Femtosecond Micromachining

- <250 nm possible beam size
- <1 um resolution and accuracy
- Wavelengths: 258/343/515/1030 nm, 400/800 nm, 1250 nm
- Down to <50 fs pulse duration
- Up to 20 W average power
- Processing of almost any material
- No heating side effects
- High beam quality
- Beam positioning system with software

Applications:
- Si wafer dicing for microchip production
- Sapphire wafer singulation for photovoltaics
- Thin film cutting
- Photomask repair
- Diamond cutting
- Two-photon polymerization
- Precise material photodeposition
- Optical material manipulation (tweezers)

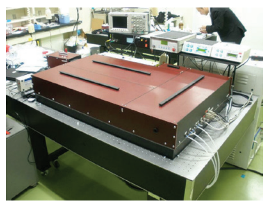
Description

Femtosecond ablation technique is a revolutionary method of material processing on um and nm level. The quality of femtosecond ablation undoubtedly surpasses all existing conventional laser systems. This quality is achieved due to the fact that femtosecond ablation mechanism eliminates all thermal side effects typical of conventional systems. The duration of the femtosecond pulse (10^-15 s) is so short that heat does not dissipate into the neighboring areas of the irradiated material. This is so-called plasma-induced ablation mechanism, i.e. the material is ablated by direct transfer of the composing material into plasma state. The main advantage of this mechanism is higher selectivity as this plasma conversion takes place only at the focal point of the focused laser beam and only if the ablation threshold fluency has been surpassed. Thus, with proper femtosecond laser source a user can achieve processing resolution smaller than the wave length of the radiation itself.

The mechanism described above has been already employed in many fields of industrial applications, such as Si wafer dicing for microchip production, solar cell wafer singulation and scribing, photomask repair, thin-film cutting and many more. Medical applications include ophthalmology (femtosecond LASIK vision correction procedure) and ultra-precise surgery. Moreover, besides femtosecond ablation, the multiphoton effects that are observed right below the ablation threshold offer additional novel applications like two-photon polymerization technique, material deposition etc. Many more fields are currently emerging on the market and much more are being researched in various institutions around the globe.

We offer various femtosecond sources suitable for a vast range of material processing tasks, from industrial applications to high-end scientific research. We also provide inexpensive sources for start-ups and post-graduate research projects.

Available sources



	TETA/ANTAUS	Reus/MATEKO	FREGAT
Possible wavelengths (fixed), nm	1030 / 515 / 343 / 258	800 / 400 / 266	1240 / 620
Possible repetition rates	up to 15 MHz	up to 10 kHz	up to 1 kHz
Max. output pulse energy	>2 mJ@1030 nm >60 uJ@258 nm	>20 mJ@800 nm	>5 mJ@1240 nm
Pulse duration	<250 fs	<50 fs	<120 fs
Max. average power	>30 W	>5 W	>5 W

- a demo scanning system is also available, see reverse

AVESTA
LASERS AND OPTICAL SYSTEMS

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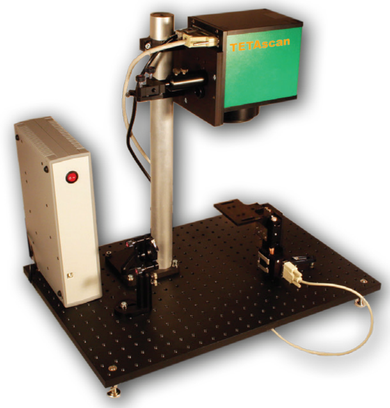


	TETAscan-1030F160/110*
Field size	110x110 mm
Focal distance	160 mm
Typical deflection	±0.393 rad
Angular resolution	12 µrad
Repeatability	40 µrad
Spatial resolution	2 µm
Beam spot size	30 µm
** - all specs at 1030 nm with a typical F-theta f=160 objective*	

TETAscan Beam Positioning System

The TETAscan galvanometer scanning head features a hardware controller with PC software and X-Y-Z step-motor translation table connection option and control (not including tables). The software is capable of 2.5D performance (i.e. multi-layer processing) and various CAD files import (dxf, dwg etc.).

Sample testing

Sapphire plate hole drilling (t=440 um)

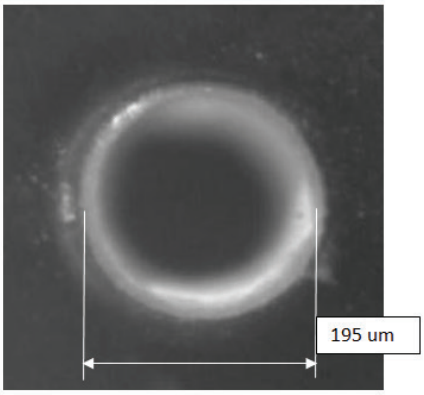


Figure 1. Frontal plate surface.

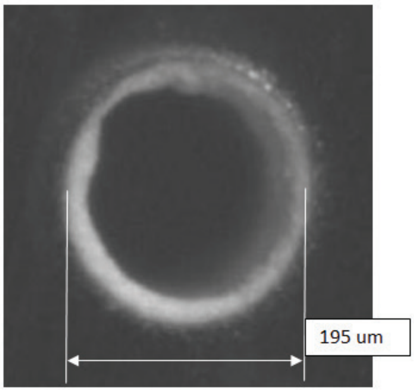


Figure 2. Rear plate surface

Side view (machining progress left to right)

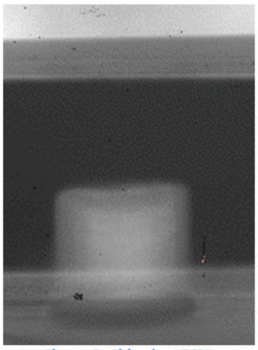


Figure 3. Side view 30%.

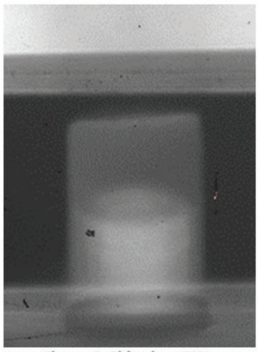


Figure 4. Side view 70%.

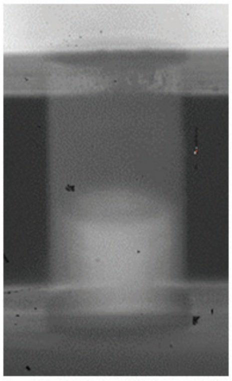
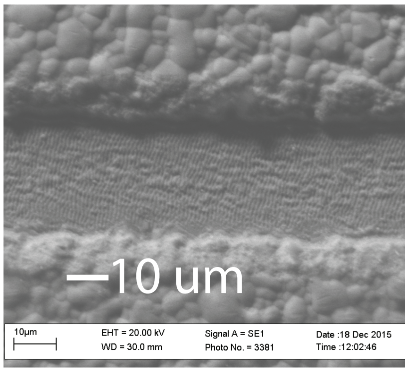
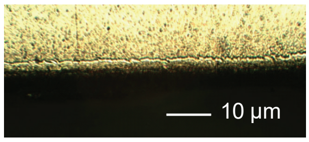


Figure 5. Side view 100%.

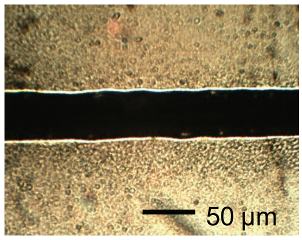
Ag scribing



$GeAl_2O_3$ wafer cutting

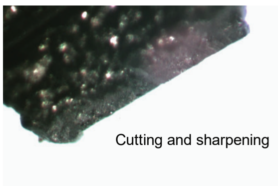


Cut edge at 300 Hz

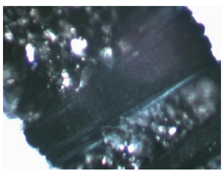


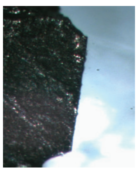
Cut at 3 kHz

Industrial diamond cutting, sharpening and smoothing

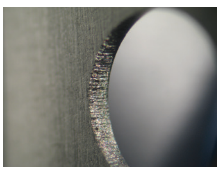


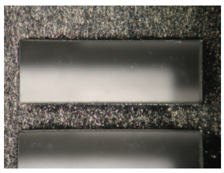
Surface smoothing (polishing)





Ti and Mo cutting





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