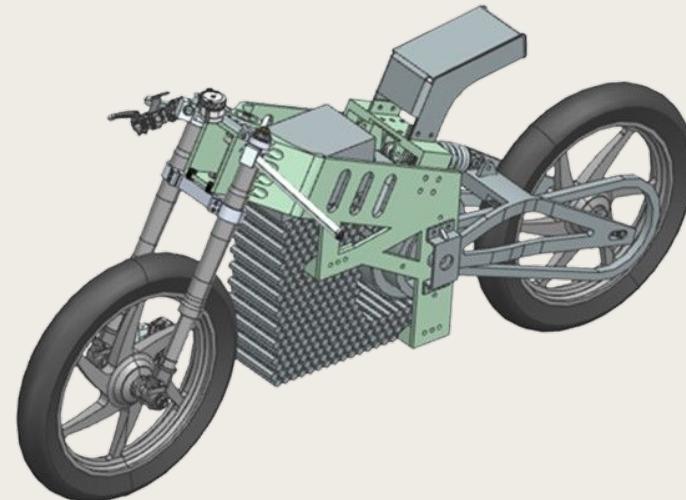


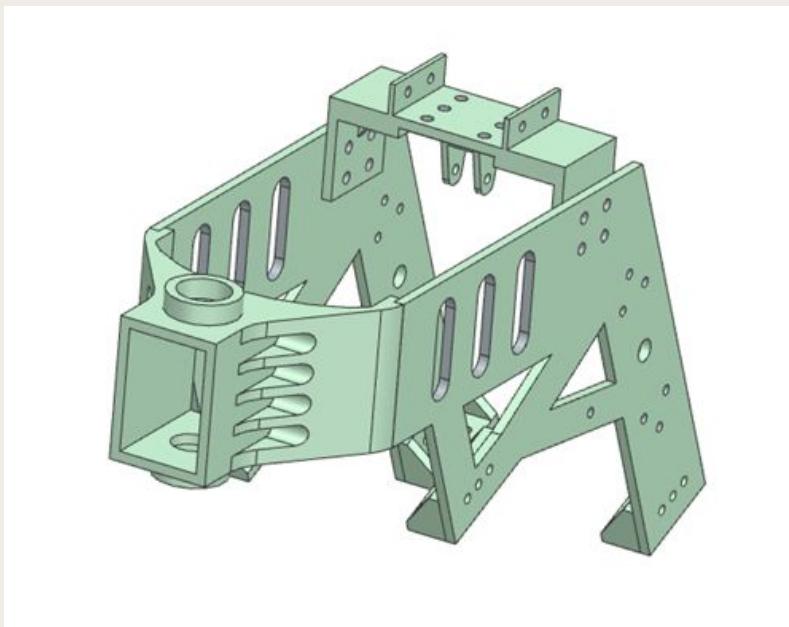
# STRESS AND DISPLACEMENT SIMULATION OF A MOTORBIKE CHASSIS

By Maider, Furkan, Pablo and Unai



# INTRODUCTION

**SIEMENS  
NX**



# STEPS



## 1 Boolean

Join the different parts in a single one for the study

## 2 Meshing

Create a mesh for an accurate study

## 3 Materials

Establishing material properties

## 4 Constrains

Establishing different constrains of the model

## 5 Loads

Apply the loads which happen in real life

## 6 Events

Open the different scenarios to watch the results

## 7

## Simulation

Run the model

## 8

## Analysis

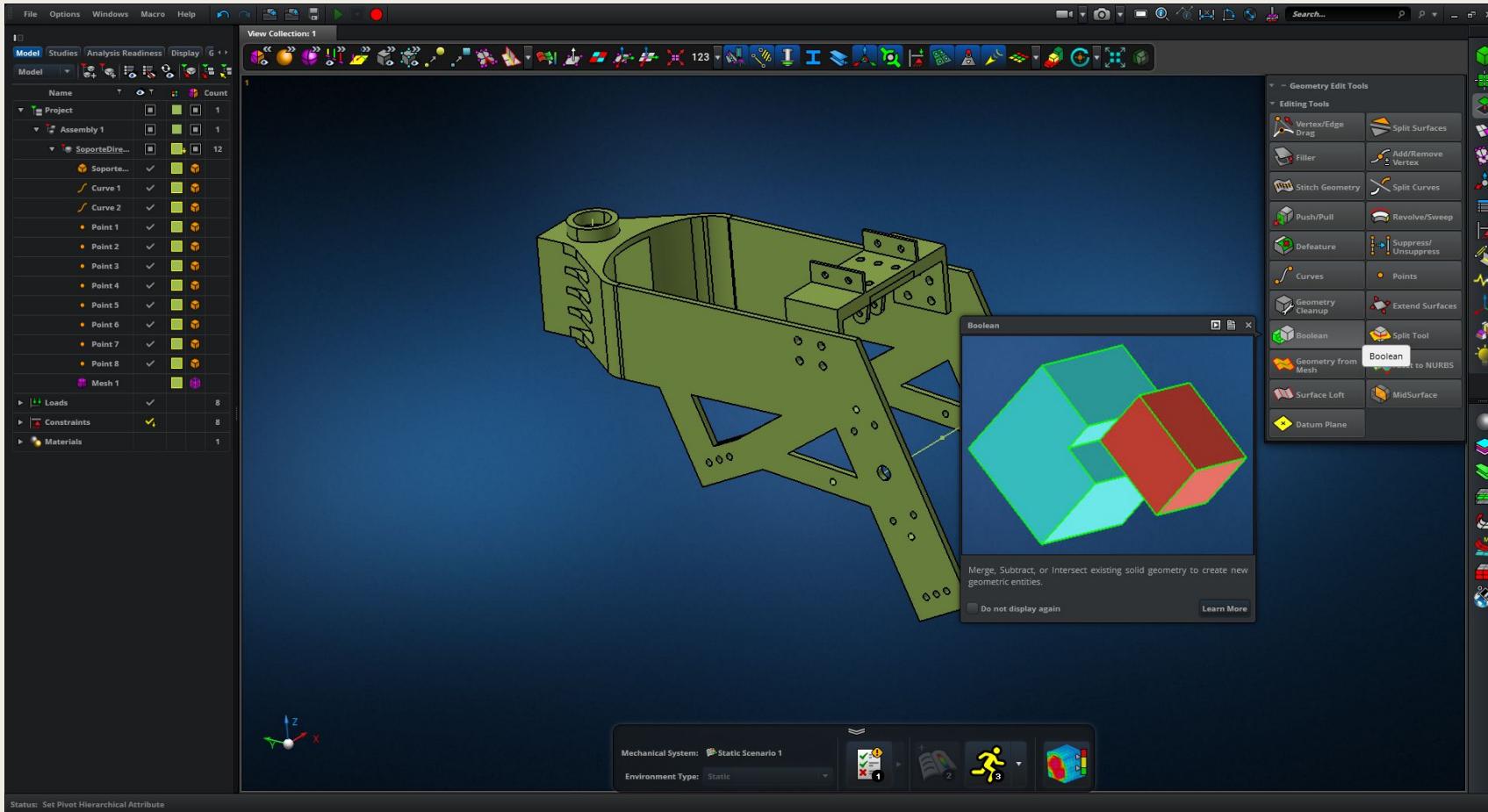
Analyze the results to search for possible changes

## 9

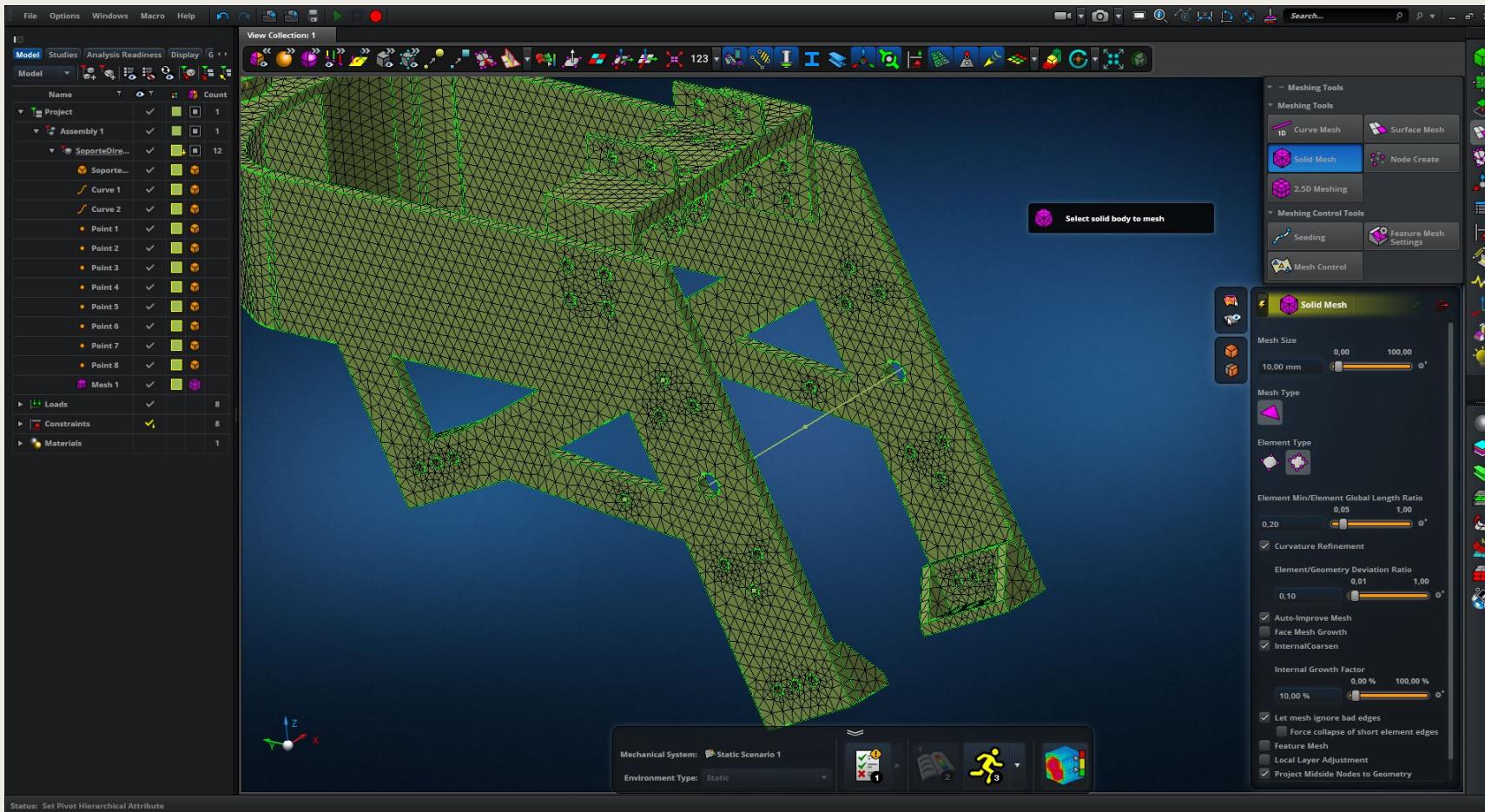
## Optimization

Make the possible changes to optimize the geometry based on the results

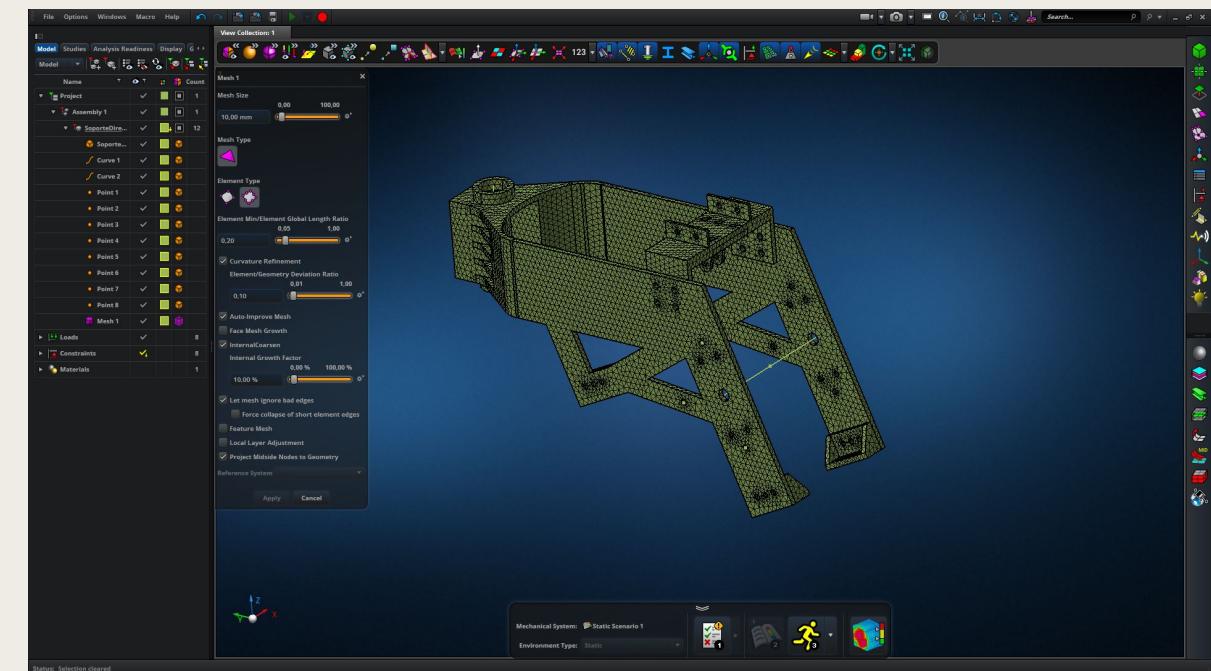
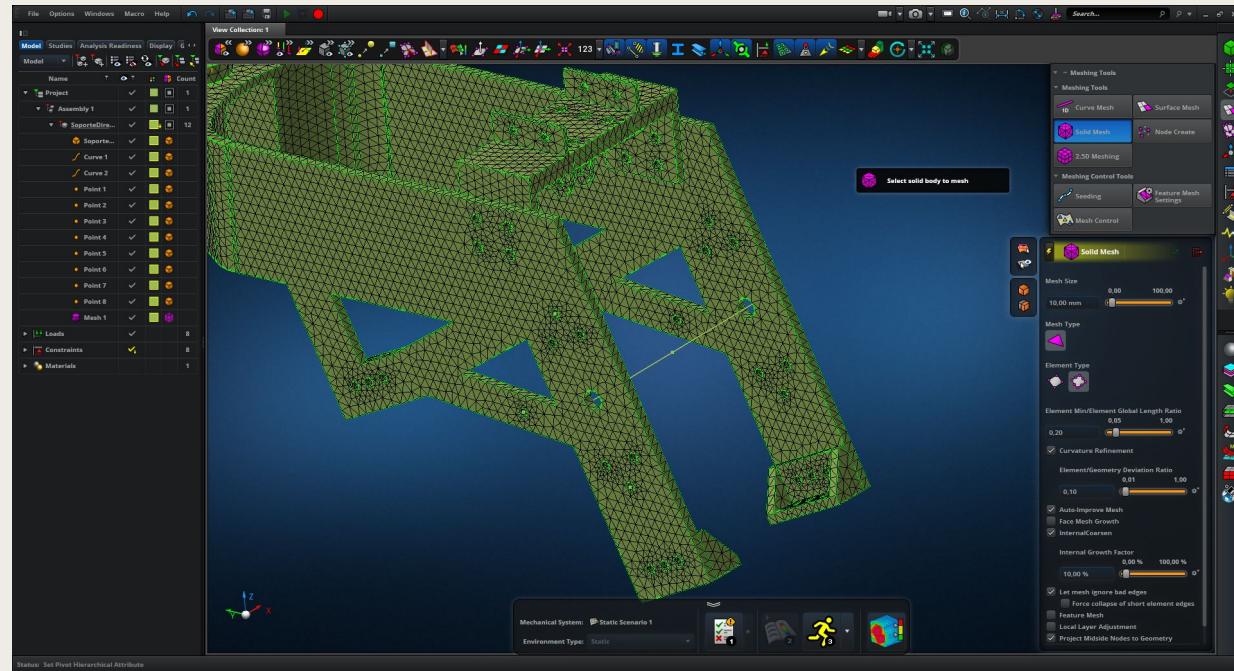
# BOOLEAN



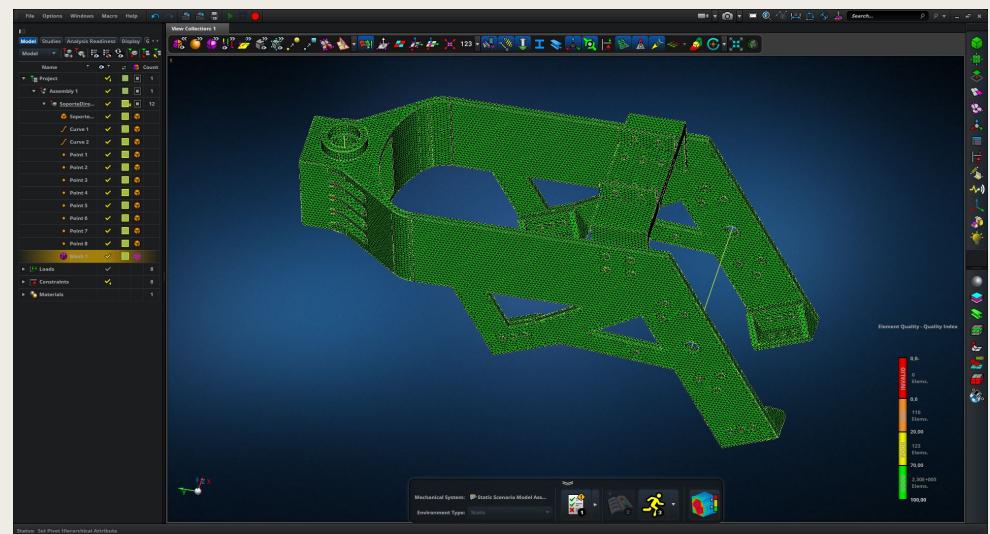
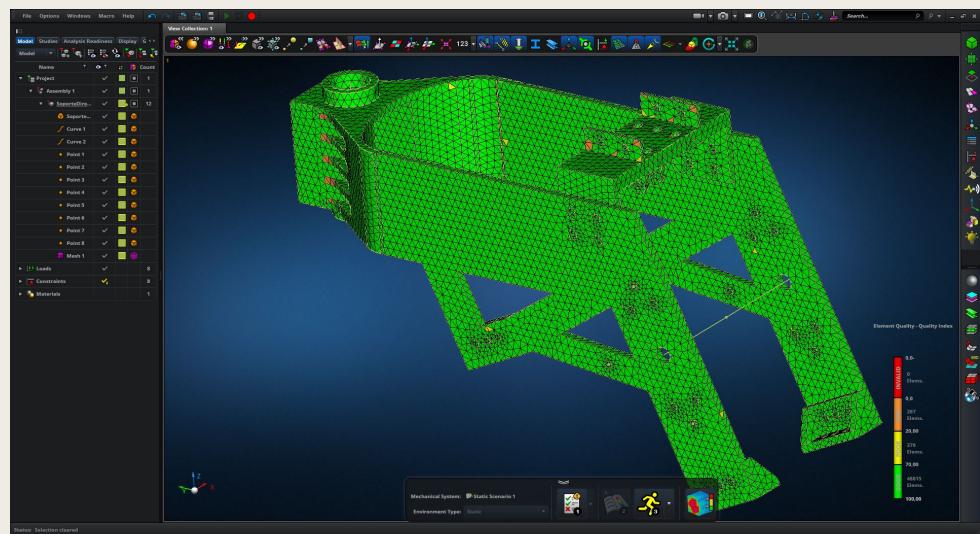
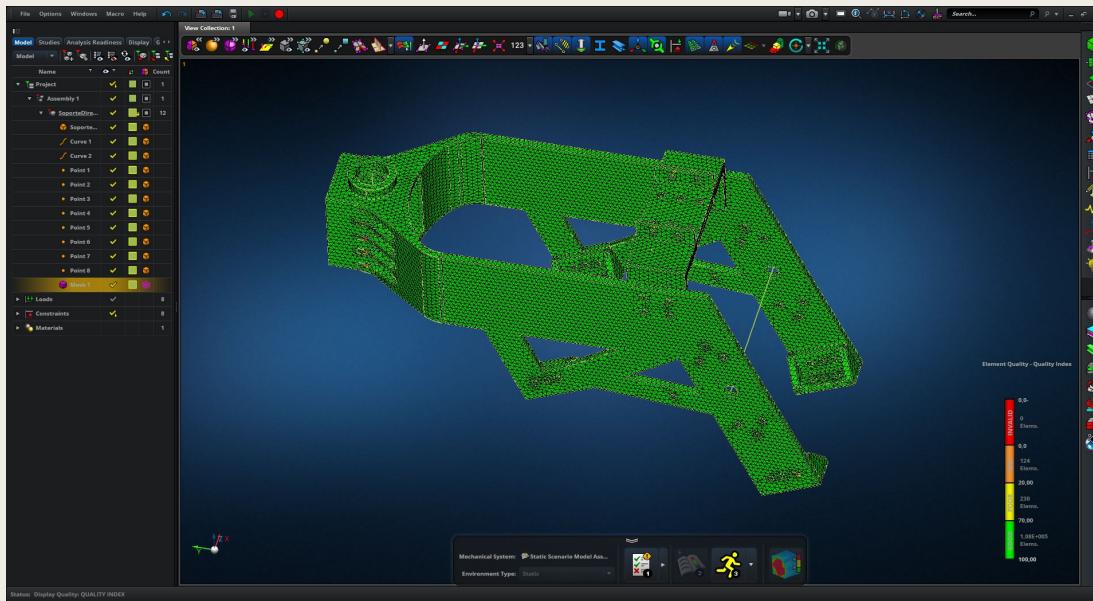
# MESH



# MESH TYPE



# MESH CHECK



# MATERIAL

## Aluminium 6082

Anticorodal / 9006/4 / AlMgSi1 / 3.2315 / H30 / A-SGM0.7 / P-AlSi1MgMn

Versatile alloy with an excellent combination of mechanical and physical properties. Thanks to its suitability for machining and welding and its good chemical resistance, it is ideal for a wide variety of applications.



### Material properties

Density	2,7	g/cm³
Tensile strength	ISO 6892	285 MPa
Elongation at break	ISO 6892	6 %
Yield strength	ISO 6892	230-240 MPa
Elastic modulus	ISO 6892	69,5 GPa
Hardness	ISO 6508	100 HB
Melting temperature		645 °C
Thermal conductivity (20°C)		170 W/mK
Electrical resistivity		0,04 Ωmm²/m

#### Main alloy elements

Aluminium - Magnesium - Manganese  
- Silicon

#### Maximum dimensions

500x500x300 mm (19.7x19.7x11.8 in)

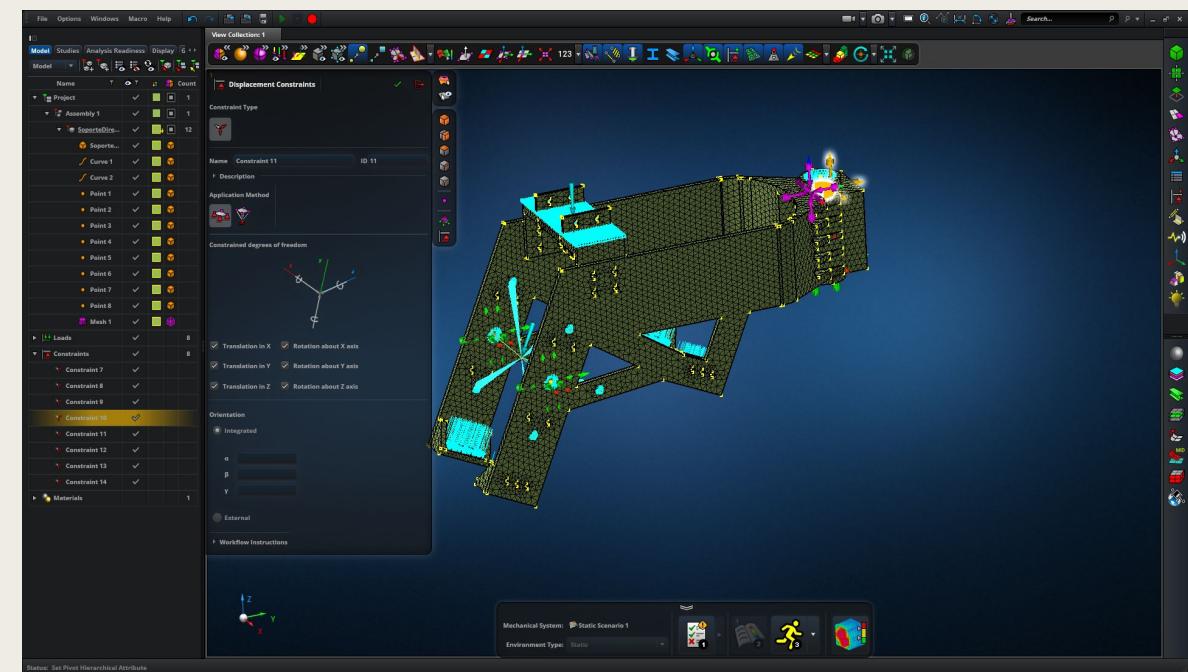
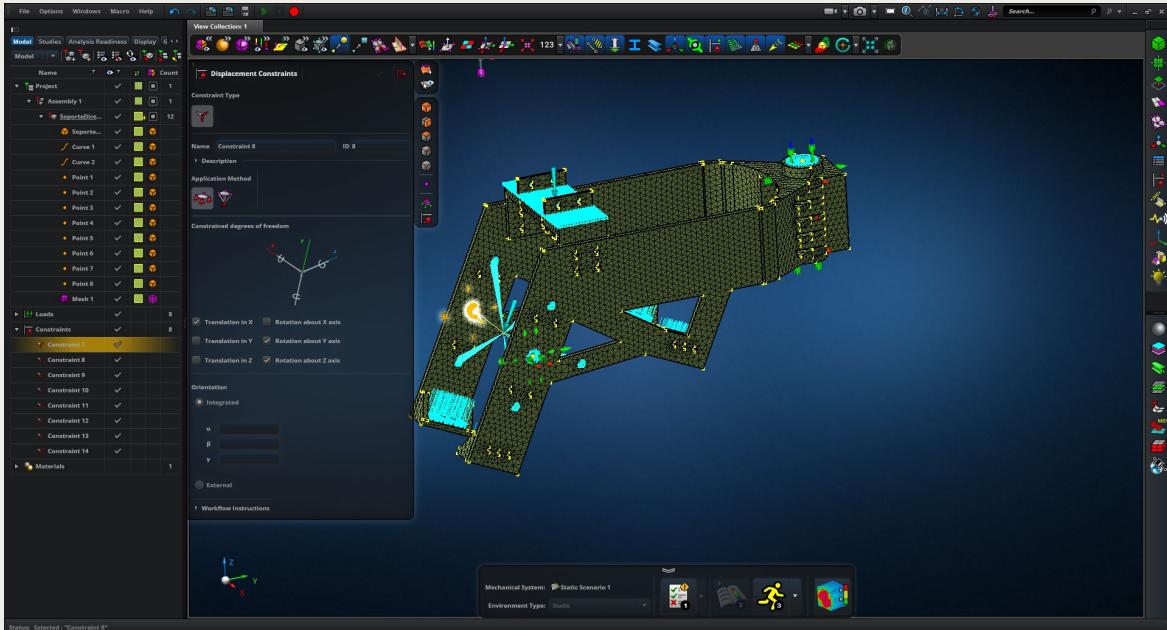
#### Tolerances

ISO 2768-1 fine (f) or medium (m)  
class

#### Applications

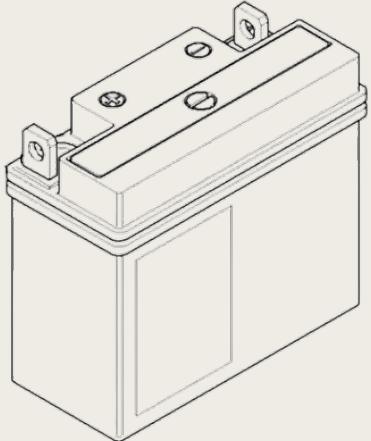
It is widely used in the transport industry, ideal for components such as railway carriages, truck bodies and trailers. It is also used in the construction industry, ideal for components such as roofing and cladding. In the sporting goods industry, it is used for components such as bicycle frames and sports equipment due to its high strength-to-weight ratio. It is also used in the electrical industry for busbars and electrical connectors.

# CONSTRAINTS

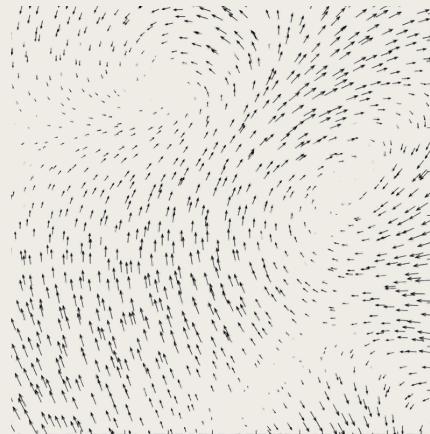


# LOADS

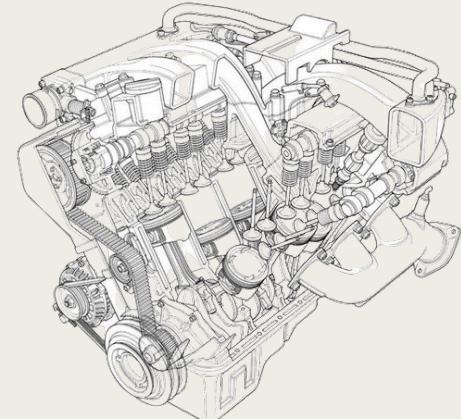
BATTERY



PRESSURE LOADS

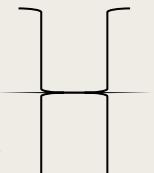


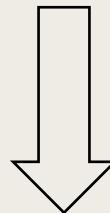
MOTOR



# LOADS

## BATTERY

- Weight : 40kg
  - Pressure =  $F/A$
- 
- $F = (40 \text{ kg} * 9,8\text{m/s}^2) / 4 \text{ pieces} = 98\text{N}$
  - $A = 80\text{mm} * 30\text{mm} - (2\pi*5^2)*3 \text{ holes} = 1928,76\text{mm}^2$

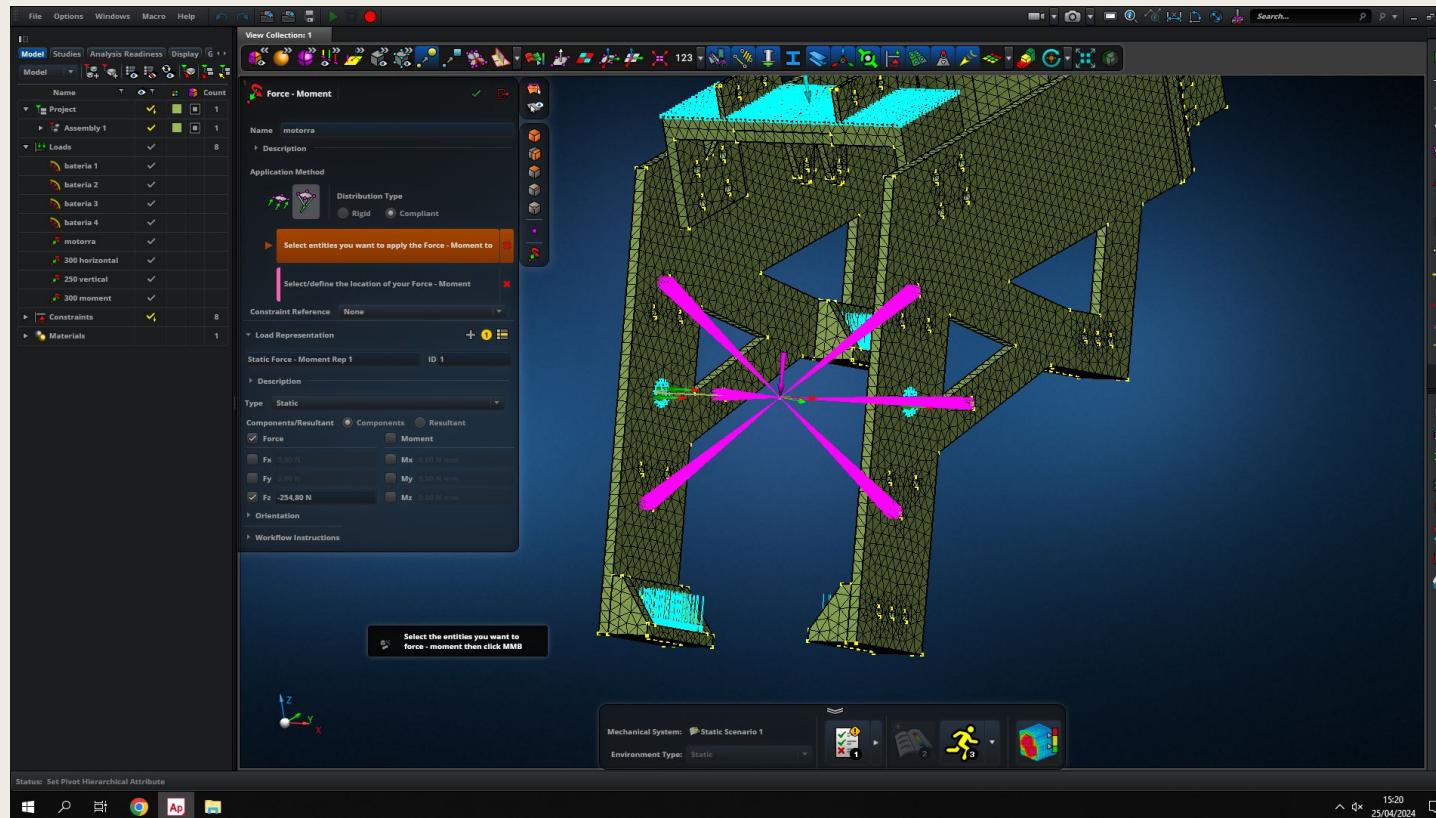


- **Pressure load =  $98 / 1928,76 = 0,0508 \text{ N/mm}^2 = 0.0508 \text{ MPa}$**

# LOADS

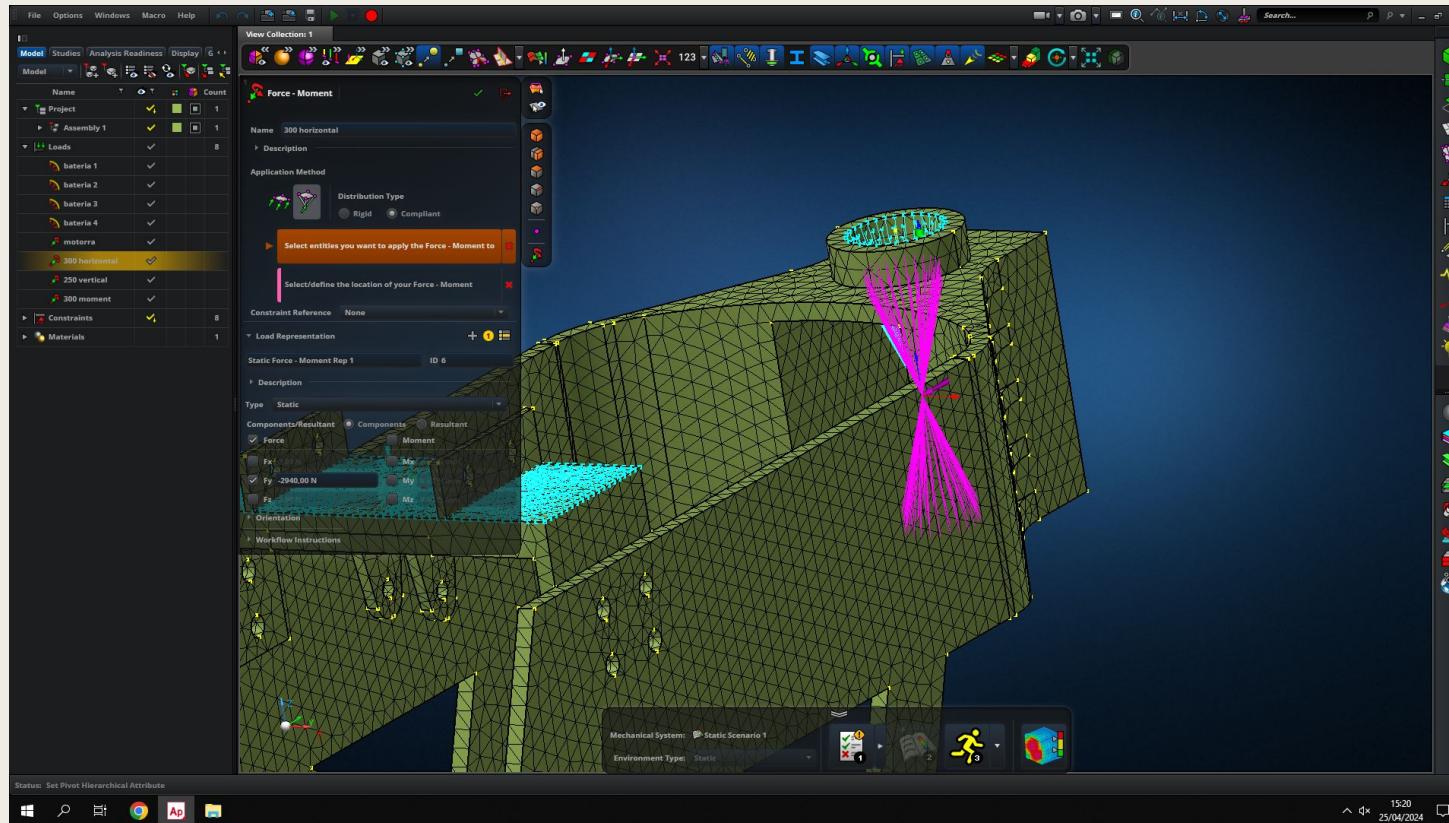
## MOTOR

- Weight : 26kg  $\square F = (26 \text{ kg} * 9,8\text{m/s}^2) = 254,8 \text{ N}$



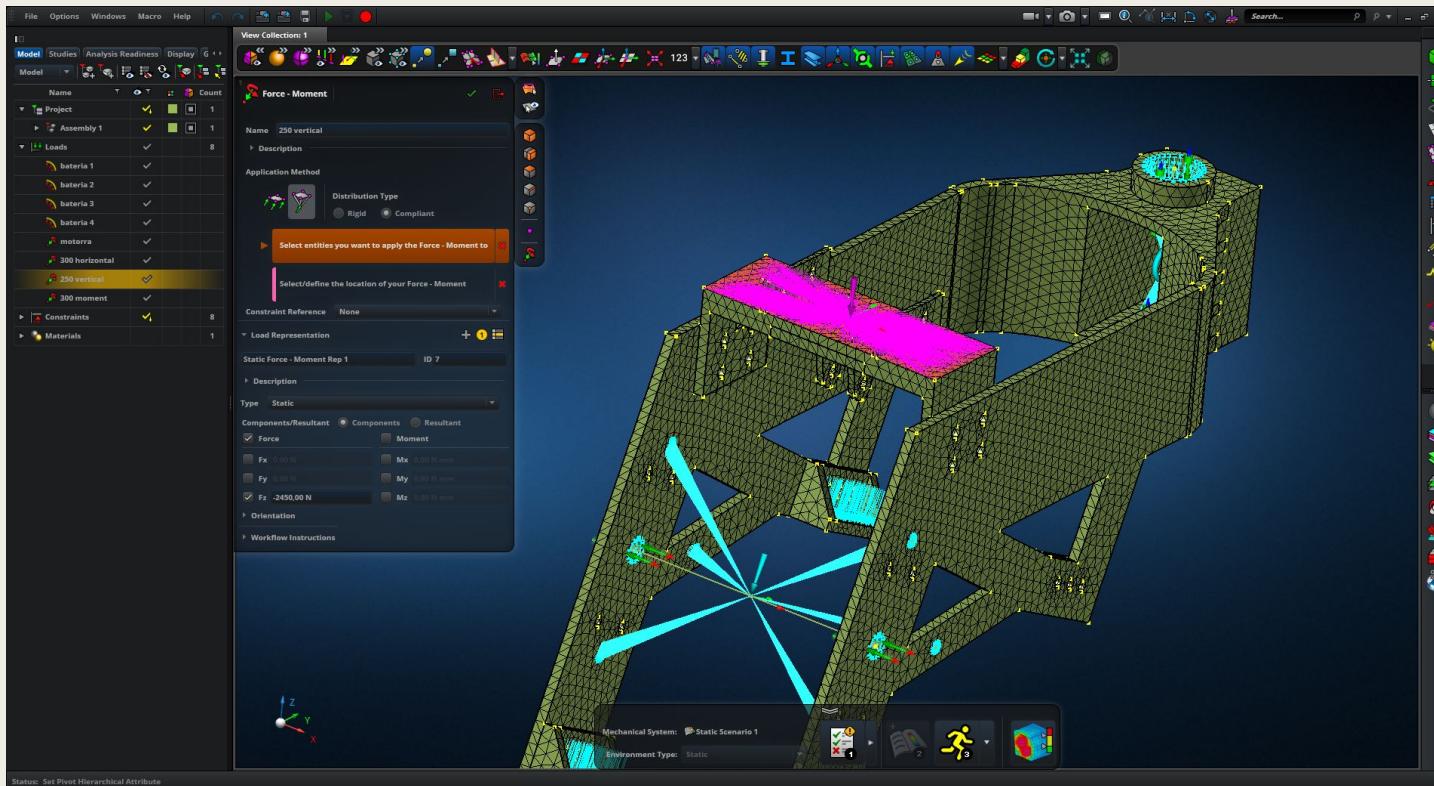
# HORIZONTAL FORCE (300 KG)

- Force : 300 kg  $\square$   $F = (300 \text{ kg} * 9,8\text{m/s}^2) = 2940 \text{ N}$

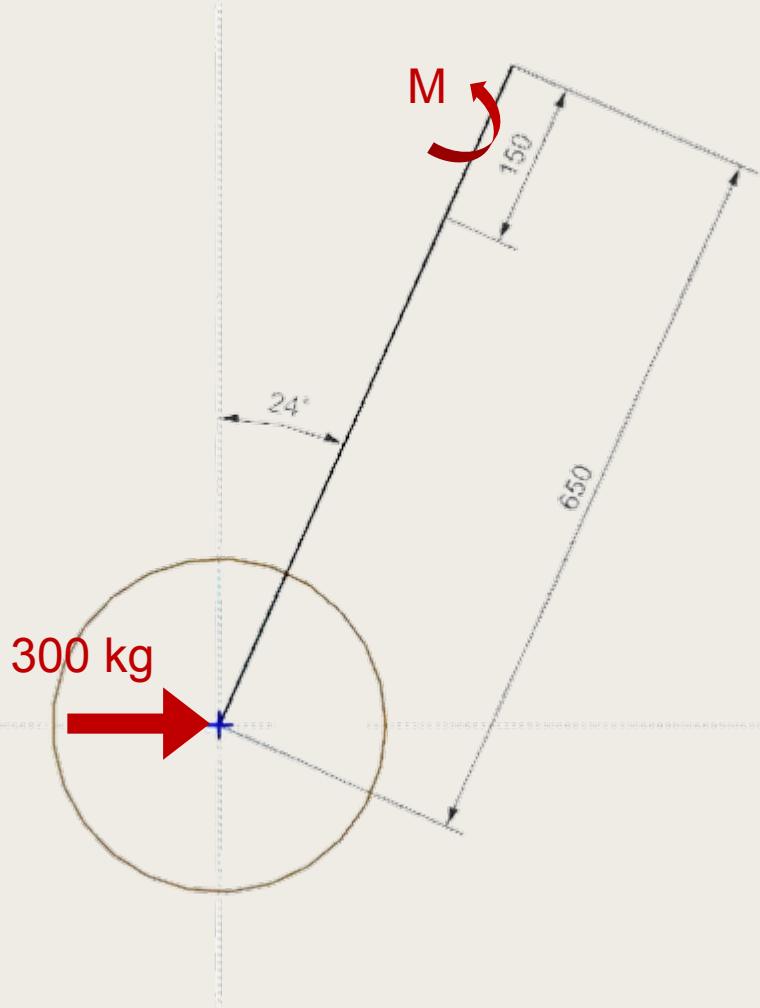


# VERTICAL FORCE

- Force : 250 kg  $\square$   $F = (250 \text{ kg} * 9,8 \text{ m/s}^2) = 2450 \text{ N}$



# MOMENTS

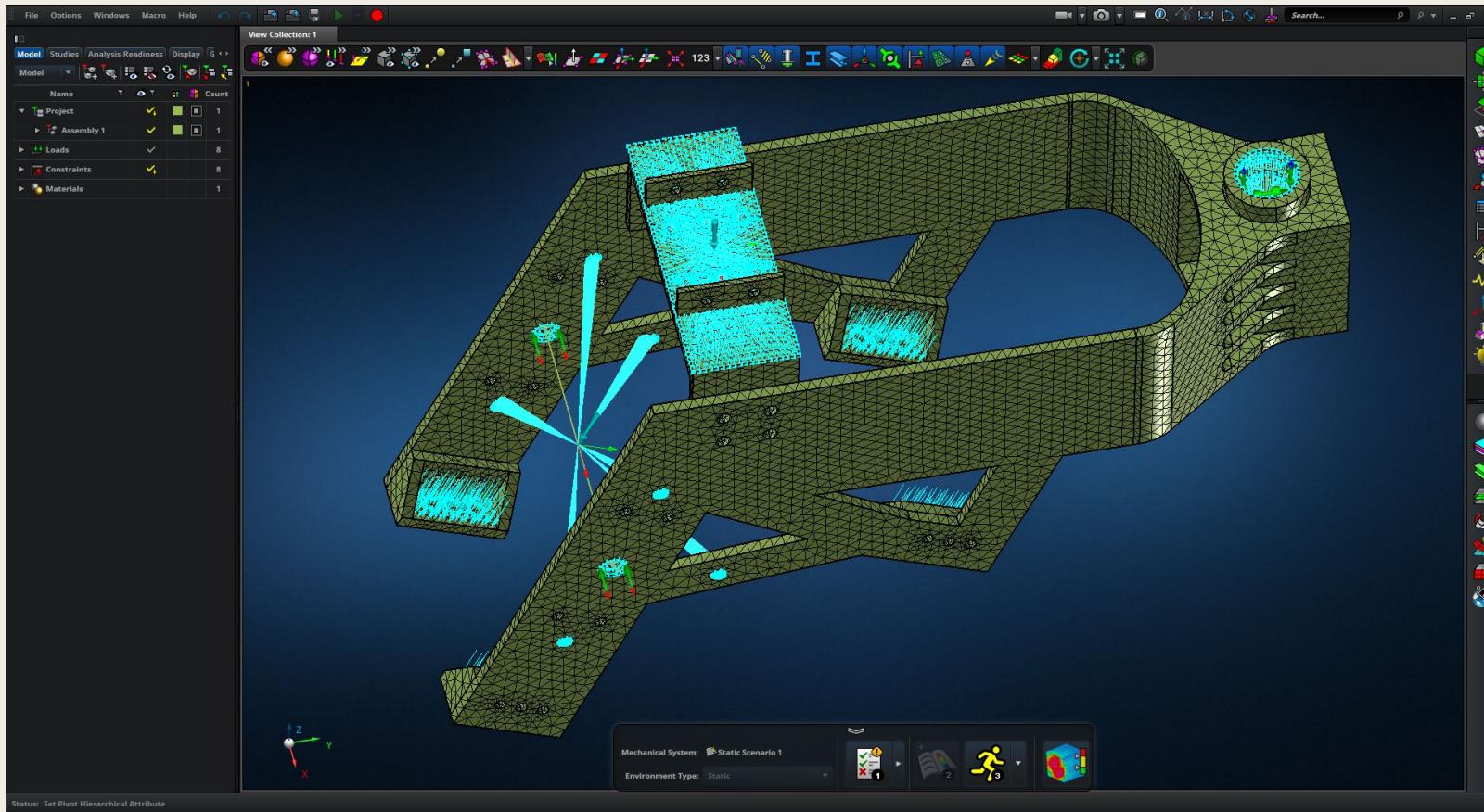


$$M = F * d$$

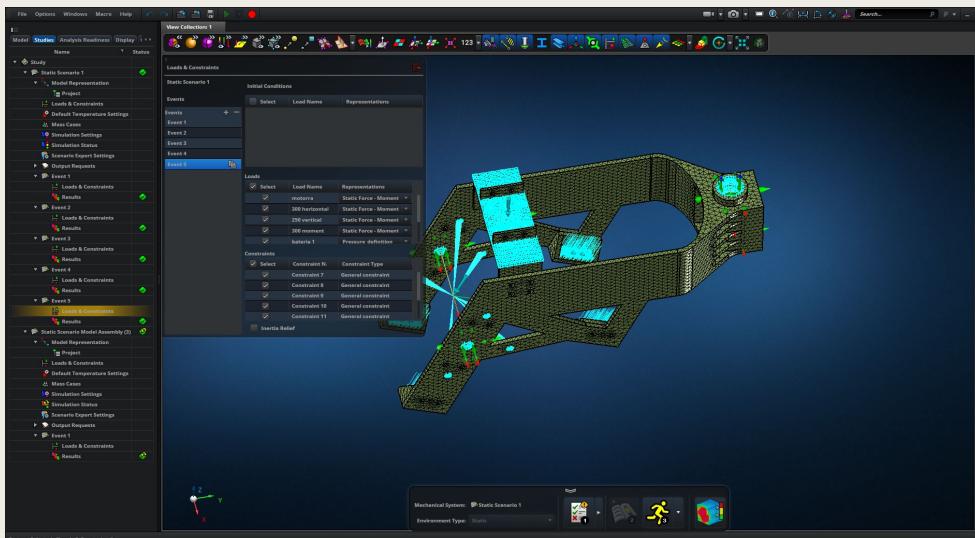
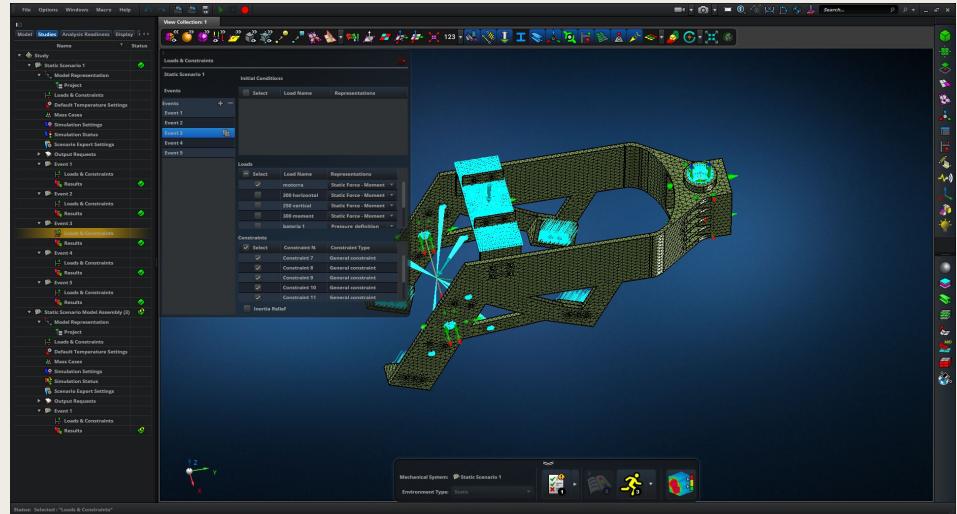
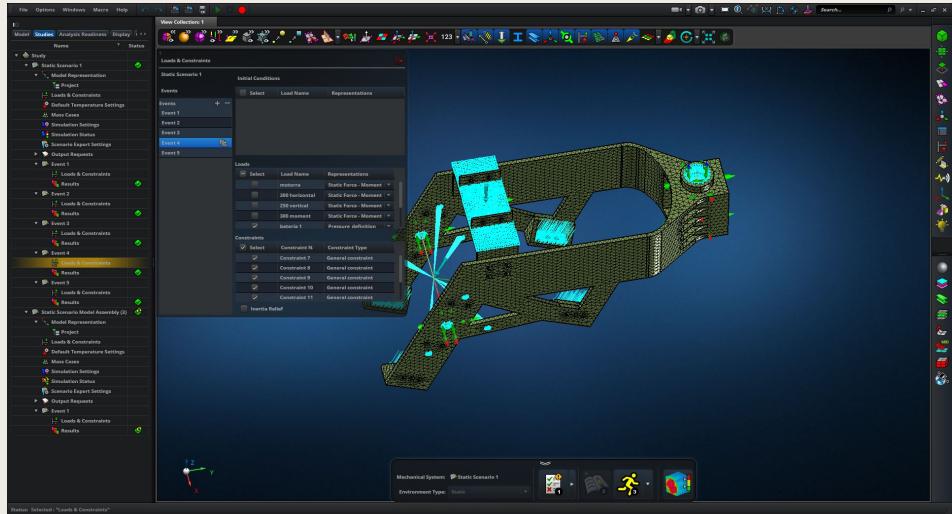
$$M = (300 * 9,8) * (650 - (150/2) * \cos(24^\circ)) = 1544.348 \text{ Nm}$$

Middle point in  
the chassis

# PRESSURE LOADS

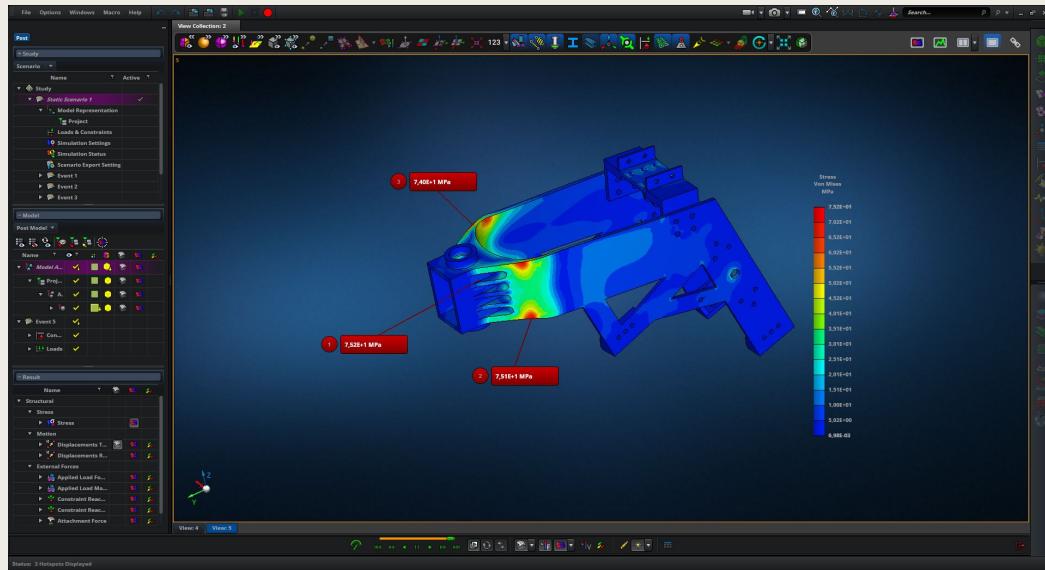


# EVENTS

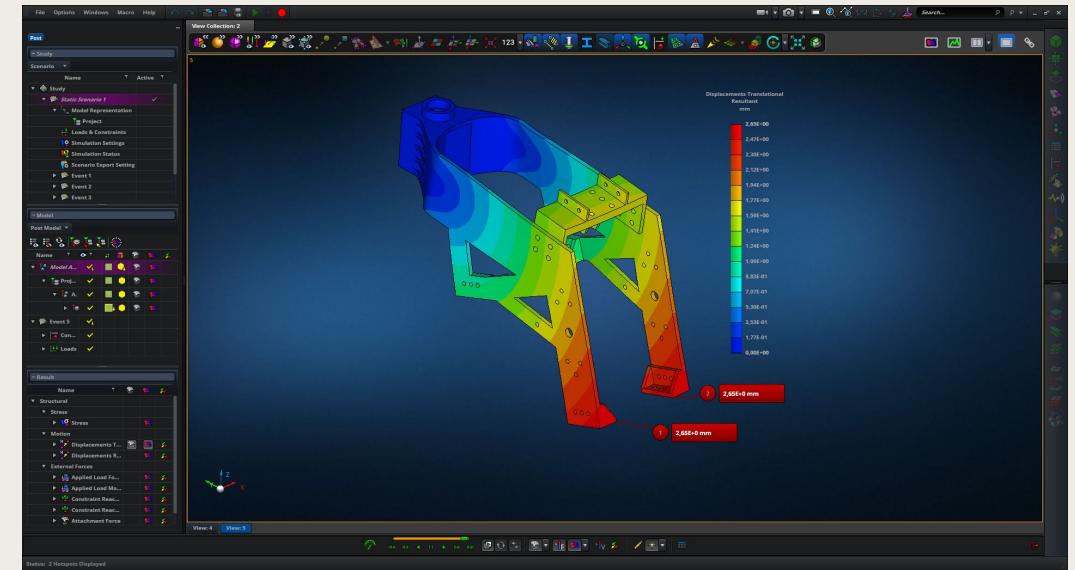


# SIMULATION

## Maximum stress

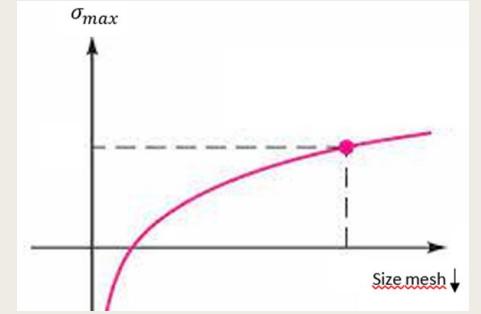


## Displacements

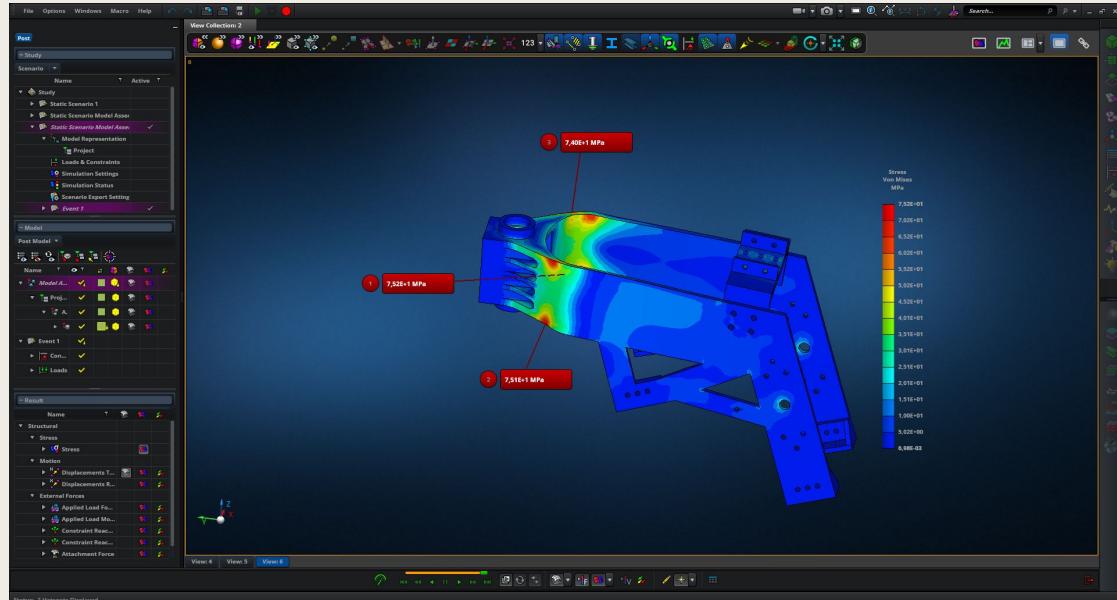


$$\text{Yield strength} = \text{Maximum stress} * \text{SF} ; \text{SF} = 230 \text{ MPa} / 75.2 \text{ MPa} ; \text{SF} = 3.06$$

# OPTIMIZATION

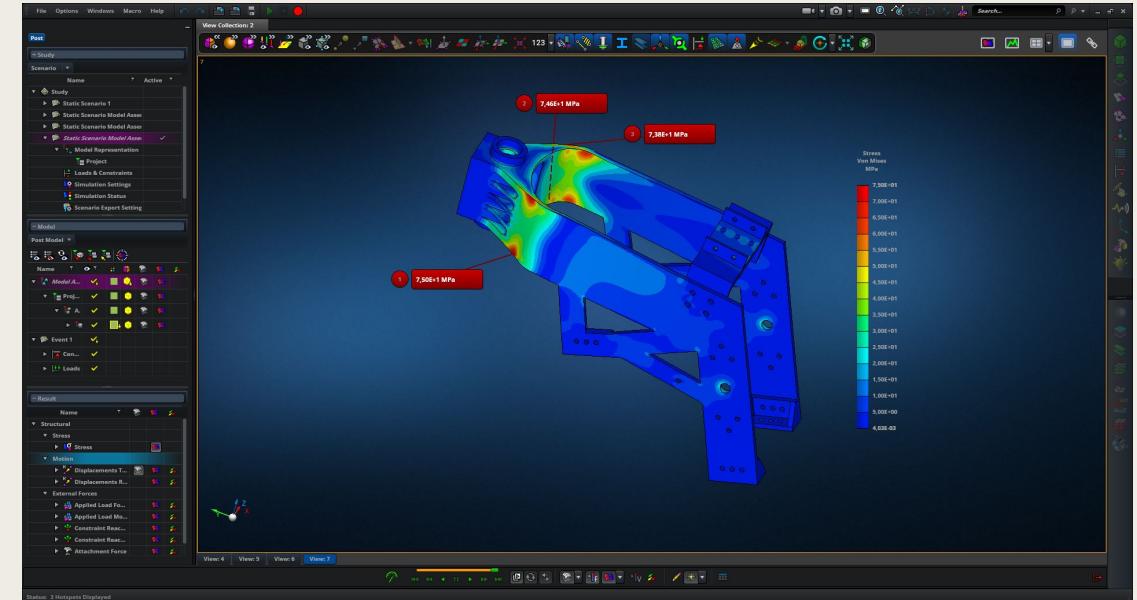


Mesh size 7 mm

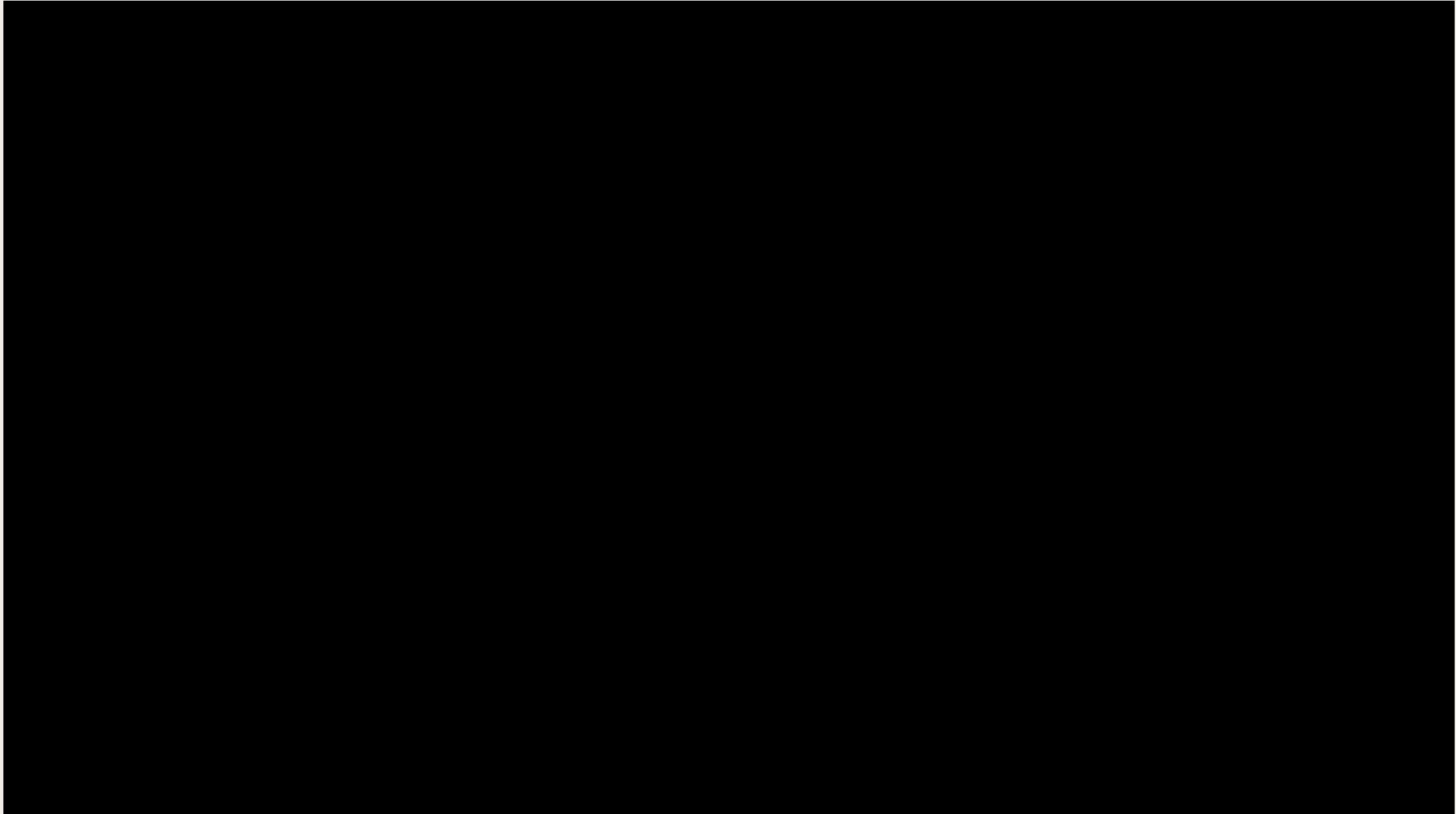


Maximum stress = 75.2 MPa

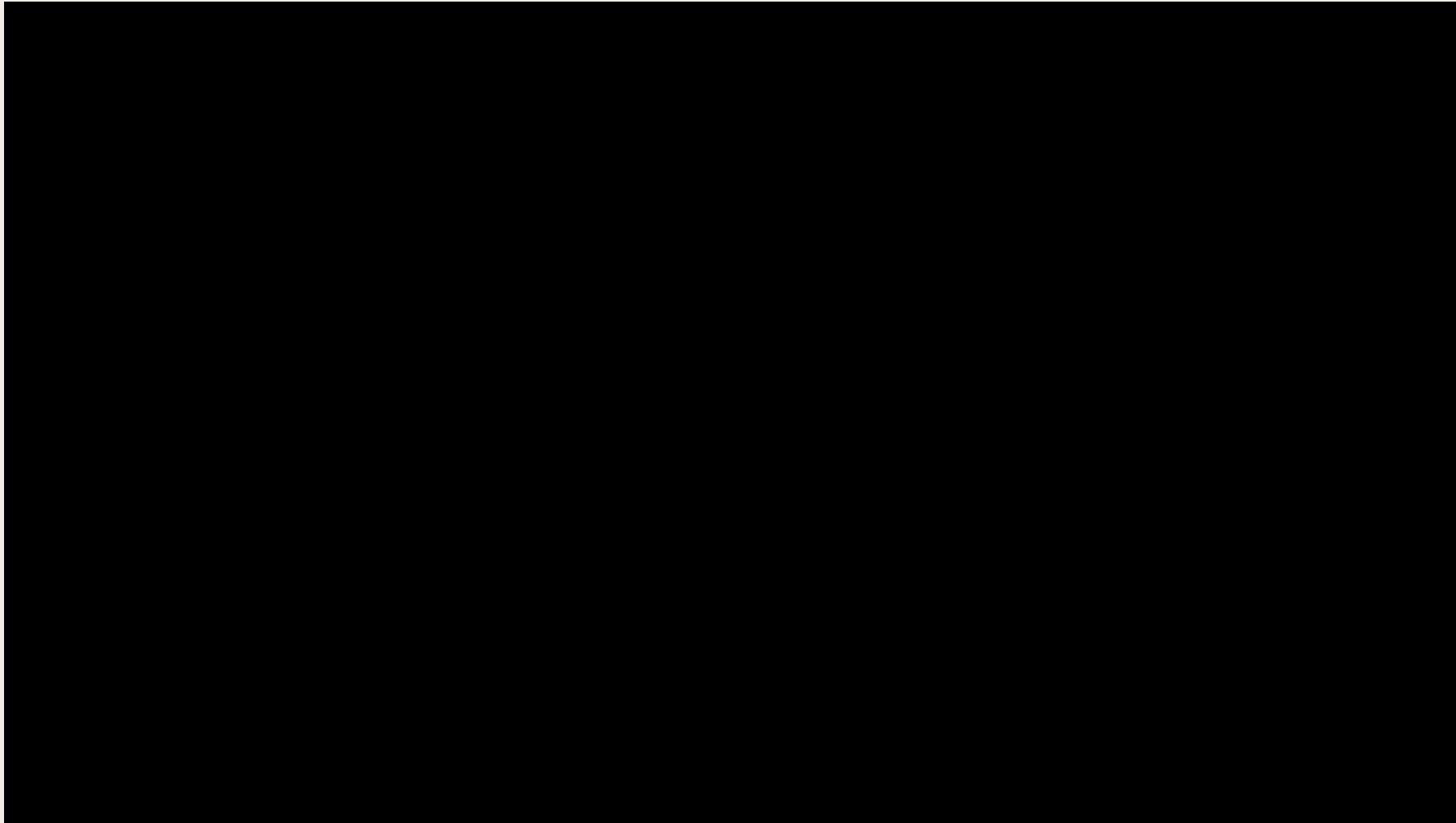
Mesh size 5 mm



Maximum stress = 75 MPa



# RESULTS COMPARATIVE



# IS THE DESIGN ADEQUATE?

Yield strength > maximum stress \* security factor (sf( $\gamma$ ))

## Aluminium 6082

Anticorodal / 9006/4 / AlMgSi1 / 3.2315 / H30 / A-SGM0.7 / P-AlSi1MgMn

Versatile alloy with an excellent combination of mechanical and physical properties. Thanks to its suitability for machining and welding and its good chemical resistance, it is ideal for a wide variety of applications.



### Material properties

Density	2,7	g/cm <sup>3</sup>	
Tensile strength	ISO 6892	285	MPa
Elongation at break	ISO 6892	6	%
Yield strength	ISO 6892	230-240	MPa
Elastic modulus	ISO 6892	69,5	GPa
Hardness	ISO 6508	100	HB
Melting temperature		645	°C
Thermal conductivity (20°C)		170	W/mK
Electrical resistivity		0,04	Ωmm <sup>2</sup> /m

**Main alloy elements**  
Aluminium - Magnesium - Manganese - Silicon

**Maximum dimensions**  
500x500x300 mm (19.7x19.7x11.8 in)

**Tolerances**  
ISO 2768-1 fine (f) or medium (m) class

**Applications**  
It is widely used in the transport industry, ideal for components such as railway carriages, truck bodies and trailers. It is also used in the construction industry, ideal for components such as roofing and cladding. In the sporting goods industry, it is used for components such as bicycle frames and sports equipment due to its high strength-to-weight ratio. It is also used in the electrical industry for busbars and electrical connectors.

$$\text{SF} = 230 \text{ MPa} / 77.3 \text{ MPa}$$
$$\text{SF} = 2.98$$

# THANK YOU

ANY QUESTION?