

## A-Arms conception and manufacturing

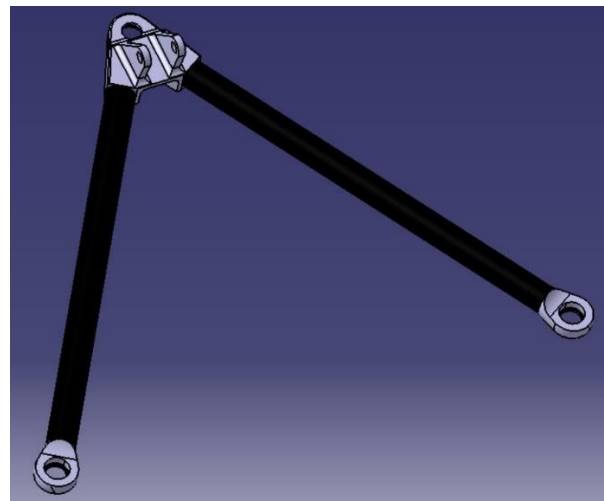
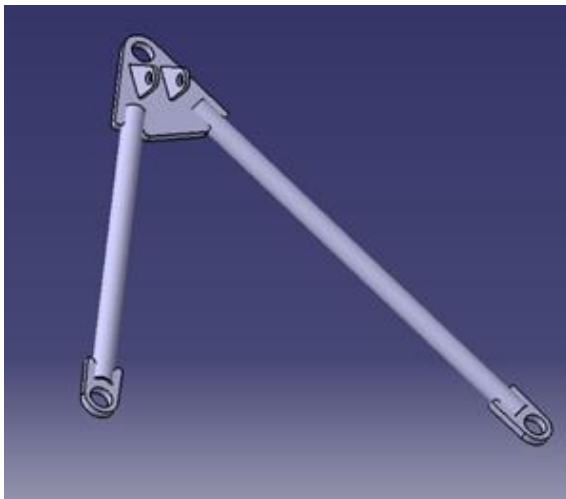
### Objectives

- **Reliability**
  - o Maximal load case on the car: 6250 N
- **Weight**
  - o Target of 2 kg
- **Cost**
  - o Ratio of comparison of weight saving < 1 euros by grams

### Conception and manufacturing steps

- **Comparisons of different solutions:** Comparison of a steel solution, an aluminium solution and an hybrid solution (aluminium + carbon tubes).
- **Validation of the process:** tensile strength.
- **Verification of the A-arms:** tensile test after integration.

### Comparisons of the 3 designs



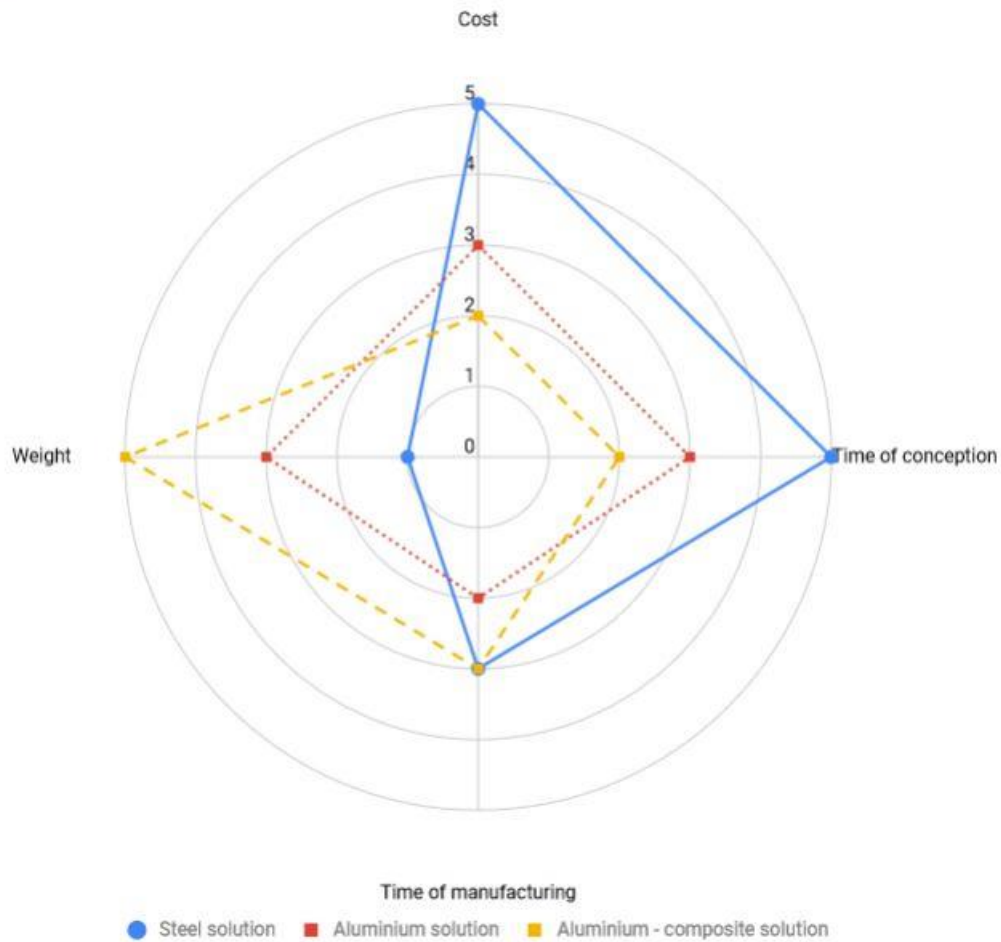
*Steel design (left) and hybrid design (right) represented*

- **Steel design:** Laser cutted part with tubes, assembled together by welding
- **Aluminium design:** Machined parts with tubes, assembled together by welding
- **Hybrid solution:** Aluminium machined parts with carbon tubes, assembled together with glue

Design	Steel	Aluminium	Hybrid
Cost estimation	600,00 €	2 010,00 €	3 350,00 €
Weight estimation (g)	5980	3070	1840
Ratio €/g decrease (comparison with steel)		0,49 €	0,66 €

*Comparisons of the cost and weight of the 3 designs*

## A-arms choice



→ Aluminium-carbon composite design chosen to achieve the 2 kg target.

## Process of gluing

Gluing surface	1,13E-03 (carbon-alu)/ 0,75E-03 (alu-alu)
Theoretical maximum shear stress of epoxy structural adhesive used (from datasheet, for a contact between two plates)	30.2 MPa
Worst load case (obtained with MecaMaster)	6,25 kN
Minimal tensile strength to reach for our process (with a security coefficient of 2.5)	15 kN

### Process flow

#### Step 1: sanding

- ⇒ Sanding of the aluminium parts with sandpaper P180
- ⇒ Sanding of the carbon tubes with sandpaper P180
  - 3 times on a length of 30 mm
  - Visual control

#### Step 2: cleaning with acetone

- ⇒ 2 times for aluminium parts and carbon tubes
- ⇒ Let evaporate after

#### Step 3: Gluing

- ⇒ Application of the epoxy structural adhesive on the inserts parts all along the surface
- ⇒ Insert it by turning
- ⇒ Place it and fix it on the fixture

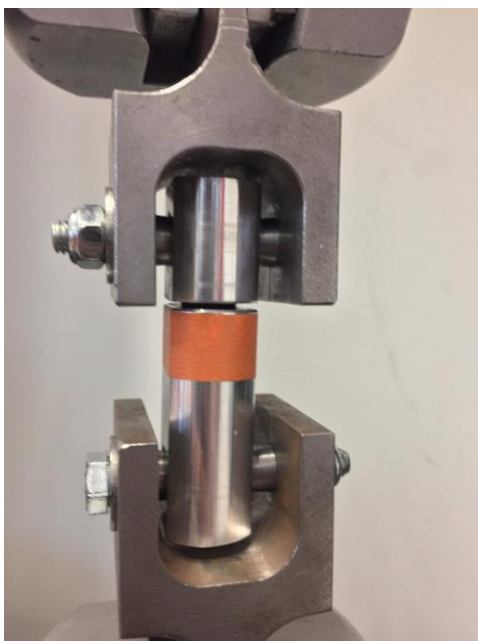
#### Step 4: Drying

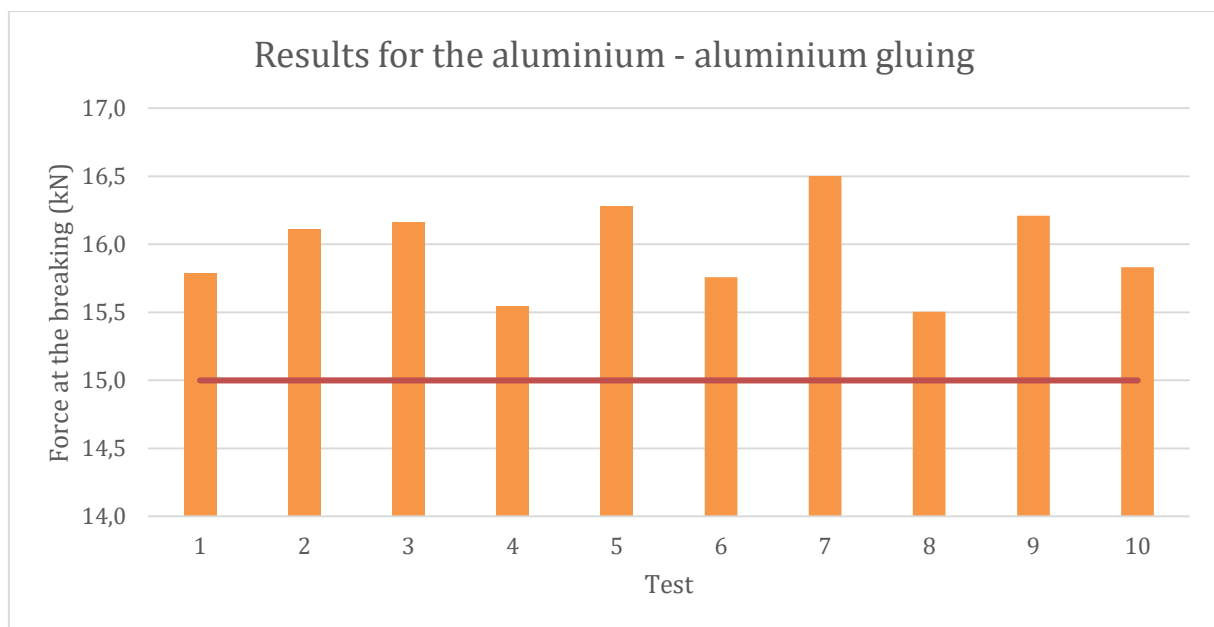
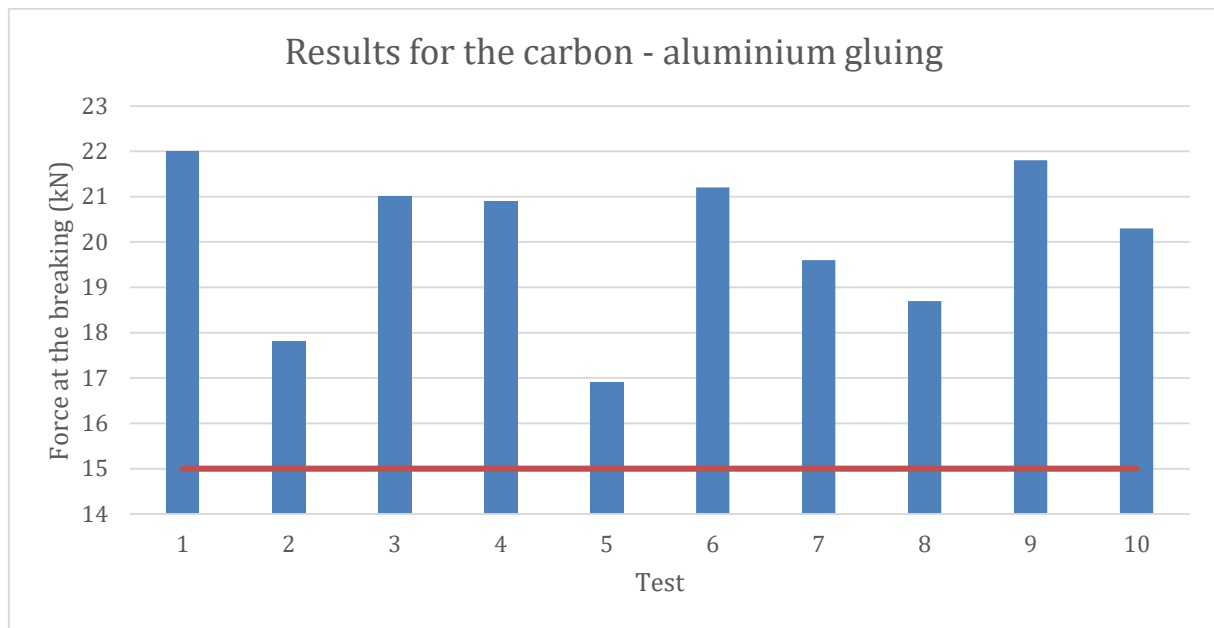
- ⇒ Let it dry for 7 days at 20°C



### Gluing tests

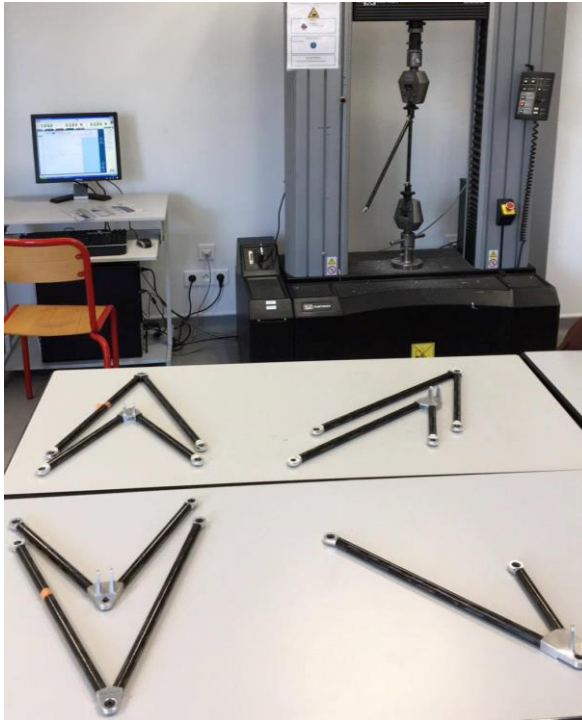
Tensile strength tests on 10 gluing aluminium-aluminium and 10 gluing carbon tube – aluminium.



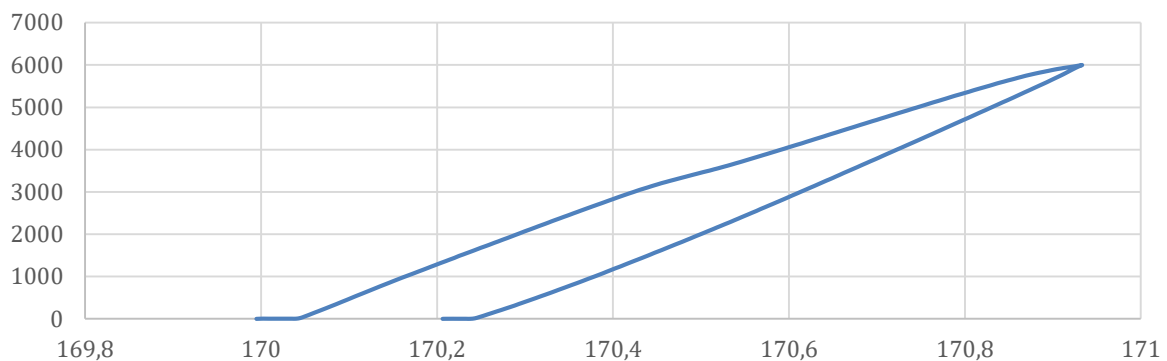


	Carbon-alu	Alu-alu
Standard deviation	1,73	0,33
Mean	20,02	15,97
Min.	16,9	15,50
Max.	22	16,50
Confidence interval (99%)	4,45	0,85
Min. of confidence interval	15,57	15,12

## Verification of current A-arms



Load (N) versus displacement (mm)  
- Front lower A-arms, rear arm



Load (N) versus displacement (mm)  
- Carbon-alu gluing witness n°1

