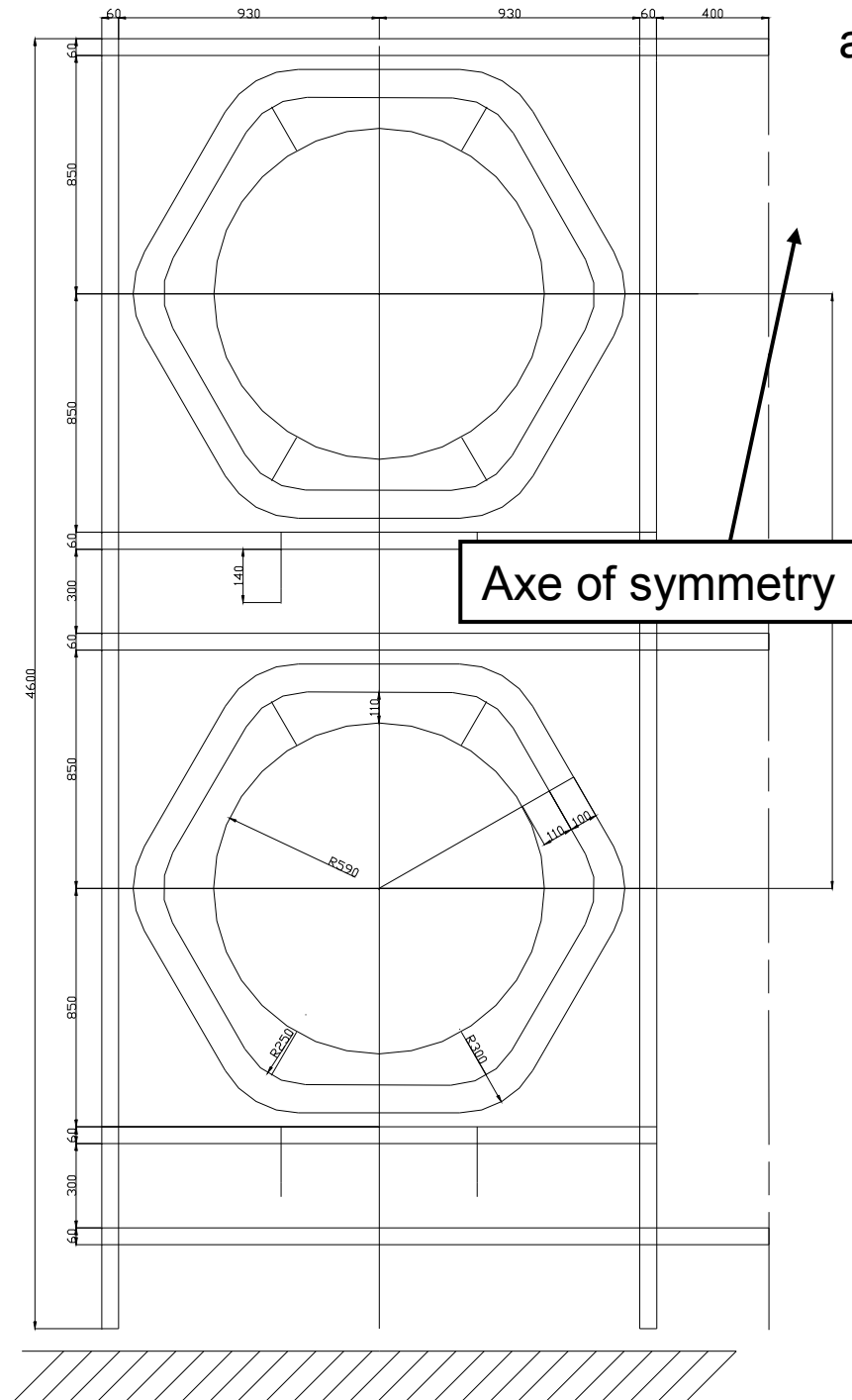


Four horns support system – update

B.Szybiński, Cracow University of Technology



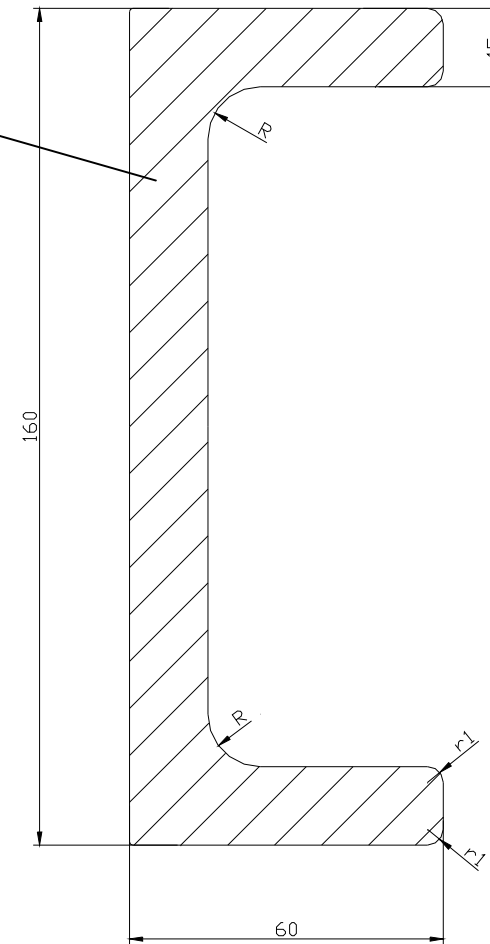
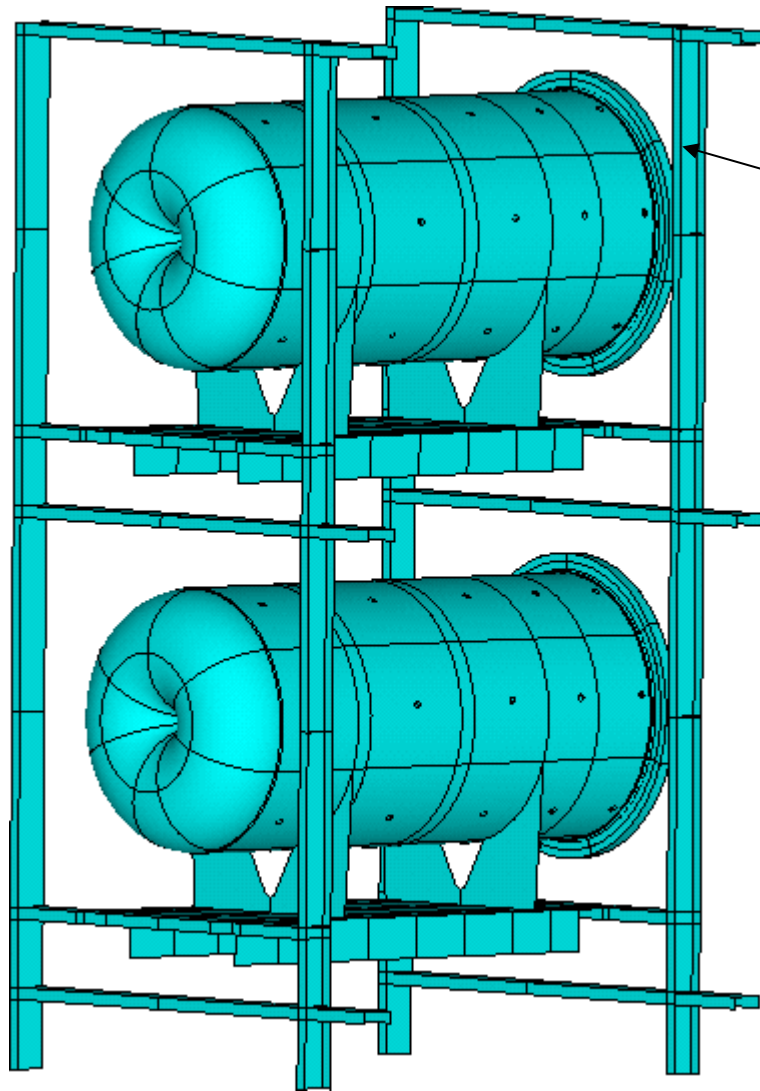
at present

1. Total height: $H = 4300 [mm]$
2. Distance between horn centres (horiz. and vert.): $L = 2000 [mm]$
3. Distance between frames: $B = 235 [mm]$
4. Width of the cell for single horn: $C = 2 \times 830 [mm]$
5. Height of the cell for single horn: $J = 2 \times 830 [mm]$

previously

1. Total height: $H = 4600 [mm]$
2. Distance between horn centres: $L = 2120$
3. Distance between frames: $B = 2 \times 400 [mm]$
4. Width of the cell for single horn: $C = 2 \times 930 [mm]$
5. Height of the cell for single horn: $J = 2 \times 850 [mm]$

Standard aluminium channel
section for frame structure



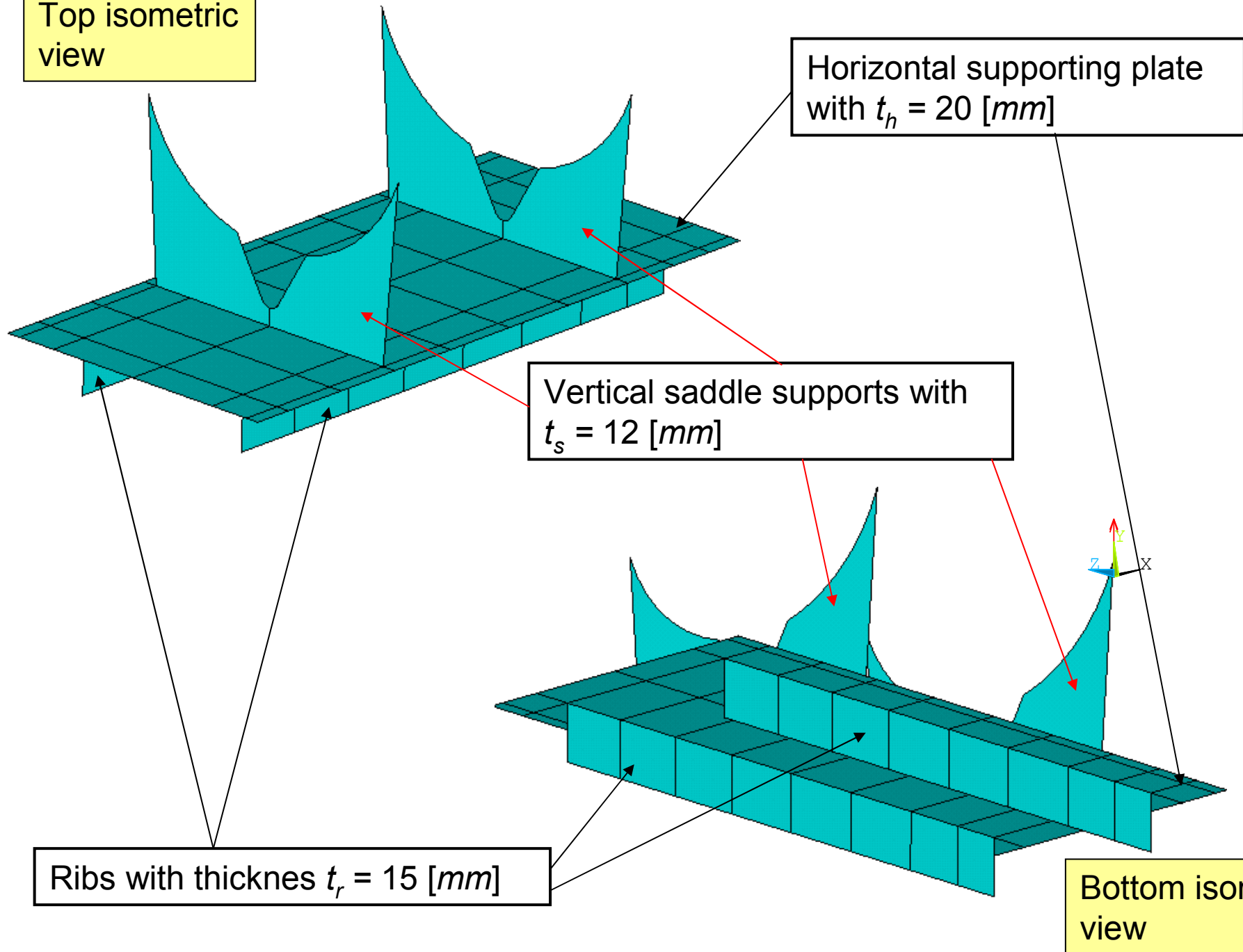
Top isometric
view

Horizontal supporting plate
with $t_h = 20$ [mm]

Vertical saddle supports with
 $t_s = 12$ [mm]

Ribs with thicknes $t_r = 15$ [mm]

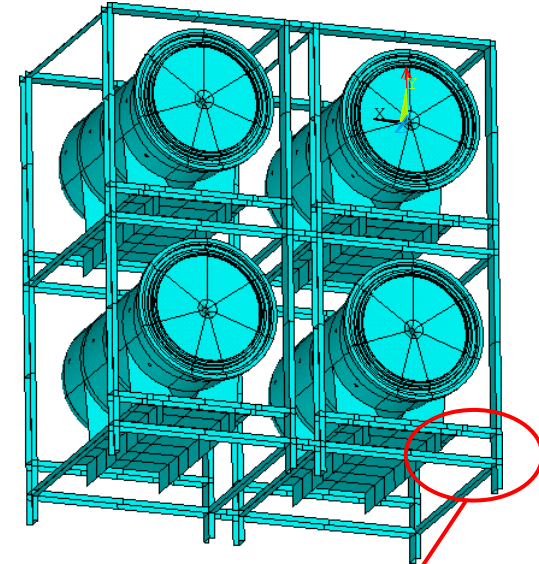
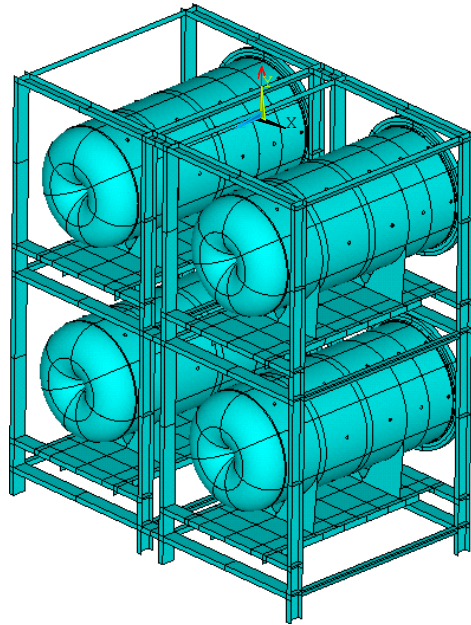
Bottom isom.
view



Full structure with longitudinal spans, supported
on the top,

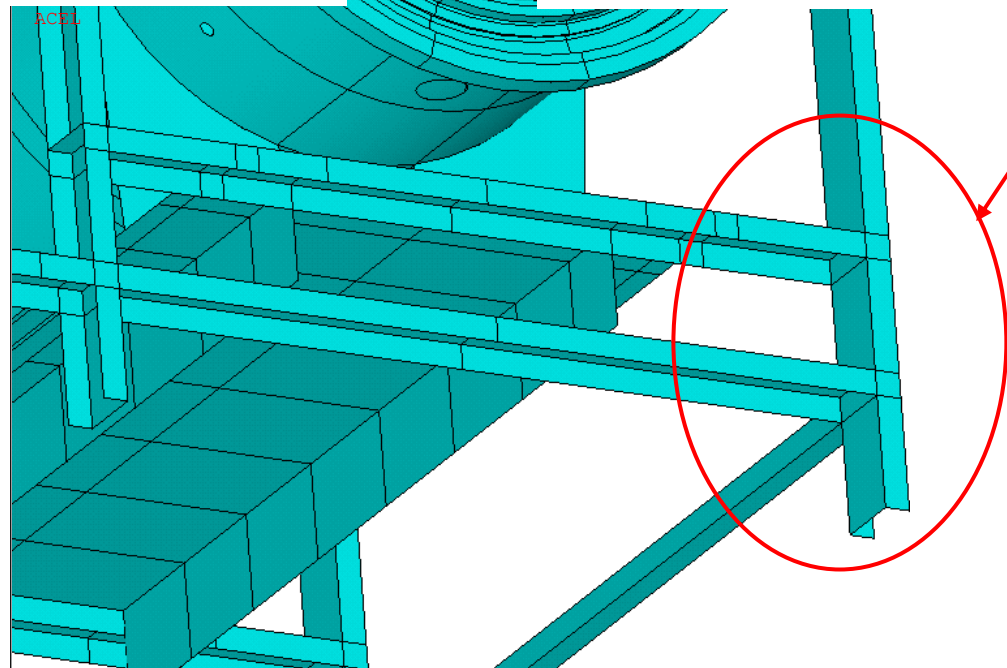
Results in slides: 8 – 17 (load: deadweight)

Results in slides: 19 – 27 (load: deadweight +
hydrostatic pressure)



Total mass:
2850 [kg]

Mass of support
system:
1560 [kg]



1

ELEMENTS

U

ROT

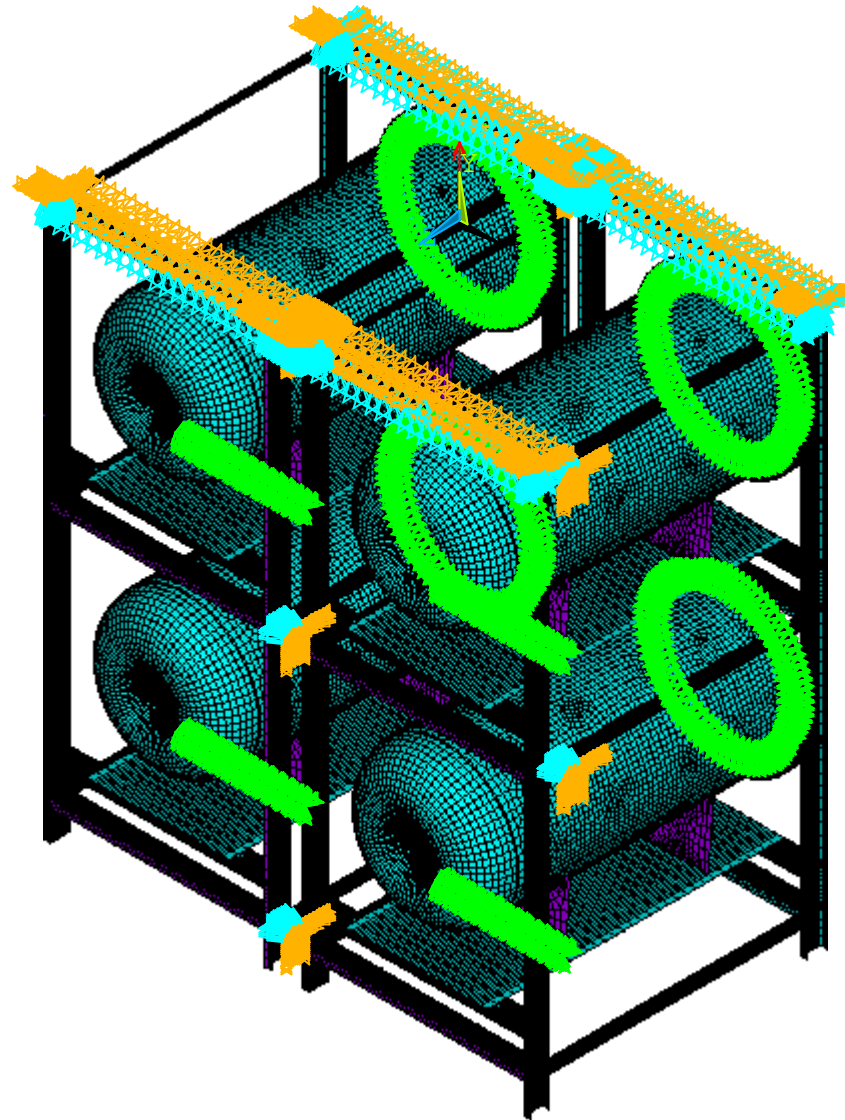
CP

ACEL

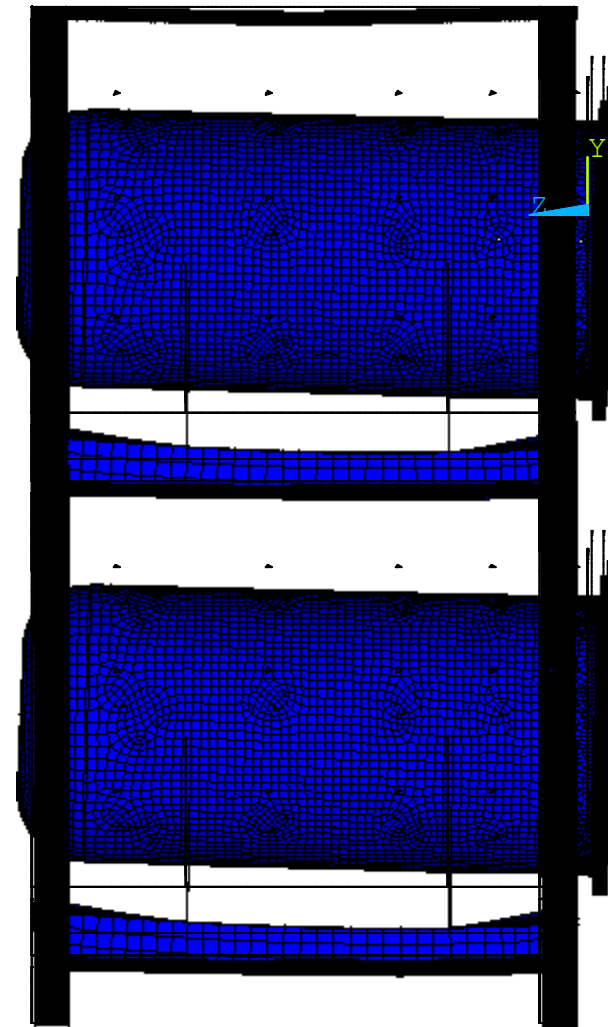
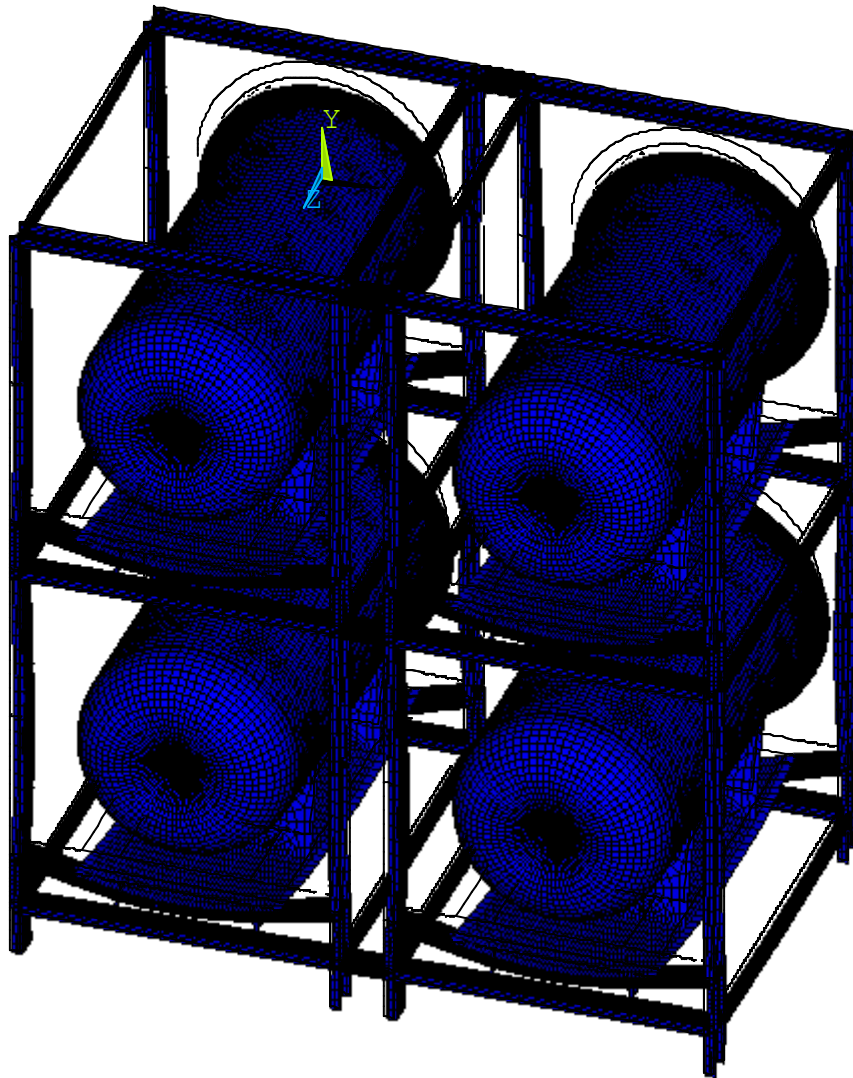
ANSYS

MAR 27 2012

10:35:04



Isometric view of mesh with boundary conditions introduced



Deformation of structure under deadweight – not to scale drawing

1

NODAL SOLUTION

STEP=1

SUB =1

TIME=1

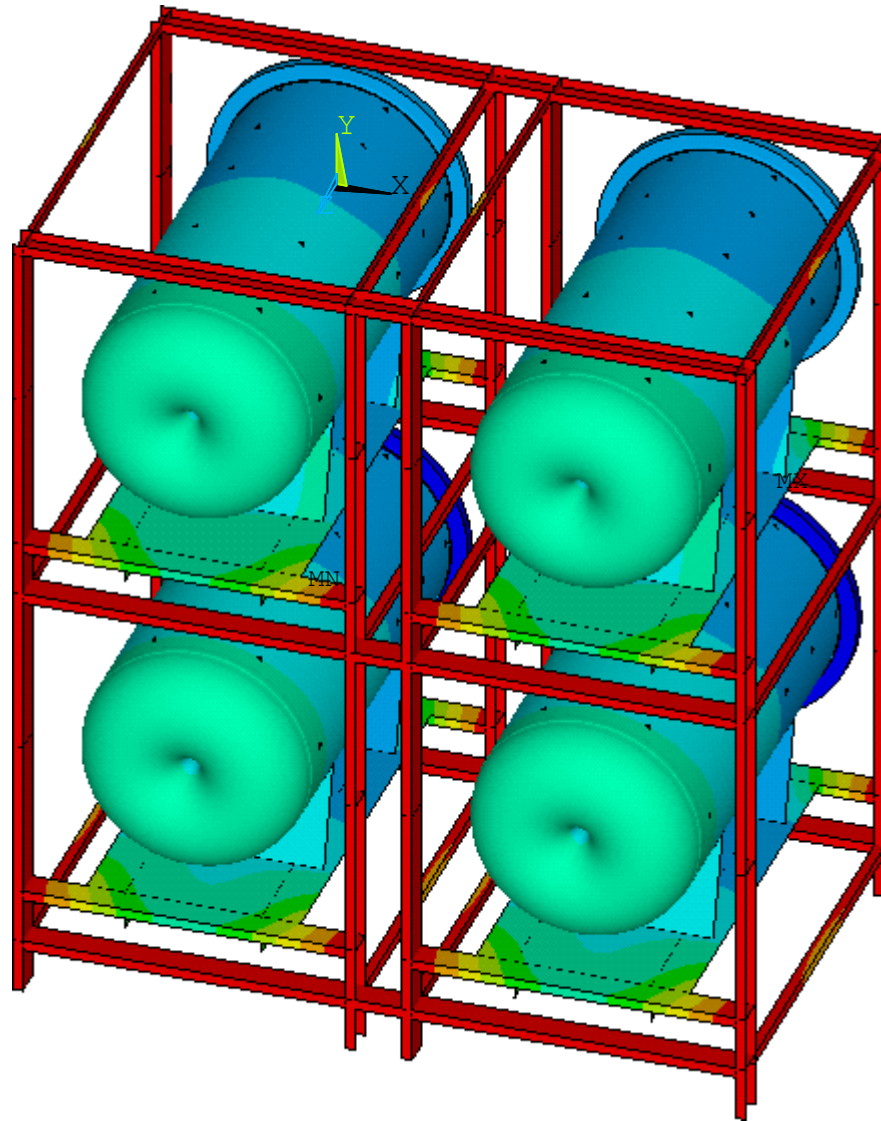
UY (AVG)

RSYS=0

DMX =.832E-03

SMN =-.828E-03

SMX =.439E-05



ANSYS

MAR 27 2012

10:20:03

-.828E-03

-.735E-03

-.643E-03

-.550E-03

-.458E-03

-.365E-03

-.273E-03

-.181E-03

-.881E-04

.439E-05

U_y displacement in [m]

1

NODAL SOLUTION

STEP=1

SUB =1

TIME=1

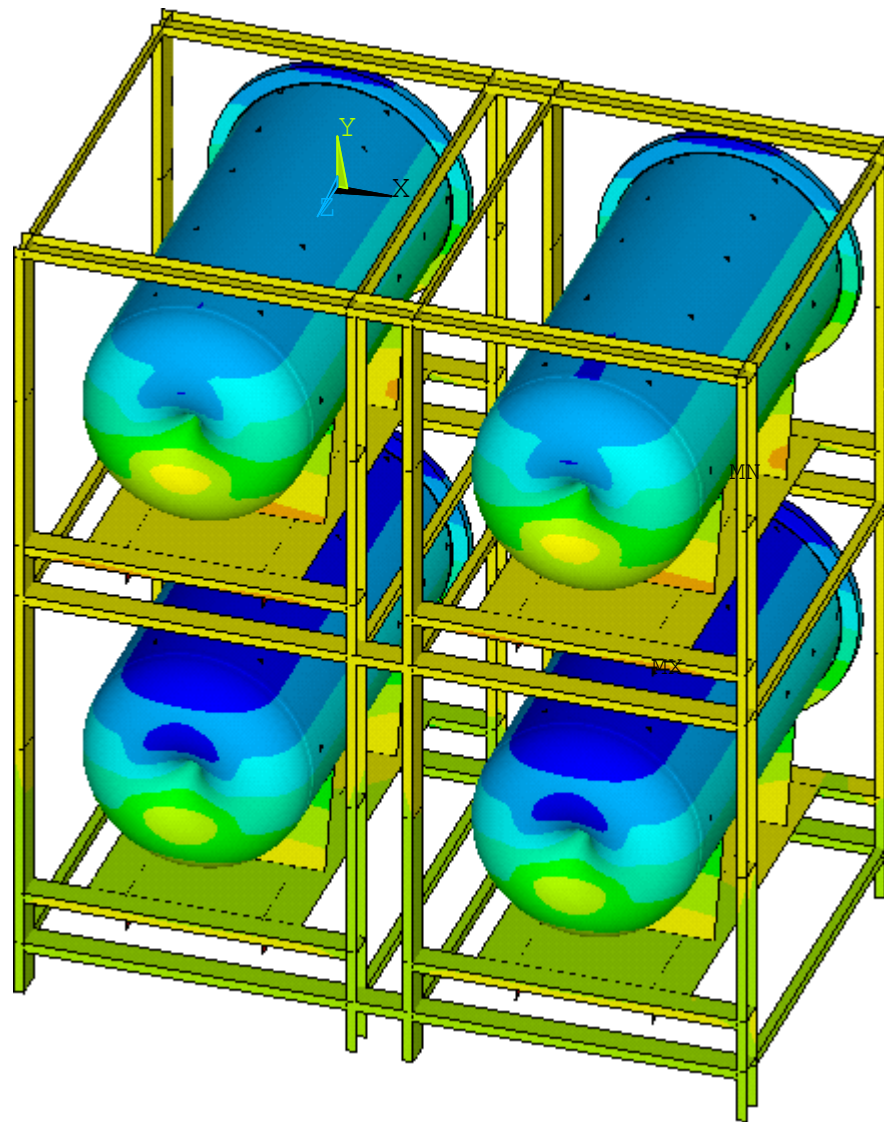
UZ (AVG)

RSYS=0

DMX =.832E-03

SMN =-.140E-03

SMX =.460E-04



ANSYS

MAR 27 2012

10:20:20

-.140E-03

-.120E-03

-.989E-04

-.782E-04

-.575E-04

-.368E-04

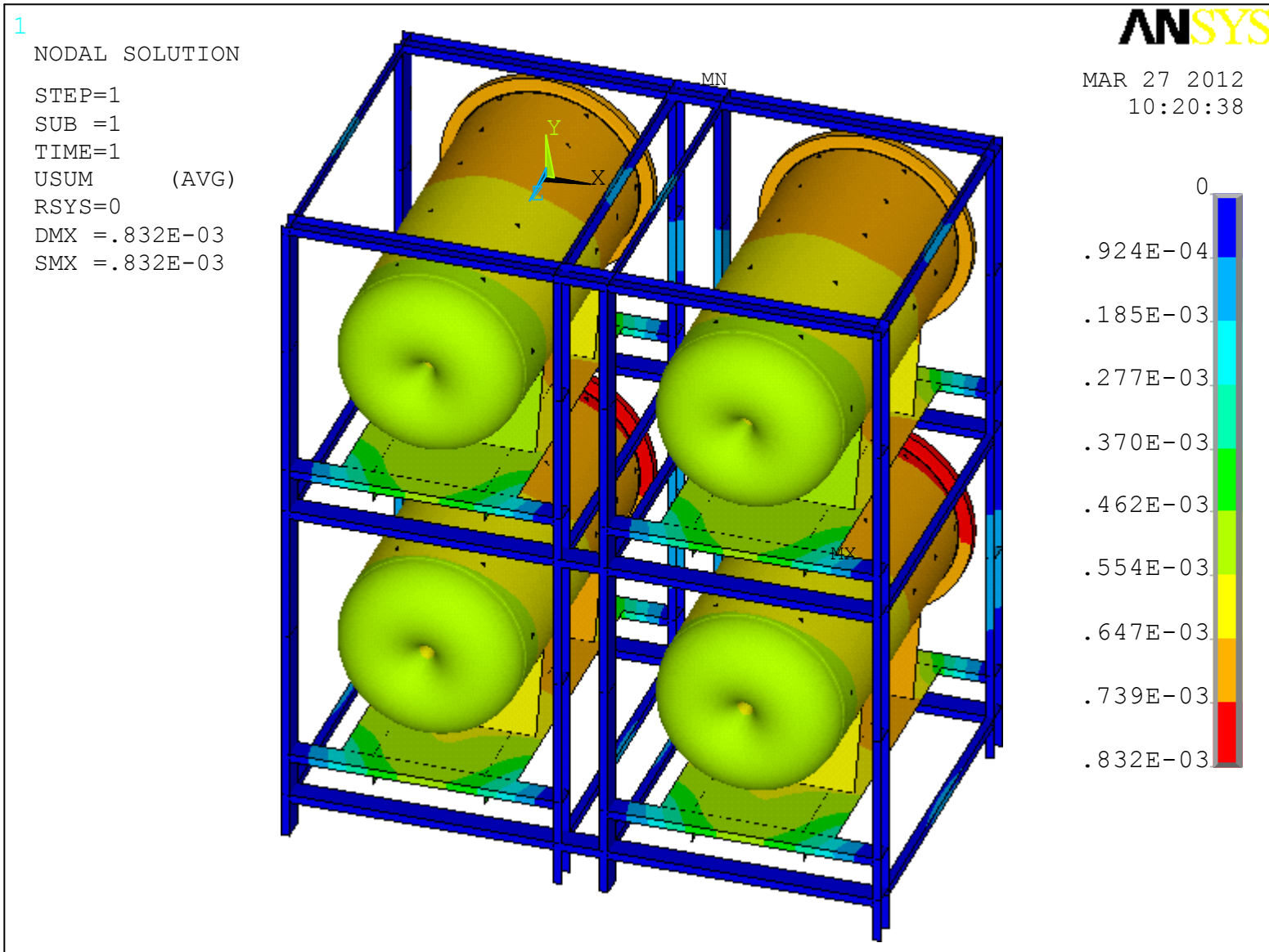
-.161E-04

.458E-05

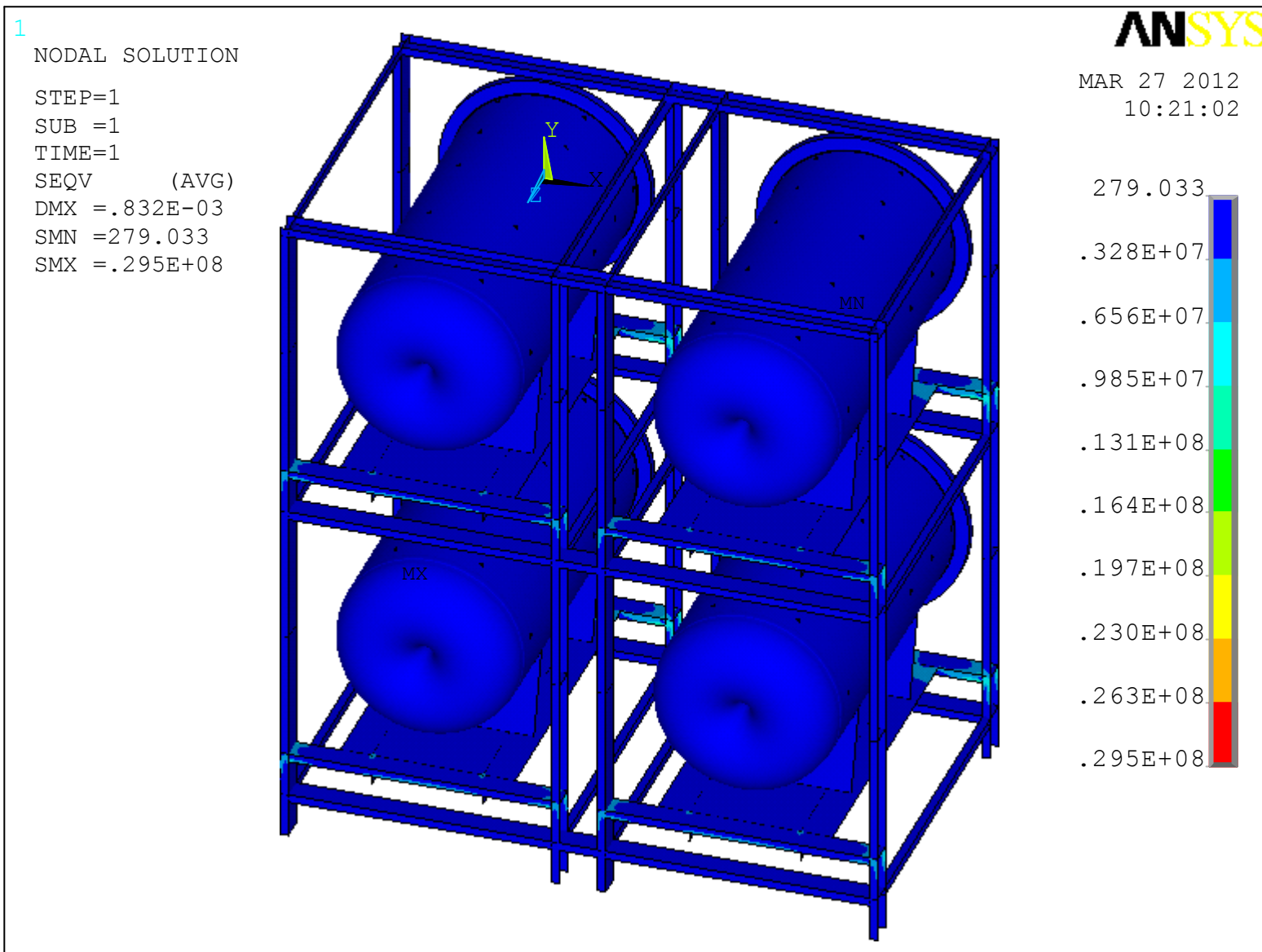
.253E-04

.460E-04

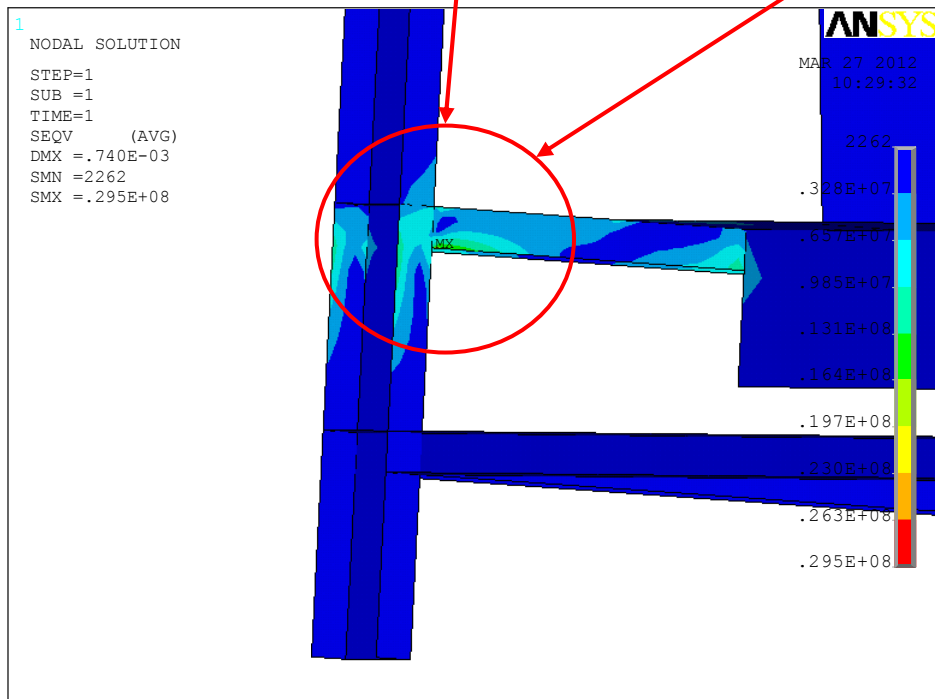
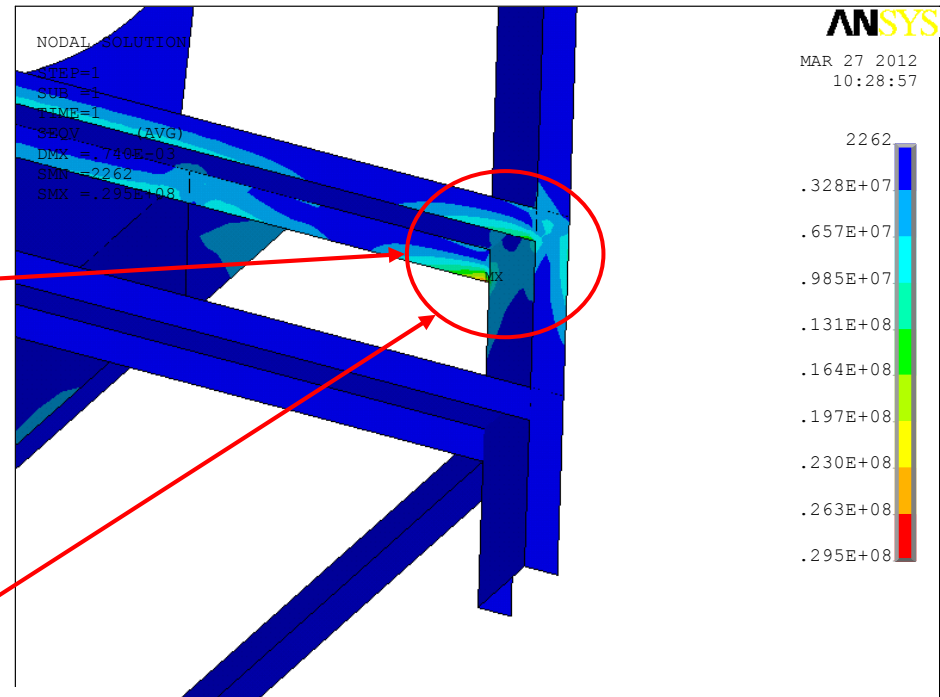
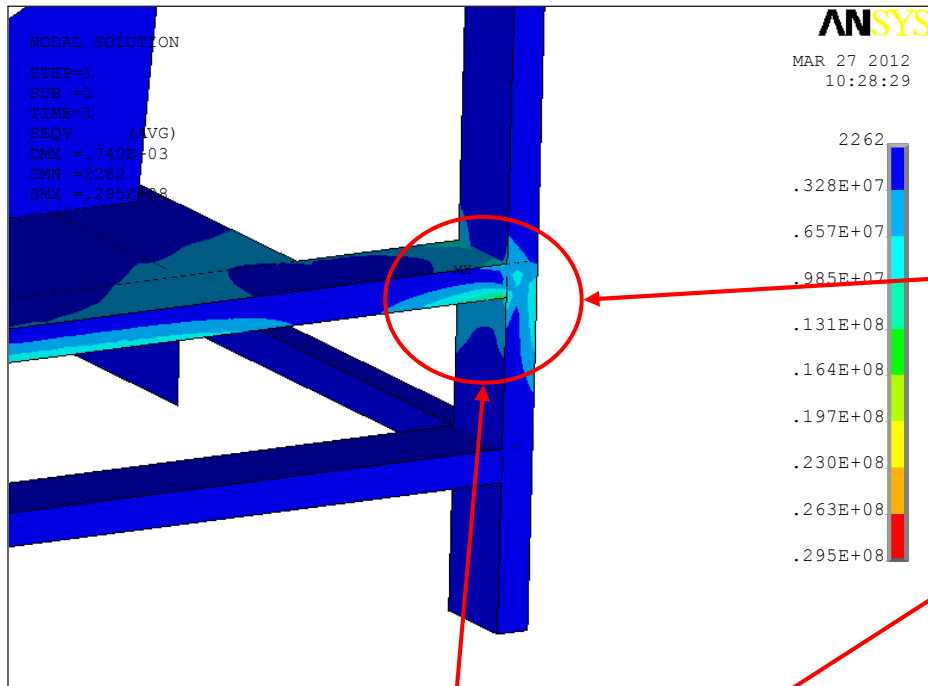
U_z displacement in [m]



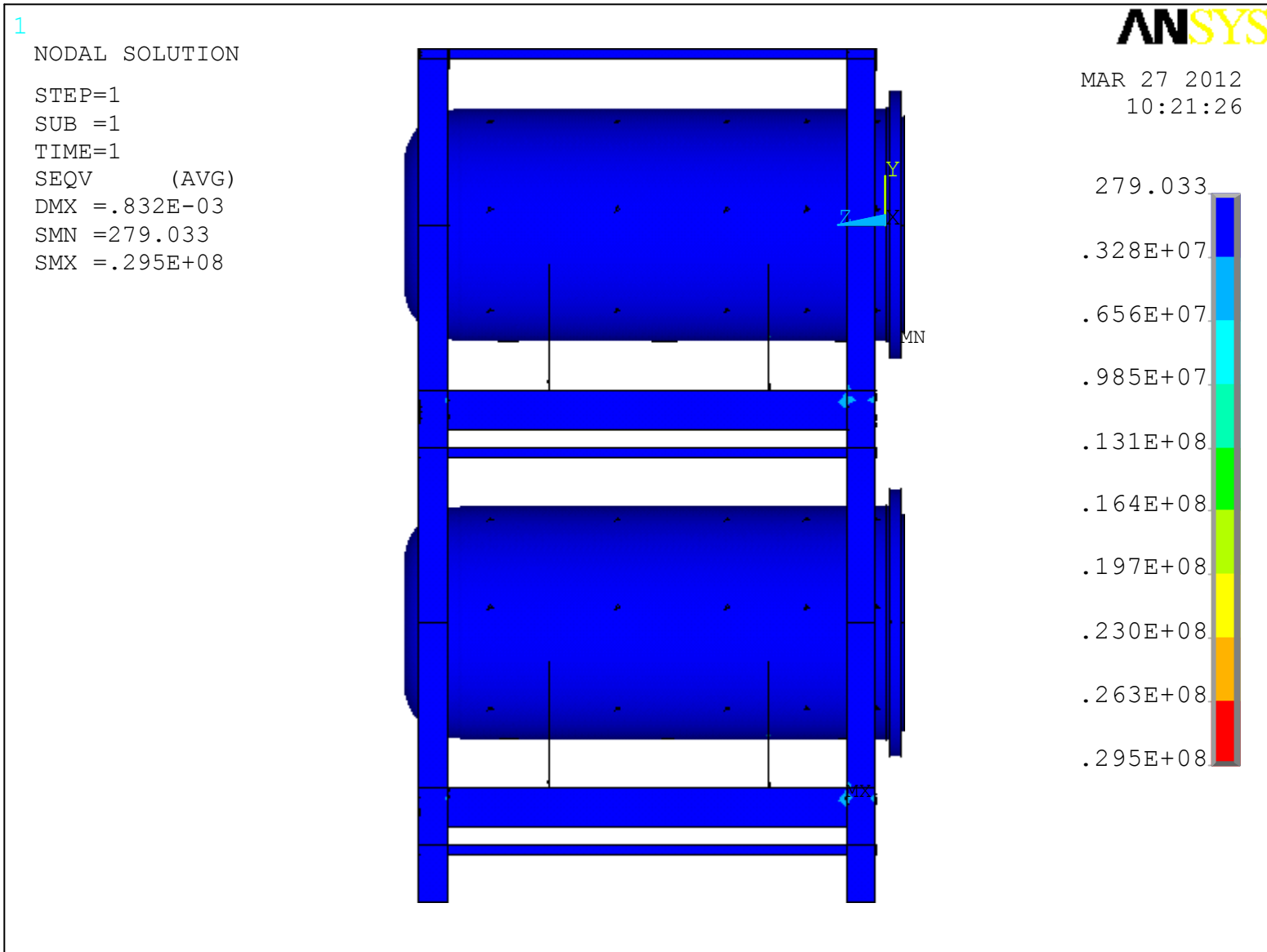
U_s vector of displacements in [m]



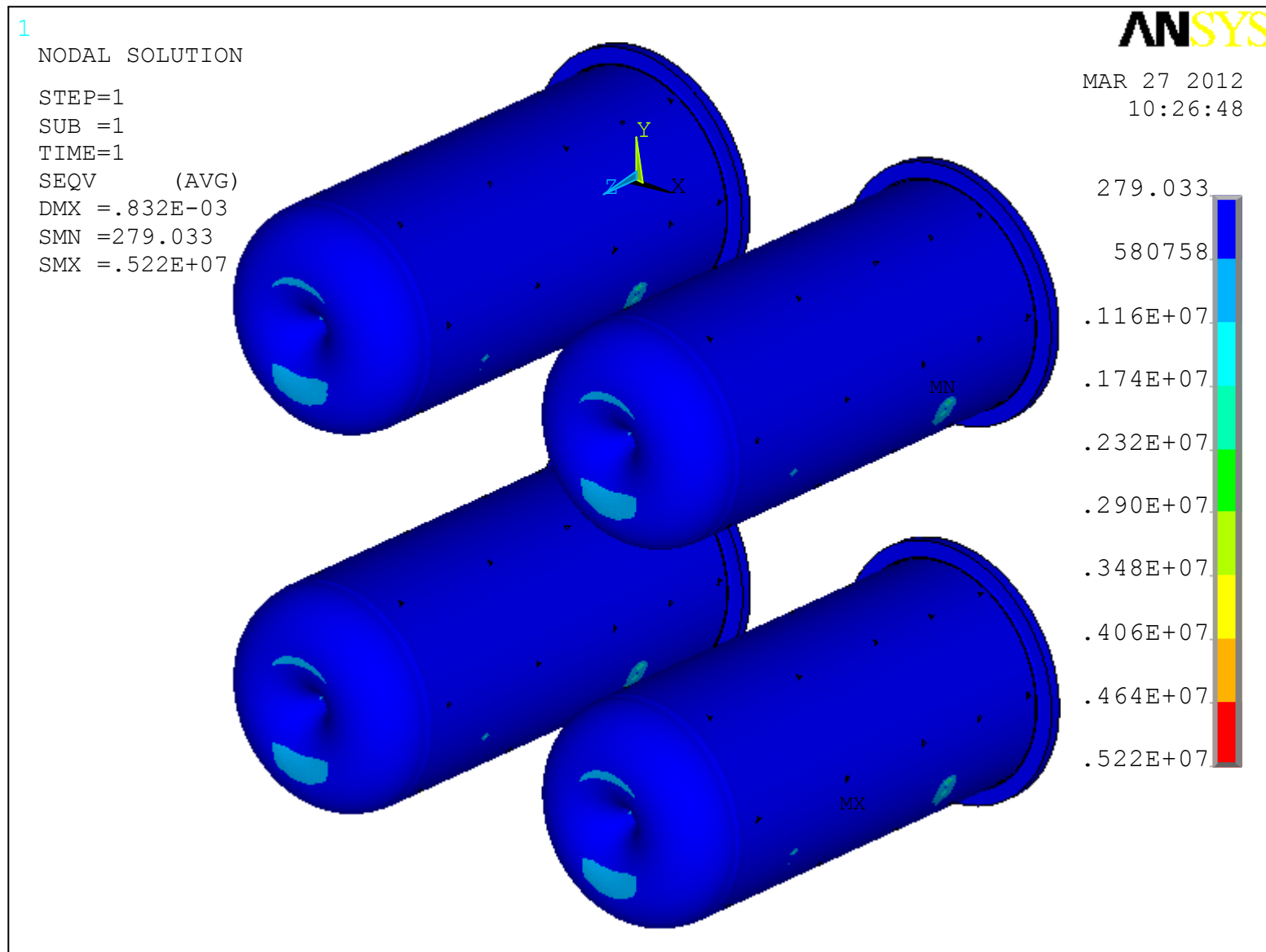
Distribution of equivalent stress in [Pa]



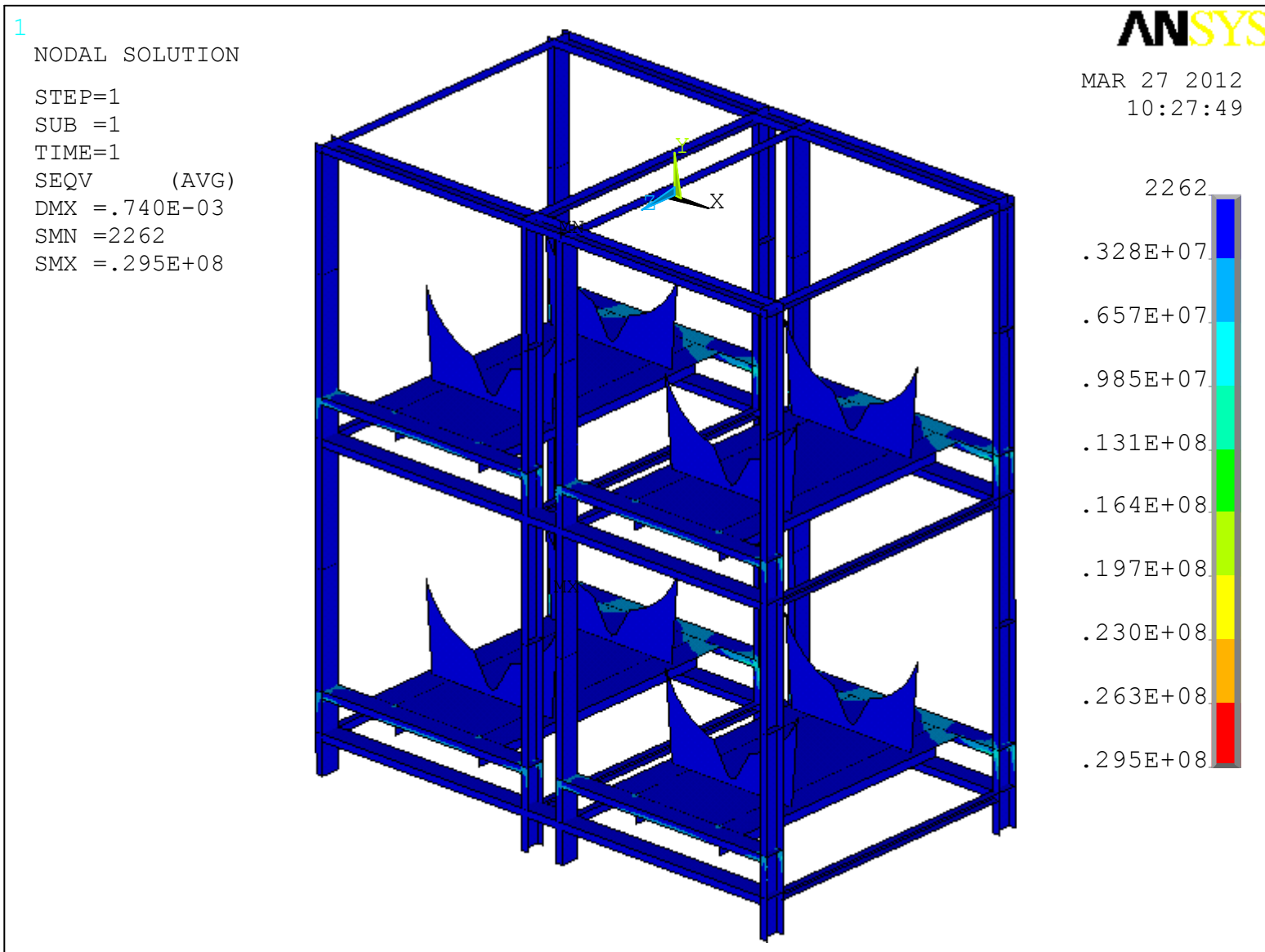
Distribution of equivalent stress
in [Pa] – detail of frame is
shown



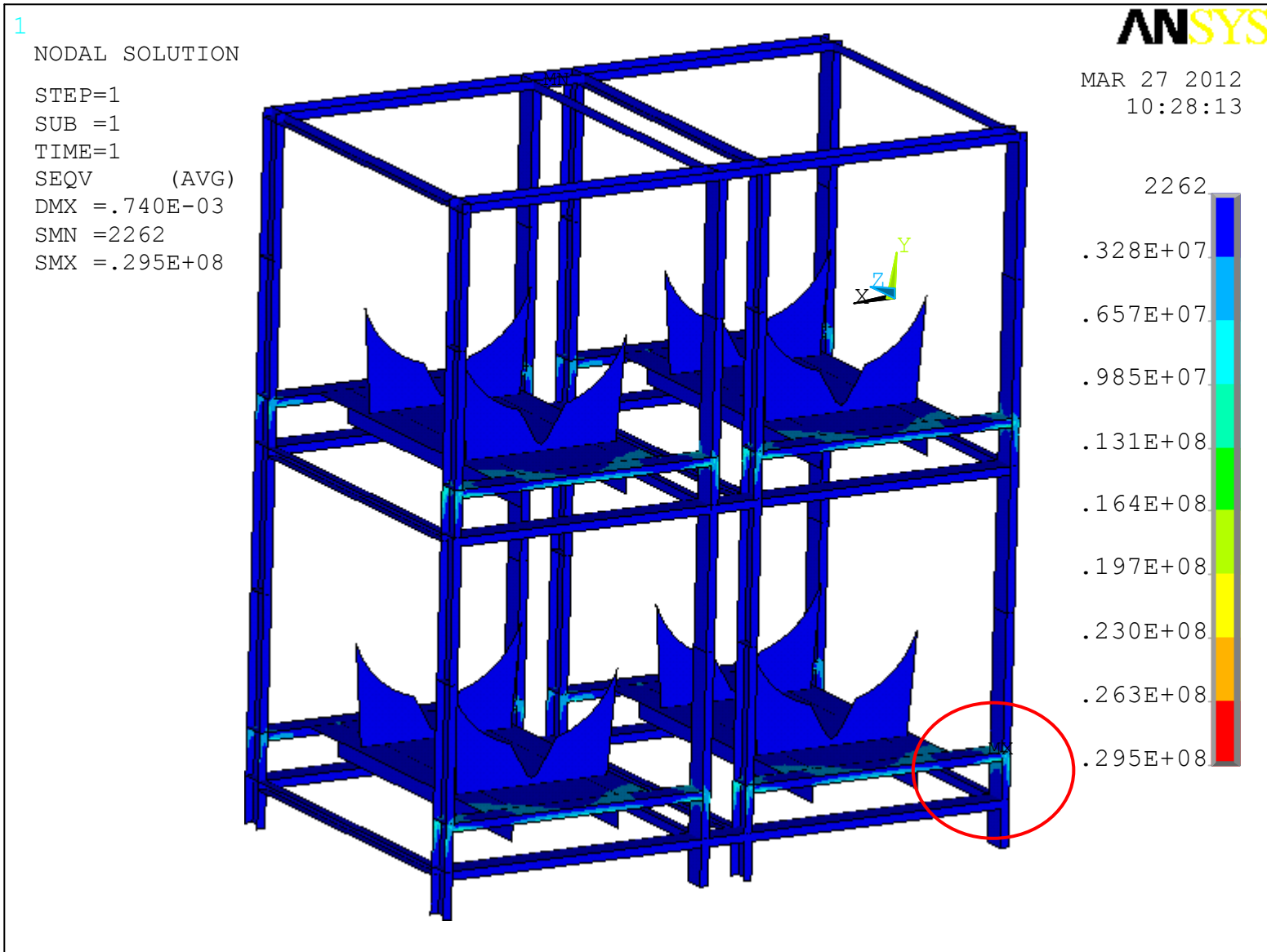
Distribution of equivalent stress in [Pa]



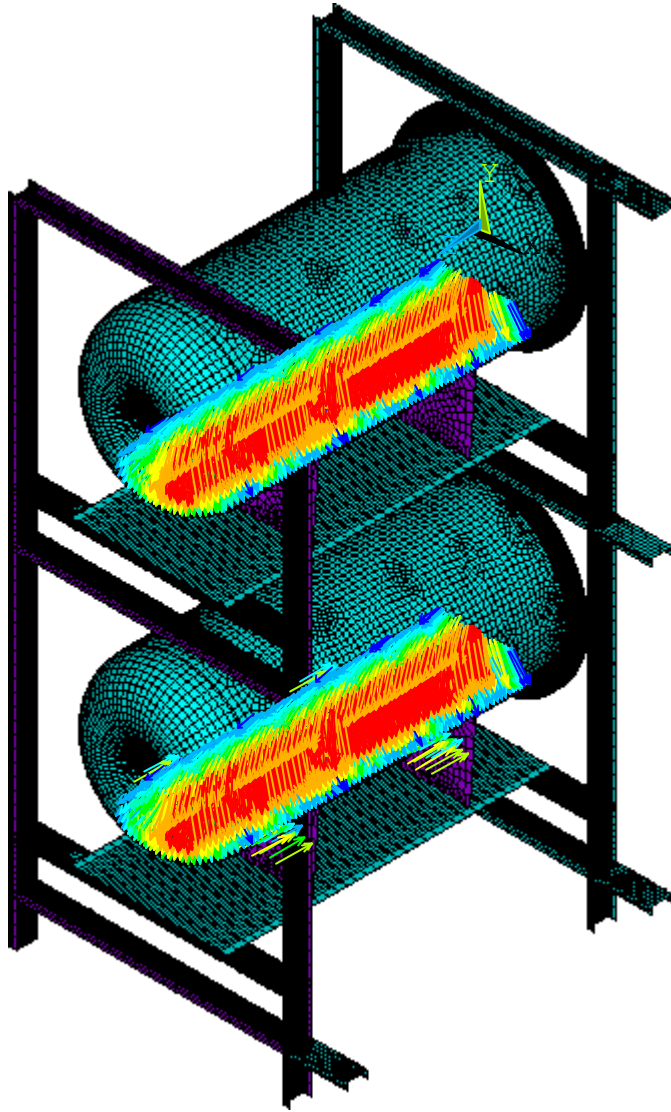
Distribution of equivalent stress in [Pa] – only horns are shown



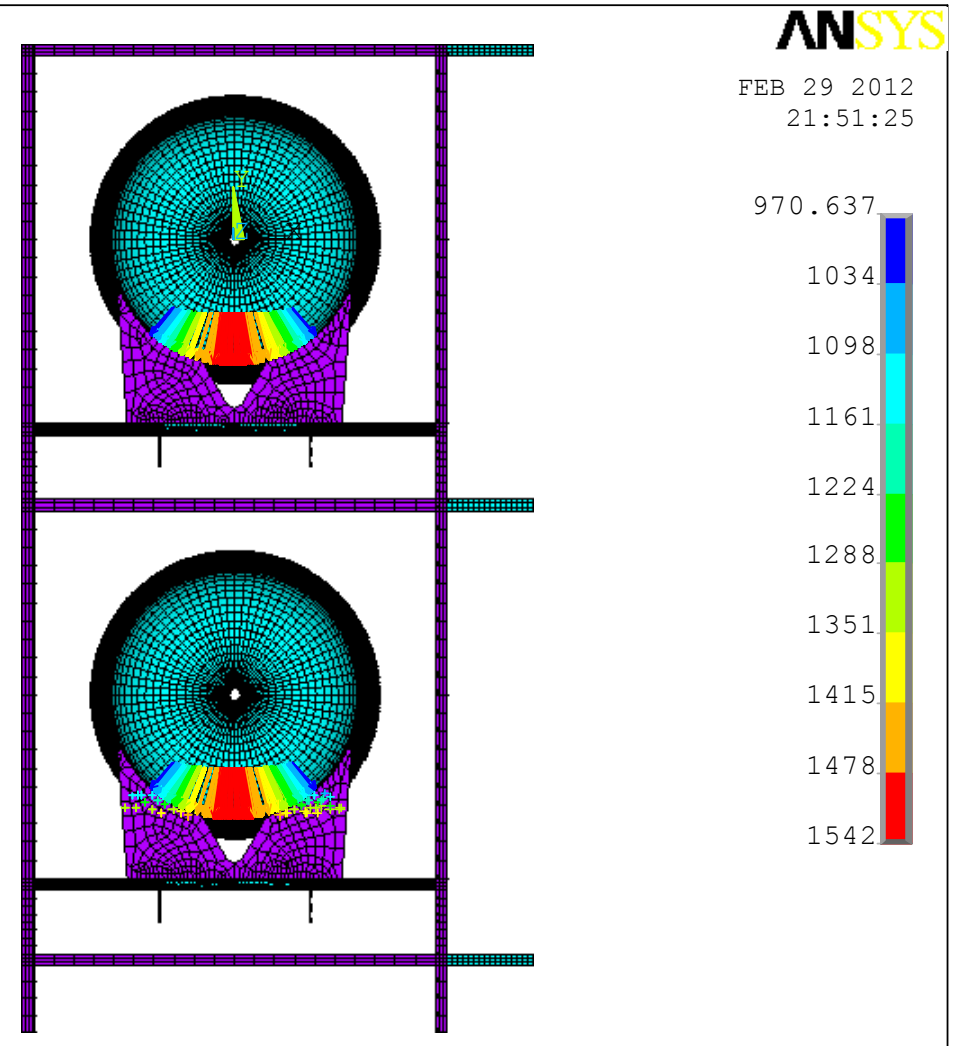
Distribution of equivalent stress in [Pa] – only frames are shown



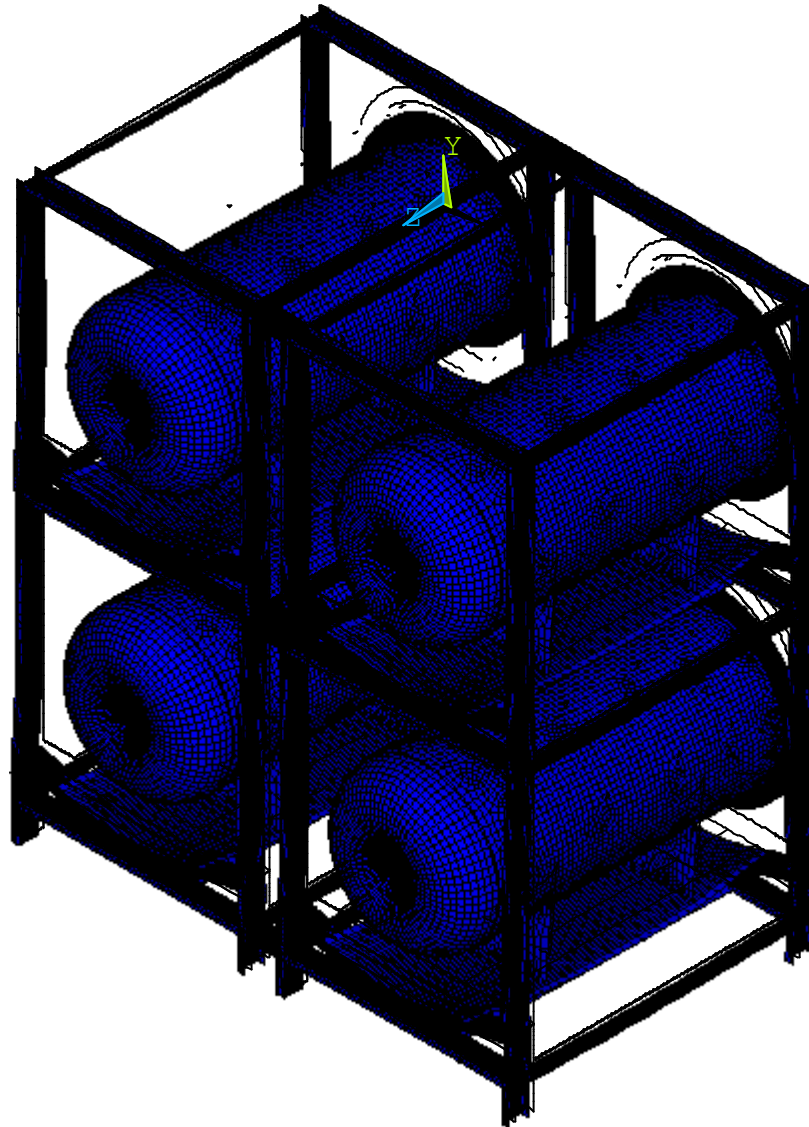
Distribution of equivalent stress in [Pa] – only frames are shown (opposite view)



Pressure of water inside
horns added (only
symmetric half shown)



1
DISPLACEMENT
STEP=1
SUB =1
TIME=1
DMX =.001125

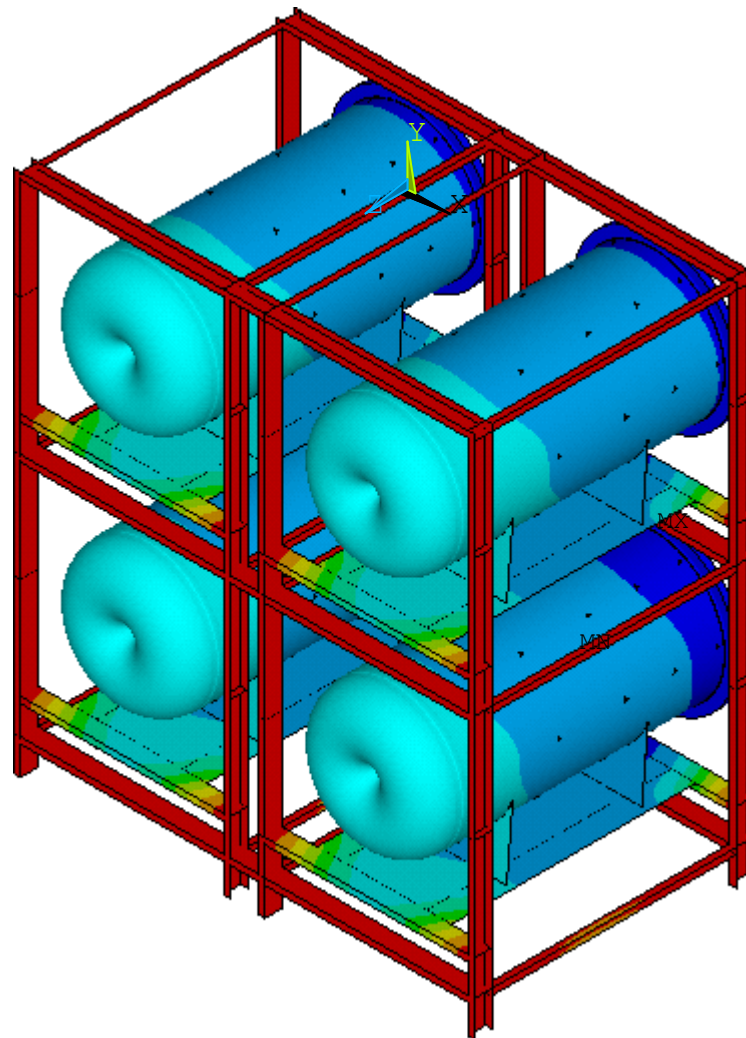


MAR 21
12

Loads:
deadweight +
hydrostatic
pressure of
water

Loads:
deadweight +
hydrostatic
pressure of
water

01 (AVG)
RSYS=0
DMX =.001125
SMN =-.001107
SMX =.255E-04



ANSYS

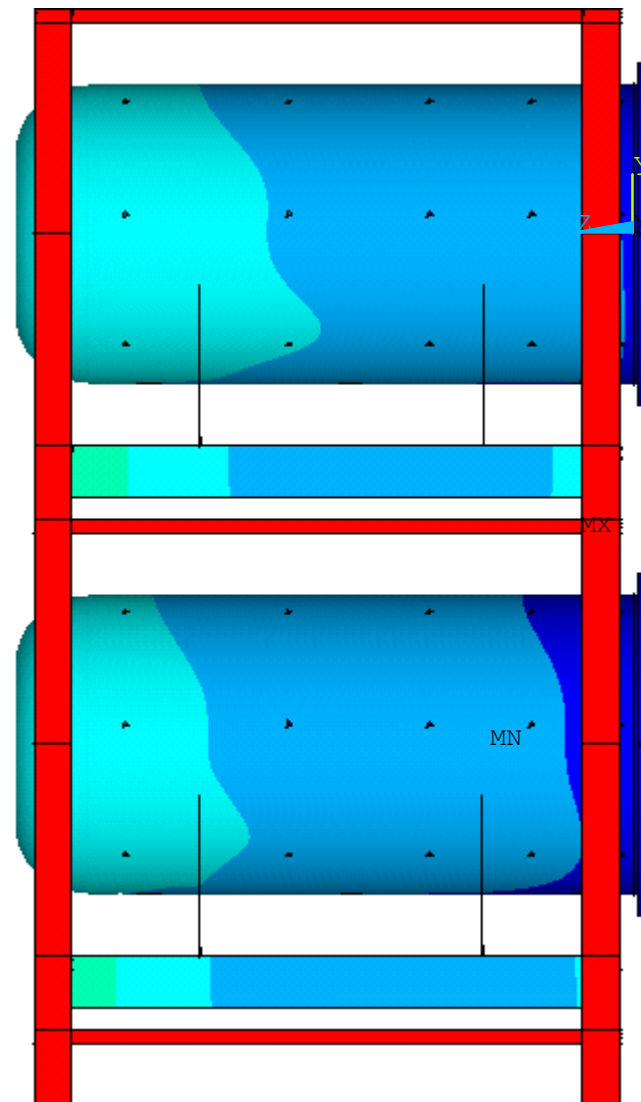
MAR 27 2012
12:41:30

-.001107
-.981E-03
-.855E-03
-.729E-03
-.604E-03
-.478E-03
-.352E-03
-.226E-03
-.100E-03
.255E-04

U_y displacement in [m]

Loads:
deadweight +
hydrostatic
pressure of
water

01 (AVG)
RSYS=0
DMX =.001125
SMN =-.001107
SMX =.255E-04



ANSYS

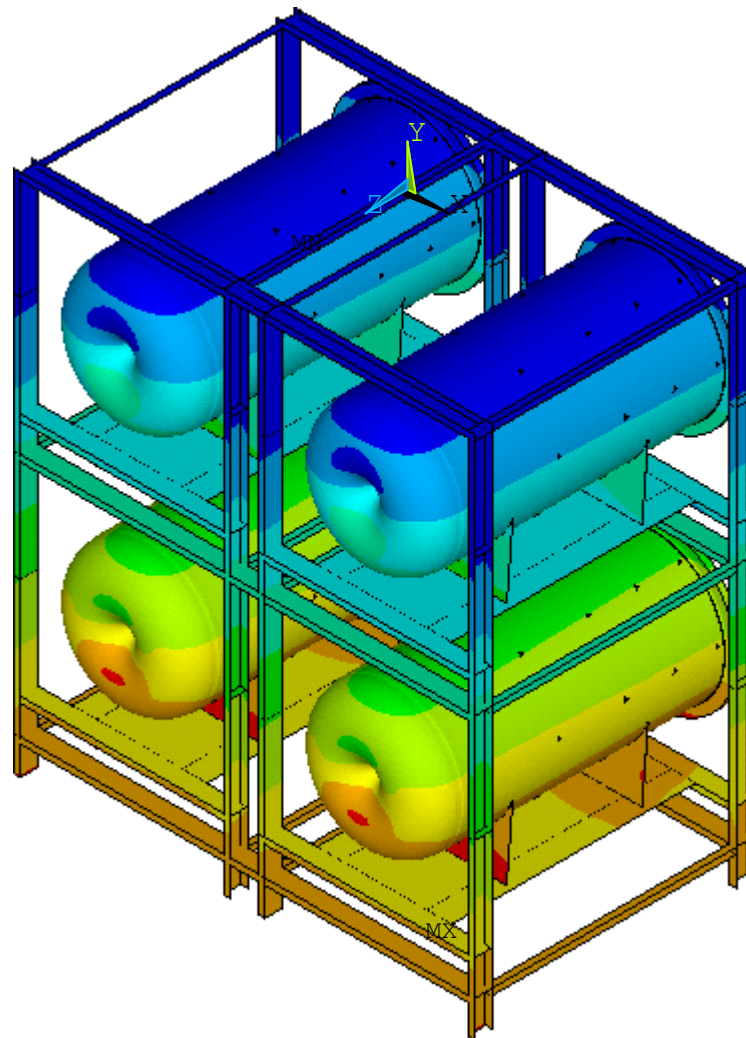
MAR 27 2012
12:42:17

-.001107
-.981E-03
-.855E-03
-.729E-03
-.604E-03
-.478E-03
-.352E-03
-.226E-03
-.100E-03
.255E-04

U_y displacement in [m]

Loads:
deadweight +
hydrostatic
pressure of
water

UZ (AVG)
RSYS=0
DMX =.001125
SMN =-.387E-05
SMX =.289E-03



ANSYS

MAR 27 2012
12:40:42

-.387E-05

.287E-04

.613E-04

.938E-04

.126E-03

.159E-03

.191E-03

.224E-03

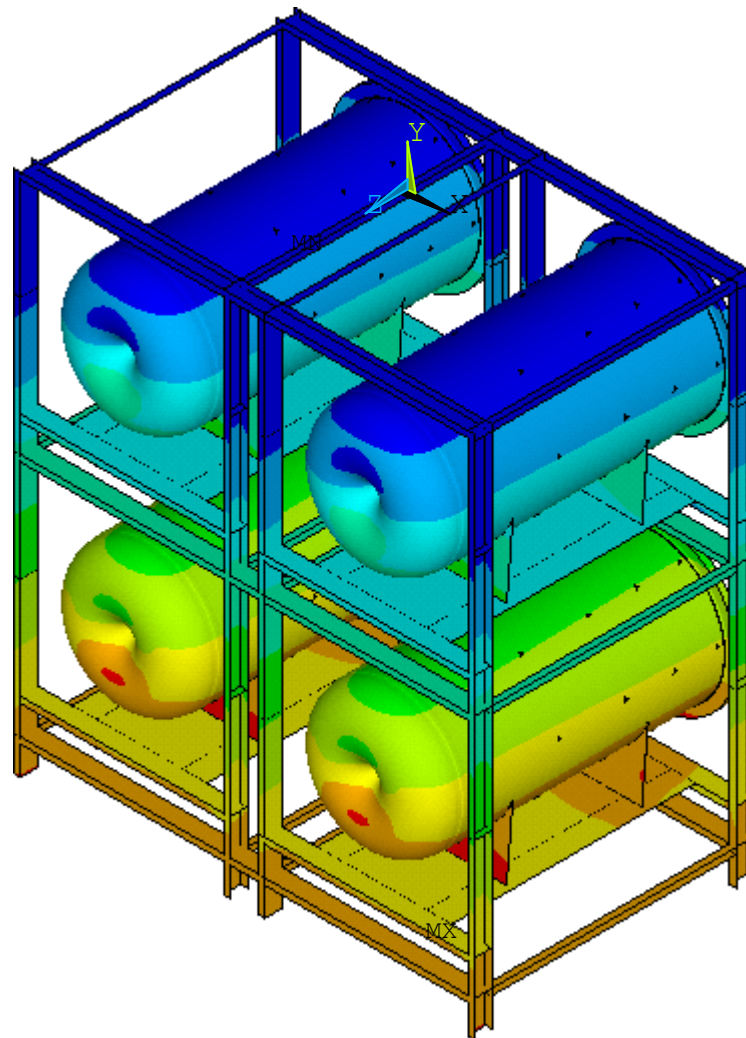
.257E-03

.289E-03

U_z displacement in [m]

Loads:
deadweight +
hydrostatic
pressure of
water

UZ (AVG)
RSYS=0
DMX =.001125
SMN =-.387E-05
SMX =.289E-03

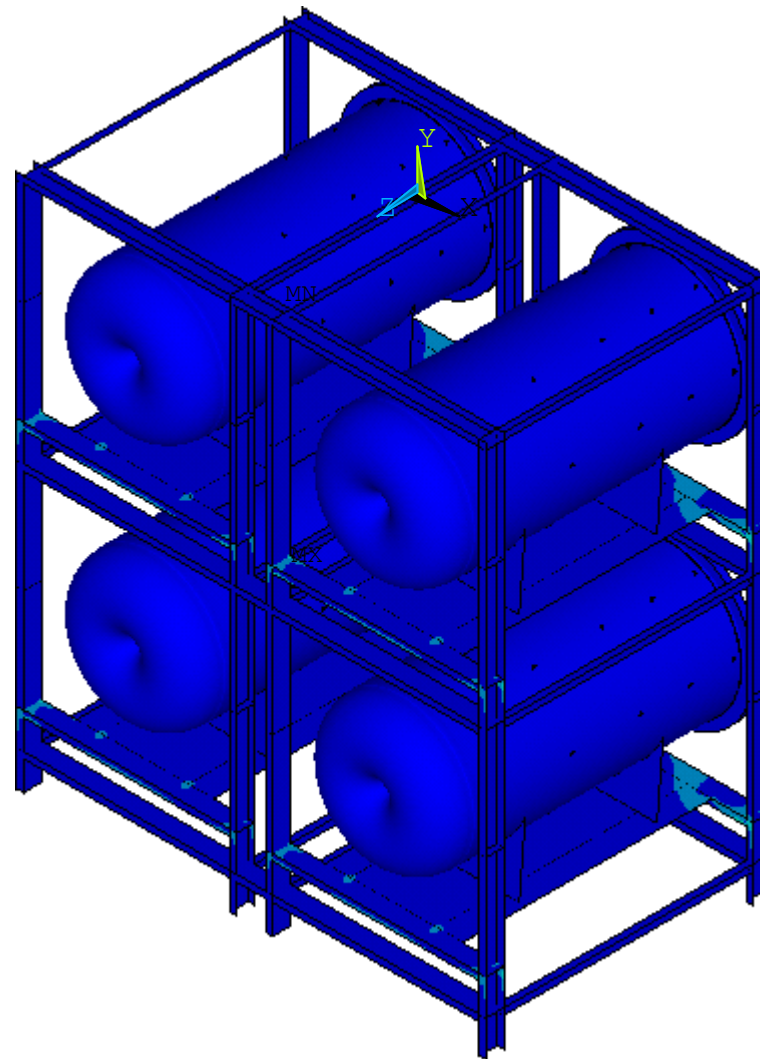


-.387E-05
.287E-04
.613E-04
.938E-04
.126E-03
.159E-03
.191E-03
.224E-03
.257E-03
.289E-03

Distribution of displacements vector in [m]

Loads:
deadweight +
hydrostatic
pressure of
water

DMX =.001123
SMN =215.957
SMX =.415E+08



ANSYS

MAR 27 2012
12:39:02

215.957
.462E+07
.923E+07
.138E+08
.185E+08
.231E+08
.277E+08
.323E+08
.369E+08
.415E+08

Distribution of equivalent stress in [Pa]

1

NODAL SOLUTION

STEP=1

SUB =1

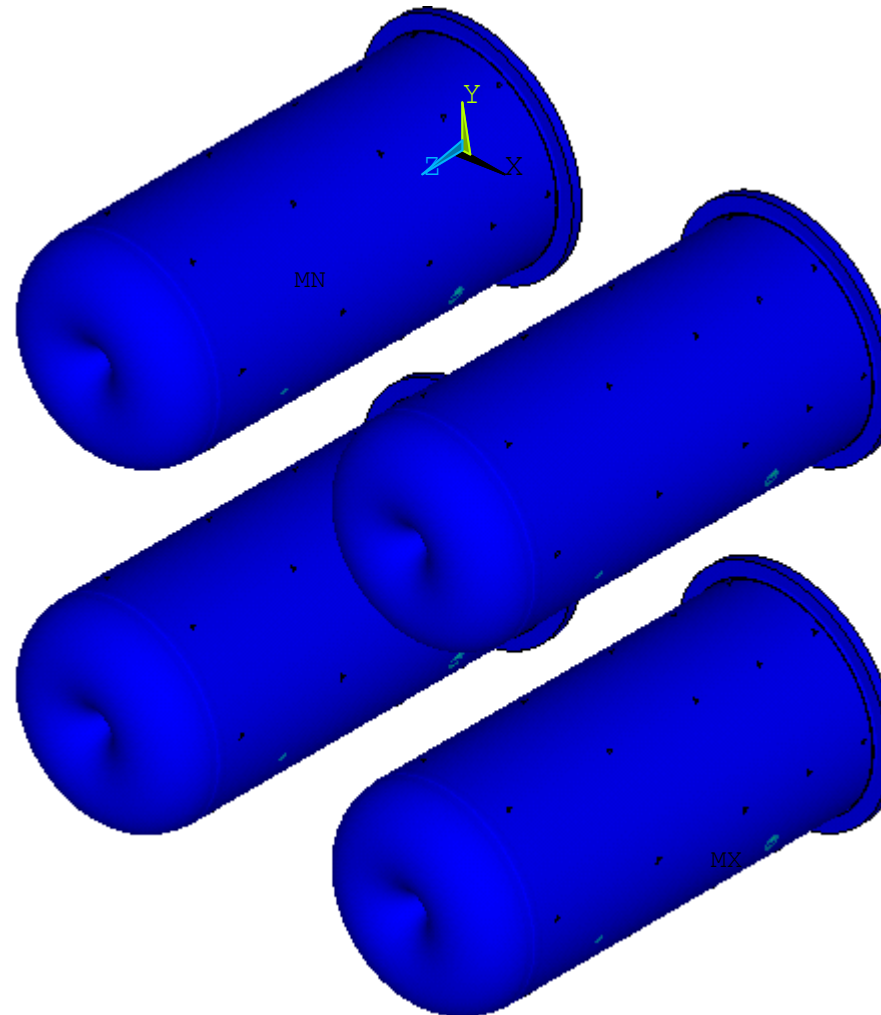
TIME=1

SEQV (AVG)

DMX =.001125

SMN =215.957

SMX =.101E+08



MAR 21

12

215.

.112E+07

.225E+07

.337E+07

.450E+07

.562E+07

.674E+07

.787E+07

.899E+07

.101E+08

Loads:
deadweight +
hydrostatic
pressure of
water

Distribution of equivalent stress in [Pa] – only horns are shown

1

NODAL SOLUTION

STEP=1

SUB =1

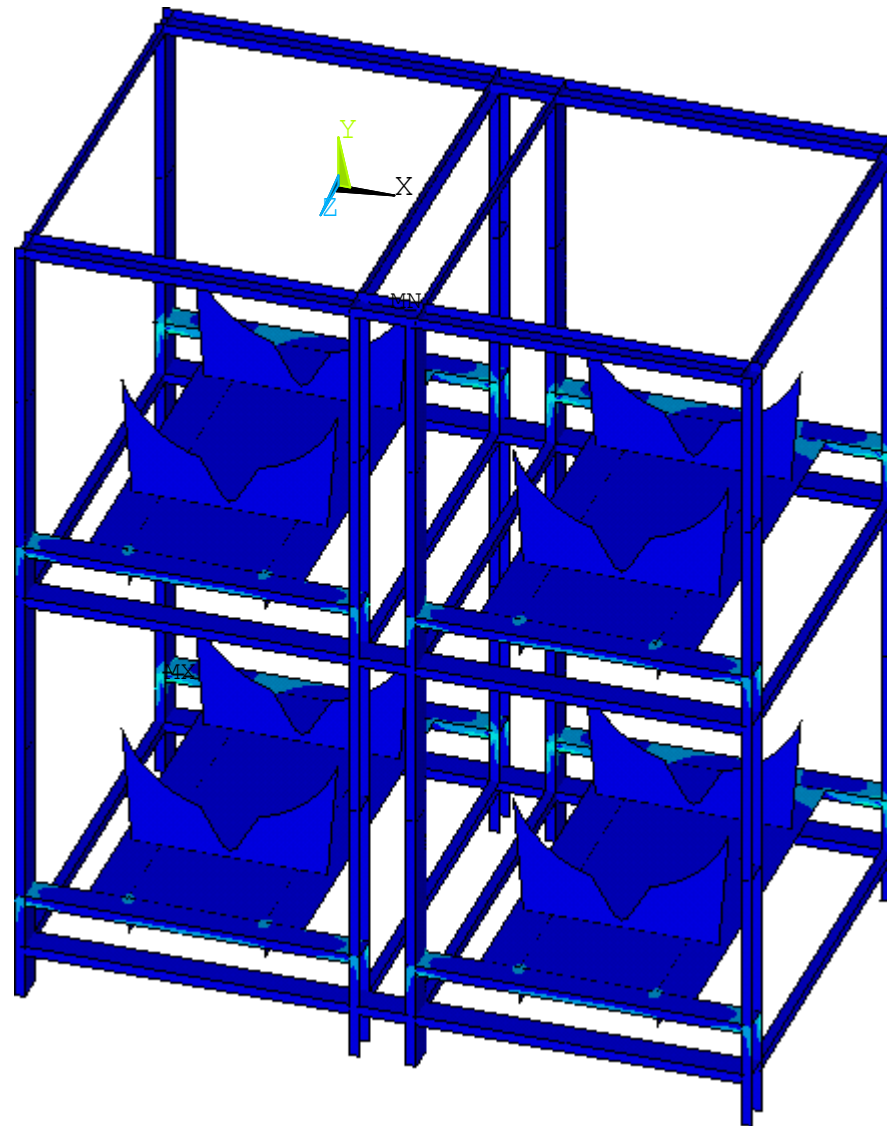
TIME=1

SEQV (AVG)

DMX =.001049

SMN =743.331

SMX =.415E+08



MAR 21

12

Loads:
deadweight +
hydrostatic
pressure of
water

743.331

.462E+07

.923E+07

.138E+08

.185E+08

.231E+08

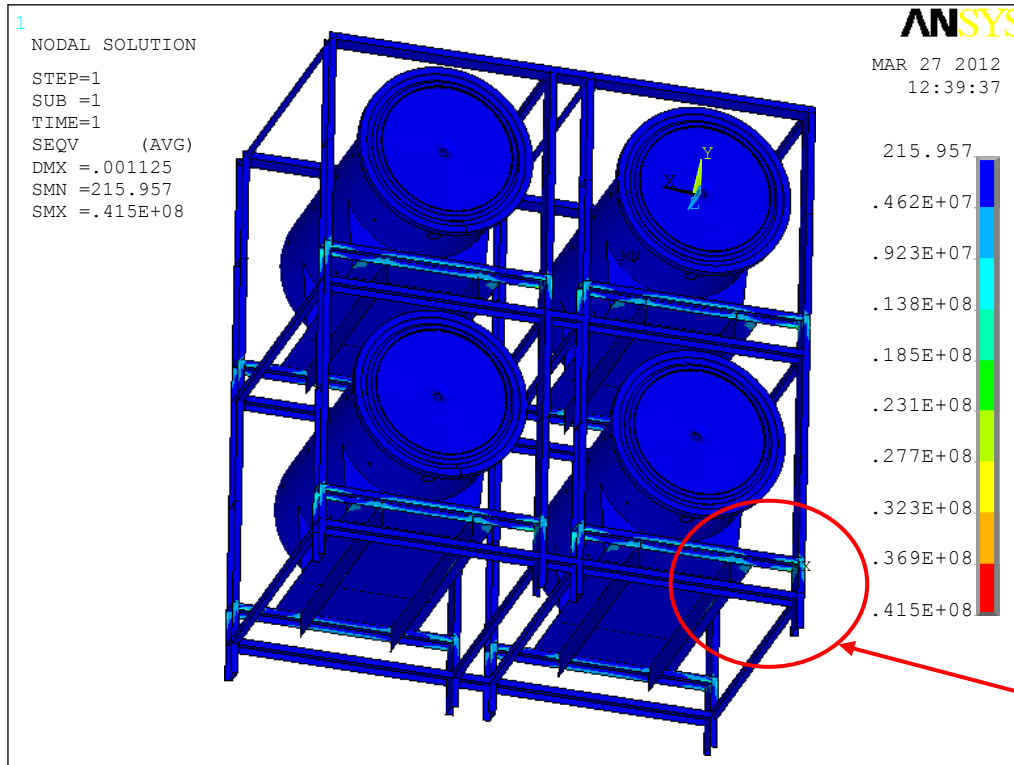
.277E+08

.323E+08

.369E+08

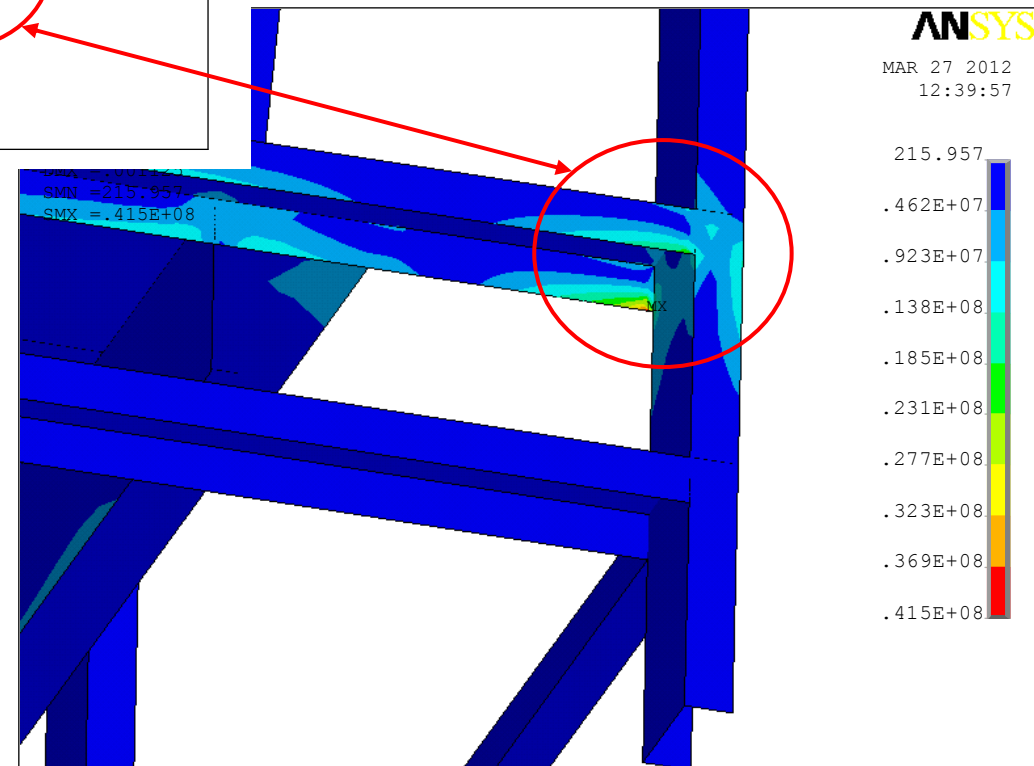
.415E+08

Distribution of equivalent stress in [Pa] – only frames are shown



Loads:
deadweight +
hydrostatic
pressure of
water

Distribution of equivalent
stress in $[Pa]$ – opposite
view with maximum area
magnified



Summary of results for structure with longitudinal spans

Strucutre, loads	$ u_y _{\max}$ <i>mm</i>	$\sigma_{\text{eqv, max}}$ <i>MPa</i> (horn)	$\sigma_{\text{eqv, max}}$ <i>MPa</i> (frame)
(plate with ribs), deadweight	0.83	5.2	29.5
(plate with ribs), deadweight + hydrostatic pressure	1.11	10.1	41.5

Further steps to make:

1. Calculations of natural frequencies for the whole structure (not only symmetric half)
2. Introduction of water frame
3. Introduction of strip line plates

Thank you for your attention