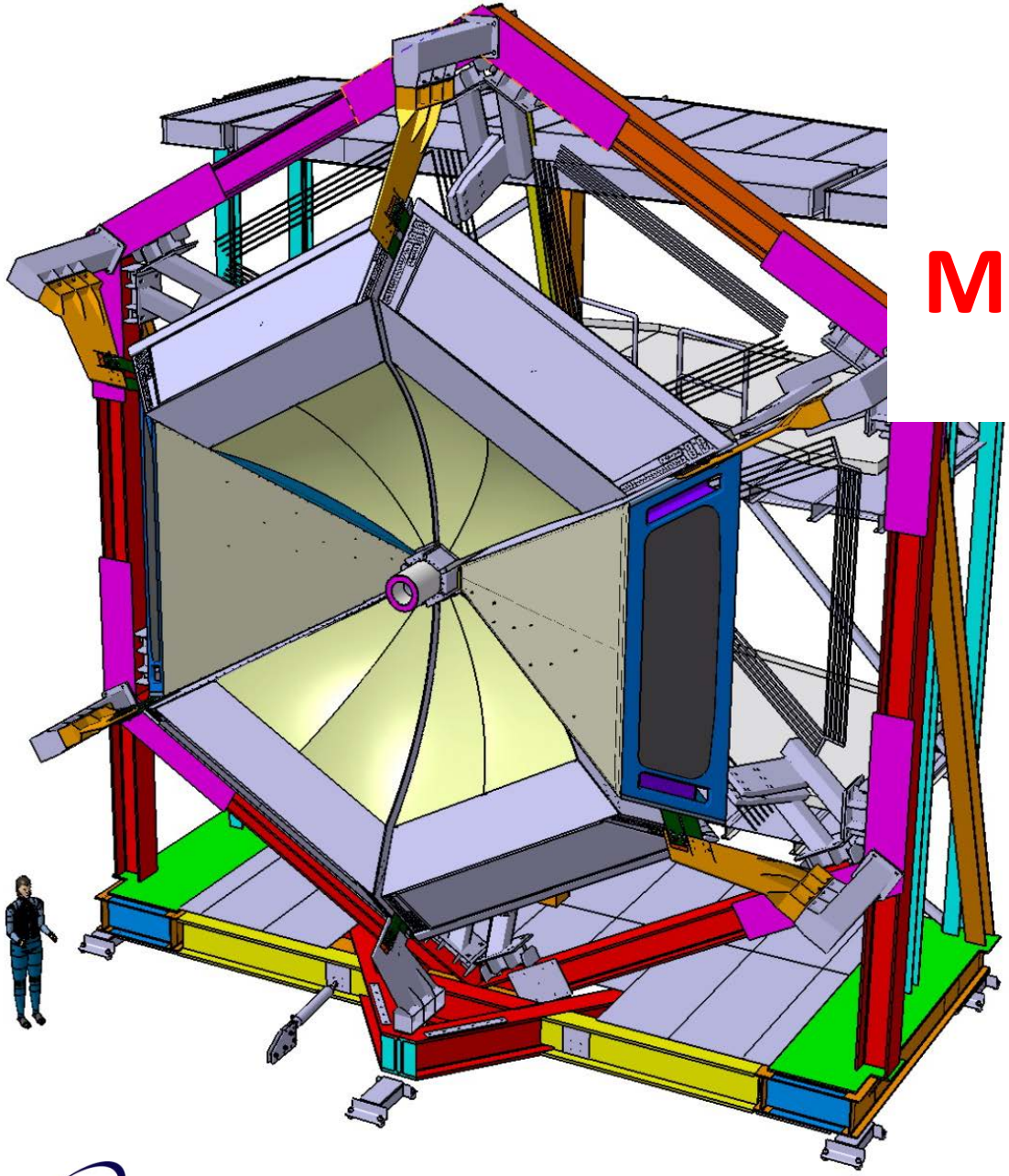


CLAS12-RICH Mechanical Review

RICH Technical review Meeting

June 20th 2014

D. Orecchini, S. Tomassini

INFN Istituto Nazionale di Fisica Nucleare

Outline

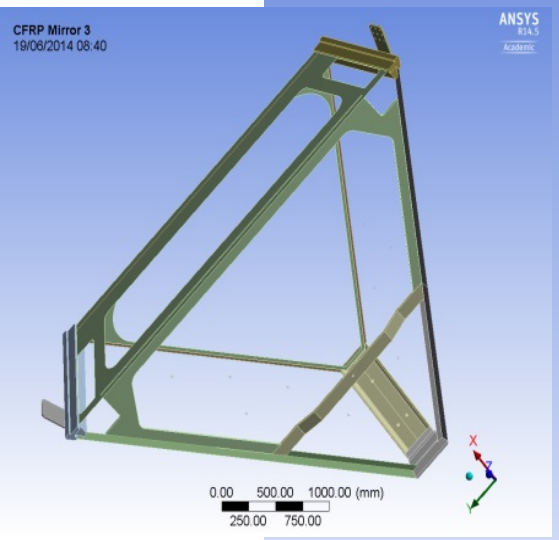
1. **FEA analysis of the whole structural assembly on the forward carriage.**

2. **Seismic Analysis of the RICH structural Parts**

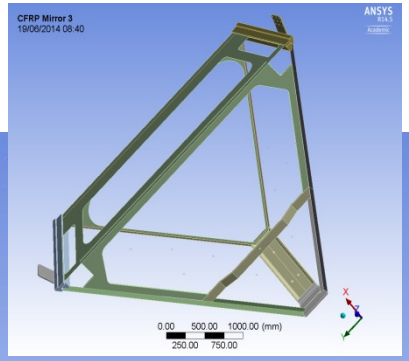
3. **Constraint Reactions at the interface with the forward carriage.**

4. **Conclusions.**

FEA Model for Stress-Strain Analysis

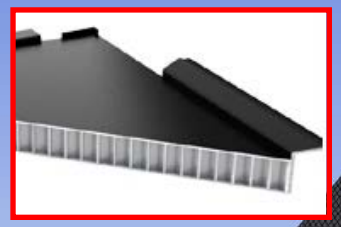


Front & Rear Mesh View and Materials



Mesh
17/06/2014 09:04

ANSYS
R14.5
Academic



Stiffening Ribs
Thick Al

CFRP

Sandwich Panel with
aluminum honeycomb core

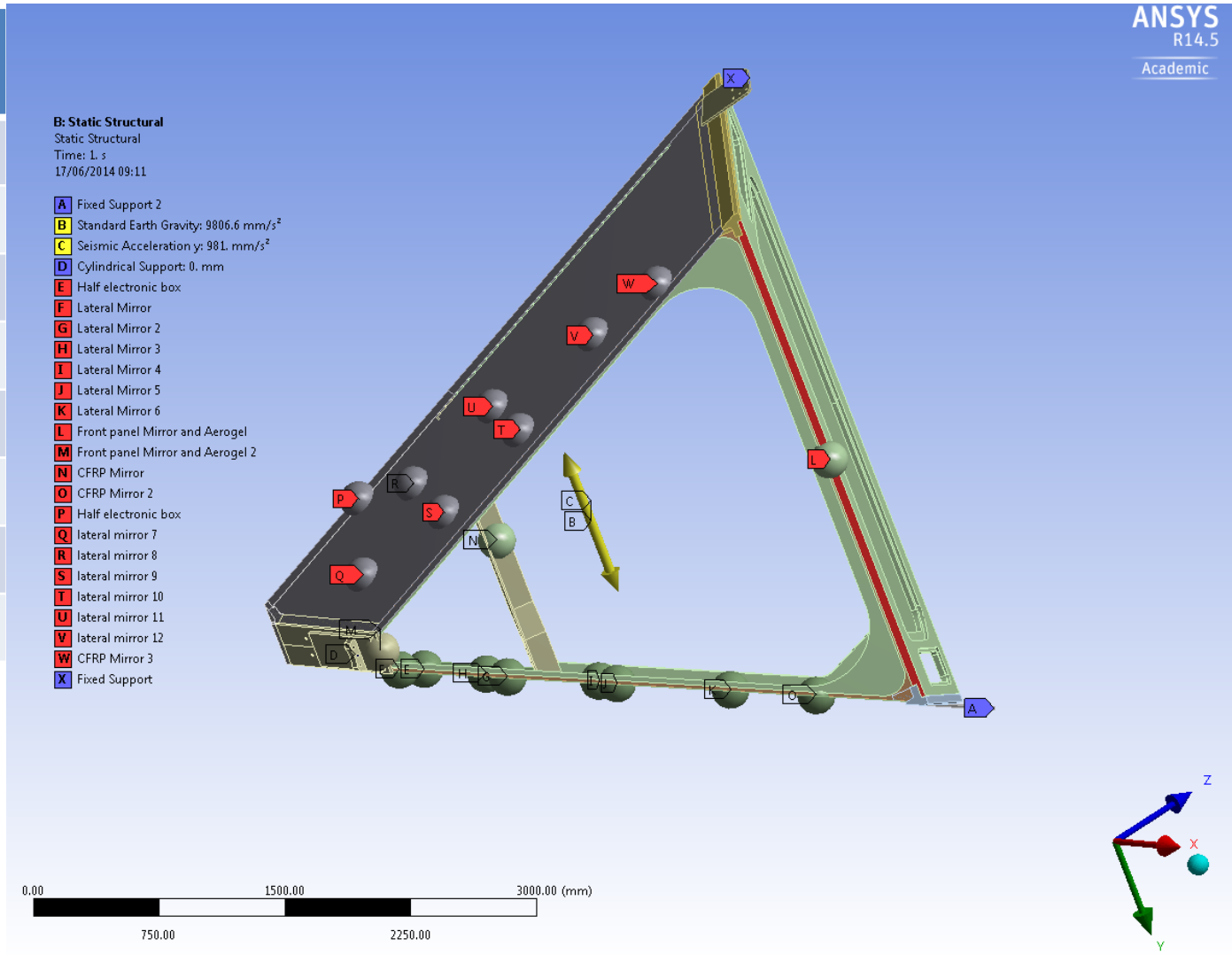
Z

1000.00 2000.00 (mm)
1500.00

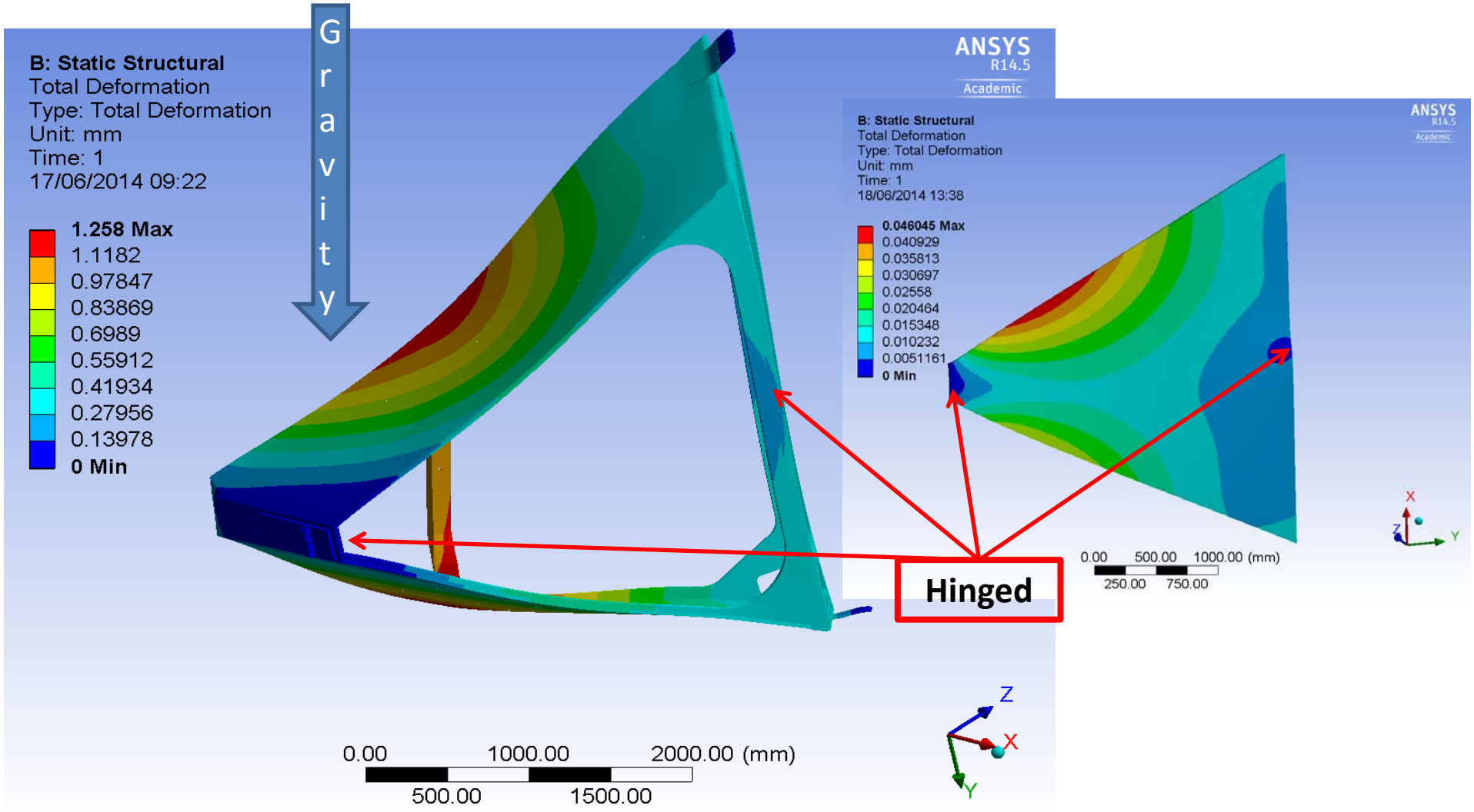
Layer	Material	Thickness (mm)	Angle (°)
(+Z)			
3	Aluminum Alloy	0.7	0
2	5/32-5052-0.002	23.6	0
1	Aluminum Alloy	0.7	0
(-Z)			

Inner Components Simulated as Lamped Masses

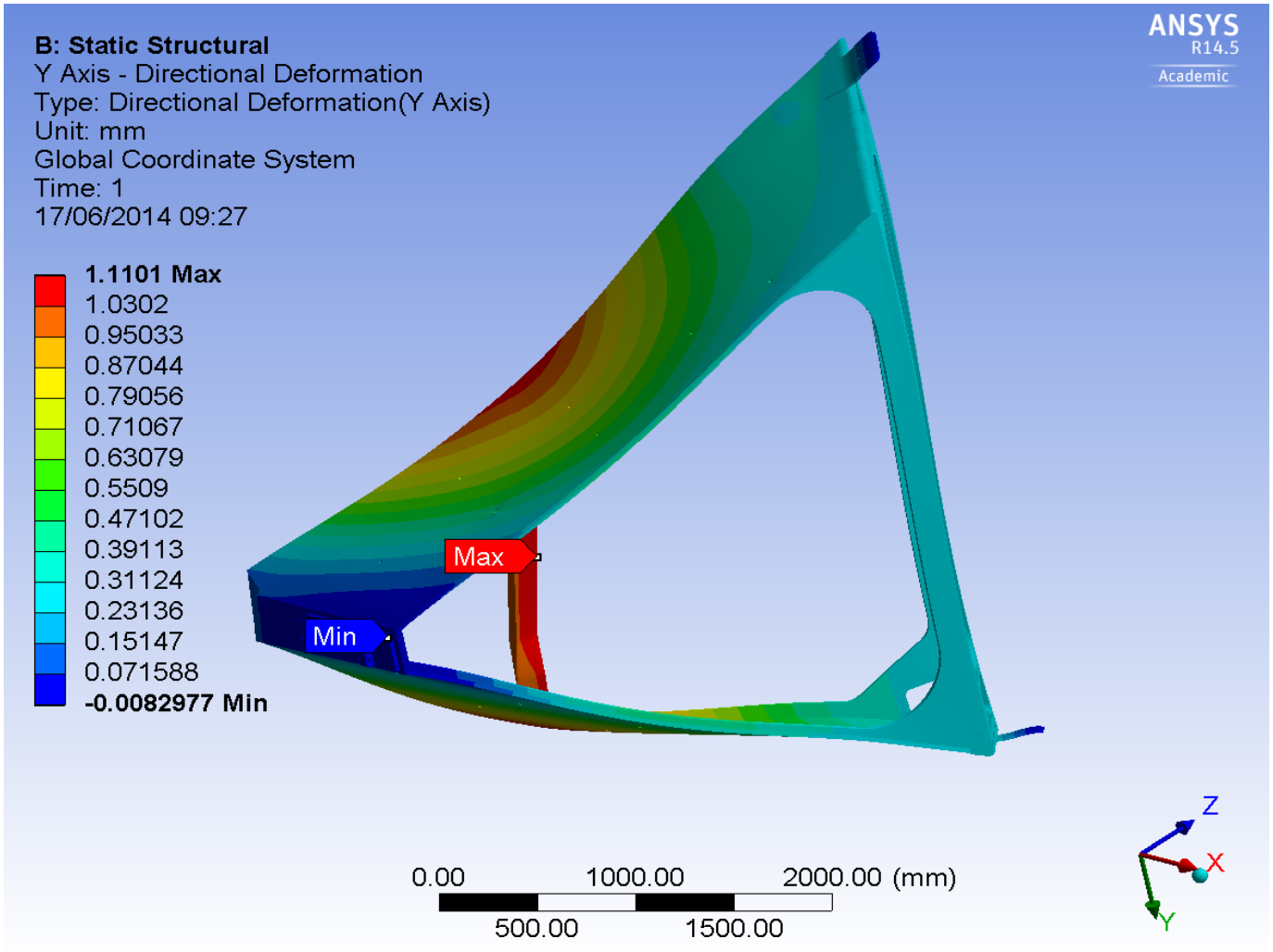
Lamped Mass Name	Weight (kg)
E,P	35
F,G,H,I,J,K	2.34 each
L	30
M	30
N	50
O	20
W	20
Q,R,S,T,U,V	2.34 each



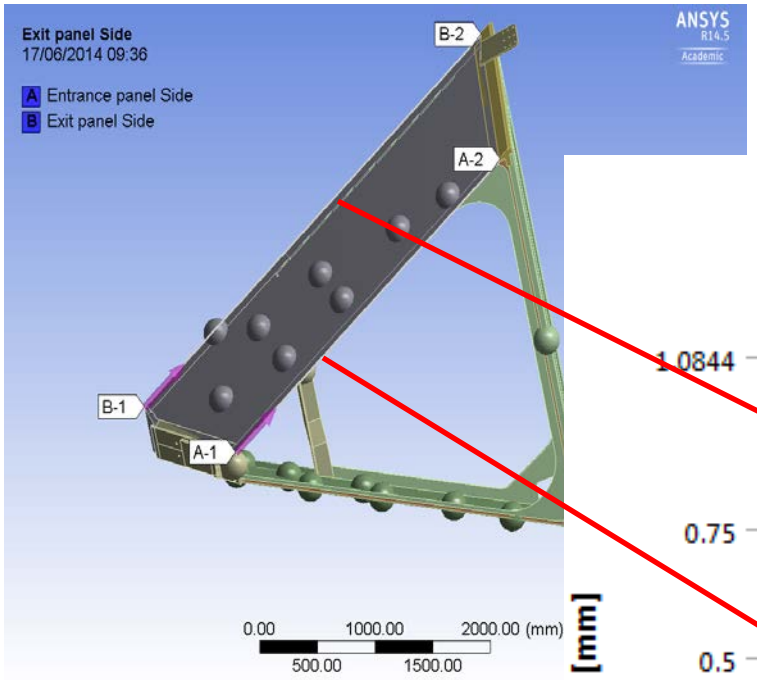
Total deformation due to weight load

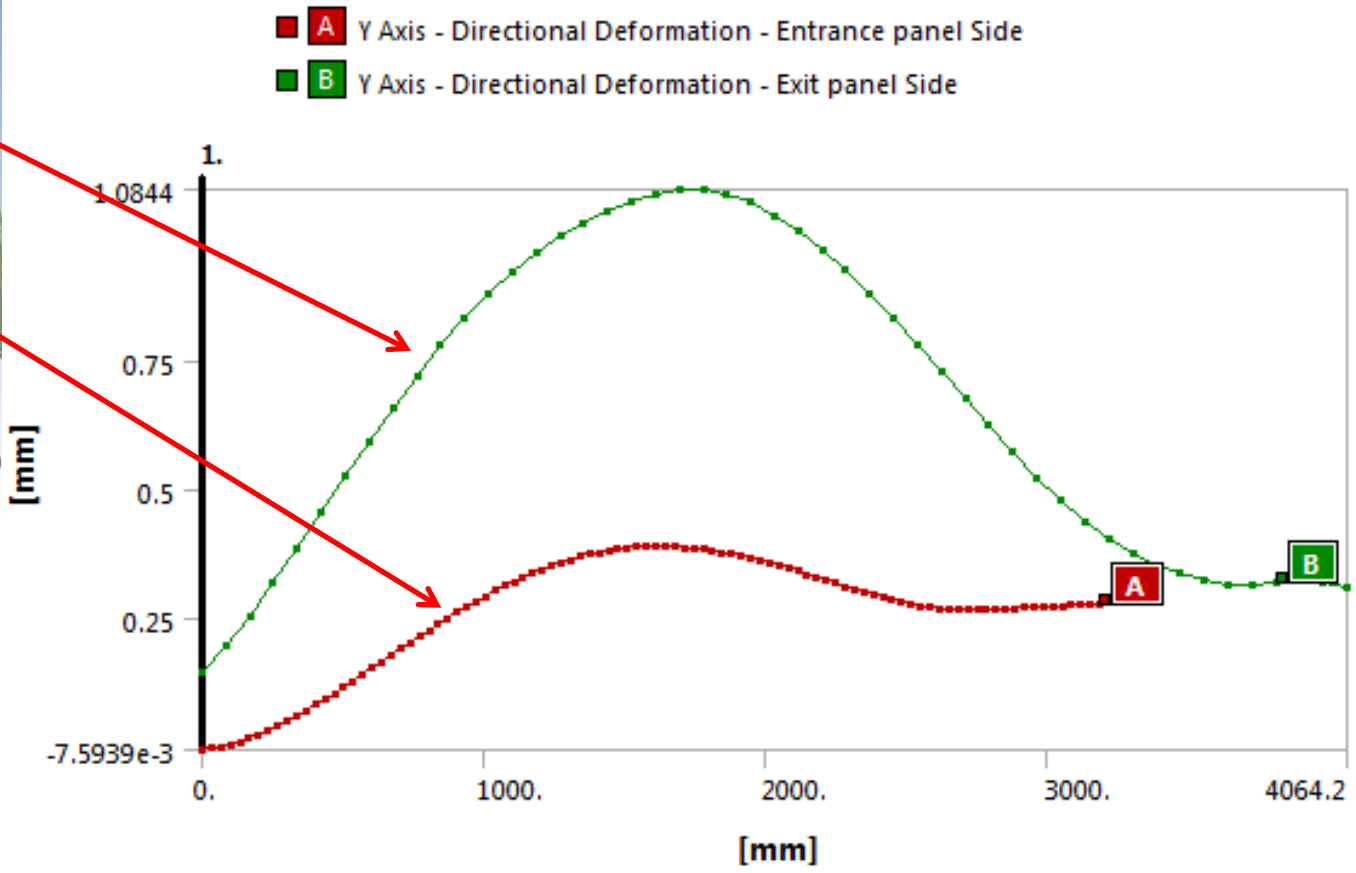


Directional Deformation along the weight direction (y)



Path plot of Y Component Deformation





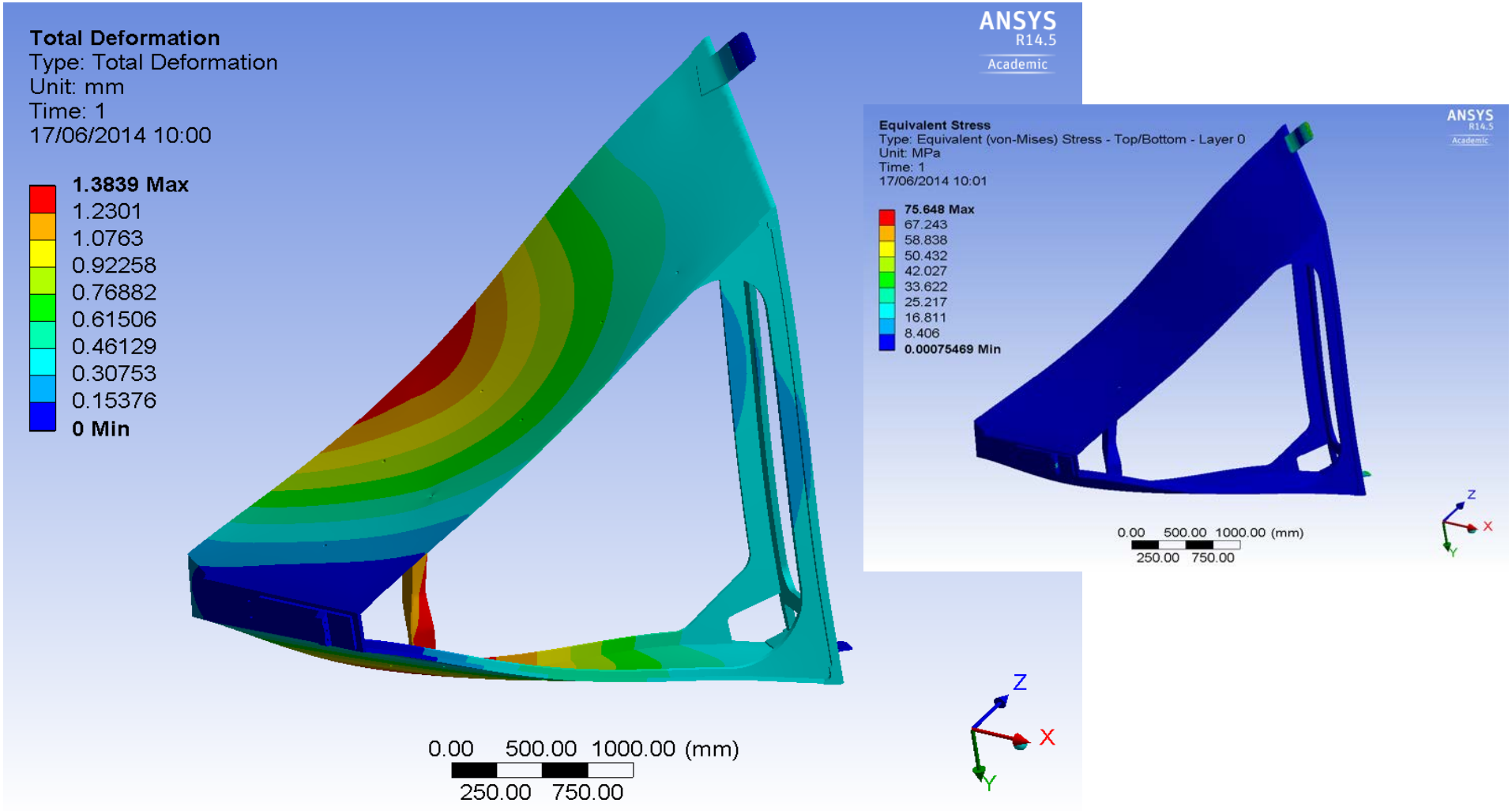
Seismic Analysis

An additional 10% of **g** in all x,y,z directions were applied separately for each axis.

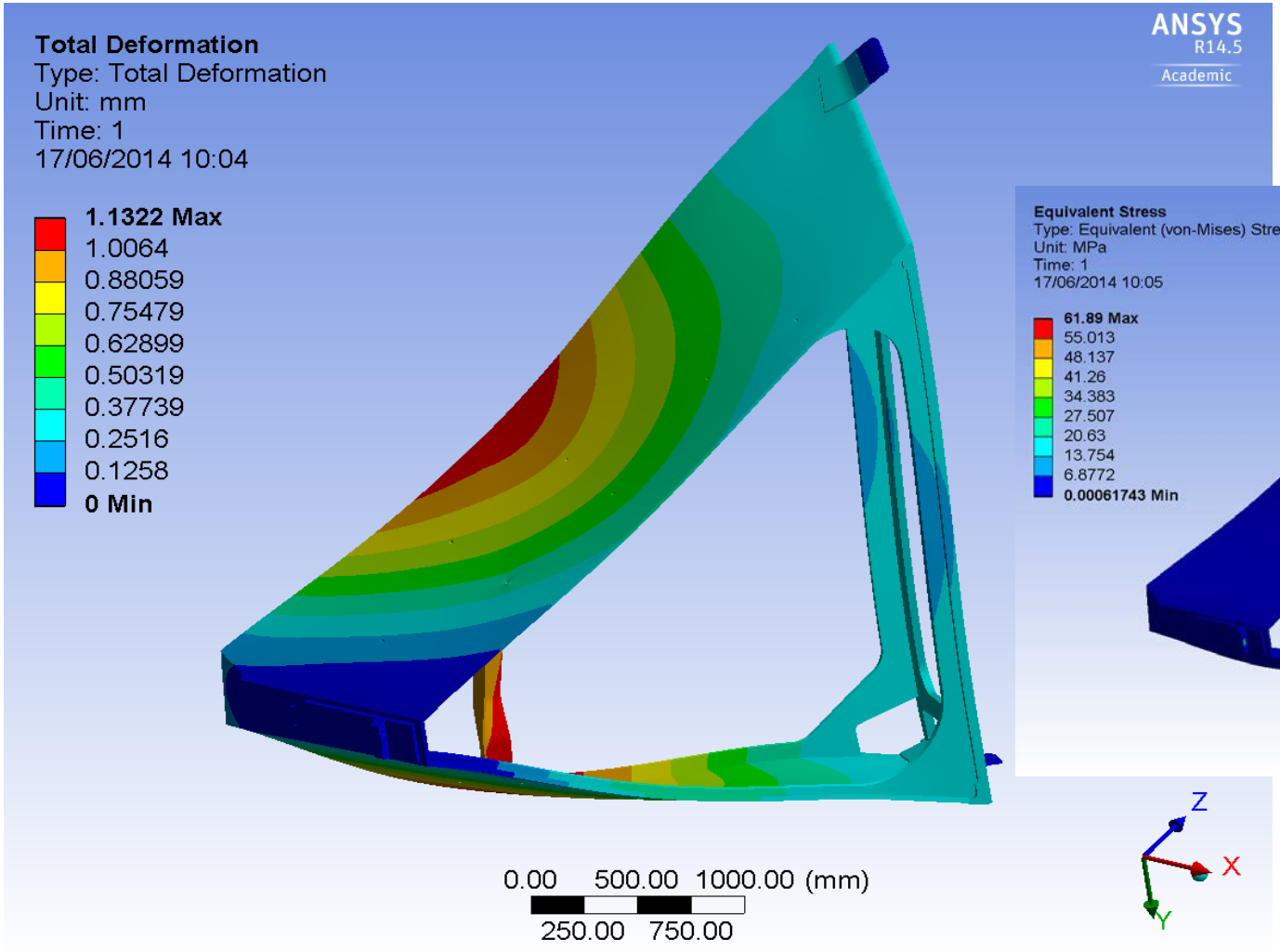
Positive and negative directions were taken into account.

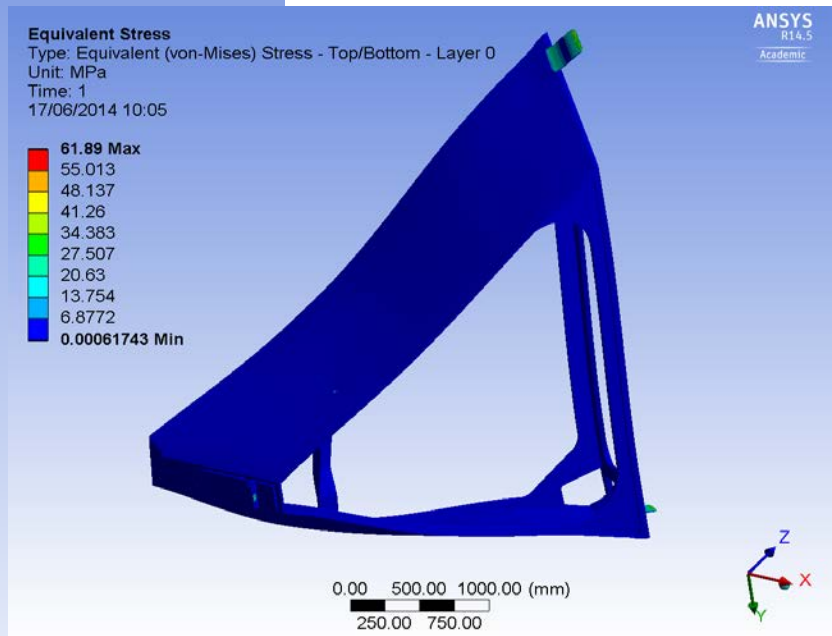
Positive value for the seismic load means that the force is acting in the verse of the axis

Additional Seismic load 10% g acting along +y



Additional Seismic load 10% g acting along -y

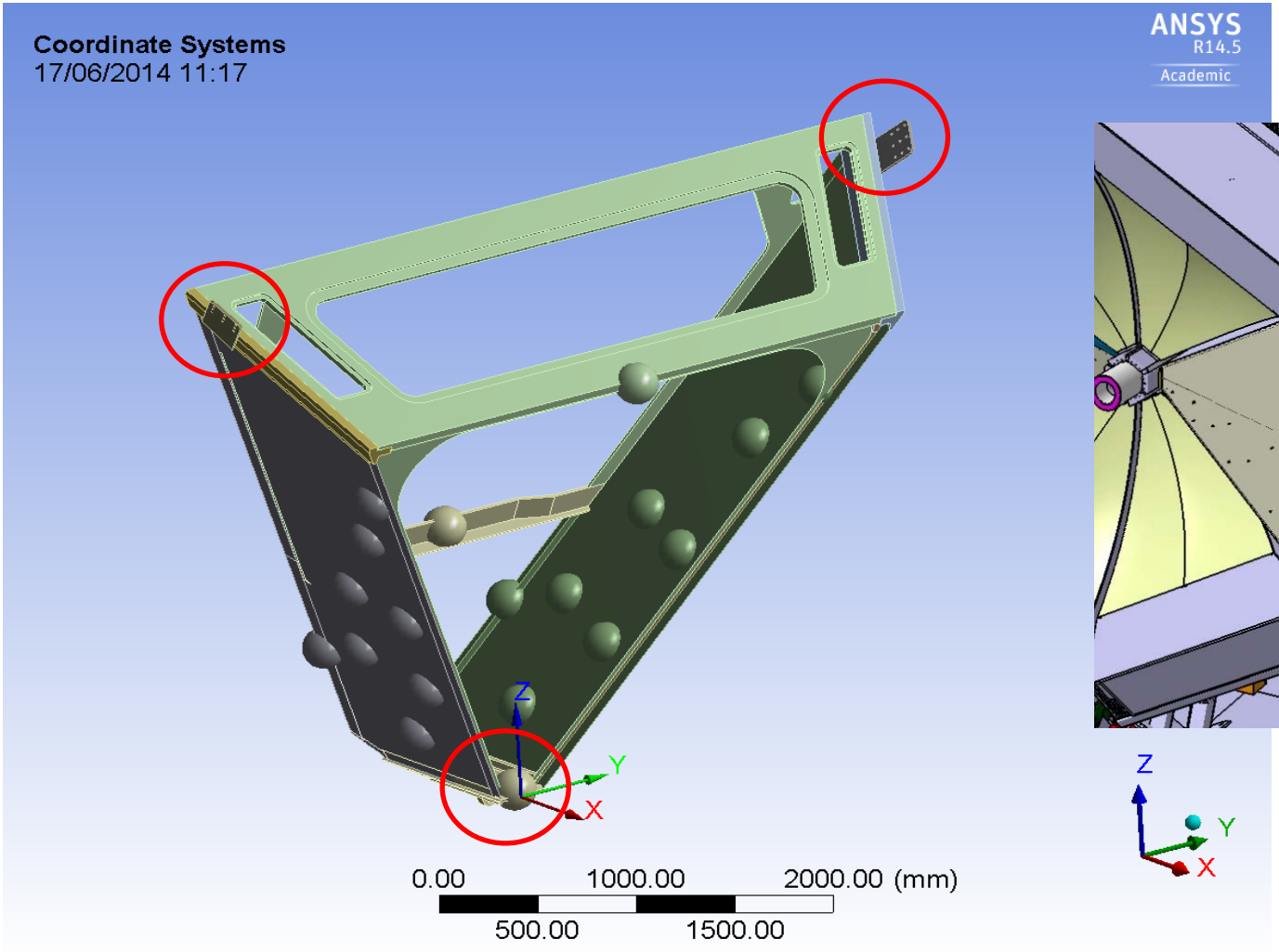


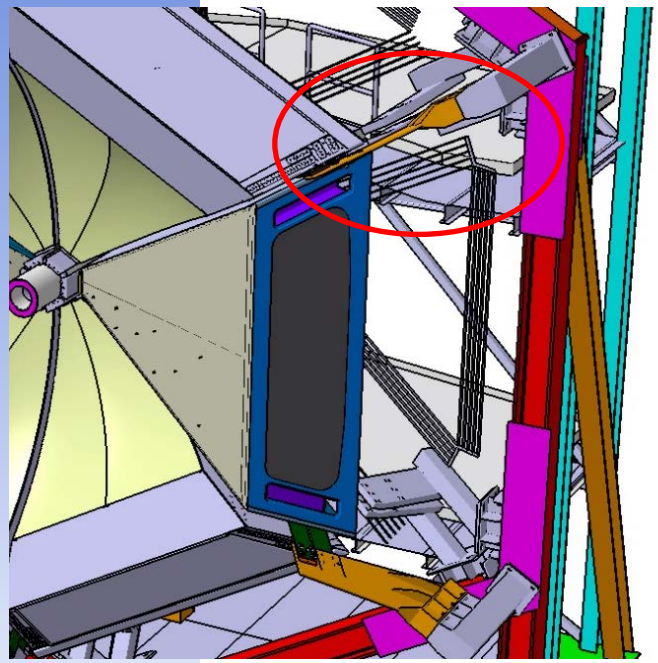


Force reaction on the constraints

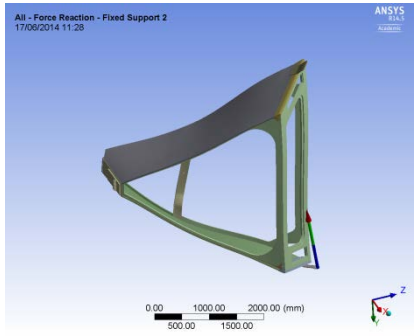
1. The additional seismic load has been taken into account
2. Jlab personnel should verify that the forward carriage constraint points (the interface between the RICH and the forward carriage) are OK to support the load from the RICH detector
3. The RICH whole weight is about 900 kg (**400 kg less than the LTCC**)

Reference System and Constraints

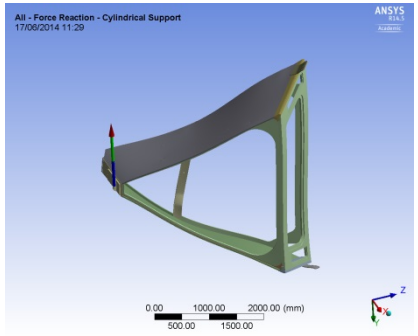




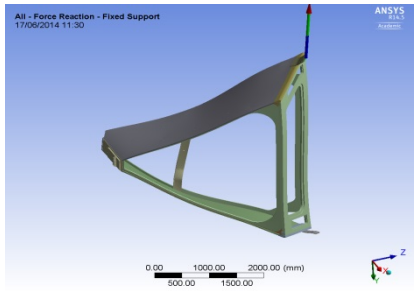
Constraint Reactions in the Worse load Case



Reaction X [N]	Reaction Y [N]	Reaction Z [N]
-71	-2860	-741



Reaction X [N]	Reaction Y [N]	Reaction Z [N]
15	-3157	16



Reaction X [N]	Reaction Y [N]	Reaction Z [N]	
56	-2805	725	
0	**-8822**	**0**	**SUM**

CONCLUSIONS

- **The FEA results show that the maximum displacement on the lateral skins is of the order of 1.3 mm (1.3/4000= 0.03%) and the max equivalent stress on the support constraint is less than 75 Mpa.**

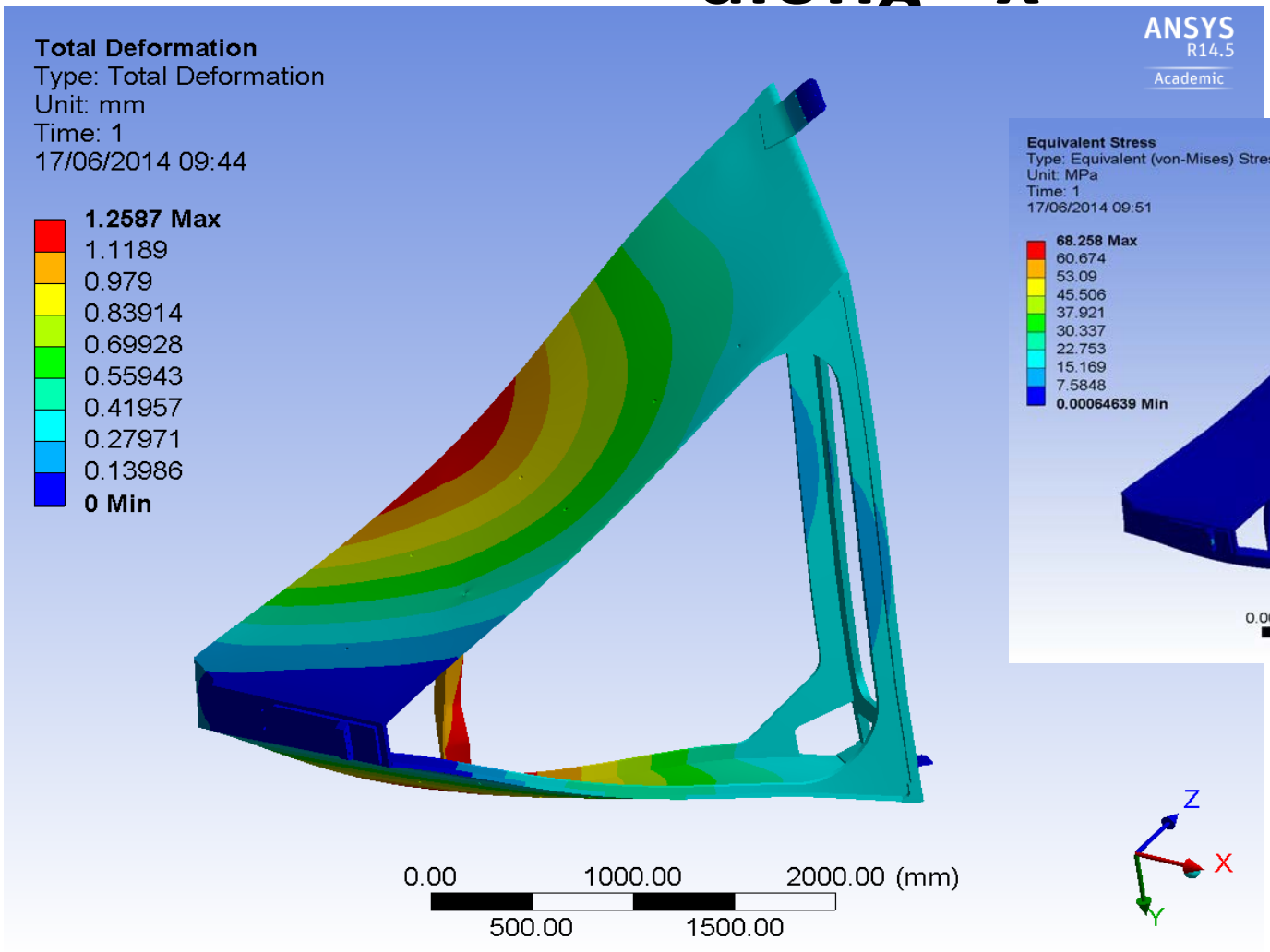
- **The usage of aluminum sandwich for the lateral skins and CFRP for the closing panels (entrance and exit) as well as for the spherical mirror and support gave the opportunity to reduce the whole weight of about 400 kg (30% of the LTCC weight).**

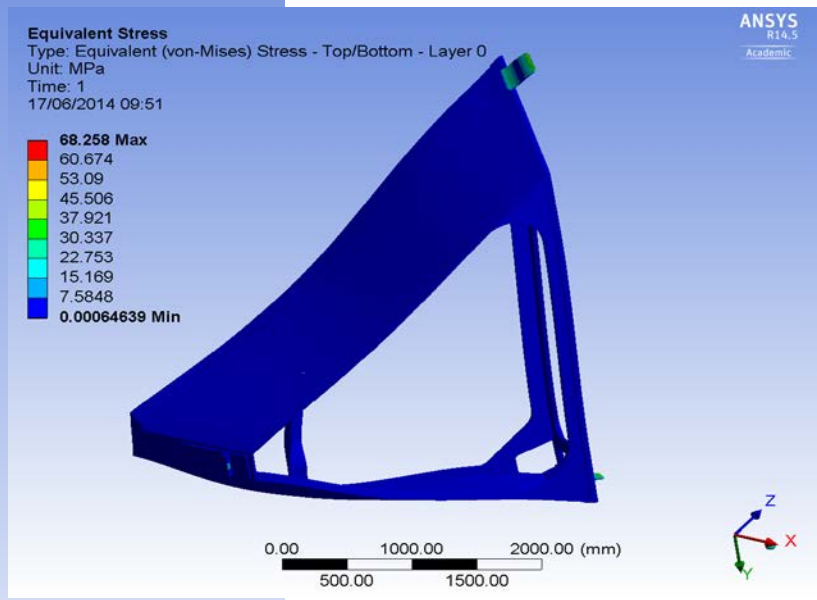
- **The weight reduction will improve the mechanical behavior as well as the handling and installation**

- **Force reactions are listed in the dedicated slide**

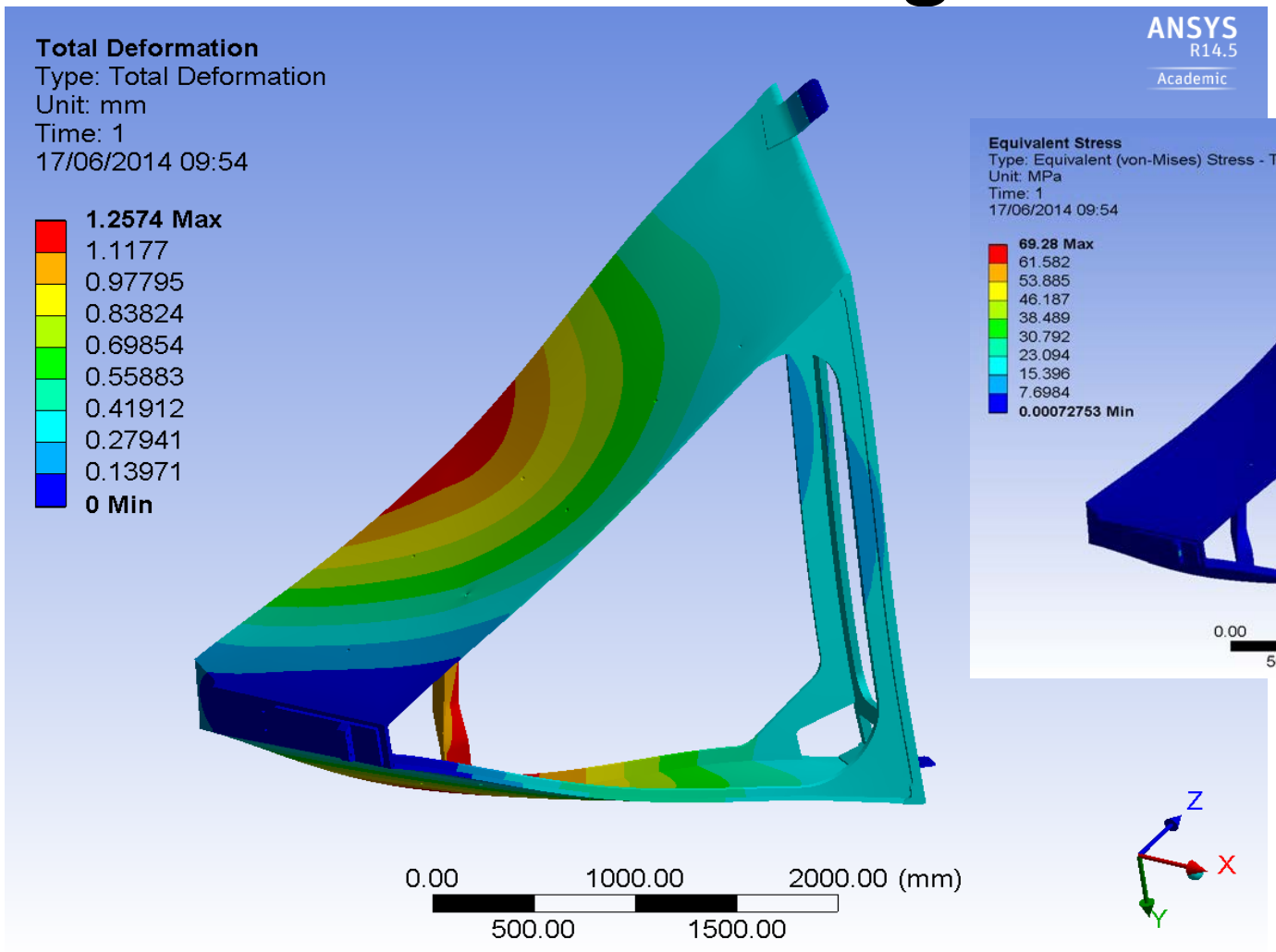
Spare Slides

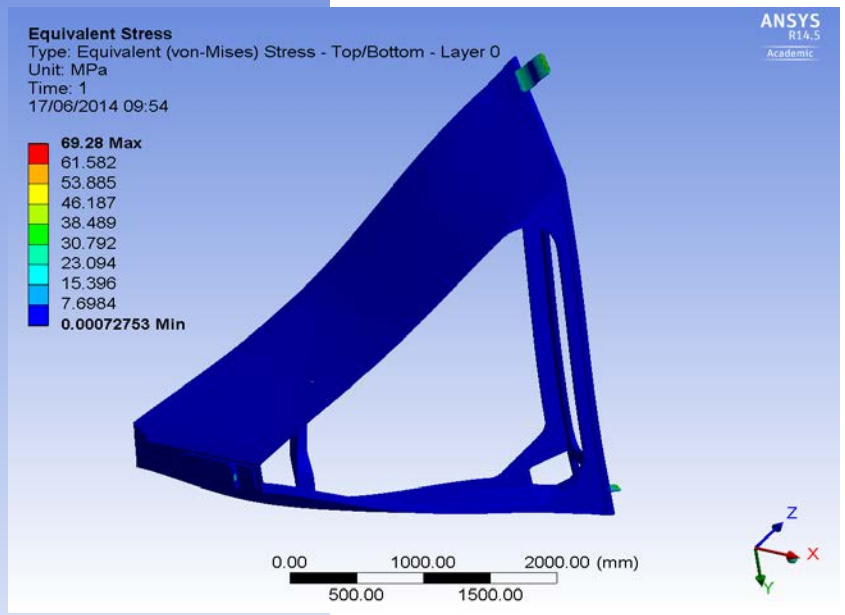
Additional Seismic load 10% g acting along +x



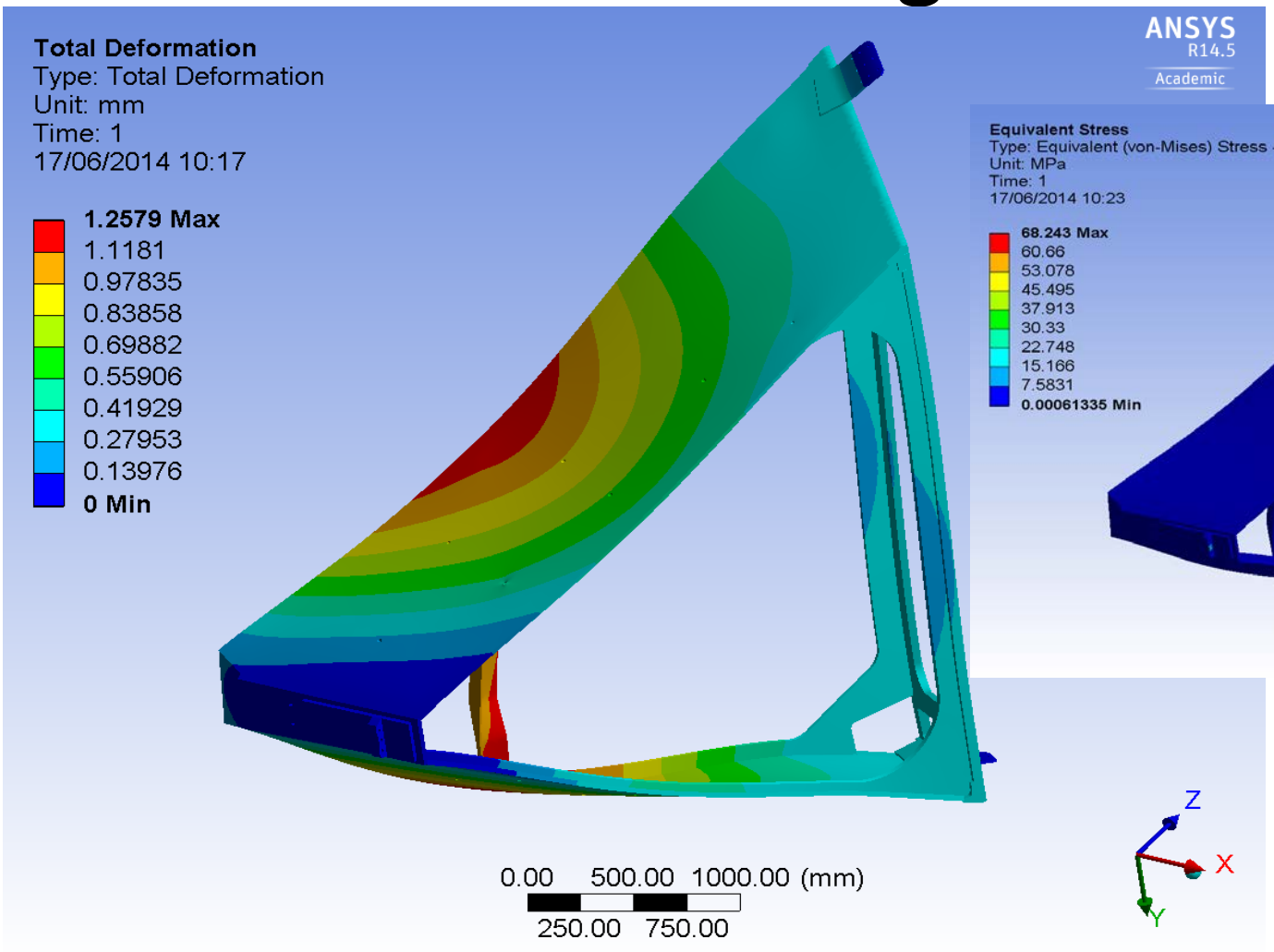


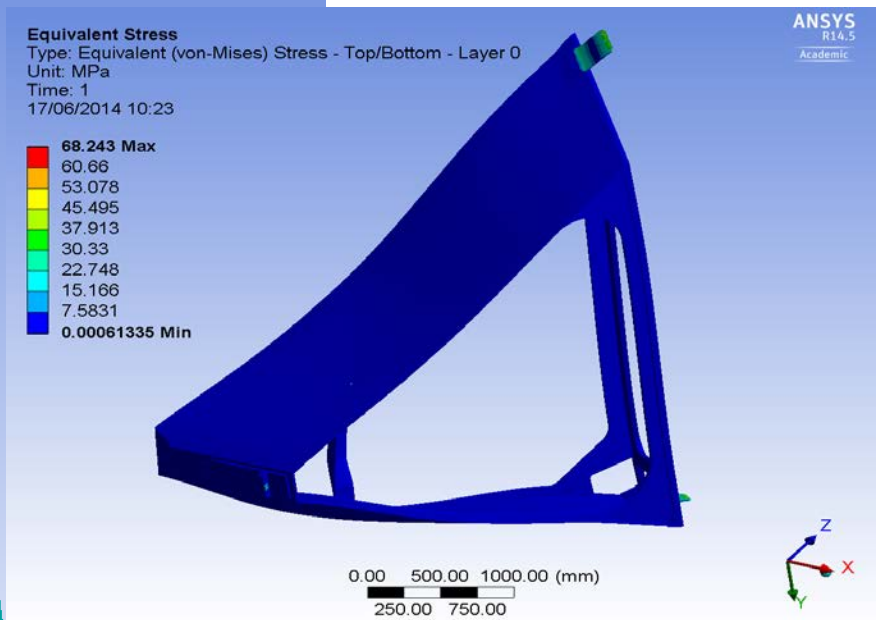
Additional Seismic load 10% g acting along -x



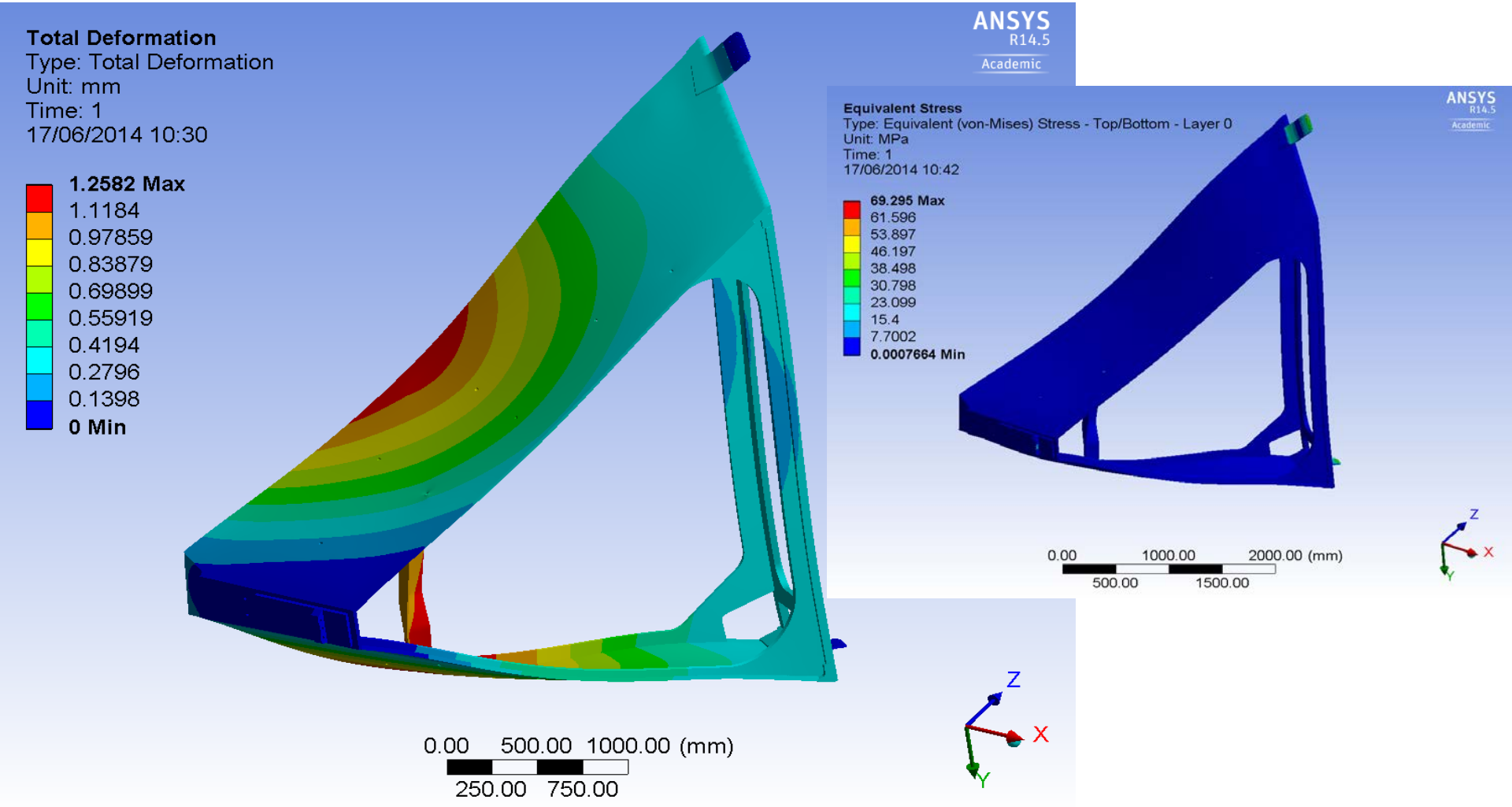


Additional Seismic load 10% g acting along +z



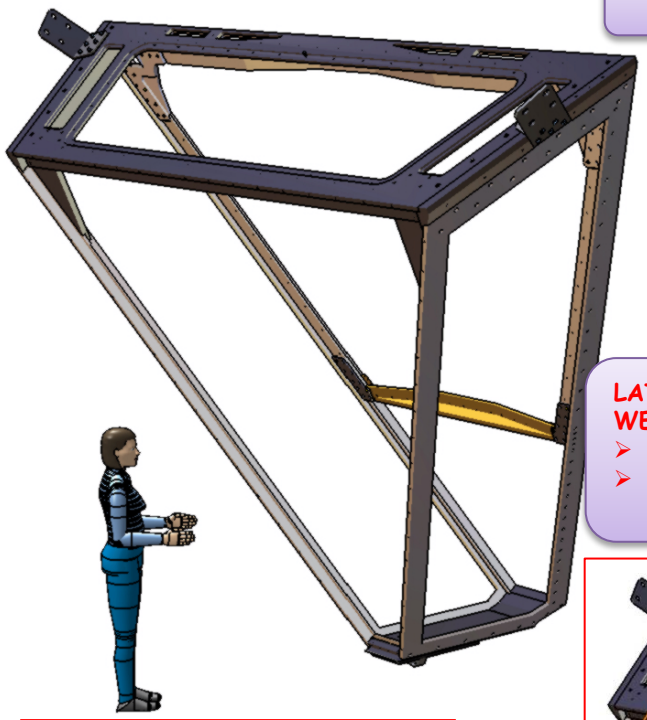


Additional Seismic load 10% g acting along -z



THE RICH Module: *Mechanical Shell Overview.*

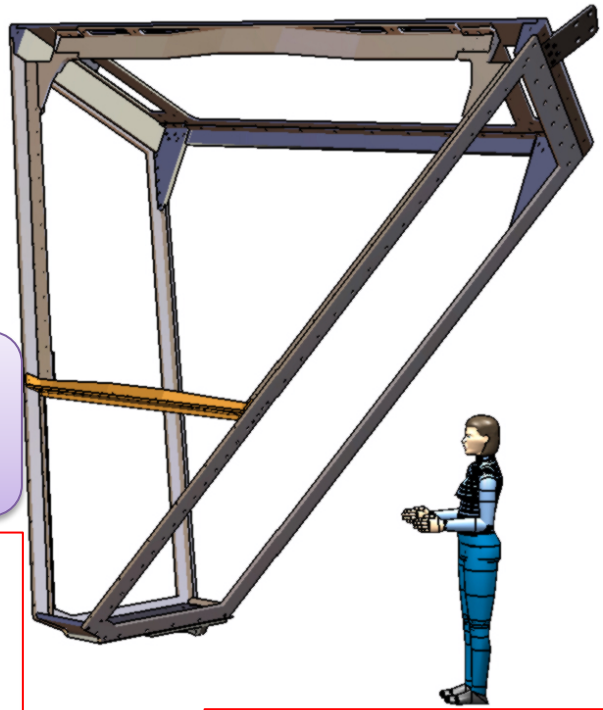
STRUCTURAL FRAME WITHOUT SANDWICH PANELS



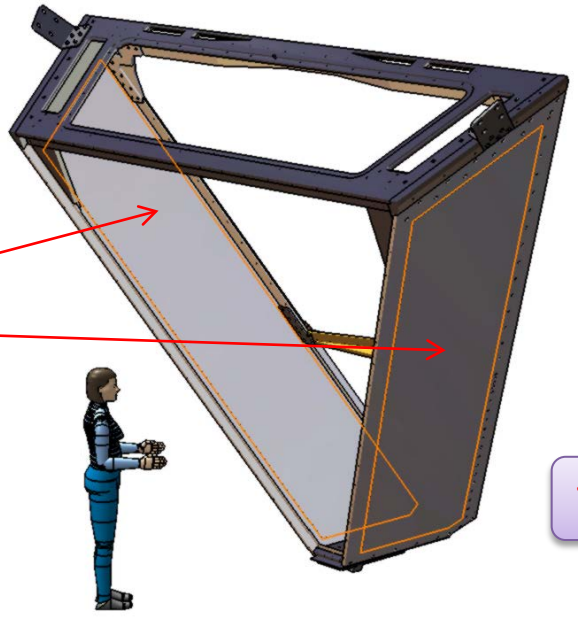
RICH MODULE BACKWARD VIEW

LATERAL PLATES MATERIAL SHYPOTESIS WEIGHT COMPARISON:

- **MONOLITIC SLABS 17mm Th.:400Kg (Both)**
- **SANDWICH PANELS: 25mm Th.:180Kg (Both) (220Kg LESS)**



RICH MODULE FORWARD VIEW



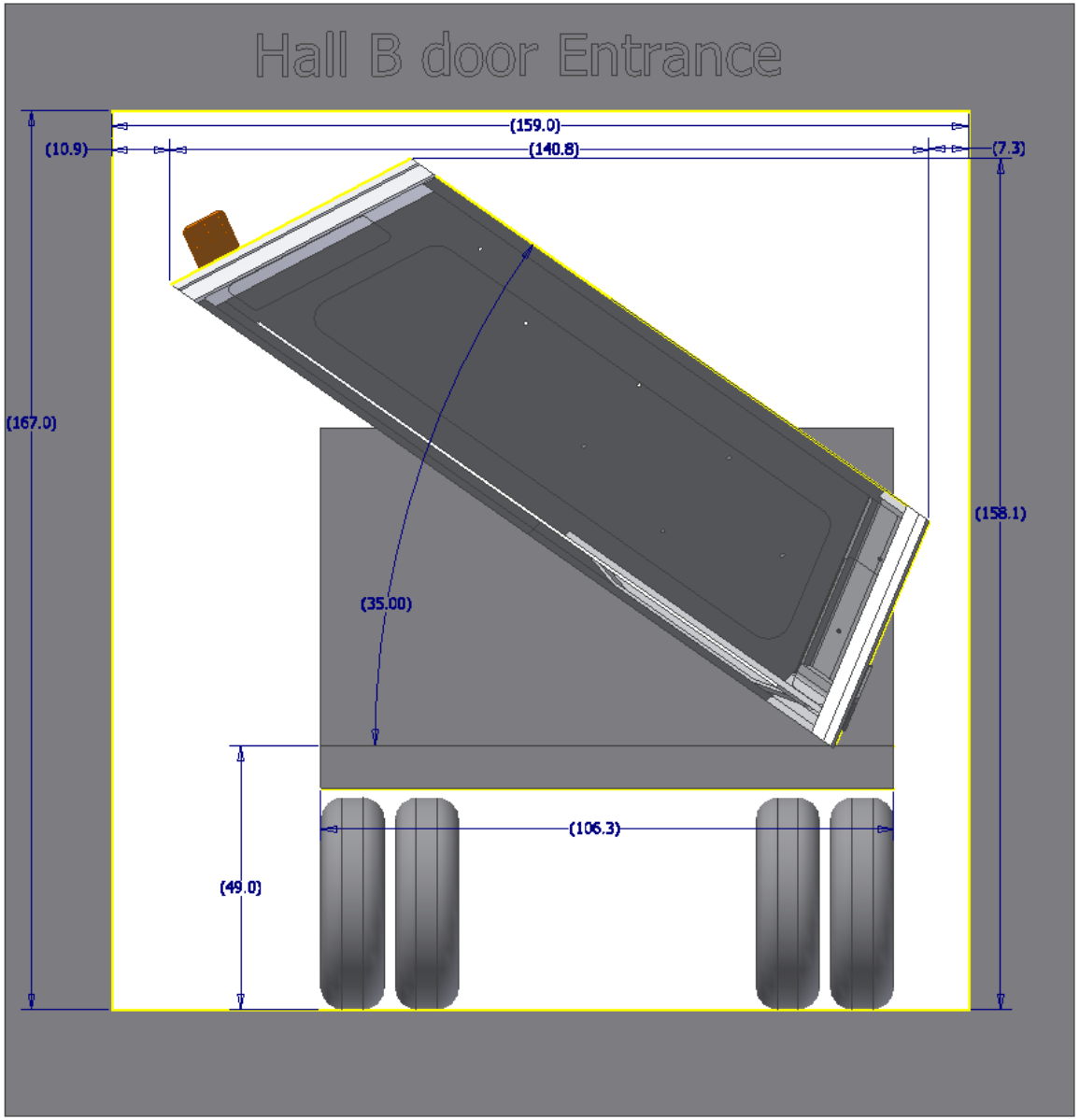
LATERAL PANEL

ALUMINUM HONEYCOMB

STRUCTURAL FRAME WITH HONEYCOMB PANELS

- FEM ANALYSIS RESULTS IN SANDRO TALK -

Transportation



All the dimensions are in inches

The height of the truck (49”) is the real one of the Jlab truck just measured on March this year.

The required tilt angle of the Rich module on the truck must be 35 deg

The front panel with the aerogel tiles and glass mirrors will be transported separately taking in mind the extremely fragile nature of the aerogel.

Transportation cont’

Loads= 2.5 g
Tilt angle= 35 deg