

Technical data

- compact turn-key sealed short pulse femtosecond laser with dispersion management module
laser pulse duration: < 15 fs
repetition frequency: 85 MHz
mean laser output: 200 mW / 400 mW
wavelength: 800 ± 10 nm
- full-frame scanning, region-of-interest (ROI) scanning, line scanning, single-point illumination (spot scan, drilling)
- typical beam scan range: $350 \mu\text{m} \times 350 \mu\text{m}$ (horizontal)
 $200 \mu\text{m}$ (vertical)
- stage range: $120 \text{ mm} \times 102 \text{ mm}$
- focusing optics: magnification 40×
numerical aperture (NA) 1.3
- video adapter for visualization with CCD-camera
- operating temperature: $15 \dots 35 \text{ }^{\circ}\text{C}$ ($59 \dots 95 \text{ }^{\circ}\text{F}$)
- relative humidity: $5 \dots 95 \%$ (non-condensing)
- power requirements: 230 VAC (50 Hz) or 115 VAC (60 Hz)

System dimensions

- stand: $490 \times 280 \times 480 \text{ mm}^3$
- scan module: $280 \times 190 \times 90 \text{ mm}^3$
- control unit: $450 \times 300 \times 130 \text{ mm}^3$
- femtosecond laser: $507 \times 280 \times 81 \text{ mm}^3$ (laser head)
 $483 \times 280 \times 88 \text{ mm}^3$ (user interface)
 $175 \times 104 \times 102 \text{ mm}^3$ (dispersion management modul)

Notes: These specifications are subject to change without notice.
Images kindly provided by A. Uchugonova, A. Iseman, and K. König



Experts in Femtosecond
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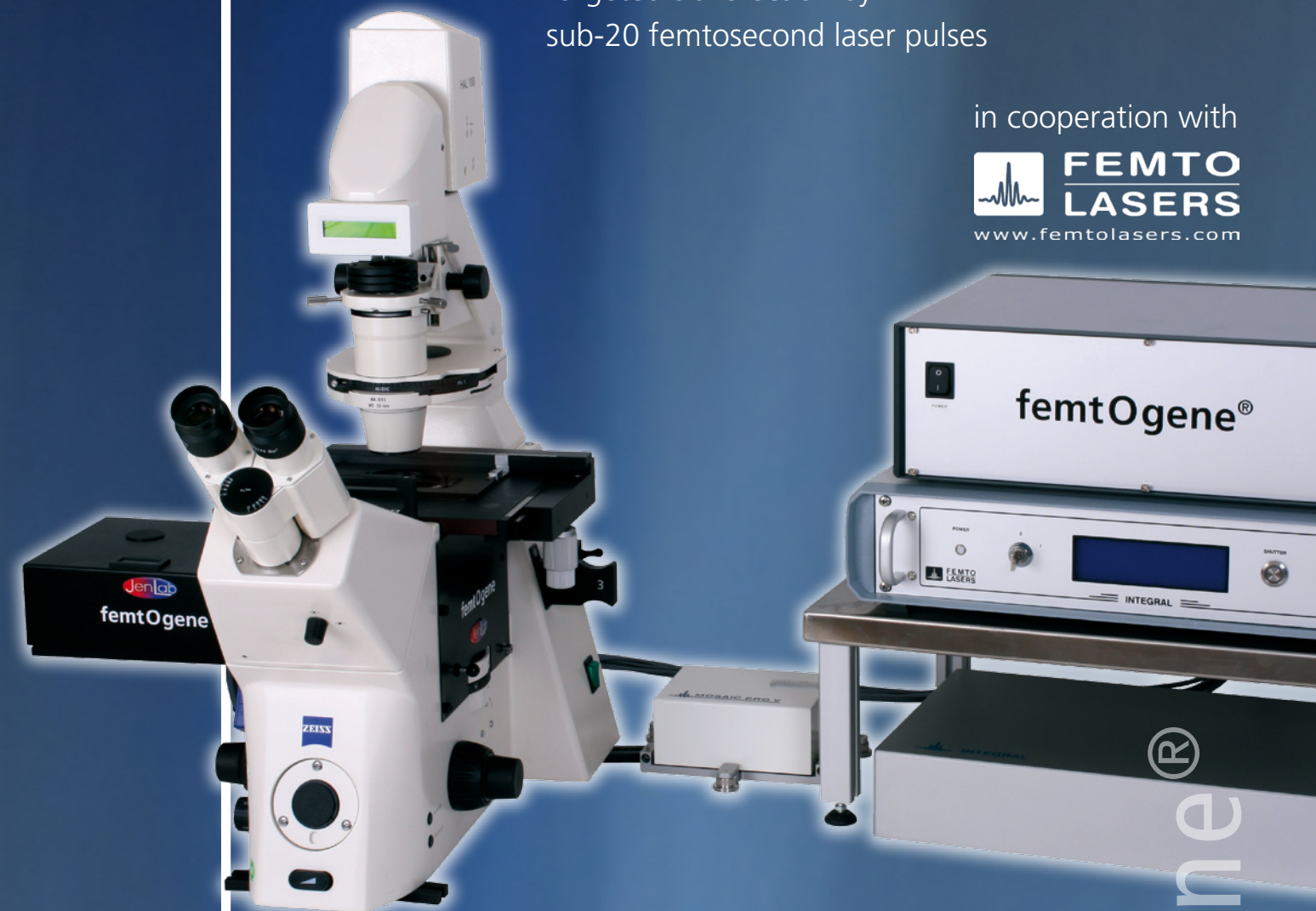


Experts in Femtosecond Laser Technology

femtOgene®

Targeted transfection by
sub-20 femtosecond laser pulses

in cooperation with



- Gene therapy
- Stem cell manipulation
- Optical nanoinjection of macromolecules
- Optical knock-out of cellular organelles
- Intracellular chromosome dissection
- High resolution Imaging

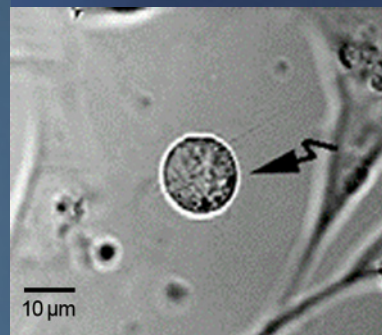
femtOgene®

Product description

The femtOgene® is an ultracompact scanning non-linear microscope with galvoscaners for beam scanning and focussing optics equipped with large-NA objectives (40x/1.3). Multiphoton effects in a sub-femto-liter focal volume induce a transient nanohole in the cellular membrane which allows optical nanoinjection of macromolecules including DNA, RNA, and proteins. The non-invasive gentle creation of a nanoopening without any collateral damage avoids cell death and enables fast self-repairing. Targeted transfection can be performed with high efficiency.

femtOgene® is based on a sub-20 femtosecond near infrared laser microscope with high-order dispersion compensation. The novel dispersion technology overcomes the problems of beam fluctuations observed in femtosecond laser systems based on prism technology. Nanoprocessing is performed in two exposure modes: (a) scanning of a region of interest (ROI) and (b) by single point illumination. Ablation, drilling and cutting can be performed with submicron accuracy.

Targeted transfection and optical nanoinjection are based on millisecond exposure times and <10 mW mean power at 85 MHz repetition frequency.



Laser induced transient changes in cellular membrane

References

Tirpalur U. K. & König K. Targeted transfection by femtosecond laser. *Nature* **418**, 4295-4298 (2002).

Stracke, F., Riemann, I. & König, K. Optical nanoinjection of macromolecules into vital cells. *J. Photochem. Photobiol.* **811**, 36-142(2005).

König, K., Riemann, I., Stracke, F. & LeHarzic, R. Nanoprocessing with nanojoule near-infrared femtosecond laser pulses. *Medical Laser Application* **20**, 169-184 (2005).

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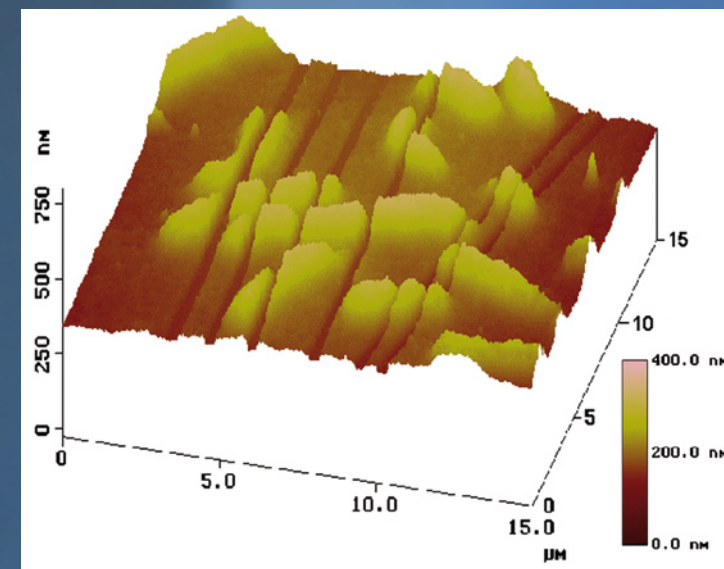
Applications

Nanojoule sub-20 fs laser pulses at 85 MHz repetition rate can be used to perform targeted transfection and optical nanoinjection of macromolecules as well as optical knock-out of intracellular organelles.

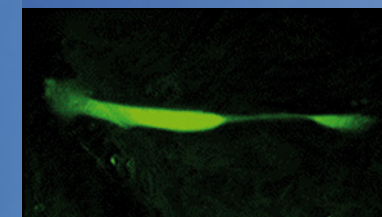
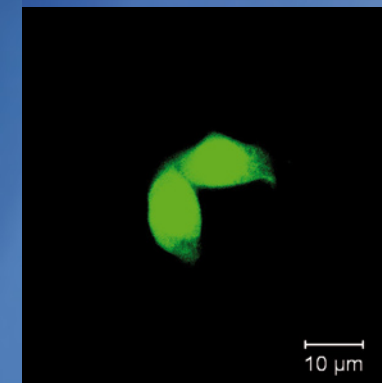
Of major interest is the transfection of stem cells.

Stem cells may revolutionize current therapy such as gene therapy and tissue engineering. Genetically modified stem cells can be used for the production of immune system mediator proteins.

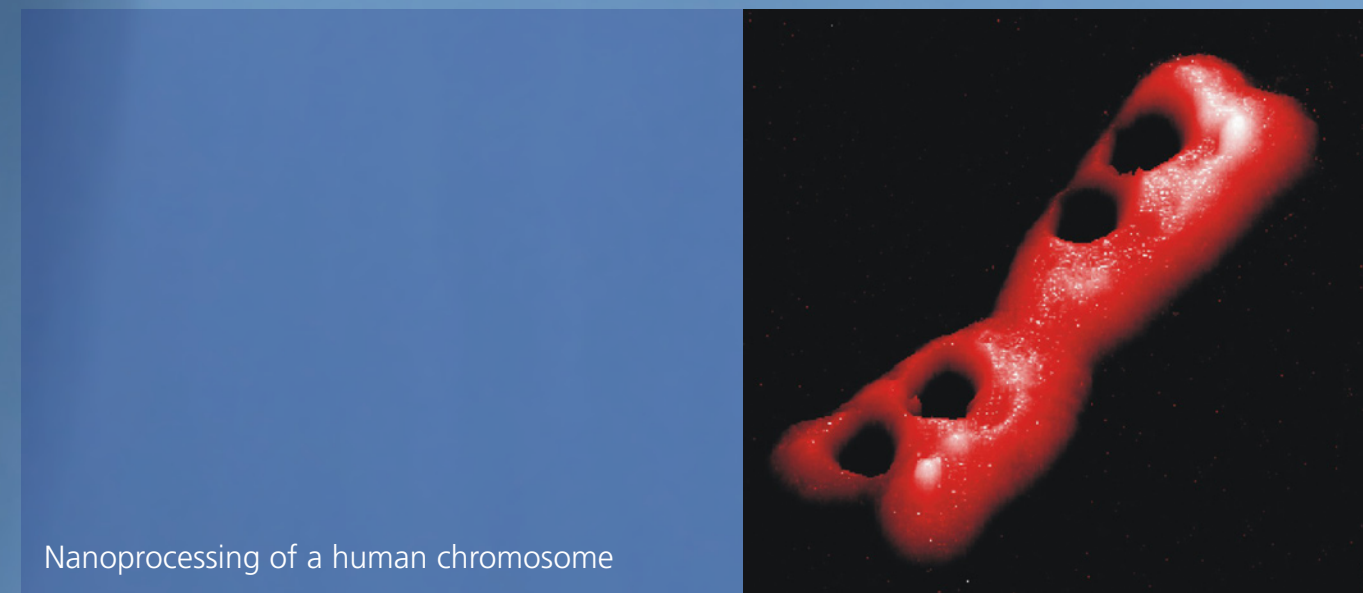
femtOgene® has been employed for the efficient targeted transfection of human salivary gland and pancreas stem cells.



Chromosome dissection by femtosecond laser pulses



Targeted transfection of human stem cells. Green fluorescence occurs 1-2 days after sub-20 fs laser optoporation and diffusion of GFP plasmid into the cytoplasm.



Nanoprocessing of a human chromosome