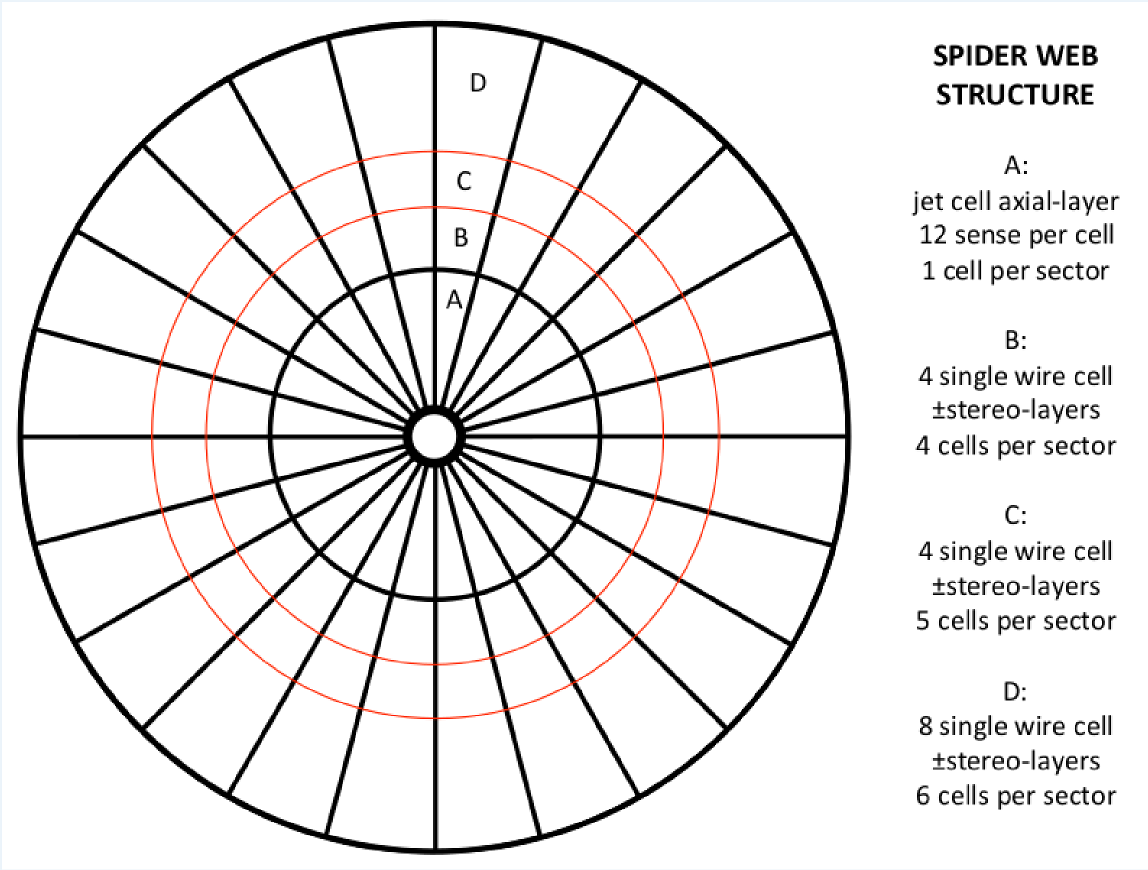
CREMLIN PLUS

Connecting Russian and European Measures for Large-scale Research Infrastructures

Mechanical design for CMD-3 drift chamber

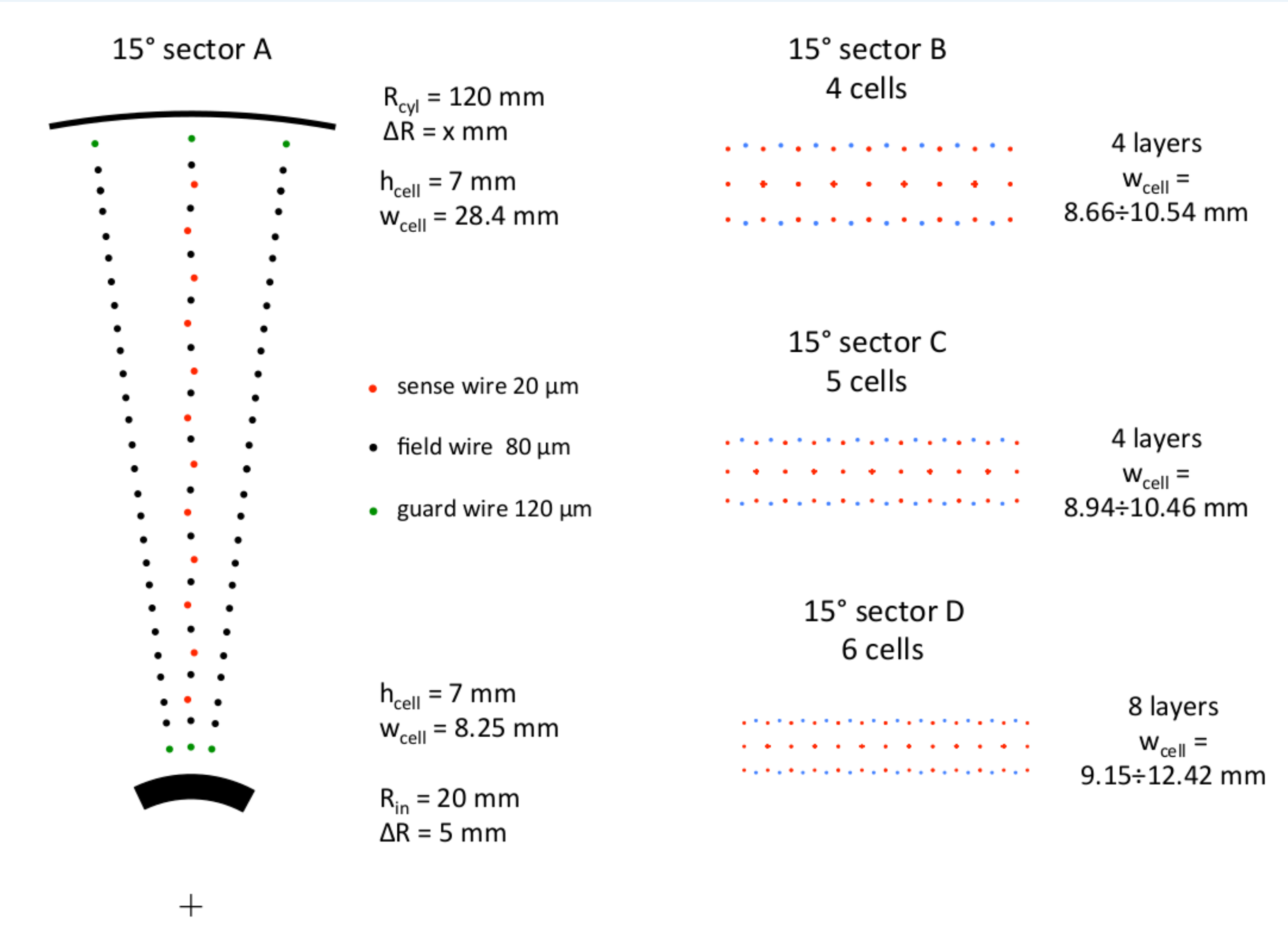
Details about the cell structure in chamber sectors.



From inside to outside, marked with black circle:

- inner cylinder
- middle cylinder
- outer cylinder

Red circles show the different sectors in which the chamber is conceptually divided.



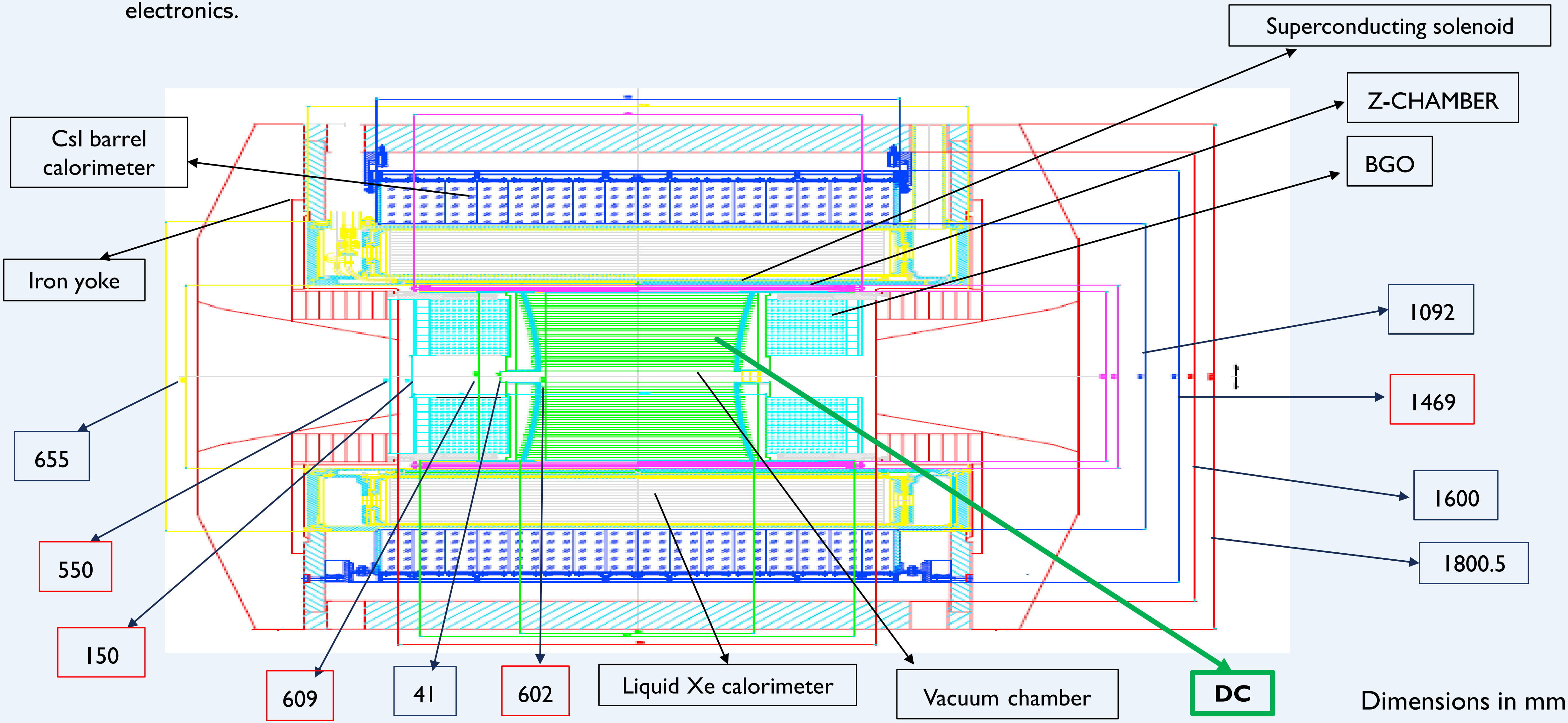
Sector A: jet-cells with wires arranged axially.

Sector B, C, D: single-wire cells with the wires arranged in stereo angle configuration.

DIMENSIONS

- Along beam axis (distance between end-cap calorimeter) = 484 mm
- Transverse direction (diameter) = 609 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: 24 spokes-48 PCBs

The construction of the chamber is driven by two main purposes:

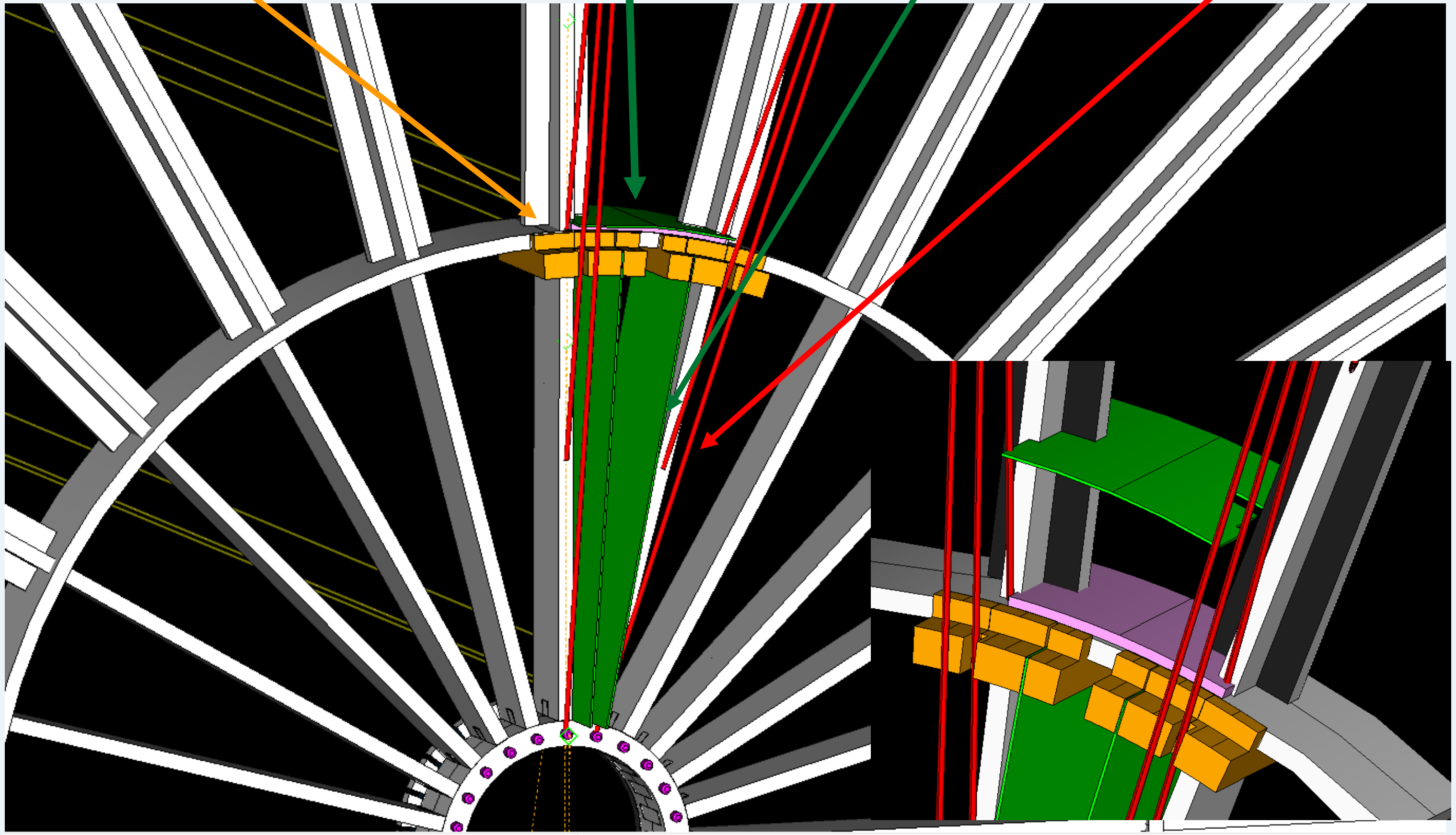
1) The high transparency
2) The mechanical stability of the whole structure

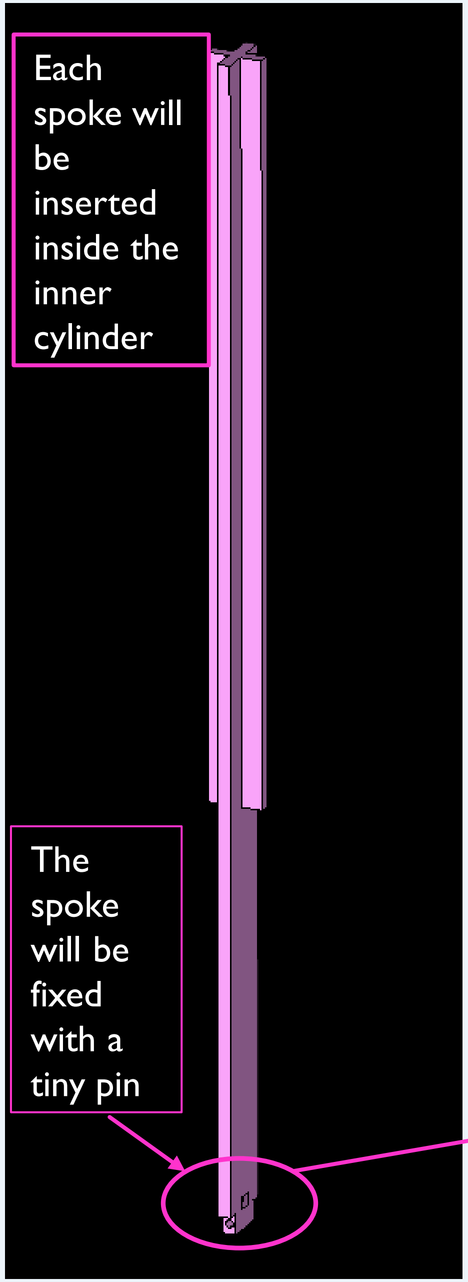
Support for PCB

Wire PCB for sector B

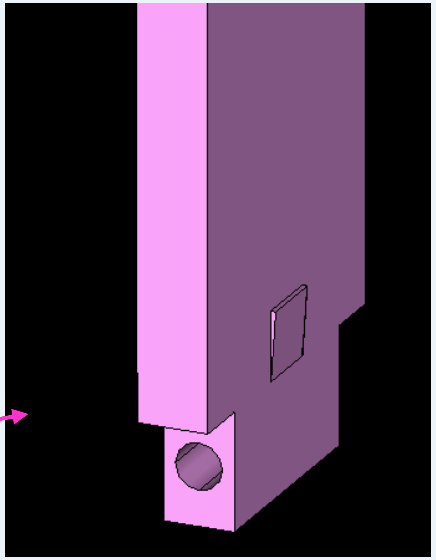
PCB for sector A

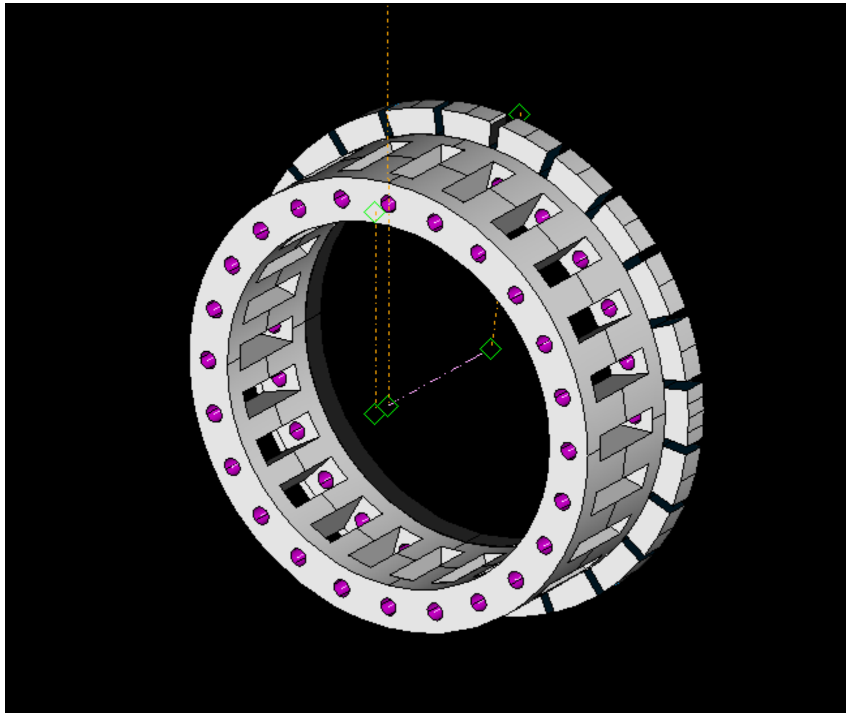
Tie-rod

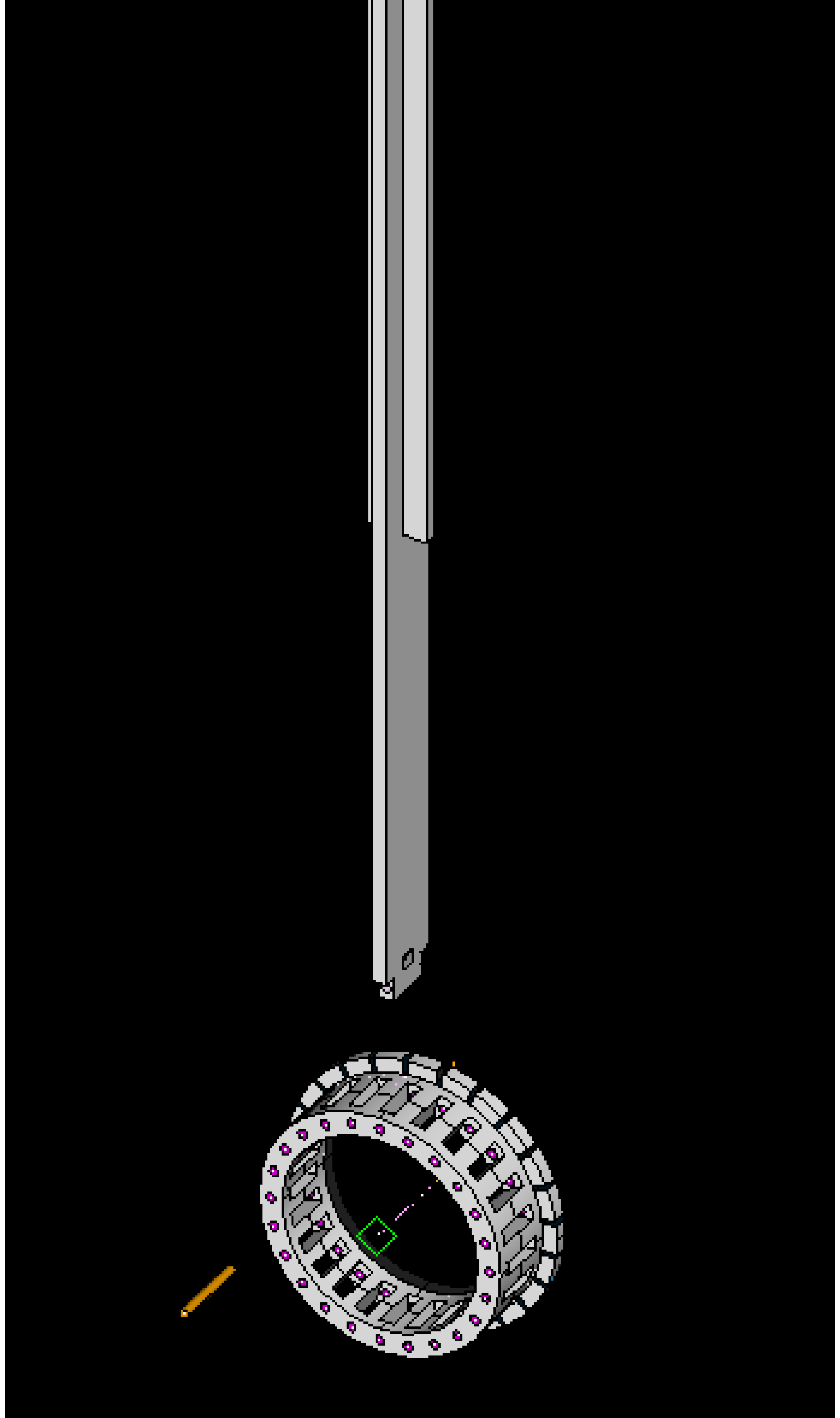
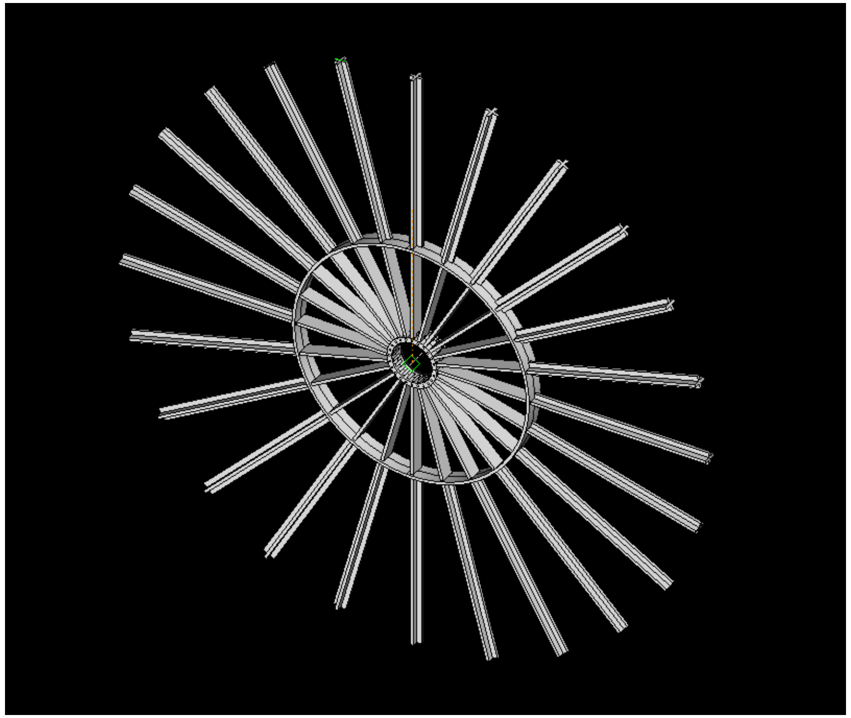
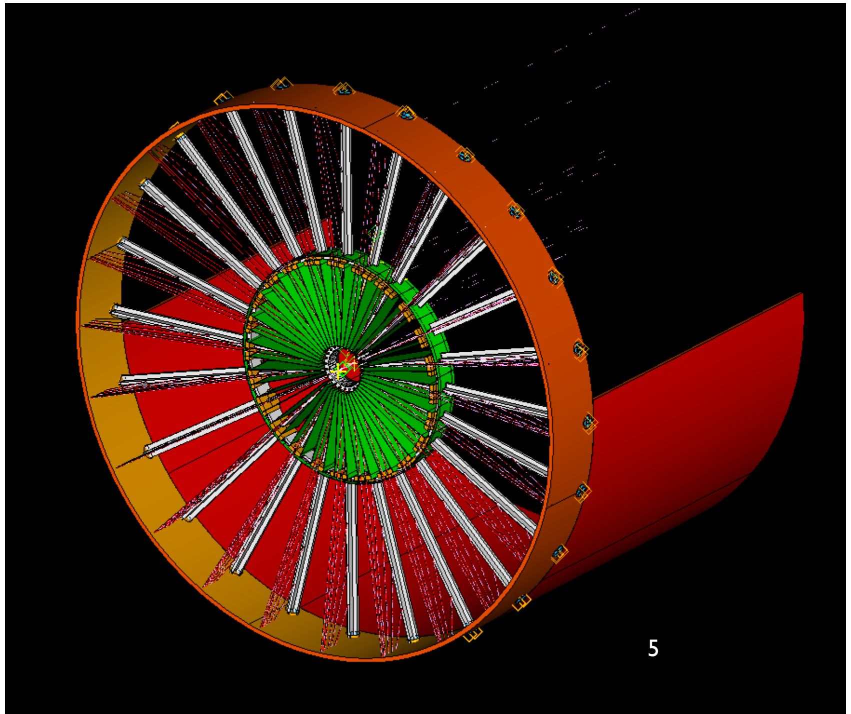




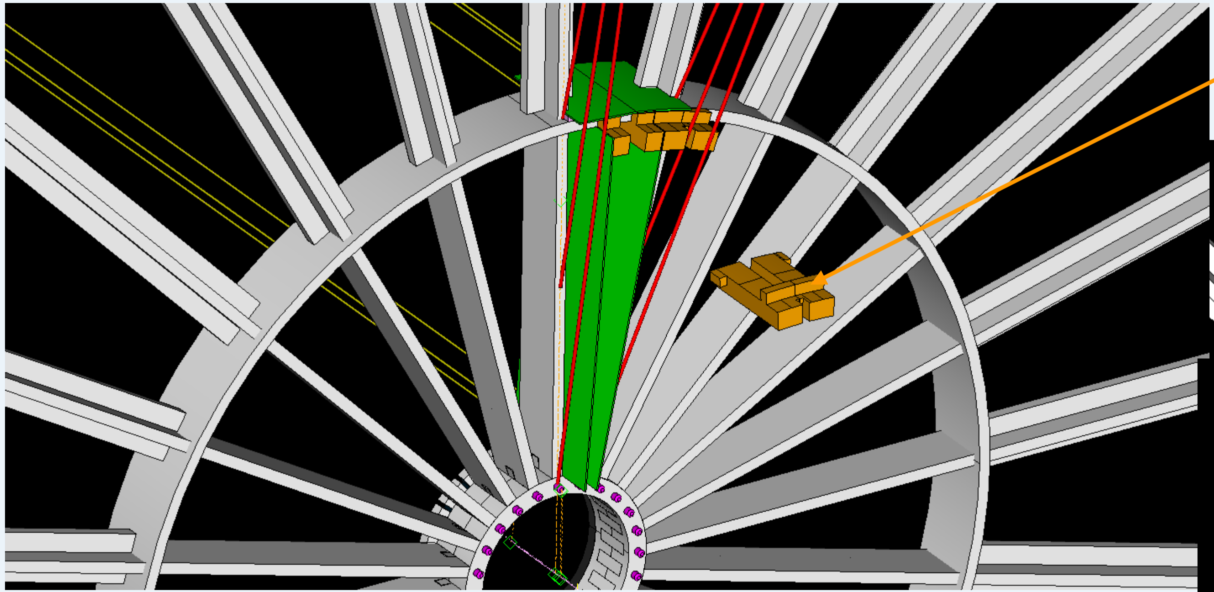
The spider web structure will be built in carbon fiber.



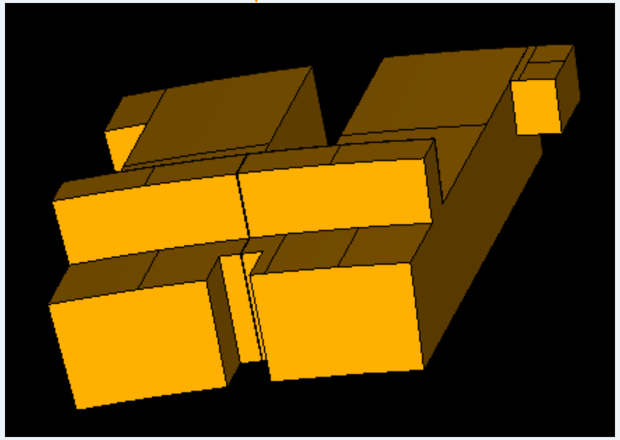


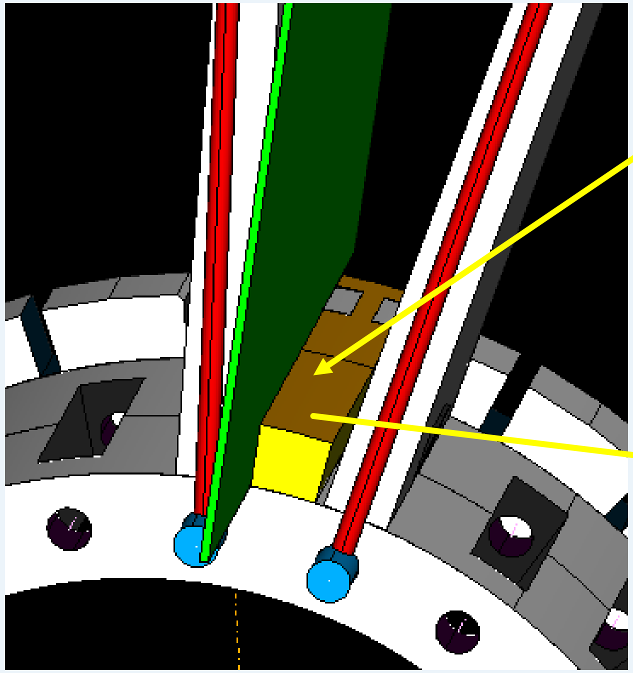




Details about the positioning of PCBs in sector A

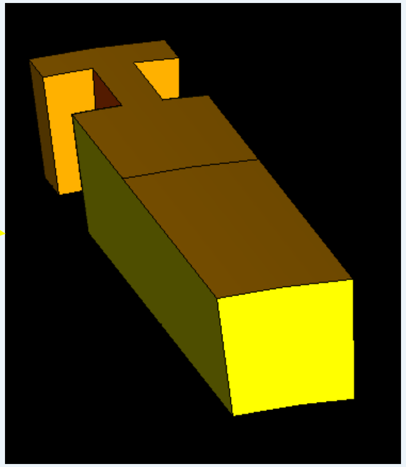


At the intermediate ring, supports will be built with a suitable shape to host the PCBs.



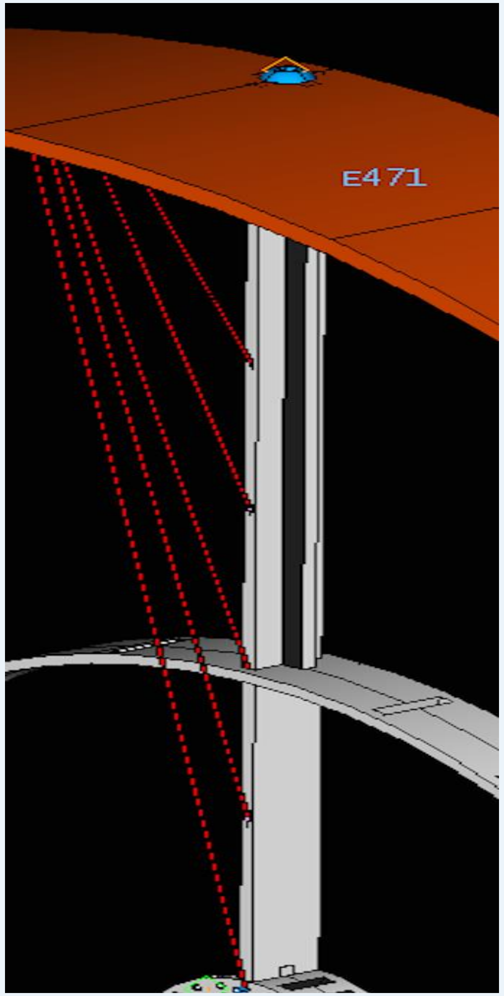


At the inner ring, we will insert a wedge-shaped locking plate.

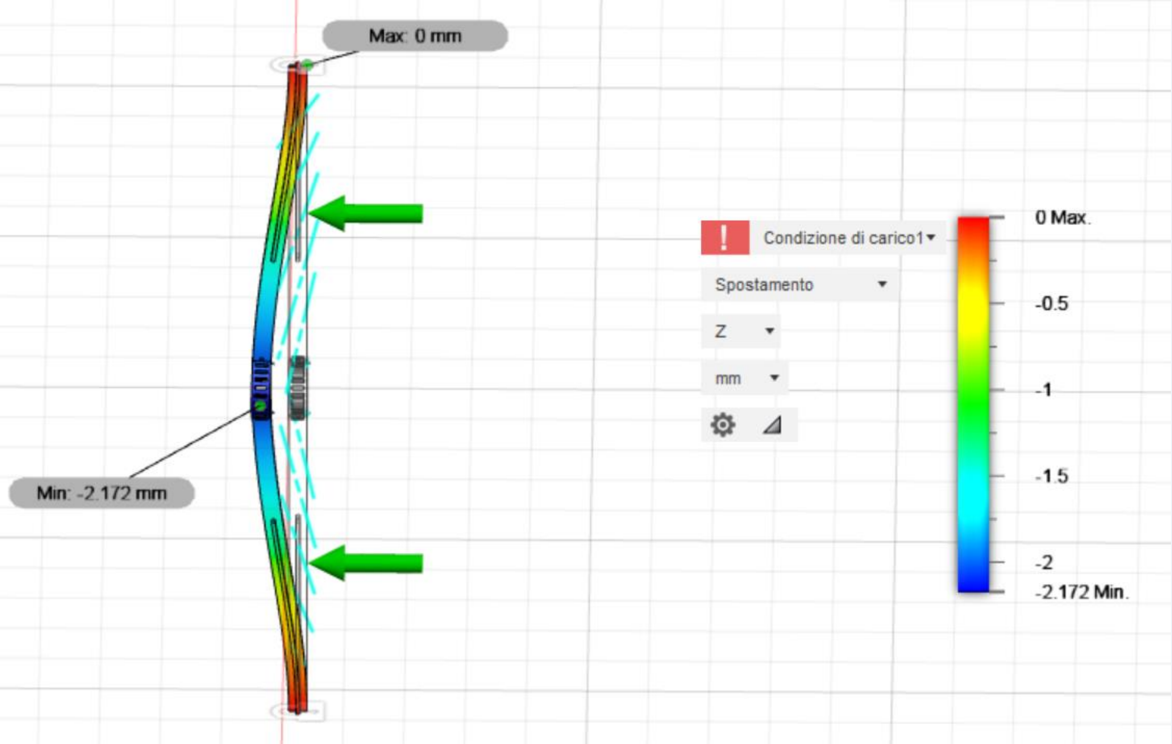


Tie rod to prevent deformations

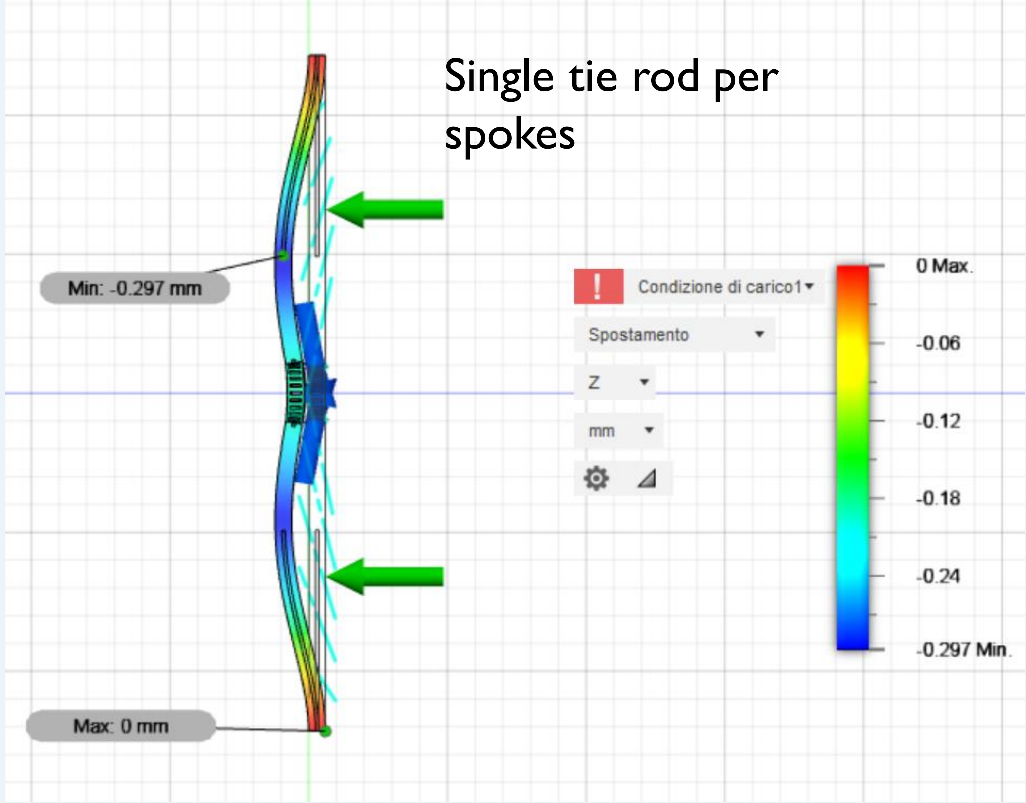
Due to the wire loads, (≈20 kg per spokes), the end-plates are affected by **deformations**.
We intend to install an appropriate number of tie rods per spoke to minimize the deformations due to the wire load.



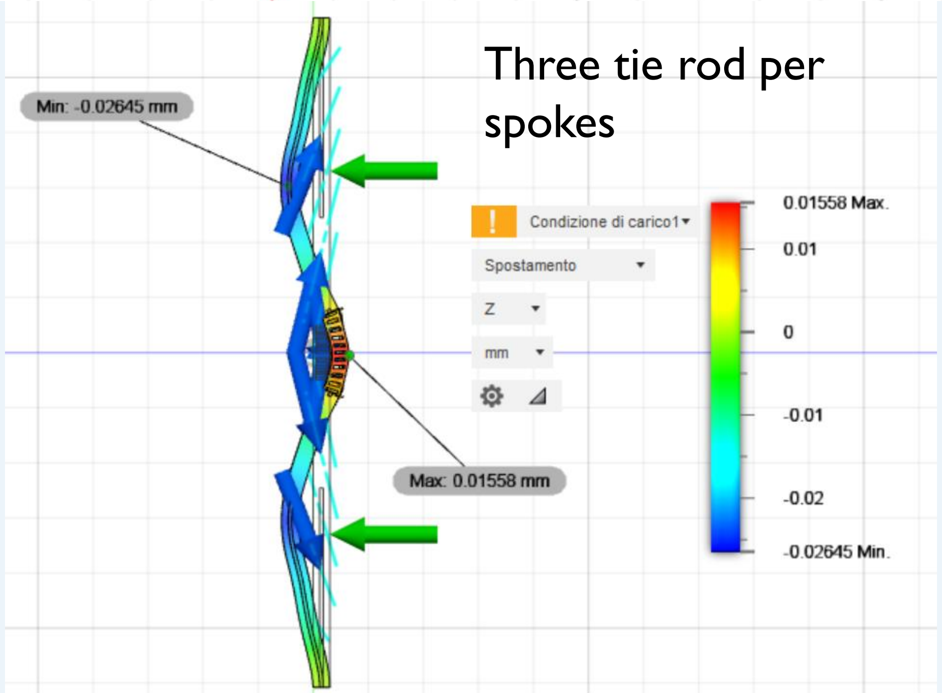
C-fiber (low modulus, 133 GPa) 4.8 mm deflection
Al 9.4 mm deflection
Ss 3.3 mm deflection



Single tie rod per spokes



Three tie rod per spokes



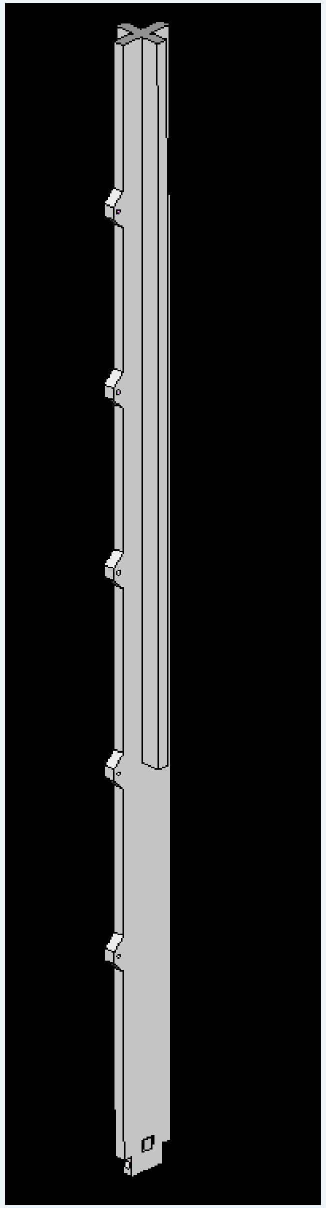
Just by adding symmetry reduces to 2.2 mm deflection

Single tie-rod at inner radius loaded with 450 N at 10°: max deflection < 300 µm

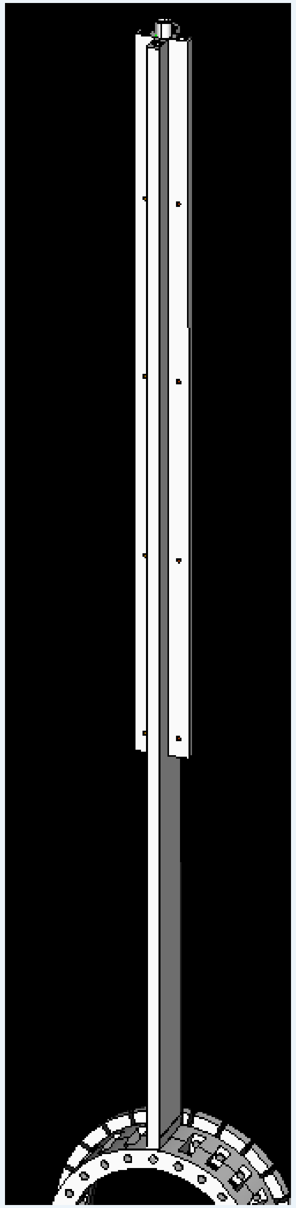
Three tie rods loaded with : 140 N at 10°, 240 N at 14°, 200 N at 21°: max defection <±25 µm

Possible ways to attach the tie rods on the spokes

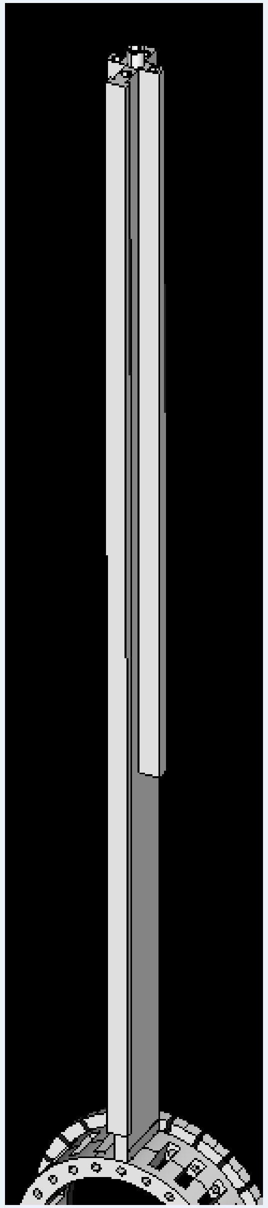
First proposal:
create buttonholes, insert an eyelet and hook the tie rod.



Second proposal:
create two buttonholes, insert an eyelet and hook the tie rod.



Third proposal:
use a "cart", like the mast of a sailboat



Conclusion

We started a collaboration with the technicians from University and Polytechnic of Bari, planning the following steps:

1. Finite elements simulation of the inner cylinder and spokes
2. Analysis and choice of suitable materials
3. Building of a prototype