Mu2e TS Magnet support rod analysis

Final Presentation

September 24, 2014

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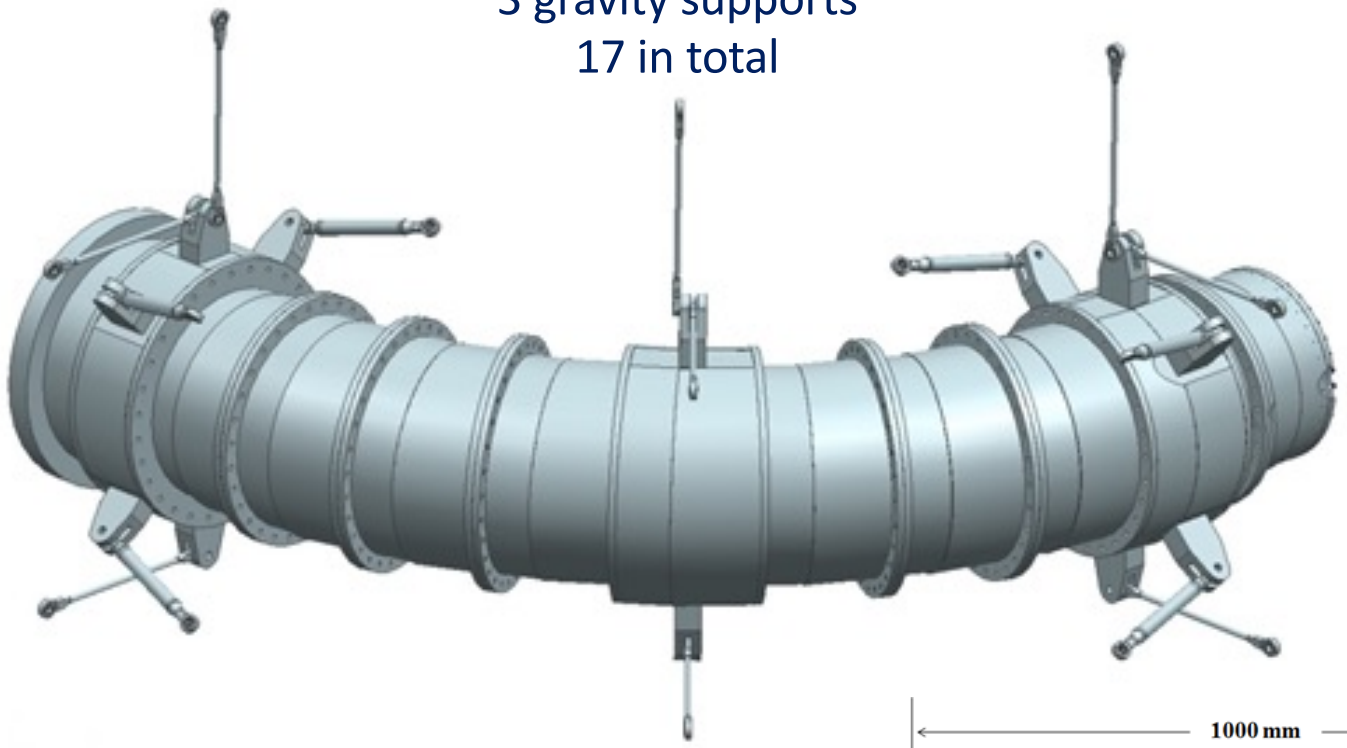
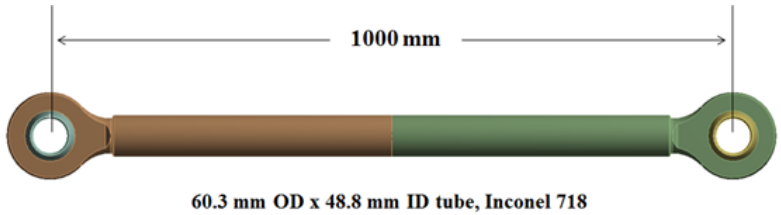
Transport Solenoid cold mass

4 axial supports in each side
2,2,2 radial supports
3 gravity supports
17 in total



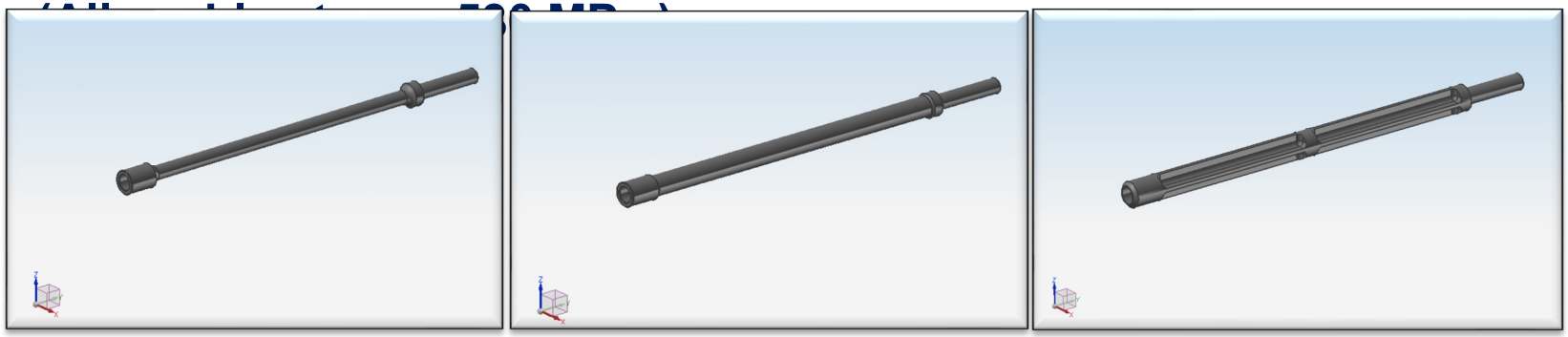


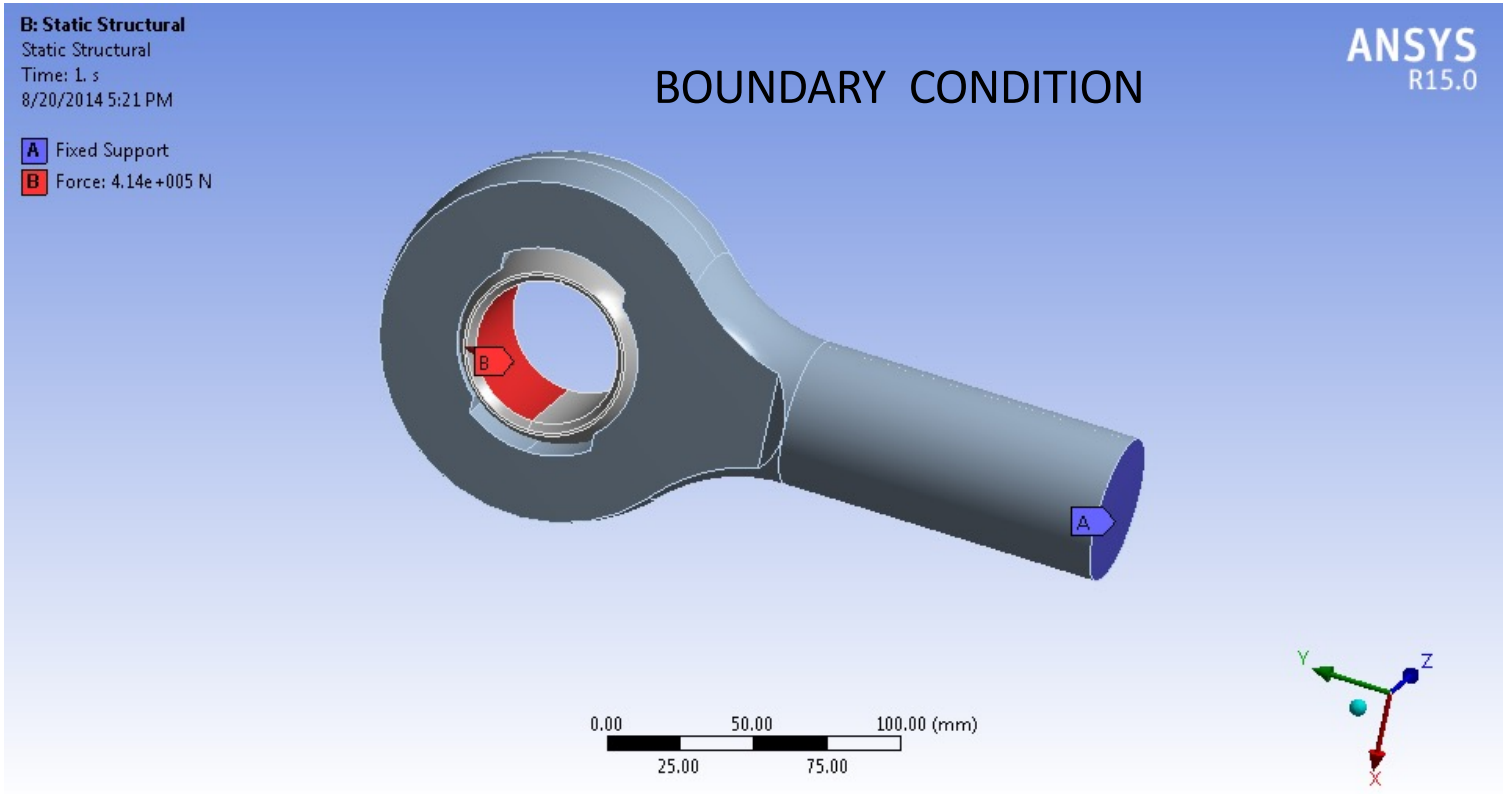
The TS magnet is sitting in between two other magnets.
Depending on the power conditions the forces can change direction.

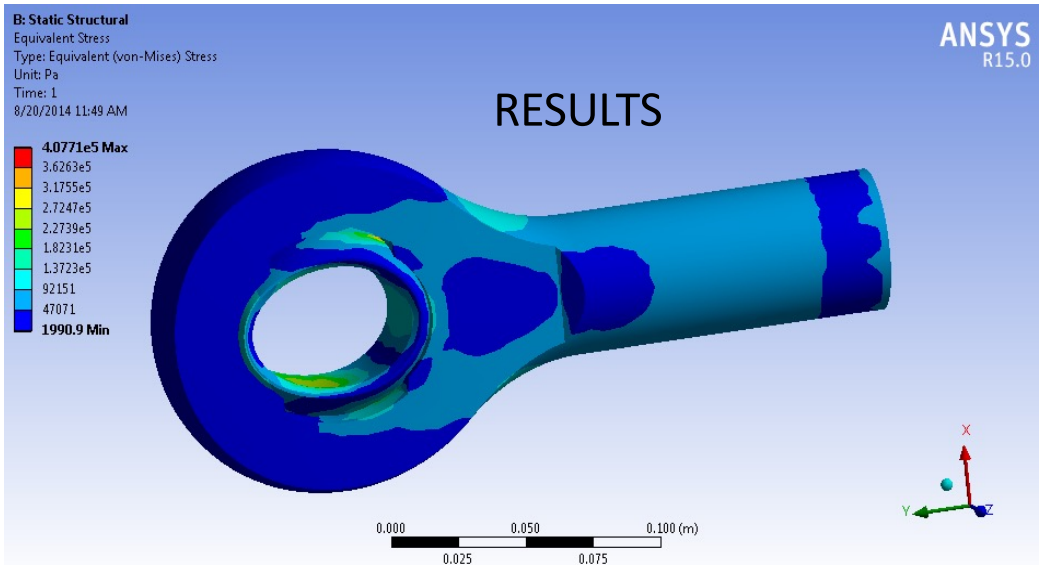
OBJECTIVES ACHIEVED

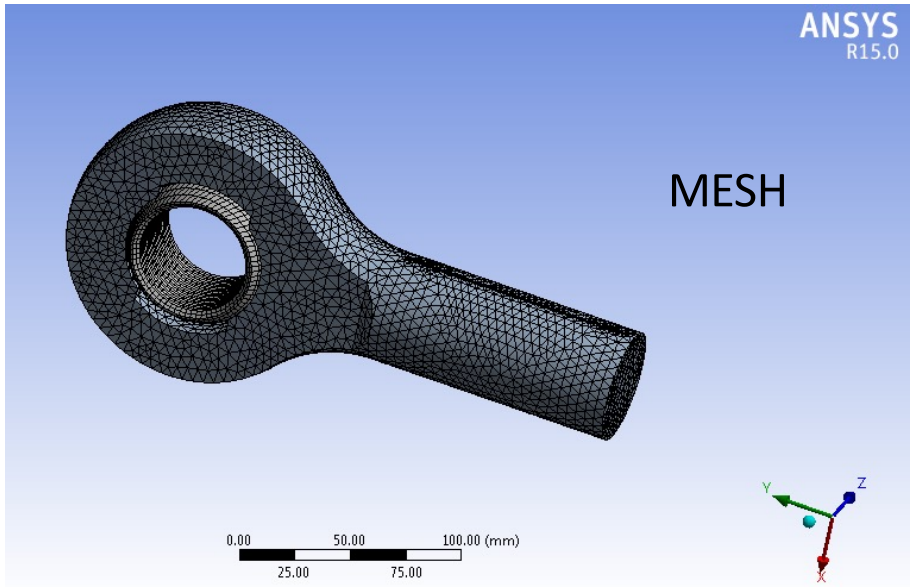
- To learn and become familiar with Ansys and to use it to solve real-world problems.
- We want to determine the stress distribution in the housing as a result of cutting the slot to ins

- We want to determine the maximum stress in each case when we apply a 414kN tensile load and then we want to optimize the cross sections so that the maximum stresses in all three are equal.



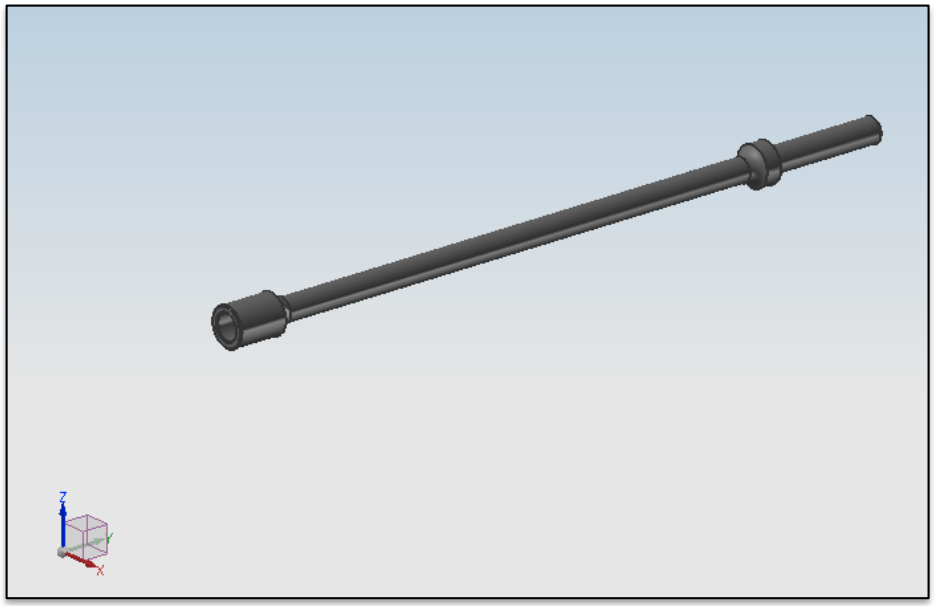

B: Static Structural
Static Structural
Time: 1. s
8/20/2014 5:21 PM
A Fixed Support
B Force: 4.14e+005 N
ANSYS
R15.0
BOUNDARY CONDITION
B
A
0.00
50.00
100.00 (mm)
25.00
75.00
Y
Z
X


B: Static Structural
Equivalent Stress
Type: Equivalent (von-Mises) Stress
Unit: Pa
Time: 1
8/20/2014 11:49 AM
4.0771e5 Max
3.6263e5
3.1755e5
2.7247e5
2.2739e5
1.8231e5
1.3723e5
92151
47071
1990.9 Min
ANSYS
R15.0
RESULTS
0.000
0.050
0.100 (m)
0.025
0.075
X
Y
Z

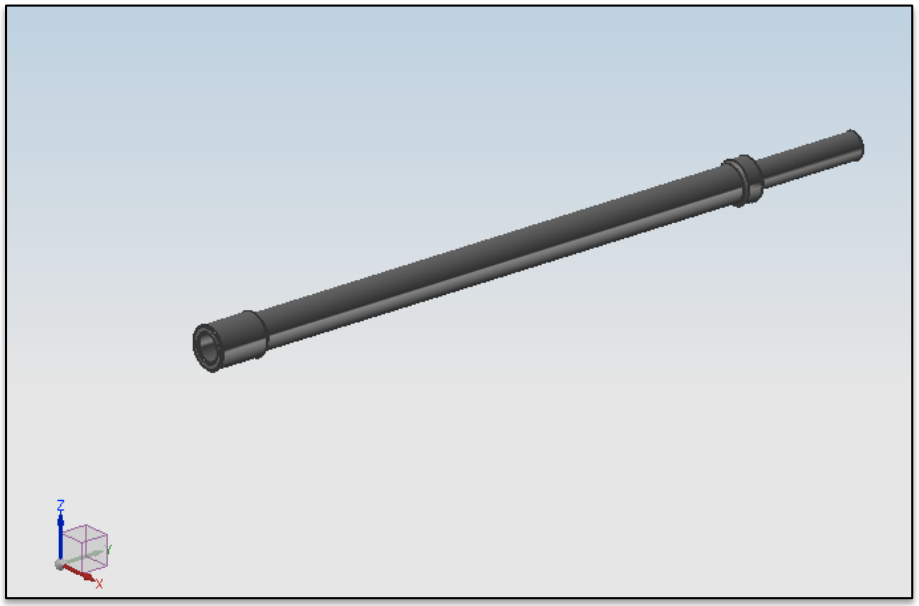

ANSYS
R15.0
MESH
0.00
50.00
100.00 (mm)
25.00
75.00
Y
Z
X

The three rod cross sections

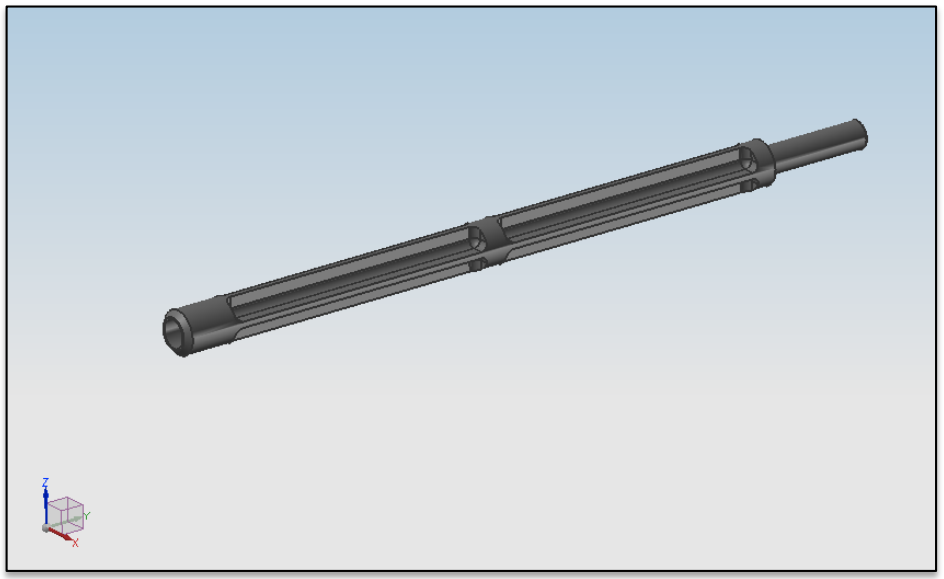
Solid rod



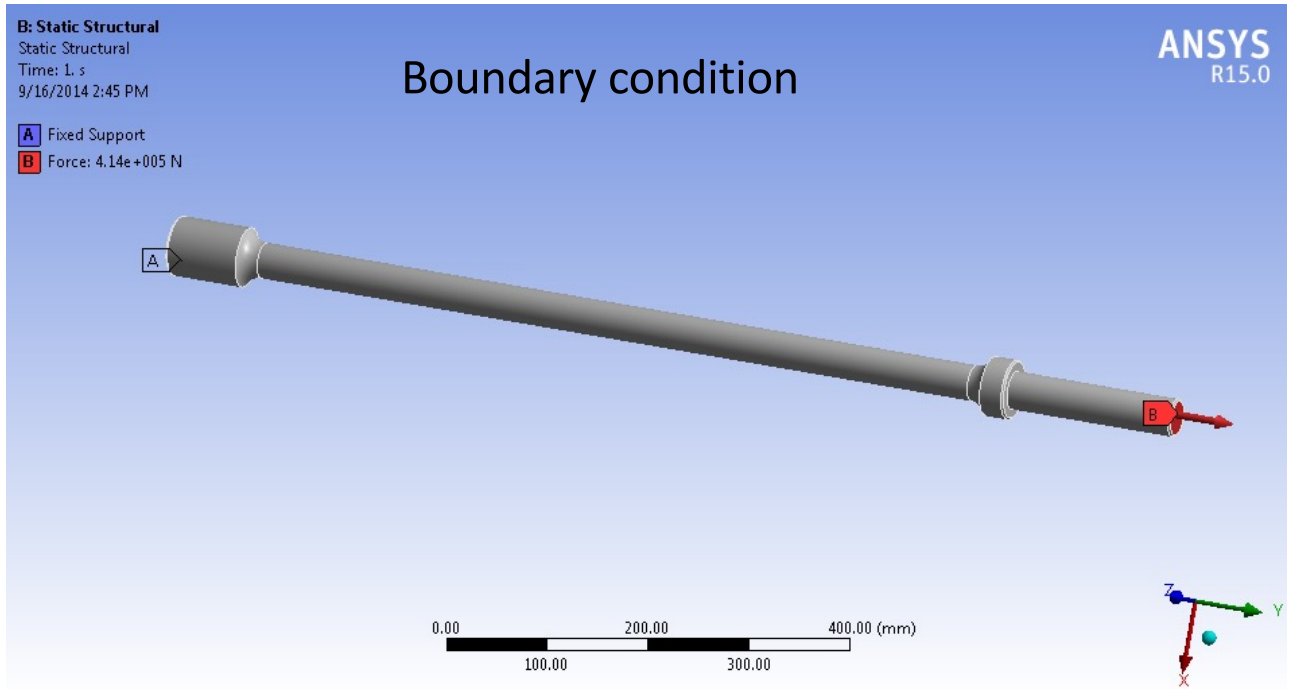
Tube

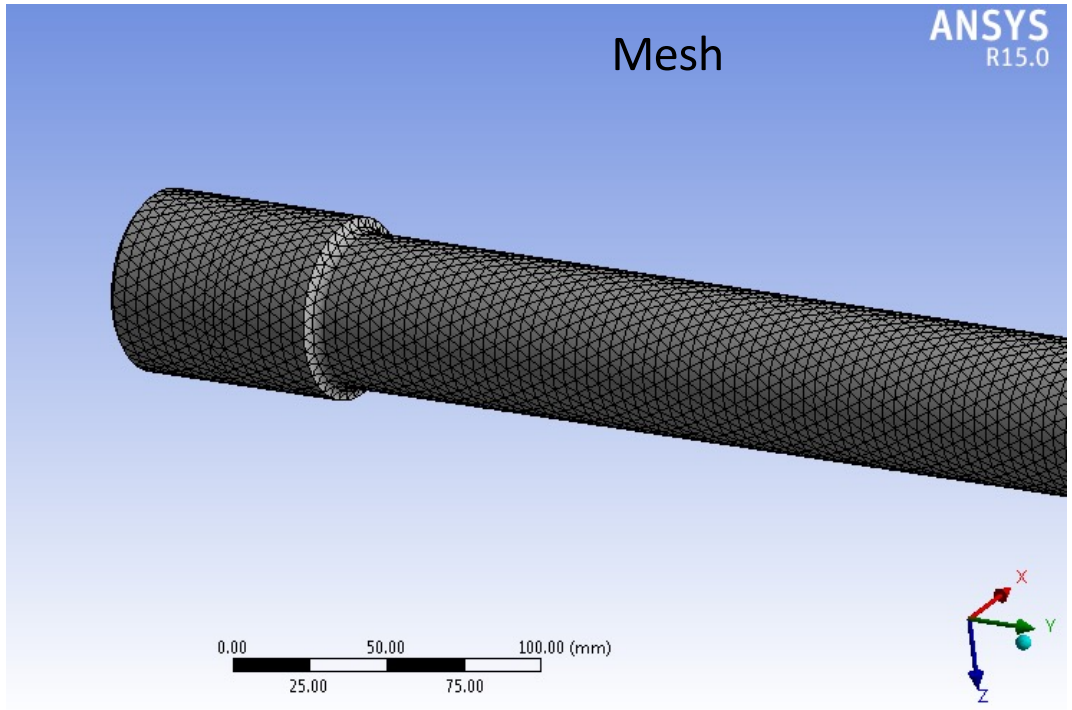


X - section



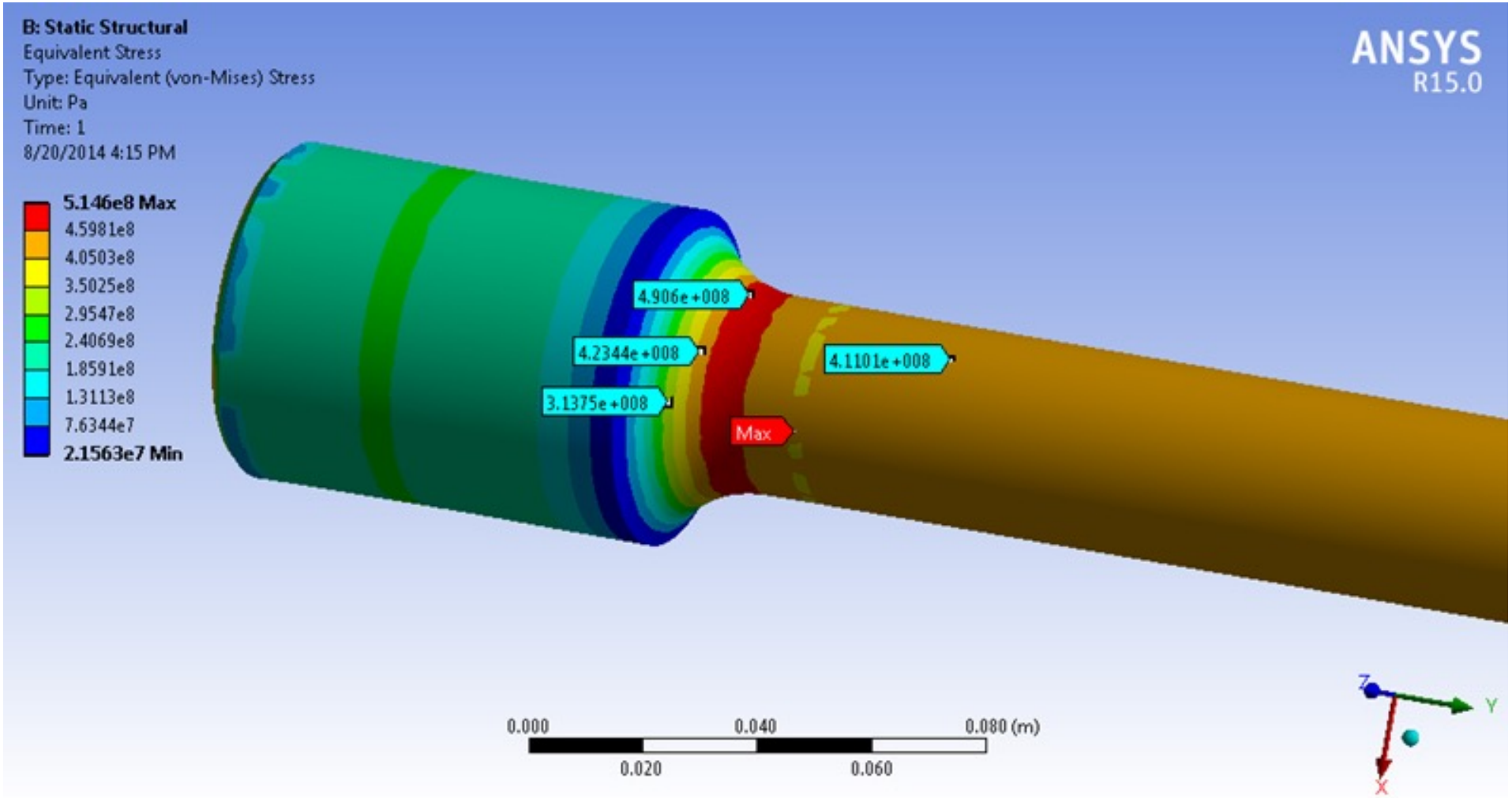
Solid rod


B: Static Structural
Static Structural
Time: 1. s
9/16/2014 2:45 PM
A Fixed Support
B Force: 4.14e+005 N
Boundary condition
ANSYS
R15.0
A
B
0.00
200.00
400.00 (mm)
100.00
300.00
Z
Y
X

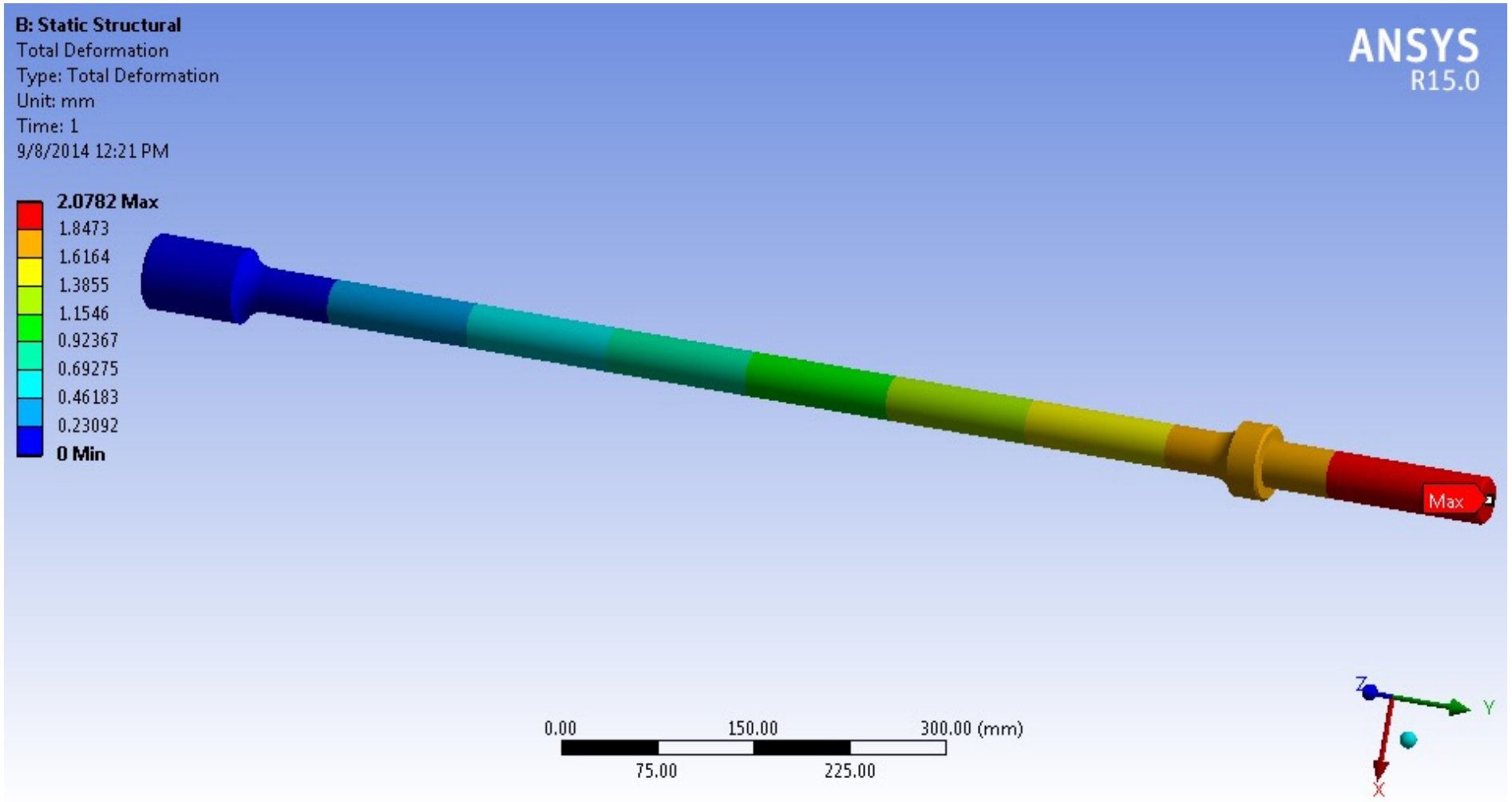

Mesh
ANSYS
R15.0
0.00
50.00
100.00 (mm)
25.00
75.00
X
Y
Z

Determination of the maximum stress in each rod when applying a 414 kN tensile load.

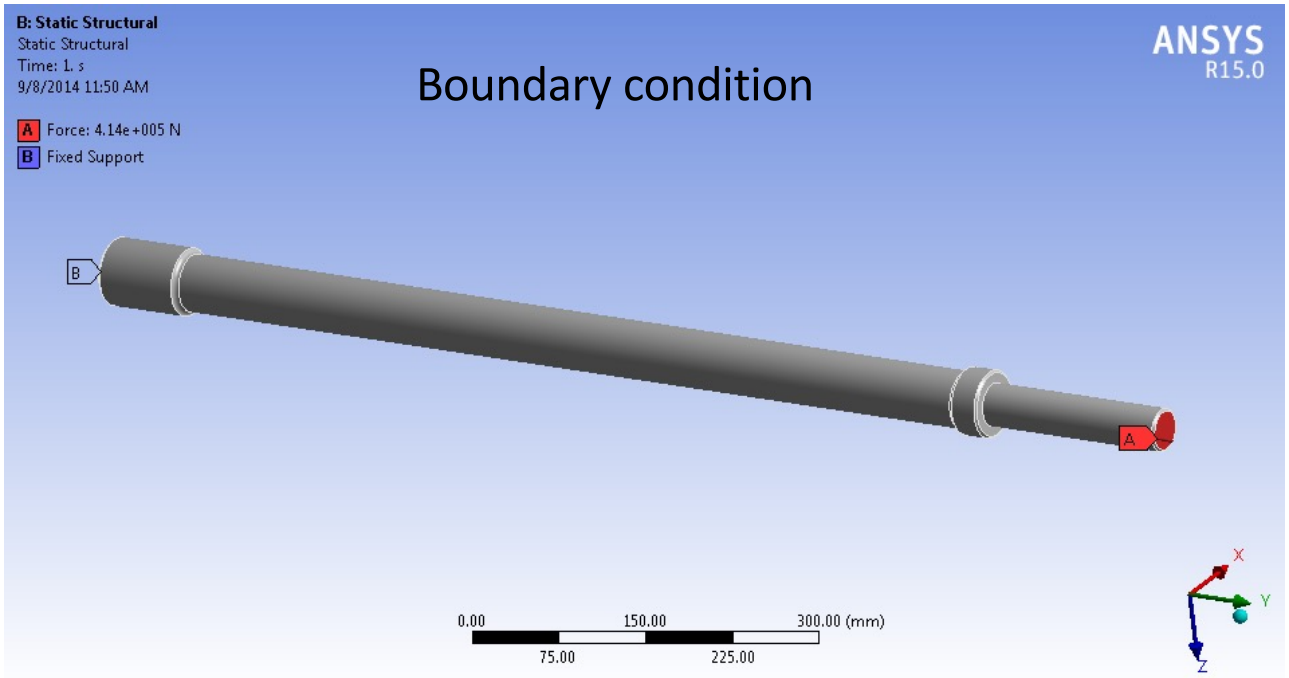
(Allowable stress : 530 Mpa)

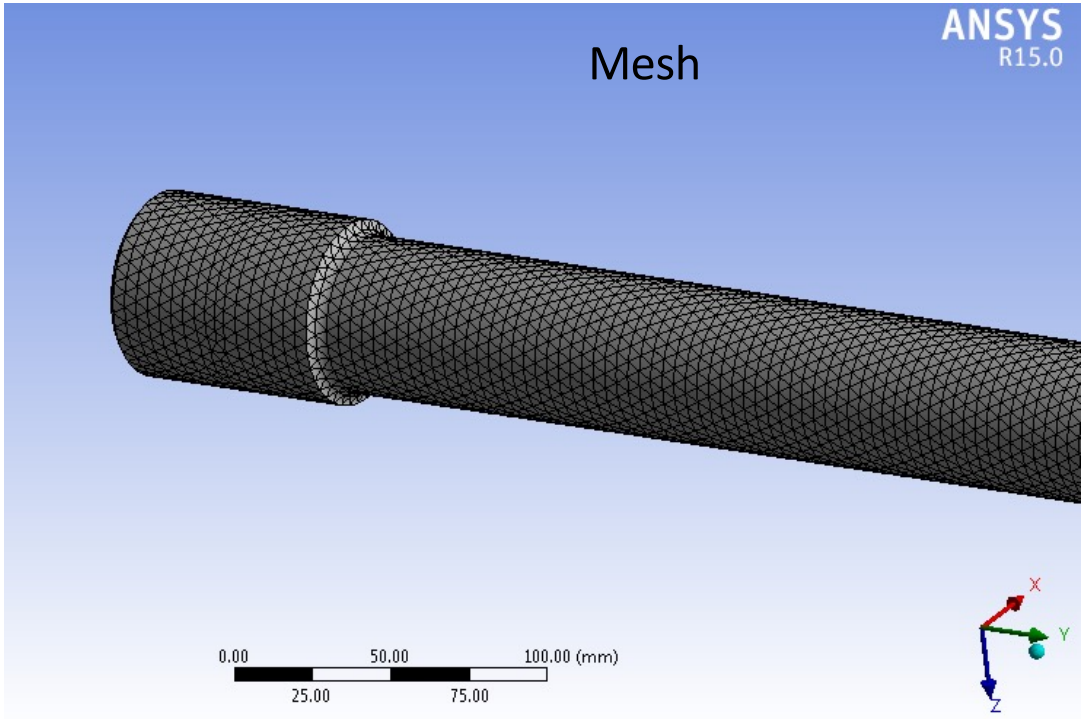


Solid - Deformation



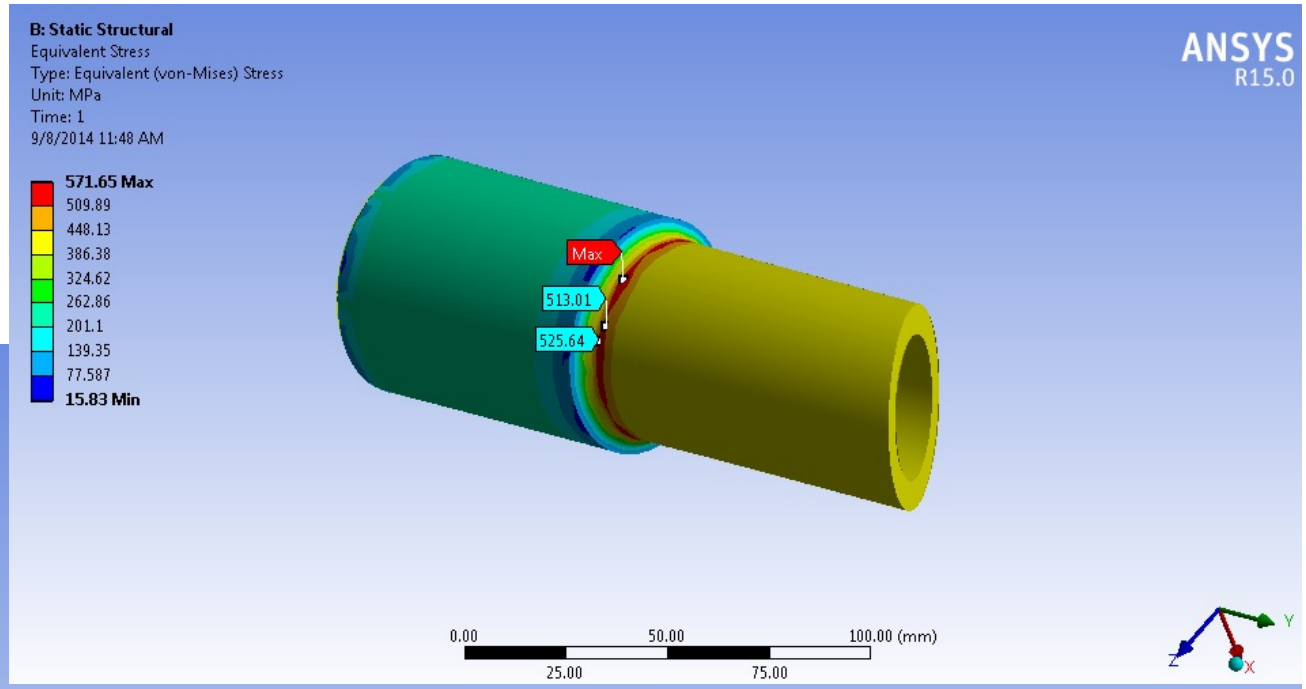
Tube


B: Static Structural
Static Structural
Time: 1. s
9/8/2014 11:50 AM
A Force: 4.14e+005 N
B Fixed Support
Boundary condition
ANSYS
R15.0
B
A
0.00
150.00
300.00 (mm)
75.00
225.00
X
Y
Z

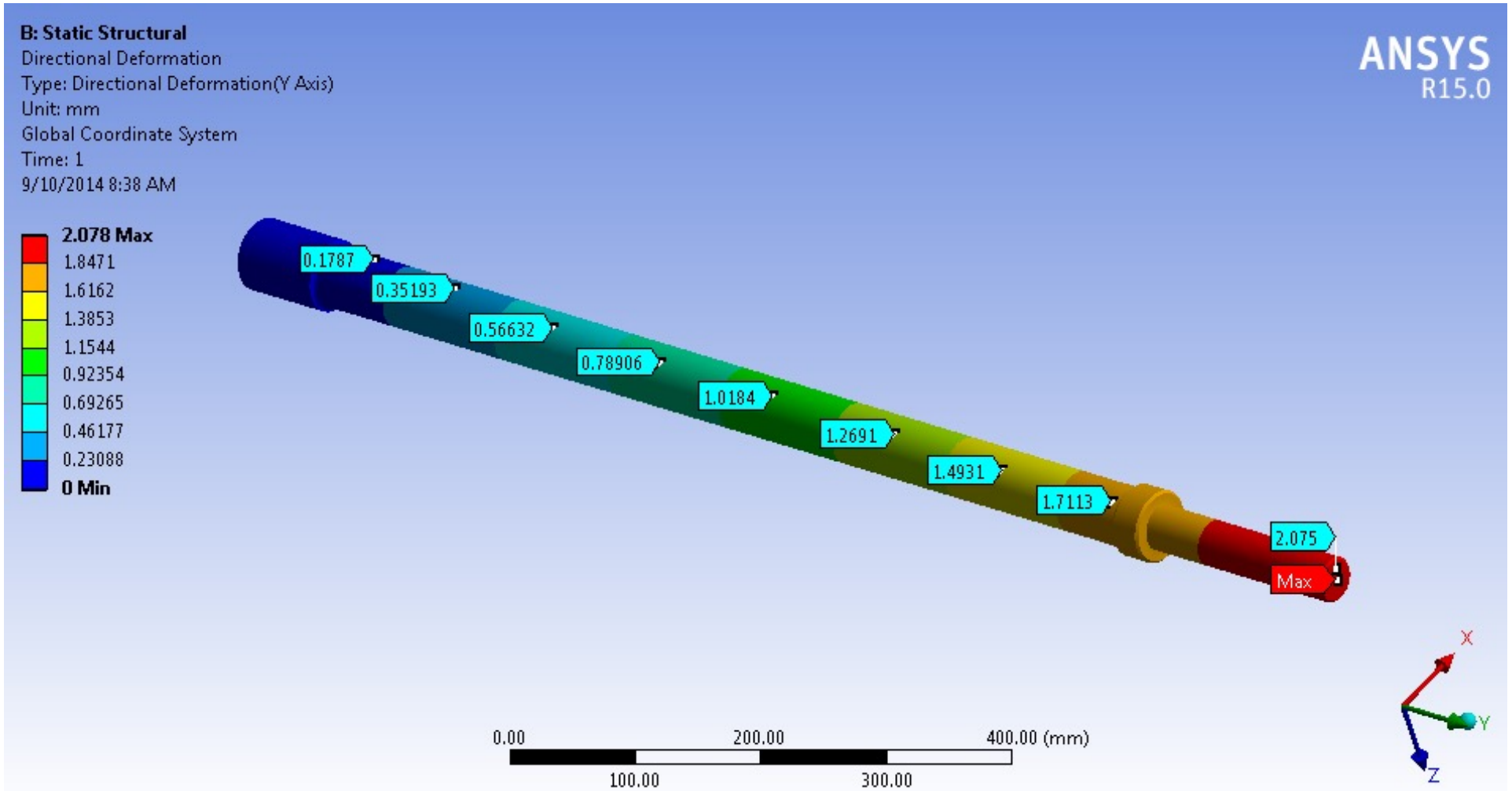

Mesh
ANSYS
R15.0
0.00
50.00
100.00 (mm)
25.00
75.00
X
Y
Z

Tube

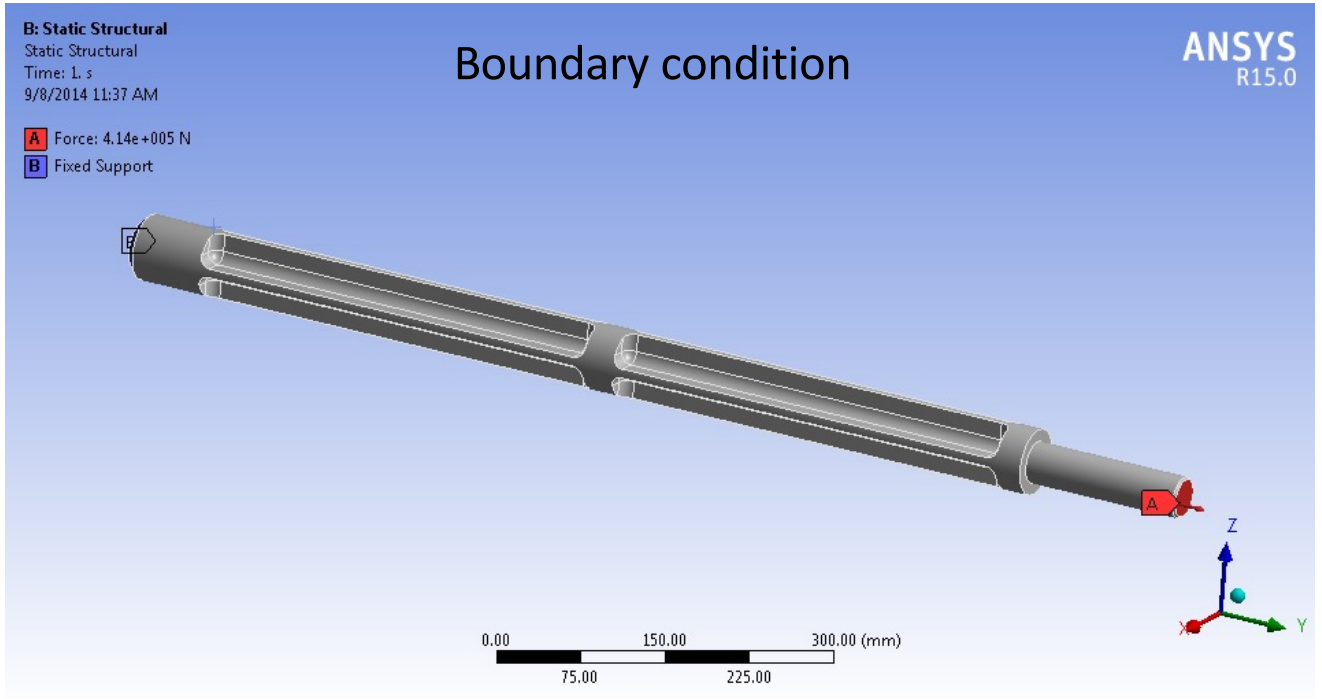
Allowable stress: 530 MPa

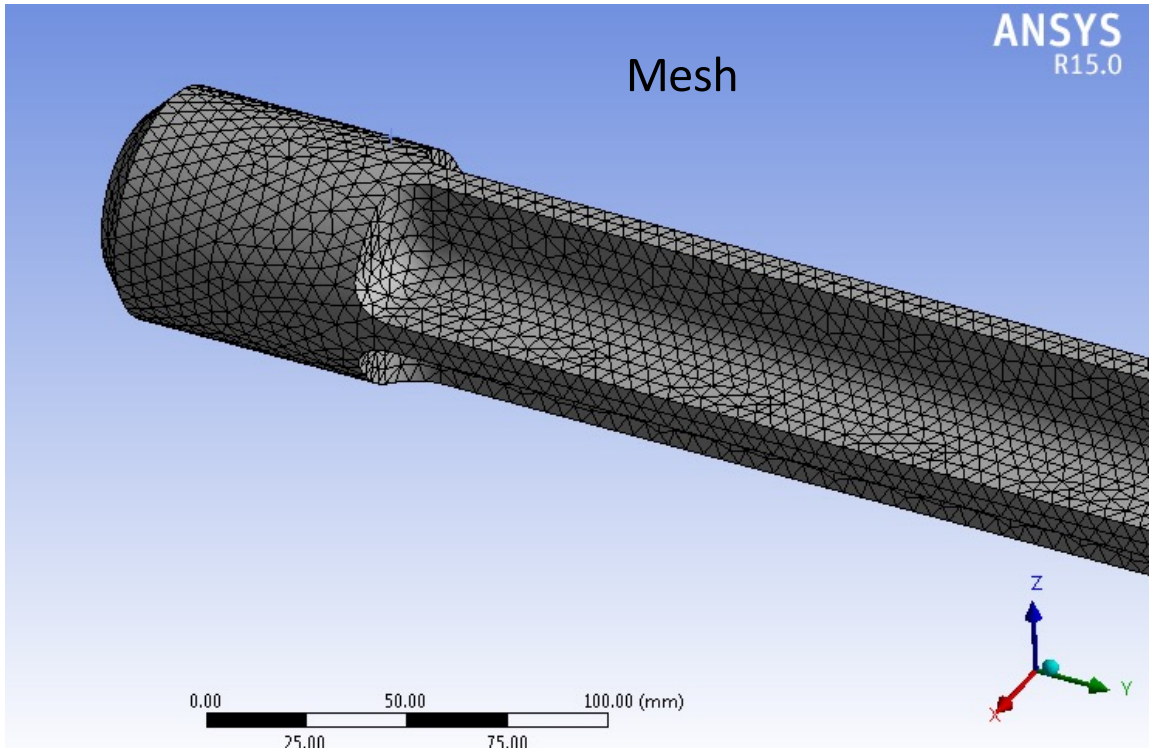


Tube - Deformation



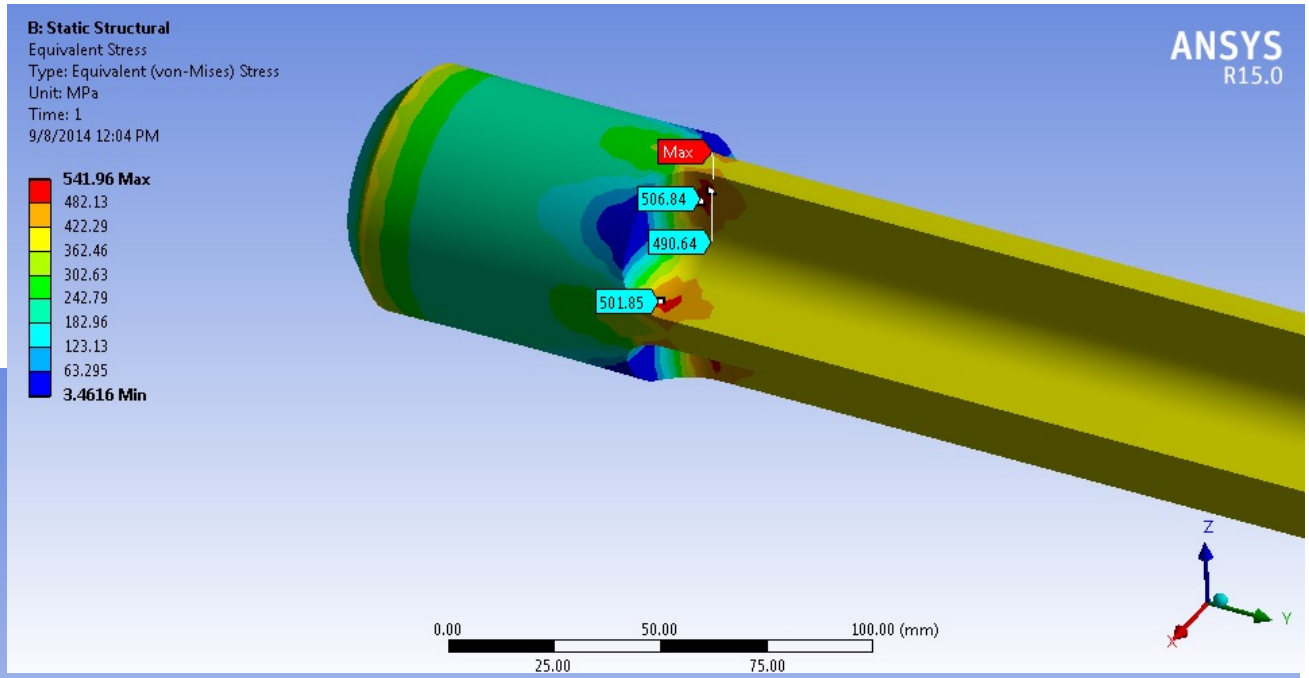
X

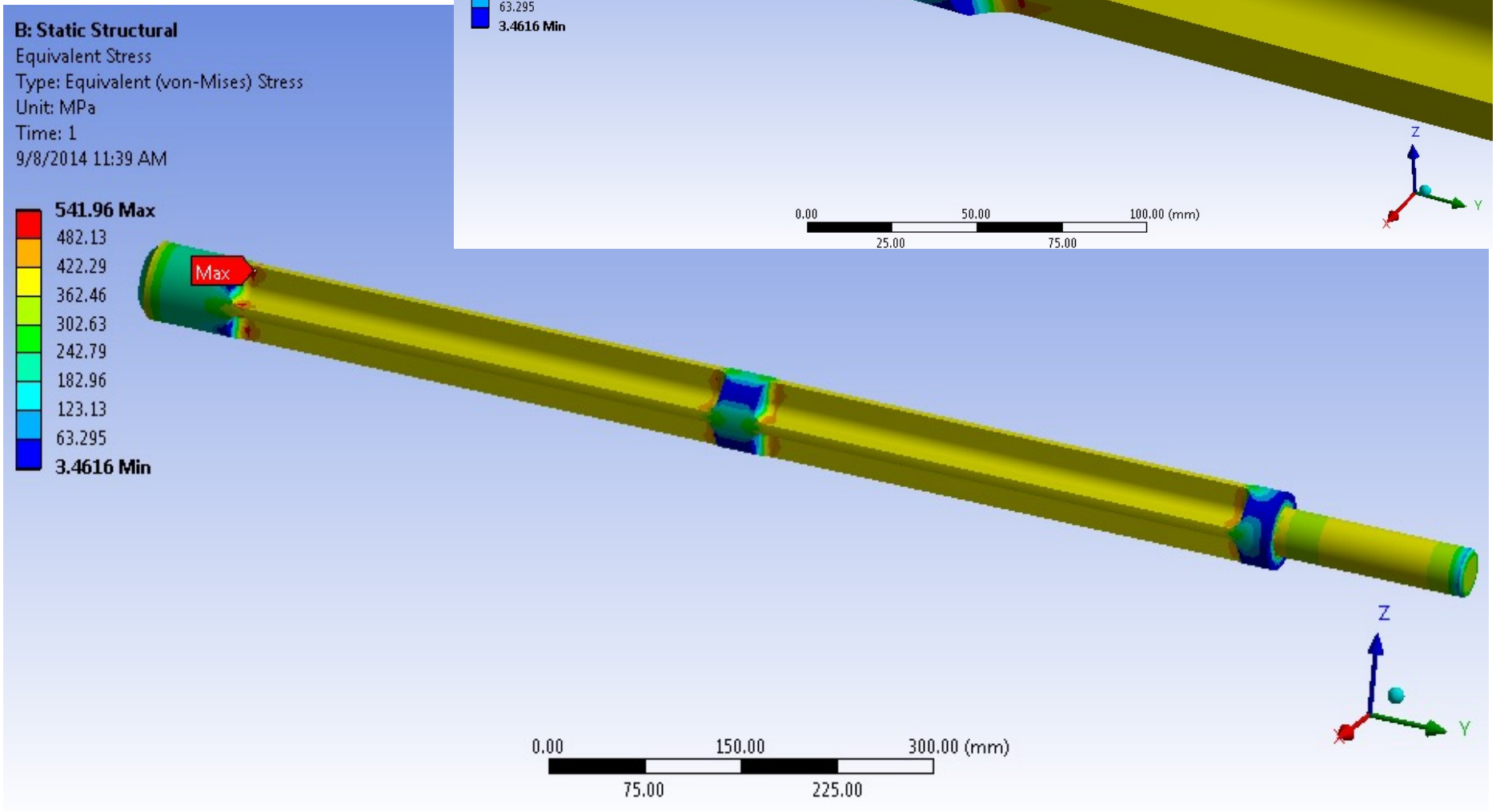

B: Static Structural
Static Structural
Time: 1. s
9/8/2014 11:37 AM
A Force: 4.14e+005 N
B Fixed Support
Boundary condition
ANSYS
R15.0
0.00
150.00
300.00 (mm)
75.00
225.00
Z
Y


Mesh
ANSYS
R15.0
0.00
50.00
100.00 (mm)
25.00
75.00
Z
Y

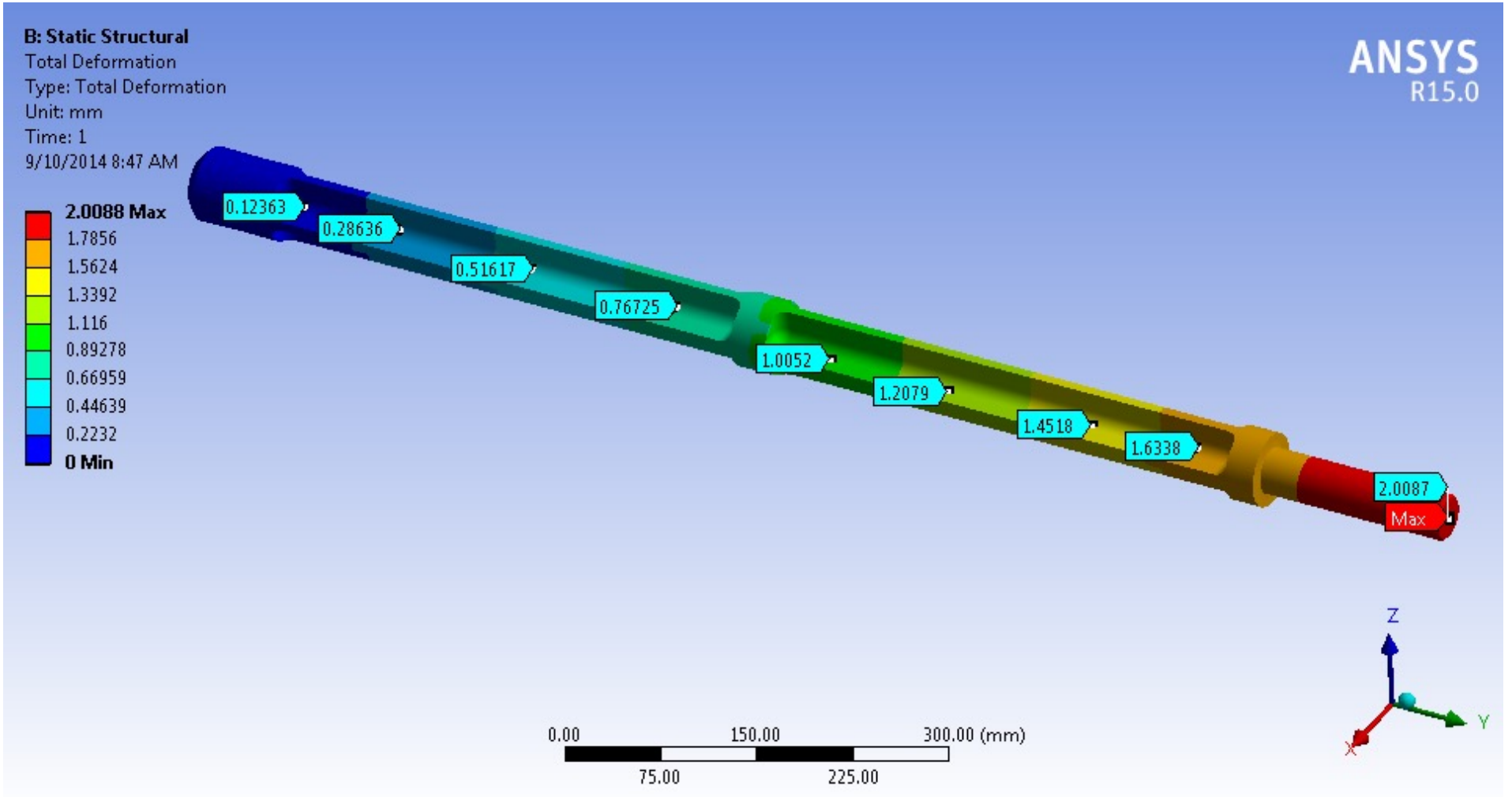
X-section

Allowable stress: 530 Mpa



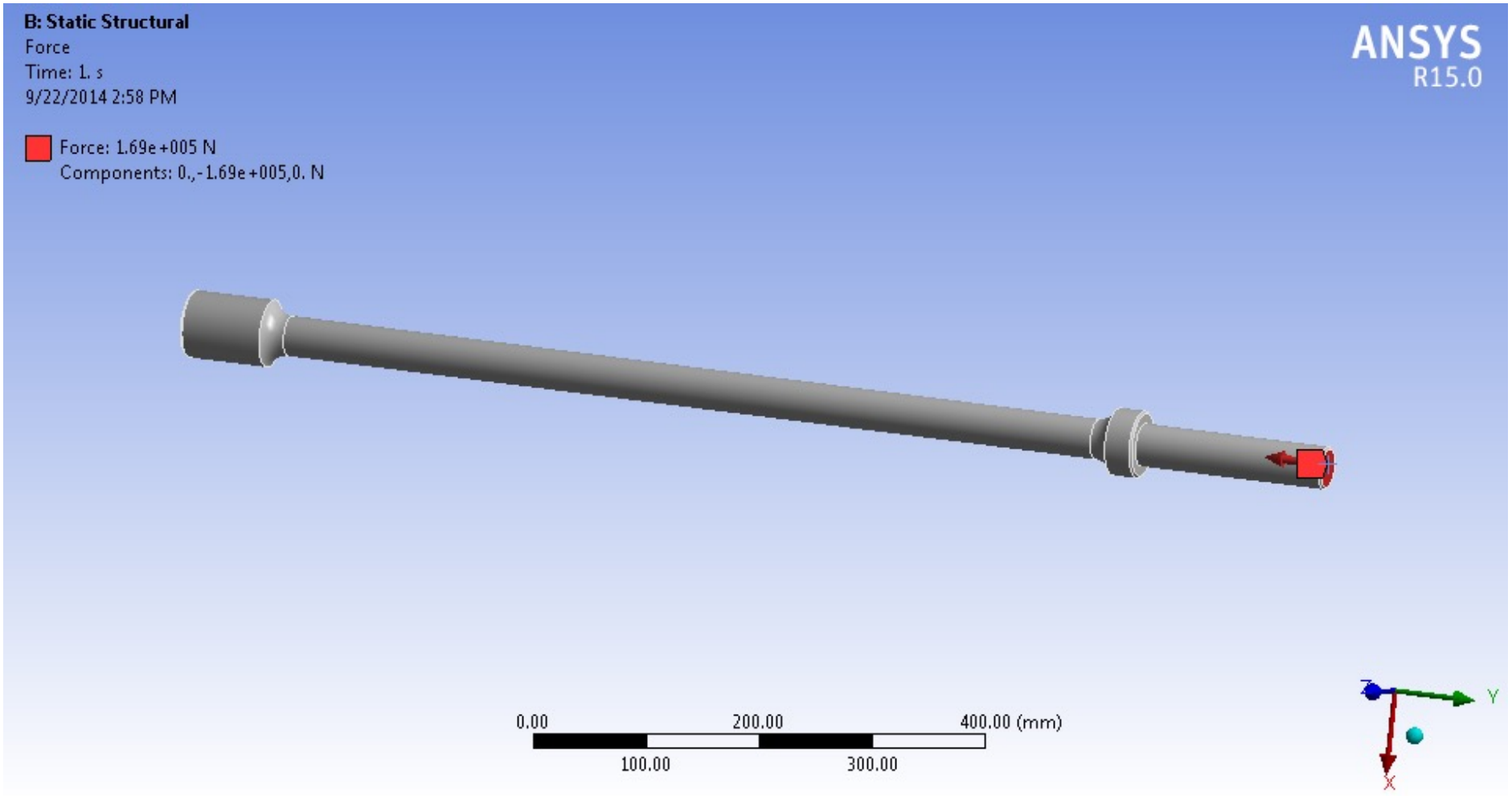


X - Deformation



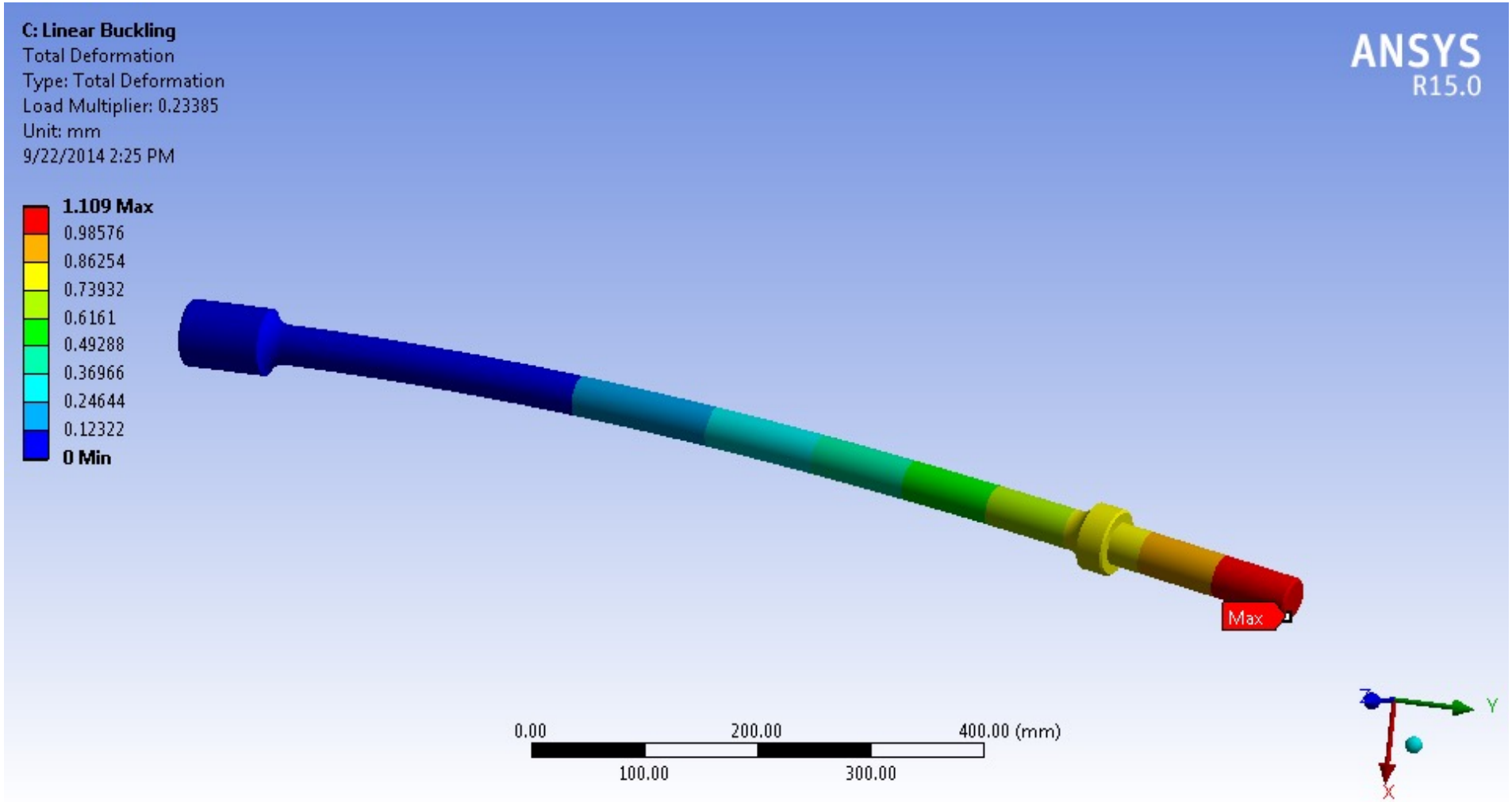
Linear Buckling

Solid rod – Boundary condition



Linear Buckling

Solid rod – Deformation



The solid rod is not good for compression!

Conclusion

- The solid rod is the most simple and is good for tension-only supports.
- The tube and x-section are possible candidates for the tension/compression supports.
- The solid rod is not good for compression.

Thanks for your attention