

## High-NA chromatically and field corrected Endomicroscope Tube for CARS and non-linear imaging

GRINTECH's high-NA Endomicroscope tube with object Numerical Aperture of 0.50 features sub-micron resolution imaging with a field of view of 300  $\mu\text{m}$  for CARS/2-Photon-Fluorescence/SHG modalities. It has a diameter of 3.0 or 2.2 mm and a rigid length of 178 mm. A GRIN-refractive multilens hybrid design allows chromatic and off-axis correction between 795 nm and 1029 nm.

### Applications:

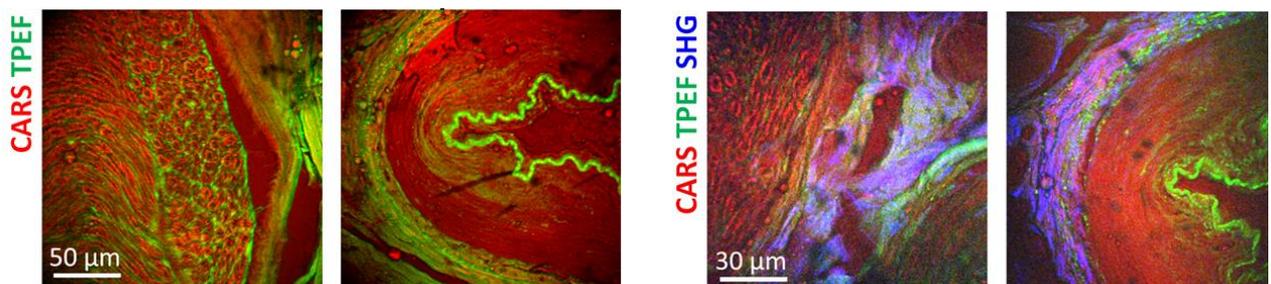
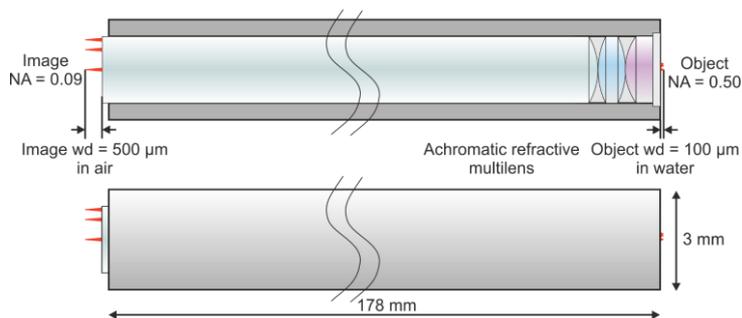
In vivo endomicroscopy, nonlinear optical endoscopy (CARS, SHG, TPF), tissue imaging, proximal scanning, NA conversion

**GT-MO-050-009-ACR795/1029-10-50** represents a high resolution field- and NIR-chromatically corrected objective with a magnification of 5.6. The image side NA of 0.09 matches to low NA telecentric spot scanning. Chromatic correction is realized between 795 nm to 1029 nm together with an optimal performance.

The optics is assembled in a stainless steel tube of 3.0 or 2.2 mm diameter (optional).

### Specifications:

GT-MO-050-009-ACR795/1029-10-50	
Object NA	0.50
Object WD in water [ $\mu\text{m}$ ]	100
Image NA	0.09
Image WD in air [ $\mu\text{m}$ ]	Approx. 500
Magnification	5.6
Dimensions $\varnothing$ / L [mm]	3.0 or 2.2 / 178



### Images:

Human nervus suralis – cryosection, images recorded through Endomicroscopic tube + Plan-Apo 5x/0.16 + Zeiss CARS LSM (Courtesy by TU Dresden)

Reference: Zirak, P., et al. (2018). "Invited Article: A rigid coherent anti-Stokes Raman scattering endoscope with high resolution and a large field of view." *APL Photonics* 3(9): 092409.

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

## 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:  $\pm 0.02$  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:  $-20^{\circ}\text{C} - 80^{\circ}\text{C}$ .

**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.