

Almax·easyLab
science under pressure

Products



PulseCube - UV

PulseCube - UV Laser Micromachining

The PulseCube is a precision micromachining system designed for gasket drilling in diamond anvil cells, sample cutting, and mask fabrication for electrodes' deposition. Designed for demanding research environments, it is an indispensable tool for laboratories specialising in high-pressure science and advanced materials research, where dimensional accuracy at the micron scale is essential.

Its key advantage is a 355 nm UV laser that ablates material rather than melting it, unlike conventional IR lasers. This minimises thermal effects, producing cleaner surfaces, sharper features, and superior dimensional accuracy in both conducting and insulating materials.

Achieve cleaner cuts and higher accuracy with advanced UV laser technology;

Work seamlessly with a wide range of conductive and non-conductive materials;

Simplify workflows through intuitive, fully software-controlled operation;

Ensure maximum safety with a compact, fully enclosed Class 1 laser system.

RELATED PRODUCTS:

- uDrill Pro - EDM drilling

RELATED ACCESSORIES:

- Gasket Sample Holder (Standard)
- Gasket Tilt Sample Holder
- Glass Sample Holder
- Customised Sample Holder

Technical Specifications:

Dimensions (WxDxH)	49x47x41cm
Weight (Approx)	40kg (incl. Laser power supply)
Laser	355nm, Energy/pulse>25uJ, Pulse width<350ps, repetition rate variable 1-1000Hz. Class I.
Voltage	110-250V, 50-60Hz
Sample Stages (X, Y, Z)	Linear piezo stages 32mm, 25nm steps (X, Y)
Typical dimensions	Hole down to 6 µm , Laser focus 4 µm
Software	Python proprietary software - PulseCube Manager

Specifications subject to change without prior notice.
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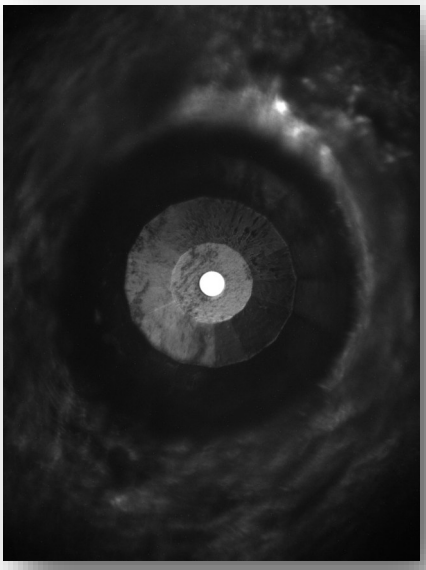
PulseCube: Compact Precision Laser Micromachining System



The **PulseCube** is a fully enclosed laser micromachining system designed for simplicity, safety, and precision. User interaction is intentionally limited to three access points: the power port, the USB connection to a PC (supplied), and the front loading shutter for sample loading. All system functions are controlled through **PulseCube Manager**, the intuitive software interface at the heart of the instrument. With just a few mouse clicks, users can configure machining parameters, position samples, and execute complex micromachining tasks efficiently and reliably. Whether performing routine operations or advanced processes, PulseCube Manager provides a seamless user experience suitable for both new and experienced users.

PulseCube Manager

Hole Drilling



Hole drilling is one of the primary applications of the PulseCube, particularly for the preparation of gaskets used in Diamond Anvil Cell (DAC) experiments. The system can produce holes as small as **6 µm** in both conductive and non-conductive materials with typical thicknesses of up to **250 µm**. Thicker materials can also be processed using the advanced machining capabilities of PulseCube Manager.

The software provides full control over all key drilling parameters, including hole diameter, laser power, number of passes, pulses per point, and laser repetition rate from **1 Hz to 1000 Hz**. Users can choose between a simplified drilling mode for rapid operation or an advanced mode offering additional parameters for thick-material machining, such as drop-per-loop control. Sample alignment can be performed manually using mouse-driven positioning or automatically through the integrated **FindCentre** function. Frequently used positions can also be saved and recalled, making the creation of multiple holes in multi-indented gaskets fast and efficient.

50 µm hole in a 550 µm thick Rhenium gasket. Culet of 150 µm (bevel 300 µm)

Sample Cutting



The PulseCube enables precise cutting of microscopic samples with exceptional accuracy and repeatability. Researchers can rapidly prepare samples for DAC loading, fabricate micro-scale targets, or create specimens with defined sizes and geometries. Samples can be cut in circular or square shapes, with dimensions tailored to the specific application.

PulseCube Manager offers extensive control over cutting parameters, including sample dimensions, spacing between samples, and the number of attachment points retained to keep the sample connected to the surrounding material during machining. Arrays of samples can be generated automatically in matrix formats, enabling efficient batch preparation. Once pre-cut, samples can be easily released under a microscope, ensuring safe handling of even the smallest specimens.

100 µm sample cut with 1 leg left

Technical Corner

Mask Cutting



The PulseCube's XY platforms' motion allows the creation of complex patterns beyond simple drilled holes and cutouts. Users can generate intricate mask geometries, including triangular, linear, and custom-patterned structures for material deposition applications such as coating diamond anvils and other substrates. Adjustable parameters include overall dimensions, track spacing, orientation, and pattern repetition, enabling rapid production of highly customized masks in just minutes.

Pattern of 4 cut outs. Inter-distance 60 micron between tips.

Sample Holders



To support a wide range of applications, the PulseCube is supplied as standard with two sample holders: a **Standard Gasket Holder** and a **Standard Gasket Holder with Tilt**, allowing angular adjustment of the sample. Additional custom holders can be designed and manufactured to meet specific application requirements. Customers are encouraged to discuss any specialized sample mounting needs at the time of ordering.

Surface Quality Comparison of Different Drilling Technologies

SEM analyses were performed on gaskets drilled using UV laser micromachining, IR laser machining, and traditional EDM drilling techniques. As illustrated in the images below, UV laser micromachining produces cleaner and smoother hole edges, with reduced machining artefacts and improved geometric definition. This enhanced surface quality is particularly advantageous for demanding applications such as helium gas loading, where gasket integrity is critical. The SEM images presented correspond to **50 µm diameter holes machined in 50 µm thick rhenium gaskets** and highlight the superior edge finish achieved with UV laser processing.

