

The AM MODULE III - Setting New Standards for Industrial Additive Manufacturing

RAYLASE launches the AM MODULE III, providing a production-optimized scanning solution for more efficient industrial additive manufacturing

Weßling, Germany - October 23, 2023 - RAYLASE presents this year its latest scanning solution for the AM market - the AM MODULE III, combining the experience from previous AM products with the know-how from the AXIALSCAN FIBER series. The result is a matched and reliable integrated system that helps users to scale their AM production process. This makes AM production a real competitor to conventional manufacturing methods.

With its strong focus on the AM market, RAYLASE pays close attention to the applications and needs of users and can thus provide **optimized solutions** for their challenges. Hence, during the development of the new AM MODULE III, the focus lay on highest productivity, as well as process safety and reliability of the scanning system for all functionalities. The AM MODULE III offers a **patented in-focus zoom functionality** (U.S. Patent No. 11,402,626), the **new dynamic z-axis RAYVOLUTION DRIVE**, an optical design designed **for beam shaping and high laser powers** as well as a **multi-scan head design**. The requirements led to an **integrated scanning system** that enables users to get the most out of their AM machine and to build an **efficient additive production**.

READY FOR AM PRODUCTION

In additive production, a lot of attention revolves around the efficiency of the production line. The aim is to produce as many parts as possible per unit of time while keeping the costs per part as low as possible. This is essential to remain competitive with other manufacturing methods. This requirement is reflected in the AM MODULE III.

FASTER EXPOSURE THANKS TO RAYVOLUTION DRIVE Z-AXIS

Pre-focusing beam deflection units such as the AM MODULE III use a combination of moving and fixed lenses in front of the scan mirrors to focus the laser. In order to take advantage of a pre-focusing system and at the same time benefit from the **full dynamics** of the xy-deflection unit, the lens that holds the focus in the z-plane must be able to follow the dynamic movements of the xy-mirrors without delay. This is essential to keep the z-position of the focus stable. RAYLASE has developed **RAYVOLUTION DRIVE (RD) technology** for precisely this purpose. With it, the lens can be moved very quickly based on the voice coil principle. It ensures a **stable z-position of the focus** even during fast movements and wide jumps of the xy-mirror. In addition, an innovative mount allows highly accurate alignment and guidance of the lenses even under dynamic movements and enables excellent imaging performance of the lens

system. Even single-mode fiber lasers or special beam shaping such as ring-mode lasers remain virtually undisturbed. RAYVOLUTION DRIVE technology thus ensures **optimum flat-field correction even at high scanning speeds** throughout the entire processing field of up to 650 x 650 mm². In addition, it enables **highly dynamic scanning strategies such as hatching with a constant focus position** and makes the AM MODULE III the ideal solution for precise and highly dynamic AM applications.

HIGH BUILD RATES THANKS TO ZOOM FUNCTION

One of the greater challenges in additive manufacturing is to keep the exposure time per layer as short as possible in order to be able to produce profitably. To **fill large areas**, the user therefore often uses a defocused laser. In this way, more area can be filled with each pass, as with a brush that is pressed down harder. This **saves processing time**. However, as with the pressed brush, the shape of the defocused laser spot is poorly defined. In order to be able to provide the appropriate "brush width" for each application in the AM MODULE III, RAYLASE has developed the **zoom function**. This allows a **highly dynamic adjustment of the focus diameter by up to 2x**.

At the same time, the patented optics design ensures that even with an enlarged spot diameter, the build process can continue in focus **with an undisturbed beam profile**. It is particularly important for **alternative beam shapes** such as a ring or tophat profile.

This makes the AM MODULE III the only deflection unit worldwide that can **enlarge a ring-mode laser spot without loss of quality**.

The zoom function of the AM MODULE III thus makes a decisive contribution to **implementing high build rates in the machine** and thus making additive production competitive with conventional production processes.

FASTER BUILD PROCESS THROUGH HIGHER POWER COMPATIBILITY

In order to be able to further increase build-up rates in the AM process, more power must be applied. That's because the additional power can **increase the scanning speed in the powder**, allowing faster build rates to be realized. Ring-mode lasers also require more laser power to ensure the same energy density in a larger spot.

Therefore, RAYLASE has designed the AM MODULE III for the use of **stronger lasers up to 3 kW average power**. The higher power compatibility is made possible by the **dust-tight housing and manufacturing in an ISO Class 7 clean room**. But higher power alone is not enough. The right **power distribution** also is a crucial point. In the AM MODULE III, it is solved with suitable optical elements for **beam shaping** that ensure **uniform energy distribution in the focus**.

HIGHER PRODUCTIVITY THROUGH MULTI-SCAN HEAD DESIGN

To manufacture profitably in additive production, it helps to have **multiple lasers and deflection units available in a machine**. This way, they can build **multiple parts in parallel**, minimizing non-productive time between exposure steps. Alternatively, the scan systems work **simultaneously on a single part**, achieving higher build rates.

However, in order for such multi-head systems to work in more than just the laboratory, deflection units are needed that serve this purpose. This involves both the mechanical design and the alignment of the scan fields to each other.

To provide the AM community with a convenient solution here, the AM MODULE III was designed for exactly this application. It offers a 100% overlap between adjacent fields and thus allows highest build-up rates. Attention was also paid to ensuring that the deflection units remain easily accessible even in an expandable row of two, so that production can be resumed quickly in case of maintenance.

RELIABLE PRODUCTION THANKS TO PROCESS MONITORING

Seamless quality monitoring is becoming important in more and more AM applications. Especially critical application fields such as aerospace or medical technology are interested in integrating **layer-by-layer process monitoring** into their production process. For this purpose, it is necessary to **collect measurement data during the exposure process and to link these with the position values in the image field**. The various sensors used have different requirements for the beam deflection units.

While **pyrometers for melt pool monitoring** can typically be used directly via the **achromatic camera port** integrated in the AM MODULE III, camera solutions require **precise focus tracking** at the observation port. The tracking of the camera port must be able to follow the fast movements of the scan mirrors. Otherwise, the image becomes blurred and analysis is often impossible.

With the **RAYSPECTOR**, RAYLASE offers **focus tracking that is optimally adapted to the AM MODULE III**. Thanks to highly dynamic lens shifting using RAYVOLUTION DRIVE technology, the process observation precisely follows the scan movement and enables **sharp images in the entire image field**. This makes sophisticated image analysis possible and can thus be used for quality monitoring and even process control.

ADDITIONAL TOOLS FOR OPTIMIZED PRODUCTION

In production, the AM MODULE III is also **ideally complemented** by the **SCAN FIELD CALIBRATOR (SFC)** and the **PROCESS DATA ANALYZER (PDA)**. With the **SCAN FIELD CALIBRATOR (SFC)**, **calibration of individual build area** is just as quick and easy as **aligning the individual fields to each other in a multi-head system**. The **PROCESS DATA ANALYZER** offers the possibility of **process optimization by read-back scanner positions**. Like a **digital oscilloscope**, the PDA can track every signal delivered by the control card operating the deflection unit and the laser. With a pyrometer or other sensors connected to the deflection unit and control card, the PDA can **visualize the additional sensor data recorded**. This helps to directly understand and optimize the process result.

Both tools **offer efficient solutions for important tasks around the exposure process**, e.g. in regular calibration or optimization of the scan strategy. Thus, they enable time savings that are clearly reflected in higher plant productivity.

CONCLUSION:

With the new AM MODULE III, RAYLASE offers its customers the possibility to make **additive production more efficient and reliable**. Thanks to the zoom function and fast RAYVOLUTION DRIVE z-axis, the new AM MODULE III enables a **significant increase in performance** and makes additive manufacturing attractive for many more applications.

With the AM MODULE III, RAYLASE offers a **complete solution for the AM market** and enables AM users to take the next step in the industrial production environment: The step from rapid prototyping to fast additive manufacturing!

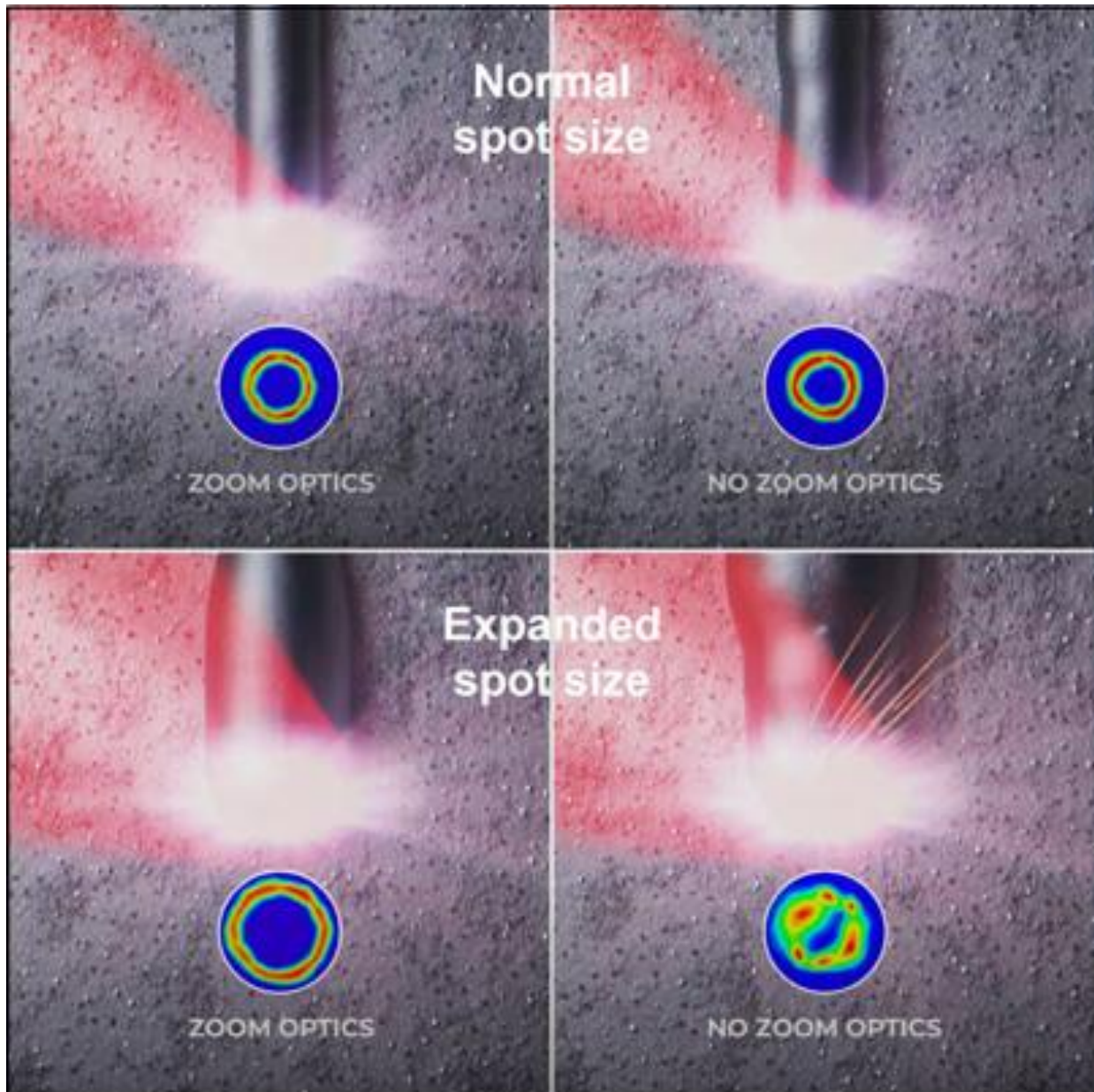
About RAYLASE

RAYLASE GmbH is the solution provider for laser applications in industrial environment. Since 1999, the Bavarian company from Wessling near Munich, provides innovative laser deflection systems for precise and efficient laser material processing. By combining opto-mechanical scanners with sensor technology and intuitive software, it enables optimized laser systems that are made for industrial production.

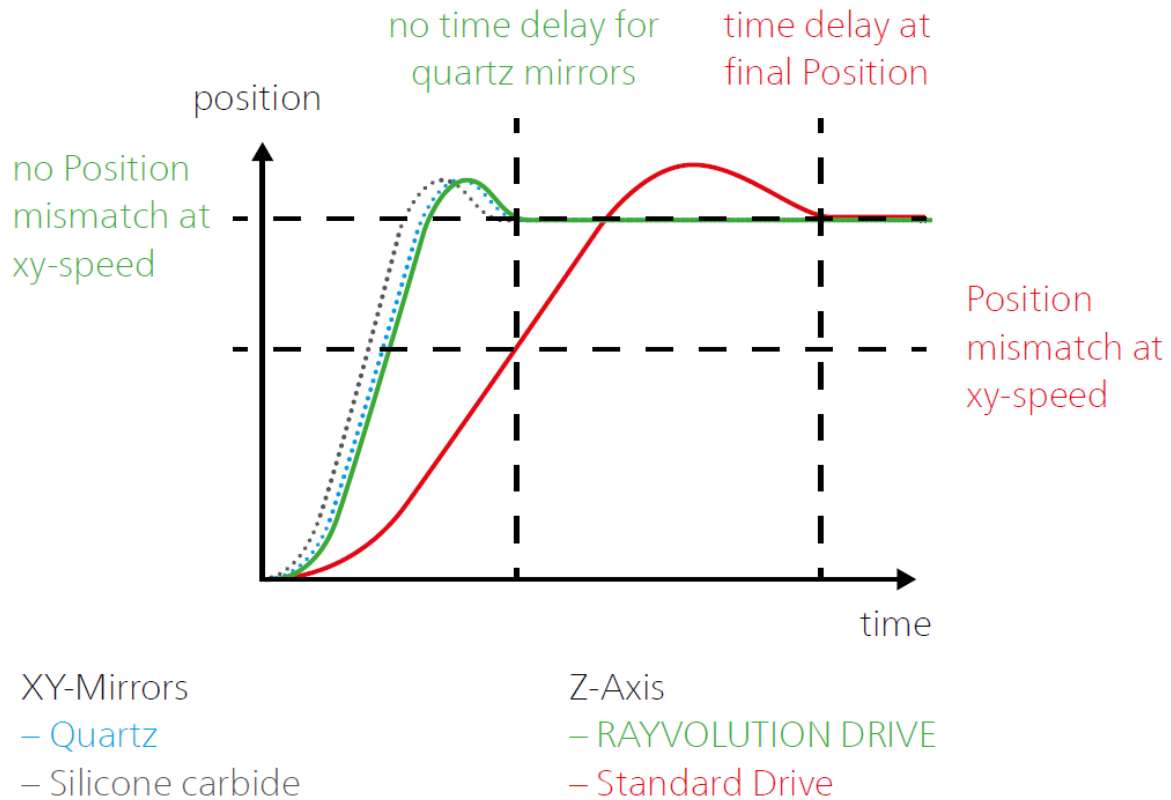
RAYLASE has its focus in the e-mobility and AM market as well as in the solar and electronic sector. With its subsidiary and its own additional production facility in Shenzhen, China, it offers a high production depth and optimized delivery times. Together with several international representatives in the US, Italy, Japan, Korea, and Taiwan, the RAYLASE group with its 170 employees supports customers worldwide with industrial solutions for laser cutting, laser welding and laser surface processing.



The AM MODULE III is the next evolutionary step in deflection units for the additive manufacturing market. With its consistent focus on industrial manufacturing, it enables users to achieve high productivity, both in terms of exposure time and overall system availability. With the AM MODULE III, the step from rapid prototyping to fast additive manufacturing is now possible!



The in-focus zoom function of the AM MODULE III allows the spot diameter to be varied by up to 2x. In contrast to defocusing the spot, the beam shape is preserved when zooming. This is especially important when the beam quality of the laser is good and when using beam shaping like ring mode or tophat.



RAYVOLUTION DRIVE: Pre-focusing beam deflection units like the AM-MODULE III use a combination of moving and fixed lenses in front of the scan mirrors to focus the laser. To keep the focus in a constant z-plane, the movable lens and thus, the focal length adjusted with each movement. With RAYVOLUTION DRIVE, the z-axis can follow the xy-movements of deflection units with quartz mirrors without delay. Quite in contrast to a standard z-axis, which shows significantly slower dynamics. With highly dynamic silicon carbide mirrors, a small difference in dynamics still remains visible, which can be compensated for using the Tracking Error Compensation function on the SP-ICE-3 control board.