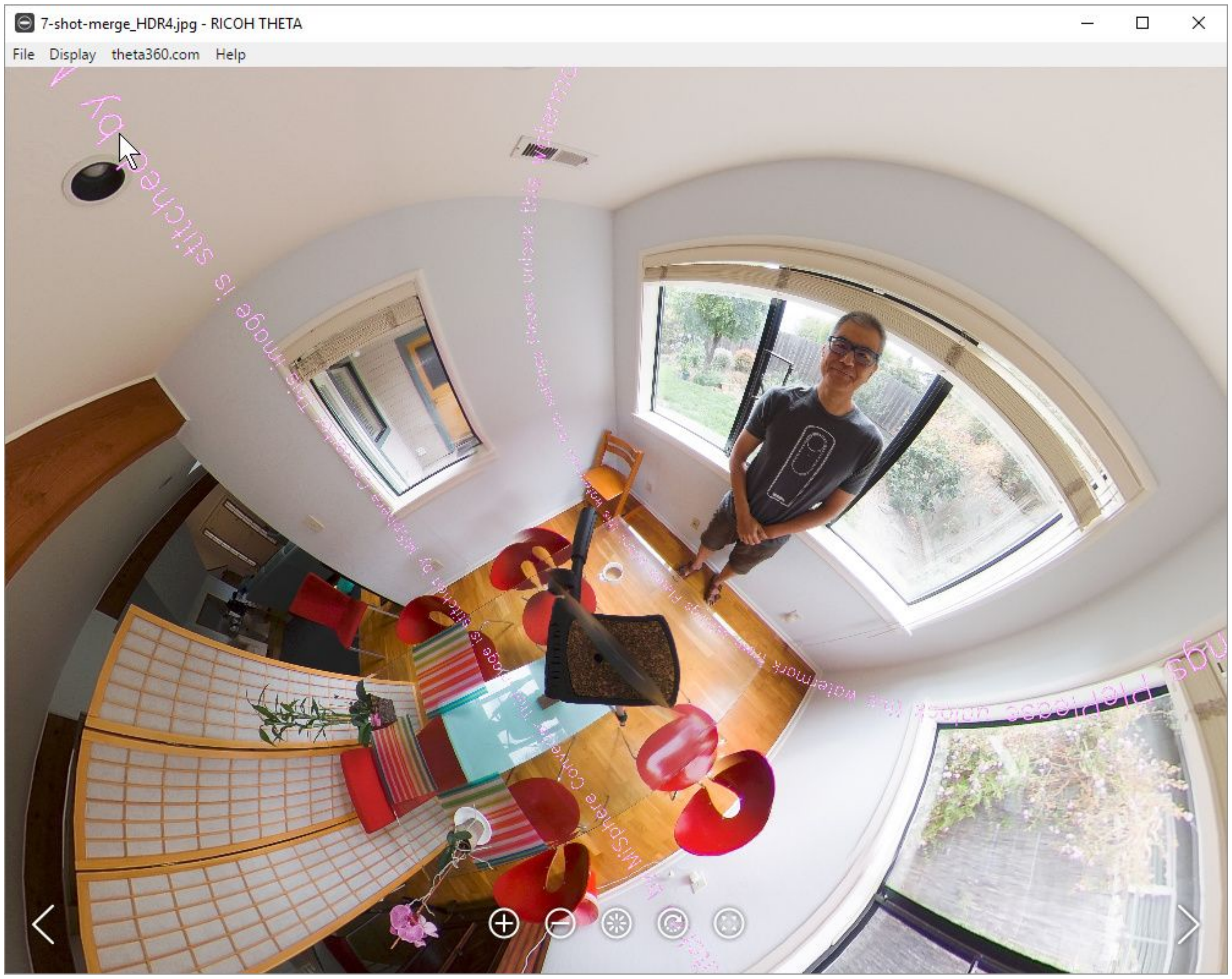
Green Hue 40 / 60

Vignetting

Amount 0

Midpoint

You can now export to jpg and view it in the RICOH THETA Desktop application.

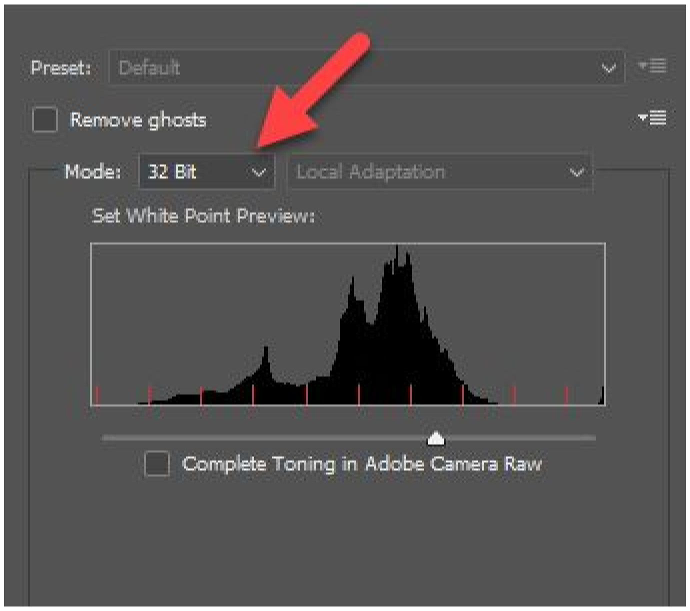

7-shot-merge_HDR4.jpg - RICOH THETA
File Display theta360.com Help

Export to OpenEXR and Radiance file formats

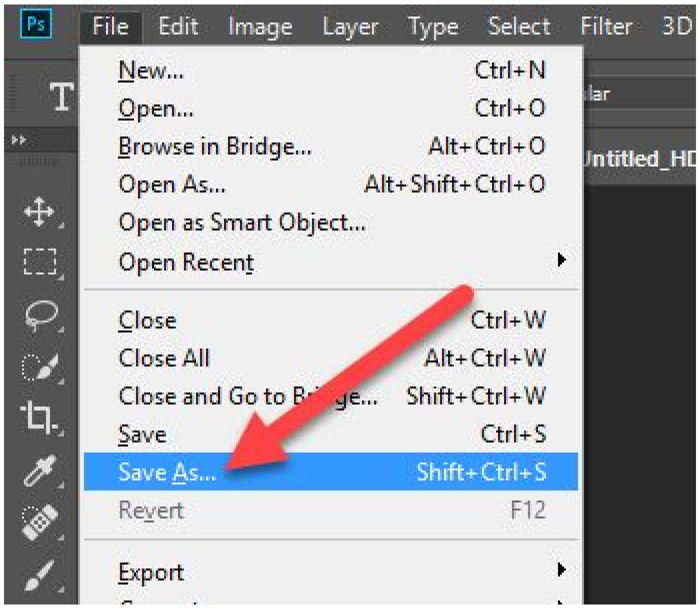
If you want to use your HDRI file with external software such as Unity for use in 3D model lighting effects, you should save the file as OpenEXR or Radiance, not JPEG.

Here is the workflow:

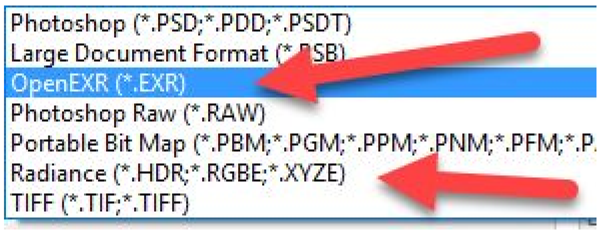
Inside of the HDR Pro tool shown the previous step, select 32 Bit mode. Uncheck *Complete Toning in Adobe Camera Raw*.



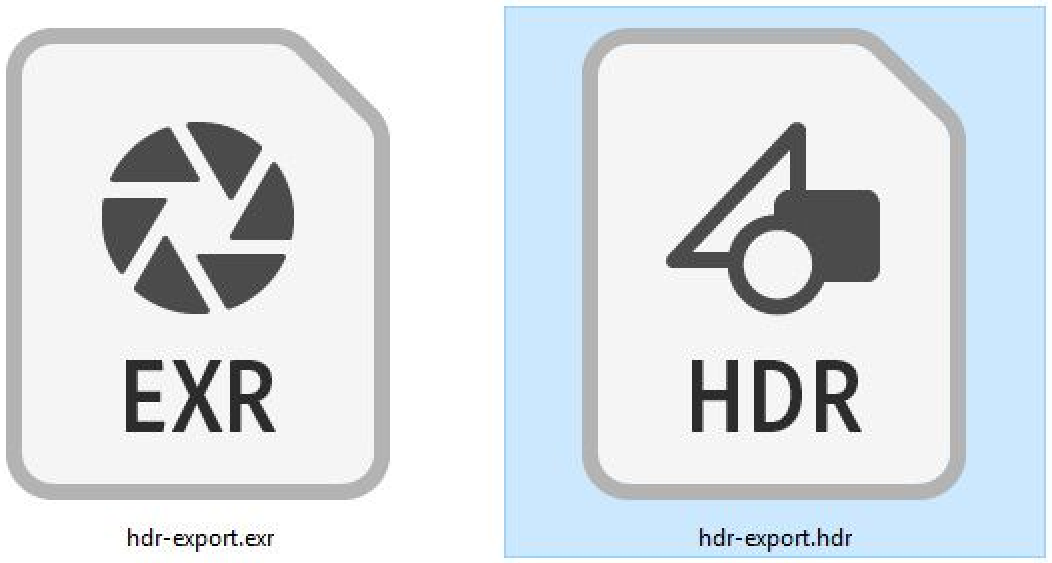
Press OK on HDR Pro. You will be back in Photoshop. From the *File* menu, select *Save As...*.

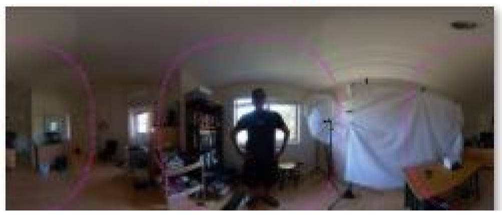


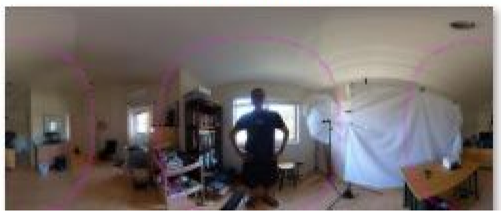
You will now see the options to save as Radiance and OpenEXR formats.


Photoshop (*.PSD;*.PDD;*.PSDT)
Large Document Format (*.PSB)
OpenEXR (*.EXR)
Photoshop Raw (*.RAW)
Portable Bit Map (*.PBM;*.PGM;*.PPM;*.PNM;*.PFM;*.P
Radiance (*.HDR;*.RGBE;*.XYZE)
TIFF (*.TIF;*.TIFF)

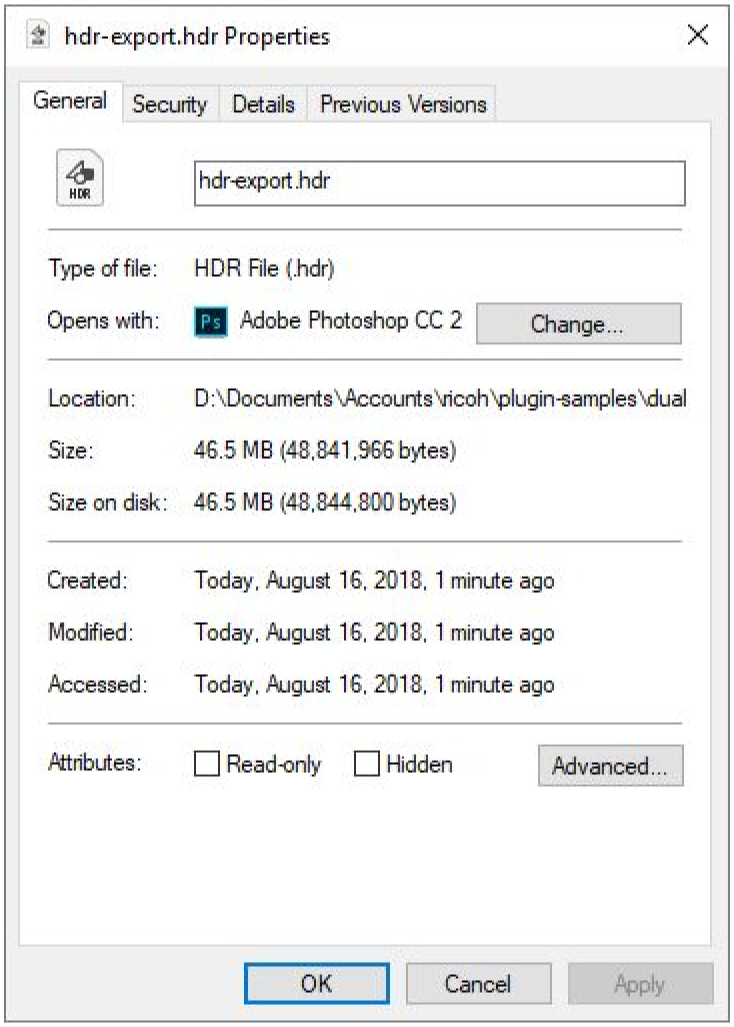
Save the files on your local computer. You can now import the files into another program such as Unity.







The Radiance and OpenEXR files will be much larger than the JPG images. Each original JPG image was approximately 3.3 MB.
The HDR files are around 45 MB.



hdr-export.hdr Properties

General | Security | Details | Previous Versions

hdr-export.hdr

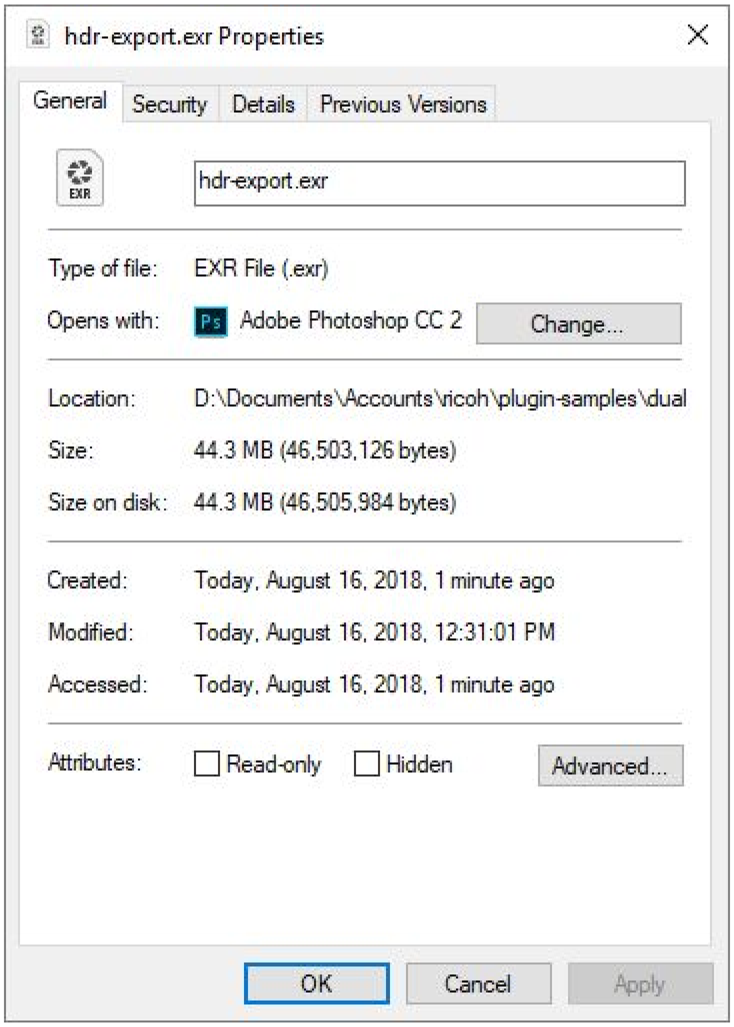
Type of file: HDR File (.hdr)
Opens with: Adobe Photoshop CC 2

Location: D:\Documents\Accounts\ricoh\plugin-samples\dual
Size: 46.5 MB (48,841,966 bytes)
Size on disk: 46.5 MB (48,844,800 bytes)

Created: Today, August 16, 2018, 1 minute ago
Modified: Today, August 16, 2018, 1 minute ago
Accessed: Today, August 16, 2018, 1 minute ago

Attributes: ☐ Read-only ☐ Hidden

Both Radiance and OpenEXR have similar file sizes.



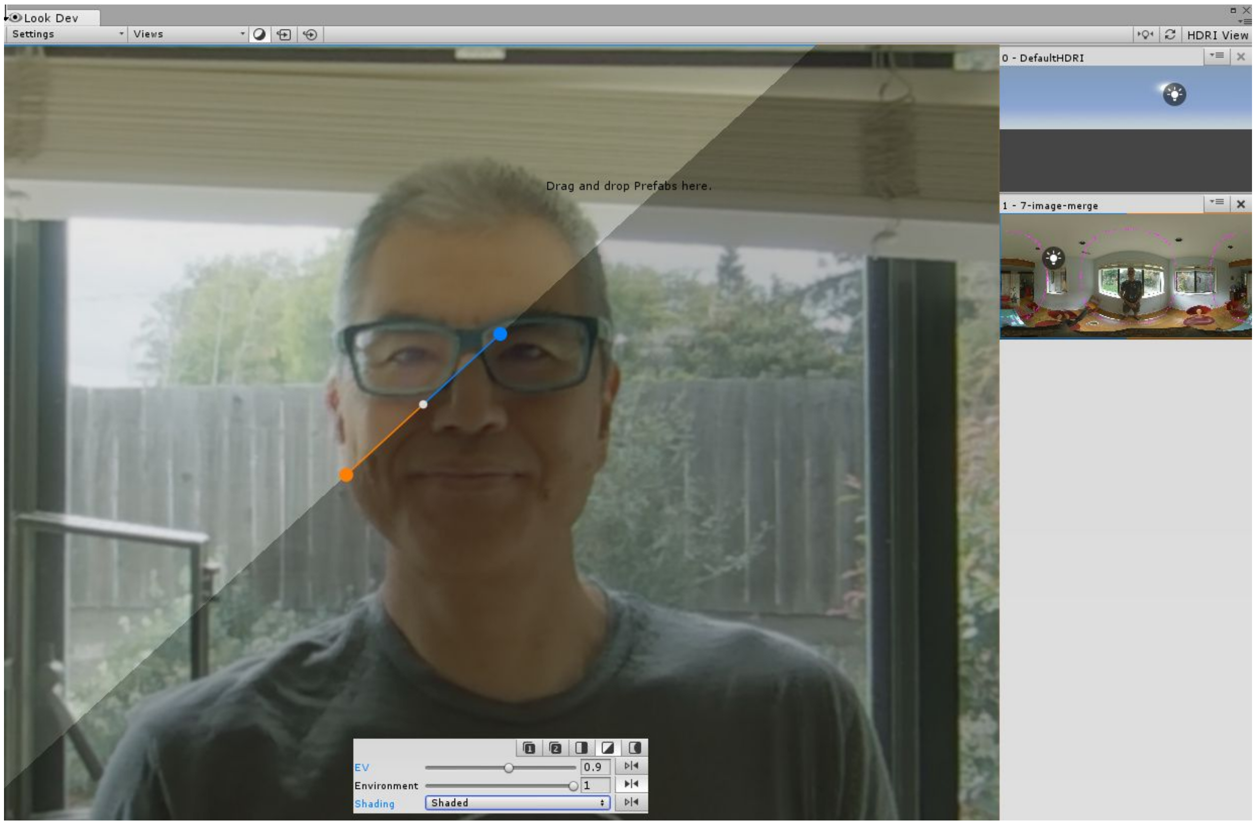
hdr-export.exr Properties

hdr-export.exr

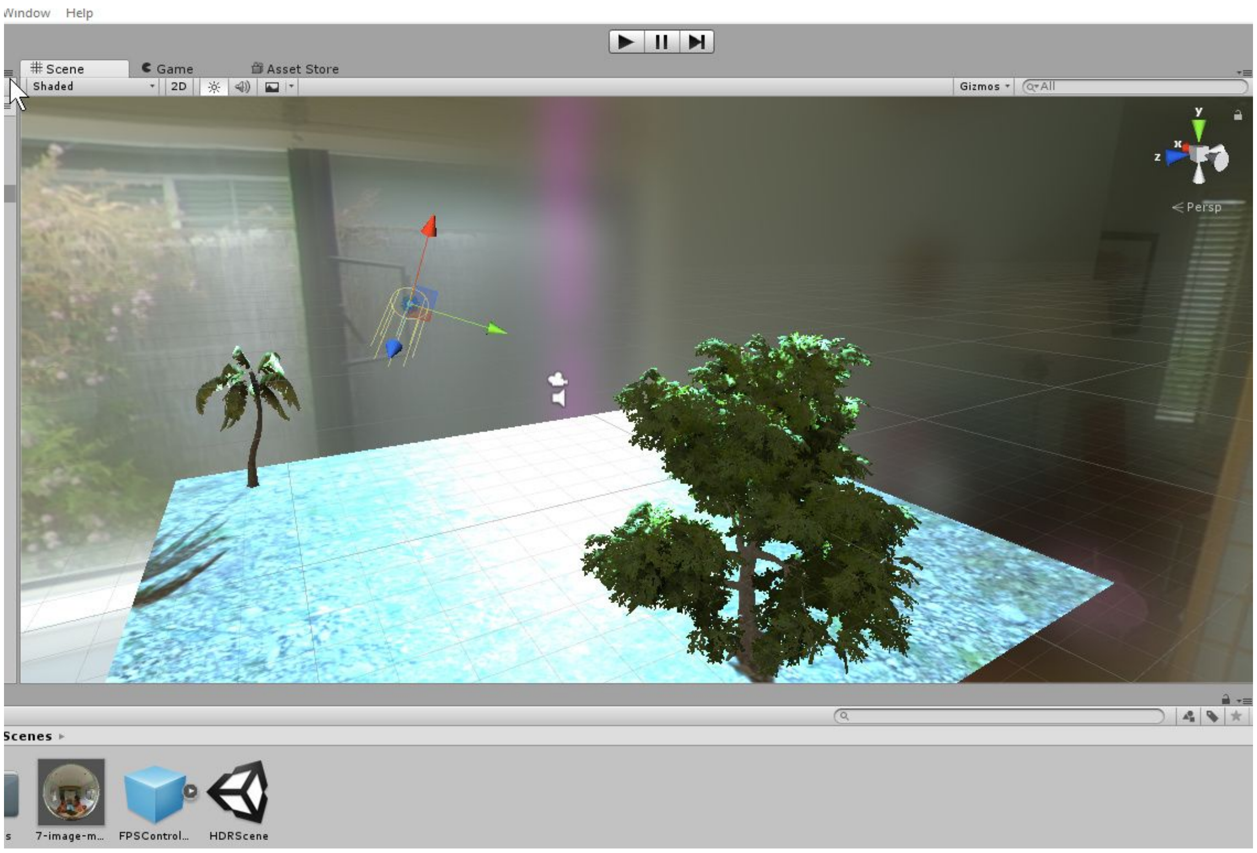
Type of file:	EXR File (.exr)
Opens with:	Adobe Photoshop CC 2
Location:	D:\Documents\Accounts\ricoh\plugin-samples\dual
Size:	44.3 MB (46,503,126 bytes)
Size on disk:	44.3 MB (46,505,984 bytes)
Created:	Today, August 16, 2018, 1 minute ago
Modified:	Today, August 16, 2018, 12:31:01 PM
Accessed:	Today, August 16, 2018, 1 minute ago
Attributes:	☐ Read-only ☐ Hidden

THETA 7 Image HDR With Unity Look Dev View HDRI

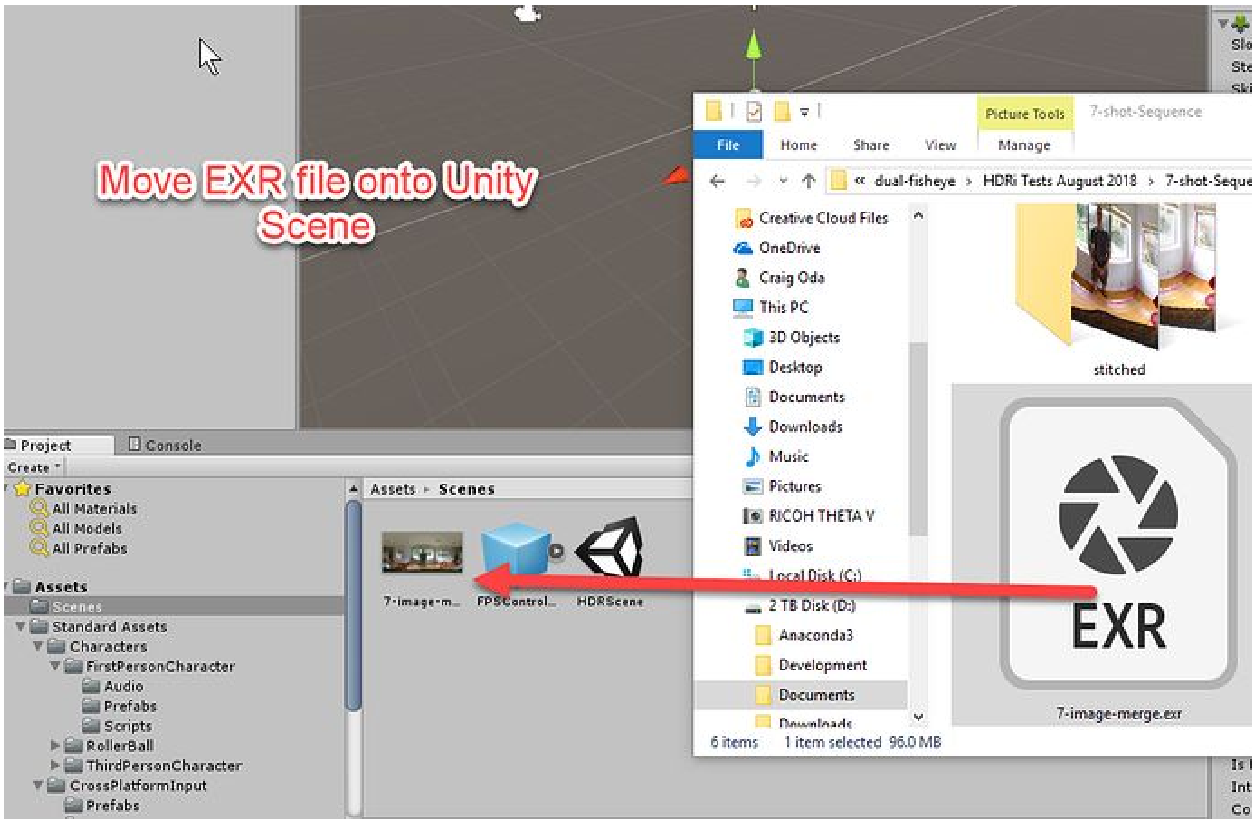
Unity has a Look Dev tool that is used to check different assets for lighting conditions. With Look Dev you can look at two different assets in different views.



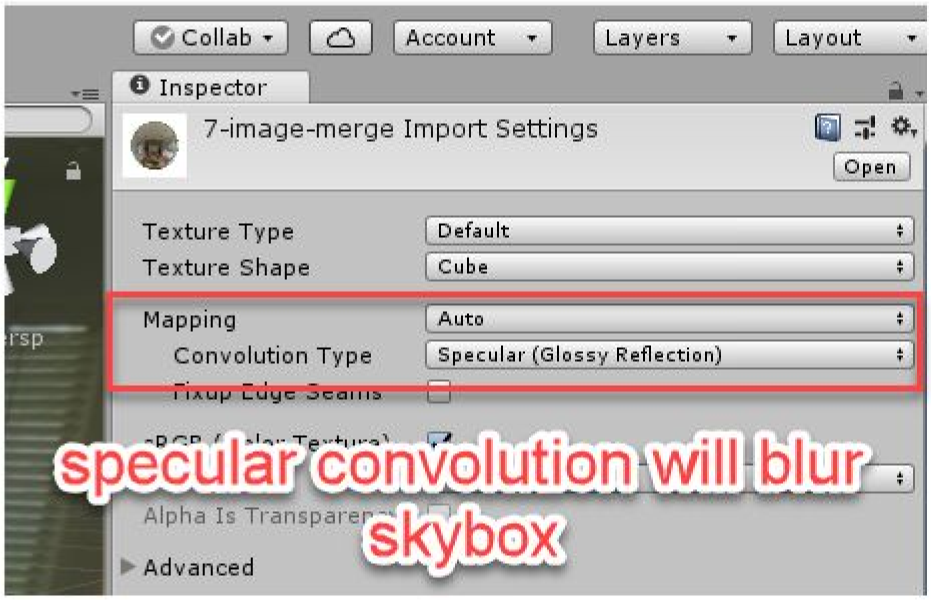
Here's an example of a blue light source.



In the example above, Unity has a known issue of specular convolution producing a blurry image in the skybox.
To get started, drag the EXR file onto Unity.



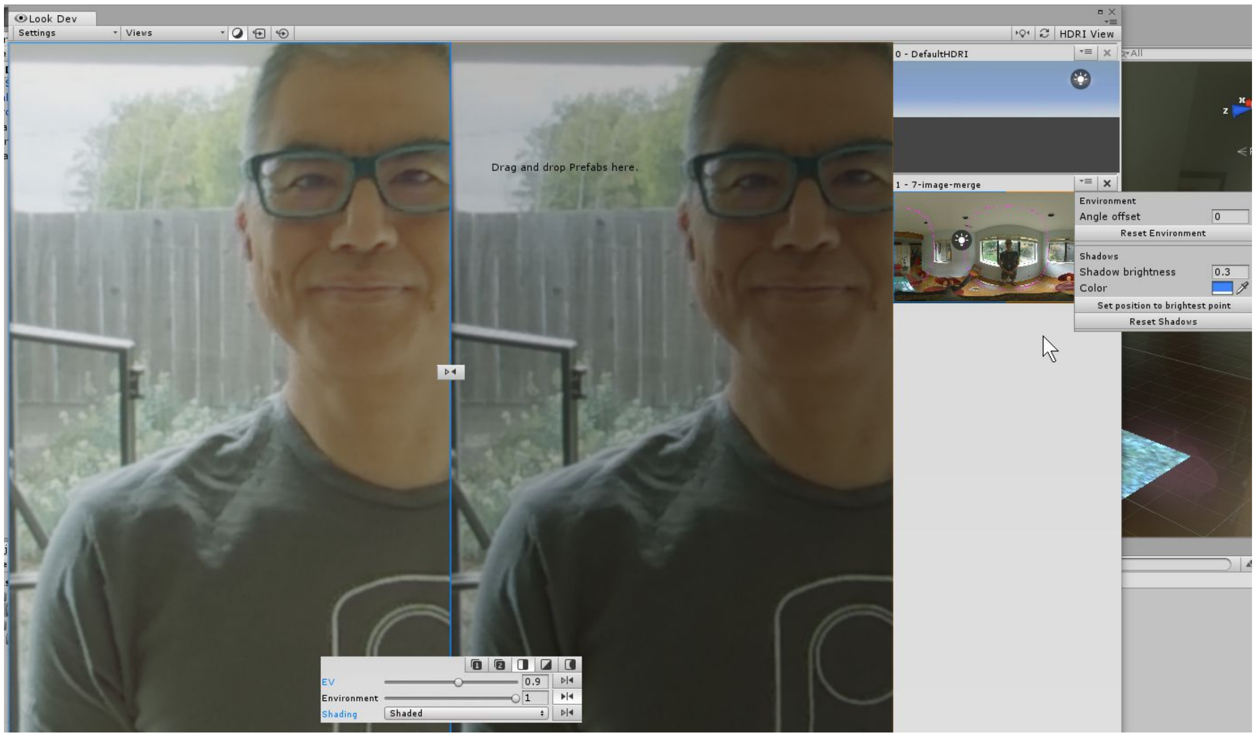
You next need to use the HDRI asset to create a material that you can apply to a 3D object such as the skybox or a sphere.
Unity recommends Specular Convolution.



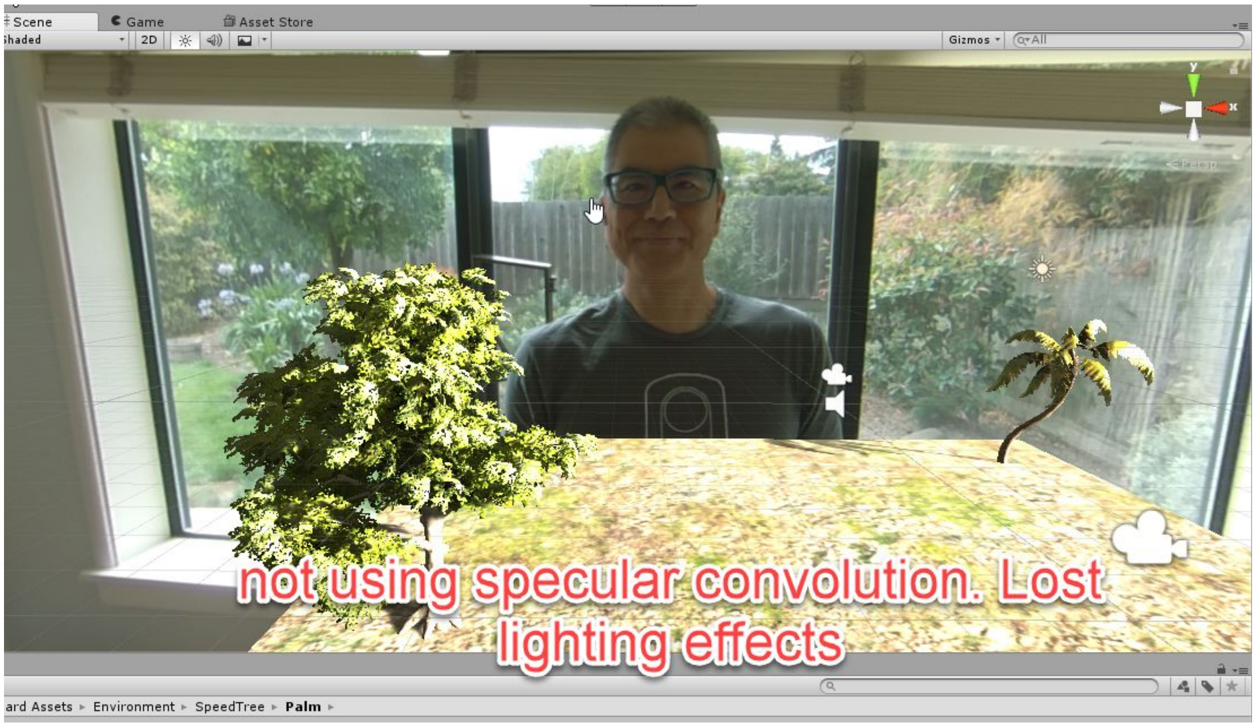
7-image-merge Import Settings

Texture Type: Default
Texture Shape: Cube
Mapping: Auto
Convolution Type: Specular (Glossy Reflection)
Fixup Edge Seams
sRGB (Color Texture)
Alpha Is Transparency

It does blur the skybox. Disabling Specular Convolution will result in a normal-looking image in the Skybox. The Texture Shape needs to be Cube. Hit Apply.
On my 6-core i7 with 32GB RAM, it took a few minutes.
Here's a horizontal comparison view inside of Look Dev View HDRI.



In the example below, I'm not using Specular Convolution and am losing the lighting effects.


Scene
Game
Asset Store
Shaded
2D
Gizmos
All
not using specular convolution. Lost lighting effects
ard Assets ▸ Environment ▸ SpeedTree ▸ Palm ▸