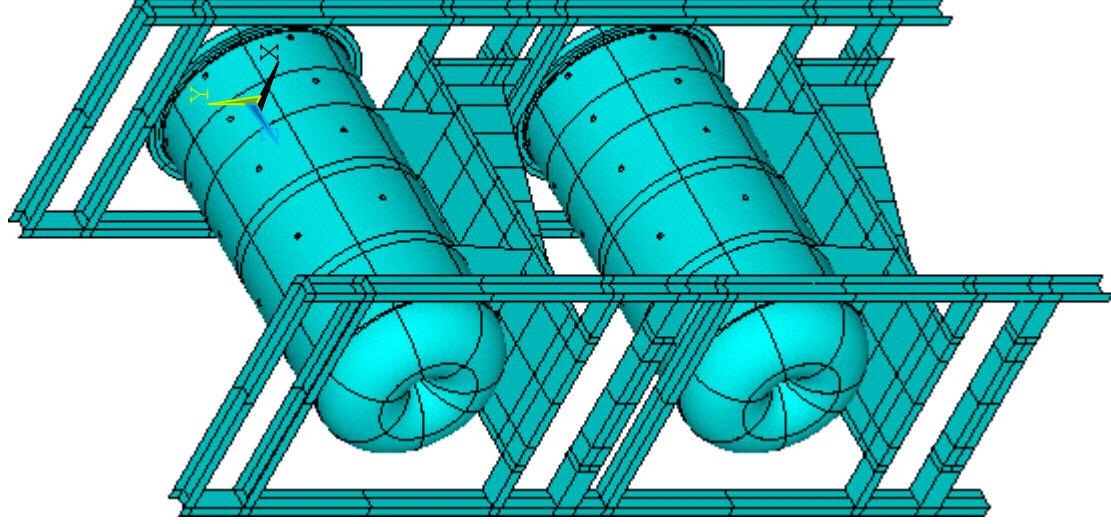


Double frame vs. single frame horns supporting concept

Bogdan Szybiński, Cracow Univ. of Technology
Piotr Cupiał, AGH Univ. of Science and Technology

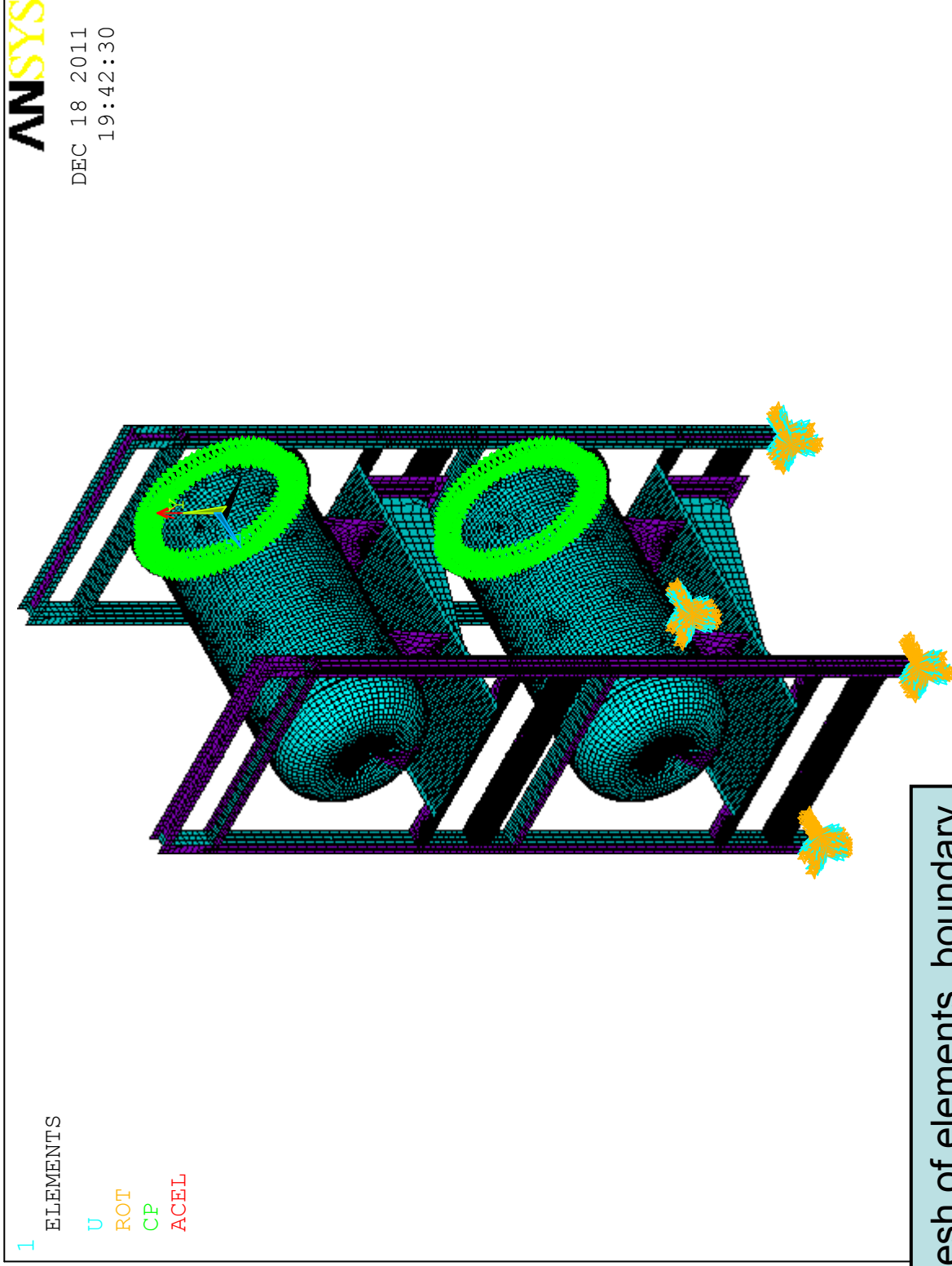
1 AREAS
TYPE NUM



Frames supported at the bottom,

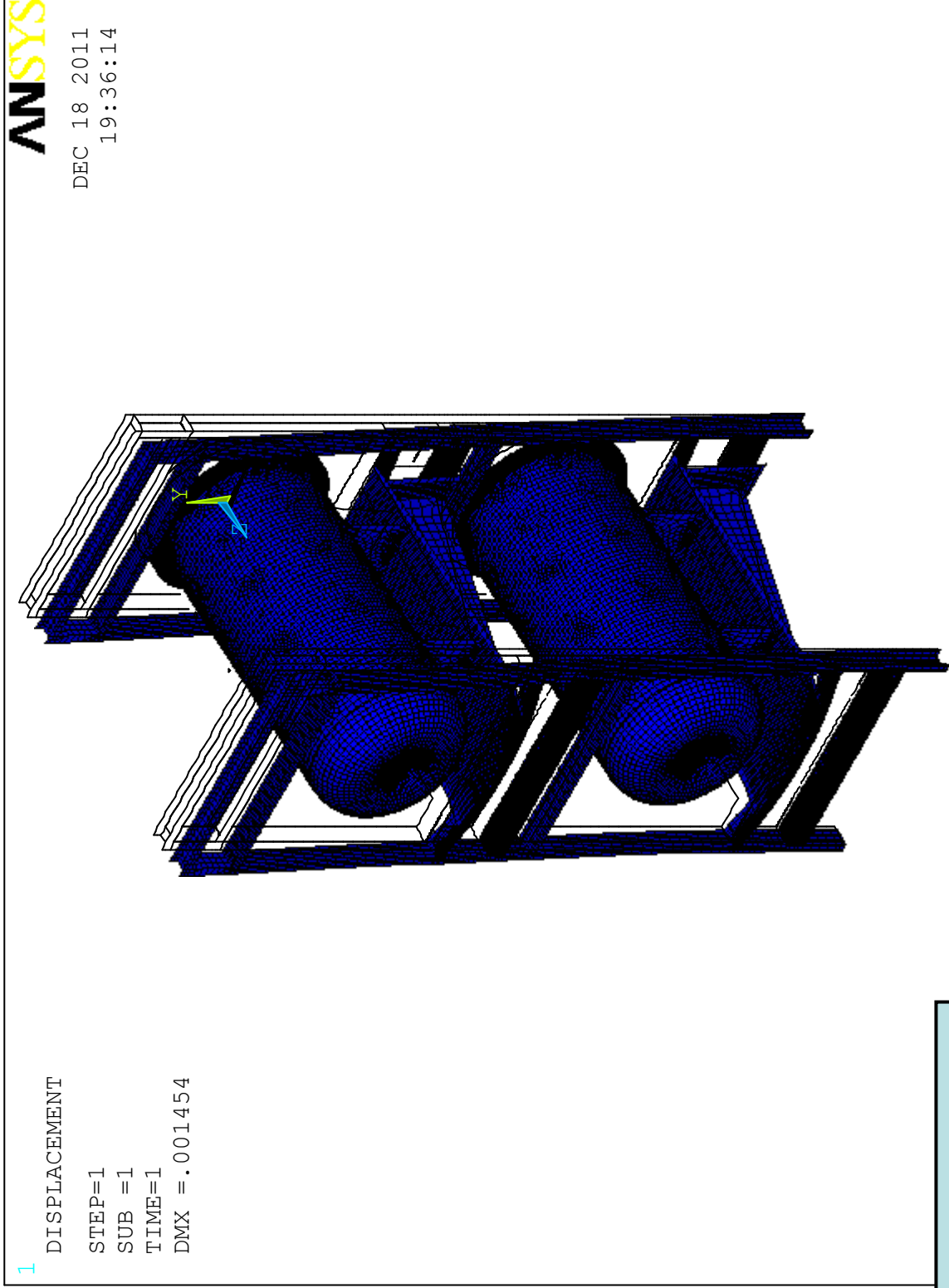
Slides: 4 - 12

Frames supported at the bottom



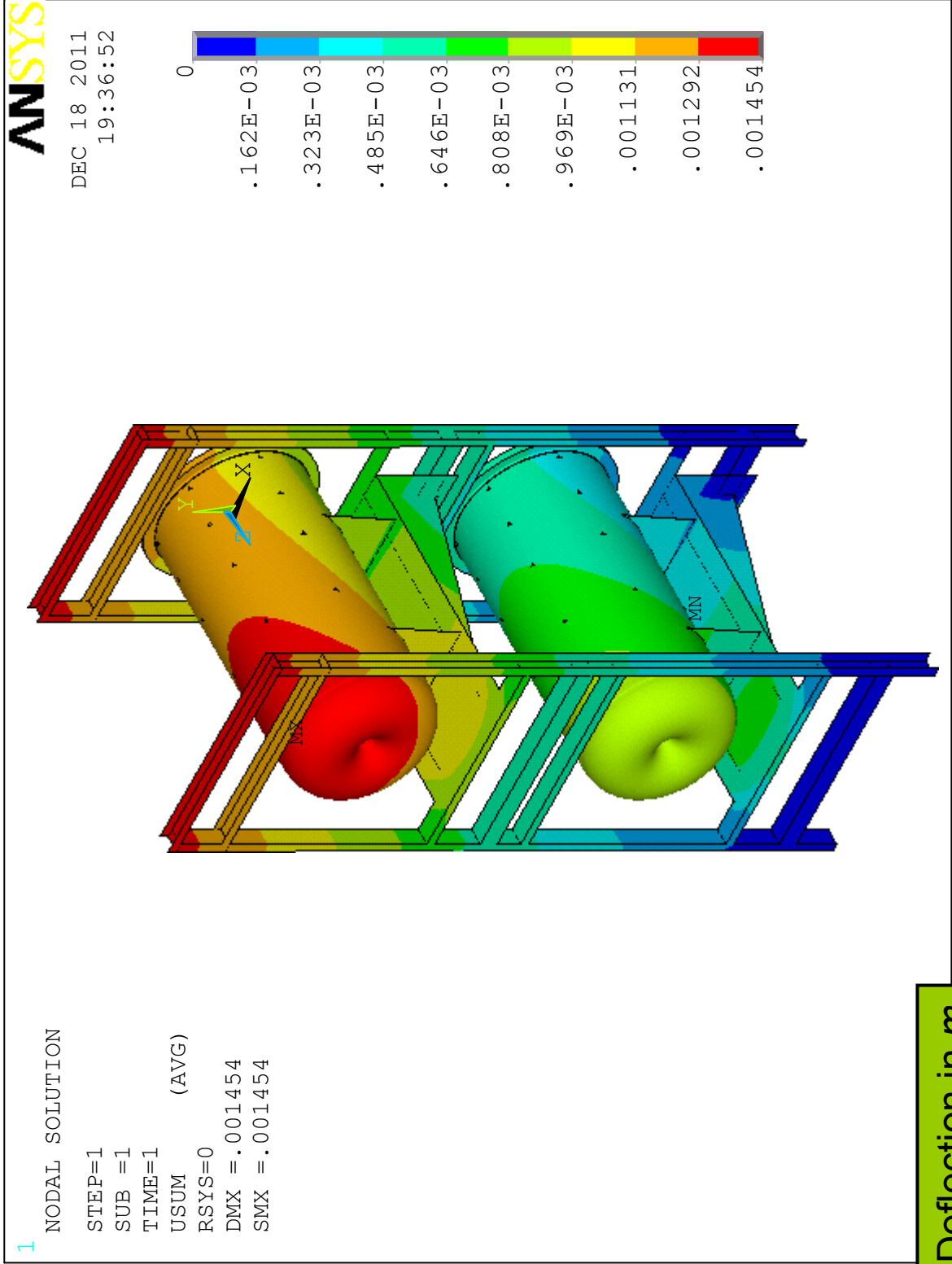
Mesh of elements, boundary conditions

Frames supported at the bottom

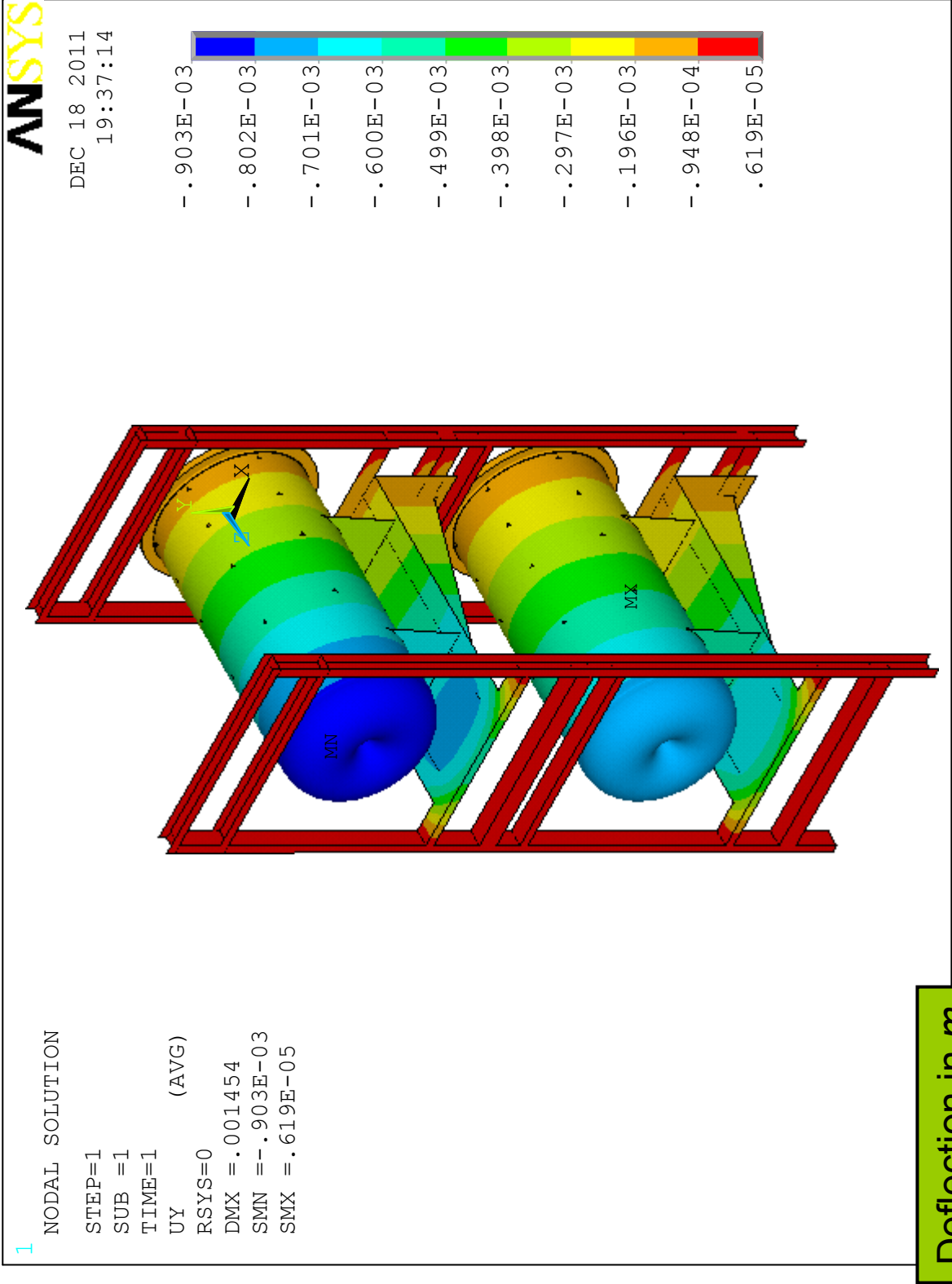


Deformation

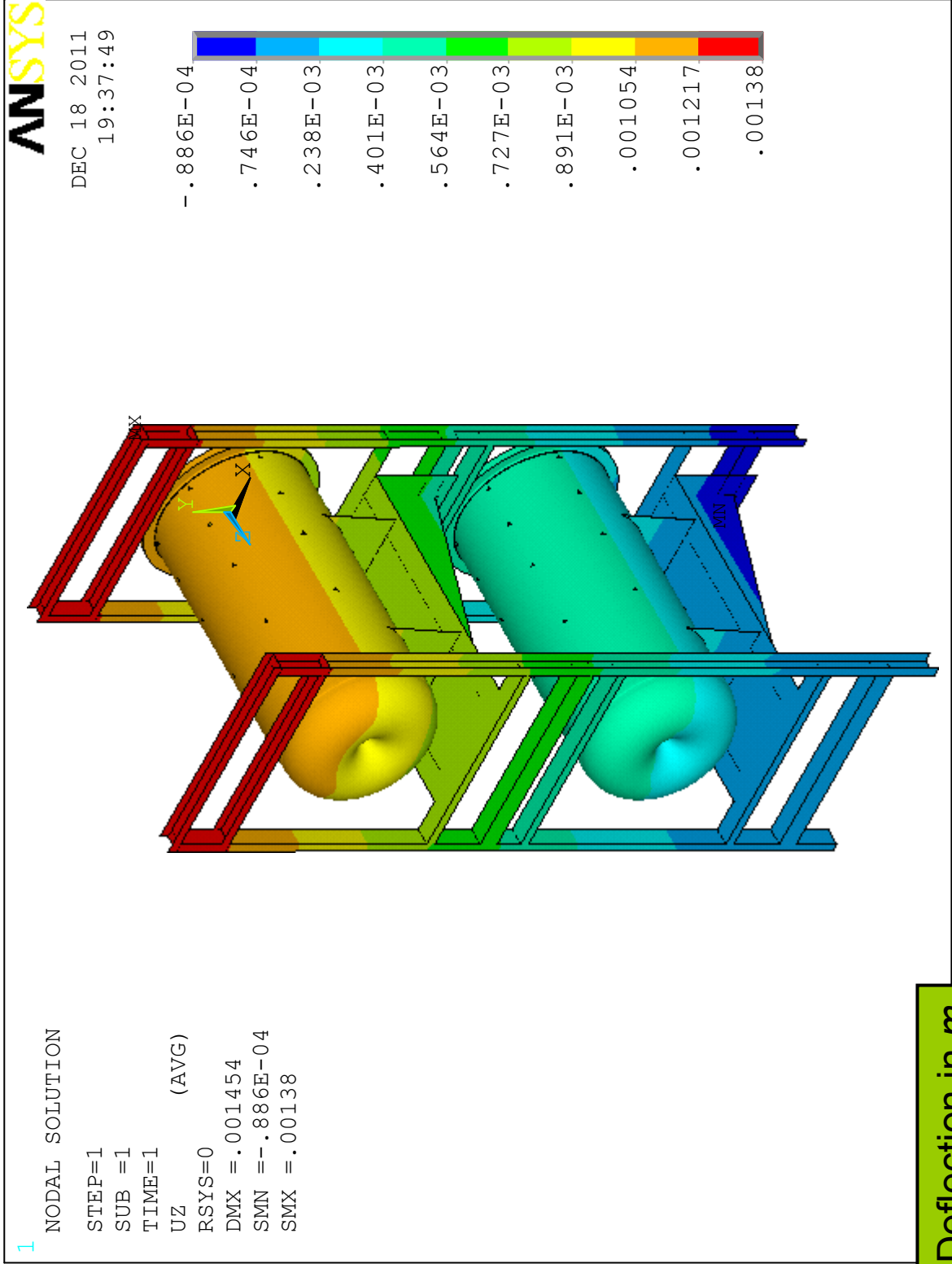
Frames supported at the bottom



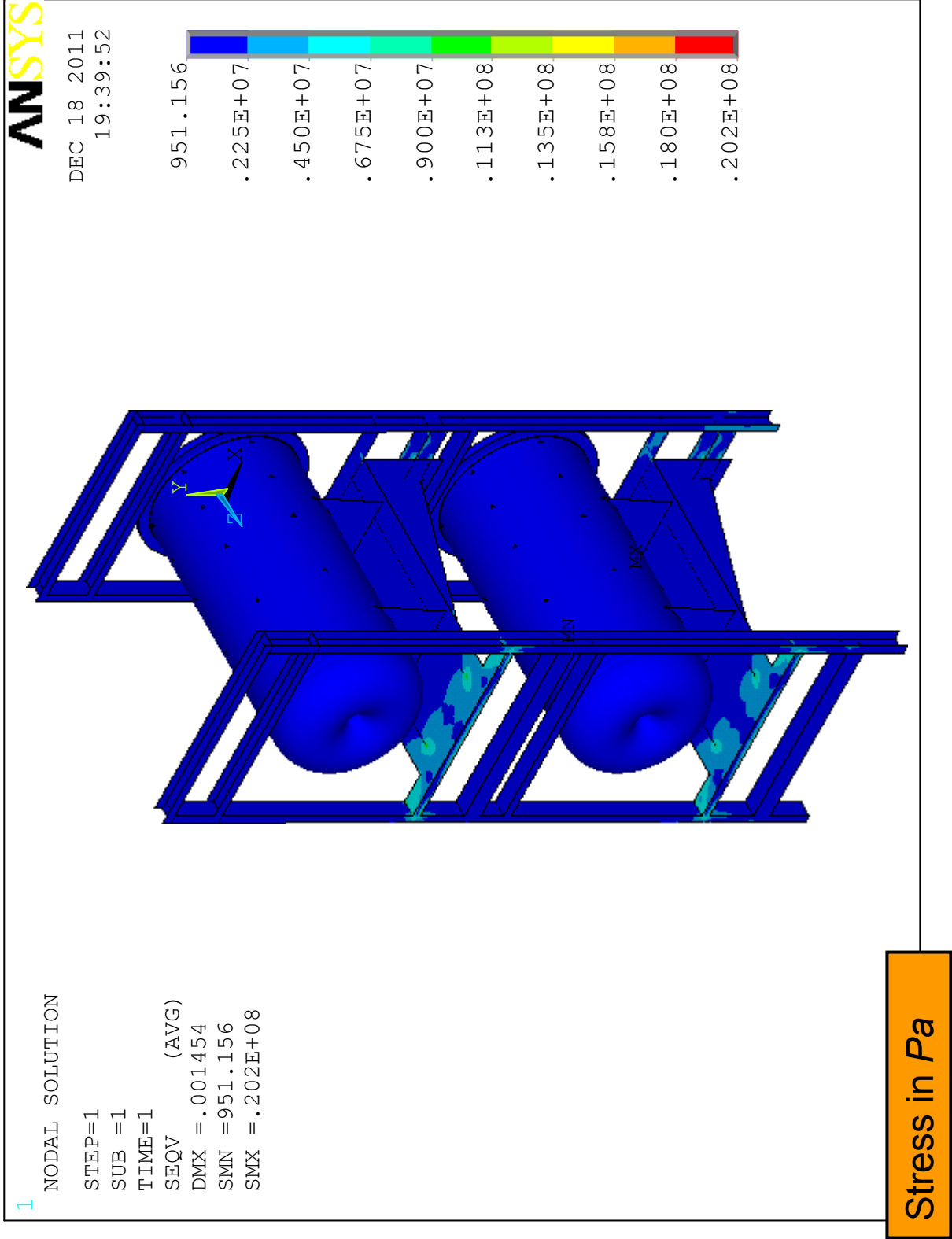
Frames supported at the bottom

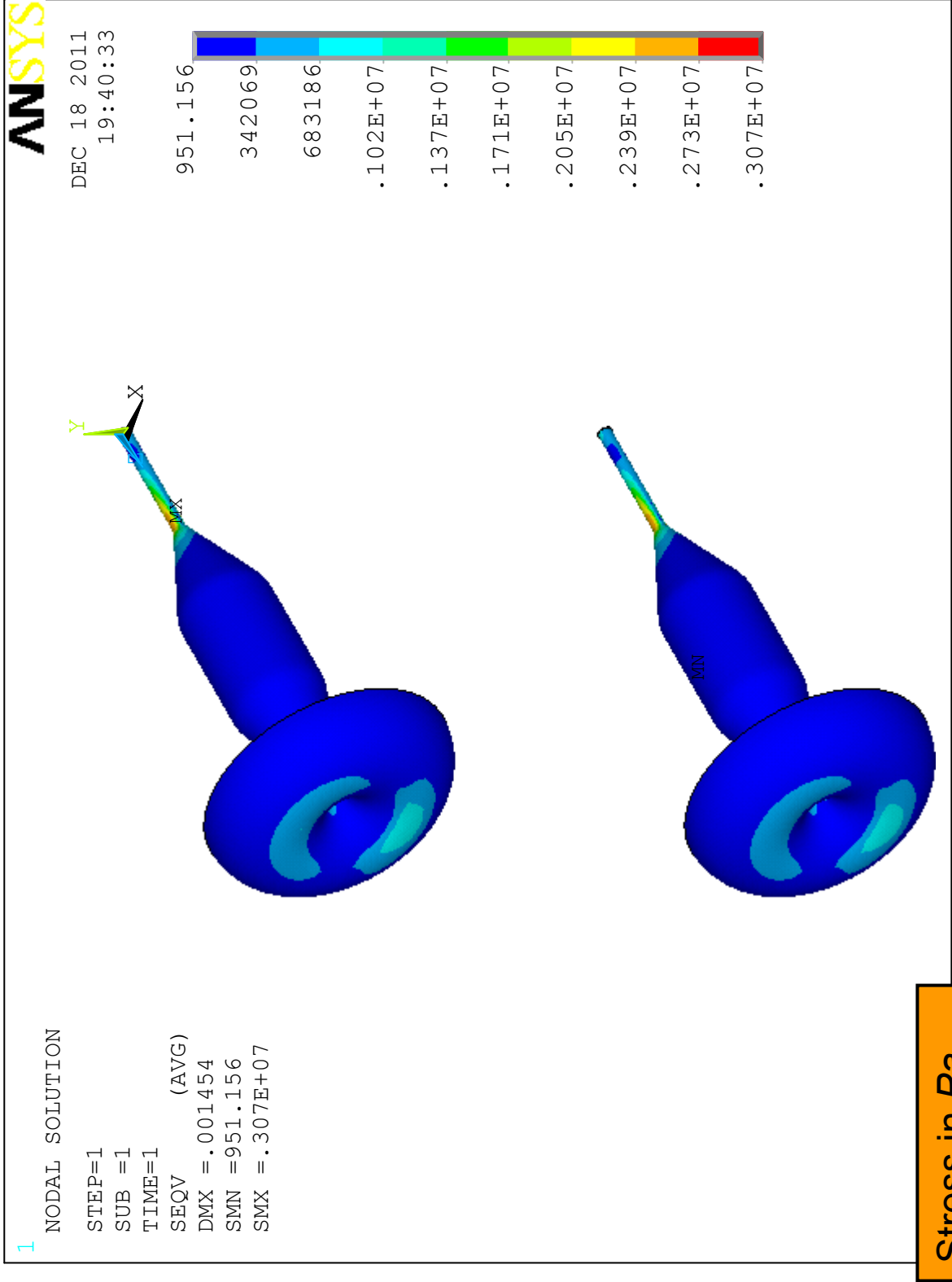


Frames supported at the bottom

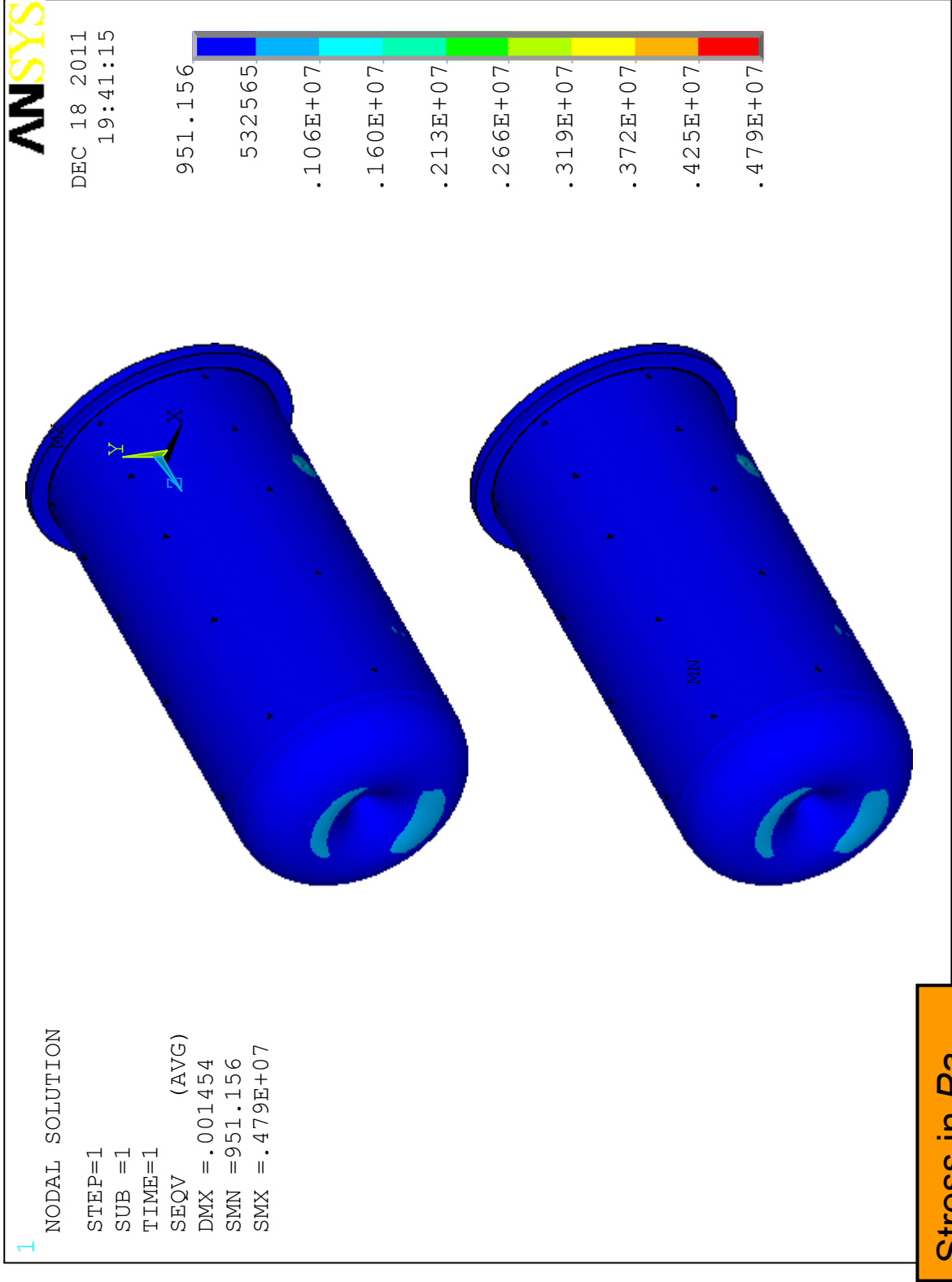


Frames supported at the bottom

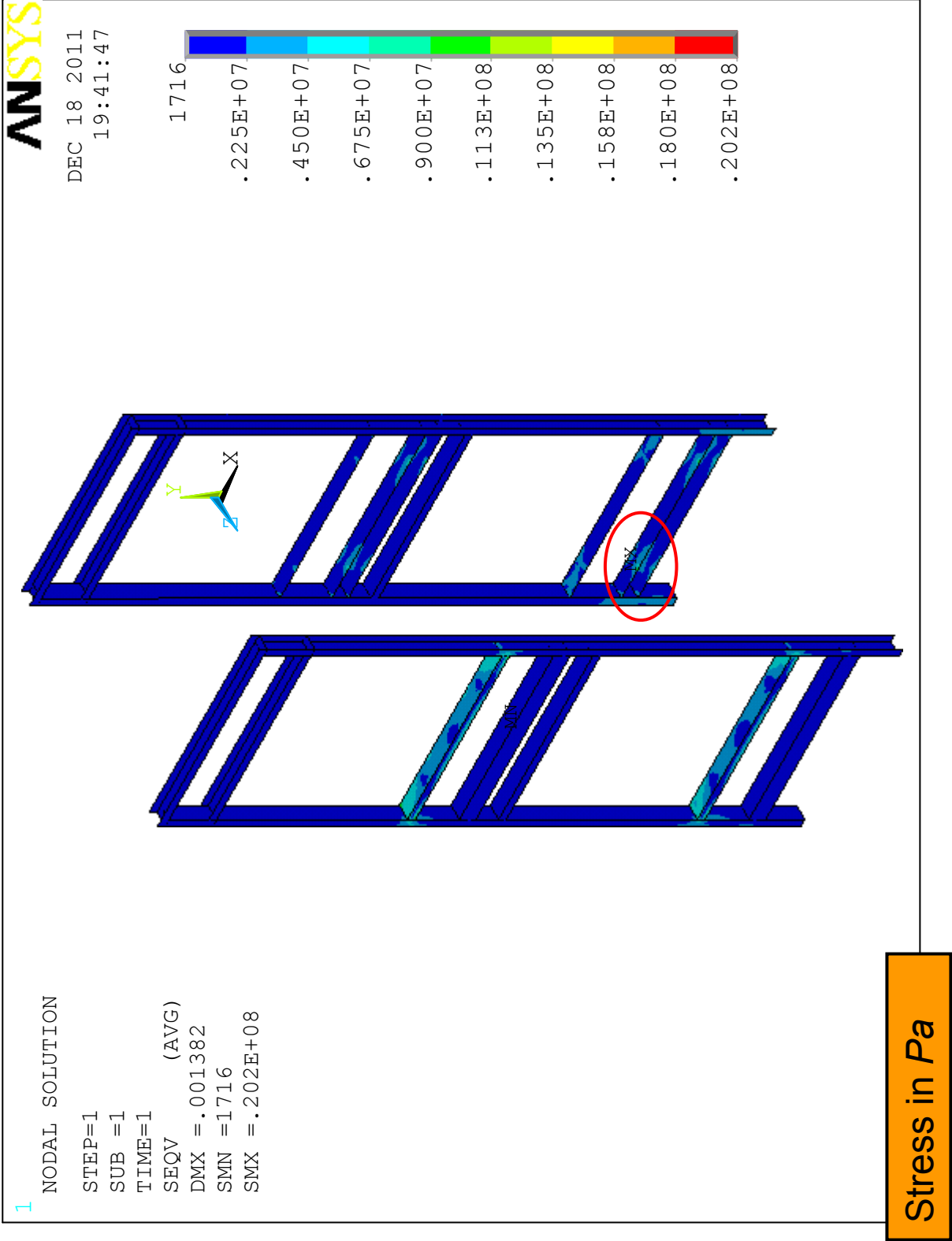




Frames supported at the bottom

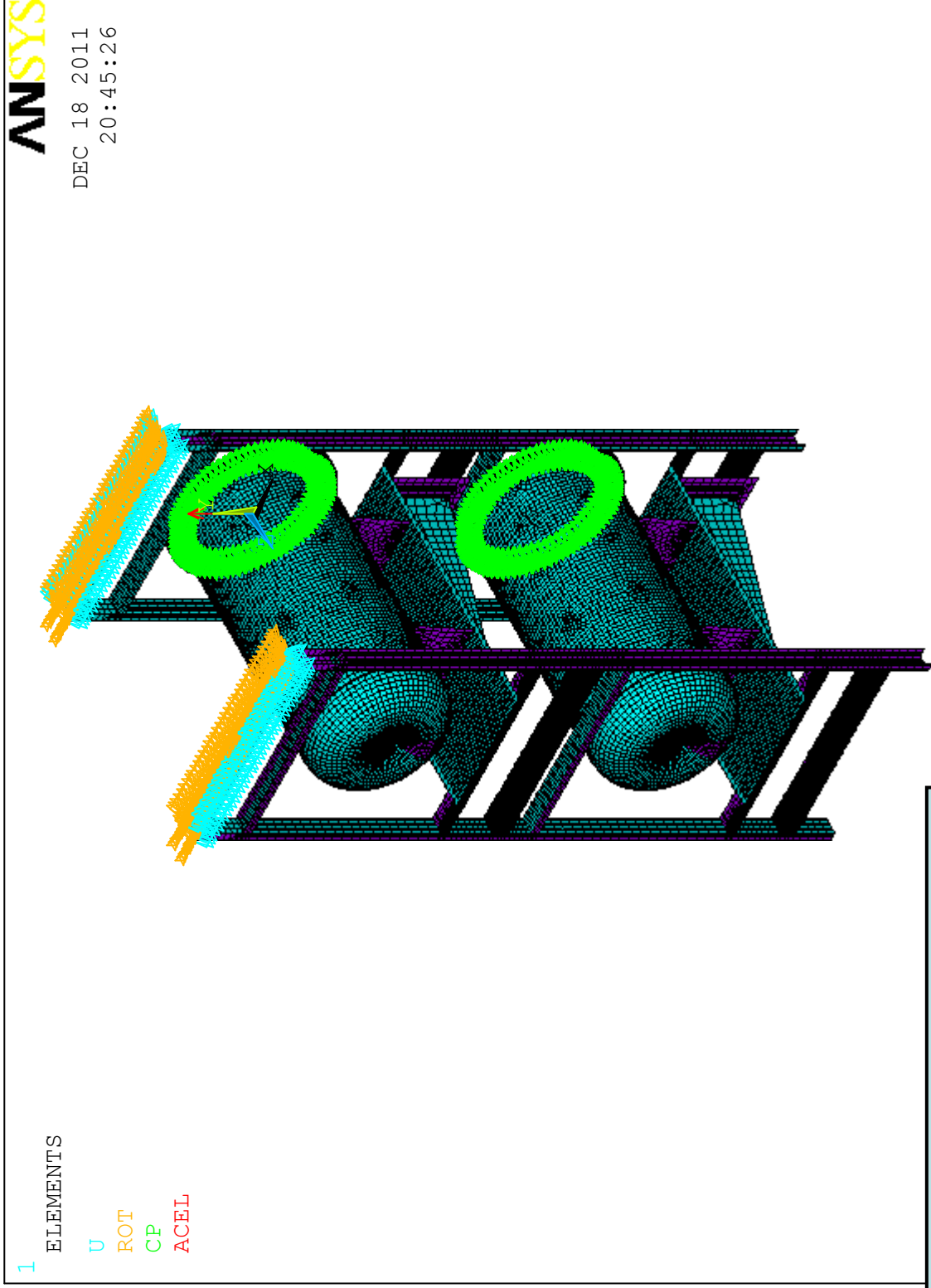


Frames supported at the bottom



Frames supported on the top,

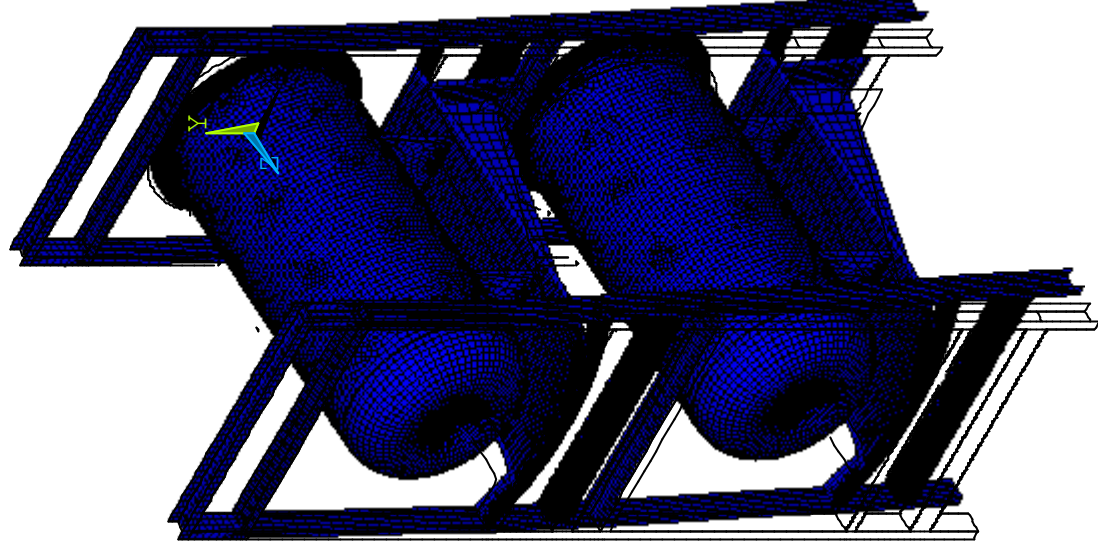
Slides: 14 - 22



Mesh of elements, boundary conditions

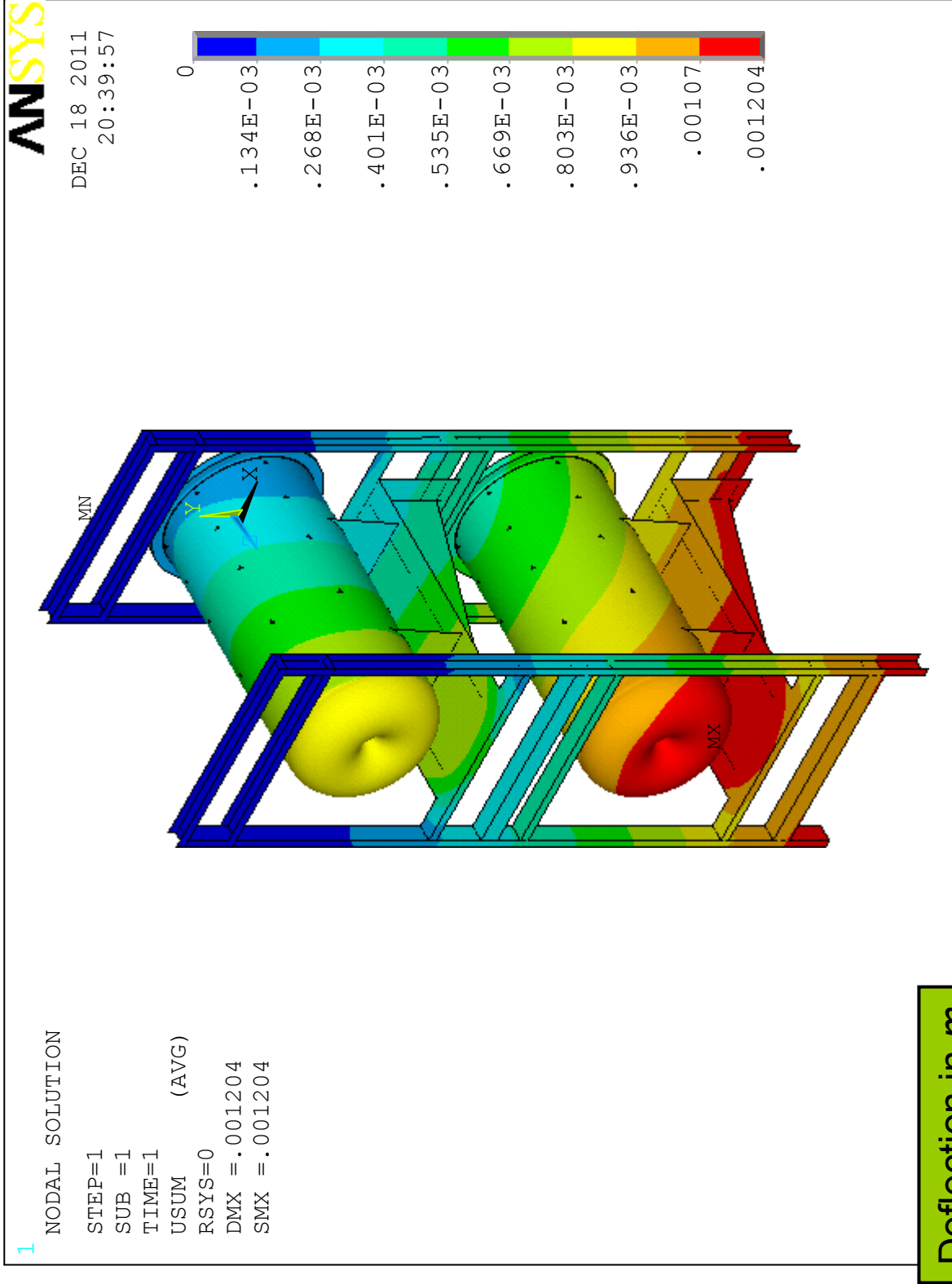
ANSYS

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20:39:02

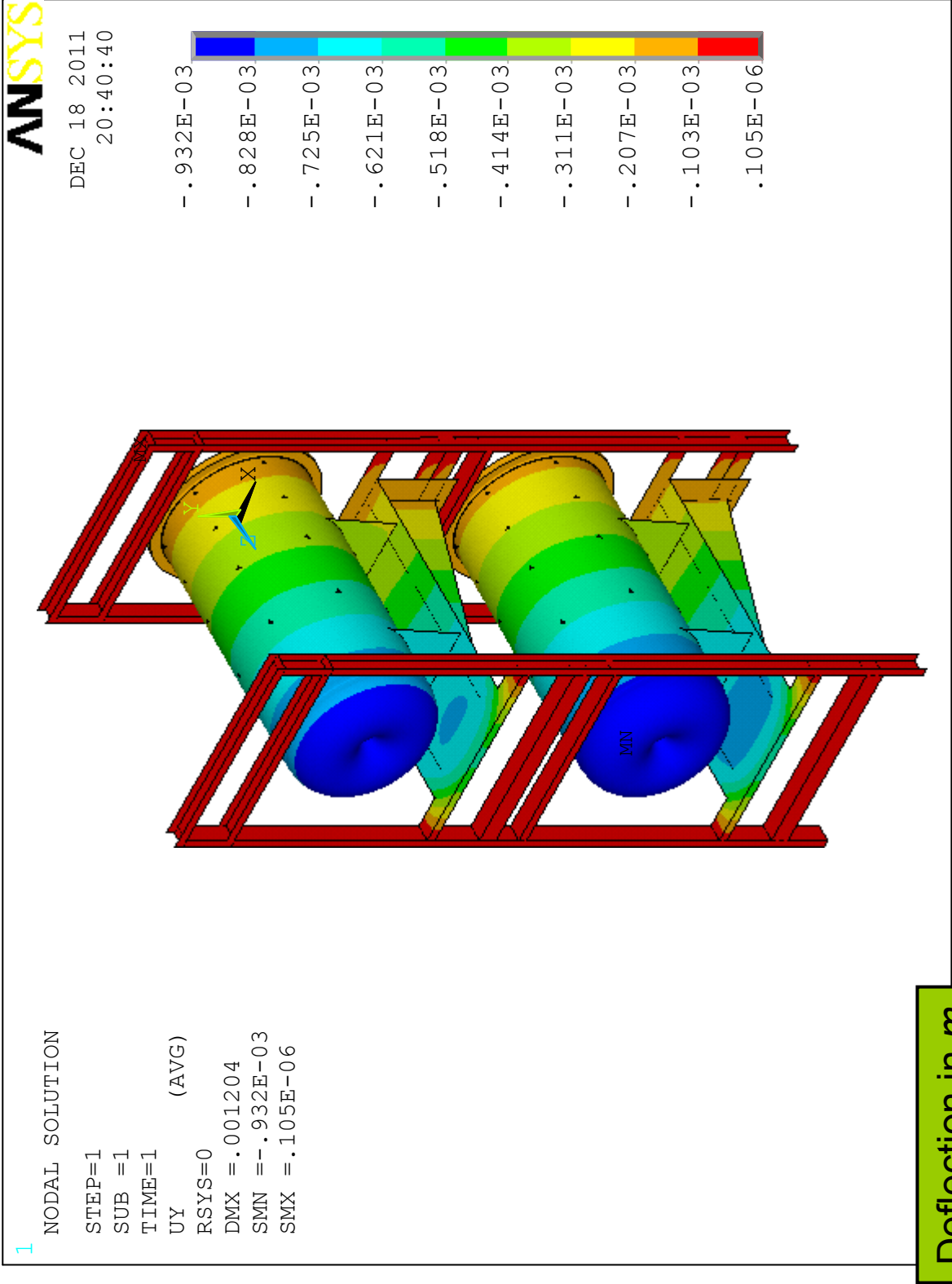


1 DISPLACEMENT
STEP=1
SUB =1
TIME=1
DMX =.001204

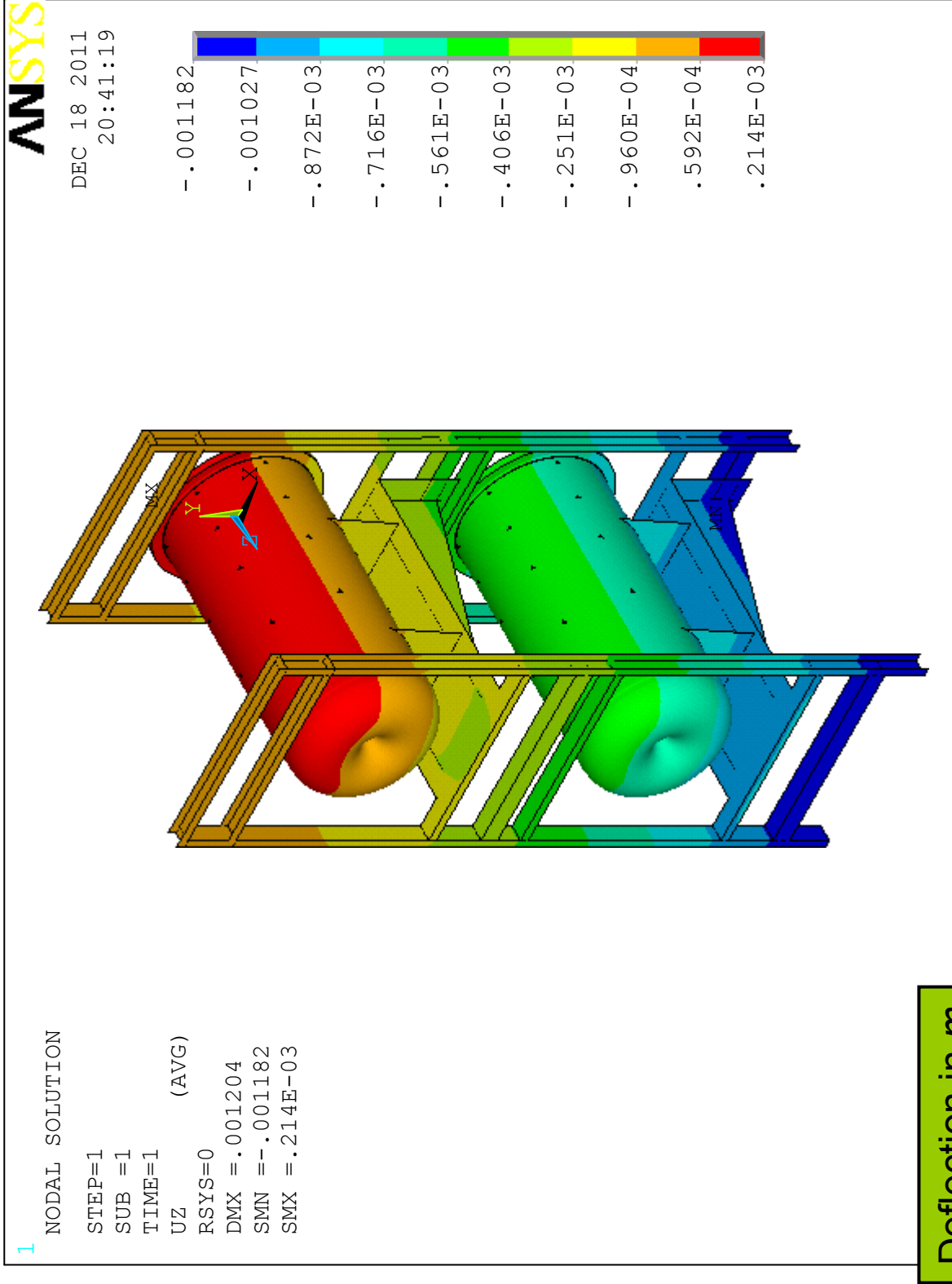
Deformation

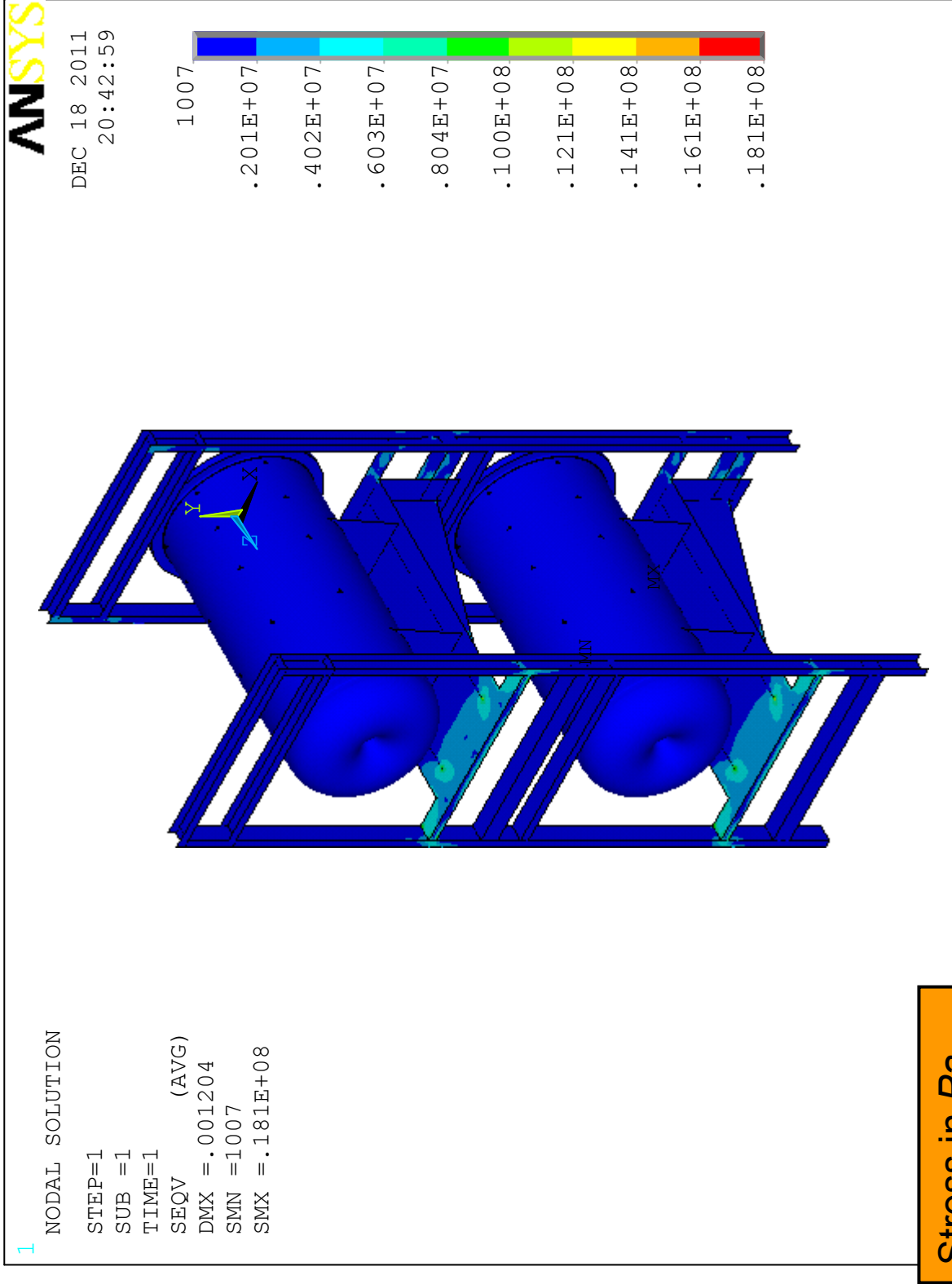


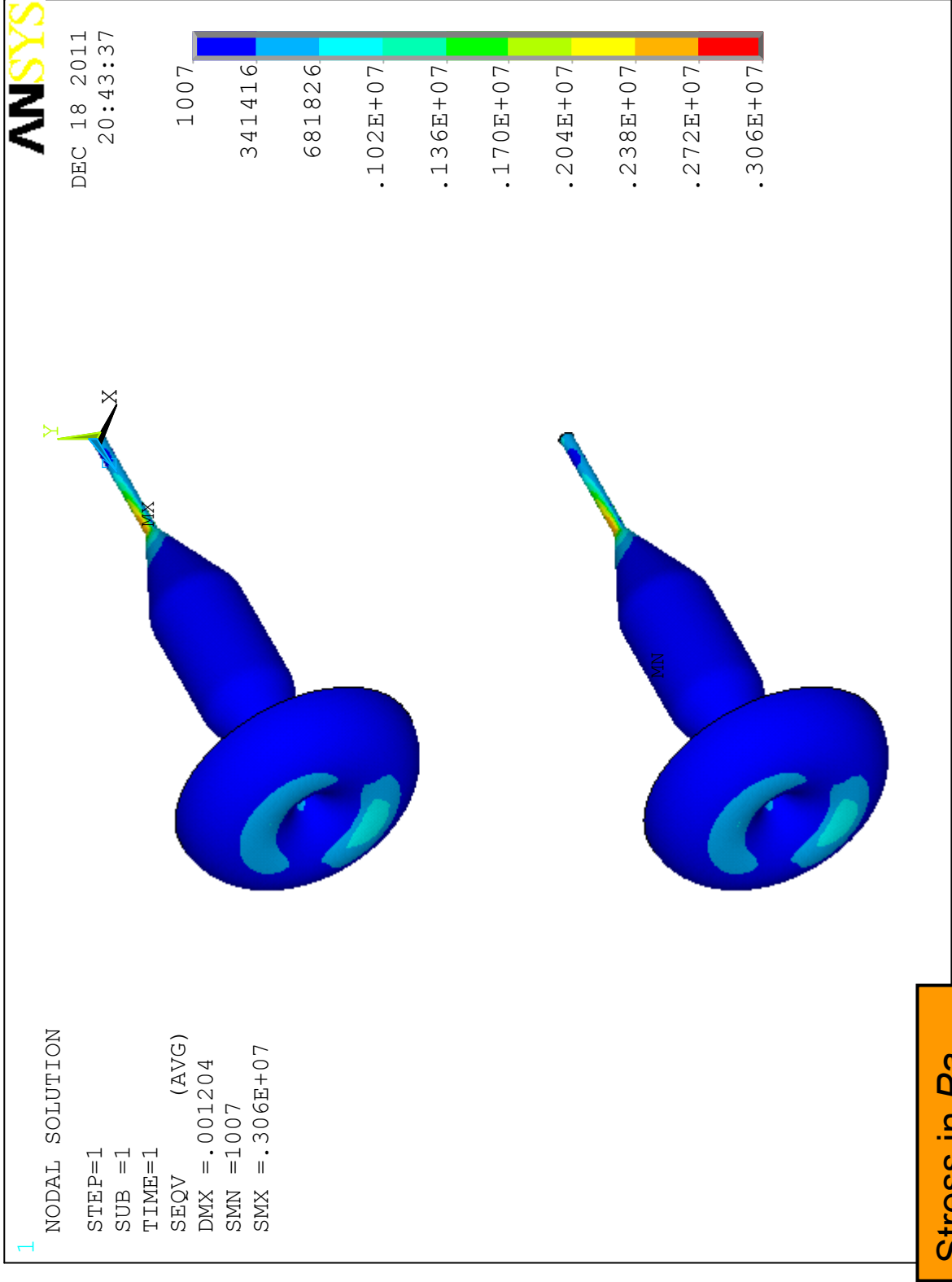
Frames supported on the top

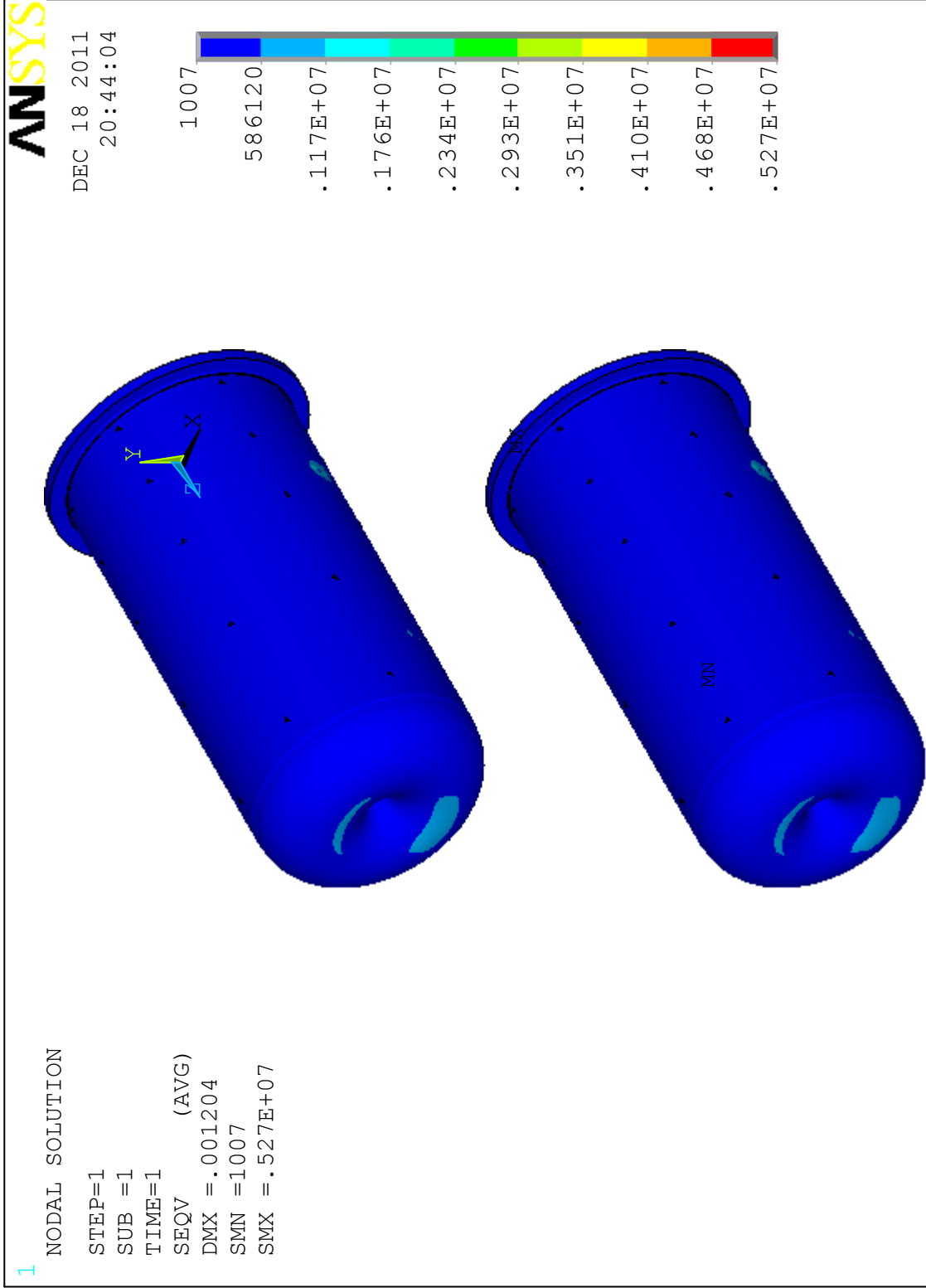


Deflection in *m*

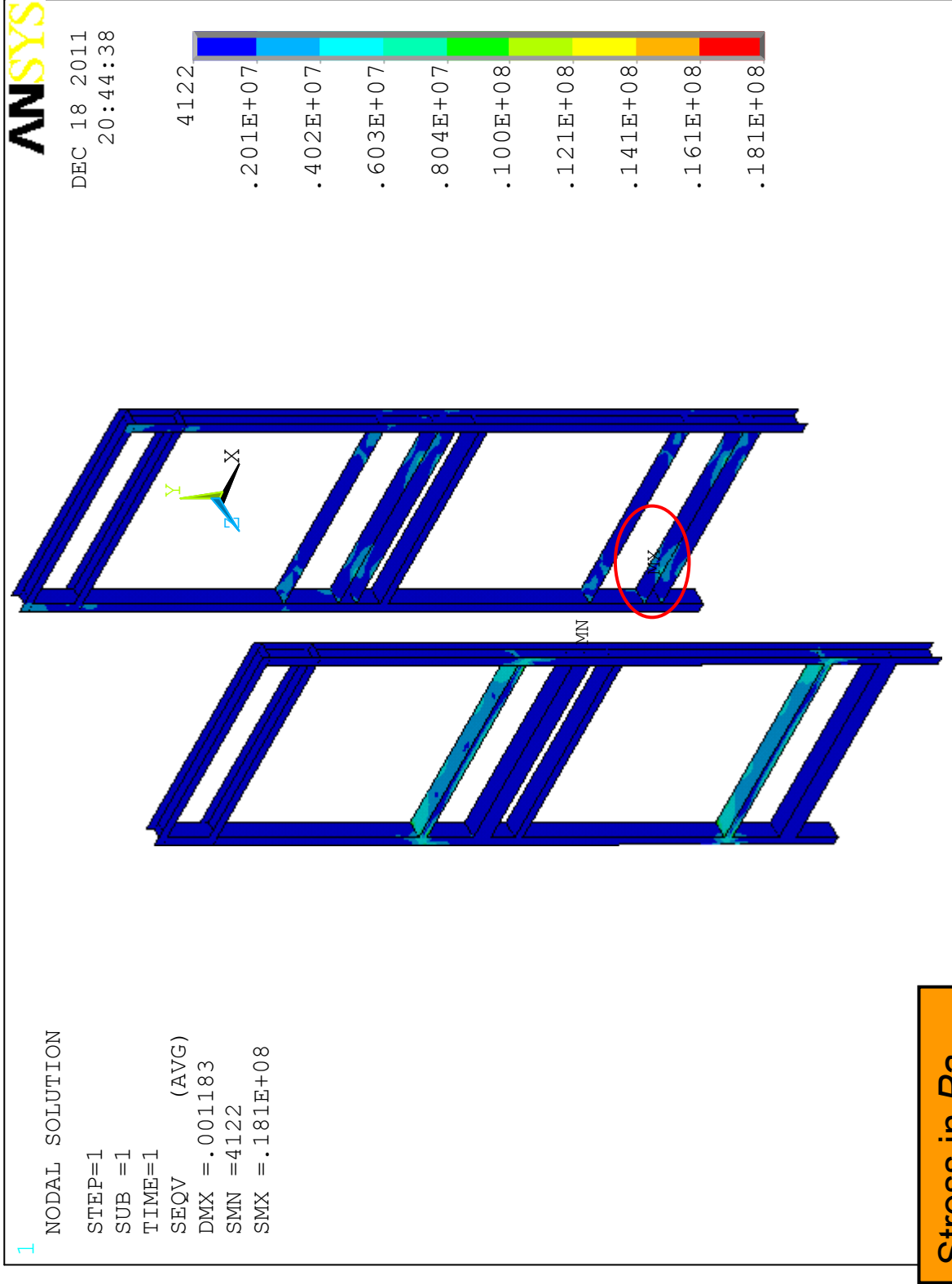








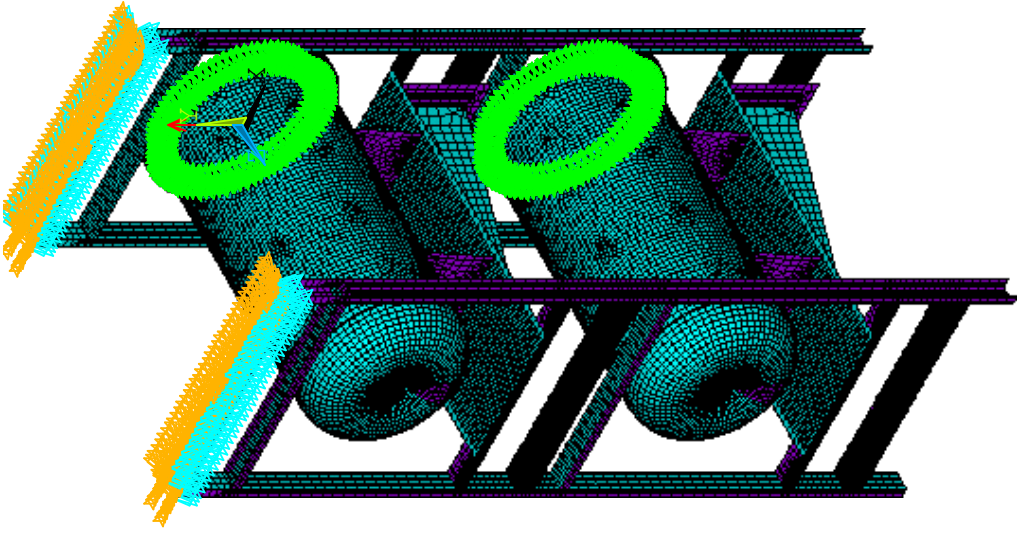
Stress in Pa



Two horns supported in two frames – summary of static results

Supports location	$ u_y _{\max}$ <i>mm</i>	$ u_z _{\max}$ <i>mm</i>	$u_{\text{sum},\max}$ <i>mm</i>	$\sigma_{\text{eqv},\max}$ <i>MPa</i>	Remarks
Bottom	0.90	1.38	1.45	20.2	Max. Stress in frame
Top	0.93	1.18	1.20	18.1	Max. Stress in frame

Modal results for 2
horns supported in 2
frames on the top



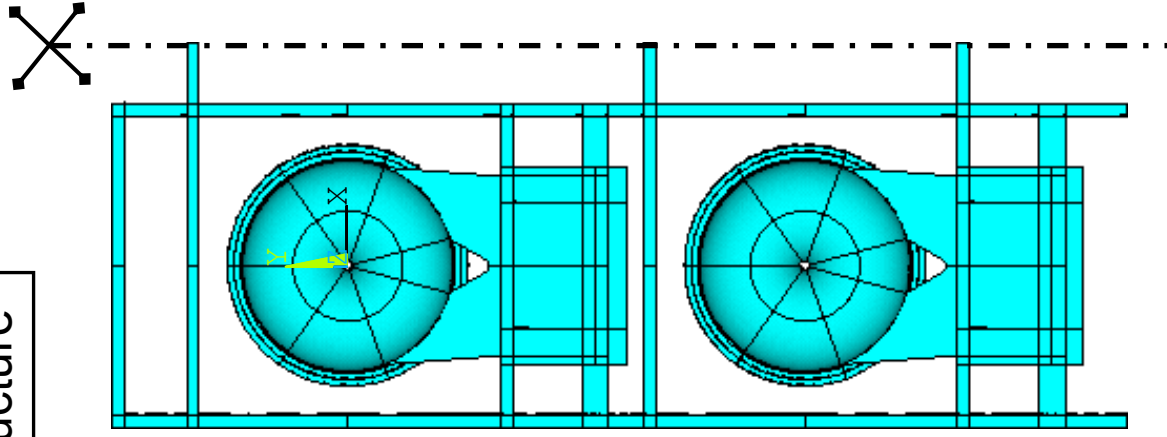
Frames supported on the top

Lowest five natural
frequencies

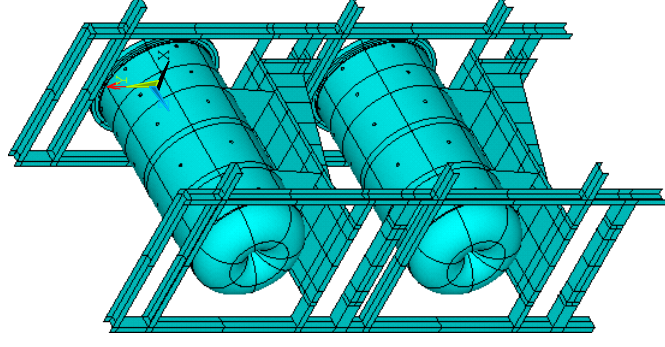
1	1.99 Hz
2	3.34 Hz
3	4.32 Hz
4	7.15 Hz
5	9.18 Hz

System of four horns supported in two frames

FE analysis of
symmetric half
of the structure

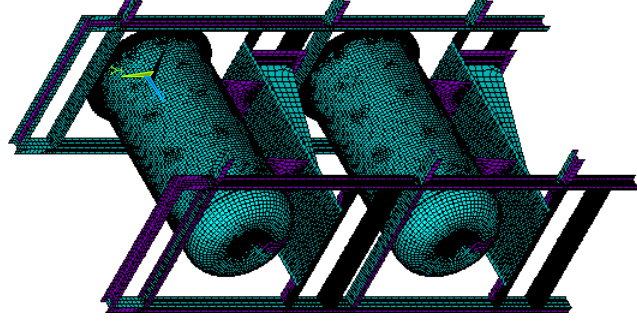


1 AREAS
TYPE NUM
ACEL



ANSYS
DEC 20 2011
11:25:39

4 ELEMENTS

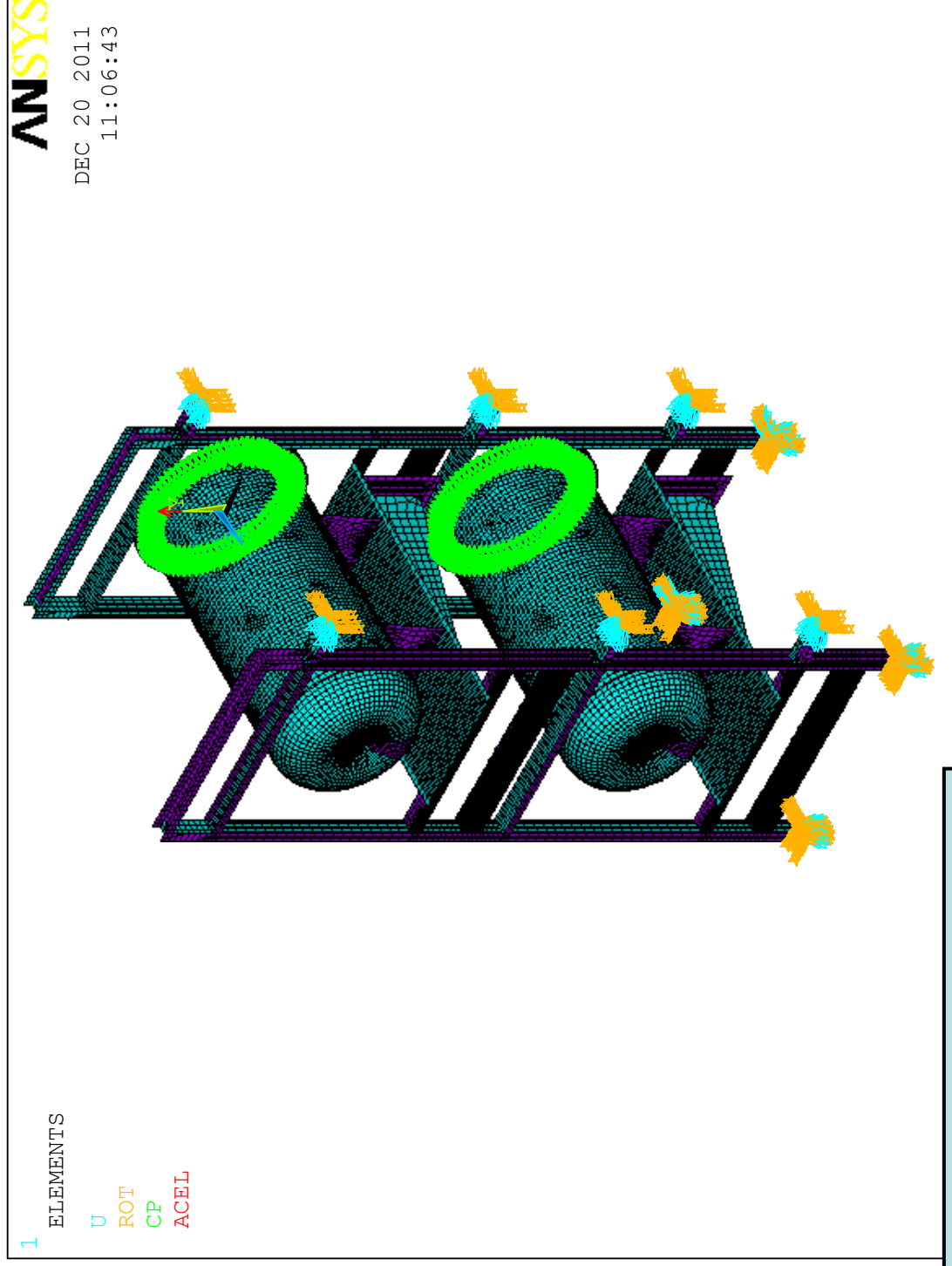


ANSYS
DEC 20 2011
09:46:52

Frames supported at the bottom,

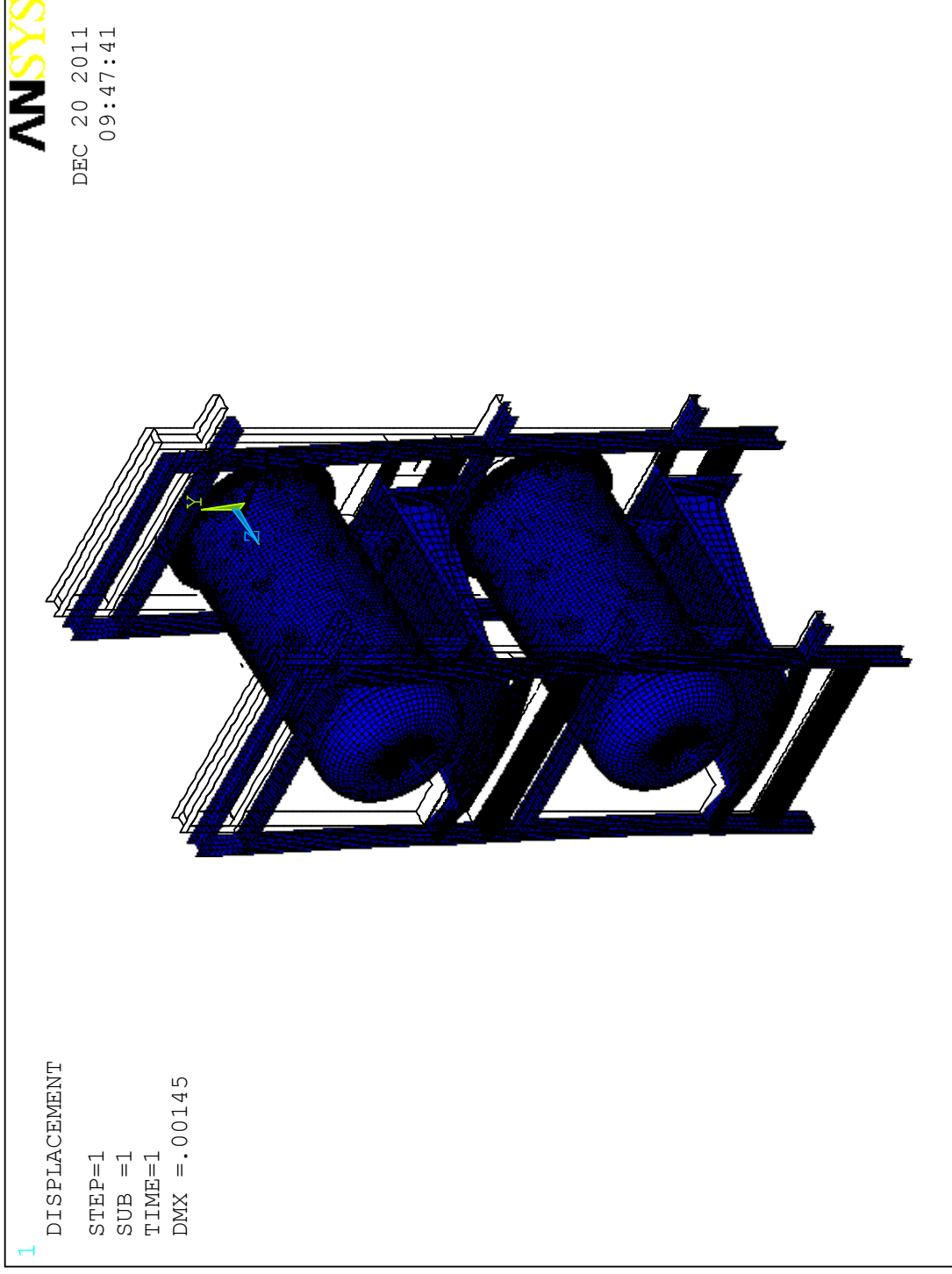
slides: 28 - 36

Frames supported at the bottom

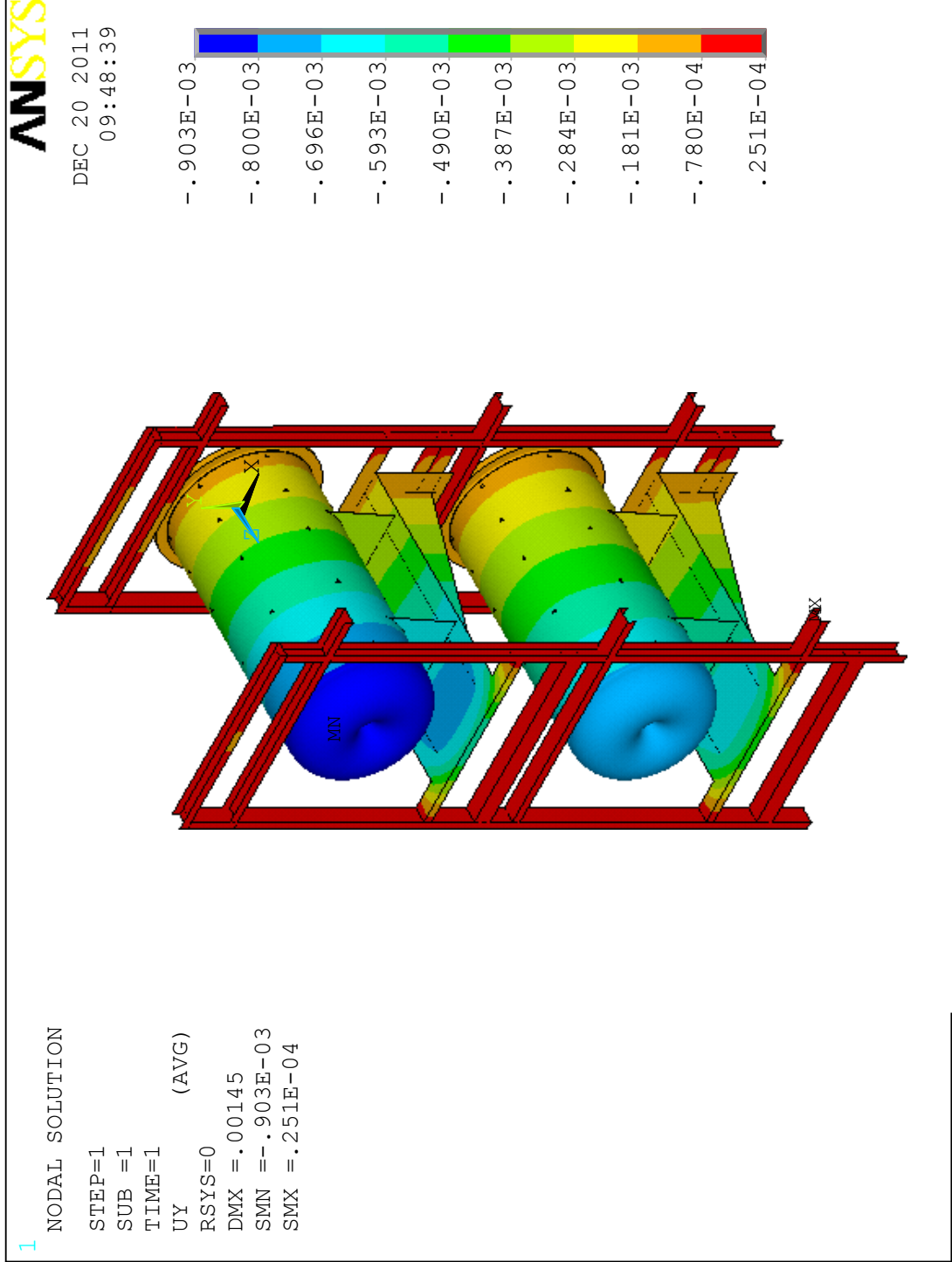


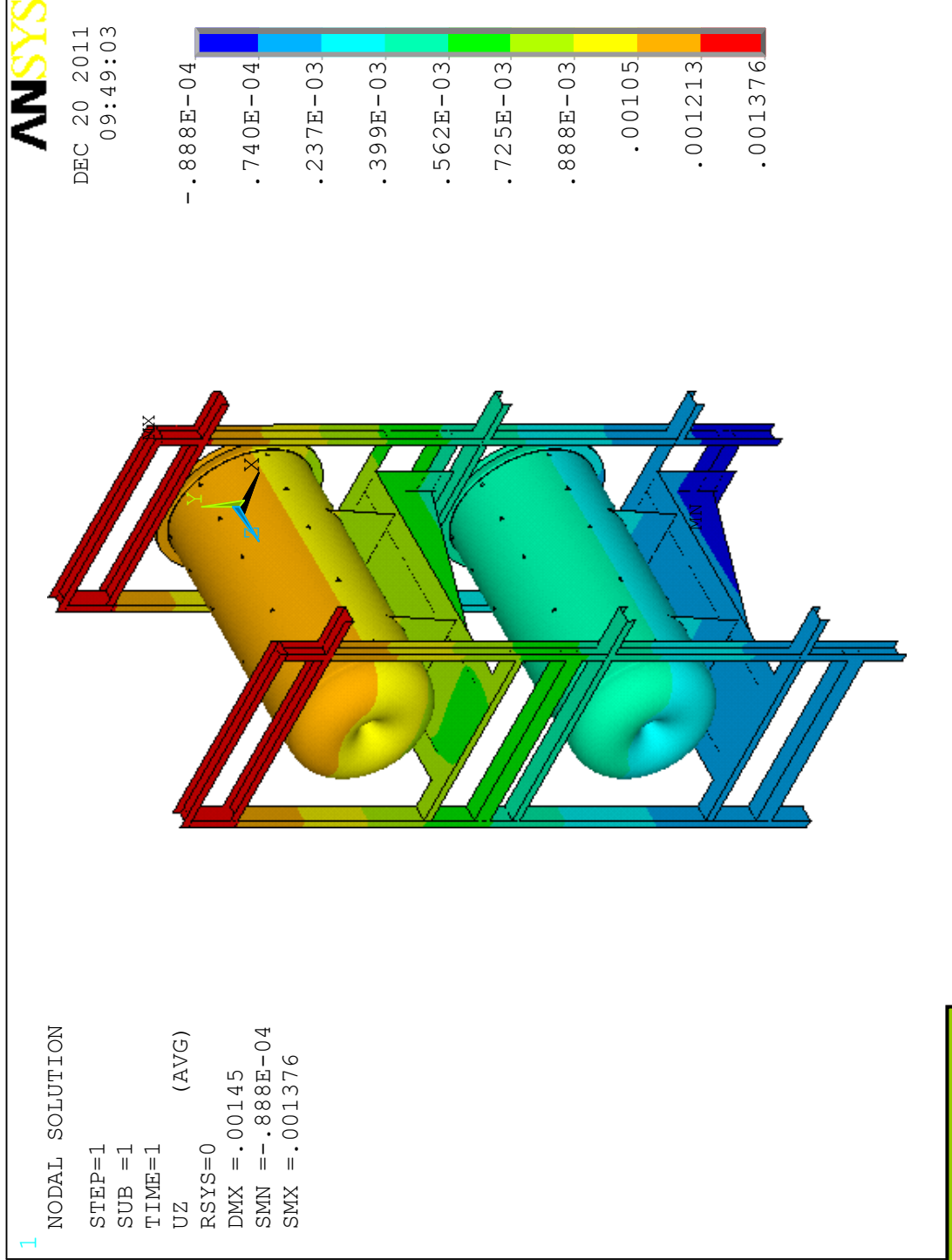
Mesh of elements, boundary conditions

Frames supported at the bottom



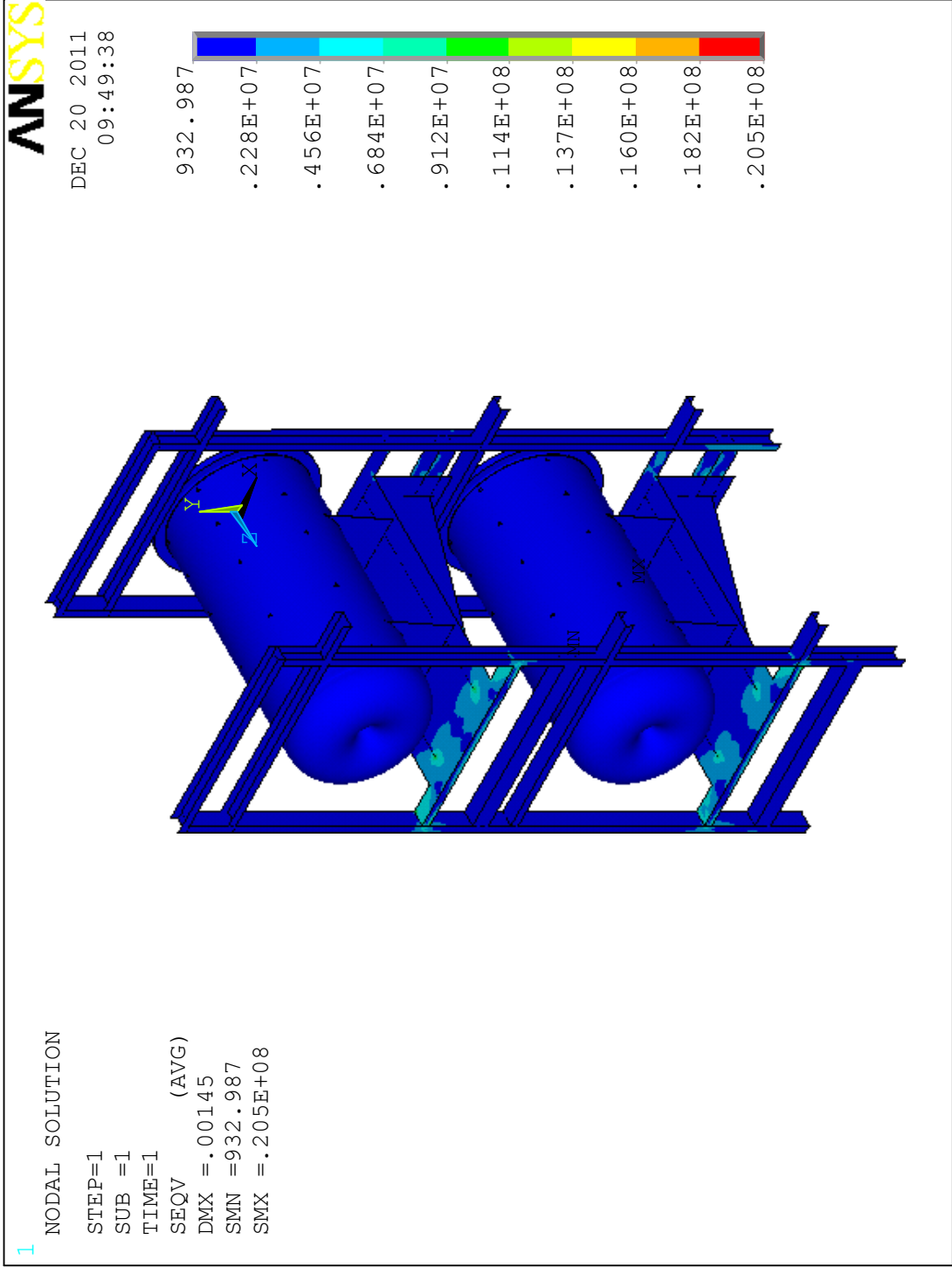
Deformation

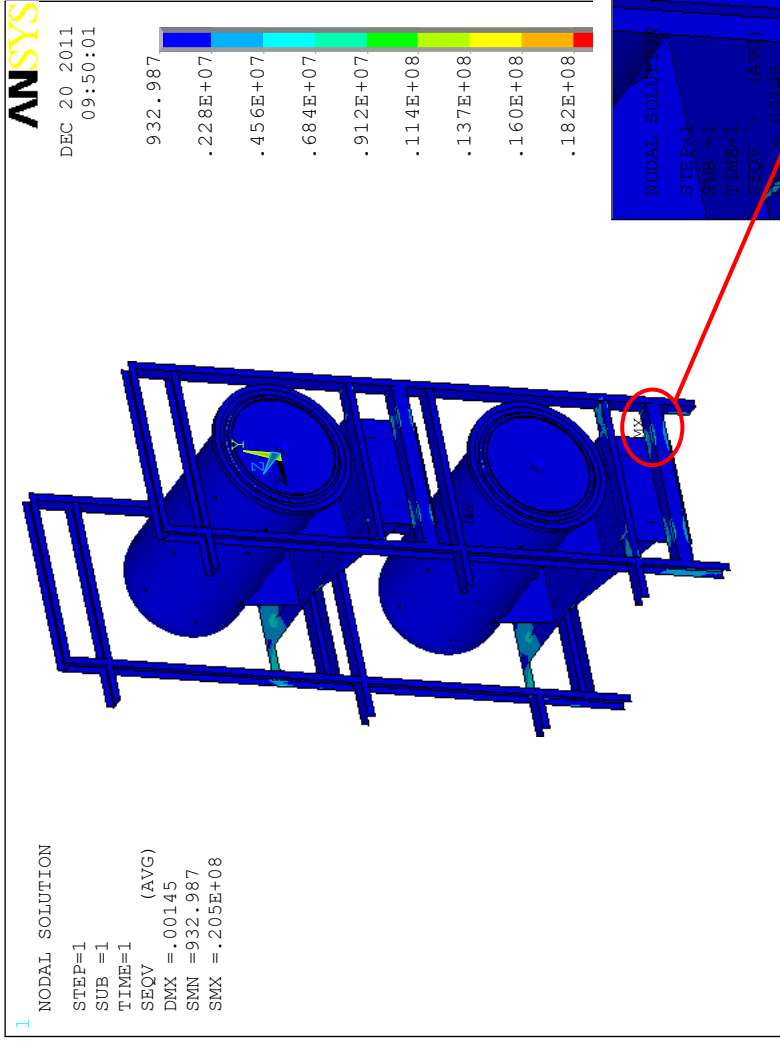




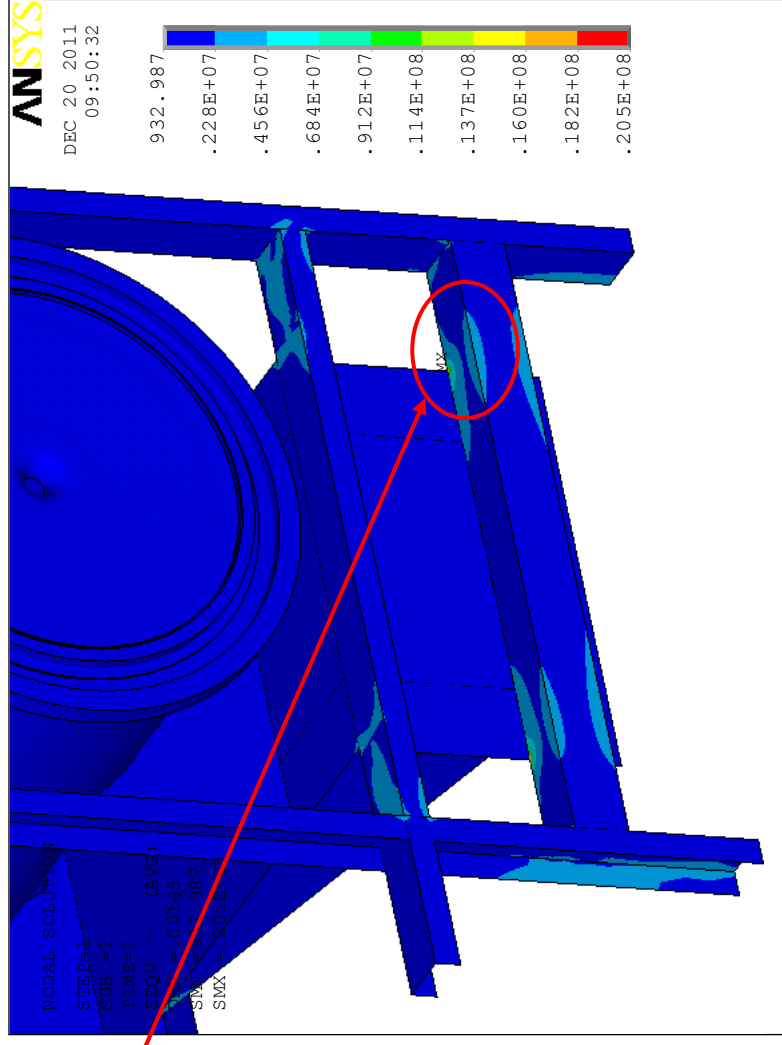
Deflection in m

Frames supported at the bottom



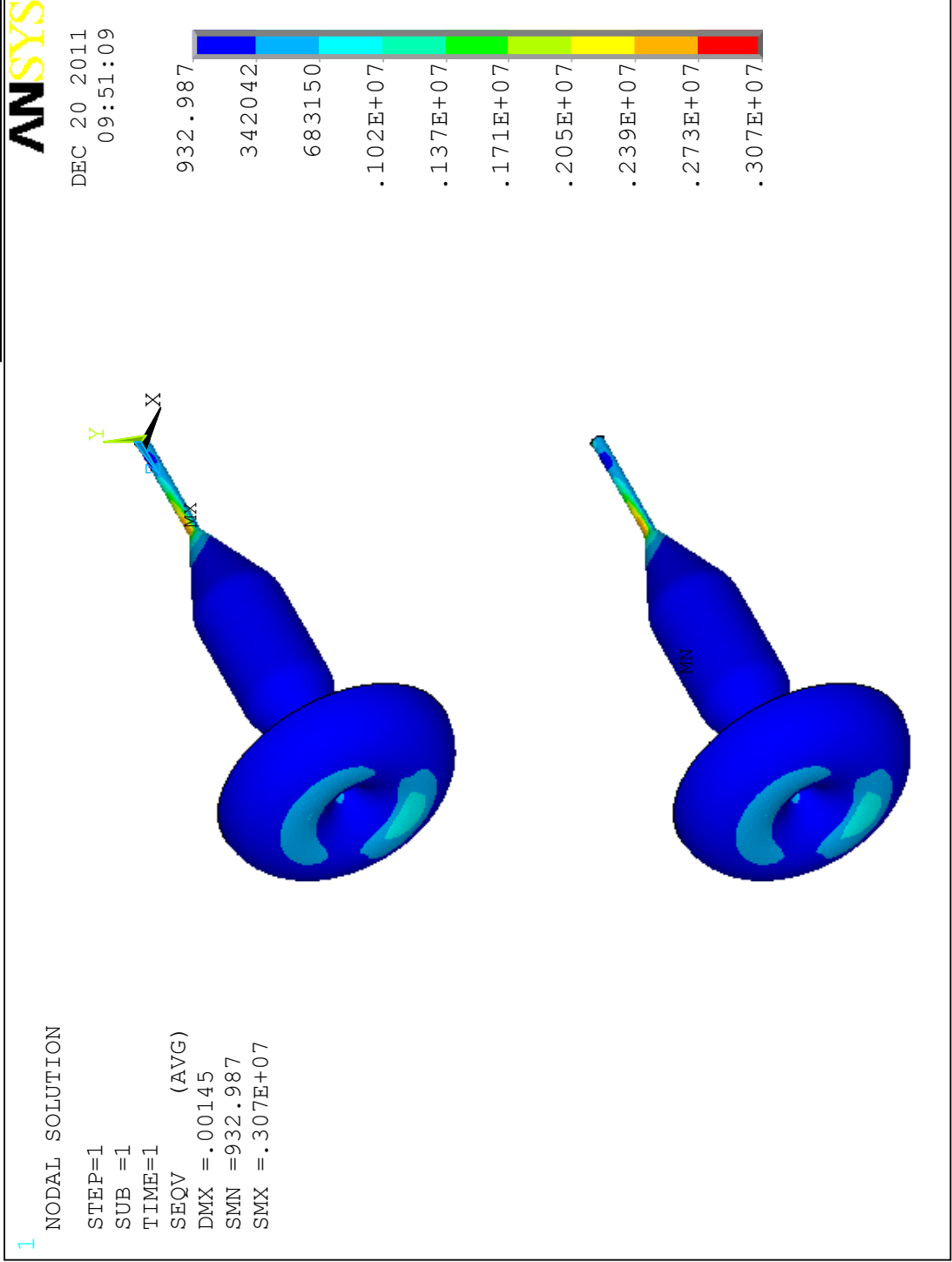


Frames supported at the bottom



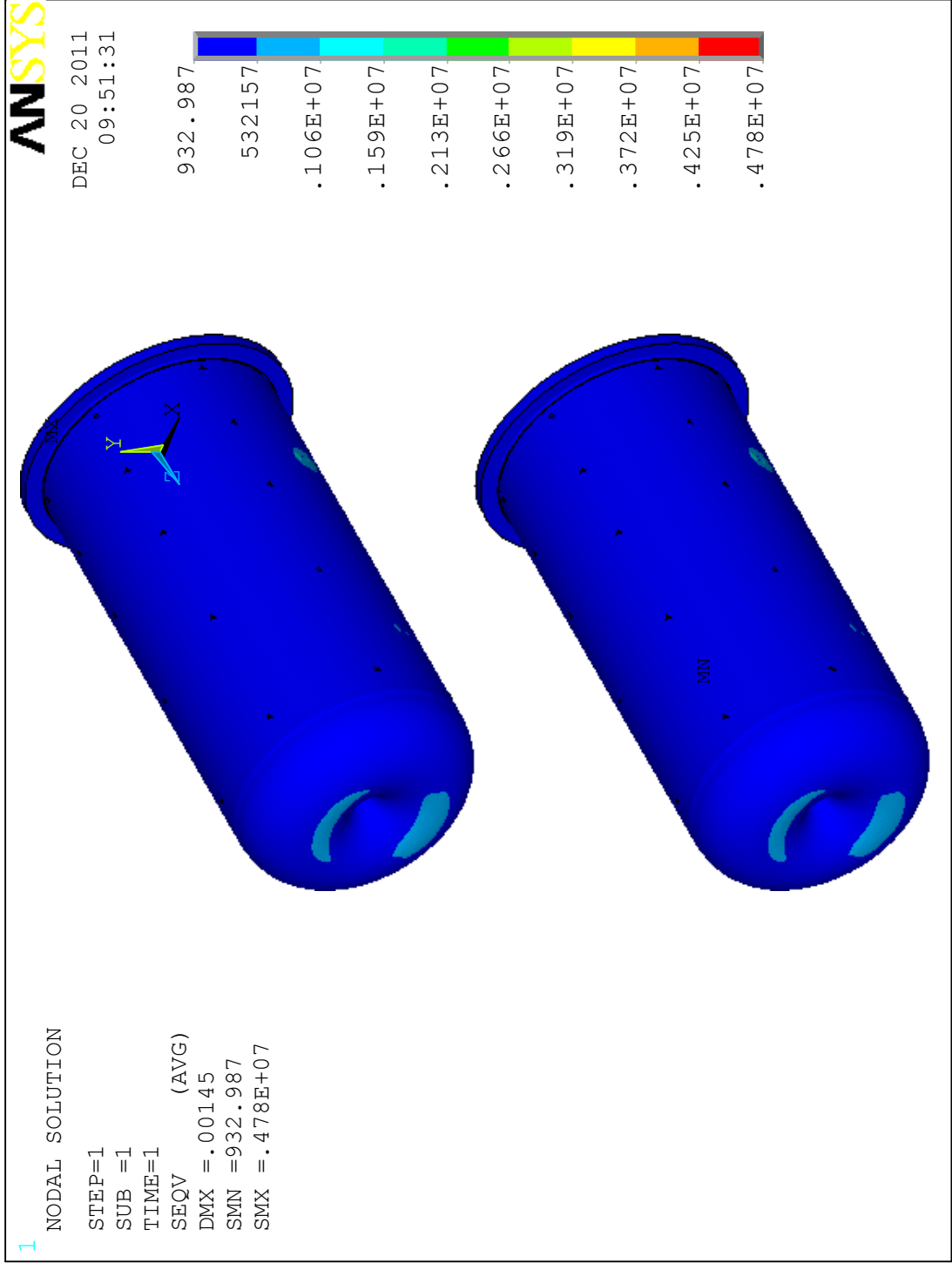
Stress in Pa

Frames supported at the bottom

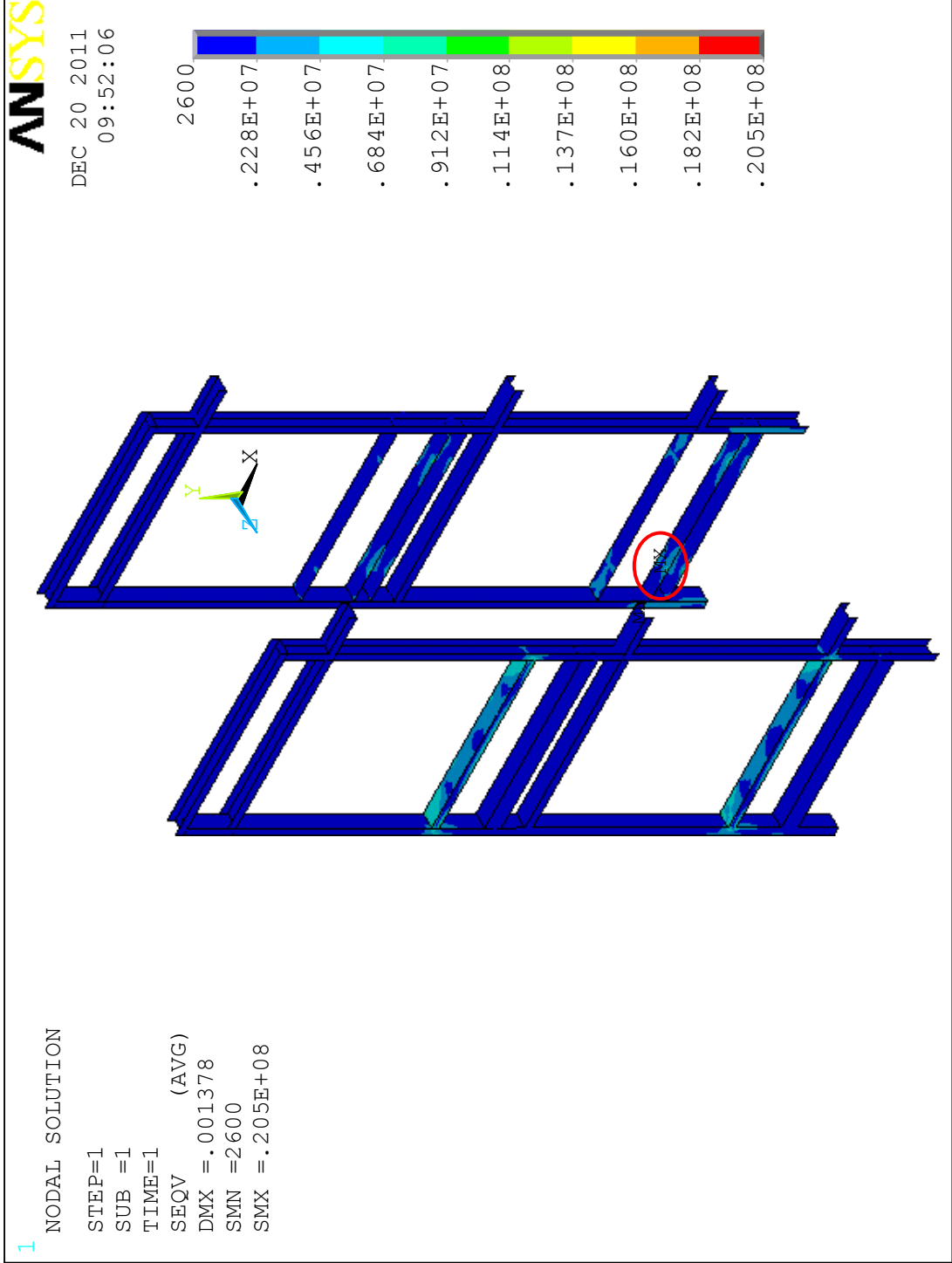


Stress in Pa

Frames supported at the bottom



Frames supported at the bottom



Stress in Pa

Frames supported on the top,

Slides: 38 - 46

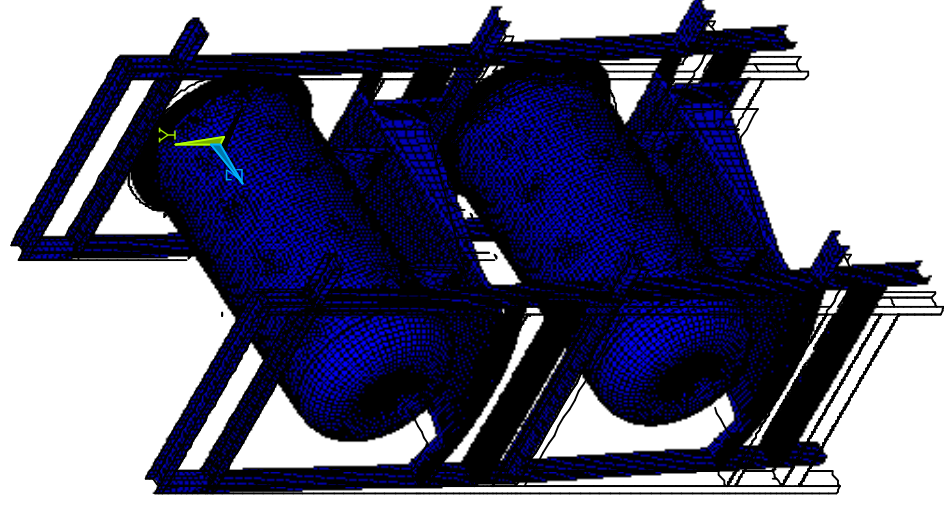
Frames supported on the top



Frames supported on the top

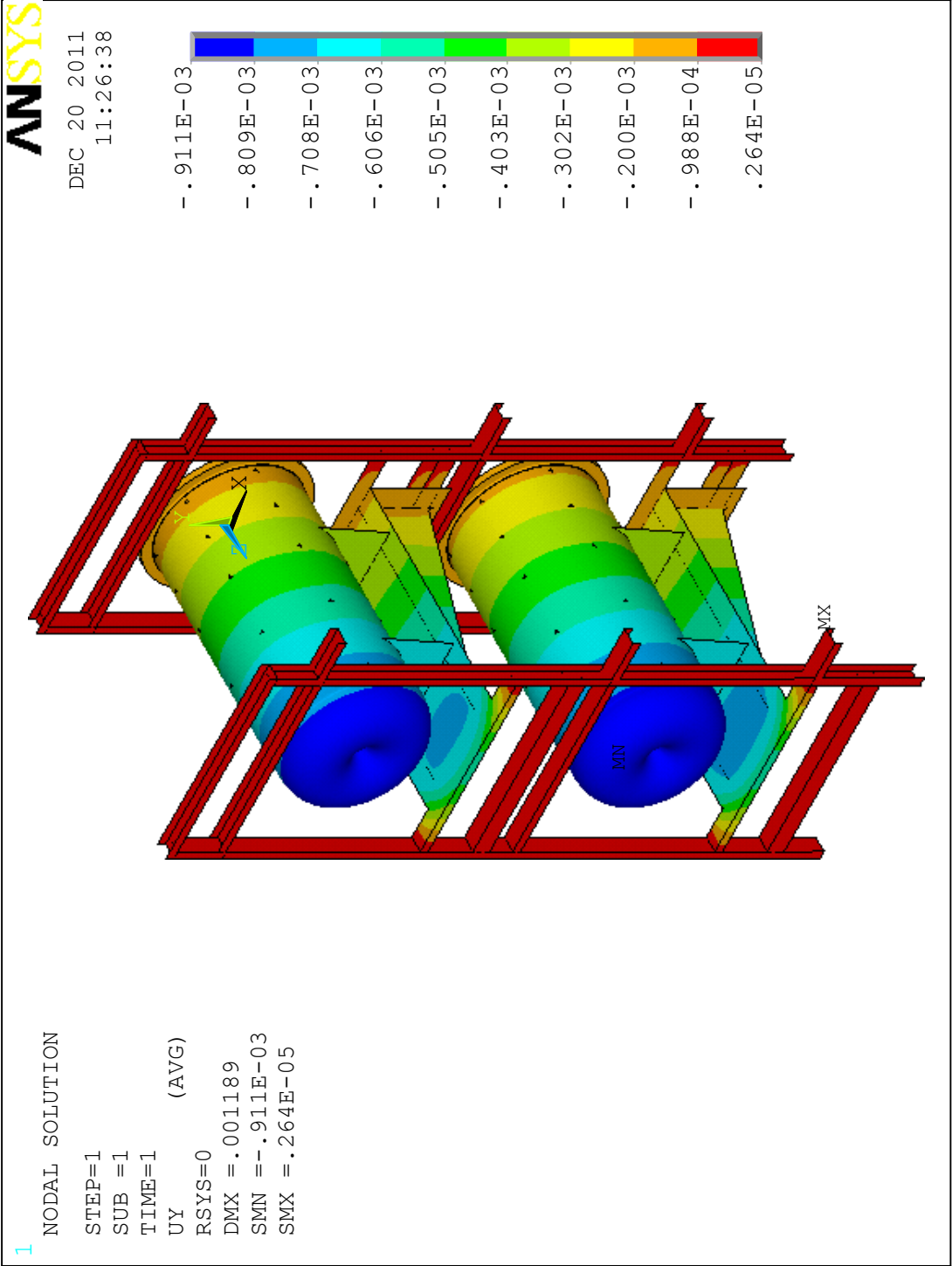
ANSYS

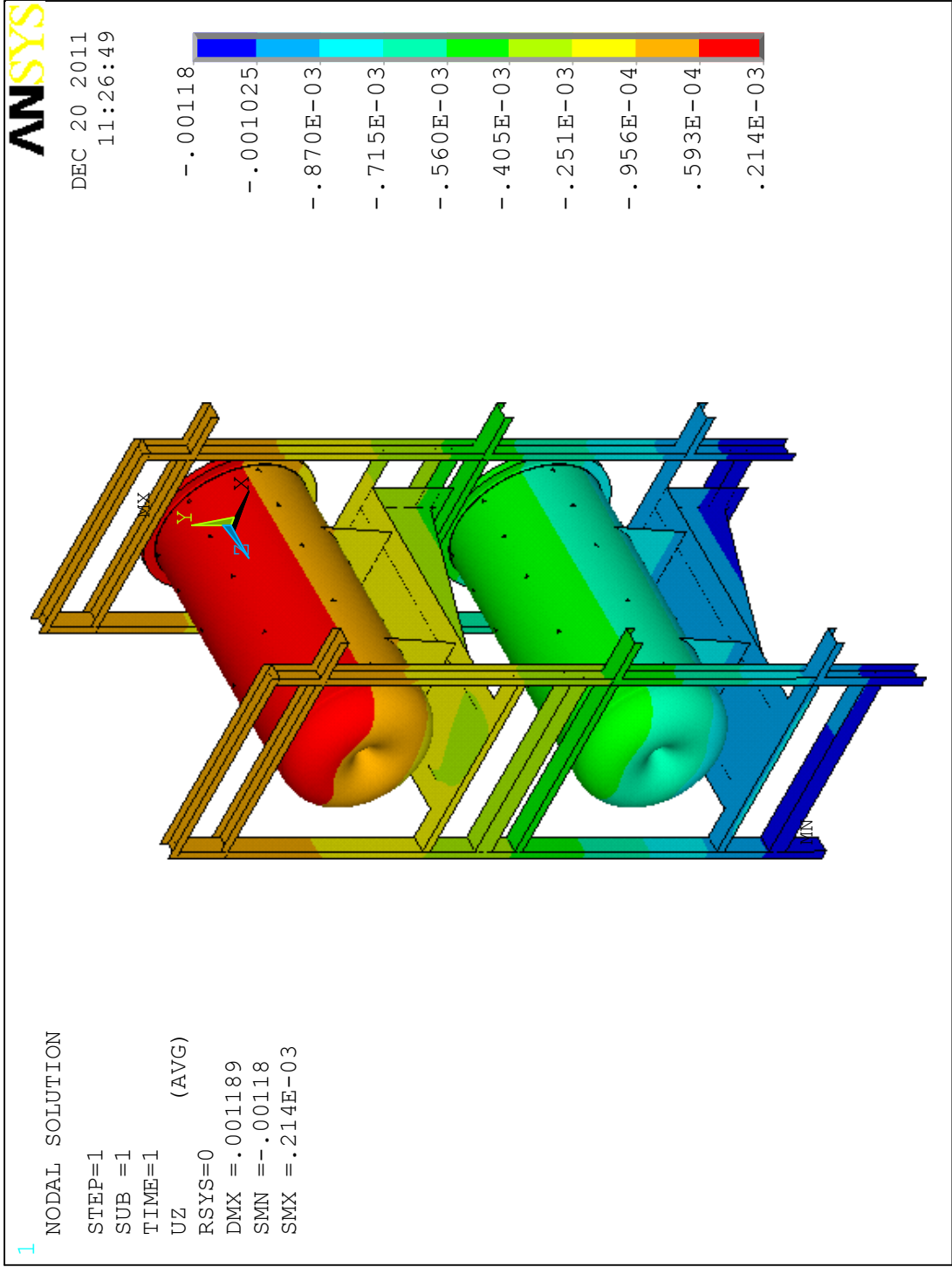
DEC 20 2011
11:24:51

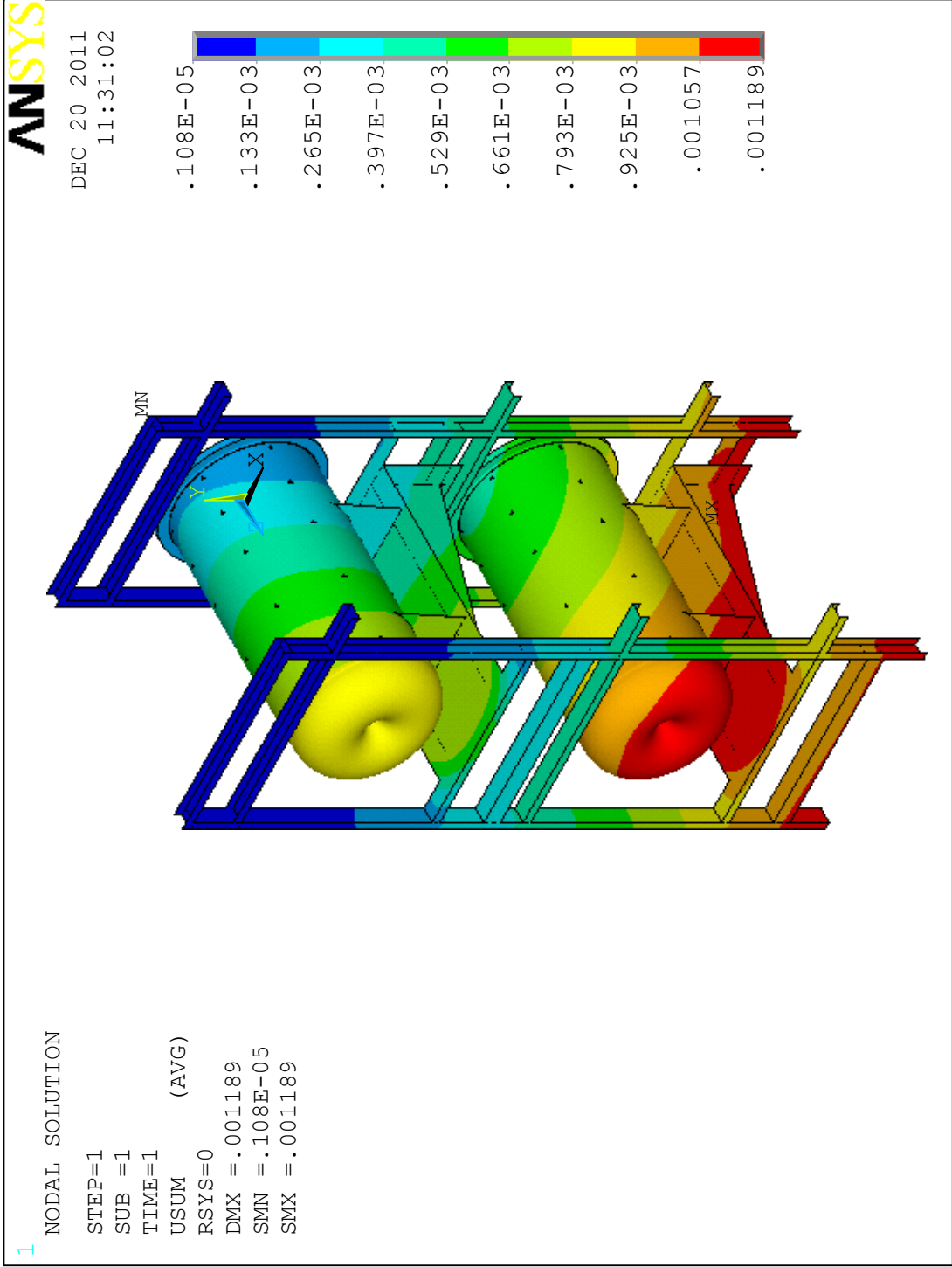


1 DISPLACEMENT
STEP=1
SUB =1
TIME=1
DMX =.001189

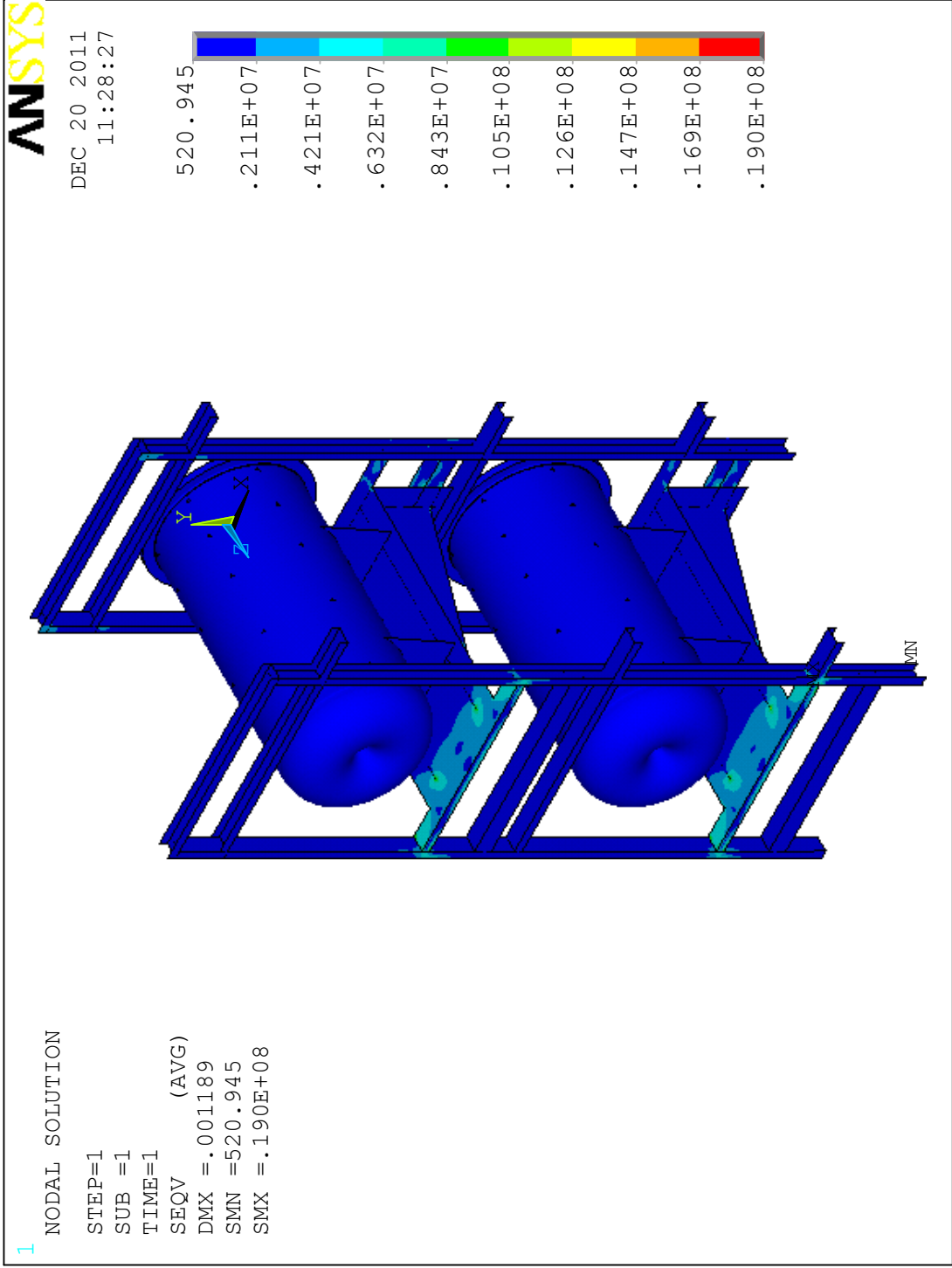
Deformation



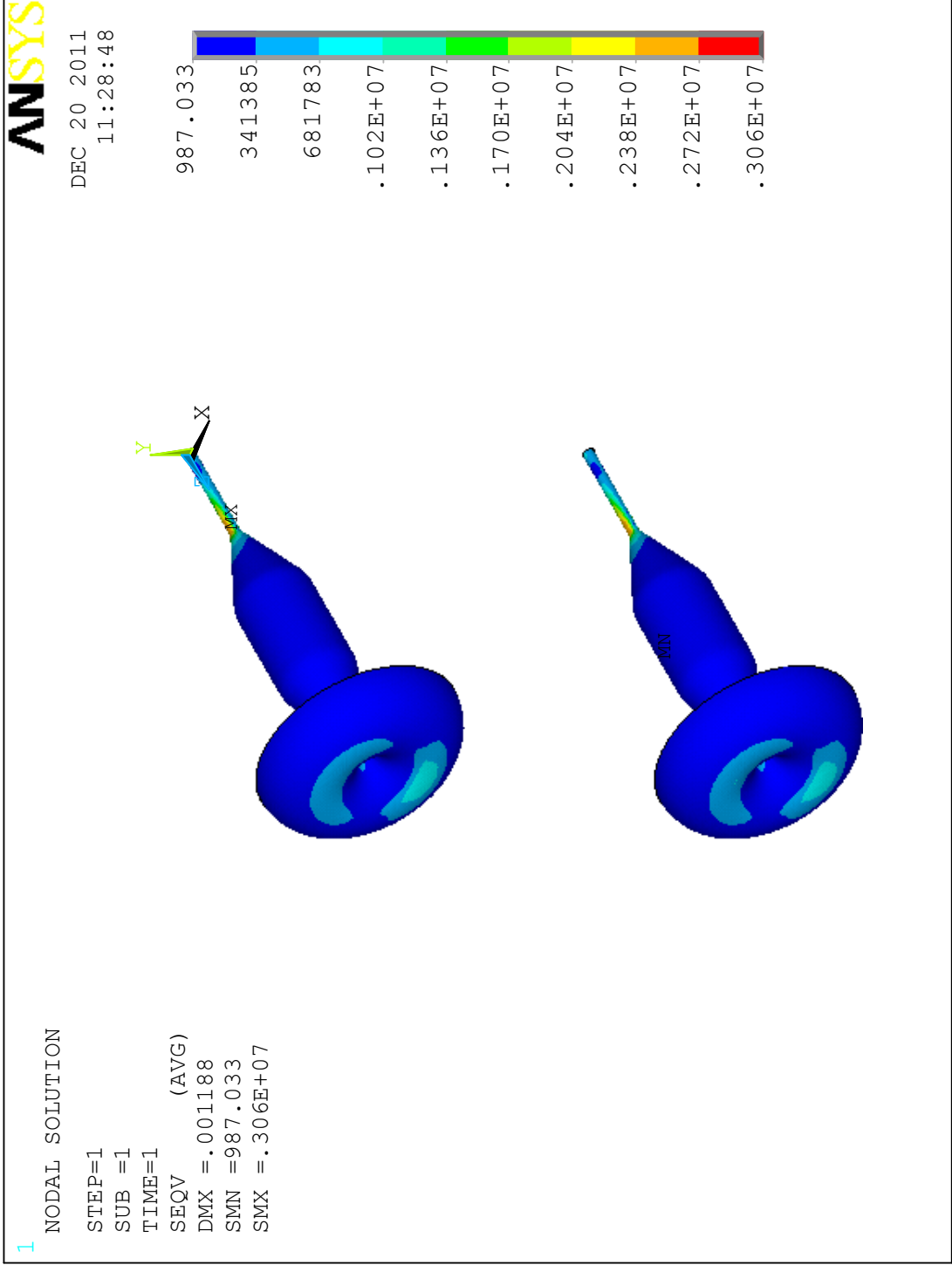




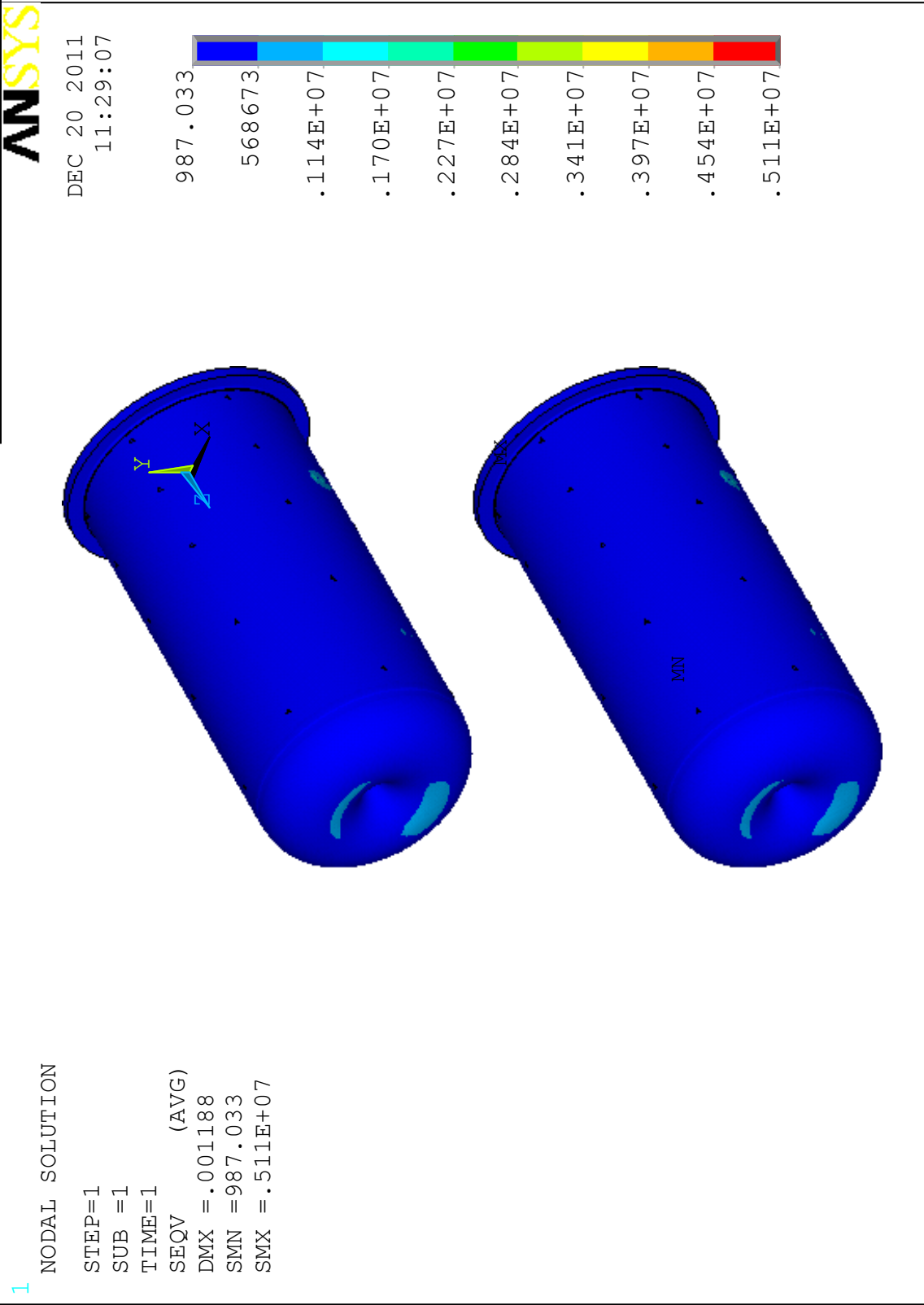
Deflection in m

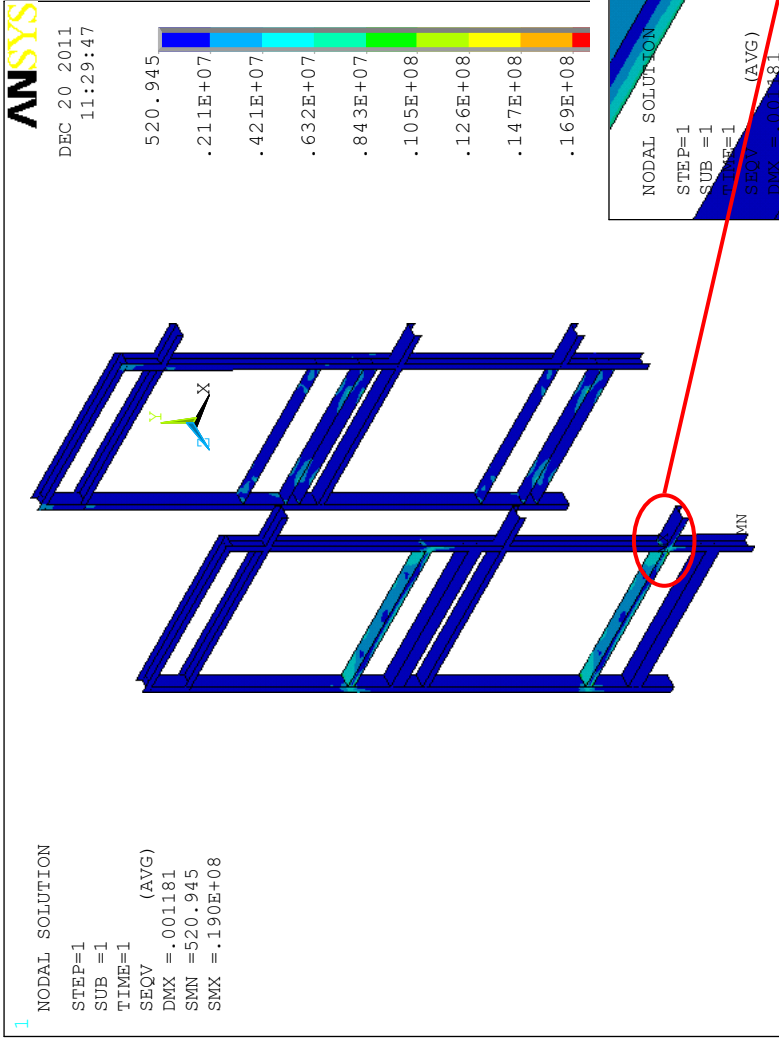


Stress in Pa

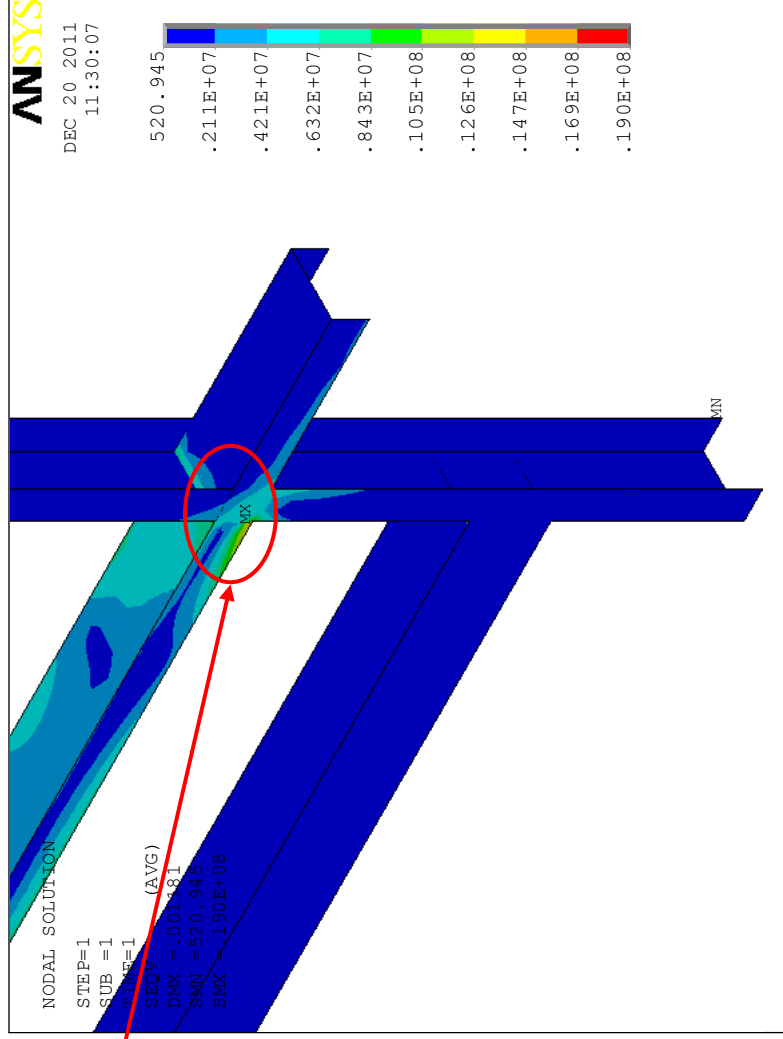


Stress in Pa





Frames supported on the top



Stress in Pa

Four horns supported in two frames – summary of static results
for ½ of the structure

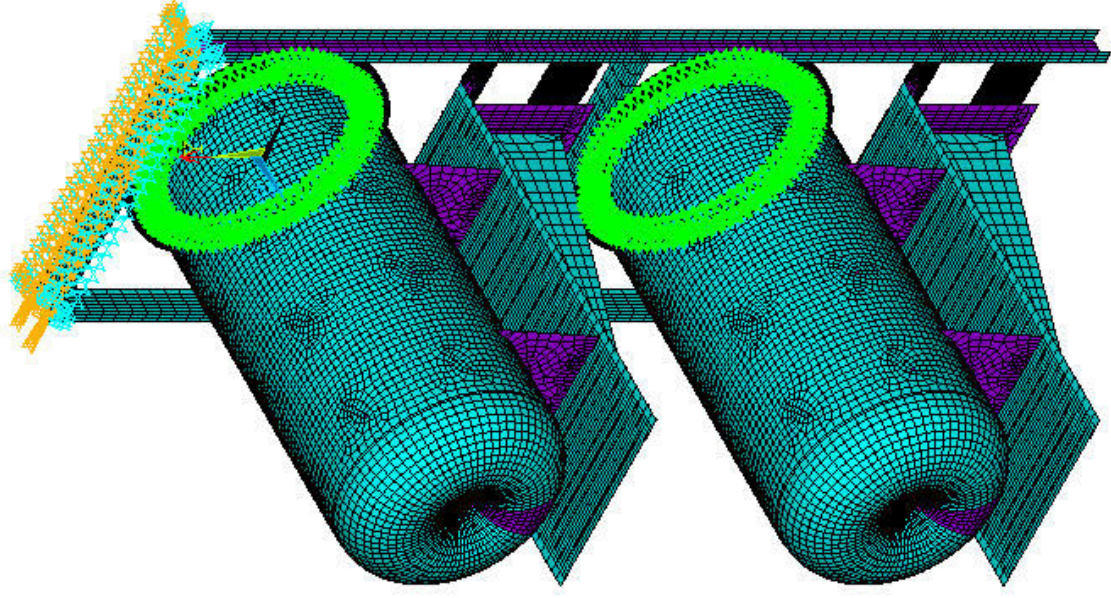
Supports location	$ u_y _{\max}$ <i>mm</i>	$ u_z _{\max}$ <i>mm</i>	$U_{\text{sum}, \max}$ <i>mm</i>	$\sigma_{\text{eqv}, \max}$ <i>MPa</i>	Remarks
Bottom	0.90	1.38	-	20.5	Max. Stress in frame
Top	0.91	1.18	1.19	19.0	Max. Stress in frame

One side frame support for
two horns – frame supported
on the top,

slides: 49-57

1 ELEMENTS
U ROT CP ACCEL

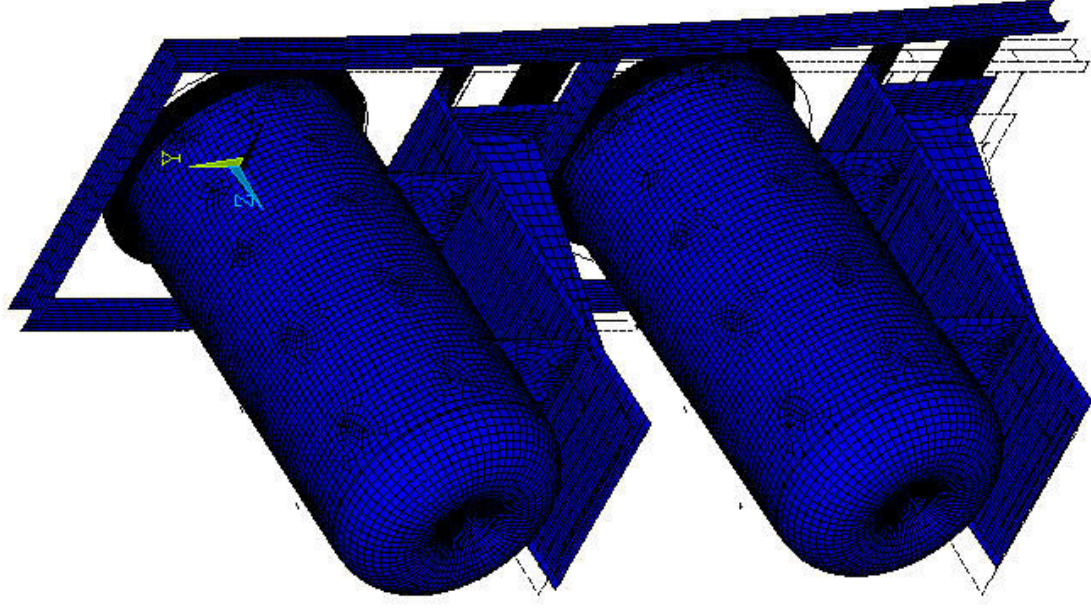
Single frame supported on
the top



Mesh of elements, boundary
conditions

Single frame supported on
the top

1 DISPLACEMENT
STEP=1
SUB =1
TIME=1
DMX =.03263



Deformation

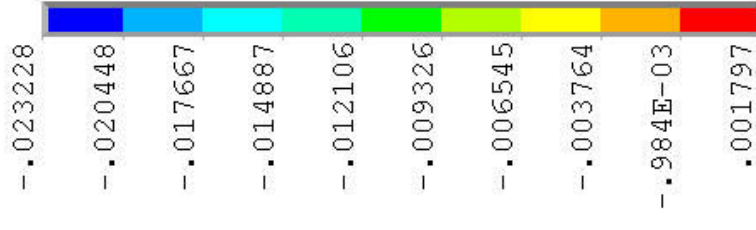
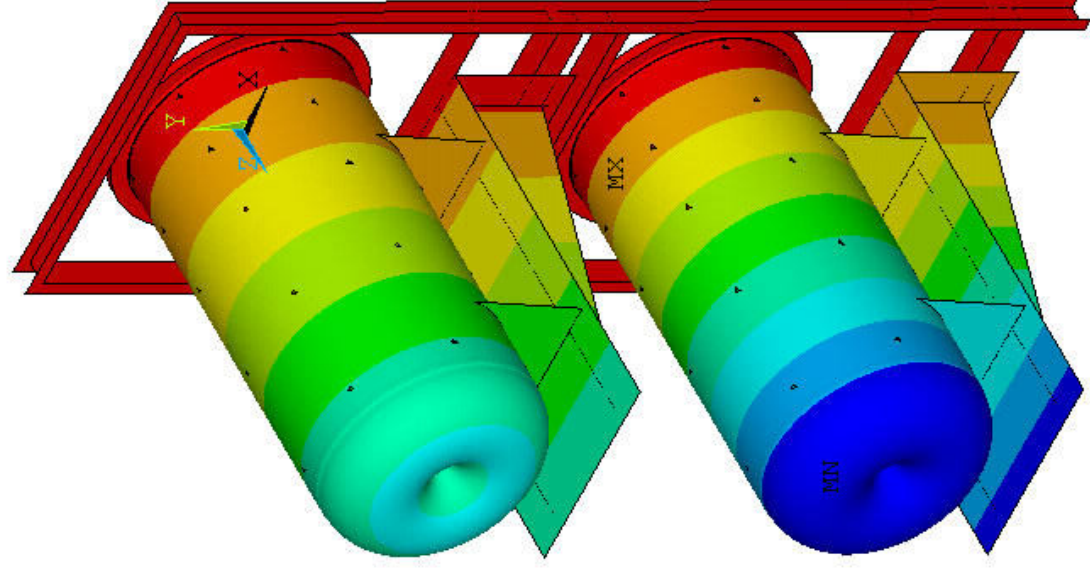
Single frame supported on the top

1

```

NODAL SOLUTION
STEP=1
SUB =1
TIME=1
UY      (AVG)
RSYS=0
DMX =.032263
SMN =-.023228
SMX =.001797

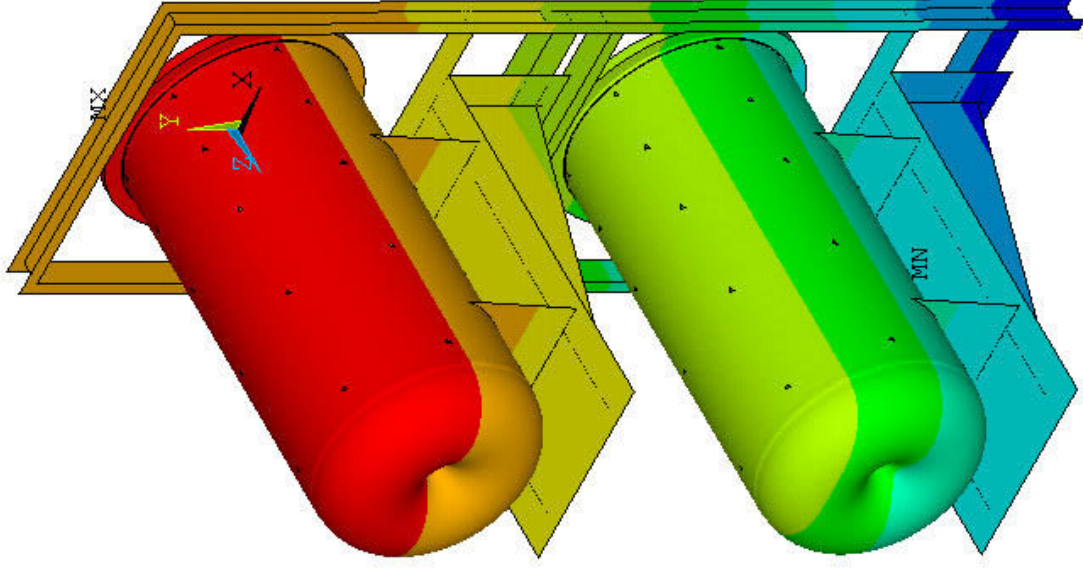
```



Deflection in m

Single frame supported on
the top

1 NODAL SOLUTION
STEP=1
SUB =1
TIME=1
UZ (AVG)
RSYS=0
DMX =.03263
SMN =-.032621
SMX =.00536



09:16:59

-0.032621
-0.028401
-0.024181
-0.019961
-0.015741
-0.01152
-0.0073
-0.00308
0.00114
0.00536

Deflection in m

Single frame supported on
the top

1

NODAL SOLUTION

STEP=1

SUB =1

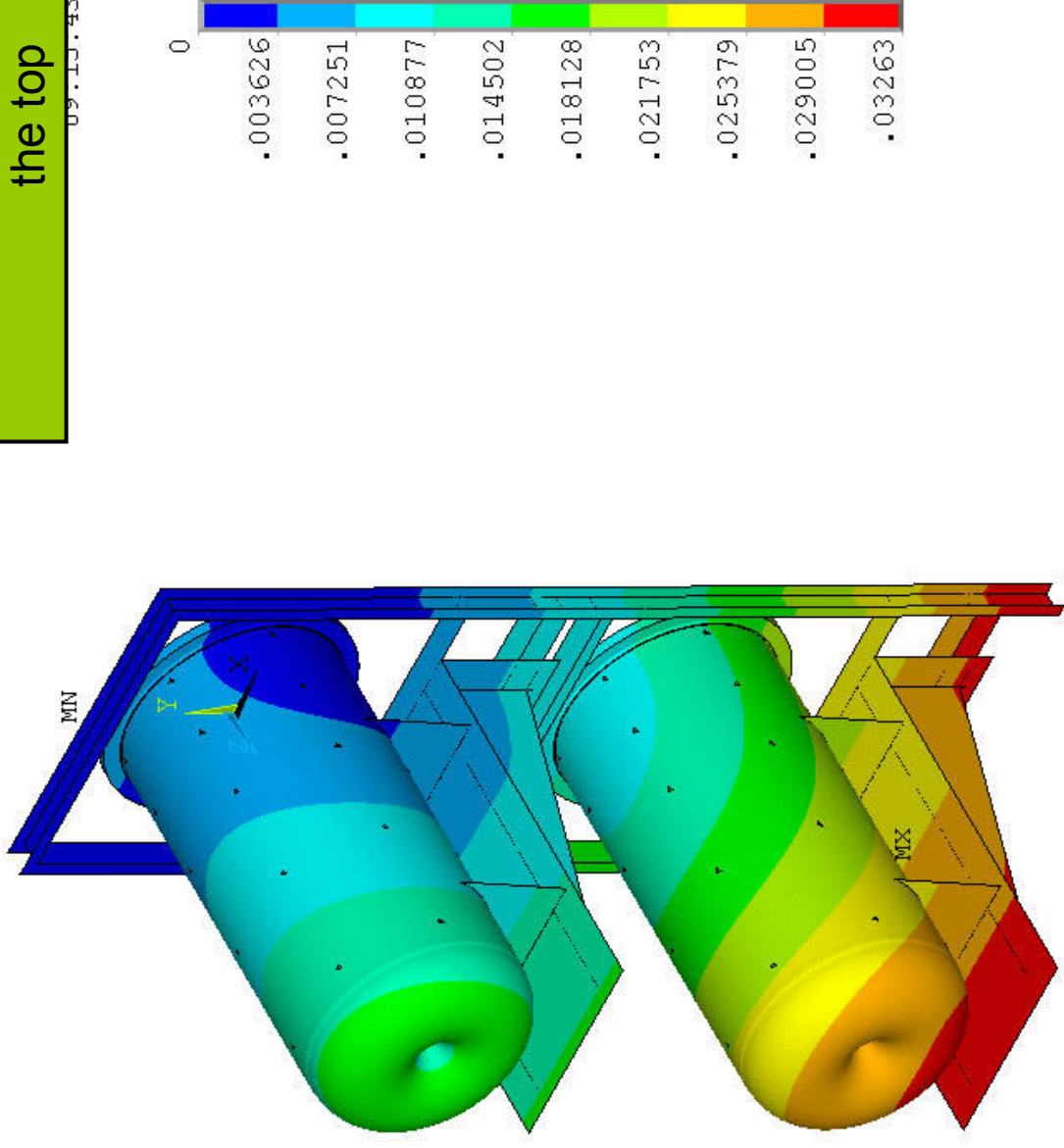
TIME=1

USUM (AVG)

RSYS=0

DMX =.03263

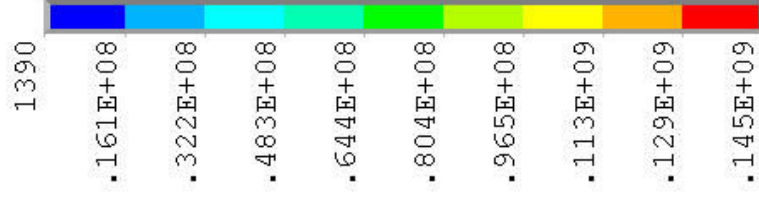
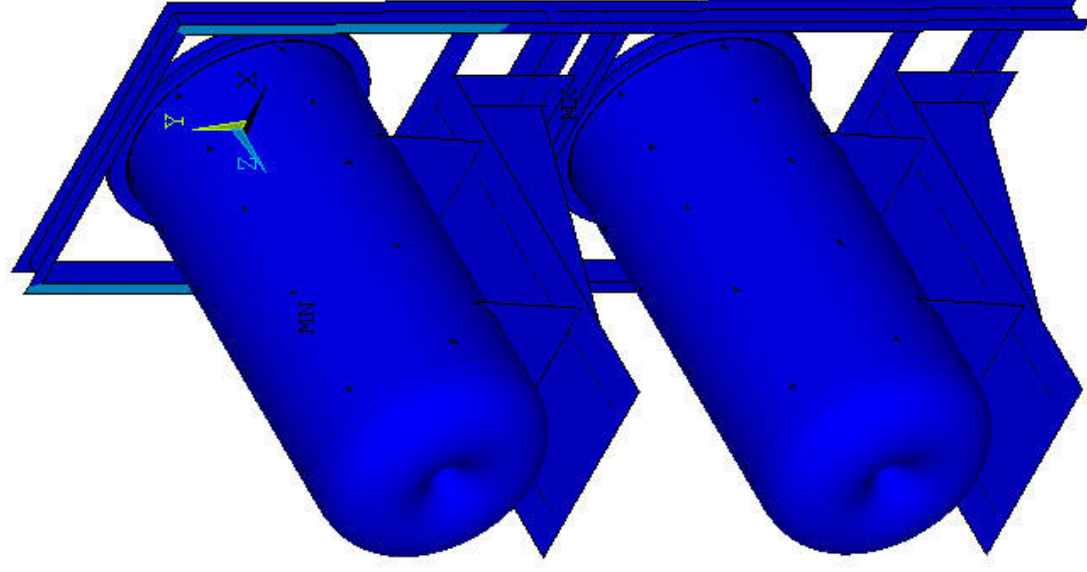
SMX =.03263



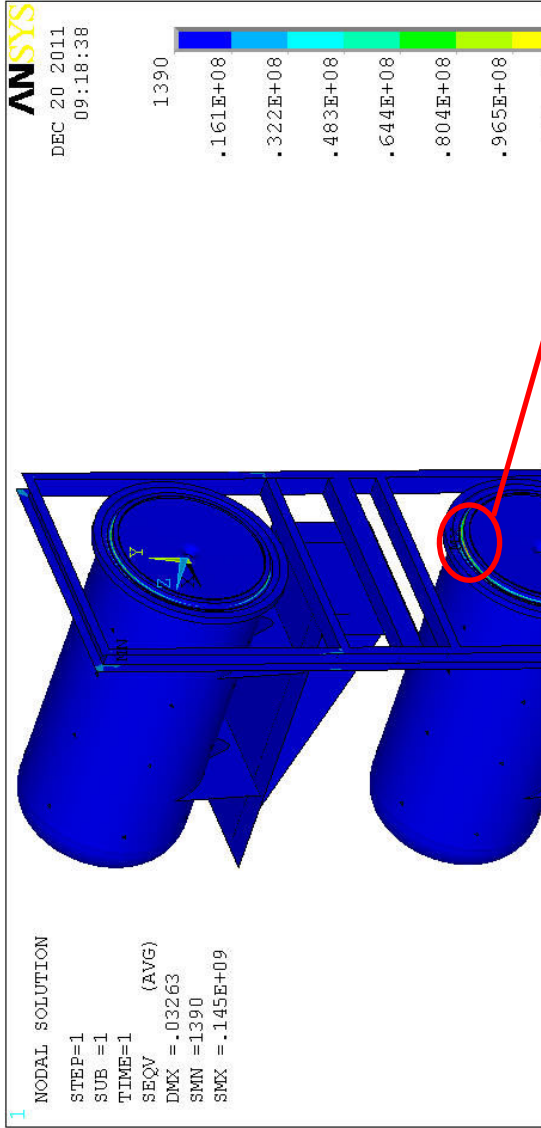
Deflection in m

Single frame supported on the top

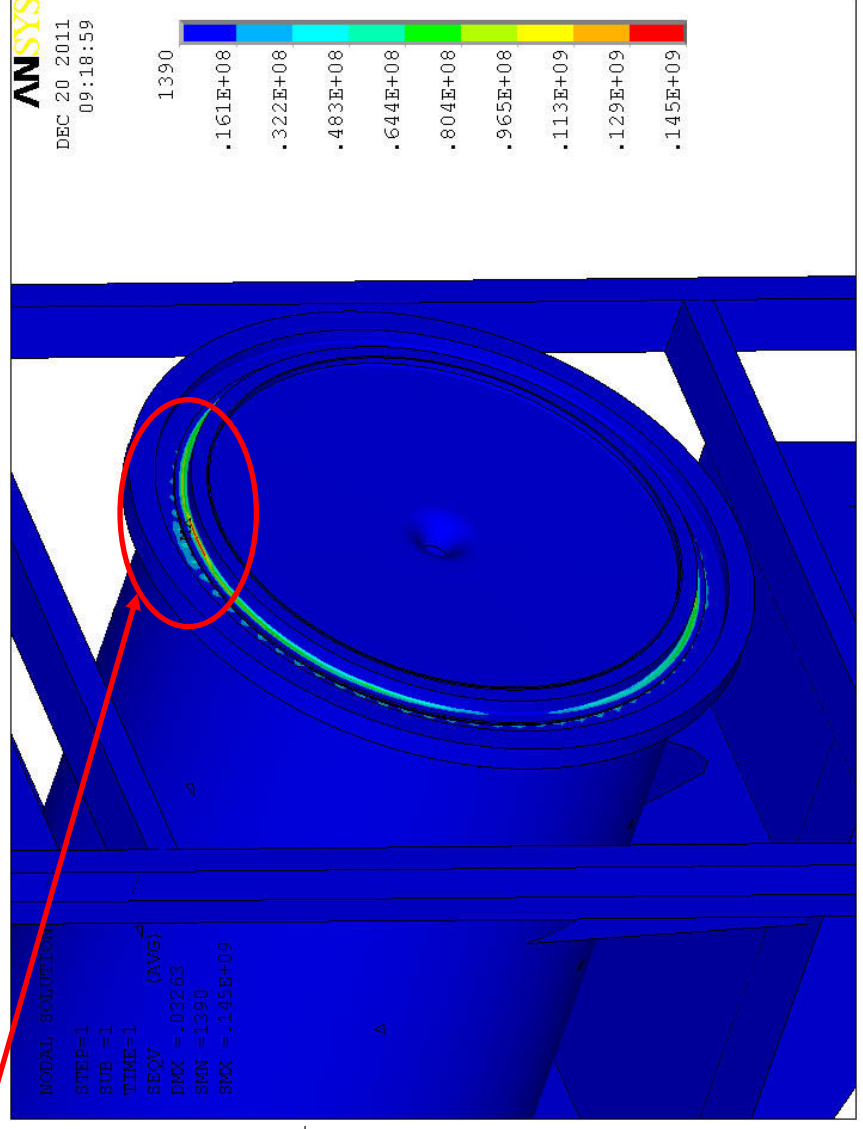
1 NODAL SOLUTION
 STEP=1
 SUB =1
 TIME=1
 SEQV (AVG)
 DMX =.03263
 SMN =1390
 SMX =.145E+09



Stress in Pa



Single frame supported on
the top



Stress in Pa

Single frame supported on
the top

1

NODAL SOLUTION

STEP=1

SUB =1

TIME=1

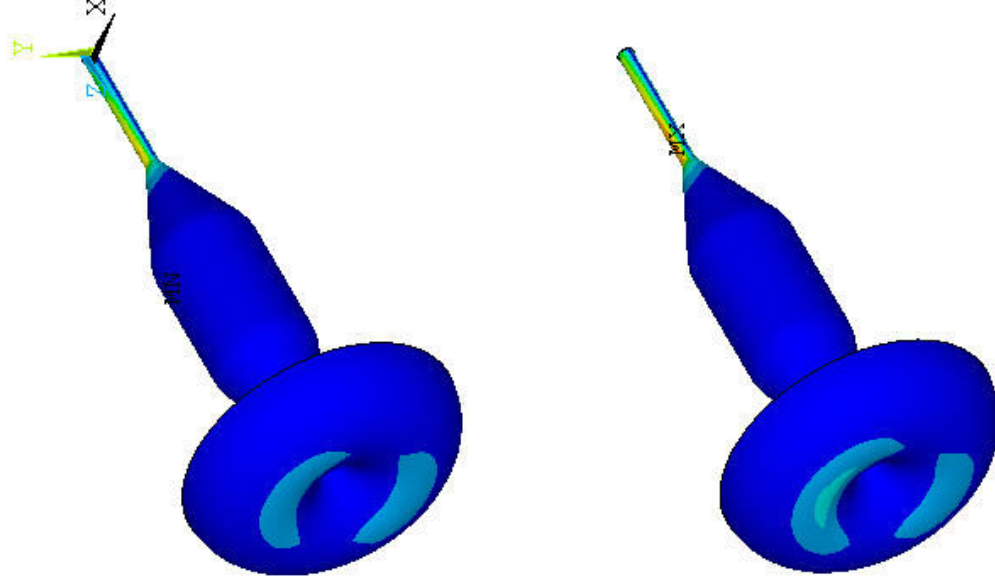
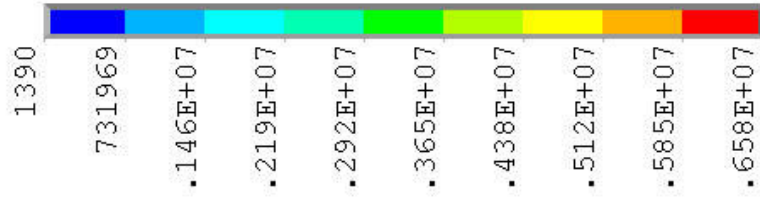
SEQV (AVG)

DMX =.030029

SMN =1390

SMX =.658E+07

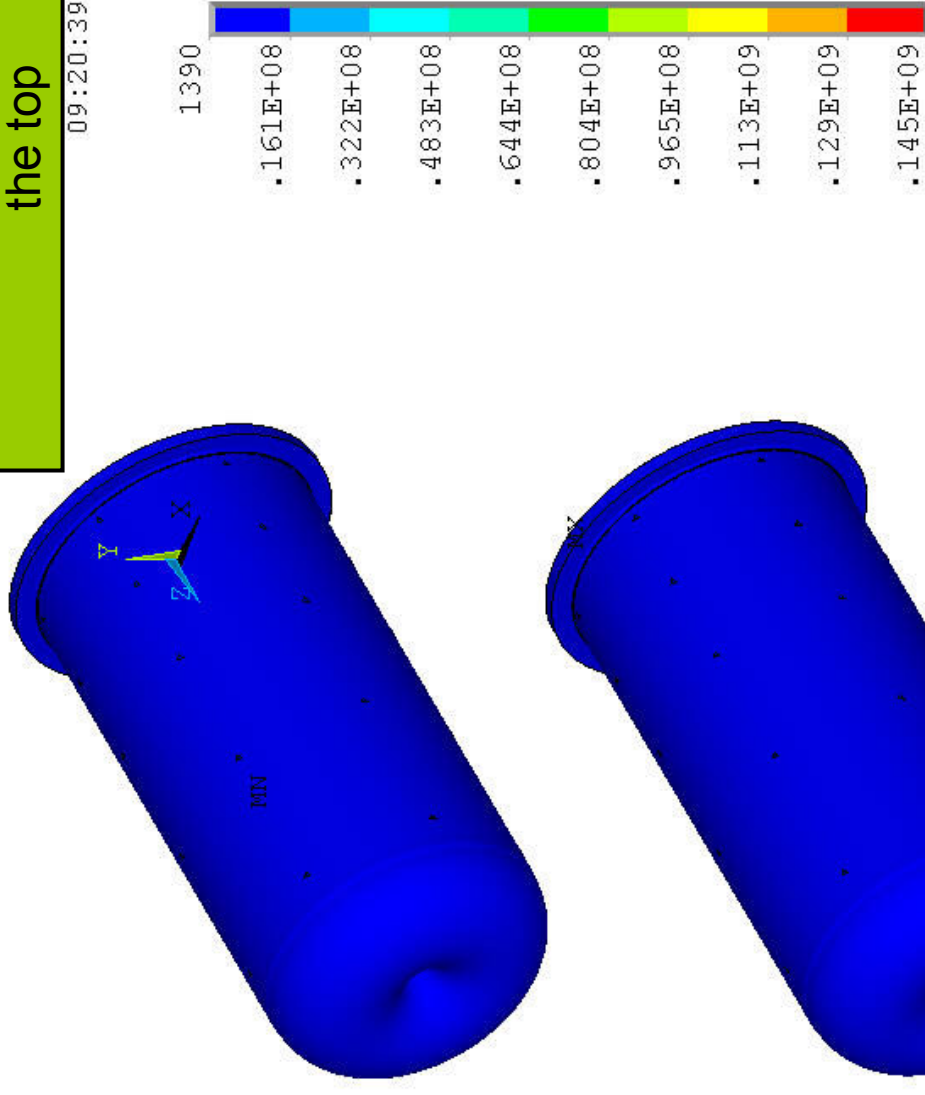
Y
X



Stress in Pa

Single frame supported on the top

1 NODAL SOLUTION
STEP=1
SUB =1
TIME=1
SEQV (AVG)
DMX =.030029
SMN =1390
SMX =.145E+09



Stress in Pa

Two horns supported in one frame – summary of static results

Supports location	$ u_y _{\max}$ <i>mm</i>	$ u_z _{\max}$ <i>mm</i>	$U_{\text{sum},\max}$ <i>mm</i>	$\sigma_{\text{eqv},\max}$ <i>MPa</i>	Remarks
Bottom	15.5	-	27.1	102.0	Max. Stress in front plate of top horn
Top	23.2	32.6	32.6	145.0	Max. Stress in front plate of bottom horn

Two horns supported at the bottom – static results

Number of frames	$ u_y _{\max}$ <i>mm</i>	$ u_z _{\max}$ <i>mm</i>	$U_{\text{sum,max}}$ <i>mm</i>	$\sigma_{\text{eqv,max}}$ <i>MPa</i>	Remarks
One frame	15.5	-	27.1	102.0	Max. Stress in front plate of top horn (Table in slide 58)
Two frames	0.90	1.38	1.45	20.2	Max. Stress in frame (see slide 23)

Two horns supported on the top – static results

Supports location	$ u_y _{\max}$ <i>mm</i>	$ u_z _{\max}$ <i>mm</i>	$U_{\text{sum,max}}$ <i>mm</i>	$\sigma_{\text{eqv,max}}$ <i>MPa</i>	Remarks
One frame	23.2	32.6	32.6	145.0	Max. Stress in front plate of bottom horn (Table in slide 58)
Two frames	0.93	1.18	1.20	18.1	Max. Stress in frame (see slide 12)

Thank you for your attention