HIGH LIGHTS

by SILL

HIGHLIGHTS 24 by SILL

DUV LENSES

Lasers in the deep ultraviolet (DUV) range of less than 270 nm have become essential for many laser processing branches like e.g. electronics manufacturing. The minimum achievable spot size of diffraction limited lenses is lower than for other wavelengths which allows the creation of extremely fine structures. Furthermore, due to the telecentricity of our DUV lenses the heat affect zone and the spot size are minimized at the whole working area.

In many cases, archieving small spot sizes with telecentric lenses at large scan fields poses conflicting requirements. However, we **have pushed the boundaries of laser material processing solutions and successfully offer small structures with high throughput**. Our DUV lenses for wavelengths from 257 nm up to 266 nm are usable for modern USP lasers and enable spot sizes of less than 5 µm on a scan field up to 20 mm x 20 mm.

Moreover, the series is highly flexible for custom designs, ensuring maximum adaptability to specific requirements.

PART NUMBER	FOCAL LENGTH [mm]	SCAN AREA [mm x mm]	FOCUS SIZE (1/e²) [pa]	MAX. BEAM-Ø [mm]	MAX. TELECENTRICITY ERROR [°]	WORKING DISTANCE [mm]	SP/USP*
257-266 nm							
S4LFT4068-199	65	20 x 20	2.5	15	1.3	85.6	yes
S4LFT3170-199	154	85 x 85	7.7	10	3.8	208.1	yes
S4LFT4263-199	163	70 x 70	9.2	10	2.6	218.4	yes

MOTORIZED BEAM EXPANDERS

Introducing our Motorized Beam Expander – the ultimate solution for automation, flexible laser processing, and versatile focal sizes in your machining system. With our cutting-edge technology, we provide a state-of-the-art solution that caters to your expanding needs. Our **Motorized Beam Expanders are specifically designed to precisely and efficiently increase or decrease the beam diameter**.

By maintaining a constant product of beam diameter and divergence, our expanders ensure optimal beam quality throughout the entire laser processing procedure. Whether you require fixed expansion or variable magnification with our zoom expanders, we have the perfect solution for you.

Our beam expanders are built using **fused silica** as the primary material for all optical elements, ensuring exceptional stability and reliability even under high average power or intense laser conditions. The standard product includes a low absorption coating, specially designed to handle the high-power density at the entrance lens element. To accommodate various requirements, we offer a **wide range of beam expanders** with different functionalities. From fixed magnification options suitable for large beam diameters to compact expanders with fixed magnification, we have the perfect solution for every application. Additionally, our **motorized divergence adjustment feature allows for seamless adaptability and fine-tuning** without the need to open your setup for adjustment.

For those seeking ultimate versatility, our motorized variable magnification beam expanders are the ideal choice. With the ability to adjust both magnification and divergence, you have complete control over the focal size and precision of your laser processing. Experience the power of automation and flexibility with our Motorized Beam Expanders.

PART NUMBER	MAGNIFICATION	CLEAR INPUT APERTURE mm]	CLEAR OUTPUT APERTURE [mm]	LENGTH [mm]	THREAD
343-355 nm					
S6EZM0940-574	0.9-4x	12.0	28.0	200.0	M30x1

*usable for SP=Short Pulse, USP=Ultra Short Pulse

TELECENTRIC F-THETA LENSES WITH LARGE SCAN FIELDS SET NEW STANDARDS FOR CUTTING DISPLAYS

Common LC display formats are generally very affordable. However, in certain industries, such as aviation or modern trains, alternative formats are necessary. Developing new displays with special aspect ratios can be exceedingly expensive, especially for small and medium quantities. Therefore, standard formats are preferred for cost-effective production. Fortunately, this approach doesn't compromise functionality, as LC displays are composed of several individual components connected in series. By terminating these components beforehand and making a clean cut between them, special formats can be produced without incurring significant costs.

Laser cutting is the method of choice for cutting the displays. It is particularly important that the cut is made perpendicular to the surface of the display. A minimal cutting depth results in minimal heat input, ensuring that neighboring assemblies remain unaffected. Additionally, the distance between the individual assemblies is small, necessitating a perpendicular cut to cleanly hit the gap.

Telecentric f-theta lenses **facilitate vertical beam incidence, ensuring a vertical section across the entire working plane owing to their low telecentric error**. This feature proves crucial for field corners, where the input beam experiences maximum deflection by the upstream galvanometer scanner. Telecentric lenses are distinguished by a notably uniform spot shape and size throughout the scan field area, particularly in scenarios involving a diffraction-limited optical design.

Nevertheless, the advantages of telecentricity come at a cost, particularly in applications requiring a high scan field size. The mechanical limitation of the scan field is determined by the diameter of the last lens. Consequently, the rear lenses of telecentric lenses must be significantly larger than those of non-telecentric versions to accommodate extended scan fields. The size of the f-theta lens's scan field directly influences the maximum section length.

The S4LFT3340-075 lens addresses both considerations at a laser wavelength of 343 nm - 355 nm, boasting a low **telecentric error of less than 1° and a substantial scan field measuring 205 mm x 205 mm**. This lens is particularly well-suited for intricate cutting tasks, such as cutting LC displays, owing to its unique properties. Telecentric f-theta lenses tailored for various fields and wavelengths are also available. Sill Optics specializes in providing customized solutions for complex applications with high-quality requirements. This means that bespoke lens designs can be developed and manufactured, and existing designs can be modified and adapted to meet specific preferences.

PART NUMBER	FOCAL LENGTH [mm]	SCAN AREA [mm x mm]	FOCUS SIZE (1/e²) [pa]	MAX. BEAM-Ø [mm]	MAX. TELECENTRICITY ERROR [°]	WORKING DISTANCE [mm]	SP/USP*
343- 355 nm							
S4LFT3340-075	340	205 x 205	17.0	14.0	0.85	479.5	yes

*usable for SP=Short Pulse, USP=Ultra Short Pulse

TRAPPED ION LENSES

Unleash the power of quantum computing with the latest breakthrough in technology: the Trapped-Ion Lens. Quantum computers, renowned for their unparalleled computing capabilities and lightning-fast speeds, are ushering in a new era of scientific advancements. **At the core of these quantum experiments lies the remarkable trapped-ion technology, offering prolonged superposition states and unprecedented control**.

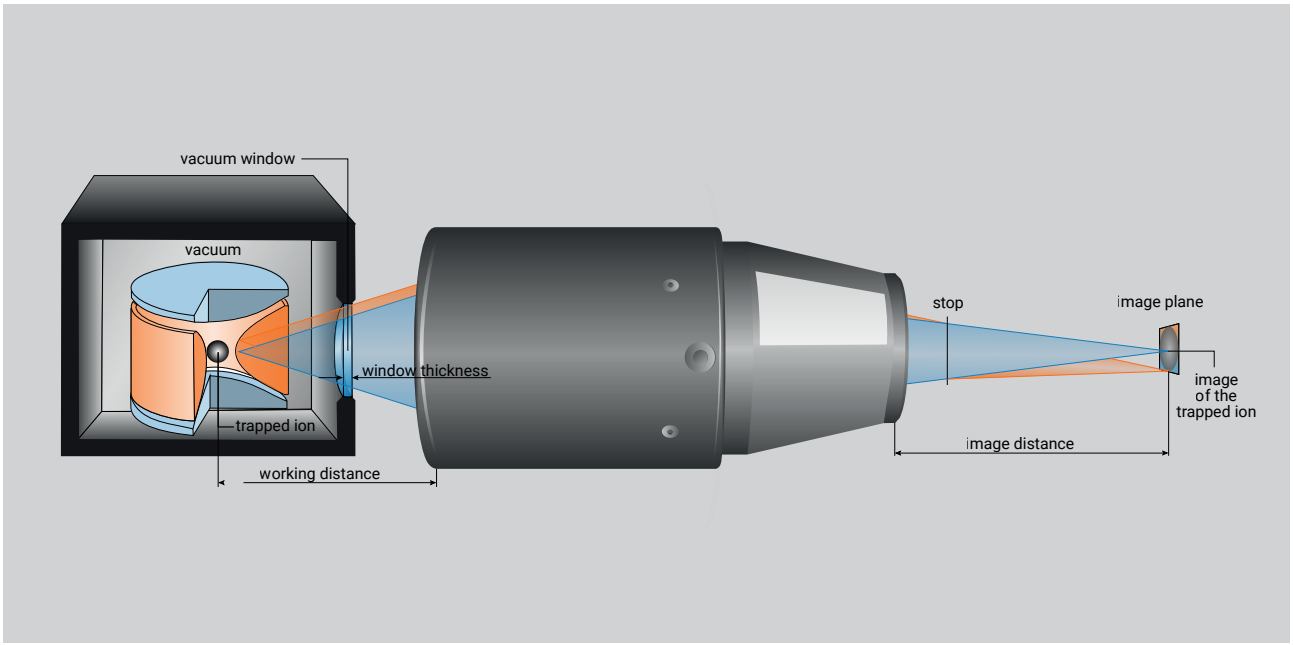
Through the integration of a Paul trap and our innovative trapped-ion lens, we have revolutionized the detection and manipulation of trapped ions. By harnessing the power of laser cooling and observing the reflected fluorescence wavelength, our lens enables precise control and extends the ions' superposition state.

The Trapped-Ion Lens is uniquely designed to accommodate multiple wavelengths, ensuring optimal stimulation and imaging of the ions on a sensor. Sill Optics can provide lenses for both observation and observation combined with laser focusing for these experiments. We understand the importance of sharp focus, which is why our lens boasts a high numerical aperture (NA) and guarantees diffraction-limited imaging at the center of the trap.

While the Paul trap secures the ions within a vacuum chamber, our lens is strategically positioned outside the chamber, allowing the beam path to pass through one or more vacuum windows. Although these windows may impose limitations on the NA and the minimum distance between the lens and the focal plane, our Trapped-Ion Lens overcomes these challenges with ease.

We acknowledge that every laboratory setup is unique, with varying ion types, wavelengths, beam parameters, and vacuum chamber dimensions. That is **why we offer both catalog optics and custom redesigns** based on our catalog optics. Our expertise in lens design, coupled with in-house manufacturing capabilities, ensures cost-efficient solutions, eliminating the need for designing from scratch and saving you valuable time and resources. At Sill Optics, we are committed to providing you with the perfect solution for your specific requirements.

Take the first step towards unlocking the potential of quantum computing. Contact our dedicated project management team today to learn more about our Trapped-Ion Lens. Provide us with a detailed description of your laboratory setup and relevant technical data, including vacuum window specifications, required wavelengths, distance to the focal plane, desired NA, installation space limitations, and working distance requirements.



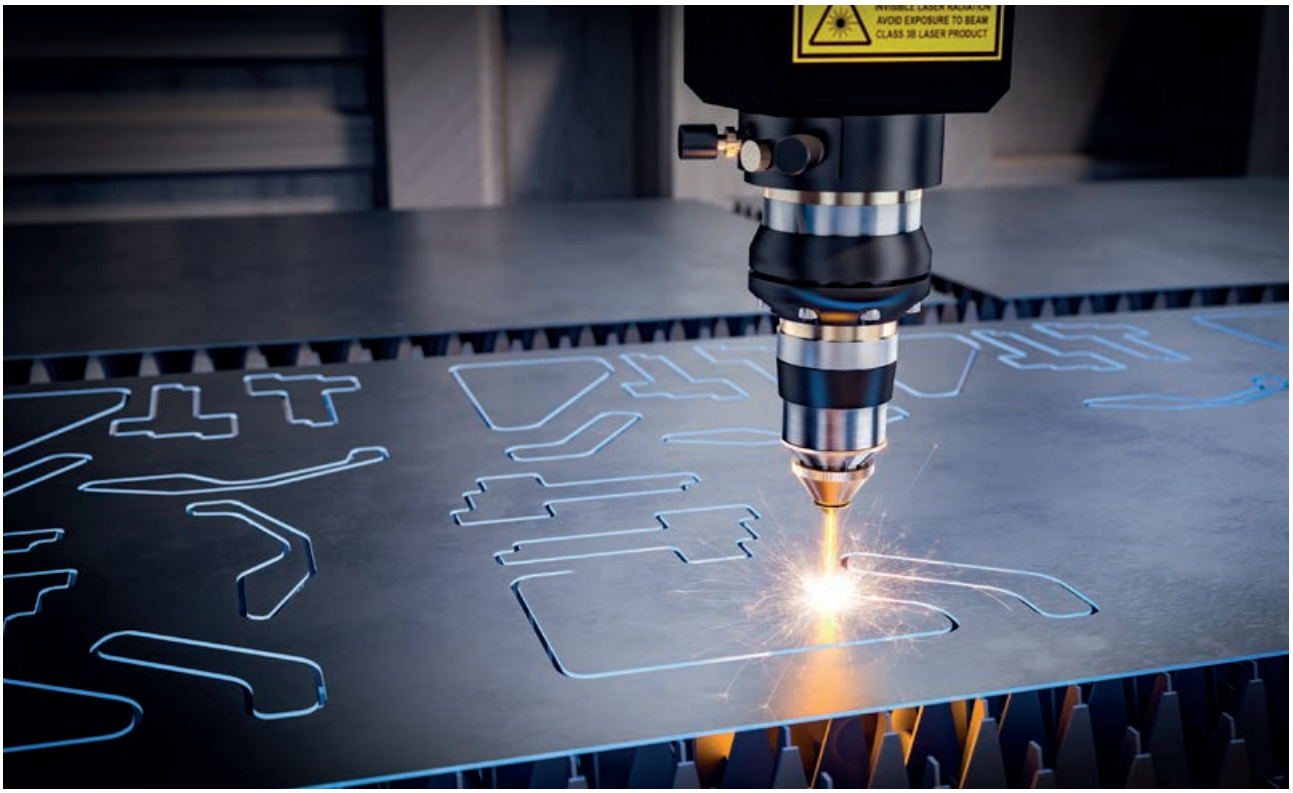
HIGH POWER F-THETA

F-theta lenses are extensively utilized in laser materials processing and find applications in various scanning systems. However, high-power f-theta scanning systems present certain challenges. Scaling the laser power necessitates careful consideration of thermally induced phenomena and ghost reflections, which further complicates the optimization of optical configurations and the correction of major sources of errors, even during the pre-design phase. Moreover, achieving high positioning accuracy requires addressing all potential causes of distortion within the processing field.

Our high-power f-theta lenses offer an **ideal solution for demanding laser material processing applications**. Equipped with state-of-the-art optics, they are perfectly suited for laser welding and laser cutting tasks. Whether you require precise welds for industrial applications or accurate material cutting, our lenses deliver impressive beam quality and ensure high focus stability, meeting your exacting standards for precision and efficiency.

Additionally, **our high-power f-theta lenses are widely employed in the automotive industry**. They enable precise marking, welding, and cutting in the production of automotive components. Furthermore, **our lenses play a crucial role in battery technology**. In the production of battery packs for the automotive industry, precise machining of components is vital. You can rely on the proven performance and quality of our lenses to meet the rigorous requirements of battery technology.

PART NUMBER	FOCAL LENGTH [mm]	SCAN AREA [mm x mm]	FOCUS SIZE (1/e²)	MAX. BEAM-Ø [mm]	MAX. TELECENTRICITY ERROR [°]	WORKING DISTANCE [mm]	SP/USP*
S4LFT5430-328	430	250 x 250	30	30	11.6	540	yes
S4LFT0910-328	910	500 x 500	65.8	30	16.2	1048.8	yes



*usable for SP=Short Pulse, USP=Ultra Short Pulse

HIGH-PERFORMANCE LENS FROM A RESEARCH PROJECT

S4LFT3350-292 was developed as part of the Next-Gen-3D-Bat project. The research focused on the production of modern lithium-ion batteries with particularly high performance and a long service life.

The lens was used to apply large-area microstructures to cell components in order to improve wettability with a liquid electrolyte and thus increase cell performance. To maximize the process speed, the DLIP method was used, in which the superposition of two parallel input beams next to the focal plane is used. The lens with a focal length of 350.5 mm is suitable for a large diameter input beam of 21 mm, which contains the two parallel DLIP beams. In addition, the scan field of 200 mm x 200 mm is very large to ensure a high production speed.

As ultra-short pulsed lasers were required for micro structuring the cell components in this research project, the S4LFT3350-292 is a fused silica lens that is also suitable for lasers with pulse durations in the femtosecond range.

The S4LFT3350-292 was developed for a green laser with a wavelength of 515 nm. A similar lens was also built for the infrared range. If you need a lens for a similar application or want to use a lens with such specifications in a completely different market, please do not hesitate to contact us.

PART NUMBER	FOCAL LENGTH [mm]	SCAN AREA [mm x mm]	FOCUS SIZE (1/e²) [pa]	MAX. BEAM-Ø [mm]	MAX. TELECENTRICITY ERROR [°]	WORKING DISTANCE [mm]	SP/USP*
515 nm							
S4LFT3350-292	350.5	200 x 200	22.0	21.0	11.3	439.6	yes

RGB NIR LENS FOR 8K LINE CAMERA

Sill launches first RGB-NIR lens for 8k line scan camera. New camera technology requires new lens designs. Teledyne Dalsa offers special line scan cameras with Red, Green, Blue and NIR sensitive line.

Common entocentric lens designs lack on the correction of axial color shift. Typically, blue or NIR channel is blurred. Sill Optics now designed an f'65mm lens for 8k with 5µm (line length 40mm) or 7.5µm (line length 56mm) to start a small series that fulfill the customers demand in color correction for all 4 waveband channels.

Further on, Sill Optics offers to tailor a lens that fit to these cameras and your individual application.

PART NUMBER	FOCAL LENGTH [mm]	LINE LENGTH [mm]	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/BAYER) NIR (800-900 nm)	RECOMMENDED PIXEL SIZE [µm]
S5LPJ4465	65	40	R,G,B,NIR	5

*usable for SP=Short Pulse, USP=Ultra Short Pulse

HIGHLIGHTS 24 by SILL

C-MOUNT LENSES FOR LARGE SENSORS

Sill Optics is responding to the increased demand for C-mount lenses for large sensors with a **new series of telecentric lenses**.

The series includes three lenses with 0.6x, 0.7x, and 0.8x magnification, optimally designed for a 22mm sensor. With high resolution, these lenses **fit perfectly on the current Sony Pregius S series sensors** with a 2.74µm pixel size.

The lenses can be used both monochromatically and with white light. They can also be used in the NIR (near-infrared) range by slightly adjusting the working distance. This lens series fills the gap in our portfolio, which now includes high-resolution telecentric lenses with magnifications ranging from 0.13x to 3.0x for 1.25-inch sensors.

PART NUMBER	MAGNIFICATION	RECOMMENDED SENSOR DIAGONAL [mm]	WORKING DISTANCE [mm]	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/BAYER) NIR (800-900 nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD
S5LPJ6406	0.600	22.0	155.0	R,G,B,W,NIR	2.74	C
S5LPJ6407	0.700	22.0	140.0	R,G,B,W,NIR	2.74	C
S5LPJ6408	0.800	22.0	131.0	R,G,B,W,NIR	2.74	C

2X TELECENTRIC LENS WITH LIQUID LENS

Sill Optics has developed a telecentric lens with a 2**x magnification, large aperture, and integrated liquid lens** for focus adjustment. The increasing demand for magnifying telecentric lenses, particularly with large apertures that accommodate a 2.74µm pixel size and a 1.1-inch sensor diagonal while maintaining stable imaging performance across various wavelengths, has posed significant challenges. However, through **collaboration between Sill Optics and Optotune**, these requirements have been met.

The lens, named EL16-40, **achieves a resolution of 90 lp/mm across the entire field of view**, exhibiting the best wavefront specification in vertical alignment. This outstanding performance enables the lens to deliver exceptional results as a 2x magnification telecentric lens for sensors with 12-20 megapixels, along with an additional automated focus adjustment capability of at least 6mm.

This groundbreaking product opens up new possibilities for the fields of semiconductor inspection and precision metrology, enabling them to achieve significant milestones.

PART NUMBER	MAGNIFICATION	RECOMMENDED SENSOR DIAGONAL [mm]	WORKING DISTANCE [mm] (TR=TUNING RANGE)	WAVELENGTH BAND MONO (RED, GREEN, BLUE) WHITE (COLOR/BAYER) NIR (800-900 nm)	RECOMMENDED PIXEL SIZE [µm]	THREAD
S5VPJ6415	1.500	19.2	80.2 TR≈6	R,G,B,W	2.74	C
S5VPJ6420	2.000	19.2	68.2 TR≈6	R,G,B,W	2.74	C
S5VPJ6425	2.500	19.2	61.4 TR≈6	R,G,B,W	3.10	C

WWW.SILLOPTICS.DE

www.silloptics.de/
en/contact

Sill Optics GmbH • Johann-Höllfritsch-Str. 13 • 90530 Wendelstein • Germany +49 9129 9023-0

Stand: 01/2024