

Laser MicroJet<sup>®</sup> Integration Package (LMJ-iP)

 **SYNOVA**

Cool Laser Machining

[www.synova.ch](http://www.synova.ch)







Discover the Laser MicroJet®  
Integration modules

# The Laser MicroJet®

The water jet guided laser is a groundbreaking cutting technology, which combines the low-temperature and large working distance advantages of high-pressure water jet cutting with the precision and speed of conventional dry laser cutting.

As a result, the Laser MicroJet (LMJ) has a remarkably wide range of applications and has established itself

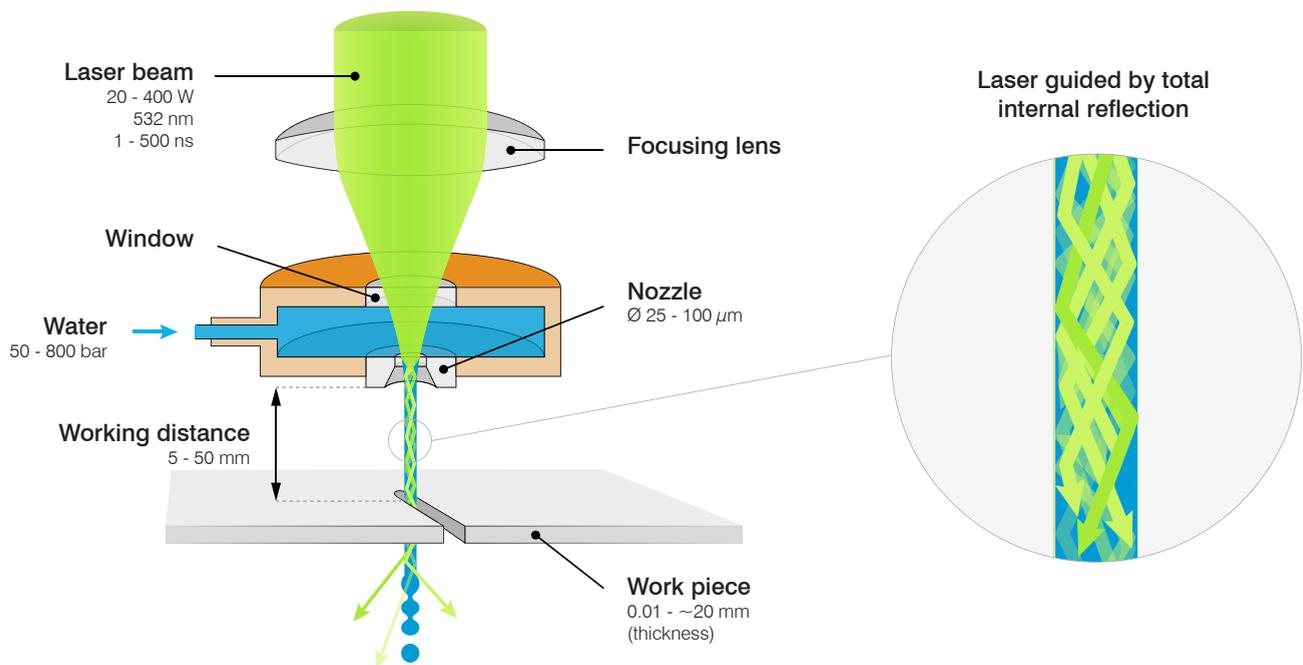
amongst other well-known cutting methods including dry lasers, diamond saws, EDM, stamping, water jet cutting and etching.

The LMJ technology is particularly valuable for narrow and parallel kerf cutting, delicate surface coatings, layered materials and high-precision processing of thin or precious work pieces sensitive to deformation and heat.

## A Simple Principle

The Laser MicroJet is a hybrid method of machining, which combines a laser with a “hair-thin” water jet that precisely guides the laser beam by means of total internal reflection in a manner similar to conventional optical fibers. The water jet continually cools the cutting zone and efficiently removes debris.

As a “cold, clean and controlled laser”, Synova's LMJ technology therefore resolves the significant problems associated with dry lasers such as thermal damage, micro-cracks, taper, deposition and lack of accuracy.



Synova S.A., headquartered in Duillier, Switzerland, manufactures leading-edge laser cutting systems since 1997 that incorporate the proprietary water jet guided laser technology (Laser MicroJet®) in a true industrial CNC platform. Customers benefit from significant yield and quality improvements in cutting, as well as enhanced capabilities for micro-machining a wide range of materials. Synova is a privately owned company with subsidiaries in North America and the Asia/Pacific region.

# The Laser MicroJet® Integration Package (LMJ-iP)

With the Laser MicroJet® Integration Package (LMJ-iP) Synova offers manufacturers a flexible, alternative solution to its complete turnkey systems. The LMJ-iP provides customers the opportunity to purchase the core components of the Laser MicroJet technology, which comprise an optical

head, a laser source and a water pump, affording users the flexibility to integrate the modules directly into their production systems. The purchase of the integration kit includes the LMJ-iP integration license for one machine.

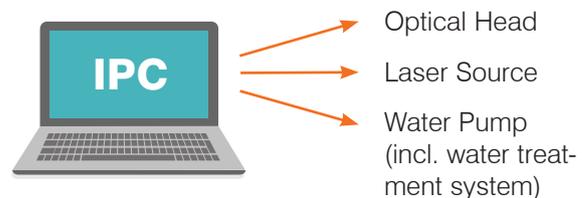
## Benefits

The integration package offers customers access to a proven, proprietary technology with a more individual approach compared to a complete Synova turnkey system. It also provides the flexibility to integrate the LMJ-iP into existing or planned production facilities, including systems from other suppliers and technologies. These advantages, combined with those offered by the LMJ processing alone

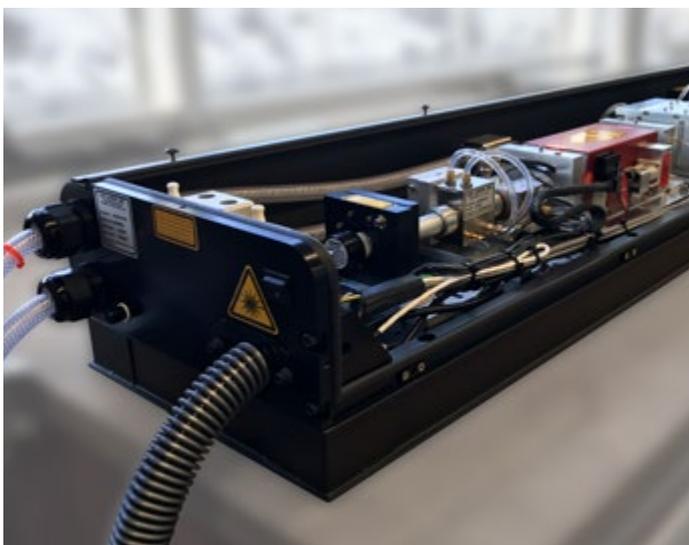
(combination of high precision, quality, speed and flexibility), can translate into lower manufacturing costs per unit – especially for high-volume manufacturing – and increased yield even when the LMJ-iP is used as a standalone module. As a result, LMJ-iP offers customers a low cost-of-ownership solution.

## LMJ-iP Components

Customers can customize their LMJ-iP system by combining different modules. Synova's integration package is a system comprising several hardware components.



### LASER SOURCE



The laser source is hosted separately from the optical head. With several types of lasers available, the LMJ-iP offers customers the flexibility to select the laser source that best meets their requirements for the process. Available laser types for integration include, pulsed diode-pumped solid-state (DPSS) Nd:YAGs operating at 1064, 532 or 355 nm. The system can accommodate either single or double cavity laser units for throughput increase, and can be modified depending on the application. While process dependent, all laser sources are fiber-coupled and remote-controlled.



## WATER PUMP

The water pump systems are located independently from the optical head with two different systems available – a compact system that includes the water components and a single laser source (1) and an external cabinet that is supplied with the double laser source (2). The pumps include an ultra-pure water treatment system which supplies de-ionized and degassed water, so that only standard tap water is needed.



▶ (1) Cabinet including water pump, water treatment system & single laser source

◀ (2) Cabinet with water pump and water treatment system (for double laser source option)



## OPTICAL HEAD

The Laser MicroJet® optical head is the central element that enables the coupling of the laser beam - transmitted over a fibre optic cable from the laser light source - into a series of lenses and mirrors that precisely focus and position the beam through the centre of the nozzle and into the laminar water jet. Available in several modules, this integrated system includes a motorized video-controlled laser beam alignment unit and a water jet coupling unit with available nozzles ranging from 25 to 100  $\mu\text{m}$ .

The nozzle can be illuminated and imaged with an

attached CCD camera, permitting users to adjust the focus and to align the laser spot into the nozzle. Two types of zoom with coaxial light are optionally available, a motorized zoom for short distances and a telecentric zoom for longer distances.

Synova offers two optical head types with camera to meet a broad range of requirements for various applications: a standard optical head and a compact optical head with slimmer coupling unit.



Standard Optical Head



Compact Optical Head with slimmer coupling unit

# LMJ-iP Applications

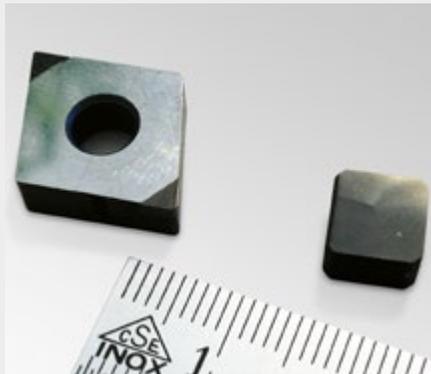
Thanks to its versatile technology and high-quality performance results the Laser MicroJet can be used for a wide range of processes and applications in numerous industries.

The technology's primary target applications include: drilling of cooling holes in turbine blade components; cutting of PCD, MCD and CVD diamond tool inserts for milling and drilling machines; dicing and edge grinding of semiconductor wafers; cutting of rough diamonds, and many others.

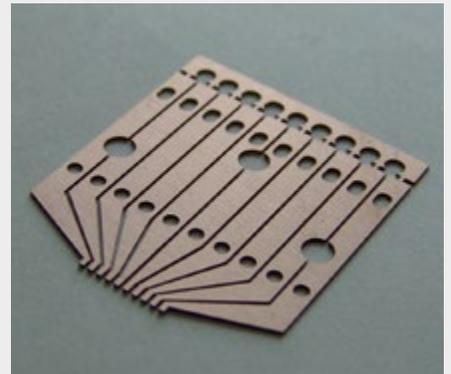
Synova is also moving into leading-edge fields such as medical instrumentation, synthetic diamond coring and slicing as well as CMC cutting.



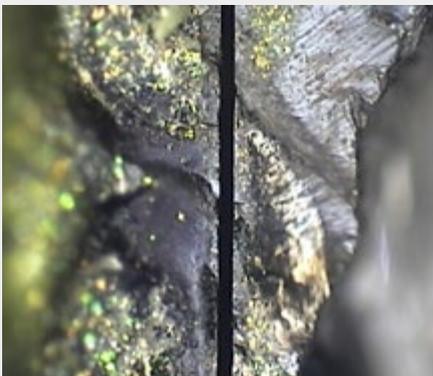
**Energy & Aerospace:** Drilling of turbine blades (superalloys + TBC)



**Tool Manufacturing:** Cutting of tool inserts (PCD/WC)



**Micro-Machining:** Cutting of connector blades (CuBe)



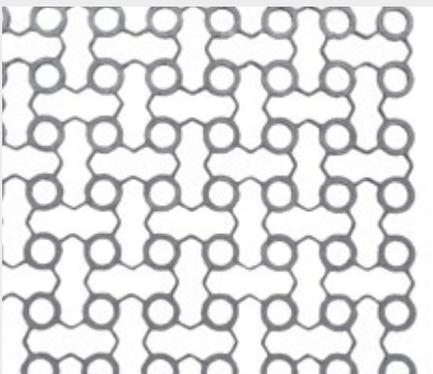
**Diamonds:** Cutting of rough diamonds



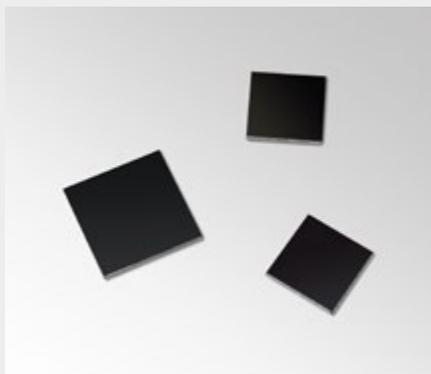
**Automotive:** Drilling of fuel injection nozzles (stainless steel)



**Watchmaking:** Cutting of escape wheels (CuBe)



**Medical:** Cutting of medical implants (titanium)



**Synthetic Diamond:** Coring and slicing of CVD diamonds



**Semiconductors:** Dicing of diode chips (silicon)

## General Specifications

## LMJ-IP

### Laser

Laser type		Diode-pumped solid-state Nd:YAG, pulsed
Wavelength	nm	355, 532, 1064
Average power	W (max.)	50, 100, 200, 400
Beam transmission (optical fiber)	$\mu\text{m}$ (core $\emptyset$ )	100/150/200, length 10 m

### Water Pump

Type		Pneumatic pressure transducer water pump
Water flow through nozzle	l/h	1
Water consumption for water treatment	l/h (average)	10
Water pressure	bar	50-500
Inlet water pressure	bar	approx. 4

### Water Treatment System

Resistivity	M $\Omega$ . cm	> 15
TOC (Total Organic Carbon)	ppb	< 30
Filtration	$\mu\text{m}$	0.2

### Optical Head

Type		Standard / Compact
Image ratio		4:1, 6:1, 8:1 or 10:1
Nozzle diameter	$\mu\text{m}$	25-100

### IPC

Industrial PC with software for laser alignment, displaying vision system image and control of all devices (laser, water pump, water treatment system, zoom)

### Utilities

Electrical power	VAC	2 x 230
2 phases	Hz	50/60
Power consumption	kVA (max.)	2.5
Compressed air, oil free	bar	5-6
Water flow for cooling of laser	l/min	max. 8-32 (depending on the laser power)
Water quality		Tap water

### Options

Vision System: up to 12x zoom (motorized or telecentric) with camera and coaxial LED light  
Chiller

The above specifications are subject to change without notice due to technical changes. The Integration Package incorporates the worldwide patented technology of water jet guided laser, invented at the Swiss Federal Institute of Technology in Lausanne, Switzerland.



CORPORATE HEADQUARTERS

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