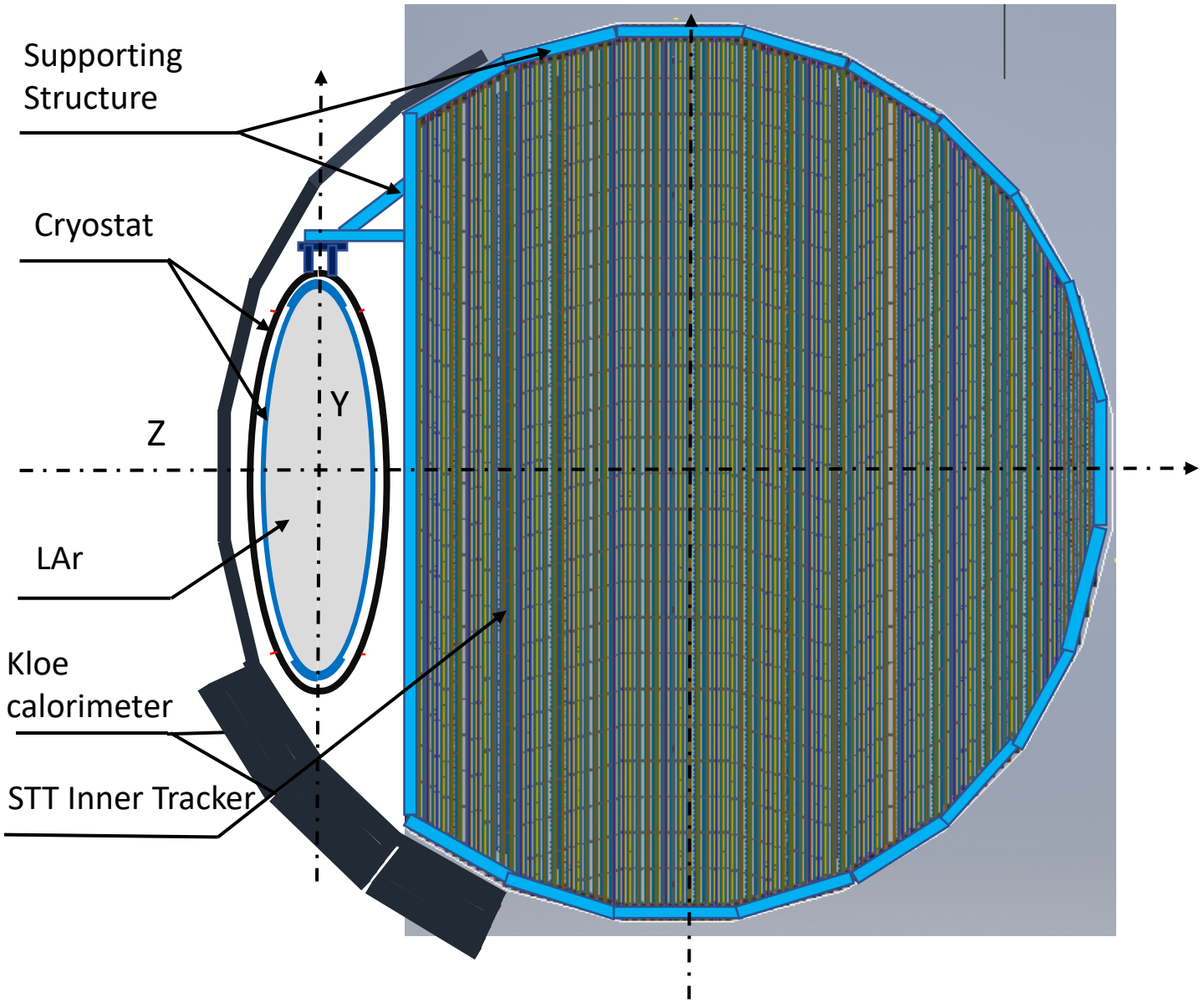
GRAIN Inside SAND



GRAIN :
Granular Argon for Interaction Of Neutrinos

LAr Cryostat V = 0,7 m^3 min

Sup insulated and vacuum

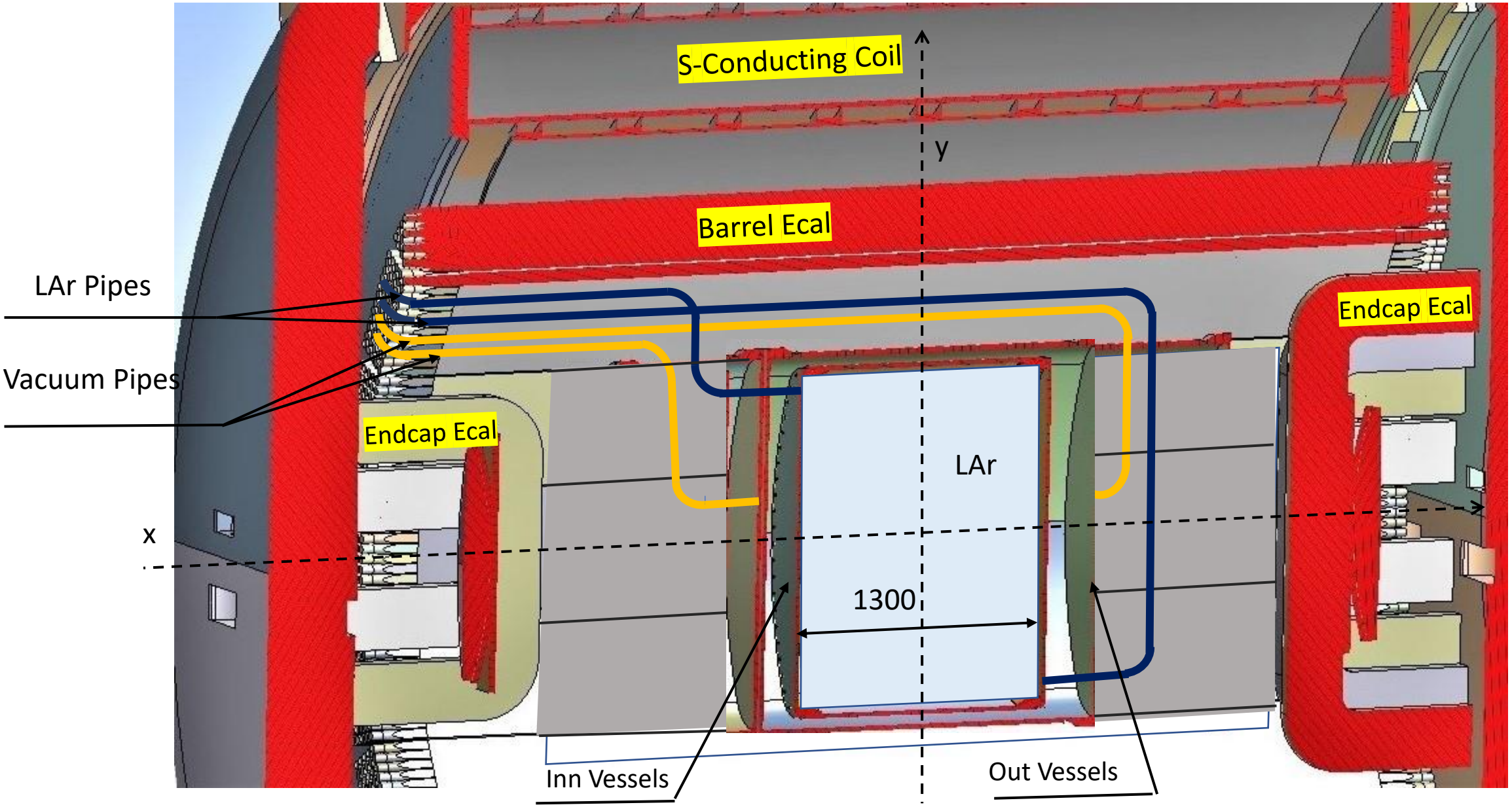
As **Thin** as possible

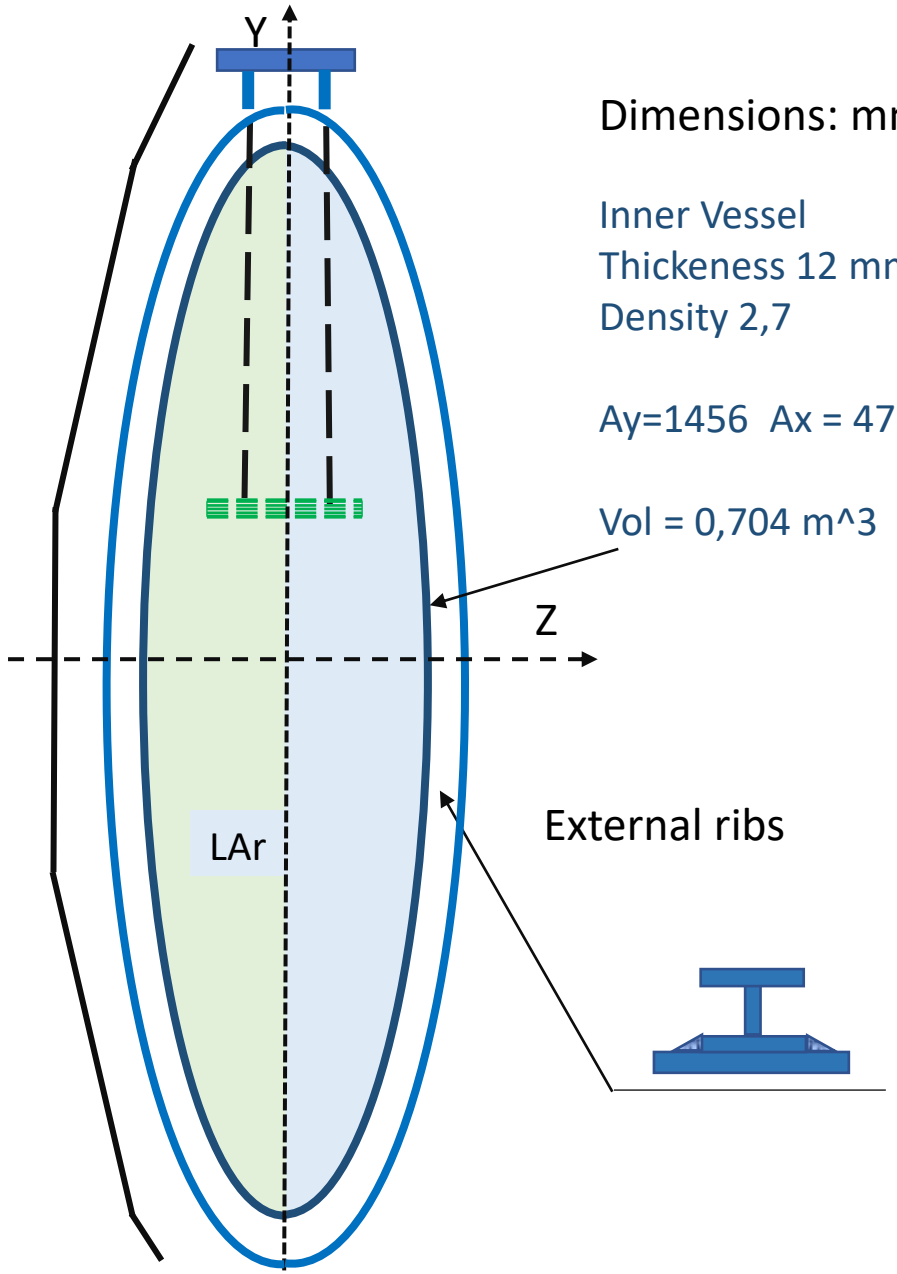
Not too large in Z

Openable (detectors inside)

C. Guandalini, M.Guerzoni, G.Laurenti INFN-Bo, R.Pengo INFN-Ln

GRAIN inside SAND



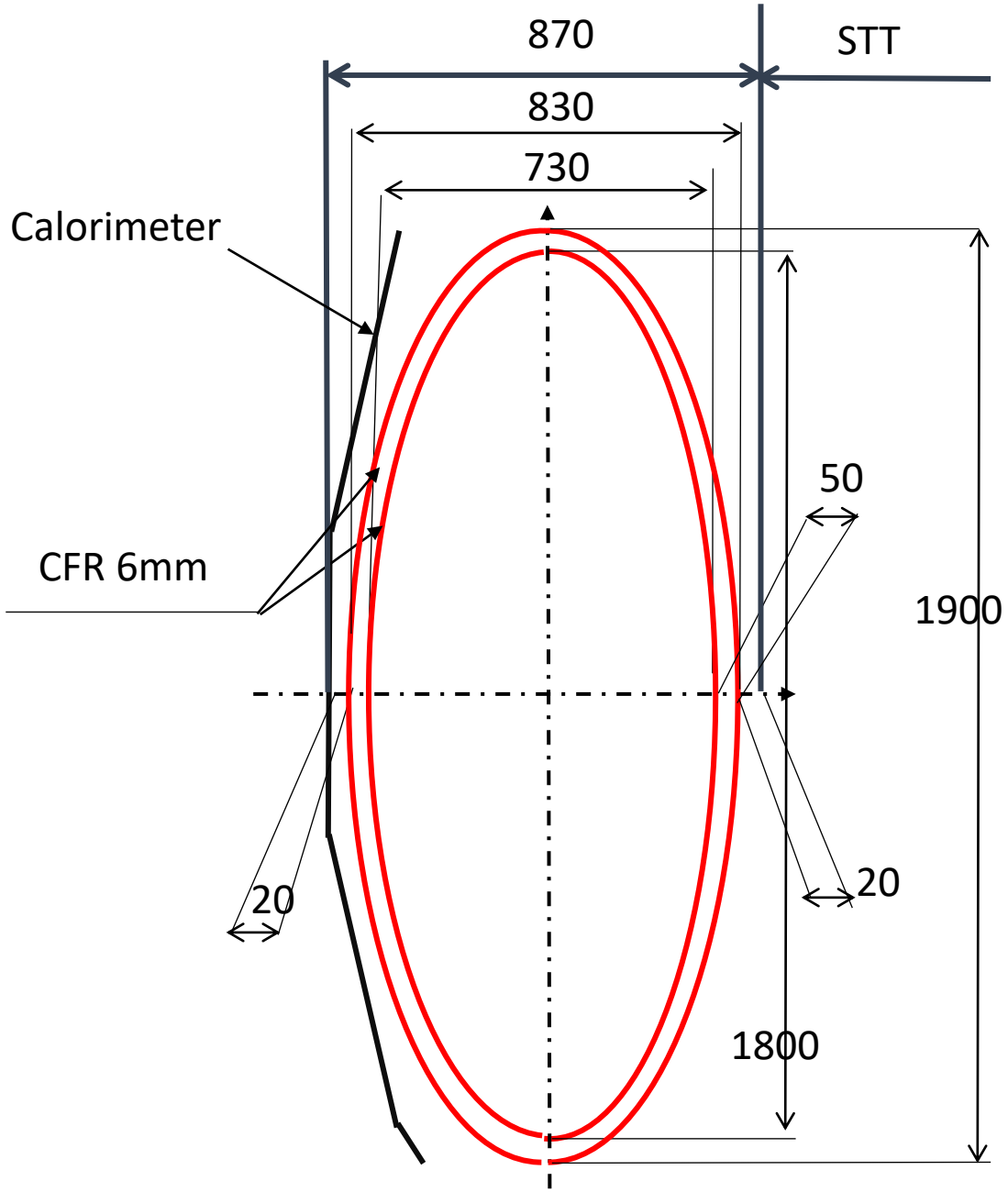


Dimensions: mm

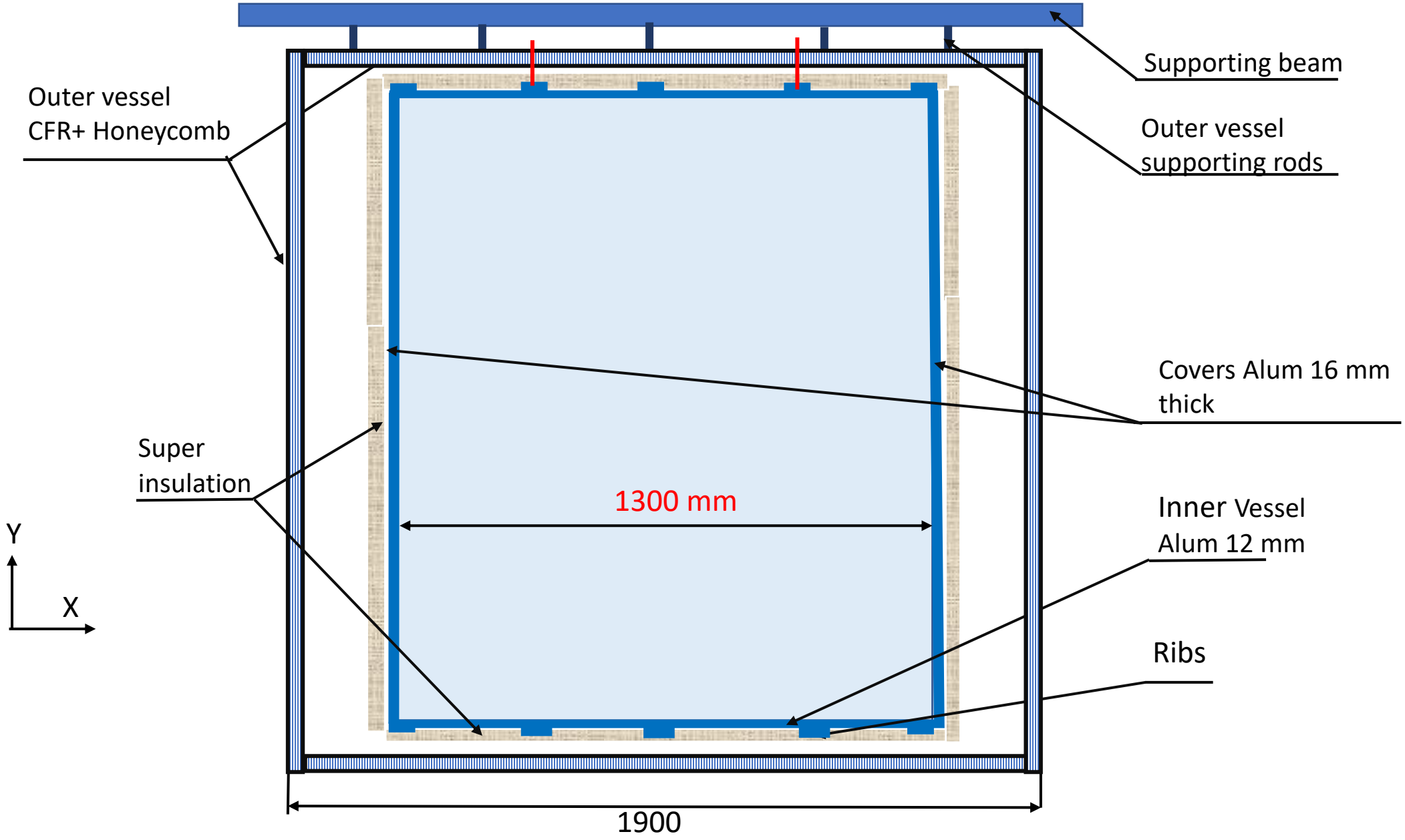
Inner Vessel
Thickeness 12 mm Aluminium
Density 2,7

Ay=1456 Ax = 475 L = 1300

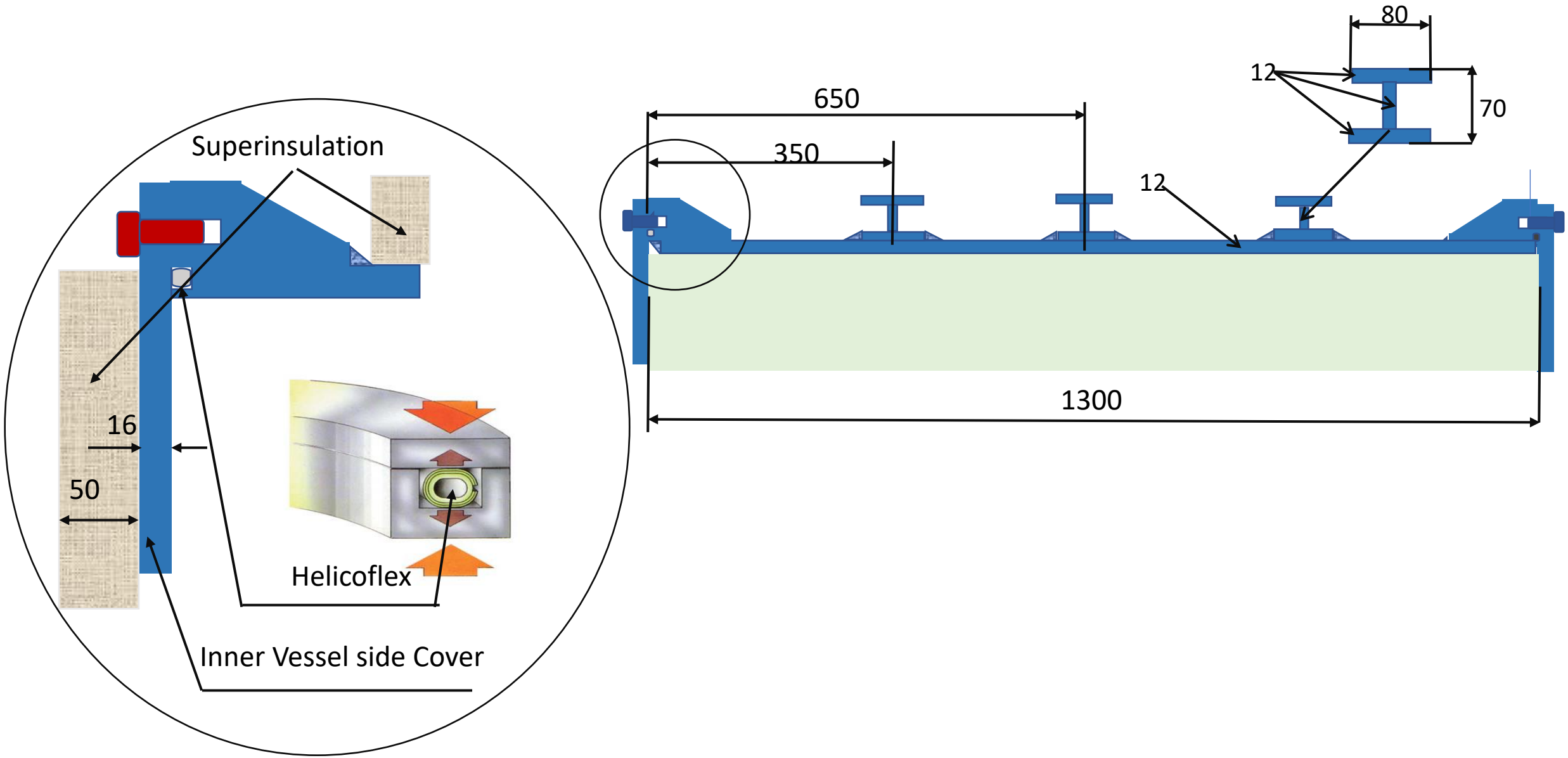
Vol = 0,704 m^3

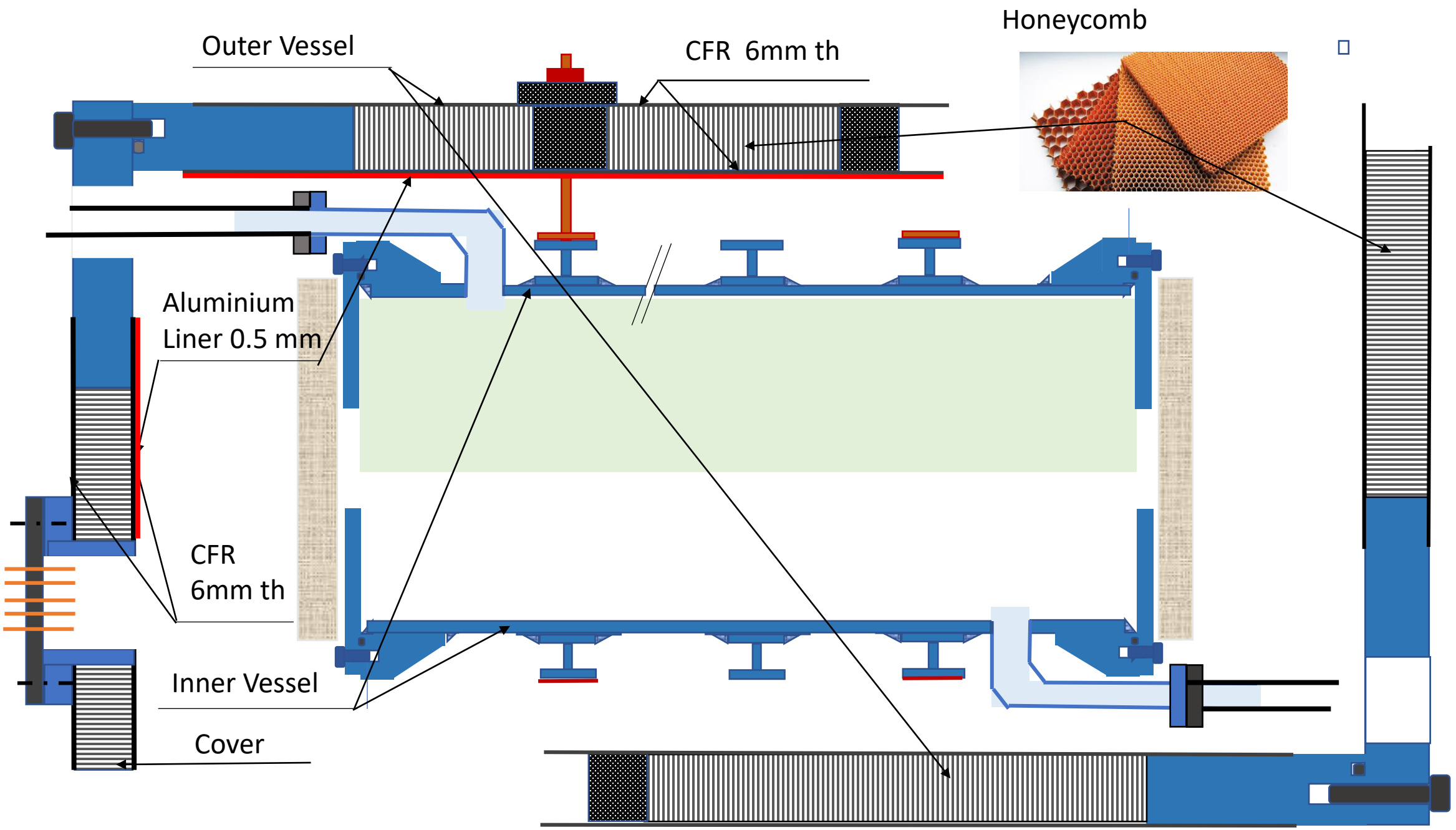


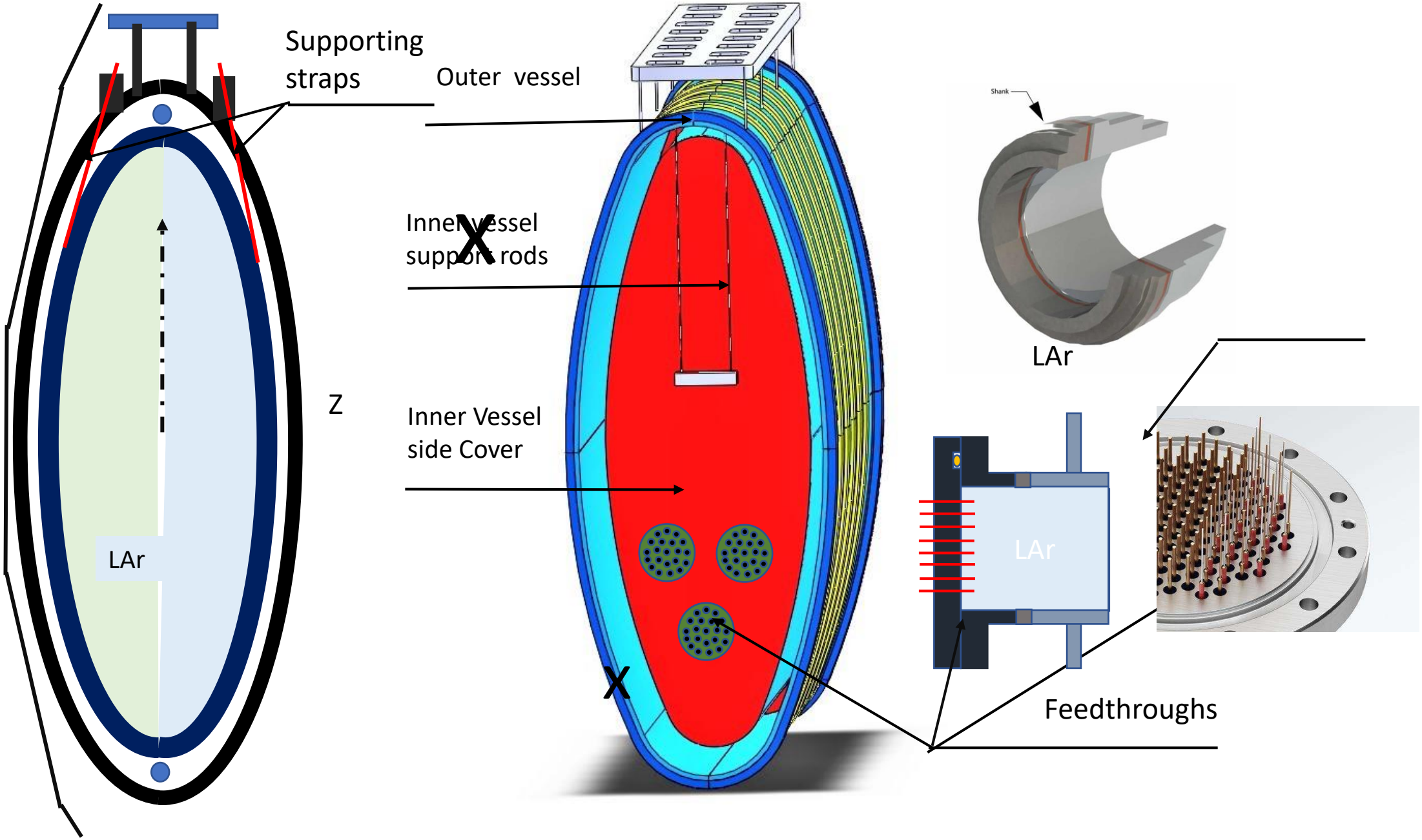
Schematic XY cross section



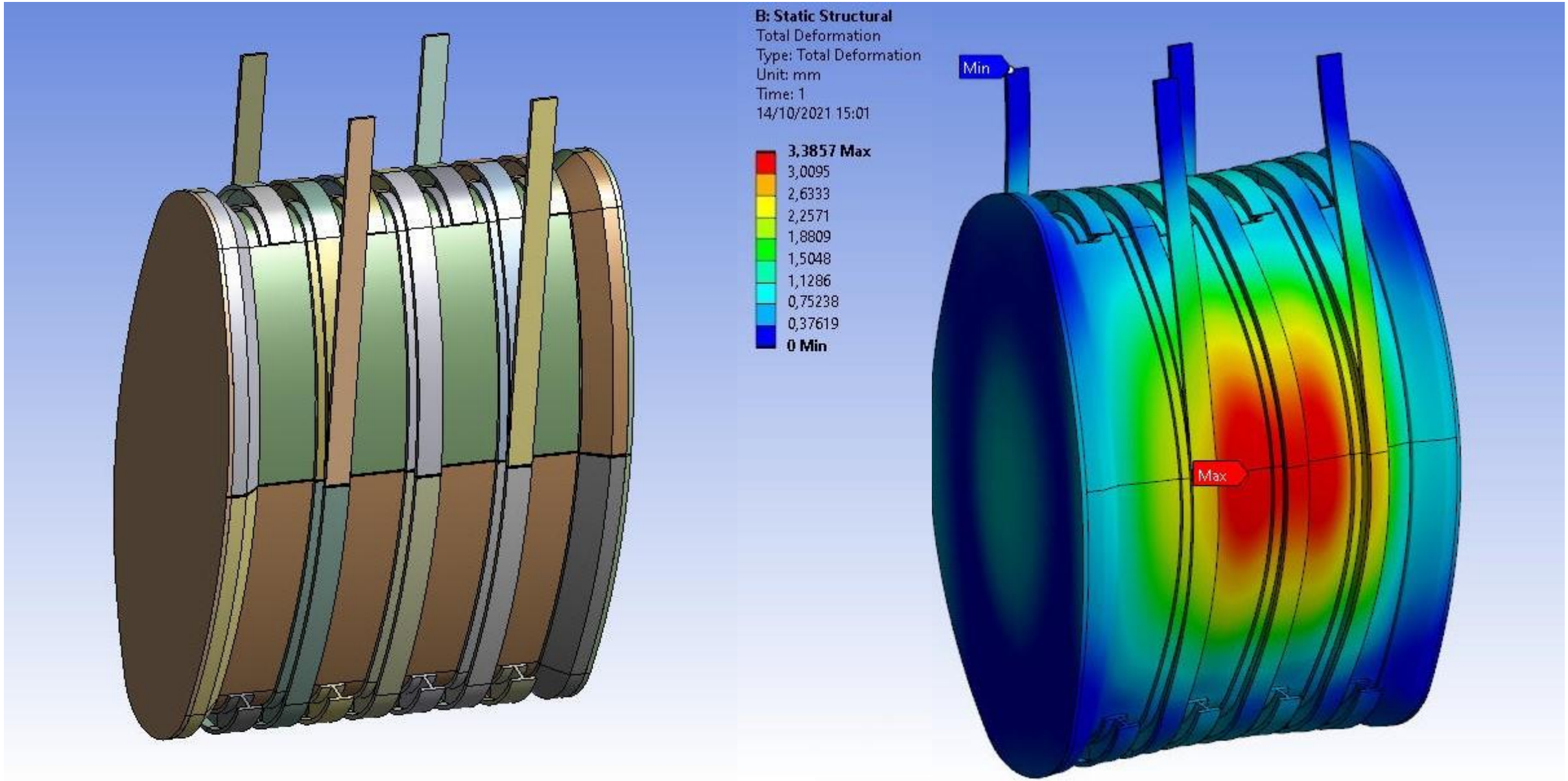
Inner Vessel Schematic cross sections



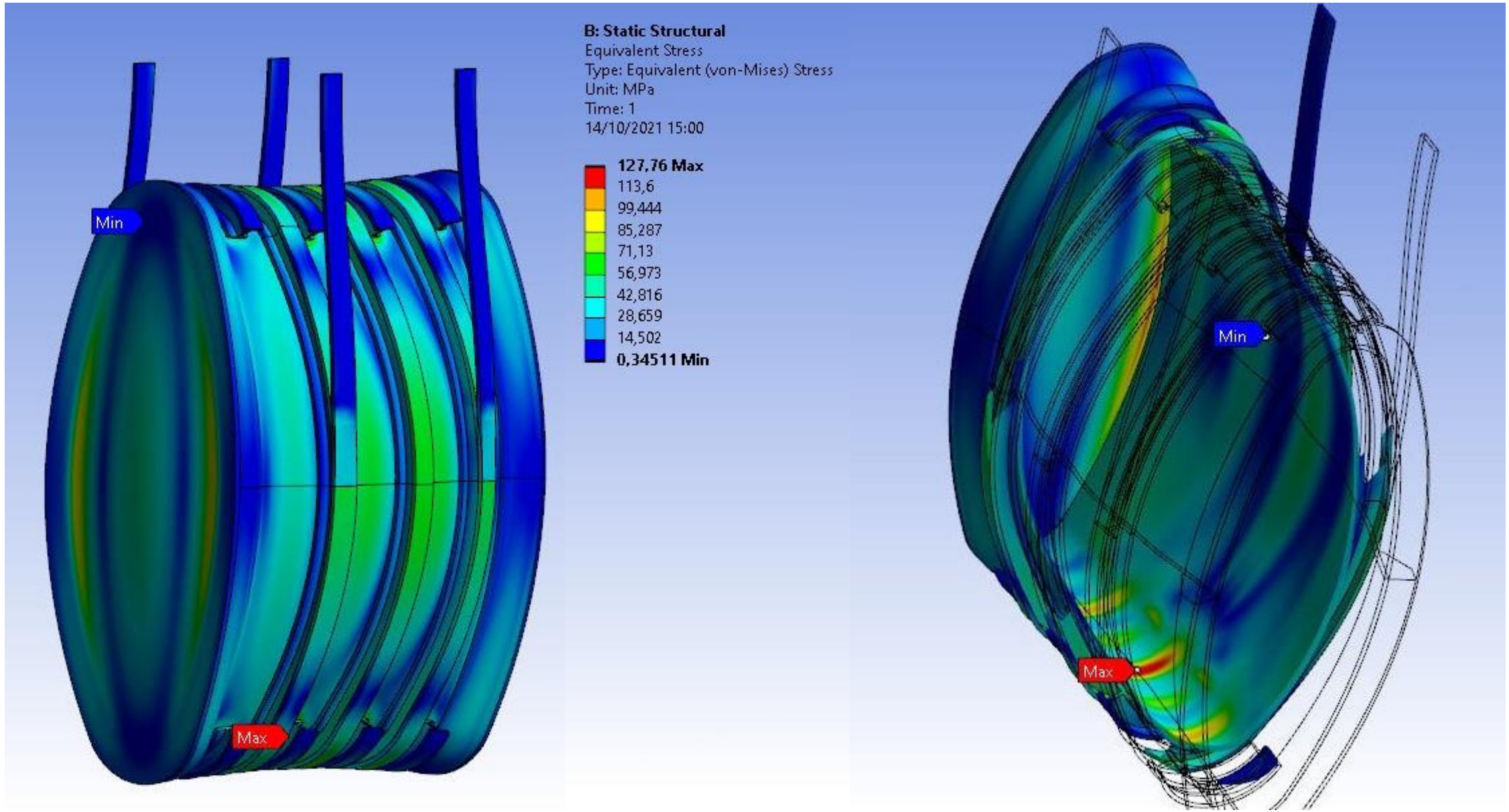

Outer Vessel
CFR 6mm th
Honeycomb
Aluminium
Liner 0.5 mm
CFR
6mm th
Inner Vessel
Cover


Supporting straps
Outer vessel
Inner vessel support rods
Inner Vessel side Cover
Z
X
X
LAr
Shank
LAr
LAr
Feedthroughs

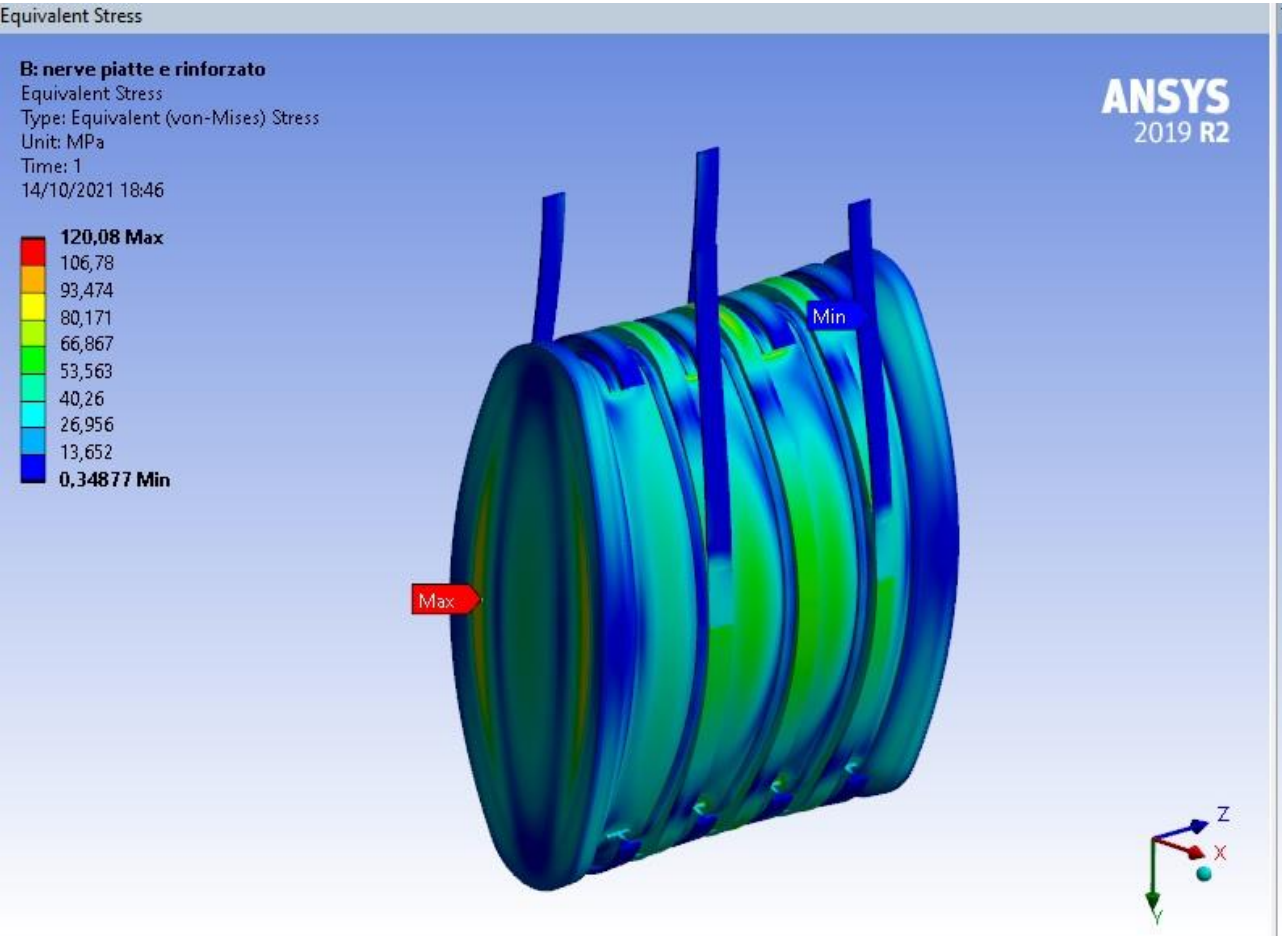
Press = 3 bars

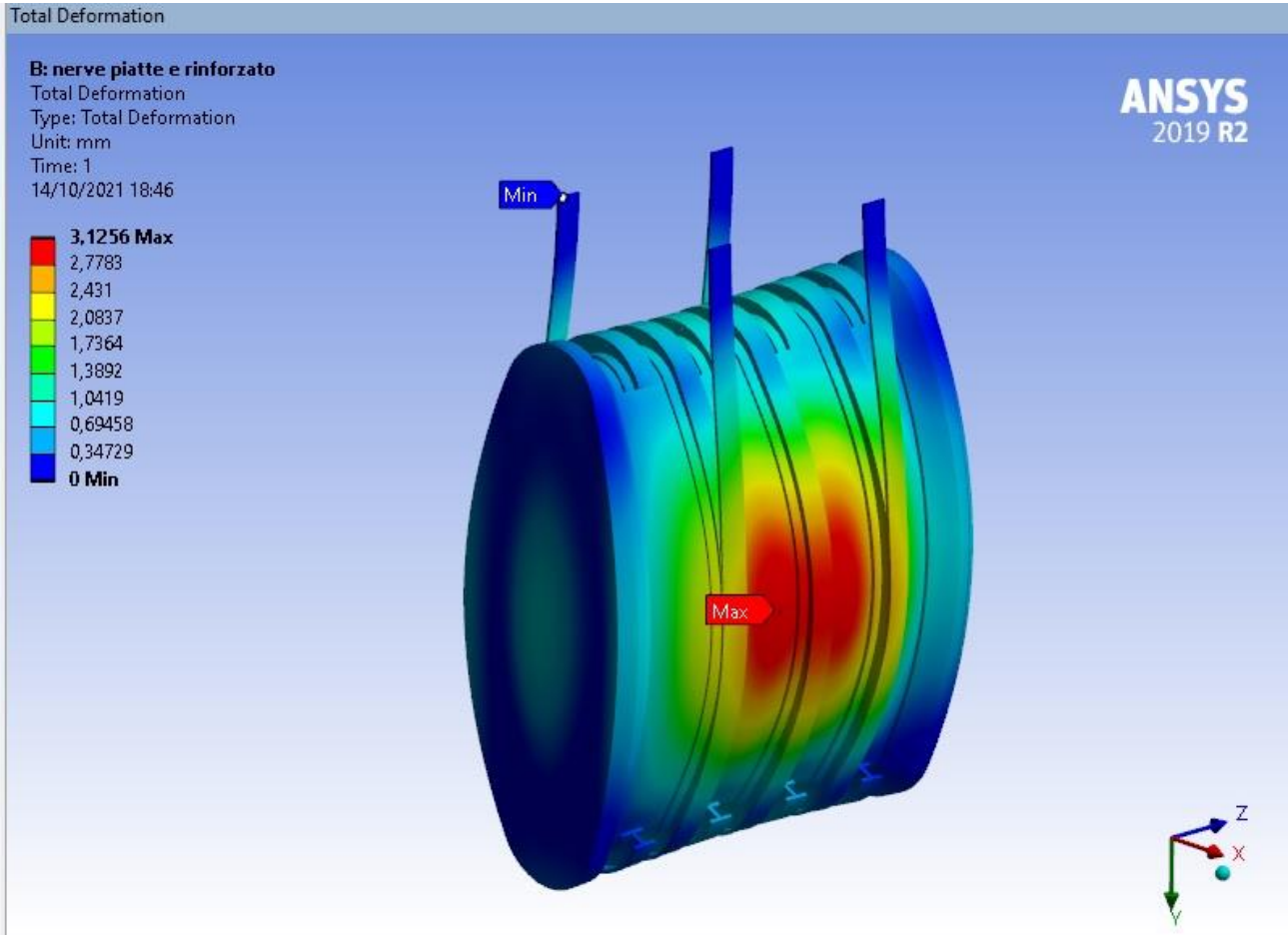

B: Static Structural
Total Deformation
Type: Total Deformation
Unit: mm
Time: 1
14/10/2021 15:01
3,3857 Max
3,0095
2,6333
2,2571
1,8809
1,5048
1,1286
0,75238
0,37619
0 Min
Min
Max

Alluminio 2024



Alluminio 6000





3.2 Verifiche Normative

Tenendo conto che l'approccio di verifica proposto è quello che, in ASME Section VIII Div. 2 Parte 5, compete all'Elastic Stress Analysis Method, dopo che saranno state condotte le analisi meccanico-strutturali corrispondenti ai casi di carico definiti in precedenza, si procederà alle verifiche normative tenendo conto della categorizzazione delle tensioni (General Primary Membrane Equivalent Stress - P_m, Local Primary Membrane Equivalent Stress - P_L, Primary Bending Equivalent Stress - P_b, Secondary Equivalent Stress - Q) e dei limiti di riferimento relativi.

Oltre alle diseguaglianze:

- $P_m < S_a$
- $P_L < 1.5\ S_a$
- $P_m + P_b < 1.5\ S_a$ (o $P_L + P_b < 1.5\ S_a$)
- $P_m + P_b + Q < 3\ S_a$ (o $P_L + P_b + Q < 3\ S_a$) (verifica a stress Ratcheting)

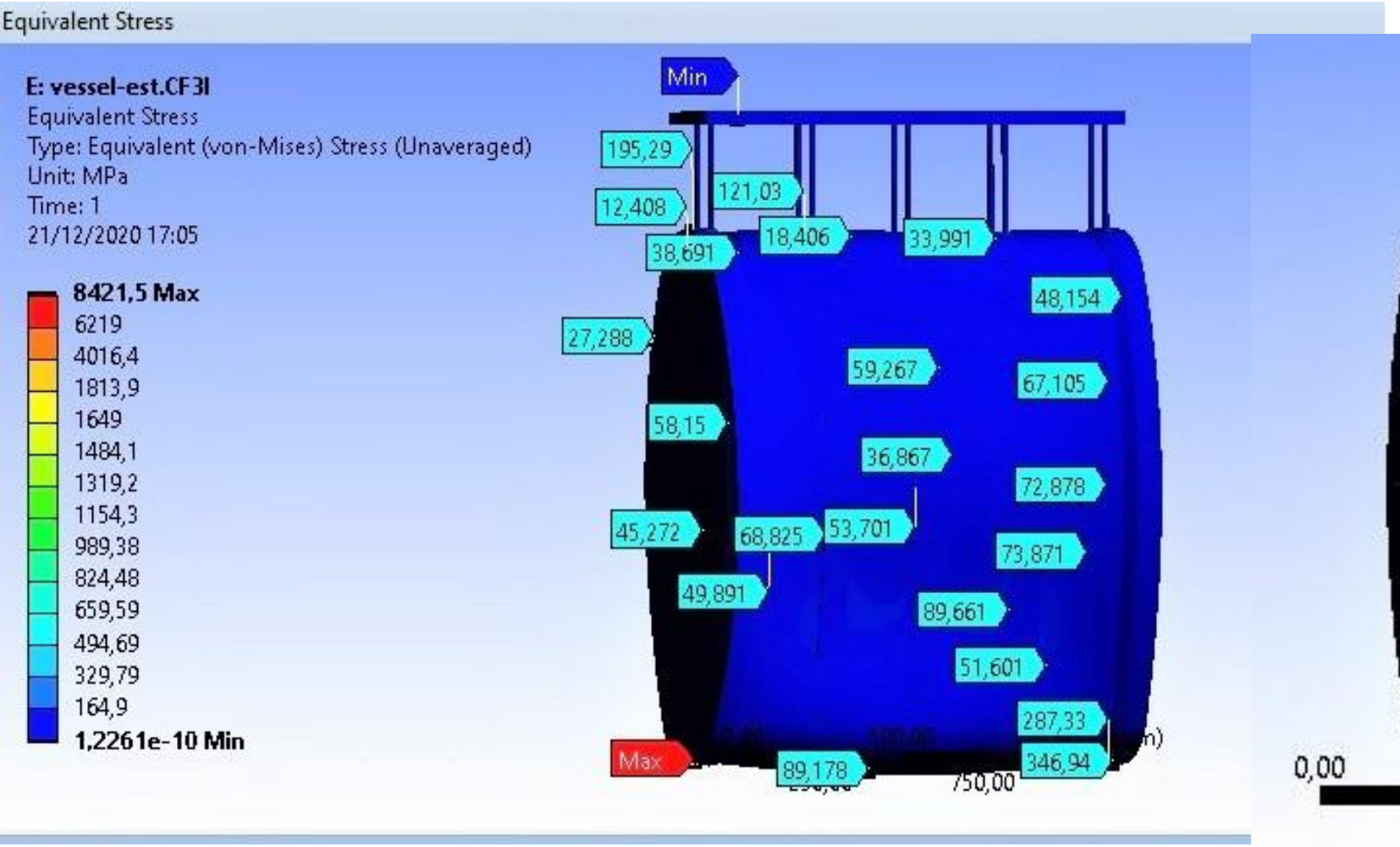
verrà verificata anche la diseguaglianza secondo cui deve essere che:

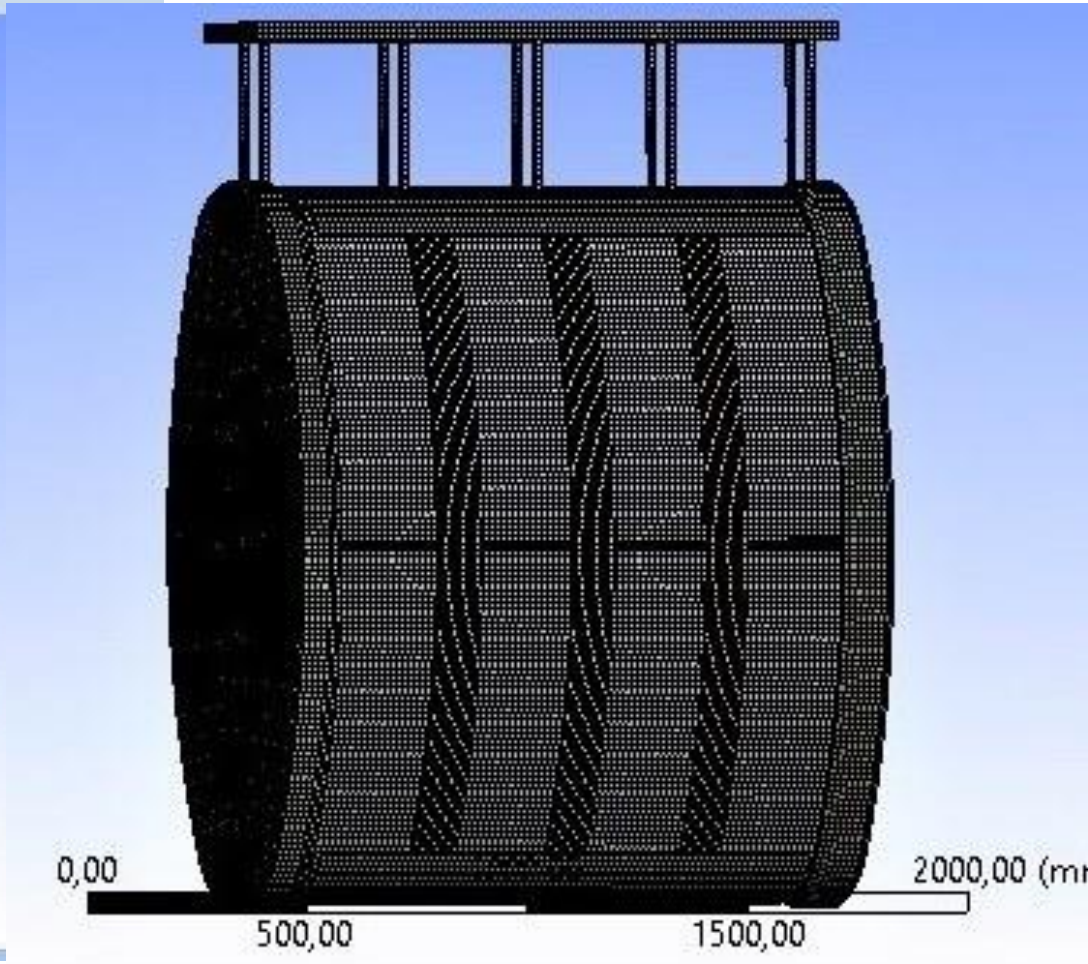
- $S_1 + S_2 + S_3 < 4\ S_a$ (Protection against Local Failure – Elastic Analysi

dove S_1, S_2 ed S_3 sono le somme delle tensioni locali principali membranali primarie e bending e S_a è la tensione ammissibile della lega d'alluminio con cui sarà costruito il Criostato.

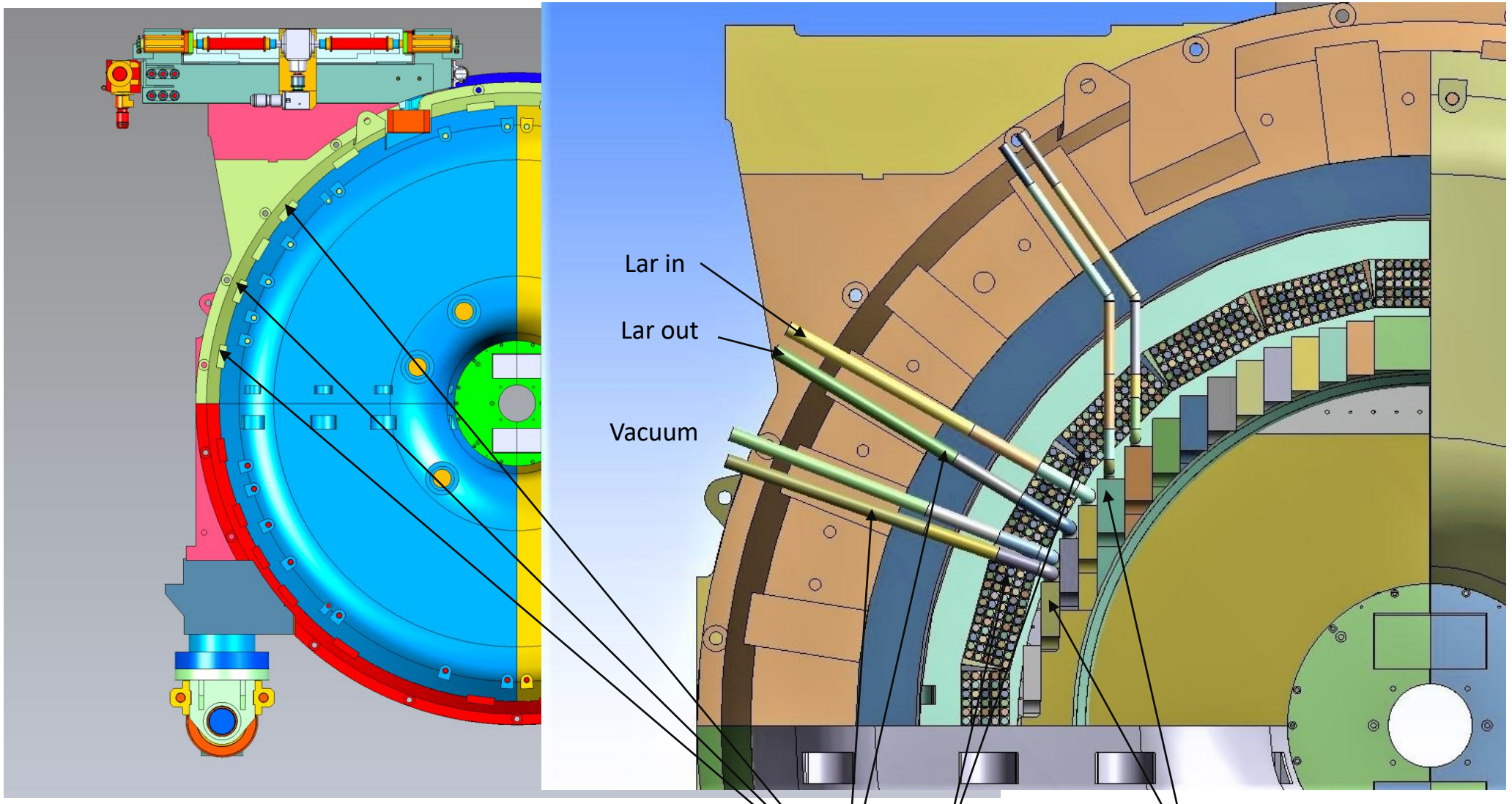
In merito ai collegamenti bullonati, in accordo ad ASME VIII Div. 2, para. 5.7.2, si verificherà che, sul gambo della vite, agli effetti di precarico e di sforzo assiale corrisponda una tensione media di valore non superiore a 2 S_b e che, sempre sul gambo della vite, agli effetti di precarico, di sforzo assiale e di momento flettente corrisponda una tensione massima di valore non superiore a 3 S_b, dove S_b è la tensione ammissibile del materiale delle viti.

Nel caso in cui, a seguito delle verifiche normative, il Criostato dovesse presentare delle zone critiche, verranno proposte delle modifiche alla struttura. Ad esempio si potrà intervenire sullo spessore del guscio del Criostato o sulle nervature di rinforzo



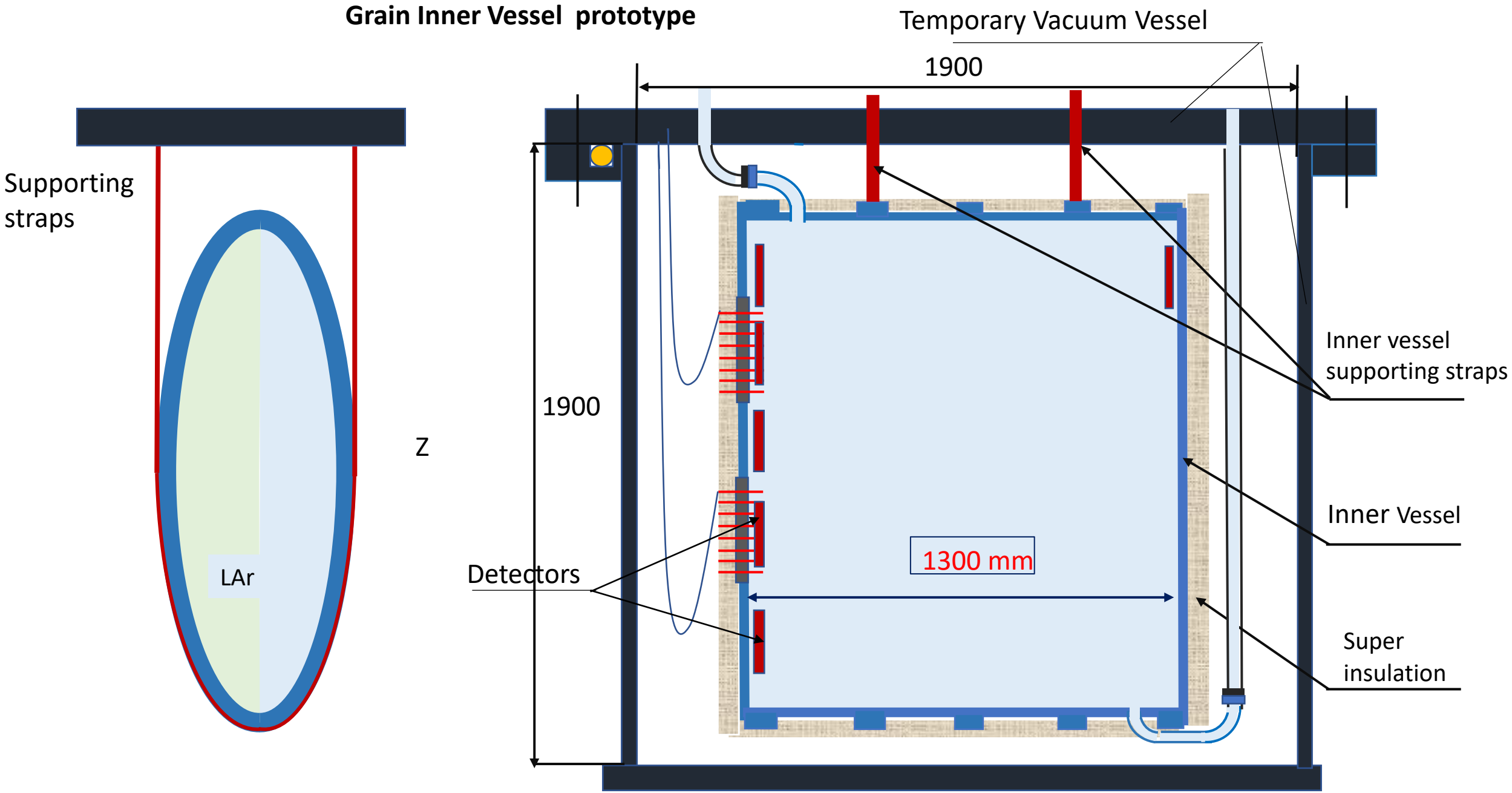


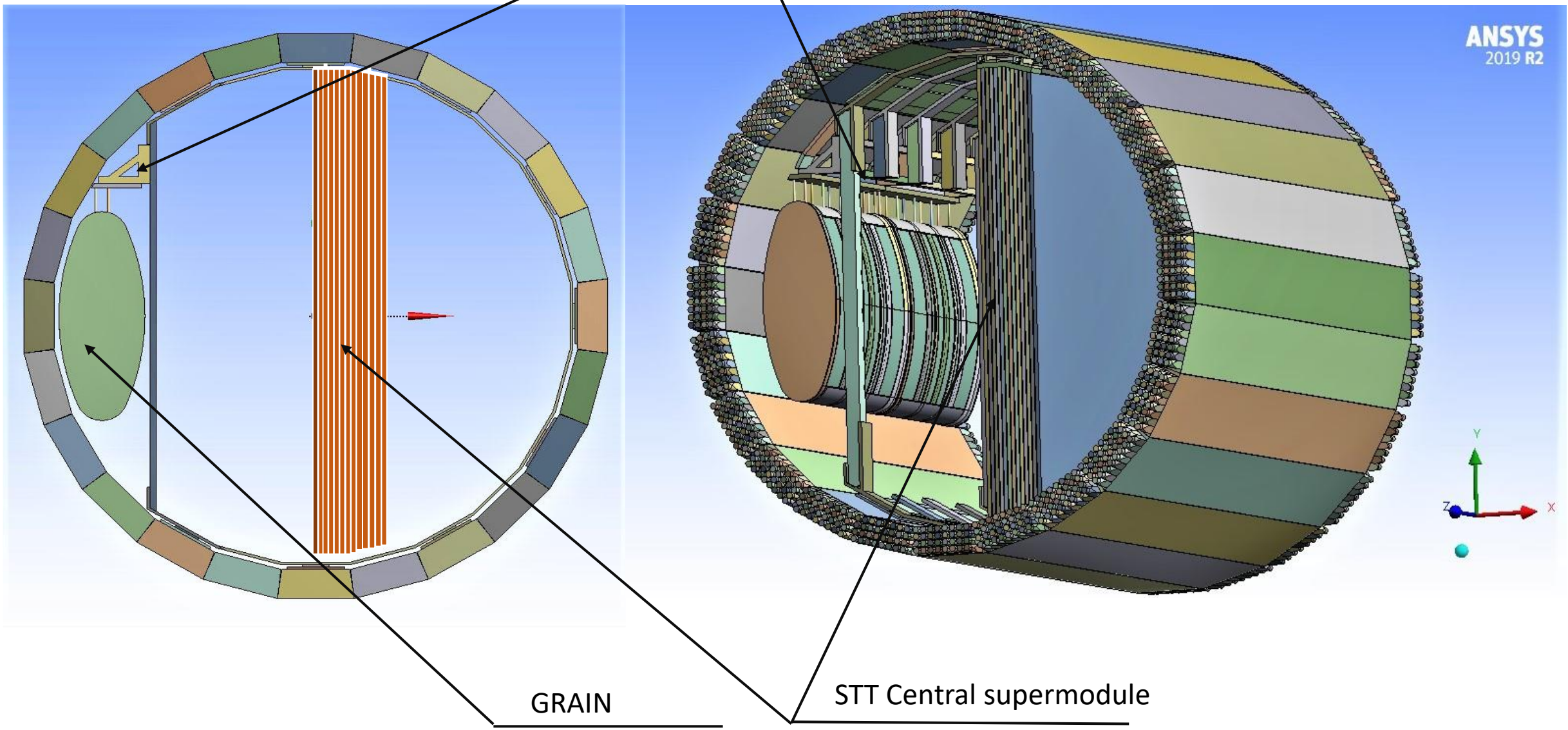
CFR Outer Vessel (Aluminium lining inside)



Lar & Vacuum Pipes exit through existing grooves

Grain Inner Vessel prototype





GRAIN & STT inside SAND