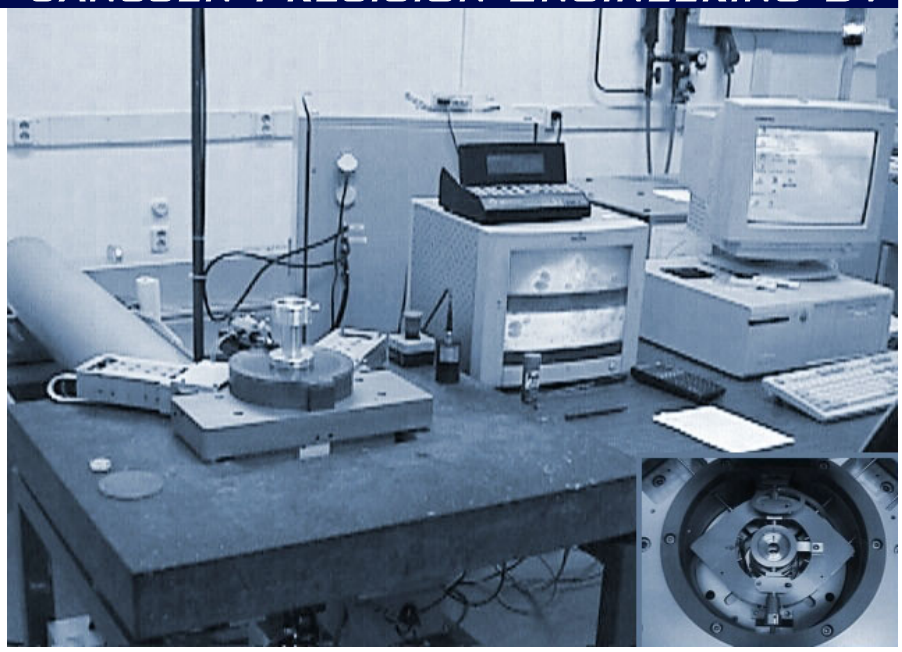
JANSSEN PRECISION ENGINEERING BV

For one of our customers, we designed and realised a system for drilling profiled holes in diamond material.

By making use of a new laser-based drilling technology, we en-abled our customer to enter a new product range.

With a minimum achievable hole size of 5 mm, the sys-tem surpassed its predeces-sor by far!



DIAMOND PROCESSING MACHINE

the problem

Laser drilling is a common tech-nique for making profiled holes in diamond. A focussed laser beam is used to 'evaporate' the material to be removed. However, the smallest geometry that can be drilled by using this technique is limited.

In striving for smaller bore diame-ters, our customer developed a new technology. It is based on the use of an optical image instead of a focussed laser beam.

Based on this technology, a system should be designed and realised.

the approach

By starting to write a system specification, we gained under-standing of the needs and considerations of our customer.

Using the physical process parameters as an input, we develope-d a system design and derived specifi-cations for all sub-modules.

the result

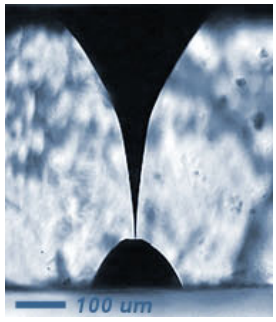
We succeeded in building a com-plete, turnkey system by inte-grating optics, mechanics, electronics and software.

A circular mask, exposed by an excimer laser, is imaged onto the diamond with a demagnification of approximately 40:1. The focus is realised by moving the objective over a stroke of ±2 mm with micrometer accuracy.

The diamond is moved in a circular motion with respect to the image focus. To realise a circular movement with an accuracy better than 1 mm, the stage is suspended by three elastic rods. They only allow an XY movement of the stage and restrict all other degrees of freedom. The stage is actuated by two linear motors in an orthogonal configuration.

To realise a concentric counterbore, the diamond is turned upside down after finishing the primary bore. Therefore, the diamond is temporarily clamped in a ball bar, which can be turned upside down with a repeatability better then 1 mm.

A section view of a finished product can be seen below.



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