



COMPOSITADOUR

COMPOSITES & ROBOTICS SOLUTIONS



IC3 – Arcachon

Innovative Heating Solution for Automatic
Fiber Placement of Dry Fibers & TP

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une plateforme d'innovation
ESTIA
INSTITUTE OF TECHNOLOGY

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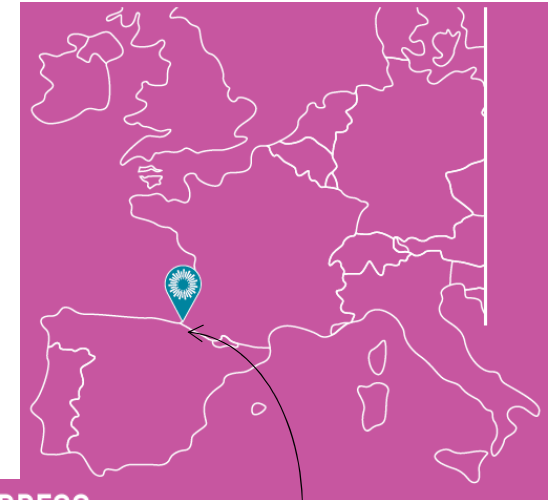
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COMPOSITADOUR => What – Where – Why??

Compositadour is a technological platform specialised in advanced processes: Composites, Robotics and Additive Manufacturing.

For 8 years, in partnership with industry, Compositadour initiates and carries out R&D project for new parts and manufacturing processes with outstanding research teams

Compositadour is an entity of engineering School ESTIA and was founded by industrial partners and regional organization



Beautiful place

INDUSTRIAL PARTNERS



INSTITUTIONAL PARTNERS



ADDRESS

Compositadour
Parc TECHNOCITÉ
1, Rue Pierre Georges Latécoère
64100 Bayonne - FRANCE

Team



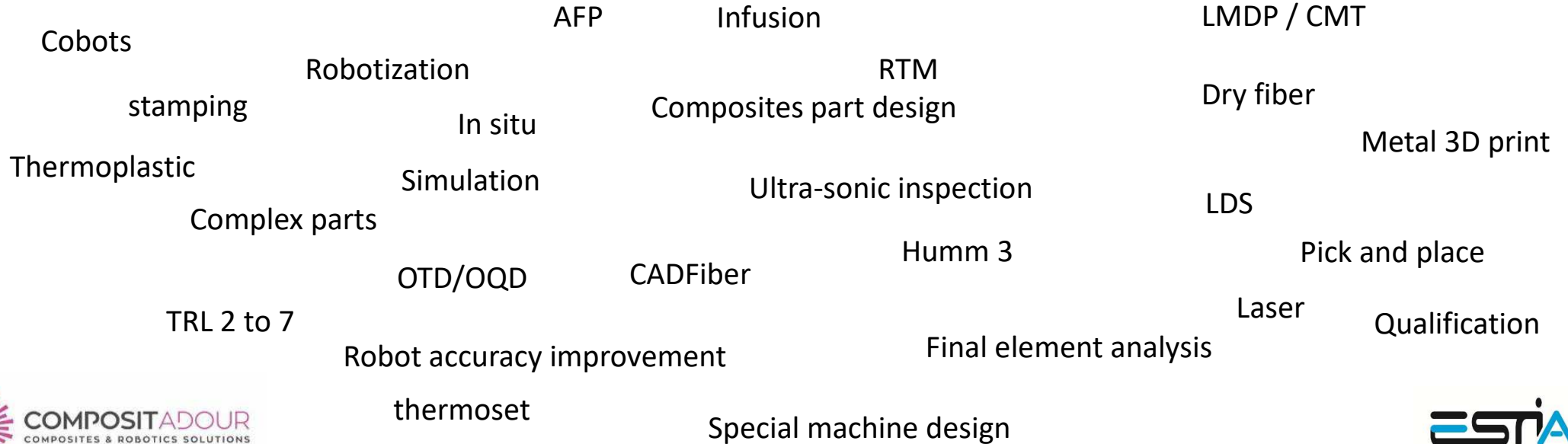
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COMPOSITADOUR => What – Where – Why??

- To help businesses appropriate these new technologies (Composites, robotic and 3D printing), Compositadour carries out the following missions:

=> **R&D, Training and technology transfer**

- Generally, Compositadour’s activities are on a maturity level **between TRL3 and TRL6**.
- Compositadour meets the needs of the industry, from the design to the development of processes and new / improved products, through prototyping and even industrial pre-launch on different subjects:



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COMPOSITADOUR => What

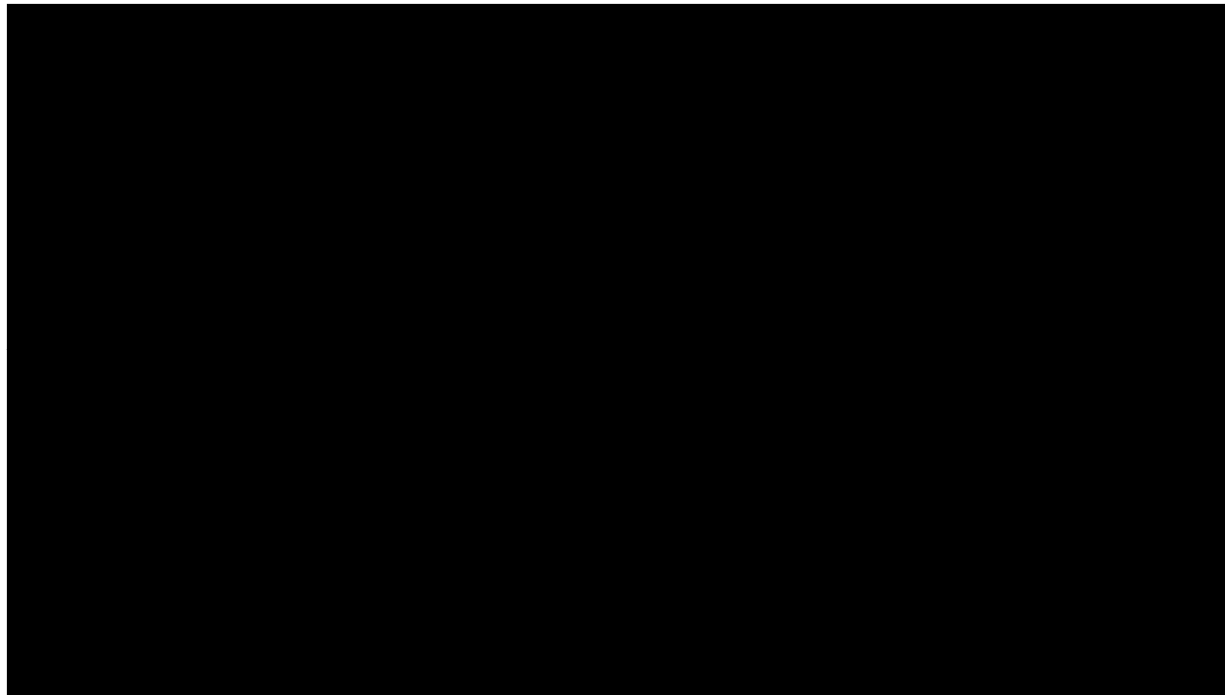


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Focus on Automatic fiber placement in COMPOSITADOUR

Compositadour works since 8 years on Automatic fiber placement with 16 tows Coriolis machine.

Dry fiber, thermoset and thermoplastic prepreg have been lay up from the beginning on large, small and complex parts



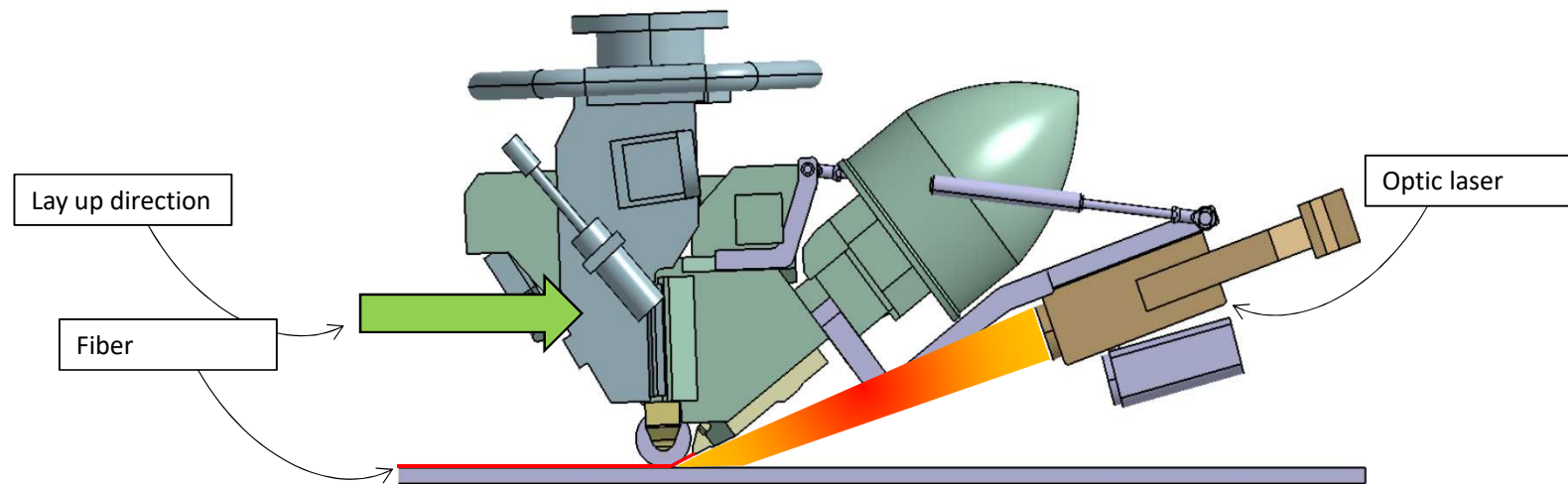
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Focus on Automatic fiber placement => Why heat with laser?

Thermoset prepreg material are tacky. We only have to increase T°C around 50°C during lay up to have good adhesion.

Due to high thermal fusion of thermoplastic prepreg and dry fiber binder (around 160°C and 350°C), IR lamps are not powerful enough to reach these temperatures at high layup speeds.

Solution => to use laser!



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Focus on Automatic fiber placement with laser heating system => Results!!

After several years of development at compositadour and, in other research institutes, lay up with laser heating system present today a good maturity!

Dry fiber

Very fast lay up speed on simple geometries (1m/s)

Very good lay up quality on complex geometries

Thermoplastic prepreg

Very fast lay up speed on simple geometries (1m/s)

Very good lay up quality on complex geometries

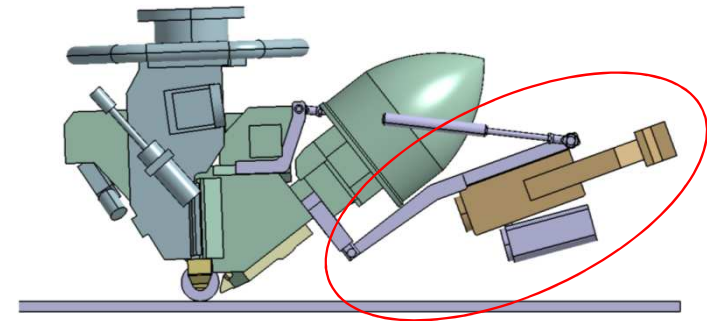
Very good material health on in situ (simple geometries) and "OoA" parts

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Focus on Automatic fiber placement with laser heating system => Why trying to change??

Because laser:

- Have safety issues
- Have a very large volume
- Is expensive
- Mono wavelength
- is very dependent on the emissivity of the area to be heated



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FOCUS on alternative heating solution for AFP

=> Today **only two heating systems** are installed on standard AFP machines with very important differences in characteristics.

IR lamps (for prepregs – 50°C)

- ✓ Cheap
- ✓ Small volume
- × Slow to heat/cool
- × Cannot reach high temperatures

Lasers (for dry fibre and TP – 180 to 400°C)

- × Expensive
- × Large volume
- ✓ Fast to heat/cool
- ✓ High Temperatures
- × Health & safety issues

What about fast, safe, small and competitive heating system ??!

Gap in the market

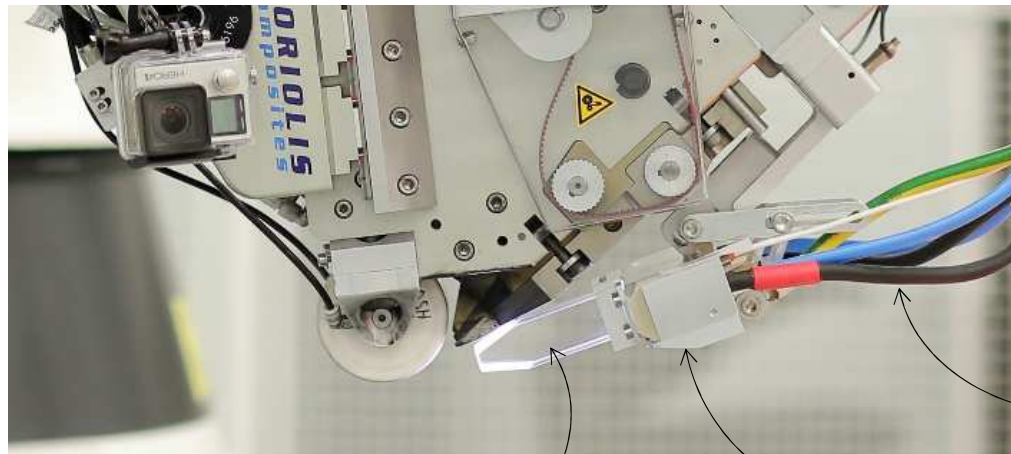


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FOCUS on alternative heating solution for AFP => Flash lamp!!?

Following the first results obtained at the NCC and at Coriolis, COMPOSITADOUR has chosen to start development on thermoplastic and dry fiber layup with the **Humm 3** Heraeus technology

A high power flashlamp (xenon) is contained within a small, scalable housing. The pulsed energy is guided to the nip point by means of a transparent guide block, which can be customised for different materials and applications.



Light guide

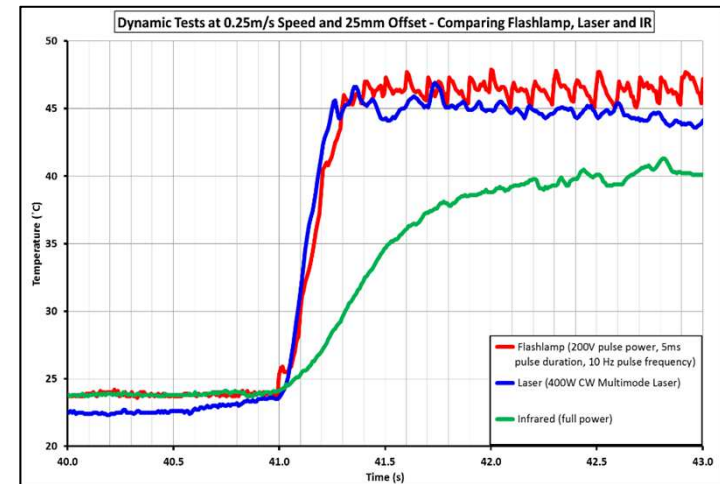
Lamp housing

Power cables and cooling water pipes

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FOCUS on alternative heating solution for AFP => Flash lamp!!?

- **Broadband Source** – absorption at many wavelengths:
 - Pulsed energy spread over visible and IR wavelengths
 - Homogeneous levels of absorption between Fibers, binder and resin
- **Pulsed source** – control of surface temperature via:
 - Pulse frequency (pulses per second)
 - Pulse Duration (short or long pulses)
 - Pulse Energy (large or small energy pulses)
- **Safe Source** – no requirement for separate laser booth:
 - Bright light source
 - Operators can remain close to lay-up



Heat time & temperature equivalent to laser

Experiments on moving targets have shown the heating rate of humm3 is equivalent to laser, and much faster than IR lamps. This is also true for cooling - humm3 has no residual heat.

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Flash Lamp => trials done in COMPOSITADOUR

The first developments at Compositadour focused on the comparison between the laser and the flash lamp.

The research focused on:

- Lay up quality
- Material health after infusion / injection for dry fibers
- Material health and mechanical properties after consolidation (autoclave, OoA and in situ) for Thermoplastic prepreg



Operators can remain close to lay-up

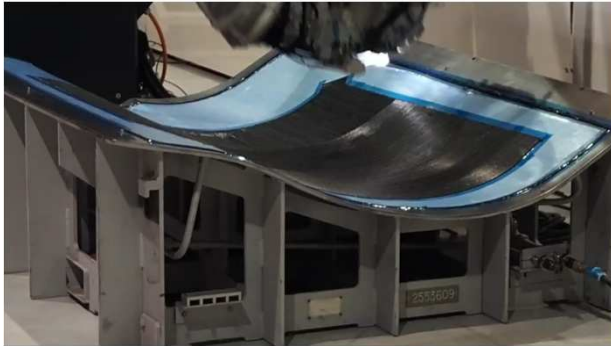
TP prepreg lay up with insitu consolidation

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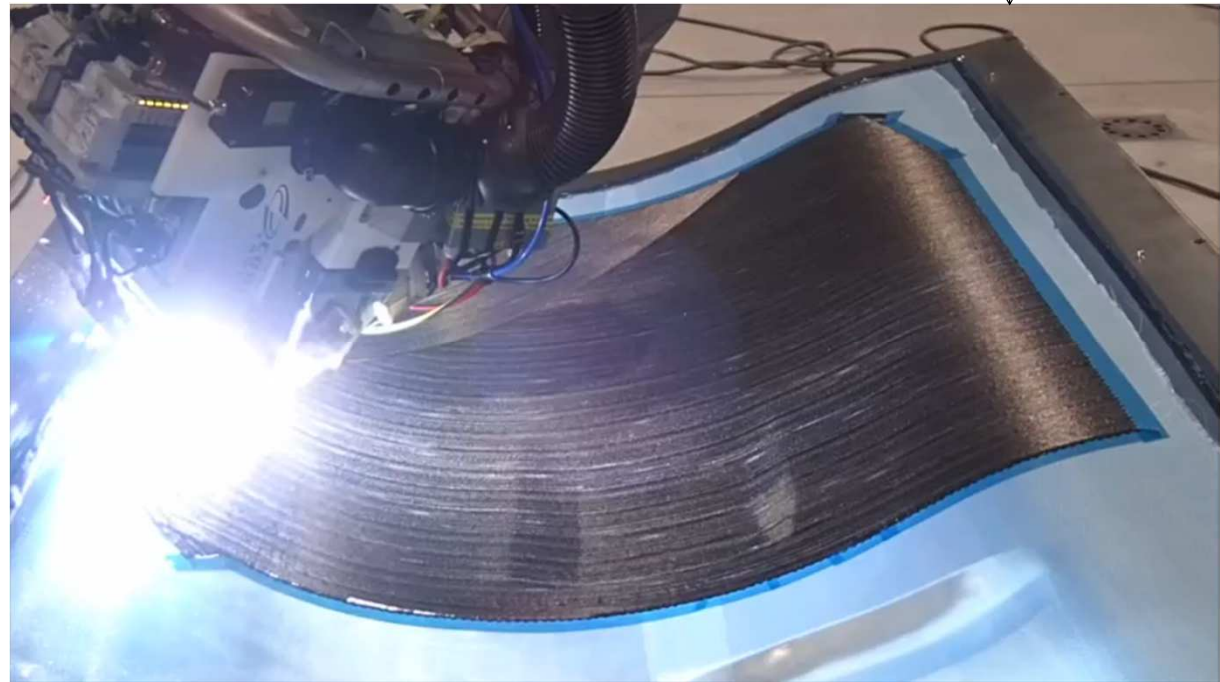
Flash Lamp => Result on Dry fibers

Manufacture of Dry fiber panels with infusion process
Level of maturity similar to the laser reached in a few hours!!

90° with complex geometry



45° orientation



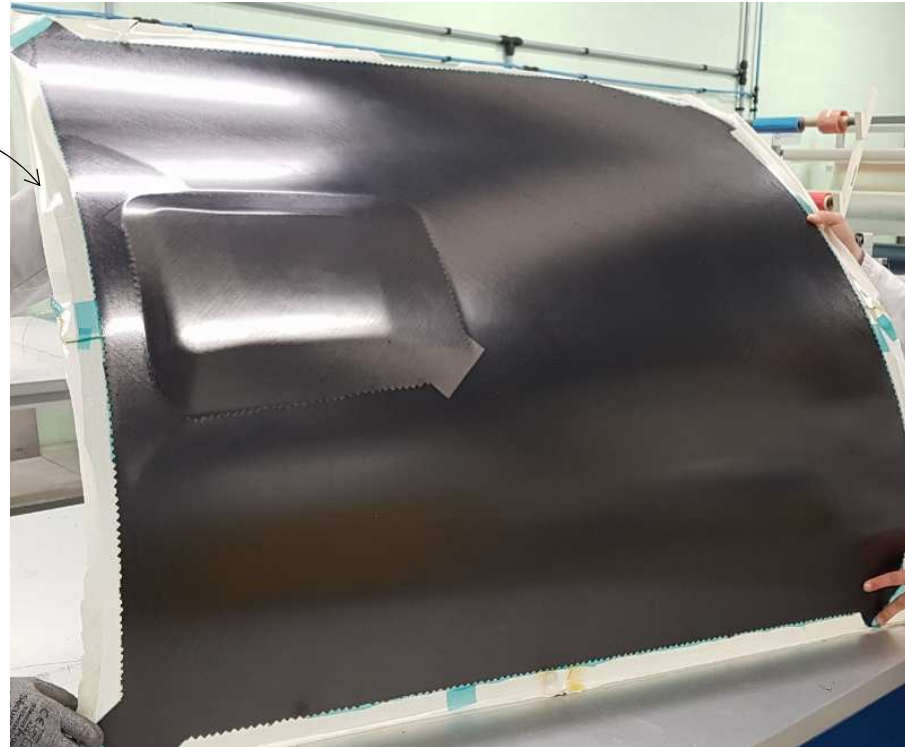
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Flash Lamp => Result on Dry fibers

Manufacture of Dry fiber panels with infusion process

Level of maturity similar to the laser reached in a few hours!!

Result after Hitape Layup and RTM6 infusion



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Flash Lamp => Result on Thermoplastic prepreg

Level of maturity similar to the laser reached in a few days!!

Trials done with PEAK and PEEK materials on:

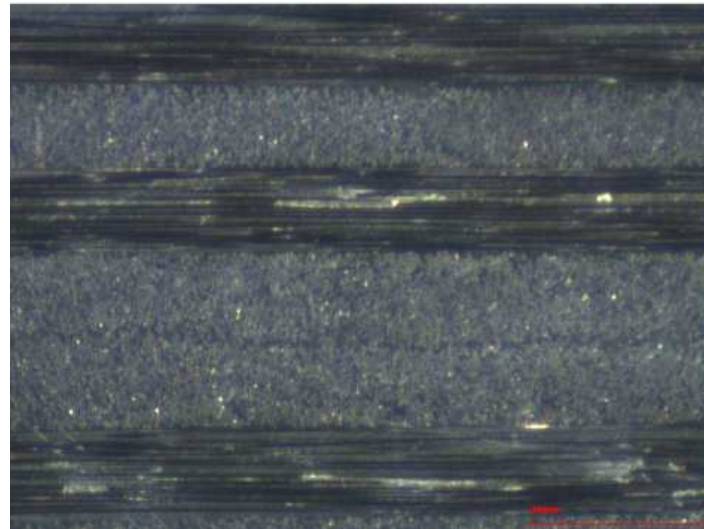
- Autoclave consolidation
- Out of autoclave consolidation
- In situ consolidation

=> results similar to laser

Out of autoclave consolidation micro cut



In situ consolidation micro cut



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What about next steps!!

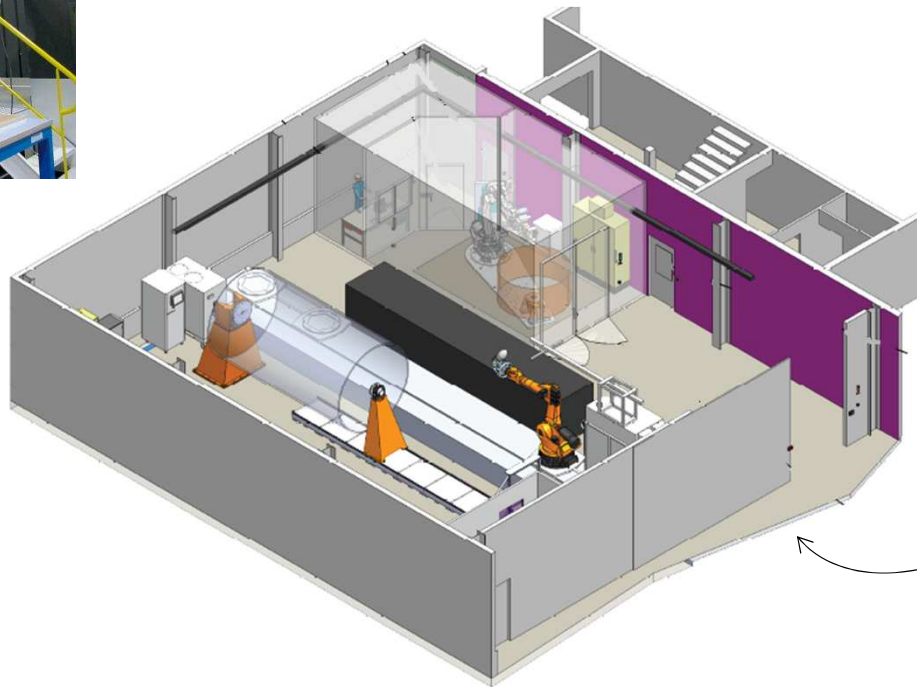
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Integration of last Humm 3 update in compositadour on C-SOLO and C1



Current machine in COMPOSITADOUR

Compositadour C-SOLO machine in finalisation at Coriolis



COMPOSITADOUR in July 2018

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Development on Dry fibers

Start to develop complex geometries parts

Manage thermal control

Development on Thermoplastic prepreg

Start to develop complex geometries parts

Manage thermal control

Increase lay up speed for out of autoclave and in situ consolidation

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Questions??!



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Director

What about robots??

Really?? You're able to print metal!!