Ultimate Lightweight Solutions

Bertrand FLORENTZ

Director of the Composite Technical Center @ Hutchinson

We make it *possible*

HUTCHINSON®

Concept History

HUTCHINSON®

Progress with co-operation : AGILE development

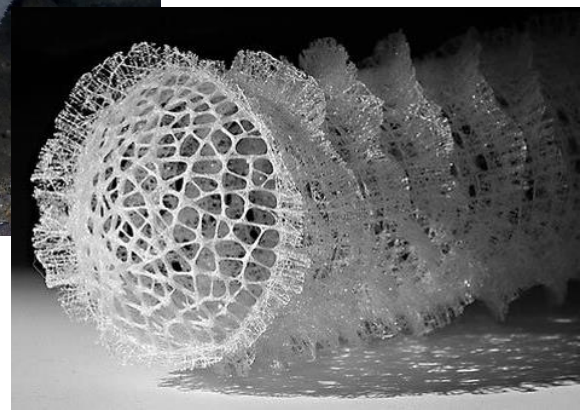
HUTCHINSON®

HUTCHINSON

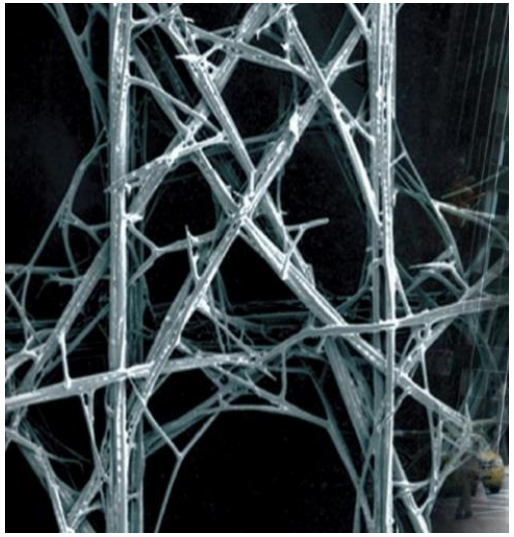
BLACK SPIRIT ..... *in progress*

HUTCHINSON®

Biomimetism



Venus’s flower (Glass sponge)
Euplectella aspergillum



Structural part

By
HUTCHINSON

HUTCHINSON®

Biomimetism

Leaves in the fall

Structural detail of a part

By
HUTCHINSON

Combination of two high performance concepts

- Efficiency of **truss** structure
- Efficiency of **Carbon**

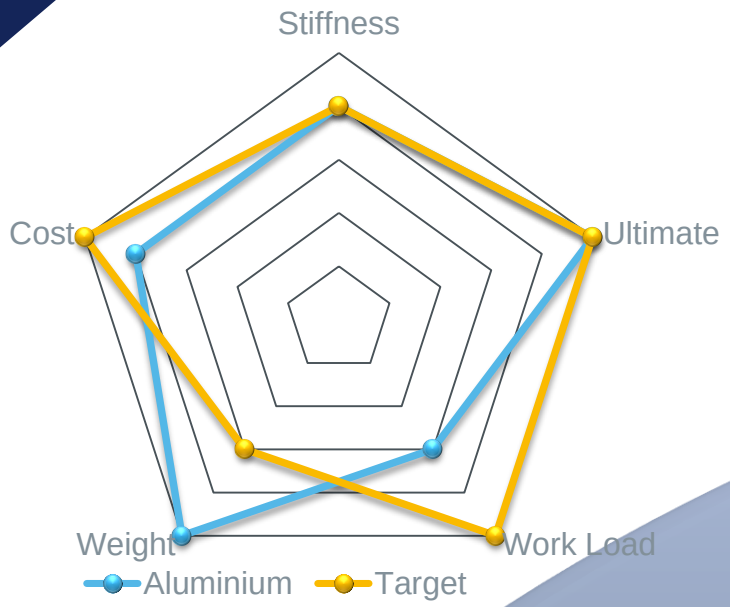
Technological breakthrough

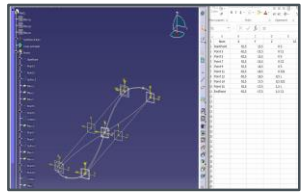
Ultra Light High Performance Composite Structural Parts

HUTCHINSON®

Design principles

Challenges to ensure an efficient use of expensive material

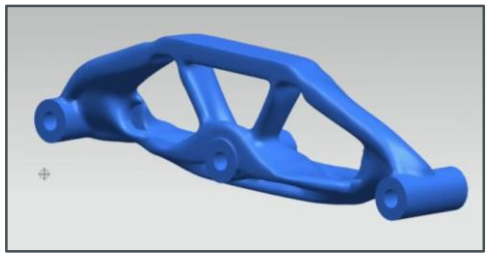




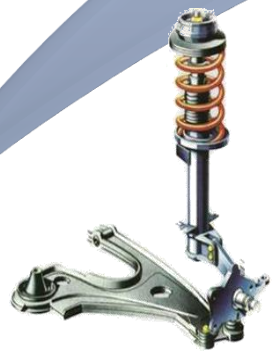
Automated CAD

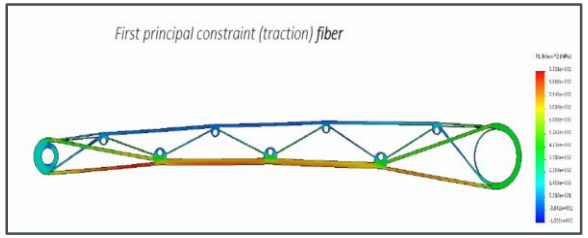
Simulation for Validation and Justification

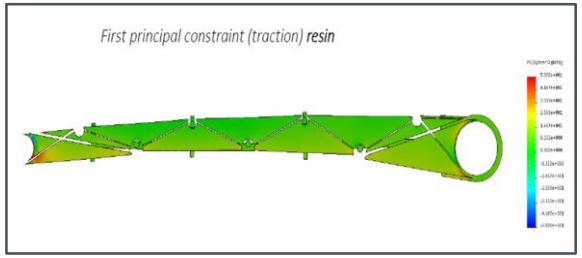
Topological Optimization



Project specs







HUTCHINSON®

Simulation

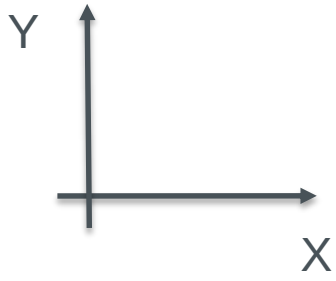
HUTCHINSON®

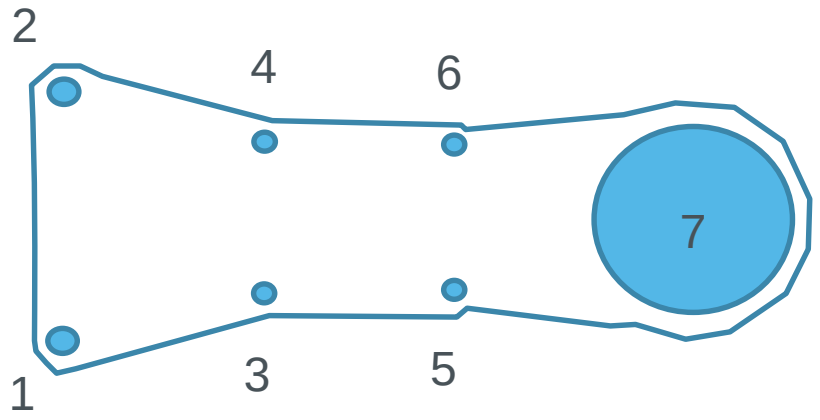
Design of a new part

A	B	C	D	E	F	G	H	I	J	K
POINT	X	Y	Ø	1	2	3	4	5	6	7
1	0	0	12	X	1,5	2	1,5	3	1,5	1,5
2	0	100	12	X	X	1,5	1,5	1,5	1,5	1,5
3	80	20	8	X	X	X	2	1,5	2	1,5
4	80	80	8	X	X	X	X	1,5	1,5	1,5
5	156	20	8	X	X	X	X	X	1,5	1,5
6	156	80	8	X	X	X	X	X	X	1,5
7	250	50	75	X	X	X	X	X	X	X

New design:

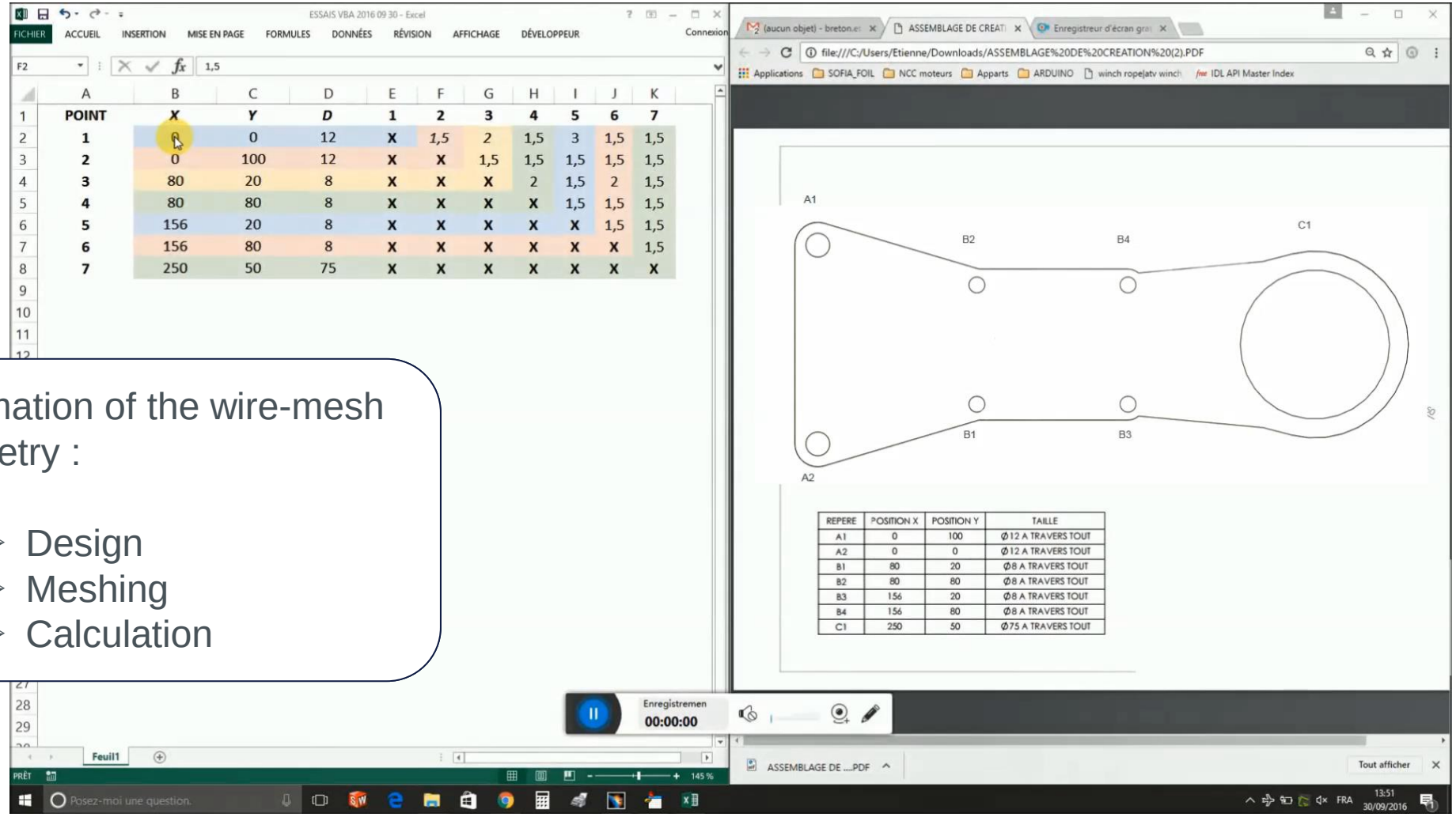
- Design sketch
- Design chart





HUTCHINSON®

Automated CAD

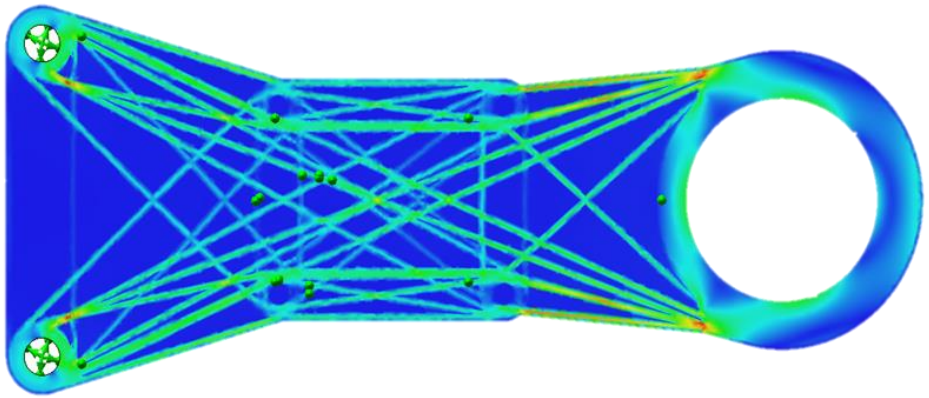


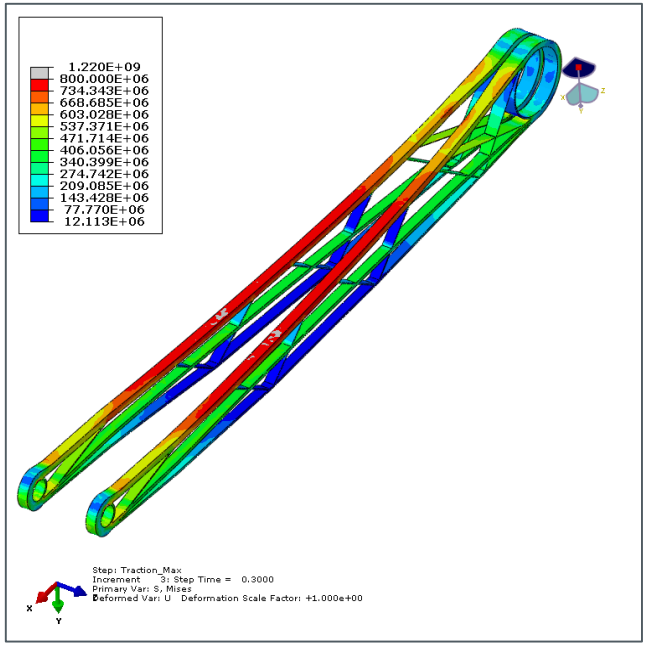
Automation of the wire-mesh geometry :

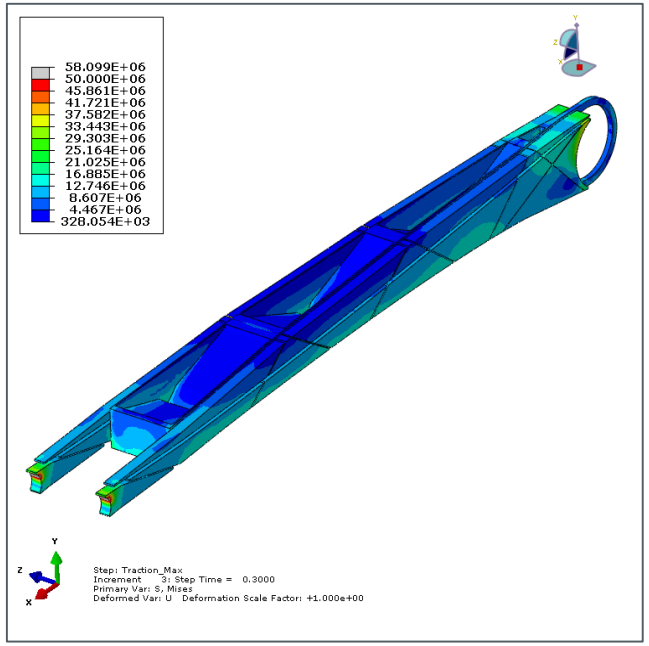
- Design
- Meshing
- Calculation

HUTCHINSON®

New numerical tools : « Macrofibres »







HUTCHINSON®

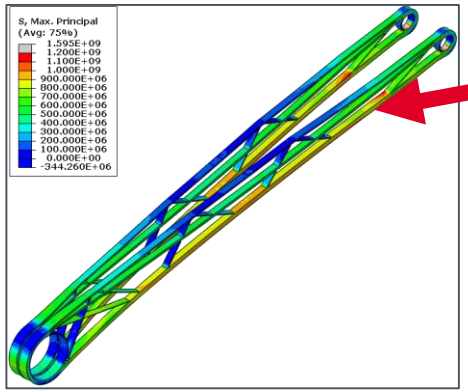
Correlation with tests

HUTCHINSON®

Simulation vs tests

- **Prediction of failure**
  - ✓Location 100%
    - Tension load (72%)
  - ✓Compression load (86%)
- **Stiffness correlation**
  - Tension (80%)
  - ✓Compression (87%)

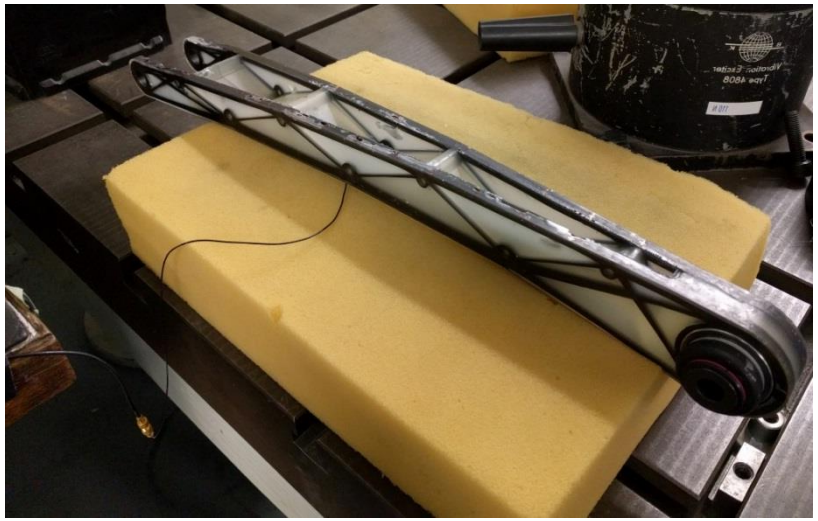
- Work is going on to improve modelling by **including singularities**

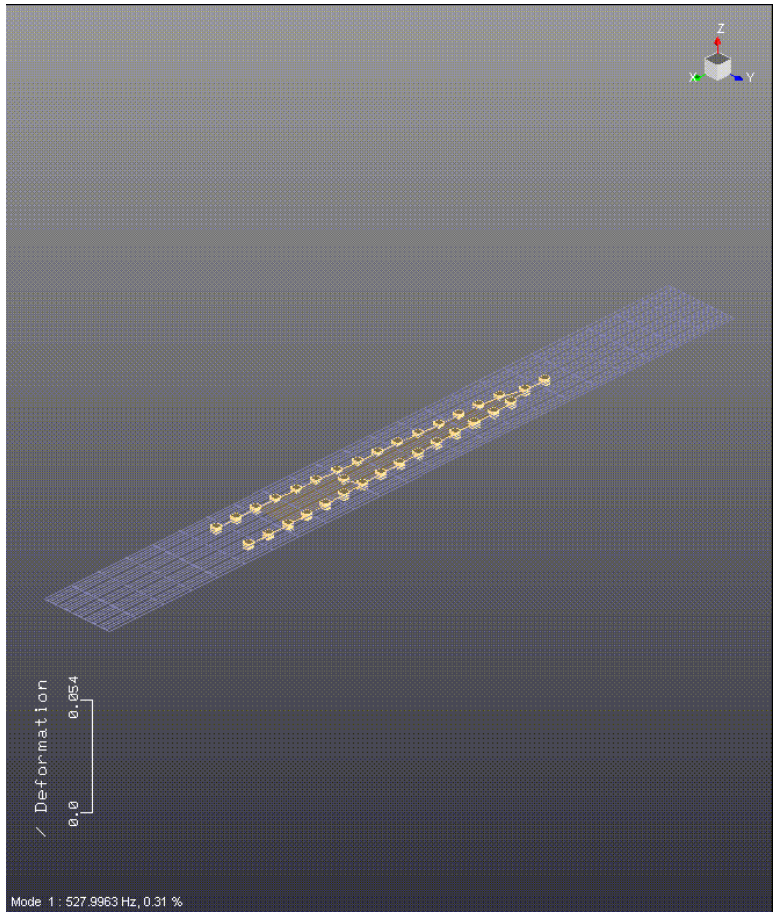


HUTCHINSON®

Modal analysis : confort level confirmed

- Boundary conditions :
  - Free-free (control arm on a foam)
- Measured first eigen mode : 528 Hz 
  - Specification : Eigen frequency > 200 Hz
  - Similar results on several parts

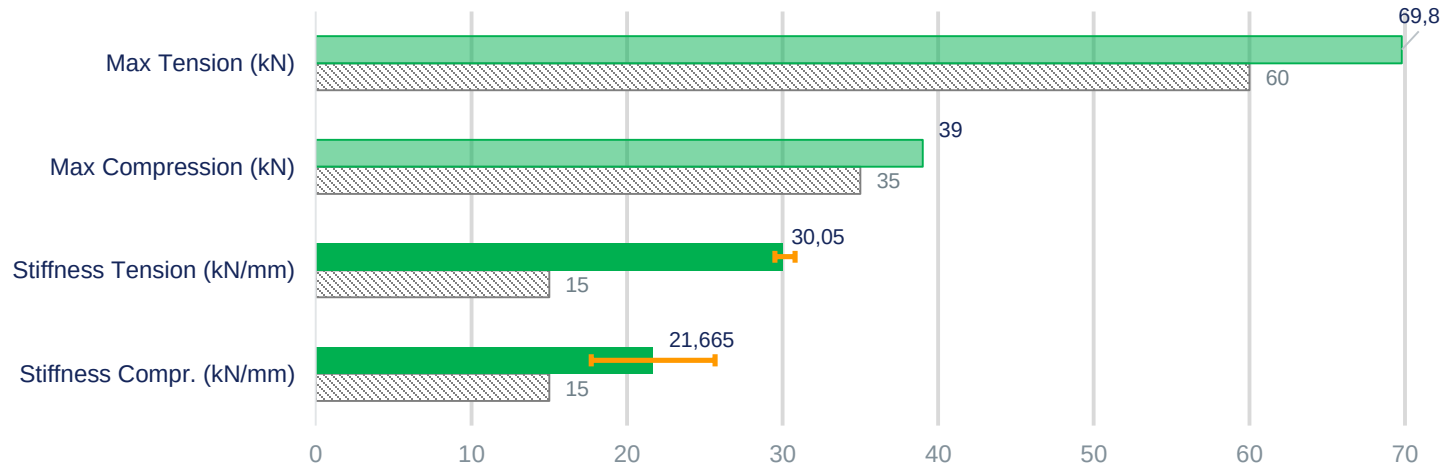




HUTCHINSON®

Performances

Carbon mass : 120g
Total mass : 480g VS Alu 699g



Weight & Cost

Some numbers

HUTCHINSON®

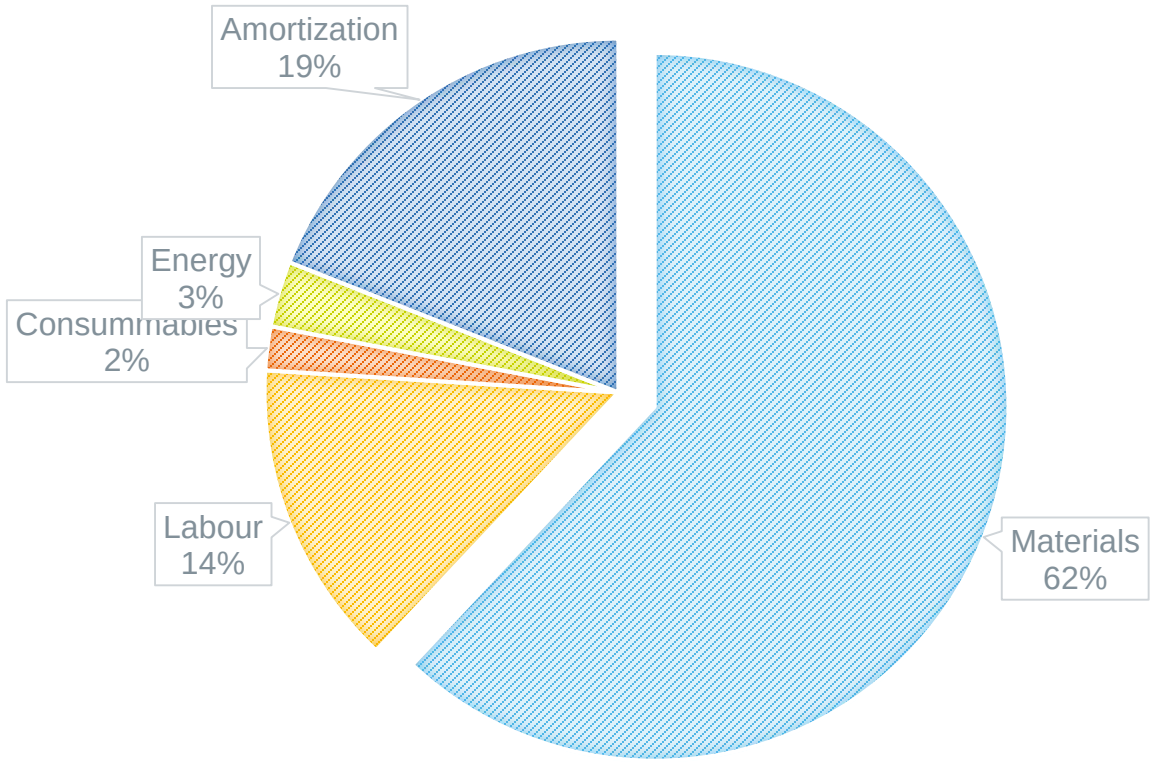
Weight Reduction

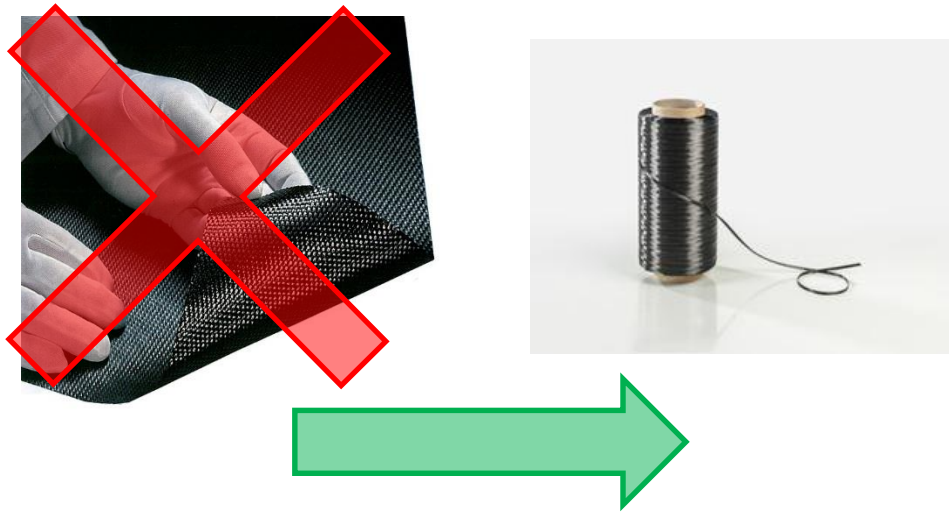
	Weight Alu part	Weight V1	Weight V2 (Target)
Aluminium mass	699g	-	-
Carbon fiber mass	-	120g	120g
Resin mass	-	360g	240g
Weight reduction	**0%**	**-30%**	**-52%**

- Necessary mass of carbon fibers : Only **17%** of inital aluminum mass

HUTCHINSON®

Cost split for a part





Tow-preg instead of prepreg :

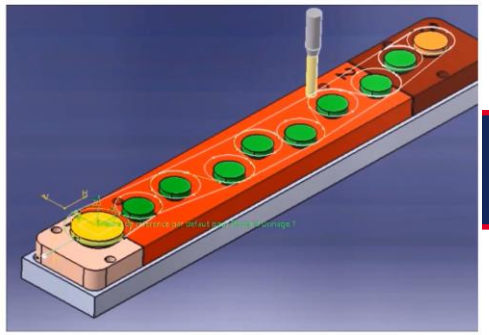
Material Costs **lower** by more 50% compared to classical composite

HUTCHINSON®

Process

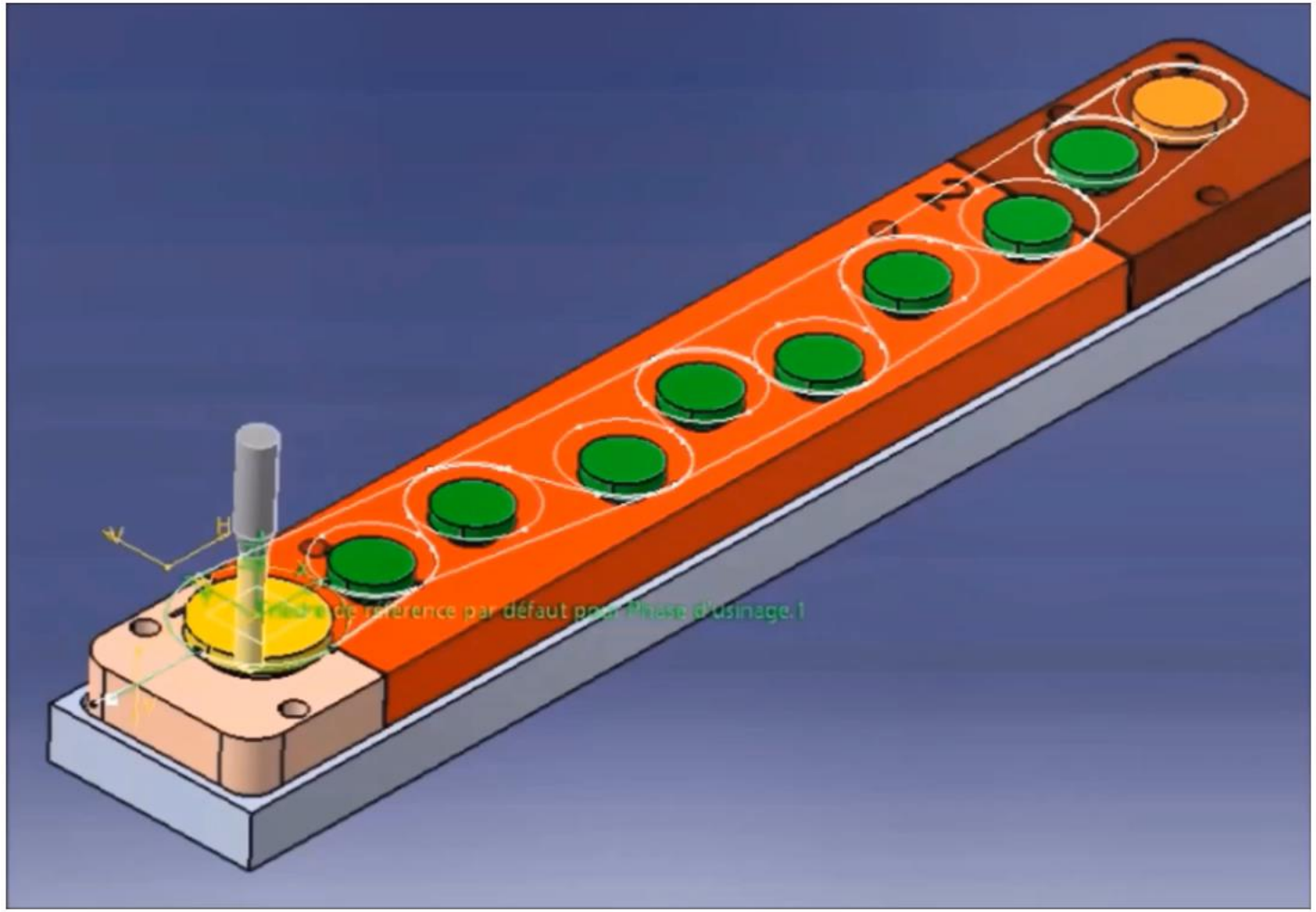
Process description

- Automated CAM



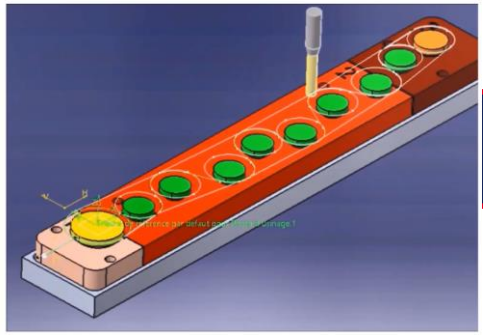
- Automated fiber deposition

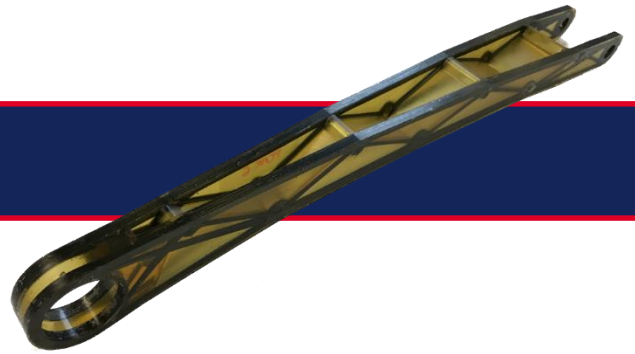
COMPUTER ASSISTED MANUFACTURING



Process description

- CAM
- Fiber deposition
- Functionalization





Conclusion

Ultra Light High Performance **C**omposite **S**tructural Parts
made by Additive **M**anufacturing

Composite **E**iffel **S**tructure **A**dditive **M**anufacturing

CESAM® **5 Patents pending**

HUTCHINSON®

Perspectives

HUTCHINSON®

We make it ***possible***

Développement AGILE

Fondements

Quatre valeurs fondamentales

Les méthodes agiles prônent 4 valeurs fondamentales :

- Individus et interactions plutôt que processus et outils
- Fonctionnalités opérationnelles plutôt que documentation exhaustive
- Collaboration avec le client plutôt que contractualisation des relations
- Acceptation du changement plutôt que conformité aux plans

Douze principes généraux

- Satisfaire le client en priorité
- Accueillir favorablement les demandes de changement
- Livrer le plus souvent possible des versions opérationnelles de l'application
- Assurer une coopération permanente entre le client et l'équipe projet
- Construire des projets autour d'individus motivés
- Privilégier la conversation en face à face
- Mesurer l'avancement du projet en termes de fonctionnalités de l'application
- Faire avancer le projet à un rythme soutenable et constant
- Porter une attention continue à l'excellence technique et à la conception
- Faire simple
- Responsabiliser les équipes
- Ajuster à intervalles réguliers son comportement et ses processus pour être plus efficace

HUTCHINSON®