

# Depth of Field document

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## Introduction:

## Parameters:

$H$ : Hyperfocal distance

$f$ : Focal length ( $\times 1.53$  crop factor for aps-c)

$N$ : F-number (aperature diameter  $\frac{f}{N}$ )

$D$ : Focus distance

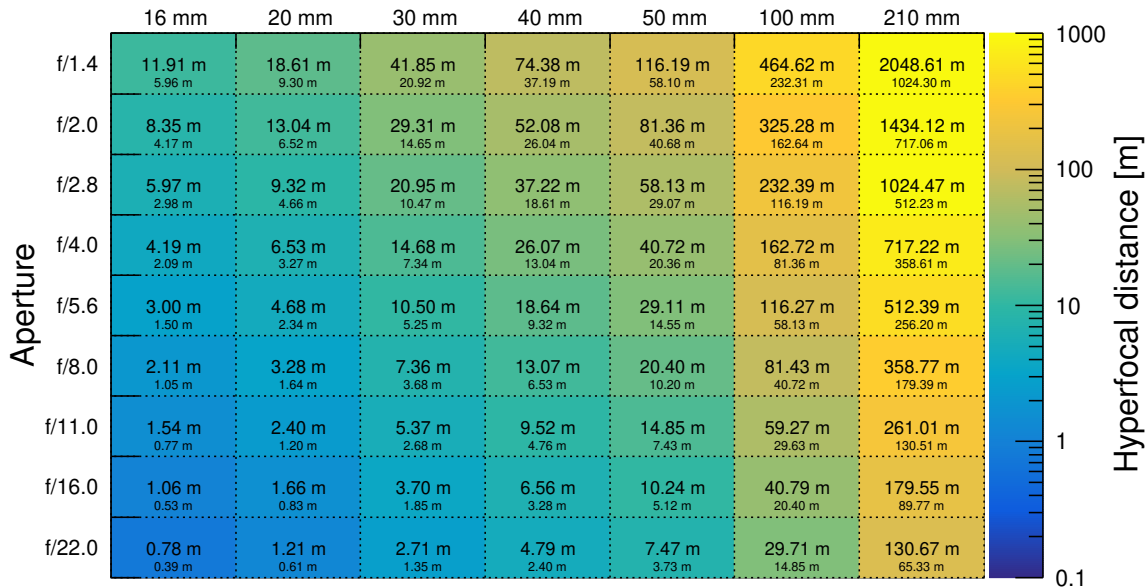
$c$ : Circle of confusion (CoC) limit (determines acceptable sharpness)

## Hyperfocal distance

$$H = \frac{f^2}{Nc} + f$$

Hyperfocal distance | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focal length



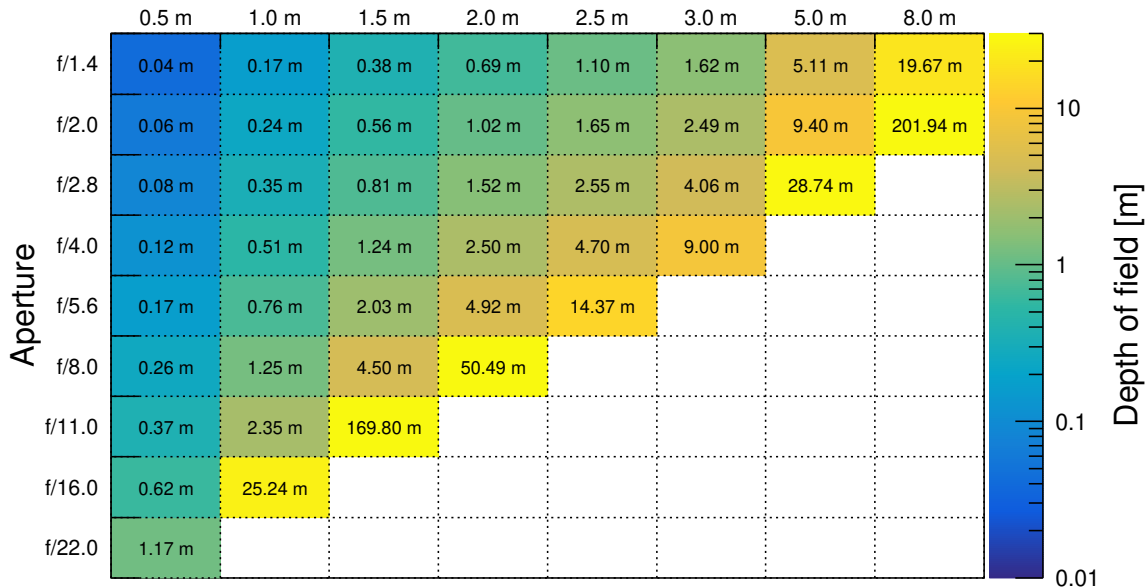
## Depth of Field

$$d = d_1 + d_2 = \frac{2NcD^2f^2}{f^4 - N^2c^2D^2}$$

$$d_1 = \frac{NcD^2}{f^2 + NcD}, \quad d_2 = \frac{NcD^2}{f^2 - NcD}$$

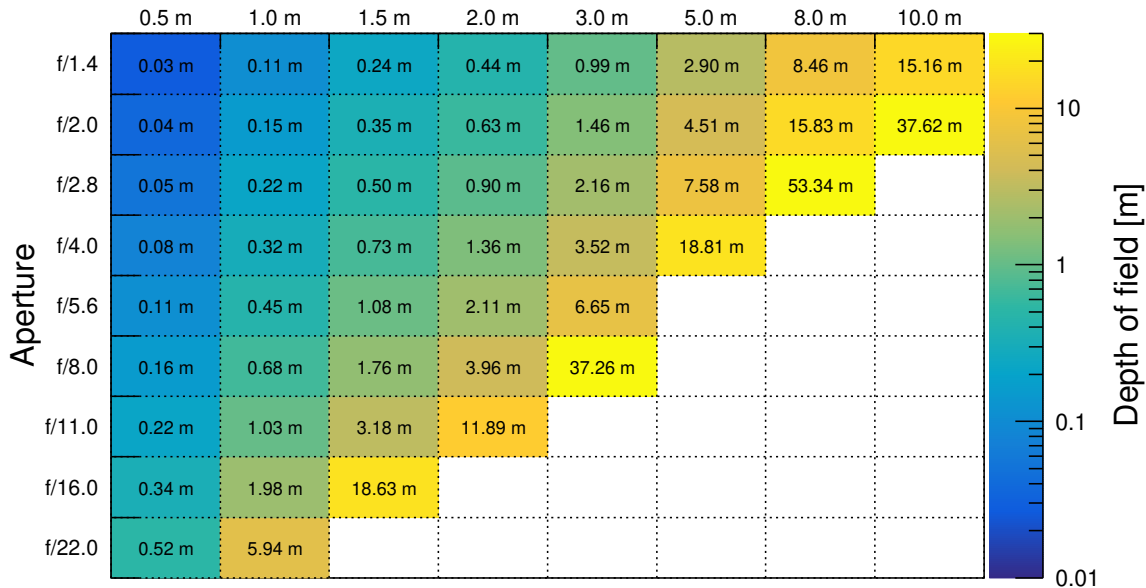
Depth of Field | **Focal length = 16 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance



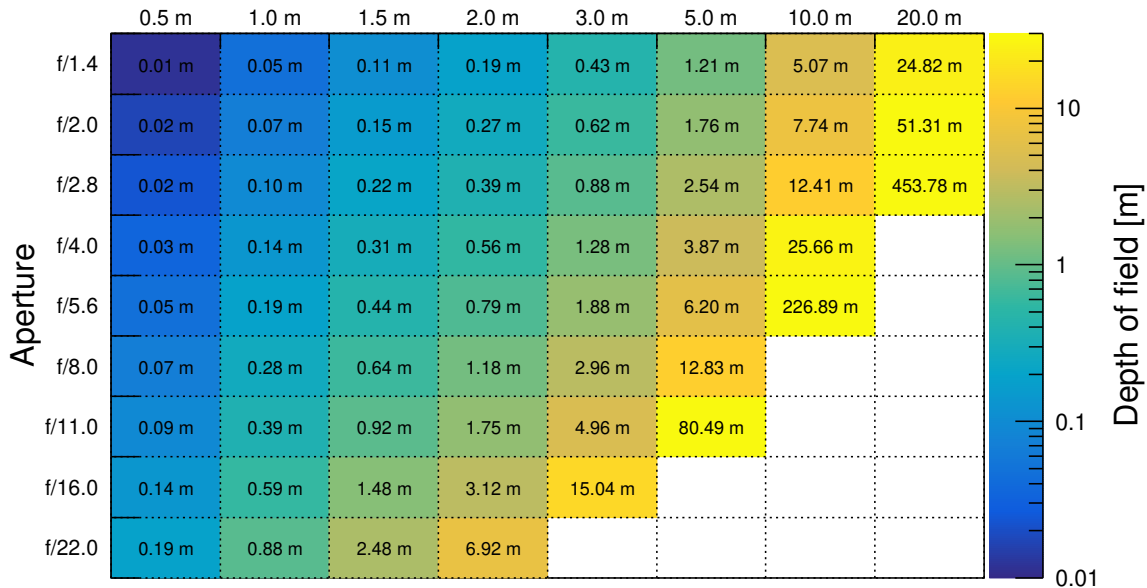
Depth of Field | **Focal length = 20 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance



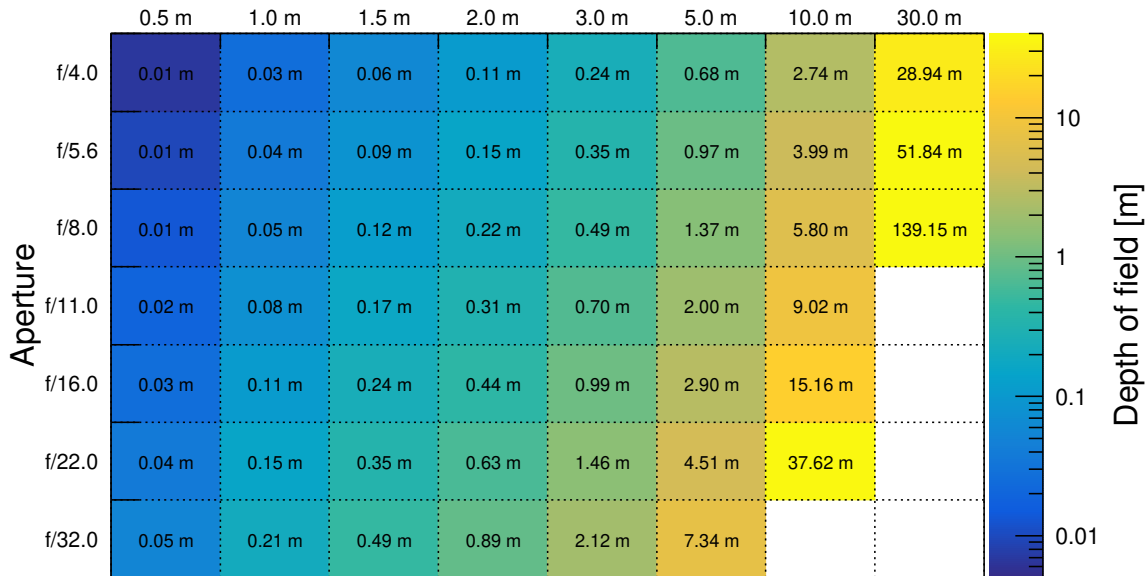
Depth of Field | **Focal length = 30 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance



Depth of Field | **Focal length = 40 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

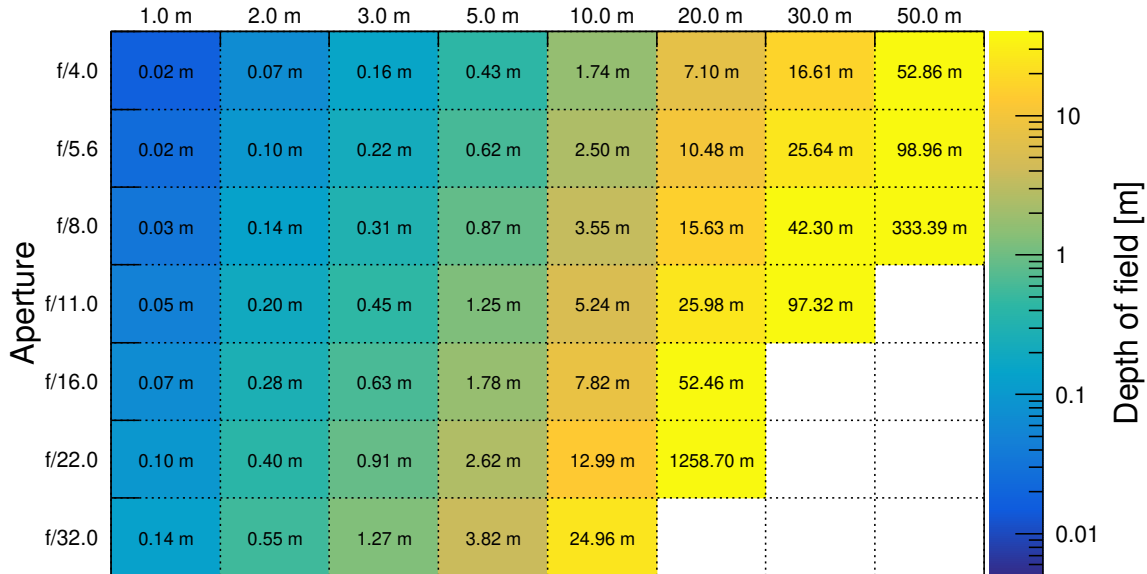
Focus distance





Depth of Field | **Focal length = 50 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance



Depth of Field | **Focal length = 100 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance

1.0 m    2.0 m    5.0 m    10.0 m    20.0 m    50.0 m    100.0 m    200.0 m

Aperture

f/5.6

0.00 m

0.02 m

0.11 m

0.43 m

1.73 m

10.89 m

45.15 m

211.45 m

f/8.0

0.01 m

0.02 m

0.15 m

0.62 m

2.47 m

15.75 m

67.94 m

395.85 m

f/11.0

0.01 m

0.03 m

0.22 m

0.86 m

3.47 m

22.58 m

105.72 m

1333.54 m

f/16.0

0.01 m

0.05 m

0.31 m

1.23 m

5.00 m

33.97 m

197.93 m

f/22.0

0.02 m

0.07 m

0.43 m

1.74 m

7.10 m

52.86 m

666.77 m

f/32.0

0.02 m

0.10 m

0.62 m

2.50 m

10.48 m

98.96 m

100

10

1

0.1

0.01

0.001

Depth of field [m]

Depth of Field | **Focal length = 210 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance

2.0 m    5.0 m    10.0 m    50.0 m    100.0 m    200.0 m    500.0 m    1000.0 m

Aperture

f/5.6

0.00 m

0.02 m

0.10 m

2.44 m

9.79 m

39.43 m

259.57 m

1281.99 m

f/8.0

0.01 m

0.03 m

0.14 m

3.49 m

14.02 m

56.90 m

397.00 m

2716.08 m

f/11.0

0.01 m

0.05 m

0.20 m

4.89 m

19.72 m

81.21 m

640.99 m

41912.62 m

f/16.0

0.01 m

0.07 m

0.28 m

7.01 m

28.45 m

121.01 m

1358.04 m

f/22.0

0.02 m

0.10 m

0.39 m

9.86 m

40.61 m

184.35 m

20956.31 m

f/32.0

0.02 m

0.14 m

0.56 m

14.23 m

60.50 m

324.07 m

100

10

1

0.1

0.01

0.001

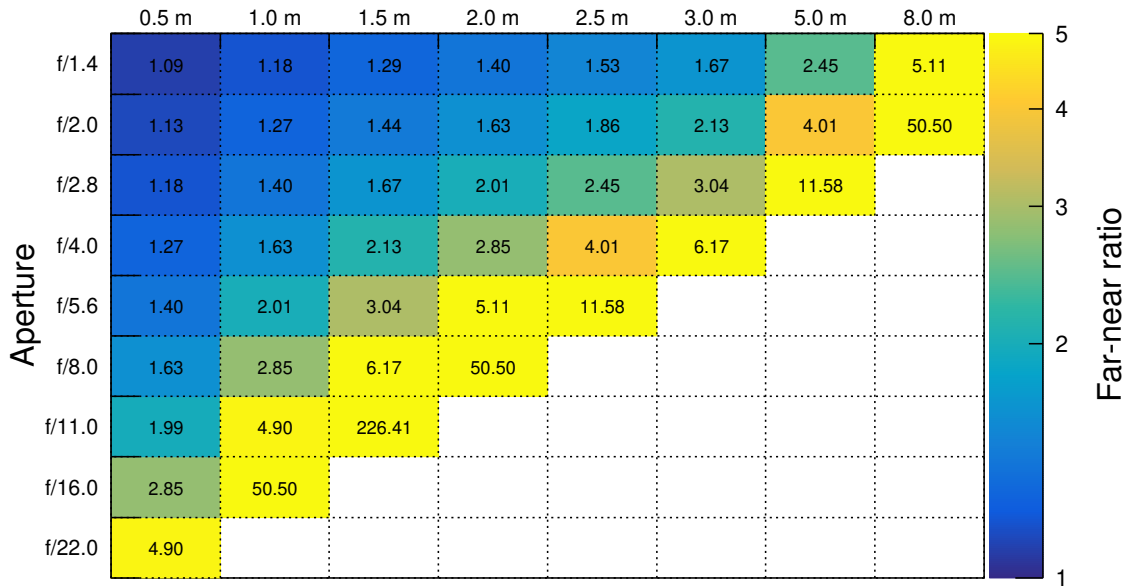
Depth of field [m]

## Far-Near ratio

$$\frac{d_2}{d_1} = \frac{f^2 + NcD}{f^2 - NcD}$$

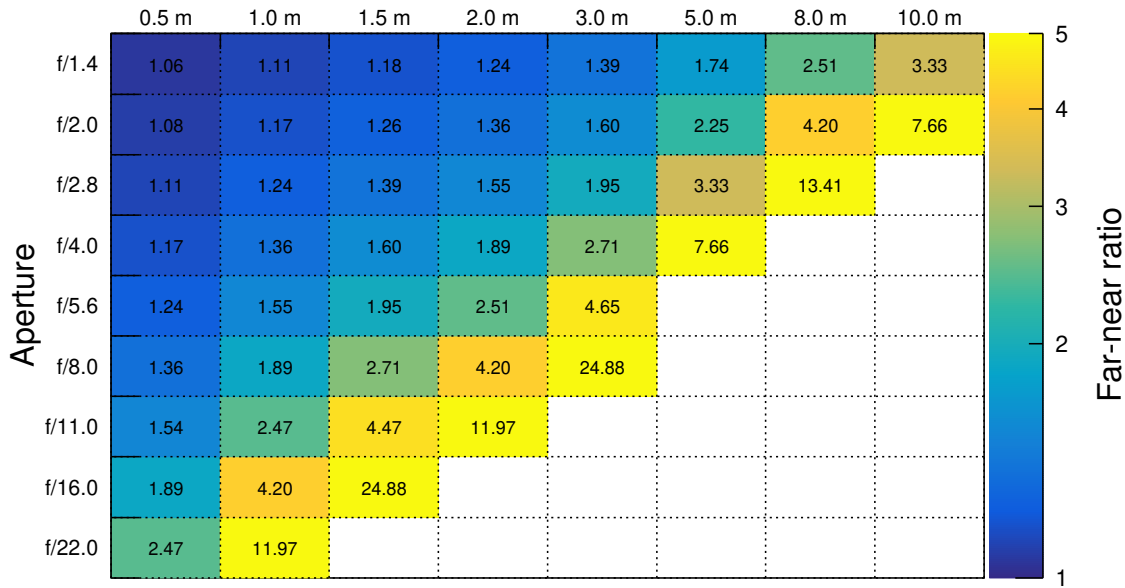
Far-Near ratio | **Focal length = 16 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance



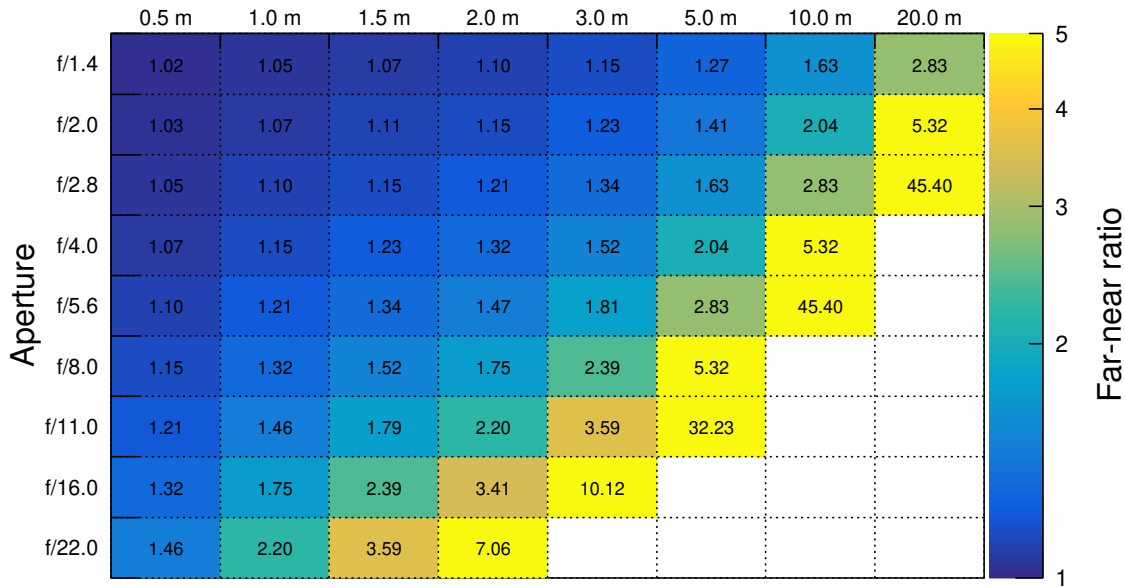
Far-Near ratio | **Focal length = 20 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance



Far-Near ratio | **Focal length = 30 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance



Far-Near ratio | **Focal length = 40 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance

0.5 m    1.0 m    1.5 m    2.0 m    3.0 m    5.0 m    10.0 m    30.0 m

Aperture

f/4.0

1.01

1.03

1.04

1.06

1.08

1.14

1.31

2.35

f/5.6

1.02

1.04

1.06

1.08

1.12

1.21

1.48

3.72

f/8.0

1.03

1.06

1.08

1.11

1.18

1.31

1.74

9.38

f/11.0

1.04

1.08

1.12

1.17

1.26

1.48

2.25

f/16.0

1.06

1.11

1.18

1.24

1.39

1.74

3.33

f/22.0

1.08

1.17

1.26

1.36

1.60

2.25

7.66

f/32.0

1.11

1.24

1.38

1.54

1.93

3.24

5

4

3

2

1

Far-near ratio



Far-Near ratio | **Focal length = 50 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance

1.0 m    2.0 m    3.0 m    5.0 m    10.0 m    20.0 m    30.0 m    50.0 m

Aperture

f/4.0

1.02

1.04

1.05

1.09

1.19

1.42

1.70

2.51

f/5.6

1.02

1.05

1.08

1.13

1.28

1.65

2.17

4.20

f/8.0

1.04

1.07

1.11

1.19

1.42

2.05

3.14

13.41

f/11.0

1.05

1.10

1.16

1.28

1.65

2.94

6.64

f/16.0

1.07

1.15

1.23

1.42

2.05

5.43

f/22.0

1.10

1.22

1.35

1.65

2.94

125.88

f/32.0

1.15

1.31

1.51

2.02

5.19

5

4

3

2

Far-near ratio

1

Far-Near ratio | **Focal length = 100 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance

1.0 m    2.0 m    5.0 m    10.0 m    20.0 m    50.0 m    100.0 m    200.0 m

Aperture

f/5.6

1.00

1.01

1.02

1.04

1.09

1.24

1.55

2.51

f/8.0

1.01

1.01

1.03

1.06

1.13

1.36

1.89

4.20

f/11.0

1.01

1.02

1.04

1.09

1.19

1.55

2.51

13.41

f/16.0

1.01

1.02

1.06

1.13

1.28

1.89

4.20

f/22.0

1.02

1.04

1.09

1.19

1.42

2.51

13.41

f/32.0

1.02

1.05

1.13

1.28

1.65

4.20

Far-near ratio

5

4

3

2

1

Far-Near ratio | **Focal length = 210 mm** | Sony  $\alpha$ 6000 (aps-c) | CoC = 0.036 mm

Focus distance

2.0 m    5.0 m    10.0 m    50.0 m    100.0 m    200.0 m    500.0 m    1000.0 m

Aperture

f/5.6

1.00

1.00

1.01

1.05

1.10

1.22

1.65

2.91

f/8.0

1.00

1.01

1.01

1.07

1.15

1.32

2.07

5.61

f/11.0

1.00

1.01

1.02

1.10

1.22

1.49

2.91

83.84

f/16.0

1.01

1.01

1.03

1.15

1.32

1.77

5.61

f/22.0

1.01

1.02

1.04

1.22

1.49

2.28

83.84

f/32.0

1.01

1.03

1.06

1.32

1.77

3.52

5

4

3

2

Far-near ratio

1