

# Focus on CSIR research in Laser Cutting

CSIR National  
Laser Centre  
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## Laser Cutting

Laser cutting was the first, and to date, the most successful machining application to have evolved from the invention of the laser. Although laser cutting has since gained a high level of maturity and global acceptance as an industrial process, it is still evolving in terms of its capabilities and new applications continue to emerge.

To ensure that the South African manufacturing industry stays abreast of developments in this important field and gains access to the latest laser cutting-techniques, the CSIR National Laser Centre has established a skills base which is supported by state-of-the-art laser-cutting machines and a network of international expertise, which includes the Fraunhofer Institute for Laser Technology (Aachen, Germany). The available infrastructure enables the centre to perform laser cutting on a comprehensive range of materials. A 5 kW CO<sub>2</sub> laser focuses on metal cutting. Both ferrous and non-ferrous metals can be cut and the additional power opens up the possibility of cutting thicker sections than those offered commercially. Both standard flat-sheet cutting as well as 3D cutting are offered. Low-power CO<sub>2</sub> lasers offer the most affordable form of laser cutting and are aimed at cutting a vast range of non-metals. These include plastics, natural and synthetic textiles, wood and wood products, rubber, paper and related materials, leather, etc. Pulsed Nd:YAG lasers are available

to perform precision cutting and drilling of all metals, as well as certain ceramics.

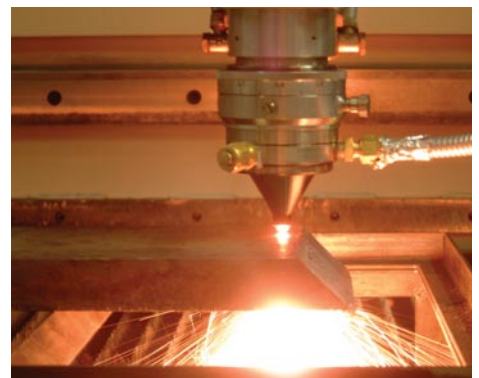
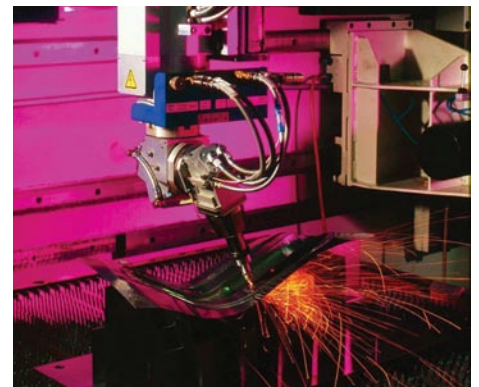
### Based on the available infrastructure and expertise base, the CSIR undertakes:

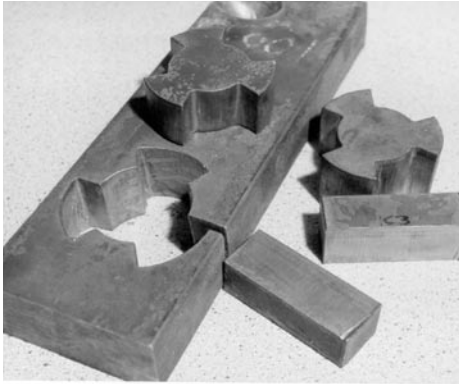
- Specialist consulting;
- Feasibility studies;
- Process development and process optimisation;
- Prototype and small batch production;
- Specification of production equipment; and
- Assistance with the selection and acquisition of appropriate production equipment.

The CSIR has the capability to manufacture and support certain categories of laser cutting equipment. These systems have a high local content and will be offered specifically where tailor-made solutions are required or where a cost advantage can be passed on to the end-user.

### Laser cutting offers the following competitive advantages:

- *Edge quality.* Burr-free edges with low surface roughness and small heat-affected zones are possible. This eliminates the need for post-processing;





- **Flexibility.** Laser profile cutting is a Computer Numerical Control (CNC) process, which does not require hard tooling. Design changes are therefore easily and quickly implemented;
- **No tool wear.** Laser cutting is a thermal process, which does not involve mechanical contact. This could be important where hard, flexible or brittle materials have to be cut; and
- **Fine detail.** The laser "tool" has an effective diameter of some 100 - 200 microns. This is an important advantage in the case of profiles with fine and intricate detail, and where small holes need to be drilled in hard or flexible material.

The CSIR offers a comprehensive 3D laser cutting service. Customer-supplied CAD data are used to generate the tool paths and holding fixtures required for cutting 3D sheet metal parts. As a typical laser-based CAD/CAM process, 3D laser cutting offers the following advantages:

- Short lead times are possible since no hard tooling is required;
- Simple, inexpensive holding fixtures are generated as part of the process;
- Fast non-contact machining process;
- Accuracy up to 0.2 mm is achieved; and
- Excellent burr-free edge quality is achieved.

The main application for 3D laser cutting is the trimming of 3D sheet metal pressing and hydro-formed parts, particularly for the automotive industry. 3D laser cutting is the method of choice where:

- Prototypes are required for trim tool development;
- Pre-production prototypes are required to set up production lines;
- Trim tool manufacturing has been delayed;
- Production volumes do not justify the cost of the trim tool; and
- A high level of customisation is required.

The CSIR's 3D laser cutting service is supported by the following infrastructure:

- Trumpf Lasercell TLC1005  
Working range:  
X 3 000 mm  
Y 1 500 mm  
Z 750 mm  
(The Lasercell is equipped with a 5 kW CO<sub>2</sub> laser);
- PEPS Pentacut off-line programming system CAD interfaces for CATIA, IGES, etc.; and
- Experienced and skilled programmers and machine operators.

The 3D cutting capabilities will soon also include an articulated arm robot in combination with a fibre-delivered Nd:YAG laser.

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[http://www.csir.co.za/lasers/overview\\_nlc.html](http://www.csir.co.za/lasers/overview_nlc.html)