BILASURF project

Brussels, May 8th 2024

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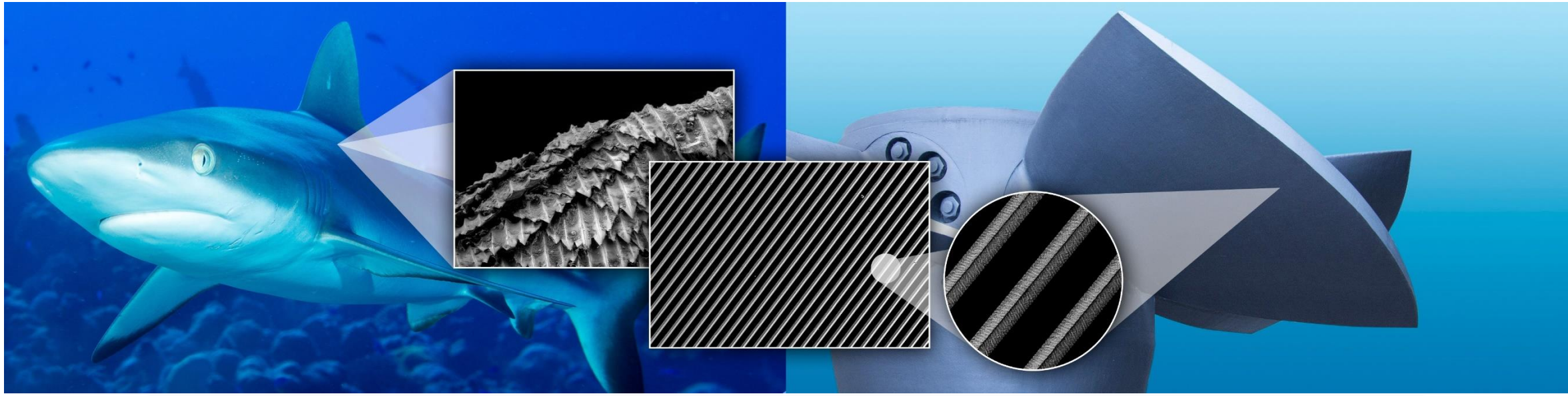
bilasurf



BILASURF

Main objective

BILASURF aims at developing and integrating a process for high-rate laser functionalization of complex 3D surfaces using tailored designed riblets to reduce friction and improve the environmental footprint of industrial parts, ensuring a high throughput with the help of inline monitoring capabilities. This solution will provide European industry with a key tool to use a more efficient and environmentally friendly manufacturing process.

Specific Objectives

Specific Objective 1	Tailored design of riblets for a surface functionalisation specifically oriented to each application.
Specific Objective 2	Transfer of bionic design solutions to technical applications using replication technologies.
Specific Objective 3	In line monitoring system for quality control.

Specific Objective 4	**Design and integration of a surface functionalisation process for 3D complex industrial parts based on a high-rate laser process.**
Specific Objective 5	**Validate the technology in working final parts.**

Energy

Enhance the turbine efficiency and broaden the operation range resulting in higher revenues due to a better technical and overall product.

With the riblet technology the product will be more flexible concerning tailor-made solutions causing more orders.

HVAC

The technology offered by BILASURF can reduce friction in order to improve fans performance, achieve higher efficiency and reduce energy use.

Other

Development of an integrated high-speed surface functionalisation system based on laser technologies will enable functionalisation processes to be applied to large surfaces of complex 3D parts, an area that has not yet been addressed.

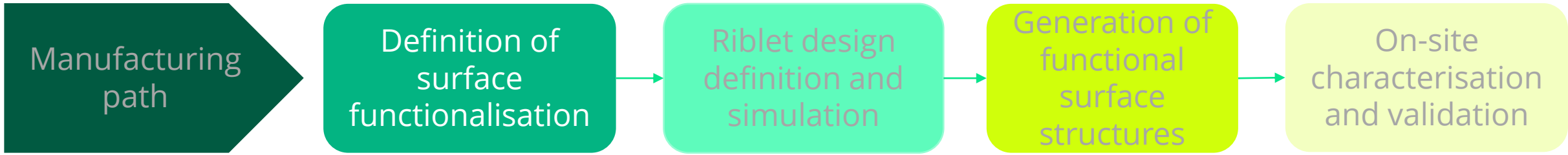
The laser processes to be developed for the generation of riblet structures will avoid the use of more expensive solutions such as coatings and chemical processes. They will be applied for surface treatments, replacing commonly used coating materials.

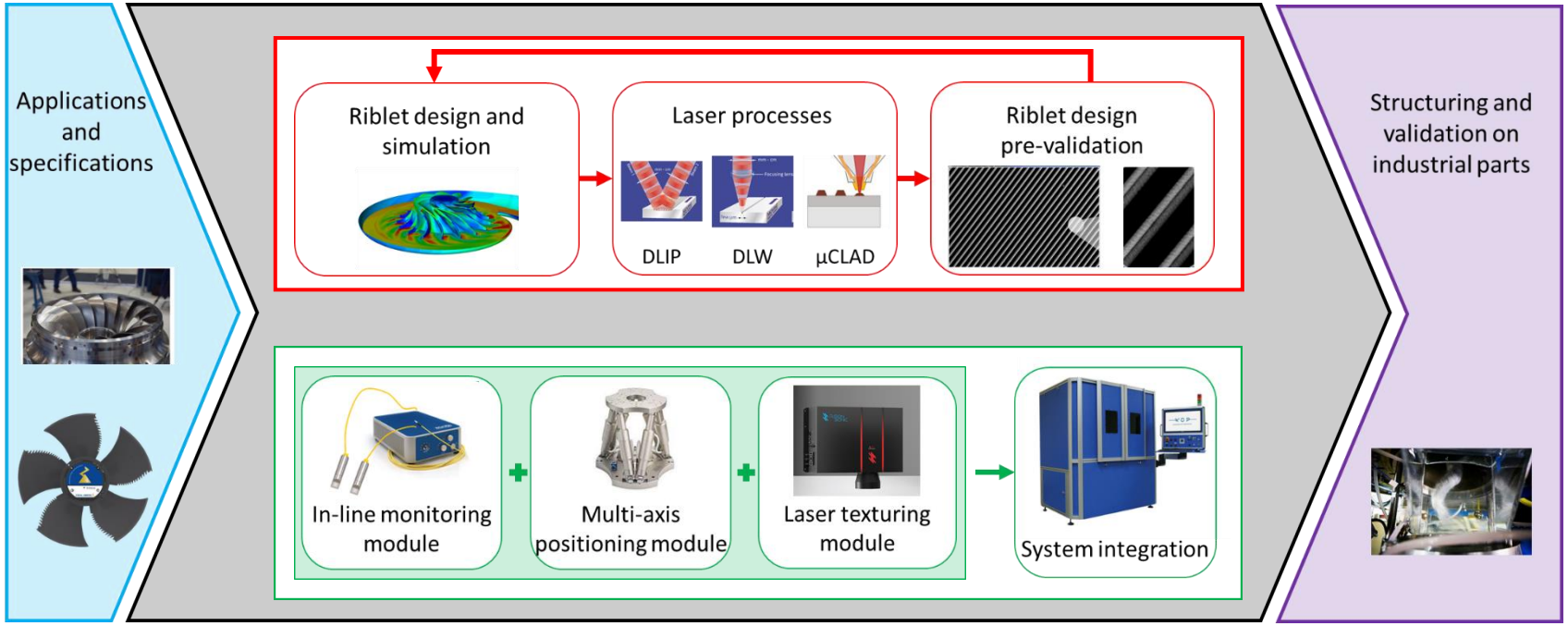
Partners

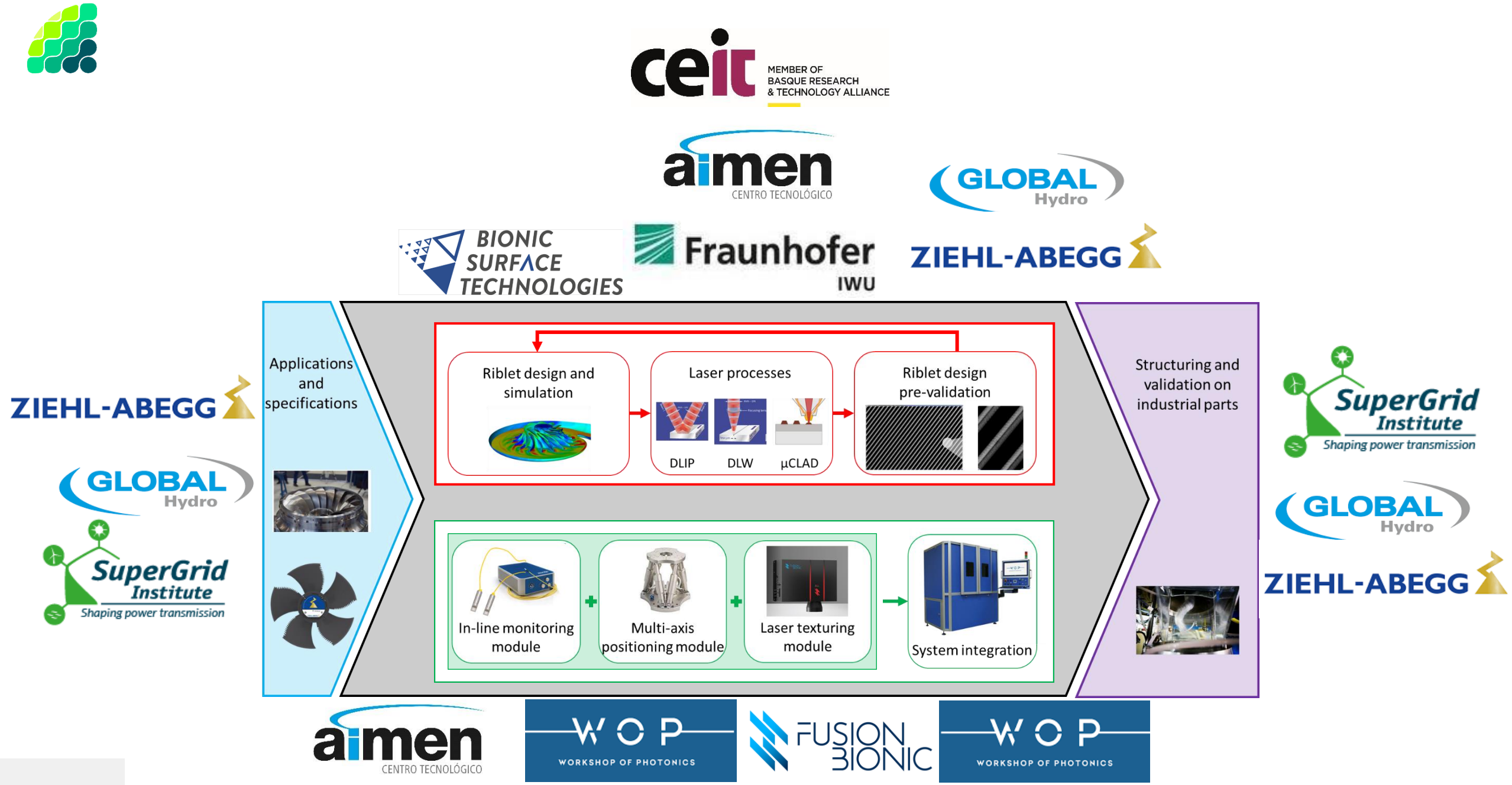
BILASURF
consortium

BILASURF consortium

Manufacturing path






MEMBER OF
BASQUE RESEARCH
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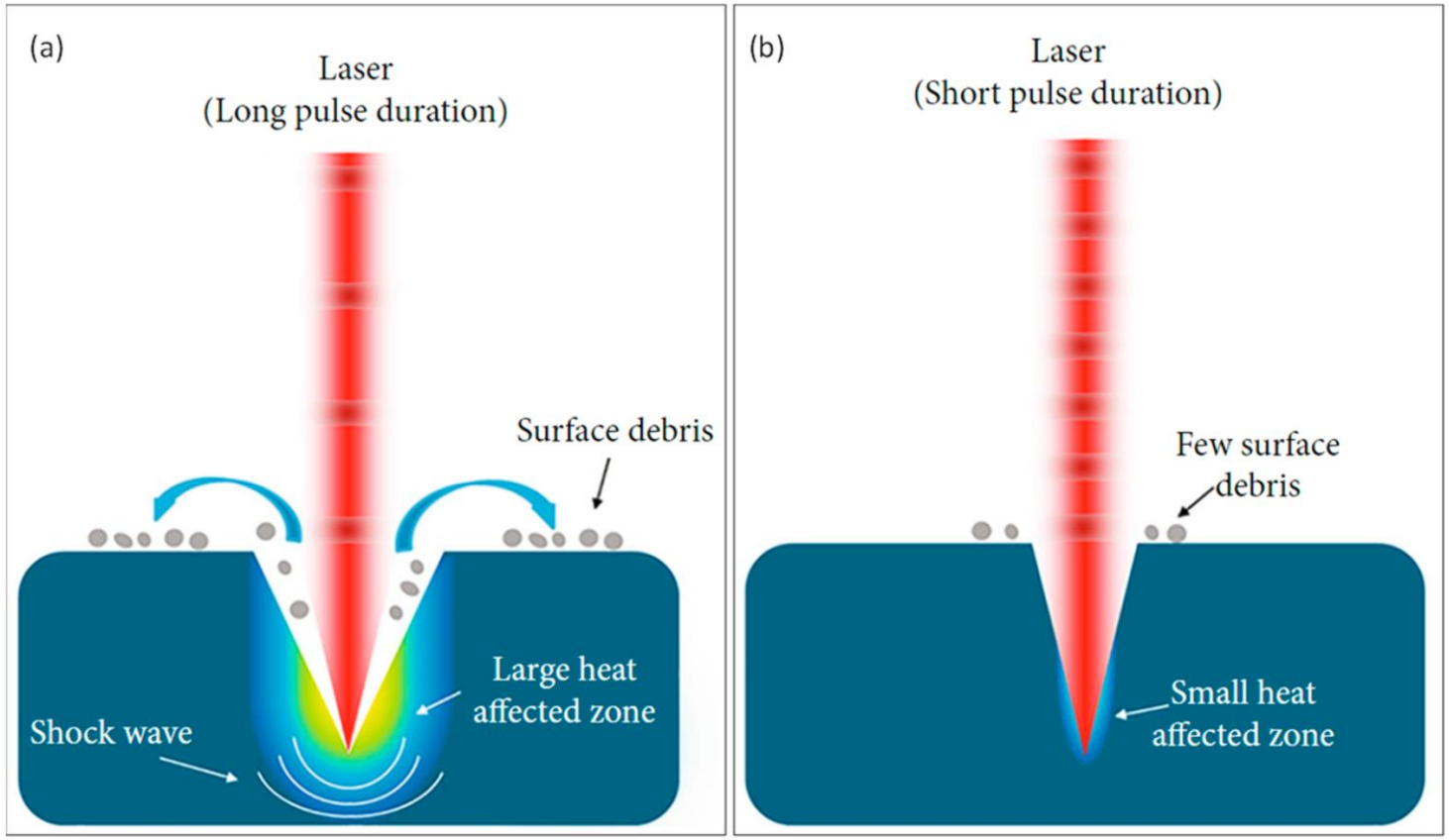
CENTRO TECNOLÓGICO
GLOBAL Hydro
BIONIC SURFACE TECHNOLOGIES
Fraunhofer IWU
ZIEHL-ABEGG
Applications and specifications
Riblet design and simulation
Laser processes
DLIP
DLW
µCLAD
Riblet design pre-validation
In-line monitoring module
Multi-axis positioning module
Laser texturing module
System integration
Structuring and validation on industrial parts
SuperGrid Institute
Shaping power transmission
WORKSHOP OF PHOTONICS
FUSION BIONIC

Laser technologies

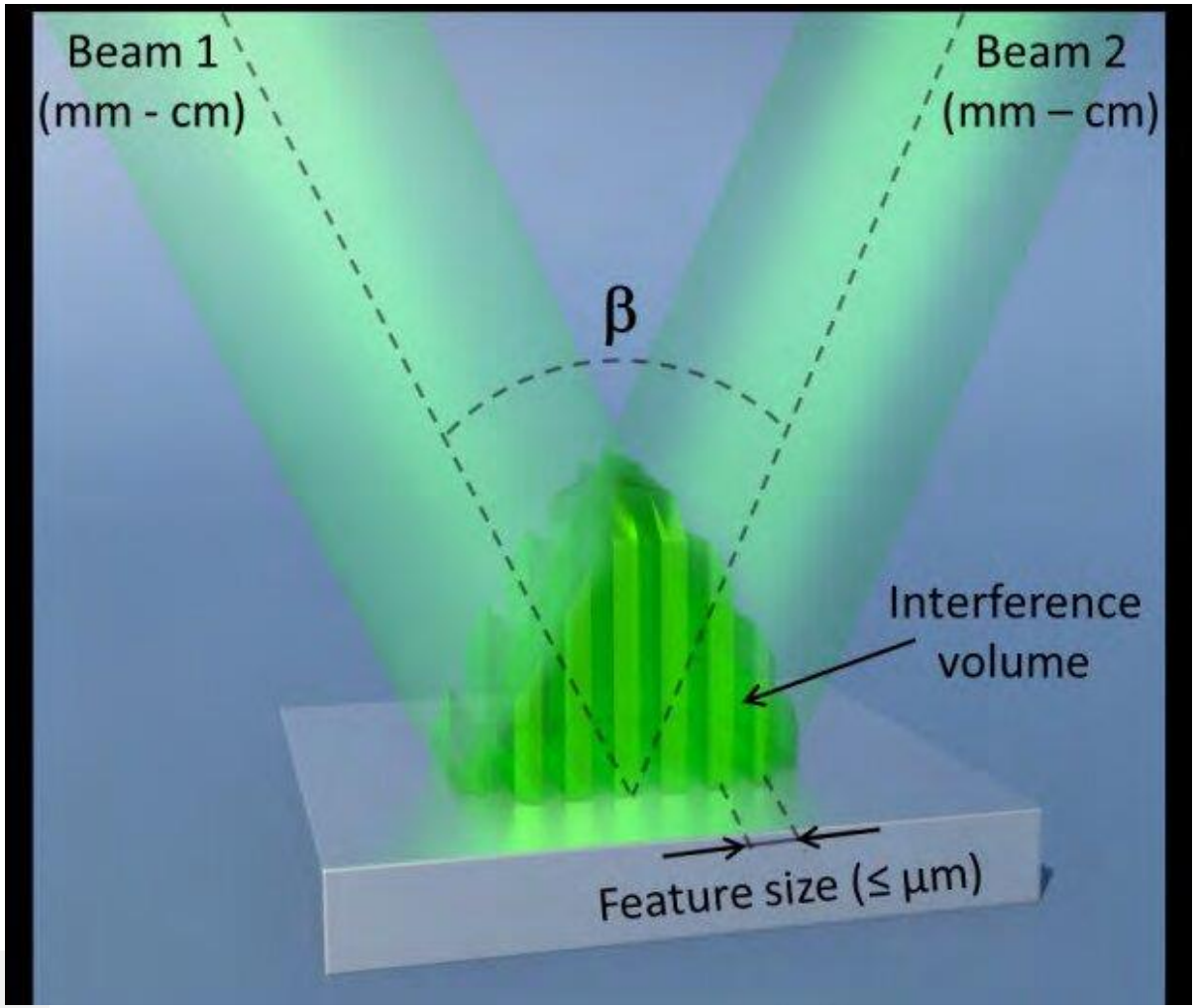
Why ultrasort pulsed lasers?



T. Wang et al.

- Minimal thermal effect on the processed material (“cold ablation”)
- High precision
- Processing a wide variety of materials: metals, ceramics, glass, plastics…

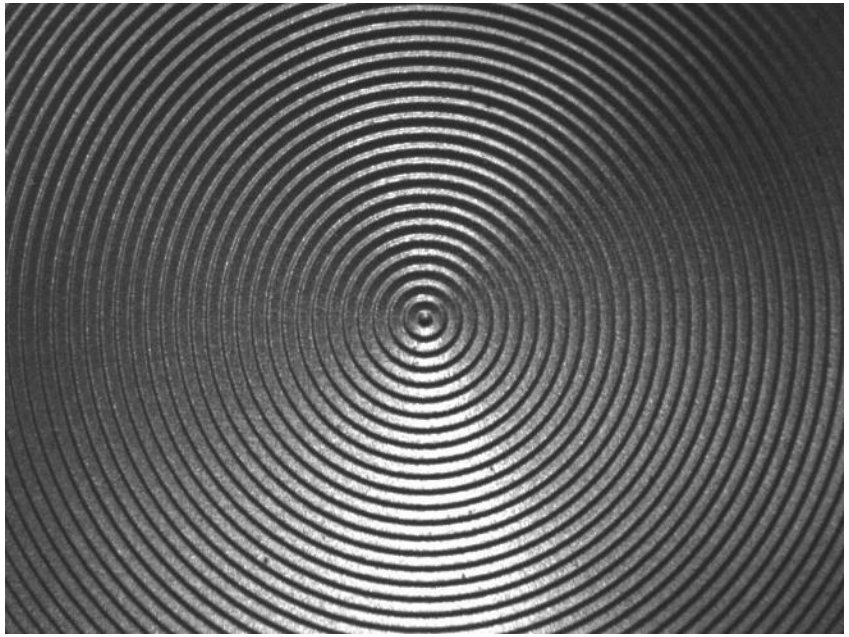
Direct Laser Interference Patterning

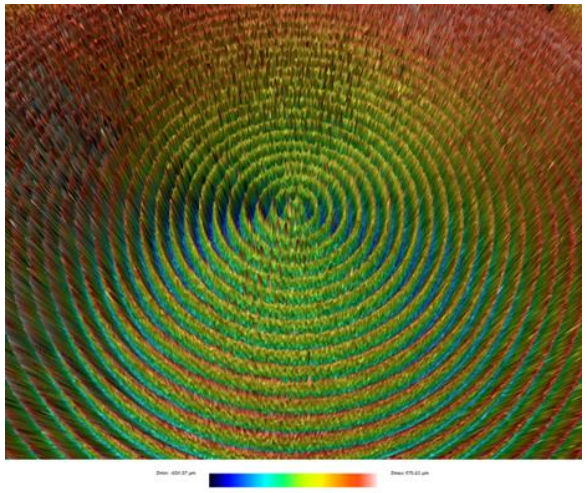


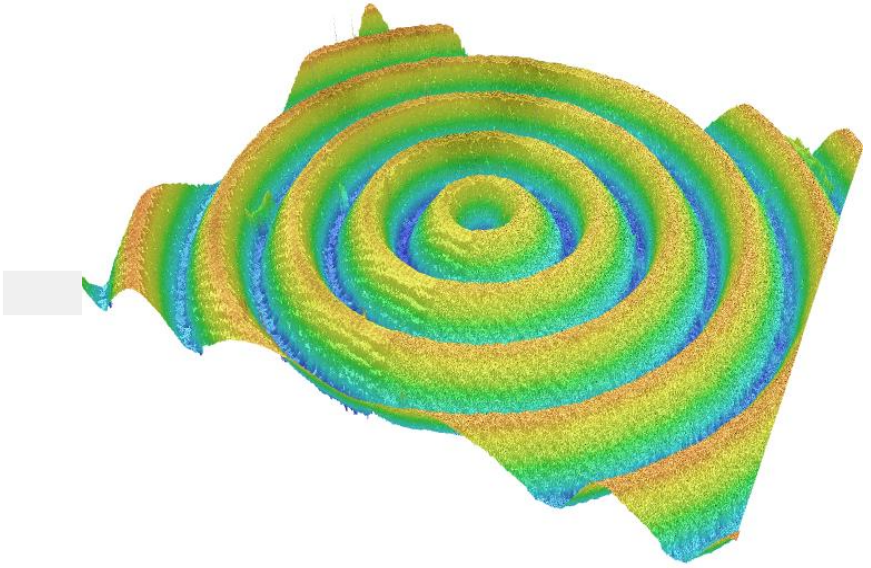
T. Kunze et al.

Riblet periods up to 40 µm

Direct Laser Writing



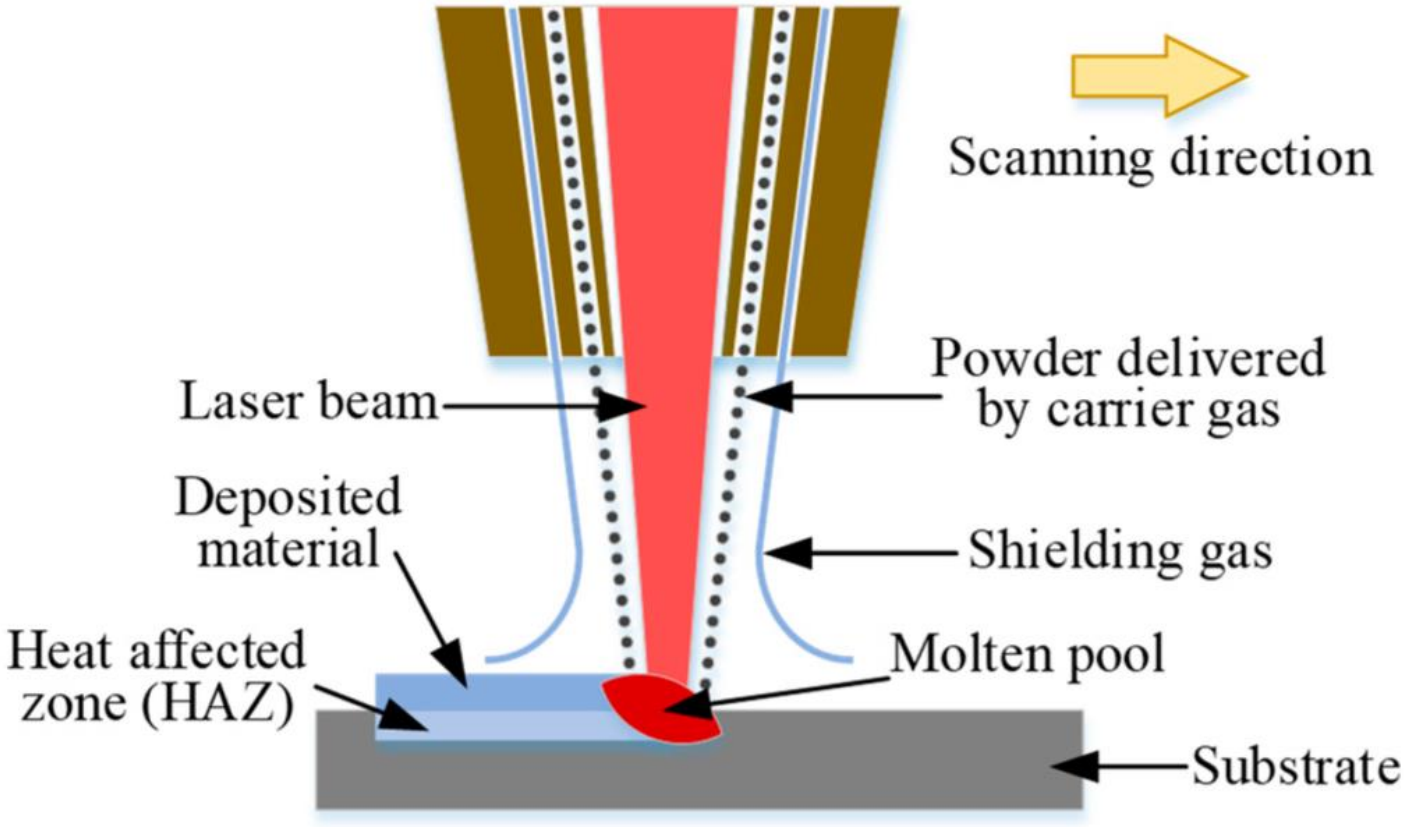




Riblet periods from 40 µm*

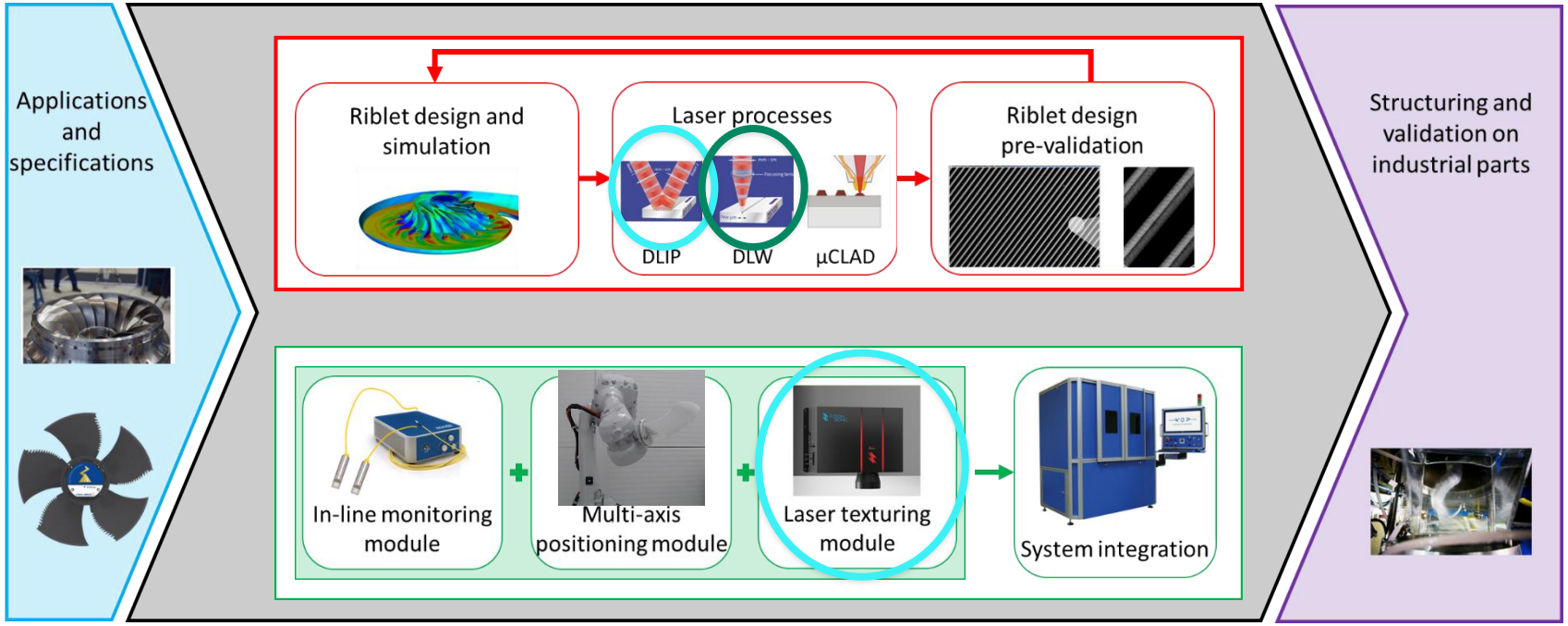
Micro Cladding

Riblet periods from 150 μm*



Haitian Laser

Manufacturing path



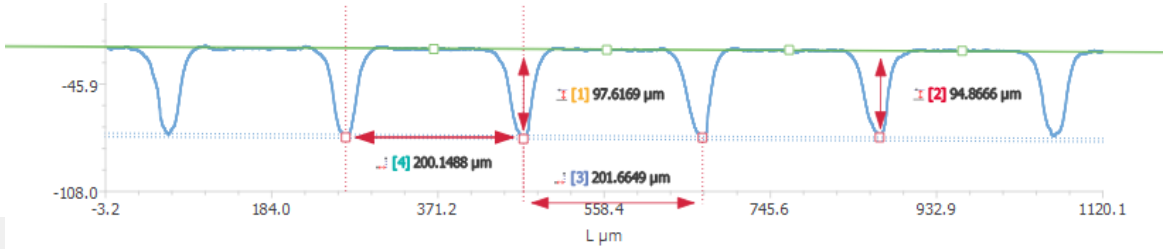
Ongoing work

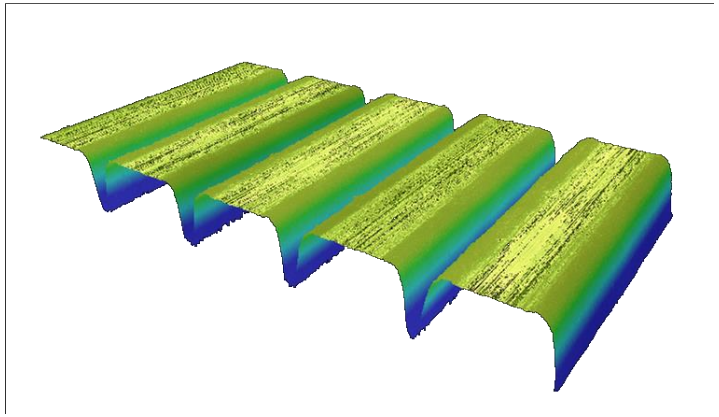
Riblet reproduction with ultrashort pulsed laser technology

Design, generation and pre-validation of riblets with DLIP, DLW and uCLAD, depending on the size and precision needed for different applications.

Generation of negative riblets using DLW

From the ideal design to the reproduction on a stainless steel plate.



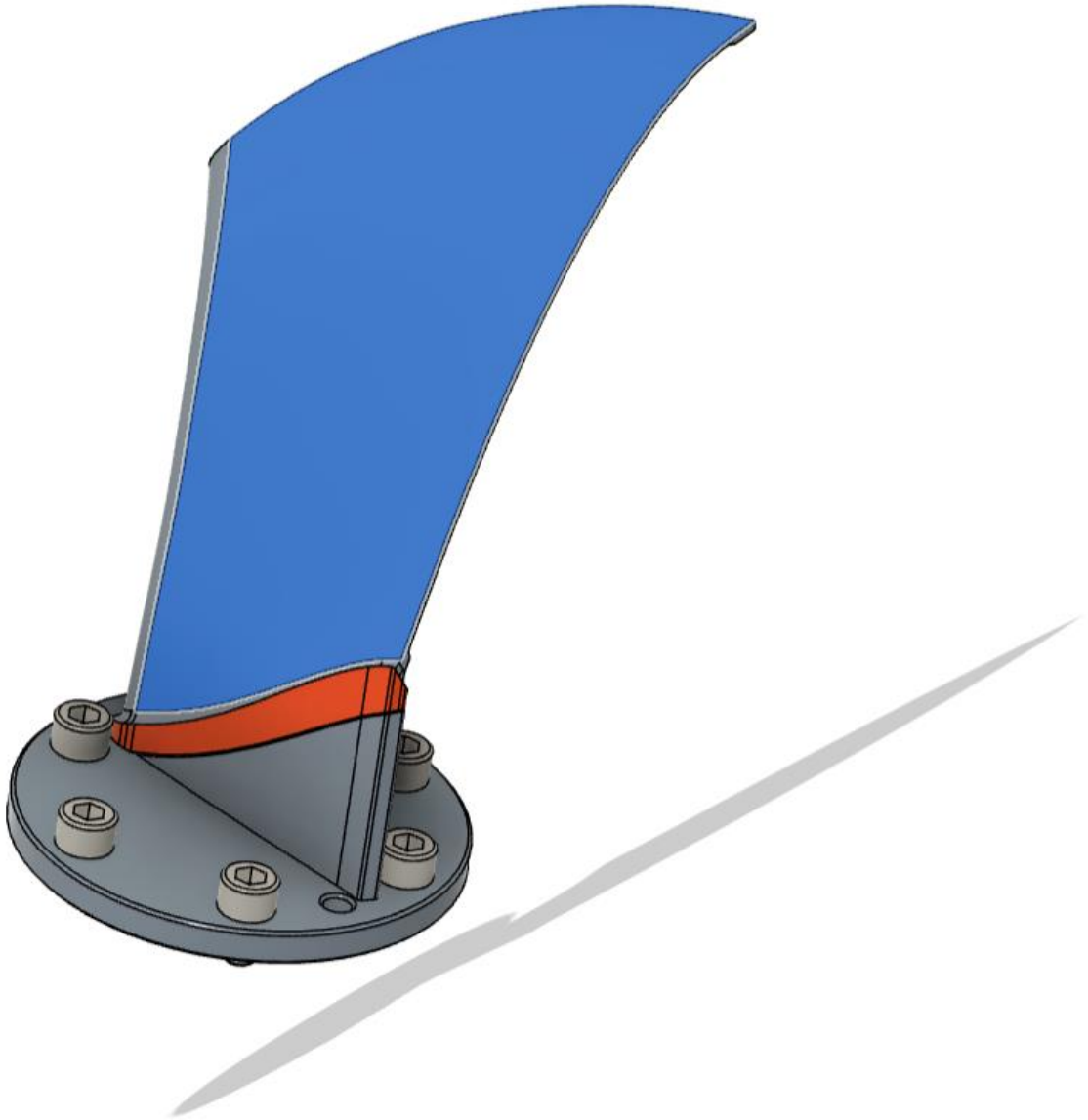


Pre-validation tests

Adaptation of platform test for scaled turbine.

Positioning module

Positioning system for two technologies that can manipulate the parts and situate them where is needed.



That‘s a blade of the Francis turbine –

make the water flow smoother!

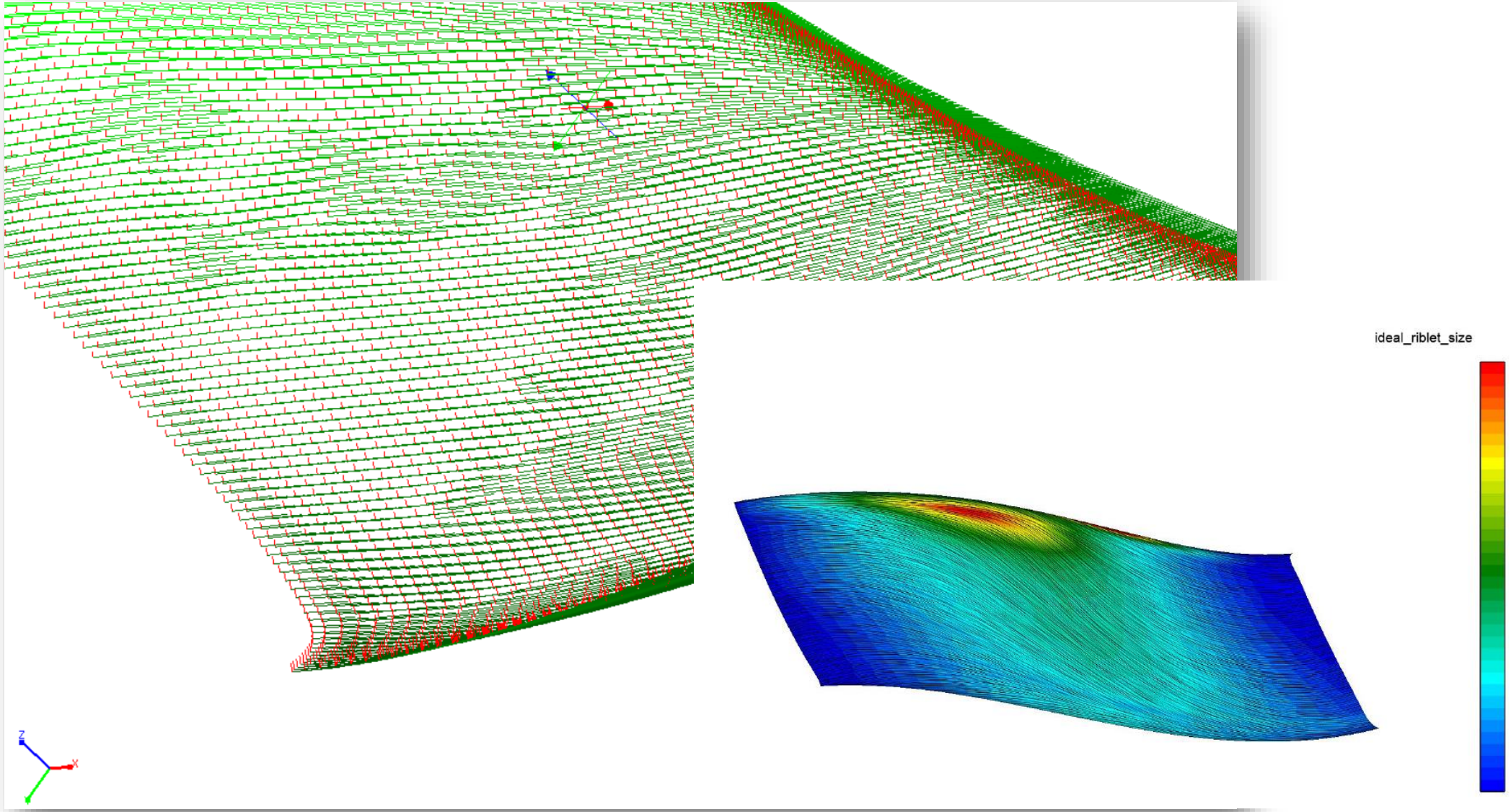
Input data ideal surface is calculated

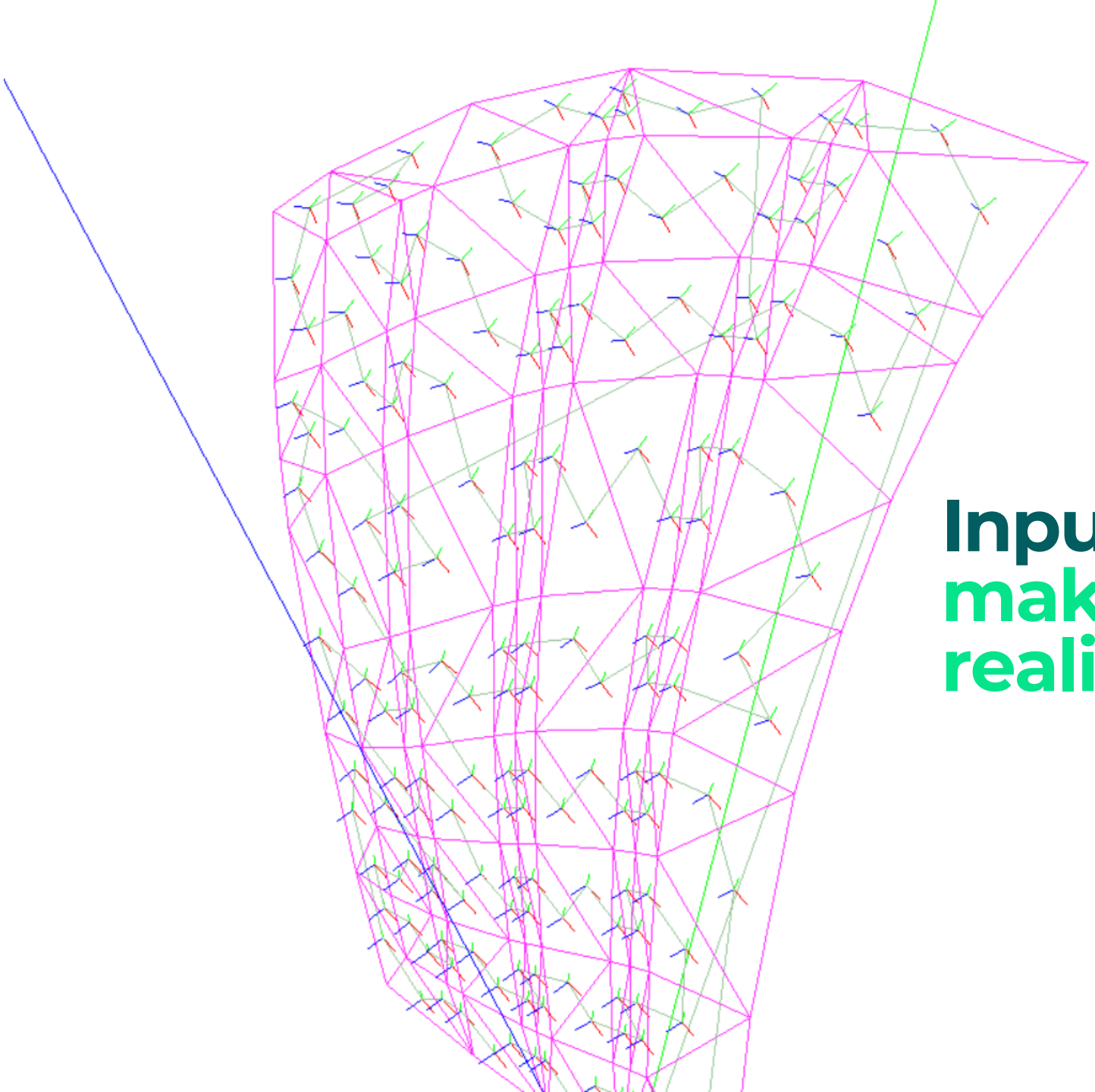
Ideal riblet size is not discretized

Riblet direction is not discretized

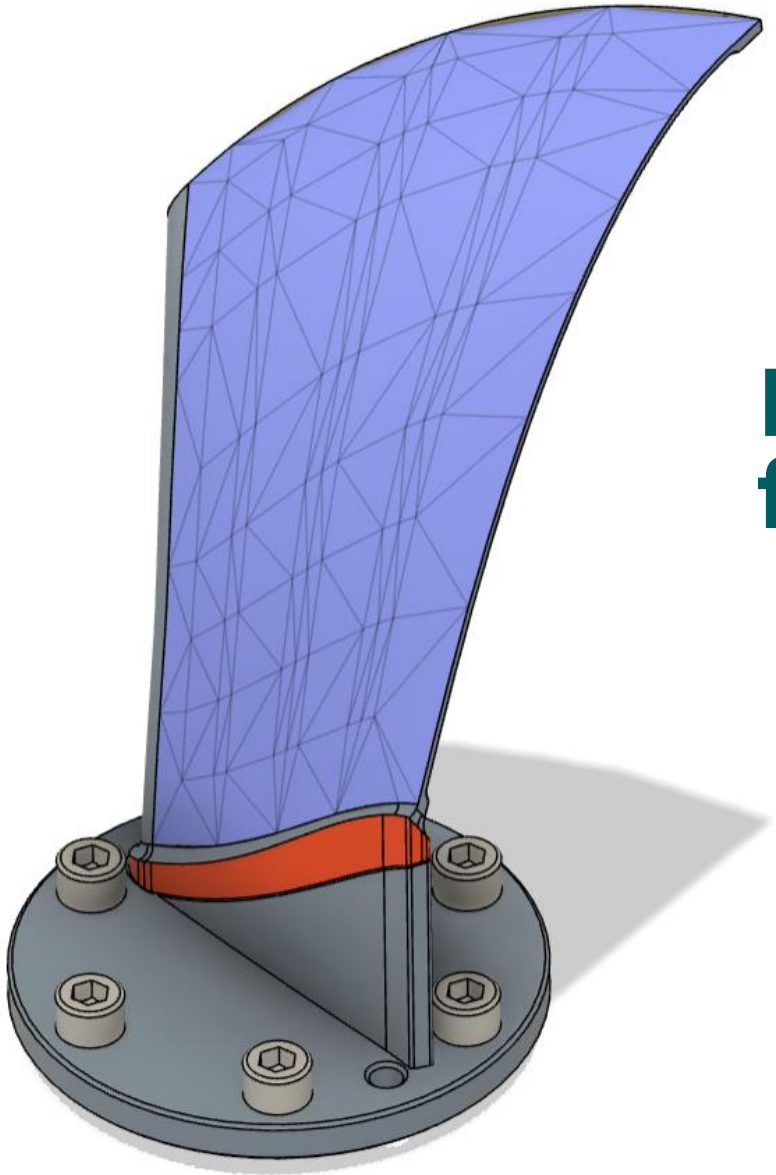
coordinates [m]			Riblet pitch (p) [µm]	normal vector [m]			normalized wall shear vector [Pa]		
x	y	z	tip to tip distance, s+	nx	ny	nz	nwx	nwy	nwz
-0,1617210100	-0,0077396138	-0,0929972750	33,0843280000	-0,0795195400	-0,6170635200	0,7828851900	0,0876355566	-0,7866588660	-0,6111365573
-0,1615941200	-0,0062110079	-0,0917646660	32,3818700000	-0,0850309210	-0,6254312400	0,7756323200	0,0795477062	-0,7802280103	-0,6204163174
-0,1603291500	-0,0070961970	-0,0923391880	28,2843490000	-0,0832477510	-0,6240277900	0,7769550700	0,1962559758	-0,7746586656	-0,6011551661
-0,1614594000	-0,0046997396	-0,0905160380	31,1806200000	-0,0903943930	-0,6339911200	0,7680391700	0,0746235578	-0,7733402038	-0,6295842117
-0,1602033800	-0,0056041949	-0,0911134180	26,8223480000	-0,0889470500	-0,6321564300	0,7697185900	0,1540482233	-0,7722141692	-0,6164044954
-0,1584488300	-0,0065109725	-0,0916609170	23,8254850000	-0,0840219860	-0,6321877800	0,7702460300	0,1346788645	-0,7730913752	-0,6198316958
-0,1567321400	-0,0074097416	-0,0922138170	23,0668560000	-0,0815851760	-0,6319388700	0,7707121400	0,1058306327	-0,7744110379	-0,6237688291
-0,1548914500	-0,0068329144	-0,0915330570	23,2389030000	-0,0877355710	-0,6394641400	0,7637984800	0,0721669134	-0,7688207256	-0,6353792399
-0,1601077900	-0,0041673835	-0,0899089200	25,5421750000	-0,0944133850	-0,6401925700	0,7623906700	0,1150033883	-0,7676981777	-0,6304076561
-0,1613065700	-0,0032755218	-0,0893088130	29,6944350000	-0,0962724090	-0,6420925900	0,7605581900	0,0623195185	-0,7664967354	-0,6392174832
-0,1599991800	-0,0028122172	-0,0887442230	24,3919450000	-0,0999191180	-0,6481924100	0,7548925300	0,0810476789	-0,7614703727	-0,6431128984
-0,1583197400	-0,0050482121	-0,0904321600	23,1002940000	-0,0900251120	-0,6402041900	0,7629116200	0,1033235343	-0,7678921919	-0,6321913599
-0,1565833500	-0,0059134350	-0,0909562190	22,7999170000	-0,0874848740	-0,6404119100	0,7630327300	0,0846737778	-0,7679780948	-0,6348542814
-0,1547234200	-0,0053989100	-0,0902990180	23,2145810000	-0,0938016030	-0,6472746100	0,7564633500	0,0585709659	-0,7620851809	-0,6448222105
-0,1530350400	-0,0062435442	-0,0908086970	23,6083680000	-0,0969362110	-0,6471647000	0,7561621700	0,0542016228	-0,7620452224	-0,6452512922
-0,1583130800	-0,0023596801	-0,0881270170	22,2462640000	-0,1002837600	-0,6554212600	0,7485760500	0,0578652406	-0,7549372786	-0,6532389890

Fine mesh, normal vector to each cell provided





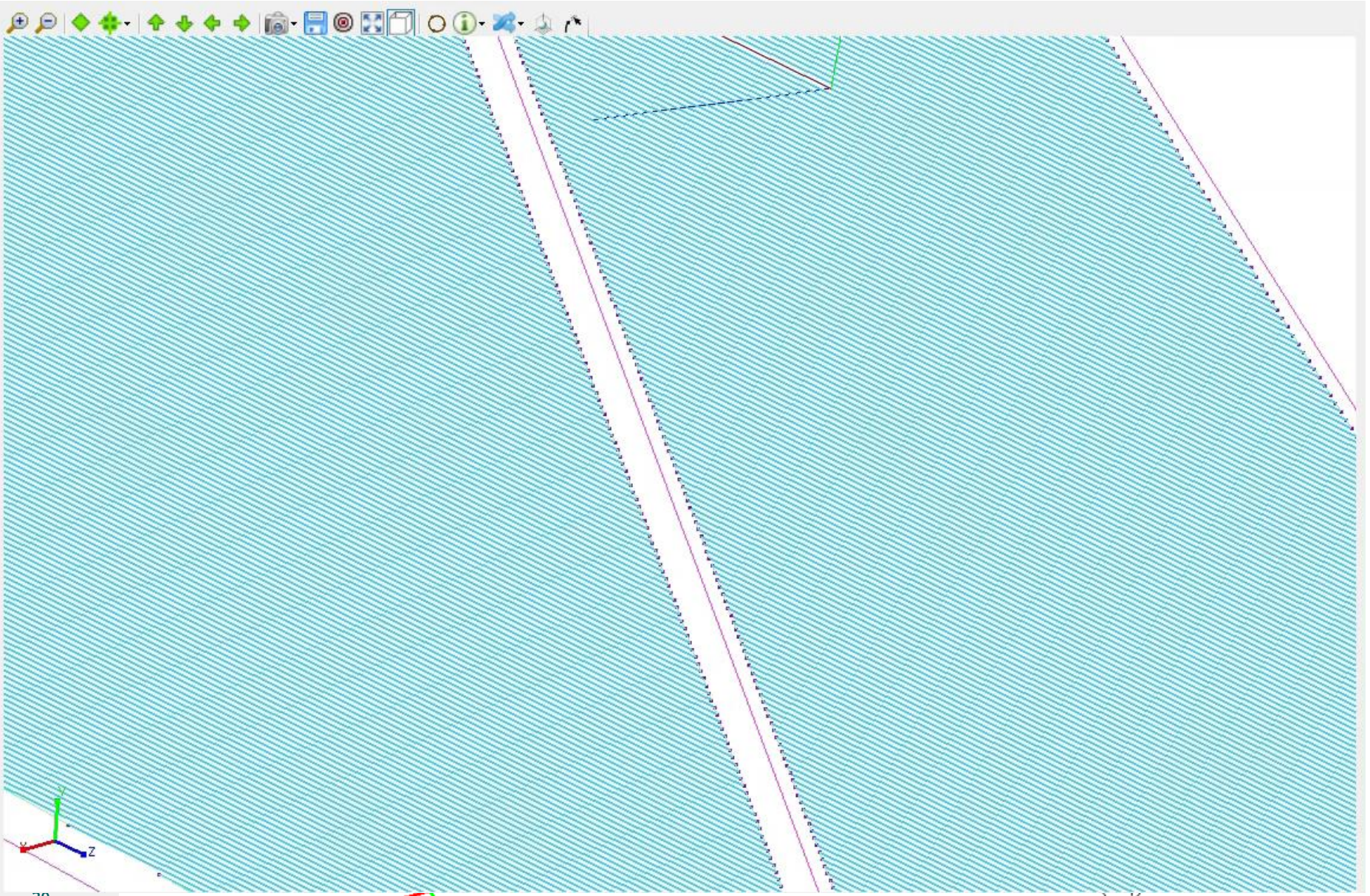
Input data – make it realistic!



Blade ready for texturing

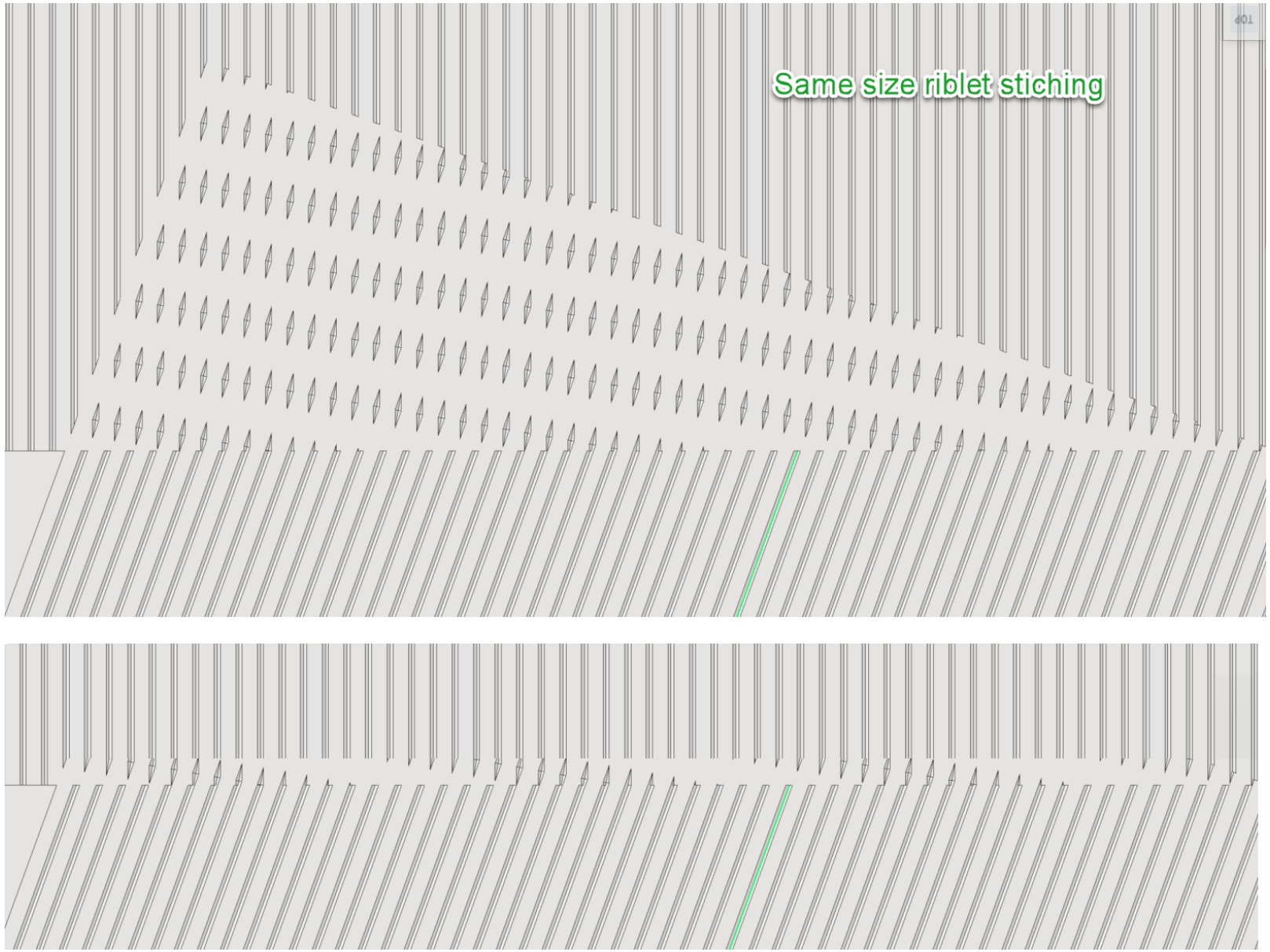
1. Let the robot bring right cell to right place

2. Let the laser do the job

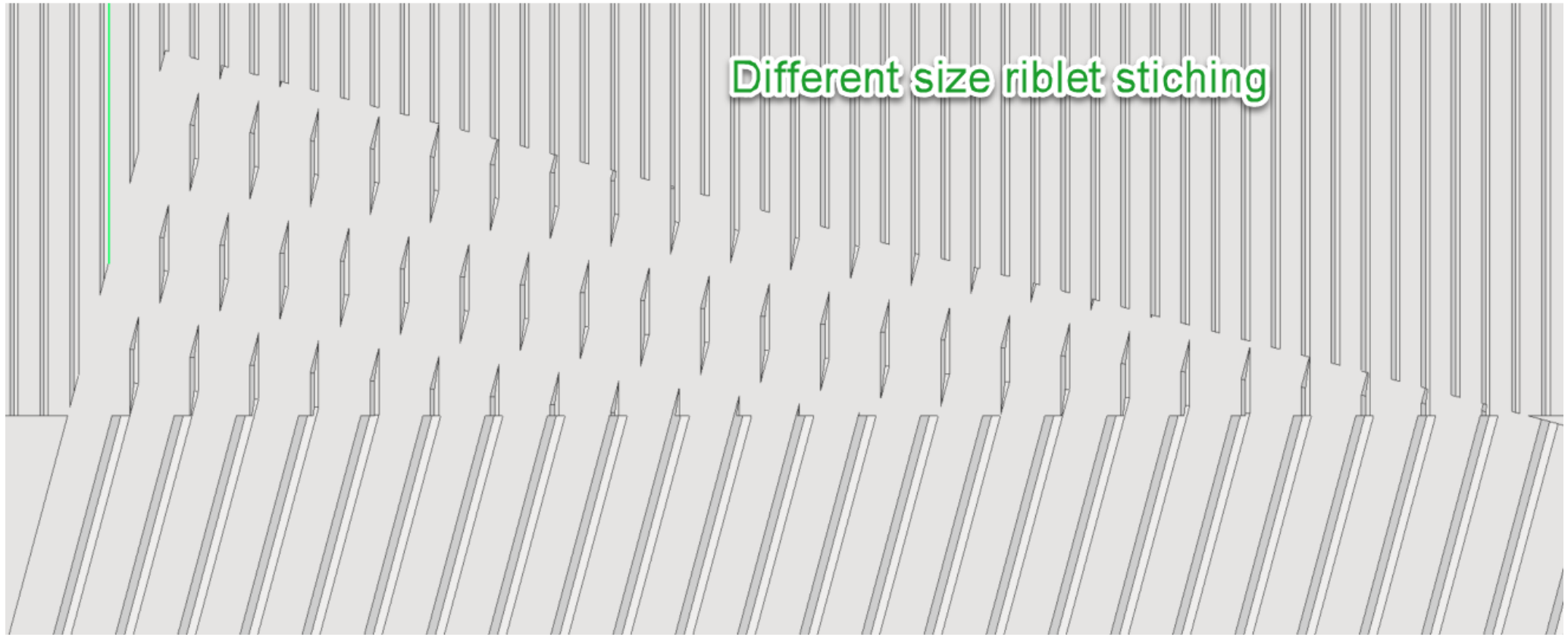


Eating layer by layer, just like .STL file stands

And that‘s the result!



And that‘s the result!



Thank you for your attention

Funded by the European Union

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