

# Minimally Invasive Surgery

3mikron™ - High-power, diode pumped laser technology (2 - 3 μm)

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

Compared to mechanical tools, traditional laser technologies (e.g. flash lamp pumped Er:YAG laser, CO<sub>2</sub> lasers) and RF technology 3mikron™ offers several benefits regarding treatment of soft and hard tissue:

## APPLICATION BENEFITS

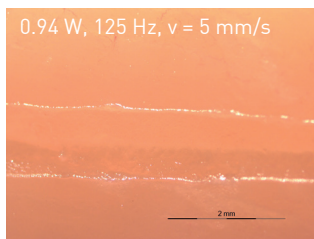
- . Precise treatments (cutting width < 100 μm)
- . Controllable thermal impact by laser parameters
- . Cold ablation (cut like a scalpel)
- . Hot ablation (coagulation) by stacked pulses
- . Limited lateral thermal damage
- . No unwanted vibrations to the patient
- . Short operation time
- . Fast healing
- . Combines benefits of flash lamp pumped Er:YAG and CO<sub>2</sub> lasers
- . Optimized for soft and hard tissue treatment

This work was done in cooperation with the Institut für Lasertechnologien in der Medizin und Meßtechnik at the University of Ulm, Germany

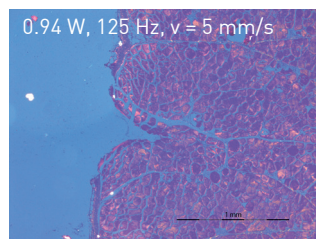
## Soft Tissue

### DPM-15 Laser Module

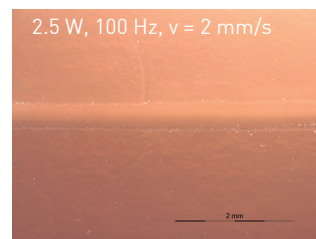
#### Cold Ablation



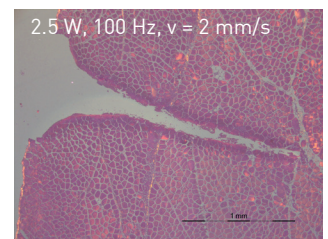
Chicken breast, Treatment without waterspray



Histology, Chicken breast, Treatment without waterspray

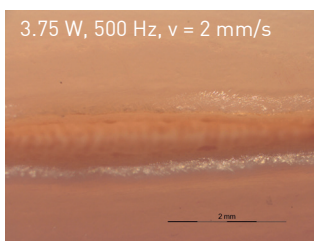


Chicken breast, Treatment without waterspray

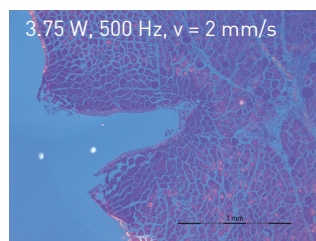


Histology, Chicken breast, Treatment without waterspray

#### Coagulation



Chicken breast, Treatment without waterspray



Histology, Chicken breast, Treatment without waterspray

## RESULTS

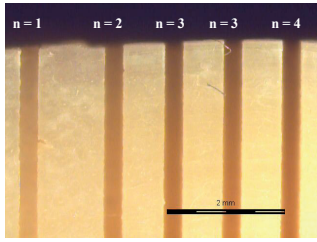
- . Constant speed and power, but higher repetition rate at lower pulse energy leads to lower depth of cut and more thermal impact
- . Cuts with very high quality
- . Thermal impact (cold / hot ablation) and depth of cuts (10 μm to 6 mm) is controllable by laser parameters and cutting speed

## Hard Tissue

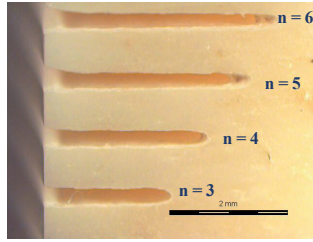
Efficient bone cutting: Results for Ø 330µm, increasing number of cycles (n)

### DPM-30 High Brightness Laser Module

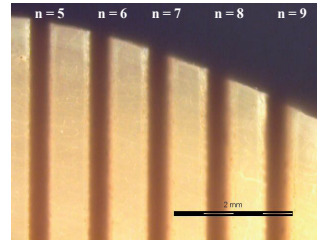
14.5 W, 72.5 mJ, 200 Hz, v=10mm/s



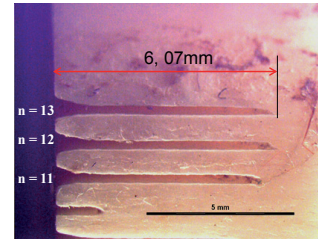
Bone, Treatment with waterspray



Bone, Treatment with waterspray



Bone, Treatment with waterspray



Bone, Treatment with waterspray

## RESULTS

- . Good ablation quality (smooth groove walls, sharp edges, no carbonization)
- . High cutting depth: > 6mm
- . High ablation / drilling speed: e.g. 34.4 mm/s
- . High ablation efficiency: e.g. 0.141 mm<sup>3</sup>/J

Optical parameters	DPM-15 (HE)	DPM-30 (HE)
Technology	Monolithic DPSSL	
Wavelength	2940 nm	
Average Output Power (max)	15 W	25 W
Pulse Energy (max)	75 mJ (HE: 150 mJ)	150 mJ (HE: 300 mJ)
Pulse Repetition Rate	up to 2 kHz	
Pulse Duration	1 to 250 µs (HE: 1 to 400 µs)	1 to 300 µs (HE: 1 to 400 µs)
Duty Cycle (max)	10 %	
Mode of Operation	Pulsed	
Ideal Fiber Diameter	≤ 200 µm	
Beam Quality	M <sup>2</sup> < 15	M <sup>2</sup> < 15
Efficiency (optical-optical)	~ 10 %	
Divergence (half angle) (mrad)	< 20 mrad	< 16 mrad
Beam Diameter	1.6 mm	
Beam Shape (focus)	top hat like	



  
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 medical laser



Pantec Medical Laser strives for innovative solutions in the field of minimal-invasive laser based medical engineering. As exclusive supplier of unique laser technologies - 3mikron™ and fam™ - Pantec Medical Laser provides customized solutions from laser unit to complete application devices. Pantec Medical Laser is a business unit of Pantec Engineering AG.

Pantec Engineering AG provides solutions in automation and mechatronics for the mechanical engineering and medical device industries worldwide. Through its rigorous focus on niche strategies and high degree of service orientation, the company has become a world leader in its five primary markets.

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