

FTV469208

# The Power of Reality in Rich Volumetric VR Realtime Experiences

Eric Hanson/ Blueplanet VR

## Learning Objectives

- Ability to capture locations with correct methodology and hardware
- Discover the untapped potential of utilizing real-world volumetric capture in a variety of fields
- Ability to budget or schedule the correct scope of work

## Description

This class will cover an overview of the workflow of capturing and utilizing real-world locations in order to make powerful realtime volumetric 6DOF virtual reality experiences. Starting with site capture methodologies, techniques of utilizing 360 panoramas, DSLR photogrammetry, and laser scanning are discussed, along with specific hardware concerns. Post-production workflow is then described, utilizing raw conversion, tone-mapping, photogrammetry solves, cleanup and prep in Autodesk Maya, then final import into Unity. Final examples are shown through a VR headset session that illustrates detailed captures.

## Speaker

**Eric Hanson** is CEO of Blueplanet VR, as well as a faculty member at the USC School of Cinematic Arts. With a background in design, architecture, photography, and feature film visual effects, Eric currently creates volumetric VR content spanning natural history, cultural heritage, and science visualization. His VFX work can be seen in “The Day After Tomorrow”, “Cast Away”, “Fantasia 2000”, and “The Fifth Element”, among others. Recent work has led to collaborations with The Dunhaung Foundation, Frontline/PBS, The Navajo Nation & Ai Weiwei, and the Onward Project. Eric finds enormous potential in volumetric VR for creating important and meaningful experiences.

## SITE CAPTURE TECHNIQUE

### Spherical Panoramas/ Mono or Stereo

- Camera/ lens choice dictates resolution, only 8k required for VR.
- Use this pano chart to calculate image overlap w/ 21MP sensor:

#### Fullframe Sensor:

15mm > 11.4K H resolution	20mm > 16.9K H resolution	35mm > 27.6 K H resolution
6 every 60 deg H, +/-30 deg tilt 1 every 90 deg tilt (13 img)	9 every 40 deg H, +/-35 deg tilt 1 every 90 deg tilt (19 img)	18 every 20 deg H, 0 deg tilt 9 every 40 deg H, +/-45 deg tilt 1 every 90 deg tilt (37 img)

#### Cropped Sensor:

15mm > 15.8K H resolution	20mm > 20.4K H resolution	35mm > 30.4K H resolution
12 every 30 deg H, 0 deg tilt 6 every 60 deg H, +/-45 deg tilt 1 every 90 deg tilt (25 img)	12 every 30 deg H, +/-20 deg tilt 6 every 60 deg H, +/-60 deg tilt 1 every 90 deg tilt (37 img)	24 every 15 deg H, 0 deg tilt 15 every 24 deg H, +/-30 deg tilt 12 every 30 deg H, +/-60 deg tilt 1 every 90 deg tilt (79 img)

- Use indexed pano head rotator, Nodal Ninja/ Fanotec recommended.
- 8mm lens on fullframe sensor fastest to shoot w/ only 4 positions, yields 14k on Sony a7Riii.

### HDR Lighting Probes

- Use 8mm 180deg (fullframe sensor) at 4 rotations
- Use special rotator w/ 90 deg detents, Nodal Ninja/ Fanotec recommended.
- Shoot at 1 stop increments, 9-11 stops total.
- Always shoot digital grey/color calibration chart, X-Rite Color Checker recommended.

### **Shooting Photogrammetry**

- Use all manual settings, but AF acceptable.
- Maintain sharp focus throughout.
- Establish heavy 50% overlap with a continuous flow of images with no breaks.
- 25mm lens is a sweet spot for resolution/speed.
- Always move camera in world space, take a step and shoot, repeat.
- Always shoot in RAW + small JPG for nightly review or reconstruction in the field.
- 25mm lens is a sweet spot for resolution/speed in photogrammetry.
- Use carbon pole to increase reach, shoot floor surface, Nodal Ninja/ Fanotec recommended.
- Three different shooting scenarios: Interior, Exterior, Object.

### **Interior Capture**

- Never shoot from center or pan from one spot.
- Place back against the wall, “step then shoot” along perimeter.
- Repeat perimeter moves w/ rotated camera positions.
- HDR and tripod may be necessary but slows speed.
- Can use custom rigs to provide tilts, add speed from multiple cameras.

### **Exterior Capture**

- Cover full expanse with all occlusions captured.
- Mostly handheld, but poles invaluable for hard to reach areas and ground capture.
- Consider what final VR experience will be and shoot accordingly, full extent will be prohibitive.
- Use of UAV/ drone useful for larger site context.
- Fixed-wing or helicopter charter for next level of scale, higher resolution.
- GIS data useful for largest level of scale

### **Laser Scanning**

- Used to fill photogrammetry’s shortcomings.
- Always used w/ urban or built subjects, less required w/ natural subjects.
- Expensive but rentable w/ insurance.

## POST-PRODUCTION TECHNIQUE

### **RAW Color Grading**

- Use of Adobe Bridge, speed counts.
- Define white point w/ color chart.
- Adjust varying exposure levels w/ curves, etc.
- Boost fill shadows, make 2<sup>nd</sup> set for texturing w/ intended final grade.
- Export max quality JPGs.

### **Panorama/ HDR Stitching**

- Use of PTGui, best for spherical stitching.
- Also can export 32 bit HDR for CGI lighting and/or tonemap for background.
- Typically export at 8k x 4k equirectangular map.
- Useful for variety of VR tasks, video re-projection, etc.
- Use of SNS-Pro for photogrammetry tonemapping.

### **Processing Photogrammetry**

- Verify all images for sharpness, exposure before import.
- Use of Reality Capture for highest quality rendition, large loading, GPU speed.
- Use of open-source Meshroom for learning, minor work.
- Will create billions of polygons, but export 2-5M with single 8k texture map to start.
- Processing speed has dramatically reduced due to GPU.
- Decisions depend on pre-rendering or realtime use.

### **Cleanup/ Import into Unity and VR**

- Use of Maya, Meshmixer, Mudbox.
- Import initial mesh, then cleanup unneeded faces and trim excess w/ Maya or Meshmixer (handles large meshes faster).
- Cut into pieces for further re-texturing, then paint fix in Mudbox.
- Final poly reduce in Maya, then import into Unity or UE.

- VRTK useful in Unity for basic locomotion, interaction.
- Delivery platforms are desktop (Most tethered HMDs) or Android (Quest, Pico).
- Establish correct perceptual scale of model.
- Establish region and means of movement (teleporting).
- Deep well of UI possibilities.
- Social potential w/ Normcore.io.

## PRESENT TO FUTURE OF IMMERSION

### Useful For All Human Endeavors

- Virtual Travel
- Interactive Storytelling (Wolves in the Walls)
- Real Estate
- Medicine
- Architecture and Construction, etc etc

### Increasingly Social

- Pandemic has shown need and increased growth.
- Affords remarkable presence (Museum of Other Realities).
- Obvious use in education (historic recreation).

### Needs Wide Proliferation of HMDs

- Needs a major like Apple to bring millions of users.
- AR will be a gateway drug for VR.

### Needs Evolution of Content Offerings

- Majority of titles are gaming-centric, needs expansion.
- Most creative work in film festivals but usually non-commercial.
- Potential remains untapped (world of “what if?”).

Contact: [eric@blueplanetvr.com](mailto:eric@blueplanetvr.com), [www.blueplanetvr.com](http://www.blueplanetvr.com)