

Pantec Biosolutions AG
Innovative Laser Systems



MEDICAL 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).

Compared to mechanical tools, traditional laser technologies (e.g. flash lamp-pumped Er:YAG or CTH laser) or RF technology (e.g. CO2 laser), 3m.i.k.r.o.n.™ offers several benefits within the particular field of application.

BENEFITS

- Combines benefits of traditional Er:YAG and CO2 lasers
- Reduced down-time period, faster healing
- Less invasive
- Easier to use
- Less heating of surrounding tissue
- Precise treatments (cutting width < 100 μm)
- Controllable thermal impact by laser parameters
- Cold ablation (cut like a scalpel)
- Hot ablation (coagulation) by stacked pulses
- Selective ablation
- Maintains healthy tooth structure
- Minor lateral thermal damage
- No unwanted vibrations to the patient
- Short operation time
- Optimized for soft and hard tissue treatment

- 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) μ m
Beam Quality	$M^2 < 50$
Efficiency (optical-optical)	$\sim 10 \%$
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



DERMATOLOGY

3m.i.k.r.o.n.™ impresses with its high degree of flexibility. It enables cold ablation with high energy pulses or high thermal impact by heat stacking with a series of low energy pulses. A few high energy pulses can open the skin and drill into the target skin layer, dermis. Then a series of low energy pulses can heat the dermis for strong rejuvenation effect, which is comparable to the effect of a CO2 laser.

Furthermore, the repetition rate can be adjusted up to 1 kHz, allowing usage of a beam deflection unit for sequential micropore generation, instead of using multi-lense arrays. This results in a homogeneous pore distribution, variable pore densities and very high energy respectively thermal impact per pore (25 times higher energy compared to traditional Er:YAG lasers with multi-lense arrays).

Track record: Er:YAG fractional ablative laser

P.L.E.A.S.E.® Research



The P.L.E.A.S.E.® Research is a portable fractional ablative laser system developed by Pantec Biosolutions. It combines the painless generation of micropores with a high thermal impact activating the production of collagen in the dermis with the generation of minimal pain.

The method is best described by the fact that only a fraction or a percentage of the skin is treated. The laser generates micropores surrounded by untreated intact tissue. Since there is only few necrotic tissue that has to be removed before wound repair, a very fast wound healing response takes place. Additionally, precisely controlled thermal effects produce a selective dermal damage within the respective target tissue layer which effectively stimulates fibroblasts to produce new collagen and elastin.



Micropores generated with 100 ppp (in vivo). Minimal coagulation, without bleeding.



Micropores generated on thermal paper. The grid results from a disposable, keeping the skin in focus over the whole treatment area.

Now, the new P.L.E.A.S.E.® Research represents remarkable technology innovations ensuring superior clinical results but greatly minimizing associated downtime as a result of advanced pulse shaping technology, controlled heat stacking, superior pore quality, and precise pore distribution.

Note: The P.L.E.A.S.E.® Research is a non-medical device. Only to be used for non-medical and research applications.

OPHTHALMOLOGY

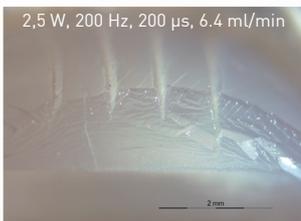
Starting in the year 2000, many experiments were performed regarding the usage of flashlamp-pumped Er:YAG-lasers for ophthalmologic applications by different institutes and companies. The results clearly show, that contrary to ultrasound systems, flashlamp-pumped Er:YAG lasers can be used for cataract extraction (including precise capsulorhexis) as well as for vitrectomy.

Our new generation diode-pumped Er:YAG lasers based on the 3m.i.k.r.o.n.TM technology extend the advantages of the flashlamp pumped Er:YAG laser, while at the same time removing flashlamp laser's disadvantages because of its high efficiency, compactness and high repetition rates. In the last few years, several companies presented femtosecond laser systems, which are comparable to 3m.i.k.r.o.n.TM lasers as regards the clinical advantages for cataract extraction. However compared to 3m.i.k.r.o.n.TM femtosecond technology isn't recommendable for hard lenses and its costs are about 10 times higher.

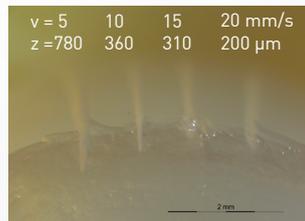
Comparison of different technologies for ophthalmologic applications				
	3m.i.k.r.o.n. TM Phaco	Ultrasound Phaco	Flashlamp Phaco	Femtosecond Laser
Invasiveness	very good	medium	good	very good
Usability	very good	medium	good	medium
Hard lenses	very good	medium	very good	low
Heat	x/10	x	x/10	negligible
Speed	very good	very good	low	very good
Size	(460 x 380 x 250) mm ³	(380 x 350 x 150) mm ³	(360 x 650 x 970) mm ³	> flashlamp phaco ²
Weight	12 kg ¹	15 kg ²	85 kg ²	> flashlamp phaco ²
Repetition rate	up to 2 kHz	n.a.	up to 30 Hz ²	up to 30 kHz ²
Cost	x	x	x	10x

¹ P.L.E.A.S.E.® Research device (intraepidermal drug delivery, dermatology & aesthetics);
² Typical device.

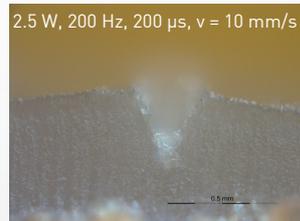
All specifications and ratings are assumptions based on literature.



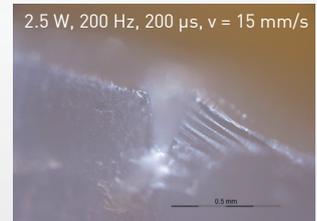
Humid pork lenses, > 365 days in formalin



Humid pork lenses, > 365 days in formalin



Humid pork lenses 72h in formalin



Humid pork lenses 24h in formalin



In cooperation with Institut für Lasertechnologien in der Medizin und Messtechnik at the University of Ulm (Germany)

DENTISTRY

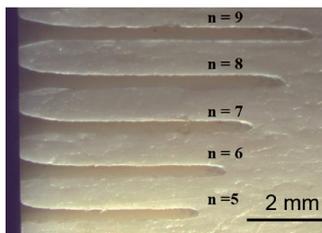
Treatment of soft and hard dental tissue

- Perfect for replacement of flash lamp-pumped lasers.
- Design of small and convenient lasers systems possible.
- Faster healing and minor thermal damage.
- Ideal for soft and hard tissue treatments.
- Multifunctional laser tool for dental and maxillofacial surgery / applications.

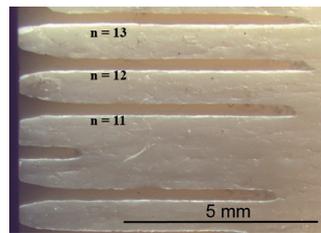
No more dentophobia, painless treatments, no mechanical drilling, less injections and narcotics, maintains healthy tooth structure.

RESULTS

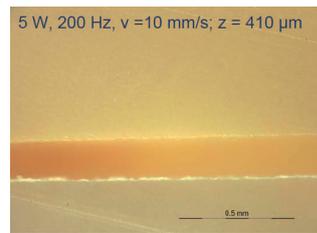
- Smooth and homogeneous cuts on the cut border (in case of the fiber tip).
- High cutting depth > 6 mm
- Thermal impact controllable by laser parameters and cutting speed.



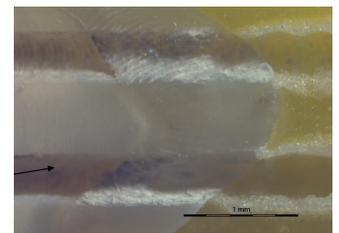
Bone ablation



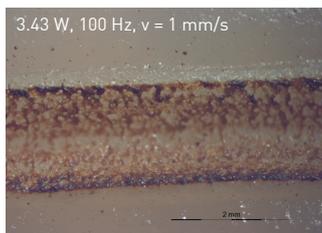
Bone ablation



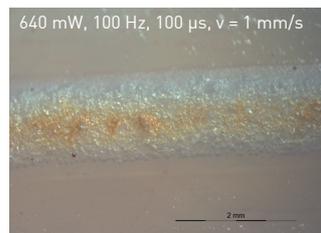
Tooth (Dentin), with waterspray



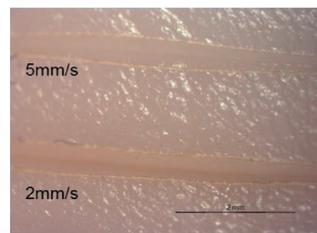
Tooth (Enamel), with waterspray



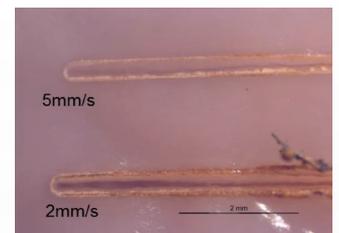
Soft tissue, Coagulation



Soft tissue, Coagulation



Porcine mucosa
2.17 W, 300 Hz, 250 μs



Porcine mucosa
1.4 W, 300 Hz, 250 μs

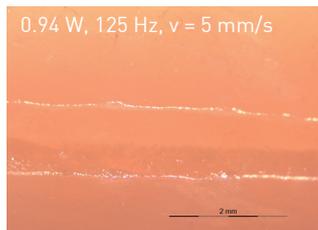
MINIMALLY-INVASIVE SURGERY

Treatment of soft tissue

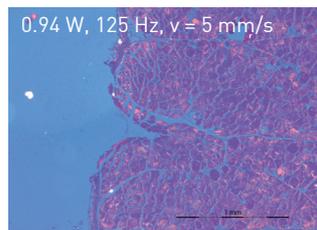
RESULTS

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

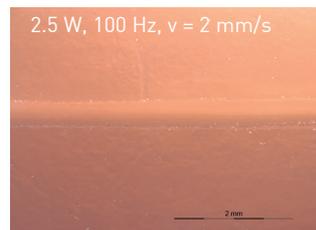
Cutting (cold ablation)



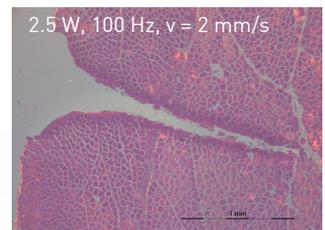
Chicken breast, Treatment without waterspray



Histology, Chicken breast, Treatment without waterspray

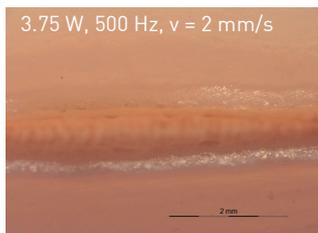


Chicken breast, Treatment without waterspray

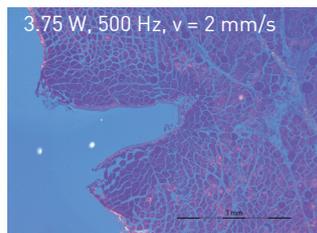


Histology, Chicken breast, Treatment without waterspray

Coagulation (hot ablation)



Chicken breast, Treatment without waterspray



Histology, Chicken breast, Treatment without waterspray



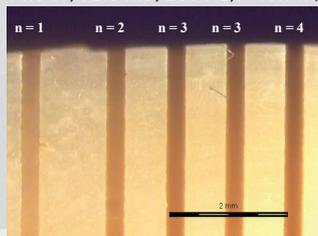
In cooperation with Institut für Lasertechnologien in der Medizin und Messtechnik at the University of Ulm (Germany)

Treatment of hard tissue

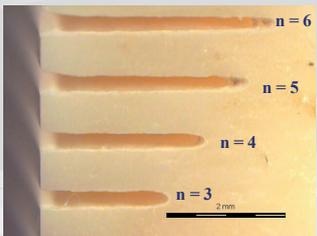
RESULTS

- Good ablation quality (smooth groove walls, sharp edges, no carbonization).
- High cutting depth: > 20 mm
- High ablation / drilling speed: e.g. 34.4 mm/s
- High ablation efficiency: e.g. 0.141 mm³/J
- Higher ablation spur: eg. up to 10 mm³/s

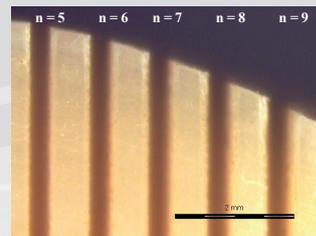
14.5 W, 72.5 mJ, 200 Hz, v=10mm/s



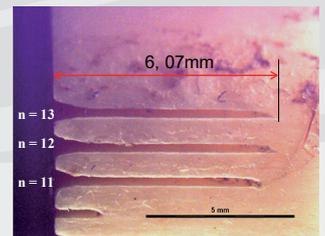
Bone, Treatment with waterspray



Bone, Treatment with waterspray



Bone, Treatment with waterspray



Bone, Treatment with waterspray



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