Depth of Field document

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Introduction:

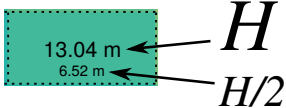
Calculations and tables of depth of field (focus depth) and hyperfocal distance for various camera settings for the Sony α6000 (aps-c).

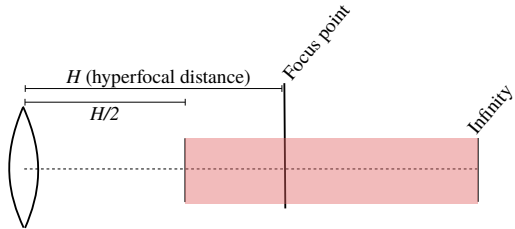
Parameters:

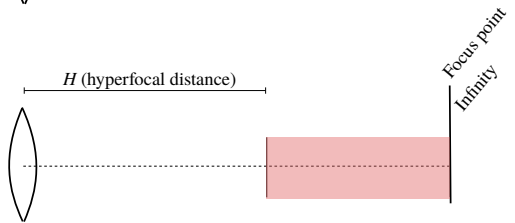
H : Hyperfocal distance
f : Focal length ($\times 1.53$ crop factor for aps-c)
N : F-number (aperature diameter $\frac{f}{N}$)
D : Focus distance (distance to focus point)
c : Circle of confusion (CoC) limit (determines acceptable sharpness)
c = 0.036 mm used (suitable for 15x10cm print viewed at 25cm distance)

Hyperfocal distance

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







Hyperfocal distance | Sony α6000 (aps-c) | CoC = 0.036 mm

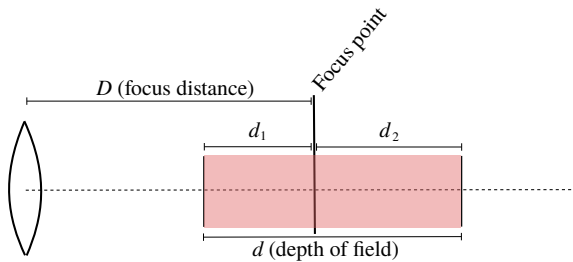
Focal length

Aperture	16 mm	20 mm	30 mm	40 mm	50 mm	100 mm	210 mm
f/1.4	11.91 m 5.96 m	18.61 m 9.30 m	41.85 m 20.92 m	74.38 m 37.19 m	116.19 m 58.10 m	464.62 m 232.31 m	2048.61 m 1024.30 m
f/2.0	8.35 m 4.17 m	13.04 m 6.52 m	29.31 m 14.65 m	52.08 m 26.04 m	81.36 m 40.68 m	325.28 m 162.64 m	1434.12 m 717.06 m
f/2.8	5.97 m 2.98 m	9.32 m 4.66 m	20.95 m 10.47 m	37.22 m 18.61 m	58.13 m 29.07 m	232.39 m 116.19 m	1024.47 m 512.23 m
f/4.0	4.19 m 2.09 m	6.53 m 3.27 m	14.68 m 7.34 m	26.07 m 13.04 m	40.72 m 20.36 m	162.72 m 81.36 m	717.22 m 358.61 m
f/5.6	3.00 m 1.50 m	4.68 m 2.34 m	10.50 m 5.25 m	18.64 m 9.32 m	29.11 m 14.55 m	116.27 m 58.13 m	512.39 m 256.20 m
f/8.0	2.11 m 1.05 m	3.28 m 1.64 m	7.36 m 3.68 m	13.07 m 6.53 m	20.40 m 10.20 m	81.43 m 40.72 m	358.77 m 179.39 m
f/11.0	1.54 m 0.77 m	2.40 m 1.20 m	5.37 m 2.68 m	9.52 m 4.76 m	14.85 m 7.43 m	59.27 m 29.63 m	261.01 m 130.51 m
f/16.0	1.06 m 0.53 m	1.66 m 0.83 m	3.70 m 1.85 m	6.56 m 3.28 m	10.24 m 5.12 m	40.79 m 20.40 m	179.55 m 89.77 m
f/22.0	0.78 m 0.39 m	1.21 m 0.61 m	2.71 m 1.35 m	4.79 m 2.40 m	7.47 m 3.73 m	29.71 m 14.85 m	130.67 m 65.33 m

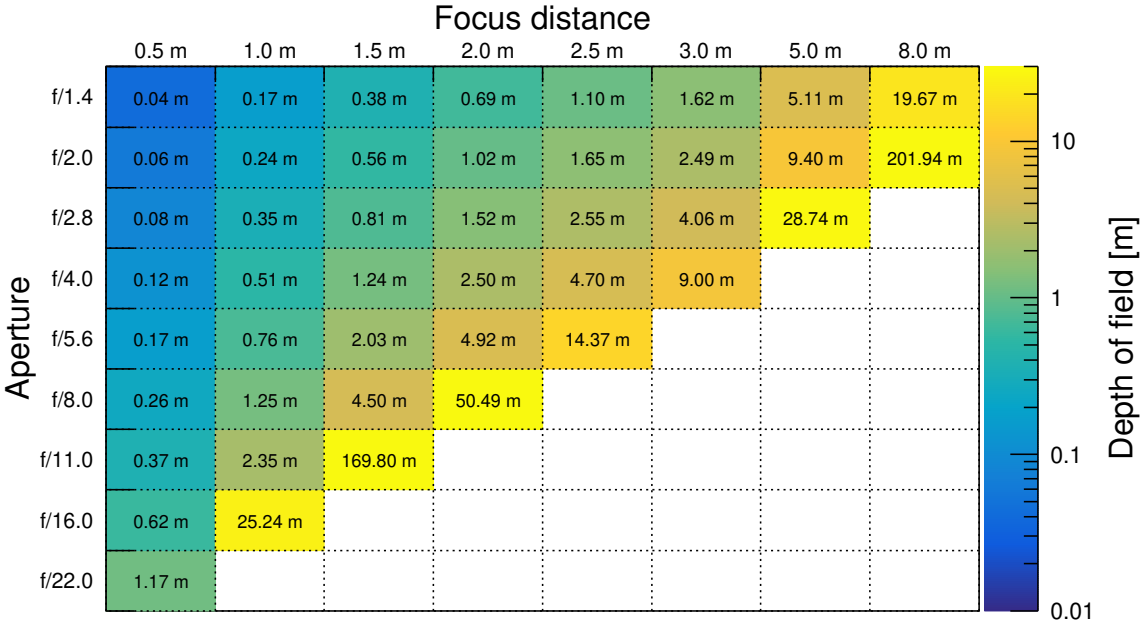
Depth of Field

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

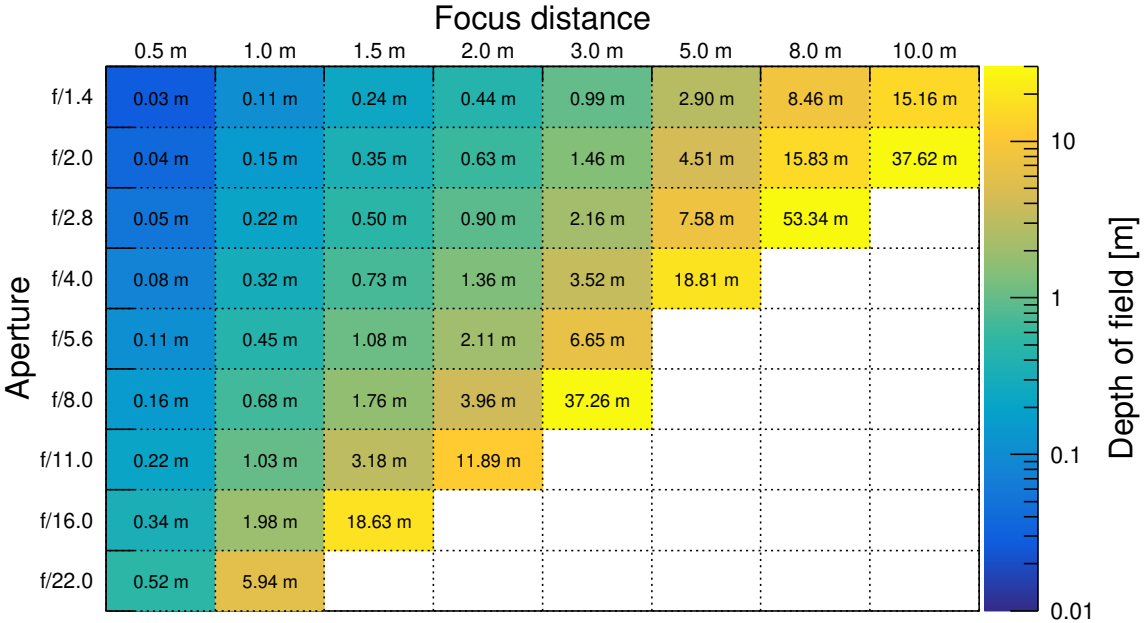
$$d_1 = \frac{NcD^2}{f^2 + NCD},\ d_2 = \frac{NcD^2}{f^2 - NCD}$$



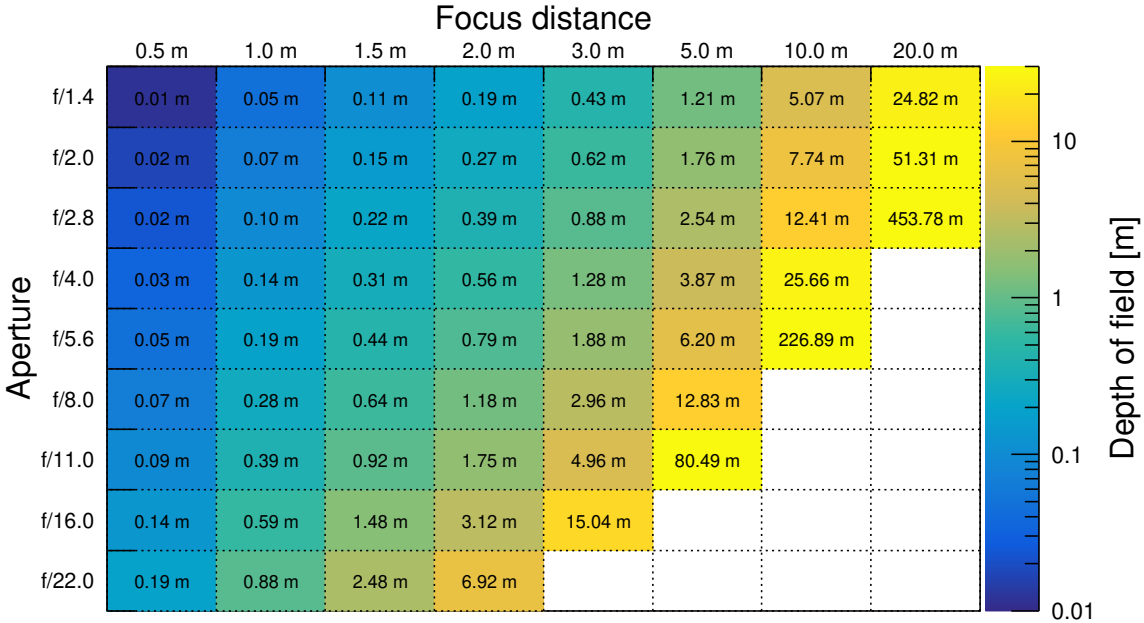
Depth of Field | **Focal length = 16 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm



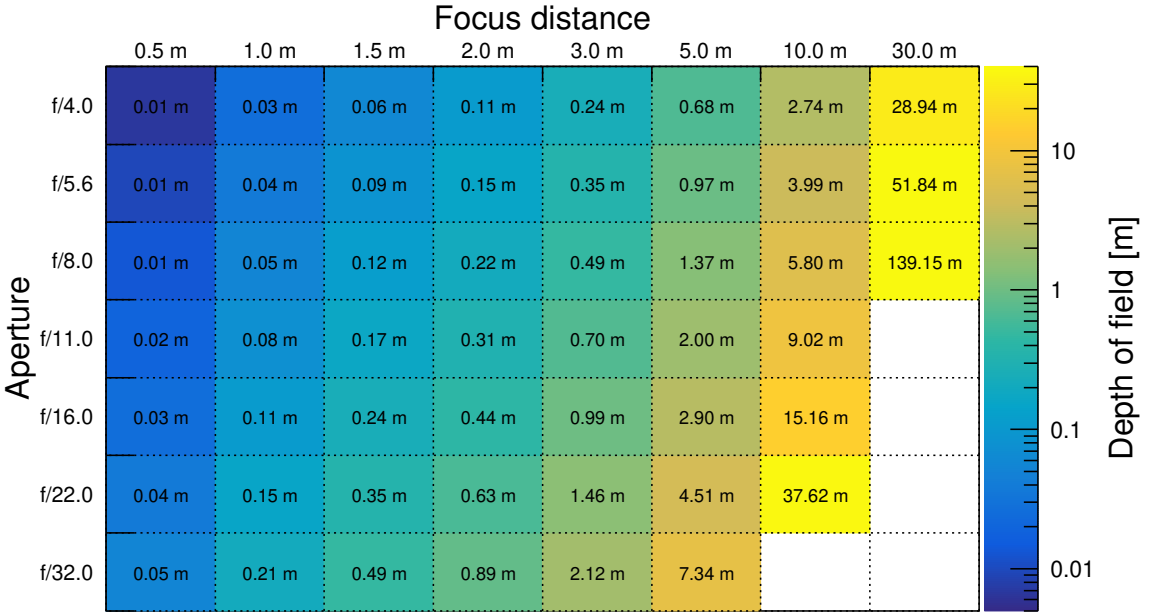
Depth of Field | **Focal length = 20 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm



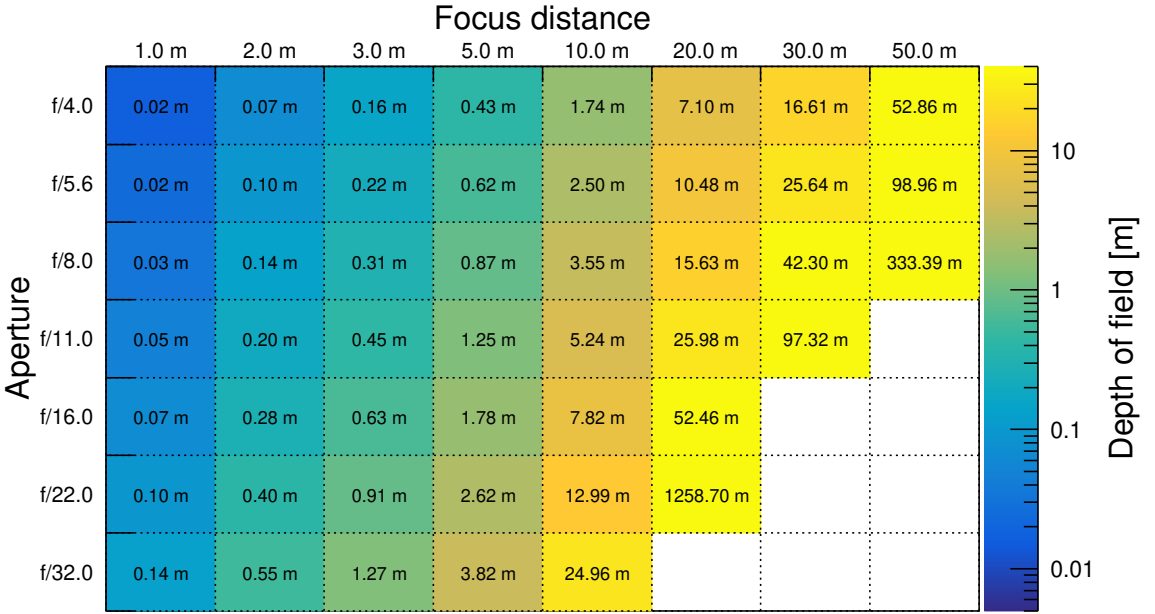
Depth of Field | **Focal length = 30 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm

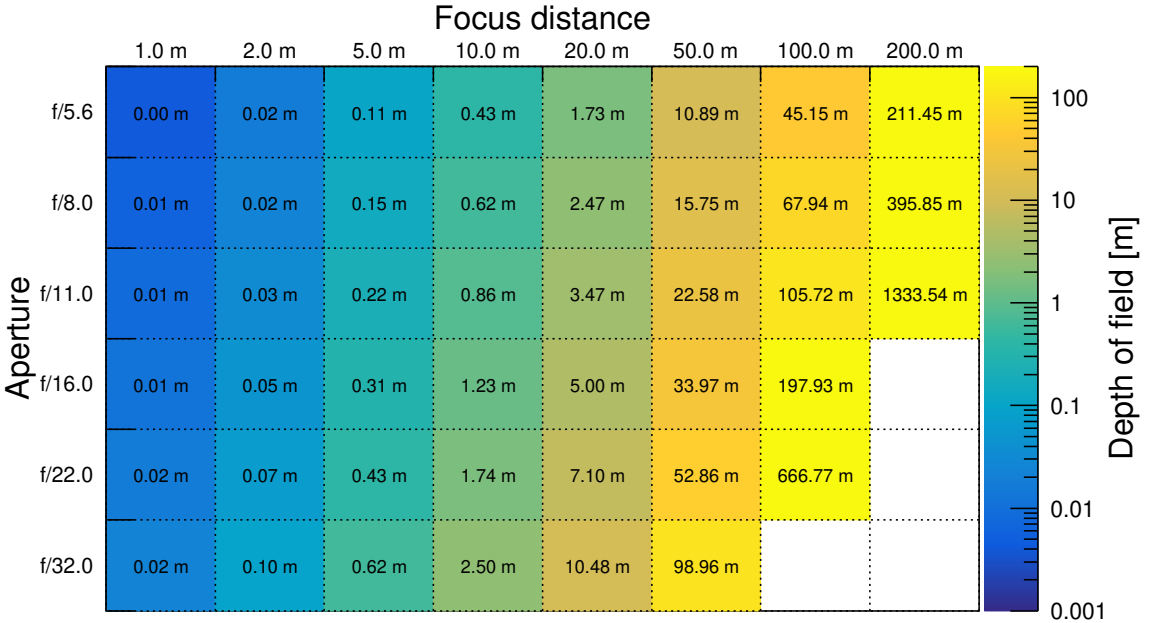


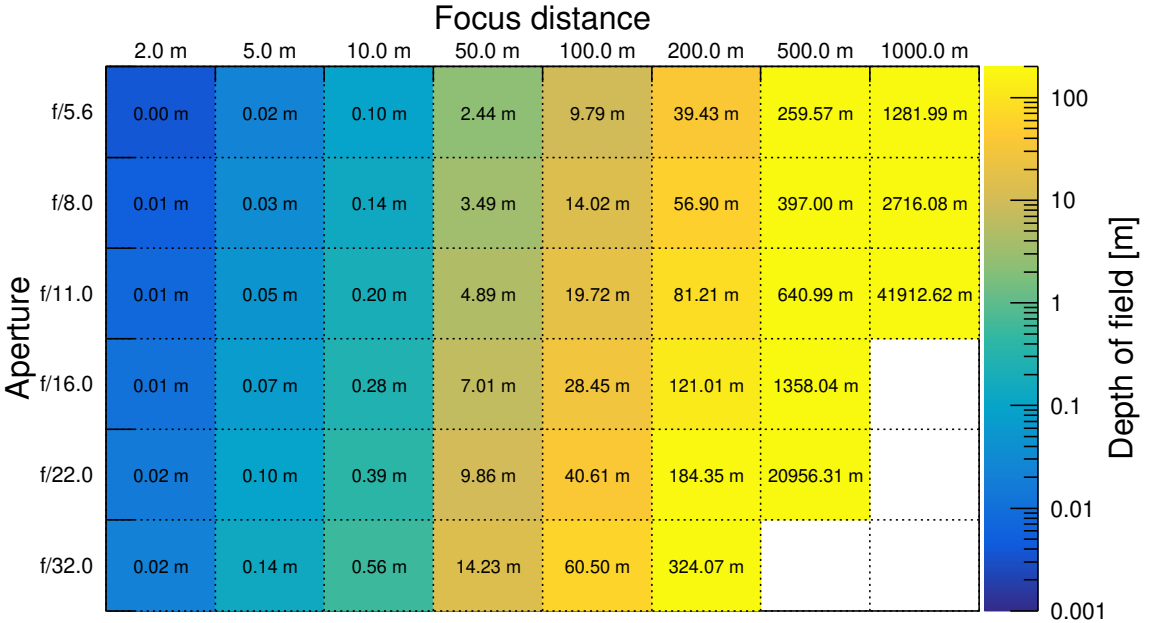
Depth of Field | **Focal length = 40 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm



Depth of Field | **Focal length = 50 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm

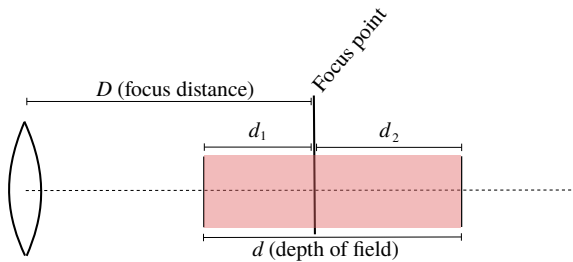


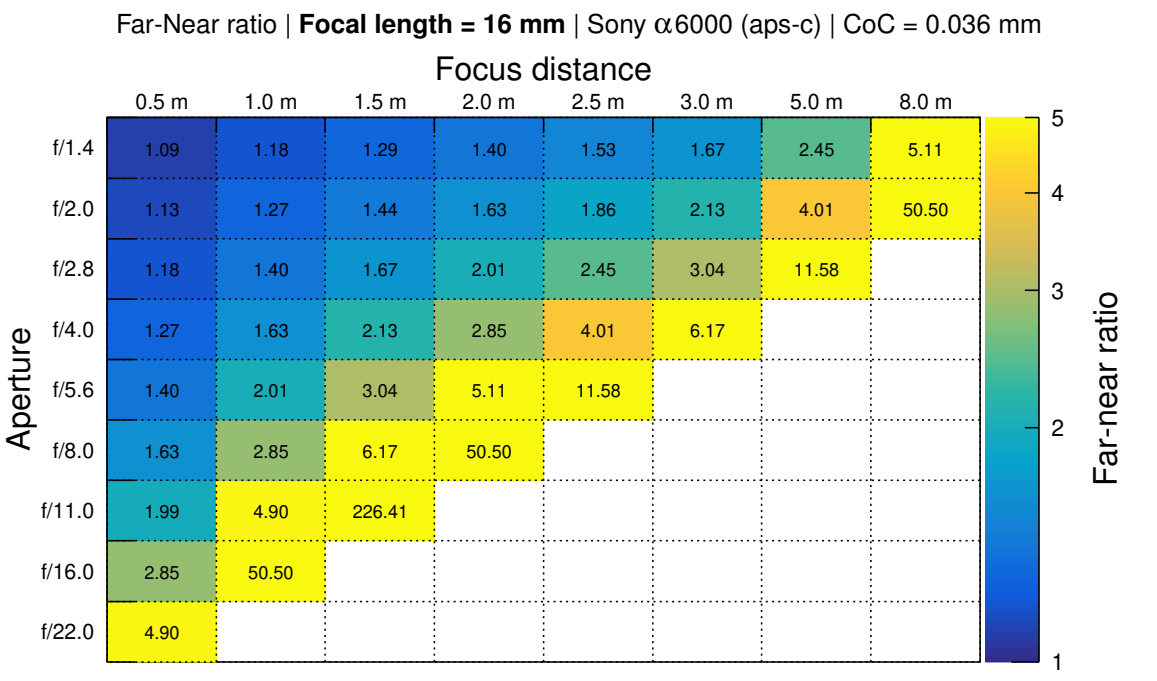

Depth of Field | **Focal length = 100 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm
Focus distance
1.0 m
2.0 m
5.0 m
10.0 m
20.0 m
50.0 m
100.0 m
200.0 m
Aperture
f/5.6
0.00 m
0.02 m
0.11 m
0.43 m
1.73 m
10.89 m
45.15 m
211.45 m
f/8.0
0.01 m
0.02 m
0.15 m
0.62 m
2.47 m
15.75 m
67.94 m
395.85 m
f/11.0
0.01 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
Depth of field [m]
100
10
1
0.1
0.01
0.001


Depth of Field | **Focal length = 210 mm** | Sony α6000 (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
Depth of field [m]
100
10
1
0.1
0.01
0.001

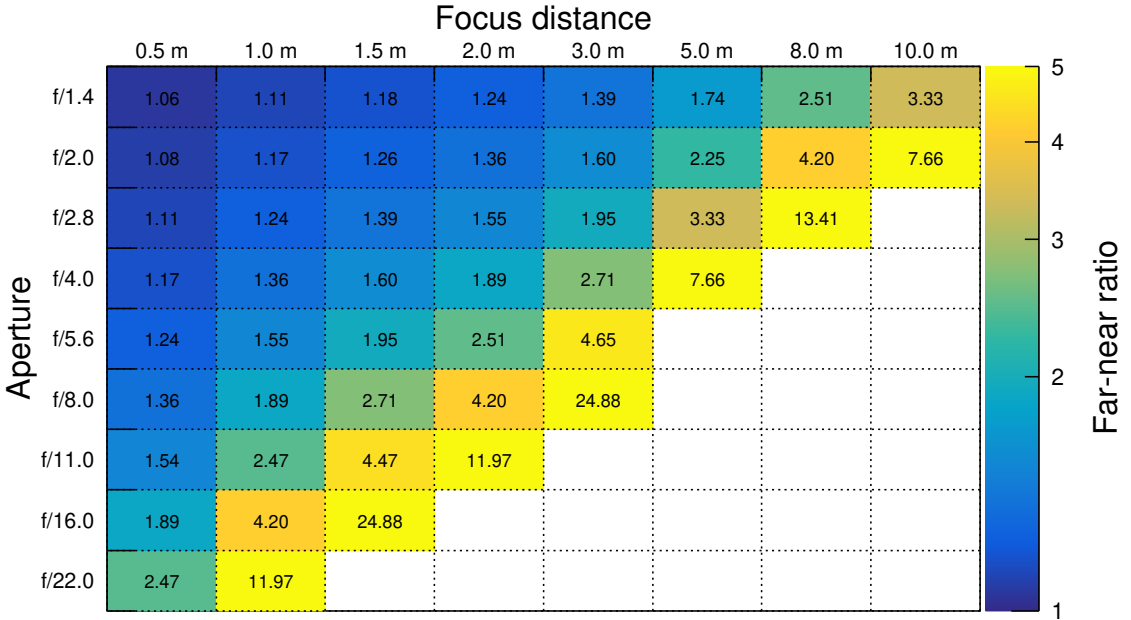
Far-Near ratio

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

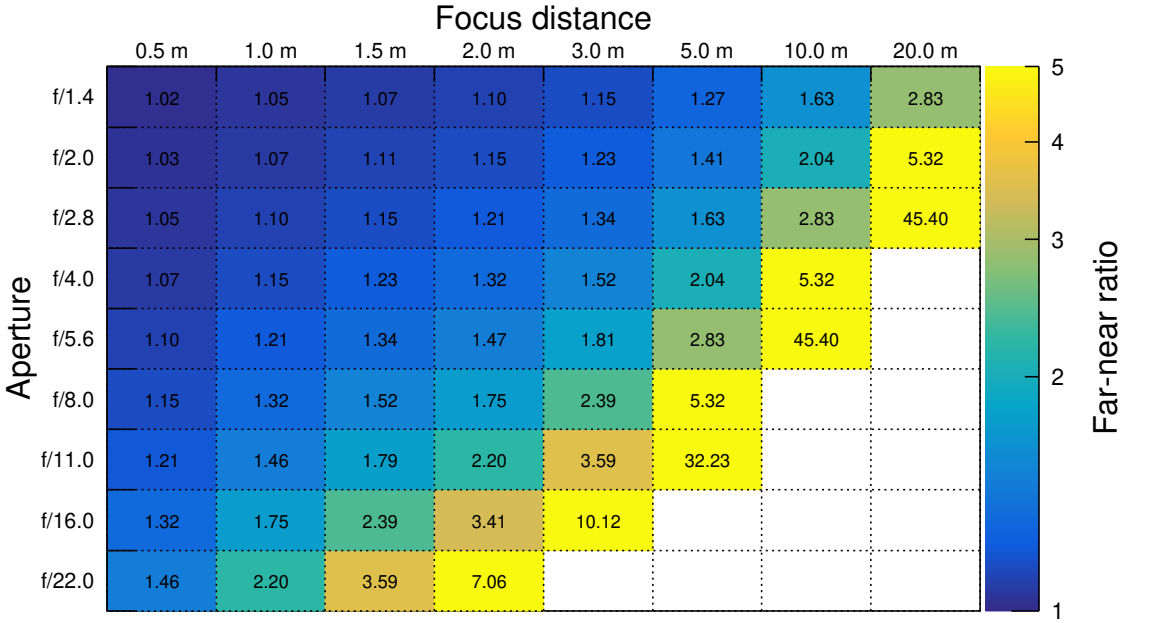



Far-Near ratio | **Focal length = 16 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm
Focus distance
0.5 m
1.0 m
1.5 m
2.0 m
2.5 m
3.0 m
5.0 m
8.0 m
Aperture
f/1.4
f/2.0
f/2.8
f/4.0
f/5.6
f/8.0
f/11.0
f/16.0
f/22.0
1.09 1.18 1.29 1.40 1.53 1.67 2.45 5.11
1.13 1.27 1.44 1.63 1.86 2.13 4.01 50.50
1.18 1.40 1.67 2.01 2.45 3.04 11.58
1.27 1.63 2.13 2.85 4.01 6.17
1.40 2.01 3.04 5.11 11.58
1.63 2.85 6.17 50.50
1.99 4.90 226.41
2.85 50.50
4.90
Far-near ratio
5
4
3
2
1

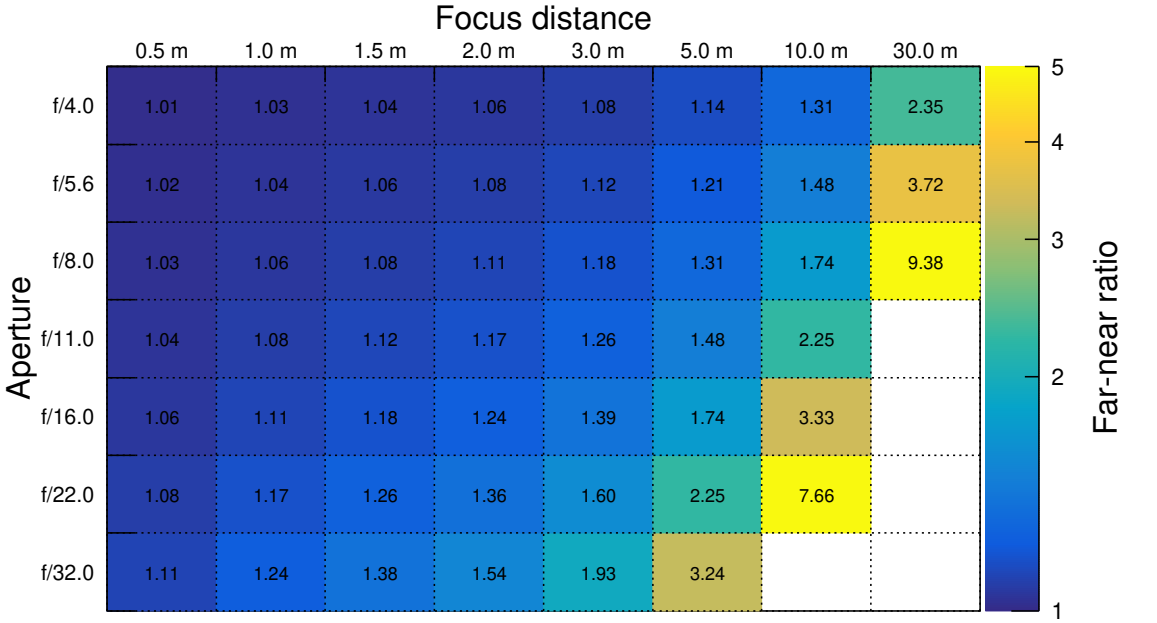
Far-Near ratio | **Focal length = 20 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm

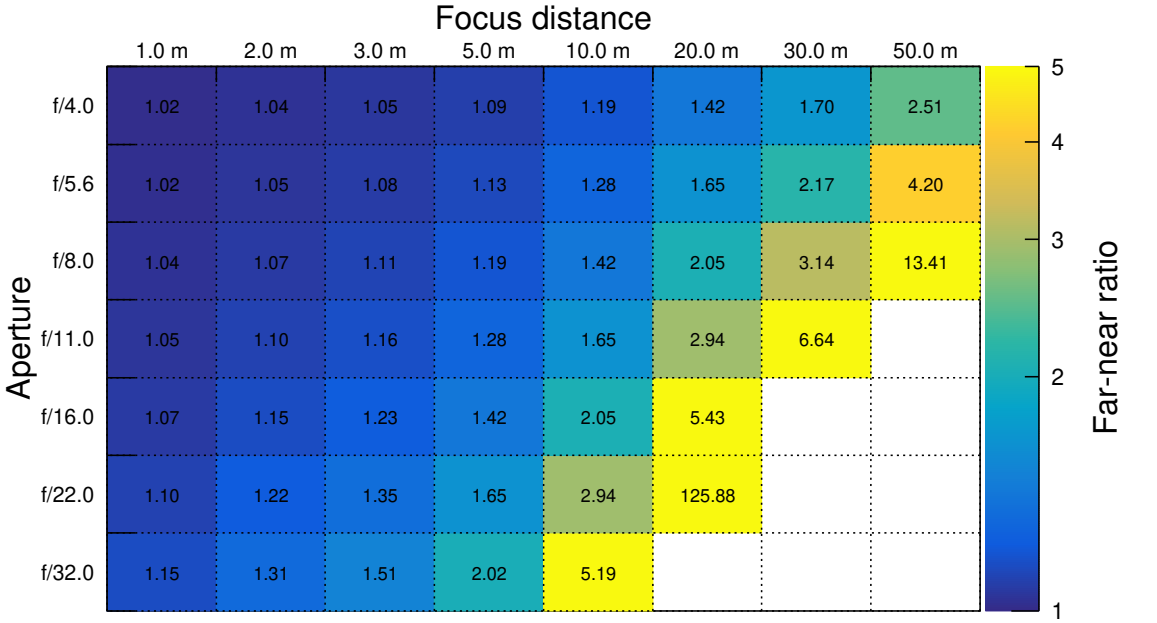


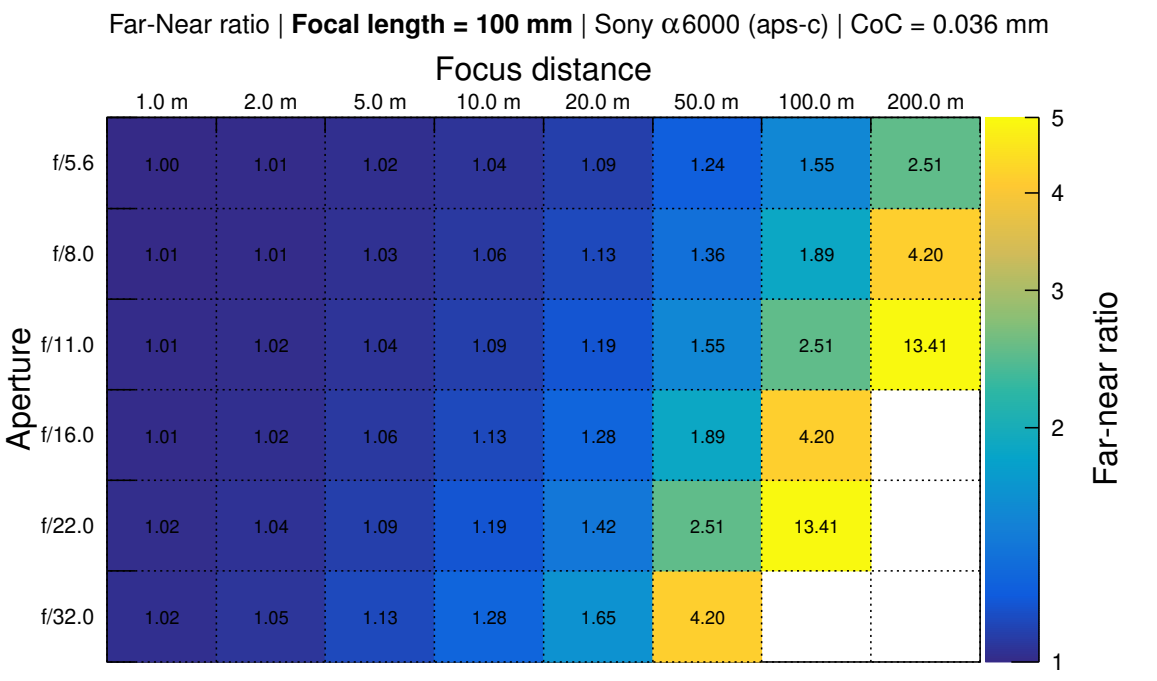
Far-Near ratio | **Focal length = 30 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm

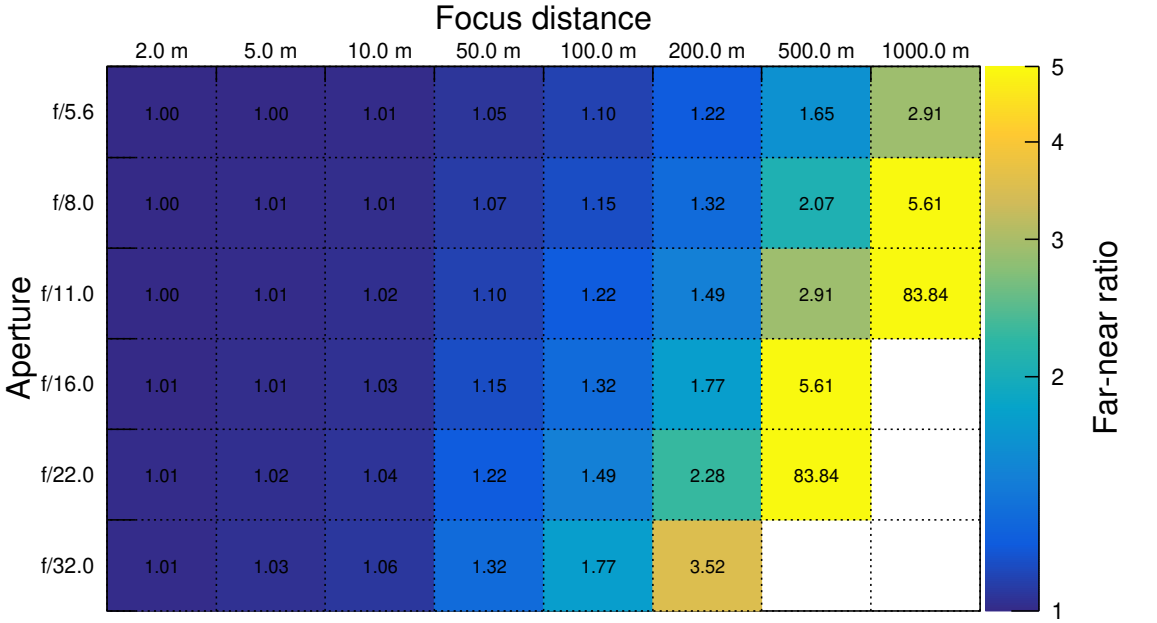


Far-Near ratio | **Focal length = 40 mm** | Sony α6000 (aps-c) | CoC = 0.036 mm




Far-Near ratio | **Focal length = 50 mm** | Sony α6000 (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
Far-near ratio
5
4
3
2
1


Far-Near ratio | **Focal length = 100 mm** | Sony α6000 (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 α6000 (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
Far-near ratio
5
4
3
2
1