



Photographing VR Panoramas

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MacWorld 2009

User Conference **US946**

<http://macpres09.shownets.net>



January 9, 2009



Visual Impact of the Panorama





Visual Impact of the Panorama





Visual Impact of the Panorama



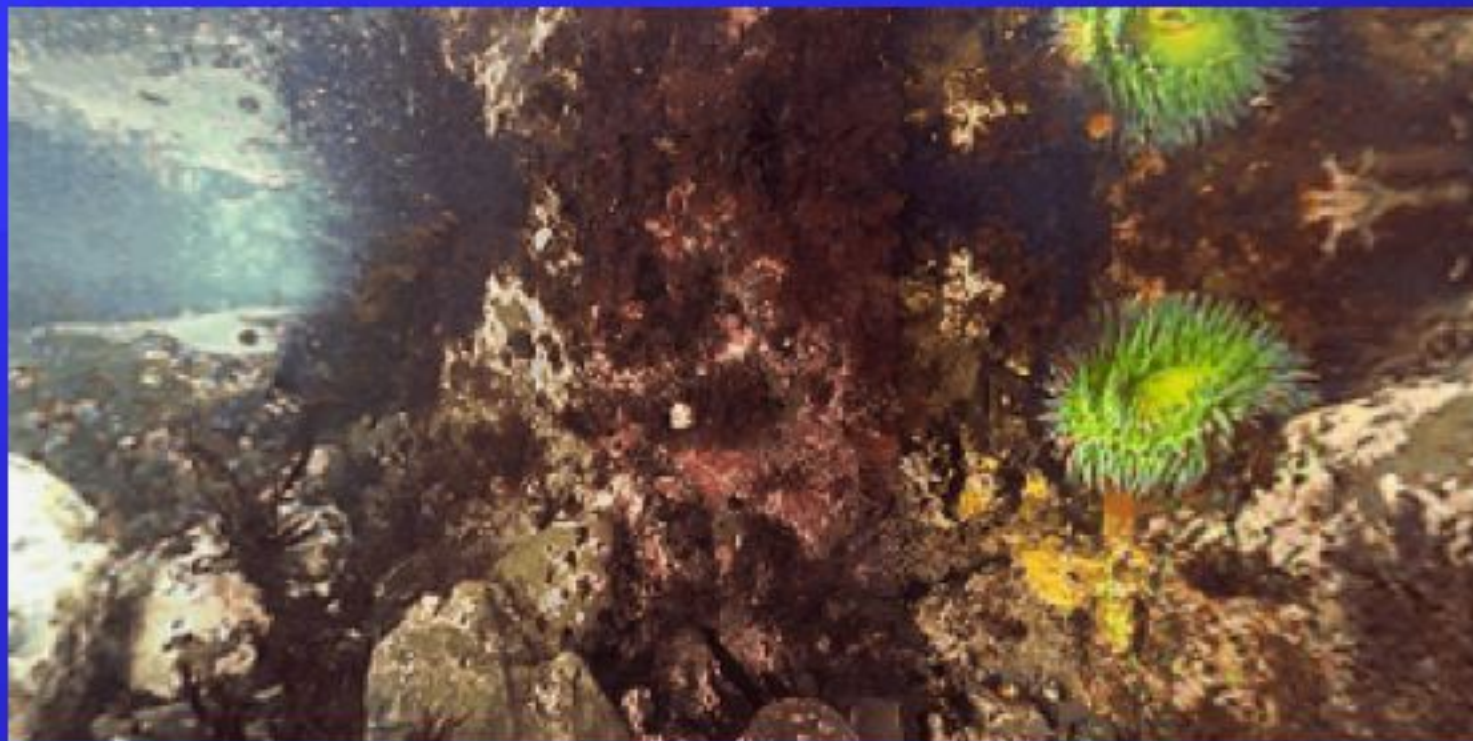


Visual Impact of the Panorama





Visual Impact of the Panorama





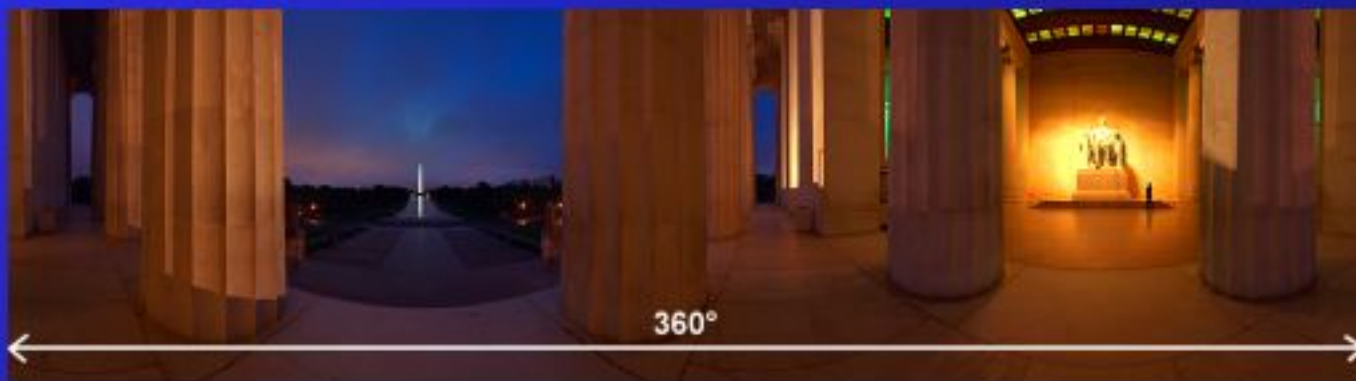
Visual Impact of the Panorama





Horizontal Views

- ◆ “Partial” panorama:
 $< 360^\circ$ fov(x)
- ◆ “Full” panorama:
 $\geq 360^\circ$ fov(x)

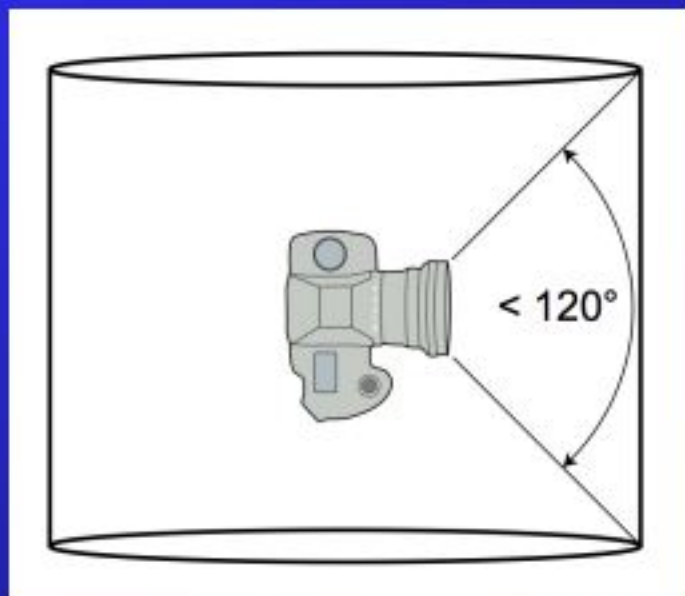




Cylindrical Format – fov(y)

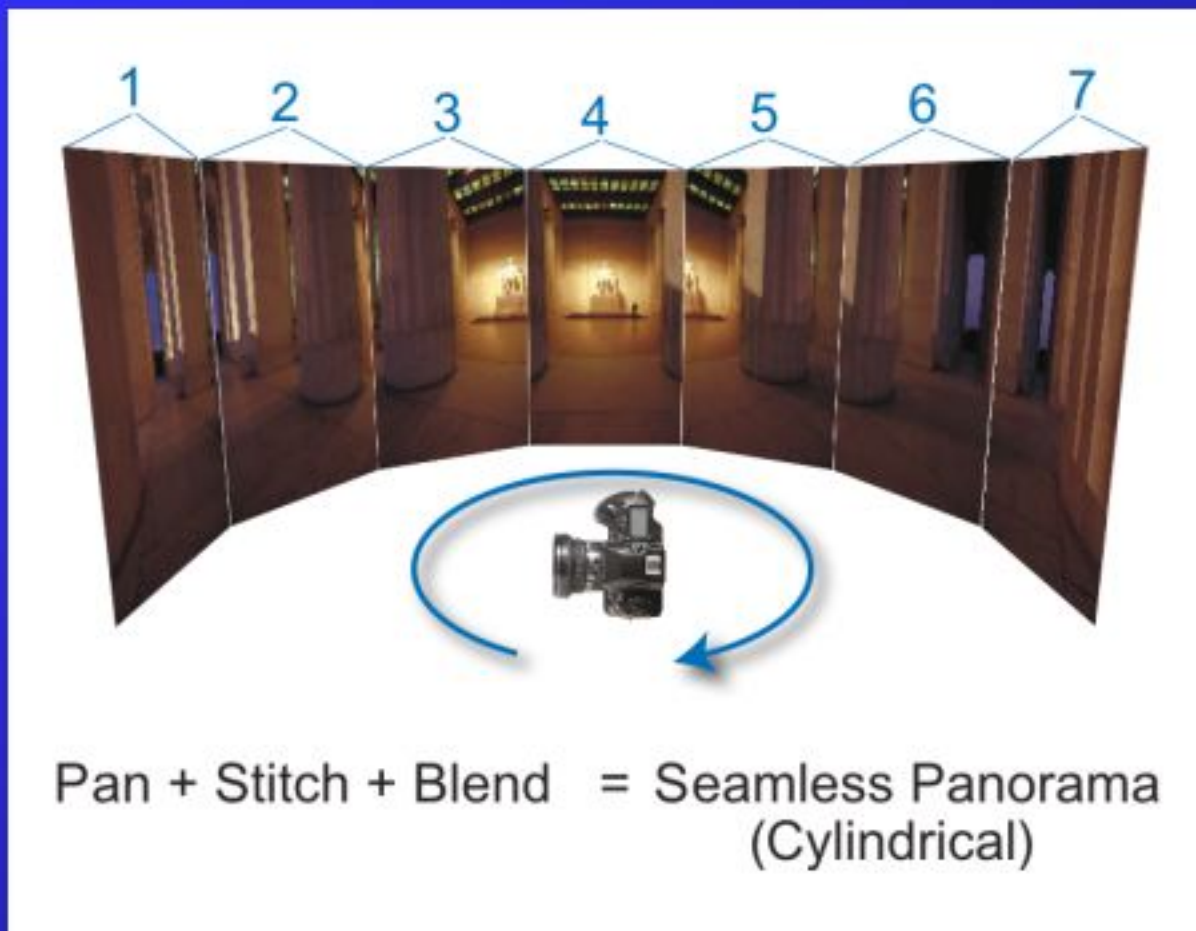
- ◆ *Vertical views*

Cylindrical – restricted fov(y)





Cylindrical Stitching





Shooting & Stitching Basics

- ◆ Images should overlap by **1/3** to **1/2**
- ◆ Pan left to right
- ◆ Exposure, WB, focus, focal length match
- ◆ Tripod use **highly** recommended
- ◆ Entrance Pupil (formerly N. P.) Alignment

- ◆ **Stitching software:**

PTGUI

Autodesk Stitcher

VRWorx

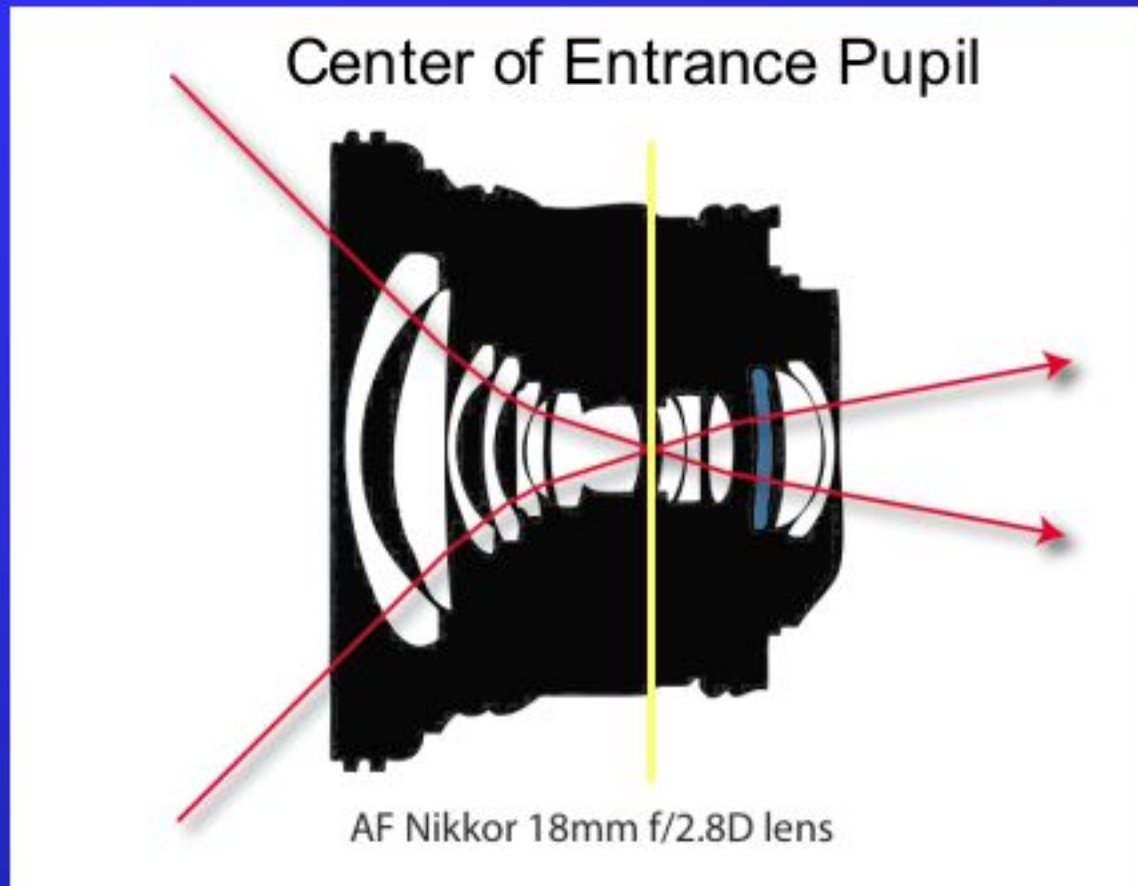
Panoweaver

Apple QTVRAS

PTMac



Entrance Pupil Alignment





Entrance Pupil Alignment





Entrance Pupil Alignment



(Misaligned)



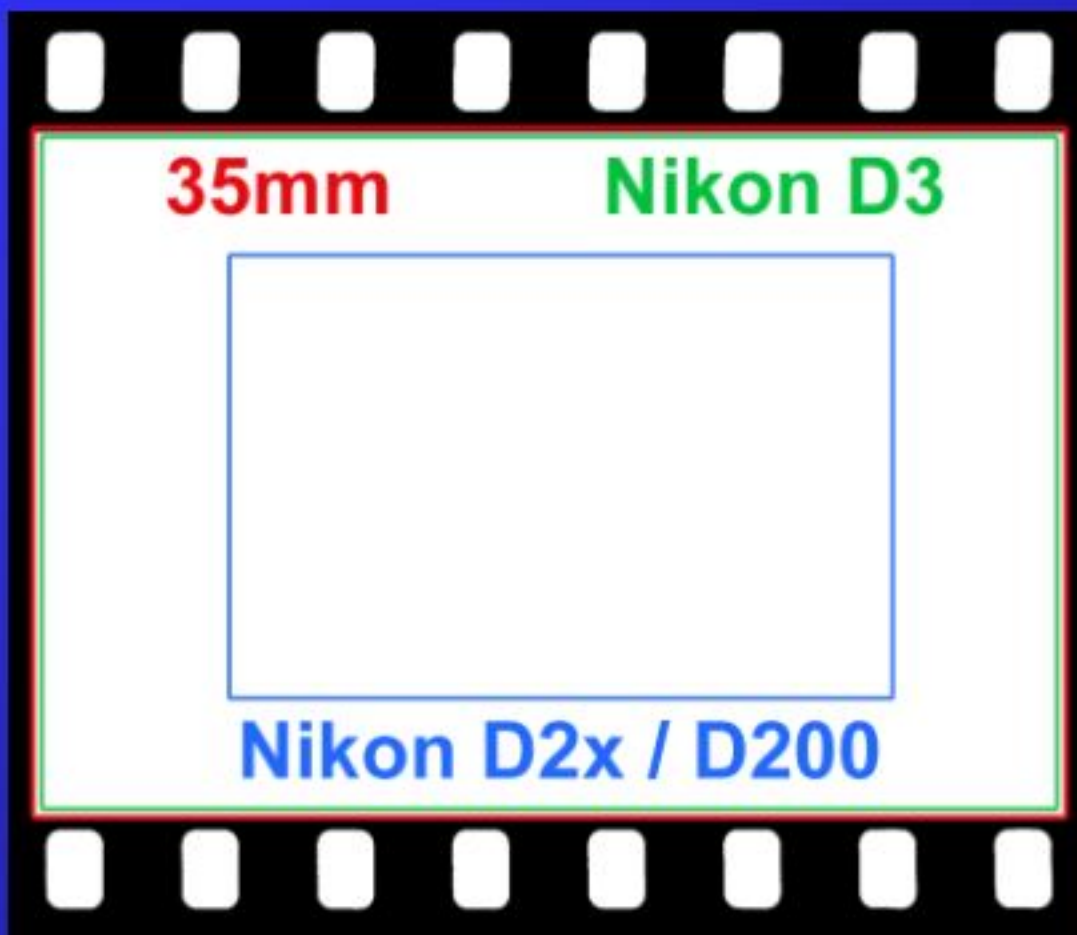
Entrance Pupil Alignment



(Aligned)



Cropping – Digital Sensors





Camera Orientation

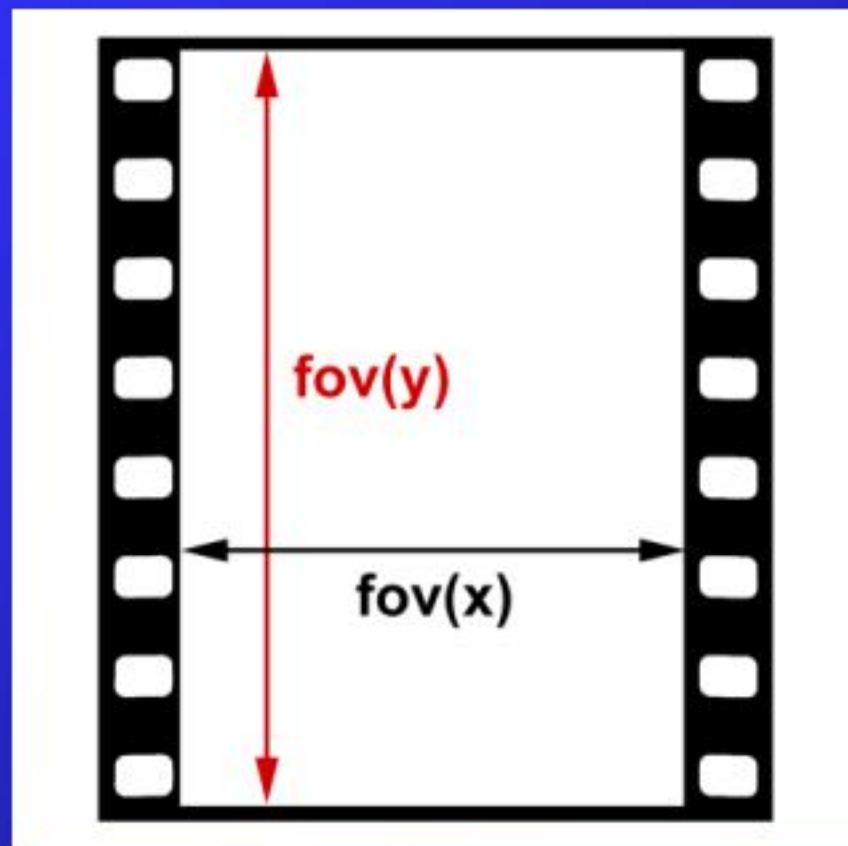
Horizontal
(Normal)

Vertical
(Portrait)





Fields of View – fov





Camera Orientation – fov(y)

Vertical



Horizontal





Fields of View: Images Needed

Focal Length	Fov(y)	Fov(x)	Shots/360°
14mm	104°	82°	6
15mm	100°	78°	8
18mm	90°	68°	8
20mm	84°	63°	9
24mm	73°	54°	10
28mm	65°	47°	12
35mm	54°	38°	15
50mm	39°	27°	18
85mm	24°	18°	36

Rectilinear (non-fisheye) lenses – **35mm format**
Vertical orientation!



VR Photo Slate Book

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VR Photo Slate

www.vrphotography.com

Lens / Camera: _____ Date: _____

Exposure: _____ Location / Subject(s): _____

Shots per 360°: _____
(Rows / shots) Panorama Object

Node: _____ Roll or Disk: _____

Fields of View (Fov): 35mm camera & lenses

Focal length	FovH	FovV	Shots/360°
28mm	84°	54°	8
35mm	63°	42°	8
50mm	47°	31°	8
75mm	32°	21°	8
100mm	25°	16°	8
150mm	17°	11°	8
200mm	13°	8°	8
300mm	9°	6°	8
400mm	7°	5°	8
500mm	6°	4°	8
600mm	5°	4°	8
800mm	4°	3°	8
1000mm	3°	2°	8

Slate Book Instructions

The Slate Book is designed to allow photographers to be productive in the field and to properly expose their VR photos. It is a spiral-bound book that contains a VR Photo Slate, a color calibration chart, and a field of view chart. The book is designed to be used with a 35mm camera and lens. The book is designed to be used with a 35mm camera and lens. The book is designed to be used with a 35mm camera and lens.

Hyperfocal Distances

	35mm	45	55.6	88	135	216	352
11mm	11	1.5	2.4	3.8	5.8	9.2	14.4
15mm	15	2.1	3.2	4.8	7.2	11.2	18
20mm	20	2.8	4.0	6.0	9.0	13.5	22.5
25mm	25	3.5	5.0	7.5	11.2	16.8	28
30mm	30	4.2	6.0	9.0	13.5	20.2	33
40mm	40	5.6	8.0	12.0	18.0	27.0	45
50mm	50	7.0	10.0	15.0	22.5	33.8	56.2
60mm	60	8.4	12.0	18.0	27.0	40.5	67.5
80mm	80	11.2	16.0	24.0	36.0	54.0	90
110mm	110	14.7	21.0	31.5	47.2	70.5	117

↑ Depth of field increases

→ Field of view increases

www.vrphotography.com



Cylindrical Panorama Capture

- ◆ Traditional camera + pan head + stitching





Cylindrical Panorama Capture

- ◆ Parabolic mirror (single shot) + Dewarping





Cylindrical Panorama Capture

- ◆ Parabolic mirror (single shot) + Dewarping



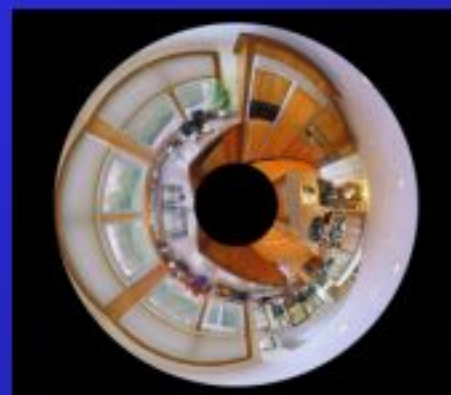
Produces flattened
torus image





Cylindrical Panorama Capture

- ◆ Parabolic mirror (single shot) + Dewarping



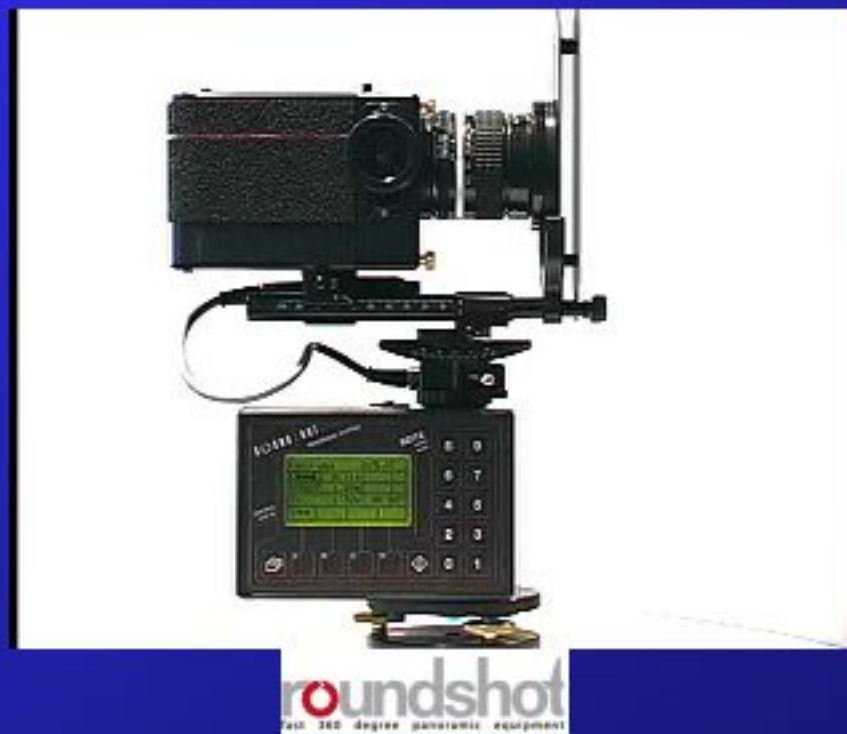
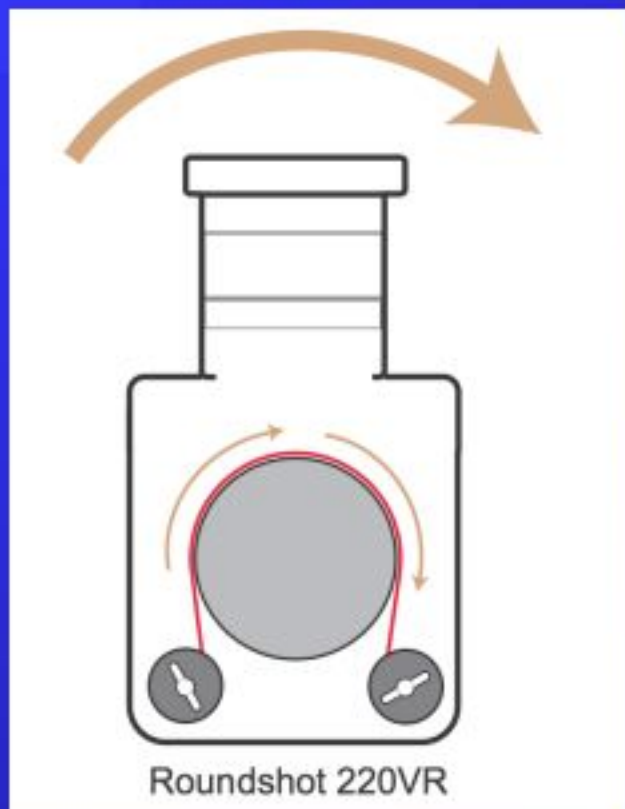
**PhotoWarp
software**





Cylindrical Panorama Capture

- ◆ Slit-scan full rotation camera





Fov(y) - Cylindrical vs. Cubic

Cylindrical

Cubic

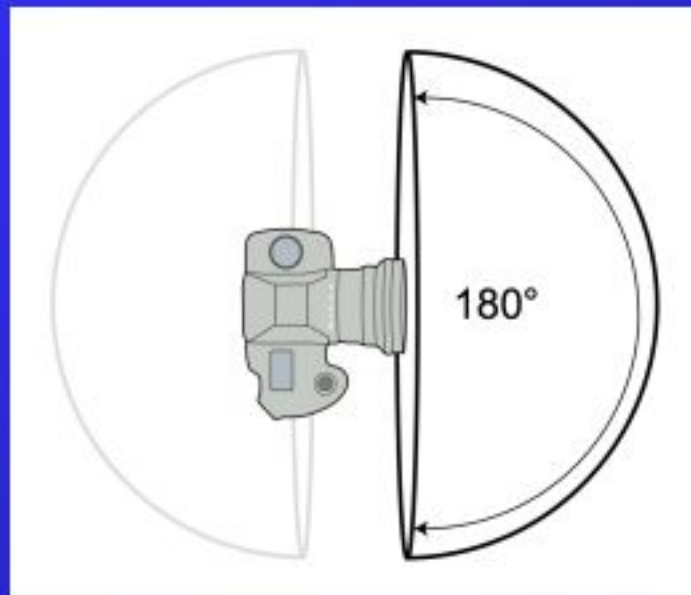




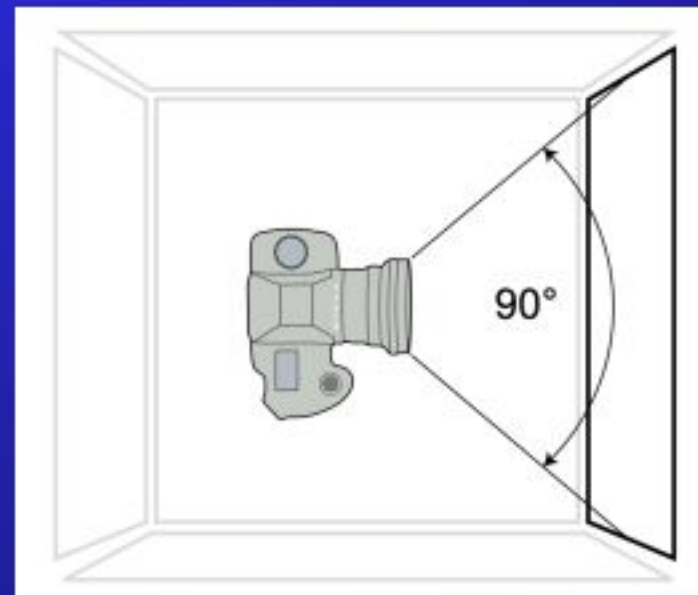
Panoramic Formats

- ◆ *Vertical* views – unlimited fov(y)

Spherical

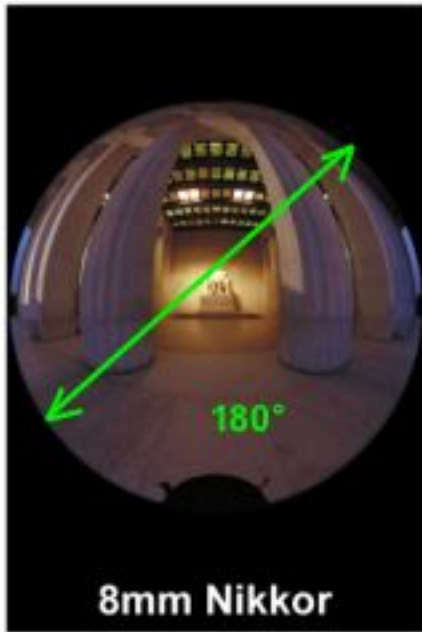


Cubic



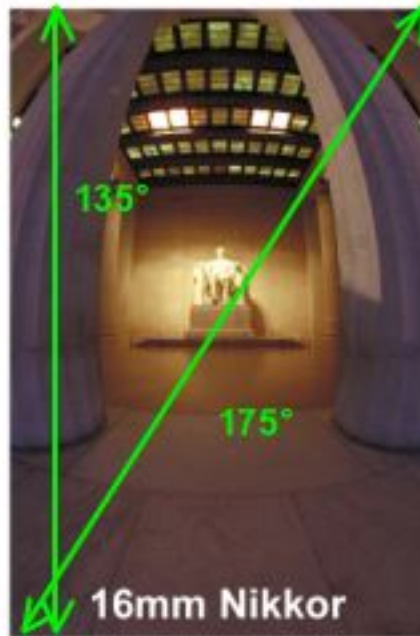
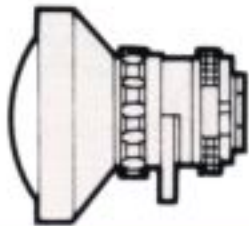


Lenses for 360°x180° Capture



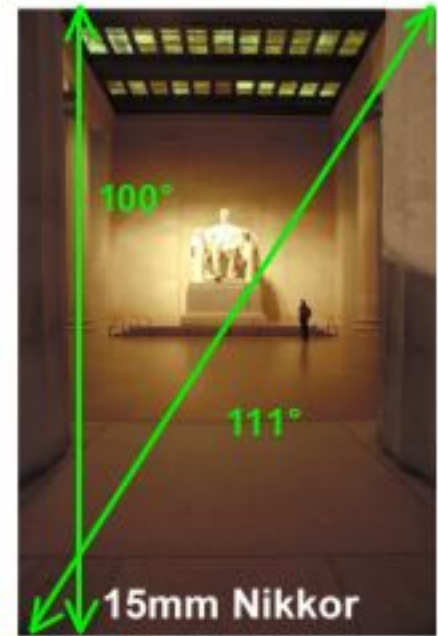
8mm Nikkor

True Fisheye



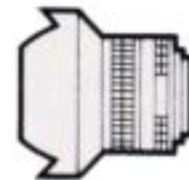
16mm Nikkor

Full Frame Fisheye



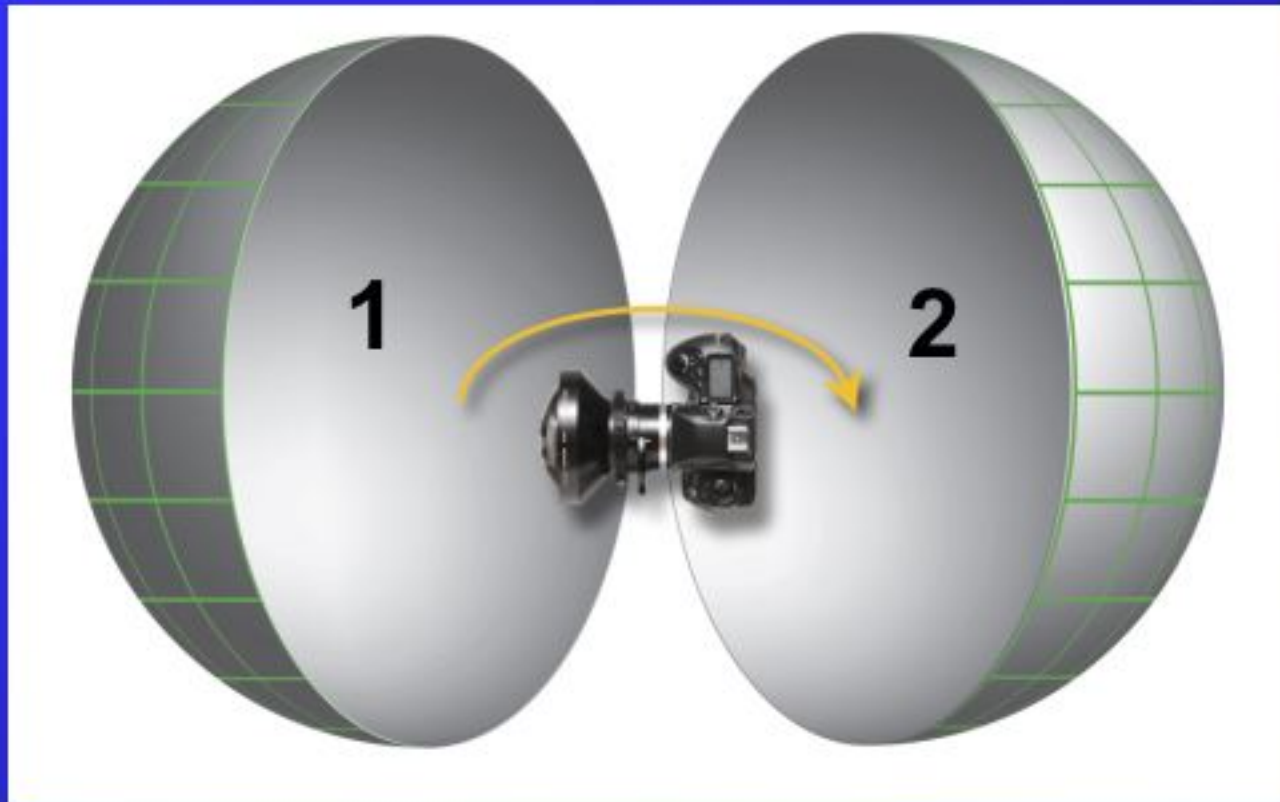
15mm Nikkor

Rectilinear





Spherical Panoramas



Two or More (True) Fisheye Images - IPIX

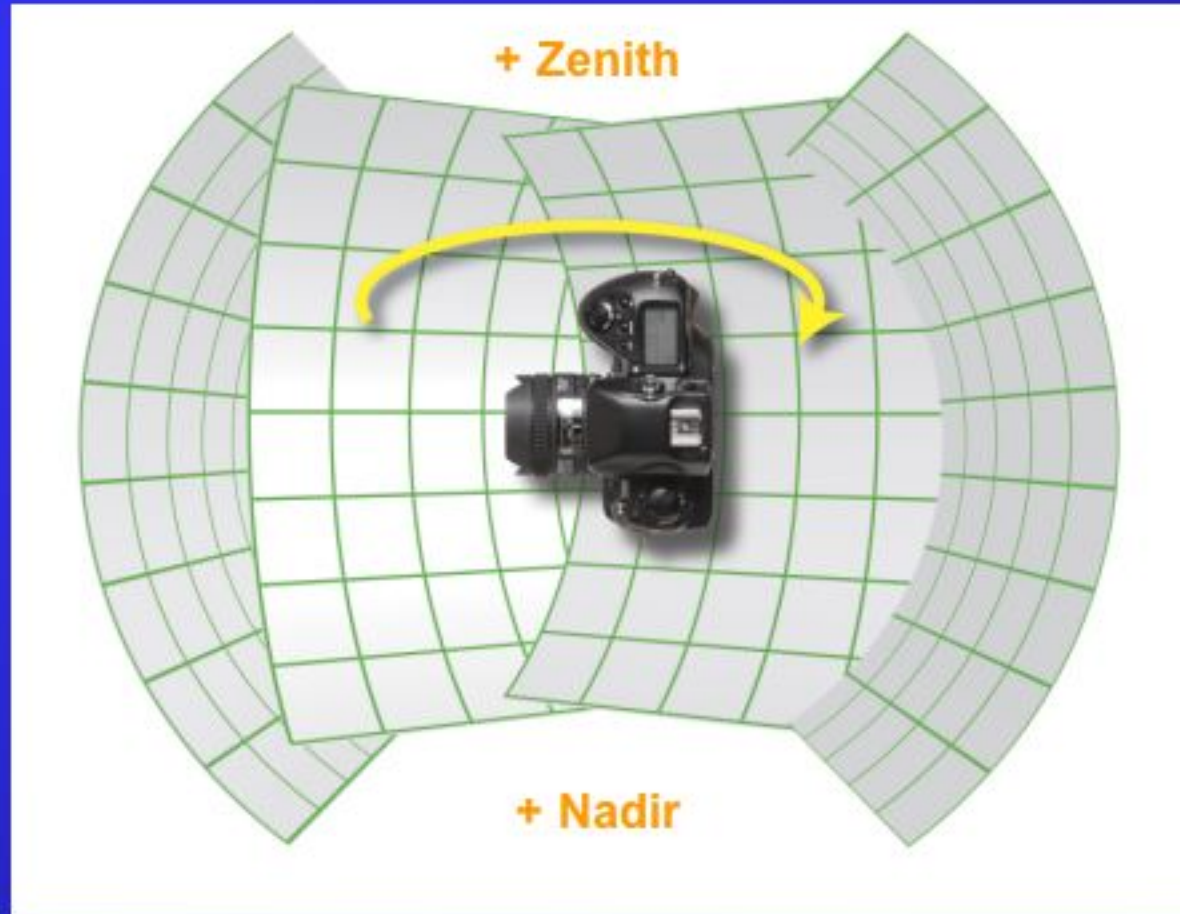


Scanning Digital Cameras





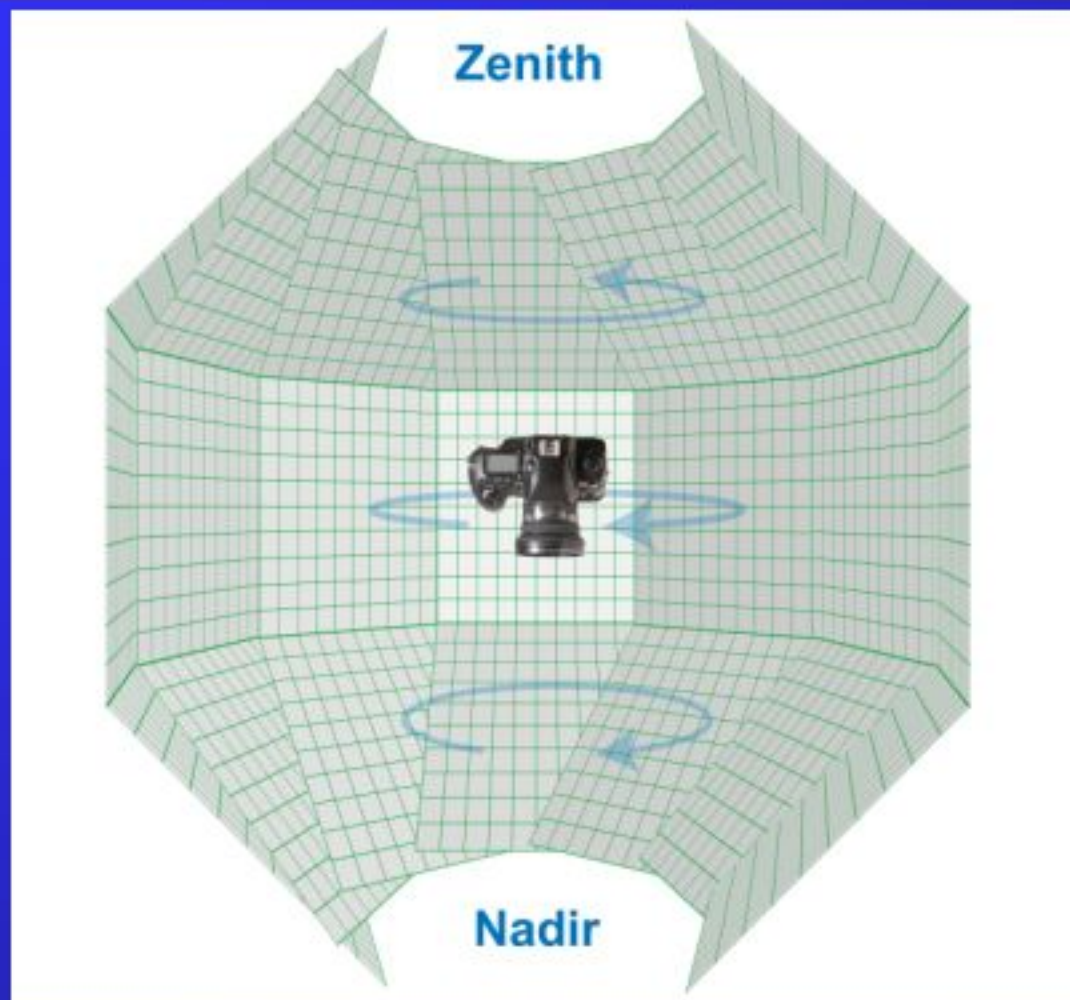
Spherical / Cubic Panoramas



Stitched Full Frame Fisheye Images



Multi-Row Panoramas





Multi-Row Image Capture



Kaidan QuickPan Pro



Multi-Row Image Capture



Lens: Nikkor 18mm

Exp: 1/125 sec @ f/11

Pan: 3 rows - 12 exp. ea.

Date: 8/20/04



Multi-Row Image Capture





Multi-Row Stitching





Multi-Row Stitching





Create VR Panoramic Movie





Stitching Applications

- ◆ Autodesk Stitcher
www.realviz.com
- ◆ PTGUI
www.ptgui.com
- ◆ Photoshop CS4 Extended (3D) & PhotoMerge
www.russellbrown.com

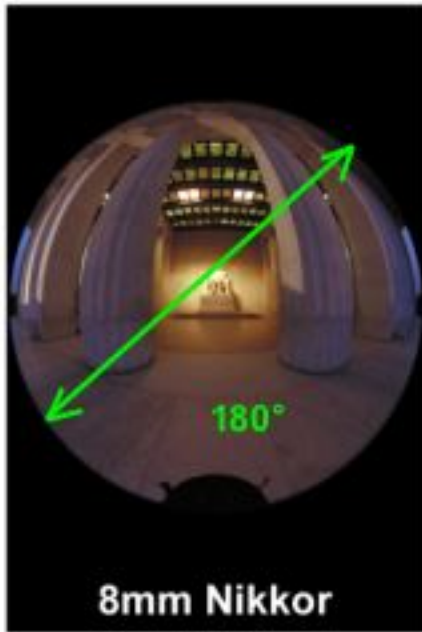


Choosing Your Tools

- ◆ Choose stitching/assembly software first!
- ◆ Do you need full 360°x180° vs. cylindrical?
- ◆ Then, choose photo tools:
 - ◆ Camera & lens
 - ◆ Digital vs. film
 - ◆ Grip, camera support, pan head
 - ◆ Other post production needs (retouching, etc.)
- ◆ Other limitations
 - ◆ Lighting needs
 - ◆ Location requirements

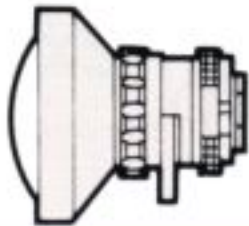


Choosing Your Tools



8mm Nikkor

True Fisheye



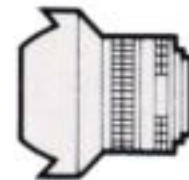
16mm Nikkor

Full Frame Fisheye



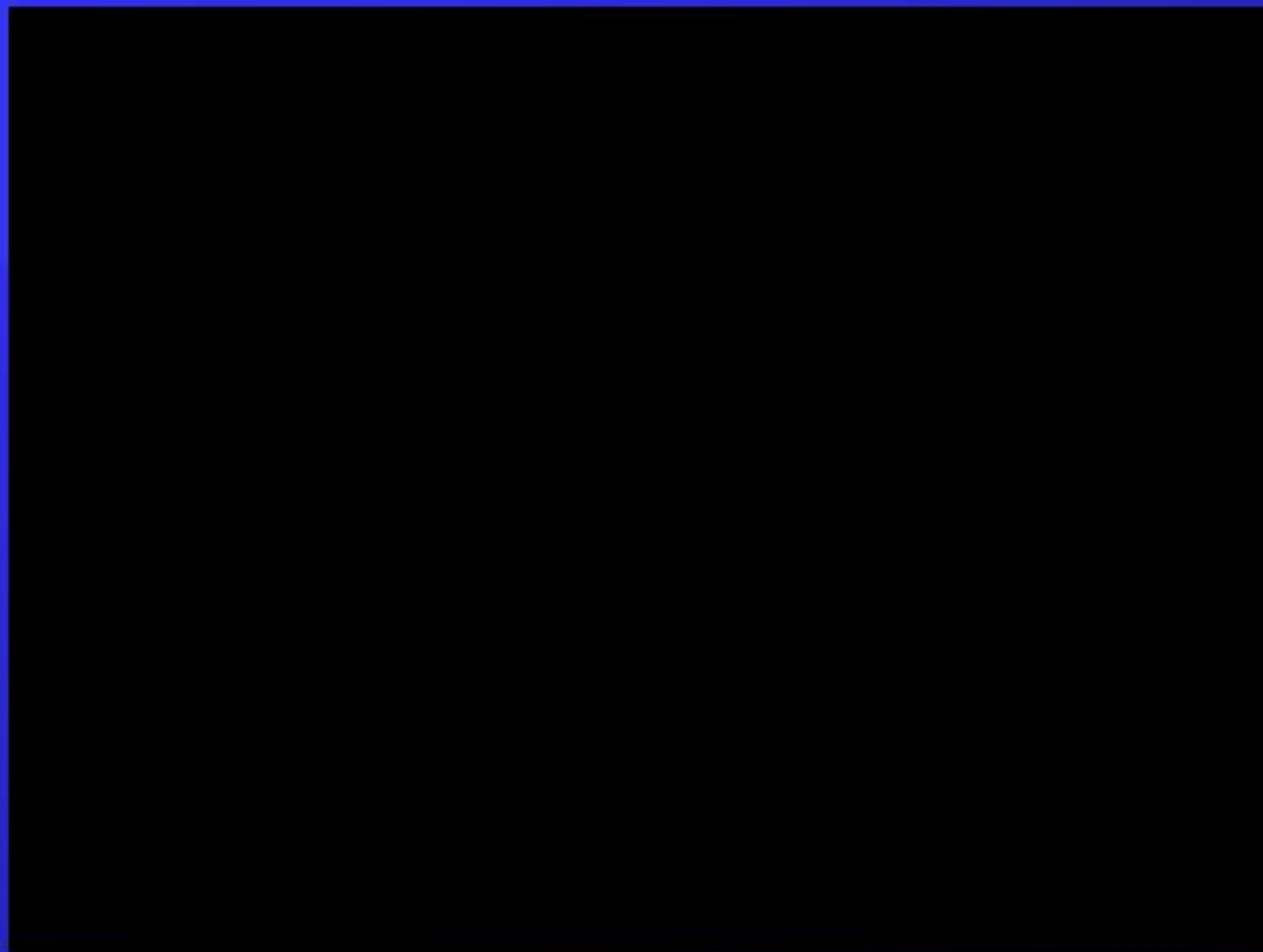
15mm Nikkor

Rectilinear





Shooting On Location





Shoot Results: QTVR



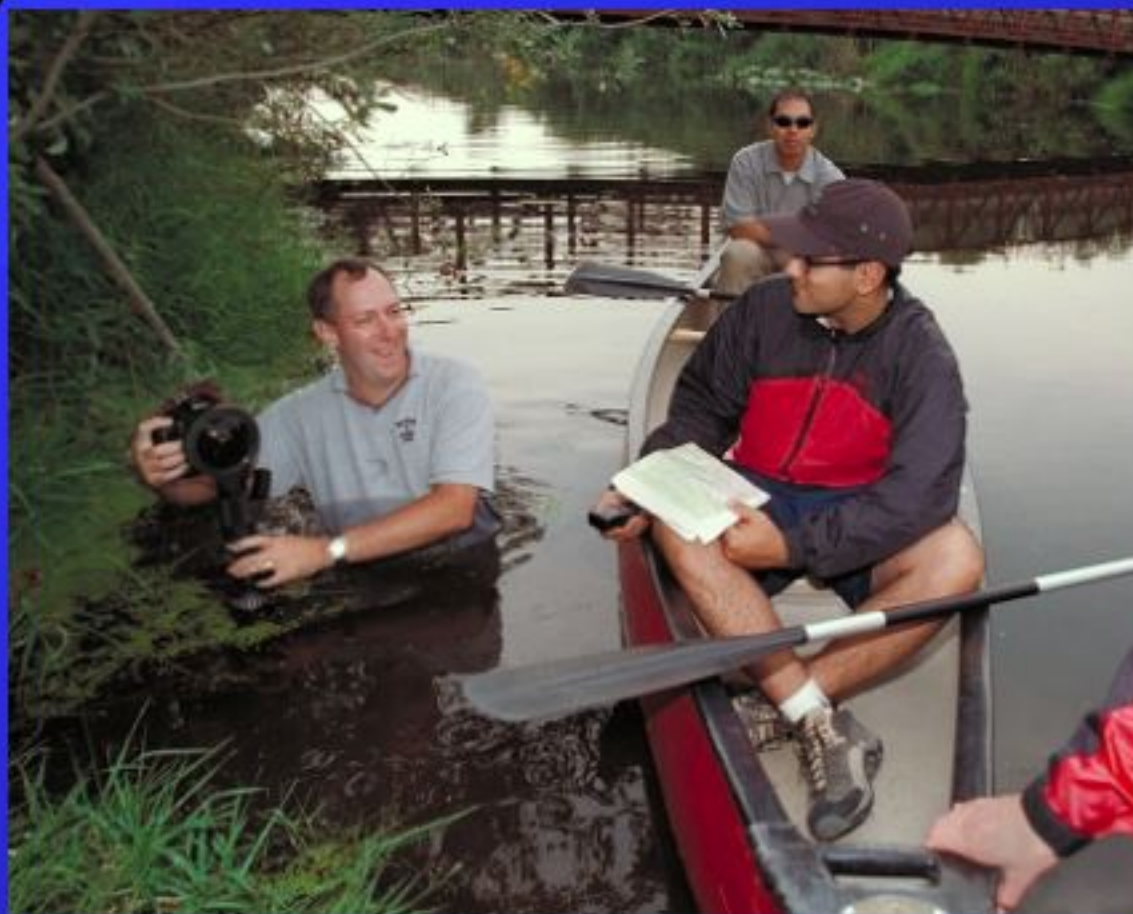


Shoot Results: IPIX (spherical)





Location Photography





Location Lighting



6:06 am

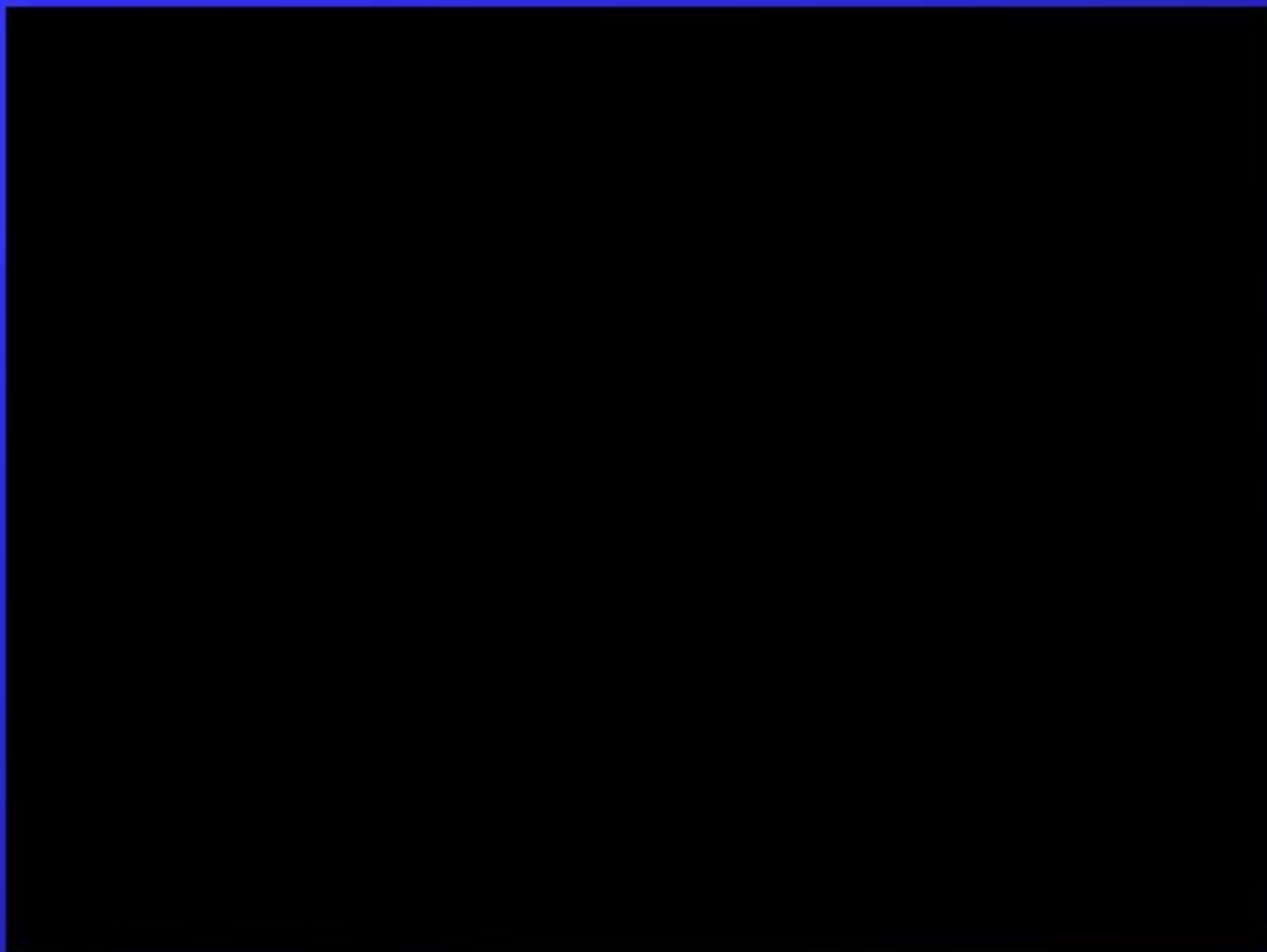


Subject Interest





Yosemite - Half Dome





Virtual Reality Photography



Scott Highton
Author, Virtual Reality Photography

www.vrphotography.com

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