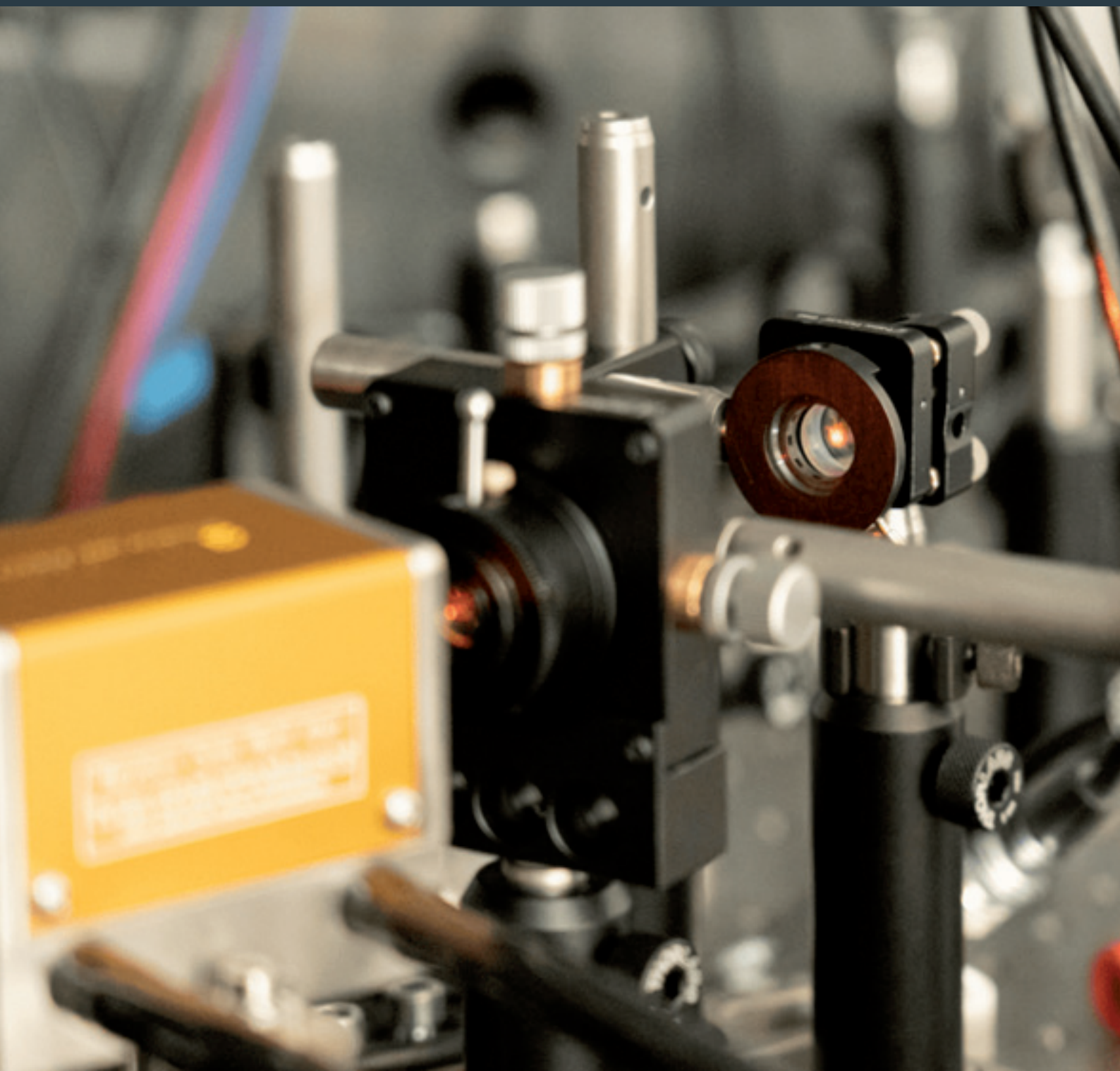
Pantec Biosolutions AG
Innovative Laser Systems

INDUSTRIAL APPLICATIONS



3m.i.k.r.o.n.™

High-power, diode-pumped laser technology

3m.i.k.r.o.n.™ is the technology platform for compact, efficient, fast and reliable lasers for a wide range of potential applications in the field of medical engineering and industry. It enables a new generation of innovative mid-IR lasers based on diode-pumped solid-state technology, operating at wavelengths of (2 - 3) µm using different types of laser crystals (e.g. Er:YAG, Er:YLF, Tm:YAG).

Beam Quality: 3m.i.k.r.o.n.™ offers high beam quality and accordingly high focusability.

Speed: 3m.i.k.r.o.n.™ enables repetition rates up to 1 kHz.

Efficiency and TCO: Because of higher efficiency, electricity consumption and cooling demands are reduced drastically compared to flash lamp-pumped lasers. Higher efficiency and lack of consumables reduce the TCO drastically in comparison to CO2 lasers.

Life time and availability: Compared to flash lamp, laser diodes have a longer life time. Compared to CO2 lasers, no consumables, such as gas, are needed. Both effects involve longer maintenance intervals and thus higher availability.

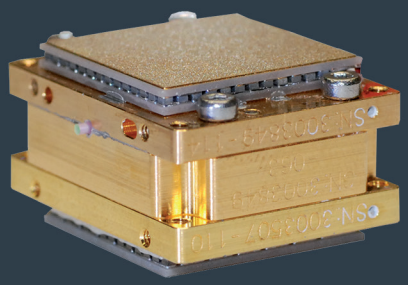
Compactness: 3m.i.k.r.o.n.™ modules are very compact due to their smaller pump sources and cooling systems, leading to laser devices which are more convenient to use.

Flexibility: The wider range of adjustable laser parameters (pulse energy, pulse duration, repetition rate) offers a high level of flexibility for different applications.

Reliability: 3m.i.k.r.o.n.™ modules are maintenance free and allow for robust construction of laser devices.

Process efficiency: The very good absorption of many organic materials at 3 µm wavelength allows for a very efficient cutting process. The 3m.i.k.r.o.n.™ technology combines the benefits of CO2 and solid state lasers.

- Various output powers available



LASER PARAMETERS

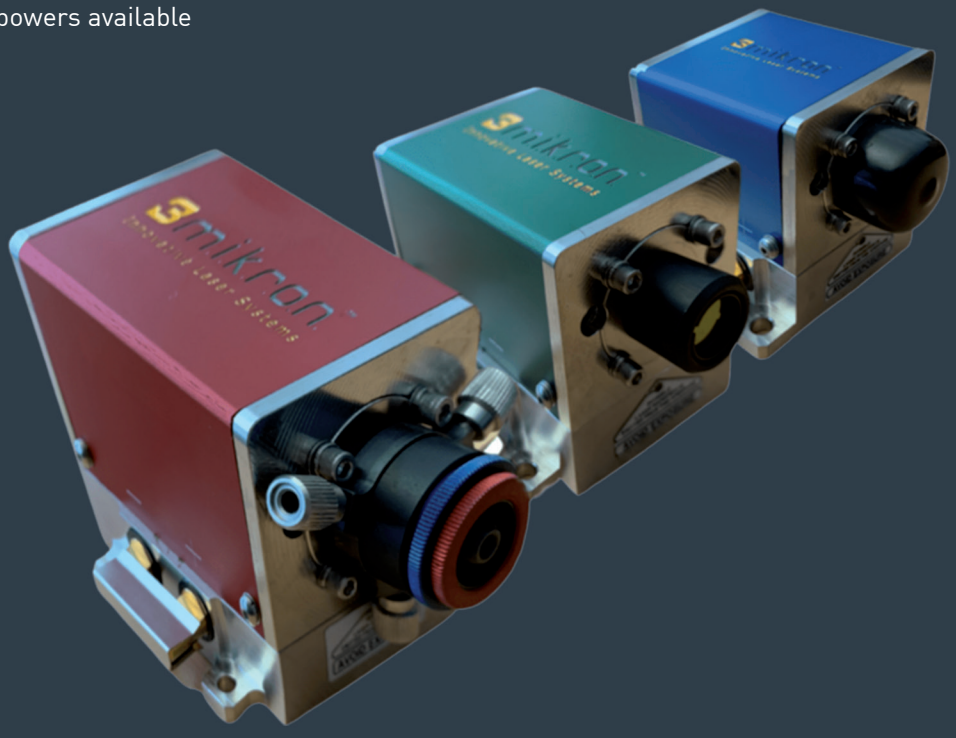
High power Mid-IR laser sources

Technology	Monolithic DPSSL
Wavelength	2940 nm / 2020 nm
Average Output Power (max)	up to 100 W
Pulse Energy (max)	up to 8 J [1]
Pulse Repetition Rate	up to 1 kHz
Pulse Duration	up to 20 ms [1]
Duty Cycle (max)	up to 10 %
Mode of Operation	Pulsed
Ideal Fiber Diameter	(100 - 450) µm
Beam Quality	$M^2 < 50$
Efficiency (optical-optical)	~ 10 %
Divergence (half angle) (mrad)	< 50 mrad
Beam Diameter	1.6 mm
Beam Shape (focus)	top hat like

[1] @ 2020 nm with Pantec Ultrapulse Mode (on request only)

The research experiments on the following pages have been done with 3m.i.k.r.o.n.™ Er:YAG laser sources ranging from 20 to 30 W average output power.

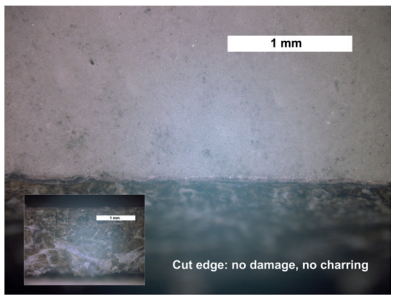
- Er:YAG / Tm:YAG laser source
- Fiber coupled or free beam
- Various output powers available



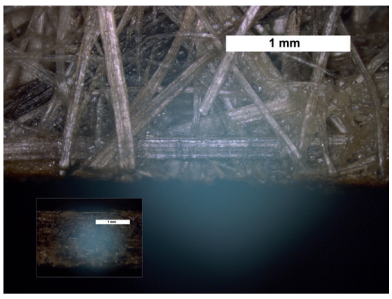
ORGANIC MATTER CUTTING

Cutting, perforating, partly scoring

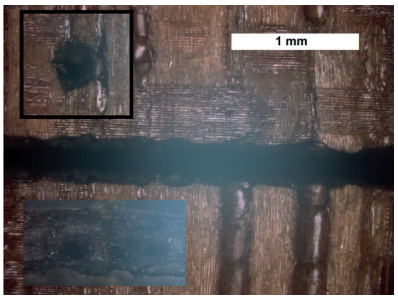
High flexibility: High cutting quality and speed with many different materials possible, such as leather, wood, compounds, etc.



Cutting of Leather 1.3 mm thick
Speed: 1.0 m / min



Cutting of organic compound 1.5 mm thick
Speed: 1.2 m / min (wood/resin)

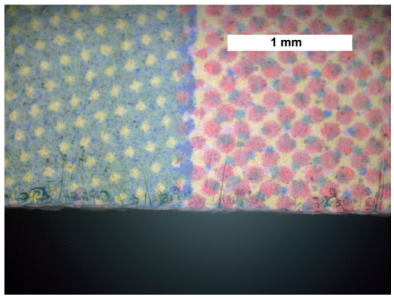


Cutting and perforation of wood 0.6 mm
Speed: 7 m / min and 40 m / min

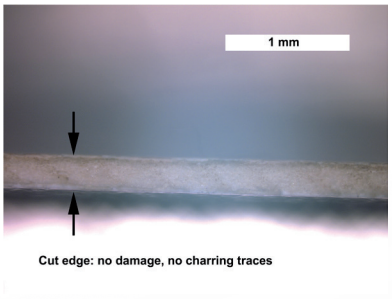
PAPER CUTTING

Cutting, perforating, scoring

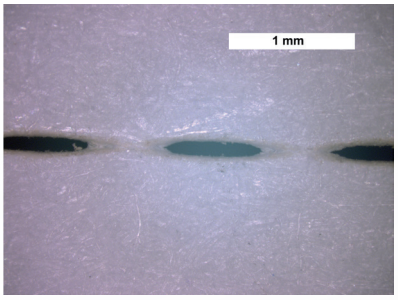
Outstanding cutting quality and speed. No burning and no soot stains.



Cutting of printed paper (80 g / m²)
Speed: 40 m / min



Cutting of plain paper (300 g / m²)
Speed: 10 m / min



Long hole perforation of paper (80 g / m²)
Speed: 75 m / min

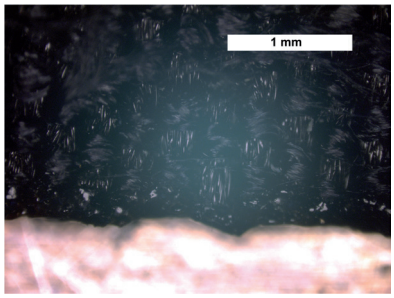
CHRISTOPH DEININGER
Ingenieurbüro für optische Technologien

All experiments were done in cooperation with CHRISTOPH DEININGER, Ingenieurbüro für optische Technologien in Reutlingen, Germany

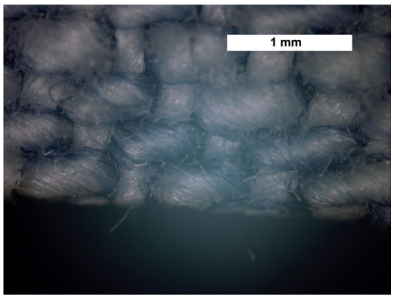
TEXTILE CUTTING

Cutting, perforating

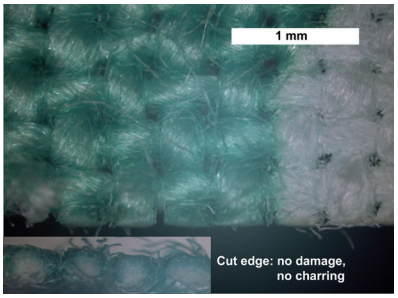
High flexibility: High cutting quality and speed with many different materials possible, such as alcantara, cotton, fleece, etc.



Cutting of Alcantara
Speed: 8 m / min



Cutting of Jeans
Speed: 7 m / min

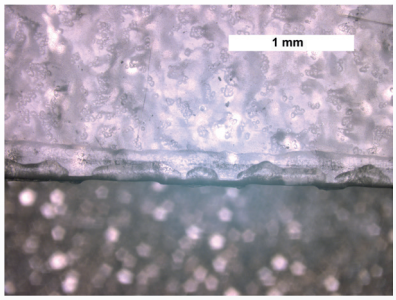


Cutting of Cotton
Speed: 10 m / min

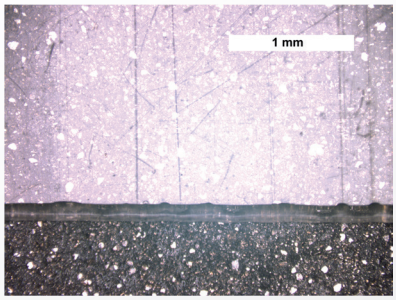
PLASTIC CUTTING

Cutting, perforating, and in special cases even welding

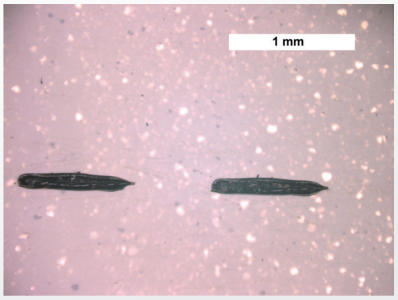
High flexibility: High cutting quality and speed with many different materials possible, such as PP, PE, PEN, PET, antistatics, etc.



Cutting of PP
Speed: 10 m / min



Cutting of PE low density
Speed: 8 m / min

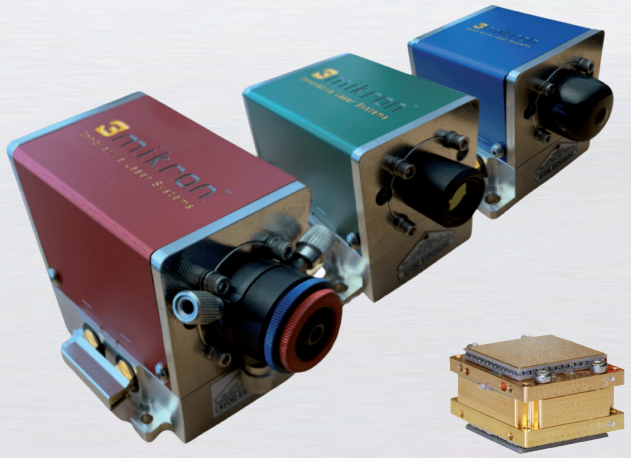


Long hole perforation of PEN
Speed: 20 m / min

High Power
3 µm DPSSL Modules

3 m.i.k.r.o.n™
Innovative Laser Systems

- Compact monolithic laser systems
- Highly efficient diode pumping
- Fiber-coupled versions available
- No high-voltage required
- Reduced waste heat
- Maintenance free
- Process variability



Specifications

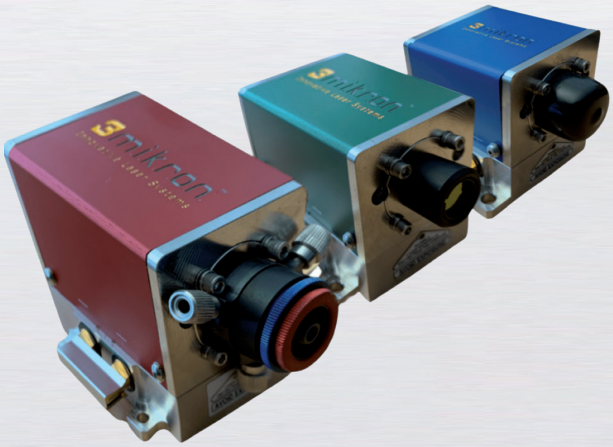
	DPM-2 (Er:YAG) free / fiber [1]	DPM-25 (Er:YAG) free / fiber [1]	DPM-50 (Er:YAG) free / fiber [1]
Optical Parameters			
· Wavelength	2940 nm	2940 nm	2940 nm
· Average Output Power (max)	2 / 1.2 W	25 / 16 W	50 / 33 W
· Pulse Energy (max)	20 [2] / 13 [2] mJ	300 [2] / 200 [2] mJ	600 [2] / 400 [2] mJ
· Pulse Repetition Rate	up to 1 kHz	up to 1 kHz	up to 1 kHz
· Pulse Duration	(40 - 1000 [3]) µs	(40 - 1000 [3]) µs	(40 to 1000 [3]) µs
· Average Current (max)	30 A	25 A	25 A
· Mode of Operation	Pulsed	Pulsed	Pulsed
· Efficiency (optical-optical)	> 10 %	> 10 %	> 10 %
· Beam Shape (focus)	Top Hat like	Top Hat like	Top Hat like
· Free Beam Quality	M^2 < 5	M^2 < 25	M^2 < 50
· Free Beam Diameter	0.6 mm	1.6 mm	1.6 mm
· Free Divergence (half angle)	< 25 mrad	< 25 mrad	< 50 mrad
· Fiber Diameter GeO_2 [1]	~ 250 µm (NA ‹ 0.2)	~ 250 µm (NA ‹ 0.2)	~ 450 µm (NA ‹ 0.2)
Cooling Requirements			
· Coolant	Air-cooled or cooled with distilled Water with Algaecide and Corrosion Inhibitor	Distilled Water with Algaecide and Corrosion Inhibitor	Distilled Water with Algaecide and Corrosion Inhibitor
· Coolant Temperature	(20 - 35) °C	(20 - 25) °C	(20 - 25) °C
· Coolant Flow Rate	≥ 1 lpm	> 5 lpm	≥ 6 lpm
· Coolant Pressure	(1 - 3) bar	(2 - 5) bar	(3 - 5) bar
· Required Cooling Power	~ 150 W @ 25 °C Environment Temperature	≥ 540 W @ 25 °C Environment Temperature	≥ 780 W @ 25 °C Environment Temperature
Electrical Parameters			
· Diode Forward Voltage	2 V	~ 20 V	~ 30 V
· Diode Forward Current (max)	350 A Pulsed	300 A Pulsed	300 A Pulsed
· Average Power Consumption	< 120 W incl. 2 TECs	< 450 W	< 900 W
Mechanical Dimensions			
· Dimension (L x W x H)	(29 x 38 x 22) mm^3 [4]	(59 x 78 x 59) mm^3 [4]	(90 x 78 x 59) mm^3 [4]
· Weight	80 g	1 kg	1 kg
· Emission Height	-	38.1 mm	38.1 mm

[1] Fiber as specified by Pantec
[2] For pulse durations > 600 µs
[3] 600 µs standard, 1000 µs on request
[4] Dimensions for bare modules

High Power
2 µm DPSSL Modules

2m.i.k.r.o.n™
Innovative Laser Systems

- Compact monolithic laser systems
- Highly efficient diode pumping
- Fiber-coupled versions available
- No high-voltage required
- Reduced waste heat
- Maintenance free
- Process variability



Specifications

	DPM-25 (Tm:YAG) free / fiber [1]	DPM-50 (Tm:YAG) free / fiber [1]	DPM-100 (Tm:YAG) free / fiber [1]
Optical Parameters			
· Wavelength	2020 nm	2020 nm	2020 nm
· Average Output Power (max)	25 / 20 W	50 / 40 W	100 / 80 W
· Pulse Energy (max)	(0.2 - 1.6 [2]) / (0.16 - 1,28 [2]) J	(0.5 - 4 [2]) / (0.4 - 3.2 [2]) J	(1 - 8 [2]) / (0.8 - 6.4 [2]) J
· Pulse Repetition Rate (max)	500 Hz	500 Hz	500 Hz
· Pulse Duration	(100 - 500) (20 000 [2]) µs	(100 - 500) (20 000 [2]) µs	(100 - 500) (20 000 [2]) µs
· Average Current (max)	7.5 A	7.5 A	7.5 A
· Mode of Operation	Pulsed	Pulsed	Pulsed
· Efficiency (optical-optical)	> 15 %	> 20 %	> 20 %
· Beam Shape (focus)	Top Hat like	Top Hat like	Top Hat like
· Free Beam Quality	M^2 < 20	M^2 < 30	M^2 < 40
· Free Beam Diameter	1.6 mm	1.6 mm	1.6 mm
· Free Divergence (half angle)	< 20 mrad	< 30 mrad	< 40 mrad
· Fiber Diameter	~ 250 µm (NA ‹ 0.2)	~ 250 µm (NA ‹ 0.2)	~ 450 µm (NA ‹ 0.2)
Cooling Requirements			
· Coolant	Distilled Water with Algaecide and Corrosion Inhibitor	Distilled Water with Algaecide and Corrosion Inhibitor	Distilled Water with Algaecide and Corrosion Inhibitor
· Coolant Temperature	25 °C	25 °C	25 °C
· Coolant Flow Rate	≥ 4 lpm	≥ 5 lpm	≥ 6 lpm
· Coolant Pressure	(2 - 5) bar	(3 - 5) bar	(3 - 5) bar
· Required Cooling Power	≥ 350 W @ 25 °C Environment Temperature	≥ 500 W @ 25 °C Environment Temperature	≥ 750 W @ 25 °C Environment Temperature
Electrical Parameters			
· Diode Forward Voltage	< 40 V	< 75 V	< 130 V
· Diode Forward Current (max)	150 A Pulsed	150 A Pulsed	150 A Pulsed
· Average Power Consumption	< 500 W	< 750 W	< 1000 W
Mechanical Dimensions			
· Dimension (L x W x H)	(59 x 78 x 59) mm^3 [3]	(90 x 78 x 59) mm^3 [3]	(90 x 78 x 59) mm^3 [3]
· Weight	1 kg	1 kg	1 kg
· Emission Height	38.1 mm	38.1 mm	38.1 mm

[1] Fiber as specified by Pantec
[2] With Pantec Ultrapulse Mode (on request only)
[3] Dimensions for bare modules

Pantec Biosolutions AG
Industriering 21 · 9491 Ruggell · Liechtenstein
Tel: +423 377 13 33 · Fax: +423 377 13 34
info@pantec-biosolutions.com www.pantec-biosolutions.com

301664A-03-DTS IndustrialApplication