



# WatAJet

 **spin off**<sup>®</sup>  
POLITECNICO DI MILANO

HIGH PRECISION CUTTING WITH MICRO ABRASIVE WATERJET



# EXPERTISE AND KNOWLEDGE FROM UNIVERSITY TO INDUSTRY



**VR** Vito Rimoldi SpA :

**2009: consultancy agreement**

**July 2010: Master thesis**

*Numerical simulation of a pure water jet inside an orifice: jet stability and effects of droplets collisions*

**2011: research agreement**

**April 2012: Master thesis**

*Analisi numerica e sperimentale del processo di efflusso attraverso un ugello innovativo per applicazioni pure water jet*

**July 2013: Master thesis**

*Experimental and numerical characterization of an innovative air assisted pure water jet system*

**December 2013: Master thesis**

*A novel air assisted abrasive waterjet concept for microcutting applications*

**2013: research agreement**

**January 2014: PhD thesis**

*Air-assisted water jet cutting technology*



From University



to industrial world

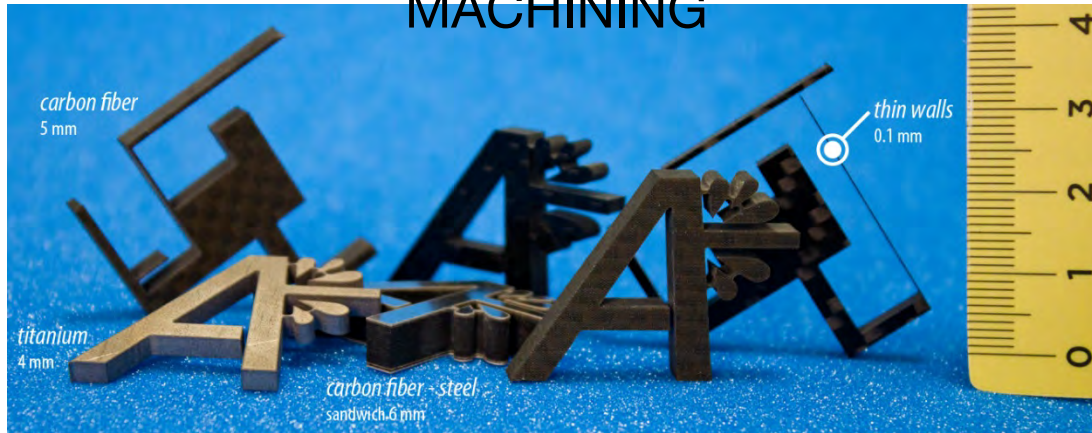


**WatAJet**





## HIGH PRECISION AND QUALITY MACHINING

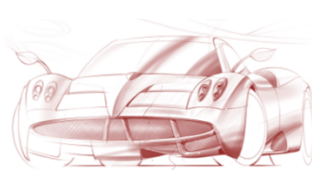


- high accuracy: **down to 10  $\mu\text{m}$**
- excellent **surface finish < 1  $\mu\text{m}$  (Ra)**
- small and complex features < 1mm
- completely **material independent**
- **High thickness** machining
- **no HAZ** nor thermal distortions
- low mechanical residual stresses
- high **flexibility**
- easy **setup**
- **fast delivery times**

STEEL – TITANIUM – MAGNESIUM – COMPOSITES – CERAMICS – SANDWICHES – PLASTICS



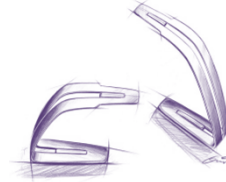
Watchmaking



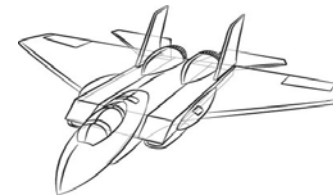
Automotive



Biomedic  
and surgery



Luxury&Design



Aerospace



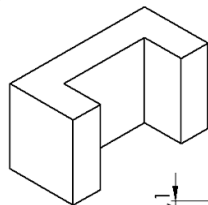
Electronics



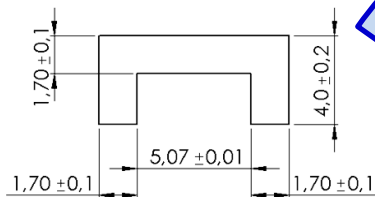


# THE VIRTUOUS CIRCLE ATTITUDE: think – design – make - inspire

Tell us your ideas, needs and requirements



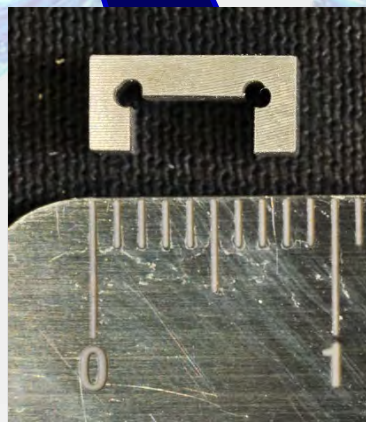
THINK



INSPIRE

Foster new ideas  
through the new  
possibilities  
offered by  $\mu$ AWJ  
technology

Steel – 5mm thick



DESIGN

We support the  
functional design or re-  
design of your part  
focusing on its  
functional requirements  
and feasibility

MAKE

Produce your final parts and  
Check its quality and  
functionality







# OUR $\mu$ AWJ CUTTING SYSTEM



## Main features:

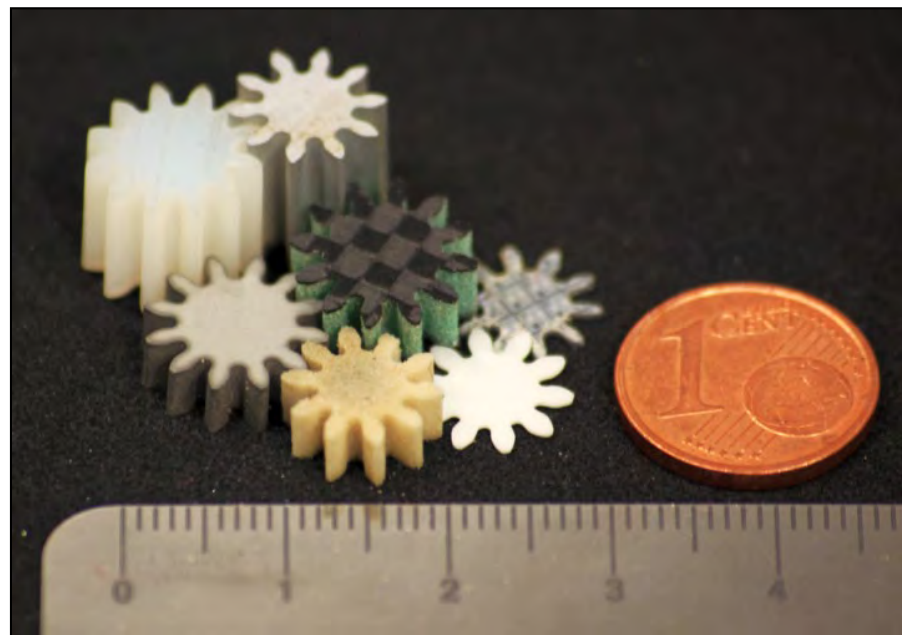
- 2 working areas: 480X580 mm
- Positioning precision:  $< 2.5 \mu\text{m}$
- Machining accuracy:  $< 10 \mu\text{m}$





# $\mu$ AWJ CUTTING TEST on different materials

- Aluminum 10 mm
- Nylon 9 mm
- Titanium 4 mm
- Alumina 0.5 mm
- Silicon 0.3 mm
- Sandwich 5 mm
- Rubber 4 mm



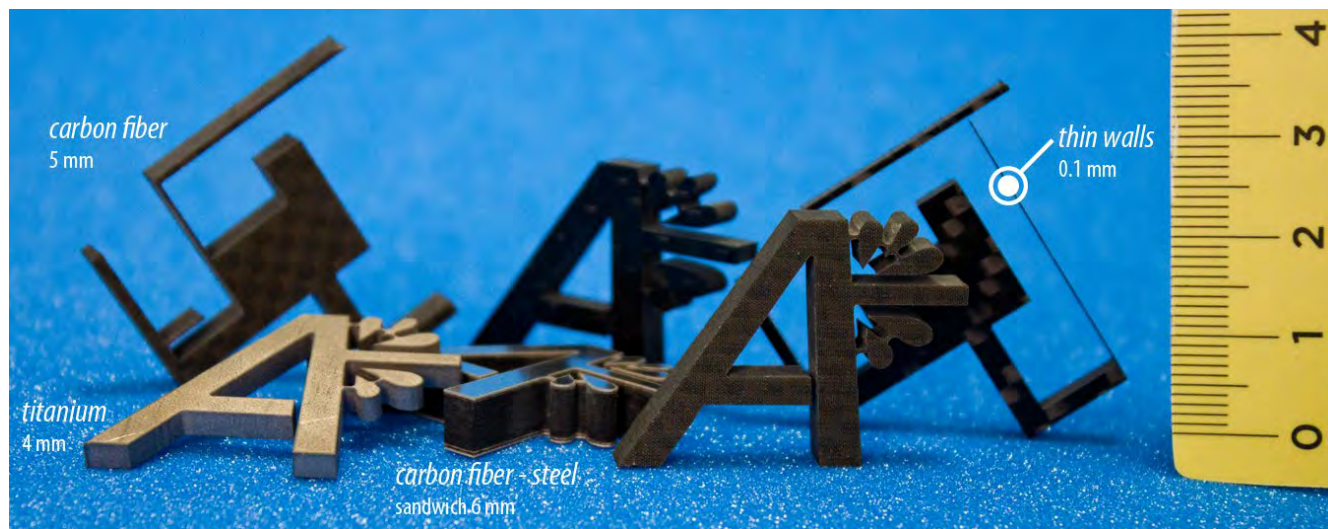
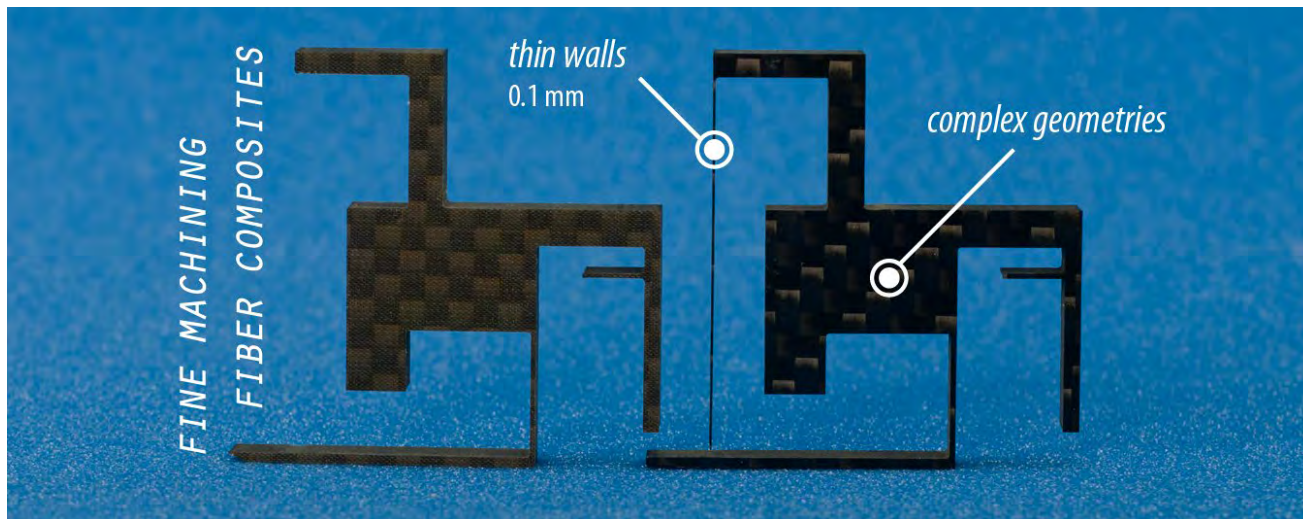
*9 mm carbon fiber composite cutting*





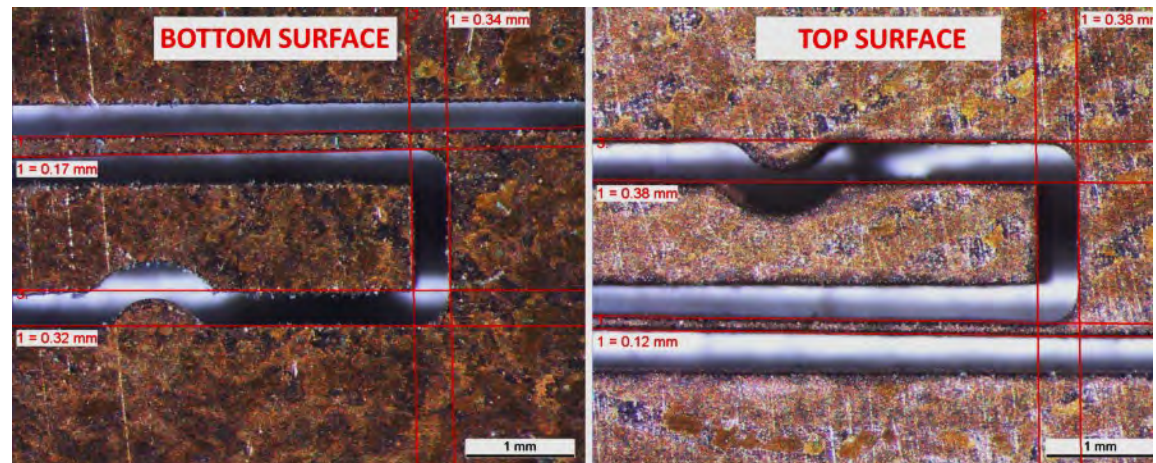
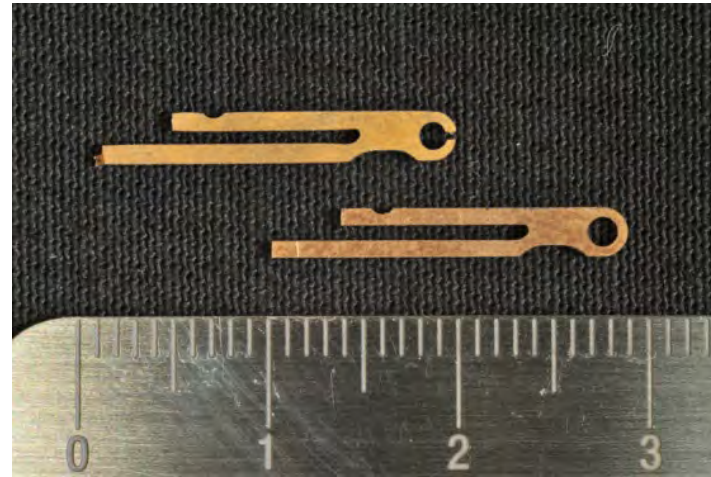
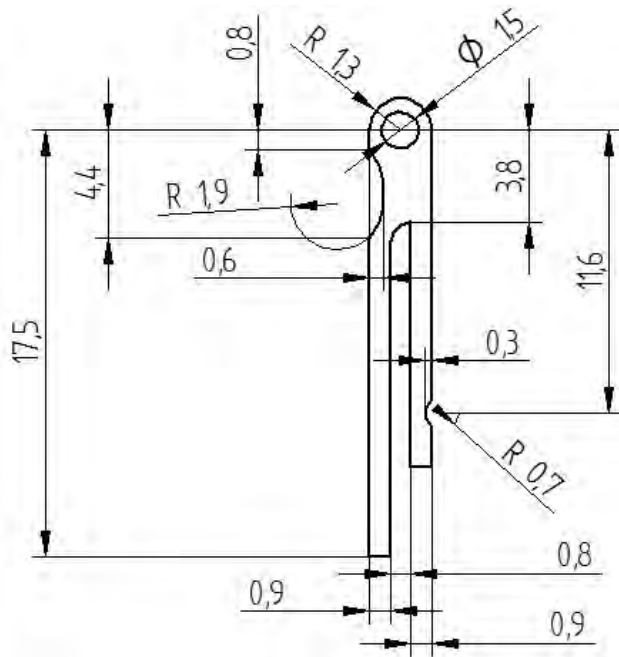


# $\mu$ AWJ CUTTING TEST on different materials





# $\mu$ AWJ CUTTING of an electrical connector

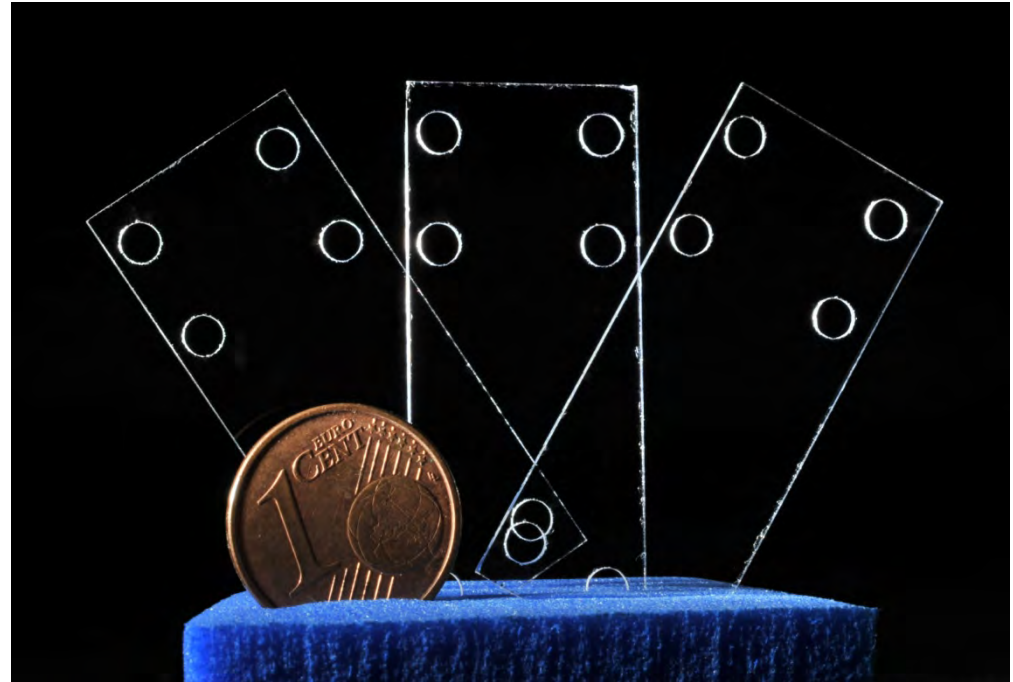
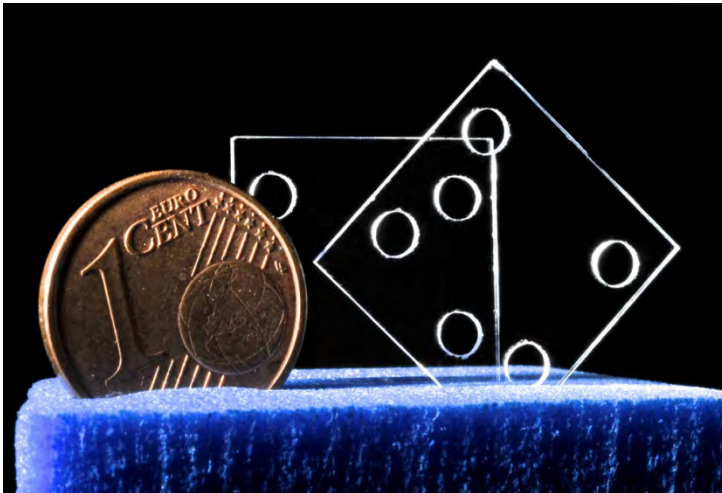


Top and bottom kerf of a copper electrical connector machined by  $\mu$ AWJ






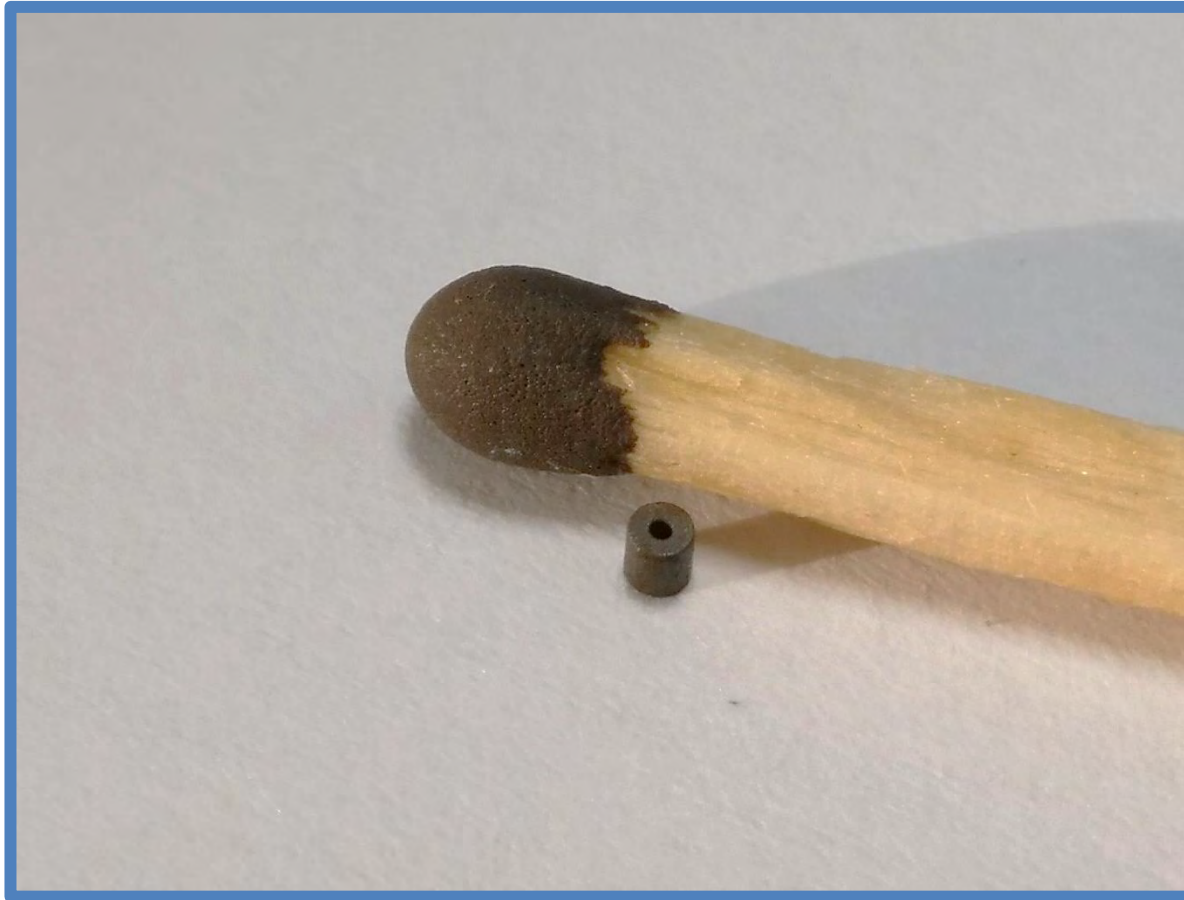
*3 mm diameter holes  
performed with  $\mu$ AWJ  
in a 0.6 mm thick  
quartz plates*



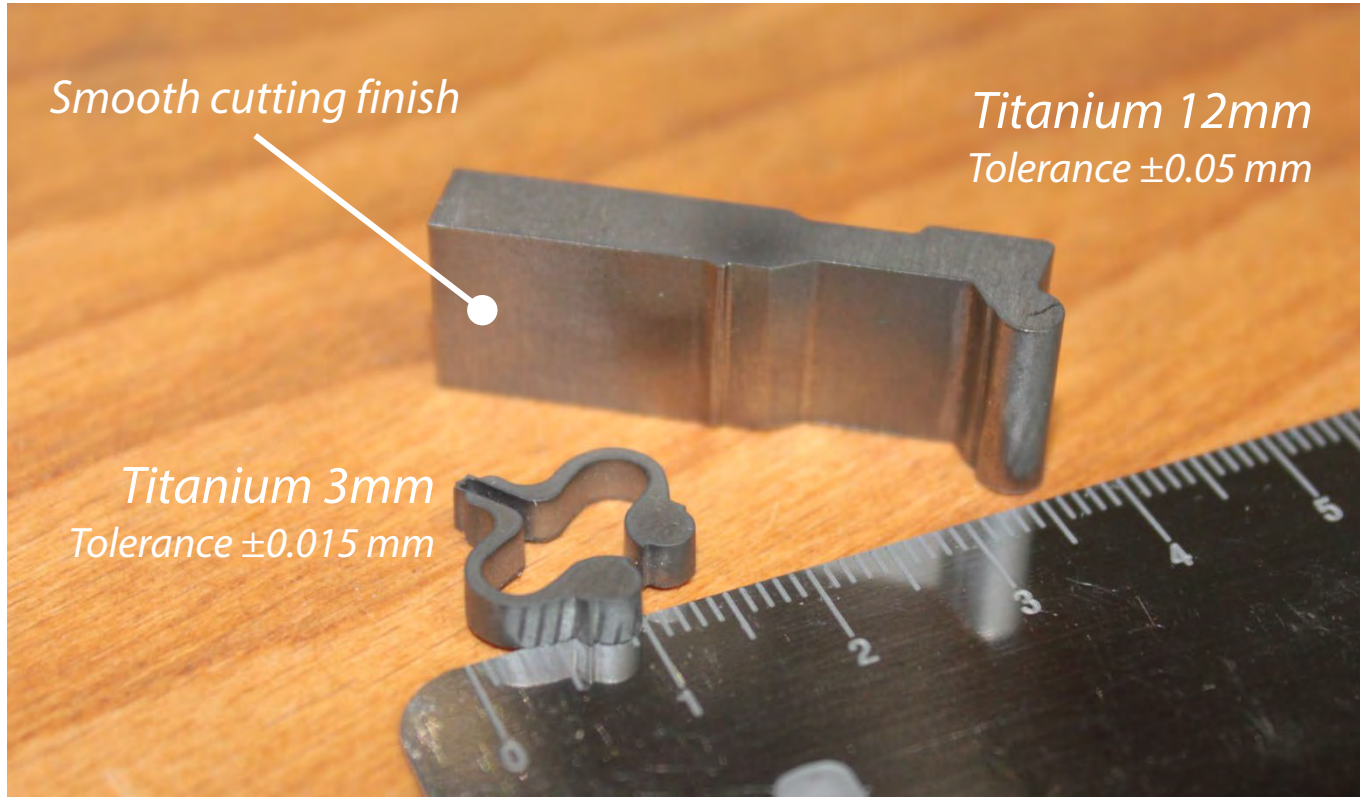
*Components for electronical  
applications*

*In collaboration with*  **Consiglio  
Nazionale delle  
Ricerche**





*Micro cylinder in brittle material 1 mm thickness; 0.4 mm ID, 1.1 mm ED*

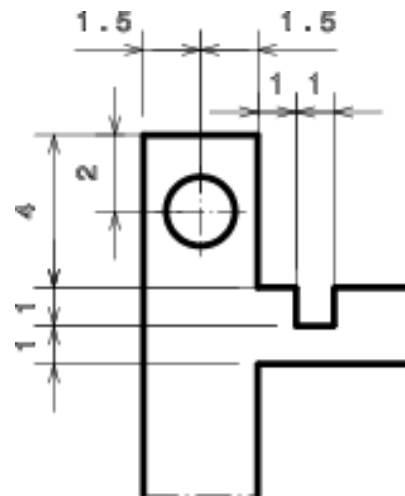
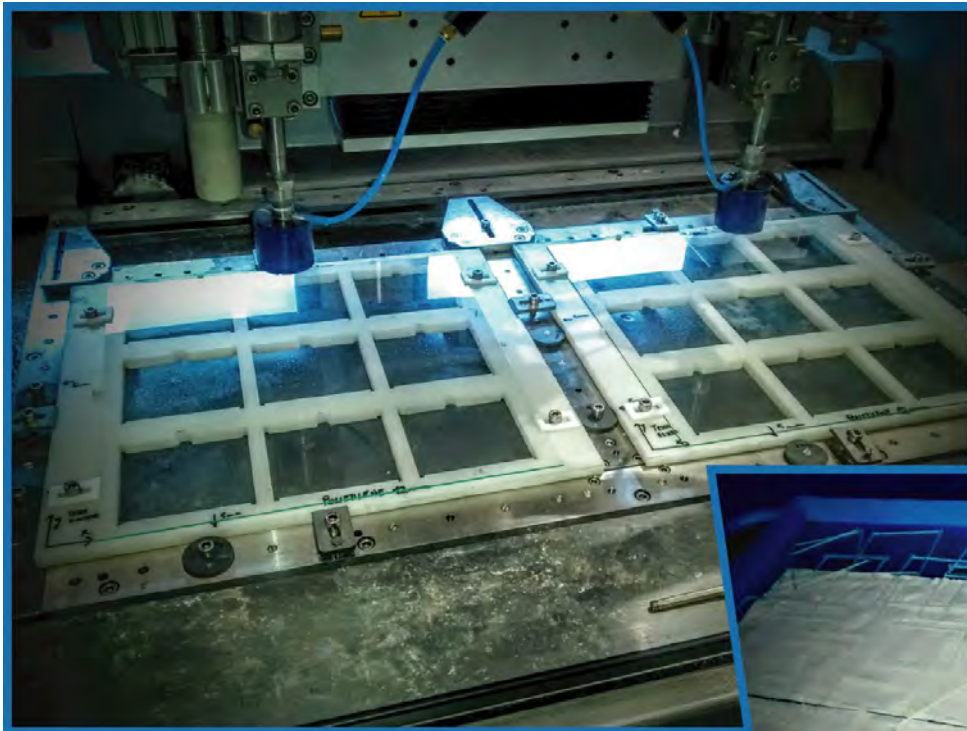


*Titanium Components, 12 mm and 3 mm thickness  
Tolerances  $\pm 0.05$  mm and  $\pm 0,015$  mm respectively*





# $\mu$ AWJ CUTTING of amorphous glass frames



*Detail  
of the frame corner*

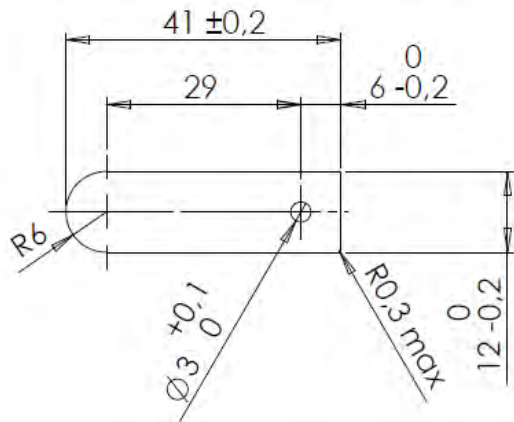
*Slender frames  
with 1 mm thin walls*

*amorphous glass  
thickness 1 mm*





# $\mu$ AWJ CUTTING of pre-series or prototypes



Stainless steel 0.5 mm thick



***Preparatory prototypes  
for fine blanking process***







## **Sandwich**

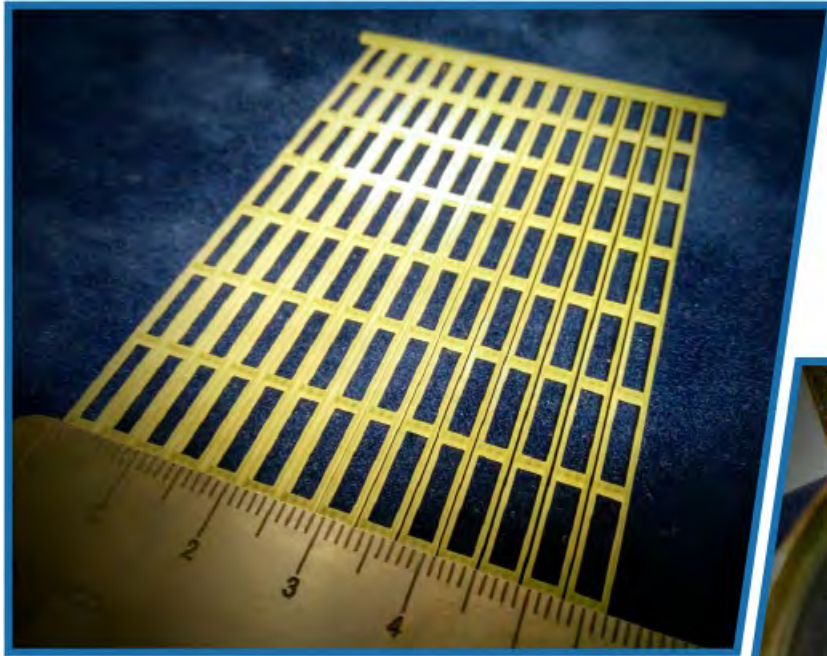
*1mm marble +  
2mm carbon fiber*





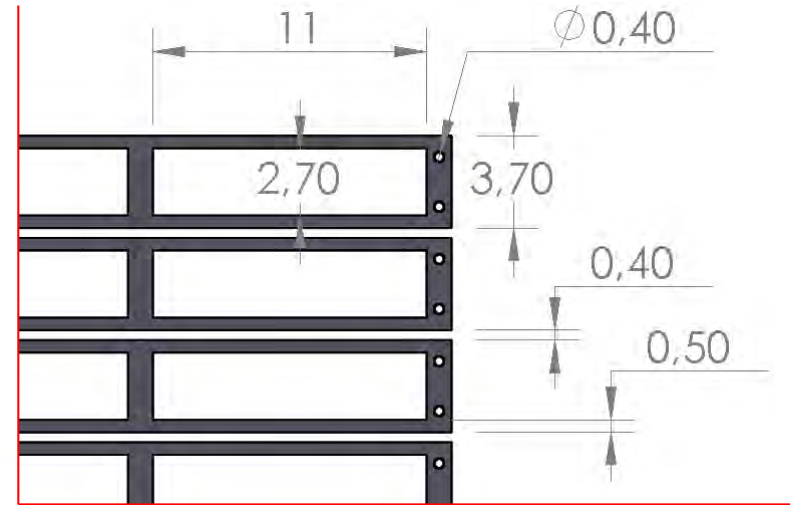


## Emissions detector for applied physics applications



Vetronit frame 1 mm thick with

- Holes diameter 0.4 mm
- Thin walls 0.5 mm
- Gap b/w walls 0.4 mm

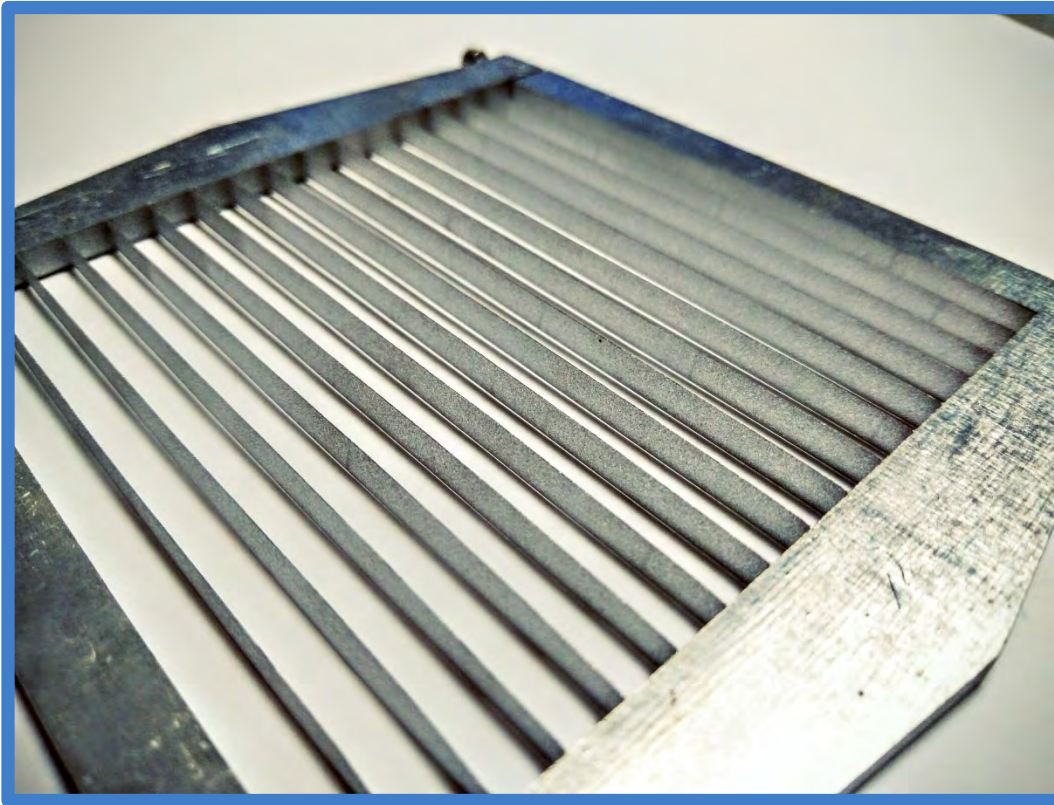


**Detail**  
of the frame corner  
dimensions in mm





## Emissions detector for applied physics applications



Grid with **thin walls 100  $\mu$ m wide**

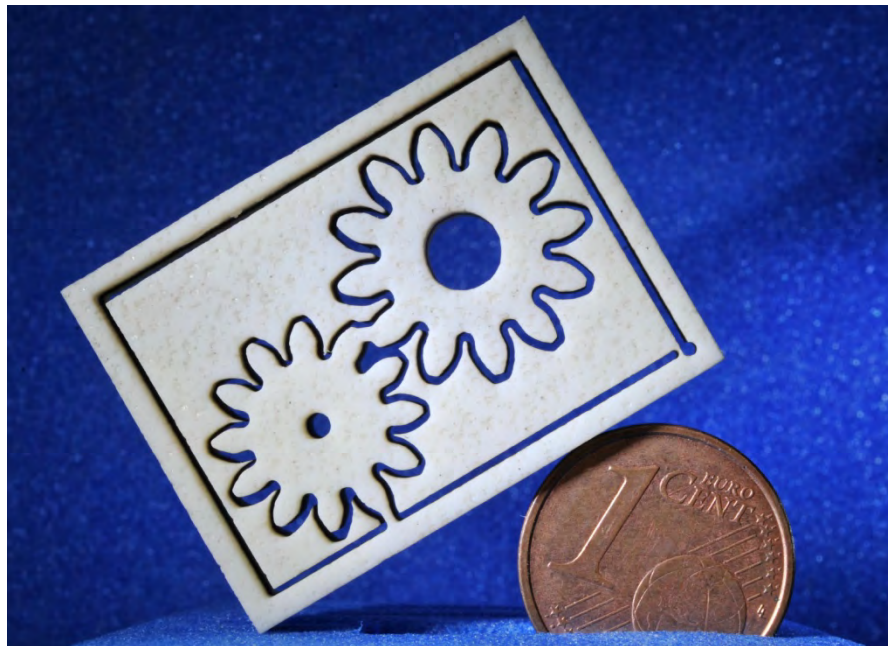
Aluminium and Titanium  
3mm thick

*In collaboration with*  Consiglio Nazionale delle Ricerche



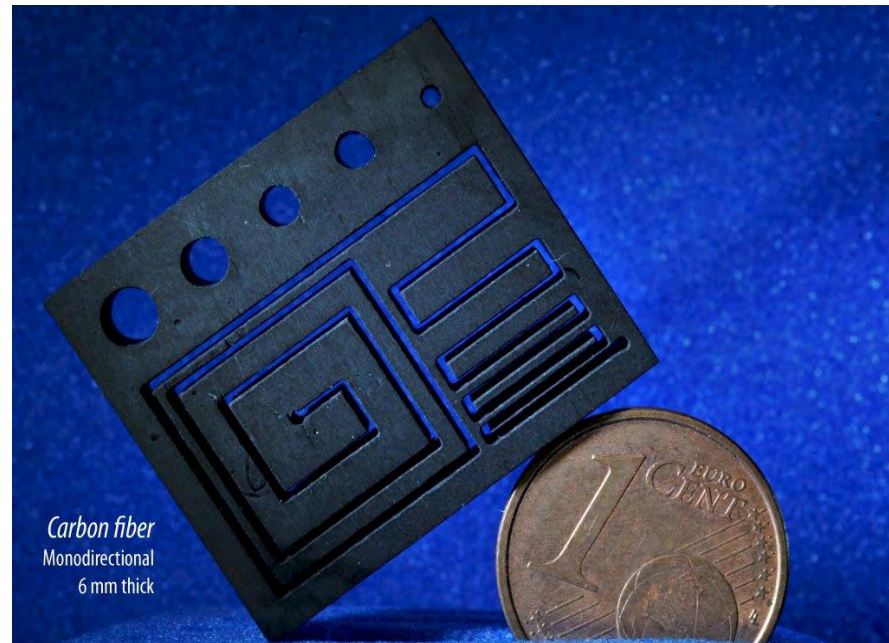


# $\mu$ AWJ CUTTING TEST on different fiber composites



*7 mm thick sandwich of  
glass  
fiber and carbon fiber*

*6 mm thick carbon fiber*



*Carbon fiber  
Monodirectional  
6 mm thick*





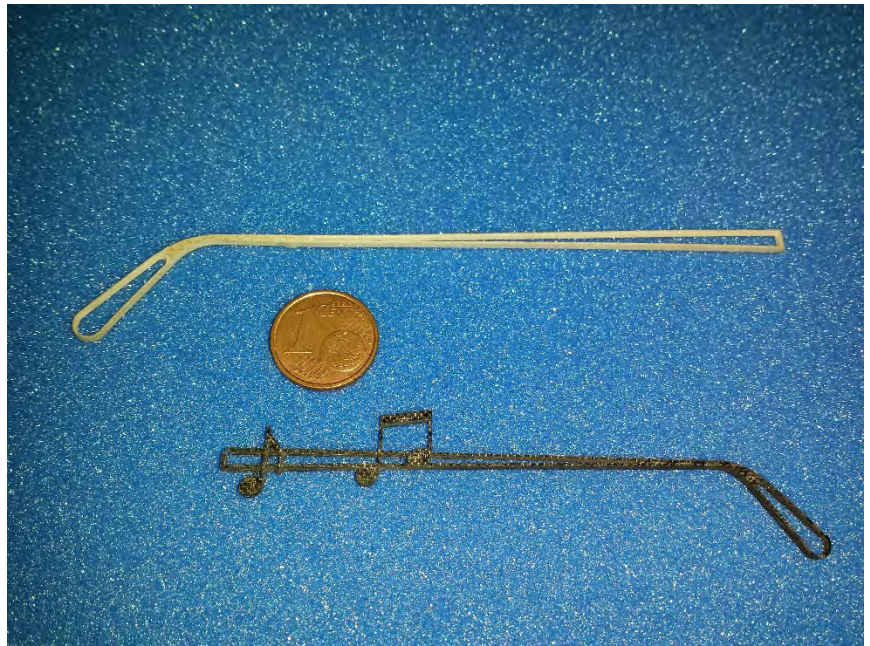


*Musical notes and thin walls on 0.4 mm thick carbon fiber plate*

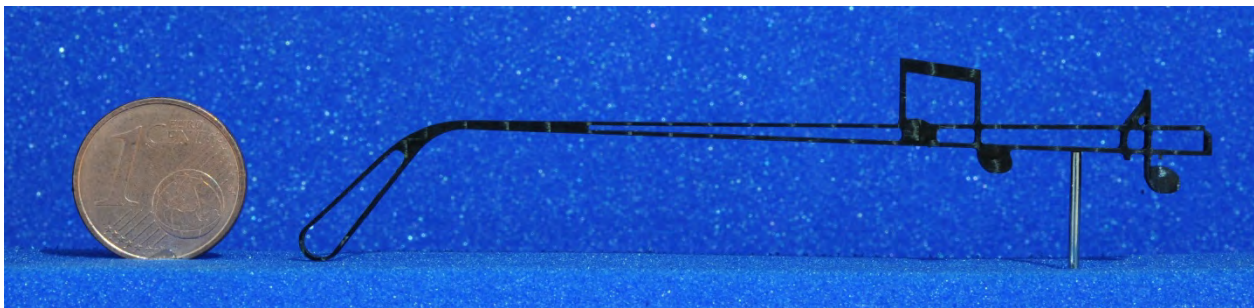


# $\mu$ AWJ CUTTING TEST of eyeglasses dipsticks

*Examples of magnesium (1.3 mm thick) and carbon fiber (2 mm thick) eyeglasses dipsticks*



*Details of the carbon fiber musical*

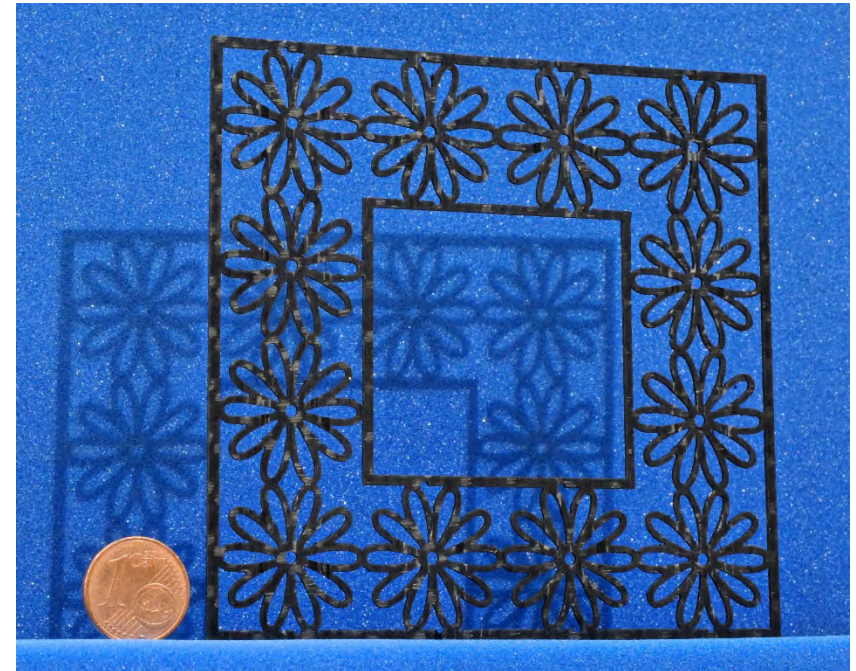






# $\mu$ AWJ CUTTING TEST on carbon fiber samples

*Frame with flowers on  
0.6 mm thick carbon  
fiber*

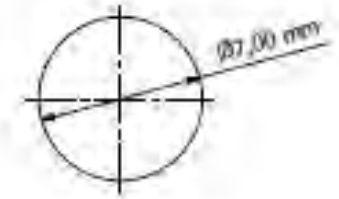
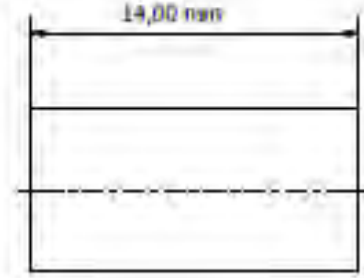


*Water jet logo  
on 4 mm thick carbon fiber*

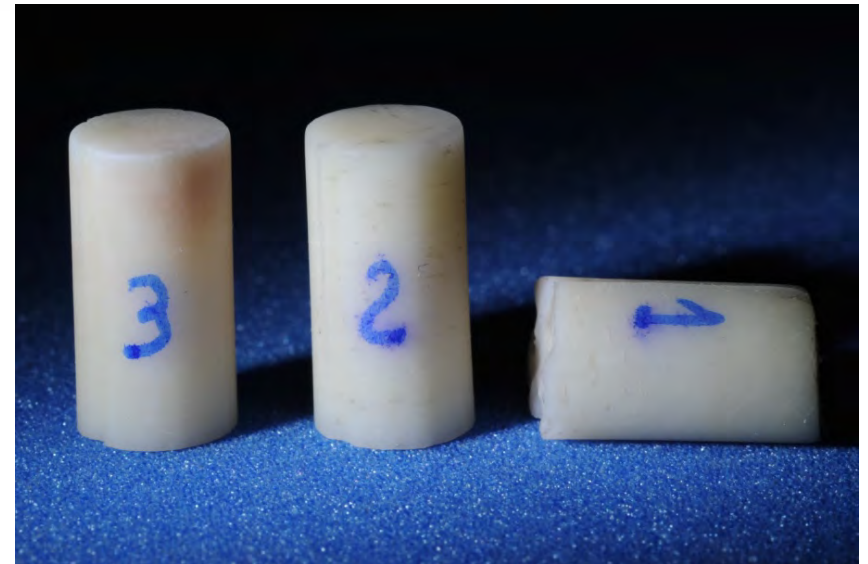




# $\mu$ AWJ CUTTING of bovine bone specimens

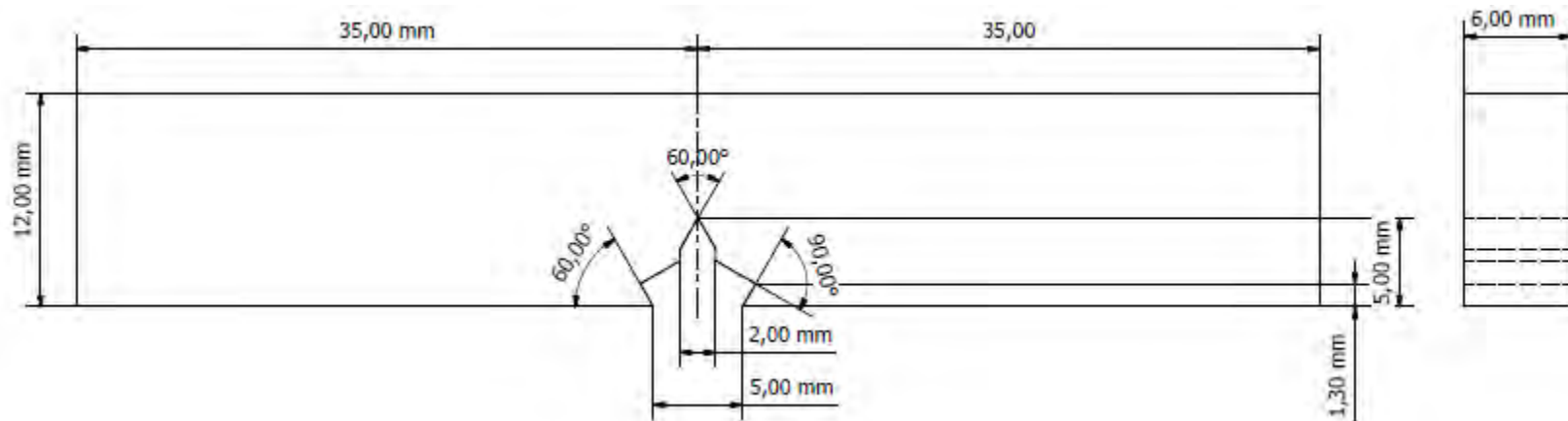


*Bovine bone specimens  
for bio-mechanical applications  
(compression test)*





# $\mu$ AWJ CUTTING of a bovine bone specimen



*Bovine bone specimen  
for bio-mechanical  
applications  
(bending test with  
an induced fracture)*



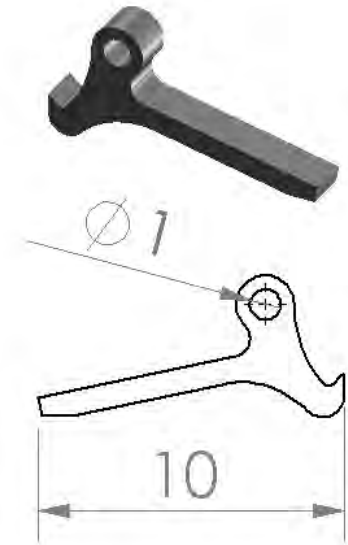


# $\mu$ AWJ CUTTING of a biomedical lever

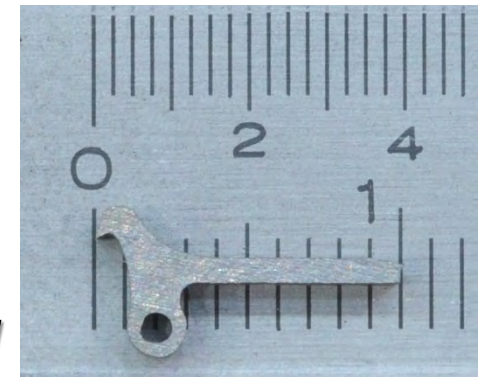


*2 mm thick  
titanium*

*Lever for biomedical  
applications*



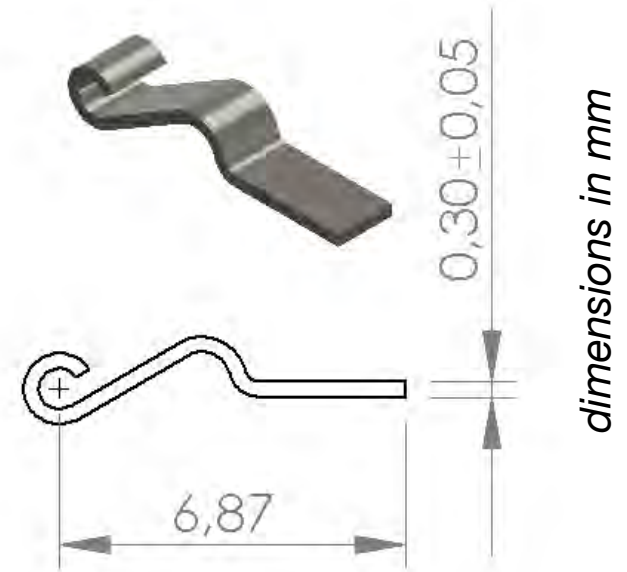
dimensions in mm







# $\mu$ AWJ CUTTING of a leaf spring



*Leaf spring  
used in biomedical devices*

*1.5 mm stainless steel*

*0.3 mm wall thickness*





*Tungsten fracture test  
specimens  
obtained by  $\mu$ AWJ turning*

Cutting is not the only process  
 $\mu$ AWJ can perform.

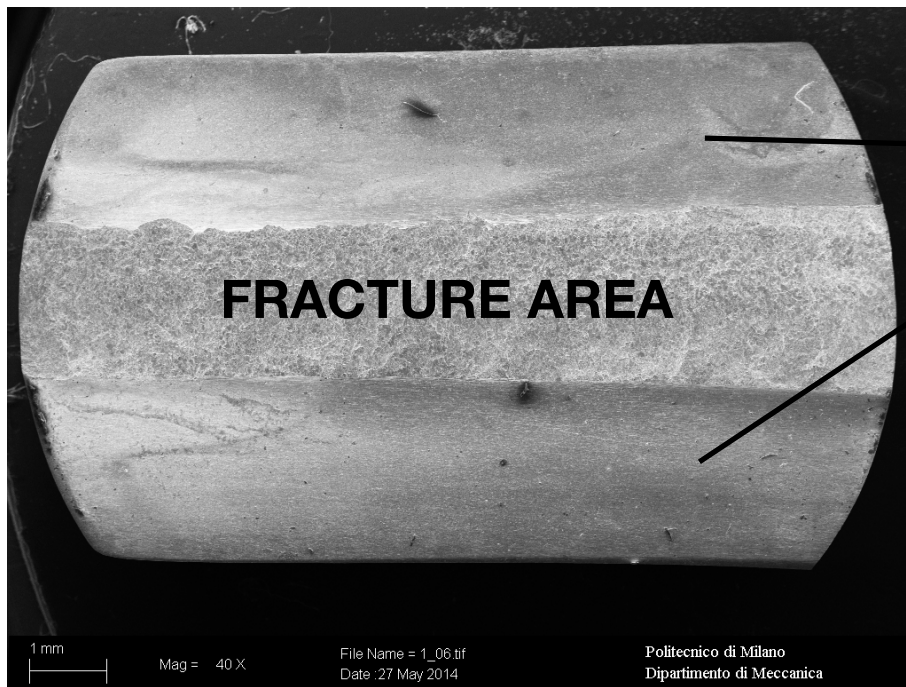
Turning can be considered as a  
very interesting alternative  
application of this technology





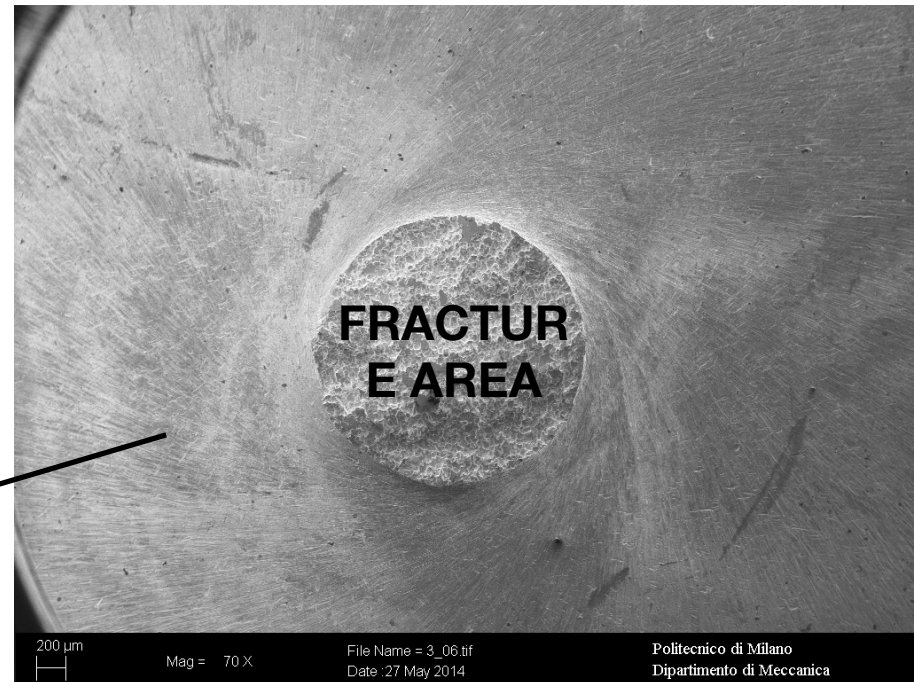


# $\mu$ AWJ CUTTING TEST on tungsten turning



*Areas cut with  $\mu$ AWJ  
(linear striations)*

*Area turned with  $\mu$ AWJ  
(radial striations)*



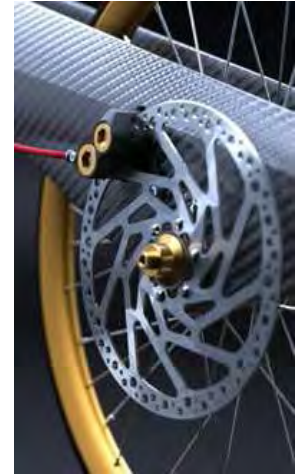




# RACE BRAKES and CUSTOMIZATION

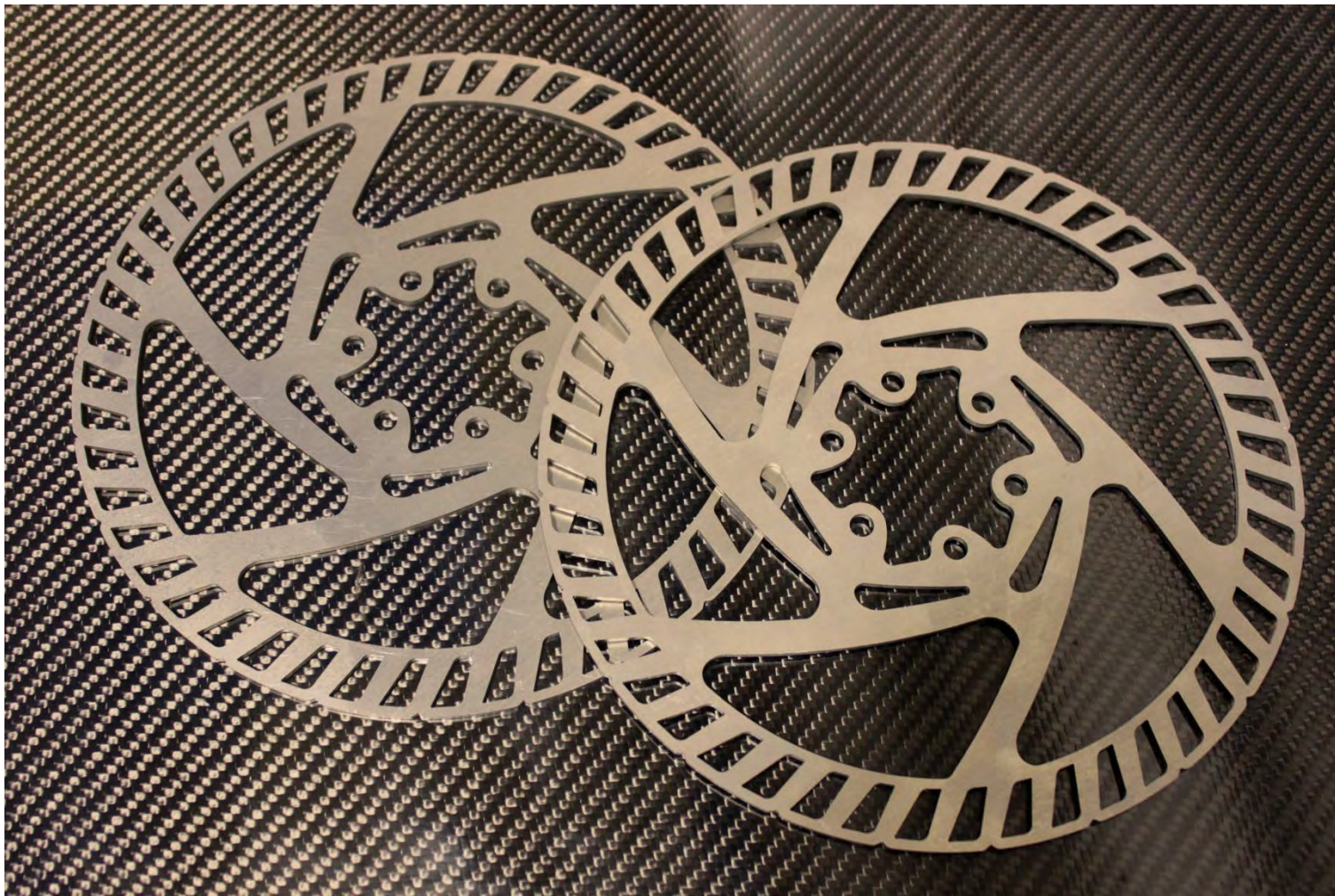
Easy machining of any type of metal

- Easy machining of inhomogeneous materials
- Easy setup and fast delivery time
- Suitable for prototyping
- Pre-series preparation
- Possibility of complete customization
- Cut, marking or etching of names and logos





# MTB TITANIUM RACE BRAKES



*2 mm thick  
titanium*





## Technical/Commercial area:

*Ing. Stefano Volpi*

[stefano.volpi@watajet.com](mailto:stefano.volpi@watajet.com)

Info:

[info@watajet.com](mailto:info@watajet.com)

