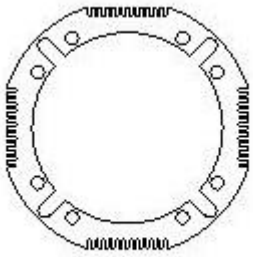
REPORT: Stainless steel cutting by Laser-MicroJet®

for Anonymous

by Mr Stephane Delahaye; Synova SA

TASK

The Laser-MicroJet® technology has been tested for the cutting of stainless steel according to the drawing below.



Picture 1: Drawing used for the cut

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE	Material	Stainless steel
	Dimension	~170*310 *mm*
	Thickness	1200 *µm*
	Quantity	1 *pcs*

Release of application report			
Project Leader		Responsible Application Group	
Name:	Mr Stéphane Delahaye	Name:	Dr Benjamin Carron
Date:	14.05.2012	Date:	14.05.2012
Visum:		Visum:	

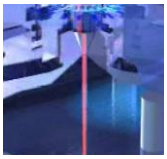
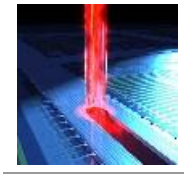
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LCS 150 equipped with a frequency-doubled Q-switched Nd-YAG laser has been used as the machine configuration in our lab.
It is a manually-loaded machine allowing to cut, drill, groove, scribe, trench, mark, or grind a wide range of materials.

Major advantages of Laser-MicroJet® technology with regards to your application are:

- Cutting of arbitrary shapes
- Negligible heat damage to the material
- Negligible contamination / re-deposition
- Limited slag/burr formation

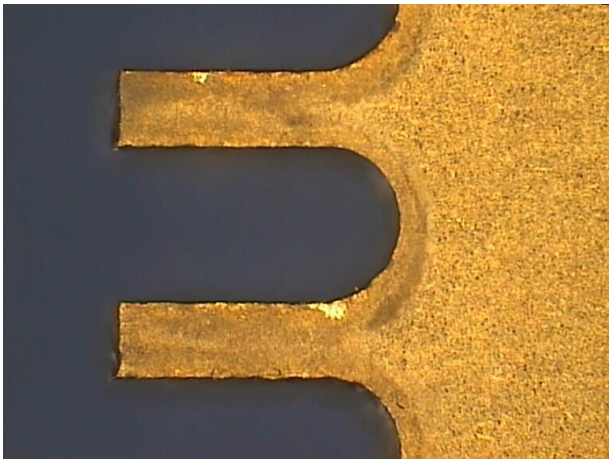
In the table below, the optimized processing parameters used in the experiments are summarized:

	**SYSTEM**	Machine type	LCS 150
	**MICROJET® PARAMETER**	Nozzle diameter	80 *µm*
		MicroJet® diameter	~64 *µm*
		Water pressure	200 *bar*
		Assist gas	He
	**LASER PARAMETER**	Laser type	L101G
		Wavelength	532 *nm*
		Pulse frequency	14 *kHz*
		Average power	~76 *W*
	**CUTTING PARAMETER**	Cutting speed	5 *mm/s*
		Number of passes	~60
		Overall speed	5 *mm/min*
		Fixing system	clamps

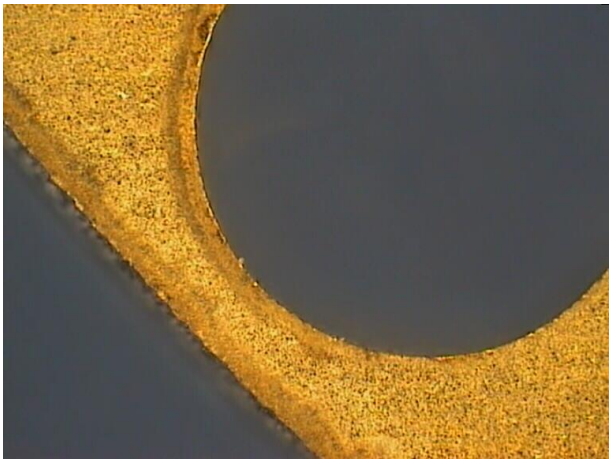
RESULTS

The following microscope picture give an overview on the quality obtained with the Laser-Microjet® technology.

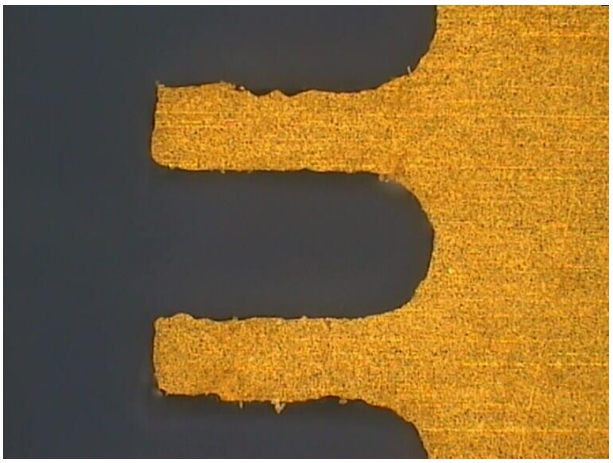
PICTURE 2: Digital camera pictures of the 2 samples.



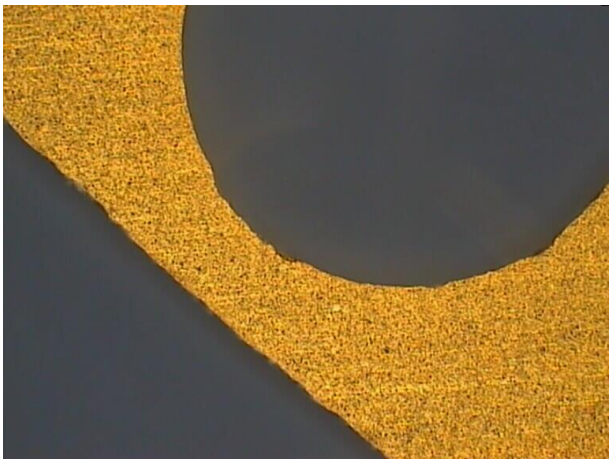
PICTURE 3: Microscope image of the frontside (dark field illumination)



PICTURE 4: Microscope image of the frontside (dark field illumination)



PICTURE 5: Microscope image of the backside (dark field illumination)



PICTURE 6: Microscope image of the backside (dark field illumination)

The table below summarized Anonymous expectations and our results:

	What are your priorities? (please put a cross)	Quantified expectations or improvements
Speed / throughput:	3	5 mm/min
Burr-free:	1	Backside shows irregular parts on the teeth
Heat-damage free:	2	Small HAZ on the frontside

CONCLUSION

The cutting of stainless steel was investigated on SYNOVA LCS 150. This machine is based on the MicroJet® technology and combines the advantages of the high energy pulsed laser with a hair-thin water jet. While the laser is used for material ablation, the water jet is used for guiding the laser light, cooling the edges and preventing the sample from particle contamination, advantages that are essential for the cutting of stainless steel with high quality.

These tests show that:

- It is possible to cut stainless steel plate 1.2 mm thick with a good overall quality.
- Small HAZ is visible on the frontside while few irregular parts and burrs can be seen on the backside

There are possibilities to improve the cut quality on backside and the process speed by using a double cavity laser but a feed-back would be welcome before investigating further this application

We thank you for your interest in our technology and we hope our results meet your requirements. Our sales agency will contact you soon to obtain a feedback about the analysis of these results and to discuss with you the further steps.