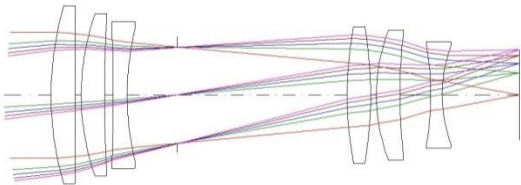
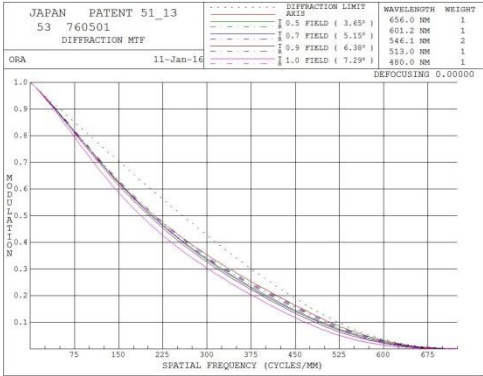
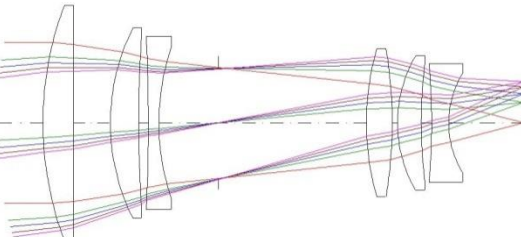
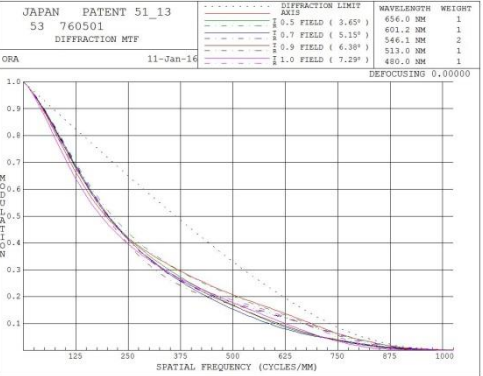
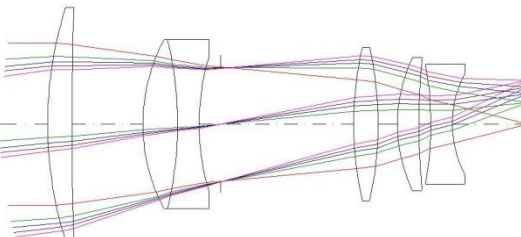

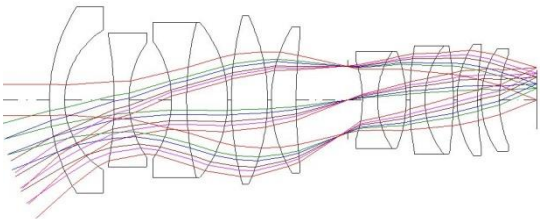
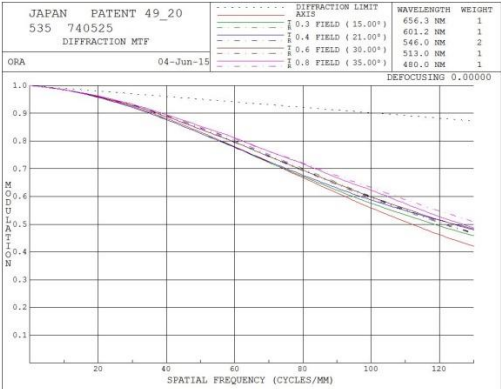
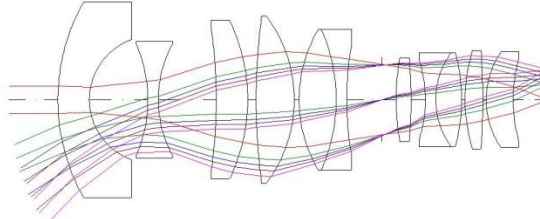
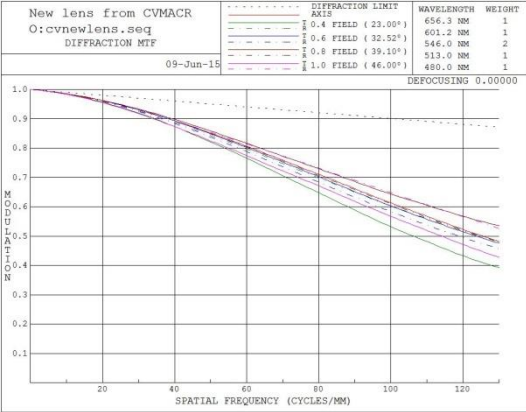
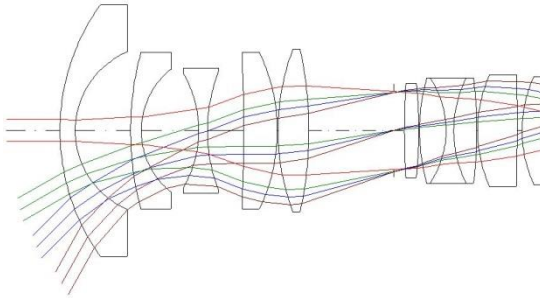
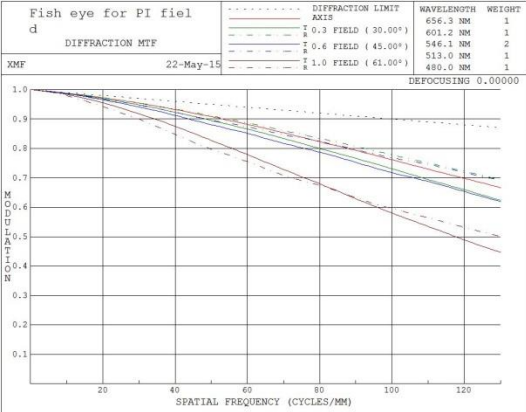
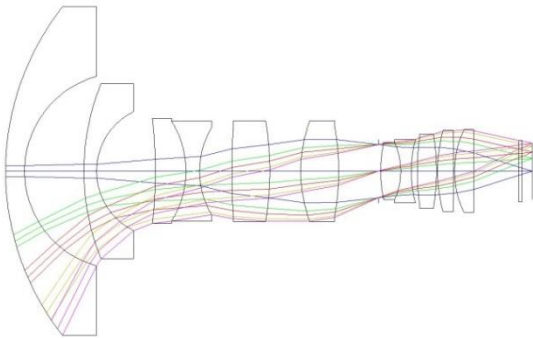
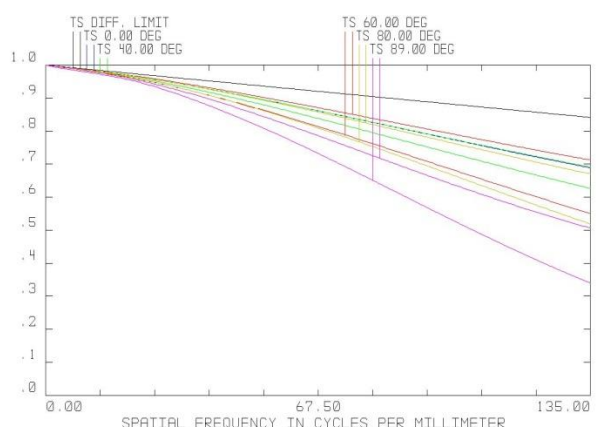


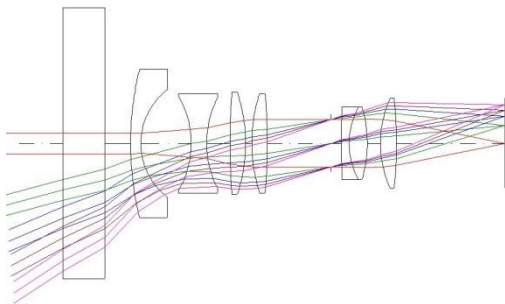
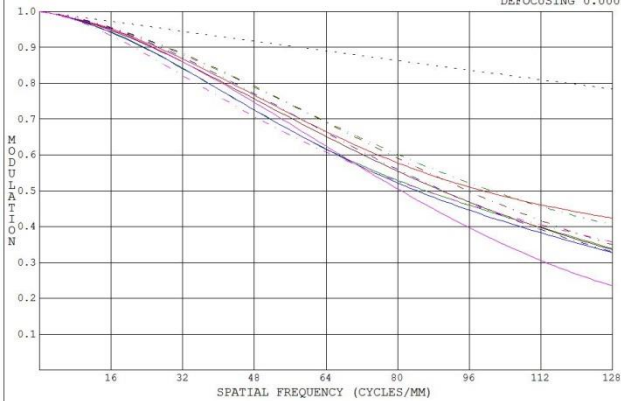
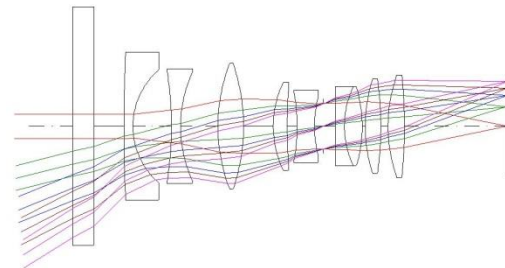
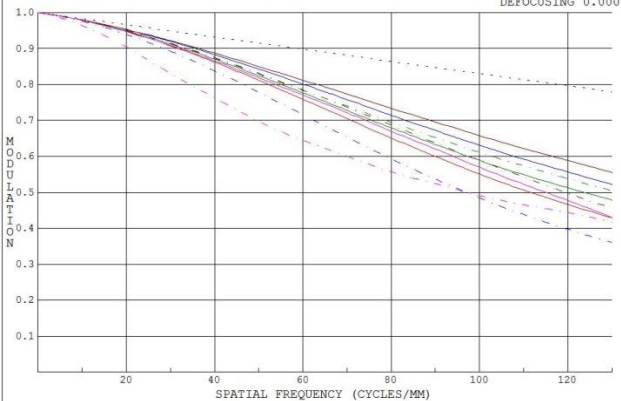
Lens Design Archive

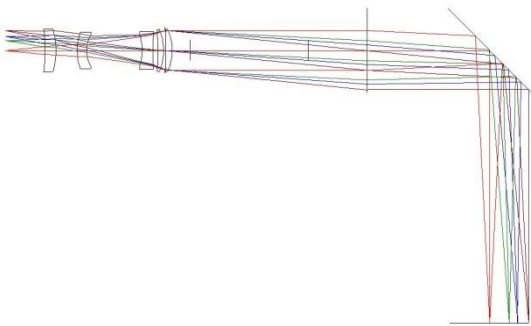
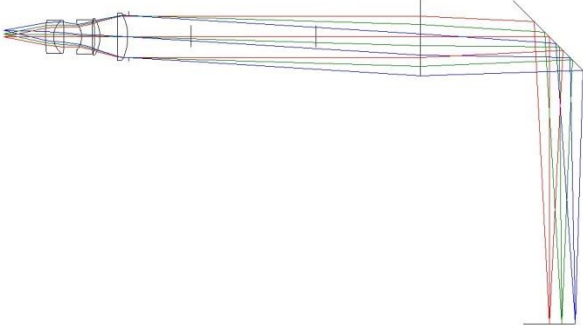
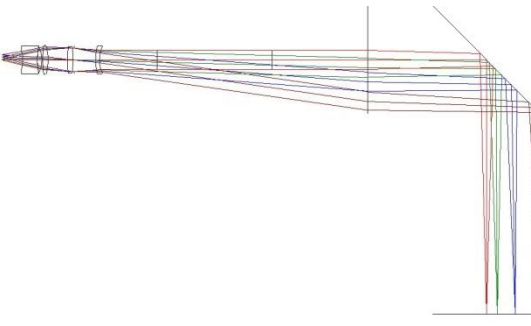
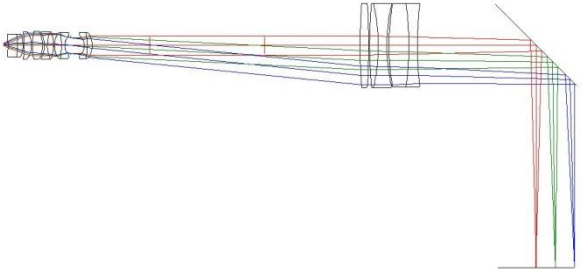
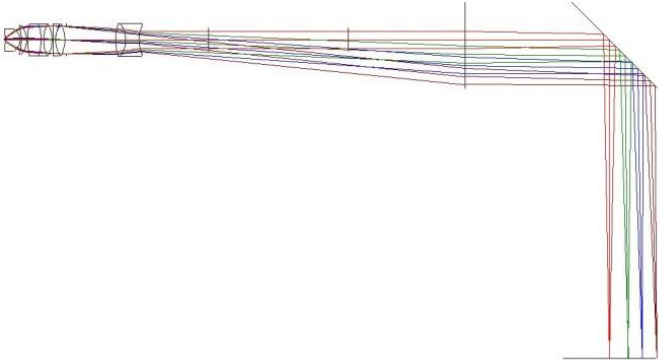
Designer: Wubin Pang • (919)641-0067 • wp48@duke.edu

NAME	Petzval portrait lenses	
wavelengths	480-656nm visible	
EFFL	30mm	
F/#	2.8/2.0	
FOV	15°	
Layout & MTF CodeV model	 <p>F/#=2.8</p>	
	 <p>F/#=2</p>	
	 <p>F/#=2</p>	

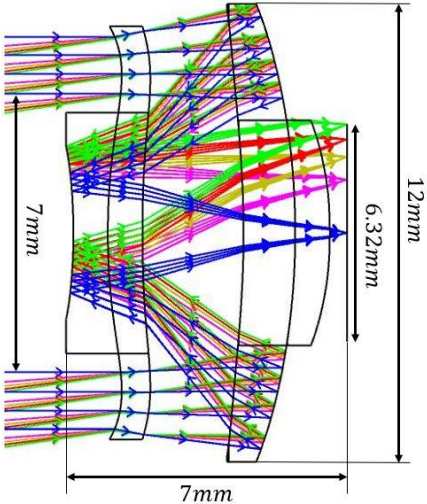
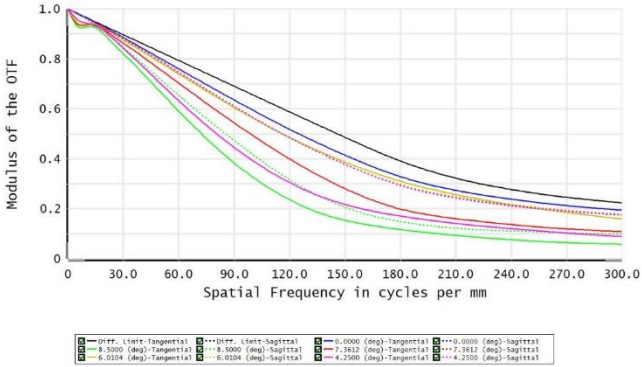
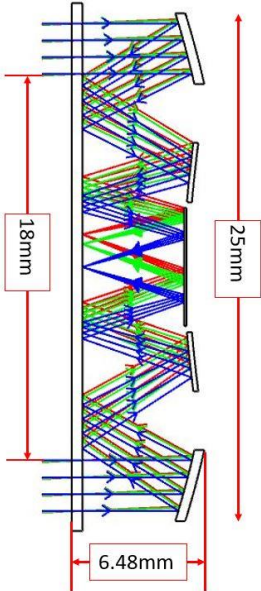
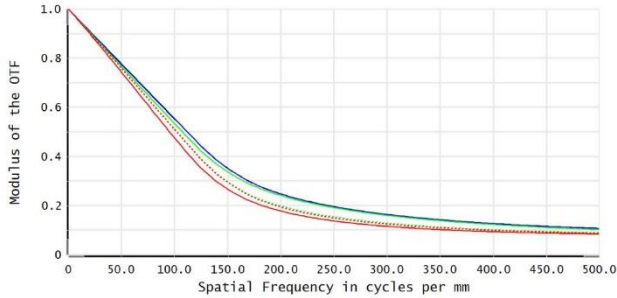
NAME	Wide_angle_lenses	
wavelengths	480-656nm visible	
EFFL	5.8mm/5.45mm/4.0mm	
F/#	1.4/2.0	
FOV	84° /92° /122°	
Elements number	9	
Layout&MTF CodeV model	 <p>84° F/#=1.4 135 lp/mm</p>	
	 <p>92° F/#=1.4 135 lp/mm</p>	
	 <p>122° F/#=1.4 135lp/mm</p>	

NAME	Fisheye_lens																									
wavelengths	480-656nm visible																									
EFFL	1.7mm																									
F/#	1.6																									
FOV	180°																									
Elements number	9																									
Layout&MTF Zemax model	<div><p>135 lp/mm</p></div>	<div><table><caption>MTF Plot Data (Approximate)</caption><tr><th>Spatial Frequency (cycles/mm)</th><th>MTF (0.00 DEG)</th><th>MTF (40.00 DEG)</th><th>MTF (60.00 DEG)</th><th>MTF (80.00 DEG)</th><th>MTF (89.00 DEG)</th></tr><tr><td>0.00</td><td>1.00</td><td>1.00</td><td>1.00</td><td>1.00</td><td>1.00</td></tr><tr><td>67.50</td><td>0.95</td><td>0.85</td><td>0.75</td><td>0.65</td><td>0.55</td></tr><tr><td>135.00</td><td>0.85</td><td>0.70</td><td>0.55</td><td>0.45</td><td>0.35</td></tr></table></div>	Spatial Frequency (cycles/mm)	MTF (0.00 DEG)	MTF (40.00 DEG)	MTF (60.00 DEG)	MTF (80.00 DEG)	MTF (89.00 DEG)	0.00	1.00	1.00	1.00	1.00	1.00	67.50	0.95	0.85	0.75	0.65	0.55	135.00	0.85	0.70	0.55	0.45	0.35
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67.50	0.95	0.85	0.75	0.65	0.55																					
135.00	0.85	0.70	0.55	0.45	0.35																					

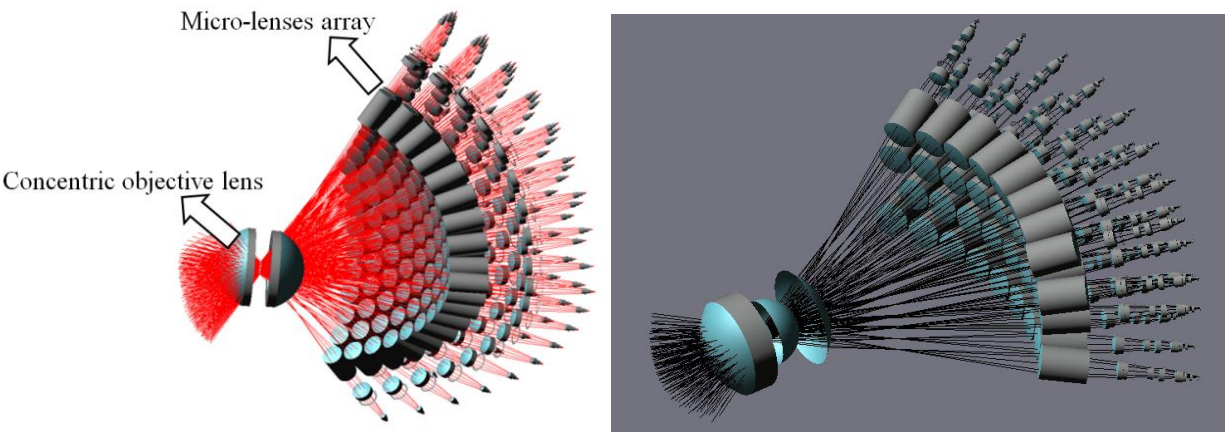
NAME	Underwater Lenses																									
wavelengths	434-656nm visible																									
EFFL	10mm																									
F/#	2.5																									
FOV	66°																									
Elements number	6																									
Layout&MTF CodeV model	<div><p>135 lp/mm</p></div>	<div><table><tr><td>JAPAN PATENT 51_23</td><td>DIFFRACTION LIMIT</td><td>WAVELENGTH</td><td>WEIGHT</td></tr><tr><td>348 760716</td><td>AXIS</td><td>656.0 NM</td><td>1</td></tr><tr><td>DIFFRACTION MTF</td><td>0.4 FIELD (15.00°)</td><td>579.0 NM</td><td>1</td></tr><tr><td></td><td>0.7 FIELD (23.00°)</td><td>532.0 NM</td><td>2</td></tr><tr><td></td><td>0.8 FIELD (28.00°)</td><td>483.0 NM</td><td>1</td></tr><tr><td></td><td>1.0 FIELD (33.00°)</td><td>434.0 NM</td><td>1</td></tr></table><div>ORA11-Jan-16</div><div>DEFOCUSING 0.00000</div></div>	JAPAN PATENT 51_23	DIFFRACTION LIMIT	WAVELENGTH	WEIGHT	348 760716	AXIS	656.0 NM	1	DIFFRACTION MTF	0.4 FIELD (15.00°)	579.0 NM	1		0.7 FIELD (23.00°)	532.0 NM	2		0.8 FIELD (28.00°)	483.0 NM	1		1.0 FIELD (33.00°)	434.0 NM	1
	JAPAN PATENT 51_23	DIFFRACTION LIMIT	WAVELENGTH	WEIGHT																						
348 760716	AXIS	656.0 NM	1																							
DIFFRACTION MTF	0.4 FIELD (15.00°)	579.0 NM	1																							
	0.7 FIELD (23.00°)	532.0 NM	2																							
	0.8 FIELD (28.00°)	483.0 NM	1																							
	1.0 FIELD (33.00°)	434.0 NM	1																							
<div><p>135 lp/mm</p></div>	<div><table><tr><td>USA PATENT 3012476</td><td>DIFFRACTION LIMIT</td><td>WAVELENGTH</td><td>WEIGHT</td></tr><tr><td>ZIMMERMAN</td><td>AXIS</td><td>656.0 NM</td><td>1</td></tr><tr><td>DIFFRACTION MTF</td><td>0.4 FIELD (14.00°)</td><td>587.6 NM</td><td>1</td></tr><tr><td></td><td>0.6 FIELD (22.00°)</td><td>532.0 NM</td><td>2</td></tr><tr><td></td><td>0.8 FIELD (27.20°)</td><td>486.1 NM</td><td>1</td></tr><tr><td></td><td>1.0 FIELD (32.00°)</td><td>435.0 NM</td><td>1</td></tr></table><div>ORA11-Jan-16</div><div>DEFOCUSING 0.00000</div></div>	USA PATENT 3012476	DIFFRACTION LIMIT	WAVELENGTH	WEIGHT	ZIMMERMAN	AXIS	656.0 NM	1	DIFFRACTION MTF	0.4 FIELD (14.00°)	587.6 NM	1		0.6 FIELD (22.00°)	532.0 NM	2		0.8 FIELD (27.20°)	486.1 NM	1		1.0 FIELD (32.00°)	435.0 NM	1	
USA PATENT 3012476	DIFFRACTION LIMIT	WAVELENGTH	WEIGHT																							
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	0.8 FIELD (27.20°)	486.1 NM	1																							
	1.0 FIELD (32.00°)	435.0 NM	1																							

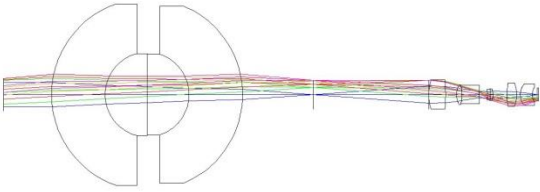
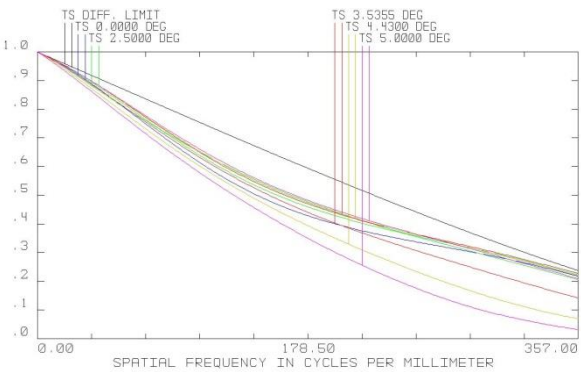
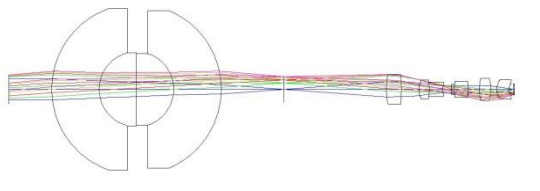
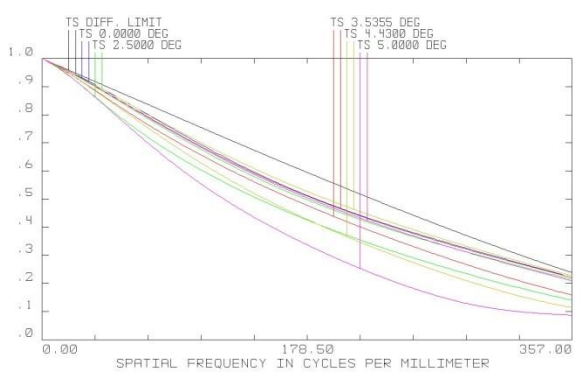
NAME	Microscope Objectives	
wavelengths	450-680nm visible	
EFFL	100/50/20/10/5mm	
NA	0.1/0.2/0.25/0.5/0.75	
FOV(height)	10/5/2/1/0.5mm	
Elements number	5-6	
Layout CodeV model		
	2X	4X
		
	10X	20X
		
	40X	

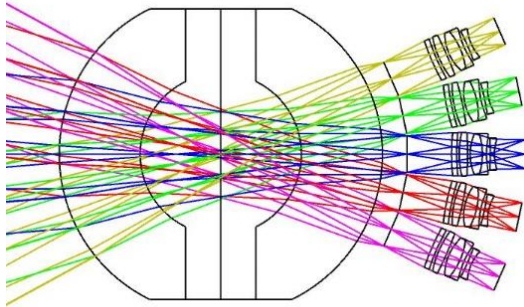
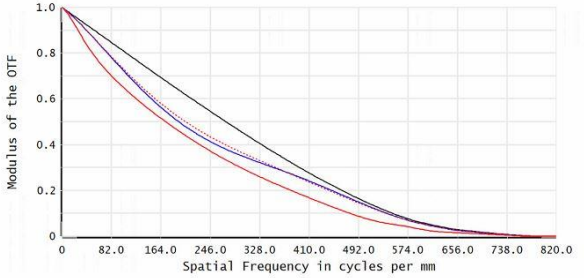
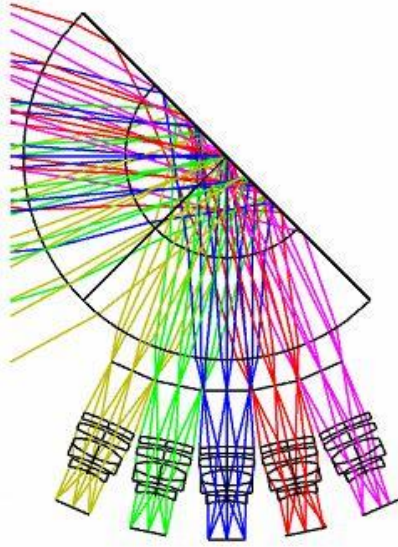
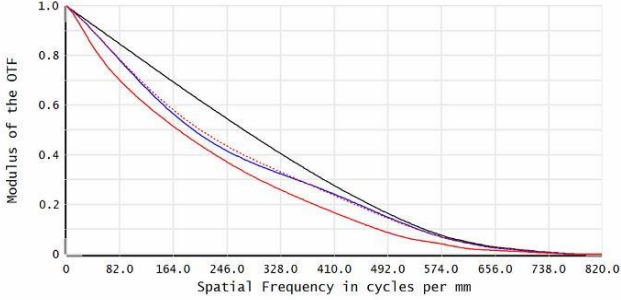
Ultrathin lenses

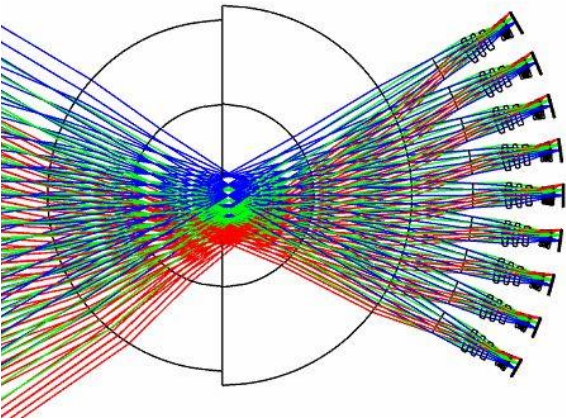
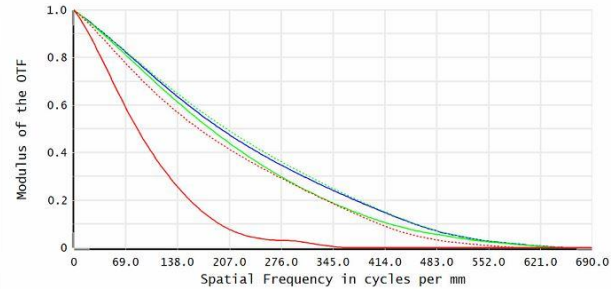
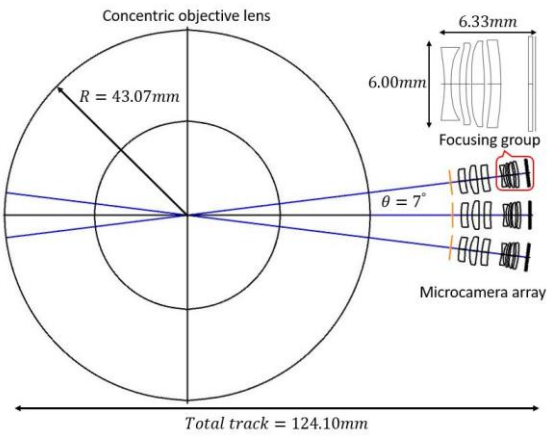
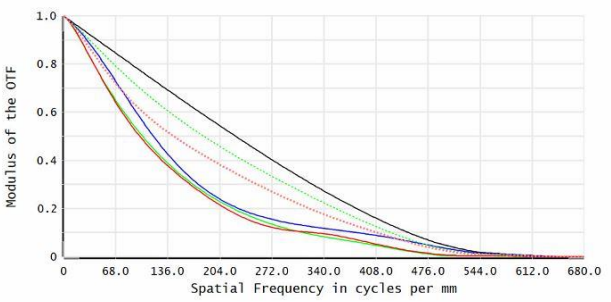
NAME	Ultrathin Lenses	
wavelengths	434-656nm visible	
EFFL	20mm & 30mm	
F/#	2 & 1.73	
FOV	17° & 5°	
Layout&MTF Zemax model		
		

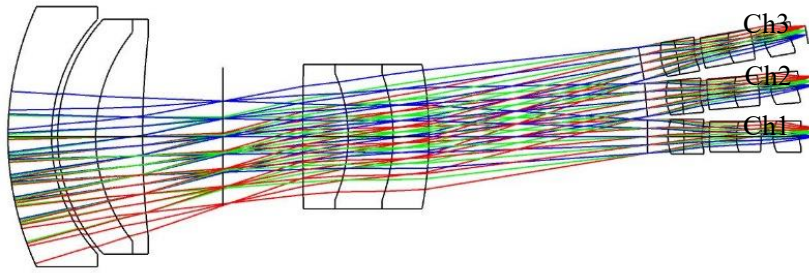
MULTISCALE Lenses



NAME	Monocentric Multiscale lenses of Keplerian style	
wavelengths	434-656nm visible	
EFFL	31mm	
F/#	3	
MFOV	10° (FoV of a single channel)	
Layout&MTF Zemax& CodeV model	 357 lp/mm	
	 357 lp/mm	

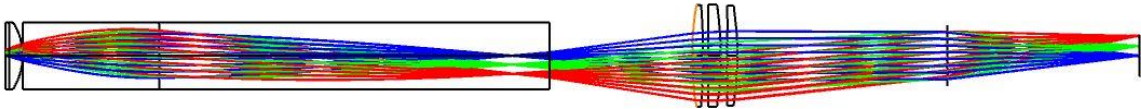
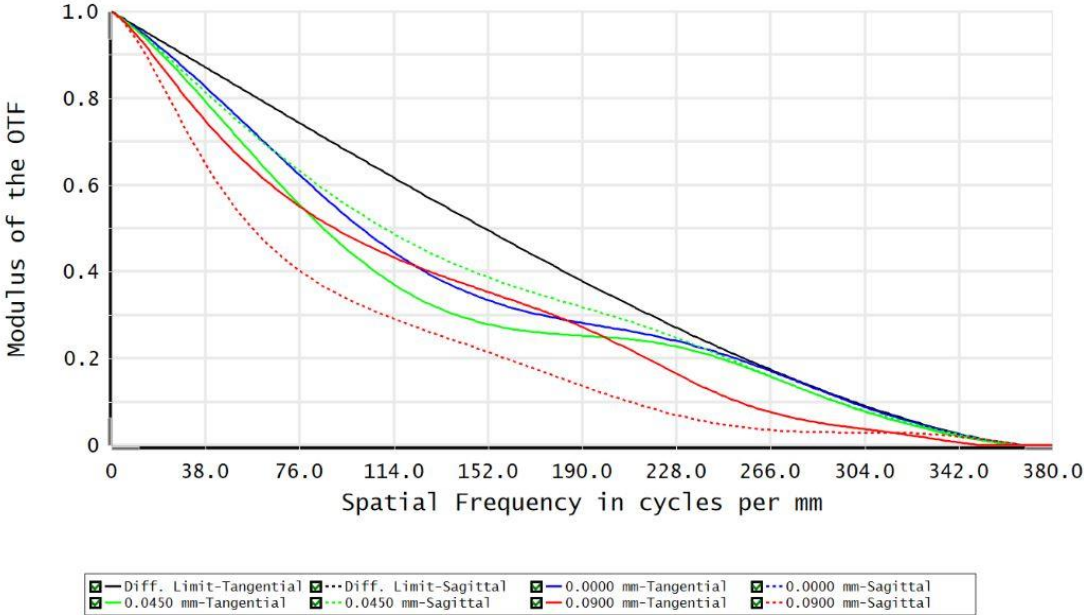
NAME	Monocentric Multiscale lenses of Galilean style	
wavelengths	434-656nm visible	
EFFL	34mm	
F/#	2.5	
MFOV	9.6°	
Layout&MT F Zemax model		
		

NAME	Multiscale Lenses with VCM based focusing	
wavelengths	434-656nm visible	
EFFL	50mm/45mm	
F/#	2.5	
MFOV	9.6°	
Layout&MT F Zemax model		
		

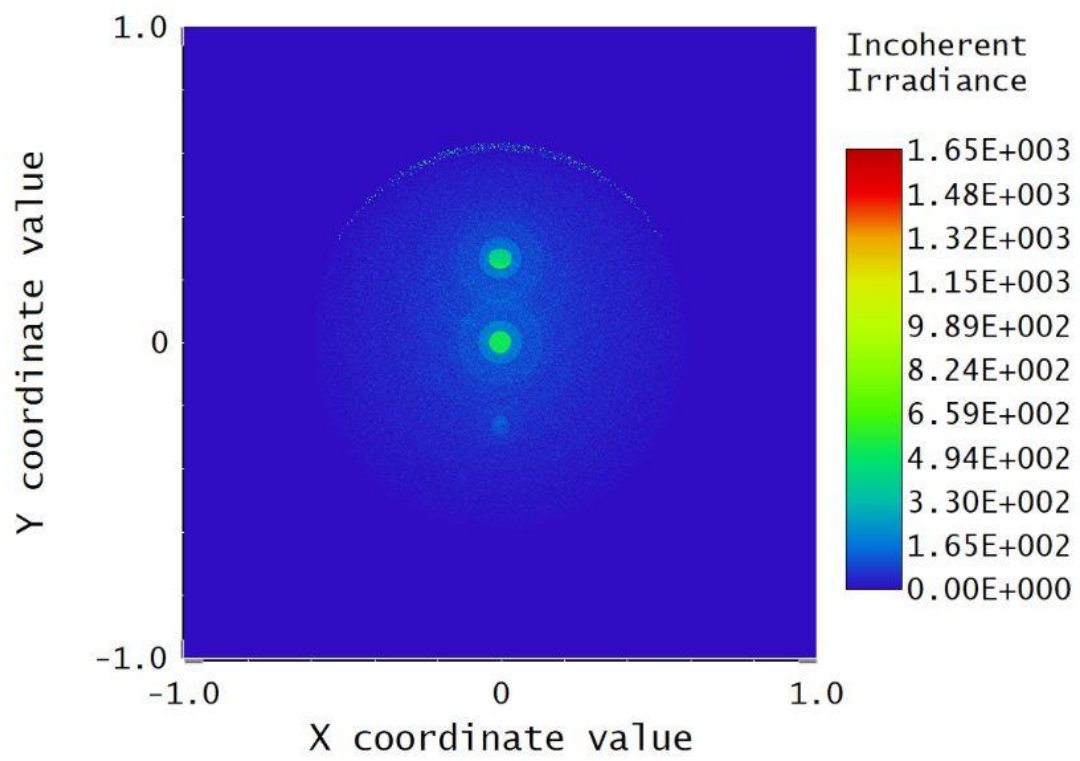
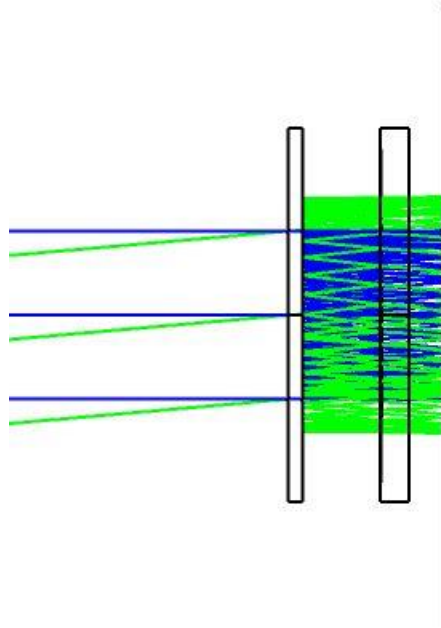


NAME	Telephoto Multiscale lenses
wavelengths	434-656nm visible
EFFL	150mm
F/#	3
MFOV	2°
MTF Zemax model	<p>Ch1</p> <p>Ch2</p> <p>Ch3</p>

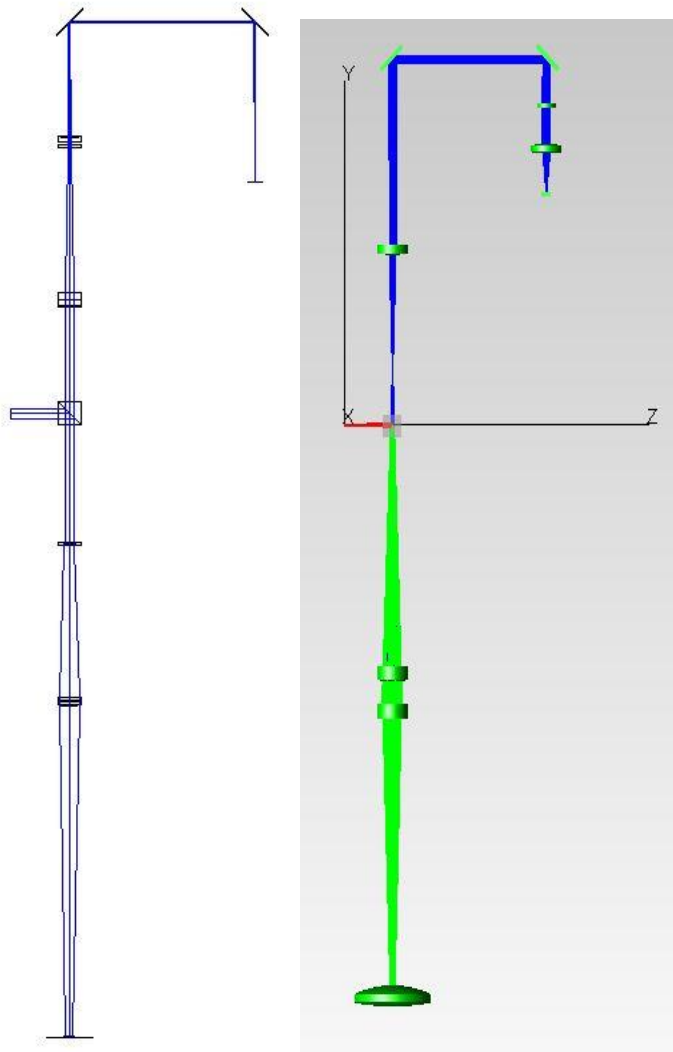
Grin Lens

NAME	Grin lens for biological tissue probe
wavelengths	810nm
NA	0.5
FoV	180μm
Layout&MTF Zemax model	<div></div> <div></div>

Fabry Perot Cavity



LENS CENTERING TOOL



Wavelengths	635nm solid state red laser
Magnification	8X

Zemax and lightTools model