



新特光电
Sintec Optonics

**Schneider Kreuznach PYRITE 4.0-60 C-LF-SD
with EL-16-40-TC-VIS-5D**

Summary

- Almost Nyquist limited performance along the WD range (very good also on corner and edges)
- Good correlation with the MTFs on the datasheet
- Visible coma in Horizontal optical axis at F/4, better at F/5.6
- Decent performances in Horizontal optical axis overall

Test setup



Camera:

1.1" (IDS UI-3200SE-M)
4104x3006 pixels, 3.45 μm px

Lens:

PYRITE 4.0-60 C-LF-SD
with EL-16-40-TC-VIS-5D embedded

F/#

4-32

Driver:

Optotune Lens Driver 4

Target:

Transparent USAF target

Light:

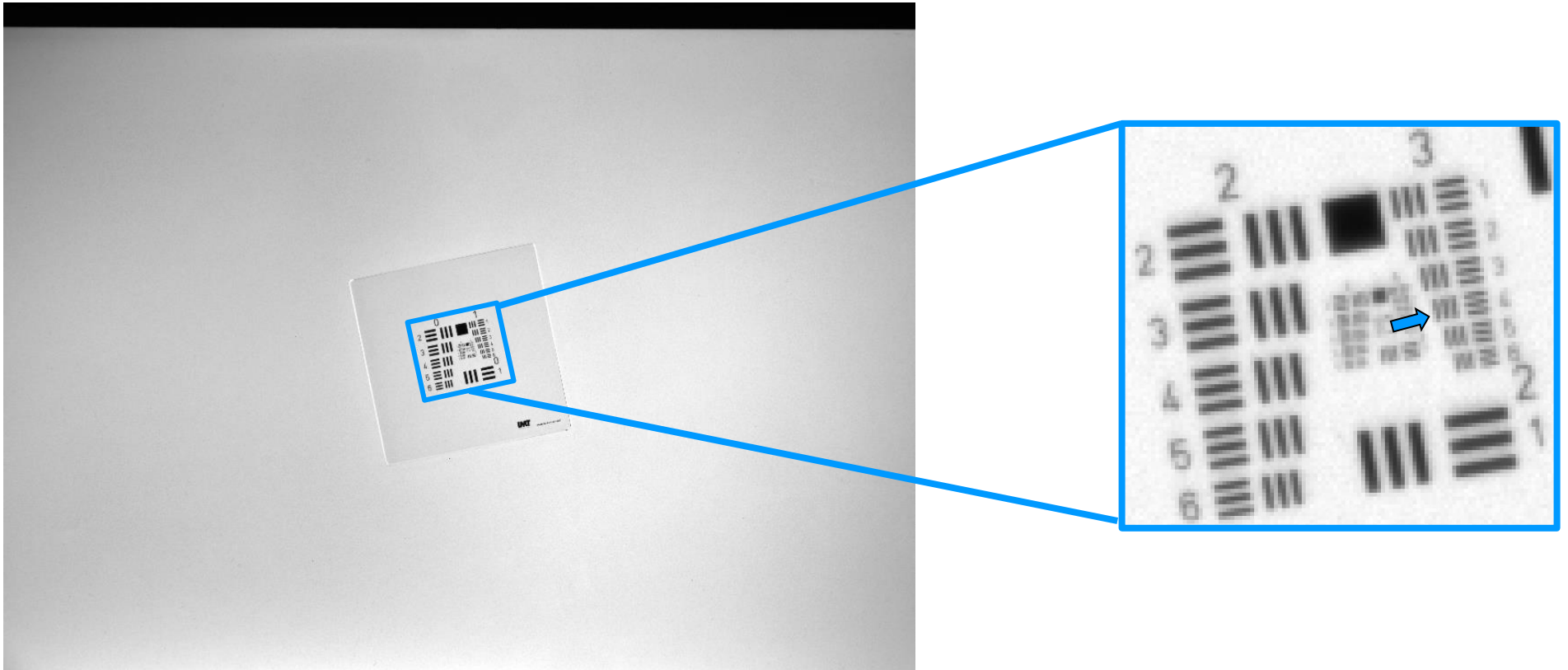
White backlight

Optical axis:

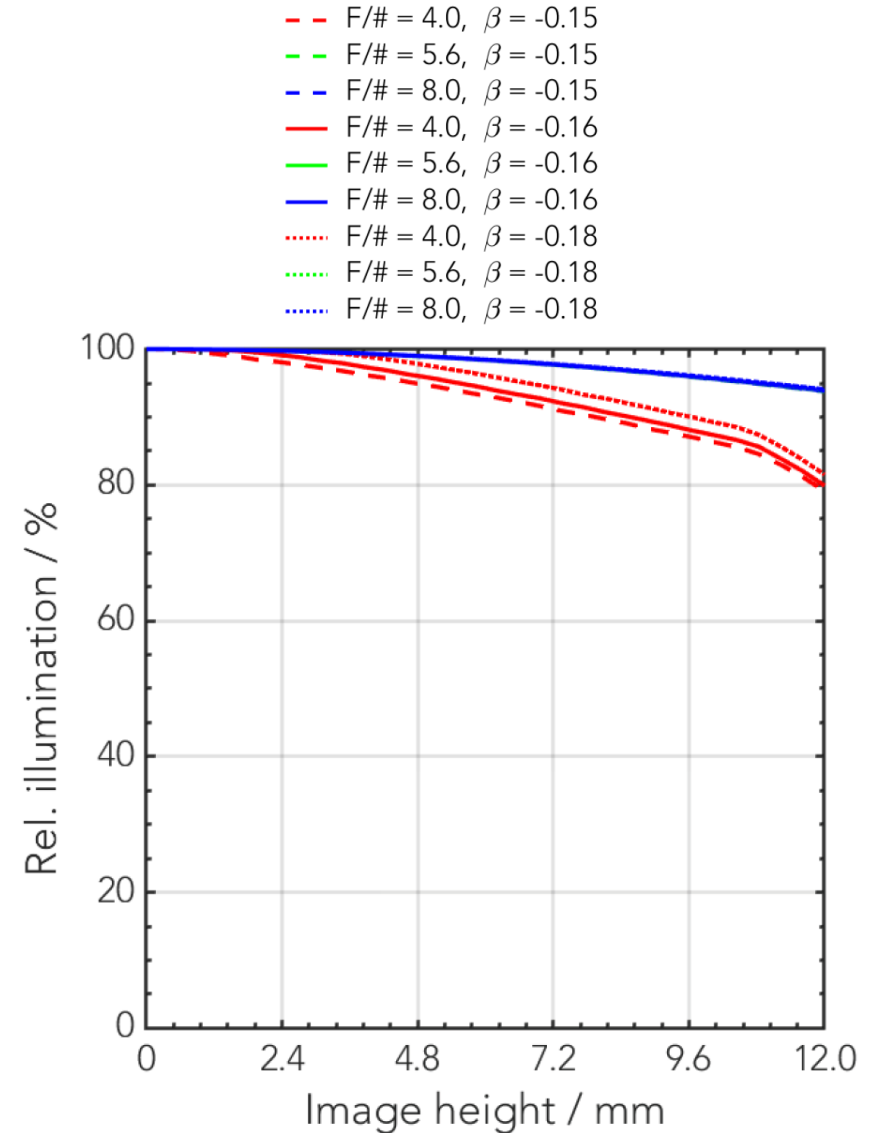
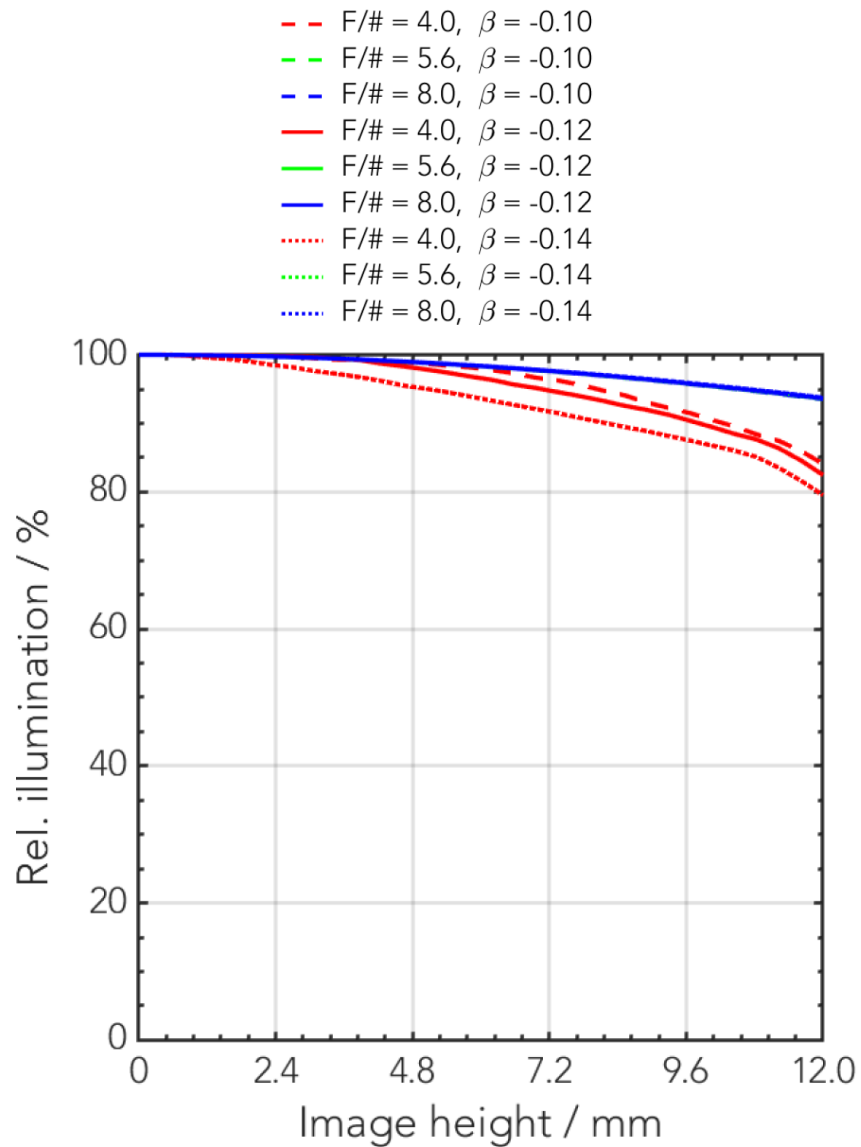
Vertical

Method for image evaluation

- After acquisition, images are zoomed in to show resolution limited element



Relative illumination plots (β = magnification)



0 dpt, 480 mm WD F#/4

Camera

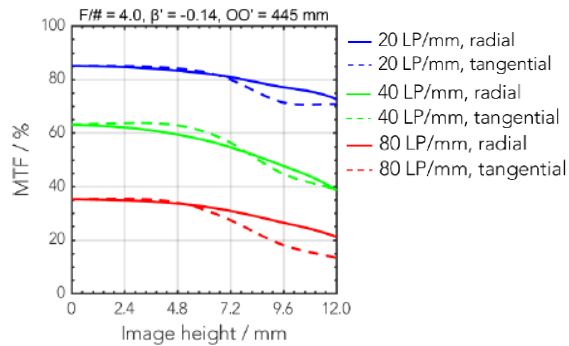
Sensor size = 4104x3006 pixels

Nyquist limit = 144 lp/mm

Pixel size = 3.45 μm

Light

White background illumination



USAF element:

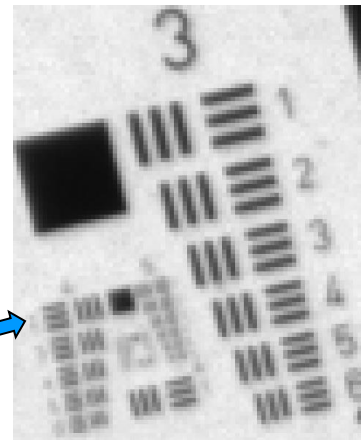
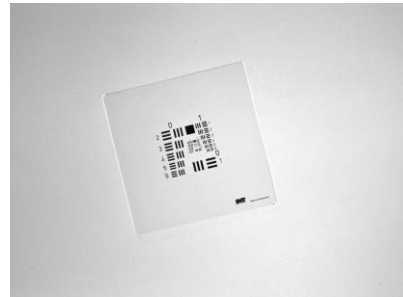
Line width (μm):

Lp/mm (object):

Magnification:

Lp/mm (image):

Center



4/2

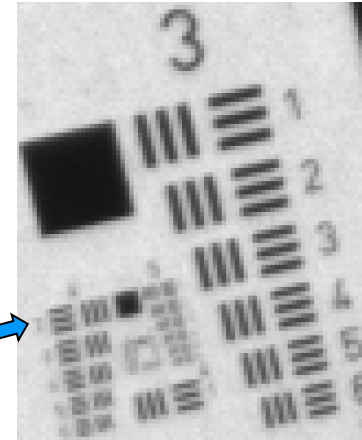
27.84

18

0.137

131

Edge



4/2

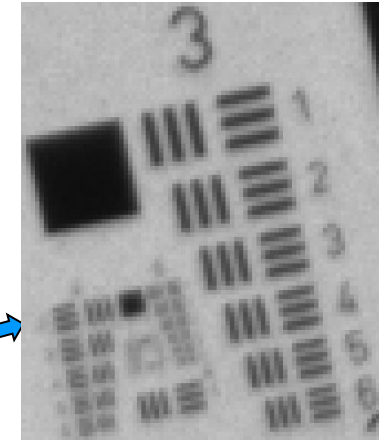
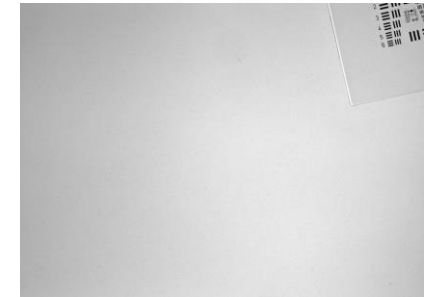
27.84

18

0.137

131

Corner



4/2

27.84

18

0.137

131

-2.86 dpt, 900 mm WD F#/4

Camera

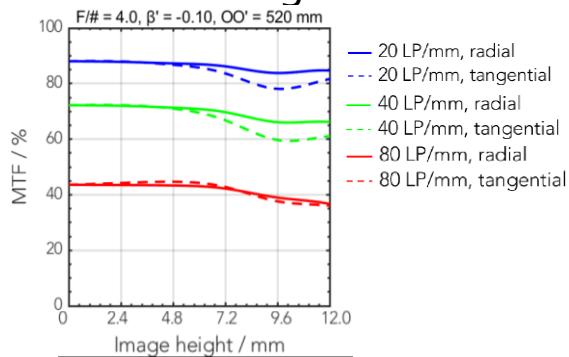
Sensor size = 4104x3006 pixels

Nyquist limit = 144 lp/mm

Pixel size = 3.45 μm

Light

White background illumination



USAF element:

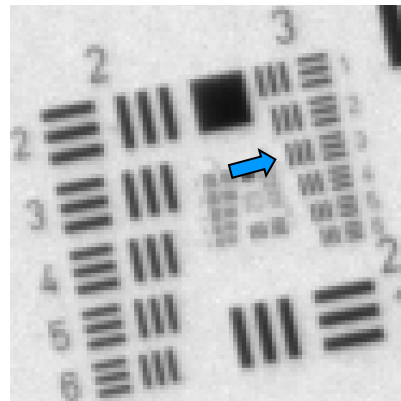
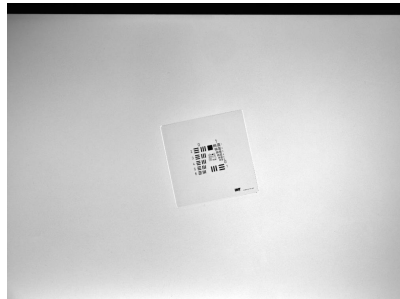
Line width (μm):

Lp/mm (object):

Magnification:

Lp/mm (image):

Center



3/3

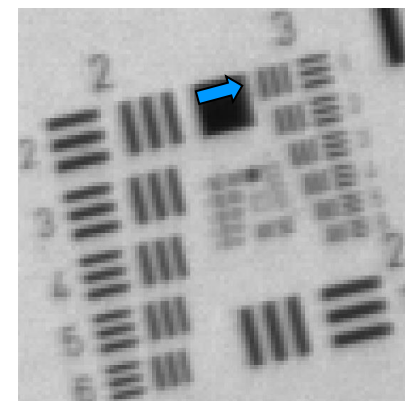
49.61

10

0.077

130

Edge



3/1

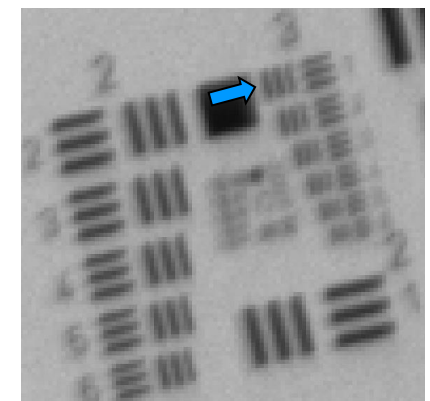
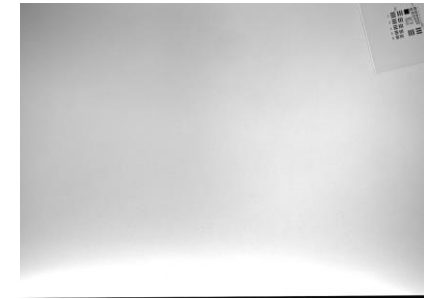
62.5

8

0.077

103

Corner



3/1

62.5

8

0.077

103

2.64 dpt, 320 mm WD F#/4

Camera

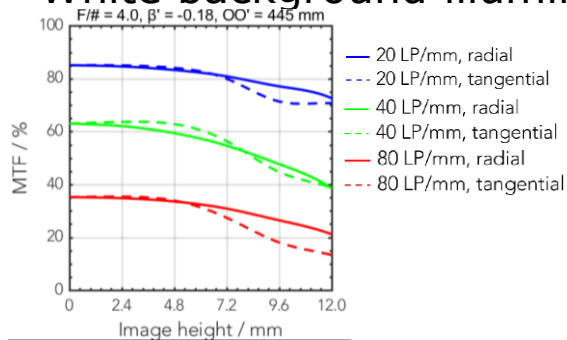
Sensor size = 4104x3006 pixels

Nyquist limit = 144 lp/mm

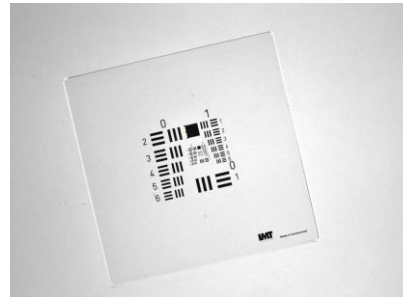
Pixel size = 3.45 μm

Light

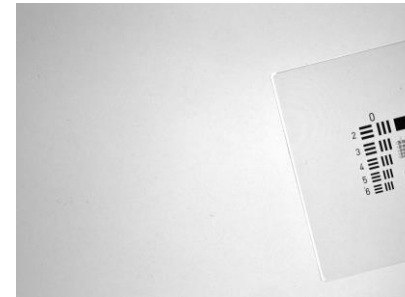
White background illumination



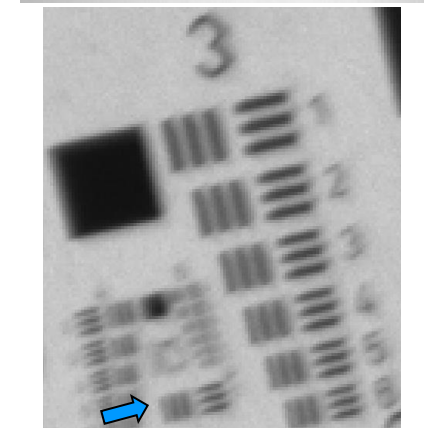
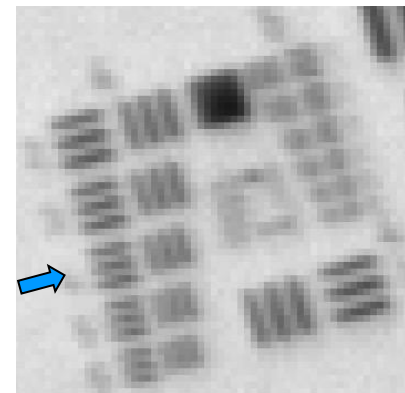
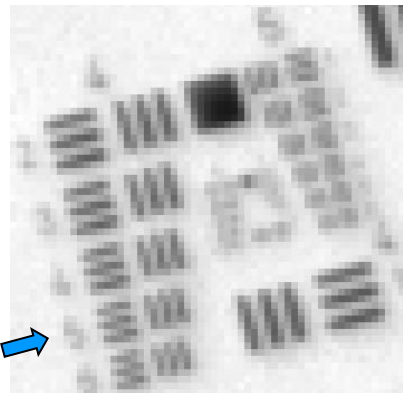
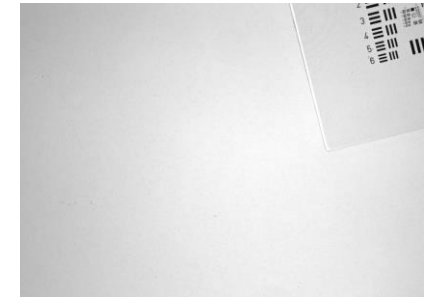
Center



Edge



Corner



USAF element:

Line width (μm):

Lp/mm (object):

Magnification:

Lp/mm (image):

4/5

19.69

25

0.191

133

4/3

24.8

20

0.192

105

4/1

31.25

16

0.192

83

2.64 dpt, 320 mm WD F#/5.6

Camera

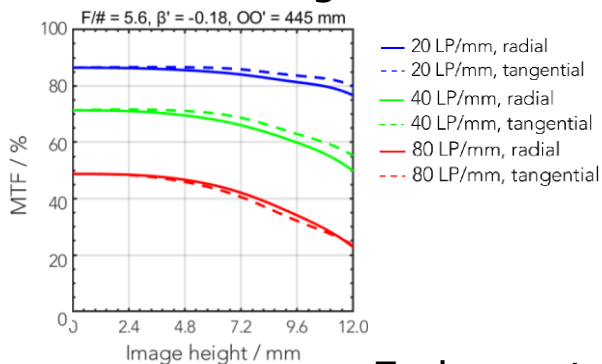
Sensor size = 4104x3006 pixels

Nyquist limit = 144 lp/mm

Pixel size = 3.45 μm

Light

White background illumination



USAF element:

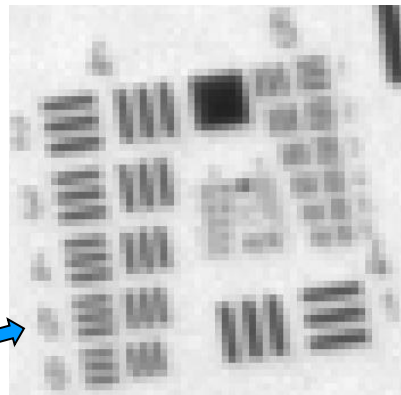
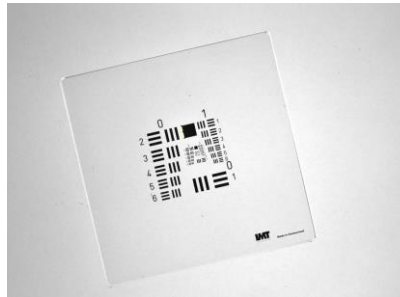
Line width (μm):

Lp/mm (object):

Magnification:

Lp/mm (image):

Center



4/5

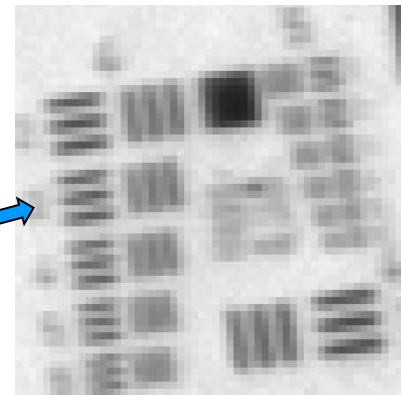
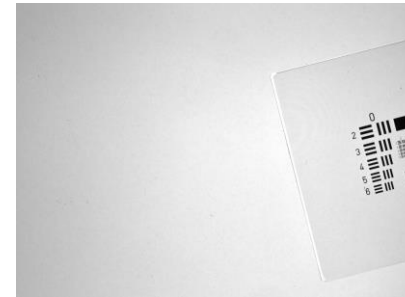
19.69

25

0.191

133

Edge



4/3

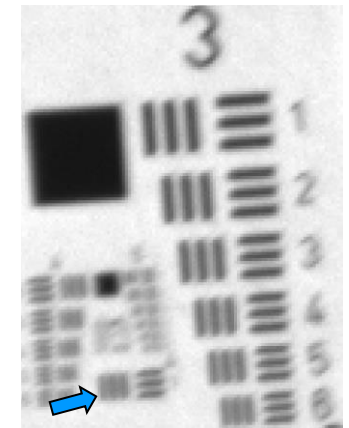
24.8

20

0.192

105

Corner



4/1

31.25

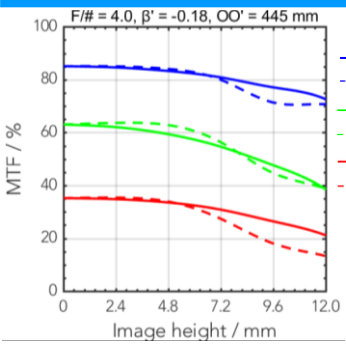
16

0.192

83

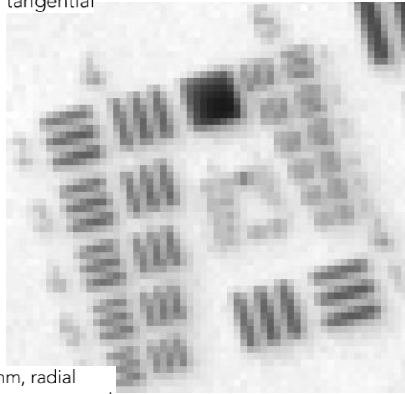
Comparison: F#/4 vs. F#/5.6 @320 mm WD

Vertical Optical axis

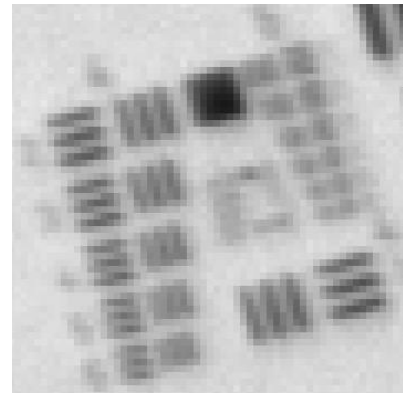


F#/4

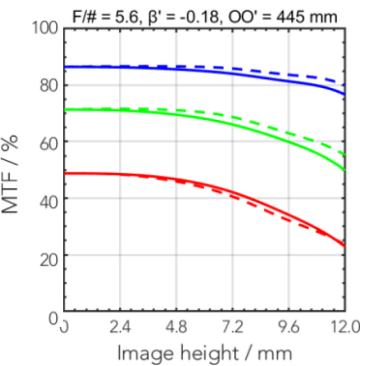
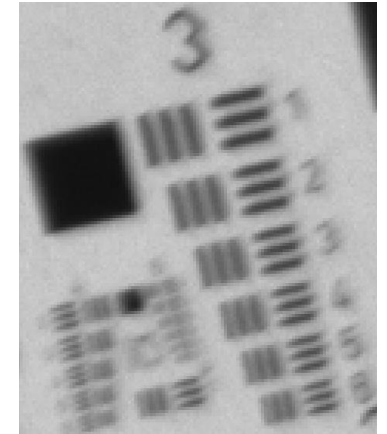
Center



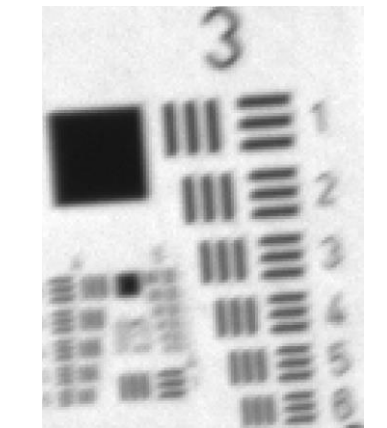
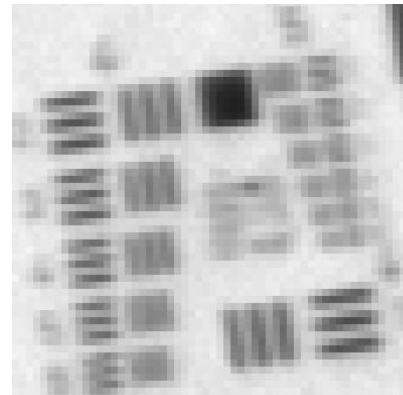
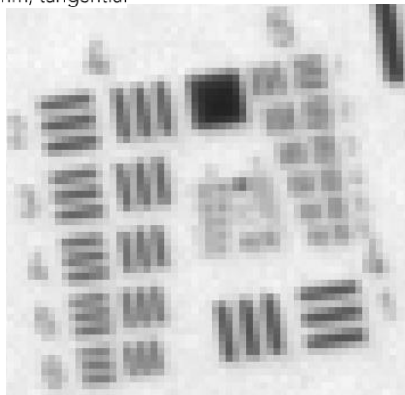
Edge



Corner



F#/5.6



Horizontal Optical Axis, @0 dpt, 480 mm WD F#/4

Camera

Sensor size = 4104x3006 pixels

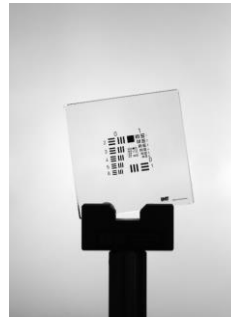
Nyquist limit = 144 lp/mm

Pixel size = 3.45 μm

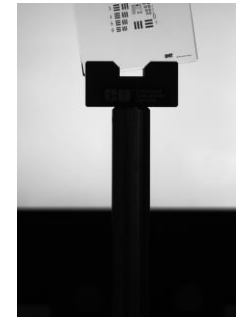
Light

White background illumination

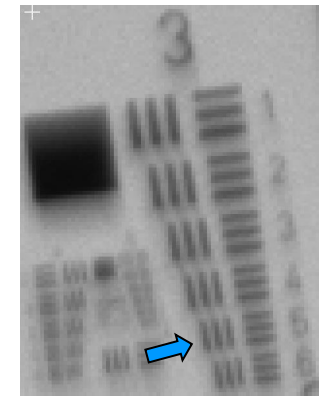
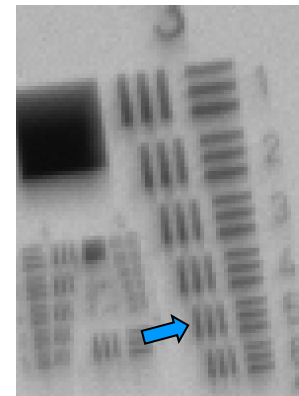
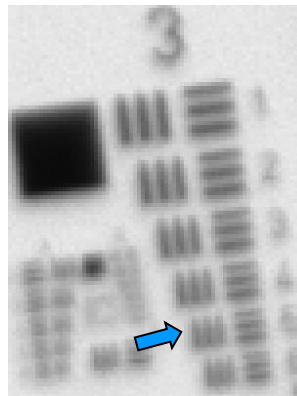
Center



Edge



Corner



USAF element: 3/5
Line width (μm): 39.37
Lp/mm (object): 13
Magnification: 0.137
Lp/mm (image): 93

3/5
39.37
13
0.137
93

3/5
39.37
13
0.137
93

Horizontal Optical Axis, @ 2.64 dpt, 320 mm WD F#/4

Camera

Sensor size = 4104x3006 pixels

Nyquist limit = 144 lp/mm

Pixel size = 3.45 μm

Light

White background illumination

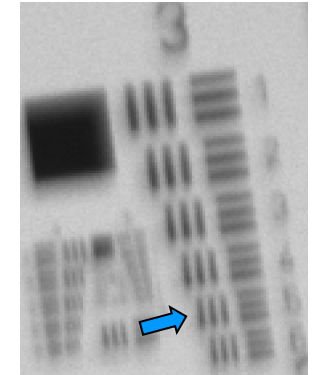
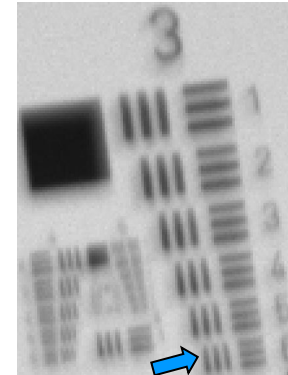
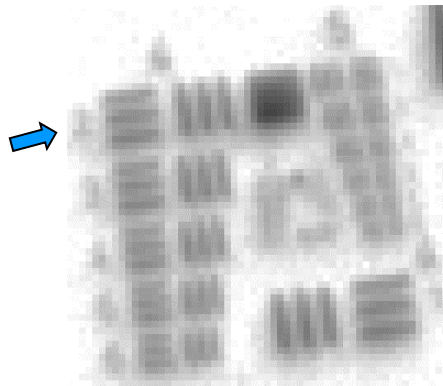
Center



Edge



Corner



USAF element: 4/2
Line width (μm): 27.84
Lp/mm (object): 18
Magnification: 0.191
Lp/mm (image): 94

3/5
39.37
13
0.192
66

3/6
35.08
14
0.192
74

Horizontal Optical Axis, @ 2.64 dpt, 320 mm WD F#/5.6

Camera

Sensor size = 4104x3006 pixels

Nyquist limit = 144 lp/mm

Pixel size = 3.45 μm

Light

White background illumination

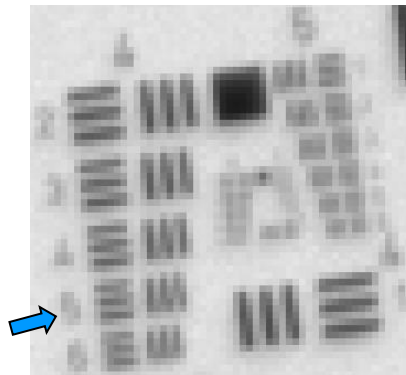
Center



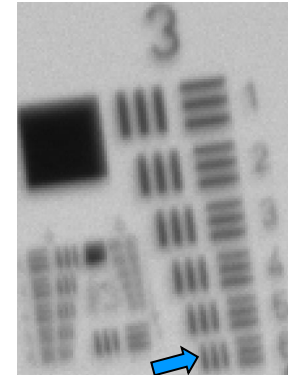
Edge



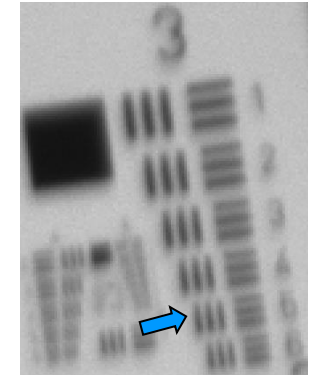
Corner



USAF element: 4/5
Line width (μm): 19.69
Lp/mm (object): 25
Magnification: 0.191
Lp/mm (image): 133



USAF element: 3/5
Line width (μm): 39.37
Lp/mm (object): 13
Magnification: 0.192
Lp/mm (image): 66



USAF element: 3/6
Line width (μm): 35.08
Lp/mm (object): 14
Magnification: 0.192
Lp/mm (image): 74

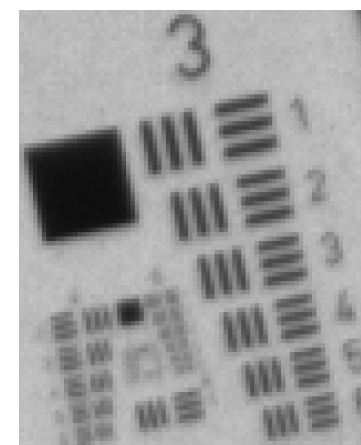
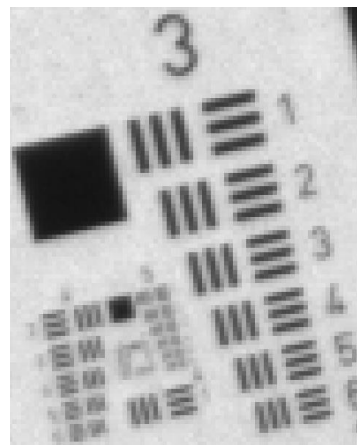
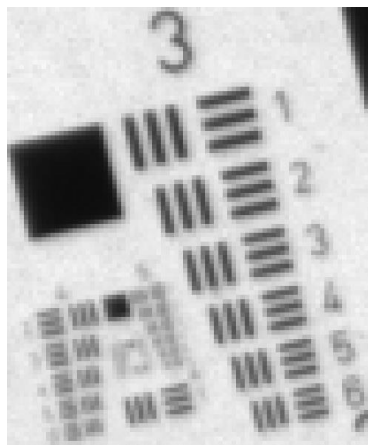
Comparison: Vertical vs. Horizontal Optical axis @ 480 mm WD

Center

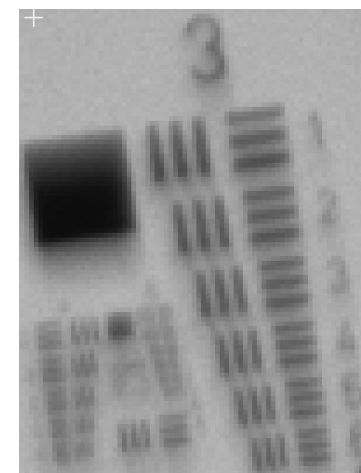
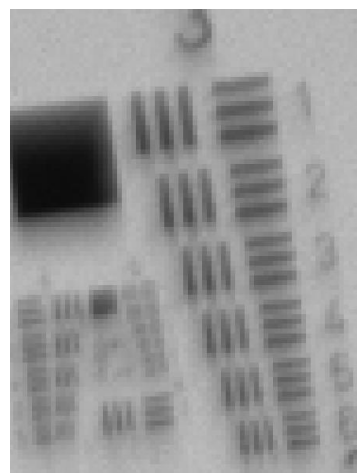
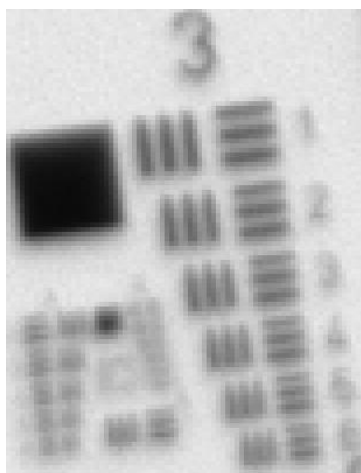
Edge

Corner

Vertical



Horizontal



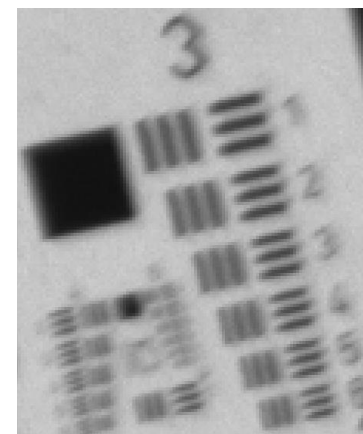
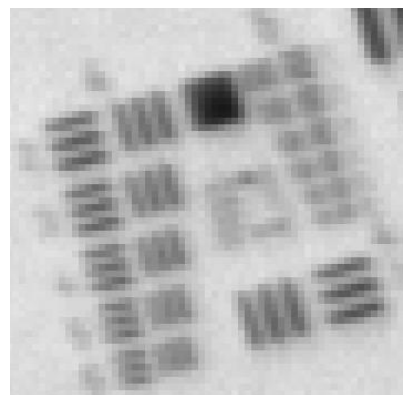
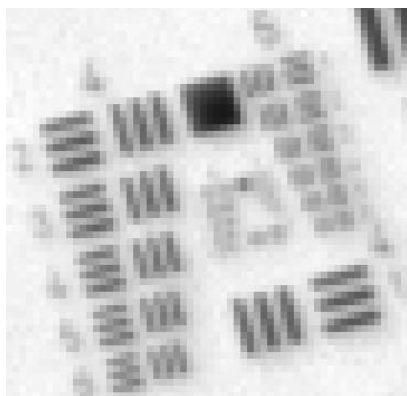
Comparison: Vertical vs. Horizontal Optical axis @320 mm WD

Center

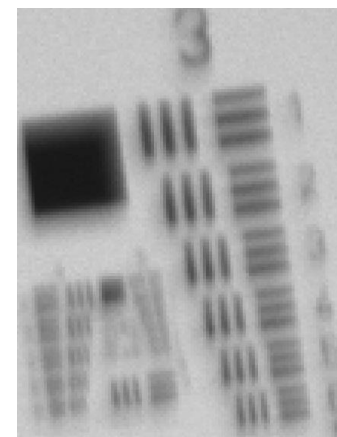
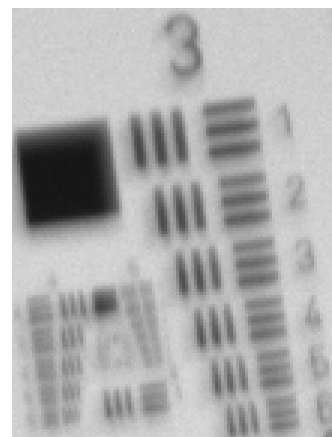
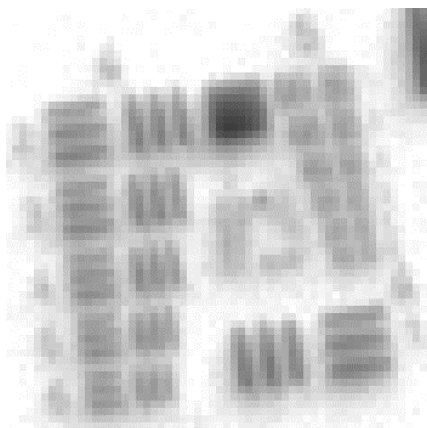
Edge

Corner

Vertical



Horizontal



Comparison: F#/4 vs. F#/5.6 @320 mm WD

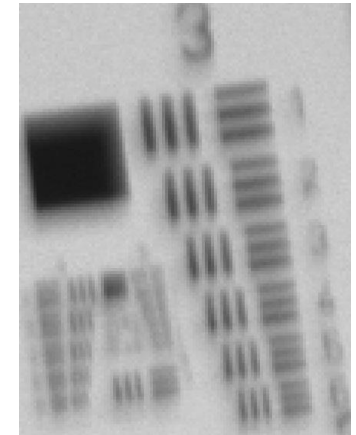
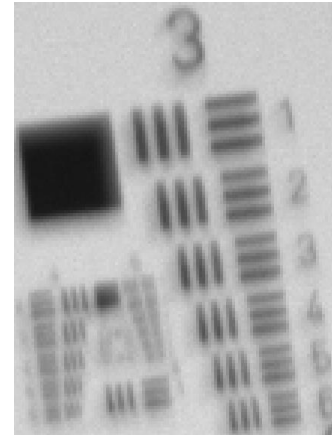
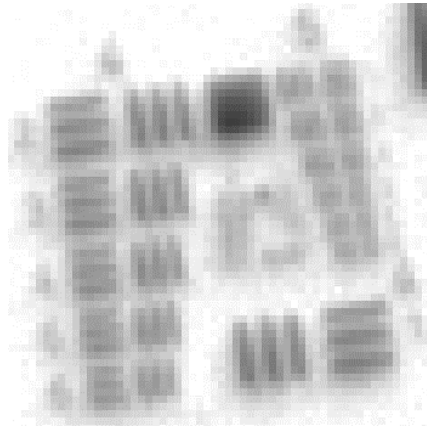
Horizontal Optical axis

Center

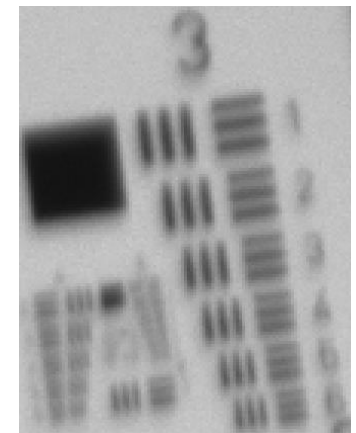
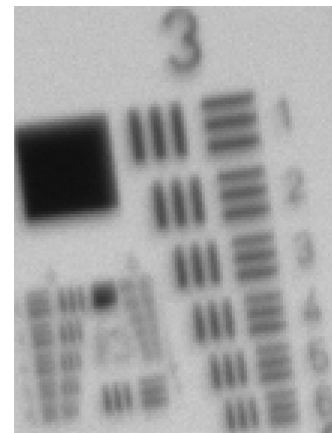
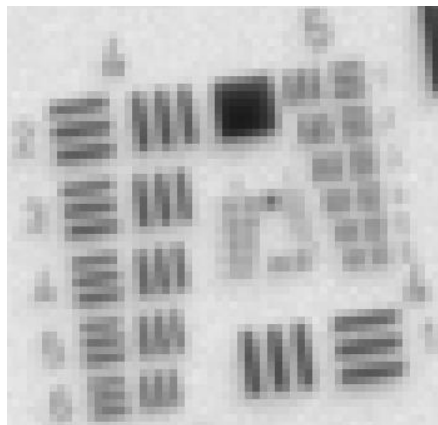
Edge

Corner

F#/4



F#/5.6



Comparison: F#/4 vs. F#/5.6 @320 mm WD

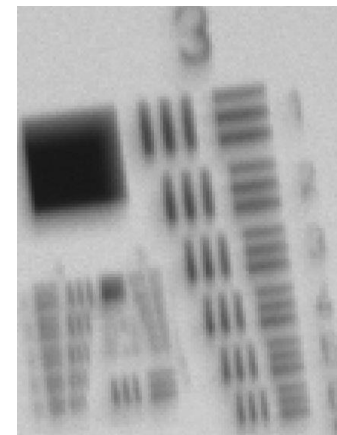
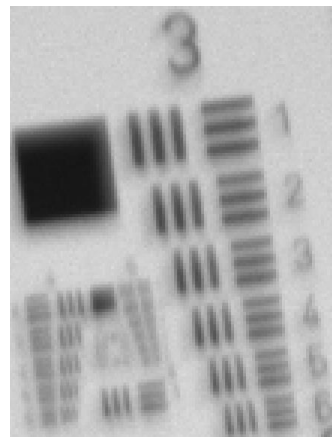
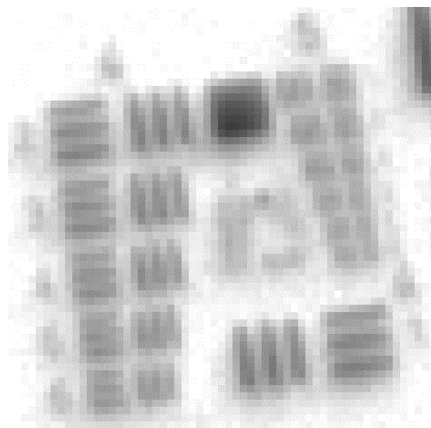
Horizontal Optical axis

Center

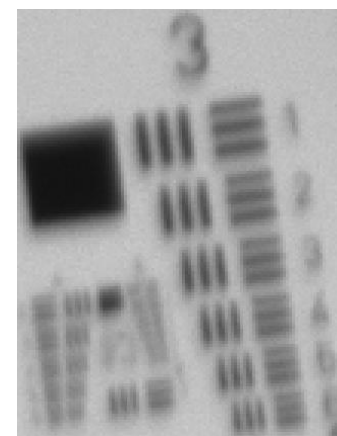
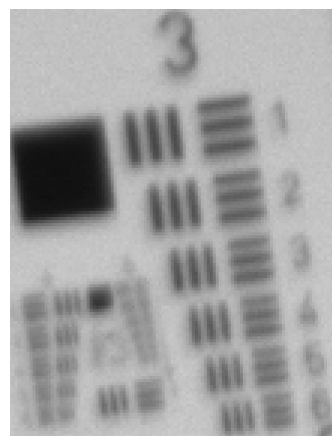
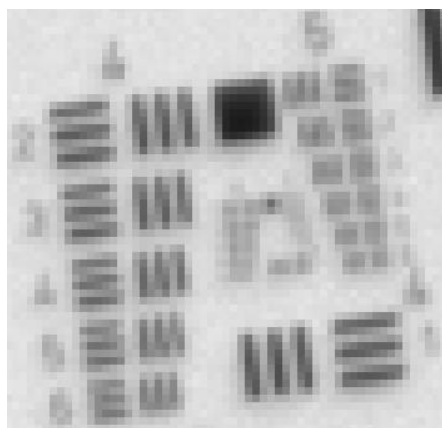
Edge

Corner

F#/4



F#/5.6



0 dpt, 480 mm WD F#/4

Camera

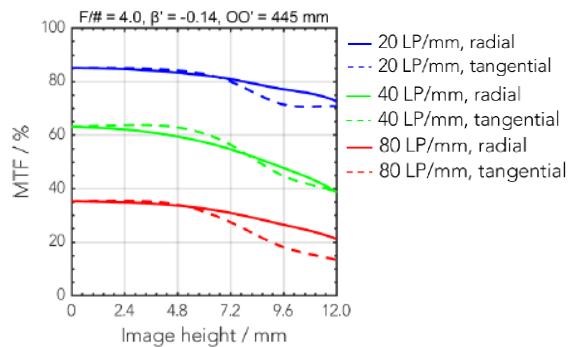
Sensor size = 4104x3006 pixels

Nyquist limit = 144 lp/mm

Pixel size = 3.45 μm

Light

Red background illumination



USAF element:

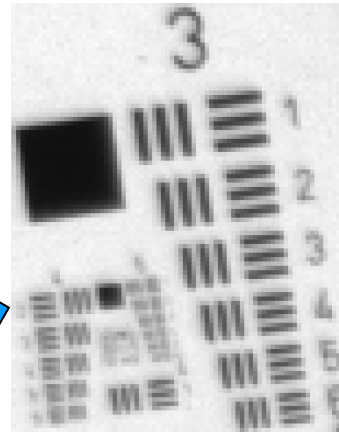
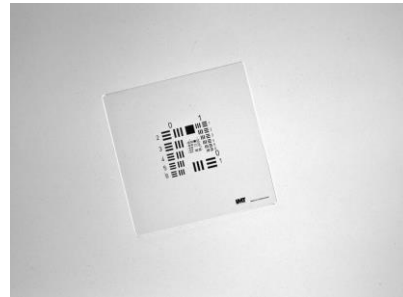
Line width (μm):

Lp/mm (object):

Magnification:

Lp/mm (image):

Center



4/2

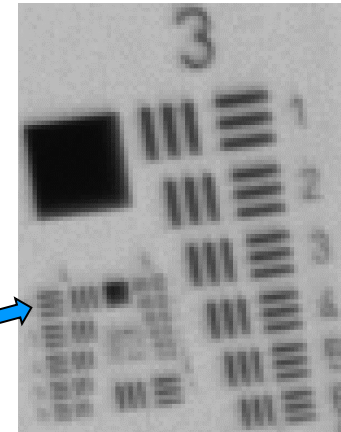
27.84

18

0.137

131

Edge



4/2

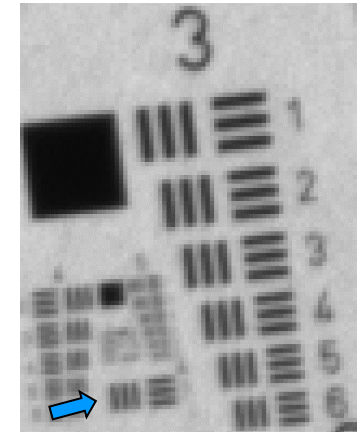
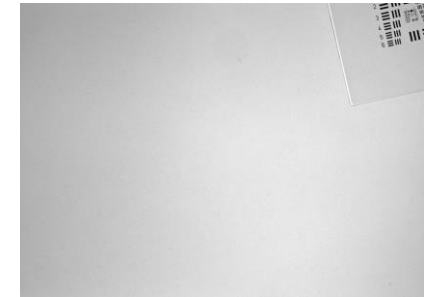
27.84

18

0.137

131

Corner



4/1

31.25

16

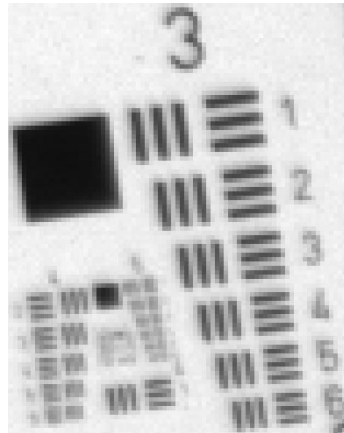
0.137

117

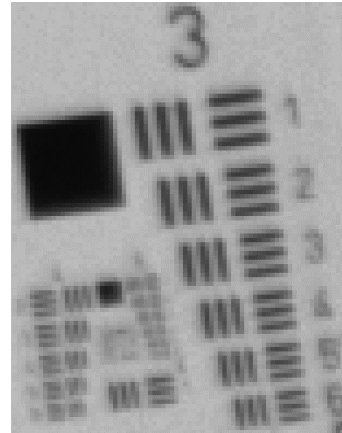
Comparison Red vs. White light

Red

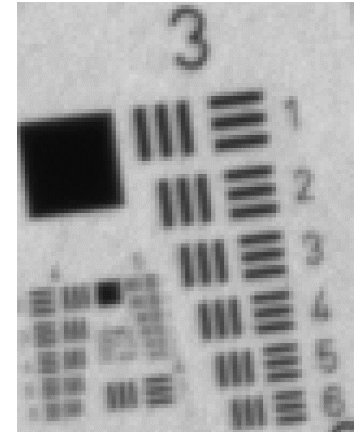
Center



Edge



Corner



White

