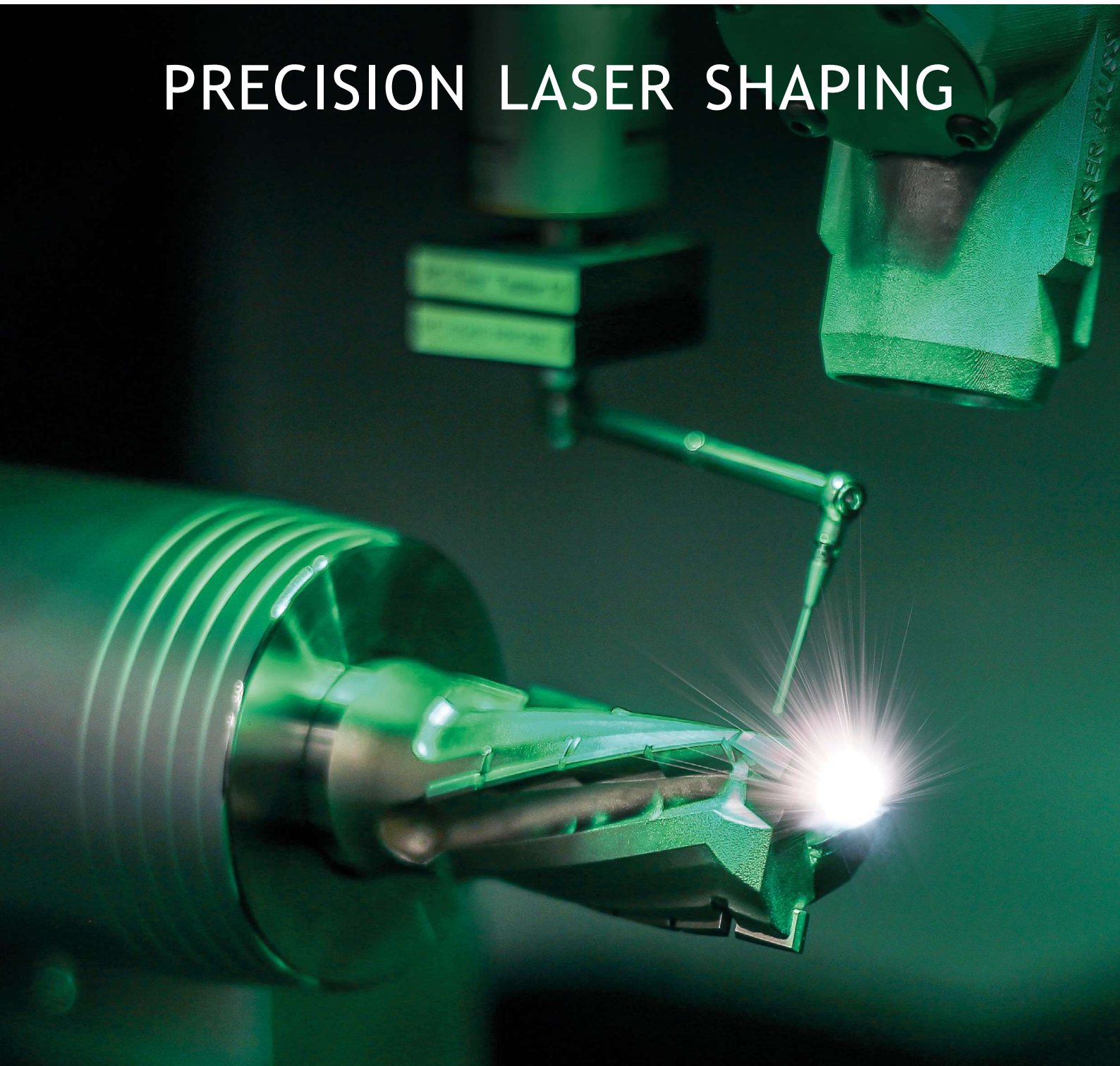




# PRECISION LASER SHAPING





## TECHNOLOGY PARTNER FOR INNOVATIVE LASER SYSTEMS

Along with innovative laser technology, LaserPluSSS offers further benefits: data handling and workpiece handling can be integrated into the company's systems. In this way the laser technology allows innovative, cost-effective further developments and new developments in many areas to be used efficiently and successfully in numerous applications.

This is all the more important because the precision that can be achieved in industrial manufacturing by laser technology opens up entirely new horizons. Production processes can be designed more efficiently and with more flexibility. The range of products and services from LaserPluSSS is diverse: from standard solutions for a very wide range of segments to the manufacturing of customer-specific solutions, LaserPluSSS develops and supplies laser machining systems for the highest precision and cost-effectiveness.

The focus is on the usage of lasers for micromachining for marking, deep engraving, welding and the precision cutting of hard materials as well as for 3D material removal.

LaserPluSSS produces laser machining systems for industrial manufacturing process for customers of watch-making & jewellery, semiconductor, tool-making, plastics, automotive and aerospace as well as medical technology industries.

The company's strength is in the development of new solutions tailored to the specific customer. Based on the existing product portfolio, our laser systems are specifically matched to customer requirements.



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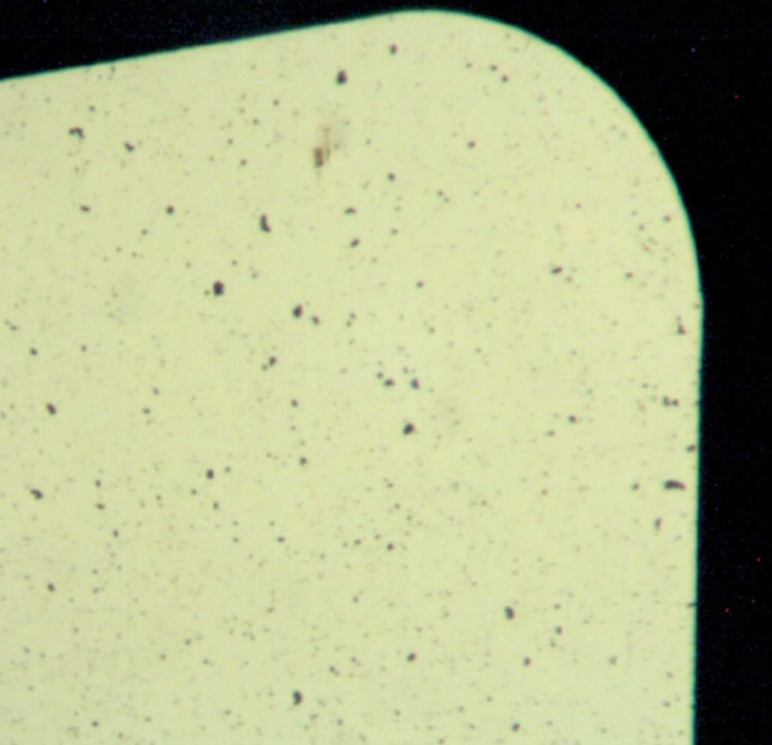
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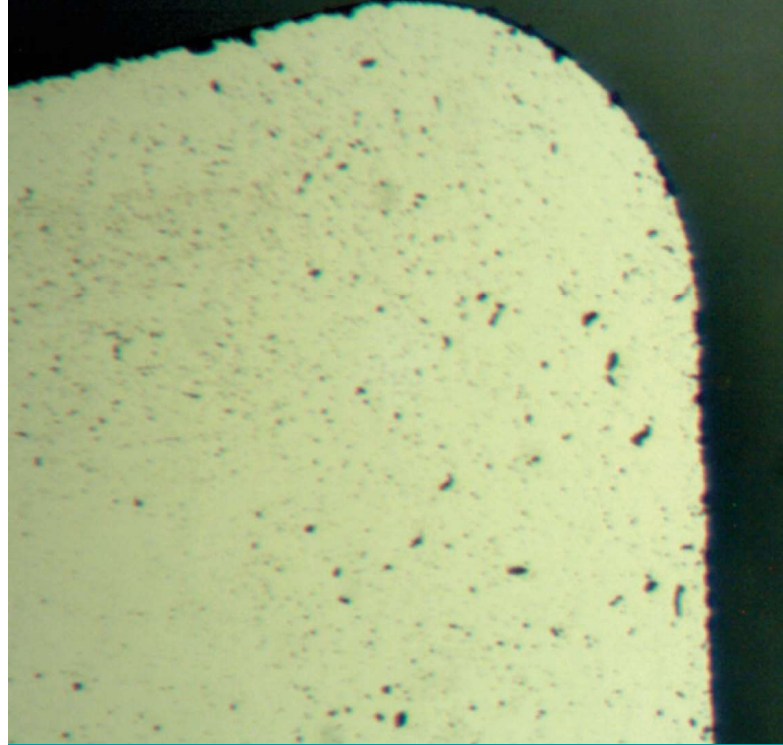
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PCD cutting edge, enlarged 2000-times, laser machined



PCD cutting edge, enlarged 2000-times, ground

## PRINCIPLE OF LASER SHAPING

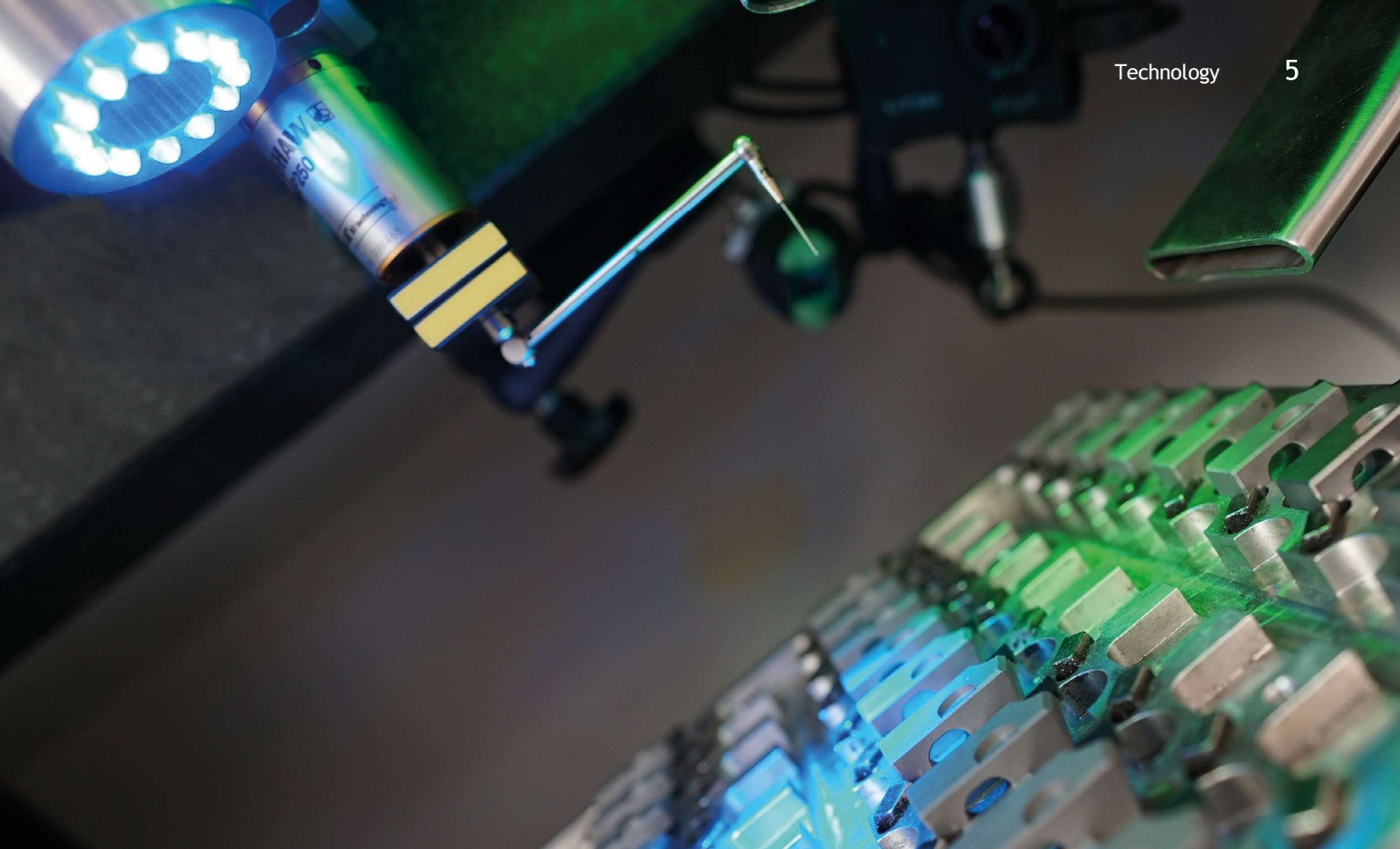
For the high-precision machining of diamond tools, LaserPluSSS uses a diode-pumped solid-state laser. The laser uses laser diodes that convert electrical energy into light and supply it to a crystal (laser-active medium). These laser crystals are able to store energy for a short time and release it again as a very short pulse of light. Due to this effect, a laser with an average power output of 10 watts can achieve a peak pulsed power of 100 kW.

The pulse length is in the nanosecond range. If the laser beam is incident on a material, this material absorbs the energy from the light and heats up. Due to the laser pulses, the material to be machined is heated up so strongly at a specific point that material is removed by evaporation. For precision machining a very large number of laser pulses are used; these pulse are positioned on the part with high geometric accuracy.

The laser sources from LaserPluSSS are specially designed and engineered for machining diamonds. They are the optimal tool for precision machining due to the excellent beam quality.

### Features of the laser machining:

- No chipping at the cutting edges, as with on ground PCD
- Cutting edges with even rounding can be manufactured up to 1  $\mu\text{m}$
- No measurable thermal damage - even with 4  $\mu\text{m}$  particle size the diamonds are perfectly cut
- No erosion of the binder phase that affects the strength of the cutting edge
- Machining regardless of the hardness and the composition of the material
- Cutting edges produce better, more accurate machining results
- Longer tool life of the cutting edge
- Significantly lower operating costs and energy costs compared to EDM or grinding because no consumables are required
- Quieter, cleaner and more eco-friendly machining process
- Contours with very fine internal radii can be manufactured

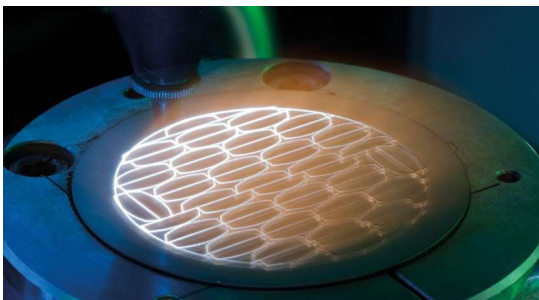


## POSSIBLE MACHINING TASKS

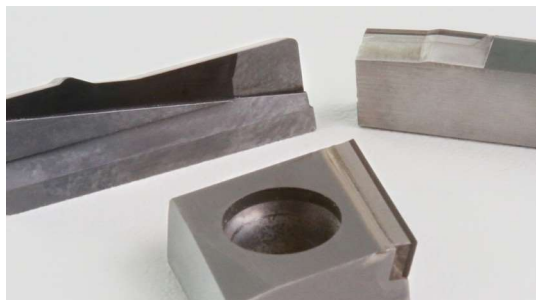
Common diamond cutting materials such as PcBN (cubic boron nitride), PCD (polycrystalline diamond) and CVD-D (CVD thick-film diamond) can be machined by using systems from LaserPluSSS.

Along with the contour of the cutting edge, it is possible to machine clearance angles, chip guiding geometries and to apply markings in one operation.

Process for tool manufacture in four steps:



1. Cut off/separate circular blanks



2. Machine the cutting edges (including the cutting edge rounding) and clearance angles



3. Removal of material to produce chip guiding geometries











4. Marking



# PRODUCT PORTFOLIO

Laser systems for every application

		Marking 	Engraving 	Cutting 	Precision mat. removal 	
	CutMaster (side 10)	■	■	■	■	
	PreCutter (side 14)			■		
	RayCutter® S (side 18)	□		■	■	
	RayCutter® HS (side 22)	■		■	■	

	Applications	Properties			
		Flexibility	Working area	Working area	Investment
	<ul style="list-style-type: none"> <li>- Tool marking</li> <li>- Cutting of circular blanks</li> <li>- Pre-cutting</li> <li>- Chip guiding stage on round and flat tools</li> </ul>	<p>A bar chart with four columns: Flexibility, Working area, Working area, and Investment. The bars are filled with teal. Flexibility is high (top 2/3), the first Working area is medium (middle 1/3), the second Working area is low (bottom 1/3), and Investment is low (bottom 1/3). A '-' sign is at the bottom left and a '+' sign is at the bottom right.</p>			
	<ul style="list-style-type: none"> <li>- Cutting of circular blanks</li> <li>- Pre-cutting with clearance angle</li> <li>- Precision cutting</li> </ul>	<p>A bar chart with four columns: Flexibility, Working area, Working area, and Investment. Flexibility is medium (middle 1/3), the first Working area is high (top 2/3), the second Working area is low (bottom 1/3), and Investment is high (top 2/3). A '-' sign is at the bottom left and a '+' sign is at the bottom right.</p>			
	<ul style="list-style-type: none"> <li>- Finish machining of cutting edges and clearance angles</li> <li>- Chip guiding stages</li> <li>- Tool marking (optional)</li> </ul>	<p>A bar chart with four columns: Flexibility, Working area, Working area, and Investment. Flexibility is high (top 2/3), the first Working area is medium (middle 1/3), the second Working area is low (bottom 1/3), and Investment is high (top 2/3). A '-' sign is at the bottom left and a '+' sign is at the bottom right.</p>			
	<ul style="list-style-type: none"> <li>- Complete machining of cutting edges and clearance angles</li> <li>- Chip guiding stages</li> <li>- Tool marking</li> </ul>	<p>A bar chart with four columns: Flexibility, Working area, Working area, and Investment. Flexibility is high (top 2/3), the first Working area is high (top 2/3), the second Working area is low (bottom 1/3), and Investment is high (top 2/3). A '-' sign is at the bottom left and a '+' sign is at the bottom right.</p>			

# THE PATH TO A TOOL

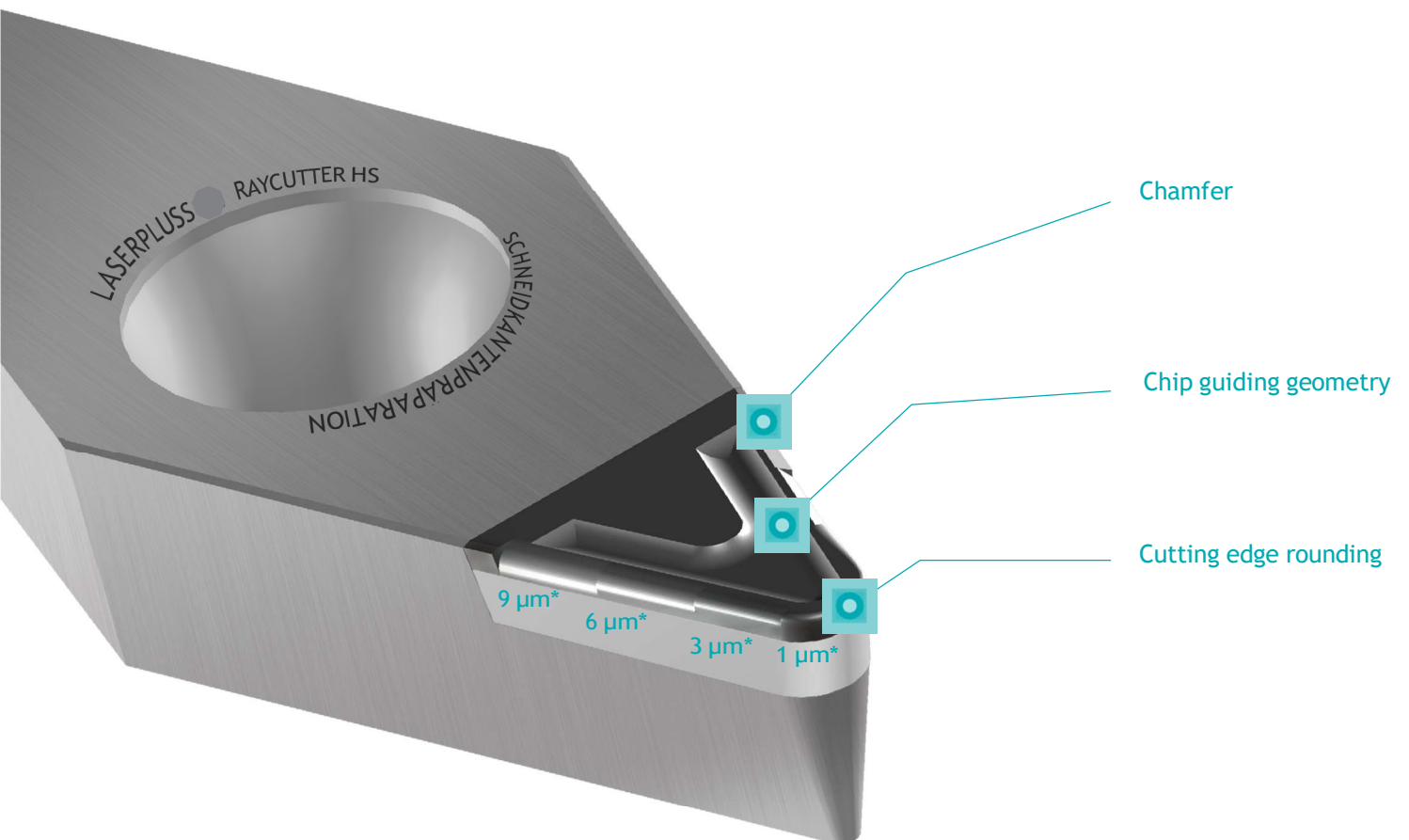
For the production of precision tools with cutting edges made of PCD, CBN and CVD-D, there is no way around laser processing for reaching best results.

## WITH THE PERFECT CUTTING EDGE PREPARATION TO OPTIMAL RESULTS

When productivity, product quality and process reliability should be increased while boosting cost-effectiveness, the solution leads through specific cutting edge preparation. With use of laser technology, cutting edges can be produced without microdefects and thus tools with longer service life.

Meanwhile, it has been shown, that a defined reduction of the notchedness leads to a stabilization of the cutting edge and improvement of the surface structure.

The fastest, safest and most economical realization takes place via laser processing. With this technology, the various required work steps such as cutting and 3D ablation can in almost any form with the highest precision down to  $<2 \mu\text{m}$  and highly reproducible be implemented. Depending on the circumstances life of a tool can be increased of up to 30 percent compared to standard tools.



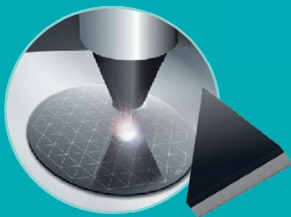
*\* Presentation of the principal possibilities summarized in one illustration*



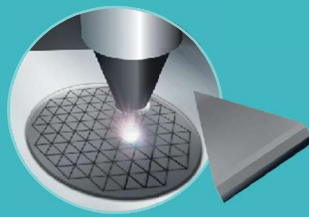
LaserPlu<sup>SSS</sup> offers various machine options that can be selected according to the tool, production volume and working environment:

Operation

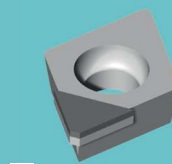
### 1. Cut off/separate circular blanks



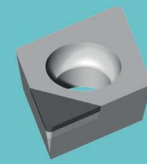
### 2. Chamfer inserts



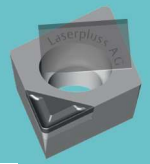
### 3. Pre-cutting, finish machining, clearance angles, chip guiding geometries and marking



**a** Pre-cutting incl. clearance angles



**b** Edge rounding, chamfer



**c** Chip guiding stages, marking

Machine variant 1



#### PreCutter

- Fast pre-cutting inclusive all-round clearance angles
- Cutting depths up to 5 mm



#### RayDesk XL

- Precision machining, optional with roundtable for multiple machining
- Easy to integrate into existing production lines



#### RayCutter S und HS

- Finish machining of cutting edges and clearance angles, edge rounding, chip guiding geometries and marking
- Chip-free cutting edge up to 2  $\mu\text{m}$
- With palletizing system, optional rotary axes, tool adapters HSK 63 und SK 50
- HS - System of choice for complete machining in one clamping incl. pre-cutting and marking

Machine variant 2



#### CutMaster

- Cutting is performed by repeated removal of layers of material
- Cutting depths up to 2 mm



#### CutMaster

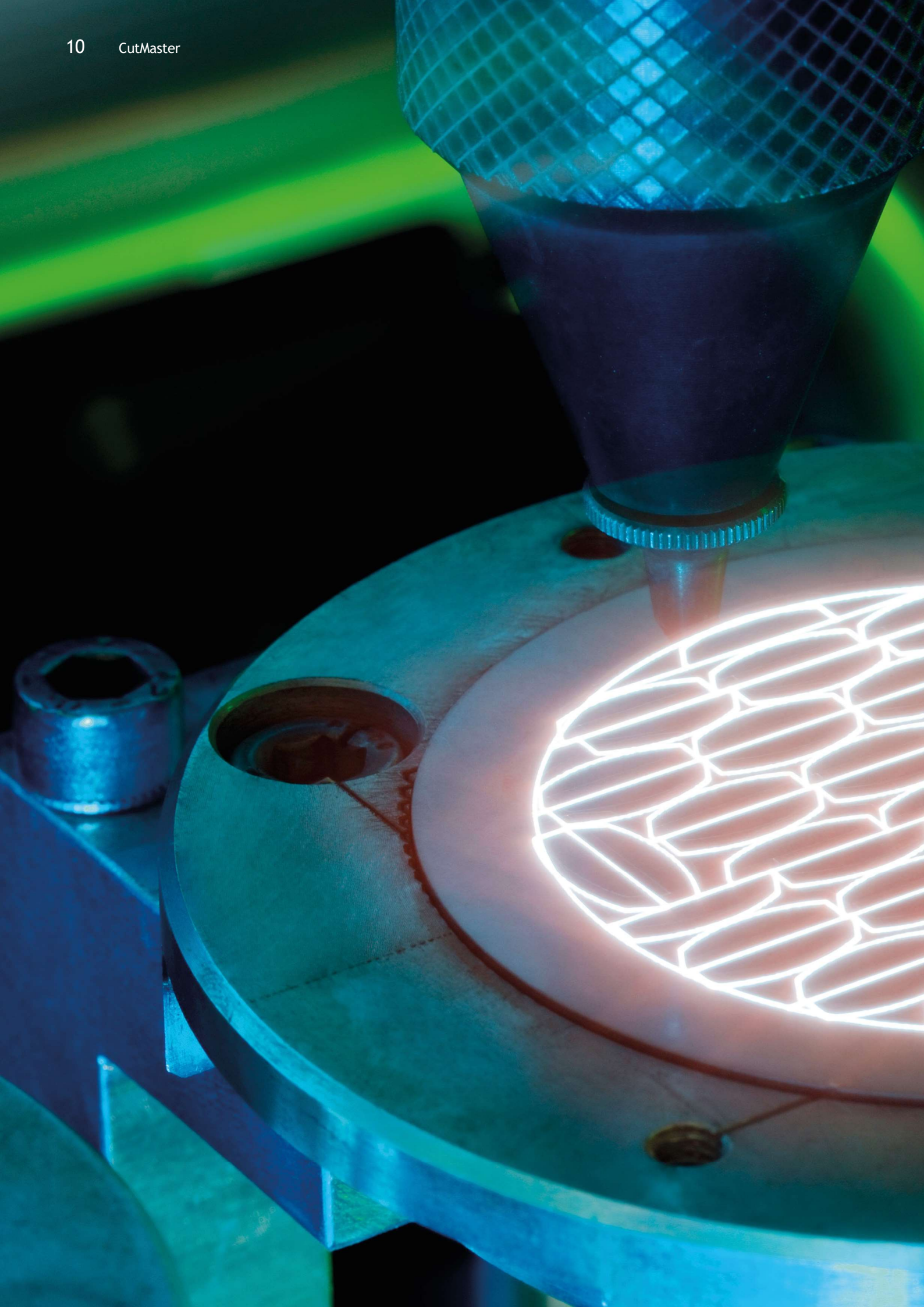
- Chamfering in an operations with the separation of the blanks

**c**



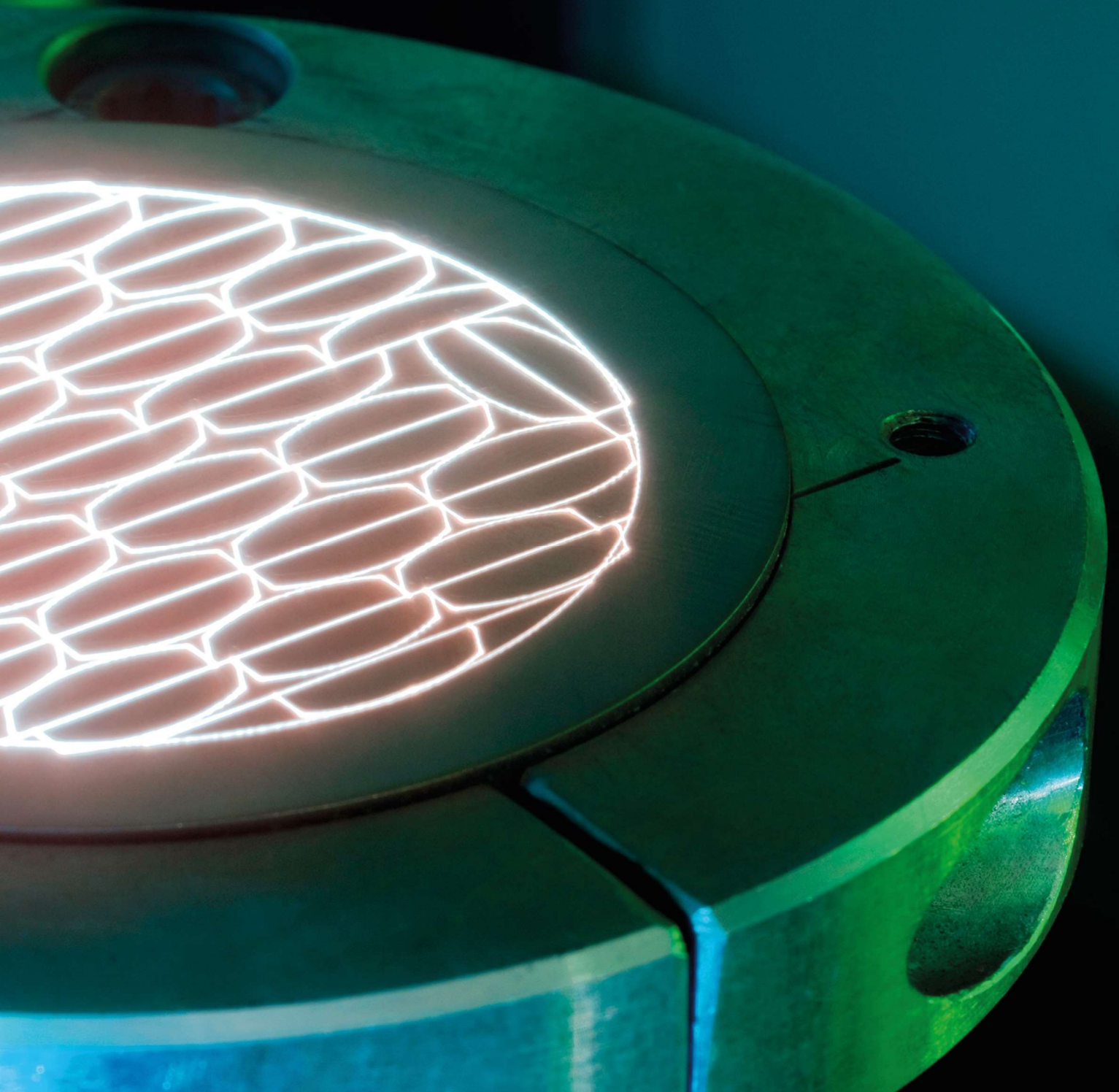
#### CutMaster

- Chip guiding stages and marking in one operation
- Optional with rotary axes and carriers for circular blanks
- System of choice for combined machining



# CutMaster

Cutting off circular blanks, pre-cutting,  
precision cutting, chip guiding geometries,  
marking



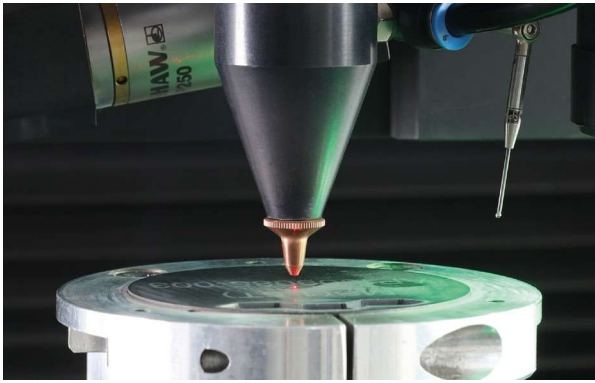
## CutMaster

The CutMaster is the optimal machine if different laser machining processes use only one system. With the CutMaster it is not only possible to mark parts to the highest precision, but also to cut circular blanks, produce chip guiding stages and cut various materials. As such, pre-cutting technology using a short-pulse laser is integrated into the machine among other features. The system can be used both flexibly and also cost-effectively.

The pre-cutting technology permits the efficient, economical entry into the market of machining hard and ultra-hard materials. The cutting of PCD, PcBN and CVD circular blanks is performed by repeated removal of material. This precise 3D machining protects the material and makes it possible to cut depths of up to 3 mm, as well as a cutting gap with a defined angle and chip guiding geometries.

The system is intuitive and easy to program, so that the training period for specialist personnel is short and efficient. Alternatively, the CutMaster can produce highly precise markings, engravings and chip guiding stages using a three-axis system.





## FIELDS OF APPLICATION

- Cutting off circular blanks
- Chip guiding stages
- Precision cutting
- Pre-cutting
- Marking



## MATERIALS THAT CAN BE MACHINED

- PCD
- PcBN
- CVD
- Metals
- Ceramics



## OPTIONS

- Rotary axis
- Carriers for circular blanks

## FEATURES AND ADVANTAGES

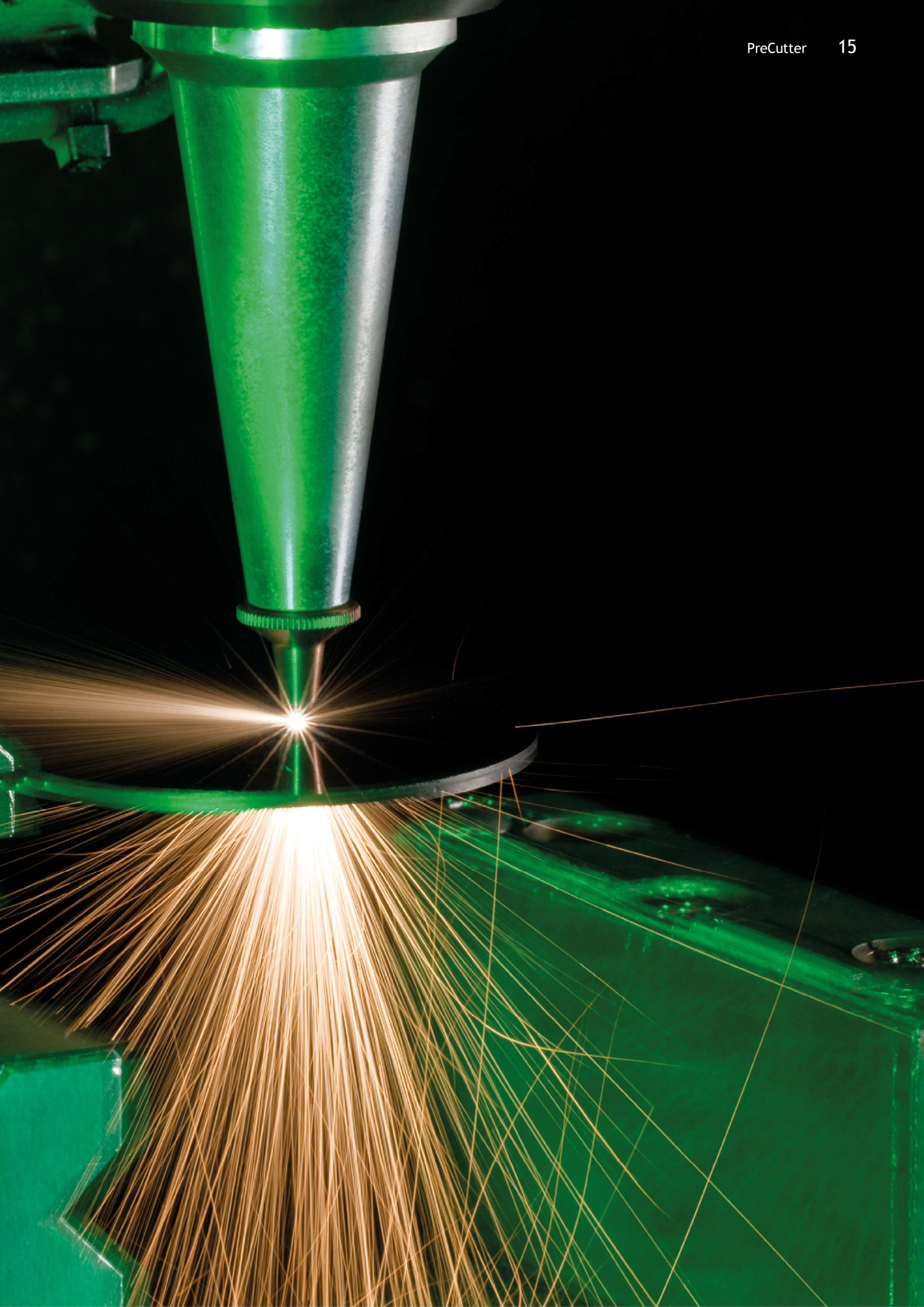
- Cutting, 3D material removal and marking on one machine
- Small cutting gap and low material loss
- Precision cutting of metals up to 2 mm thick with the best cutting quality
- Trimming hard materials and carbides
- Measuring camera RayVision for measuring the position of parts and position correction for machining
- 3D material removal by reading in STL files
- Zero point clamping system for quick changes



# PreCutter

Cutting off circular blanks,  
pre-cutting, precision cutting





## PreCutter

The PreCutter is a system for cutting of circular blanks and the precise pre-machining of diamond tools. The PreCutter is excellently suited to serial production and, optionally, can be expanded with higher power laser sources and additional axes. The modular systems can be specifically adapted to customer requirements.

The PreCutter is based on the design of a RayCutter and is equipped with an identical clamping system. As such the PreCutter can be integrated into production as a central machine in the pre-cutting process.

Even clearance angles on the contour can be pre-cut precisely using the five-axis machine. In this way time and costs are saved during the subsequent machining.





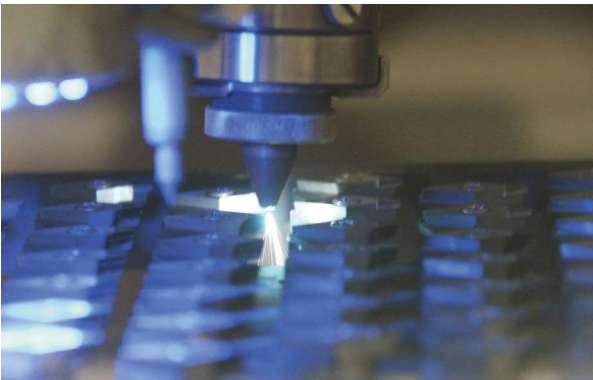


## FIELDS OF APPLICATION

- Fast pre-cutting of tools
- Usage in series production
- Precision cutting

## MATERIALS THAT CAN BE MACHINED

- PCD/CVD
- PcBN
- Carbides or steel
- Metals
- Ceramics



## OPTIONS

- Clamping pallets for circular blanks
- Connection to other LaserPluSSS systems for automation
- Networking to form process solutions



## FEATURES AND ADVANTAGES

- Small cutting gap and low material loss
- Short setup times due to quick-change pallet system
- High cutting speed of up to 150 mm/min
- All-round clearance angle
- Measurement using 3D probe for highest precision
- Due to automation can be expanded for even greater machine availability
- LaserPluSSS RayMake software



# RayCutter S

Finish machining, chip guiding stages,  
edge rounding





## RayCutter S

The laser technology specially developed for machining of diamond tools, highly dynamic part positioning and the intuitive user software form the basis for the RayCutter series. As a result of the new C axis, it is possible to machine up to 20 percent faster. Perfect cutting edge qualities are achieved on diamond-tipped tools.

Through the zero point clamping system, the machine can be quickly and straightforwardly changed from insert machining to round machining (rotary axis).

The basis of the system is formed by a robust granite base on which all movement axes are mounted with thermal stability and the highest precision. As standard the machine is offered with four axes. Five-axis machining is possible by expanding with a rotary axis.





## FIELDS OF APPLICATION

- Finish machining of cutting edges and clearance angles
- Edge rounding
- Chip guiding geometries

## MATERIALS THAT CAN BE MACHINED

- PCD/CVD, PcBN
- Carbide
- MCD
- Ceramics



## OPTIONS

- Rotary axes up to 240 mm diameter
- Tool adapters HSK 63 and SK 50
- Palletizing systems
- Automation
- Reference box



## FEATURES AND ADVANTAGES

- 3D measuring probe and measuring camera for precise part measurement
- Complete system with extraction
- LaserPluSSS RayMake software
- Low space requirement
- Generous machining compartment for round tools up to diameter 240 mm
- Laser machining independent of the PCD material, parameters can be adjusted individually by the operator
- Sharp cutting edges up to 2  $\mu\text{m}$  without chipping



# RayCutter HS

Complete machining, chip guiding stages,  
edge rounding, marking



RENGAGE™ 3D  
MADE IN USA



## RayCutter HS

The RayCutter HS is the machine of choice for the complete machining of diamond tools. The machining time is reduced enormously because the roughing cut can be integrated into the machine. In this way the finishing volume is reduced.

This performance is achieved by means of specially developed adaptive beam shaping that automatically adapts the profile of the laser beam to the operating mode. The machine concept is similar to the RayCutter S.

The RayCutter HS is significantly more cost-effective than classic grinding or EDM with much better surface quality.







## FIELDS OF APPLICATION

- Pre-cutting and finish machining of cutting edges and clearance angles
- Edge rounding
- Chip guiding geometries
- Marking

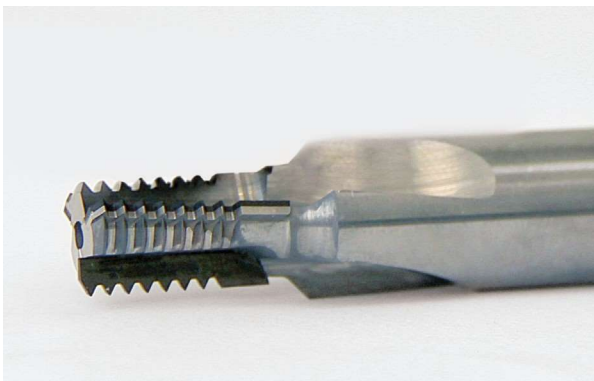
## MATERIALS THAT CAN BE MACHINED

- PCD/CVD, PcBN
- Carbide
- MCD
- Ceramics



## OPTIONS

- Rotary axes up to 240 mm diameter
- Tool adapters HSK 63 and SK 50
- Palletizing systems
- Automation
- Reference box



## FEATURES AND ADVANTAGES

- Pre-cutting and finish machining on one system
- All machining operations in one clamping position
- Ideal for pallet machining
- Low setup times thanks to quick-clamping system
- Cutting edges free of chipping with very small rounding up to 2  $\mu\text{m}$
- Compact installation dimensions of the complete system
- Laser machining independent of the PCD material
- Parameters can be adjusted individually by the operator
- Marking of the tools
- Optional production management using Jobmanager
- Remote monitoring of the manufacturing at an external workplace also for several machines





## RAYMAKE - SOFTWARE

The software specifically for precision laser shaping

The software RayMake is specially designed for precision laser machining. In combination with a system from LaserPluSSS, the software ensures the highly precise production of diamond tools. The entire manufacturing process is run in an intuitive manner.

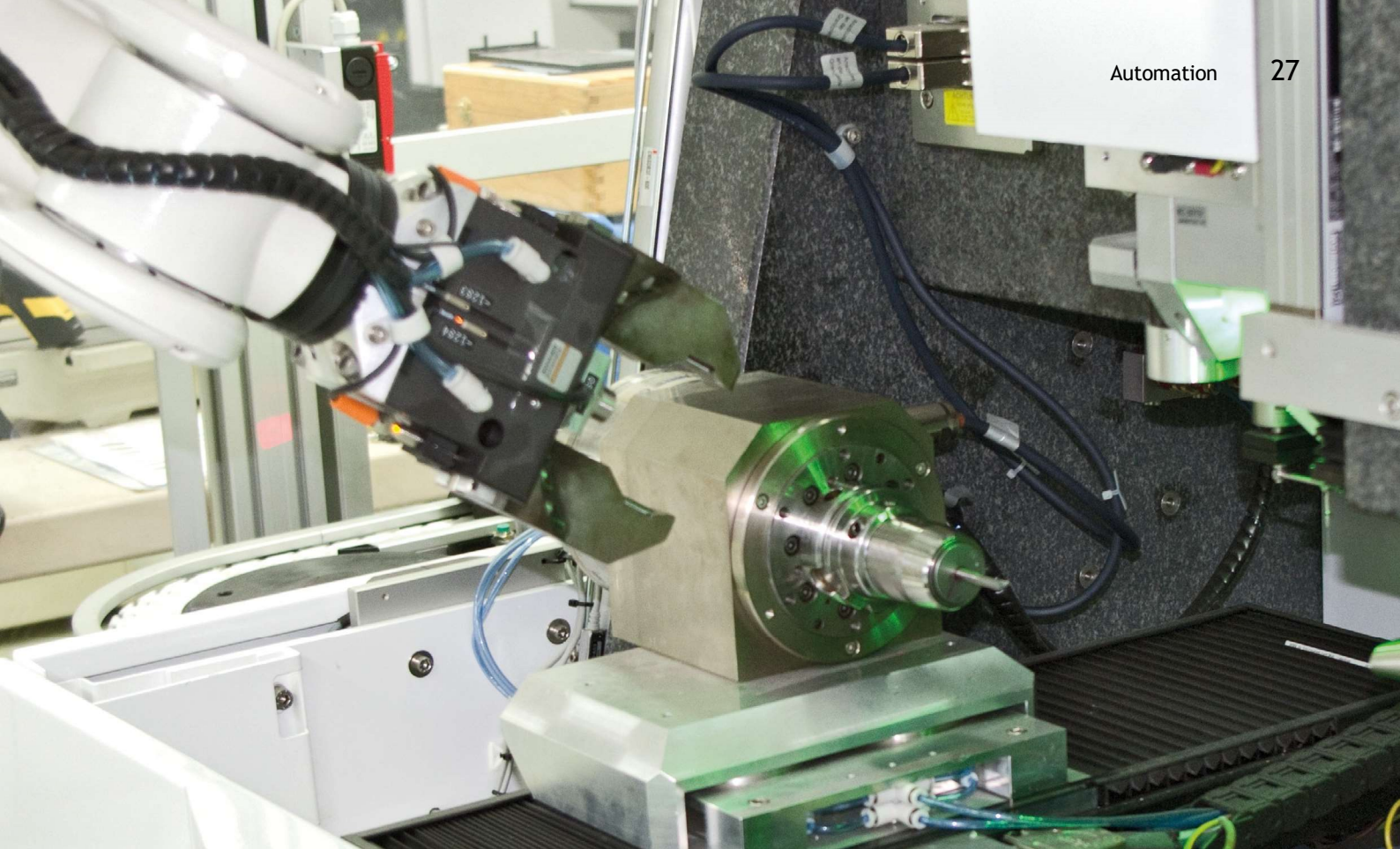
The part is setup directly in the software RayMake. Geometry data are imported, measurements with a tactile sensor or camera specified, and the machining parameters defined. The part can be checked and edited in the 3D view. Any number of laser tasks can be added; these tasks are then worked through in sequence. These tasks can be distributed across several machines if necessary.

RayMake supports the manufacture of individual parts as well as the manufacture of parts that are positioned on tool holders and pallets. The holder editor in the software is used to add tool holders and then to load them with parts in the graphic view. After this the laser system is setup for manufacturing using RayMake. For this purpose the machine axes can be moved and zero points set. During this process an overview of the status of the LaserPluSSS system is ensured. A bar indicating the status is always visible. The detailed view is to be found in the setup window.

In the basic version RayMake supports the machining of cutting edges that have been imported from IGES/DXF files.

RayMake offers numerous possibilities for expansion:

- Specification and manufacturing of turning workpieces, for example drills and milling cutters on a machine equipped with a rotary axis
- Chamfers and roundings that are imported from IGES/DXF files
- Chip guiding stages and ablations that are imported from STL/3DS files
- Templates for cutting out 2D geometries that are imported from IGES/DXF files
- Markings including text, rectangles, circles, lines, 2D/barcodes and vector graphics
- Database-supported job planning and distributed manufacturing on several machines using the „JobManagement Module“
- Connection to automation with robot loading using the „Automation Module“



## AUTOMATION

The Cutter systems can be expanded as necessary by means of automation. In this way the machine availability is increased. Round tools are stored in a belt magazine or cabinet magazine. Each individual tool is coded using a transponder and contains all the information relevant for manufacturing. The tool with adapter is fed to the Cutter using a robot and the clamped in the rotary axis automatically.

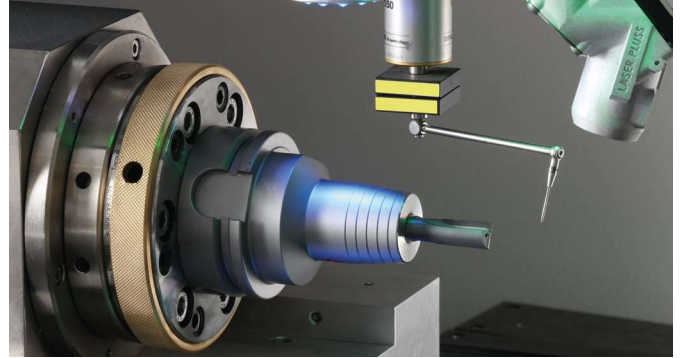
Smooth data exchange between the automation and Cutter is guaranteed by the software module Job Management.

### Features:

- Production possible 24/7 almost unmanned
- High level of machine utilisation
- Rapid payback of the automation costs
- Software-based production planning
- Transparency in the manufacturing process
- Automation can be flexibly expanded

# OPTIONS AND ACCESSORIES

## ROTARY AXES



Manual and automatic clamping of the tool

- Tool length up to 100 mm (diameter up to 240 mm)
- Tool length between 100 mm and 270 mm (diameter up to 150 mm)
- Tool weight up to 10 kg
- Resolution of the axis 0.005' minutes of angle
- Radial run-out of the connection/axis less than 1.5  $\mu\text{m}$
- Tool adapters HSK 63 and SK 50

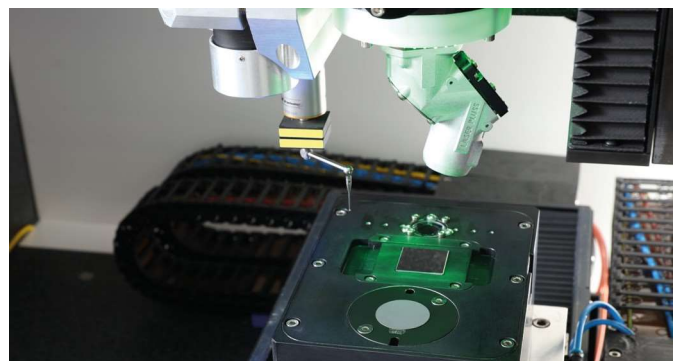
## INTERCHANGEABLE PALLETS



The interchangeable pallets from LaserPluSSS can be adapted highly precisely to the Cutter systems. Each individual pallet can be loaded with up to 200 parts, for example indexable inserts, and fed to the machine quickly and straightforwardly. In this way high machine running times can be achieved without additional automation.

Every standard pallet can be adapted specifically to the geometry of the related parts using adapter plates.

## REFERENCE BOX



The newly developed reference box offers even more transparency and production reliability for the LaserPluSSS systems. With the aid of the reference box, the parameters for the laser source can be checked quickly and straightforwardly, and adjusted if necessary.

# SERVICES

## TECHNICAL CUSTOMER SERVICE

LaserPluSSS offers comprehensive and individually tailored service support - from advice on various adjustments of the system, to maintenance and training. For this purpose, LaserPluSSS service engineers are available at various locations so that it is possible to react in the event of an emergency and to make scheduled visits without delay.

## SERVICE PACKAGES

To ensure the laser systems are always perfectly utilised, LaserPluSSS offers different service packages with fixed prices. Annual flat rates, for instance, make it possible to plan maintenance and operating costs. The services range from extended hours for call-outs in the event of a malfunction, to the full-service agreement that includes coverage of the total costs for the necessary stocking of spare parts as well as the maintenance.

## CUSTOMISATION

The modular design of the systems makes it possible to retool and upgrade all LaserPluSSS systems at a later date. As a result, the software and hardware for every system can be adapted to suit the related requirements at any time.

## TRAINING COURSES

The usage of the laser systems is conveyed practically in the LaserPluSSS training courses. The range of training courses is modular. Courses cover detailed specialised knowledge in various areas of laser machining.

### Basic

- Basic knowledge on operating the system
- Preparation of part and holder specifications
- Basics of setting up the system
- Introduction into production









### Advanced

- For beginners and advanced users
- New functions after updates
- Tips and tricks for daily use
- Separate training units on the topics of operation, workpiece weight, speed programming, maintenance, repair and troubleshooting

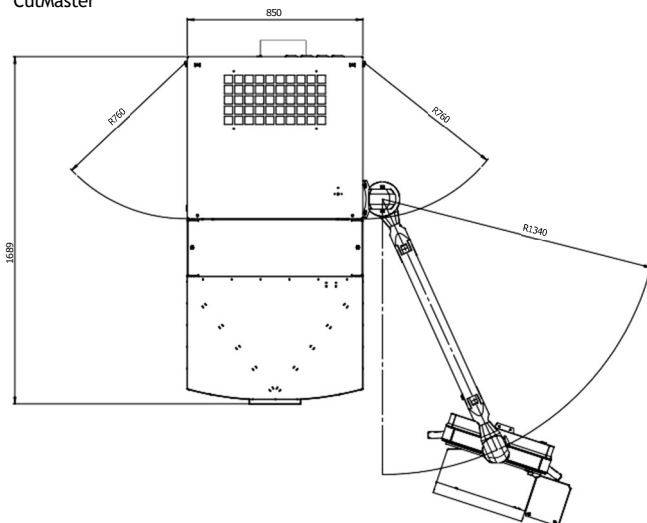
### Complete

- Individual training units specially adapted to customer requirements, including programming, process optimisation and application development
- Analysis of the production structures and need for training

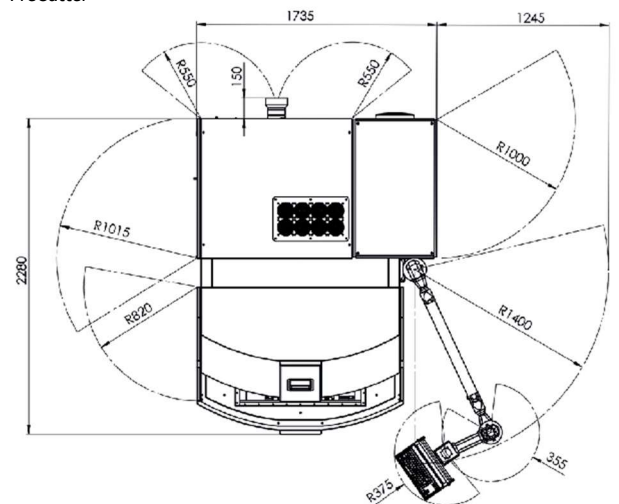
# TECHNICAL DATA

		Machining parameters			
		Machining area	Accuracy	Workpiece weight	Speed
					
	CutMaster	420 x 420 mm	≤ 25 µm	50 kg	6 mm/min (PCD 1.6 mm)
	PreCutter	400 x 185 mm	≤ 10 µm	≤ 25 kg	100 mm/min (PCD 1.6 mm) 300 mm/min (Steel 1 mm) 400 mm/min (CVD 0.5 mm)
	RayCutter® S	300 x 250 mm	≤ 1 µm	≤ 20 kg	≈ 1 mm/min (PCD + carbide 1.6 mm)
	RayCutter® HS	300 x 250 mm	≤ 1 µm	≤ 20 kg	≈ 2.5 mm/min (PCD + carbide 1.6 mm)

CutMaster



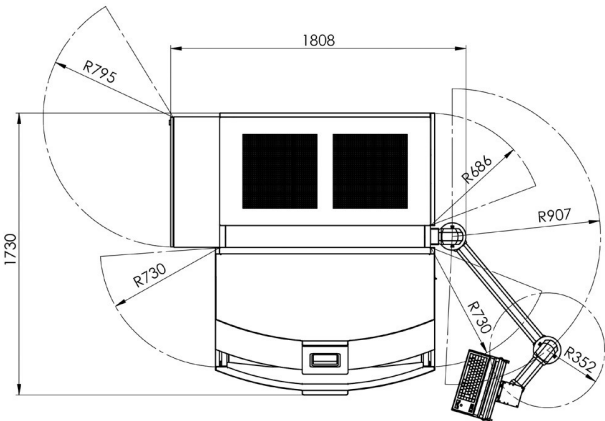
PreCutter



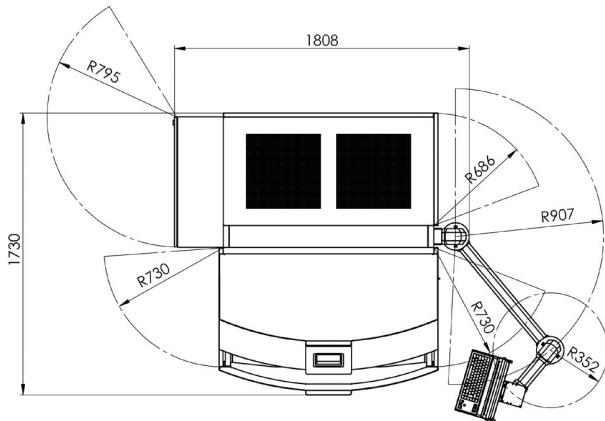
Machine data						
Machine dimensions W x D x H	Cover opening height	Machine weight	Energy consumption*	Connections	Travel distances	
845 x 1671 x 1820 mm	486 mm	700 kg	800 W	230 V / 50 Hz 1N + S 2KVA	X = 300 mm Y = 300 mm Z = 350 mm	
1730 x 2300 x 1900 mm	650 mm	2100 kg	2 kW (Typ 1.5) 4 kW (Typ 6)	400 V / 50 Hz 3 Ph	X = 400 mm Y = 250 mm Z = 100 mm	
1808 x 1730 x 1600 mm	575 mm	1600 kg	1,5 kW	400 V / 50 Hz 3 Ph	X = 400 mm Y = 250 mm Z = 150 mm	
1808 x 1730 x 1600 mm	575 mm	1800 kg	1 kW	400 V / 50 Hz 3 Ph	X = 400 mm Y = 300 mm Z = 150 mm	

\*without extraction

RayCutter® S



RayCutter® HS





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LaserPluSSS UG  
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