FAST MINIATURIZED LASER SCANNER

Task

Hand-held laser-surgical and laser-based therapy systems need fast 2D beam deflection systems, so-called scanners, to precisely distribute the power of the therapeutic radiation in the tissue. The parameters characterizing such scanners are the scanning speed v_{sc}, the scanning angle θ, the mirror aperture d and the overall volume V. The requirements for the scanner are $v_{sc} > 20$ m/s, $\theta > 10°$, $d > 8$ mm and $V < 100$ cm^3. For 2D beam deflection, there are different scanner technologies – such as galvanometers, MEMS, piezo scanners and acousto-optical or electro-optical deflectors (AOD and EOD) – each with specific strengths and weaknesses. None of the available technology, however, meets all of the requirements simultaneously.

Method

Fraunhofer ILT has developed a new compact 2D scanner technology that unifies a small unit volume with large mirror apertures and fast scan speeds along with large deflection angles. The production of such mini scanners is based on the most modern manufacturing methods of laser technology. The Fraunhofer ILT can, thus, flexibly implement designs tailored to a customer's needs without them having to pass complex process lines during manufacturing. Due to the direct implementation of digital design into a product, it is now possible to manufacture individual scanner systems in small quantities economically.

Result

The mini scanner developed by Fraunhofer ILT reaches scanning speeds of more than 35 m/s in optical deflection angles of up to 20°. The mirror aperture is 10 mm in spite of the small construction volume of l x w x h = 40.5 x 29 x 32 mm^3. The mirror surface can be provided with metallic or dielectric reflection coatings, therefore, making the scanner suitable for laser wavelengths in the entire optical and infrared spectral range and power range up to 200 W.

Applications

The scanner is ideal for use in laser therapy systems, since, thanks to its compact design, it can easily be integrated in a handpiece for the application of therapeutic laser radiation. Other possible applications are confocal microscopy or use in the 3D printers.

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2 Compact scanner mirror.

3 Customized production with laser technology.