

*Increase of the T600 maximum drift  
distance  
and  
preliminary considerations for larger  
aluminum vessels*

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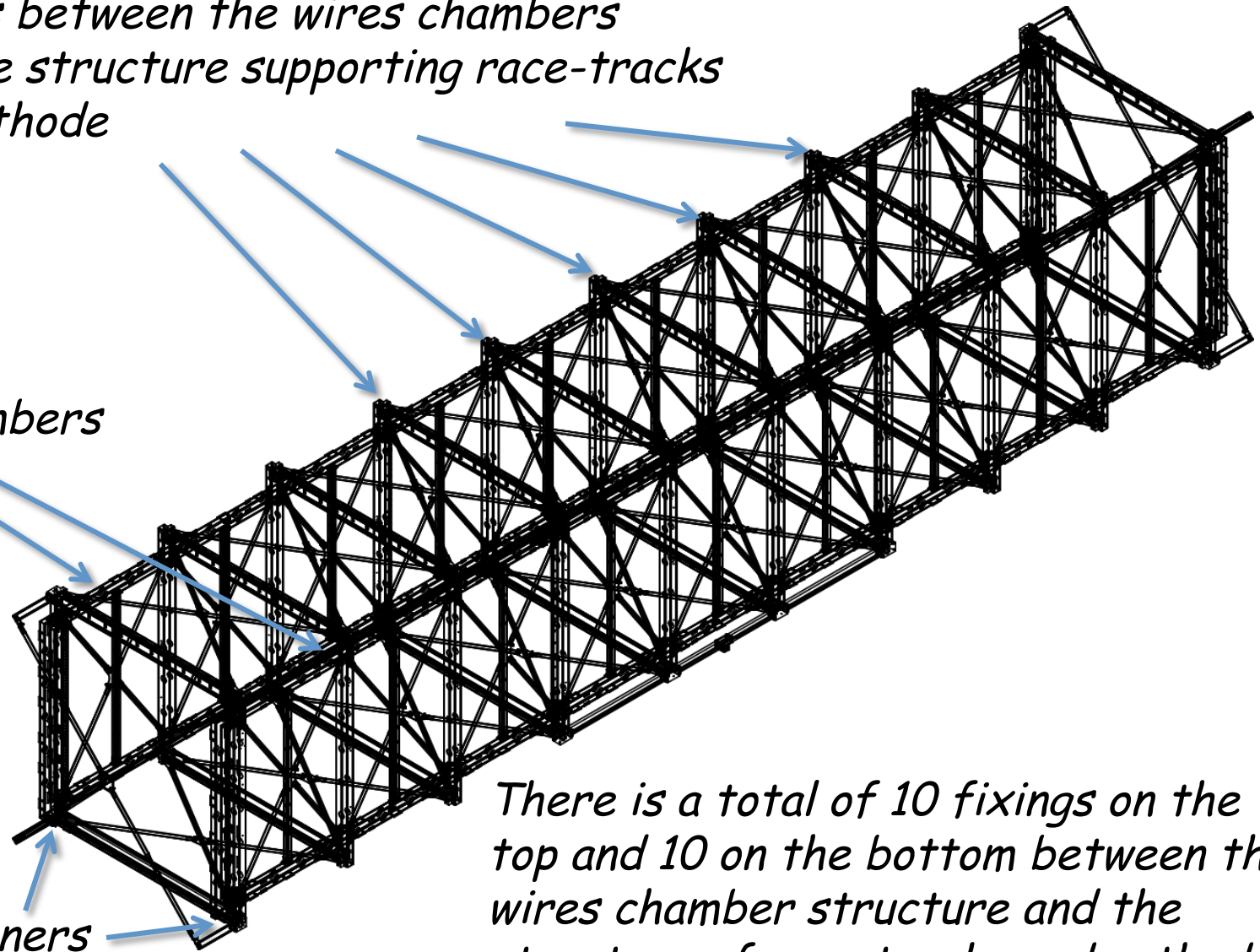
# Foreword

- In view of an increase of sensitive mass for the experiment at FNAL, and considering the extremely high LAr purity achieved with the T600 at LNGS, we are evaluating the possibility to increase the actual maximum drift distance of the T600.
- This presentation will focus on two technical items:
  - The modification of the internal detector mechanics;
  - The preliminary evaluation of new aluminum vessels with increased width.

# T600 TPC support structure

*Fixings between the wires chambers and the structure supporting race-tracks and cathode*

*Wires chambers*

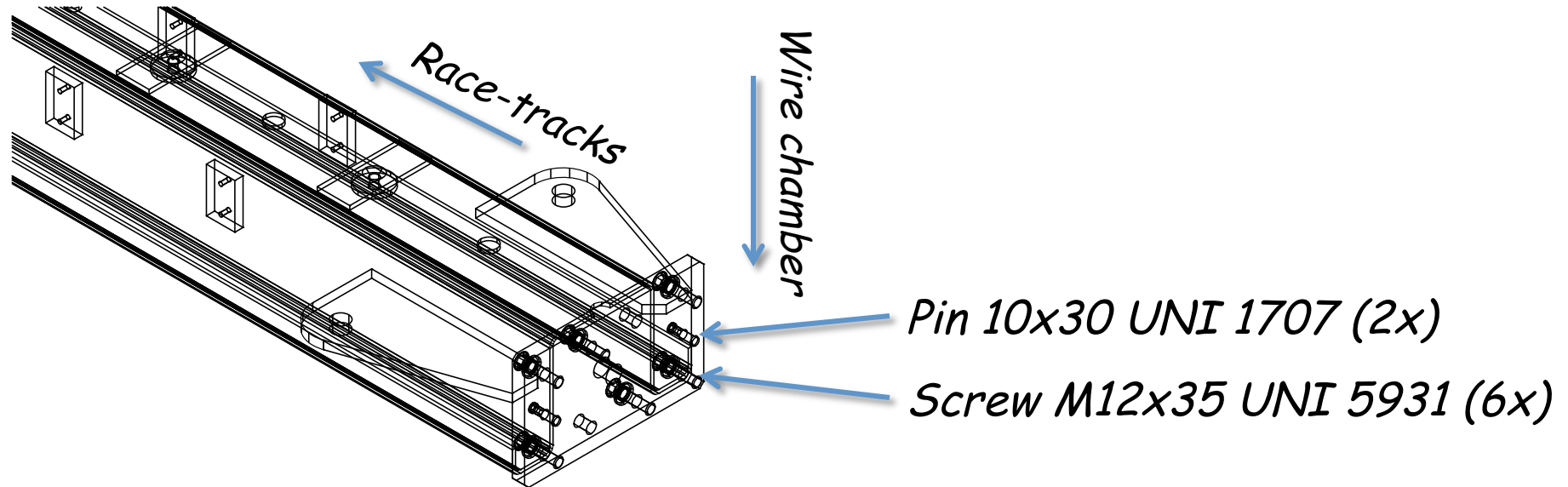


*Fixings at the corners*

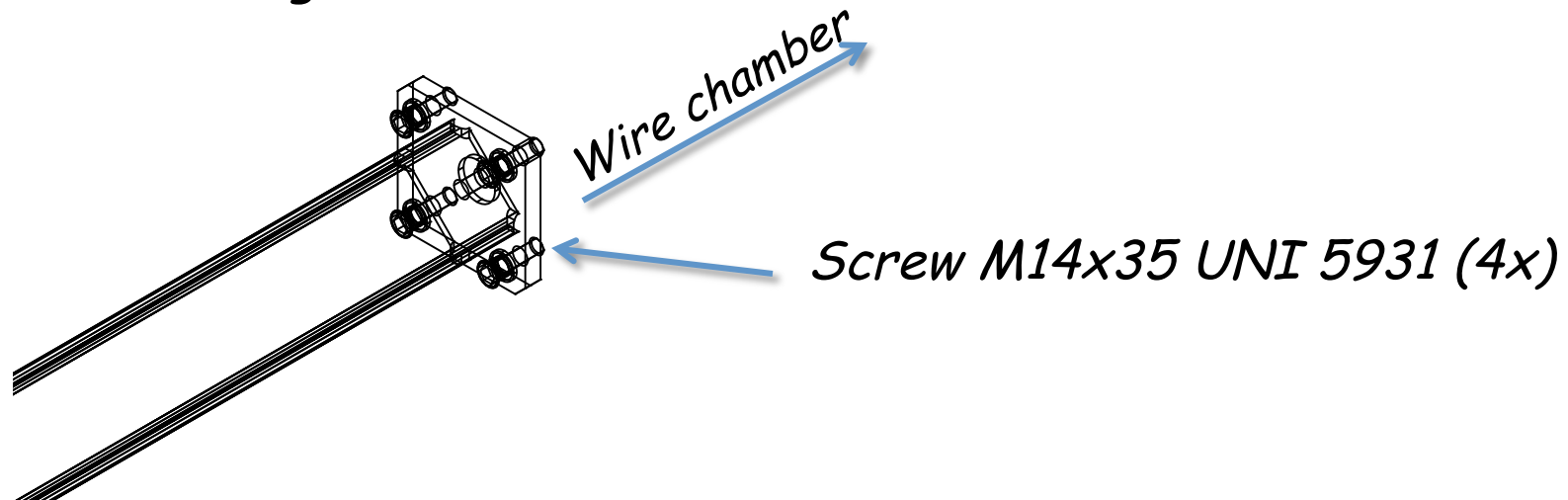
*There is a total of 10 fixings on the top and 10 on the bottom between the wires chamber structure and the structure of race tracks and cathode. Other 4 fixings are at the corners.*

# Wires chambers fixings

*Detail of the fixing between the race-tracks /cathode and wires chamber*

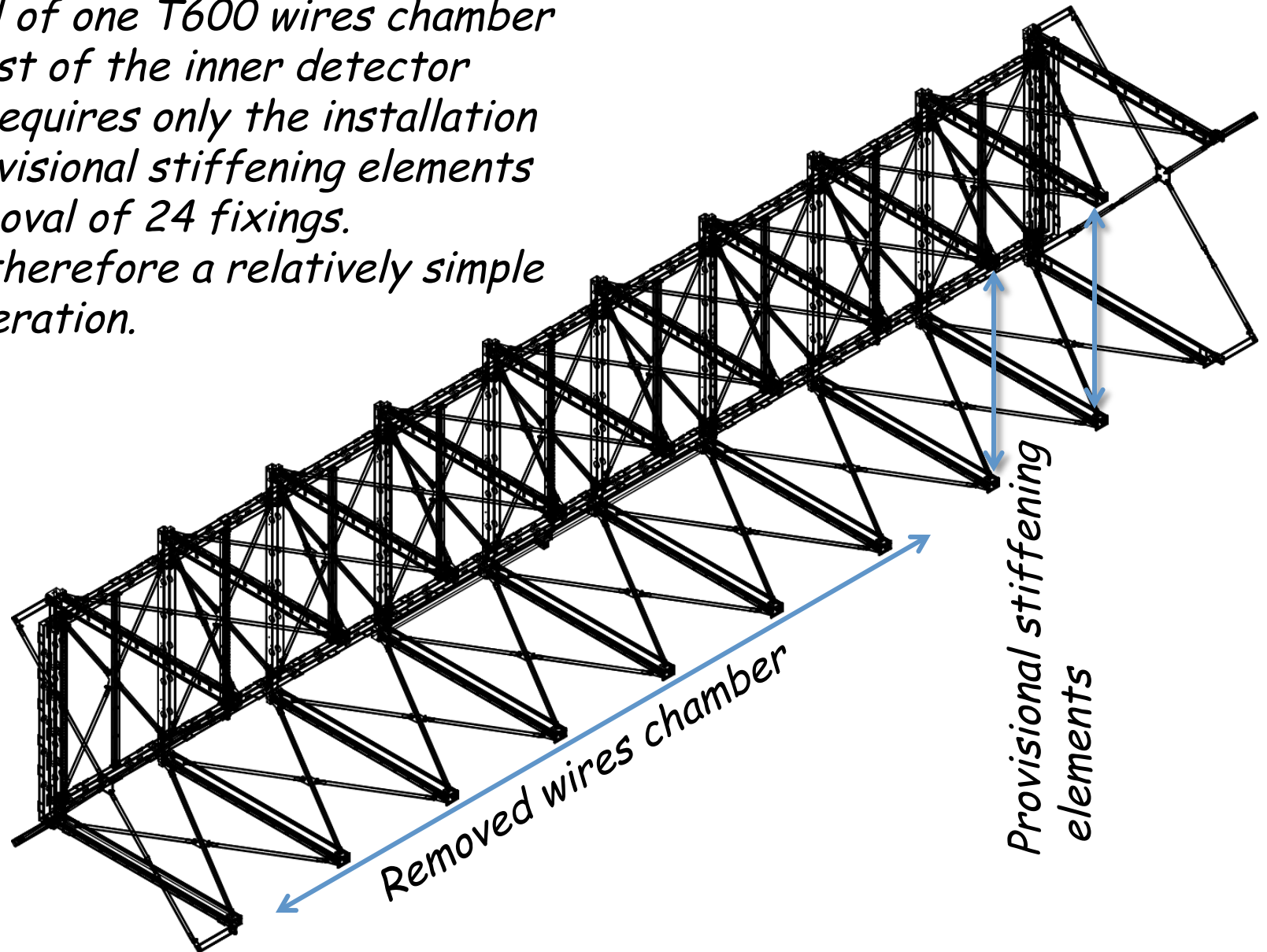


*Detail of the fixing of wires chamber at the corners*



# Removal of the wires chamber

*The removal of one T600 wires chamber from the rest of the inner detector structure requires only the installation of some provisional stiffening elements and the removal of 24 fixings. It appears therefore a relatively simple and safe operation.*



# Increasing the T600 maximum drift

- Several options can be considered to increase the T600 drift volume:

- Option 1 (T1200-like):

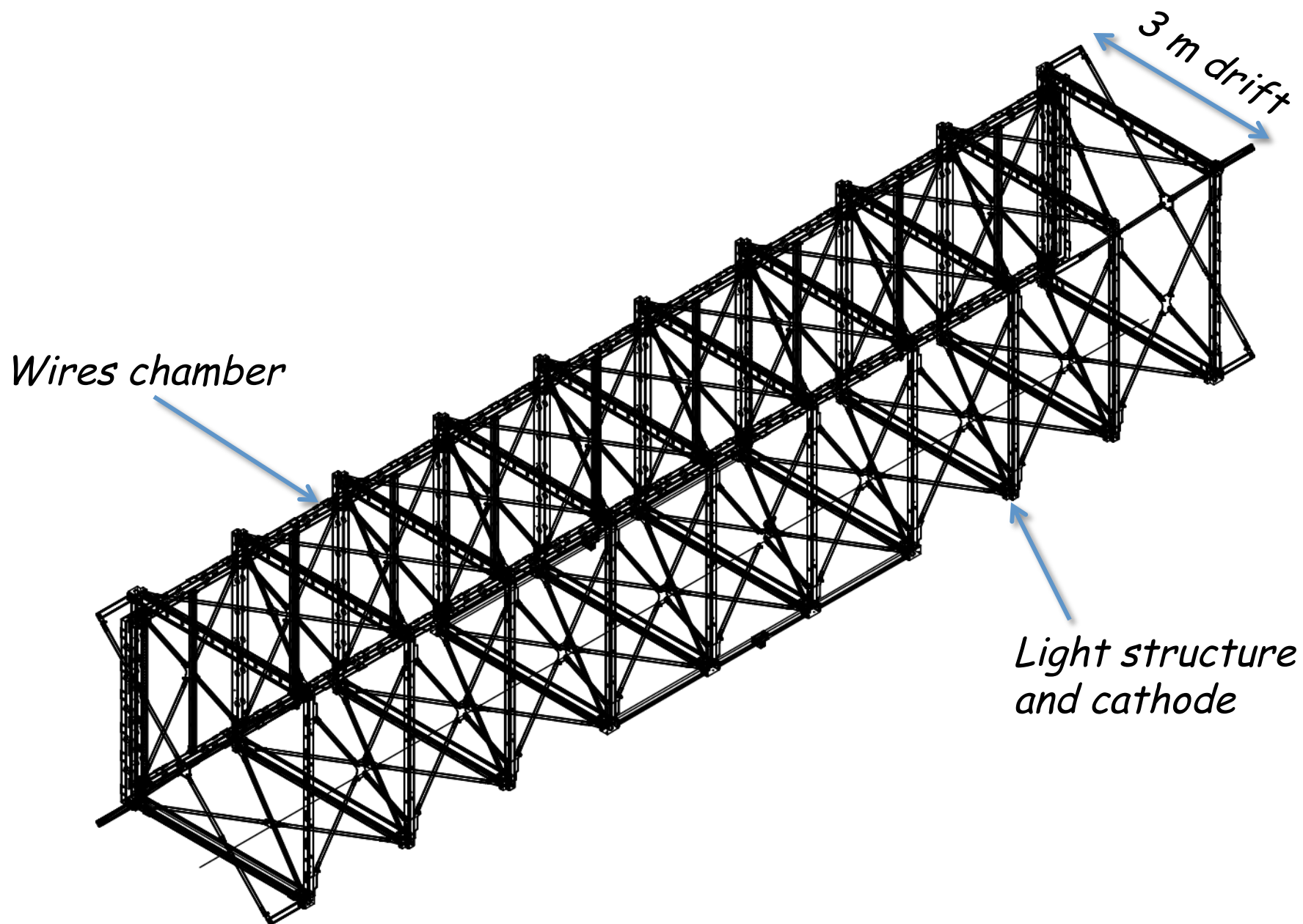
- the removed wires chamber is replaced with a light structure.
- The cathode is placed at the position of the removed wires (3m drift); the metallic structure is at  $\approx 27$  cm from the cathode (same as at present).
- Features: modest new design for the light structure; no need to re-design the LAr containers, the insulation and cryogenics.

- Option 2 (T600++):

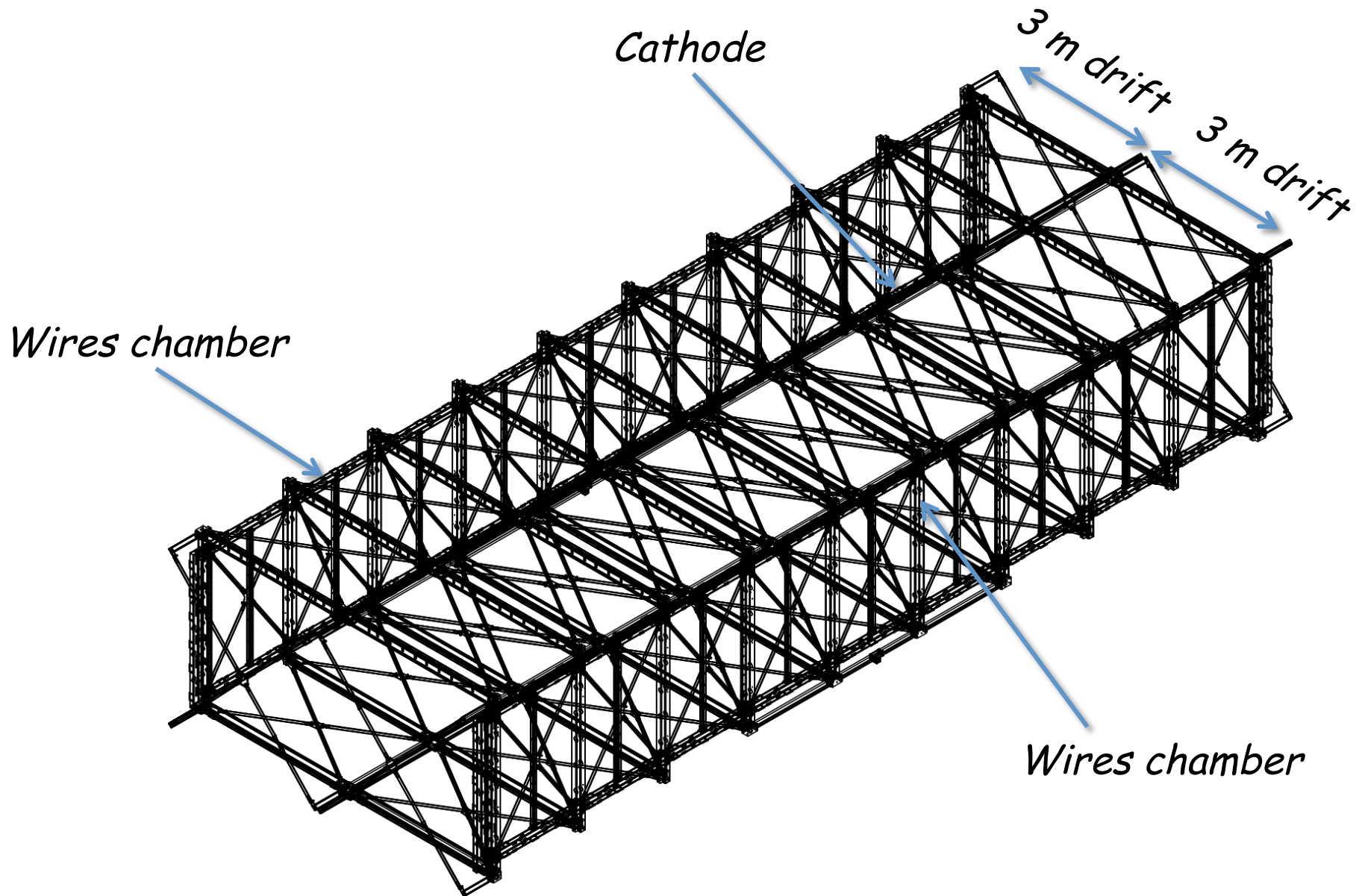
- the two T300 chambers, with one of the wires chambers being removed, are placed face to face and connected with simple elements.
- a cathode is placed in the middle, reproducing the present T300 layout with  $\approx 3.2$  m drift. Distance of the cathode from the metallic structure is identical as the one at present.
- Features: minor new design for the connecting elements; the LAr containers have to be re-designed; no need to re-design insulation and cryogenics; assembly schemes and logistics have to be re-considered.

- For both layouts the drift could be further extended with additional structures. In this case the thermal insulation has to be re-designed.

# Option 1: (T1200-like)



# Option 2: (T600++)





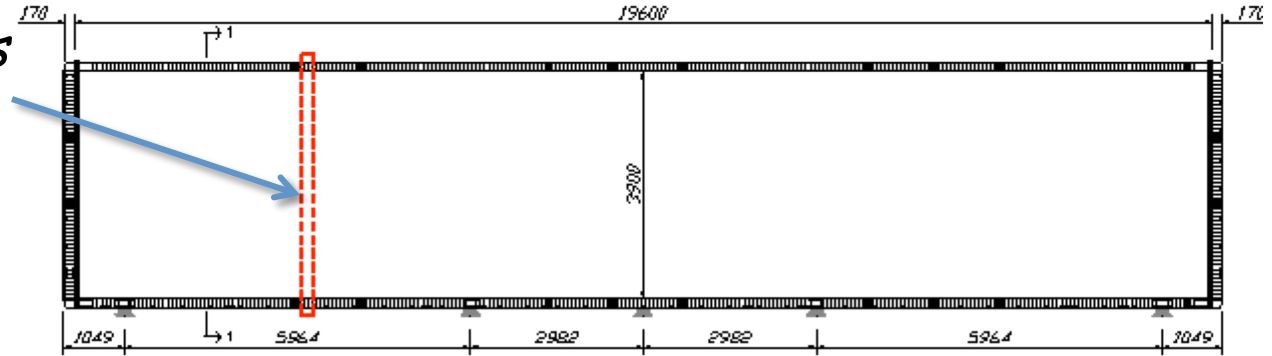
# Aluminum vessels with increased ( $\approx 7.5\text{m}$ ) width

- A preliminary evaluation for an aluminum vessel with a width adequate to host a T600++ module (central cathode, two chambers with  $\approx 3\text{ m}$  drift) has been performed by the structural engineers that made the design of the new containers for the present T600.
- The preliminary evaluation shows that the present solution with the same extruded aluminum profiles could also be applied for the larger containers. An additional set of "annular" reinforcements have to be implemented together with a longitudinal reinforcement and a set of central supports on the basement to hold the weight of the LAr. The reinforcements are of the same type as those already designed for the "standard" containers to be used in correspondence of the "feet" of the wires chambers structure.

# Aluminum containers with increased ( $\approx 7.5$ m) width

*Extracted for the structural engineers reports*

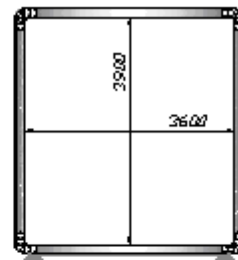
*"Annular" reinforcements*



*Present container*

*Container with 7.6 m int. width*

*Longitudinal reinforcement and addition set of supports*



SECTION 1-1

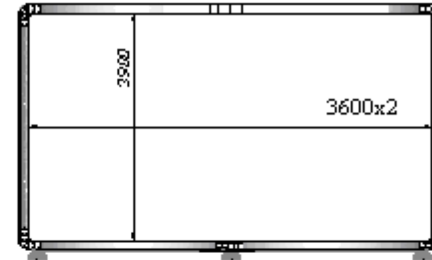
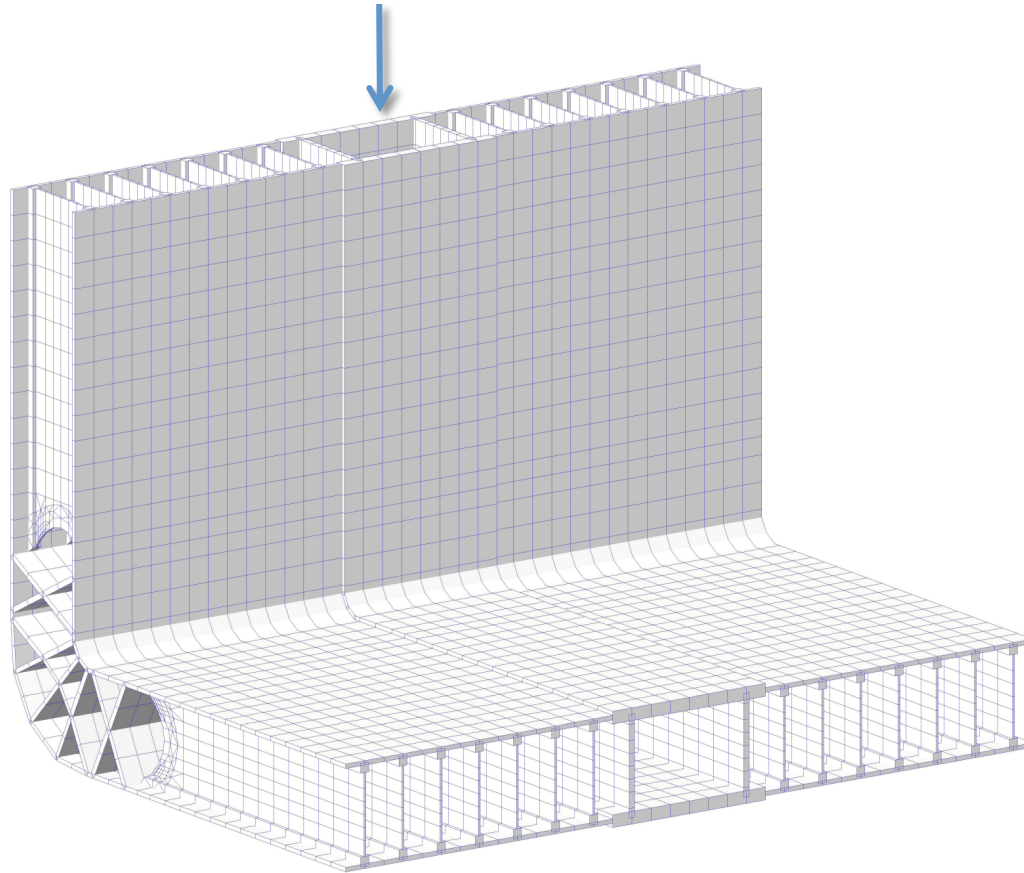


Figure 1 - vessel longitudinal section in a vertical plane (above) and transversal section, (below). Left side, the actual cross section, right side that presently discussed.

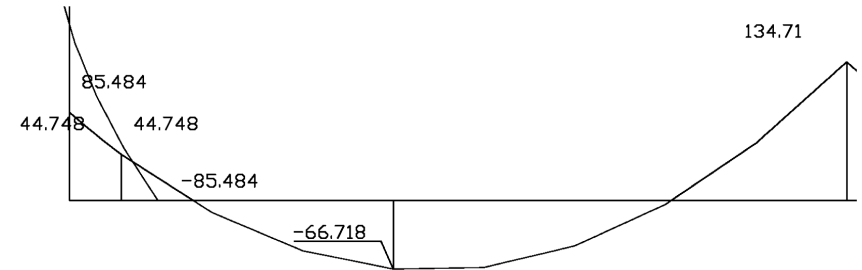
The discussion is based on the assumption of a third line of supports, linked together by a longitudinal beam, as fig. 1 shows. Similarly, the plate at the top of the vessel should be reinforced by a longitudinal center-line beam. Next section shows that without this intermediate support line, the elements thickness (presently 7 mm) will increase to a thickness at the limit of the extrusion capability. The increase of the external dimension of the wall, presently 170 mm, shall be examined. The presence of the longitudinal beams is thus taken for granted.

# Aluminum containers with increased ( $\approx 7.5$ m) width

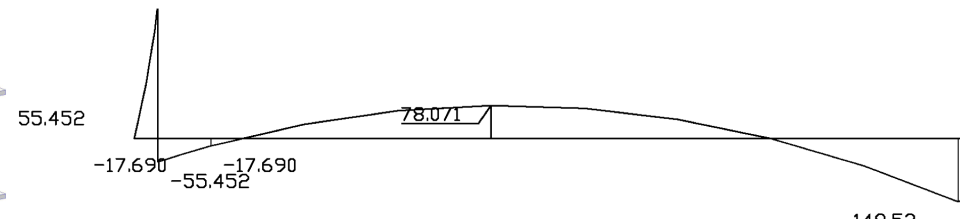
*"Annular" reinforcement*



*Deformations while filled with LAr (Top) and under vacuum (Bottom)*



new dimensions and scheme (service condition)



new dimensions and scheme (void condition)

*With the reinforcements the maximum bending will be from  $\approx 65$  mm (with LAr) to 78 mm (under vacuum)*

# Conclusion

- A preliminary evaluation of some options for an increase (to 3 m or more) of the T600 TPCs maximum drift has been performed.
  - Separating one of the wires chamber from the present T300 structured appears to be a relatively simple and safe operation
  - The enlargement of the drift requires some new mechanical design, the extent of it being determined by the chosen option.
  - The "spare" chambers can be equipped with an identical race-tracks + cathode system.
- The preliminary study for an aluminum vessel with doubled width shows the most of the present solutions can be retained. A new detailed design with a new set of structural calculations has to be performed for this option.