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		Sample No: no box
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REPORT: Aluminum cutting by Laser MicroJet®

for Anonymous

by Florent Bruckert, Jonathan Créquy, Synova SA

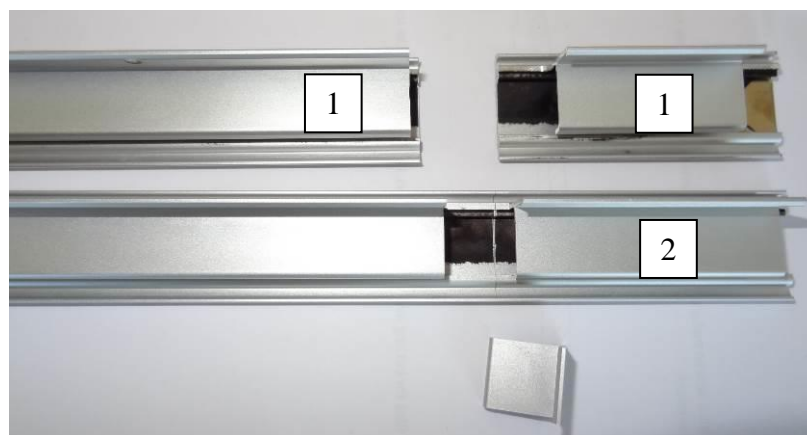
1. TASK

The Laser MicroJet® technology has been tested for cutting and scribing an aluminum rail. The aim was to perform the scribing process using the Laser MicroJet® technology.

2. SAMPLE DESCRIPTION

The scribing was performed on a rail of aluminum in order to weaken the rail with the following specifications:

SUPPLIED MATERIAL		Workpiece
	Material	Aluminium
	Thickness [µm]	100 to 1000
	Quantity	2




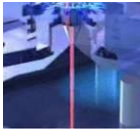

PICTURE 1: Pictures of the final workpieces

Release of application report			
Project Leader		Industry BU Responsible	
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Date:	08.04.2014	Date:	08.04.2014
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3. PROCESS: INSTRUMENT & TEST PARAMETERS

For this application, an LCS300 equipped with a frequency-doubled, Q-switched, Nd:YAG laser, has been selected as the best machine configuration available in the lab.

The table below summarizes the general parameters used in the experiments.

	SYSTEM	Machine type	LCS300
		Fixture	Clamped
	MICROJET® PARAMETER	Nozzle diameter	80 μm
		Working distance	25 <i>mm</i>
		Assist gas	He
		Water pressure	100 <i>bar</i>
	LASER	Laser type	L202G
		Wavelength	532 <i>nm</i>
		Repetition rate	10 <i>kHz</i>
		Power in the laser head	47 <i>W</i>
		Power in the waterjet	28 <i>W</i>
		Pulse duration	150 <i>ns</i>

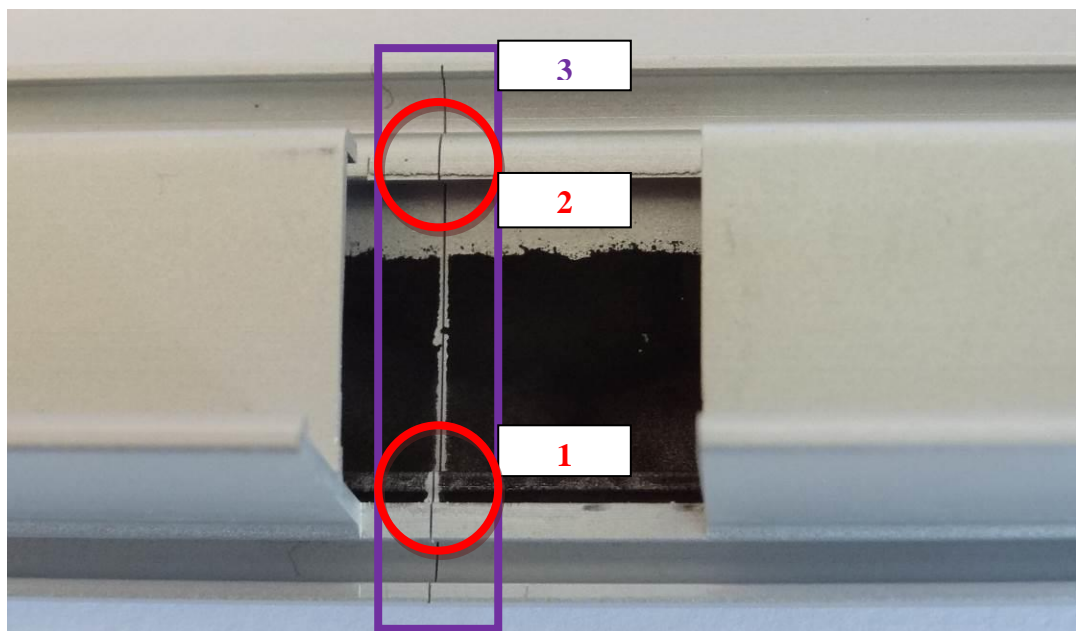
4. SCRIBING RESULTS

In this section, you can find a summary of the steps done to cut the 2 samples.

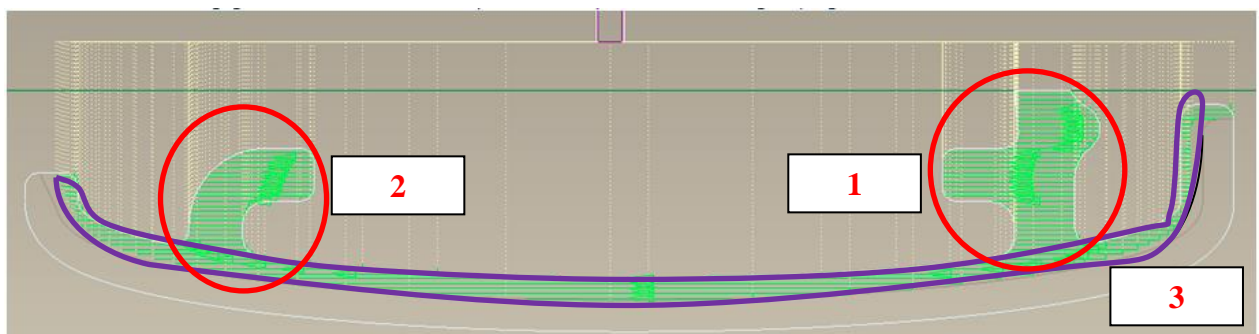
4.1. SCRIBING

The aim was to scribe from the backside of the rail in order to weaken it. The scribing had to be blind (not visible on the other side) but deep enough to allow the rail to be broken in two pieces by hand.

In order to weaken the rail homogeneously, the scribing process has been divided in three different steps as you can see below:



PICTURE 2: Picture of the different scribing steps

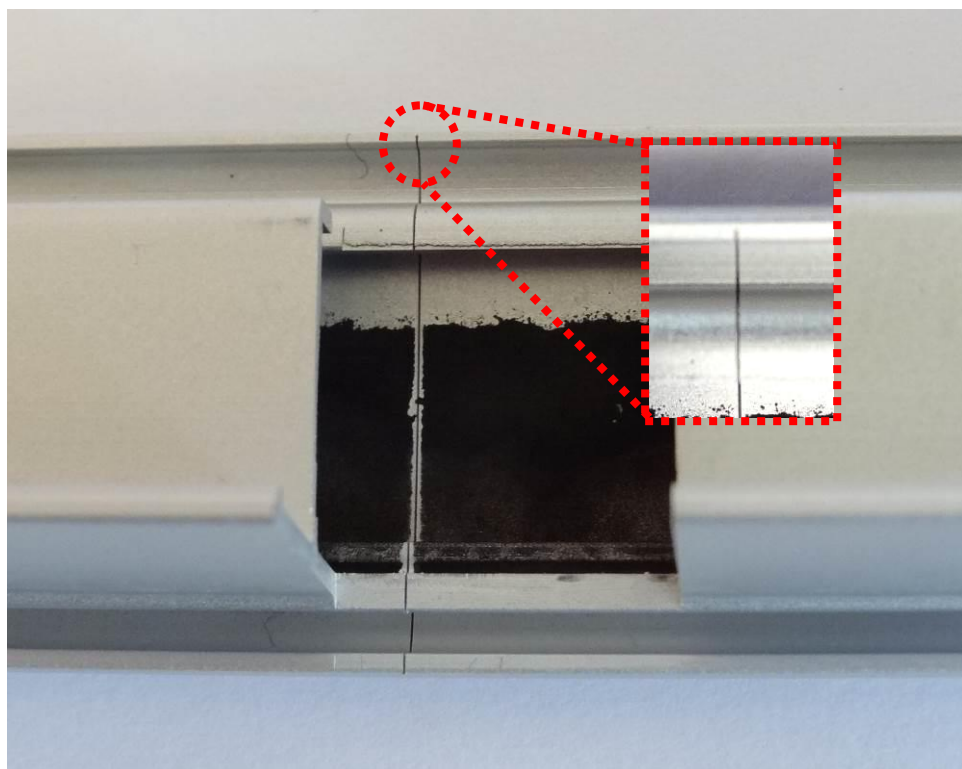


PICTURE 3: Different steps of scribing



PICTURE 4 : Back side of the rail

As can be seen in picture 4, the back side of the rail does not show any flaw from the scribing process.



PICTURE 5 : Scribing of the rail



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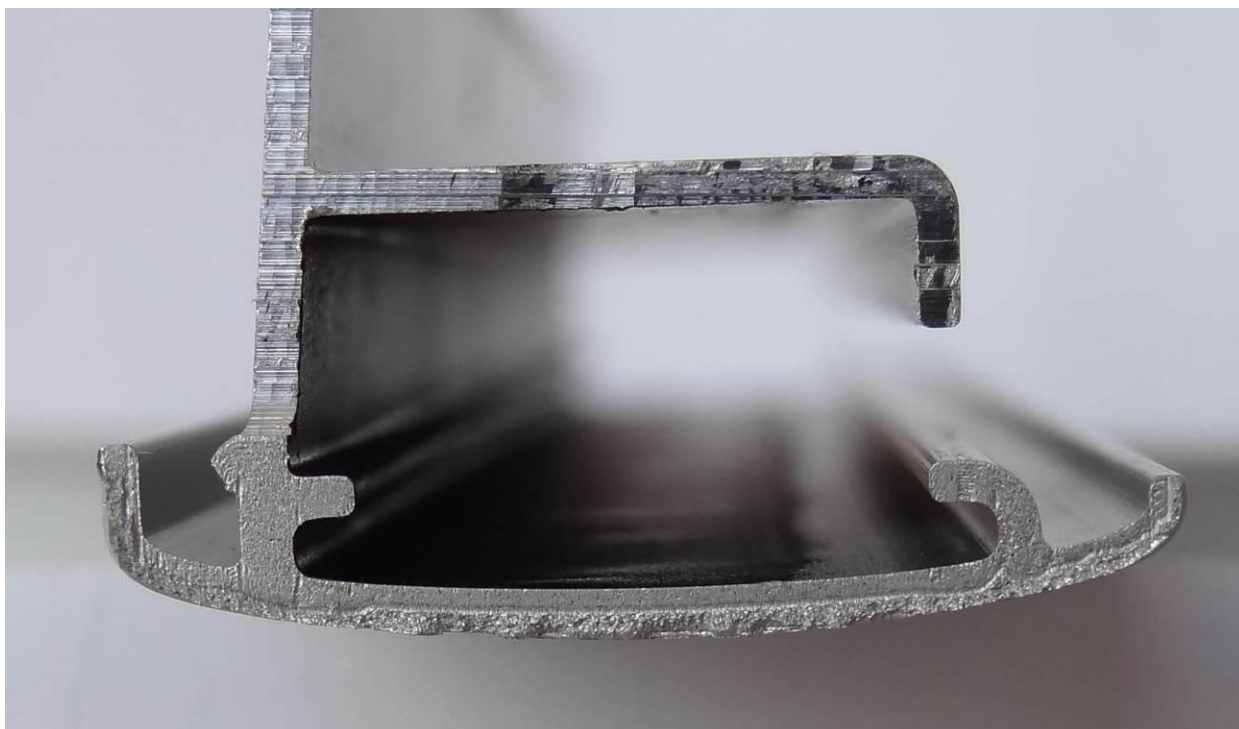
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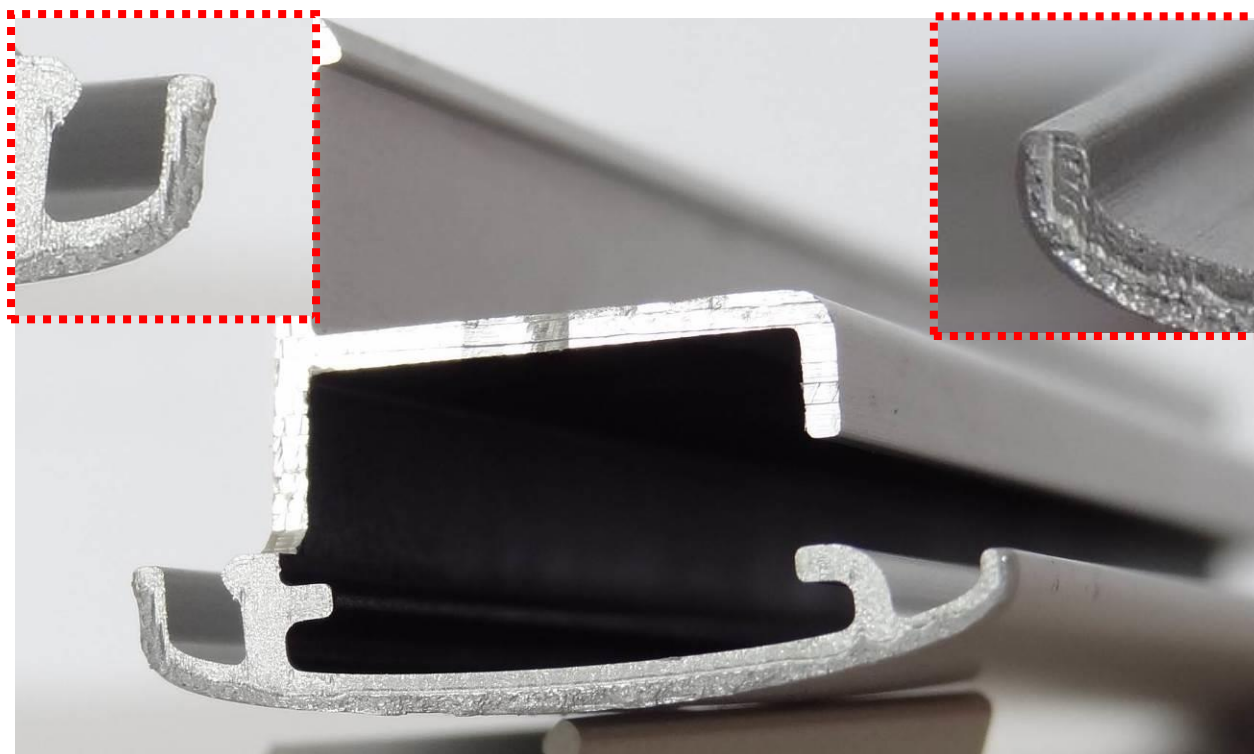
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PICTURE 6 : Profile of the broken rail after scribing

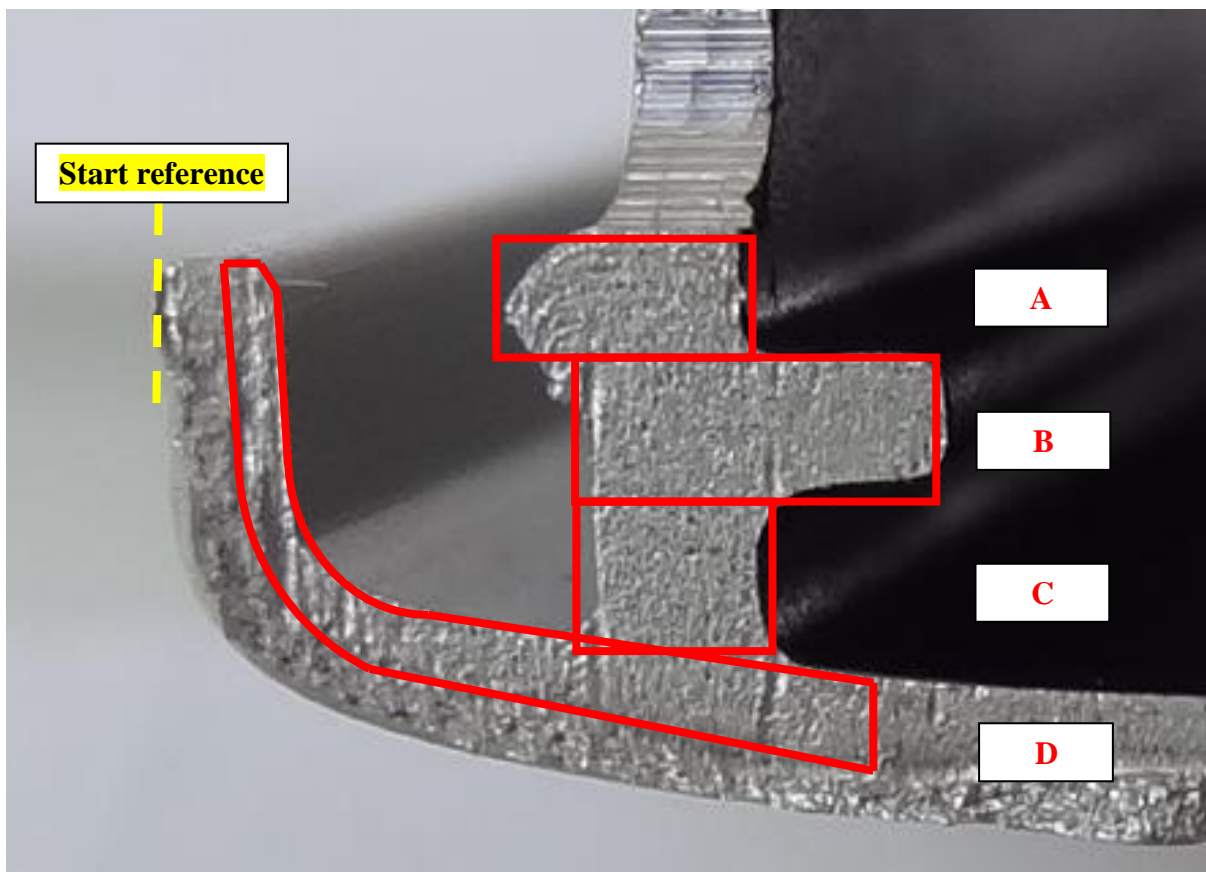


PICTURE 7 : Profile of the broken rail after scribing

4.2. NC PROGRAMS

All the parameters for each step with their parts (A, B, C... L) are summarized in the last table p.9.
 The program uses the start reference shown on PICTURE 8 for its moves for the two first steps.

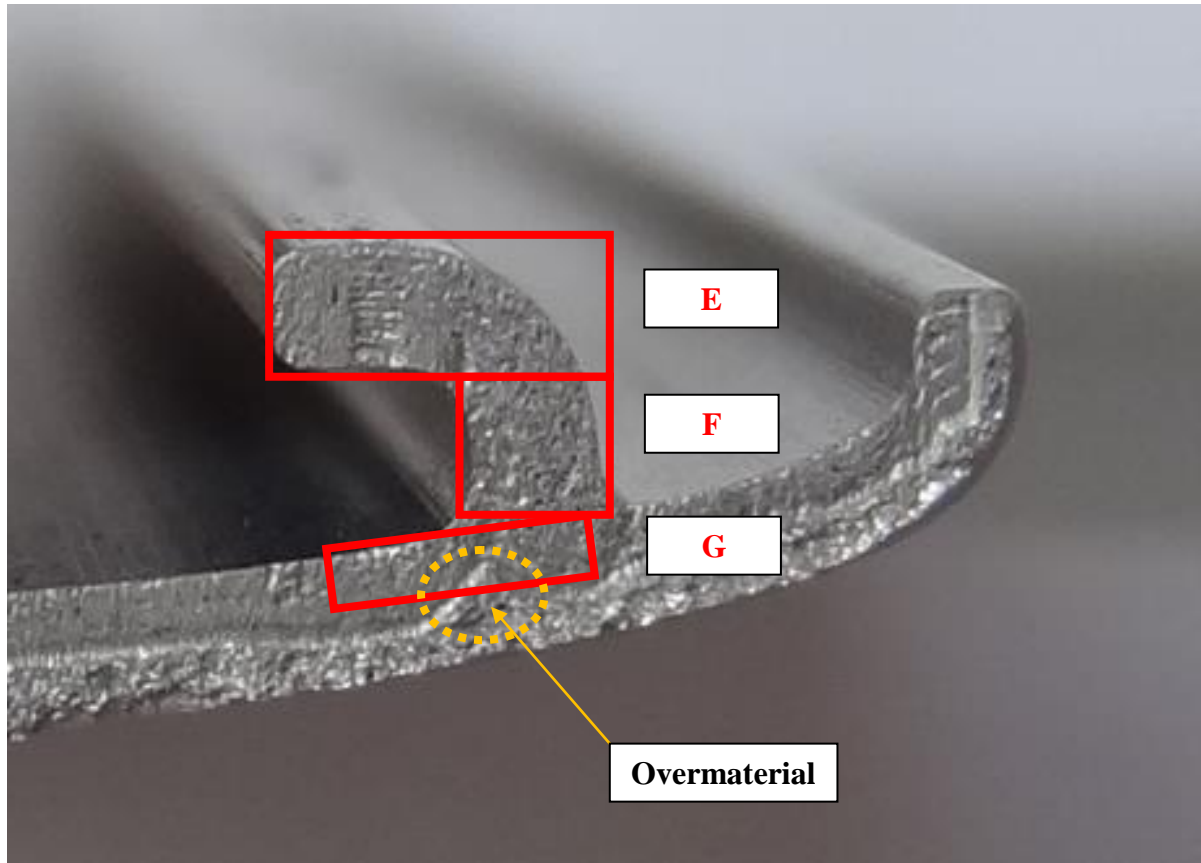
Step 1:



PICTURE 8 : Scribing step 1

A, B and C are the first parts cut by the LMJ according to the dimensions on the drawing 836632.
 D is the last part of this step, it is used to remove the overmaterial and begin to scribe the left side of the sample at the same time.

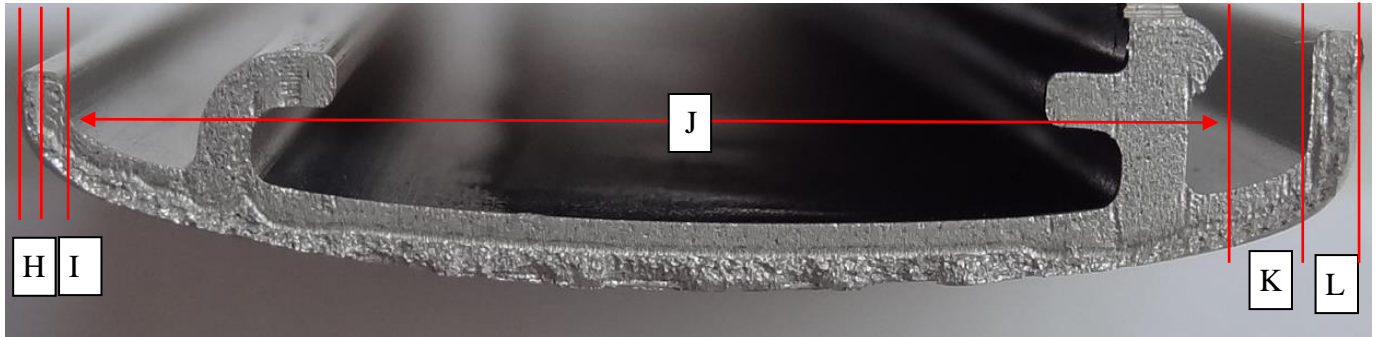
Step 2:



PICTURE 9 : Scribing step 2

E and F are the parts cut by the LMJ according to the dimensions on the same drawing, and the part G, as the part D on the previous step, is there to remove the overmaterial. However it still remains a bit of aluminum after G.

Step 3:



PICTURE 10 : Scribing step 3

This step is the last one which scribes all the rail width divided into different parts shown on the PICTURE 10. There the start reference is move to 0.1mm on the right from the previous one. In order to respect the drawing as well as possible and to get a regular final scribing, each part has its own speed and number of passes shown in the table p.9.

The scribing process with these parameters cuts at about 0.4 mm depth.

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The process time for the two first steps is 23s (NC program: Steps 1&2)

The process time for the third step is 18s (NC program: Step 3)

Please note 7s by program still have to be removed due to the load/unload inherent time.

Scribing part	Number of passes	Cutting speed (mm/s)	Width (mm)
A	8	20	1.9
B	10	20	2.8
C	28	20	1.35
D	7	20	4.9
E	10	20	2.8
F	5	20	1.3
G	6	20	2.5
H	9	70	0.55
I	9	5	0.35
J	9	30	22.05
K	9	13	1
L	9	7	0.45

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5. CONCLUSION

The cutting of the aluminum rail has been performed with a Synova LCS300. This machine is based on the Laser MicroJet® technology and combines the advantages of a 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 cutting and scribing aluminum rails.

This application demonstrated the feasibility of the process using the Laser MicroJet® technology.

We are open to further discuss your needs regarding:

- The process time;
- The work piece cleaning;
- The pattern;
- The handling;

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