

High-NA chromatic and field corrected Endoscopic Imaging Objectives (MO-ACR)

GRINTECH's high-NA Endoscopic Imaging Objectives with object Numerical Apertures of 0.75 are offered in a broad achromatic and field corrected version to significantly increase the usable field of view. A GRIN-refractive multilens hybrid design allows a broader chromatic and off-axis correction resulting also in a higher confocal sensitivity (confocal signal throughput) compared to the previous versions with diffractive correcting elements.

Applications:

In vivo endomicroscopy, single photon fluorescence microscopy, nonlinear optical imaging modalities (SHG, TPF), tissue imaging, flexible fluorescence microscopy, NA conversion

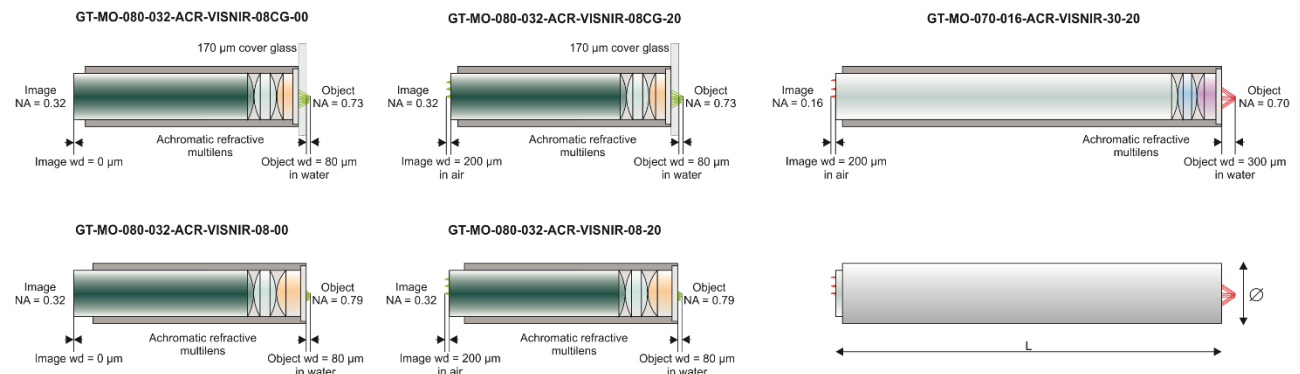
GT-MO-080-032-ACR-VISNIR-xx-xx series represents high resolution field and color corrected objectives with a magnification of 2.3. The image side NA of 0.32 matches to imaging fiber bundles. Color correction is from 450 nm to 900 nm with an optimal performance from 488 nm to 520 nm. The objectives are assembled in stainless steel mounts.

GT-MO-070-016-ACR-VISNIR-30-20 is optimized for wavelengths of 450 nm and 900 nm to achieve an ideal performance in SHG and TPF applications within a large field of view.

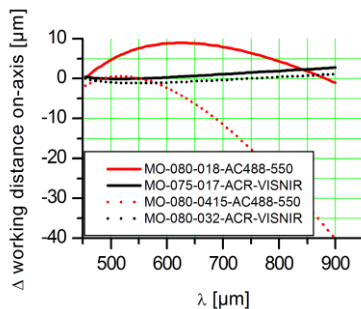
Four combinations of proximal and distal working distances are offered as listed below:

GT-MO-080-032-ACR-VISNIR-...	...08CG-00	...08CG-20	...08-00	...08-20
Object NA	0.73	0.73	0.79	0.79
Object WD in water [μm]	80	80	80	80
Designed for cover glass [μm]	170	170	none	none
Image NA	0.32	0.32	0.32	0.32
Image WD in air [μm]	0	200	0	200
Magnification	2.2	2.2	2.3	2.3
Dimensions Ø / L [mm]	1.3 / 4.89	1.3 / 4.57	1.3 / 5.02	1.3 / 4.7

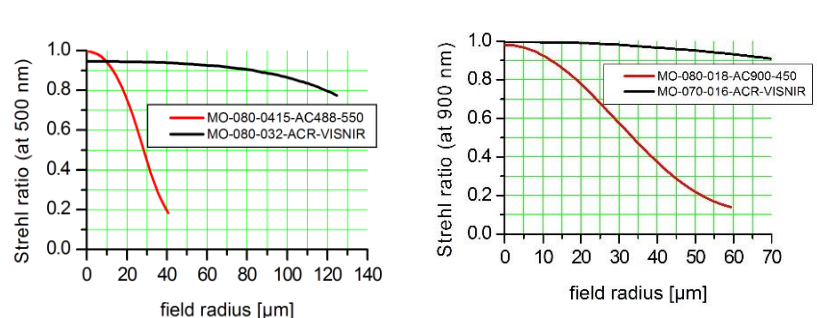
GT-MO-070-016-ACR-VISNIR-30-20
0.7
300
none
0.16
200
4.5
1.3 / 8.36



Chromatic Aberration in Object Space



Field Dependent Strehl Ratio in Object Space (From Optical Design)



Variations due to modifications of the production process are possible. It is the user's responsibility to determine suitability for the user's purpose. For tolerances, handling and storage see page 26

Application Note – High NA chromatic and field corrected Endomicroscopic Imaging Objectives

The generation of GRINTECH's color and field corrected high-NA **MO-ACR** objectives resolve cellular details in micron resolution from center to the margin of the aperture

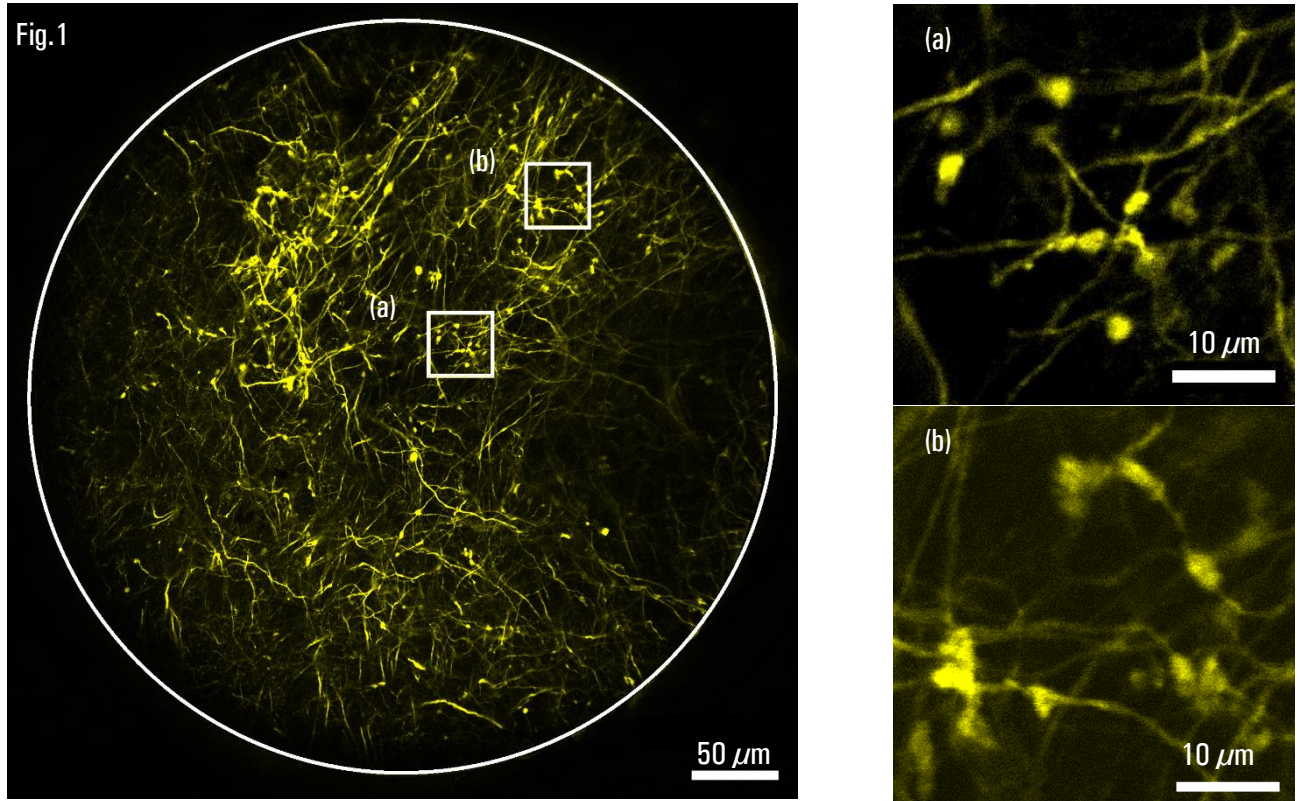


Fig.1: Mouse brain section, PFA fixation, cover glass 170 μm confocally imaged in fluorescence (exc. 488nm) with **GT-MO-080-032-ACR-VISNIR-08CG-00** coupled to Olympus FV1000 with MO 10x; NA=0.4 with XYZ-Stage. White circle shows backside aperture of 1 mm corresponding to full object FOV of 450 μm , with optimal imaging quality in FOV of 360 μm . (a) and (b): 40 μm x 40 μm sections of the center and edge of object FOV.

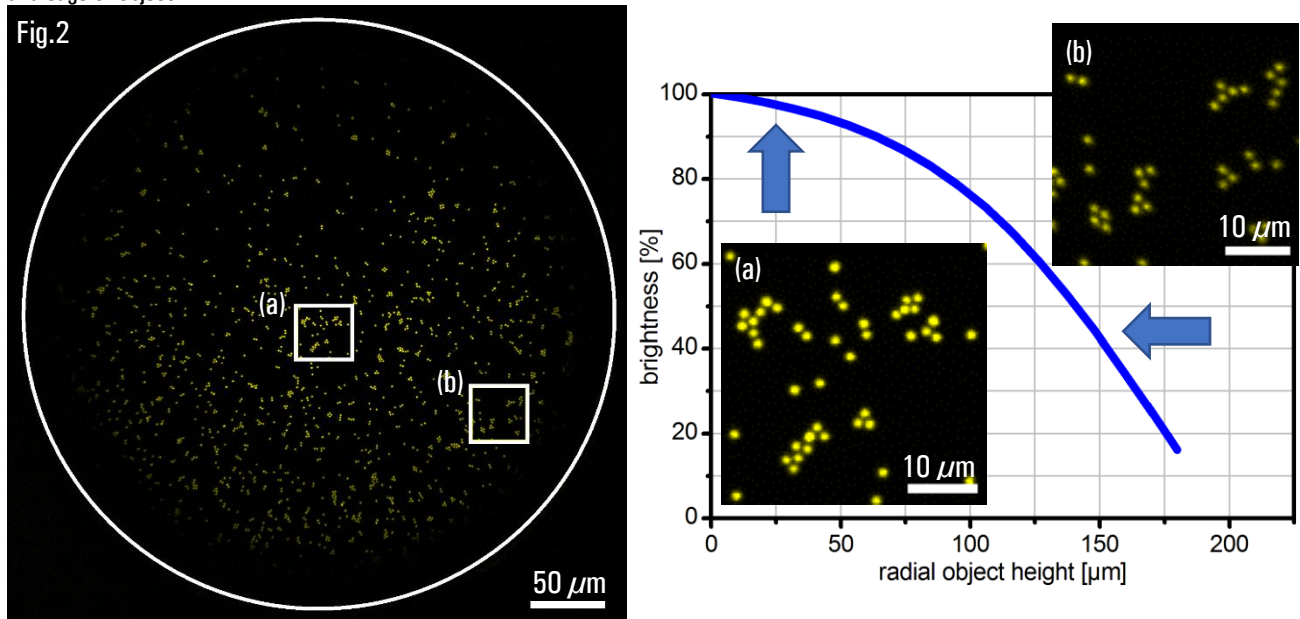


Fig.2: fluorescence beads with $\varnothing = 2\mu\text{m}$ yellow/green acquired with **GT-MO-080-032-ACR-VISNIR-08-00**. Right: bead brightness depending on the radial object height. (a) and (b) 40 μm x 40 μm sections from the center and edge of object FOV.

The usable field of view is increased to 300 % in diameter compared to previous MO-080 objectives

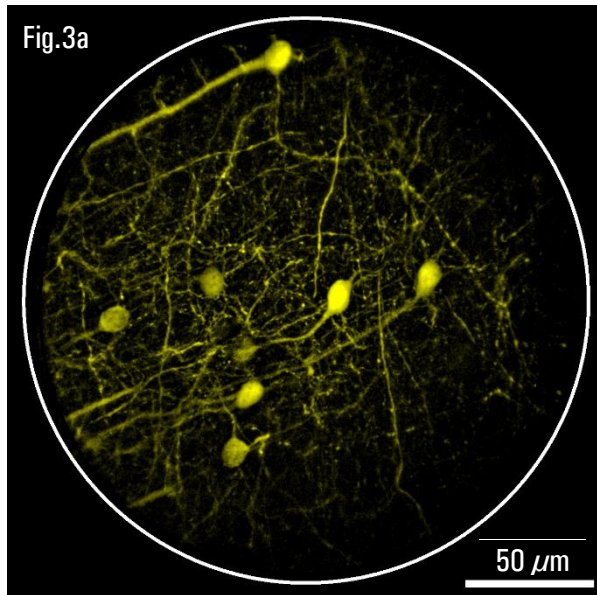


Fig.3a: GT-MO-070-016-ACR-VISNIR-30-20
with full object FOV of 200 μm (optimal imaging in 150 μm)
compared to **Fig.3b**.

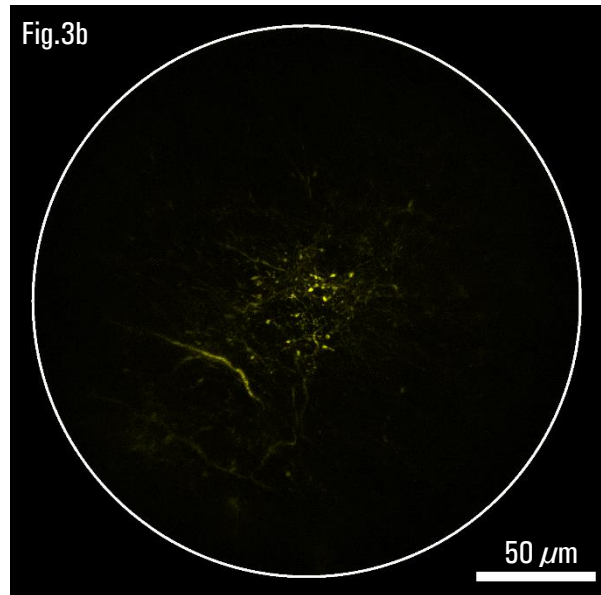


Fig.3b: GT-MO-080-018-AC900-450 with FOV of 65 μm

Now available also in 1.3 mm outer diameter instead of 1.4 mm

For more details, please contact GRINTECH.

Tolerances / Handling Instructions

Tolerances:

For of our single lenses we have the following fabrication tolerances and quality criteria:

Tolerances:

lens length z : $\pm 5\%$ due to variations of the gradient constant
working distance s : ± 0.02 mm (only LFRL- and CFRL lens series)
diameter d : $+ 0 / -0.01$ mm
- tighter diameter tolerances on request

Surface quality:

5 / 3 x 0.025; L 3 x 0.005; E 0
(defined by DIN ISO 10110-7:2000-02).
The surface quality is defined within 90 % of the lens diameter.
Outside of this area defects are allowed.

Storage and Handling of Lenses

Storage

GRIN lenses and lens systems should be stored in a dry environment. For short term storage, the plastic box or foam packing in which the lenses are shipped will provide adequate storage.

Recommended storage temperature: -20°C - 80°C .

Storage boxes should ensure that the lenses do not touch each other to prevent chipping and scratches. Best is to use the original box.

Handling

Lenses should be carefully handled with plastic tweezers, preferably those with a tapered end. Lenses should be picked up out of their individual compartments by firmly holding each on its side cylinder surface (not the polished ends). Especially small sized lenses may stick to the lens box material and can be lost during removal.

Cleaning

If it is necessary to clean the lens surfaces due some dust or other contaminant which may impair the optical performance. GRINTECH generally recommends the use of ethyl alcohol as a cleaning solvent, maybe combined with some smooth lintfree lens cleaning tissue.

Acetone may also be used, but it should be pure enough, otherwise it might leave some residue on the lens surface.