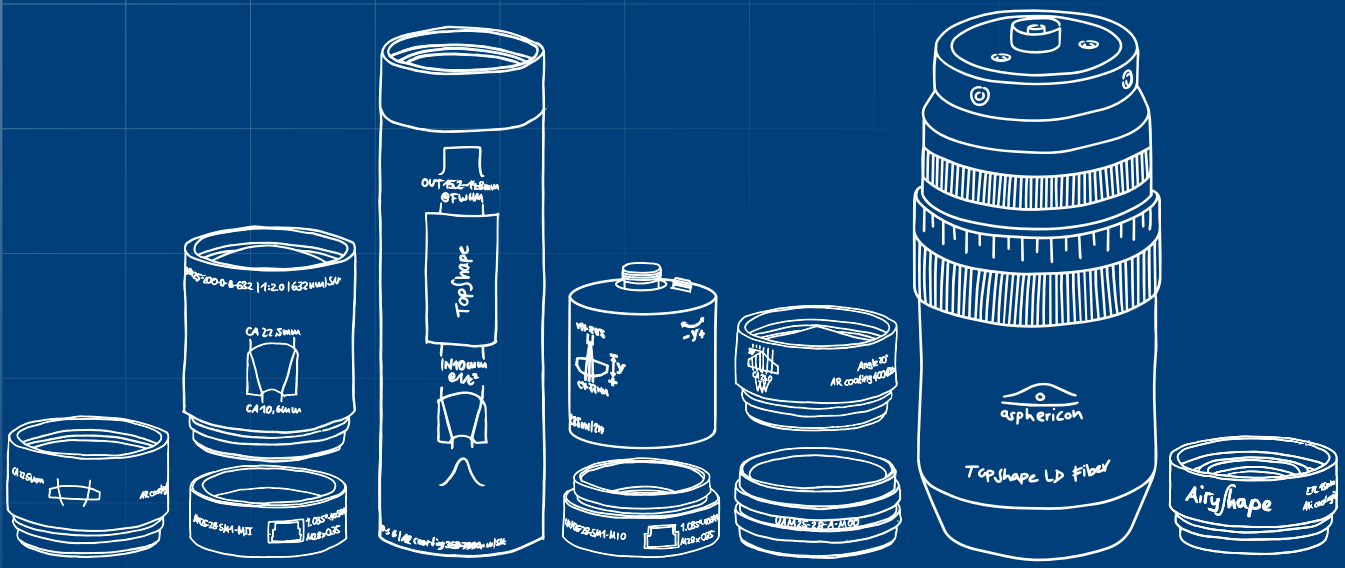
asphericon

BeamTuning

Beam expansion and
Beam shaping at the next level



Discover plug and play perfection.

asphericon BeamTuning

asphericon BeamTuning for beam expansion, fiber collimation and beam shaping at the next level. Discover a comprehensive range of laser beam processing elements, the various possible combinations and compile your own individual product selection.

BEAMEXPANSION

The world‘s first aspheric beam expansion system is the right choice when it comes to beam expansion or reduction with outstanding quality.

BEAMEXPANSION PRODUCT:

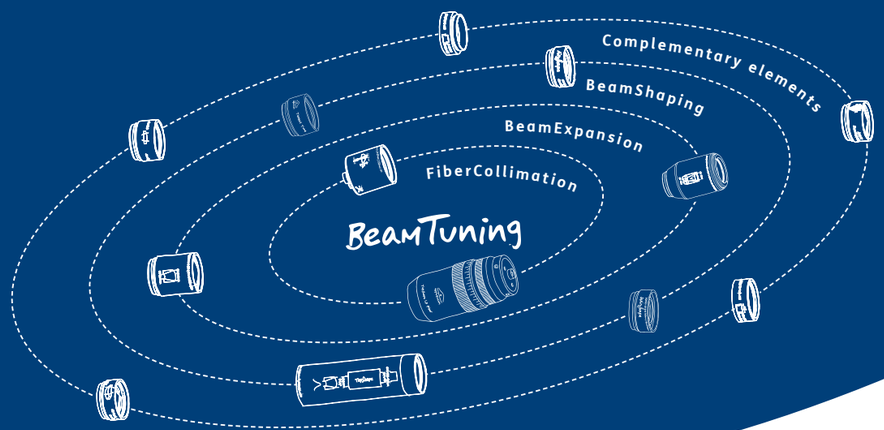
= a|BeamExpander (p. 6)
= a|BeamExpander HighPower (p. 8)

FIBERCOLLIMATION/FIBERCOUPLING

Use our adjustable fiber collimation packages to easily combine all BeamTuning elements directly to your fiber coupled laser source.

FIBERCOLLIMATING PRODUCTS:

= a|AspheriColl (p. 10)



BEAMSHAPING

Simply transform collimated Gaussian laser beams into collimated and focused Top-Hat beams and take advantage of the easy handling.

BEAMSHAPING PRODUCTS:

= a|TopShape LD Fiber (p. 12)
= a|TopShape, a|TopShape LDX (p. 14)
= a|TopHat Tune (p. 16)
= a|AiryShape, a|SqAiryShape (p. 18)

COMPLEMENTARY ELEMENTS

Connect all elements or combine them with other systems. Matching adapters and MountedOptics allow for 100 % flexibility.

COMPLEMENTARY PRODUCTS & INFORMATION:

= Optomechanical components (p. 21)
= a|MountedAspheres/Axicons (p. 24)
= Notes on high-power solutions (p. 26) & environmental conditions (p. 27)

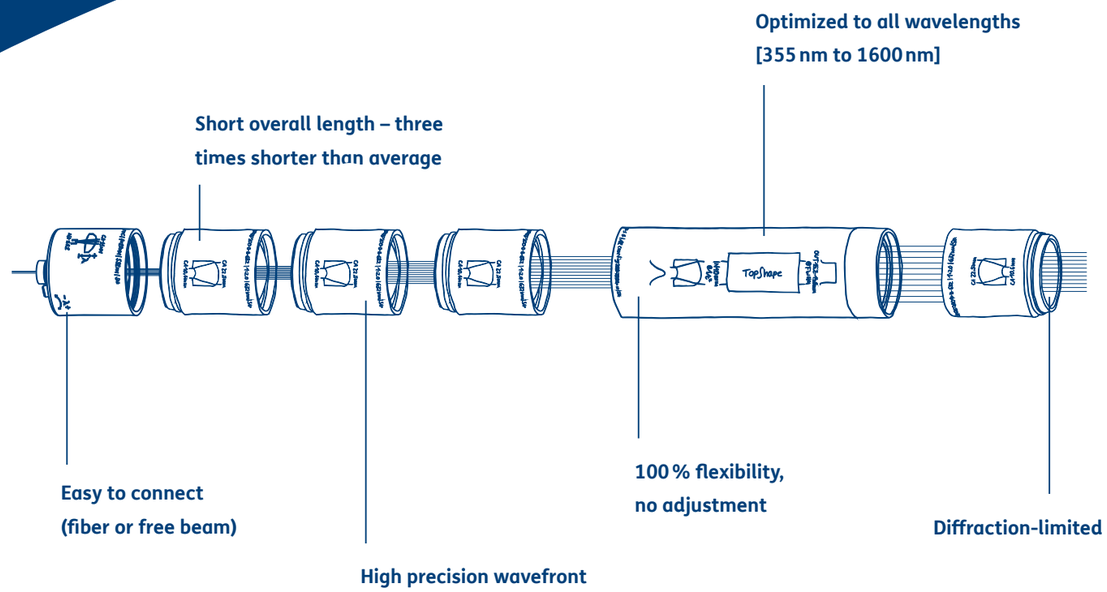
tu·ning [‘tju:nIŋ],
to adjust something for maximum usability or performance

= Flexible choice of input and output beam diameter

= Economical to use – Simple integration into any optical system by an intelligent mounting concept

= Low contamination due to tightly sealed mountings

= Easy and timesaving handling



Application areas

Discover the wide application range of our BeamTuning products. Flexible in use, with the highest quality, ideal for your specific needs. Below you find some selected examples. Need help with an individual solution? Let us know!

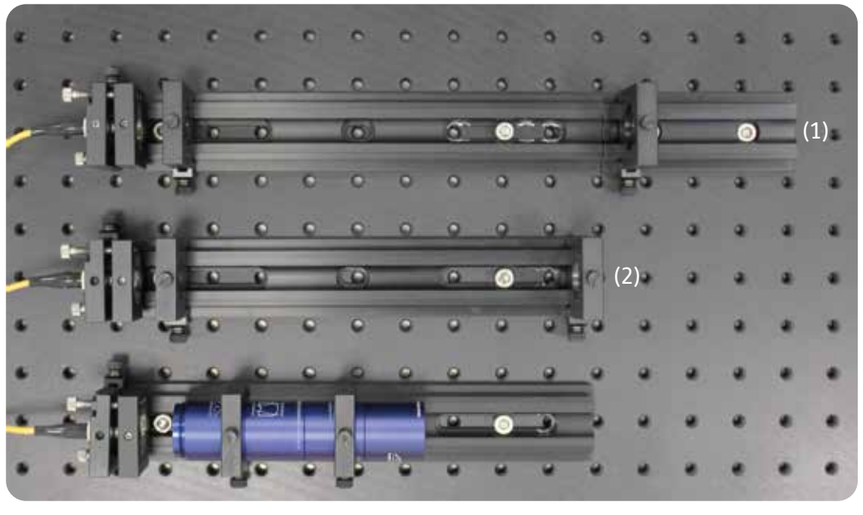
LABORATORY

Beam expansion and beam shaping systems are used for optimum beam adaption between light sources (i.e. laser) and a following optical element. Accurate illumination of the optically effective surfaces is especially essential for beam shaping and focusing with high numerical apertures. Conventional systems can only be adapted with high effort, are relatively large and only suitable for a certain wavelength.

BeamTuning by asphericon covers a wide wavelength range with just a few products, enables flexible adjustments and saves you a lot of time.

Discover, for example, how the a|BeamExpander can help you reduce the overall length of your beam expansion system and still achieve outstanding performance results.

→ *Learn more on page 6/7.*



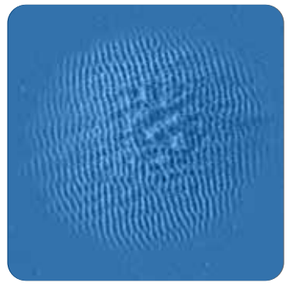
Magnification (M = 10) with a|BeamExpander compared to conventional systems (1) Kepler and (2) Galilean.

High-end BeamTuning solutions for your application.

MATERIAL PROCESSING

If a laser beam with a Gaussian intensity profile is used, e.g. for drilling or cutting, the energy loss at the edge of the beam affects the cutting edge quality of the workpiece. Good results require further cuts, which influence the efficiency of the process. In the case of surface functionalization, a Gaussian distribution is also disadvantageous, since uneven melting of the surface prevents homogeneity. Discover how BeamTuning elements easily generate homogeneous intensity distributions (e.g. Top-Hat or Donut). The latter allows for a uniform heat input into the material, which results in smooth profiles.

→ *Learn more on page 14/15.*



Surface functionalization with conventional system (Gaussian Beam)

Surface functionalization with a|AiryShape (Top-Hat)

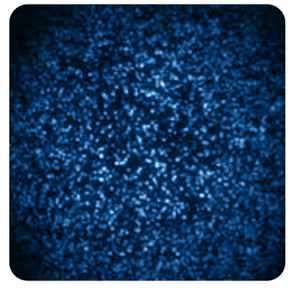
Surface functionalization with a|AiryShape (Donut)

Image reference: Otto Schott Institute of Materials Research (OSIM) at the Friedrich Schiller University of Jena

IMAGING/ILLUMINATION

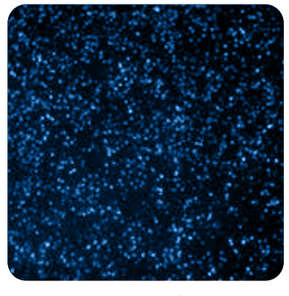
The uneven illumination of Gaussian intensity profiles makes quantitative analysis in laser-based wide-field fluorescence microscopy highly challenging. One disadvantage of non-uniform illumination is the uneven activation of molecules. Those being closest to the center of the beam fluoresced more strongly than those near the periphery. Discover how BeamTuning by asphericon allows to achieve uniform illumination (homogeneity > 95 %) while remaining tolerant to variations in size of the incoming laser beams.

→ *Learn more on page 14/15.*



Conventional illumination system

Paper Download:



Illumination with a|TopShape

Image reference: I. Khaw, B. Croop, J. Tang, A. Moehl, U. Fuchs, K. Y. Han: „Flat-field illumination for quantitative fluorescence imaging“, In: OPTICS EXPRESS, Vol. 26, No. 12, 11 Jun 2018, pp. 15276-15288

a|BeamExpander

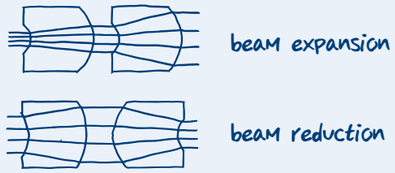
Discover the world's first aspheric and diffraction-limited beam expander. The a|BeamExpander is a monolithic laser accessory with just one aspheric lens for the highest level of precision. Experience nearly endless possibilities with up to 32× beam magnification and optimized performance for different design wavelengths – individually measured and certified.

- Available with magnifications of 1.5 | 1.75 | 2.0
- Max. input aperture 10.6 – 14.7 mm, max. output aperture 22.5 mm
- Available in design wavelengths 355 nm, 532 nm, 632 nm, 780 nm and 1064 nm (best performance at design wavelength, see p. 23 for usable coating wavelength range)
- Possibility of combining up to five expander for up to 32 times beam expansion and over 230 intermediate stages
- Completely diffraction-limited – individually measured and guaranteed by an original asphericon certificate
- Laser induced damage threshold (Coating): 12 J/cm², 100 Hz, 6 ns, 532 nm
  Like all BeamTuning elements all a|BeamExpander come with a broadband coating. For higher laser power applications please request a V-Coating. Contact us for an individual offer. Please note the material damage threshold of your set-up!

Also available as UV version, made of Suprasil and optimized for Nd:YAG-Laser [355 nm], which enables diffraction-limited beam expansion in the UV range.

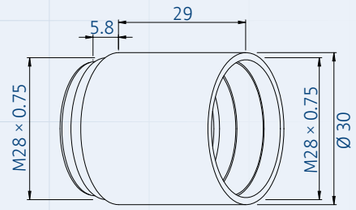
APPLICATION

A beam expander is used to increase or decrease the diameter of a collimated input beam to a larger or smaller collimated output beam.
Use the a|BeamExpander for applications such as interferometry, telescopes, or microscopy.

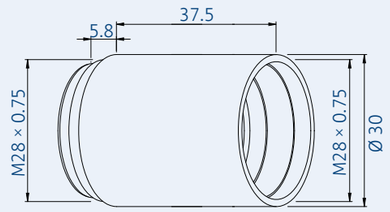


TECHNICAL DIMENSIONS [MM]

a|BeamExpander [532 – 1064 nm]

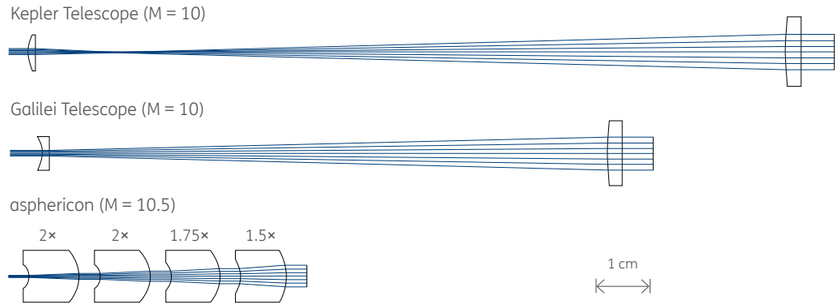


a|BeamExpander UV [355 nm]



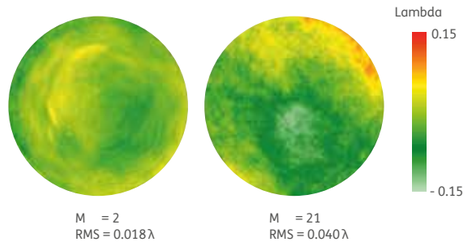
LENGTH

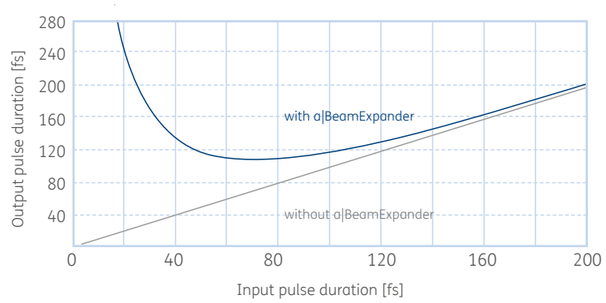
The a|BeamExpander, based on the use of aspheric and monolithic beam expansion elements, achieves overall lengths up to 50 % shorter than those of conventional systems – even when used in a cascade. Shown are a Kepler and Galilean telescope with 10× magnification (M = 10) in comparison with our beam expansion system.



PERFORMANCE

Its high performance is particularly evident regarding the wavefront measurements. Depicted are the measured wavefront maps of an a|BeamExpander with a magnification M = 2 (left) and a five element set of a|BeamExpander with M = 21 (right) at 532 nm. The aspheric element is made of glass by grinding and polishing the surface. Having values of wavefront RMS = 0.018 λ (left) and RMS = 0.040 λ (right) prove the exceptional precision of the lenses and its well-suited use in a cascade system.





FLEXIBILITY

The a|BeamExpander can also be used flexibly in the wavelength range from 500 nm to 1600 nm for ultra short pulse laser applications. Please be aware of the pulse broadening effect. In the chart on the left, you can see how your input pulse changes by propagating through an optical element such as the a|BeamExpander.

a|BeamExpander HP

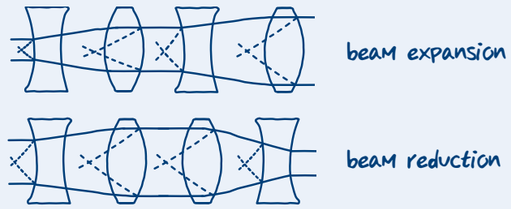
Experience precision beam expansion with exceptional durability. Designed for high power laser applications, the a|BeamExpander HighPower (HP) features robust coatings that minimize susceptibility to damage and ensure long-term stability. Its superior optical surface quality and high cleanliness standards enable optimum performance in demanding environments. Available in four magnifications and five design wavelengths - now including 1550 nm - the a|BeamExpander HP delivers outstanding results from 500 to 1600 nm as both expander and reducer, fully compatible with all a|BeamTuning elements.

- Large spectral range: 500 nm to 1600 nm
- Available with magnifications 1.25 | 1.5 | 1.75 | 2.0
- Optimized for design wavelengths 532 nm, 632 nm, 780 nm, 1064 nm and 1550 nm thanks to robust coatings (best performance at design wavelength)
- Compact design with minimal system length
- Fully compatible with all BeamTuning elements
- Functions as both a beam expander and reducer
- Optimized for input beams up to 8 mm and output beams up to 10 to 16 mm
- Free aperture up to 27 mm for maximum flexibility

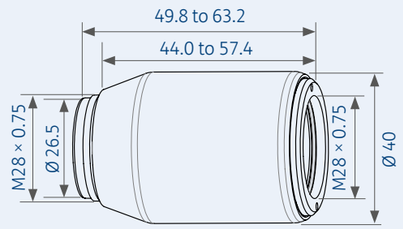
NEW: Beam expander for high-power applications!

APPLICATION

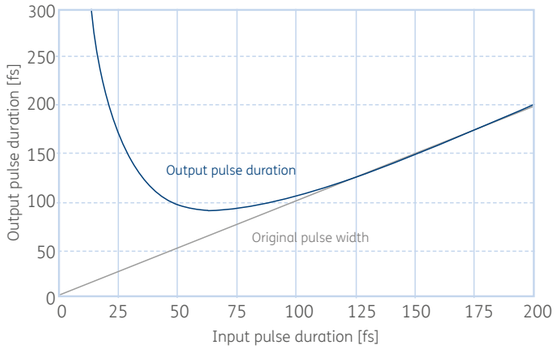
By modifying the beam diameter, a beam expander enables the enlargement or reduction of a collimated input beam while preserving its collimation. Use the a|BeamExpander HP for applications such as marking/engraving and laser microfabrication.



TECHNICAL DIMENSIONS [MM]



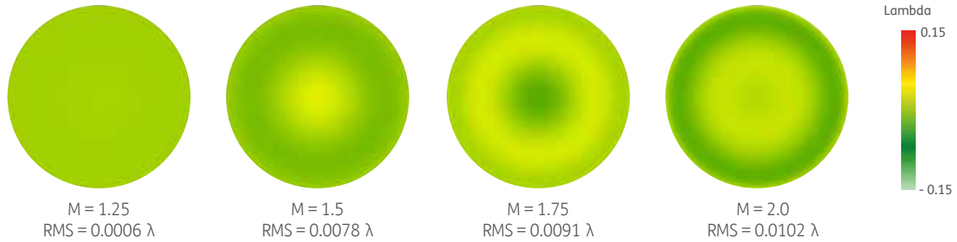
FLEXIBILITY



The a|BeamExpander HP can be used flexibly in the wavelength range from 500 to 1600 nm for ultra short pulse laser applications. Please be aware of the pulse broadening effect. The chart on the left shows, how the input pulse changes by propagating through an optical element such as the a|BeamExpander HP. Contact us for detailed information about the expected puls broadening.

PERFORMANCE

The a|BeamExpander HP delivers outstanding optical performance with stable magnification and diffraction-limited quality for input beams up to 8 mm. Designed for high-power laser applications, it ensures maximum efficiency and reliability across various magnifications. The maps below illustrate the simulated wavefronts of the a|BeamExpander HP at 532 nm, demonstrating its exceptional performance at different expansion ratios.



Made of ultra-pure glass, the a|BeamExpander HP ensures exceptional transmission up to 2 µm, while advanced V-coatings minimize residual reflections to below 0.1%. To protect the optical components from back reflections that could exceed the Laser Induced Damage Threshold (LIDT), potential reflections are strategically positioned away from the lenses and confined within the mount. The sophisticated optical design ensures that these reflections occur at a sufficient distance from the lenses, further enhancing stability in high power applications.
When used as a reducer, minor reflections may extend up to 8 mm beyond the a|BeamExpander HP. However, this has no impact when paired with another a|BeamExpander HP, as both units are precisely engineered to work seamlessly together, regardless of their orientation.

For applications that require optical elements to be placed directly on the mount of an inverted expander, please contact us for further advice.

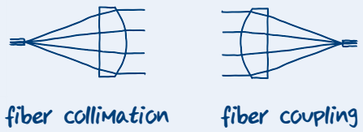
a|AspheriColl

Now even easier to adapt: the a|AspheriColl, an adjustable fiber collimation device, which enables the perfect connection of FC/PC patch fibers to your set-up. Combine the world's smartest off-the-shelf fiber collimator for NAs up to 0.275 with BeamTuning or other beam shaping elements to obtain any desired output beam while maintaining a diffraction-limited wavefront.

- = Fiber collimator covering for NAs up to 0.275
- = Focal length: f = 20 mm, with $Ø_e$ = 11.5 mm
- = Optimized for wavelength range 355 nm - 1600 nm
- = Simplified wavelength adaption by setting adjustment unit with SW2 allen key
- = Perfectly aligned lateral position
- = Completely diffraction-limited performance (Strehl > 0.95) when used with FC/PC patch fibers
- = Works with wide and narrow key FC/PC connectors
- = No truncation effects compared to other available fiber couplers
- = Thanks to bigger output beam diameters, no additional expansion might be needed (shorter system length)
- = Laser induced damage threshold (Coating): 12J/cm², 100Hz, 6ns, 532nm
  For higher laser power applications please request a V-Coating.
  Contact us for an individual offer.

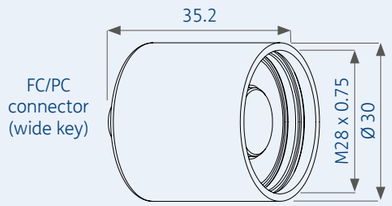
APPLICATION

Easily use a|AspheriColl to collimating or coupling fibers.



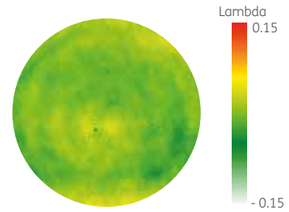
fiber collimation fiber coupling

TECHNICAL DIMENSIONS [MM]



PERFORMANCE

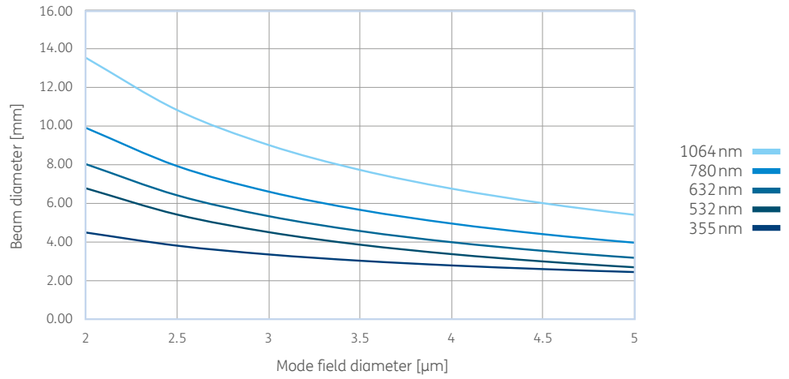
The map on the right shows the measured wavefront of an a|AspheriColl at 632 nm. The diameter of the collimated output beam, which depends on your fiber's numerical aperture (NA) and mode field diameter (MFD), is already in a usable range. It is already perfectly aligned to the design wavelength. If needed, it can also be adjusted in a certain wavelength range. Due to its outer diameter of 30 mm the a|AspheriColl fits into any standard holder (e.g. from OWIS). By simply pluging in the fiber, the a|AspheriColl is ready to use.

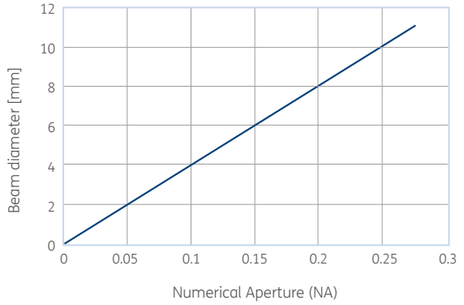


FLEXIBILITY

The diameter of the collimated output beam generated by an a|AspheriColl depends on the NA and MFD of the fiber. Both are functions of the wavelength.

Due to fiber manufacturing process, the MFD might deviate from its nominal value. The figure shows collimated output beam diameter as a function of MFD and NA for the a|AspheriColl. The large output beam diameter is advantageous, since there are no truncation effects compared to other available types of fiber couplers.





The basic diameter is set as shown in the graph on the left. The a|AspheriColl collimates the output of single mode fibers with NAs up to 0.275 for the wavelengths [nm] 355, 532, 632, 780 and 1064.

a|TopShape LD Fiber

Coming soon

The a|TopShape LD Fiber is a revolutionary beam shaping system designed for direct coupling to single mode fibers. It produces a perfectly collimated Top-Hat beam with a homogeneous intensity distribution and a flat wavefront, remaining stable over long distances. This system compensates for manufacturing variations in the numerical aperture (NA) of the fiber, allowing flexible fiber selection and greatly simplified use.

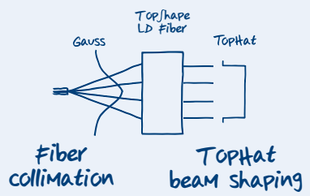
- = Unbeatable optical performance over a long and stable propagation distance (beam uniformity < 0.1 up to at least 2000 mm, RMS wavefront error < 0.05 λ)
- = Completely diffraction-limited (Strehl > 0.9)
- = Design wavelength: 780 nm
- = Enables perfect connection with FC/PC or FC/APC patch fibers
- = Output beam diameter @ FWHM: 15 mm
- = Input NA range: 0.07 - 0.095 mm to compensate for manufacturing-related deviations*

BENEFITS

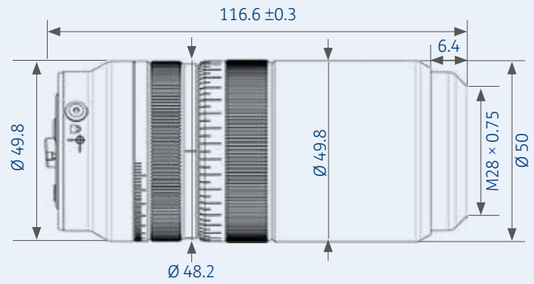
- = Optimal photon yield: aspheric design enable lossless redistribution of light
- = Plug & play: easy integration into existing systems
- = Simple and intuitive operation of all control elements
- = Flexible adaptation to specific requirements by adding compatible BeamTuning products
- = Small and lightweight design for quick and easy integration into a variety of work environments

APPLICATION

Conveniently use the a|TopShape LD Fiber for fiber collimation and beam shaping - all in one system.



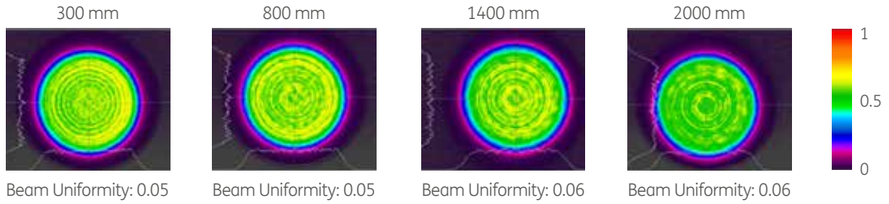
TECHNICAL DIMENSIONS [MM]



Please notice: The cut-off wavelength of the fiber should be as close as possible to the design wavelength, as it affects the MFD and NA at the application wavelength. A higher application wavelength relative to the cut-off wavelength results in a lower NA and a higher MFD.

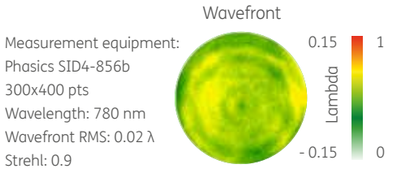
FLEXIBILITY

An outstanding feature of the a|TopShape LD Fiber is its long and stable propagation distance. The measurements below show intensity distributions at different working distances from 300 to 2000 mm, characterized by a homogeneity of < 0.06.



PERFORMANCE

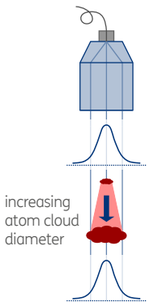
The map on the right shows the measured wavefront of the a|TopShape LD Fiber at 780 nm. This element generates a diffraction-limited wavefront, making it fully compatible with the BeamTuning line. With an RMS wavefront error of 0.02 λ, corresponding to a Strehl ratio of 0.9, the optical quality is exceptionally high.



The a|TopShape LD Fiber can be used as a stand-alone product, instead of combining a fiber coupler, a beam expander and a beam shaper. It significantly reduces the overall set-up size.

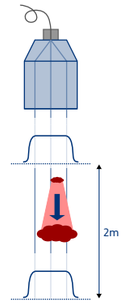
APPLICATION EXAMPLE - QUANTUM INERTIAL SENSORS

A specific application of the a|TopShape LD Fiber is in field-deployed differential quantum gravimetry, as demonstrated in the EU-funded FIQUgS project. In this context, the system must achieve an RMS wavefront error of less than λ/10 over the entire propagation range. This product serves as a proof of concept for various atomic inertial sensors and allows to adapt the a|TopShape LD Fiber for different applications requiring increased robustness, optical power, and beam propagation distances. The advantages of Top-Hat beams compared to the use of Gaussian distributions are outlined below referring to the results of the FIQUgS project.



Gaussian beam

- = Non-uniform transition probability & expansion of atomic cloud
  → Loss of interferometric contrast
- = Spurious contributions to measured acceleration
  → Loss of measurement accuracy



Fiber-coupled collimator with beam shaping system (780 nm)

- = Top-Hat output profile 15 mm FWHM
- = Beam uniformity < 0.1
- = RMS wavefront error < λ/10
- = Propagation length 2 m
- = Weight: 480 g
- = Uniform transition probability
- = Elimination of spurious contributions

More about the project: **www.fiqugs.eu**

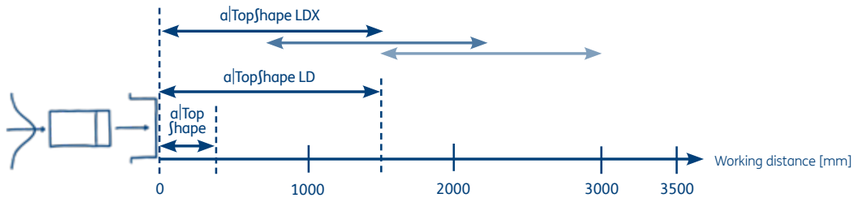
a|TopShape

Discover beam shapers, which easily transform collimated Gaussian beams into collimated Top-Hat beams. Available in three versions the a|TopShape convinces with a very compact design and unbeatable optical performance. For beam profiles up to 300 mm and as LongDistance (LD) variant for up to 1.5 m, the beam shaper accepts varying input beam diameter up to ±10%. With the a|TopShape LDX the beam profile can be shifted to large working distances of up to 3 m by adjusting the input beam diameter.

Optimized for high-power laser applications.

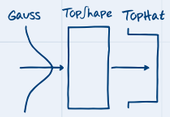
→ *Learn more on page 26*

- Unbeatable optical performance (beam uniformity up to 0.05) without any power losses
- Available in design wavelengths 355 nm, 405 nm, 532 nm, 632 nm, 780 nm and 1064 nm (best performance at design wavelength, works at other wavelegths with adapted input beam parameters, see p. 23 for usable coating wavelength range)
- Propagation depth (with beam uniformity < 0.1):
  - a|TopShape at least 300 mm
  - a|TopShape LD up to 1.5 m
  - a|TopShape LDX at least 1.5 m, shiftable to larger working distances
- Input beam diameter:
  @ $1/e^2$ = 10 mm (± 10%) for a|TopShape & a|TopShape LD
  @ $1/e^2$ = 10.0 - 10.4 mm for a|TopShape LDX
- Output beam diameter @ FWHM = between 15.2 mm and 15.7 mm
- Laser induced damage threshold: 12 J/cm², 100 Hz, 6 ns, 532 nm
  For higher laser power applications please request a V-Coating. Contact us for an individual offer.
- Find the right a|Topshape for your application:

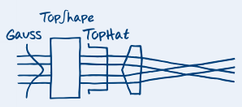


APPLICATION

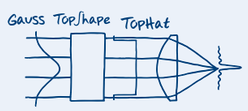
a|TopShape is the perfect support for your application, e.g. in the field of metrology, microscopy or material processing.



flat TopHat-profile

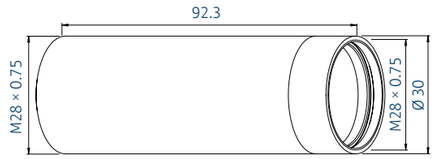


homogeneous Bessel beam

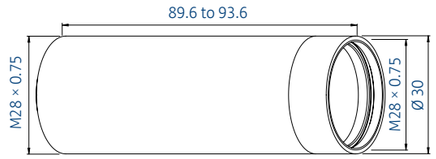


Airy-focus

TECHNICAL DIMENSIONS [MM]



a|TopShape

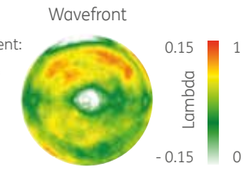


a|TopShape LD & LDX

PERFORMANCE

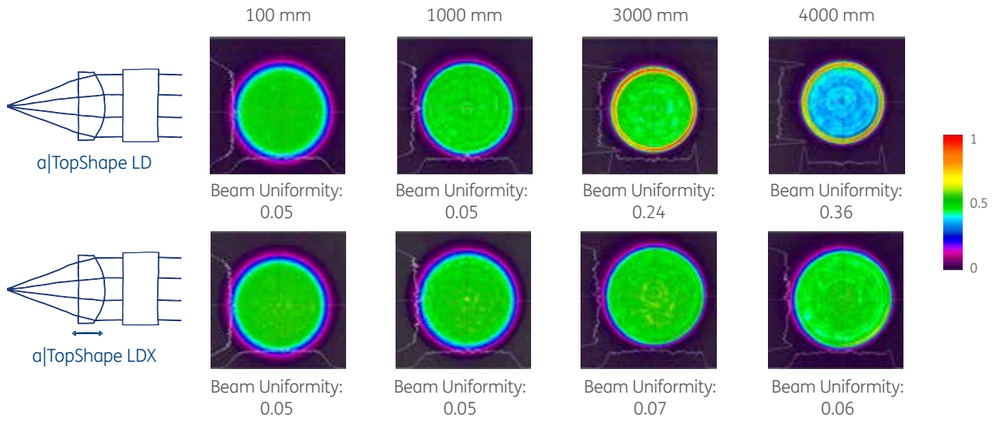
The figure on the right shows the measured wavefront, using the a|TopShape, after passing 14 surfaces, incl. seven aspheres at a working distance of 100 mm. The resulting RMS wavefront error of 0.05 λ, which corresponds with a Strehl value of 0.9, proves the high optical quality.

Measurement equipment:
Phasics SID4-HR-307c,
300x400 pts
Wavelength: 632 nm
Wavefront RMS: 0.05 λ
Strehl: 0.9



FLEXIBILITY

The outstanding feature of a|TopShape LD and LDX is their long and stable propagation distance. The figure below displays the intensity distribution at a working distance of 100 mm, 1000 mm, 3000 mm and 4000 mm. It is characterized by a homogeneity of 0.05 up to 1500 mm for both beam shapers. By varying the input beam diameter, a beam uniformity of 0.06 even up to 4000 mm can be guaranteed for the a|TopShape LDX.

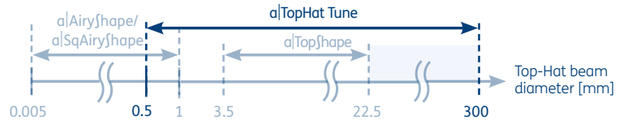


The a|VariColl is the ideal collimator for shifting the working range of the a|TopShape LDX due to its flexible output diameter. For more information on the a|VariColl, please refer to p. 10/11.

a|TopHat Tune NEW

The a|TopHat Tune is designed to generate various round, elliptical, square and rectangular Top-Hat profiles with beam diameters from 0.5 mm to large diameters. This device works seamlessly in combination with a focusing lens. Optimized for wavelengths from 266 to 2100 nm, the beam profile size is easily scalable by adjusting the focal length of the focusing lens. Perfect alignment is guarenteed through a high-precision mounting, making this beam shaper the ideal solution for material processing and other demanding applications.

- Available for various round, elliptical, square & rectangular Top-Hat profile shapes
- Optimized for wavelengths from 266 nm to 2100 nm
- Available in design wavelengths 355 nm, 532 nm, 632 nm, 780 nm, 1064 nm, 1550 nm and 2000 nm (best performance at design wavelength, also suitable for wider wavelength range due to broadband coating; *Please note: range varies with wavelength*)
- Input beam diameter 10 mm @1/e²
- Profile size easily scalable by focal length
- Design distance between beam shaper and focusing lens: 17 mm (ideal for combination with a|MountedAspheres from asphericon) or 250 mm
- Laser induced damage threshold: 12 J/cm², 100 Hz, 6 ns, 532 nm *For higher laser power applications please request a V-Coating. Contact us for individual offer.*
- Usable for applications in the following beam diameter range:

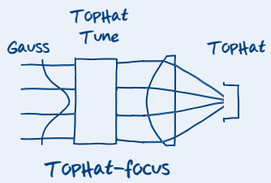


Optimized for high-power laser applications.

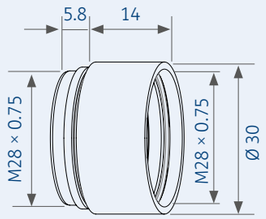
→ *Learn more on page 26*

APPLICATION

Conveniently use this beam shaper in combination with a focusing lens, e.g. for applications in material processing.

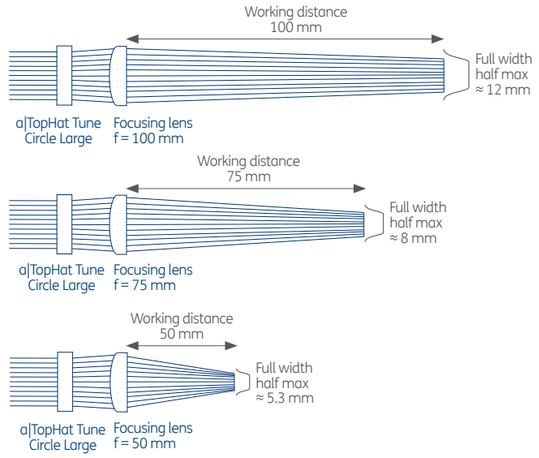


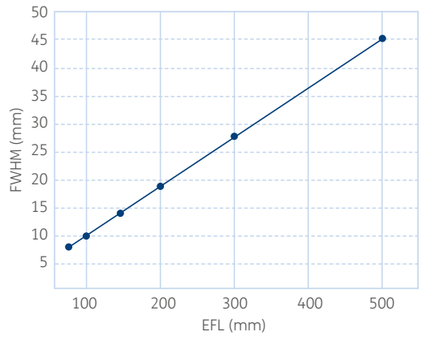
TECHNICAL DIMENSIONS [MM]*



**Please notice: Due to its outer diameter of 30 mm the a|TopHat Tune fits into any standard holder, like the a|VariMount from asphericon. By simply connecting it with a focusing lens, it is ready to use.*

FLEXIBILITY





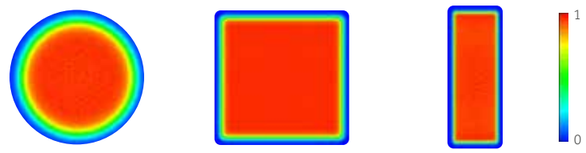
The a|TopHat Tune offers exceptional flexibility in generating Top-Hats. As illustrated above, it can be used with focusing lenses of various focal lengths allowing for easy adjustments to the working distance and profile diameter by simply changing the lens. This makes the a|TopHat Tune a versatile tool for applications requiring varying beam diameters while maintaining uniformity in the beam profile. The diagram on the right shows how the Top-Hat diameter changes as a function of the EFL, using the a|Top Hat Tune Circle Large as an example.

Type	Input beam diameter	FWHM	Working distance	Distance to focusing element
Circle Small	5 mm	1 mm*	200 mm*	250 mm
Circle Large	10 mm	8 mm**	75 mm**	17 mm
Square Small	5 mm	1 mm*	200 mm*	250 mm
Square Large	10 mm	8 mm**	75 mm**	17 mm
Rectangle low-AR	5 mm	0.5 x 1.5 mm*	200 mm*	250 mm
Rectangle high-AR	*Available on request/as customized solution*			
Ellipse	*Available on request/as customized solution*			

*with EFL of focusing element 200 mm; **with EFL of focusing element 75 mm

PERFORMANCE

The high performance of a|TopHat Tune is particularly evident with regard to its beam uniformity. Shown are the simulated intensity distributions of an a|TopHat Tune Circle and Square generated with a focusing lens with a focal length of 75 mm, as well as an a|TopHat Tune Rectangle generated with a focal length of 200 mm, all at a wavelength of 780 nm. They are characterized by a perfectly uniform intensity distribution.



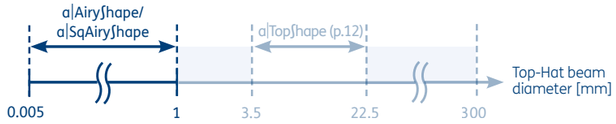
a|AiryShape, a|SqAiryShape

Want to generate focused round or squared beam profiles, like Top-Hat or Donut? No problem with a|AiryShape and a|SqAiryShape! Optimized for wavelengths from 300 nm up to 1600 nm, these beam shapers enable, in combination with a focusing lens, the transformation of collimated Gaussian beams into different focused round (a|AiryShape) and squared (a|SqAiryShape) beam profiles. Thanks to their compact designs, both beam shaping elements can be easily integrated into existing set-ups.

Optimized for high-power laser applications.

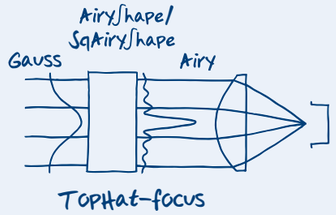
→ Learn more on page 26

- = Generation of different round and squared beam profiles
- = Profile size easily scalable by focal length
- = Available in design wavelengths 355 nm, 532 nm, 632 nm, 780 nm and 1064 nm (best performance at design wavelength, see p. 23 for usable coating wavelength range)
- = Easy integration into existing set-ups
- = Perfect alignment by high-precision mounting
- = Input beam diameter @ $1/e^2$ = 10 mm; output beam diameter d_{Airy} = 10 mm
- = Laser induced damage threshold: 12 J/cm², 100 Hz, 6 ns, 532 nm
  For higher laser power applications please request a V-Coating. Contact us for an individual offer.
- = Usable for applications in the following beam diameter range:

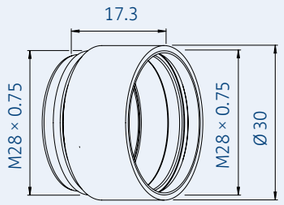


APPLICATION

Conveniently use these perfectly aligned BeamTuning elements for your application, e.g. in the fields of material processing or medical applications.



TECHNICAL DIMENSIONS [MM]

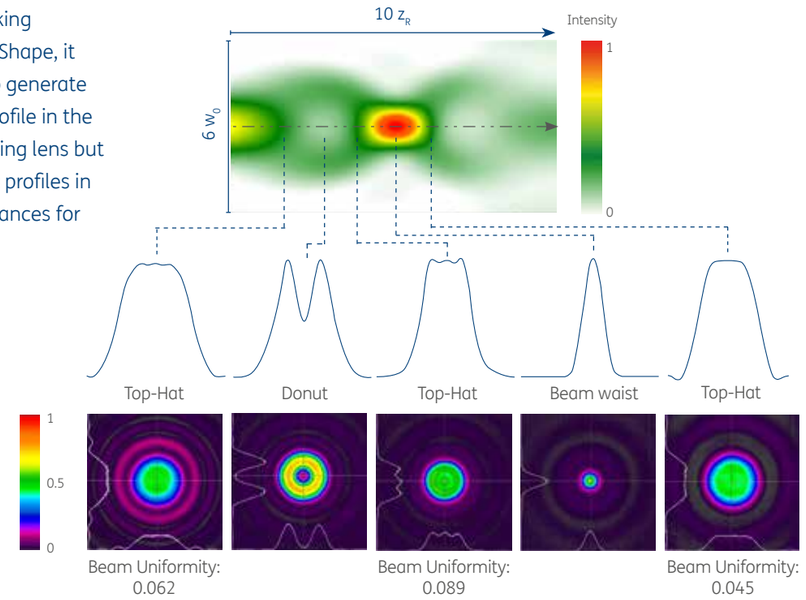


a|AiryShape & a|SqAiryShape

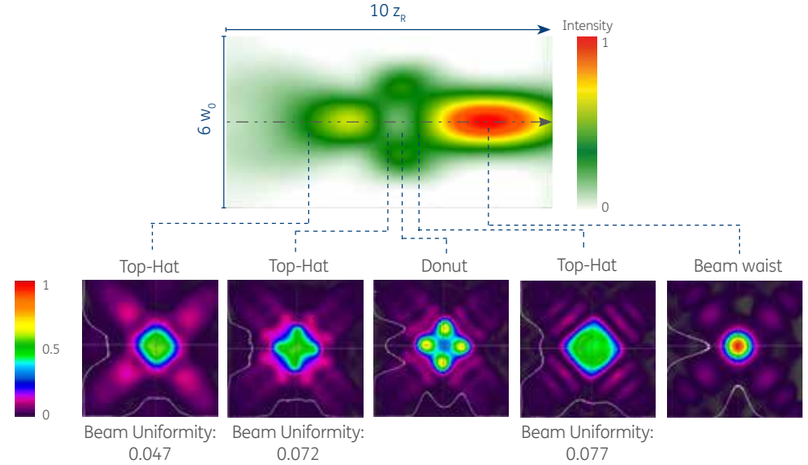
PERFORMANCE

In the figure below, beam profile cross sections along its propagation direction (z-axis) of the a|AiryShape are summarized in one diagram. The detection range covers 10 raylight lengths. Furthermore, the corresponding most interesting intensity profiles of the different working planes are shown as 2D and cross-sectional plots. The width of the profiles scale with beam waist w_0 of the focused beam.

According to the working principle of the a|AiryShape, it is possible, not just to generate one Top-Hat beam profile in the focal plane of a focusing lens but also to create various profiles in different working distances for your flexibility.



The following figure shows beam profile cross sections of the a|SqAiryShape, as well as its intensity profiles in the different working planes. Due to the working principle of the a|SqAiryShape, not only one squared Top-Hat profile is generated in the focal region, but a variety of profiles with four-fold symmetry.

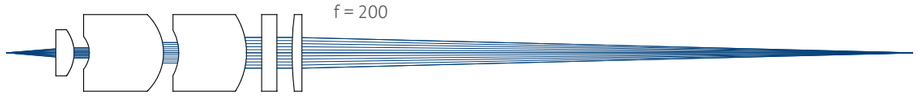


The generation of all shown beam profiles depends on the input beam quality. For optimum results a perfect collimated beam with minimized wavefront aberrations is required.

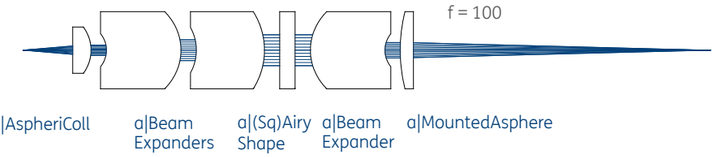
LENGTH & FLEXIBILITY

a|AiryShape and a|SqAiryShape have extremely compact designs. With lengths of only 17.3 mm, the beam shapers can easily be integrated into existing set-ups. Thanks to the optical design, the working distance can be reduced by a subsequent a|BeamExpander without altering the size of the focal intensity distribution. The example system (1) has an overall length of 290 mm. By using another a|BeamExpander (2), the length can already be reduced by 25 %, since shorter focal lengths can be used. With more a|BeamExpanders total system reductions of up to 75 % are possible.

(1)



(2)



SIZE OF THE TOP-HAT BEAM PROFILE

a|AiryShape and a|SqAiryShape are based on a modular approach, thus, only the number of elements, which are really necessary for the application, are added to the set-up. The overall length of the systems can be kept as small as possible. Following formula can be used to roughly estimate the size of the Top-Hat beam profile:

$$d_{FWHM} = 2.44 * \frac{f * \lambda}{D}$$

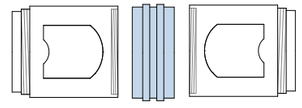
D = Input beam diameter
d = Top-Hat beam diameter (FWHM)
f = Focal length

Optomechanical components

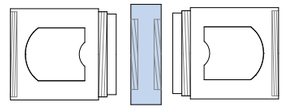
Discover how to precisely align optical elements in the beam path while minimizing tilts, reducing the overall setup length, and ensure seamless integration into any optical system through flexible cross- and intra-system connectivity.

INTRA-SYSTEM ADAPTER

Intra-system a|Adapters allow to combine all BeamTuning elements, e.g. to use a|BeamExpander in both functional directions, to expand or reduce the beam diameter.



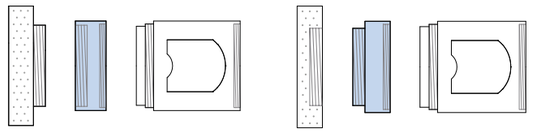
a|Adapter intra-system



a|Adapter 1.2" circumference

CROSS-SYSTEM ADAPTER

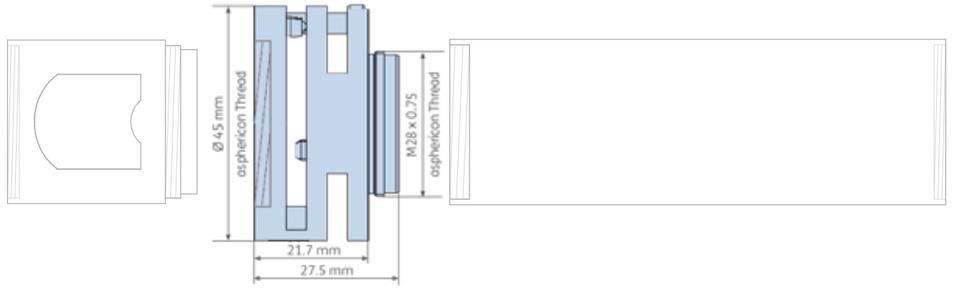
Easy integrate all BeamTuning elements into any optical system (e.g. Qioptiq, OWIS or Edmund Optics) through a variety of mounting concepts by using the cross-system a|Adapters (C-Mount, SM1). Thanks to its outer diameter, the 1.2" circumference can be used both as intra-system and as cross-system a|Adapter.



a|Adapter cross-system (female/female, male/female)

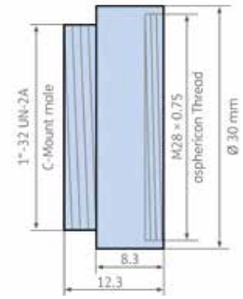
A|ADAPTER TILT

The a|Adapter tilt is infinitely tiltable in both the x and y directions thanks to its multi-joint design. It enables high flexibility when BeamTuning products are combined. If, for instance, tilting occurs in the beam due to the application, this intra-system a|Adapter allows products to be combined and also ensures they're precisely aligned in the beam path. It's technical dimensions can be found below.

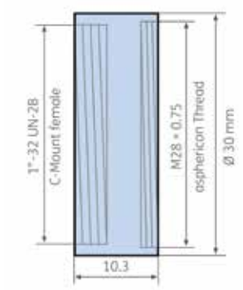


TECHNICAL DIMENSIONS [MM] ADAPTER

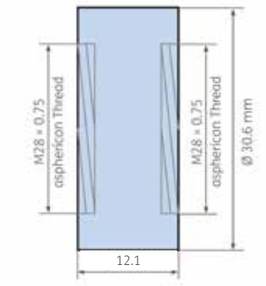
C-Mount male



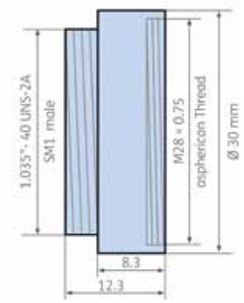
C-Mount female



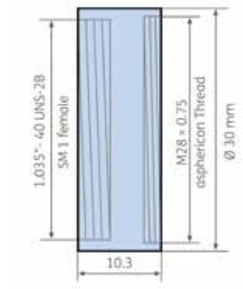
1.2" circumference (Dual use)



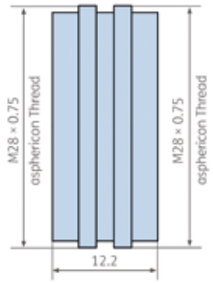
SM1 male



SM1 female



Intra-System



PRODUCT OVERVIEW ADAPTER TYPES

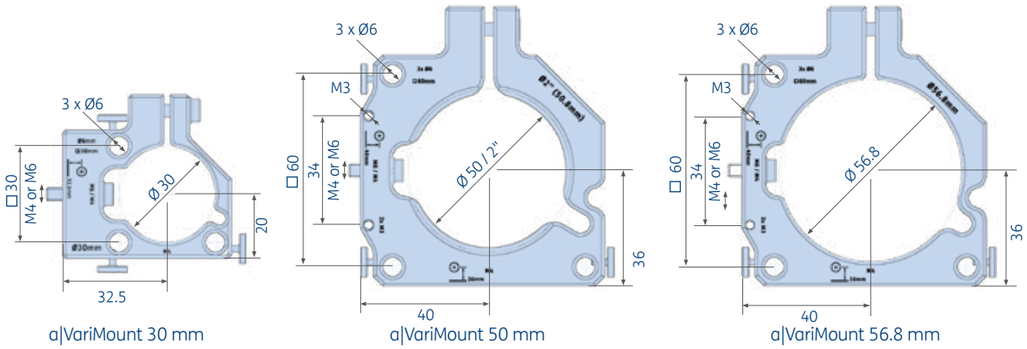
Adapter type	Product code	Thread type
C-Mount male	UAM25-28-C-MIO	male/female
C-Mount female	UAM25-28-C-MII	female/female
SM1 male	UAM25-28-SM1-MIO	male/female
SM1 female	UAM25-28-SM1-MII	female/female
Intra-System	UAM25-28-A-MOO	male/male
1.2" circumference	UAM25-28-1.2in-MII	female/female
Tilt	UAM25-28-tilt-MIO	female/male

A|VARIMOUNT

The a|VariMount enables precise alignment and easy integration of optical components directly onto mounting plates. Available in three diameters, it fits seamlessly into 30 mm and 60 mm cage systems and various rail systems without additional adapters. Its design distributes clamping force evenly, minimizing stress and deformation - ideal for delicate components like aluminum mounts. M6 and M4 threaded holes ensure compatibility with all post systems and allow mixing components from different manufacturers.

- = Optomechanical mount for BeamTuning products and cross-system components (e.g. from Thorlabs, Owis, Qioptiq)
- = Available in three internal diameters:
  - 30 mm for BeamTuning components
  - 56.8 mm for the a|VariColl
  - 50/50.8 mm (2") for unmounted aspheres and axicons
- = With M4 and M6 threaded holes as standard for all post systems
- = Compatible with 30 mm and 60 mm cage systems
- = Reduces need for additional adapters
- = Can be positioned flat directly on mounting plates

TECHNICAL DIMENSIONS [MM]

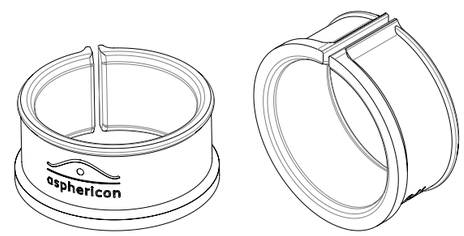


a|VariMount 30 mm | a|VariMount 50 mm | a|VariMount 56.8 mm

A|OPTIFIT

The 3D-printed a|OptiFit allows even more flexible adaptation of the a|VariMount for various optical components. The inlay simply snaps into place and can be customized to match different inner diameters, ideal for fast, tool-free adjustments in dynamic setups.

- = Inlay for all standard a|VariMount sizes
- = Adjustable inner diameter
- = Material: polycarbonate



MountedOptics

Expand your laser application with the attractive selection of pre-aligned a|Aspheres and a|Axicons from the StockOptics product line in high-precision mounts.
All aspheres and axicons with diameters from 12.5 mm to 25.4 mm are perfectly aligned with < 10 µm decentration of the optical and mechanical axis. Using the a|Adapters a very simple integration into any optical system is guaranteed.

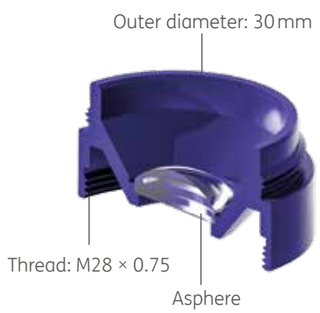
- = a|MountedAspheres and a|MountedAxicons
- = Especially designed mounts, engraved with lens specifications
- = Perfect alignment (< 10 µm decentration)
- = Tilt-reduced for optimal focusing
- = Modular design for high compatibility to all asphericon products and common optical systems
- = Comfortable and timesaving handling

THREE QUALITY LEVELS:
Rq up to < 0.5 nm

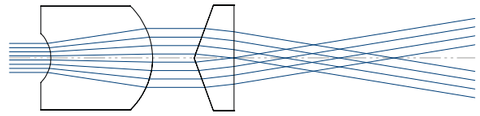
AVAILABLE WITH HIGH-QUALITY AR BROADBAND & V-COATINGS

Maximum usability from asphericon.

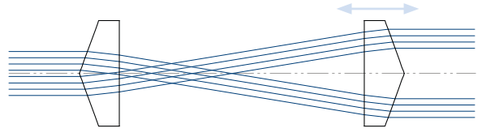
TECHNICAL DIMENSIONS



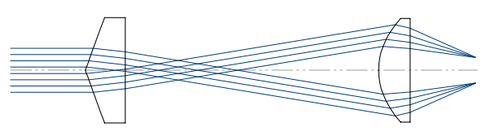
APPLICATIONS



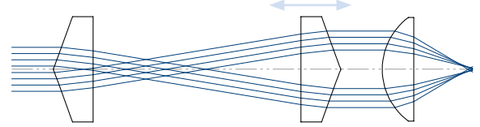
Optimizing the illumination of the axicon to adjust the length of the Bessel Beam.



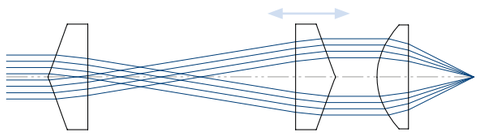
Generation of a collimated ring-shaped beam by altering the distance between the two axicons.



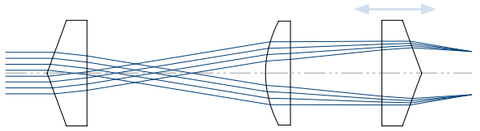
Generation of a ring focus - Distance changing through focal length of the lens, diameter changing through axicon angle.



Changing the focal length of a sphere by altering the distance between the axicons and improving the performance.



Changing the focus width of an asphere by altering the distance between the axicons - Focusing under the diffraction limit.



Generation of adjustable ring foci by shifting the last axicon to vary the ring diameters.

High-power laser solutions

When performance is critical, our high-power solutions deliver unmatched reliability. Engineered for the most demanding laser applications, our components bring together durability, optical precision and integration-ready design to help you meet even the toughest photonic challenges.

Do you have unique performance requirements or concerns about laser power? We're here to help. asphericon offers customized solutions tailored to your requirements, whether it's specialized materials, coatings or design adaptations. Together, we can develop the optimal configuration for your system.

Feel free to contact us!

WHY CHOOSE OUR SOLUTIONS?

- ☑ **Superior surface quality & wavefront precision**

  Minimizes scattering and local damage, which is essential for preserving beam integrity in high-power systems

- ☑ **Advanced optical coatings**

  Available with broadband or V-coatings, specifically designed for high-power applications

- ☑ **Material: Fused Silica**

  All components are made from fused silica to ensure: low dispersion, minimal group velocity dispersion and negligible nonlinear effects

- ☑ **Suitable for ultra-short laser pulses**

  Tailored to accommodate the spectral bandwidth of ultra-short laser pulses

- ☑ **Flexibility**

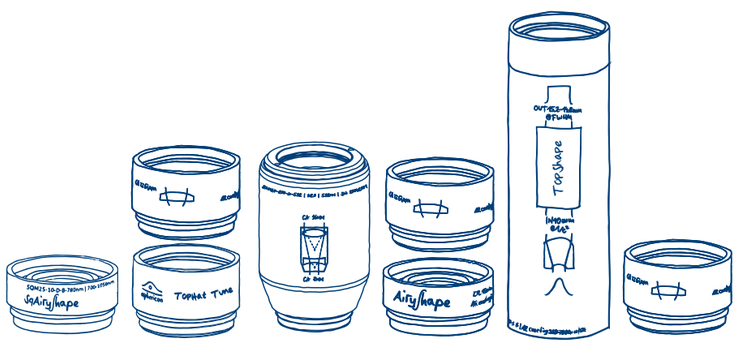
  Components are optimized for all major laser wavelengths. Beam shaping elements are engineered for use in collimated beams, ensuring increased durability

- ☑ **Easy integration**

  A compact footprint and smart mounting concept allow for seamless integration into your optical setup

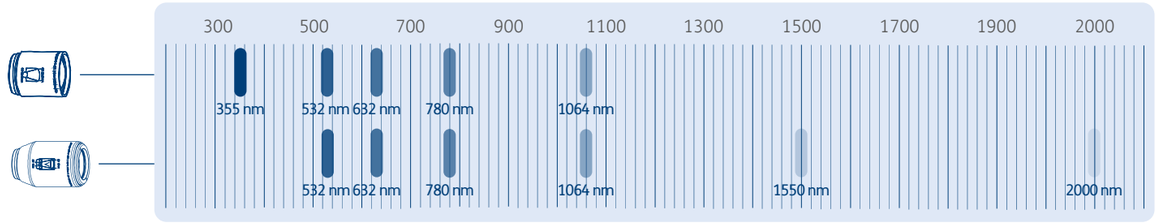
- ☑ **Modular approach**

  Adaptable systems that scale with your application needs

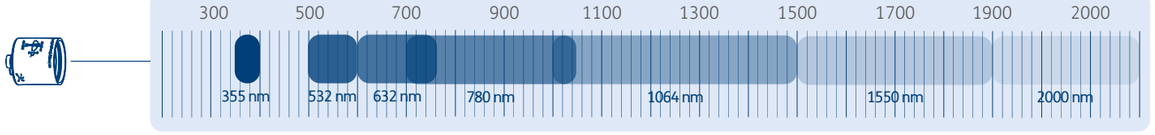


USABLE WAVELENGTH RANGE

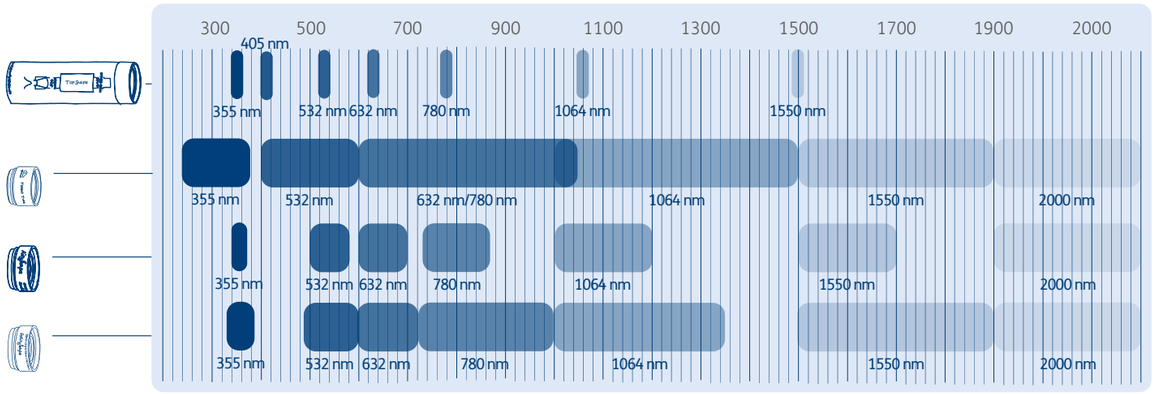
BEAMEXPANSION



FIBERCOLLIMATION



BEAMSHAPING



Best performance at design wavelength, also suitable for wider wavelength range due to broadband coatings.

Note on environmental conditions & wavefront values:

BeamTuning products are designed for laboratory conditions: 20 - 22°C, humidity below 60%, minimal pollution, normal air pressure (1atm), normal air (no vacuum, no nitrogen, etc.), no external cooling, minimal vibrations and standard electromagnetic conditions. Other environmental conditions are possible, but may limit the functionality or lead to unexpected degradation. If you require the use in critical conditions, please provide the necessary information and contact our sales team for further details.

Please also note that all values concerning the wavefront error of elements and systems exclude tilt and defocus.

COMPLEMENTARY ELEMENTS

MountedOptics

a|MountedAspheres

a|MountedAxicons

Opto-Mechanics

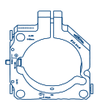
C-Mount male

C-Mount female

a|Adapter Tilt

SM 1 male

SM 1 female



a|VariMount

1.2" circumference

Intra-System

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