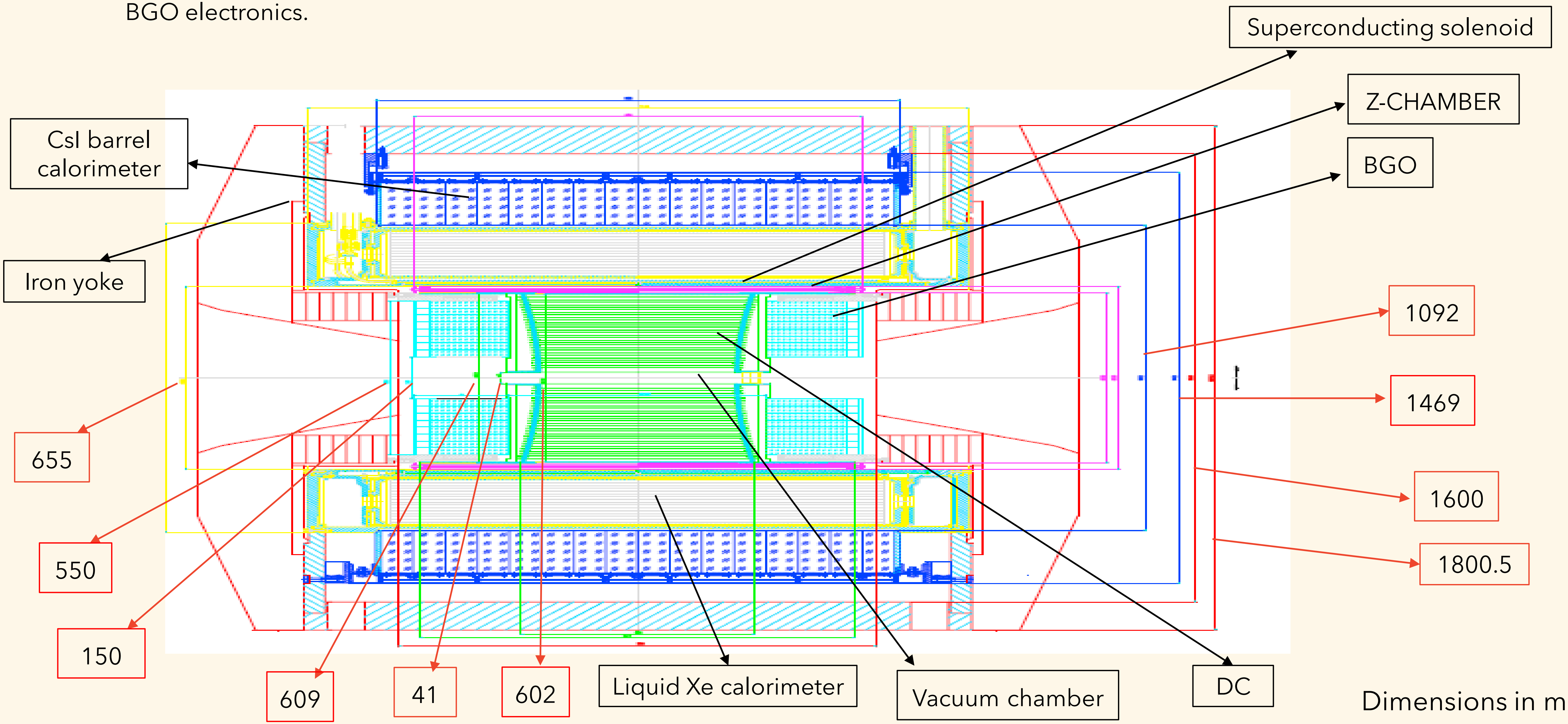
MECHANICAL DESIGN PROPOSAL FOR CMD-3 DRIFT CHAMBER

DIMENSIONS

- Along beam axis (distance between end-cap calorimeter) = 609 mm
- Transverse direction (diameter) = 484 mm
- Inner shell= 41 mm

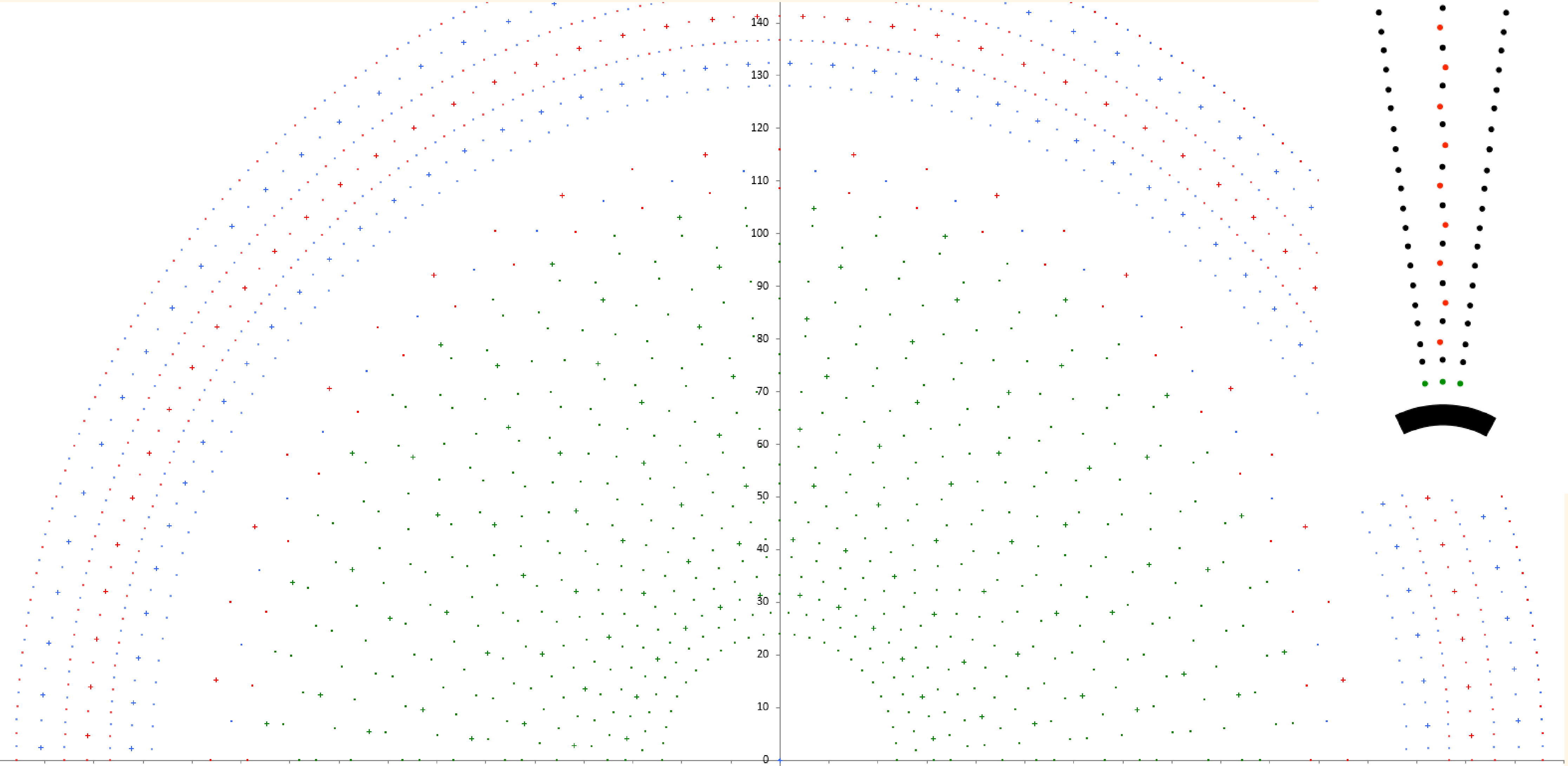
The size along beam will be change not more than **5-15 mm**, due to the optimization of BGO electronics.

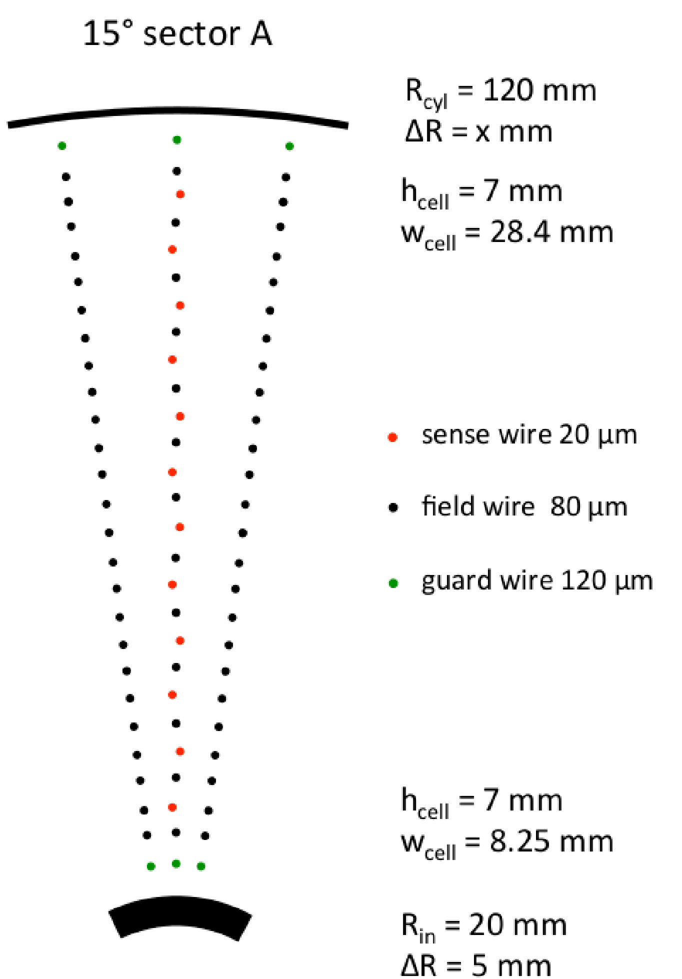


Dimensions in mm

Sector A (some remarks)

Goal: positioning of wires on the axis of the cylinder to know precisely their position in the space

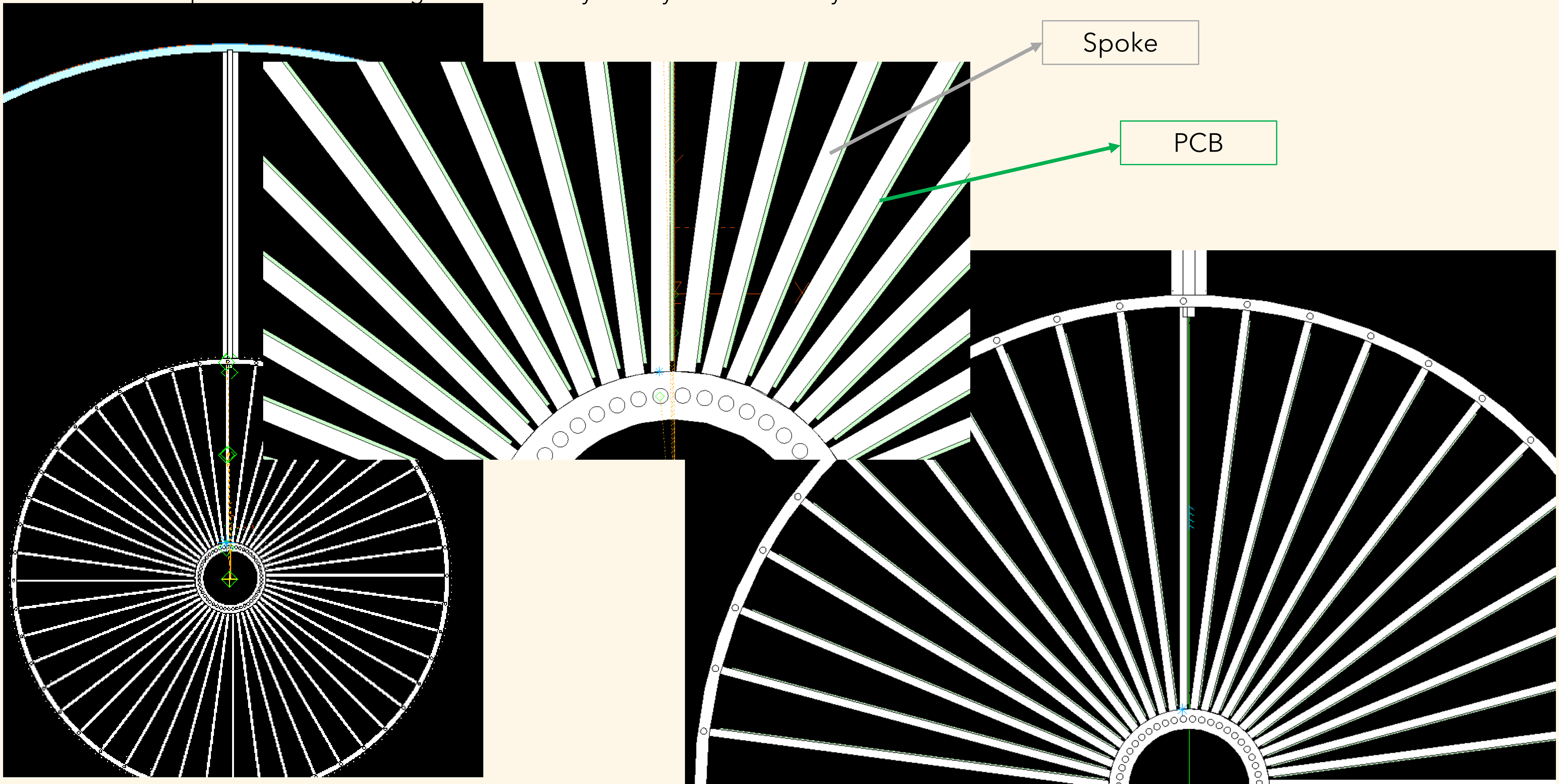




Several attempts to build the sector A

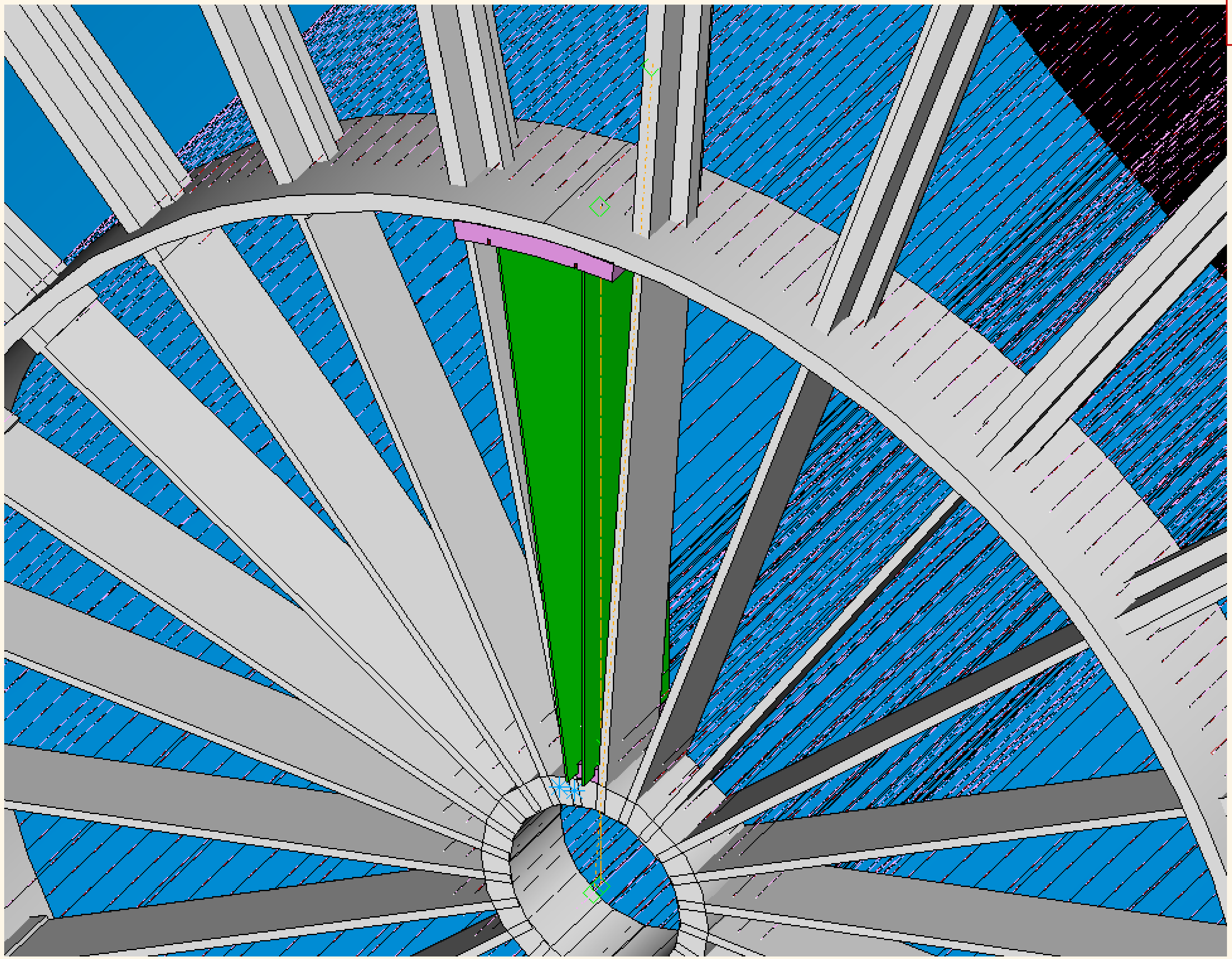
1)Constrain the PCBs to the spokes

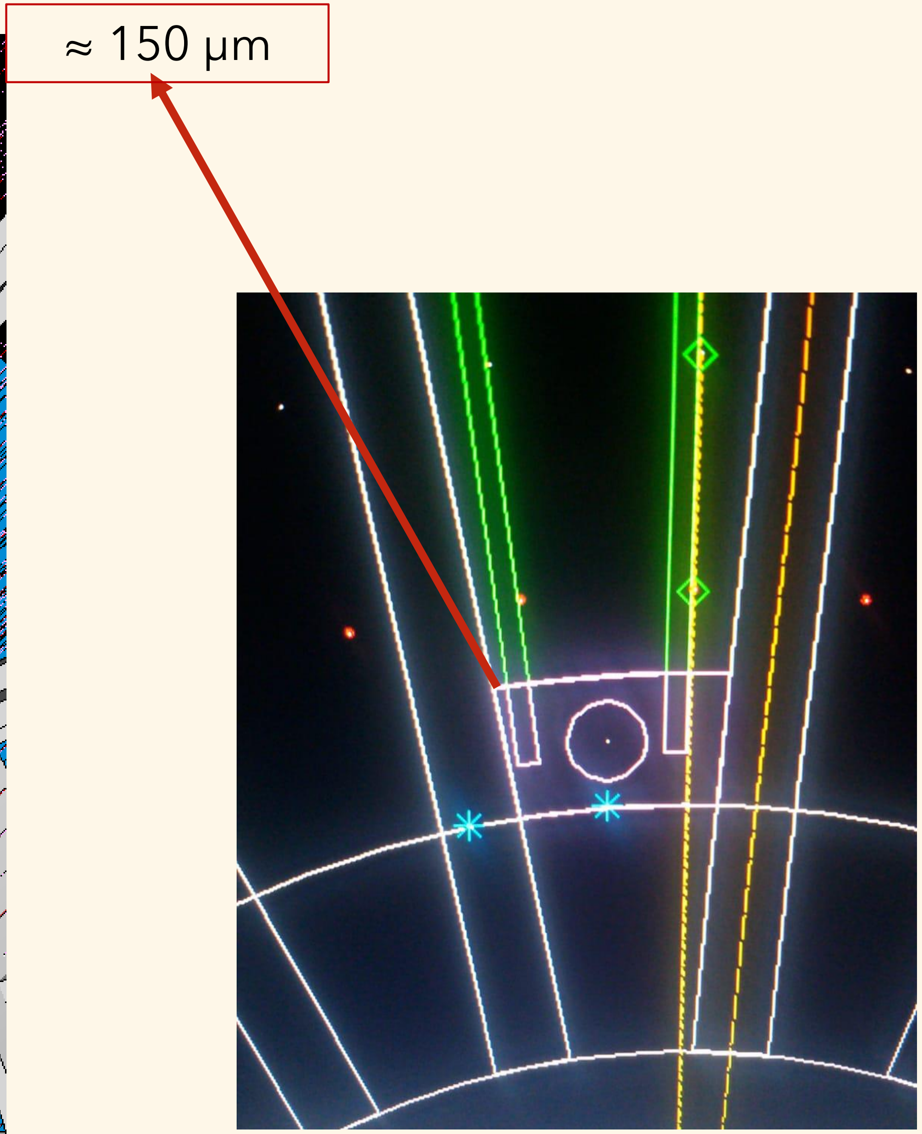
-The spokes will not converge towards the symmetry center of our cylinder



2) Put the PCBs between two spokes and use a support to fix them:

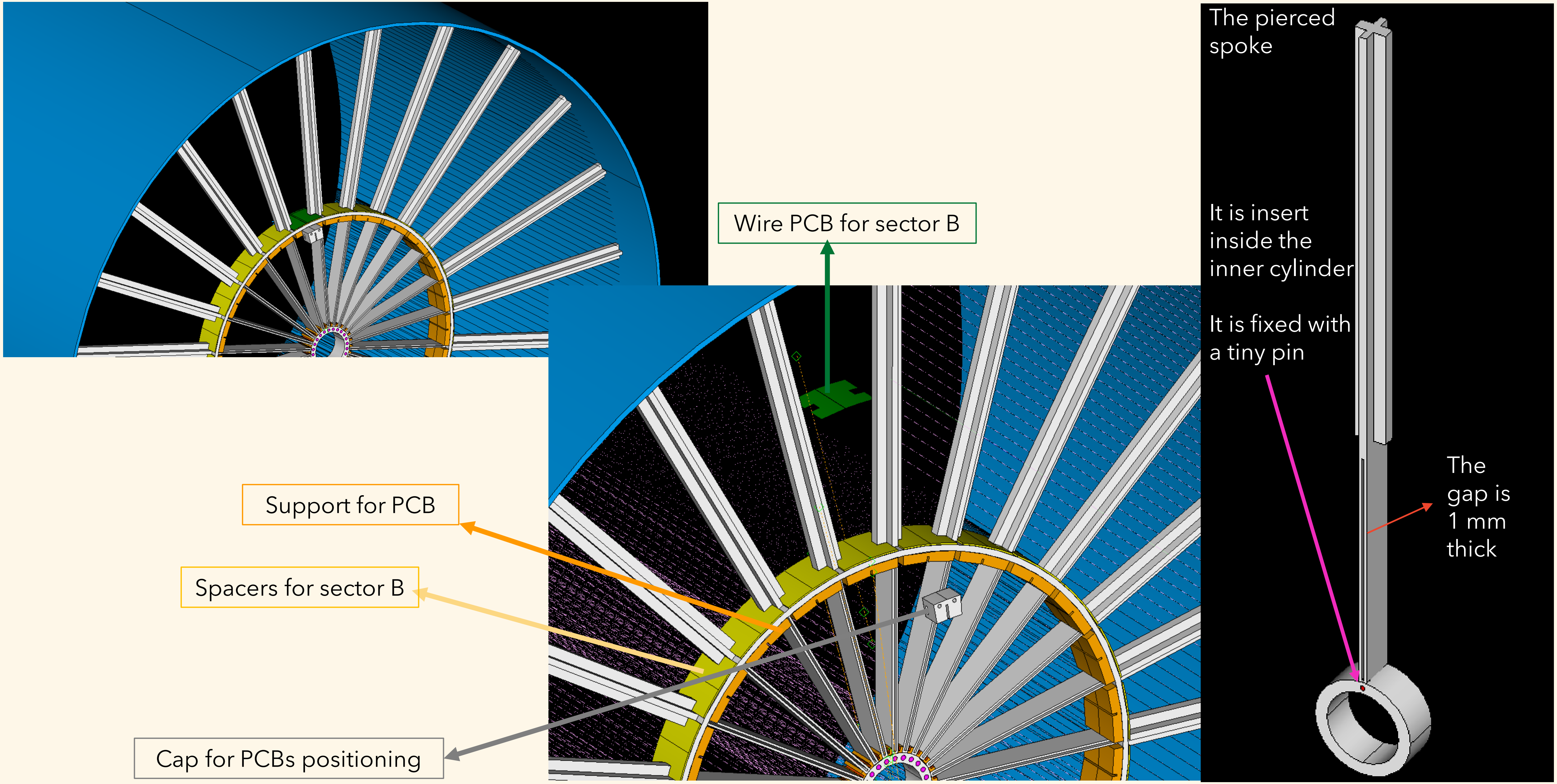
- -Same problem for the spokes
- -Really tiny dimensions for the support





The «pierced» spokes

The solution for the correct positioning of wire and the preserving of the geometrical symmetry seems to be the «**pierced**» spokes.

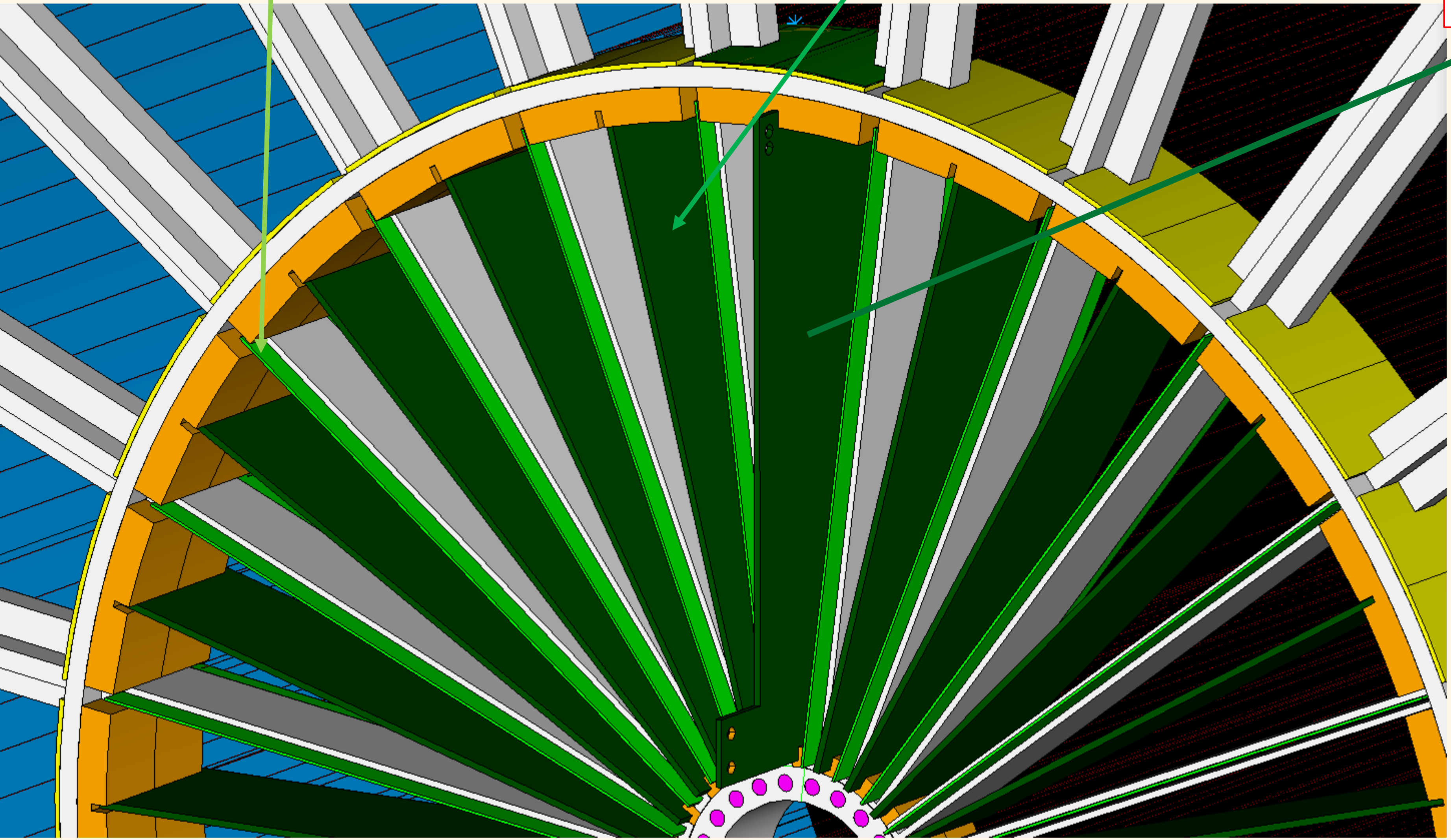


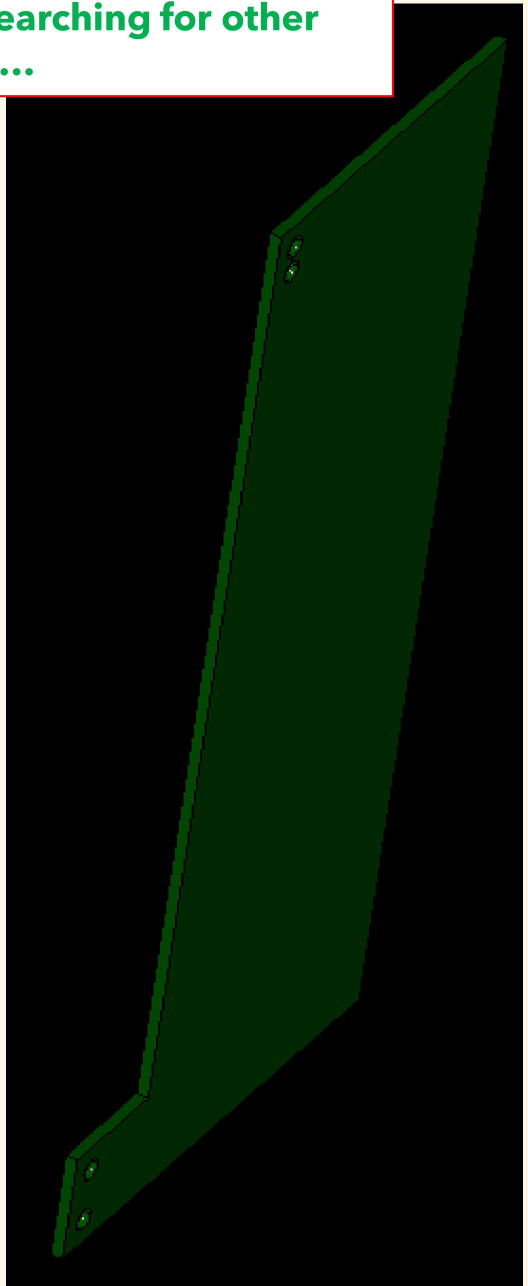
We intend to use two different thickness for PCBs

The ones inside spokes : 400 µm

The ones between two adjacent spokes : 1 mm

Possible solution to fix the position of PCB between two spokes.
We are searching for other solution....

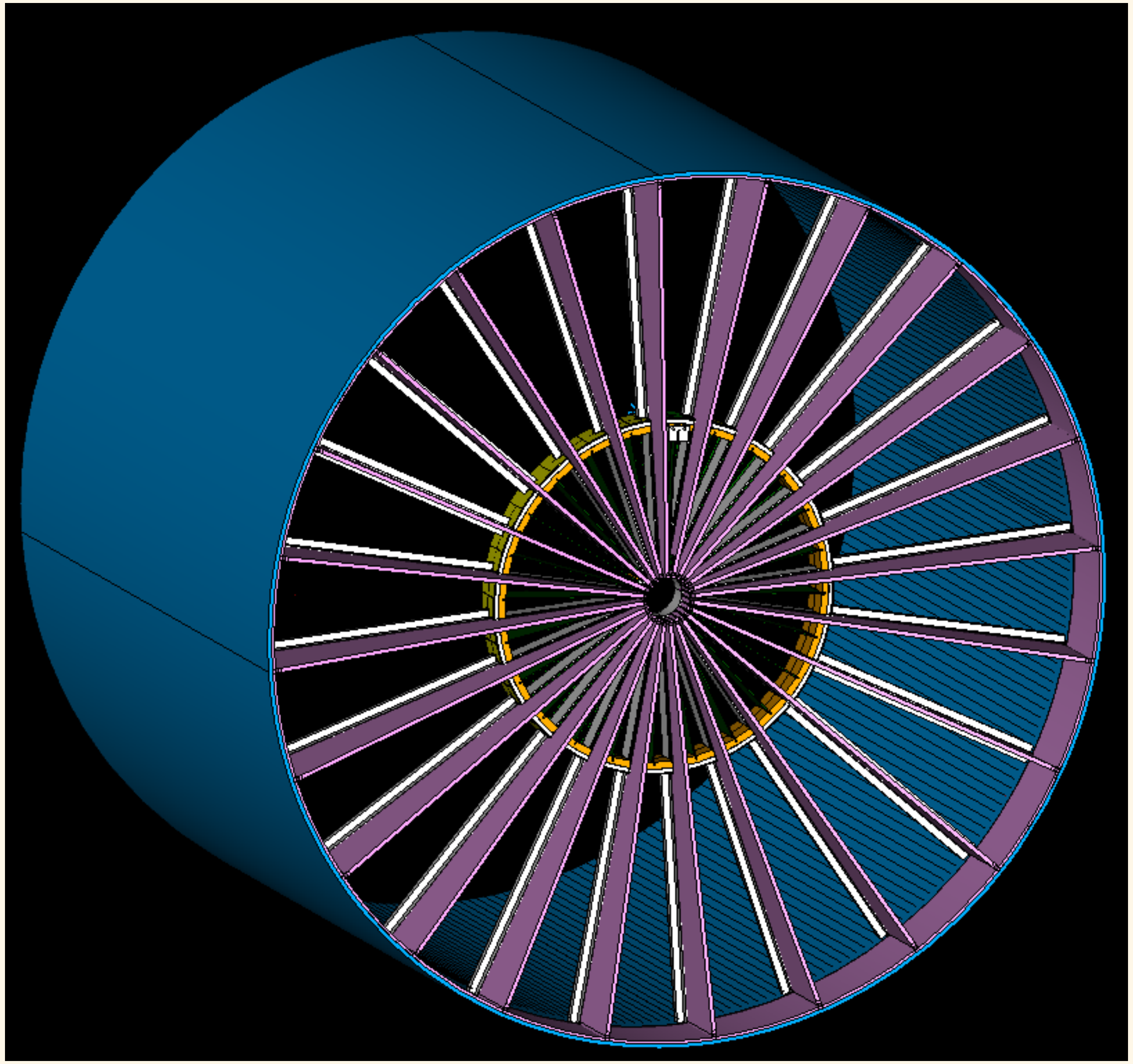


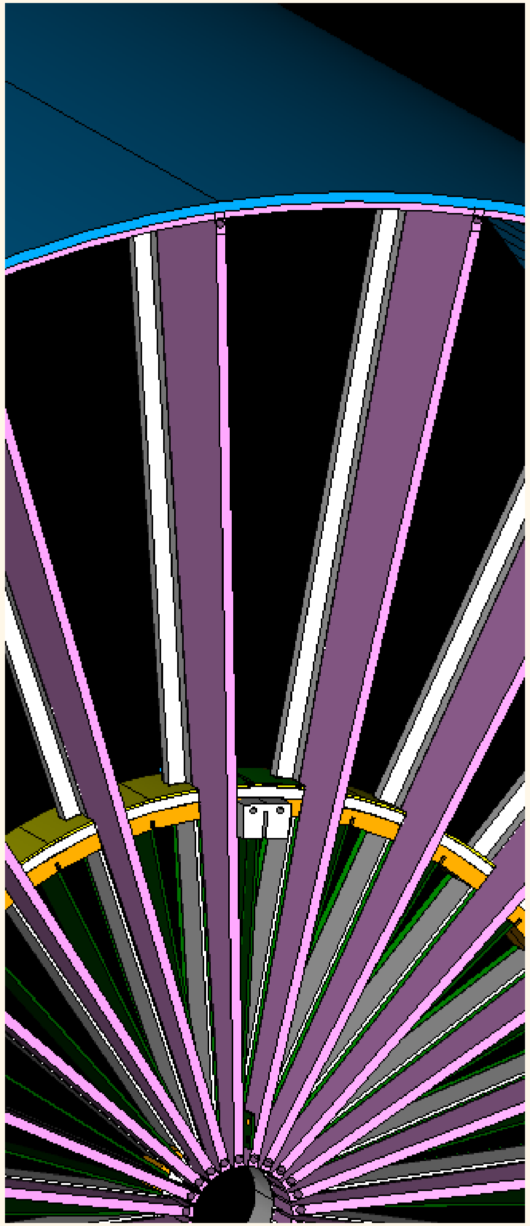


A trapezoidal structure to prevent the endplates deformation instead of tie rods

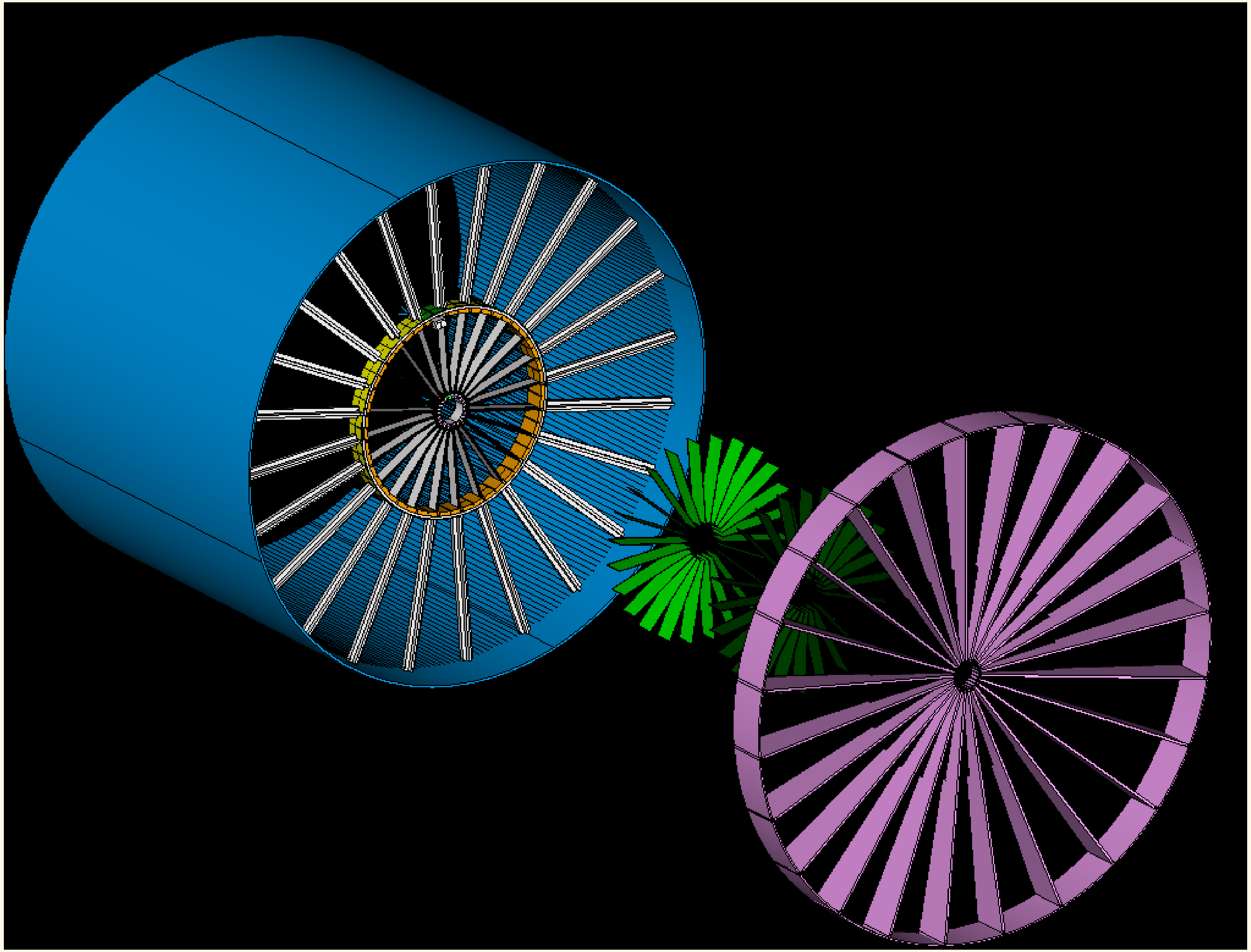
Previous calculation showed that:

- the load on the tie rods are really high
- the available space to fix the rods on the external cylinder is very small





Exploded view of the total structure



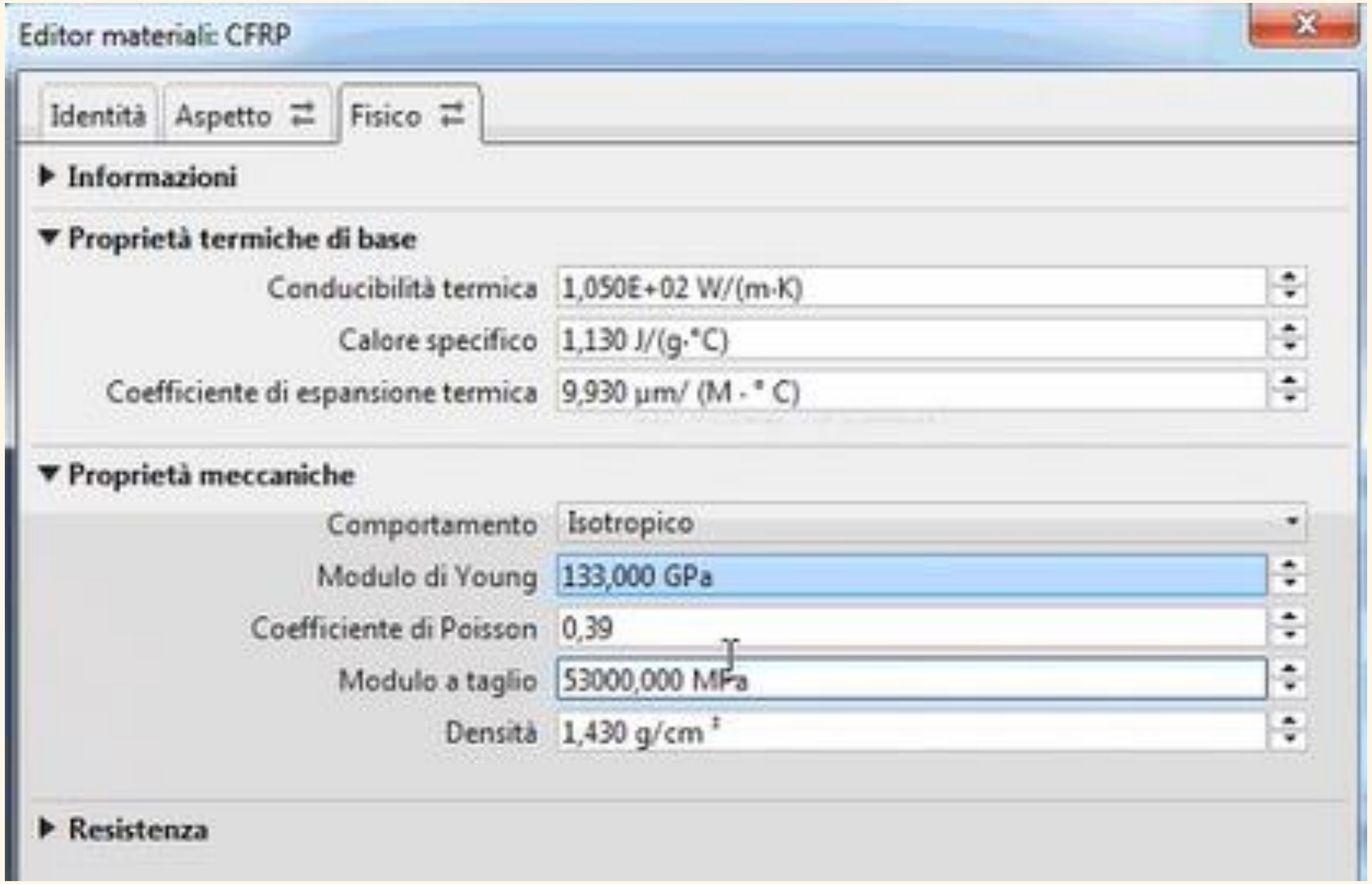
Some details about dimensions:

1. Inner cylinder :
   - Thickness = 5 mm
   - Width = 15 mm
2. Middle cylinder:
   - Thickness = 3 mm
   - Width = 25 mm
3. External cylinder:
   - Thickness = 3 mm
   - Width = 609 mm

Simulations

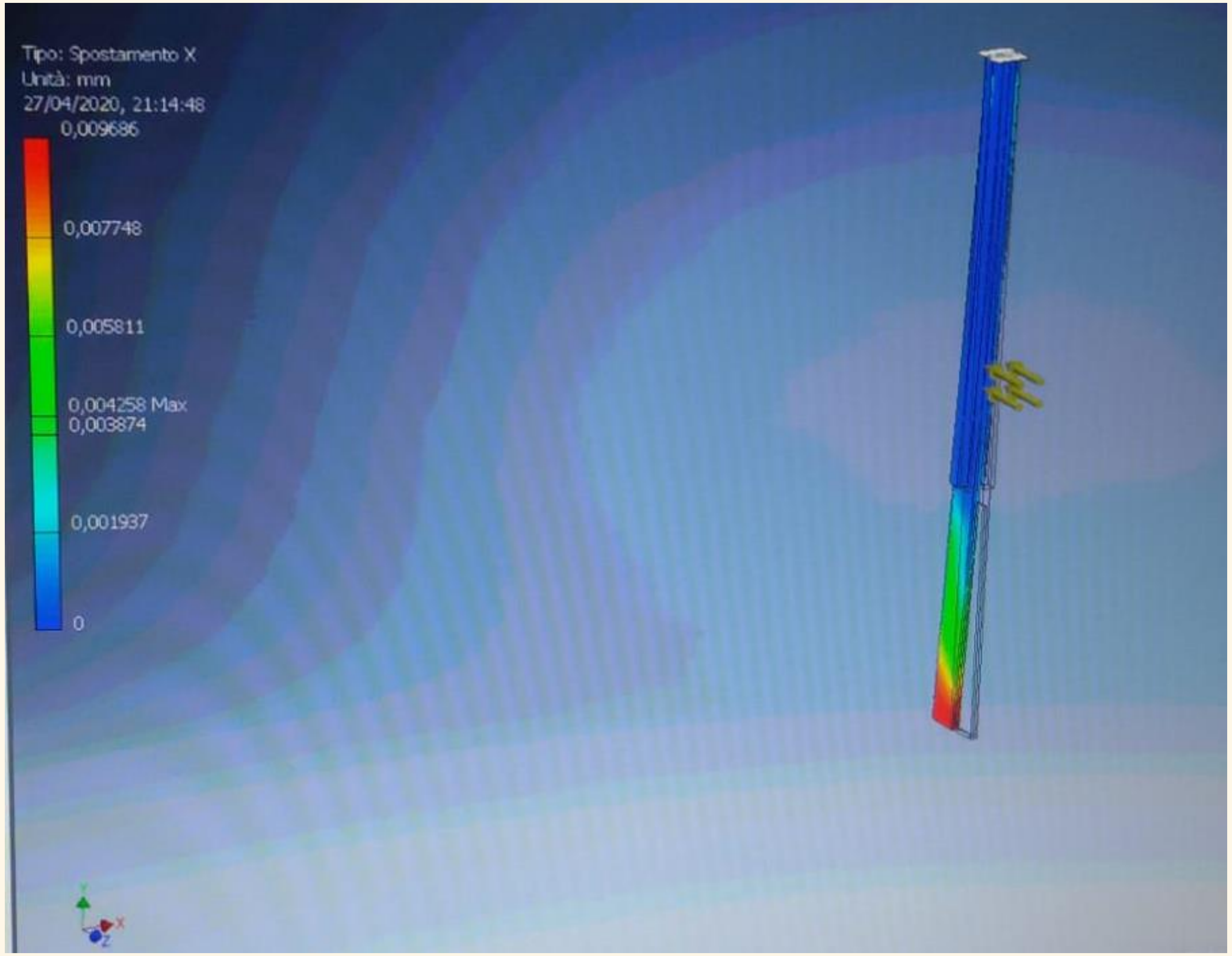
To perform simulations about the mechanical stability, we choose, as first approach, the **worst possible conditions**:

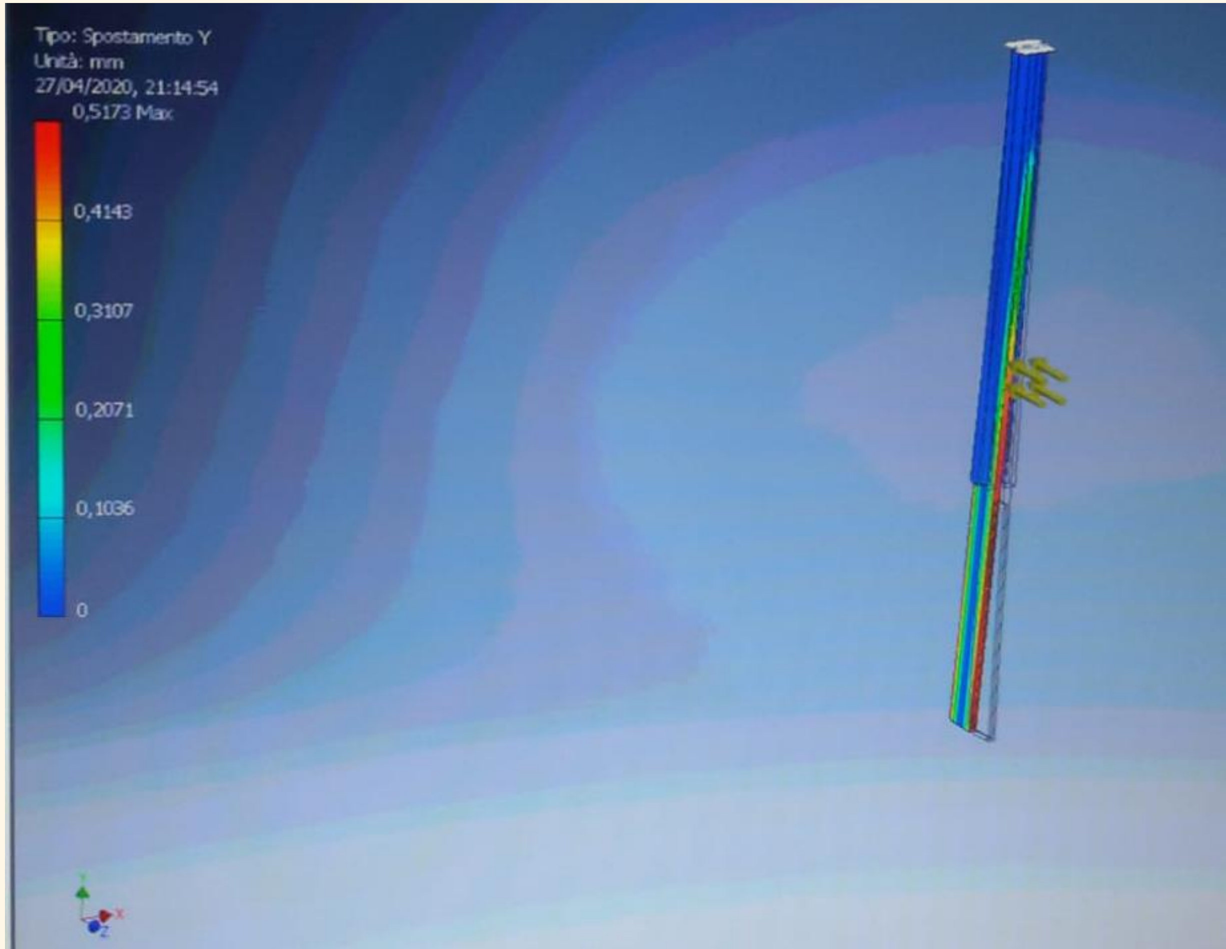
- we apply a stress about 85 Kg, higher than the expected one.
- We choose a «standard» material, with not particular features



In the future simulations we will implement the real conditions of the mechanical structure:
We will put the correct stress value and use a material with better features

Spokes simulations (x and y displacement)

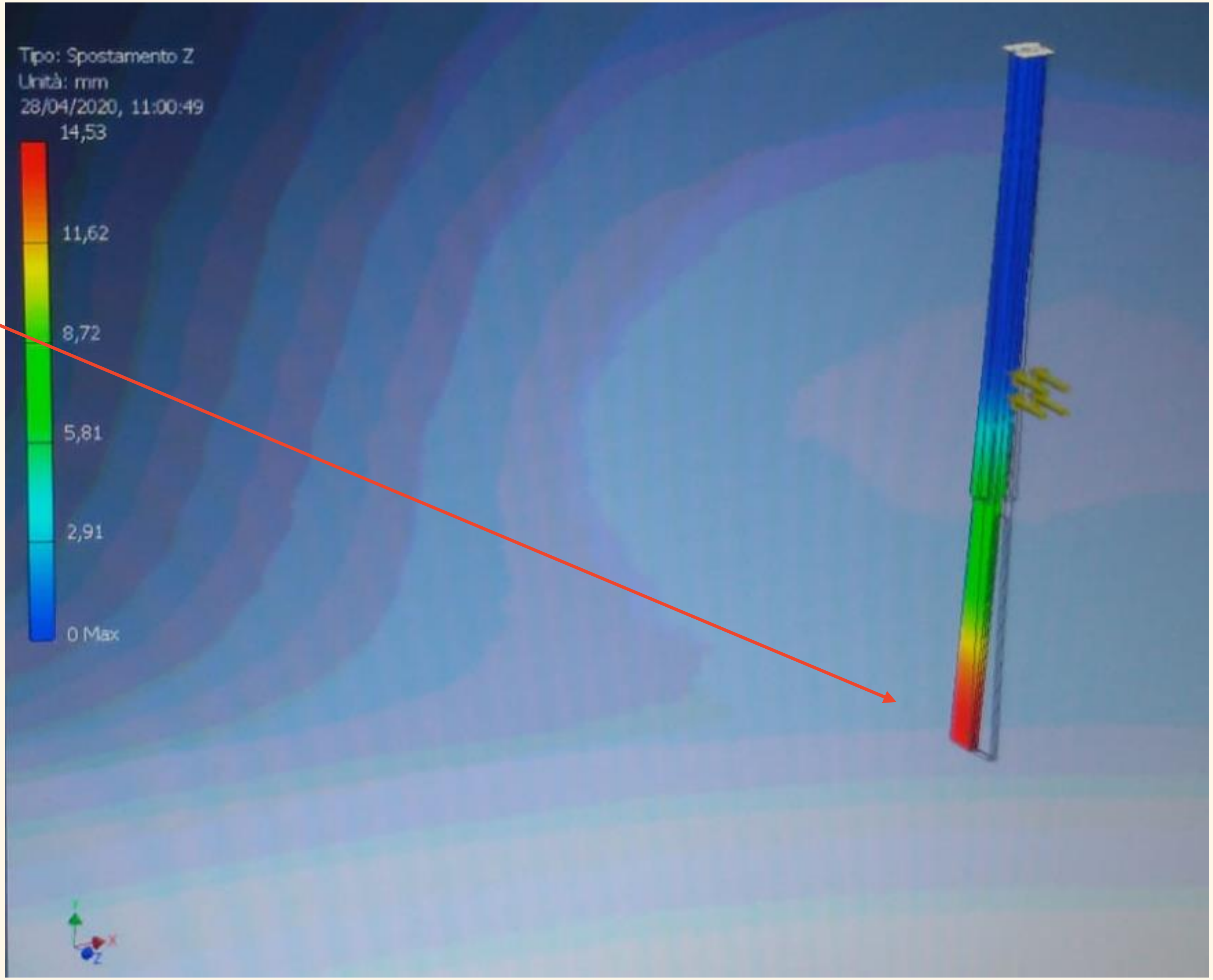




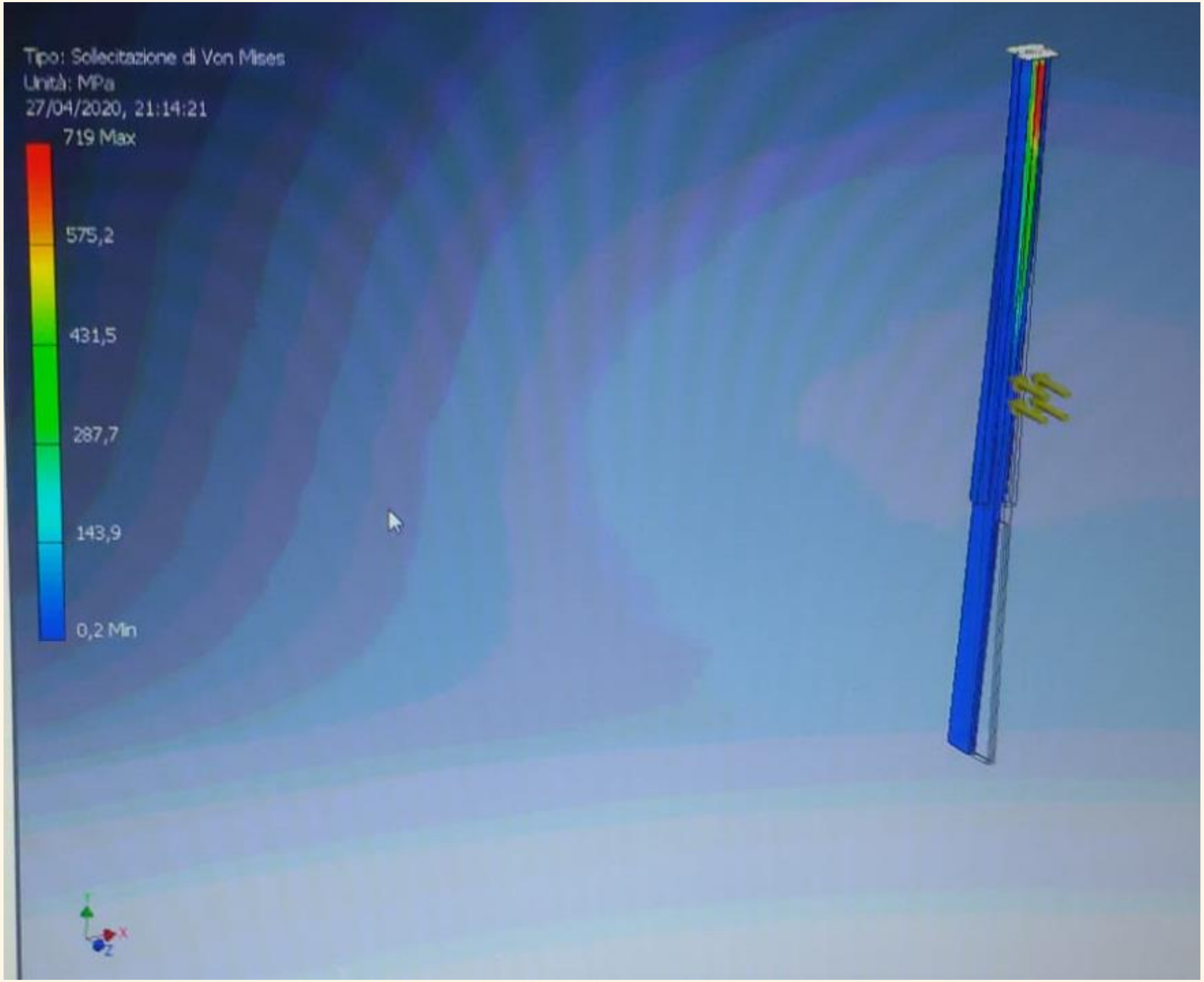
Spokes simulations (z displacement)

Note :
we have a shift of about 14 mm along z axis.

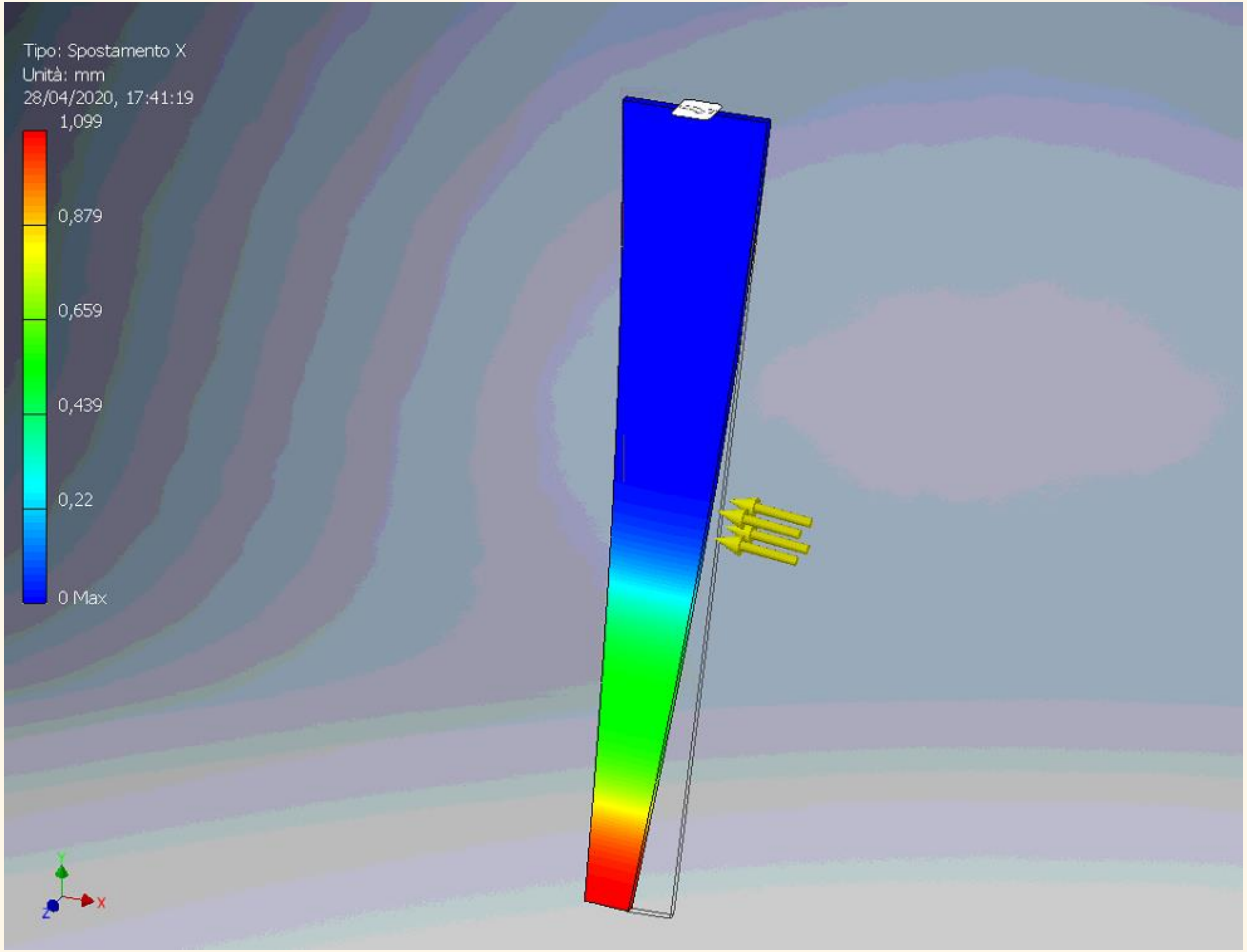
This shift will be corrected with the trapezoidal structure



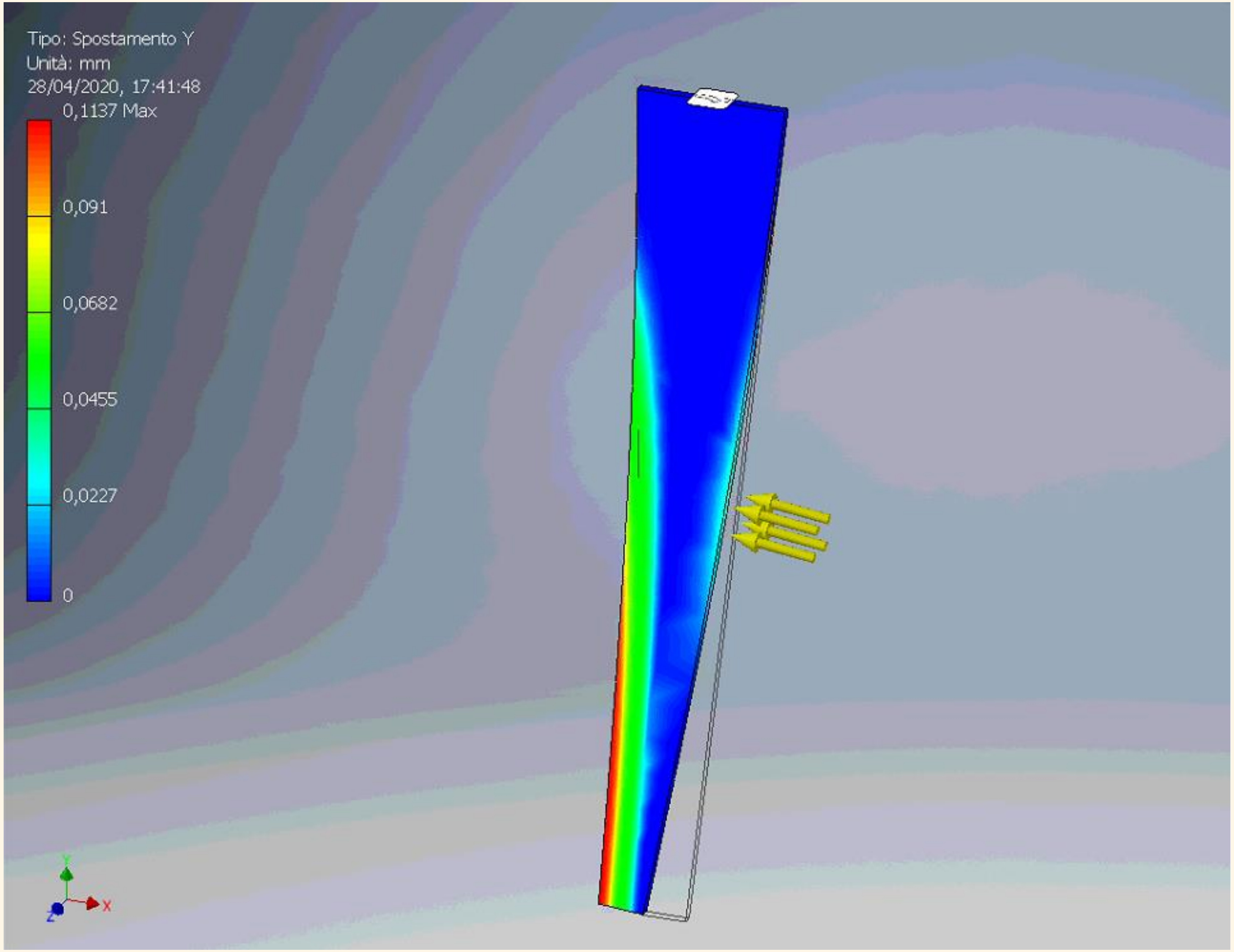
Spokes simulations **«Von Mises»**



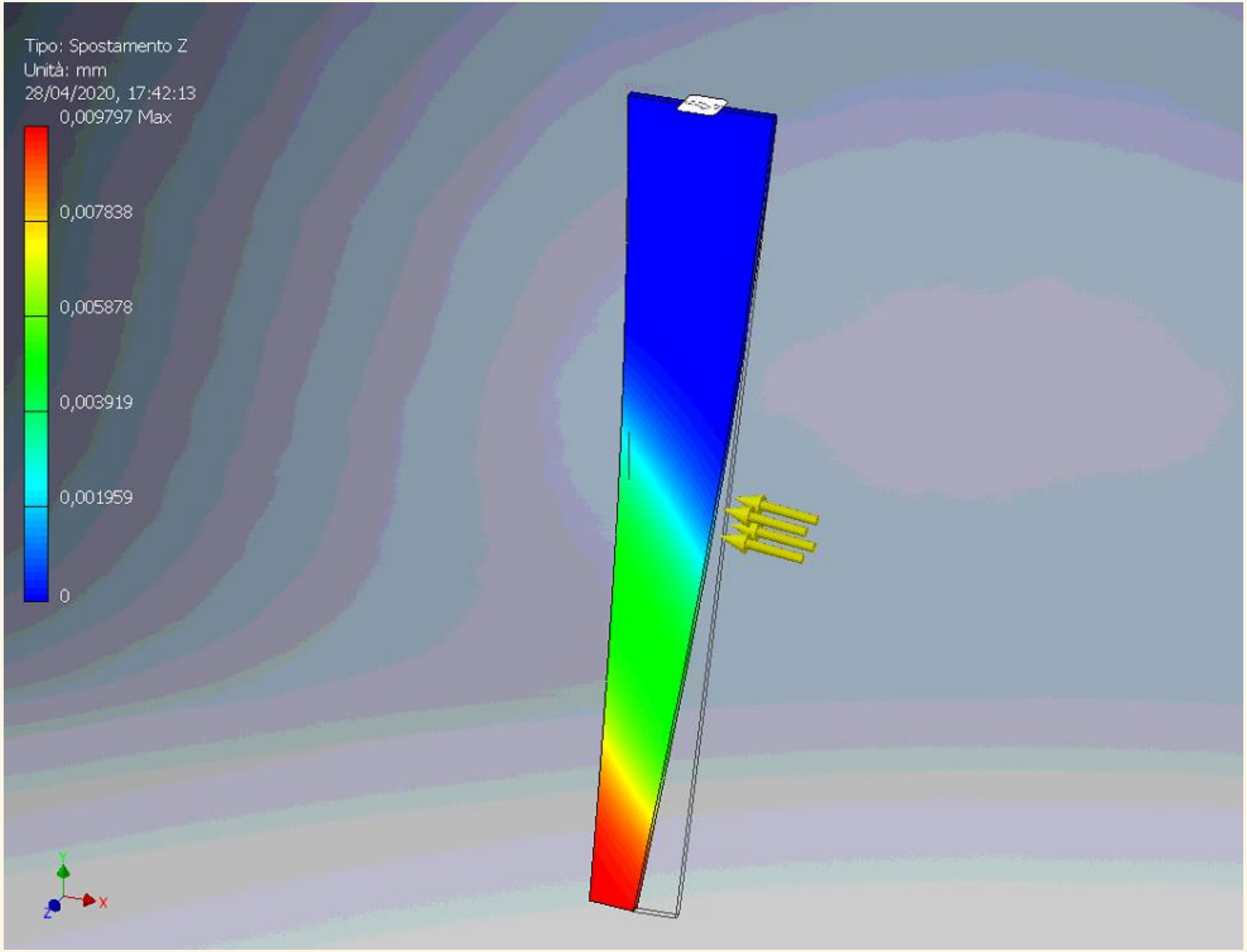
Simulations of the trapezoidal structure (x displacement)



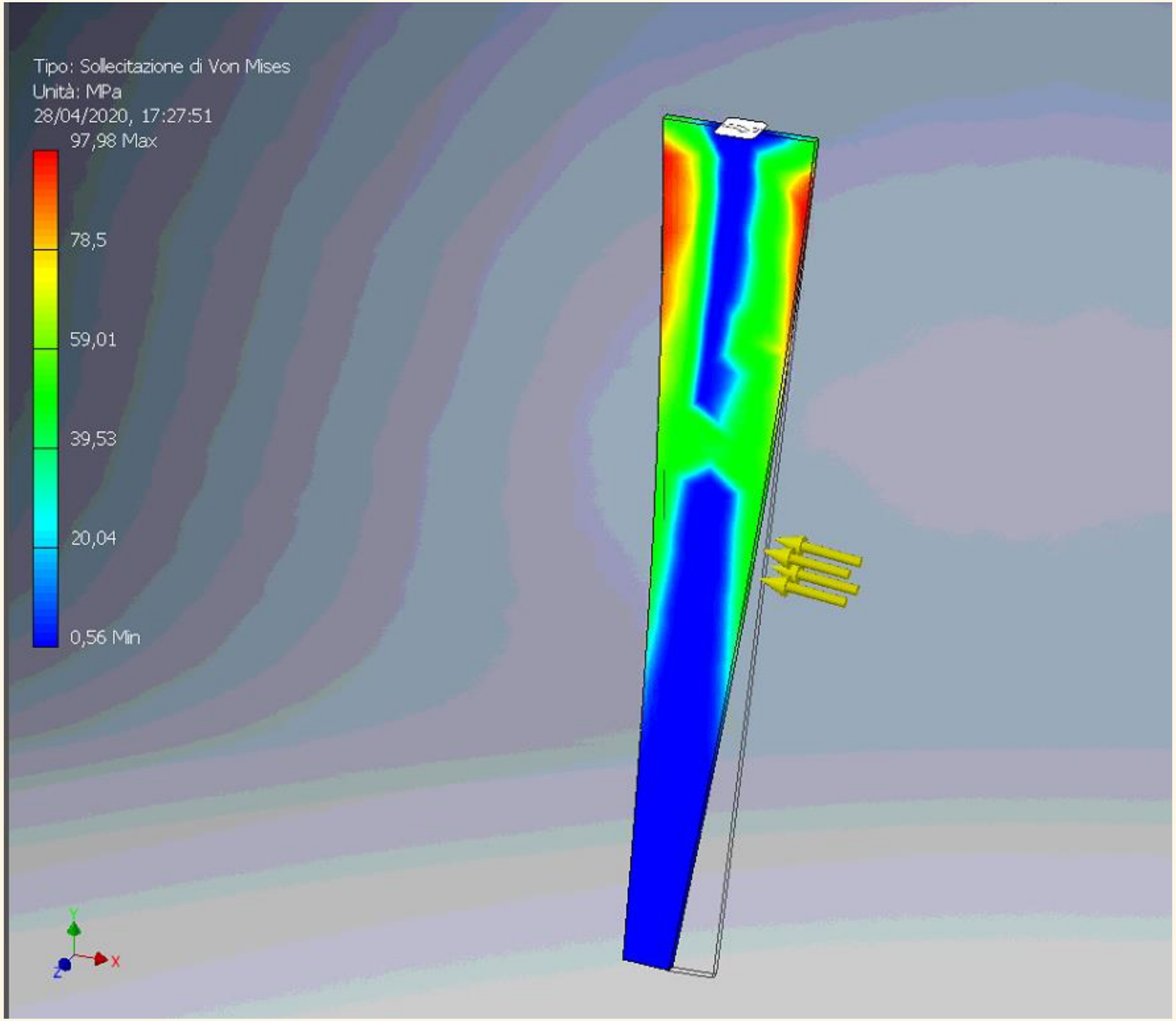
Simulations of trapezoidal structure (y displacement)



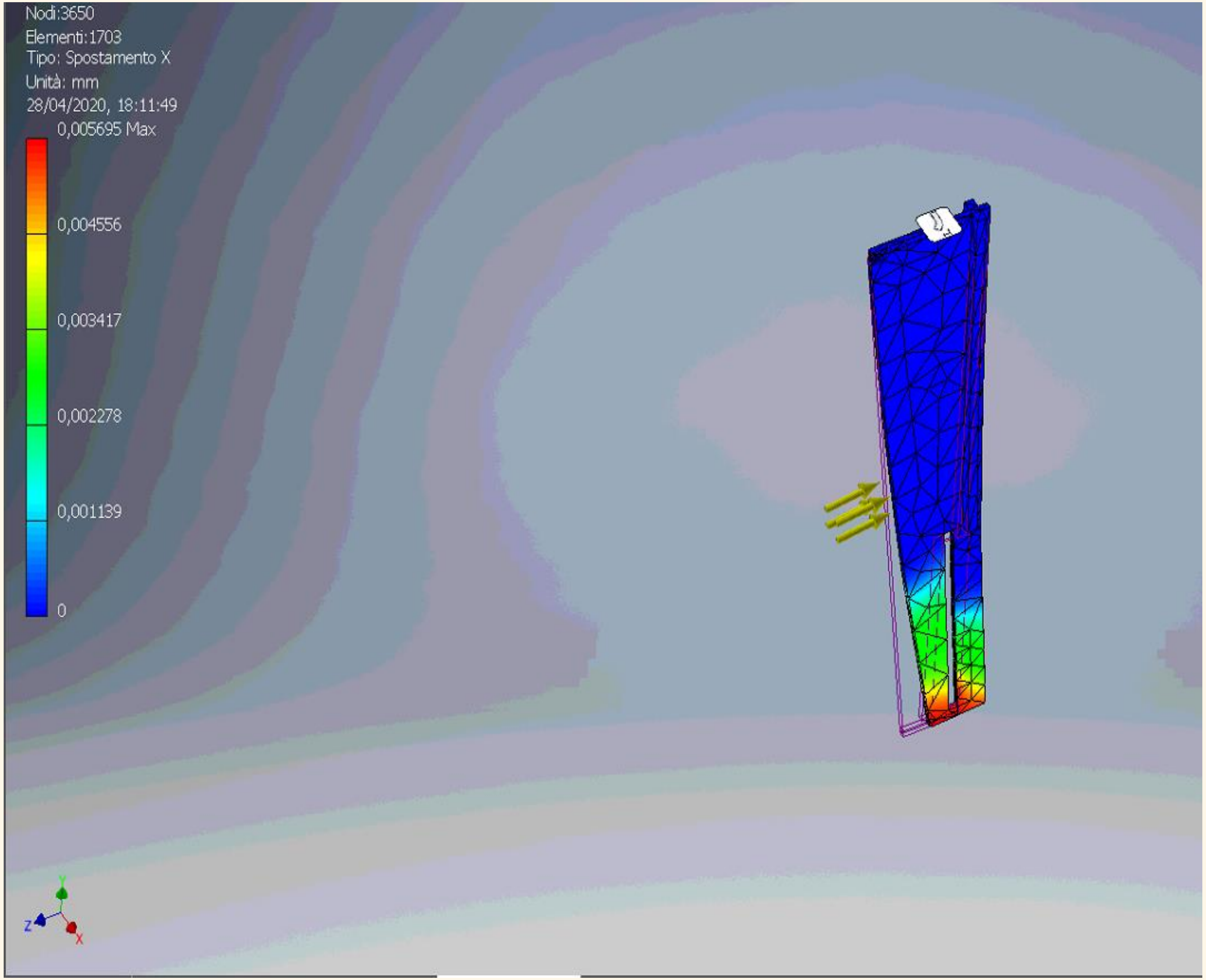
Simulations of trapezoidal structure (z displacement)



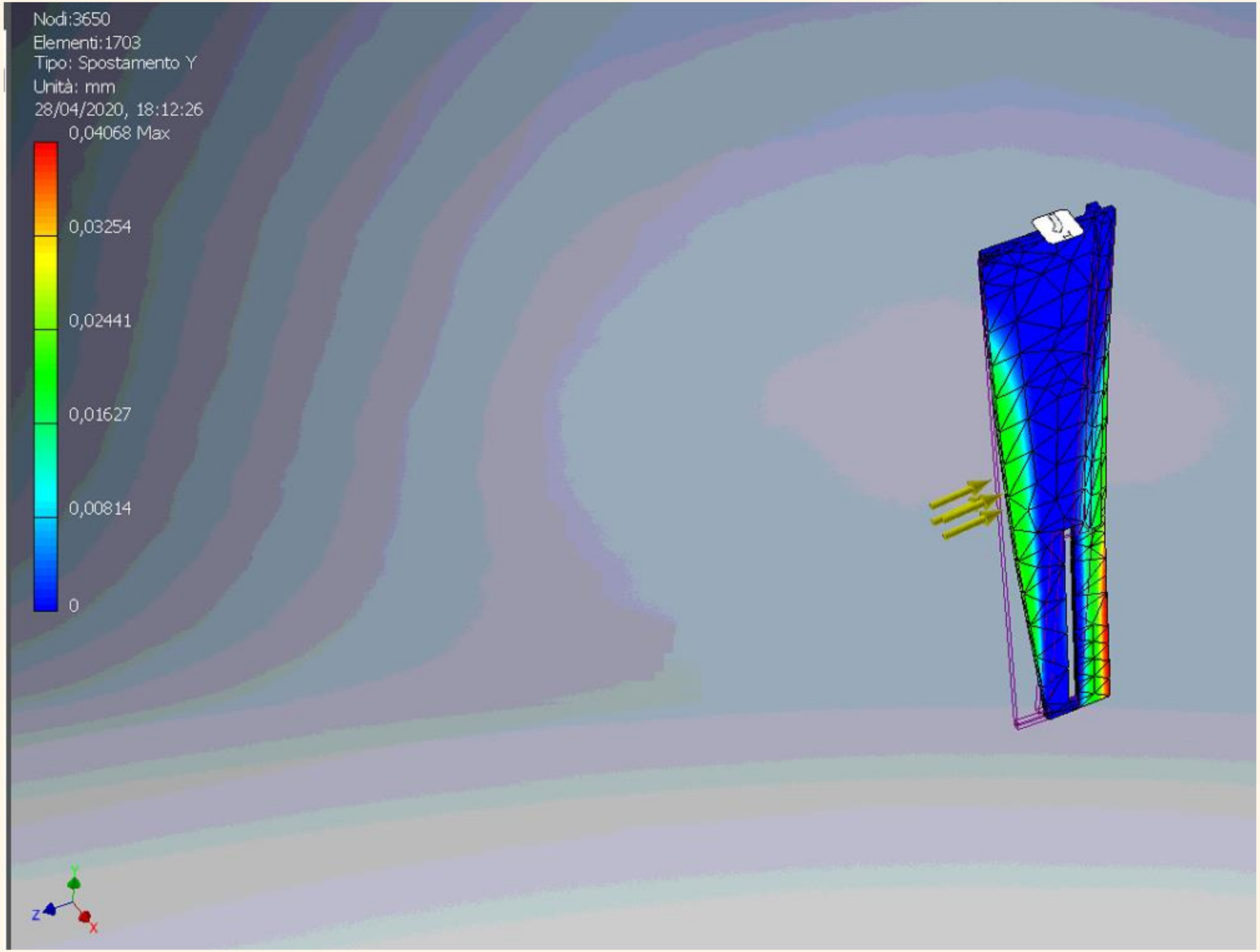
Simulations of trapezoidal structure **«von Mises»**



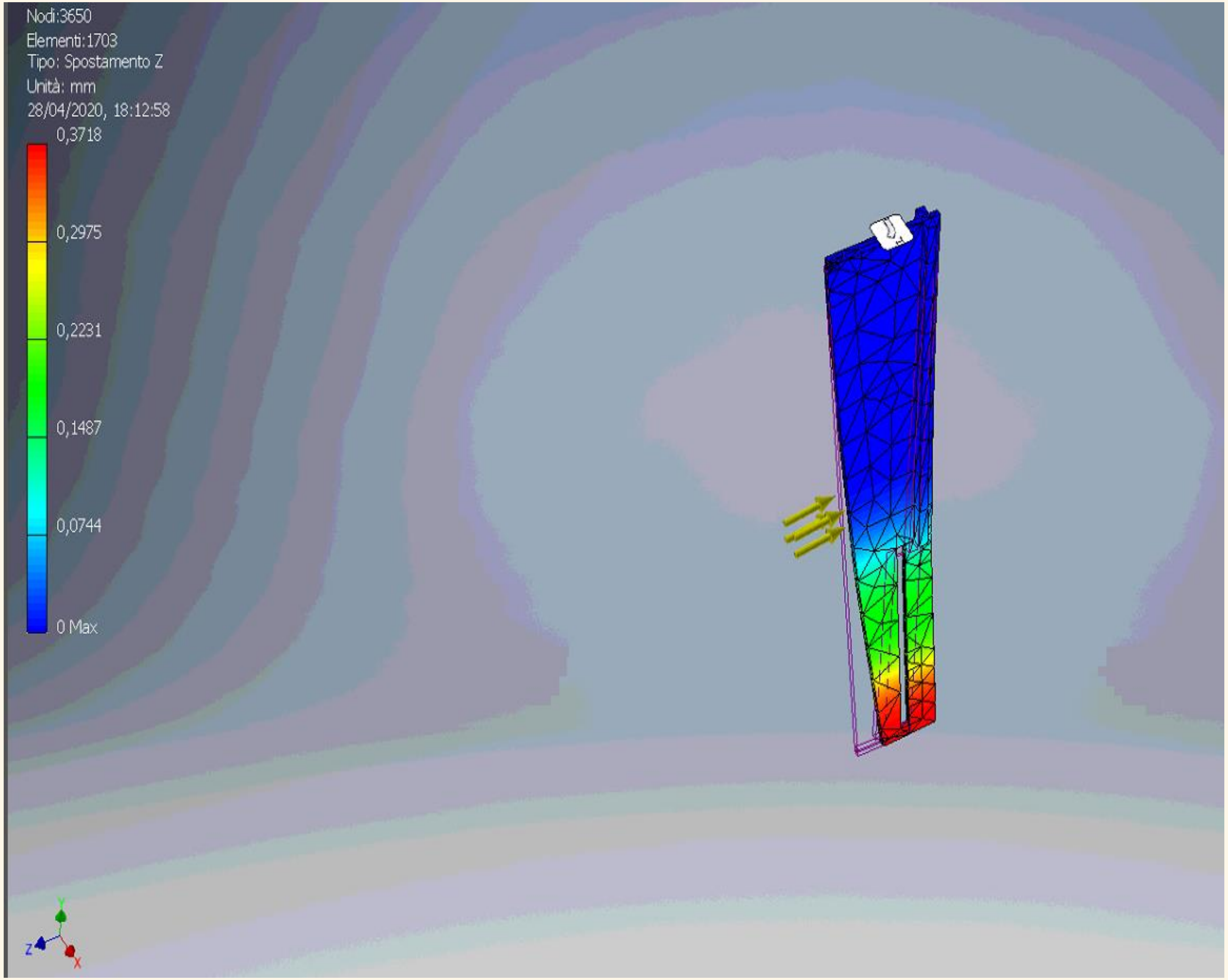
Simulations of the complete structure (x displacement)



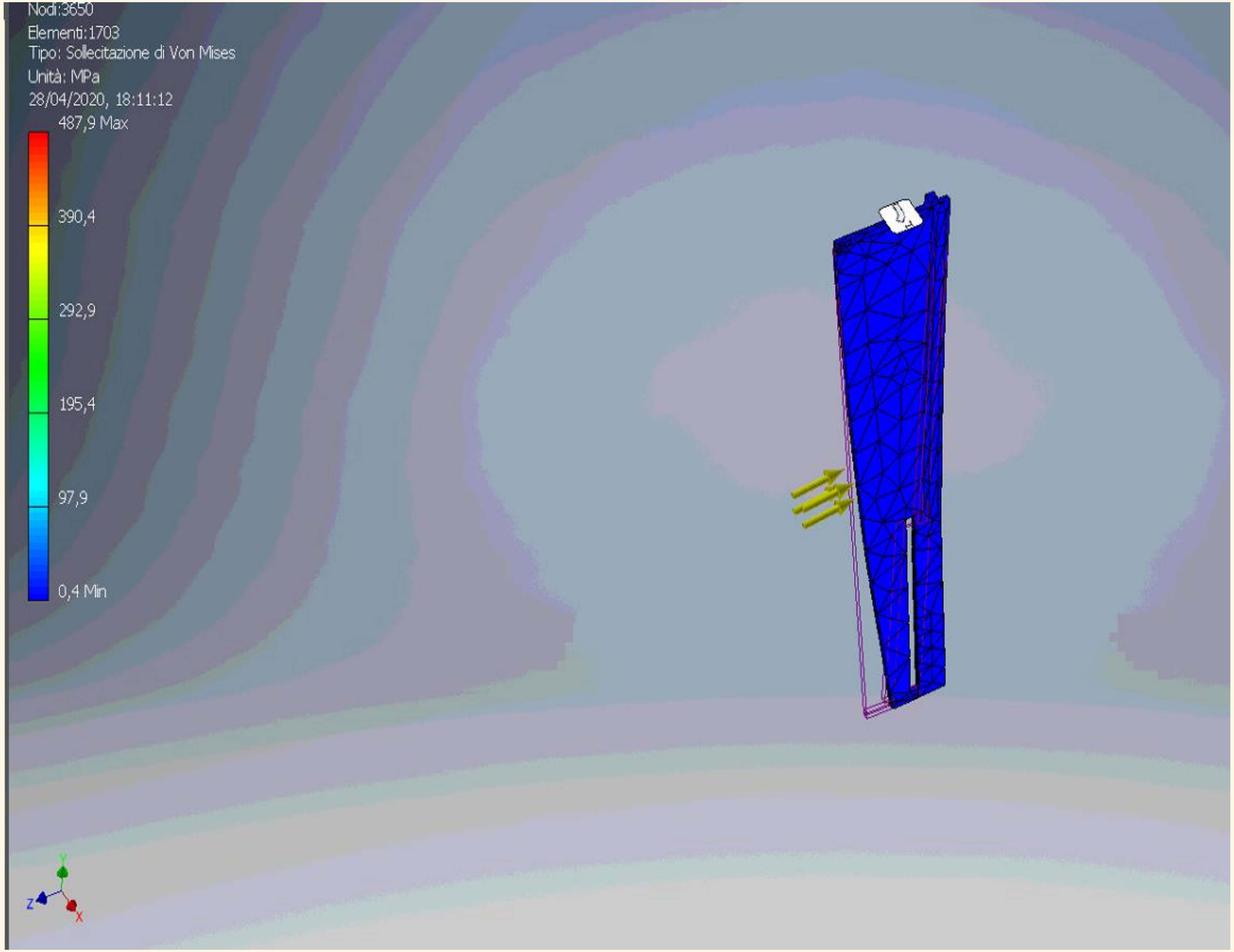
Simulations of the complete structure (y displacement)



Simulations of the complete structure (z displacement)



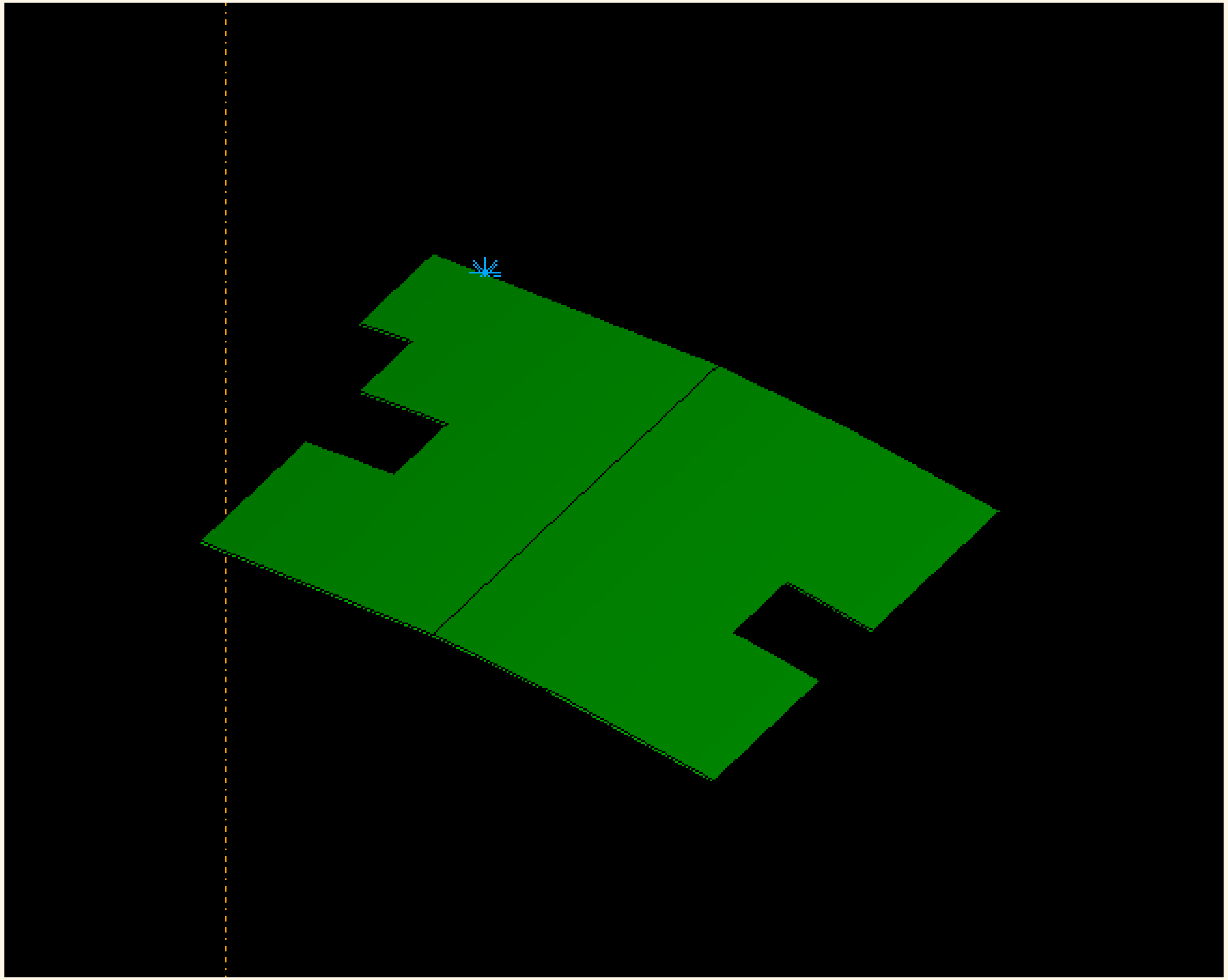
Simulations of the complete structure (Von Mises)



Sector B

Sector B has a structure similar to MEG

PCB with asymmetrical shape for the correct positioning of the wires



BACKUP SLIDES

Simulation Von Mises

Von Mises stress is a value used to determine if a given material will yield or fracture.
It is mostly used for ductile and isotropic materials, such as metals, when subjected to a complex loading condition.
The von Mises yield criterion states that if the von Mises stress of a material under load is equal or greater than the yield limit of the same material under simple tension – which is easy to determine experimentally –, then the material will yield.

The simulations tell us the position in which the spokes have the higher deformation!

For more details: https://www.simscale.com/docs/content/simwiki/fea/what-is-von-mises-stress.html