EOS VIRTUAL REALITY SYSTEM White Paper

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Abstract

This document is a short introduction to VR as a technology, leading into an overview and navigation of Canon's EOS VR system to help decide which EOS VR system products will work for your project. As well as some helpful tips on shooting VR content.

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EOS VIRTUAL REALITY SYSTEM

1 Background

Virtual Reality is not a new term; however, it is enjoying its largest ever boom thanks to serious advancements in technology. Within this document, we will start at the beginning with an introduction to virtual reality, ensuring that anybody reading this document is equipped with the knowledge to understand the past, present, and potential future of VR.

Canon expect the VR industry to continue to expand and have decided to provide a system of interchangeable lenses that can be used on select EOS R / Cinema EOS system cameras to create VR content, making high quality VR content creation more accessible than ever before. Here, you will find all the information you need to navigate the EOS VR SYSTEM and find out which combination of products will be right for your project.

Finally, shooting virtual reality can be tricky, it's very different to shooting 2-dimensional, controlled view video content. We've made the mistakes during our testing and have included some helpful tips and tricks to make the move to VR an easier step to make.

1.1 Introduction to VR

Stereoscopic Virtual Reality(VR) stills and videos have been around for some time in various formats, with the more modern take on VR devices appearing in the mid-1980's, such as those developed by VPL Research and its founder Jaron Lanier, but analogue film devices such as the View-Master have been around since 1939, offering a static, fixed field of view. Even earlier than this, stereoscopes were being conceived and developed as far back as the camera itself in the early 1800's. So, it is possible to understand that there has always been and is a real desire to see the world in a three-dimensional (stereoscopic) format, restricted in some ways by the technology available at the time. However, it is at about the time Facebook acquired Oculus VR (for about $2 billion) that technology has progressed and 'stereoscopic' virtual reality was really gaining interest, particularly among the gaming community, and by 2016 there were over 230 companies developing VR related products, including Amazon, Apple, Facebook (Meta), Google, HTC, Varjo, Pico, Microsoft and Sony, to name a few.

But with the lack of capable computing technology at an affordable price, the relatively low image quality from early Head Mounted Displays (HMD) / VR headsets and cameras, it struggled to gain traction in the wider market, remaining of interest to the gaming industry, theme parks and specialist industries / governments.

However, in the last few years, technology has progressed significantly, giving rise to the increased availability of high-quality Head Mounted Displays from a growing number of manufacturers (like VARJO, Pimax and HTC etc), plus the availability and affordability of the necessary high-powered computers to tether to and edit from. These latest devices and computers are better able to cope with the high resolution, high dynamic range files being generated by the latest simulations, capture devices and cameras, producing more realistic and immersive 3D 180°/360° VR content that is demanded by many medical, industrial and governmental institutions. But it is the development and improvement in dedicated imaging processors within some of the latest 'consumer' level and some enterprise level device VR headsets, that have enabled many of these to ditch the need to be tethered to an external computer (with external positional sensors), making them more mobile, affordable and accessible for a greater number of users and applications.

It was the Oculus (now Meta) Quest 2 in 2020, that really heralded the popularity and practicality of an untethered VR headset that was both affordable and practical to use, gaining interest from both consumers and small business users. Later, in 2023, it was the Meta Quest 3

and Pico 4 (Enterprise) with their more advanced internal processors, smoother/faster performance and improved image quality, that would really propel these lower cost headsets to even more consumers and business users, being more capable products. It was then the launch of the Apple Vision Pro in early 2024 that gave the industry another kick start by a giant in the technology world, looking at how such technologies could be applied in the enterprise world. Although not very affordable for many at an initial $3,500, the image quality surpassed many of its rivals, backed up by the Apple ecosystem and hype. With Apple being well known for its innovative take on user interface, interaction and user experience, it will be interesting to see how well Apple's proposed new way of working will take off.

In addition to technological improvements that make the ability to capture, process and view VR content more practical and appealing, the world is rapidly changing in how we all interact with each other. This was no easily seen during the unfortunate and tragic circumstances caused by COVID-19 and the global pandemic in 2020, which had an effect of accelerating change. Industries and individuals are now using technology more than ever to conduct work, view entertainment and interact with each other remotely, more regularly and over longer distances. This has opened up a whole future of possibilities and acceptance of 'new ways of working', with an interest in how virtual reality could become an increasing part of some of our lives, be it for work, education or entertainment, adding value to how we interact with the world.

With the improvements in Head Mounted Displays driving a lot of the interest in greater realism and creating opportunities for more uses, then it is the creation of high-quality content that is now needed. However, VR cameras had been mostly polarised into either low-end, low-cost 'consumer' type products, or high-end multi-camera setups/rigs, with a few dedicated more 'professional' all-in-one systems becoming available too — but all using multiple files and sensors.

Canon's EOS VR SYSTEM (which includes the RF 5.2MM F2.8L DUAL FISHEYE, RF-S 3.9mm F3.5 STM DUAL FISHEYE and RF-S 7.8mm F4 STM DUAL lenses and compatible cameras) aims to provide a better balance of price and performance while making the process of 180° VR and spatial content creation a lot simpler and more efficient, enabling greater opportunity to create more content and enabling more people to enter the VR content creation market.

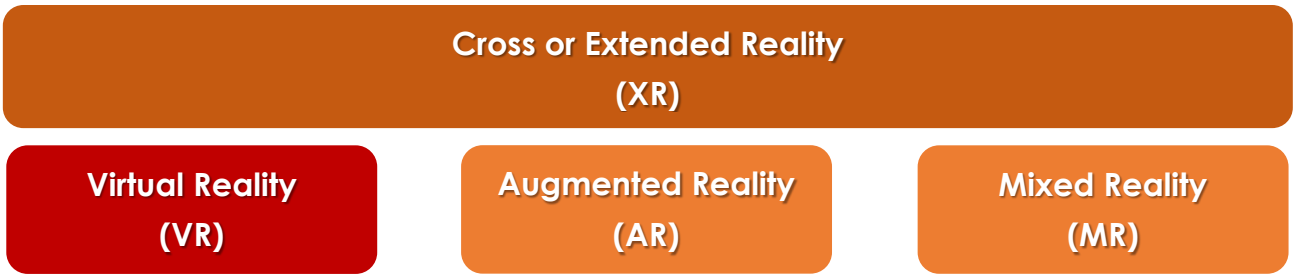
1.2 What is Virtual Reality?

Virtual Reality is the creation of an environment that fills the viewers field of view and presented in such a way as to immerse the user within that environment and make them 'believe' they are somewhere else.

Environments can be filmed with real life scenes, using specialist camera systems, or can be computer generated (or can even be a mixture of the two).

To experience virtual reality in its truest form, the user must wear a Head Mounted Display (HMD) / VR headset that projects a (3D) stereoscopic image onto the users eyes (using two images, one for each eye, showing the same scene but from slightly different angles), providing depth perception and filling their field of view, while ideally also incorporating spatial audio.

1.3 Virtual Reality vs Augmented Reality vs Mixed Reality



Requiring the use of a Head Mounted Display (HMD) / VR headset, users are fully immersed in a Computer Generated (CG) or real-world environment, simulating the user's actual presence within that environment. Users are able to move their head to look around them, as if they are really there. Viewing a 3D/stereoscopic scene adds a true sense of realism with depth perception.

Users typically use a mobile phone or tablet that can be moved around while using the device's camera to view the real world on its 2D, flat screen in real time. Digital information and imagery is superimposed onto the screen. Computer vision and object recognition can enhance the relative size, position and representation of the digital overlay on the screen.

Mixed reality takes augmented reality a step further and incorporates VR characteristics, blending the physical and digital world together in an immersive mixed environment.

Wearing a head mounted display, users can still see the real world around them, but now digital objects can be placed relative to real objects within that world, and can typically be interacted with. With six degrees of movement users can even move around a digital object, while still seeing the boundaries and obstacles of the real world.

1.4 360° VR vs 180° VR

Ideally, requiring the use of a Head Mounted Display (HMD), and even though the viewers field of view is filled, only a portion of the scene is visible at any one time, requiring the user to move their head to view all the scene. Two popular formats of Virtual Reality are 360° VR, where the user can look in all directions and be totally surrounded by the environment and 180° VR, where only the forward facing (half sphere) part of the environment is visible.

*Note: **360° VR** and **180° VR** can be captured/displayed as either **monoscopic** or **stereoscopic** content, depending on the requirements of the content creator or distribution method.*

360° VR

Used when the viewer is made to feel like an entire scene, in any viewing direction, is visible. Various on-line 'street view' applications are an example of 360° VR.

Benefits of 360° VR:

Fully immersive 360-degree environment where users can look in all directions including at what is behind them

Possible to add a 3D look to the 360° viewing experience, but TWO cameras would be required for initial capture of each view (most on-line street view apps use a single camera, so there's no 3D effect)

180° VR

More useful when a content creator wants the viewer to be immersed in the environment, but also wants to focus the viewer's attention on the story / message they have to tell (i.e. documentary, natural history, training, travel, sports, concerts).

Benefit of 180° VR:

It is not always desirable to shoot 360° VR, so the option to only show what is happening in front of the user has its own benefits.

Focus's the viewer's attention on the story being told in front of the camera

It is a lot easier to shoot 180° VR — there is no need to worry about what is behind the camera (and therefore, no need to hide equipment or operators during the shoot)

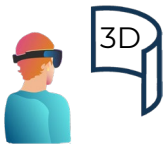
Typically, equivalent 180° VR systems are smaller than professional 360° VR rigs

Easier to incorporate an immersive, 3D experience, with a single camera and Dual Fisheye, lens, such as the Canon RF 5.2mm F2.8 L Dual Fisheye

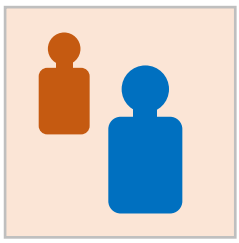
Smaller equivalent file sizes than 360° VR

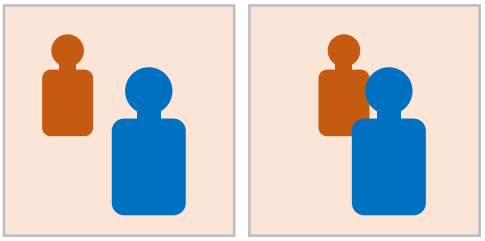
Simpler workflow with less editing / stitching

1.4.1 Comparison summary

360° VR	180° VR	140° VR	60° Spatial (3D)
			
360° produces a fully immersive VR experience, placing the viewer in the environment.	180° produces an immersive VR experience, filling the viewers field of view, placing the viewer in the environment, but in one forward facing direction.	Reducing the field of view slightly, to 140°, can help to reduce costs of the lens, but still provides an immersive VR experience. It also means there is less likelihood of feet, tripod legs and other unwanted objects being captured, so is great for quicker, more robust setups.	With such a small field of view, the viewer can see all the image at once, with no need to look around. Unlike the other views, this does not provide an immersive VR experience, but is more like watching a 3D television (when viewing a stereoscopic file). Great for viewing 3D content on various devices, including stereoscopic viewers, 3D print etc, as well as VR headsets.

1.5 Monoscopic vs Stereoscopic





Left eye *Right*

Monoscopic (2D)

Only a single image from one direction is captured and displayed. This image can be viewed on a standard flat screen, and if shot as a wide 'stitched' 360-degree image, it can simply be scrolled left/right or up/down on the screen to see the rest of the view.

As mentioned on the previous page, on-line sources like web-based 'street view' sites are an example of monoscopic, 2D capture. This format of capture and display is very versatile, as it requires no specialist equipment to view the content, so anyone with a computer, mobile phone or tablet can easily view the image.

However, for a more immersive experience, a Head Mounted Display could be used to fill the viewers field of view, but the content will still be monoscopic with no depth perception.

Stereoscopic (3D)

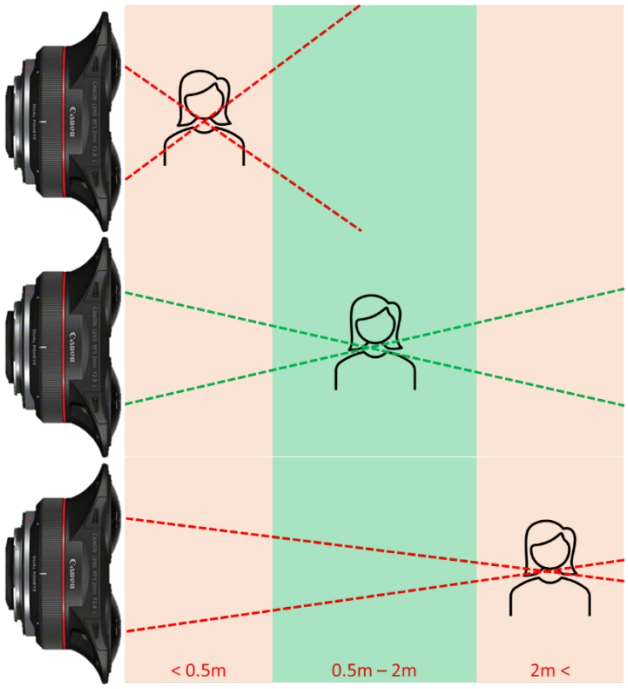
Two images of the same scene are captured at the same time, but from slightly different angles (creating a parallax), requiring the use or two lenses, separated by a specific distance. For a more natural view, this 'baseline' distance usually approximates to an average interpupillary distance (the distance between the pupils) in a human. In the case of the RF5.2mm F2.8L DUAL FISHEYE lens the baseline distance is 60mm.

When viewing a stereoscopic VR image, a Head Mounted Display is required, where these two images from two slightly different angles can be seen and interpreted by the brain, calculating depth. Hence providing a true 3D and fully immersive experience, adding a greater sense of realism than a monoscopic image could.

1.6 What difference does the interpupillary distance make?

The interpupillary distance, otherwise known as the baseline length, is the distance between the two lenses- measured from the centre of each lens at the front. This separation of the lenses gives two different viewpoints and therefore a 3-dimensional effect.

By having a smaller or larger baseline length, a VR system can be optimised for shooting subjects at different distances. A larger baseline length is better optimised for subjects that are further in the distance, whereas a smaller baseline length will be better for close-ups.



In the diagram on the left, we can see how subject distance affects the 3D effect on a dual fisheye lens with a baseline length of 60mm.

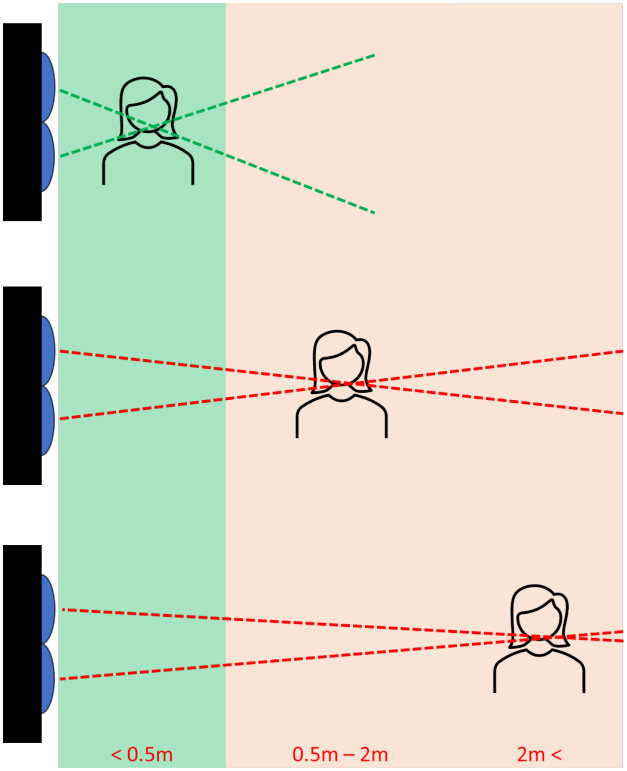
Lenses with a baseline length of 60mm such as the RF 5.2mm F2.8L DUAL FISHEYE and the RF-S 3.9mm F3.5 STM DUAL FISHEYE are optimised for a subject distance of 0.5 – 2m. At this distance, the 3D effects is maximised and comfortable to view, whilst there is not so much difference that the effect is lost. Shooting subjects further away will still enable a 3D effect, but will start to reduce.

The average interpupillary distance of the human eyes is 63mm, so a baseline length around this figure gives the most natural 3D effect for viewers.

Alternatively, if you are working exclusively with close-up subjects, a smaller baseline length is beneficial to achieve a good difference between the images at shooting distances below 0.5m.

A small baseline length, however, will mean that subjects shot further away will have less difference in the images, resulting in less of a 3D effect.

For subjects further away, a larger baseline length would be required and this is usually achieved by using two separate cameras and lenses rigged together.

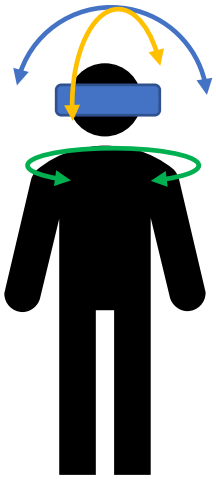


1.7 3-degrees vs 6-degrees of Freedom

More relevant to the headset capabilities and the viewing software. Degrees of freedom (DoF — not to be confused with depth of field) references how an object moves through three-dimensional space, of which there are a total of six degrees of freedom:

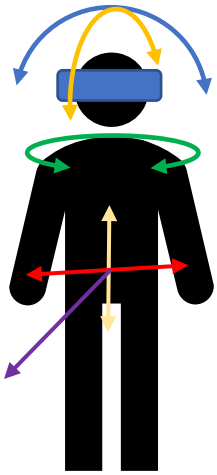
- Three degrees of freedom for rotation - pitch, yaw and roll
- Three degrees of freedom for translation - forwards/backwards, left/right and up/down

3-degrees of freedom



3-degrees of freedom (rotation) is more suited to being an observer within an immersive environment.

6-degrees of freedom



6-degrees of freedom (rotation and translation) is more suited to being an interactive participant within an immersive environment, as it allows the user to move within it. It is particularly associated with modern VR video games and training, often created with computer graphics.

1.8 Benefits of Virtual Reality

There are many benefits in the use of Virtual Reality in education, training, marketing, entertainment and industry. In particular, using VR can more effectively instil an '*emotional connection*' to the story or message you want to tell:

"I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel."
Maya Angelou (1928-2014) - American poet, memoirist, and civil rights activist

Virtual Reality also provides a more *realistic 'real-world'* view with depth perception to better understand relative positioning and textures of objects or situation, which can be particularly useful for training / education.

It has been argued that there are other benefits:

- It can help retention and recall of what has been shown / learnt
- It can put people in realistic environments that many be dangerous or unachievable before, but in a safe, low risk way

- Content can be viewed remotely
- It can be exciting, enjoyable and stimulating

1.9 Challenges of 'traditional' VR capture

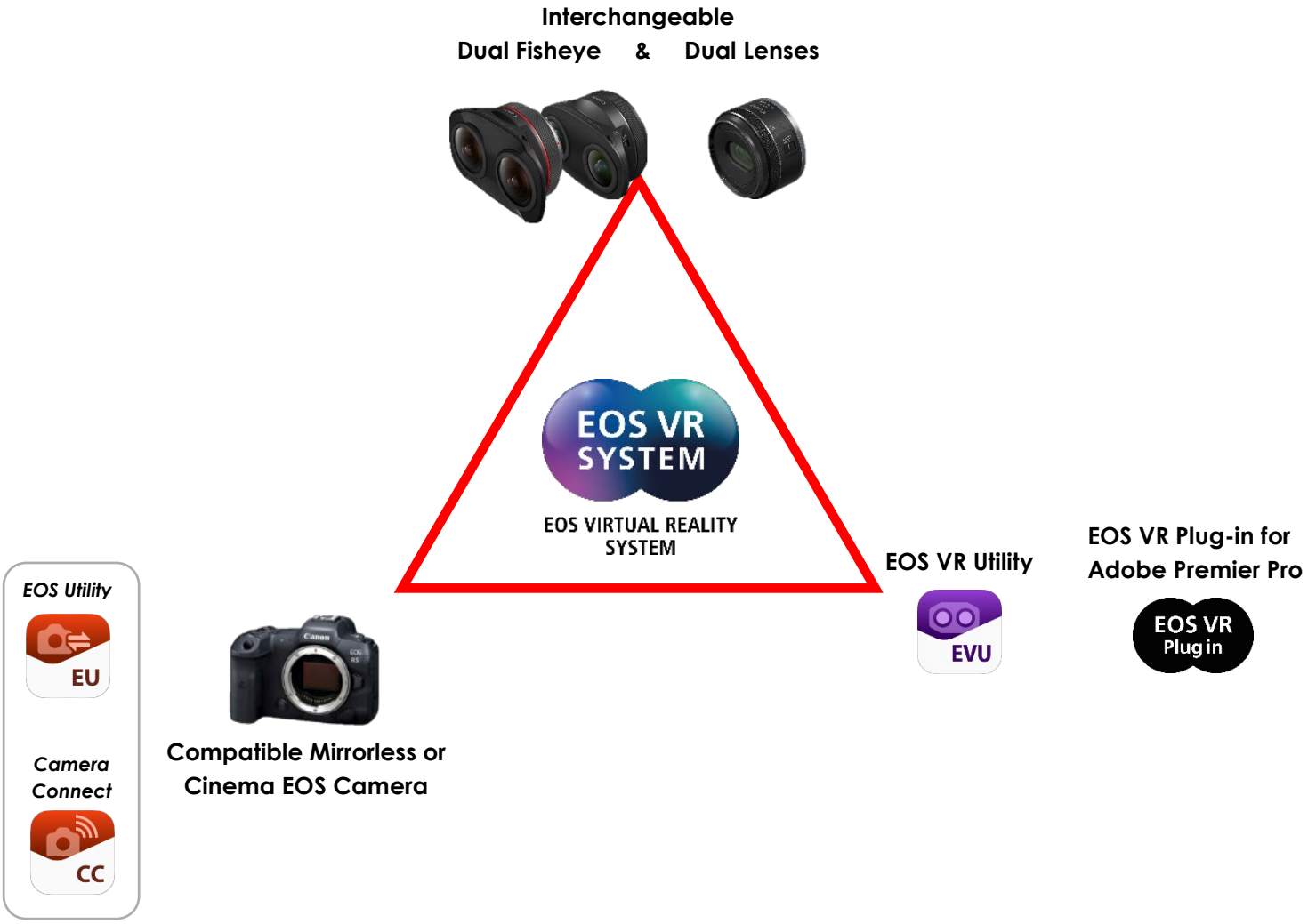
'Traditional' forms of VR capture can involve multiple cameras to setup and can mean there are multiple files to manage, process and stitch together:

- Need to have fully, precisely aligned cameras / images
- Need to have all the images fully synchronised
- Can take time to set-up the camera system, especially if there are rigs involved for multiple cameras.
- Difficulty in lighting 360° VR scenes without seeing the lights
- Higher frame rates are preferred for faster moving subjects and scenes with a lot of fast movement (e.g. 60fps or greater)
- Need high-quality ultra-wide lenses to reduce image stitching requirements.
- Edge-to-edge performance is especially important if using a single fisheye lens for each 'eye', to aid an accurate conversion to an equirectangular projection
- The resolution needs to be high for a clearer, more immersive experience
- Images need to be level and stable to be comfortable to view
- Users need to be able to easily manage all the files for a quicker, more trouble-free post-production
- Equipment needs to be compact as rigs, etc can be cumbersome
- Converting the footage can be very time-consuming and needs expertise and/or software to stitch
- If using multiple cameras/lenes, stitch lines can sometimes be visible in the final output, especially if this is where the action happens to occur, providing a poorer, less realistic experience

Canon's aim with the EOS VR SYSTEM is to address many of these challenges and simplify the process from input to output.

2 Canon's EOS VR System

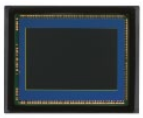
Canon's innovative solution for VR & Spatial capture simplifies and streamlines the whole process from capture to output. It utilises the benefits of the RF mount system to enable the design of a compact dual fisheye lens that projects stereoscopic left and right eye images *onto a single Full Frame or APS-C size sensor (depending on the camera / lens being used)*. This innovative design effectively eliminates issues of lens alignment and image synchronisation, capturing a dual side-by-side fisheye image directly onto a single file. Therefore, the process of converting and exporting to a final equirectangular projection is made simpler, more efficient and more robust.



2.1 Benefits of the EOS VR SYSTEM

Ease of setup and operation	**Efficient workflow** in shooting and post-production	**High-quality** up to 8K + Canon lens combination
To prepare for shooting, simply attach a DUAL FISHEYE or DUAL lens to a compatible EOS camera. Anyone can promptly start shooting VR/Spatial content with minimal shooting gear.	Single imaging sensor system dramatically reduces the burden of shooting and post-production that used to be difficult for a conventional VR / Spatial system.	Full Frame RAW up 8K or APS-C sensor compatible cameras, plus high-performance L-series or standard lenses, realise corner-to-corner high-quality images.

Single file



Up to 8k FF

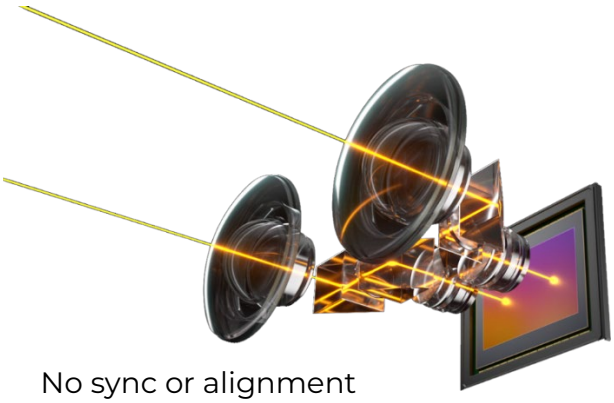
L-series and standard

2.1.1 Ease of setup

Setup is as simple as attaching one of the DUAL FISHEYE or DUAL lenses to a compatible EOS camera, and set the camera settings to the desired shooting parameters.

2.1.2 Efficient workflow — one sensor, one file

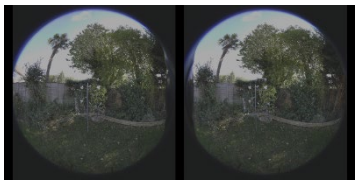
An efficient workflow is enabled by the recording of the stereoscopic image onto a single sensor, which in turn means there is only a single file to handle within the system, making file management incredibly simple.



No sync or alignment needed for left and right images

One sensor – consistent colour and brightness

Projects two stereographic images onto the same sensor, perfectly synced and perfectly aligned



No stitching required

A single file is recorded to a single memory card

2.1.3 High Image Quality

High image quality is assured through the use of L-series or high quality standard lenses that utilise special glass and coatings to ensure edge to edge performance, while a Canon sensor capture the detail and dynamic range needed for VR / Spatial reproduction.

2.1.4 Simplicity of image conversion to an Equirectangular Projection

What was once a complex process of alignment, synchronisation and stitching with multiple camera/file systems, is now made infinitely easier thanks to Canon's EOS VR Utility[1] software, which makes conversion of the stereoscopic footage and stills for editing and playback, a much more efficient process. You can even import and automatically convert Canon's VR footage direct into Adobe Premiere Pro[1], by using Canon's EOS VR Plug-in for Adobe Premier Pro.

EOS VR Utility

EOS VR Plug-in for Adobe Premier Pro

No stitching required!

[1] EOS VR Utility or the EOS VR Plug-in for Adobe Premiere Pro are required to perform the equirectangular projection of recorded VR and conversion of Spatial images from compatible Canon cameras. Download the latest version for the latest features and support, including support for RAW files, image stabilisation, export to different format and support for Apple Silicon and GPU acceleration. A paid for subscription service may be required to convert videos longer than 2 minutes, requiring a Canon ID. The installation of the specific "HEVC Activator" for the specific camera used, will also be required.

2.2 Available Lenses

The EOS VR SYSTEM currently consists of 2 RF virtual reality lenses designed for interchangeable lens cameras. Both have many similar characteristics, but also specific differences which will determine which one is best for each project. The system also consists of 1 RF Spatial lens for 3D image capture. Here, we will initially look at an overview comparison of all these lenses and discuss what this means for shooting. It is recommended to select the lens for your project first, and then choose a compatible camera. This section will give an overview and comparison of the lenses to start and then dive deeper into the technologies which are shared and those which are unique to each lens.

2.2.1 Top level lens specification table

Specification	RF 5.2mm F2.8L DUAL FISHEYE	RF-S 3.9mm F3.5 STM DUAL FISHEYE	RF-S 7.8mm F4 STM DUAL
Lens type	Virtual Reality	Virtual Reality	Spatial
Viewing Angle (recording / output) (°)	190 / 180	144 / 140	63/60
Image size (for sensor)	Full Frame	APS-C	APS-C
Maximum aperture	F2.8	F3.5	F4
Autofocus actuator	None	STM	STM
Weather sealing	Yes	No	No
Projection type	Equidistant	Equidistant	Centre
Adjust mechanism	With hex key	Toolless	Toolless

2.2.2 RF 5.2mm F2.8L DUAL FISHEYE

Headline Specifications:

Image size (for sensor)	Full Frame
Viewing Angle (°)	190
Maximum aperture	2.8
Autofocus Actuator	None
Weather Sealing	Yes
Projection Type	Equidistant
Adjustment Mechanism	With hex key

Capture the world in stunning virtual reality with this ground-breaking L-series lens, designed to make your VR journey as simple and seamless as possible.

The compact, single mount design simplifies quick camera setups for professional stereoscopic 180° VR capture, when using compatible high resolution, Full Frame, RF mount cameras, such as the EOS R5 Mark II and Cinema EOS cameras like the EOS C400. Featuring a stereoscopic 190° field of view, two offset circular fisheye images are perfectly synchronised and recorded side-by-side onto a single Full Frame sensor, ready for Canon's powerful EOS VR Utility[2]/plug-in[2] to seamlessly process for final edit, requiring no additional stitching.

Compatibility:

- EOS C400
- EOS C80
- EOS R5C
- EOS R5 Mark II
- EOS R5
- EOS R6 Mark II

Useful genres

- Experiential
- Training
- Documentary
- News / natural history archive

As the original and flagship L-series EOS VR System lens, this lens is the choice for professional VR production. Providing a 180° output field of view, this lens can be used with full frame EOS R system cameras (check compatibility) to create up to 8K 60 frames per second virtual reality movies at the time of writing. Excellent for creating fully immersive content where you want your audience to have the opportunity to look around and explore the scene.

With a maximum aperture of f/2.8, this lens can be used in a wide range of shooting environments including for lowly lit indoor scenes.

Unique Lens Features:

- 180° VR content creation
- f/2.8 aperture for low light shooting

2.2.3 RF-S 3.9mm F3.5 STM DUAL FISHEYE

Headline Specifications:

Image size (for sensor)	APS-C
Viewing Angle (°)	144
Maximum aperture	3.5
Autofocus Actuator	STM
Weather Sealing	None
Projection Type	Equidistant
Adjustment Mechanism	Toolless

Step into virtual reality content creation with the innovative RF-S 3.9mm F3.5 STM DUAL FISHEYE lens for APS-C cameras . Realistic, immersive 3D VR filmmaking is now within reach.

The Canon RF-S 3.9mm F3.5 STM DUAL FISHEYE camera lens opens up a whole new world of 3D VR content creation. Take your stories deeper in immersive virtual reality with this stereoscopic lens built for APS-C EOS R cameras[2]. The innovative dual fisheye design and 144° viewing angle let you maximise your 3D storytelling potential, combining the high quality you expect, with the usability you need.

Compatibility:

- EOS R7

Useful genres

- Documentary
- Storytelling
- Music Video

Introduced in 2024, this lens further lowers the barrier to entry for virtual reality content creation. With the two image circles covering an APS-C sensor size, it can be used on more affordable and more compact EOS R series cameras (check compatibility). With a 140° field of view after conversion, it is significantly easier to use to shoot as you needn't worry about tripod legs and other gear intruding on the shot. As the first Canon dual lens with autofocus, setting up a sharp shot is more convenient.

With tool-less calibration, this lens is designed to make every aspect of VR content creation easier and more accessible.

Standout Lens Features:

- Simplified VR creation with 140° view
- Autofocus to easily achieve sharp shots.

2.2.4 RF-S 7.8mm F4 STM DUAL

Headline Specifications:

Image size (for sensor)	APS-C
Viewing Angle (°)	63
Maximum aperture	4
Autofocus Actuator	STM
Weather Sealing	No
Projection Type	Centre
Adjustment Mechanism	Toolless

Introducing more accessible ways to get into 3D content creation, the Canon RF-S 7.8mm F4 STM DUAL is a 'spatial' lens that adds a whole new dimension to storytelling for APS-C camera users and tech enthusiasts.

Capture stunning spatial video and 3D stills with the Canon RF-S 7.8mm F4 STM DUAL lens. Relive your experiences through vivid visuals that come alive from the screen with its 63-degree viewing angle and STM AF. So you can witness first-hand more layers of emotional depth, either through a VR headset or on smartphones using stereoscopic glasses.

Compatibility:

- EOS R7

Useful genres

- Close-up
- Flora & Fauna
- Landscape
- Architectural
- Demonstrations (Arts and crafts)

This stereoscopic dual lens is an excellent gateway into the world of spatial video and 3D stills. Designed for APS-C cameras, it offers a 63° field of view, mimicking human eyes – for a natural, realistic look. The STM autofocus makes set-up faster, while the f/4 aperture offers indoor and outdoor shooting. Ideal for close-up storytelling, the 3D effect adds an extra dimension making your memories pop out of the screen.

As a cross between a more traditional lens with a standard field of view and a VR lens with 3D imaging capabilities, the RF-S 7.8mm F4 STM DUAL is the best option for getting started with 3D capture.

Unique Lens Features:

- Simplified 3D imaging with a 63° field of view
- Designed for spatial video for Apple Vision Pro

2.3 Shared Technologies

2.3.1 RF mount and lens design concept

Applies to RF 5.2mm F2.8L, RF-S 3.9mm F3.5 STM & RF-S 7.8mm f4 STM DUAL

Using the benefits of the RF mount, with its large rear diameter and short back focus, Canon has been able to design a sophisticated folding lens configuration that enables two circular images to be projected onto a single imaging sensor, while maintaining image quality.

This compact design, utilising a single lens mount for compatible RF system cameras, ensures both lenses (and hence images) are perfectly aligned, unlike systems that require two cameras and two lenses on a rig. These previous style systems required specialist rigs and are often difficult and time consuming to align/set-up. With the EOS VR SYSTEM, you simply attach a lens to a single compatible camera in the normal way and once levelled on a tripod or gimbal you are ready to shoot (once the camera settings have been chosen). Being so compact and simple to setup, significant time, effort and expertise is saved.

Since both the left and right images from the dual lenses are perfectly aligned and projected side-by-side onto one single sensor, then these images are also perfectly captured in sync, with no delay or difference between them, ensuring a good VR / spatial experience, especially for video.

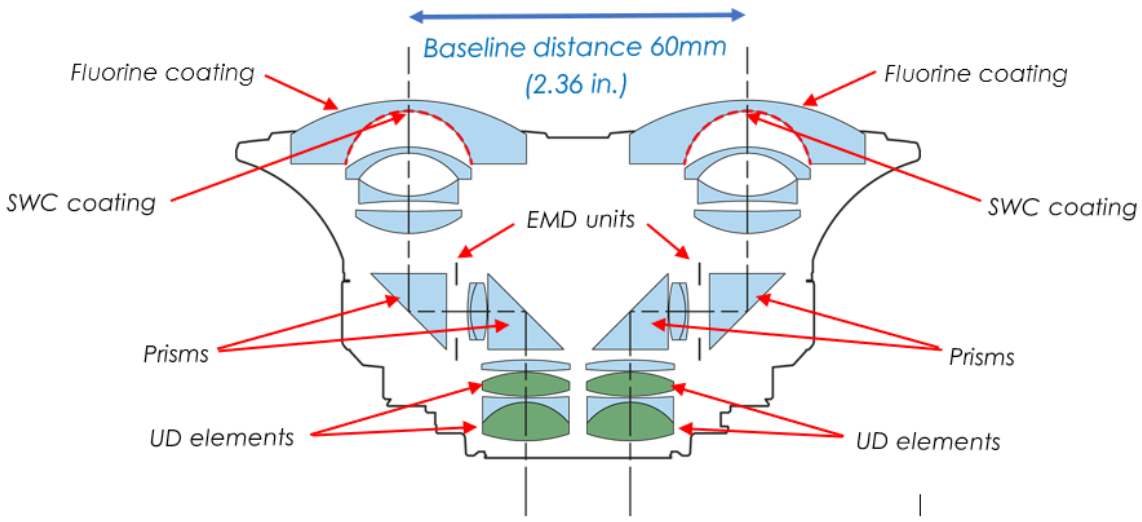
Another benefit of using a single sensor system on a single camera, is that both images exhibit the same colour response and exposure characteristics, as well as all the camera settings being the same.

All the above ensures that both the left and right images are automatically synchronised in every way, enabling for a more efficient conversion to an equirectangular projection in VR and less work is needed in post-production, enabling the content creator/editor to focus on the edit than trying to get the images to align, sync and match.

2.3.2 Advanced optical design

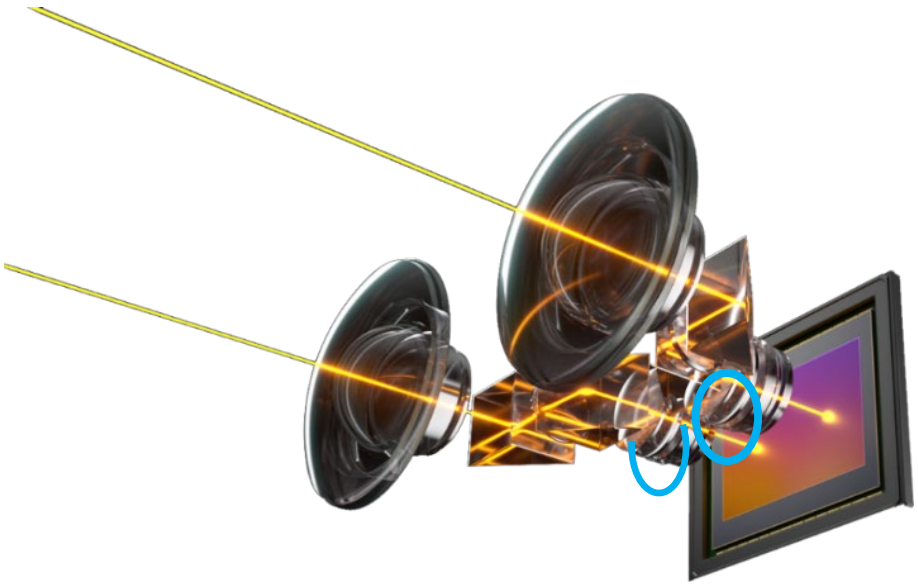
Applies to RF 5.2mm F2.8L & RF-S 3.9mm F3.5 STM

The construction features an optical prism system that folds the optical path to provide images with natural parallax, with a baseline length (similar to interpupillary distance) of 60 mm (2.36 inches). This enables the camera to use interchangeable lenses for simple and straightforward VR shooting while still retaining the camera's general-purpose capability with the wide variety of other lenses available for the RF mount.



Lens shown in diagram is RF 5.2mm F2.8L DUAL FISHEYE, but demonstrates a similar design principle to the RF-S 3.9mm F3.5 STM DUAL FISHEYE

The use of advanced lens design techniques (including the use of prisms), technologies and materials (such as UD elements, SWC and Fluorine coatings, and strategically placed EMD diaphragm units) has enabled Canon to create this compact and lightweight stereoscopic VR lens, while maintaining image quality.



2.3.3 2 x UD elements per lens

Applies to RF 5.2mm F2.8L, RF-S 3.9mm F3.5 STM & RF-S 7.8mm f4 STM DUAL

Two strategically placed UD (Ultra-low Dispersion glass) elements help to reduce aberrations for sharper/clearer, high contrast images from edge-to-edge.

2.3.4 Exposure control

Applies to RF 5.2mm F2.8L, RF-S 3.9mm F3.5 STM & RF-S 7.8mm f4 STM DUAL

2.3.4.1 Dual Electro-magnetic diaphragms (EMDs)

Two EMD (aperture) units, one for each lens, are precisely synchronized and finely controlled to maintain a consistent exposure onto the sensor for each image helping to reduce post-production grading and expertise required to match the left and right image output.

Electro-magnetic Diaphragm (EMD), showing wide-open and stopped-down aperture coordinated but separate aperture units for each lens in the Dual Fisheye design.

2.3.4.2 Automatic Exposure

Automatic exposure through the lens is calculated in the same way as usual, however, it should be noted that the automatic metering range is limited to within the image circle of the left lens (the right hand image as seen on the back of the camera).

Also, if shooting stills, then because this is an ultra-wide lens, there may be large discrepancies in the exposure value for auto exposure in close range flash photography. Therefore, it is recommended to use a light meter and set the exposure manually.

2.3.5 Lens focus difference adjustment

Applies to RF-S 3.9mm F3.5 STM DUAL FISHEYE & RF-S 7.8mm F4 STM DUAL

As both lenses' focus systems are linked, if they become misaligned, they will need to be adjusted. This is a quick, easy, and tool-less process using the ADJUST switch on the lens barrel, adjusting the right lens using the manual focus ring.

The procedure for checking and adjusting the left and right focus positions is as follows:

1- Display the left lens image enlarged and then either use autofocus or manually focus on a subject.
2- Switch to the enlarged image for the right lens and check focus on the same subject. If subject is in focus, no need to continue. If subject is not in focus, continue with these instructions.
3- Slide the left-right focus difference adjustment mode switch to ADJUST.
4- Turn the focus/control ring until the subject is in focus in the right lens.
5- Slide the left-right focus difference adjustment mode switch away from ADJUST.

2.4 RF 5.2mm F2.8L DUAL FISHEYE lens

World's first* lens for digital interchangeable lens cameras enabling 180° VR shooting with one camera to a single sensor

**As of October 5th 2021, among all lenses for full-frame digital interchangeable lens cameras (based on Canon research).*

Right lens focus adjust screw (behind rubber cover)

Gelatin filter holder

Focus ring

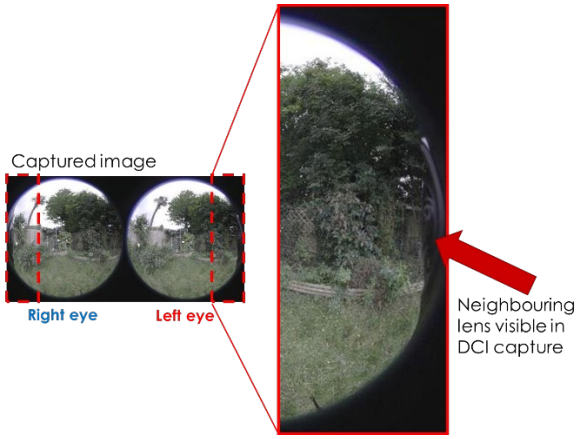
Lens Cap 5.2

2.4.1 L-series build and weather resistance*

Being an L-series lens, the RF 5.2mm F2.8L DUAL FISHEYE lens has a similar professional build and weather resistance* to other L-series lenses in the range. The below diagram highlights where weather resistant seals have been positioned and includes a seal on the lens mount.

** Cannot guarantee to prevent all dust and moisture from entering*

2.4.2 Lens is visible in DCI recording



Note: Slight visibility of the adjacent lens is normal on original, unprocessed video files, using DCI recording. Visibility of the neighbouring lens upon capture is reduced a little further when capturing in the UHD format.

2.4.3 Lens focus difference adjustment

A left-right focus differences in this lens can be adjusted by turning the left-right focus difference adjustment screw/dial and can be found on the right lens only. When first mounting this lens on the camera, or when using the lens after a long period of transportation, a check of the left-right focus should be made. If the left and right focuses differ, then the focus should be adjusted, using the left-right focus difference adjustment dial.

The procedure for checking and adjusting the left and right focus positions is as follows (for the EOS R5...if using the EOS R5 C, place the camera in 'stills' shootings mode for this procedure):

1. Set the camera to f/2.8 and use the magnify button **<🔍>** to enlarge the image on the left lens (right hand image on the camera's LCD screen) and turn the focusing ring to set the focus.

- The default on the EOS R5, is to show the enlargement frame in the centre of the left lens image. Manually adjust focus for the left lens first. The enlargement frame can also be displayed in any position in the left or right lens image by touching the camera's LCD.
- While the enlarged image is displayed, the display can be switched between the left and right lens enlarged images by pressing the **<INFO>** button on the camera.

EOS R5 screen

Magnify

Press the INFO button when magnified to swap between left and right images to easily check for

Dual Pixel Focus Guide – arrows and frame turn green

Magnifying

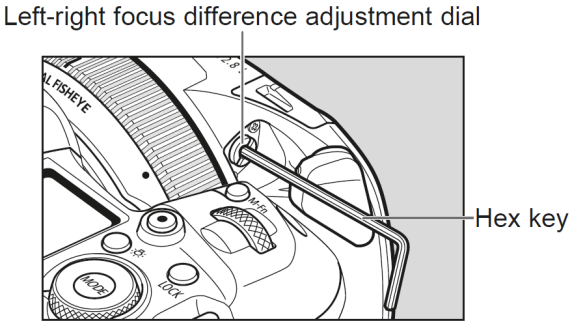
2. Press the **<INFO>** button on the camera to switch to the enlarged image from the right lens.

If the enlarged image is in focus (obtained by focusing with the left lens, viewed on right side of the camera's LCD screen) after switching to the enlarged image from the *right lens*, no adjustment is needed. If the image is out of focus, then the focus will need to be adjusted.

3. Remove the cap on the left-right focus difference adjustment dial (right lens).

4. Use the bundled 1.5mm hex (Allen) key to turn the left-right focus difference adjustment dial and adjust the focus. Standard, commercially available 1.5mm hex (Allen) wrenches/keys can also be used for this adjustment.

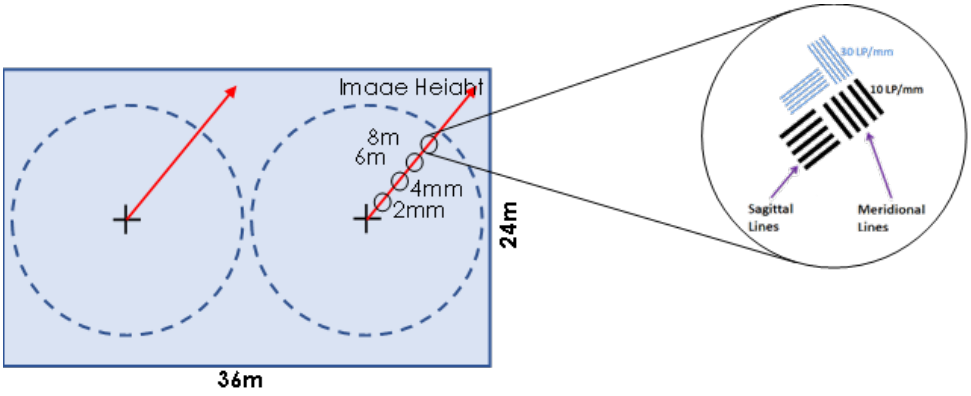
- Turning the left-right focus difference adjustment dial roughly ±90° moves the right lens by the maximum amount.
- Turning the left-right focus difference adjustment dial more than ±90° reduces the amount of right lens movement, and turning the dial ±180° returns the right lens to its starting point (zero movement).

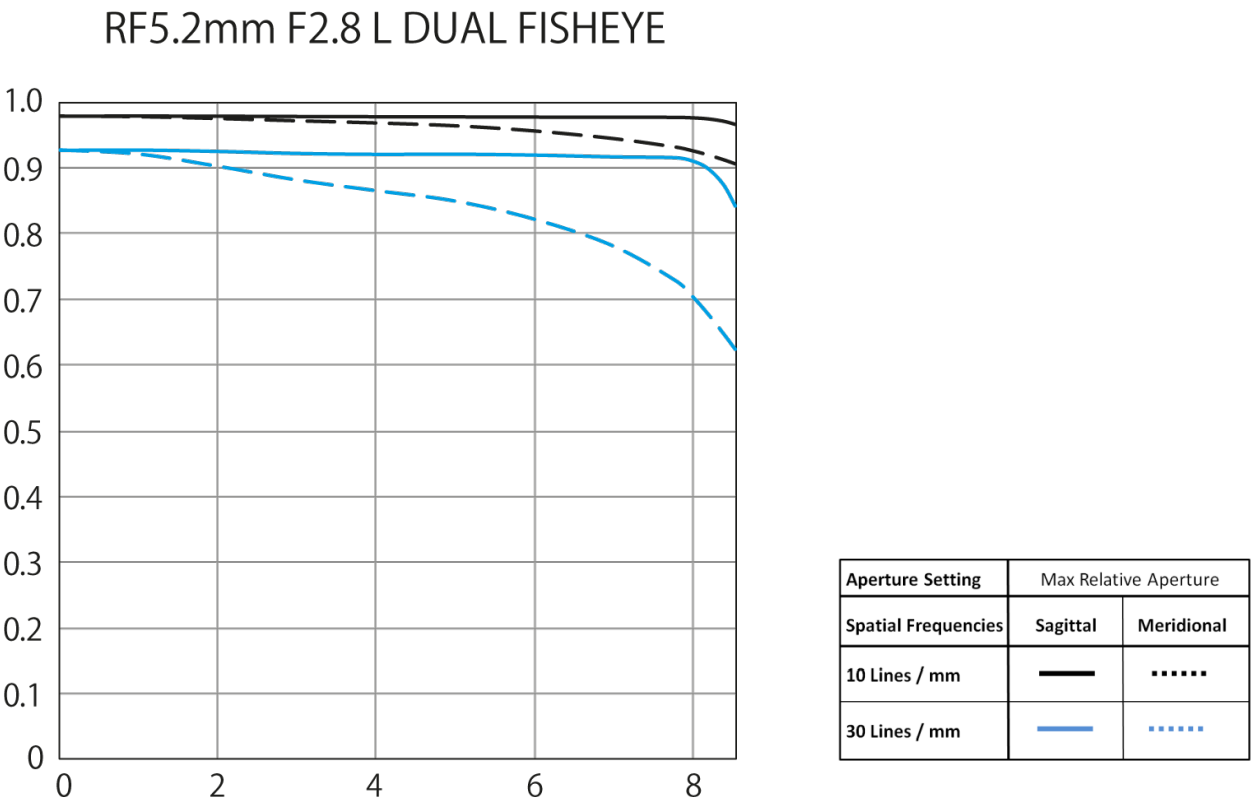


If the enlarged image for the right lens is in focus, adjustment is complete.

2.4.4 MTF Graph

The MTF curves in the graph below show the behaviour of this lens measured at four distances from the image centre. Two spatial frequencies are used — one, at the low 10 line pairs per millimetre (LP/mm) which is an important measure of the contrast of the lens, and the second is at a higher 30 LP/mm which indicates resolving power. Two separate measurements are made for each at right angles to each other. The term “image height” refers to how far toward the edge of the image a measurement is taken as shown in the diagram below.

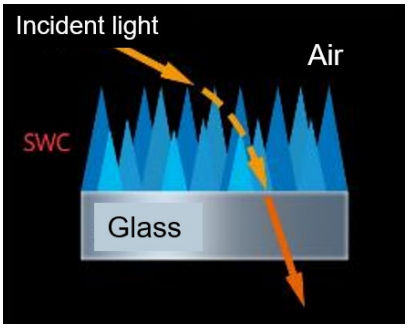




This graph shows the excellent edge-to-edge performance characteristics of the RF 5.2mm F2.8L DUAL FISHEYE lens in relation to contrast and resolution, with only the behaviour of the 30 Lines/mm Meridional curve falling slightly as it approaches the extremity.

2.4.5 Subwavelength Structure Coating (SWC)

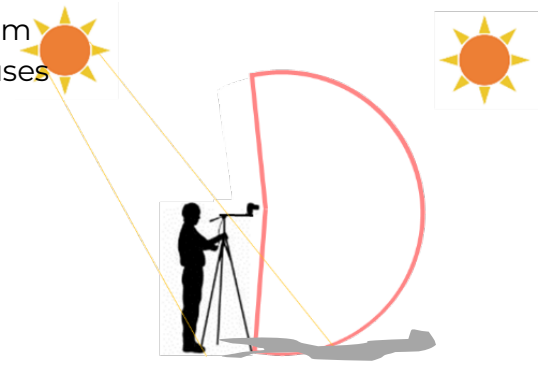
Developed by Canon, this remarkable anti-reflection technology controls light striking at strong angles, greatly reducing risk of flare, ghosting, and internal reflections. SWC coating — especially valuable on ultra wide-angle lenses — achieves this by adding innumerable nanometer-sized wedge-shaped structures smaller than the wavelength of visible light (380 to 780 nm*) on a critical internal surface of the lens.



Better results with backlighting

For precisely this reason, back-lit shots with the sun just outside the frame, or even shooting into the sun, are at far less risk of flare and stray reflections. The RF 5.2mm F2.8L DUAL FISHEYE lens with its Subwavelength Structure Coating (SWC) displays exceptional antireflection performance, for effective ghost and flare reduction. This allows you to actively shoot in the morning and evening, capturing attractive images of oblique ambient lighting.

The sun from behind causes shadows in the frame.



The sun pointing into the lens causes issues of flare and ghosting in conventional lenses

Direct front light

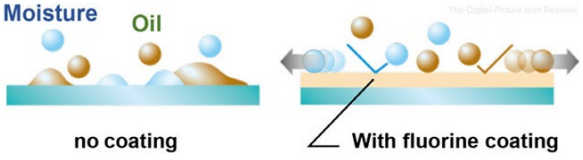
When the sun descends, the photographer's shadow is revealed.

Backlight

Shooting into the sun, when the sun descends lower, ghosting now occurs with conventional lenses.

2.4.6 Fluorine coating — easy maintenance

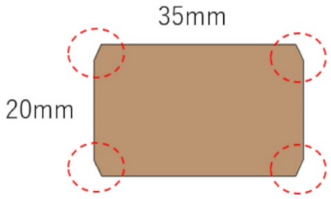
Since the focal length is so short, a foreign object like dust on the front lens can be visible in finished imagery. The Fluorine coating on the front two elements of the lens makes it easier to clean and repel dirt.



2.4.7 Rear mounted gelatin filter holder

Particularly useful for video capture — helping to maintain smooth images by suppressing the 'fluttering' or choppy feeling of videos caused by high shutter speeds.

Use a single third-party gelatin filter, designed for use with camera lenses, and cut it to size:



Carefully slide the gelatin filter into the holder, covering the two rear elements

2.4.8 f/2.8 — Great low light performance

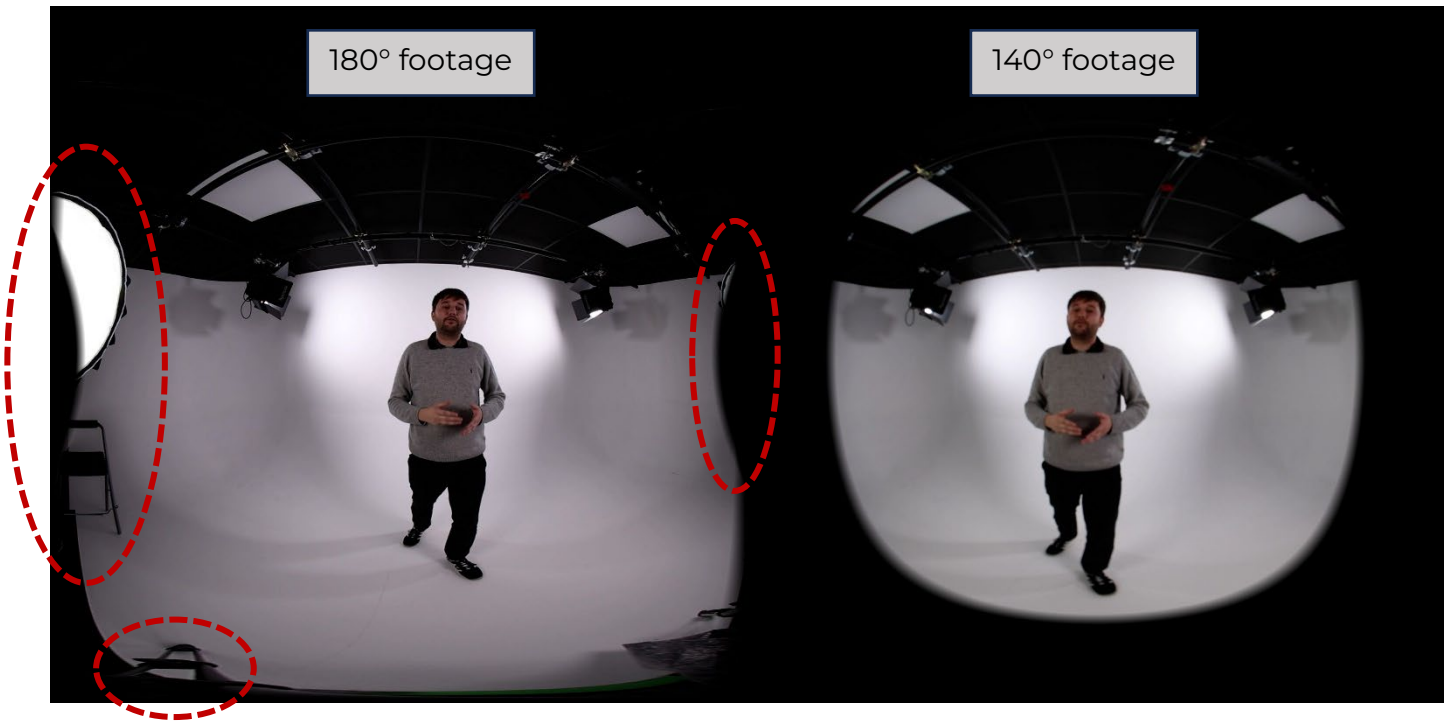
With an aperture range of f/2.8 to f/16, the RF 5.2mm F2.8L DUAL FISHEYE has great low light performance. Along with Canon's high-performance CMOS sensor and DIGIC X processor, images demonstrate a high noise reduction capability for clear, clean images in low light.

2.5 RF-S 3.9mm F3.5 STM DUAL FISHEYE lens

2.5.1 Other lens and kit is not visible in recording

Thanks to the 140° viewing angle, the area that you have to be concerned with capturing is reduced. This can be used to facilitate a simpler setup process as demonstrated below.

This image has been created specifically to demonstrate the difference in viewing angle, and all of the difficulties shown on the 180° angle can be overcome with proper planning and setup.

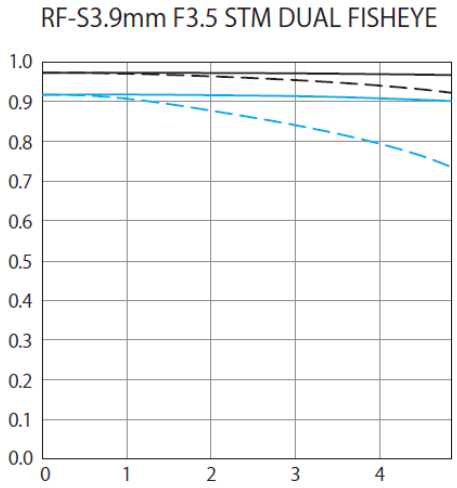


Equipment such as the lighting and other things that may be around the location such as this chair will have to be moved further away, and just something that needs more thought than shooting with a narrower field of view. Even the tripod legs come into the equation, requiring a boom arm (including counterweights) to be used for 180° shooting. For 140°, a standard tripod can be used without the need for a boom arm or other equipment.

Camera accessories such as microphones mounted on top of the camera can also be shown in the 180° capture, but are less likely in 140° capture.

Something else to bear in mind, is that 180° shooting will capture the other lens, however with 140° this won't happen. The EOS VR Utility software will mask out the lens where required, so this doesn't require further action from the user.

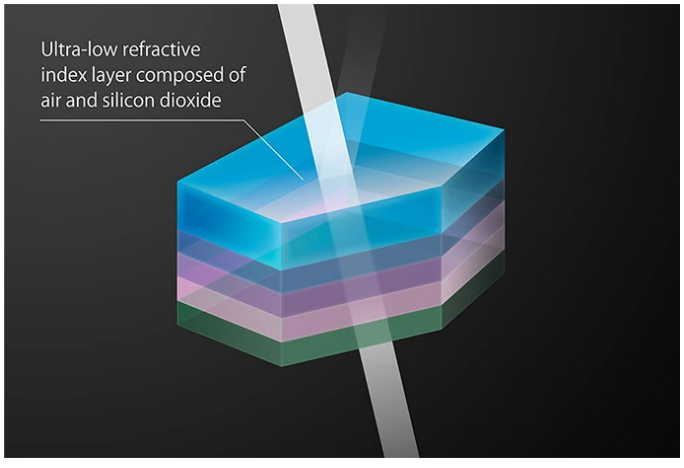
2.5.2 MTF Graph



2.5.3 Air Sphere Coating

In addition to optimized coatings, ASC is used on surface R2 of the 1st lens to alleviate ghosting by providing higher anti-reflectivity than conventional evaporated coatings and uniform colour balance within the screen.

This is the first time that ASC coating has been used on a non-L-series lens, owing to the ultra-wide angle optical design being susceptible to flare and ghosting which requires advanced coatings to prevent.



When secondary reflections happen between the lens elements and the image sensor, they distort light or cause other effects that lower the quality of the image. This is what causes ghosting and lens flare. When shooting into the sun or in other situations with a lot of backlight, lens flare, which looks like a white spot that is too bright, can cover up part of the image. Reflections on the lens's surface can also show up in the picture as extra stuff (ghosting). ASC is the latest step that Canon has taken to improve coating technology. As a result, lens flare and ghosting are much less likely to happen because light always hits the image sensor's surface at the right angle.

2.5.4 STM autofocus

As Canon's first dual lens to feature autofocus, the addition of this feature is another way that this lens breaks barriers for those wanting to get into VR shooting. Featuring two STM motors (one for autofocus, one for adjustment only), the autofocus is fast, accurate and quiet.

Unlike standard lenses, however, the autofocus is limited. Subject detection and tracking is not possible, with autofocus limited to just the two smallest AF areas. Only One Shot AF is possible, so you have to set the focus before recording, and cannot use autofocus during recording. You can, however, adjust the focus during recording manually.

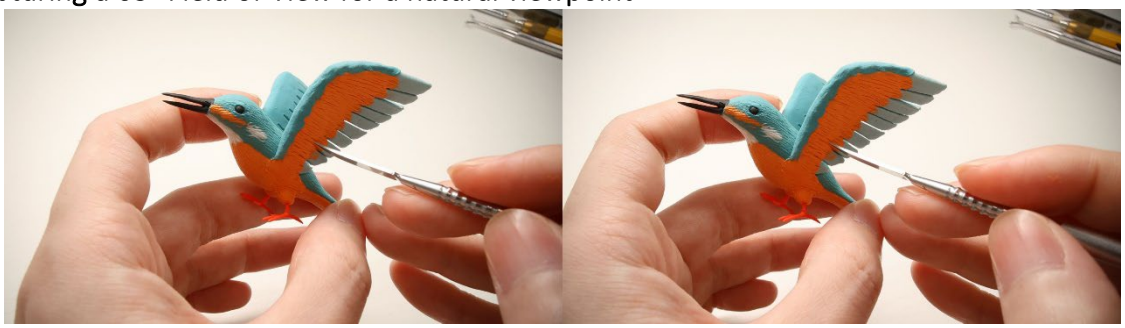
2.5.5 Rear screw-on filter holder

Using a filter for video is very useful and gives you further creative control, at the settings that you wish. This is notoriously difficult, however, with ultra-wide angle lenses and especially with two bulbous front elements. To combat this, the RF-S 3.9mm F3.5 STM DUAL FISHEYE uses a rear screw-on filter adapter, allowing the use of standard filters that users will be familiar with.

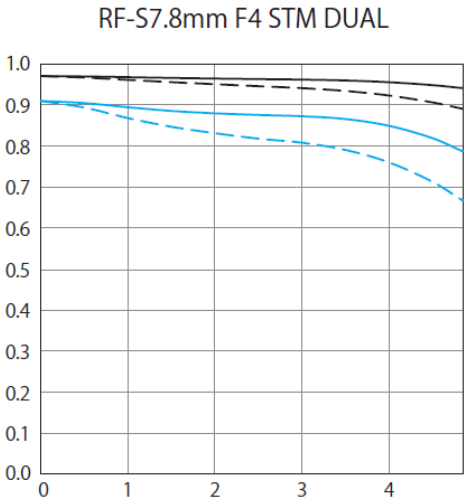
This filter adapter can also be used to hold gelatin filters which have been cut to the correct size, giving the opportunity for even greater control.

2.6 RF-S 7.8mm F4 STM DUAL lens

2.6.1 Capturing a 63° Field of View for a natural viewpoint



The field of view for human vision is roughly 60°, so viewing content shot at this focal length feels natural. This creates a more natural feeling when viewing through a VR headset. It does have other benefits too. As discussed above, an ultra-wide angle means that special considerations have to be made when shooting to ensure that kit isn't shown in the final output. With a narrower field of view, shooting setup and methods can be more like traditional photography and video capture.



2.6.2 MTF Graph

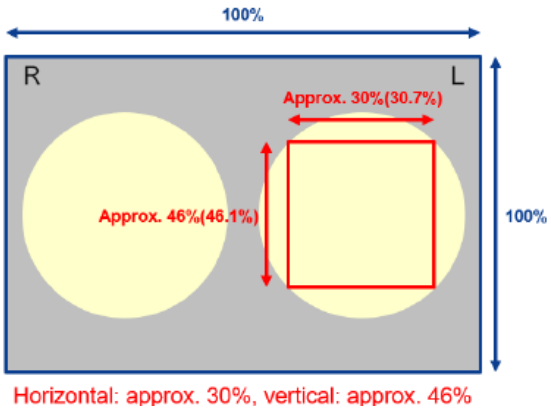
2.6.3 Advanced Optics

The construction features a dual lens that captures two different viewpoints with a baseline length of 11.8 mm. This enables the camera to use interchangeable lenses for simple and straightforward stereoscopic shooting while still retaining its general-purpose utility.

A 63° wide-angle view together with high image quality across the entire screen, owing to a lens construction optimized for short back focus, with the effective placement of 2 UD lenses.

2.6.4 Auto Focus Area

Most of the left lens area can be used for autofocussing with Dual Pixel CMOS AF, as below.



2.7 Compatible cameras

The EOS VR SYSTEM allows you to choose the camera and lens combination to match the requirements of your project. Ranging in specification and price point, all of the cameras on offer will provide high quality virtual reality and spatial capture, but each will have it's own benefits. This section will firstly identify compatibility with your chosen lens, and then go into more detail about each camera, separated by lens compatibility.

2.7.1 Camera compatibility Matrix

	APS-C	Full Frame					
	EOS R7	EOS R6 Mark II	EOS R5	EOS R5 Mark II	EOS R5 C	Cinema EOS C80	Cinema EOS C400
RF 5.2mm F2.8L DUAL FISHEYE	✗	✓	✓	✓	✓	✓	✓
RF-S 3.9mm F3.5 STM DUAL FISHEYE	✓	✗	✗	✗	✗	✗	✗
RF-S 7.8mm F4 STM DUAL	✓	✗	✗	✗	✗	✗	✗

2.7.2 Cameras compatible with RF 5.2mm F2.8L DUAL FISHEYE

With a wealth of compatible full frame EOS Cameras, you have all the options to choose from to create 180° VR content. From compact solutions for mobile creation to professional systems for complete cinematic control.

Camera	**EOS R6 Mark II**	**EOS R5**	**EOS R5 Mark II**	**EOS R5 C**	**EOS C80**	**EOS C400**
Max. recording resolution	Up to UHD 4K 60P	Up to DCI 8K 30P	Up to DCI 8K 60P	Up to DCI 8K 60P	Up to DCI 6K 30P	Up to DCI 6K 60P
Movie formats	MP4	RAW, RAW Light, MP4	RAW, Light RAW, XF-AVC S, XF-HEVC S	RAW HQ, RAW ST, RAW LT, MP4	RAW LT, XF-AVC S, XF-HEVC S	RAW HQ, RAW ST, RAW LT, XF-AVC S, XF-HEVC S
Max. movie frame rate	Up to 60P (UHD 4K MP4)	Up to 30P (8K RAW) Up to 120p (4K)	Up to 60P (8K Light RAW)	Up to 60P* (8K RAW LT) Up to 120P (4K)	Up to 30P (6K RAW LT) Up to 120P (4K)	Up to 60P (6K RAW LT / ST) Up to 120P (4K)
Log recording	Log 3 enables 4:2:2 10-bit HEVC (MP4)	Log 3 enables 4:2:2 10-bit HEVC (MP4)	Log 2 / Log 3 with Custom Picture profiles	Log 3 when selecting Custom Picture: C2	Log 2 / Log 3 with Custom Picture profiles	Log 2 / Log 3 with Custom Picture profiles
Still images	JPEG only (RAW is not supported by the Canon software)	JPEG only (RAW is not supported by the Canon software)	JPEG only (RAW is not supported by the Canon software)	JPEG only (RAW is not supported by the Canon software)	JPEG only (RAW is not supported by the Canon software)	JPEG only (RAW is not supported by the Canon software)

**EOS R5 C - Records DCI 8K / 60P (by selecting RAW LT) – see the appendix for required power options.*

2.7.2.1 EOS R5 C

Headline Specifications:

Compatibility	RF 5.2mm F2.8L DUAL FISHEYE
Sensor Size	Full Frame
Sensor Resolution	45 MP
Maximum Video Resolution	DCI 8K 60P RAW LT
Log recording	C-Log 3
Memory	1 x CFexpress slot 1 x SD UHS II slot
Weight	680 g (body only)

The EOS R5 C is Canon's entry into the professional Cinema EOS family of video cameras and a true hybrid, capable of both 45MP Full Frame stills and 8K 60P video (RAW LT), featuring both the EOS stills menu system for stills photography and the Cinema EOS menu system and controls for video – *see the appendix for power requirements to be able to shoot at 8K 60P, requiring either external power or the later LP-E6P battery pack.*

Featuring a built-in fan for active cooling, the EOS R5 C is ideal for long form shooting of professional VR content in a small form factor.

Connectivity:

- 3.5mm microphone jack
- 3.5mm headphone jack
- Multi-function shoe
- Micro-HDMI out
- USB-C
- LP-E6NH battery
- Bluetooth (for remote start / stop)

Useful Accessories:

- LP-E6P Battery (2024 model - enables 8K 60P without external power) – recommended.
- PD-E2 USB-C power adapter (2024 model)
  (Optional USB-C DR-E6P DC Coupler is NOT compatible)
- PD-E1 USB-C power adapter
- CA-946 AC power + DR-E6C DC

**Always regularly update the camera to the latest firmware and install the latest version of Canon's software/apps, to ensure maximum compatibility and access to the latest features.*

***Shoot in DCI 8K/4K to avoid vignetting of the image*

2.7.2.2 EOS R5 Mark II

Headline Specifications:

Compatibility	RF 5.2mm F2.8L DUAL FISHEYE
Sensor Size	Full Frame (BSI)
Sensor Resolution	45 MP
Maximum Video Resolution	DCI 8K 60P RAW Light
Log recording	C-Log 2 / C-Log 3
Memory	1 x CFexpress slot 1 x SD UHS II slot
Weight	656 g (body only)

The EOS R5 Mark II is Canon's next gen professional mirrorless camera with enhanced video capability and synergy with the next gen Cinema EOS cameras (e.g. EOS C400, C80), matching codecs, Custom Picture profiles and many other video related features. Capable of both 45MP Full Frame stills and 8K 60P video (RAW Light), it is great for short-form 8k 60P or long-form 8K 30P / 4K 60P shoots.

The optional CF-R20EP Cooling Fan grip is recommended for longer shoots, especially when shooting 8K 60P and 30P to help reduce cool-down times. If needing to shoot-long form at 8K 60P (>22mins continuous shooting), then consider the EOS R5 C or other Cinema EOS cameras with built-in cooling fans for more efficient cooling and longer continuous recording.

Connectivity:

- 3.5mm microphone jack
- 3.5mm headphone jack
- Multi-Function Shoe
- Full Size HDMI out
- USB-C
- Updated (2024) LP-E6P battery pack
- Bluetooth (for remote start / stop)

Useful Accessories:

- CF-R20EP Cooling Fan - recommended.
- BG-R20EP Battery
- PD-E2 USB-C power adapter
  - Optional USB-C DR-E6P DC Coupler
- DM-E1D microphone
- BR-E1 remote control

**Always regularly update the camera to the latest firmware and install the latest version of Canon's software/apps, to ensure maximum compatibility and access to the latest features.*
***Shoot in DCI 8K/4K to avoid vignetting of the image*
****When using the RF 5.2mm F2.8L DUAL FISHEYE lens, certain functions are automatically restricted / disabled, and the settings do not go back automatically even after taking the lens off. Therefore, save the camera settings to a memory card before attaching the RF 5.2mm F2.8L DUAL FISHEYE, so they can be restored once the RF 5.2mm F2.8L DUAL FISHEYE is removed.*

2.7.2.3 EOS R5

Headline Specifications:

Compatibility	RF 5.2mm F2.8L DUAL FISHEYE
Sensor Size	Full Frame
Sensor Resolution	45 MP
Maximum Video Resolution	DCI 8K 30P RAW or MP4
Log recording	C-Log 3
Memory	1 x CFexpress slot 1 x SD UHS II slot
Weight	650 g (body only)

The EOS R5 was Canon's first professional VR capable camera enabling high resolution 8K 30P VR capture. The EOS R5 produces great image quality for short-form recordings (lower continuous shoot times) and slower moving subjects. Ideally, a frame rate of 60P is better for faster moving subjects in VR, so if this is required, then consider the EOS R5 Mark II, and if long-form recording is also required then consider the EOS R5 C or Cinema EOS C400.

Connectivity:

- 3.5mm microphone jack
- 3.5mm headphone jack
- Micro-HDMI out
- USB-C
- LP-E6NH battery

Useful Accessories:

- LP-E6P Battery (2024 model)
- PD-E2 USB-C power adapter (2024 model)
  - Optional USB-C DR-E6P DC Coupler
- PD-E1 USB-C power adapter
- ACK-E6 AC Power Adapter (including CR-E6 DC Coupler)
- DM-E1 microphone

**Always regularly update the camera to the latest firmware and install the latest version of Canon's software/apps, to ensure maximum compatibility and access to the latest features.*

***Shoot in DCI 8K/4K to avoid vignetting of the image*

****When using the RF 5.2mm F2.8L DUAL FISHEYE lens, certain functions are automatically restricted / disabled, and the settings do not go back automatically even after taking the lens off. Therefore, save the camera settings to a memory card before attaching the RF 5.2mm F2.8L DUAL FISHEYE, so they can be restored once the RF 5.2mm F2.8L DUAL FISHEYE is removed.*

2.7.2.4 EOS R6 Mark II

Headline Specifications:

Compatibility	RF 5.2mm F2.8L DUAL FISHEYE
Sensor Size	Full Frame
Sensor Resolution	24.2 MP
Maximum Video Resolution	UHD 4K 60P MP4
Log recording	C-Log 3
Memory	2 x SD UHS II slot
Weight	588 g (body only)

The EOS R6 Mark II is Canon's entry into Full Frame VR capture with the RF 5.2mm F2.8L DUAL FISHEYE lens, offering great value. Capable of both 24.2MP Full Frame stills and UHD 4K 60P video (MP4), it is great for quicker, less data intensive post-production edits, while maintaining an excellent UHD 4K image quality and great low light performance.

If needing the highest resolution for more detail, then consider the EOS R5 C, EOS R5 Mark II or EOS R5, depending on your needs.

Connectivity:

- 3.5mm microphone jack
- 3.5mm headphone jack
- Multi-Function Shoe
- Micro-HDMI out
- USB-C
- LP-E6NH battery pack
- Bluetooth (for remote start / stop)

Useful Accessories:

- LP-E6P Battery (2024 model)
- PD-E2 USB-C power adapter (2024 model)
  - Optional USB-C DR-E6P DC Coupler
- PD-E1 USB-C power adapter
- ACK-E6 AC Power Adapter (including CR-E6 DC Coupler)
- DM-E1D microphone

**Always regularly update the camera to the latest firmware and install the latest version of Canon's software/apps, to ensure maximum compatibility and access to the latest features.*

***When using the RF 5.2mm F2.8L DUAL FISHEYE lens, certain functions are automatically restricted / disabled, and the settings do not go back automatically even after taking the lens off. Therefore, save the camera settings to a memory card before attaching the RF 5.2mm F2.8L DUAL FISHEYE, so they can be restored once the RF 5.2mm F2.8L DUAL FISHEYE is removed.*

2.7.2.5 EOS C400

Headline Specifications:

Compatibility	RF 5.2m F2.8L Dual Fisheye
Sensor Size	Full Frame (BSI)
Sensor Resolution	26.6 MP
Maximum Video Resolution	6K 60p RAW LT / ST DCI 4K 120P XF-AVC S / XF-HEVC S
Log recording	C-Log 2, C-Log 3
Memory	1 x CFexpress 2.0 (Type-B) 1 x SD UHS II
Weight	1540 g

The CINEMA EOS C400 redefines versatility – designed to excel in cinematic shooting, live broadcast, and virtual production. Unleash your creativity with a mighty 6K full frame BSI sensor and 16 stops of dynamic range.

Capture breathtaking footage with Canon's cutting-edge backside illuminated (BSI) sensor, delivering next-generation capabilities, triple base ISO (800 / 3200 / 12800), organic colour reproduction, and 16 stops of dynamic range. Including 12-bit Cinema RAW Light LT / ST up to 6K 60P, and 4K 120P. Oversampled 4K 4:2:2 10-bit is available via improved XF-AVC S / XF-HEVC S (MP4) formats, all featuring detailed metadata and filename structures.

Connectivity:

- 2x Mini XLR 3-pin
- 3.5mm stereo mini mic jack
- 3.5mm stereo mini headphone jack
- Multi-Function Shoe
- HDMI Type-A
- USB-C 3.2 Gen1
- 12G-SDI Output (BNC) & 3G-SDI output
- Gen Lock and Sync (DIN 1.0 / 2.3)
- 12V 4-pin XLR power

Useful Accessories:

- DM-E1D microphone
- CA-CP300 B Compact Power Adapter
- Remote Camera Controller RC-V100
- Remote Camera Controller RC-IP100
- Remote Camera Controller RC-IP1000
- Tascam CA-XLR2d XLR Microphone Adapter

2.7.2.6 EOS C80

Headline Specifications:

Compatibility	RF 5.2m F2.8L Dual Fisheye
Sensor Size	Full Frame (BSI)
Sensor Resolution	26.6 MP
Maximum Video Resolution	DCI 6K 30p RAW LT DCI 4K 120P XF-AVC S / XF-HEVC S
Log recording	C-Log 2, C-Log 3
Memory	2 x SD UHS II
Weight	1310 g

Elevate your creativity with the CINEMA EOS C80, a professional powerhouse, to give your video and live productions the full frame edge. Stay nimble with the compact and ergonomic EOS C80, with its mighty 6K full frame BSI sensor and 16 stops of dynamic range.

Capture breathtaking footage with Canon's cutting-edge backside illuminated (BSI) sensor, delivering next-generation capabilities, triple base ISO (800 / 3200 / 12800), organic colour reproduction, and 16 stops of dynamic range. Including 12-bit Cinema RAW Light LT up to 6K 30P, and 4:2:2 10-bit up to 4K 120P. Oversampled 4K is available via improved XF-AVC S / XF-HEVC S (MP4) formats, all featuring detailed metadata and filename structures.

Connectivity:

- 2x Mini XLR 3-pin
- 3.5mm stereo mini mic jack
- 3.5mm stereo mini headphone jack
- Multi-Function Shoe
- HDMI Type-A
- USB-C 3.2 Gen1
- 12G-SDI Output (BNC)
- Time Code (BNC) terminal
- RJ45 Ethernet (1000BASE-T compatible)

Useful Accessories:

- DM-E1D microphone
- CA-CP300 B Compact Power Adapter
- Remote Camera Controller RC-V100
- Remote Camera Controller RC-IP100
- Remote Camera Controller RC-IP1000
- Tascam CA-XLR2d XLR Microphone Adapter

2.7.3 Cameras compatible with the RF-S 3.9mm F3.5 STM DUAL FISHEYE & RF-S 7.8mm F4 STM DUAL

For simplified 140° virtual reality capture, choosing the correct camera that can allow you the right level of control and quality for your project is key.

2.7.3.1 EOS R7

Headline Specifications:

Compatibility	RF-S 3.9mm F3.5 STM Dual Fisheye RF-S 7.8mm F4 STM DUAL
Sensor Size	APS-C
Sensor Resolution	32.5 MP
Maximum Video Resolution	4K 30p oversampled from 7K / 4K 60p
Log recording	C-Log 3
Memory	2x SD UHS II slots
Weight	612 g

The EOS R7 is a real all-rounder camera with a high-resolution APS-C sensor in a compact body which maintains all the required controls for adjusting settings quickly and easily.

Shooting up to 4K resolution C-Log either oversampled from 7K or at 60 frames per second, you have the choice between fine detail and crisply capturing moving subjects.

Connectivity:

- 3.5mm microphone jack
- 3.5mm headphone jack
- Multi-function shoe
- HDMI out
- USB-C
- LP-E6NH battery
- Bluetooth (for remote start / stop)
- WiFi (for remote capture)

Useful Accessories:

- DM-E1D microphone
- PD-E1 USB-C power adapter
- BR-E1 remote control

3 Basic shooting guidelines and tips

The below information aims to add to the information and advice already provided.

Also see the Canon Inc guideline: https://cam.start.canon/en/V001/manual/html/index.html

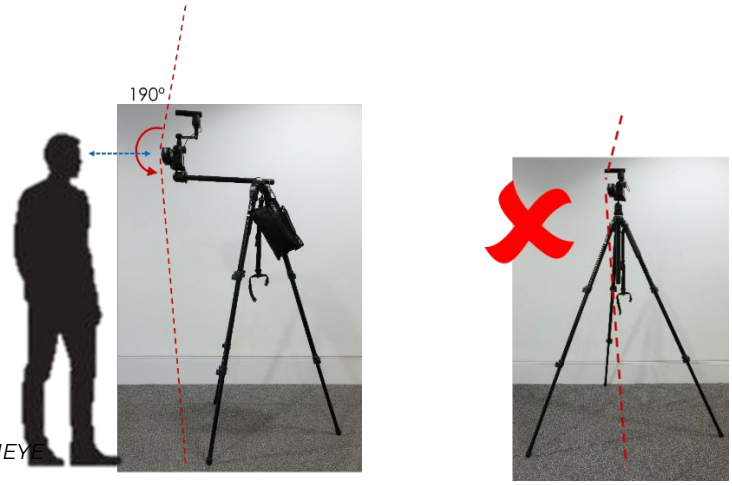
3.1.1 Clean the lenses

Since the focal length is short, foreign objects like dust on the front/back lens can be captured, a blower should be used to remove dust and dirt before shooting to reduce the risk of seeing dust or ghosting.

3.1.2 Level and stable

For a natural feeling when viewing through a headset, the camera/lens should be level at all times — use a tripod (and use the camera's electronic level display) or gimbal.

Note: for realistic capture, the camera should be mounted/held at about typical adult head height for shooting, to capture a more realistic and comfortable point of view, as if the viewer was standing in that same position themselves.



Example when using the RF 5.2mm F2.8L DUAL FISHEYE

- Care should be taken to avoid camera shake when shooting. A VR movie shot when riding in a moving vehicle or while walking could cause a sense of fatigue or discomfort.
- Movies should not be shot that involve extreme movement. Doing so may cause the user to experience motion-sickness when viewing the VR movie, especially using headsets. Slow forward and backward movement can work, but take extra care if wanting to pan.

3.1.3 Angle of view

Due to the extreme wide angle of view, care should be taken to avoid getting the operators body, tripod legs, gimbal, microphone, cables etc in the shot. The screen should be checked carefully for anything that is not wanted in the frame, and the camera and accessories should be mounted in such a way as to avoid these. This is of most concern when shooting 180° VR, and significantly alleviated when shooting with a 140° angle of view.

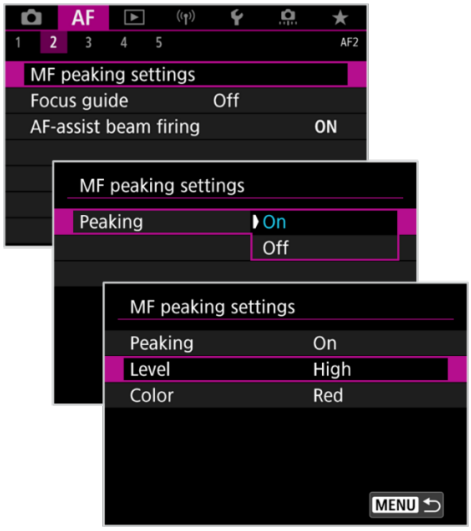
3.1.4 Focusing:

Ensuring sharp focus is key to VR as an out of focus image would break the realism and be uncomfortable to view. Achieving this on lenses which have limited or no autofocus capabilities takes a little extra care, however the compatible EOS cameras provide features which can assist with this. The Dual Pixel Focus Guide can be enabled to help focus, but it is advised to use Focus Peaking in magnified view for greater accuracy / fine tuning.
Note: the magnified window can be moved around the frame by using the camera's joystick or by touching the LCD screen.

3.1.4.1 Focus Peaking

A manual focus peaking feature is provided on EOS cameras, highlighting the outline of in-focus subjects in colour during manual focusing, making it easier for the videographer to achieve focus. Users can also change the outline detection sensitivity (level) and outline colour as required.

With EOS R5, this function is effective even when the image is magnified*.
Note: When shooting at high ISO sensitivity, noise may occur and may be erroneously detected, resulting in decreased peaking accuracy.



In-focus subjects are highlighted by coloured outlines

Peaking also works when magnified

3.1.4.2 Dual Pixel Focus Guide

Canon's Dual Pixel CMOS AF capability can be used to provide the Dual Pixel Focus Guide on screen graphics to aid the user attain focus with this feature.

3.1.5 Exposure:

Please see the previous section on auto exposure control, noting:

- Set the cameras aperture to balance the light gathering and depth of field requirements, along with the use of ND filters in bright conditions.
- The AE (automatic exposure) metering range is limited to within the image circle in the **left lens**.
- In general, Manual exposure mode is recommended for consistent results, although all Automatic exposure modes will function.

3.1.6 Monitoring the output:

There is no way to monitor the VR output from EOS cameras with a head mounted display during recording. However, it is possible to use either EOS Utility or Canon's Camera Connect applications to view a live side-by-side preview (dual fisheye images, on-screen) remotely of the scene to be captured. In these applications it is possible to independently perform a left-right eye switch and view a live preview of the equirectangular projection, to more easily view/frame the scene.

The EOS R5 Mark II offers a preview of the recorded file in a converted view for easier preview of recorded files.

3.1.7 Audio

By default, the audio captured is from the camera's built-in microphones, but this will not provide the best audio experience, since it will not be as immersive or as high a quality as an external microphone.

A simple stereo upgrade to the audio, will be to use Canon's stereo microphones DM-E1 (set to 120°). Using the 120° pickup will help increase the stereo audio effect, but will not 'move' the sound's source location with the user's head movement when wearing a head mounted display. Also, an adapter, plate or rig will be needed to place the microphone further back from the lens when using the RF 5.2mm F2.8L DUAL FISHEYE, so that it is not picked up by the super wide 190° field of view!

3.1.7.1 Examples of Ambisonic microphones

For the capture of true spatial audio, ideal for VR productions, then a specialist Ambisonic microphone is required to achieve this immersive audio experience.

Typically, an Ambisonic microphone will have four capsules in a tetrahedral array to record 360° audio on four channels and requires a compatible audio recorder. Recording the audio in such a way allows for a fully head-tracked audio experience when combined with the video footage in the correct way in post-production. However, this requires time and expertise to ensure the audio and video tracks are correctly synchronised, with the correct metadata and the direction of the microphone is correctly mapped.

It is not possible to record Ambisonic audio directly into current Canon EOS cameras, even when using a dedicated, third-party Ambisonic microphone, so a 'clap' or other audio marker is required to help your editing application to sync the camera's audio to the Ambisonic audio later on in post-production.

3.1.7.2 Adding Ambisonic Audio to an Adobe Premier Pro timeline

[Adobe Premier Pro 23.1.0 used in the explanation below]

- Start a new Project
- Add a new "Sequence"
  - File / New / Sequence
  - **Sequence Presets**
    - Give a name to this sequence

        - From the list, select the most appropriate VR preset for your footage (e.g. VR / Stereoscopic / 8192x8192 – Ambisonic). This will automatically set 'most' of the settings you will need to a standard preset, providing a good 'starting point' for the settings actually needed for your specific video file (noting that the R5 C would have most likely been recorded as a 180 VR file of resolution 8192x4096 and 59.94fps)
          Later, when you import your actual footage onto the sequence timeline, you will be asked if you want to change the sequence settings to match the video you are importing…at this point, select "Change sequence settings".
    - Your Timeline should now be a VR Sequence set to the preset options selected and the audio tracks each having 4 channels.
- Check the Preferences Timeline
    - Premier Pro / Preferences / Timeline…
        - In the "Timeline" section, check that **Multichannel Mono Media** is set to "Adaptive"
- Import the VR video and Ambisonic (AmbiX) Audio files into the media window
    - Right click on the **Video file** and select "Modify / **Audio Channels…**", then double check:
        - **Preset** is set to "Stereo"
        - **Clip Channel Format** is set to "Stereo"
        - **Number of Audio Clips** is set to "2"
    - Next, select the **VR Properties** tab and check:
        - **Conforms to / Projection** is set to "Equirectangular"
        - **Conforms to / Layout** is set to "Stereoscopic – Side by Side"
        - **Conforms to / Horizontal Captured View** & **Vertical** should be both "180º"
    - Right click on the **Ambisonic Audio file** and select "Modify / **Audio Channels…**", then check:
        - **Preset** is set to "Adaptive"
        - **Clip Channel Format** is set to "Adaptive"
        - **Active Channels Per Clip** is set to "4"
        - **Number of Audio Clips** is set to "1"
- You are now ready to add your media into your Timeline.
    - Select the **Video file** from the media window and drag it into the new sequence timeline. You should notice that there is both a video and stereo audio component that is visible, this is needed to be able to sync to the Ambisonic Audio file later.
    - If the video file is different from the 'Sequence settings' it will ask you if you want to "Change the sequence settings to match the clip's settings?". Simply select "Change sequence settings" here, the correct settings are applied to the sequence for the file you are using.
    - Check the sequence settings are now correctly applied by selecting the Timeline and going to Sequence / Sequence Settings… and looking in the VR Properties area :
        - **Properties** - Equirectangular
        - **Layout** - Stereoscopic – Side by Side
    - **Horizontal and Vertical are both** - 180º
      [for the EOS R5 C with 180 stereoscopic VR]
    - Now select the **Ambisonic Audio file** from the media window and drag it onto the new sequence timeline, under the video file. You should be able to see/expand this one track to reveal the four audio channels.
- Sync your Video and Ambisonic audio files by selecting both on the timeline, including the video's own stereo audio, and right click:
    - Select **Synchronize** and select **Audio** before going to "OK"
    - Trim the clips so they are even.
    - The camera's stereo audio can now be muted or deleted.
- Build your Timeline in the same way for all additional clips/media until you are done.
- Grade, denoise and sharpen as desired.
- Add any titles, text and transitions as desired, remembering to make any stereoscopic adjustments for the text plane (putting the view into anaglyph mode may help here).
- Export your final edited file.
    - File / Export / Media

- Select the **Format** you want (e.g. H.264 or HEVC(H.265))
- Under **Video**, select the parameters you want to export under, based on your output device, but remembering:
  - Bitrate Settings is probably the trickiest setting to balance in terms of creating a clean image with as high a bitrate and resolution as possible, without being so high that the computer or VR headset is unable to play the file smoothly. If experiencing problems here, then reducing the output resolution and or bit rate may help.
    - e.g. Meta Quest 3 - H.265 at 8k and 140Mbps
    - e.g. High-end PC with tethered professional VR headset – H.264 at 7.6k and 180Mbps (playback using SteamVR Media Player is currently limited to H.264 compression and less than 8k files)
  - Check under **VR Video**
    - Check the check box is selected for "**Video is VR**"
    - **Frame Layout** is "Stereoscopic – Side by Side"
    - **Horizontal Filed of view** is "180°"
    - **Vertical Filed of view** is "180°"
- Under **Audio** ensure the following is set:
  - **Basic Audio Settings / Channels** is set to "4.0" (this should the un-grey the Audio is Ambisonics check box)
  - **Ambisonics** – check the "Audio is Ambisonics" check box

- **EXPORT**

3.2 Supported Models and File Types — EOS VR Utility

Lens	Camera	VR Lens	VR Firmware	VR app	Videos		Stills	
					MP4	CRM	JPG	CR3 to JPG in camera
RF 5.2mm F2.8L DUAL FISHEYE	R5 / R5 II / R5 C / R6 II / C80 / C400	✓	✓	✓	✓	✓	✓	✓
	R6 / R3 / R8	O	O	O	O	×	O	×
RF-S 3.9mm F3.5 STM DUAL FISHEYE	R7	✓	✓	✓	✓	×	✓	✓
	R10 / R50	O	O	O	O	×	O	×
RF-S 7.8mm F4 STM DUAL	R7	✓	✓	✓	✓	×	✓	✓
	R10 / R50	O	O	O	O	×	O	×

✓ - Fully compatible | O – Not fully compatible or restricted functionality | × - Not compatible

3.3 Projection and Conversion

All lenses, VR or not, project light on to a sensor which is then captured. For standard lenses, this image can then be output right away, however for images captured by the EOS VR System there is another step- conversion. This changes the stereoscopic circular images produced into a format that can then be processed in editing software or viewed on a headset. Here we will discuss the particulars of the projection and conversion for the Canon EOS VR System.

3.3.1 Equirectangular projection

Probably the most popular format for VR imagery is the Adobe standard, that uses equirectangular projection, which is a 'flattened' square / rectangular representation of the originally captured 180° (or 360°) circular fisheye image. This is the standard Canon supports.

Converting a circular fisheye image captured by the RF 5.2mm F2.8L DUAL FISHEYE lens and remapping that image into an equirectangular projection, is a similar process to that used in the cartography industry* where they take a spherical image of the world and remap it onto a flat rectangle.

**Cartographers would need to take the full 360° sphere of the world and remap to a 2:1 aspect ratio equirectangular projection, whereas the RF 5.2mm F2.8L DUAL FISHEYE lens captures a 180° equivalent image for a 1:1 aspect ratio output per lens.*

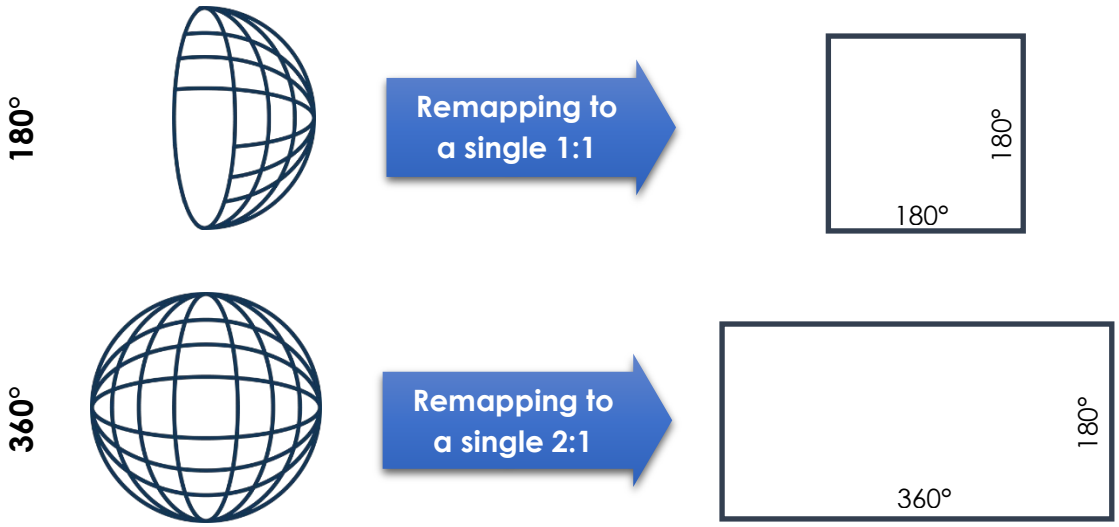
Circular fisheye
(180° image)

Equirectangular projection
(180° x 180°)

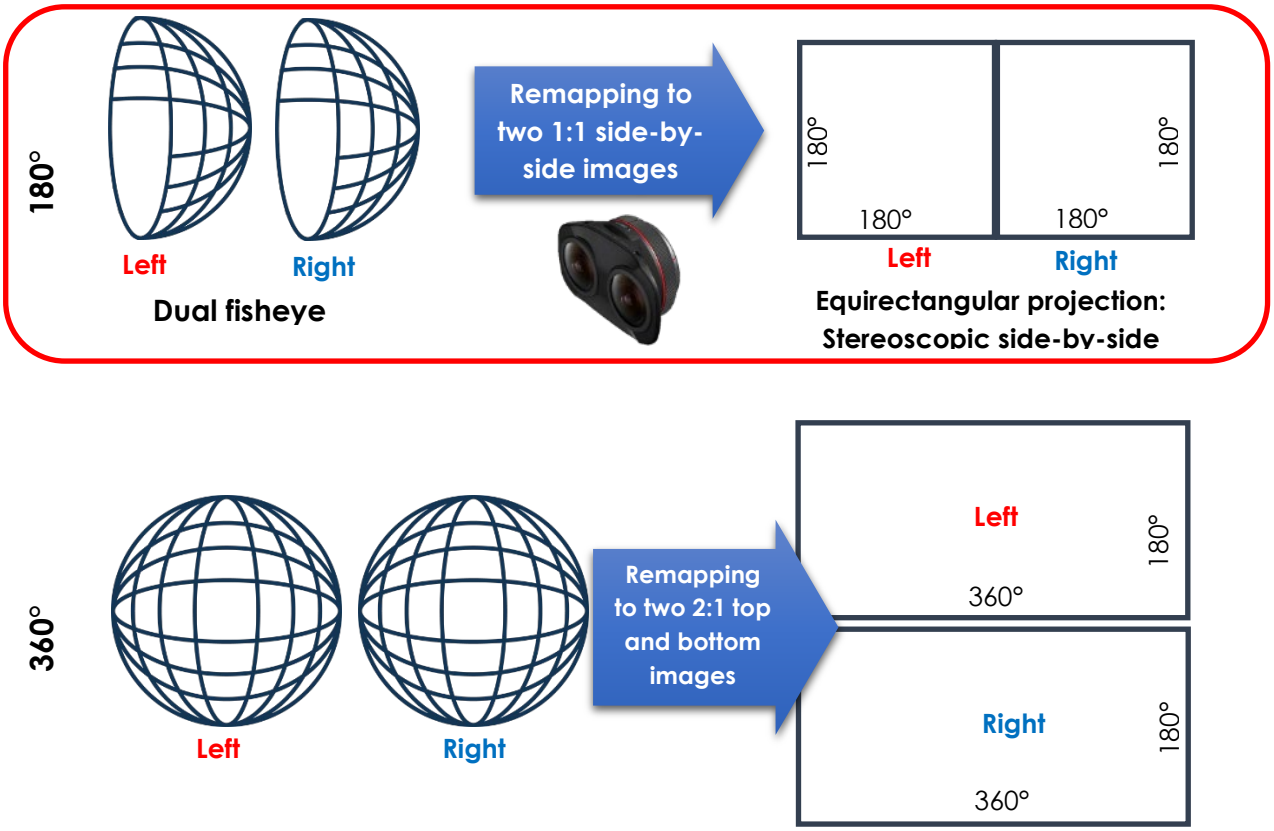
We can see that by remapping the circular fisheye image into an equirectangular projection, that the outer most pixels are 'stretched' more relative to the other pixels in the image, filling the corners of the frame.

Therefore, lens edge-to-edge performance and image resolution have a significant effect on image quality, particularly in the corners/periphery and the feeling of realism / reality when viewed on a Head Mounted Display. Canon's lens design, UD-glass elements and manufacturing expertise aims to maximise this edge-to-edge performance on capture, to help improve the image quality during conversion to an equirectangular projection.

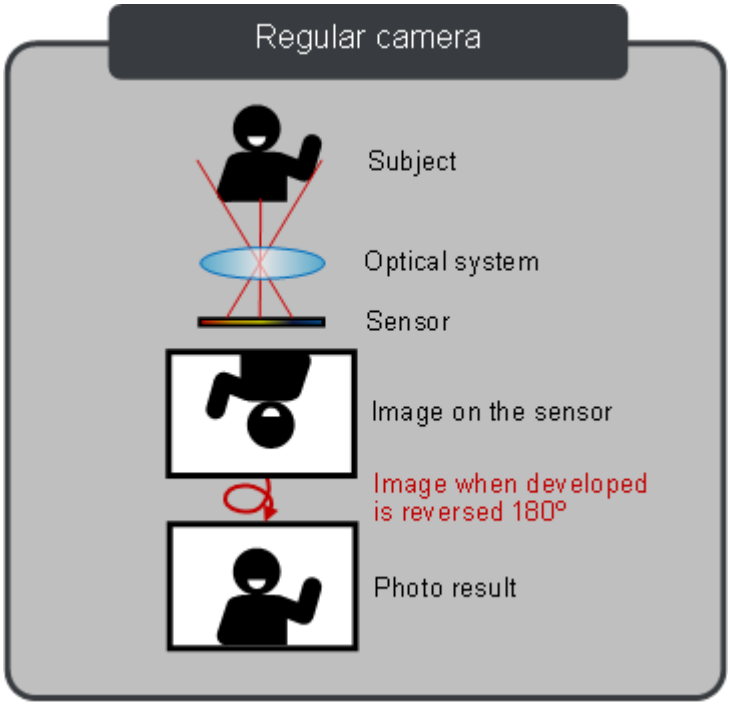
Monoscopic conversion to equirectangular projection:


180°
Remapping to a single 1:1
180°
180°
360°
Remapping to a single 2:1
180°
360°

Stereoscopic conversion to equirectangular projection:



3.3.2 VR Imaging process with the Dual lenses

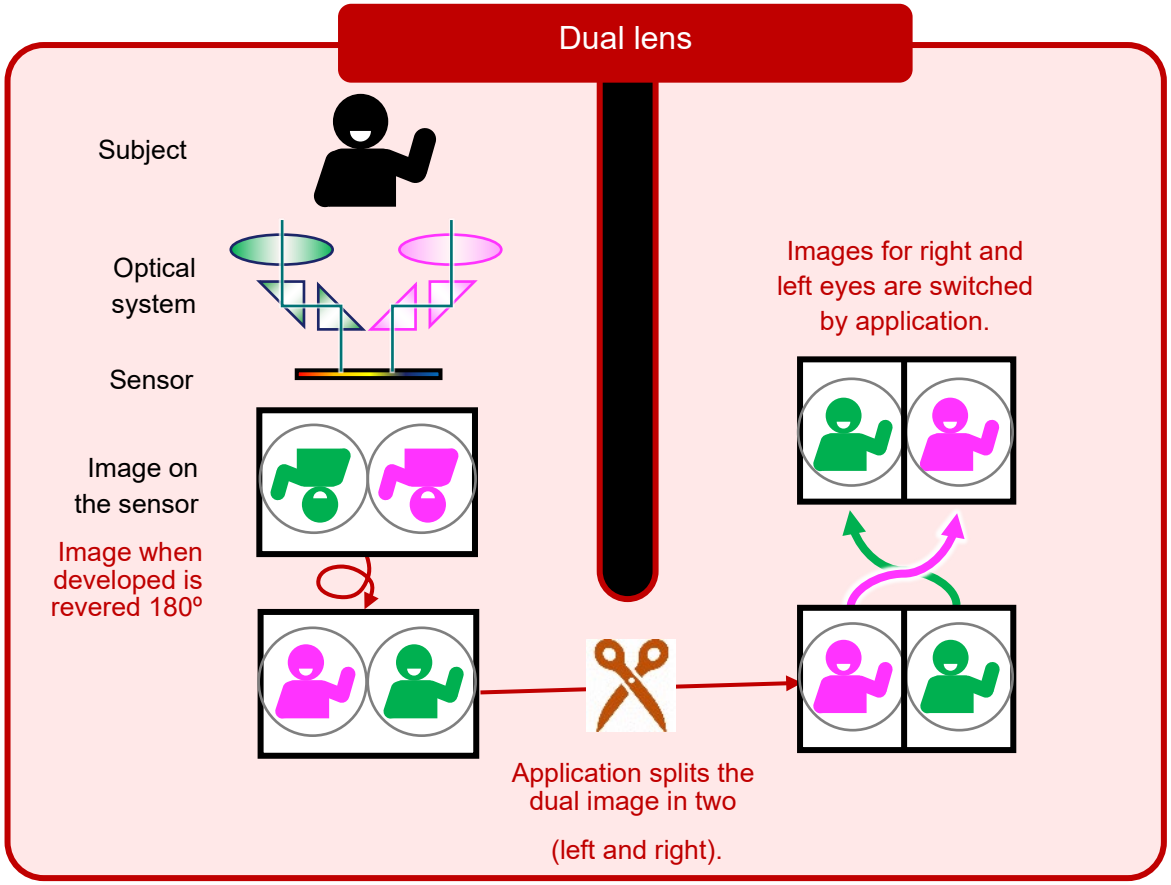


With a 'regular' camera/lens, the image is recorded upside down.

The same is true for the dual lenses of the EOS VR system, but records a dual, side-by-side image. However, when rotated 180° the correct way up, then the left-right orientation of the images is now incorrect.

This can be seen on the rear LCD of the camera.

Therefore, when using Canon software and as part of the conversion to an equirectangular projection, an additional step is required to split the image in two and reposition the left and right image into the correct orientation.



3.3.3 The conversion process – EOS VR Utility

1) Capture

The stereoscopic fisheye images are captured by one sensor onto a single file. Right and left lens images are initially captured in reverse order, as viewed on the camera's LCD screen.

2) Process / convert

Left and right eye image are automatically swapped to the correct position/order.

The 'Equirectangular projection' check box can be selected to review the converted circular fisheye image.

The EOS VR Utility, effectively, slightly crops the image circle in the conversion process to an equirectangular projection.

3) Export / Edit

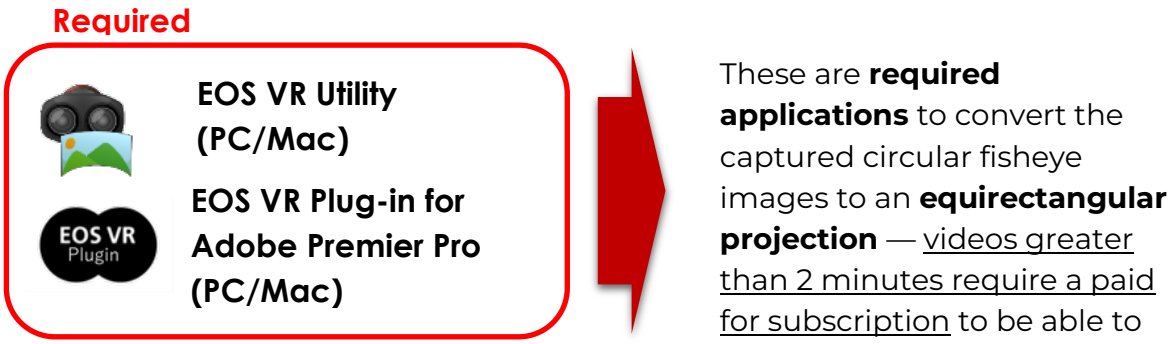
The final image is ready for export to the desired resolution (highest resolution output is recommended for best image quality) and into a side-by-side stereoscopic (2:1 aspect ratio) VR format. A choice of professional codecs is provided.

This file can then be transferred and viewed in a compatible head mounted display, or imported into a compatible NLE system, such as Adobe Premier Pro, for further editing, grading and integration into a production timeline.

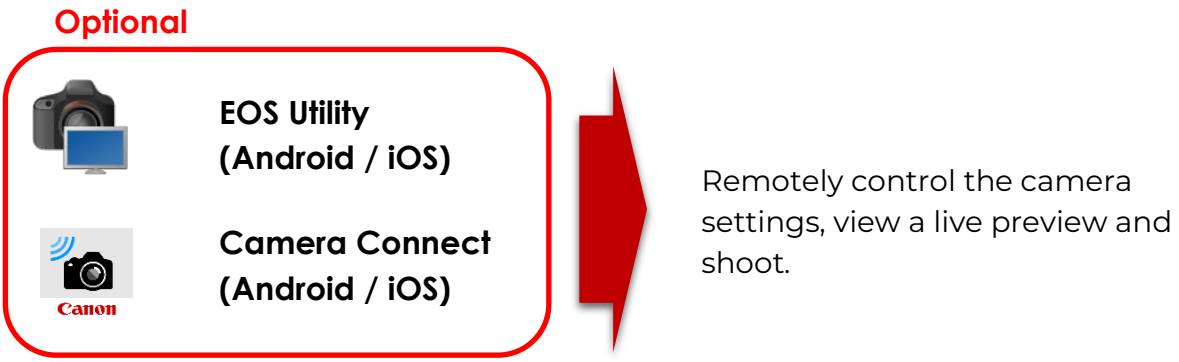
3.4 Useful Software and Applications

3.4.1 VR Conversion

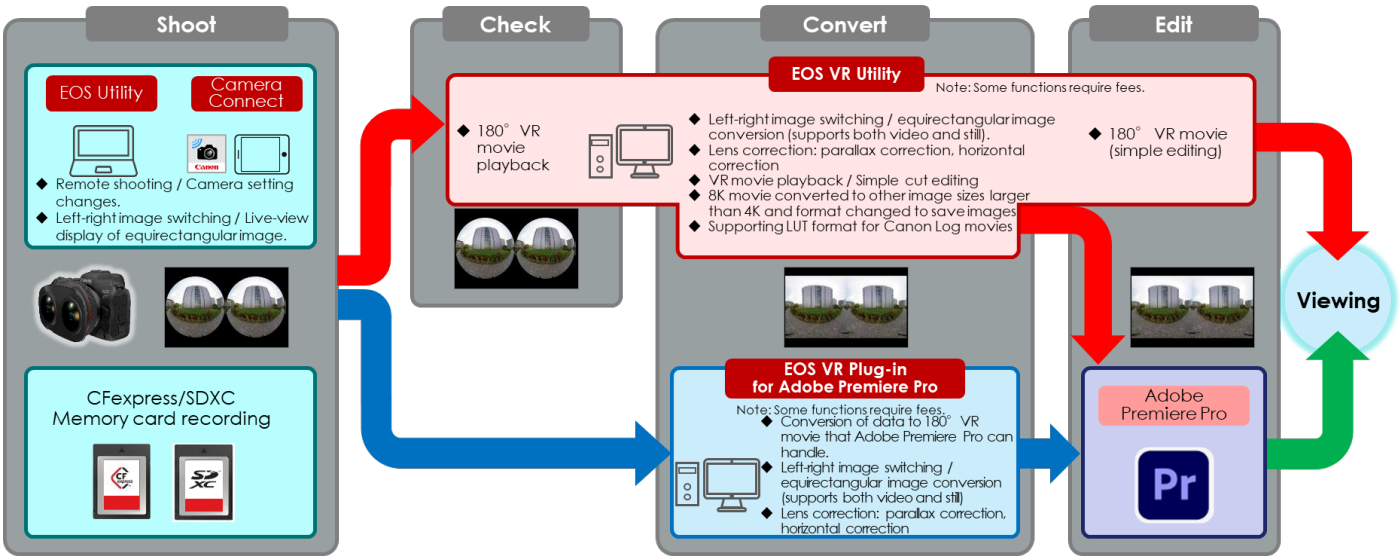
Canon have two dedicated VR applications/plug-ins, you will require one of these to convert your VR footage into something editable and watchable.



3.4.2 Remote Shooting and Camera Control



3.4.3 Post-Production Workflow – Canon software/ecosystem



Supported VR standard: *Adobe's 180° VR standard (an industry standard, editable in Adobe Premiere Pro with an upload format for YouTube)*

External recorders: *Footage recorded to an external device via the HDMI terminal are not supported by EOS VR Utility or the EOS VR Plug-in.*

Useful Links:

Canon Inc EOS VR SYSTEM page with User Manuals, guidelines and downloads:

https://cam.start.canon/en/V001/

Direct download site:

https://sas.image.canon/st/en/vru.html?region=1

(Ensure you select either the EOS R5 or R5 C, depending on your camera)

- EOS VR Utility
- EOS VR Plug-in for Adobe Premier Pro*
- Canon HEVC Activator** *(must be installed)*

*Adobe Premier Pro - Please use the latest version

**Canon HEVC Activator - Please ensure that the correct Canon HEVC Activator for the camera being used is installed (or install both), the HEVC Activator for the EOS R5 C is not the same as the one for the EOS R5 and will cause the application not to function correctly if importing footage from the wrong camera.

3.5 Recommended computer specifications

Recommending computer specifications is always difficult as recorded and supported codecs change, along with ever changing computing hardware and software. Therefore, these recommendations are a guide only for your own research, so where possible always test a configuration for your specific needs and workflow before investing, to ensure it performs to the level you require.

It is worth noting that 8K and 6K files at the highest (RAW) settings, direct from the camera, require significant processing power to even attempt to play smoothly from various computer applications at full resolution, and will vary on the number of frames that may be dropped, especially if adding any colour grades etc on top. Final playback of edited and transcoded files for output may require less hardware performance, based on your chosen settings.

- Files shot using MP4 8K 30p with **H.264 4:2:0 8-bit** (no Canon Log) are more readily supported by more systems and GPUs
- Files shot using MP4 8K 30p/60p with **H.265 4:2:2 10-bit** (with Canon Log 2 / Log 3 enabled) is a difficult codec for many systems since this H.265 4:2:2 10-bit codec is not supported by any mainstream discrete GPU (as of January 2023). However, the latest Apple Silicon processors and Intel CPU's with integrated Xe graphics, do contain decoders/encoders that support this codec and provides a significant advantage for playback and editing. Intel has already released it's first discrete GPU's (Intel Arc GPUs) based around the Xe graphics, however, these are only Mid/Entry level cards at this moment. Note however, for a significantly improved performance of the Canon **EOS VR Utility**, the use of an NVIDIA GPU is required (RTX 3070 or better).

- Movie files shot with **Canon RAW** or **RAW LT/ST** are supported by the latest versions of EOS VR Utility v1.2 or later, taking advantage of GPU acceleration from both Apple Silicon based Macs and NVIDIA based GPUs for Windows, meaning that the conversion performance for RAW file is surprisingly / relatively quick – but still needs a high performance computer.

The following specifications or higher are recommended for smoother operation at the higher image quality levels being processed (e.g. MP4 — 8K ALL-I files at 30fps) – generally the more CPU cores and higher specification GUP, the better.

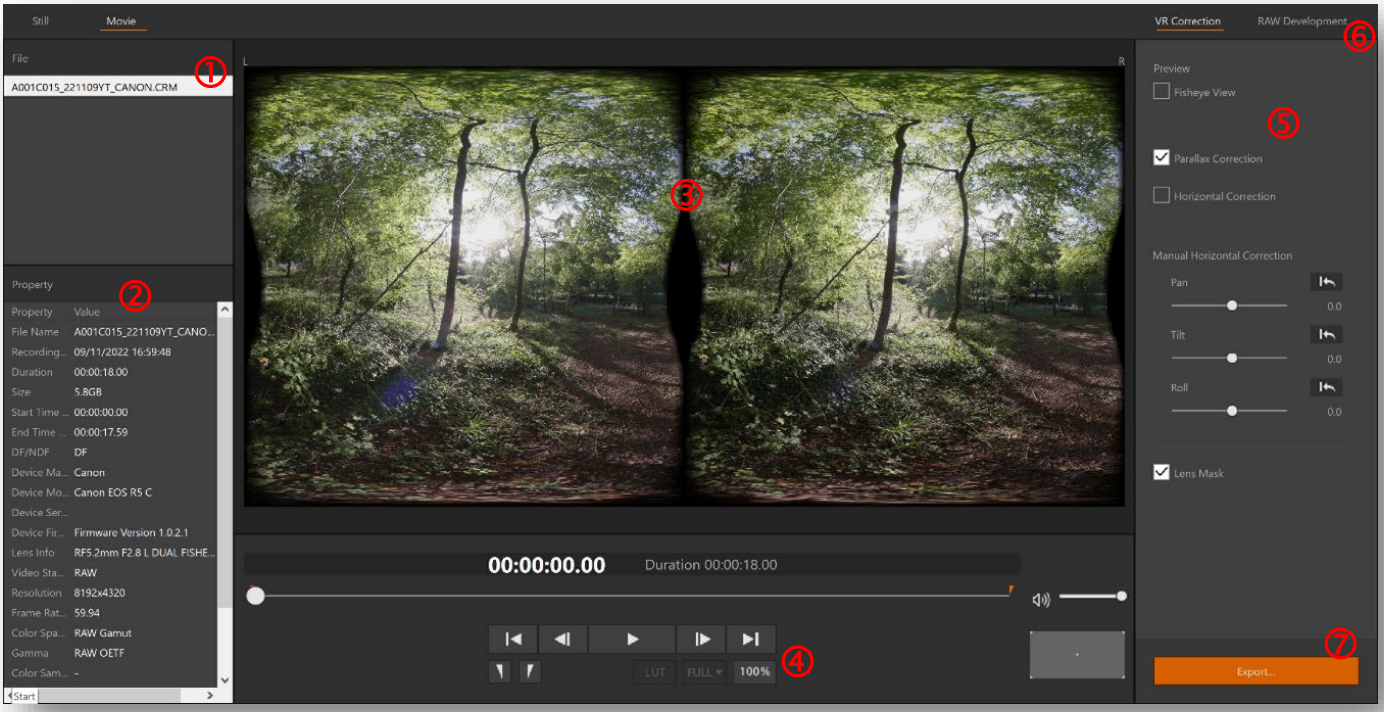
Windows 10 / 11 (64-bit) Pro or Home	**Apple Mac (MacOS 10.15.11)**
Intel 12th Gen CPU with 32GB RAM and RTX 3080 At least 32 GB RAM	- Apple M1 Max with 16GB RAM or better
Recommended: - Intel® Core™ Ultra 9 Processor 285K with 64GB DDR5 RAM and RTX 4080 or better - AMD Ryzen™ Threadripper™ PRO 7965WX 24-core or better with 64GB RAM and RTX 4080 better *(Note: NVIDIA GPUs are recommended in all cases e.g. RTX 4080 or better)*	***Recommended:*** Apple Mac Studio M2 Ultra 24-core / Max or better with 64GB RAM

4 Available Software

4.1 EOS VR Utility

EOS VR Utility is the standalone software available for converting VR footage and applying basic editing such as in/out points and applying stabilisation.

4.1.1 EOS VR Utility Software Tour



① File Window
② File properties
③ Preview window
④ Control panel
⑤ Adjustments window
⑥ RAW development tab
⑦ Export

4.1.1.1 File Window

Select the file that you want to edit / convert.

4.1.1.2 File Properties

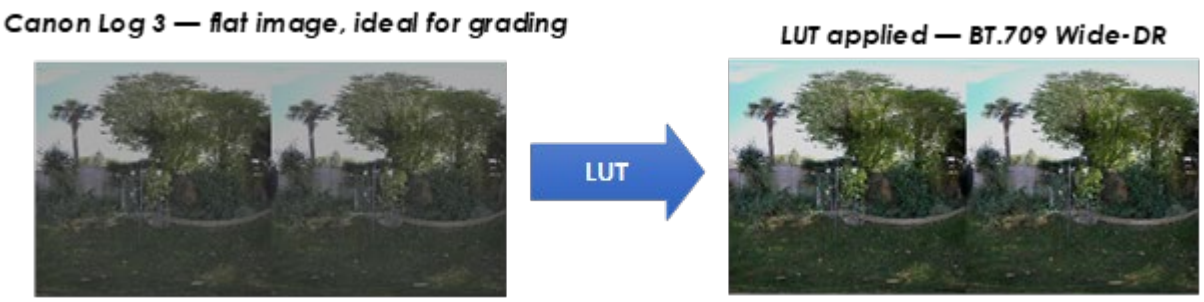
See the metadata of the file that you have selected.

4.1.1.3 Preview Window

Playback the file with any adjustments that you have made including lens masking and stabilisation.

4.1.1.4 Control Panel

Play / Pause, move frame by frame, go to the start or end and also add in / out points of the video. You can also apply a LUT and view at different magnifications.



4.1.1.5 Adjustments Window

Set the adjustments such as corrections, conversion type and adjust the pan, tilt and roll. Here you can also turn on/off the lens mask and apply stabilisation.

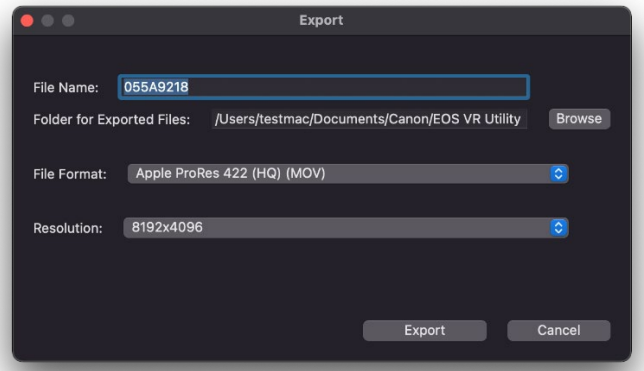
4.1.1.6 RAW Development Tab

Gives you options for more precise adjustments to be made, such as white balance, brightness, sharpness, noise reduction, changing the colour space and gamma.

4.1.1.7 Export Button

This is the final step, and will open the export window to finalise your setting

4.1.2 Export Settings

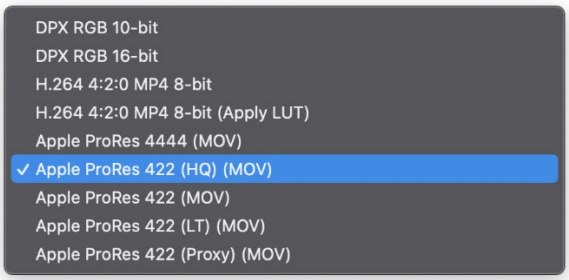


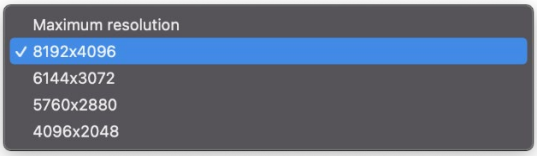
Selecting the 'Export…' button in the main window, opens the export window.

Here, you can select the:

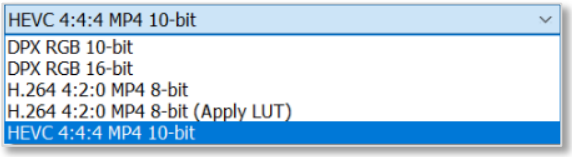
- Destination folder
- Desired codec / file type
- Output resolution

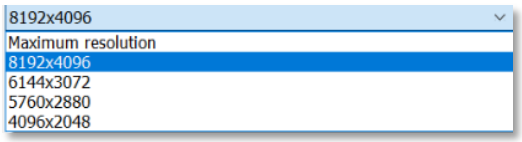
Mac





Windows





Certain codecs will be limited, depending on the shot parameters.

*Note: For **'still' images**, it is only possible to export as a JPEG file, up to a maximum of 8192x4096, with a quality setting of between 1 and 10.*

It is not possible to export to a higher resolution than the captured resolution i.e. if recorded in 4K then it is not possible to output in 8K

4.1.2.1 EOS VR Utility benefits:

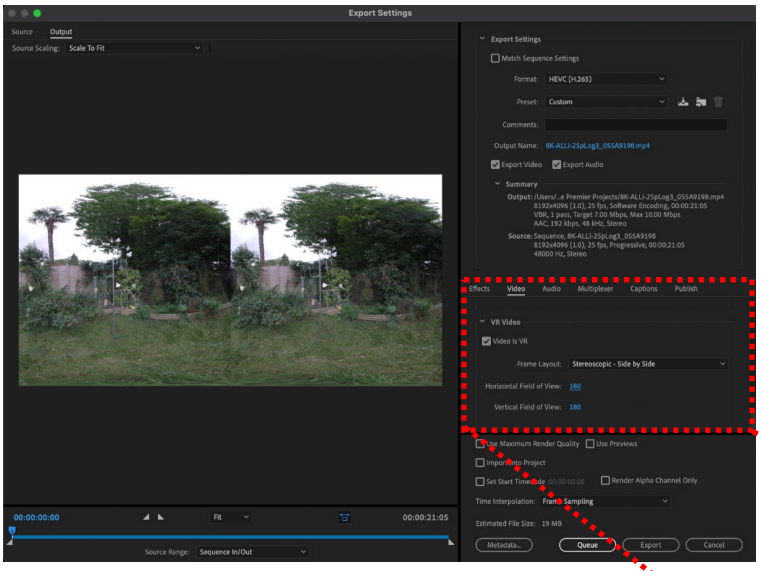
- No stitching of multiple images
- No synchronisation issues
- Only fine tune the horizontal correction, IF required
- Simple **one step conversion** to an **Equirectangular Projection and export**

- ***Firmware:*** *The latest camera firmware should always be used, otherwise the EOS VR Utility / Plugin may not be able to convert the file (e.g. the EOS R5 needs firmware version 1.5 or later).*

4.1.3 EOS VR Plug-in for Adobe Premier Pro*

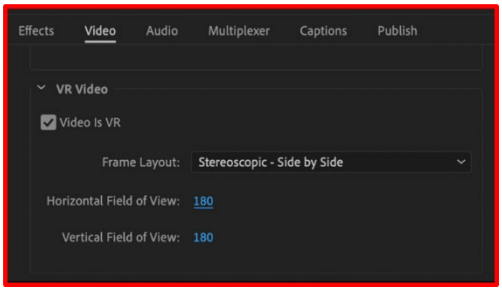
Installing Canon's EOS VR Plug-in for Adobe Premier Pro streamlines the conversion and workflow process further, when wanting to use an NLE application for post-production editing and grading. Use Adobe Premier Pro v.14.5 or later.

Installing the application enables the user to simply open Adobe Premier Pro and 'Import' the camera's VR files directly, without needing to use EOS VR Utility. The files are automatically switched for correct left and right eye orientation and converted to an 'Equirectangular Projection' upon import and placed in Adobe's media window. These files are then ready for inserting into the user's timeline where they can be cut and graded etc as required for final production output. If Ambisonic audio has been recorded at time of capture, then this can now be added and synced with the camera footage for an even greater immersive experience when viewed on a head mounted display.



When exporting from Adobe Premier Pro for VR,

select "Video is VR" in the Export window and ensure the Frame Layout is set to "Stereoscopic - Side by Side", with the Horizontal and Vertical Filed of view, both set at "180".

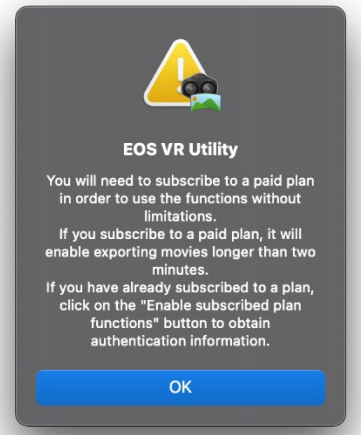


** A separate paid Adobe Creative Cloud subscription is required for access to Adobe Premiere Pro and other Adobe brand software. This is independent of paid subscription required for full access to Canon EOS VR Utility software, and EOS VR Plug-in for Adobe Premiere Pro.*

4.1.4 Subscription service

A paid for subscription service is needed to convert for export or import videos file that are longer than two minutes to an Equirectangular Projection.

Once **EOS VR Utility** and **EOS VR Plug-in for Adobe Premier Pro** have been installed, and upon opening EOS VR Utility or importing to Adobe Premier Pro, a message will be shown informing the user of paid for subscription service that is required to enable the conversion of video files of longer than two minutes.



Note, still images and video files shorter than two minutes will not need use of the subscription service to operate EOS VR Utility or use the plug-in. In this case, users can simply reject the subsequent question to sign up or manage a subscription and continue to use the applications.

If this service is required, a low monthly fee or (reduced) annual fee will be charged to the user. Users simply need to follow the prompts and messages which appear in the application and they will be taken to the Canon subscription portal and subsequent payment facility.

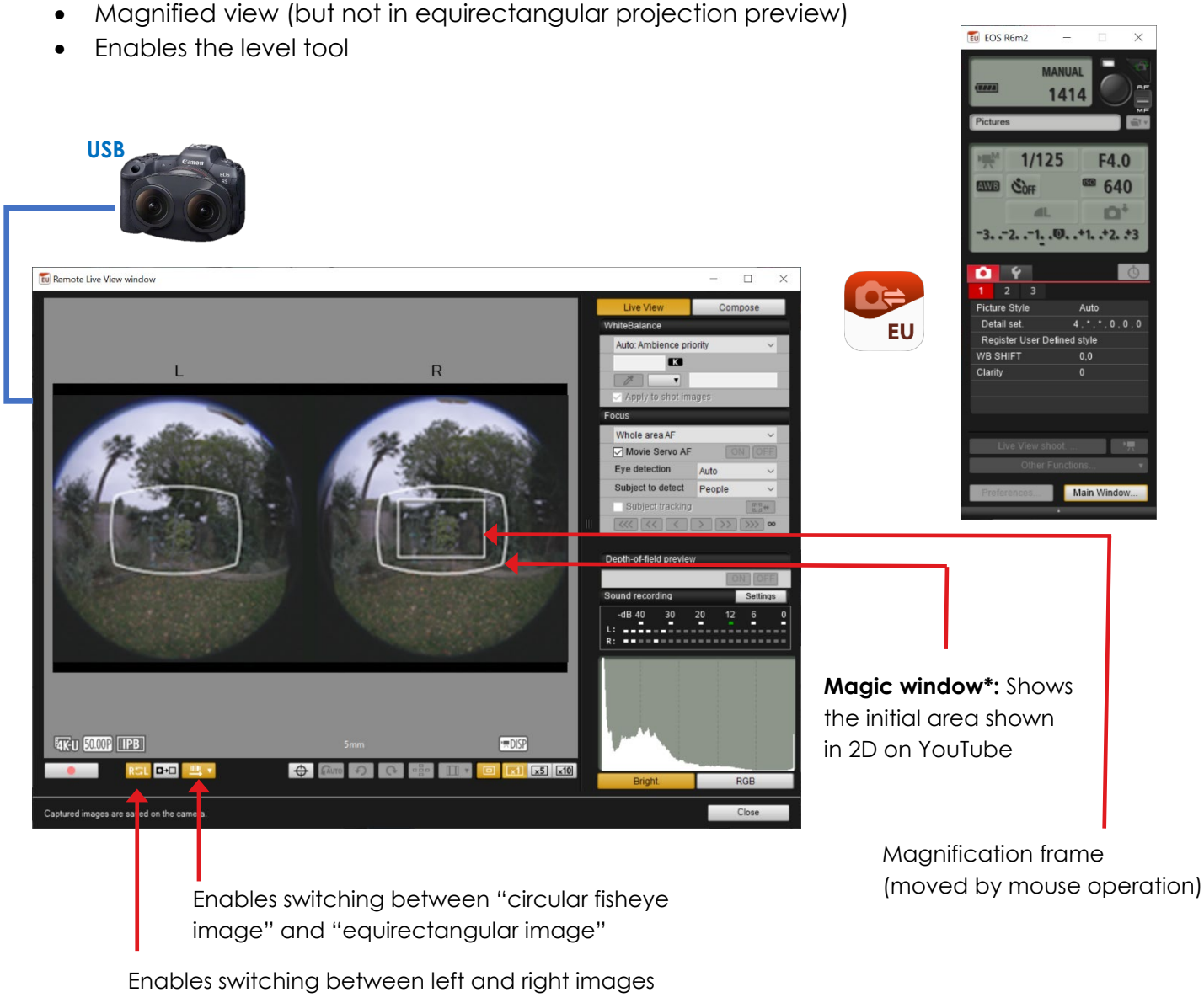
- A Canon ID will need to be used or created
- A subscription plan will be required for each application used
- Subscription plans and users can be managed from the Canon subscription portal
- Monthly service plans can be cancelled for the next month
- VAT receipts will be available
- This is separate from any requirements for paid subscriptions to Adobe's Creative Cloud, or other third-party software services

4.2 Remote capture

4.2.1 EOS Utility (Win/Mac)

EOS Utility (not to be confused with the EOS VR Utility software) supports remote shooting from a computer and automatically detects when the DUAL FISHEYE / DUAL lens is attached to the camera, enabling additional functions for VR capture.

- Switch left and right eye images to the correct orientation
- Display the live preview in either circular fisheye format or as an equirectangular projection, enabling easier visualisation for setup
- Magnified view (but not in equirectangular projection preview)
- Enables the level tool



*__Magic window:__ *The magic window size is 2045 pixels horizontally and 1391 pixels vertically with a horizontal angle of view of 100 deg and vertical angle is 68 deg.*

4.2.2 Camera Connect App (iOS / iPad OS / Android)

Camera Connect enables WiFi connection to smartphones and tablets for convenient remote shooting outdoors, automatically detecting when the DUAL FISHEYE / DUAL lens is attached to the camera, enabling additional functions for VR / Spatial capture.

- Switch left and right eye images to the correct orientation
- Display the live preview in either circular fisheye format or as a side-by-side equirectangular projection, enabling easier visualisation for setup
- Magnified view (but not in equirectangular projection preview)
- Change camera settings

5 APPENDIX

5.1 Specifications – RF 5.2mm F2.8L DUAL FISHEYE

Optical Features/Specifications		
	Image size	Full Frame
	35mm film equivalent focal length (mm)	-
	Angle of view (horzntl, vertl, diagnl)	190°, 190°, 190°
	Lens construction (elements/groups)	12/10
	Special optics	2 x UD
	Special features	Dual Fisheye with Baseline length of 60mm
	No. of diaphragm blades	7
	Minimum aperture	16
	Closest focussing distance (m)	0.2
	Maximum magnification (x)	0.03
	Control Ring	No
	Image stabilizer OIS[1]	-
	Image stabilizer IBIS x OIS[1]	-
	AF actuator	-
	Coatings	Super Spectra, SWC
	Fluorine	Front
Physical Specifications		
	Dust/moisture resistance[2]	Yes, rubber ring on lens mount
	Exterior coating	-
	Filter diameter (mm)	Rear-mounted gelatin filter (35x20mm)
	Max. diameter x length (mm)	(121.1 x 83.6) x 53.5
	Weight (g)	350
Accessories		
	Lens cap	Lens Cap 5.2 (centre pinch type)
	Lens hood	-
	Lens case/pouch	LS1014
	Rear cap	Lens Dust Cap RF
	Extender Compatibility	Not Compatible
	Other Accessories	Hexagon wrench

[1] Tested under CIPA standards

[2] Lenses with dust/moisture resistance are fitted with a rubber ring on the lens mount which may cause slight abrasion of the camera mount. This in no way effects either the lens or camera performance.

5.2 Specifications – RF-S 3.9mm F3.5 STM DUAL FISHEYE

Optical Features/Specifications		
	Image size	APS-C
	35mm film equivalent focal length (mm)	N/A
	Angle of view (horzntl, vertl, diagnl)	144°, 144°, 144°
	Lens construction (elements/groups)	11/8
	Special optics	2 x UD
	Special features	Dual Fisheye with Baseline length of 60mm
	No. of diaphragm blades	7
	Minimum aperture	16
	Closest focussing distance (m)	0.2
	Maximum magnification (x)	0.03
	Control Ring	combined / focus
	Image stabilizer OIS	-
	Image stabilizer IBIS x OIS	-
	AF actuator	STM
	Coatings	ASC
	Fluorine	No
Physical Specifications		
	Dust/moisture resistance	No
	Exterior coating	-
	Filter diameter (mm)	30.5 Rear-mounted gelatin filter (27.3x27.3mm)
	Max. diameter x length (mm)[1]	(112.1 x 83.7) x 54.6
	Weight (g)[2]	290
Accessories		
	Lens cap	Lens Cap 3.9 (center pich type)
	Lens hood	-
	Lens case/pouch	LS1014
	Rear cap	Lens Dust Cap RF
	Extender Compatibility	Not Compatible
	Other Accessories	-

[1]Lens dimensions when in retracted state
[2]Without rear filter holder attached

5.3 Specifications – RF-S 7.8mm F4 STM DUAL

Optical Features/Specifications		
	Image size	APS-C
	35mm film equivalent focal length (mm)	N/A
	Angle of view (horzntl, vertl, diagnl)	63°, 63°, 63°
	Lens construction (elements/groups)	9/7
	Special optics	2 x UD
	Special features	Dual lens with baseline length of 11.8mm
	No. of diaphragm blades	7
	Minimum aperture	16
	Closest focussing distance (m)	0.15
	Maximum magnification (x)	0.07
	Control Ring	Combined / focus
	Image stabilizer OIS	-
	Image stabilizer IBIS x OIS	-
	AF actuator	STM
	Coatings	Super Spectra
	Fluorine	No
Physical Specifications		
	Dust/moisture resistance	No
	Exterior coating	-
	Filter diameter (mm)	58
	Max. diameter x length (mm)[1]	69.2 x 41.5 mm
	Weight (g)	130
Accessories		
	Lens cap	E-58II
	Lens hood	-
	Lens case/pouch	LP1014
	Rear cap	Lens Dust Cap RF
	Extender Compatibility	Not compatible
	Other Accessories	

[1] Lens dimensions when in retracted state

5.4 EOS R5 C - Power requirements for shooting 8K 60P RAW LT

5.4.1 Using mains power

Option	Items needed		Notes
1	**Canon PD-E1 USB Power Adapter (27W)** **OR Canon PD-E2 USB-C Power Adapter (45W)**  **or**  **PD-E1** **PD-E2***		Plugs into the USB-C interface of the camera. Requires an LP-E6NH / LP-E6P* battery in the battery compartment. **New for 2024 - may need the latest camera firmware*
2	**Canon CA-946 AC Power Adapter** 	**Canon DR-E6C DC coupler** 	The DC coupler plugs into the camera's battery compartment - more secure when moving the camera. *(Note, it MUST be the DR-E6C, not the DR-E6)*
3	Third party, high quality **USB-C PD power supply** >27W	Third party high quality **USB-C PD power cable** >27W compatibility.	Plugs into the USB-C interface of the camera. Requires an LP-E6NH battery in the battery compartment. *Note: Canon can take no responsibility for the performance, compatibility and safety of equipment when using third party accessories.*

**Note: Canon DR-E6P DC Coupler is NOT compatible with the EOS R5 C*

5.4.2 Using (external) battery power

Option	Items needed			Notes
1	**(optional) Canon Battery Pack LP-E6P*** **New for 2024 - may need the latest camera firmware* ***Recommended – approx.. 45mins at 8K 60P RAW LT (under Canon testing conditions)*			The EOS R5 C can shoot internal 8K 60P RAW LT if using the optional LP-E6P battery pack. *(Note, it must be the LP-E6P battery, as other earlier battery packs will not work at 8K 60P).*
2	Third party high quality **Power Bank or V-lock battery with USB-C PD power out (>27W)**	Third party high quality **USB-C PD power cable** >27W compatibility.		For longer shooting times, an external battery can be used with a USB-C cable plugged into the USB-C interface of the camera. Requires an LP-E6NH battery in the battery compartment. *Note: Canon can take no responsibility for the performance, compatibility and safety of equipment when using third party accessories.*
3	Third party high quality / **professional (V-lock) battery with P-tap/D-tap interface (>27W)**	**Anton Bauer P-tap to C100, C100 MkII, C500** interface cable *(note, other cables/adapters may not regulate the power correctly)*	**Canon DR-E6C DC coupler** 	For longer shooting times, an external battery can be used with the DC Coupler plugged into the camera's battery compartment - more secure when moving the camera. *(Note, it MUST be the DR-E6C, not the DR-E6)* *Note: Canon can take no responsibility for the performance, compatibility and safety of equipment when using third party accessories.*

**Note: Canon DR-E6P DC Coupler is NOT compatible with the EOS R5 C*

5.5 EOS R5 Mark II - Temperature control and power recommendation for shooting 8K 60P Light RAW

5.5.1 Camera settings and options for controlling temperature and extending shooting times

When shooting VR at the maximum image quality (8K 60P Light RAW), then heat is generated by the sensor, internal processors and memory card, in particular. To help keep shooting for longer, there are a few things that can be done to help:

- If possible shoot at lower ambient temperatures.
- Set "**Auto Pwr off temp.**" to "**High**" *[Note, the camera body and memory card may become hot]*
- Set "**Standby: Low res.**" to "**On**"
- Different memory cards/brands vary in the temperature that they produce. Try to use a memory card that generates less heat while under load/in use.
- Use the **Cooling Fan CF-R20EP** (grip) with one or two LP-E6P batteries (do not use earlier LP-E6/E6N/E6NH batteries as these do not output enough power), or with the DC Coupler DR-E6P and >45W PD power supply. This will help to prolong the recording times by cooling, but only by a short amount at 8K 60P due to the high temperatures generated at this setting (however, in 8K 30P the Cooling Fan is a lot more effective during shooting). At 8K 60P, the Cooling Fan it is more useful at speeding up the cool-down time when the camera is not recording.
    - Ensure the appropriate "**Cooling fan settings**" are set:
        - **Fan** -> **On (always at set speed)** - The fan is always on, at the set "Fan rotation speed", but the internal microphone or possibly an external microphone may pick up the sound of the fan, especially at "High" speed during recording.
        - OR **Fan** -> **On (high speed in standby)** - the fan is at "High" speed when not recording and goes down to a quieter / slower setting (as set in the "Fan rotation speed" option) when recording.
- Set the "**Power saving**" options to help reduce power consumption as appropriate.
- If using the HDMI terminal to output a signal, set the "**HDMI resolution**" to 1080p/1080i to help reduce the load when using a 4K monitor and a 4K view is not necessary.

5.5.2 Using mains power

Option	Items needed		Notes
1	**Canon PD-E2 USB-C Power Adapter (45W)** 		Plugs into the USB-C interface of the camera. Requires an LP-E6P battery in the battery compartment. *(Note, it MUST be the LP-E6P, not the LP-E6, LP-E6N, LP-E6NH)*
2	**Canon PD-E2 USB-C Power Adapter (45W)** or third party high quality USB-C PD power supply (>45W) 	**Canon DR-E6P DC coupler** (USB-C interface) 	The DC coupler plugs into the camera's battery compartment - more secure when moving the camera. *Note: Canon can take no responsibility for the performance, compatibility and safety of equipment when using third party accessories.*
3	Third party, high quality **USB-C PD power supply** >45W	Third party, high quality **USB-C PD power cable** >45W compatibility.	Plugs into the USB-C interface of the camera. Requires an LP-E6P battery in the battery compartment. *Note: Canon can take no responsibility for the performance, compatibility and safety of equipment when using third party accessories.*

5.5.3 Using battery power

Option	Items needed		Notes
1	**Canon Battery Pack LP-E6P**		The EOS R5 Mark II can shoot internal 8K 60P Light RAW when using the included LP-E6P battery pack. *(Note, it must be the LP-E6P battery, as other earlier battery packs will not work).*
2	Third party high quality **Power Bank or V-lock battery with USB-C PD power out (>45W)**	**Canon DR-E6P DC coupler*** (USB-C interface) 	For longer shooting times, an external battery can be used with the DC Coupler plugged into the camera's battery compartment - more secure when moving the camera. **New for 2024 - may need the latest camera firmware* *Note: Canon can take no responsibility for the performance, compatibility and safety of equipment when using third party accessories.*
3	Third party high quality **Power Bank or V-lock battery with USB-C PD power out (>45W)**	Third party high quality **USB-C PD power cable** >45W compatibility.	For longer shooting times, an external battery can be used with a USB-C cable plugged into the USB-C interface of the camera. Requires an LP-E6P battery in the battery compartment. *Note: Canon can take no responsibility for the performance, compatibility and safety of equipment when using third party accessories..*