Ultra-wide Panorama (Tracking Panorama)

A cylindrical panorama that is as wide and as high as the title text above without distortions can be rendered using an appropriate lens. The sky or backdrop must be added separately (inspired by David Brinnen's video).

Introduction

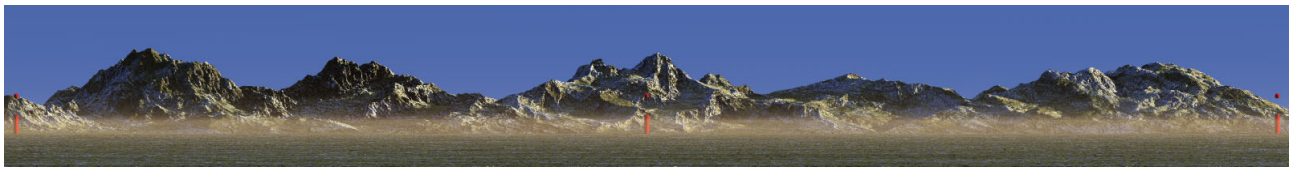
An image is usually called *panorama* if the aspect ratio is about 2:1, twice as wide as high. If the aspect ratio is 4:1 it is a wide panorama and what we call here an ultra-wide panorama has an aspect ratio of 8:1. Here is an example.

The horizontal angle of view from left to right is about 144°. The mountain range is not in a semi-circle but stretches straight from left to right and there are no distortions.

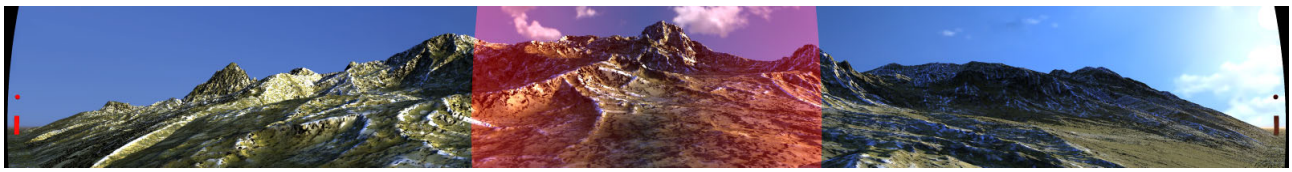
Using a real camera

The mountains are about 6.2 km (3.85 mi) wide and 600 m (1970 ft.) high. To photograph such a mountain range with a real camera, you have four options.

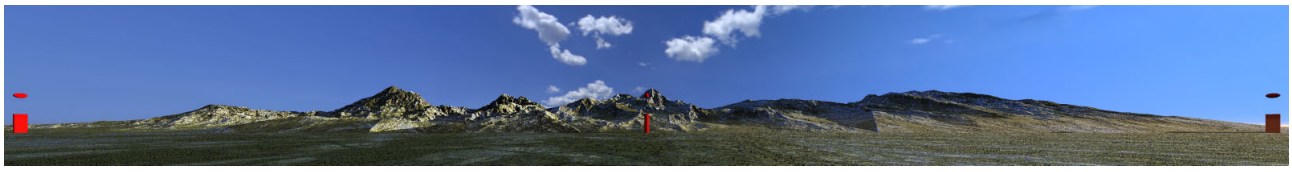
Tele-lens: assuming a 300 mm tele-lens, you have to be about 47 km (29 mi) away from the mountain range. The photo would look almost the same; except haze would obscure most of the scene except on an exceptionally beautiful dry day. Haze was reduced for the render — and the tele-lens compresses the depth.



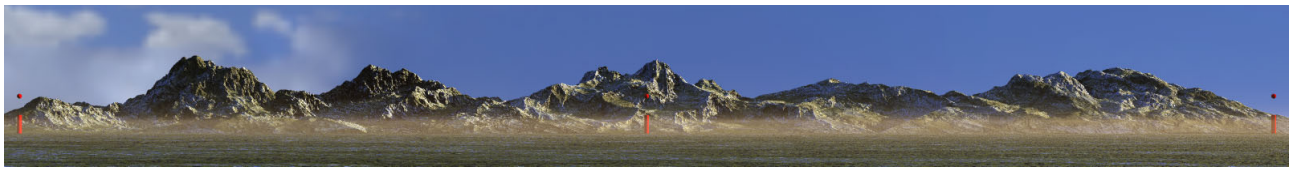
Fisheye-lens: a 15 mm fisheye-lens (FLO from the lenses and filters set) was used for the render below. You have to move very close to the mountains, about 20 m (66 ft.) and the part right in front gets huge (that's why the red cylinder centre-mark was made transparent) and the parts towards the edges appear farther away and get also progressively distorted.



Wide-angle rectilinear lens: if a 3 mm rectilinear lens really exists (Bryce has one), you have to be 0.9 km (0.56 mi) away with your camera to get the shot. The sides get extremely distorted because the left and right red cylinders are each 2.85 km (1.75 mi) away from the camera.



Normal lens: this is rectilinear lens with a focal length of 50 mm. It portrays the scene truly without zooming in or out. With such a lens, you would have to be 6.6 km (4.1 mi) away from the mountain range.



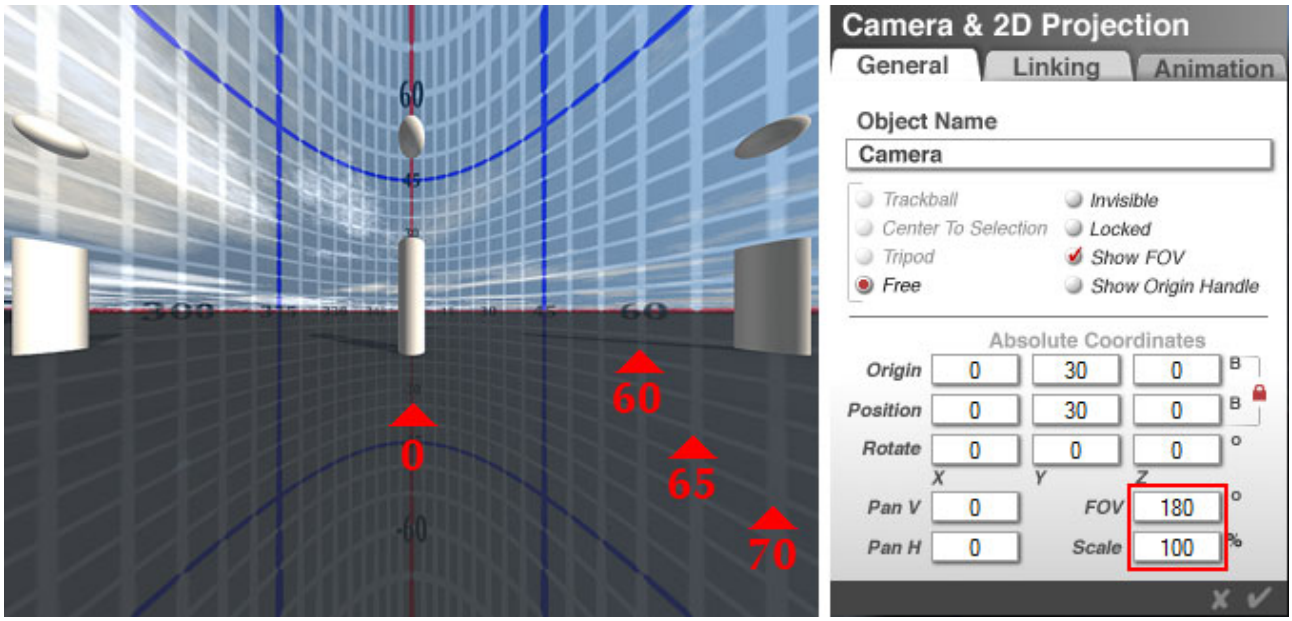
The nearest we can get to the first example is with the tele-lens. The top example also has no clouds; the sky was rendered separately and added in a graphics application. The problem with the tele-lens is the distance compression and the haze.

Using a Special Lens

The examples above are all Bryce renders emulating a camera with a real lens to give you an idea how a photo-real scene would look like.

The Bryce Camera

There is no focal length control for the Bryce camera but a *FOV* (*F*ield *O*f *V*iew) and a *Scale* control. The *FOV* at 100% *Scale* is the angle of view in the diagonal of a document with the aspect ratio 4:3. This sounds good because the horizontal angle is *FOV* divided by 5 multiplied by 4 for this aspect ratio. Unfortunately, the *FOV* loses precision after about 90°.

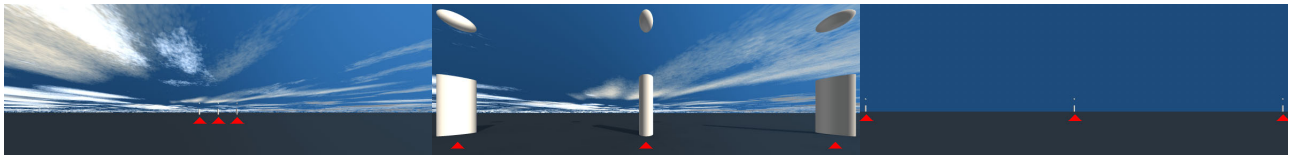


FOV works from 1.00° to 180.00° with two decimal places. *Scale* works from 1.000% to 1000.000% with three decimal places. Reducing *Scale* widens the angle and increasing *Scale* narrows the angle of view. The widest setting is *FOV* 180° with 1% *Scale* and it still does not fully reach 180°. The narrowest setting is *FOV* 1° and *Scale* 1000. The picture above shows a horizontal angle if view of about 144° at the *FOV*/*Scale* settings shown at right.

The camera behaves as if it had a rectilinear lens with a variable focal length attached. The picture above shows how the stretching gets worse after about ±45° (blue vertical lines on the HDRI sphere at infinite distance). The three cylinders and spheres are at the same distance from the camera. Without distortion, the cylinders and spheres left and right would look like the one in the centre.

The special "Lens"

Below are three renders with the same objects and the camera *FOV* and *Scale* settings shown above. The position of the objects is marked with red up arrows. Enlarge in your PDF viewer.



At left, the objects are far away, 1000 BU (Bryce Units) and apparently close together, though they are 540 BU apart. In the centre, the camera was moved 900 BU (Z) towards the objects; they are big, close together and distorted. At right, the camera is again back at Z=0, the objects are spread out and are undistorted; this render uses the special "lens".

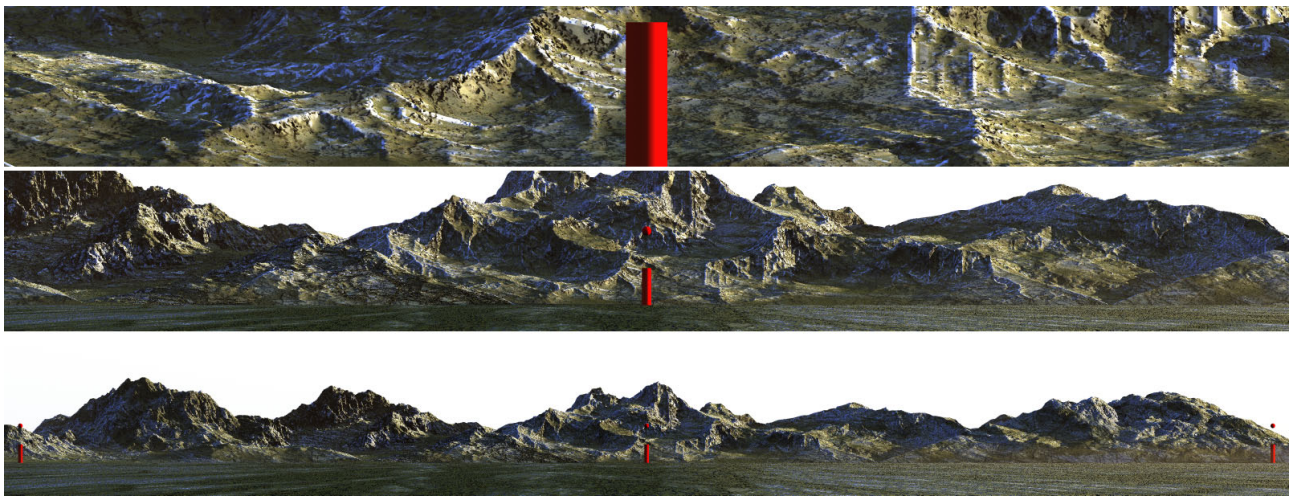
This lens can be a *2D-Face* or a vertical infinite plane (like the ground plane). The *2D-Face* must be scaled to fit the screen; the infinite plane is never too small...

Make sure, all *Shadow* options are deselected and set it to fully transparent without any Refraction (0).

The distance of the objects to the camera is important and also the distance of this lens to the camera. Assume the objects are 10 *we* from the camera, then put the lens 9 *we* from the camera. A "*we*" is a "whatever".

As an example, if the objects are 1000 BU from the camera, place the lens 900 BU from the camera. If the objects are 10,000 BU from the camera, place the lens 9000 BU from the camera. Move the lens (*2D-Face* or vertical infinite plane) a bit nearer to the camera or a bit farther away from it to fine adjust the result. Note that the wireframe view is not very helpful.

The lens works like an inverse magnifying glass. The nearer it is to the camera, the more it magnifies. A real magnifying glass magnifies more the farther away it is from the object — within limits.



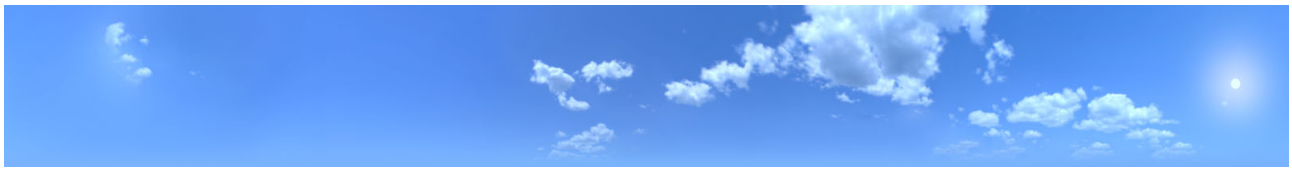
In the example above, the objects (red cylinders) are 1000 BU from the camera and the lens from top to bottom 100, 450 and 900 BU from the camera. Camera and objects are always at the same position; only the lens (infinite plane) was moved.

The Sky or Backdrop

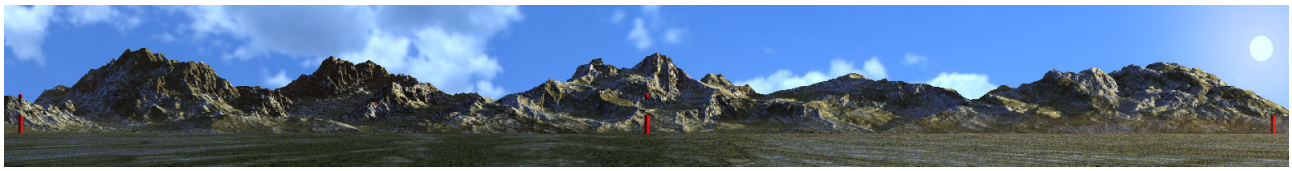
The bottom example above is the panorama we use. However, even though there is a blue sky, nothing of it can be seen, neither a Bryce sky nor an HDRI sky. This is the haze but even if it is disabled, the white is just replaced by the blue sky colour. The sky has to be rendered separately and added to the scene in a graphics application. In order to combine scene and sky, a mask of the scene must be rendered. Experiment with *Haze* for the scene and sky to make it match in the combined result.

Mask: this is quite straight forward even though we cannot render the *Object Mask*. Select everything in the scene except the lens and camera and set the material to default, then set *Diffusion* to 0 and *Ambience* to 100 (global *Ambient* white), render and save as mask.

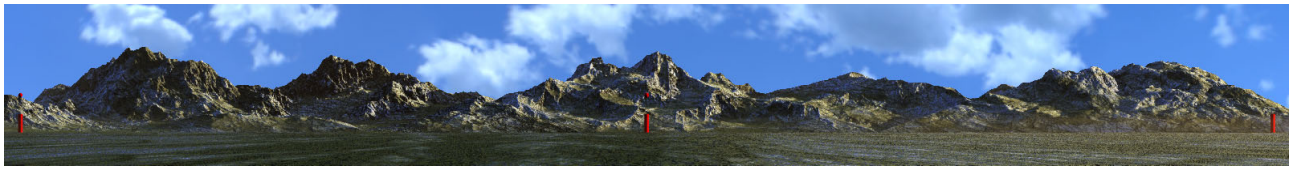
Sky: render the sky. This is different; obviously you cannot use the camera setting and the lens. Select all objects including the lens, but not the camera, and set them in the *Attributes* to *Hidden*, or delete them outright. Then render the sky with or without HDRI as *360 Panoramic Projection* and save the result.



Combine: this is an HDRI sky mixed with a cloudless Bryce sky with haze and a visible sun. The combined result is the first picture on page 1. We could argue that this is not correct because the horizontal angle of view of the scene is not 360° but only around 144° and therefore the sky is too wide. We could set the horizontal document size wider: 360/144 is 2.5 and if the initial width is 1600 pixel, we could render 4000 pixel wide. Then we crop the part we are interested in to 1600 pixel and use that part to complete the scene. If you do it that way and have *Pan H* and/or *Pan V* not at 0, you have to adjust it. In my example, I had *Pan V* at 100 and had to increase it to 250.



Above is the result. The sun and clouds are bigger. Is it better than the first picture on page 1? I am not so sure but it always depends. It is good to know there is more than one option. Below, the clouds were moved and the sun is not visible anymore.



David shows in his video how mountain range and sky can be combined using *PaintShop Pro*. But it can be done in any graphics application like *Gimp* or *PhotoImpact* for example. I used an old *PhotoShop*: first inverting the mask, selecting the black part (now the mountain range), copied and pasted it over the sky. Then I selected the black mountain part, inverted the selection, copied and pasted the remaining sky over the landscape.

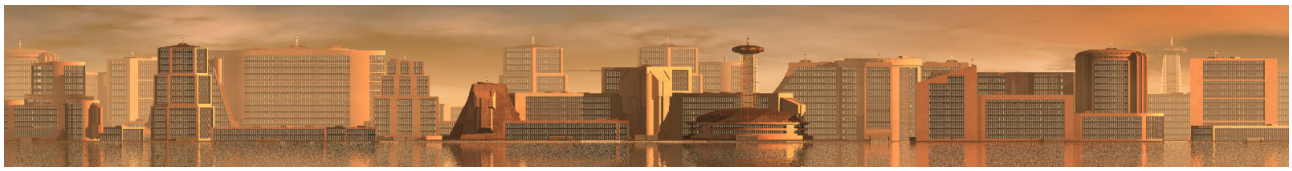
Example

Eight City Blocks (only 22% original height), a gift from *drachenlords* for the Bryce community at Daz 3D, were used for the example below. On top the render through the lens, much like the mountain range example above. The depth or 3D-ishness gets lost by the compression so haze was used to give the depth clue. Light and sky are from the *HDRI Enhanced Skies* Set.

Below is the rendered mask. There is a tiny issue with the tower at far right. There ought to be a bit of transparency at the sides.

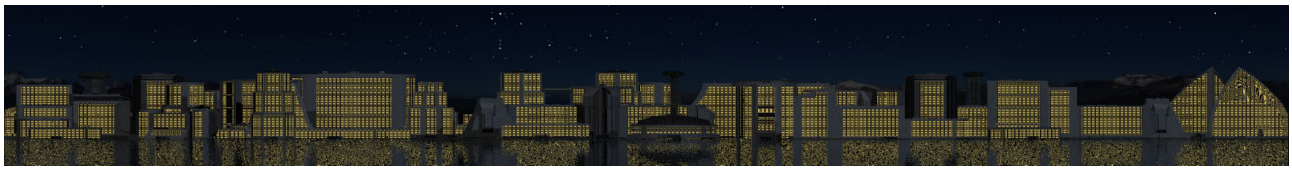
The sky was rendered as 360° panorama double as wide and the mask inserted. In the double wide sky the mask occupies only half. Also, it was moved down to clear more of the sky near the horizon. The mask can be lowered as desired but the bottom black line must be uninterrupted.

And here is the result. The issue with the tower at far right is unfortunately quite obvious. The sun was not included, though when its size is reduced, it would fit. Here, the light comes from far right and a bit from behind the viewer and should not be visible.



Below is the same setup as above but without haze, different sun position, light and HDRI for the sky. The lens was slightly moved from 900 to 925 to open the width a bit. This is just to show that small changes have quite some effect.

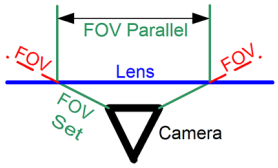
The last example is a night shot. The camera was moved back and the lens forward so the distance is not 900 BU anymore but 1270 BU to accommodate two additional blocks left and right. The camera *Pan V* was also increased from 50 to 60 to give the starry sky more space and the water less. The depth range of the buildings is 8000 BU, the farthest is not smaller.



Considerations

These ultra-wide panoramas are meant to depict a front like a mountain range, a city or a wide storefront along a street. It does not work if the objects are not in a line in front of the camera but are nearer at one side and farther in the other, or if the camera looks up or down.

Nevertheless, when using a very wide camera FOV to capture a wide scene, the "lens" that makes the angle to a parallel opening is a helpful option. The drawing at right shows how the lens works and it becomes clear why its distance from the camera adjusts the final width.



To create a render in the Isometric projection, you would set the camera *FOV* to 1°, the *Scale* to 1000% and move the camera far away. Alternatively, this lens could also be used because the ultra-wide panoramas can be considered as being in the Isometric projection.

Links to Reference Video by David Brinnen

Bryce Tutorials:

https://www.bryce-tutorials.info/bryce-tutorials/bryce-7-1-pro-advanced-create-tracking-panorama/

YouTube:

https://www.youtube.com/watch?time_continue=12&v=IKnD7Hh153U

Related Video

https://horo.ch/docs/video/horo_en.html

16. FOV as a Compositional Tool; includes Transcript. Direct link to YouTube:

https://www.youtube.com/watch?v=QRDMxX7ftUE

Bryce Sets mentioned or used

Bryce 7.1 Pro Lenses and Filters

https://www.daz3d.com/bryce-7-1-pro-lenses-and-filters

Bryce 7.1 Pro - HDRI Enhanced Skies (used for City Skies)

https://www.daz3d.com/bryce-7-1-pro-hdri-enhanced-skies

Bryce 7.1 Pro - Gritstone Hills (used for mountain range sky HDRI)

https://www.daz3d.com/bryce-7-1-pro-gritstone-hills

Bryce 7.1 Pro - Landscapes under Fantastic Skies (used for materials on mountain range)

https://www.daz3d.com/bryce-7-1-pro-landscapes-under-fantastic-skies

Additional Reading

Bryce Tips: Camera — Field of View (FOV) and Scale; features a calculator.

https://horo.ch/raytracing/tips/cam_en.html

The Bryce Camera (PDF 4 pages)

https://horo.ch/docs/mine/pdf/BryceCam_en.pdf

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