OPTOPRIM

Presents:

Application report of the SCOUT 5 kW System from K-Lab

High power scanning system with auto-offset function of scan field breaks boarders in terms of accuracy and process time

Innovative functions such as the 4-line concept for determining the focus position and the automated alignment of the scan contours enable faster set-up times as well as the processing of complex applications with high quality and repeatability.

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The further development of products in the industrial laser world is unstoppable. The overall focus is to shorten the process times for many applications. Therefore, the trend in the field of laser beam deflection is moving into higher laser powers, as more applications are getting transferred from fixed optics to galvanometer based systems. This development can be seen across industries for applications with linear systems, but also for robot-based processes. The K-Lab company goes one step further with its SCOUT system (Fig. 1). It is not only shortening the process but also the set-up time while at the same time the accuracy of homogeneous and heterogeneous component geometries gets significantly improved. With its camera technology, auto-offset feature, and intuitive and process-oriented software, the high-performance scanner addresses problems that cannot be solved with any other scanner system or are too time consuming to do the set up for the process. The laser scanning system in combination with the precise image processing solution can be used in micro machining (up to 300 W) up to macro processes (up to 5 kW). Depending on the process, depending on the contour widths to be machined and the available laser power, it is possible to realize field sizes of 800 x 800 mm².

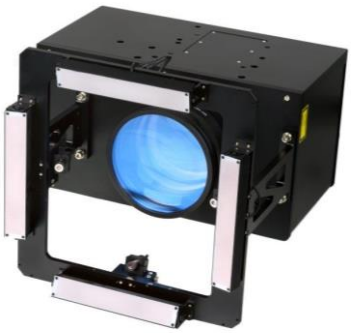

Figure 1. SCOUT-300 – 5 kW high power scanning system from K-Lab

Set up of optimum working distance – 4-line concept

Especially with galvo based process optics, it is often difficult, time-consuming to set up and maintain the optimum focus position for the components to be machined. For this purpose, a patented 4-line concept is integrated in the scanner system, which offers an interesting solution. With the help of the naked eye and the four red LED lines, the focus on the surface of the component to be machined can be aligned in the horizontal, the vertical but also in the 3-dimensional space. Here, the four lines are superimposed at optimal focus position and form a crosshair, as it is visible at a demo part in figure 2. A minimal offset in the Z direction, but also in tilted position in the room, can be recognized immediately. This makes the system well suited for 5-axis or robotic systems.

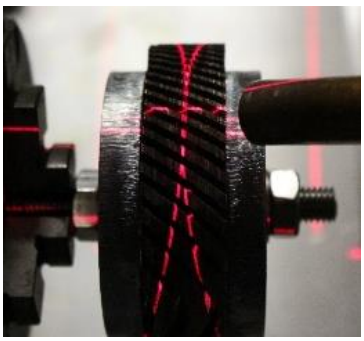

Figure 2. Alignment of focal position with help of the 4-line concept for a remote welding application – Source: Fraunhofer Institute for Material and Beam Technology IWS

Auto-offset function of the scan field

In addition to the finding of the focus position, the system provides an auto-offset function of the scan field. With help of an inline camera system and the ingenious lighting concept optimal prerequisite for capturing a wide variety of component geometries, material types and component layers has been created. The working process begins with the capture of individual images across the entire scan field or a predefined area. The recordings with up to 300-megapixel resolution get processed with the self-developed image processing program and run through a stitching routine. Stitching is the process of creating a large visual image that is made up of various small individual images. The advantage of stitching is the ability to produce a very high-resolution image. In regards to remote laser applications, it enables to record the entire working field. Thus, subsequently finest component geometries or to be machined welding contours are displayed in the highest detail and resolution. Now, with the help of these precision shots and the interaction of the image processing software, the master component can be learned. In the so-called "teaching" process, reference contours are getting determined, target areas to be processed are getting set, such as the associated desired machining contours. In the second step of the teaching process hidden contours that shouldn´t be machined get blanked out. Especially in this step, the definition of only individual, singular areas can significantly reduce the process time (Fig.3).

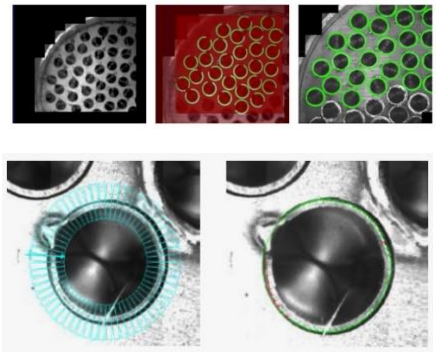

Figure 3. Example of the auto-offset function with help of the image processing of the K-Lab software during teaching process for a heat exchanger. The upper image does show the adjustment of the contours and the regulated contours. In the lower left picture preset of the search range for individual contour is made. In the lower right graphic, the search result of the individual contour is represented.

In addition, the SCOUT offers the possibility of stringing several processing areas (e.g. 200 x 200 mm scan field) together and process them one after the other in an internal CNC program. This feature makes it possible to alternate between laser processing and axis movement in order to realize larger components in a production process. After a short test of the correct interpretation of the component geometries by the image processing software and a virtual weld by the K-Draw® software, followed by the selection of individual laser parameters and - if necessary – including of a ramp function or an oscillation of the laser beam along the contour, the part can be processed. This set-up process takes only a few minutes for most applications and can be performed with the help of the very user-friendly coaxial camera and precise recordings on the monitor. Now the laser process can be started. For this purpose, the parts only have to be roughly positioned in the previously defined desired range, which makes complex, time-consuming and cost-intensive clamping steps such as devices completely superfluous. The SCOUT system easily compensates X-, Y- and rotation-offsets. Then the workpiece will be scanned, the images get stitched, repositioning is happening by the auto-offset function, and the laser process is performed within a precision range of a few micrometers. Within one production cycle, the versatile K-Draw® software can be used to realize also markings for component identification at the end. These can be simple lettering, bar codes, QR codes, but also company logos in DXF format. In addition to the time savings and lower costs because of using only one work station, the marking is always at the correct position on the workpiece because of the auto-offset function.

Scope of application and application examples

The SCOUT system does not only enable a very accurate and flexible implementation of the various remote laser processes, but also facilitates the machining of very small, often difficult-to-clamp components, as well as large, highly complex geometries. Thanks to the versatile software and preprogrammed functions even most challenging jobs can be performed quickly with high quality results. The fields of application, as well as sectors in which the SCOUT system is already in use is very

diverse. Inchoate from the watch, electrical, medical and automotive industry as well as the e-mobility sector, the are no limits regarding the capability of the SCOUT. Specific application examples are, the laser soldering of individual electrical contacts, the welding of heat exchangers, the cutting and welding processes of battery cells, welding of copper stators and much more. Currently, more than 400 systems are worldwide in use with an increasing demand.

Figure 4 describes an application where our partner initially did not think directly of a remote application. One of the main reasons was the very time-consuming setup process and the reliability of identical process results. With the SCOUT system and the K-Draw® software this was different. The SCOUT system has made it possible to teach the entire component with the polyline function in just a few steps. The laser-cut thin sheets, stratified in layers, with the changing connecting webs, had been taught and afterwards transferred in a complete program with alternately laser process and movement of the rotary axes. With the once created template and the created processing program, further components could be produced reproducibly in a very good quality with a simple repetition of the program and without further setup effort.

Conclusion

With the SCOUT system, K-Lab has developed an innovative complete system that is unique in the laser industry with its combination of coaxial camera, precision image processing, auto-offset and intuitive operator software. In order to maintain this monopoly position in the future, K-Lab continues to work on technical improvements and new functions. This progress will also be shown at different shows around the globe, e.g. the EuroBlech in Hannover. Here, the new SCOUT 300 EVS (Fig. 5) with four CCD cameras and the "Full-Field-Live" function will be presented. The new EVS model really breaks boundaries and reduces scanning time of the complete working field from 12 s to 1 s and allows a continuous live image of the work piece. In addition to that, K-Lab has released a new version of the SCOUT in the last weeks. It is called SCOUT 300L, which stands for lab system. It gives customer the possibility to change collimators and F-Theta lenses to have different magnifications, so different spot sizes to have the most suitable setup for their application. This kind of flexibility, functionality and combination of high accuracy no other remote process head in the industry can full fill and is as well another good example for the innovative developments of K-Lab.

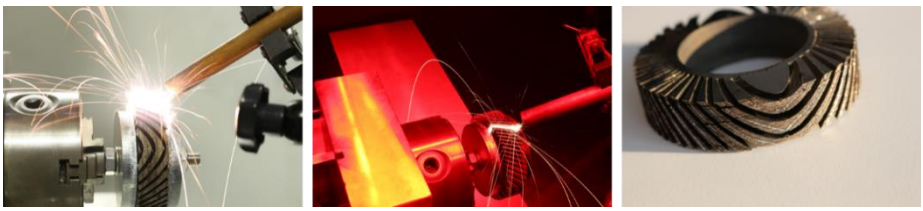

Figure 4. Example of a complex laser welding application for a new accelerating ring at CERN, the European Organization for Nuclear Research with the SCOUT 300 system and a 4 kW fiber laser from nLIGHT- Source: Fraunhofer Institute for Material and Beam Technology IWS

Figure 5. The new SCOUT 300 EVS with 4 CCD cameras and the "Full-Field-Live" function

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