foto-foXXus 5^{X}

extending Depth of Field

Applications:

- **Machine Vision**
- **Photography**
- **Cinematography**

patent pending

Features:

- **5^{X} extending the Depth of Field of objectives**
- **Image of near and far objects with the same sharpness**
- **Compatibility with popular objectives**

Specifications

Description	Optics extending the Depth of Field (DoF) of objectives: • sharp imaging with moderate contrast • afocal, to be located ahead of the objective • imaging modes with extended DoF: ▪ "moderate"  moderate continuous object field ▪ "broad"  broad continuous object field ▪ "spaced-apart"  near and far objects simultaneously	
DoF extension factor	5^{X}	
Spectral band	425 – 675 nm BBAR (*visible*)	
Field of view	±12°	
Adjustment Ring	Switching between the above given imaging modes	
	foto-foXXus 5^{X} @F50/2.8 [foto-foXXus_6_D28(F/2.8)]	**foto-foXXus 5^{X} @70-200/2.8**
Clear Aperture	28 mm	80 mm
Optimal objective focal length	50 mm	70 – 200 mm
Mounting	External thread M30.5 x 0.5 Adapters: M30.5 x 0.5 (int) -> M37.5 x 0.5 (ext) M30.5 x 0.5 (int) -> M58 x 0.75 (ext)	External thread M 77 x 0.75
Filter thread	M 37.5 x 0.5 (int)	M 82 x 0.75 (int)
Diameter / Length	56 mm / 34.5 mm	110 mm / 43.2 mm
Weight	0.2 kg	0.35 kg

Specifications are subject to change without notice

Examples:

Objective F50 + foto-foXXus 5^{X} @F50/2.8

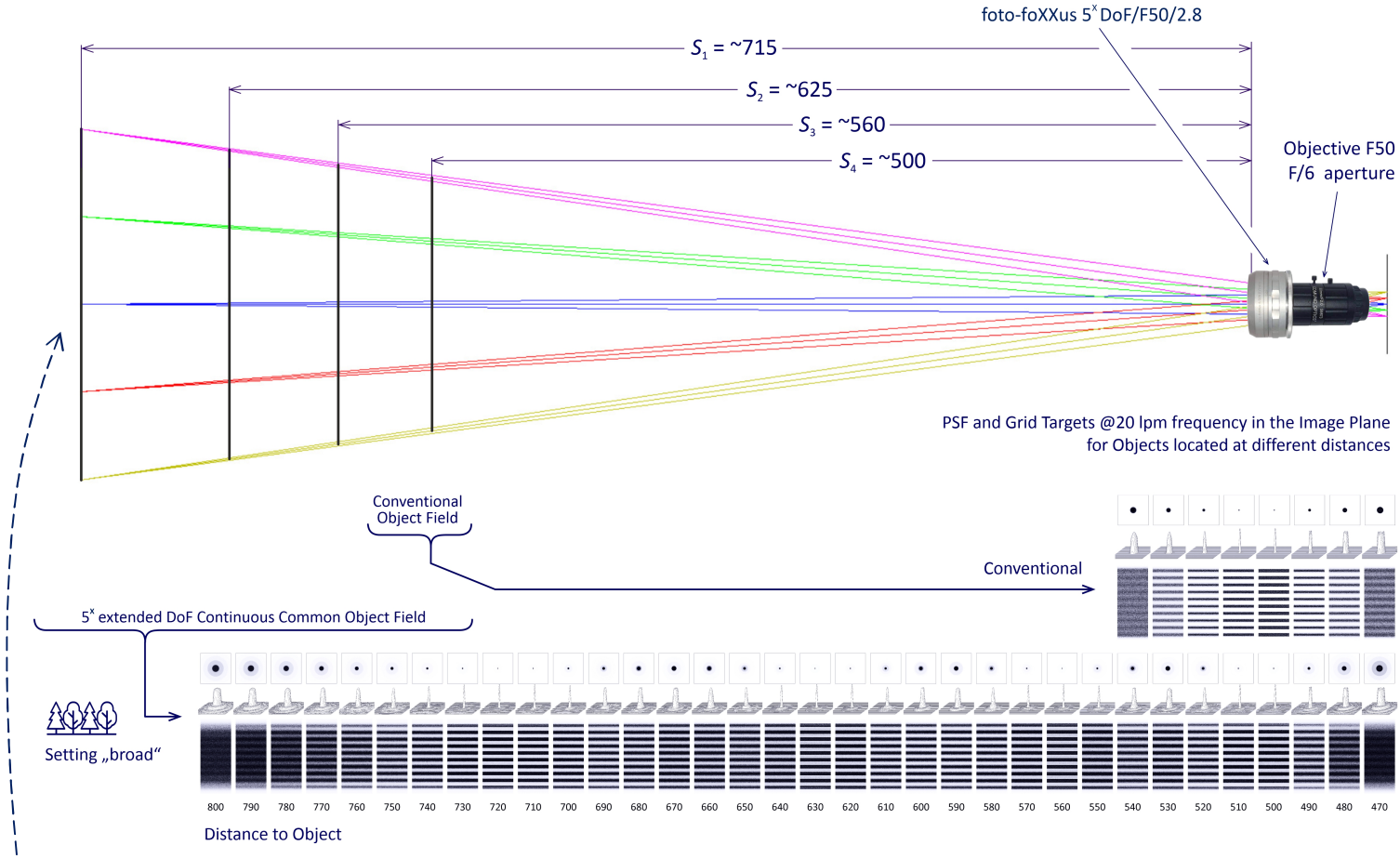
Objective F70-200 + foto-foXXus 5^{X} @70-200/2.8

Extending Depth of Field never was so easy !

Imaging example

optical system: foto-foXXus 5^X DoF/F50/2.8 + EO 59873 (F50) with F/6 aperture

PSF and Grid Target @ 20 lpm frequency in the Image Plane for Objects at different distances, modelling using optical design software



Distances to the Objects optically conjugate to the camera sensor (film), mm

foto-foXXus 5^X @F50/2.8			
S_4 (near)	S_3	S_2	S_1 (far)
300	320	340	365
400	435	475	525
500	560	625	715
600	685	785	935
800	955	1 165	1 530
1 000	1 255	1 640	2 470
1 250	1 680	2 440	4 865
1 500	2 155	3 600	13 000
1 600	2 365	4 240	30 000
1 700	2 580	5 000	∞

foto-foXXus 5^X @70-200/2.8			
S_4 (near)	S_3	S_2	S_1 (far)
1 000	1 040	1 085	1 135
1 500	1 600	1 700	1 820
2 000	2 170	2 370	2 610
2 500	2 770	3 100	3 520
3 000	3 390	3 910	4 600
4 000	4 730	5 800	7 460
5 000	6 190	8 160	11 880
6 000	7 800	11 200	19 650
7 000	9 570	15 250	37 000
8 000	11 450	20 570	84 300

Important:

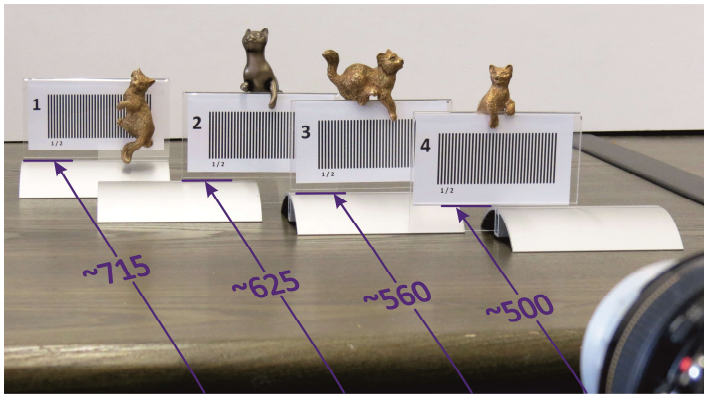
- each of the optically conjugate Objects is characterized by the corresponding Object Field
- the Object Fields are overlapping or separate depending on F-number of optics and the imaging mode set
- distances between the optically conjugate Objects
  - are determined by optical design of foto-foXXus
  - depend on distance to the nearest Object - S_4 in the above layout
  - do not depend on F-number
  - do not depend on the objective focal length

Extending Depth of Field never was so easy !

Imaging foto-foXXus 5^{X} @F50/2.8 + Objective F50

Scene layout

Grids at different distances



Conditions:

- Camera Nikon Z50
- Objective F50
- F/2.8
- natural light
- distances to Grids according to optical design of **foto-foXXus 5^{X} @F50/2.8 + Objective F50**

Objective F50 (conventional)

Grid 1 in focus (at ~715 mm)

Grid 4 in focus (at ~500 mm)

foto-foXXus 5^{X} @F50/2.8 + Objective F50

Setting “spaced-apart”

Grids 1 and 4 are sharp with acceptable contrast, while
Grids 2 and 3 are blurred

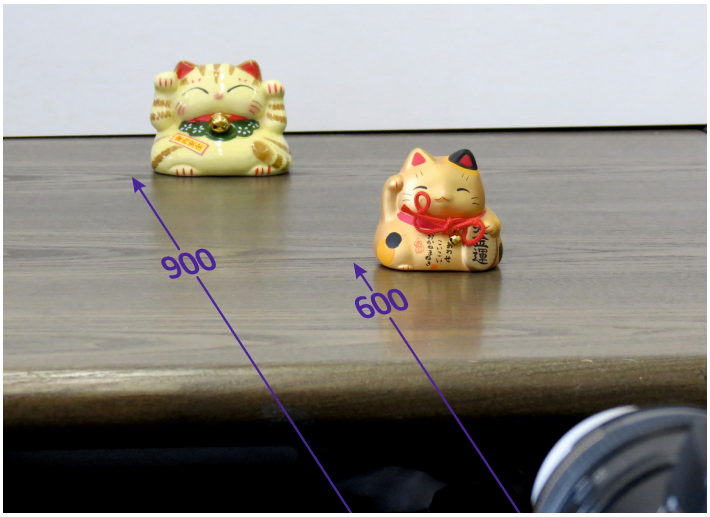
Setting “broad”

All four Grids are sharp with acceptable contrast

Imaging foto-foXXus 5^{X} @F50/2.8 + Objective F50

Scene layout

Near and Far located Objects



Conditions:

- Camera Nikon Z50
- Objective F50
- F/2.8
- natural light
- distances to Objects
  - 600 mm
  - 900 mm

Objective F50 (conventional)

Object at distance **900** mm in focus

Object at distance **600** mm in focus

foto-foXXus 5^{X} @F50/2.8 + Objective F50

Setting “spaced-apart”  both near and far located Objects are sharp with acceptable contrast

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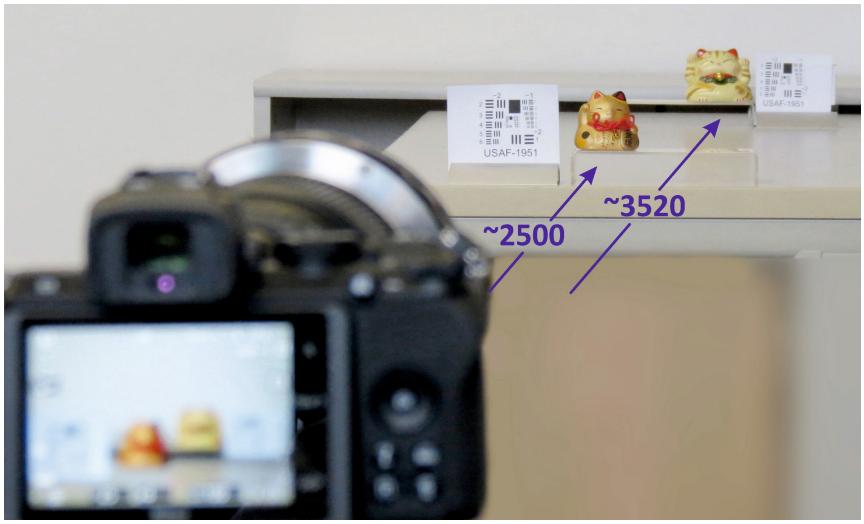
Imaging foto-foXXus 5^{X} @F70-200/2.8 + Objective F70-200

Scene layout

Near and Far located Objects



Conditions:

- Camera Nikon Z50
- Objective F70-200
- F/2.8
- natural light
- distances to Objects
  - ~2 500 mm
  - ~3 520 mm

Objective F70-200 (conventional)

Object at distance ~**2 500** mm in focus

Object at distance ~**3 520** mm in focus

foto-foXXus 5^{X} @F70-200/2.8 + Objective F70-200

Setting “spaced-apart”  both near and far located Objects are sharp with acceptable contrast

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