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# **c4c 50mm lens w. integrated EL-16-40**

## **Test report**

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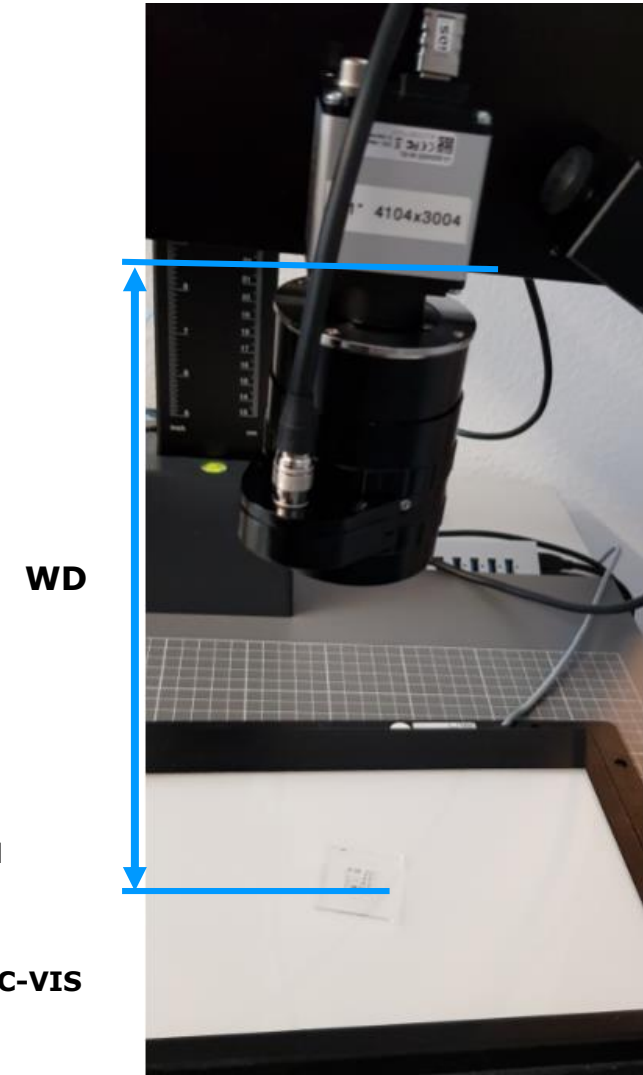
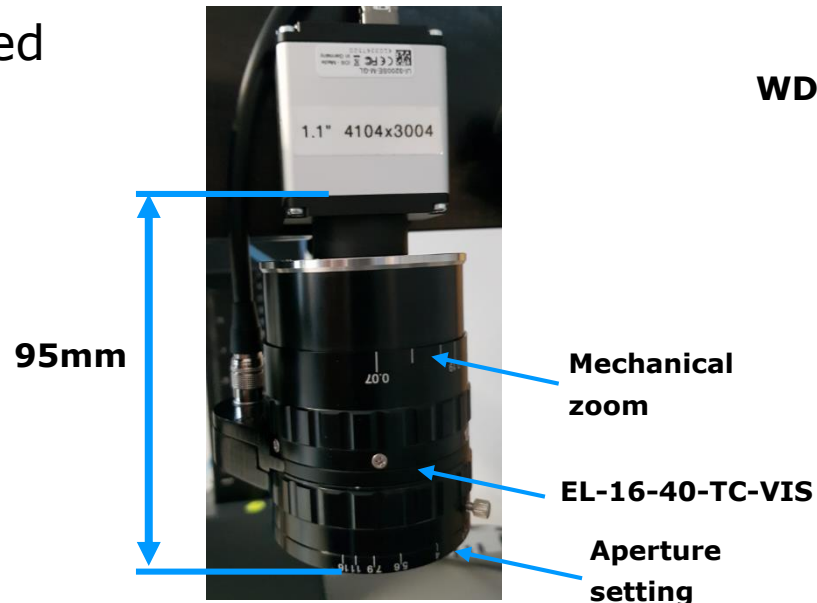
# Summary



- Working distances can range from infinity to 285mm
- Resolution is close to Nyquist limit over the tested 435mm Working Distance (WD) range and across the majority of the field:
  - @500mm WD (98mm HFOV): 24um lines resolved on object (140Lp/mm on sensor)
  - @368mm WD (61mm HFOV): 15um lines resolved on object (138Lp/mm on sensor)
- Good resolution also in horizontal lens position
- Optical leverage 74.6mm/dpt at 500mm WD
- Some vignetting observed, supposedly due to a mechanical assembly issue with the prototype

# Test setup

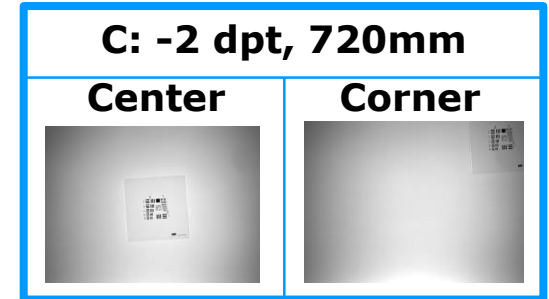
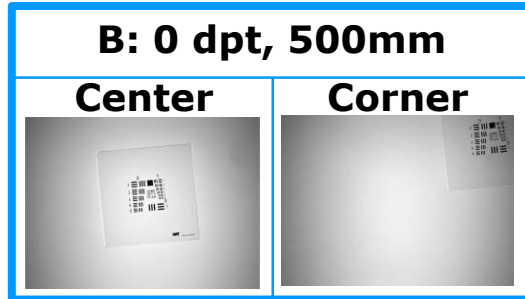
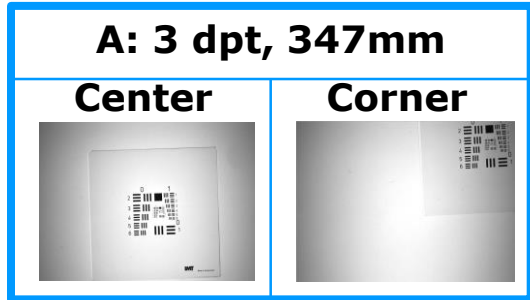
- Camera IDS UI-3200SE-M-GL, 1.1", 3.45um pixel pitch, 4104x3004 pixels
- USAF chrome target on white light background
- c4c 50mm prototype for 1.1"
- F# at 2.8
- EL-16-40-TC-VIS integrated
- Mechanical zoom:
  - Z1: 0 dpt @ 500mm WD
  - Z2: 0 dpt @ 368mm WD



# Z1: WD 500mm resolves 140 LP/mm (image)



Target measured at heights and various locations:



**A: 3 dpt, 347mm**

Center	Corner
USAF element: 4/6	4/6
Line width (um): 17.5	17.5
Lp/mm (object): 29	29
Magnification: 0.211	0.211
<b>Lp/mm (image): 135</b>	<b>135</b>
Nyquist limit: 145	145
Pixel size (um): 3.45	3.45

**B: 0 dpt, 500mm**

Center	Corner
USAF element: 4/3	4/3
Line width (um): 24.8	24.8
Lp/mm (object): 20	20
Magnification: 0.145	0.145
<b>Lp/mm (image): 140</b>	<b>140</b>
Nyquist limit: 145	145
Pixel size (um): 3.45	3.45

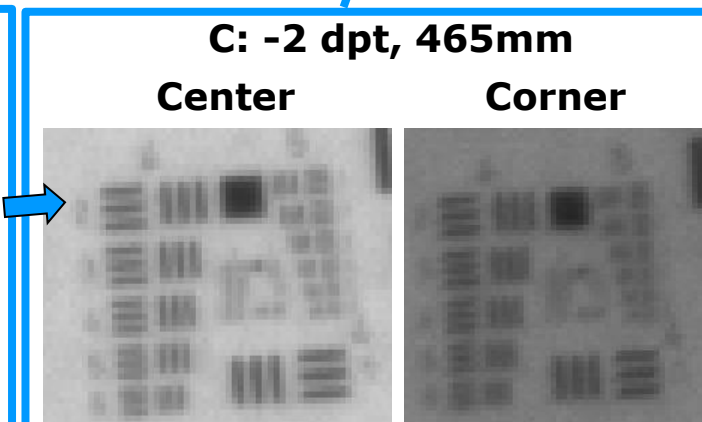
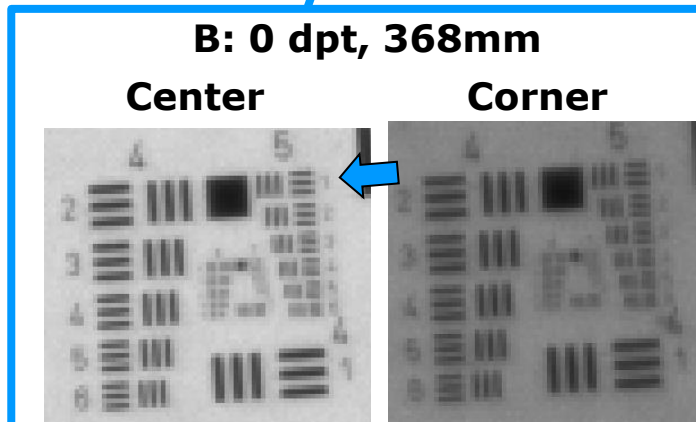
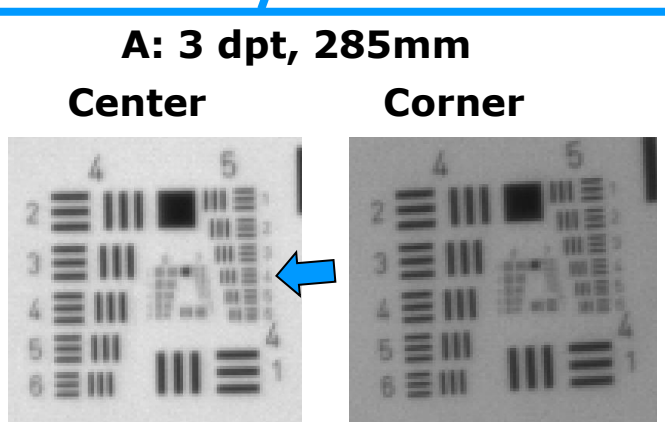
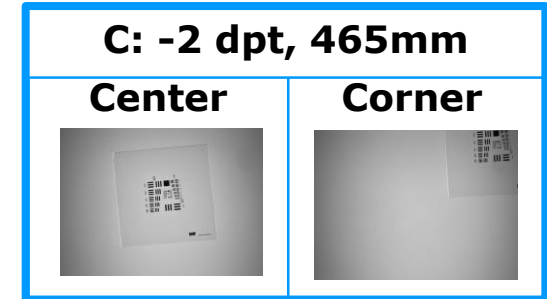
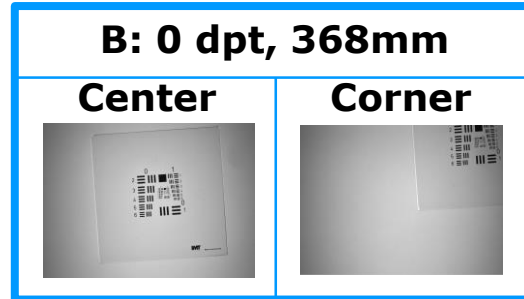
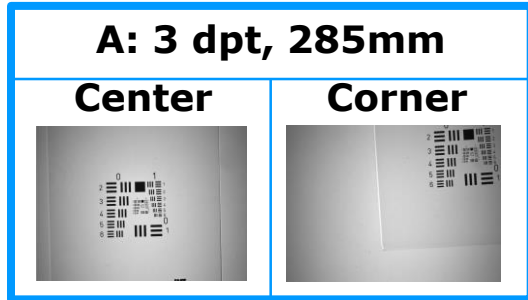
**C: -2 dpt, 720mm**

Center	Corner
USAF element: 3/5	3/5
Line width (um): 39.4	39.4
Lp/mm (object): 13	13
Magnification: 0.097	0.097
<b>Lp/mm (image): 131</b>	<b>131</b>
Nyquist limit: 145	145
Pixel size (um): 3.45	3.45

# Z2: WD 368mm resolves 138 LP/mm (image)



Target measured at heights and various locations:

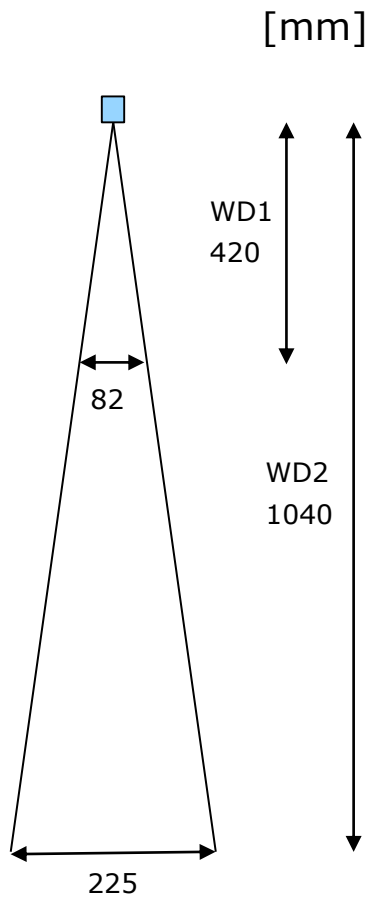


USAF element:	5/4
Line width (um):	11.1
Lp/mm (object):	45
Magnification:	0.345
<b>Lp/mm (image):</b>	<b>130</b>
Nyquist limit:	145
Pixel size (um):	3.45

USAF element:	5/1
Line width (um):	15.6
Lp/mm (object):	32
Magnification:	0.232
<b>Lp/mm (image):</b>	<b>138</b>
Nyquist limit:	145
Pixel size (um):	3.45

USAF element:	4/2
Line width (um):	27.8
Lp/mm (object):	18
Magnification:	0.179
<b>Lp/mm (image):</b>	<b>100</b>
Nyquist limit:	145
Pixel size (um):	3.45

# WD 420 – 1040 mm: 10 mils Barcodes resolved



WD1 @ 3 Dpt:

Resolution 104 LP/mm (image)  
10 mil barcodes very well resolved



WD2 @ -2 Dpt:

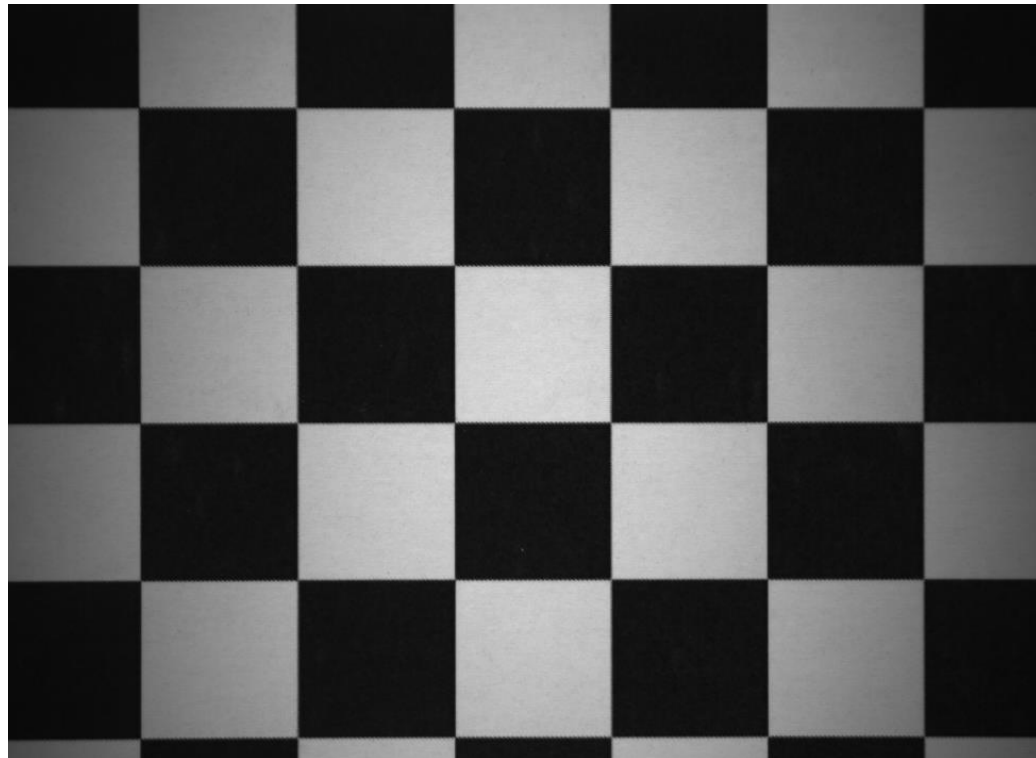
Resolution 114 LP/mm (image)  
10 mil barcodes still well resolved



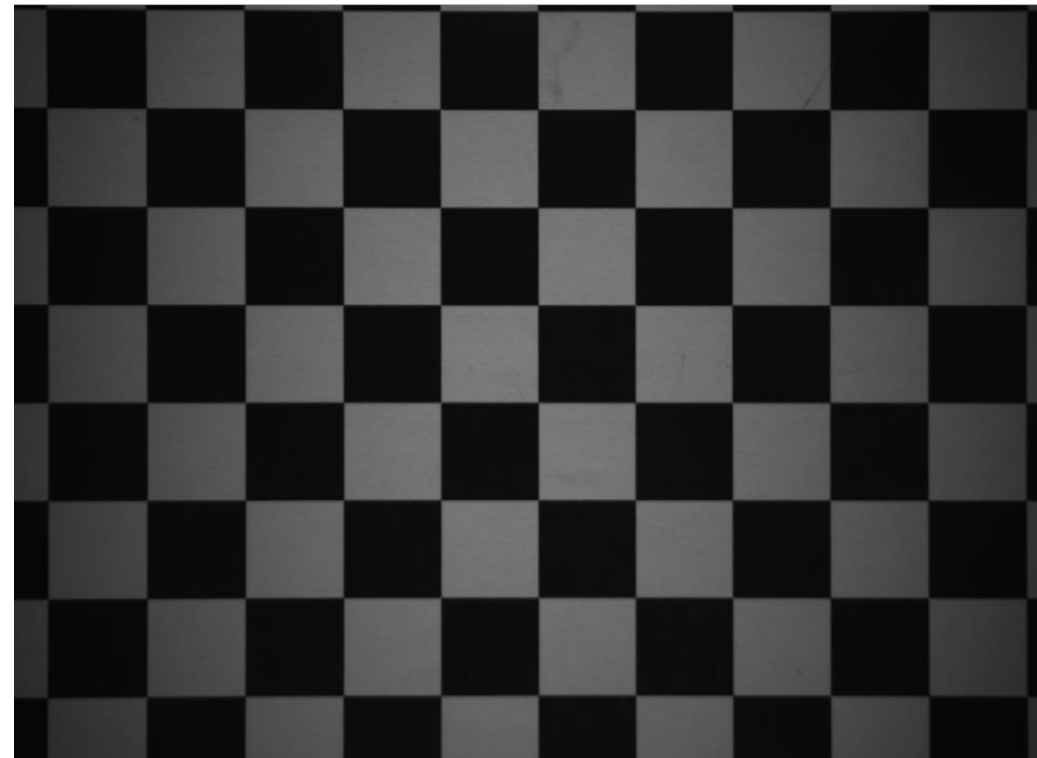
# Z1: Good Field Uniformity at Horizontal (1/2)



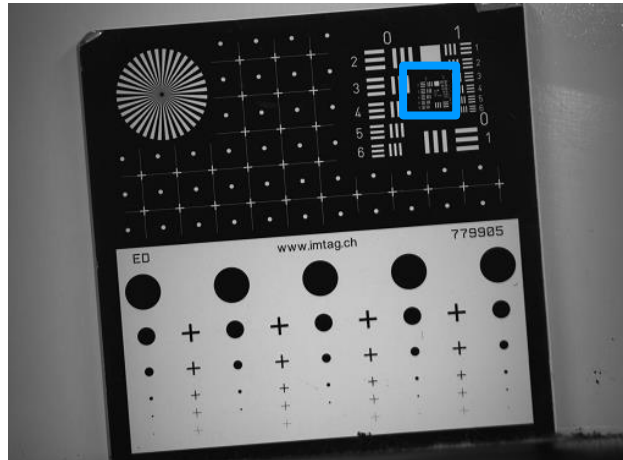
**3dpt, WD 347mm:**



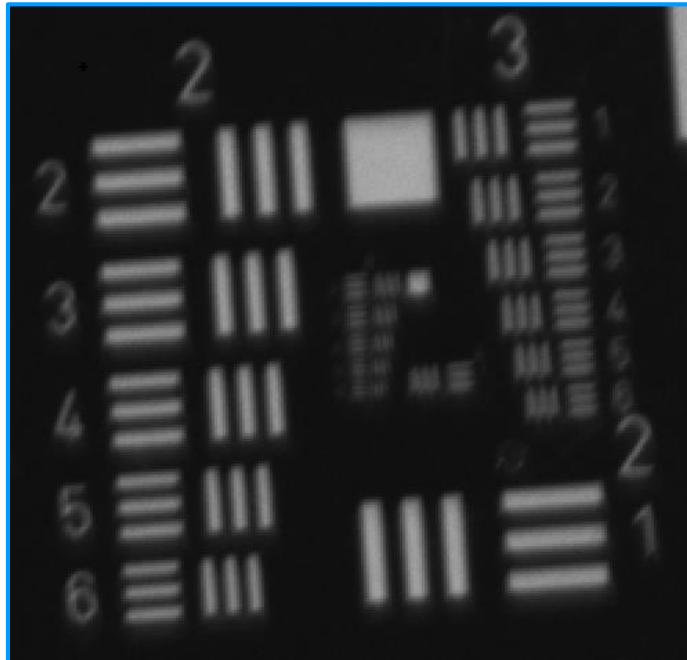
**0dpt, WD 500mm:**



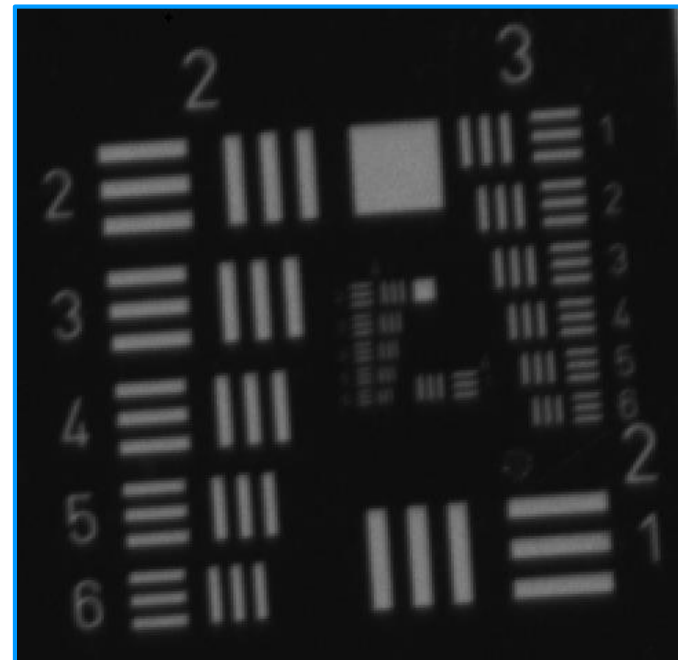
# High resolution also with horizontal optical axis using F/4 as ideal f-number



**F/2.8**



**F/4**





# Some vignetting present\*



**Z1, F# 2.8:**

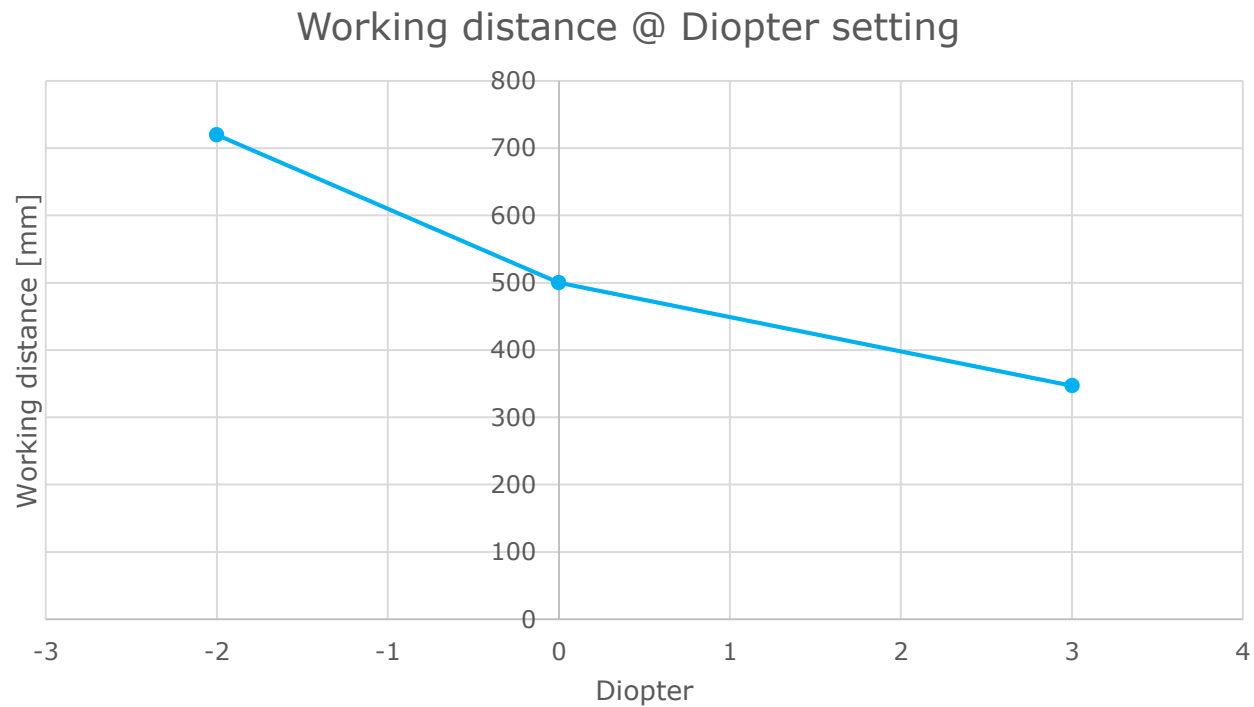


**Z2, F# 2.8 :**



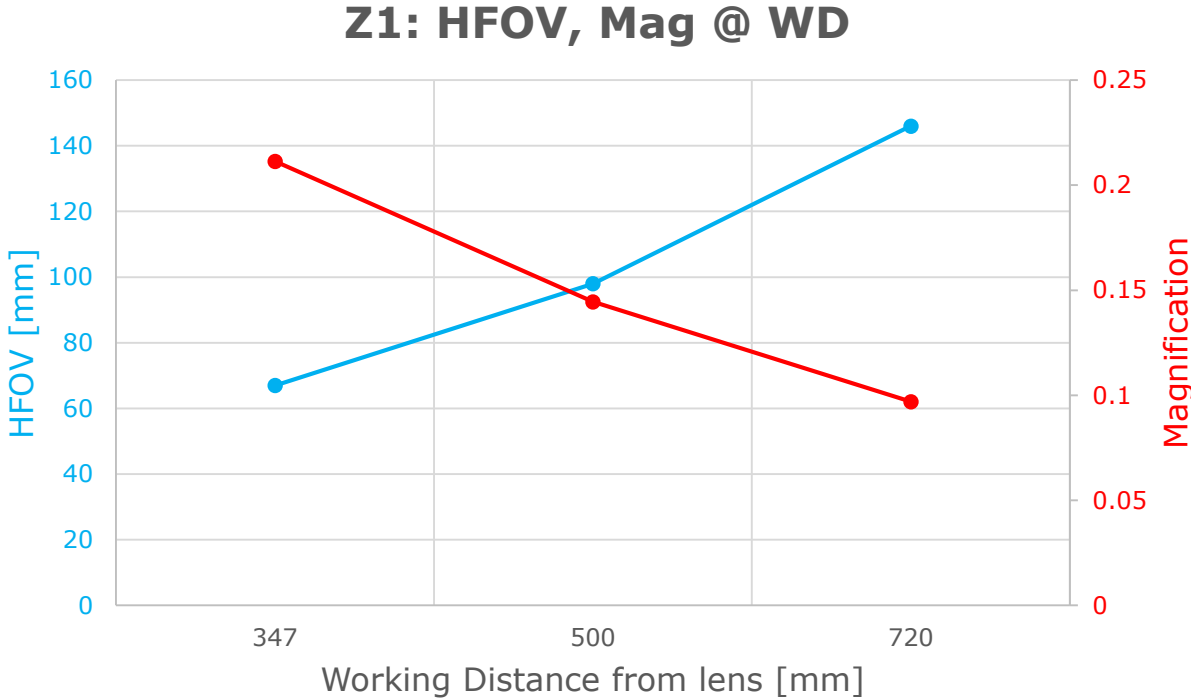
\*According to the manufacturer, this is due to a mechanical issue of the prototypes

# Z1: Optical leverage 74.6mm/Dpt



Optical leverage: 74.6mm/Dpt

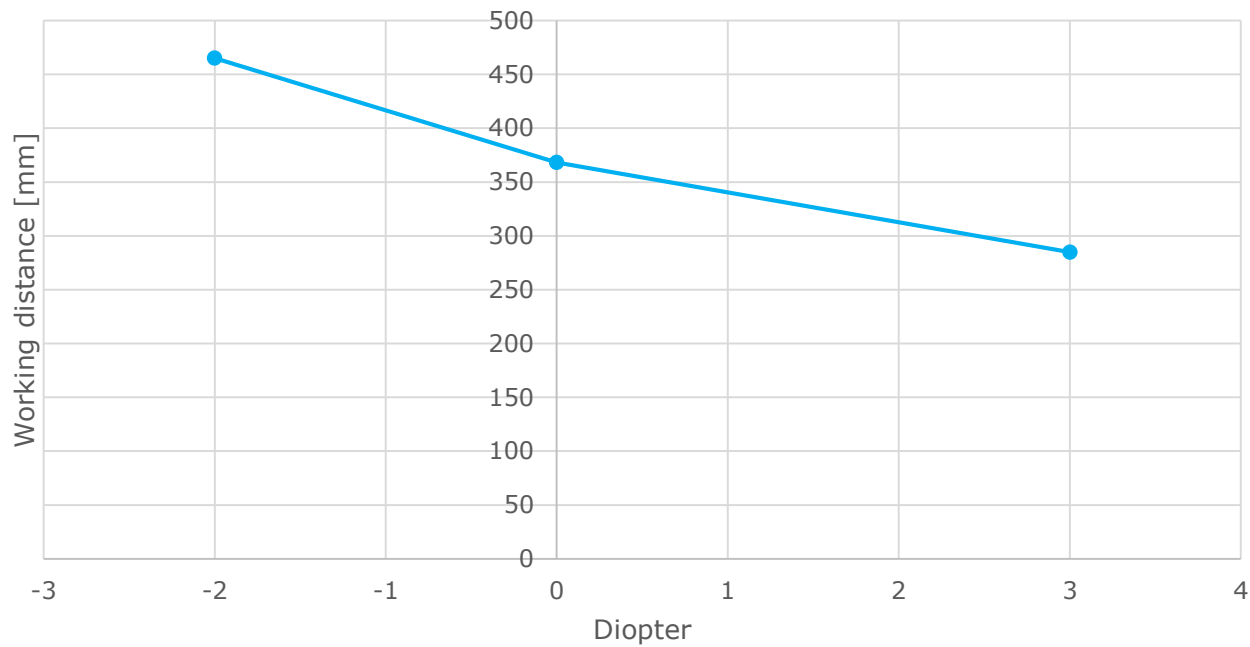
# Z1: Horizontal Field of View 98mm at 500mm WD



# Z2: Optical leverage 36mm/Dpt



Z2: Working distance @ Diopter setting



Optical leverage: 36mm/Dpt

# Z2: Horizontal Field of View 61mm at 368mm WD

