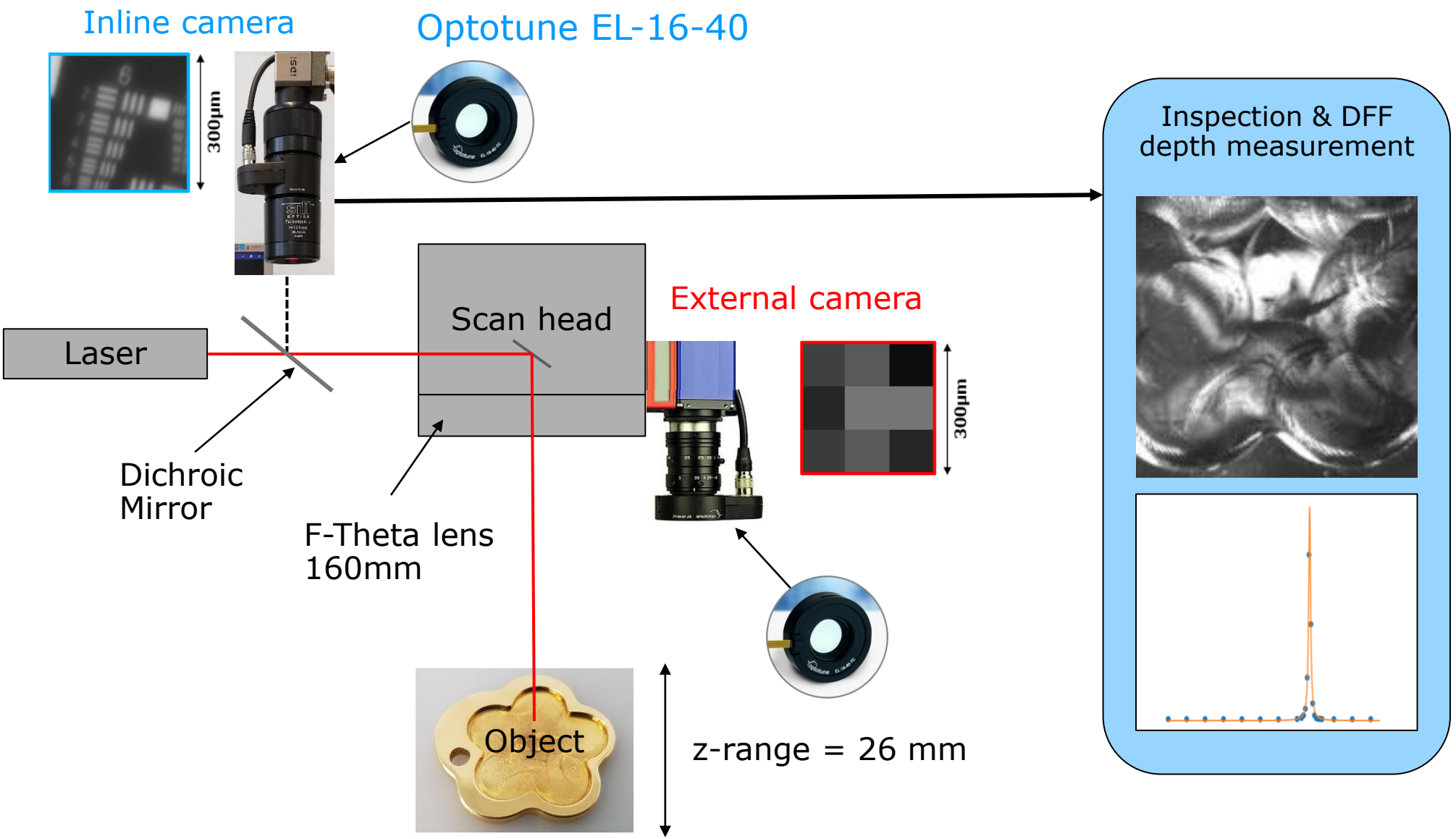
新特光电
Sintec Optronics

S5VPJ0303 + EL-16-40

Variable focus for laser processing inline inspection through galvo scan head and f-theta lens

Inline inspection and Depth from Focus (DFF) applied to laser processing applications



Summary

- Z-range of 26mm achieved with -2 to +3 dpt
  - At nominal WD of 144mm (@0dpt)
  - Optical leverage is ~5mm per diopter
- No vignetting
- HFOV of 4mm achieved with 2/3” sensor
- 4.4um resolution on the object
- Note: f-theta lens is optimized for 1064nm, while this test was done with red light

Sill Optics S5VPJ0303 with integrated EL-16-40

Test setup without galvo mirrors

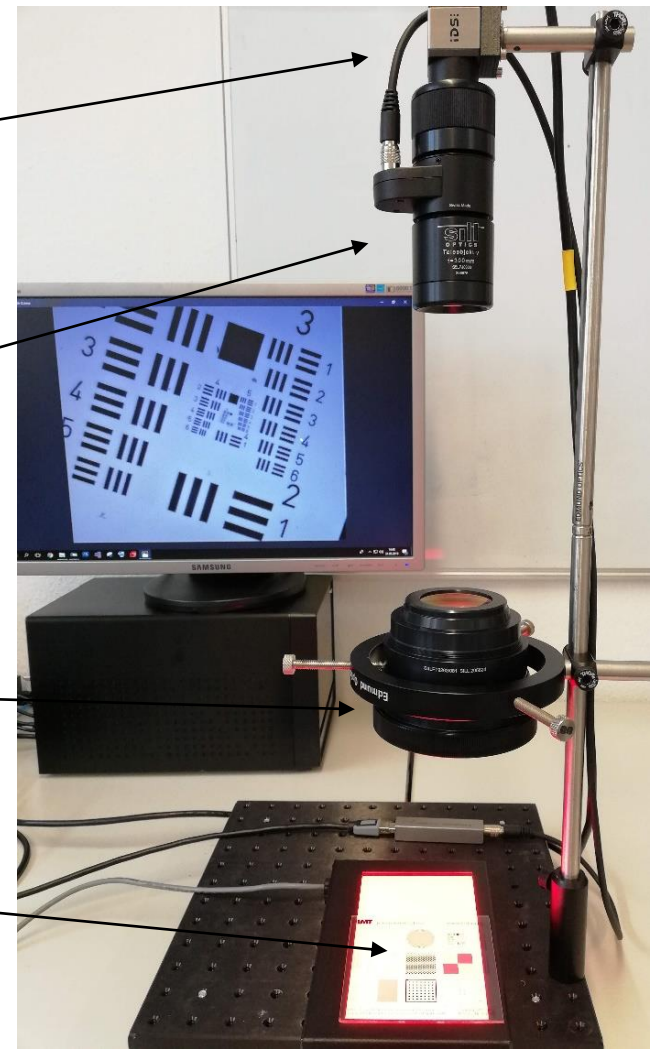
C-mount camera: UI-3080CP-M
2/3”, 2464 x 2056 @ 3.45um

Telelens:

- Sill Optics S5VPJ0303 300mm lens
- Optotune EL-16-40-TC-VIS-5D-M42 integrated

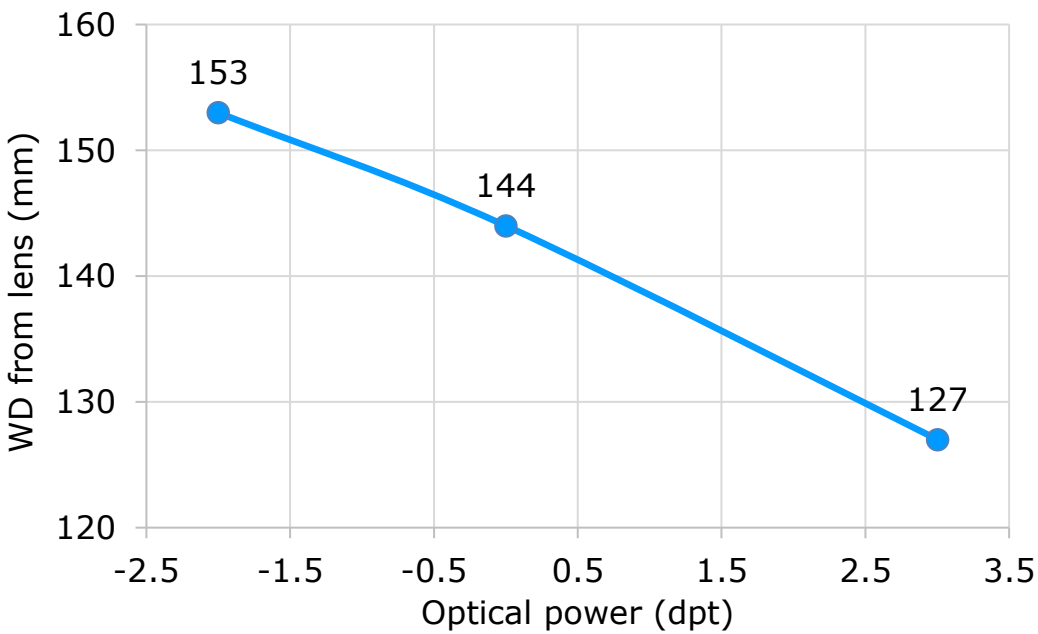
F-theta lens:
Sill Optics S4LFT9263/081 160mm focal length

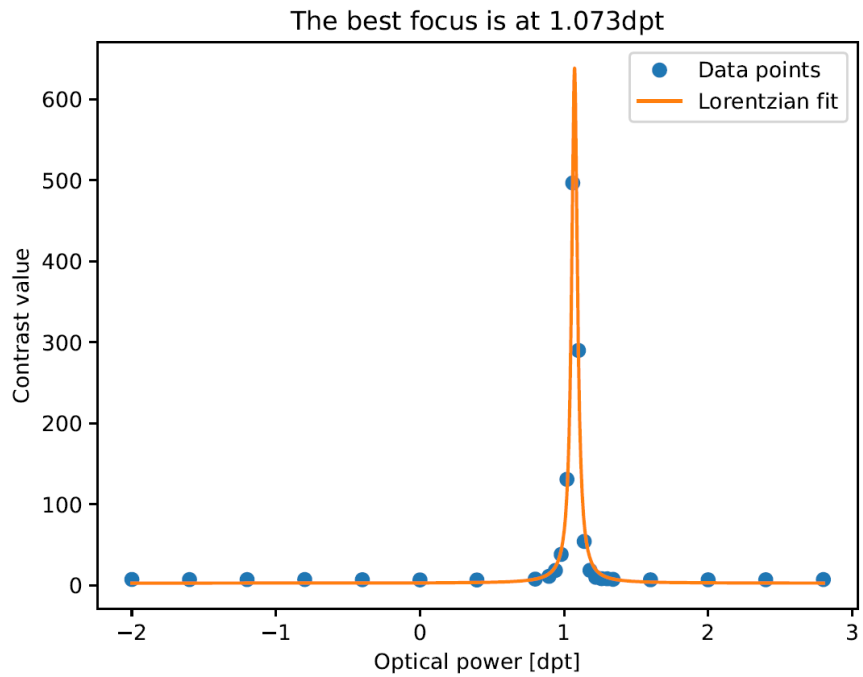
Test targets with red LED back light



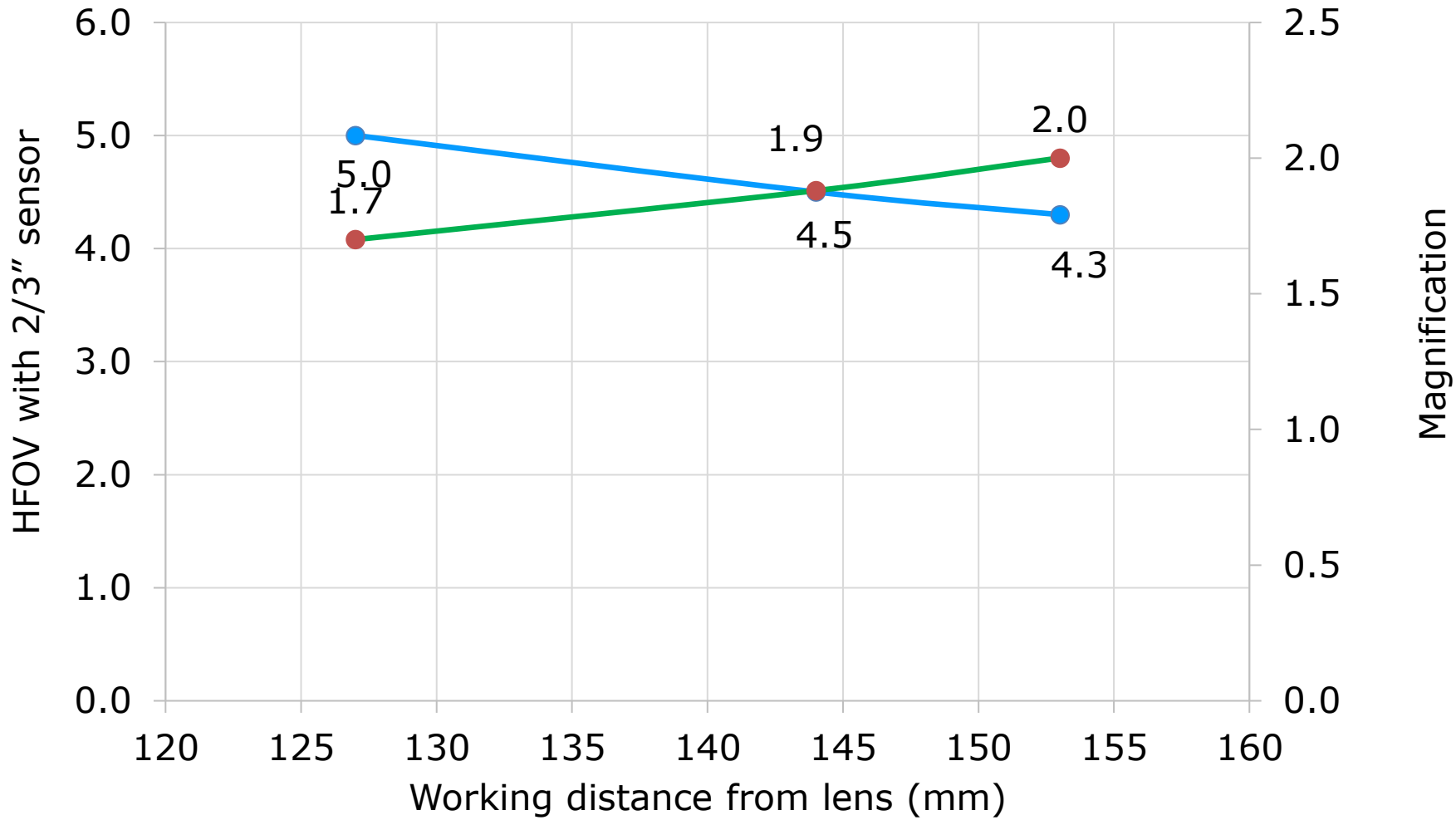
Working distance range of 26mm with autofocus accuracy of 50µm

- Working distance range of 26mm achieved with -2 to +3 diopters
  - ➢ Optical leverage: ~5 mm per diopter
- Repeatability of the autofocus is ~0.01 diopter
  - ➢ Corresponding accuracy of the distance measurement is ~50 µm

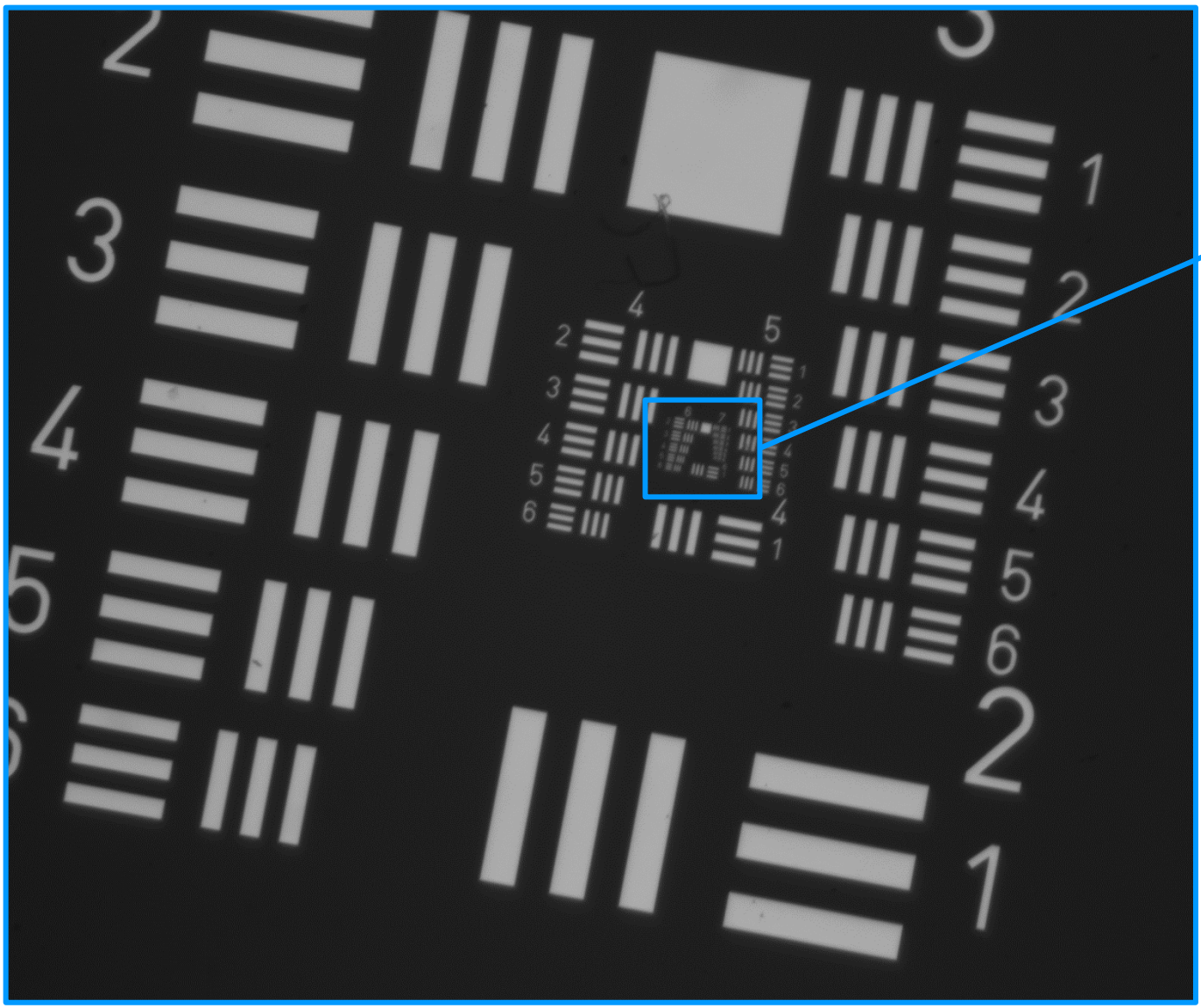


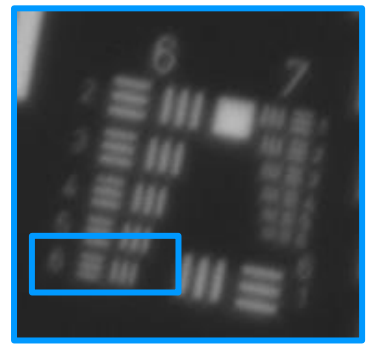


Magnification changes with 1% per mm from 1.7x to 2.0x over the 26mm z-range



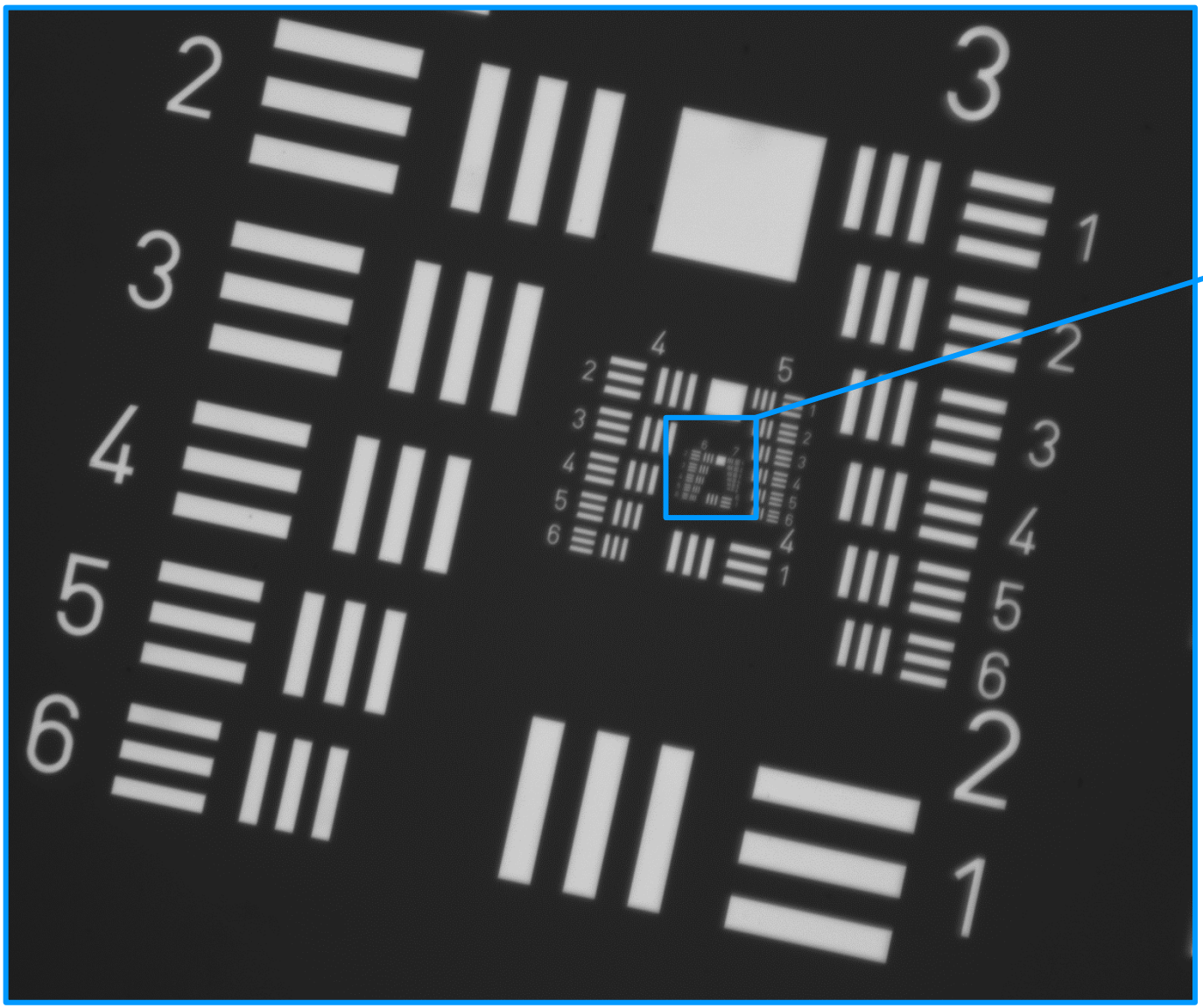
Sample image at 153mm working distance

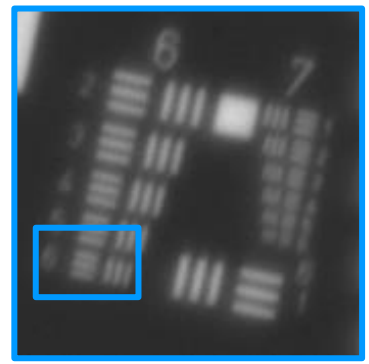




USAF element:	6/6
Line width (um):	4.38
Lp/mm (object):	114
Magnification:	2.024
Lp/mm (image):	**56**
Nyquist limit:	145
Pixel size (um):	3.45

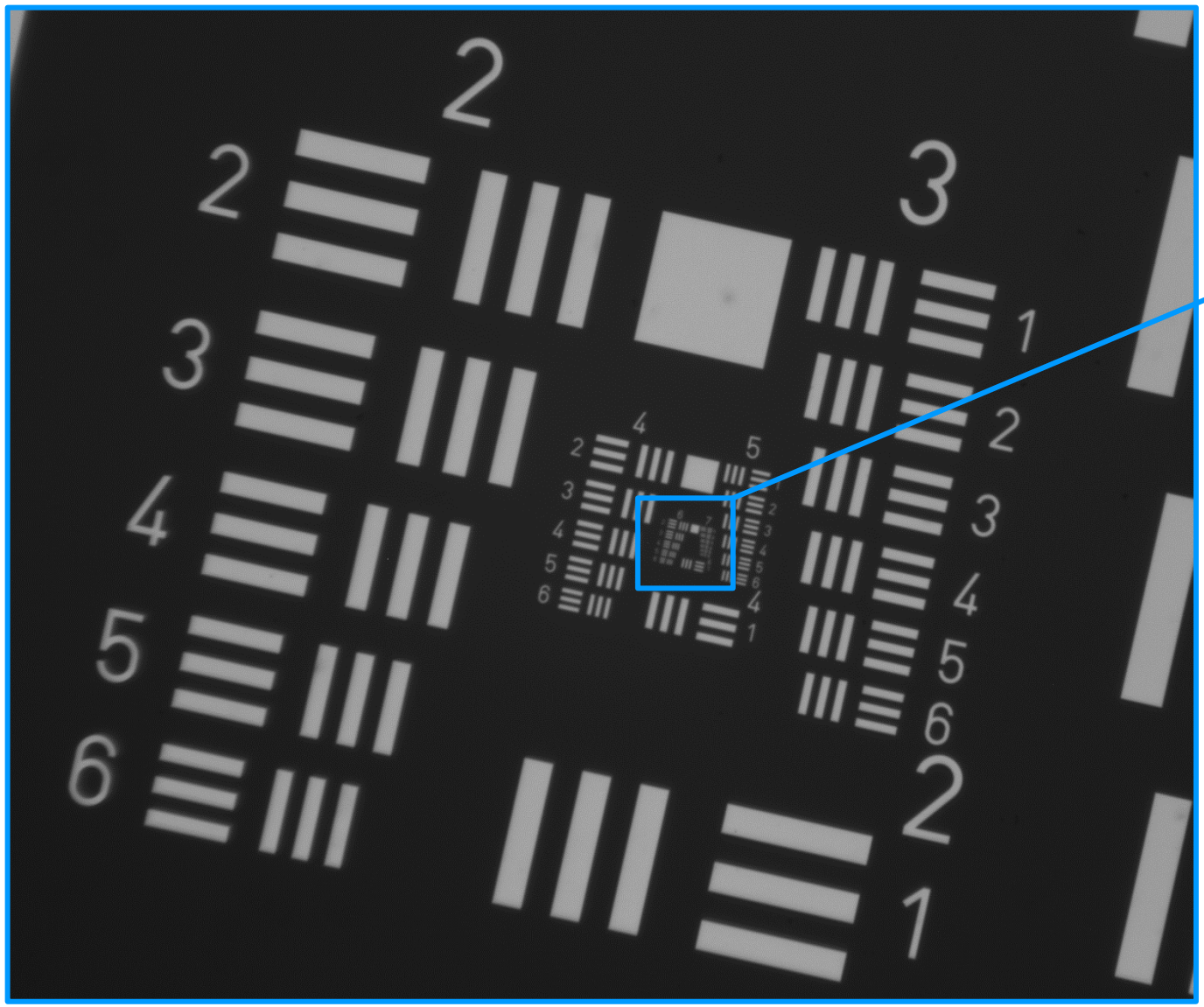
Sample image at 144mm working distance

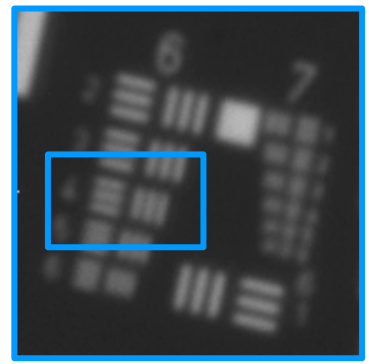




USAF element:	6/6
Line width (um):	4.38
Lp/mm (object):	114
Magnification:	1.889
Lp/mm (image):	**60**
Nyquist limit:	145
Pixel size (um):	3.45

Sample image at 127mm working distance





USAF element:	6/3
Line width (um):	6.2
Lp/mm (object):	81
Magnification:	1.700
Lp/mm (image):	**47**
Nyquist limit:	145
Pixel size (um):	3.45