Laser drilling of micro-holes in cutting tools

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Innosuisse - Swiss Innovation Agency

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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In collaboration with

Eskenazi SA, Geneva

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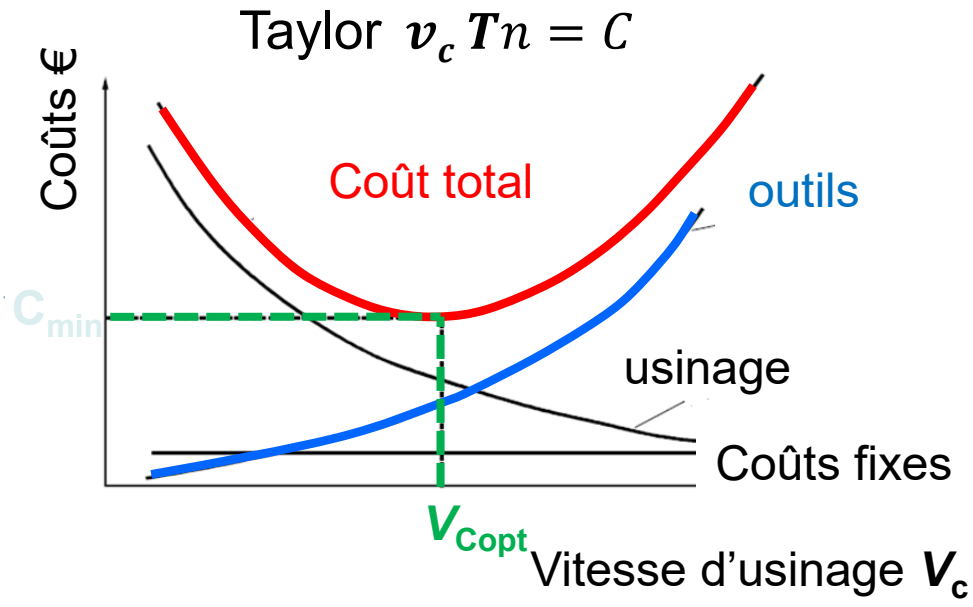
EPHJ LE MONDE DE LA HAUTE PRÉCISION

Patent Pending EP 3741500A1

Introduction



Lubrifier pour:

- Evacuer les copeaux
- Lubrifier la zone de coupe :
  - réduction friction
  - éviter adhésion
- Refroidir l'outil

→ **USURE**

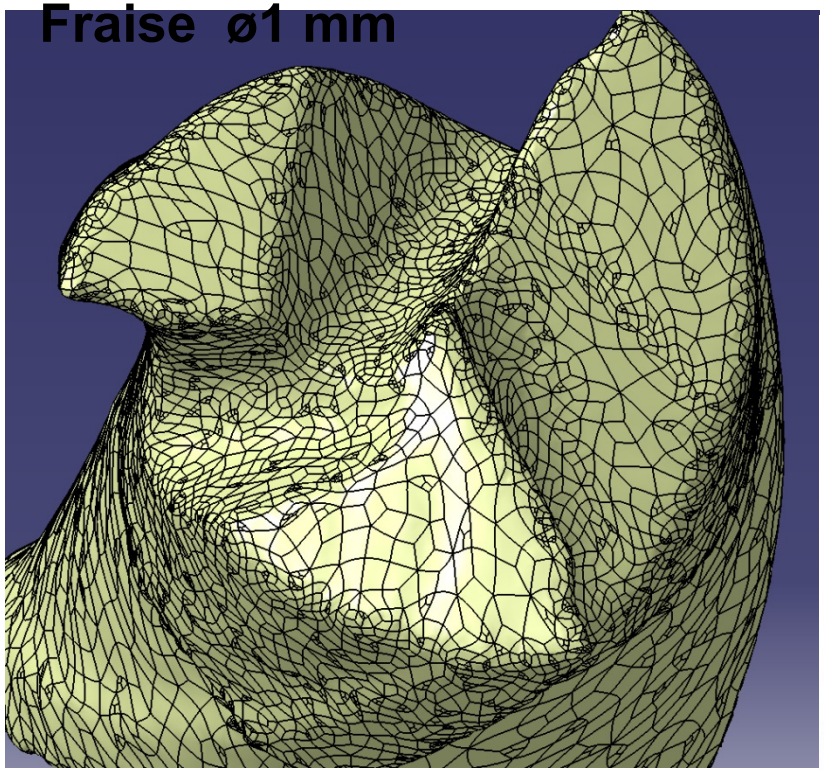
- Durée de vie
- performance
- consumation d'énergie

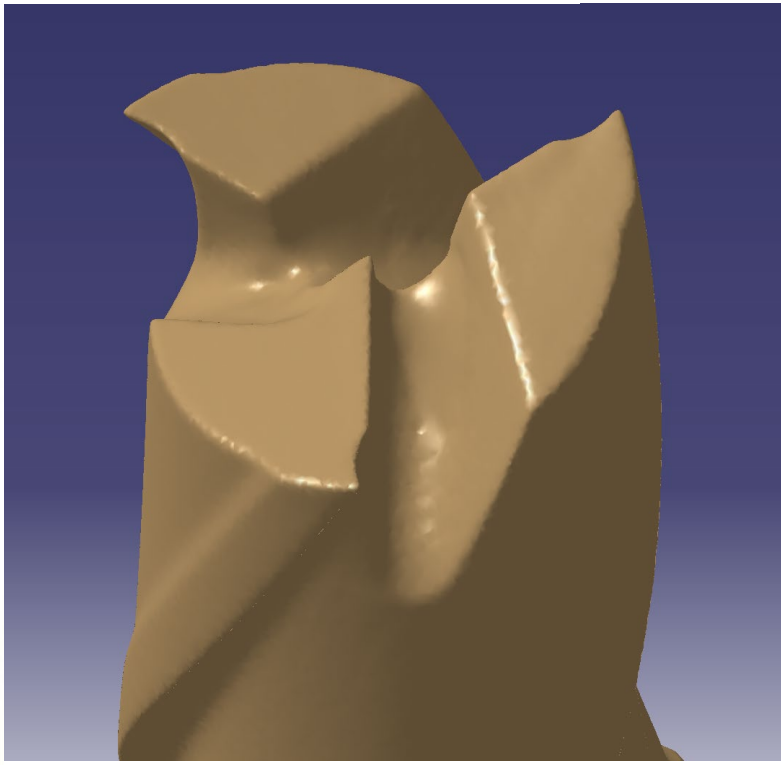
L' idée – 1er étape

Optimisation lubrification:

Idée : arrosage latéral

Fraise ø1 mm





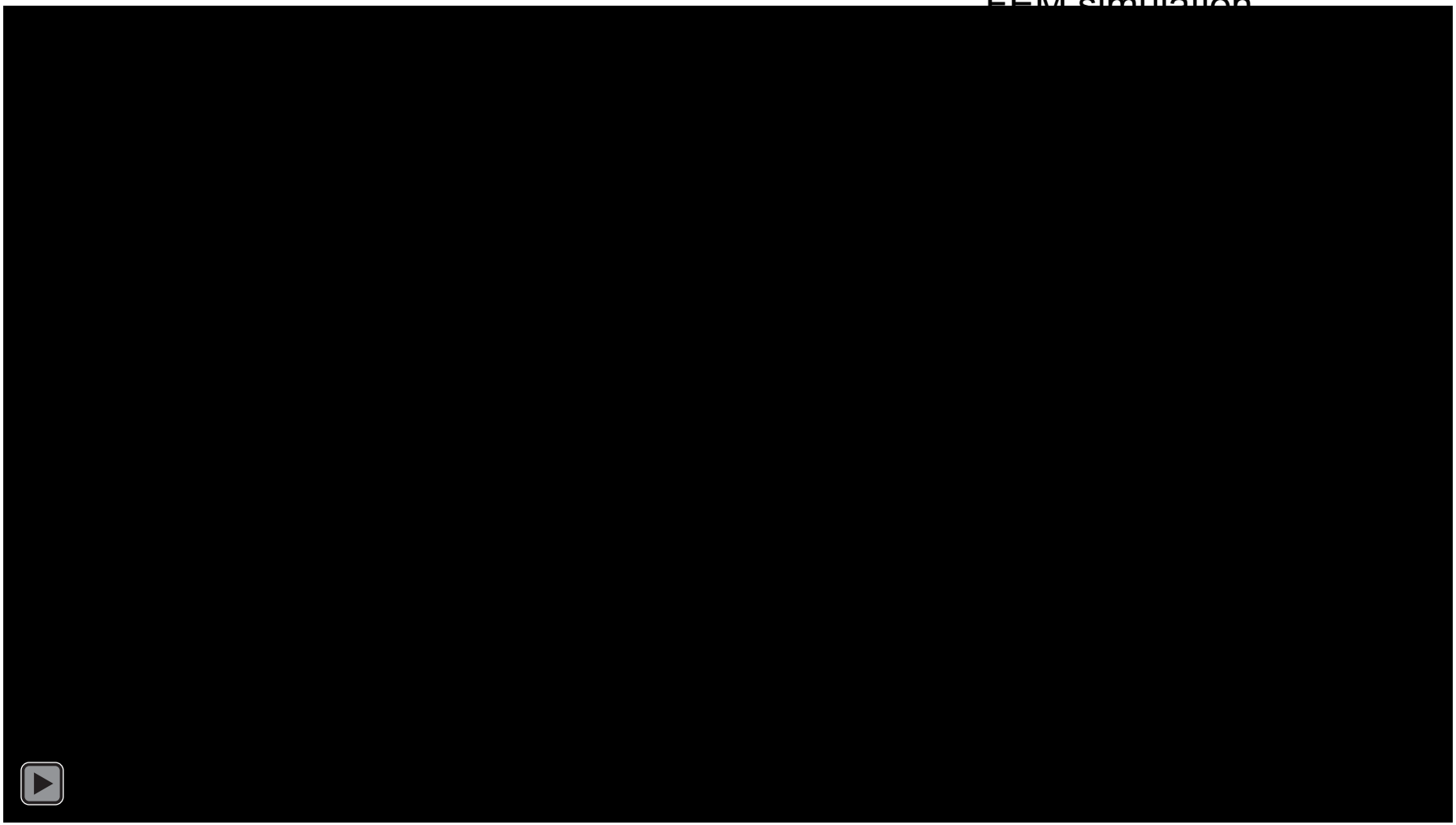
CT Scan of
Ø 1.0 mm

Reconstruction CAO

Lubrification

Fluid simulation

FEM simulation

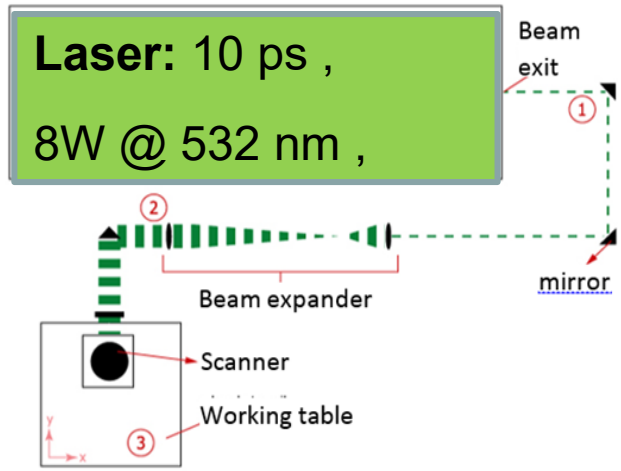


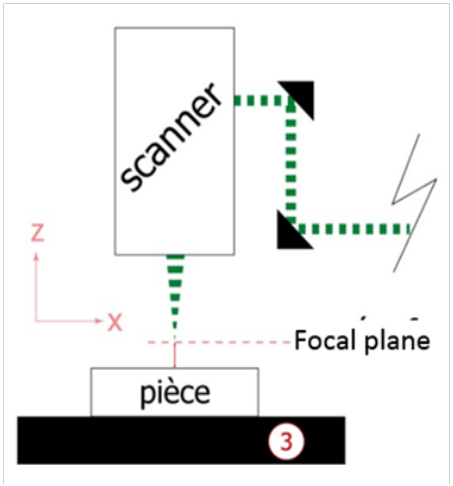
Perçage LASER

Material & Equipment

Laser: 10 ps ,

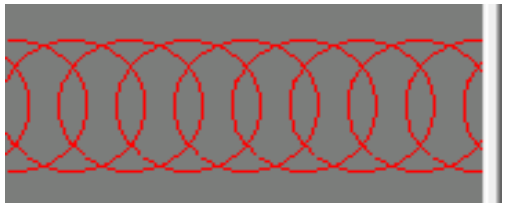
8W @ 532 nm ,

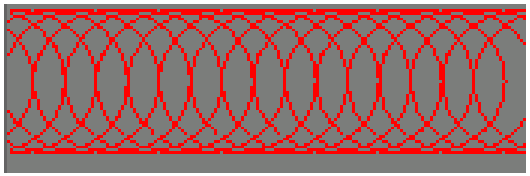


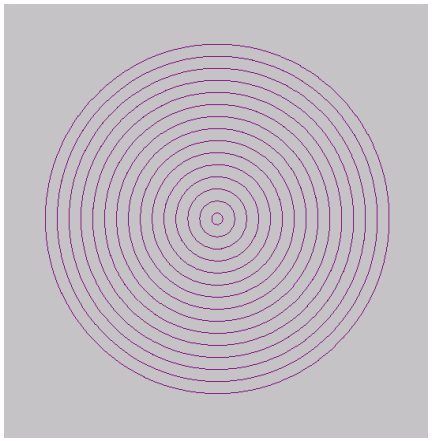


Optimisation des paramètres et faisceaux Laser

- Fréquence d'impulse
- Pulse- énergie
- Vitesse d'écriture,
- distance hachure
- # & géométrie de parcours
- Distance focal
- ….

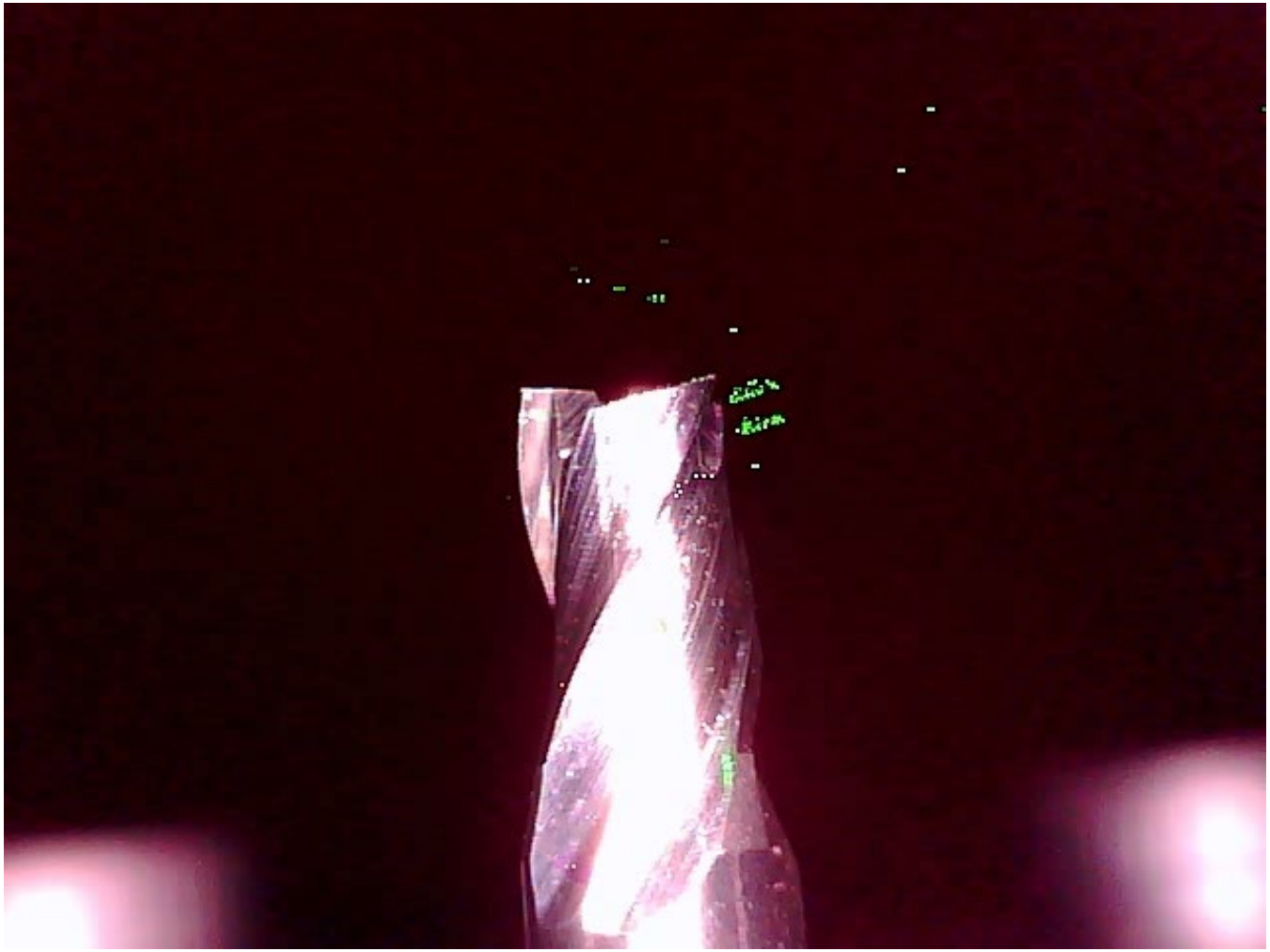






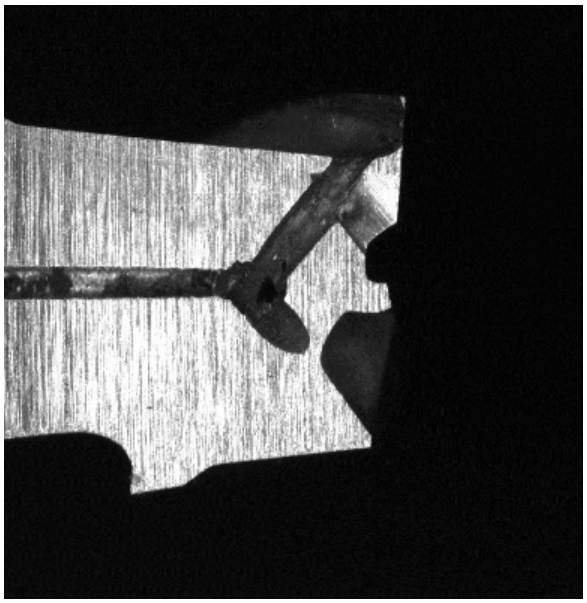
Perçage LASER

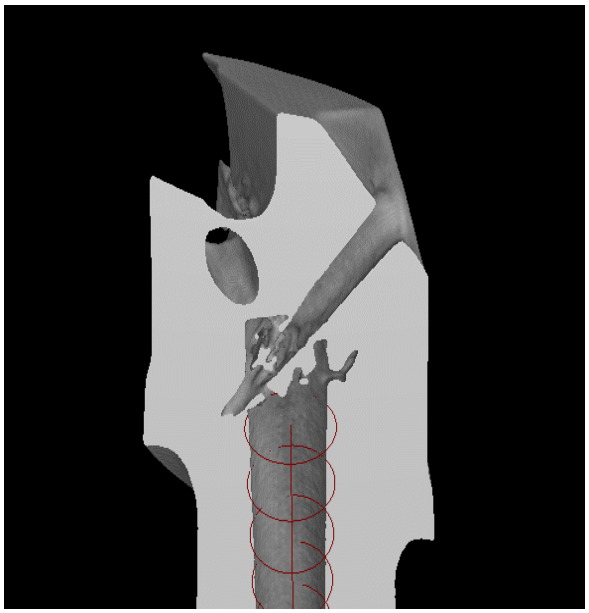
Laser drilling

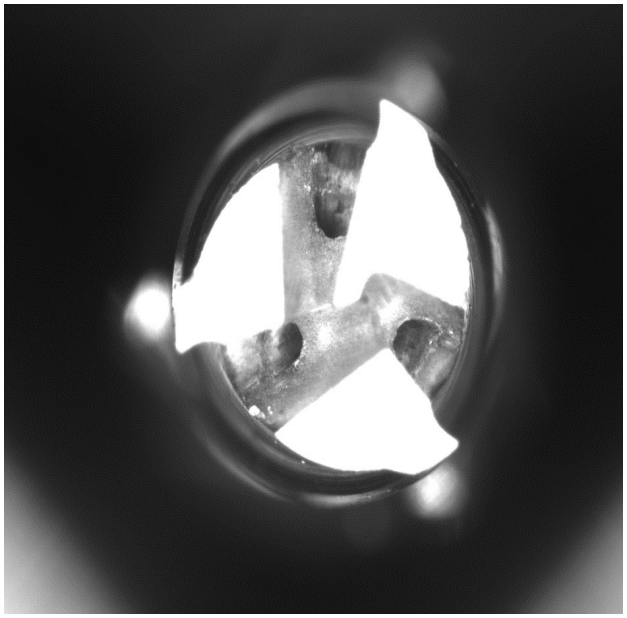


Percage LASER

Fraise avec trous percés



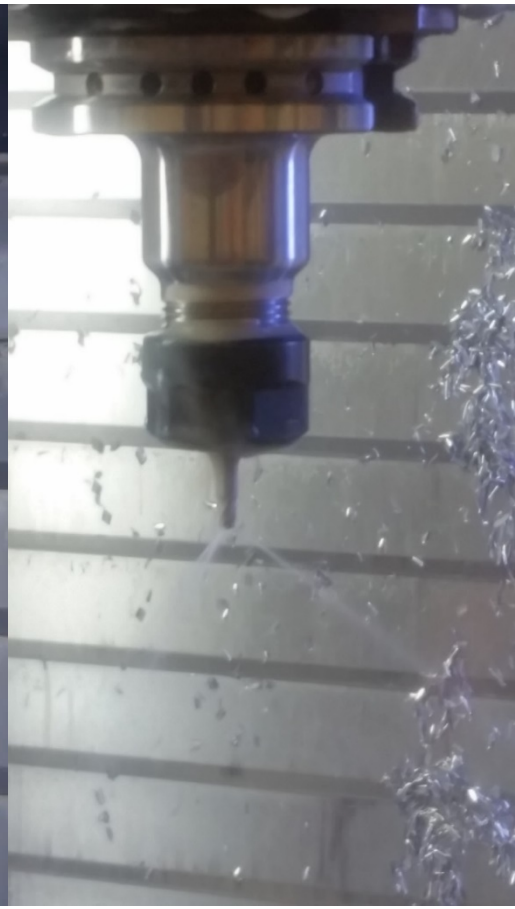




Fraise ø2.5 mm (rectifié)

CT scan fraise ø1.0 mm photo

Milling tests



Milling tests

Material	Brass without lead	Brass without lead	Stainless steel 316L
Tool ø	**2.5 mm**	**1.0 mm**	**1.0 mm**
Ae	2.5 mm	1.0 mm	1.0 mm
Ap	2.5 mm	1.0 mm	0.5 mm
Vc	115 m/min	46 m/min	40 m/min
Vf	659 mm/min	220 mm/min	66mm/min
path length	150 mm	150 mm	100 mm

Cutting length (mm) in 316L of Ø 1.0 mm tools before rupture.

tool	no hole	with 3 holes
1	3800	16000
2	6250	9800
3	2400	5100
total length	**12450**	**30900**

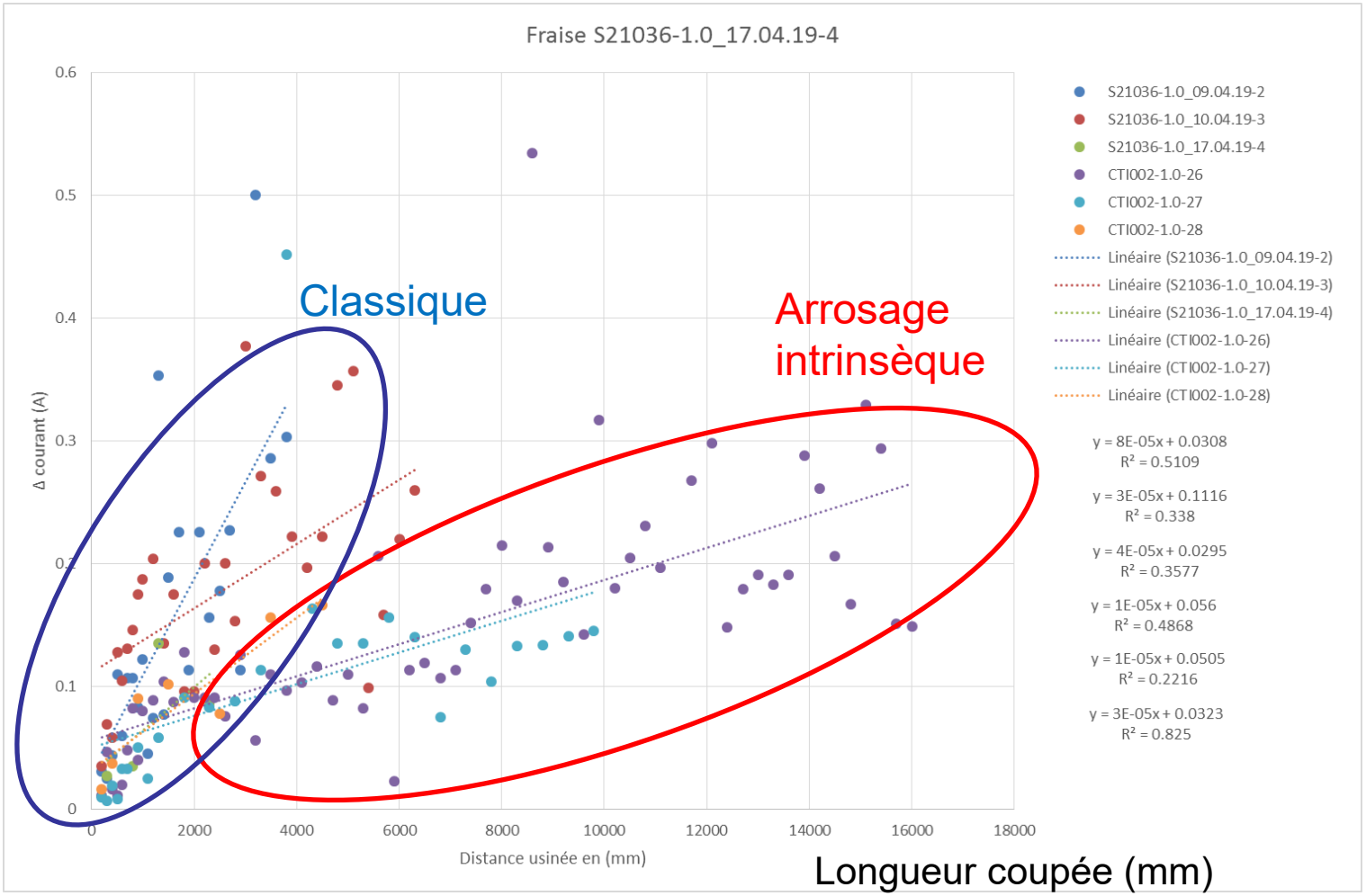
x **2.48**

DMG « DMU-60
émulsion Blaser Swisslube à 4%
@ 20 bar

Results of the Milling tests

Essaies de fraisage (inox) outil ø 1,0 mm: & mesures de la force

Force (Amp)



Longueur coupée (mm)

Resumé

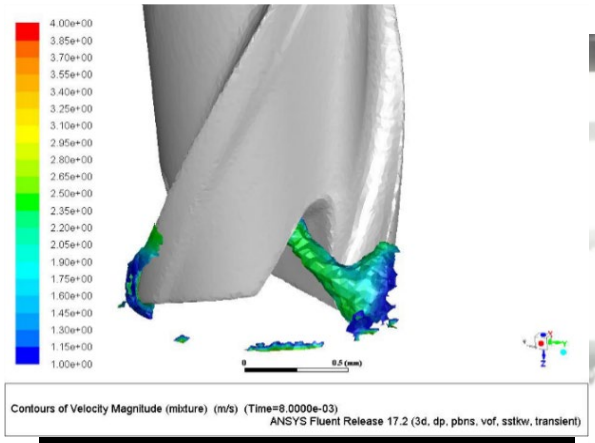
Optimisation lubrification
- Arrosage latéral

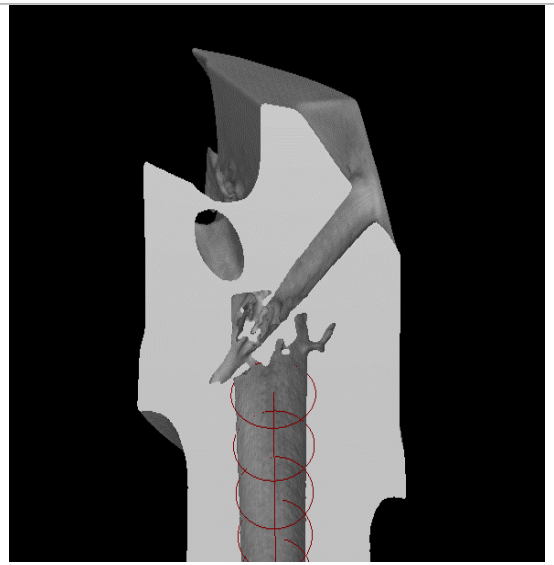
Perçage ps-Laser :

- 3 trous ø 0.12 mm
  fraise ø 1 mm en carbure

Test d'usinage
Durée de vie / longueur (316L):
Augmentation de 2.4 x

Réduction des forces de coupe et meilleur état de la surface





? Questions ?

Merci Innosuisse CTI- No 26205.2 PFIW-IW