

# Stress analysis of deflection analysis flexure and obif Vertical Load orientation

*Note:*

*Do not base your design decisions solely on the data presented in this report. Use this information in conjunction with experimental data and practical experience. Field testing is mandatory to validate your final design. COSMOSWorks helps you reduce your time-to-market by reducing but not eliminating field tests.*

Comments:

125 pound vertical load with OCM test flexures at .166" thick as delivered. Flexure properties loaded with test results.

## Table of Contents

Table of Contents .....	2
List of Figures .....	2
Description .....	4
Assumptions.....	4
Model Information.....	4
Study Properties .....	5
Units .....	6
Material Properties .....	6
Loads and Restraints.....	9
Restraint .....	9
Load.....	9
Connector Definitions .....	10
Contact.....	10
Mesh Information.....	10
Design Scenario Results .....	11
Sensor Results .....	11
Reaction Forces .....	11
Free-Body Forces.....	11
Free-body Moments.....	11
Bolt Forces .....	12
Pin Forces .....	12
Study Results.....	12
Conclusion.....	16

## List of Figures

deflection analysis flexure and obif-Study 4-Stress-Stress1 .....	13
deflection analysis flexure and obif-Study 4-Displacement-Displacement1 .....	14
deflection analysis flexure and obif-Study 4-Strain-Strain1 .....	15
deflection analysis flexure and obif-Study 4-Displacement-Displacement2 .....	16



## Description

Summarize the FEM analysis on deflection analysis flexure and obif

## Assumptions

### Model Information

Document Name	Configuration	Document Path	Date Modified
deflection analysis flexure and obif	full contact mate	D:\FIRE\FIRE SolidWorks\Instrument Assembly\Dewar Vessel\deflection analysis flexure and obif.SLDASM	Tue Jul 22 10:03:23 2008
33-20001-1	Fabrication-1	D:\FIRE\FIRE SolidWorks\Instrument Assembly\Dewar Vessel\33-20001.SLDPRT	Tue Jul 22 10:03:36 2008
33-20001-2	Fabrication-1	D:\FIRE\FIRE SolidWorks\Instrument Assembly\Dewar Vessel\33-20001.SLDPRT	Tue Jul 22 10:03:36 2008
33-20001-3	Fabrication-1	D:\FIRE\FIRE SolidWorks\Instrument Assembly\Dewar Vessel\33-20001.SLDPRT	Tue Jul 22 10:03:36 2008
33-20001-4	Fabrication-1	D:\FIRE\FIRE SolidWorks\Instrument Assembly\Dewar Vessel\33-20001.SLDPRT	Tue Jul 22 10:03:36 2008

33-20101_deflection analysis-1	Fabrication	D:\FIRE\FIRE SolidWorks\Instrument Assembly\Dewar Vessel\Vacuum Chamber\33-20101_deflection analysis.SLDPRT	Tue Jul 22 06:39:41 2008
Part1^deflection analysis fle-1	Default	C:\DOCUME~1\MATTHE~1\LOCALS~1\Temp\swx1488\Part1^deflection analysis fle.sldprt	Tue Jul 22 10:03:52 2008

### Study Properties

Study name	Study 4
Analysis type	Static
Mesh Type:	Solid Mesh
Solver type	FFEPlus
Inplane Effect:	Off
Soft Spring:	Off
Inertial Relief:	Off
Thermal Effect:	Input Temperature
Zero strain temperature	298.000000
Units	Kelvin
Include fluid pressure effects from COSMOSFloWorks	Off
Friction:	Off
Ignore clearance for surface contact	Off
Use Adaptive Method:	Off

## Units

Unit system:	SI
Length/Displacement	m
Temperature	Kelvin
Angular velocity	rad/s
Stress/Pressure	psi

## Material Properties

No.	Body Name	Material	Mass	Volume
1	33-20001-1	User Defined	0.248187 lb	3.81826 in <sup>3</sup>
2	33-20001-2	User Defined	0.248187 lb	3.81826 in <sup>3</sup>
3	33-20001-3	User Defined	0.248187 lb	3.81826 in <sup>3</sup>
4	33-20001-4	User Defined	0.248187 lb	3.81826 in <sup>3</sup>
5	33-20101_deflection analysis-1	[SW]6061 Alloy	22.7422 kg	0.00842304 m <sup>3</sup>
6	Part1^deflection analysis fle-1	[SW]6061 Alloy	31.4824 kg	0.0116601 m <sup>3</sup>

<b>Material name:</b>	<b>User Defined</b>
Description:	
Material Source:	Input
Material Model Type:	Linear Elastic Isotropic

Property Name	Value	Units	Value Type
Elastic modulus	2.4656e+006	psi	Constant
Poisson's ratio	0.1	NA	Constant

Mass density	0.065	lb/in^3	Constant
Tensile strength	50550	psi	Constant
Compressive strength	65000	psi	Constant
Yield strength	50550	psi	Constant

<b>Material name:</b>	<b>User Defined</b>
Description:	
Material Source:	Input
Material Model Type:	Linear Elastic Isotropic

Property Name	Value	Units	Value Type
Elastic modulus	2.4656e+006	psi	Constant
Poisson's ratio	0.1	NA	Constant
Mass density	0.065	lb/in^3	Constant
Tensile strength	50550	psi	Constant
Compressive strength	65000	psi	Constant
Yield strength	50550	psi	Constant

<b>Material name:</b>	<b>User Defined</b>
Description:	
Material Source:	Input
Material Model Type:	Linear Elastic Isotropic

Property Name	Value	Units	Value Type
Elastic modulus	2.4656e+006	psi	Constant
Poisson's ratio	0.1	NA	Constant

Mass density	0.065	lb/in <sup>3</sup>	Constant
Tensile strength	50550	psi	Constant
Compressive strength	65000	psi	Constant
Yield strength	50550	psi	Constant

<b>Material name:</b>	<b>User Defined</b>
Description:	
Material Source:	Input
Material Model Type:	Linear Elastic Isotropic

Property Name	Value	Units	Value Type
Elastic modulus	2.4656e+006	psi	Constant
Poisson's ratio	0.1	NA	Constant
Mass density	0.065	lb/in <sup>3</sup>	Constant
Tensile strength	50550	psi	Constant
Compressive strength	65000	psi	Constant
Yield strength	50550	psi	Constant

<b>Material name:</b>	<b>[SW]6061 Alloy</b>
Description:	
Material Source:	Used SolidWorks material
Material Library Name:	SolidWorks Materials
Material Model Type:	Linear Elastic Isotropic

Property Name	Value	Units	Value Type
Elastic modulus	6.9e+010	N/m <sup>2</sup>	Constant



Poisson's ratio	0.33	NA	Constant
Shear modulus	2.6e+010	N/m <sup>2</sup>	Constant
Mass density	2700	kg/m <sup>3</sup>	Constant
Tensile strength	1.2408e+008	N/m <sup>2</sup>	Constant
Yield strength	5.5149e+007	N/m <sup>2</sup>	Constant
Thermal expansion coefficient	2.4e-005	/Kelvin	Constant
Thermal conductivity	170	W/(m.K)	Constant
Specific heat	1300	J/(kg.K)	Constant

## Loads and Restraints

### Restraint

Restraint name	Selection set	Description
Restraint-1 <33-20101_deflection analysis-1>	on 1 Face(s) fixed.	

### Load

Load name	Selection set	Loading type	Description
Gravity-1	Gravity with respect to Edge< 1 > with gravity acceleration 9.81 m/s <sup>2</sup> normal to reference plane	Sequential Loading	
RemoteLoads/Mass-1 <Part1^deflection analysis fle-1>	Load ( Direct Transfer ) on 1 Face(s) apply force - 125 lb along Y direction at location (0 in, 0 in, 3.5 in)	Sequential Loading	

## Connector Definitions

No Connectors were defined

## Contact

Contact state: Touching faces - Bonded

## Mesh Information

Mesh Type:	Solid Mesh
Mesher Used:	Standard
Automatic Transition:	Off
Smooth Surface:	On
Jacobian Check:	4 Points
Element Size:	0.5 in
Tolerance:	0.024 in
Quality:	High
Number of elements:	116455
Number of nodes:	198398
Time to complete mesh(hh:mm:ss):	00:00:16
Computer name:	FIRE

## Mesh Control Information:

Control-1{1} <33-20001-4, 33-20001-3, 33-20001-2, 33-20001-1>	Mesh control on 16 Face(s) with seed 0.08 in, 3 layers and ration 1.5.
---	--

Control-2 <33-20101\_deflection analysis-1>

Mesh control on 13 Face(s) with seed 0.38 in, 3 layers and ration 1.5.

## Design Scenario Results

No data available.

## Sensor Results

No data available.

## Reaction Forces

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Body	N	0.0490976	1092.52	0.683603	1092.52

## Free-Body Forces

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Body	N	-0.000574872	0.000632934	-0.000125546	0.000864202

## Free-body Moments

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Body	N-m	0	0	0	1e-033

## Bolt Forces

No data available.

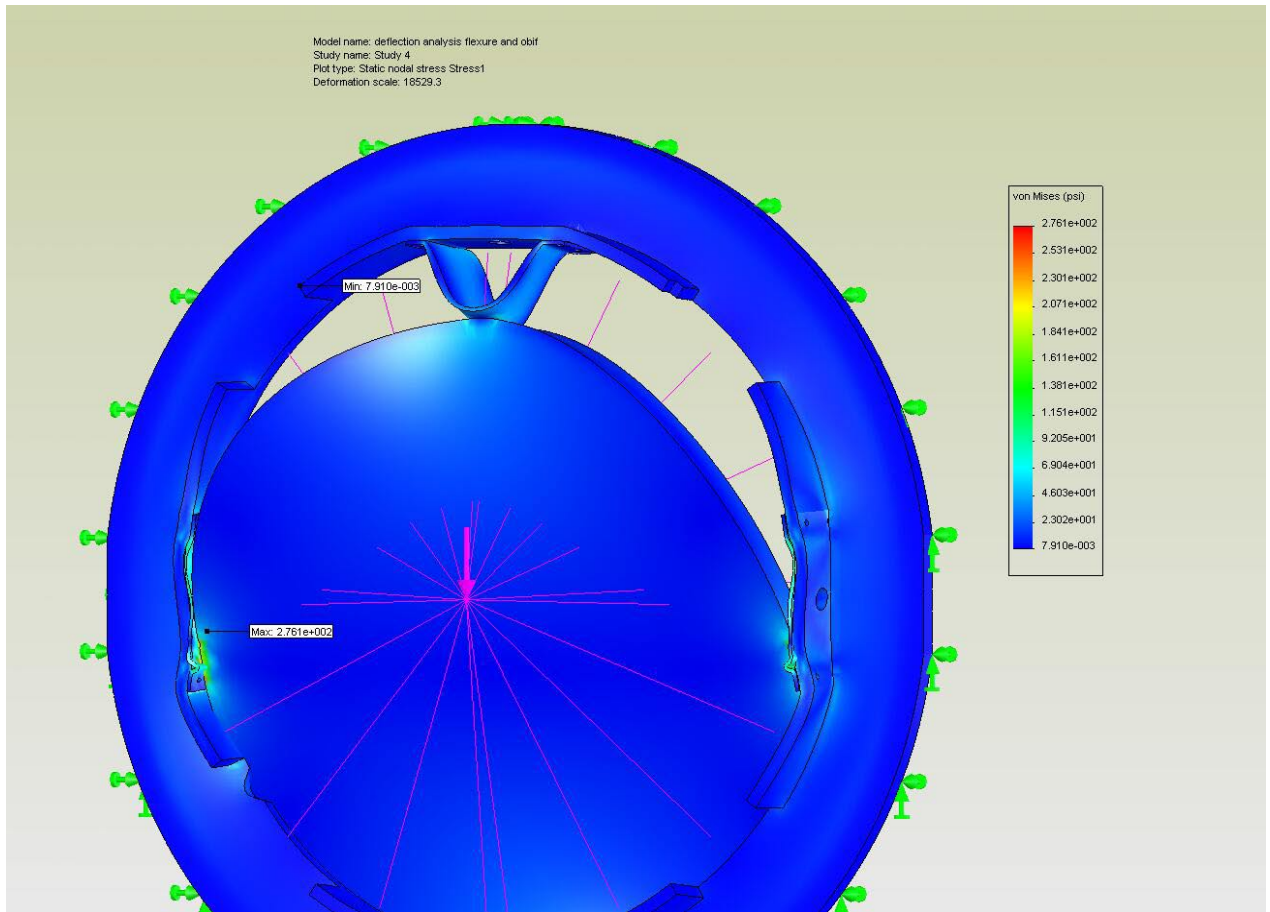
## Pin Forces

No data available.

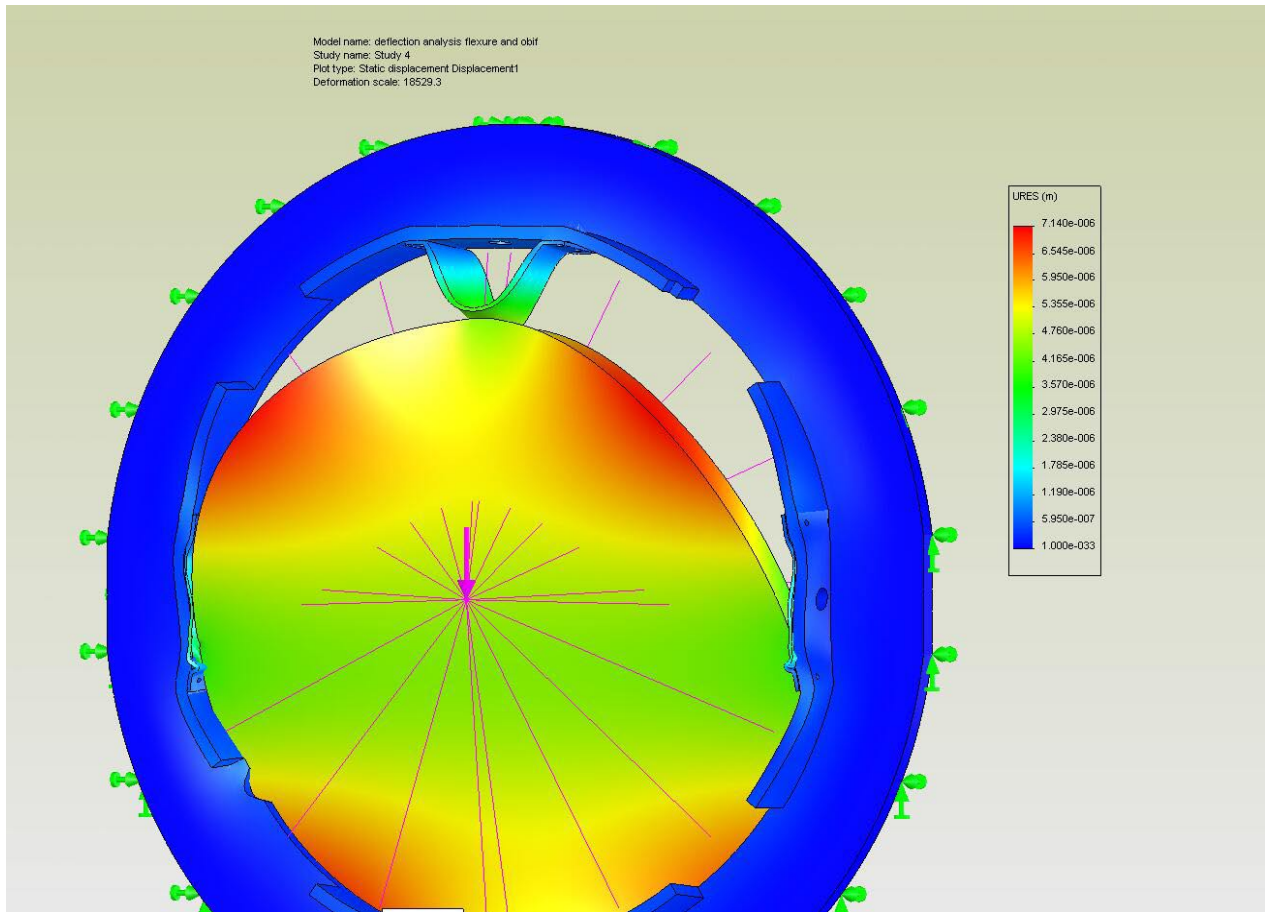
## Study Results

### Default Results

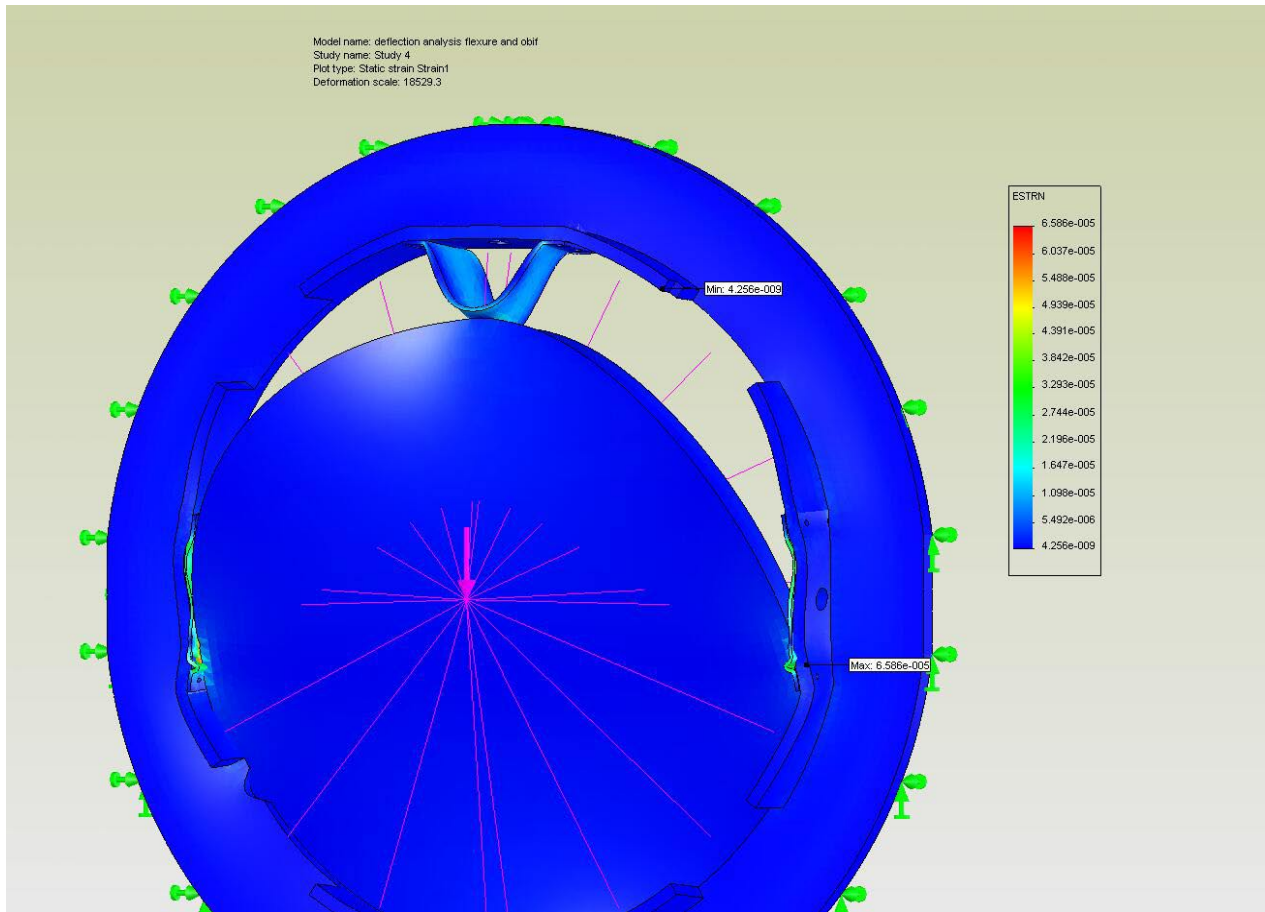
Name	Type	Min	Location	Max	Location
Stress1	VON: von Mises Stress	0.00791037 psi Node: 57976	(-9.42805 in, 13.5947 in, 1.28457 in)	276.147 psi Node: 54888	(-15.1097 in, 0.97791 in, 0.461788 in)
Displacement1	URES: Resultant Displacement	0 m Node: 56199	(9.55428 in, -16.4399 in, -1.66543 in)	7.1397e-006 m Node: 197092	(-10.3535 in, -10.7584 in, 0.5 in)
Strain1	ESTRN: Equivalent Strain	4.25577e-009 Element: 42005	(8.48928 in, 13.4804 in, 1.1608 in)	6.58576e-005 Element: 10388	(15.0098 in, -0.426766 in, 0.318889 in)
Displacement2	UY: Y Displacement	-5.14756e-006 m Node: 27982	(-0.0707221 in, -14.8079 in, -1.64543 in)	5.06358e-007 m Node: 7925	(-3.02691 in, 15.4361 in, 1.35457 in)



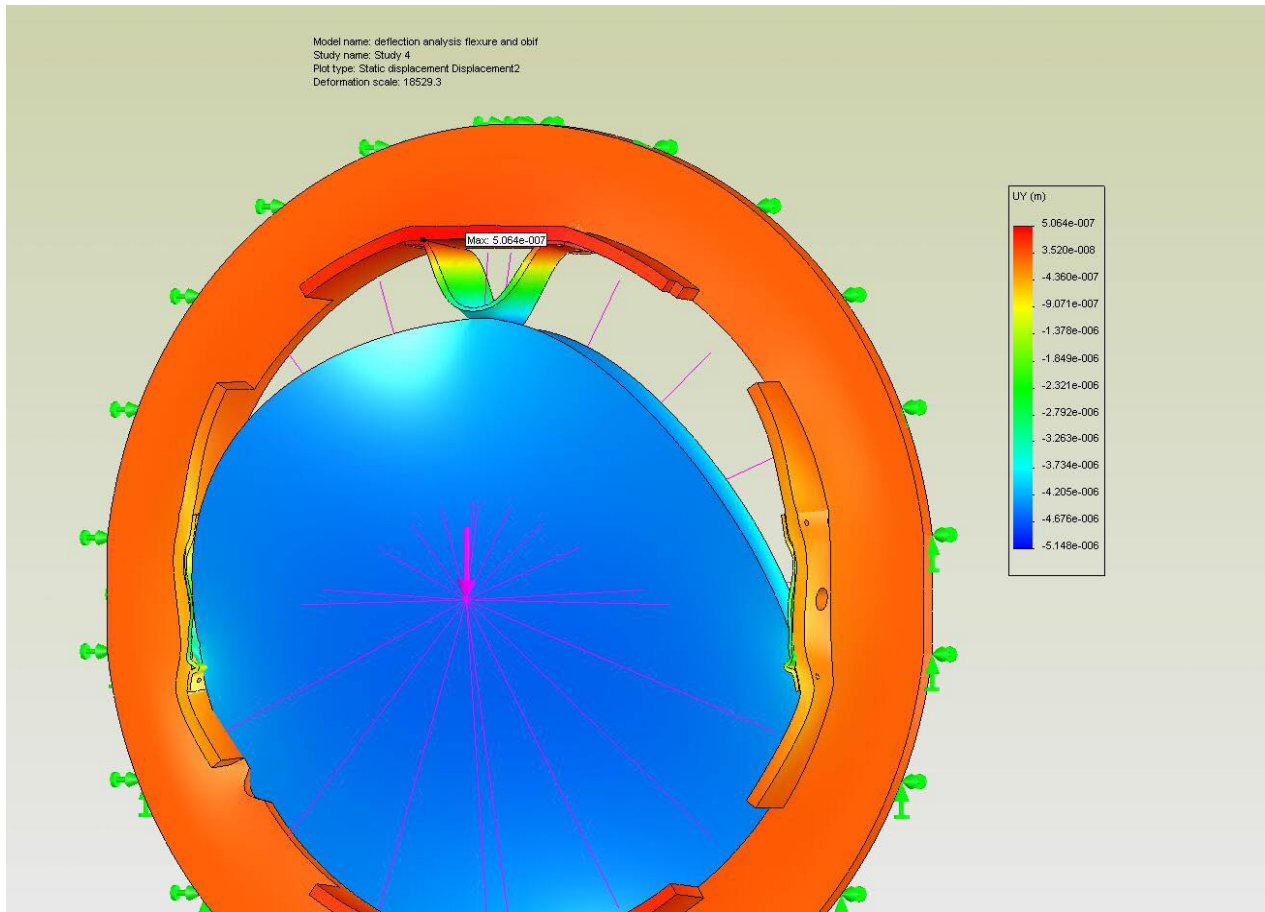
deflection analysis flexure and obif-Study 4-Stress-Stress1



deflection analysis flexure and obif-Study 4-Displacement-Displacement1



deflection analysis flexure and obif-Study 4-Strain-Strain1



deflection analysis flexure and obif-Study 4-Displacement-Displacement2

## Conclusion