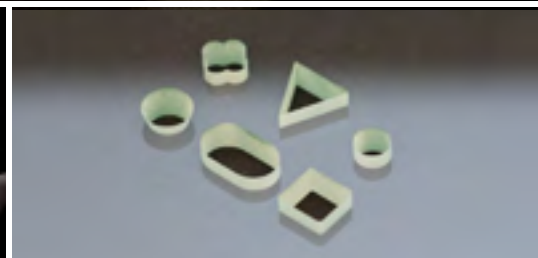
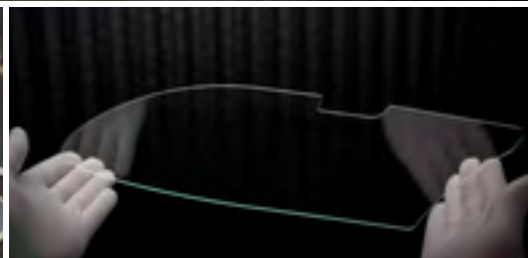


# Laser Solutions for Micromachining



# TWIN

## Multitool for Micro-Laser Processing

**PRECISION, DYNAMICS AND FLEXIBILITY**

### SYSTEM FEATURES

- High precision gantry system with granite base
- Highly dynamic linear drives
- Up to 3 laser sources (all wavelengths, all pulse durations) depending on application
- Multiple process heads for fixed optics and galvo scanners in parallel
- Dynamic beam drift correction
- Powerful path-synchronized processing
- CCD camera alignment
- CAD to motion interface
- Vacuum chuck for substrates
- Customized modules for loading / unloading of sheets and webs

### APPLICATIONS

- Glass cutting with PearlCut™
- Glass drilling
- Thin-film ablation
- Marking
- ... and precision processing of almost any material using ultrafast lasers

Watch the video!



TWIN platform



TWIN platform with tailored loading and unloading module

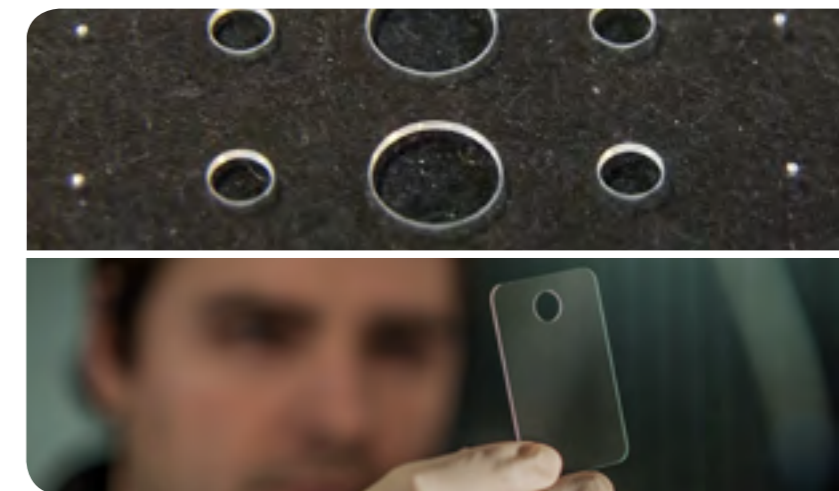
### PEARLCUT™ GLASS CUTTING

- Fast precision cutting of thin glass components in any shape
- High edge quality providing for high bending strength of the cut parts
- Clean, dry and kerf-free process allows cutting of coated glass without post-processing
- Cutting of soda-lime, borosilicate, chemically strengthened glasses and sapphire



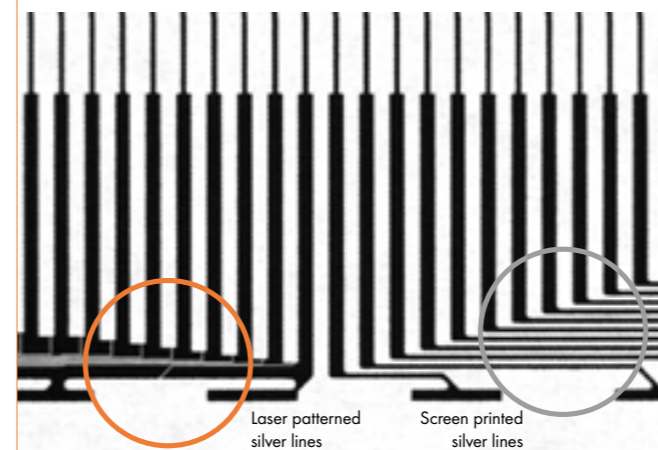
### GLASS DRILLING

- Fast and flexible via or blind hole drilling in any transparent material
- Touchless process with high repeatability
- Flexible adjustment of hole shape and diameter without re-tooling
- Integrated process controls



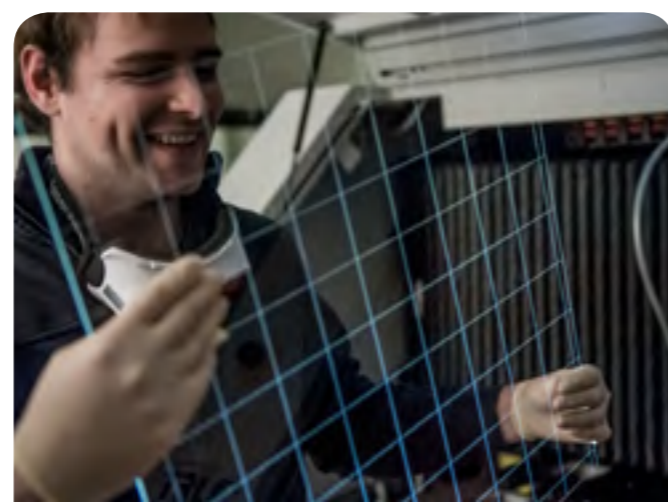
### THIN-FILM ABLATION

- Ablation of transparent conductive layers, semi-conductors and metal films
- Flexible and mask-free patterning process
- Dry, non-hazardous process
- Small feature sizes
- Direct import of CAD drawings



### MARKING

- Precision marking of any material
- Surface or sub-surface marking of transparent materials
- Bitmap, DXF and Matrix Code marking



# GDS Glass Drilling System

**AUTOMATED PRECISION  
DRILLING OF GLASS SHEETS**

## SYSTEM FEATURES

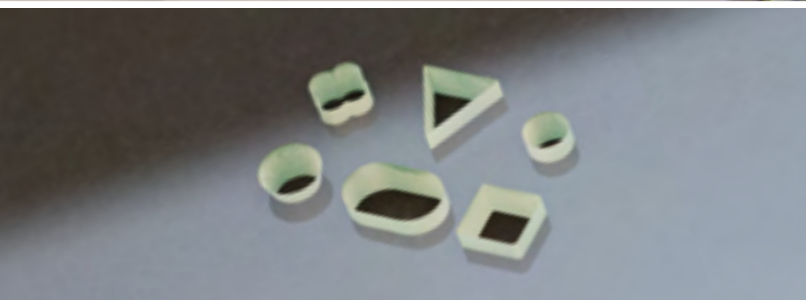
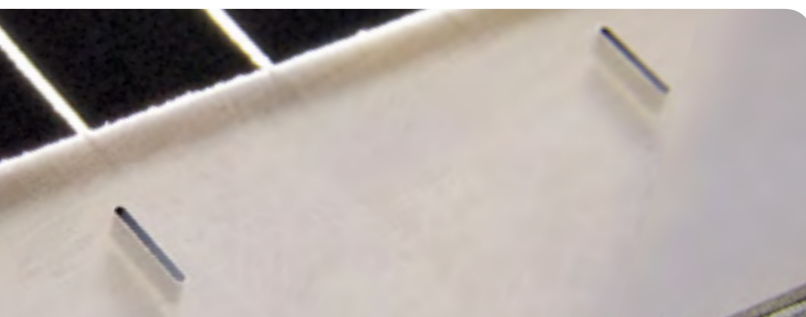
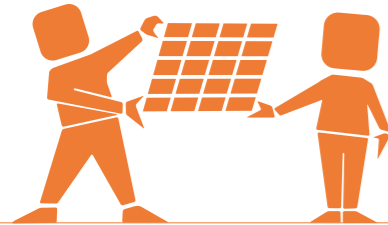
- Drills holes of any shape anywhere on the substrate
- Substrate handling with glass warp compensation
- Low maintenance laser system
- Integrated process control



GDS system



GDSflex system



## LASER GLASS DRILLING

- Touchless precision drilling
- Low edge chipping and improved breakage strength
- Flexible hole geometries, including conic shapes without re-tooling
- Dry process without post-processing
- Drilling of semi-tempered and chemically strengthened glass
- Chamfer possible
- High process stability and reproducibility

# EDS Edge Deletion System

## SYSTEM FEATURES

- Flexible inline design
- Automatic adjustment to glass format tolerance
- Programmable ablation zones and parameters
- Dynamic auto-focus for glass warpage
- Full area processing capability for inside deletion, annealing, drying or marking
- Integrated metrology

## APPLICATIONS

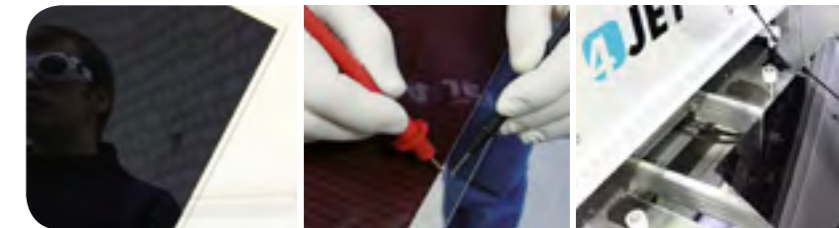
- Ablation of metallic front or back contacts (Mo, Al, Ag)
- Ablation of semi-conductors ( $\alpha$ -Si single junction/tandem junction, CIS, CIGS, CdTe)
- Ablation of TCO-coatings (ITO, ZnO, SnO<sub>2</sub>)
- Large area annealing / drying / pattern ablation



Inline system  
for edge deletion

## LASER EDGE DELETION

- Precision ablation of metals, semi-conductors or TCO films
- Touchless process without glass damage or micro-cracks
- Environmentally friendly and dry process without blasting media or chemicals
- No post-processing or washing required prior lamination
- Repeatable results
- Software edited change of processing zones and recipes without re-tooling



# MEX Molybdenum Exposure

## SYSTEM FEATURES

- Inline system
- Substrate handling with glass warp compensation
- Fast and precise re-tooling with quick-locks, no need to re-calibrate the system
- Low consumable cost exposure tools
- Flexible programming of the processing zones
- Process control



MEX system

## MECHANICAL ABLATION PROCESS

- Precise and spotless film removal of TCO and CIS/CIGS semi-conductors to expose metal films
- No damage or scratching of metal film
- Clean bus bar pad for welding, soldering or glueing
- Ability to create shunt-free isolation cuts in CIGS solar cells
- Repeatable results
- Dry and clean processing

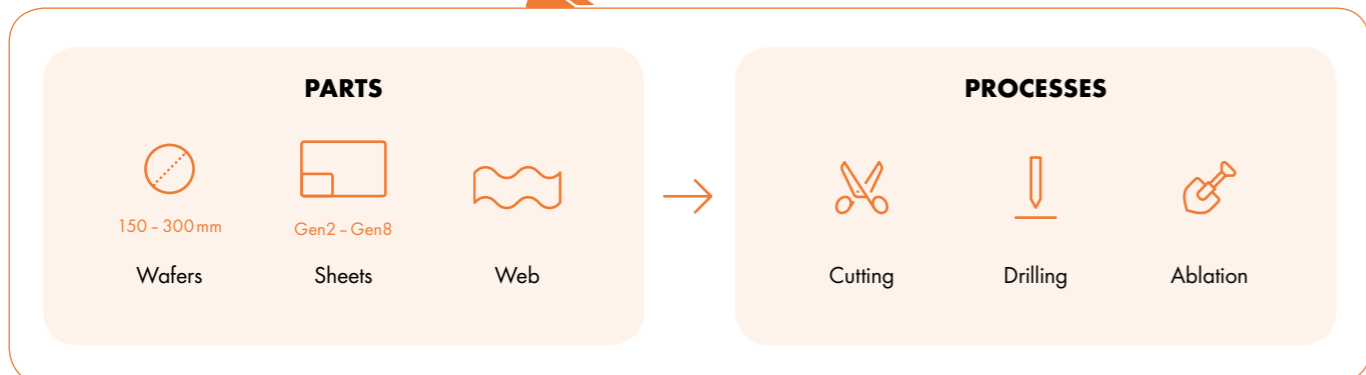




# SQUARING THE CIRCLE... ...by Customized Standardization



- 1** We develop standardized as well as customized laser machinery.
- 2** As a leading system integrator we develop turnkey, built-to-spec equipment for laser micromachining.
- 3** We start with a feasibility study based on sample parts. In our well-equipped laboratory, we analyze the process and determine the optimum parameters and the ideal laser source.
- 4** For work piece handling we make use of our modules.
- 5** Our aim - use standards wherever possible and innovate what it takes to get the job done!



↓  
**PLATFORMS**



# 4JET MicroFab

## TOTAL SOLUTION

Benefit from 4JET's high tech equipment and process solutions for prototypes and small to volume production needs - without the initial capital investment.

We offer **sub-contract processing** with state of the art laser equipment. Our spectrum of laser wavelength reaches from 355 nm, 532 nm, 1064 nm up to 10,6 µm with pulse length of fs, ps, ns to cw.

We support production needs from initial sampling up to 100% quality controlled end-products. Our **analytical lab** includes light and measurement microscopy, as well as surface analytical equipment.

Need a total solution? We provide substrate-sourcing, cleaning, packaging, and **door-to-door logistics**.

## LASER ASSISTED GLASS PROCESSING

Our process systems are capable of **free form cutting** almost any outer contours, including curves, as well as cutting inner contours.

The nearly **dust free processing** allows us to process your high end components and sensitive coated parts.

Our high precision systems produce a **component accuracy** in the micron range. Our glass cutting technology provides glass edge quality of < 2 µm, which reduces further processing in production such as mechanical polishing.

## YOUR LASER MICROMACHINING JOB SHOP

### PROCESSES

Cutting	Drilling	Patterning	Ablation	Marking
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### PRECISION

mm <sup>2</sup> - 1 m <sup>2</sup> Component Size	50 µm - 6 mm Thickness of Material	+/- 10 µm Accuracy
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### MATERIALS

Glass and Sapphire	Ceramics	Metal	Polymer	Functional layers
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## 3 SIMPLE STEPS TO THE 4JET MICROFAB

- 1** Visit [www.4micro.de/microfab](http://www.4micro.de/microfab), fill out the inquiry form, and upload sketches or CAD drawings.
- 2** We will contact you in the next **24 hours**.
- 3** **Receive our offer** within one working day after clarification of requirements.



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