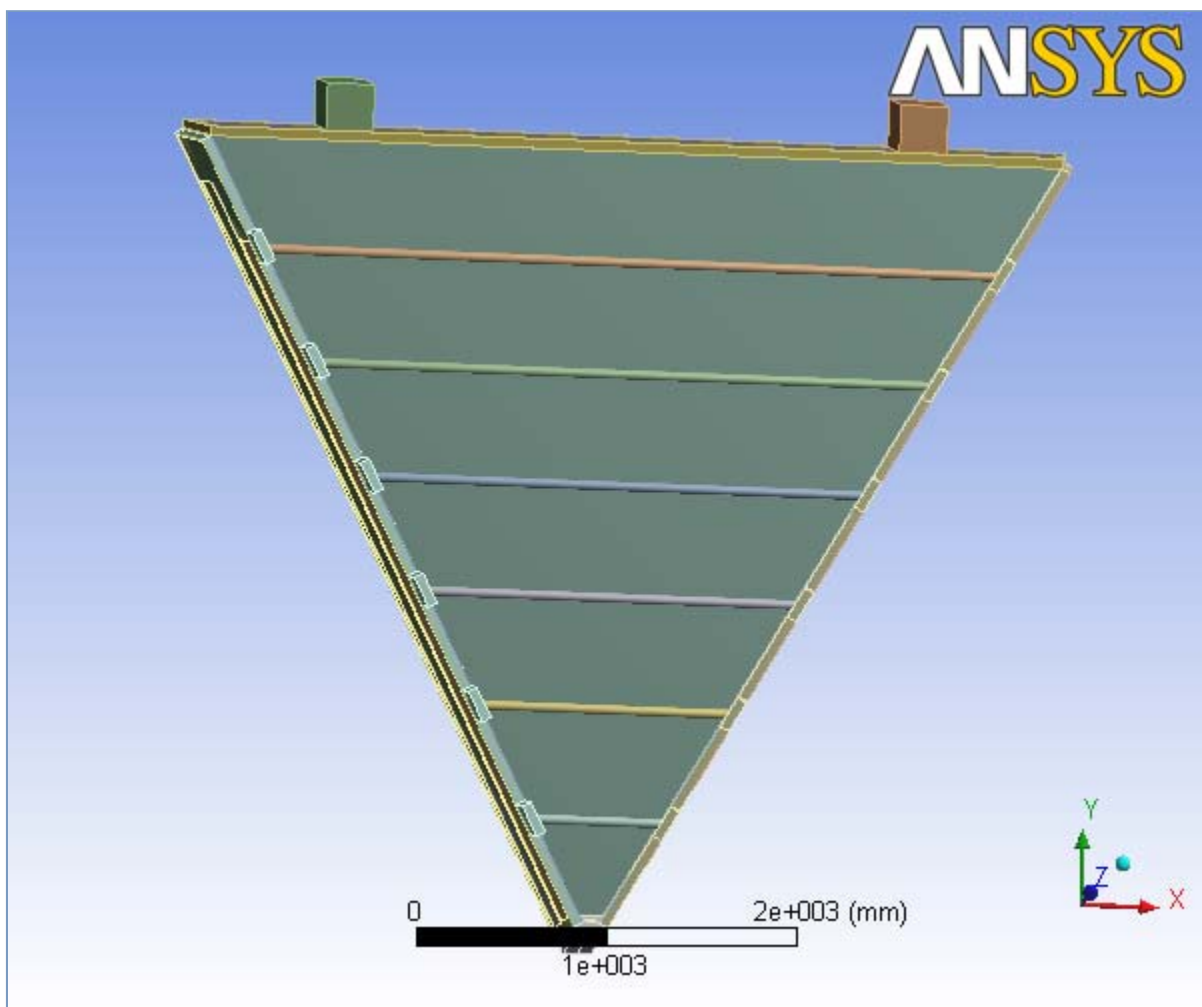




## Analysis 4.3

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<i>Subject</i>	<i>Ideal Case with Gravity, Wire loads, Hexcel, Rods</i>
<i>Prepared for</i>	<i>Region 3 Drift Chamber Design</i>
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## Units

**TABLE 1**

Unit System	Metric (mm, kg, N, °C, s, mV, mA)
Angle	Degrees
Rotational Velocity	rad/s

## Ideal slice with Wire loads, Gravity, Hexcel, Rods

### Geometry

**TABLE 2**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Geometry**

Object Name	<i>Geometry</i>
State	Fully Defined
<b>Definition</b>	
Source	C:\Documents and Settings\Jinnuri\Desktop\website\R3_2.agdb
Type	DesignModeler
Length Unit	Millimeters
Element Control	Program Controlled
Display Style	Part Color
<b>Bounding Box</b>	
Length X	4768.3 mm
Length Y	4317.7 mm
Length Z	2060. mm
<b>Properties</b>	
Volume	8.52e+008 mm <sup>3</sup>

Mass	342.76 kg
<b>Statistics</b>	
Bodies	29
Active Bodies	29
Nodes	160363
Elements	26466
<b>Preferences</b>	
Import Solid Bodies	Yes
Import Surface Bodies	Yes
Import Line Bodies	Yes
Parameter Processing	Yes
Personal Parameter Key	DS
CAD Attribute Transfer	No
Named Selection Processing	No
Material Properties Transfer	No
CAD Associativity	Yes
Import Coordinate Systems	No
Reader Save Part File	No
Import Using Instances	Yes
Do Smart Update	No
Attach File Via Temp File	No
Analysis Type	3-D
Mixed Import Resolution	None
Enclosure and Symmetry Processing	Yes

**TABLE 3**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Geometry > Parts**

Object Name	<i>Nose Plate</i>	<i>Left Endplate Downstream Hole area</i>	<i>Right Endplate Upstream Hole area</i>	<i>Left Endplate Upstream Hole area</i>	<i>Left Endplate Aluminum Casing</i>
State	Meshed				
<b>Graphics Properties</b>					
Visible	Yes				
Transparency	1				
<b>Definition</b>					
Suppressed	No				
Material	Aluminum	Polyurethane			Aluminum
Stiffness Behavior	Flexible				
Nonlinear Material Effects	Yes				
<b>Bounding Box</b>					
Length X	180.6 mm	2159.8 mm	2116.2 mm	1973.8 mm	2338.9 mm
Length Y	94.006 mm	3690. mm	3614.6 mm	3368. mm	4000.3 mm
Length Z	529.95 mm	1562.8 mm	1531.7 mm	1437.5 mm	1983.2 mm
<b>Properties</b>					
Volume	6.6319e+006 mm <sup>3</sup>	4.3107e+007 mm <sup>3</sup>	4.1332e+007 mm <sup>3</sup>	3.8462e+007 mm <sup>3</sup>	1.1673e+007 mm <sup>3</sup>
Mass	17.906 kg	10.346 kg	9.9198 kg	9.2309 kg	31.518 kg
Centroid X	-1.8724e-016 mm	-1157.7 mm	1145.5 mm	-1057.2 mm	-1178.2 mm
Centroid Y	42.65 mm	1932.5 mm	1911.3 mm	1758.4 mm	1967.9 mm

Centroid Z	-263.29 mm	368. mm	587.1 mm	528.73 mm	639.08 mm
Moment of Inertia Ip1	4.2714e+005 kg·mm <sup>2</sup>	1.68e+007 kg·mm <sup>2</sup>	1.5457e+007 kg·mm <sup>2</sup>	1.2459e+007 kg·mm <sup>2</sup>	5.6821e+007 kg·mm <sup>2</sup>
Moment of Inertia Ip2	4.4442e+005 kg·mm <sup>2</sup>	34145 kg·mm <sup>2</sup>	31455 kg·mm <sup>2</sup>	29271 kg·mm <sup>2</sup>	1.6143e+006 kg·mm <sup>2</sup>
Moment of Inertia Ip3	43603 kg·mm <sup>2</sup>	1.677e+007 kg·mm <sup>2</sup>	1.543e+007 kg·mm <sup>2</sup>	1.2434e+007 kg·mm <sup>2</sup>	5.5221e+007 kg·mm <sup>2</sup>
<b>Statistics</b>					
Nodes	440	296	272	2445	
Elements	179	24	22	926	

**TABLE 4**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Geometry > Parts**

Object Name	<i>Left Endplate Polyurethane</i>	<i>Right Endplate Downstream Hole area</i>	<i>Right Endplate Aluminum Casing</i>	<i>Right Endplate Polyurethane</i>	<i>Left Endplate Inner Steel slice</i>
State	Meshed				
<b>Graphics Properties</b>					
Visible	Yes				
Transparency	1				
<b>Definition</b>					
Suppressed	No				
Material	Polyurethane		Aluminum	Polyurethane	Stainless Steel
Stiffness Behavior	Flexible				
Nonlinear Material Effects	Yes				
Thickness					
Thickness Mode	Manual				
<b>Bounding Box</b>					
Length X	2327.6 mm	1998.1 mm	2338.8 mm	2322.8 mm	2294.9 mm
Length Y	3980.8 mm	3410. mm	4000.2 mm	3972.4 mm	3974.9 mm
Length Z	1956.7 mm	1457.6 mm	1984. mm	1954.5 mm	1983.2 mm
<b>Properties</b>					
Volume	3.4557e+007 mm <sup>3</sup>	3.9784e+007 mm <sup>3</sup>	1.1919e+007 mm <sup>3</sup>	3.4764e+007 mm <sup>3</sup>	2.9149e+006 mm <sup>3</sup>
Mass	8.2936 kg	9.5482 kg	32.181 kg	8.3434 kg	23.319 kg
Centroid X	-1396. mm	1078.8 mm	1201.6 mm	1379.8 mm	
Centroid Y	2345.1 mm	1795.8 mm	2008.4 mm	2317.1 mm	
Centroid Z	542.67 mm	316.67 mm	651.27 mm	513.21 mm	
Moment of Inertia Ip1	2.0961e+007 kg·mm <sup>2</sup>	1.321e+007 kg·mm <sup>2</sup>	6.0236e+007 kg·mm <sup>2</sup>	2.1346e+007 kg·mm <sup>2</sup>	
Moment of Inertia Ip2	2.0417e+005 kg·mm <sup>2</sup>	31513 kg·mm <sup>2</sup>	1.6548e+006 kg·mm <sup>2</sup>	1.8581e+005 kg·mm <sup>2</sup>	
Moment of Inertia Ip3	2.076e+007 kg·mm <sup>2</sup>	1.3183e+007 kg·mm <sup>2</sup>	5.8594e+007 kg·mm <sup>2</sup>	2.1163e+007 kg·mm <sup>2</sup>	
Surface Area (approx.)					
	2.3908e+006 mm <sup>2</sup>				
<b>Statistics</b>					
Nodes	1862	272	2379	1843	168
Elements	639	22	905	627	124

**TABLE 5**

**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Geometry > Parts**

Object Name	<i>Left Endplate Outer Steel slice</i>	<i>Right Endplate Outer Steel slice</i>	<i>Right Endplate Inner Steel Slice</i>	<i>Backplate Aluminum Casing</i>	<i>Backplate Polyurethane</i>
State	Meshed				
<b>Graphics Properties</b>					
Visible	Yes				
Transparency	1				
<b>Definition</b>					
Suppressed	No				
Material	Stainless Steel			Aluminum	Polyurethane
Nonlinear Material Effects	Yes				
Thickness	1.2192 mm				
Thickness Mode	Manual				
Stiffness Behavior				Flexible	
<b>Bounding Box</b>					
Length X	2294.9 mm	2294.8 mm		4682.7 mm	4659.3 mm
Length Y	3974.9 mm	3974.8 mm		186.53 mm	180.41 mm
Length Z	1983.2 mm	1984. mm		498.46 mm	476.92 mm
<b>Properties</b>					
Volume	2.9149e+006 mm <sup>3</sup>			5.2863e+006 mm <sup>3</sup>	1.1124e+008 mm <sup>3</sup>
Mass	23.319 kg			14.273 kg	26.698 kg
Surface Area (approx.)	2.3908e+006 mm <sup>2</sup>				
Centroid X				175.74 mm	-0.24556 mm
Centroid Y				3986.6 mm	3987.5 mm
Centroid Z				1225.6 mm	1222.4 mm
Moment of Inertia Ip1				7.8718e+005 kg·mm <sup>2</sup>	5.1362e+005 kg·mm <sup>2</sup>
Moment of Inertia Ip2				3.0219e+007 kg·mm <sup>2</sup>	4.725e+007 kg·mm <sup>2</sup>
Moment of Inertia Ip3				2.9438e+007 kg·mm <sup>2</sup>	4.6748e+007 kg·mm <sup>2</sup>
<b>Statistics</b>					
Nodes	176	157	155	708	241
Elements	132	113	111	74	24

**TABLE 6**

**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Geometry > Parts**

Object Name	<i>Backplate Outer steel slice</i>	<i>Back Plate Inner Steel slice</i>	<i>Rod 4</i>	<i>Rod 5</i>	<i>Rod 6</i>
State	Meshed				
<b>Graphics Properties</b>					
Visible	Yes				
Transparency	1				
<b>Definition</b>					
Suppressed	No				
Material	Stainless Steel			Carbon Fiber	
Nonlinear Material Effects	Yes				

Thickness	1.2192 mm				
Thickness Mode	Manual				
Stiffness Behavior			Flexible		
<b>Bounding Box</b>					
Length X	4524.4 mm	2618.1 mm	3260.4 mm	3902.6 mm	
Length Y	137.65 mm	50.8 mm			
Length Z	484.52 mm	50.8 mm			
<b>Properties</b>					
Volume	2.7483e+006 mm <sup>3</sup>	5.1151e+005 mm <sup>3</sup>	6.3841e+005 mm <sup>3</sup>	7.6532e+005 mm <sup>3</sup>	
Mass	21.987 kg	0.29667 kg	0.37028 kg	0.44388 kg	
Surface Area (approx.)	2.2542e+006 mm <sup>2</sup>				
Centroid X		-3.0688e-010 mm	-8.6731e-011 mm	-1.3795e-008 mm	
Centroid Y		2220.1 mm	2776.3 mm	3332.5 mm	
Centroid Z		880.31 mm	1091.6 mm	1302.9 mm	
Moment of Inertia Ip1		177.84 kg·mm <sup>2</sup>	221.97 kg·mm <sup>2</sup>	266.09 kg·mm <sup>2</sup>	
Moment of Inertia Ip2		1.6387e+005 kg·mm <sup>2</sup>	3.1853e+005 kg·mm <sup>2</sup>	5.4867e+005 kg·mm <sup>2</sup>	
Moment of Inertia Ip3		1.6388e+005 kg·mm <sup>2</sup>	3.1853e+005 kg·mm <sup>2</sup>	5.4867e+005 kg·mm <sup>2</sup>	
<b>Statistics</b>					
Nodes	174	186	27520	34352	41184
Elements	129	141	3920	4896	5872

**TABLE 7**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Geometry > Parts**

Object Name	<i>Rod 1</i>	<i>Rod 2</i>	<i>Rod 3</i>	<i>Force ref line</i>	<i>30 deg Ref line</i>
State	Meshed				
<b>Graphics Properties</b>					
Visible	Yes				
Transparency	1				
<b>Definition</b>					
Suppressed	No				
Material	Carbon Fiber			Aluminum	
Stiffness Behavior	Flexible				
Nonlinear Material Effects	Yes				
<b>Bounding Box</b>					
Length X	691.28 mm	1333.5 mm	1975.8 mm	70. mm	11.116 mm
Length Y	50.8 mm			3.6786 mm	19.253 mm
Length Z	50.8 mm			5. mm	
<b>Properties</b>					
Volume	1.3079e+005 mm <sup>3</sup>	2.577e+005 mm <sup>3</sup>	3.846e+005 mm <sup>3</sup>	643.76 mm <sup>3</sup>	535.05 mm <sup>3</sup>
Mass	7.586e-002 kg	0.14946 kg	0.22307 kg	1.7382e-003 kg	1.4446e-003 kg
Centroid X	-7.386e-011 mm	5.0812e-010 mm	-5.8382e-011 mm	2.7078e-014 mm	-3.7053 mm
Centroid Y	551.82 mm	1107.8 mm	1663.9 mm	68.426 mm	39.079 mm
Centroid Z	246.45 mm	457.74 mm	669.03 mm	2.5 mm	

Moment of Inertia Ip1	45.457 kg·mm <sup>2</sup>	89.595 kg·mm <sup>2</sup>	133.72 kg·mm <sup>2</sup>	4.9279e-003 kg·mm <sup>2</sup>	3.5962e-002 kg·mm <sup>2</sup>
Moment of Inertia Ip2	2768.1 kg·mm <sup>2</sup>	21001 kg·mm <sup>2</sup>	69702 kg·mm <sup>2</sup>	0.3585 kg·mm <sup>2</sup>	9.7246e-003 kg·mm <sup>2</sup>
Moment of Inertia Ip3	2768.2 kg·mm <sup>2</sup>	21001 kg·mm <sup>2</sup>	69702 kg·mm <sup>2</sup>	0.35618 kg·mm <sup>2</sup>	3.9668e-002 kg·mm <sup>2</sup>
<b>Statistics</b>					
Nodes	11946	7788	20576	237	294
Elements	1760	1104	2928	22	38

**TABLE 8**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Geometry > Parts**

Object Name	<i>60 Deg Ref line</i>	<i>Left Hinge</i>	<i>Right Hinge</i>	<i>Hexcel</i>
State	Meshed			
<b>Graphics Properties</b>				
Visible	Yes			
Transparency	1			
<b>Definition</b>				
Suppressed	No			
Material	Aluminum	Polyurethane	Hexcel	
Stiffness Behavior	Flexible			
Nonlinear Material Effects	Yes			
<b>Bounding Box</b>				
Length X	20.123 mm	250.37 mm		4671.1 mm
Length Y	11.618 mm	371.11 mm		3939.1 mm
Length Z	5. mm	528.13 mm		1527.6 mm
<b>Properties</b>				
Volume	584.49 mm <sup>3</sup>	2.9863e+007 mm <sup>3</sup>		3.9367e+008 mm <sup>3</sup>
Mass	1.5781e-003 kg	7.1671 kg		11.351 kg
Centroid X	-6.7077 mm	-1527.6 mm	1521.8 mm	-2.4337e-006 mm
Centroid Y	13.673 mm	4131.5 mm	4132.1 mm	2672.3 mm
Centroid Z	2.5 mm	1265.9 mm	1263.7 mm	485.69 mm
Moment of Inertia Ip1	1.1301e-002 kg·mm <sup>2</sup>	1.7368e+005 kg·mm <sup>2</sup>		1.1729e+007 kg·mm <sup>2</sup>
Moment of Inertia Ip2	4.2611e-002 kg·mm <sup>2</sup>	1.7368e+005 kg·mm <sup>2</sup>		1.0294e+007 kg·mm <sup>2</sup>
Moment of Inertia Ip3	4.7337e-002 kg·mm <sup>2</sup>	74658 kg·mm <sup>2</sup>		2.2019e+007 kg·mm <sup>2</sup>
<b>Statistics</b>				
Nodes	250	376		3394
Elements	30	54		1572

## Connections

**TABLE 9**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections**

Object Name	<i>Connections</i>
State	Fully Defined
<b>Auto Detection</b>	
Generate Contact On Update	Yes
Tolerance Type	Slider
Tolerance Slider	0.
Tolerance Value	16.886 mm
Face/Face	Yes

Face/Edge	No
Edge/Edge	No
Priority	Include All
Same Body Grouping	Yes
Revolute Joints	Yes
Fixed Joints	Yes
<b>Transparency</b>	
Enabled	Yes

**TABLE 10**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	Contact Region	Contact Region 2	Contact Region 3	Contact Region 4	Contact Region 5
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	2 Faces				1 Face
Target	2 Faces				1 Face
Contact Bodies	Nose Plate				
Target Bodies	Left Endplate Aluminum Casing	Left Endplate Polyurethane	Right Endplate Aluminum Casing	Right Endplate Polyurethane	Left Endplate Inner Steel slice
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				
<b>Advanced</b>					
Formulation	Pure Penalty				
Normal Stiffness	Program Controlled				
Update Stiffness	Never				
Thermal Conductance	Program Controlled				
Pinball Region	Program Controlled				

**TABLE 11**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	Contact Region 6	Contact Region 7	Contact Region 8	Contact Region 9	Contact Region 10
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	1 Face				4 Faces
Target	1 Face				4 Faces
Contact Bodies	Nose Plate				Left Endplate Downstream Hole area
Target Bodies	Right Endplate Inner Steel Slice	Force ref line	30 deg Ref line	60 Deg Ref line	Left Endplate Polyurethane
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				



Behavior	Symmetric
Suppressed	No
<b>Advanced</b>	
Formulation	Pure Penalty
Normal Stiffness	Program Controlled
Update Stiffness	Never
Thermal Conductance	Program Controlled
Pinball Region	Program Controlled

**TABLE 12**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	<i>Contact Region 11</i>	<i>Contact Region 12</i>	<i>Contact Region 13</i>	<i>Contact Region 14</i>	<i>Contact Region 15</i>
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	1 Face		4 Faces		1 Face
Target	1 Face		4 Faces		1 Face
Contact Bodies	Left Endplate Downstream Hole area		Right Endplate Upstream Hole area		
Target Bodies	Left Endplate Inner Steel slice	Left Endplate Outer Steel slice	Right Endplate Aluminum Casing	Right Endplate Polyurethane	Right Endplate Outer Steel slice
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				
<b>Advanced</b>					
Formulation	Pure Penalty				
Normal Stiffness	Program Controlled				
Update Stiffness	Never				
Thermal Conductance	Program Controlled				
Pinball Region	Program Controlled				

**TABLE 13**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	<i>Contact Region 16</i>	<i>Contact Region 17</i>	<i>Contact Region 18</i>	<i>Contact Region 19</i>	<i>Contact Region 20</i>
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	1 Face		4 Faces		1 Face
Target	1 Face		4 Faces		1 Face
Contact Bodies	Right Endplate Upstream Hole area	Left Endplate Upstream Hole area			
Target Bodies	Right Endplate Inner Steel Slice	Left Endplate Aluminum Casing	Left Endplate Polyurethane	Left Endplate Inner Steel slice	Left Endplate Outer Steel slice
<b>Definition</b>					
Type	Bonded				

Scope Mode	Automatic
Behavior	Symmetric
Suppressed	No
<b>Advanced</b>	
Formulation	Pure Penalty
Normal Stiffness	Program Controlled
Update Stiffness	Never
Thermal Conductance	Program Controlled
Pinball Region	Program Controlled

**TABLE 14**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	<i>Contact Region 21</i>	<i>Contact Region 22</i>	<i>Contact Region 23</i>	<i>Contact Region 24</i>	<i>Contact Region 25</i>
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	4 Faces				1 Face
Target	4 Faces				1 Face
Contact Bodies	Left Endplate Aluminum Casing				
Target Bodies	Left Endplate Polyurethane	Left Endplate Inner Steel slice	Left Endplate Outer Steel slice	Rod 4	Rod 5
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				
<b>Advanced</b>					
Formulation	Pure Penalty				
Normal Stiffness	Program Controlled				
Update Stiffness	Never				
Thermal Conductance	Program Controlled				
Pinball Region	Program Controlled				

**TABLE 15**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	<i>Contact Region 26</i>	<i>Contact Region 27</i>	<i>Contact Region 28</i>	<i>Contact Region 29</i>	<i>Contact Region 30</i>
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact				1 Face	2 Faces
Target				1 Face	2 Faces
Contact Bodies	Left Endplate Aluminum Casing				
Target Bodies	Rod 6	Rod 1	Rod 2	Rod 3	Hexcel
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				

<b>Advanced</b>	
Formulation	Pure Penalty
Normal Stiffness	Program Controlled
Update Stiffness	Never
Thermal Conductance	Program Controlled
Pinball Region	Program Controlled

**TABLE 16**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	<i>Contact Region 31</i>	<i>Contact Region 32</i>	<i>Contact Region 33</i>	<i>Contact Region 34</i>	<i>Contact Region 35</i>
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	1 Face		4 Faces		1 Face
Target	1 Face		4 Faces		1 Face
Contact Bodies	Left Endplate Polyurethane			Right Endplate Downstream Hole area	
Target Bodies	Left Endplate Inner Steel slice	Left Endplate Outer Steel slice	Hexcel	Right Endplate Polyurethane	Right Endplate Outer Steel slice
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				
<b>Advanced</b>					
Formulation	Pure Penalty				
Normal Stiffness	Program Controlled				
Update Stiffness	Never				
Thermal Conductance	Program Controlled				
Pinball Region	Program Controlled				

**TABLE 17**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	<i>Contact Region 36</i>	<i>Contact Region 37</i>	<i>Contact Region 38</i>	<i>Contact Region 39</i>	<i>Contact Region 40</i>
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	1 Face	4 Faces		1 Face	
Target	1 Face	4 Faces		1 Face	
Contact Bodies	Right Endplate Downstream Hole area	Right Endplate Aluminum Casing			
Target Bodies	Right Endplate Inner Steel Slice	Right Endplate Polyurethane	Right Endplate Outer Steel slice	Right Endplate Inner Steel Slice	Rod 4
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				

<b>Advanced</b>	
Formulation	Pure Penalty
Normal Stiffness	Program Controlled
Update Stiffness	Never
Thermal Conductance	Program Controlled
Pinball Region	Program Controlled

**TABLE 18**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	<i>Contact Region 41</i>	<i>Contact Region 42</i>	<i>Contact Region 43</i>	<i>Contact Region 44</i>	<i>Contact Region 45</i>
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	1 Face				
Target	1 Face				
Contact Bodies	Right Endplate Aluminum Casing				
Target Bodies	Rod 5	Rod 6	Rod 1	Rod 2	Rod 3
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				
<b>Advanced</b>					
Formulation	Pure Penalty				
Normal Stiffness	Program Controlled				
Update Stiffness	Never				
Thermal Conductance	Program Controlled				
Pinball Region	Program Controlled				

**TABLE 19**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	<i>Contact Region 46</i>	<i>Contact Region 47</i>	<i>Contact Region 48</i>	<i>Contact Region 49</i>	<i>Contact Region 50</i>	
State	Fully Defined					
<b>Scope</b>						
Scoping Method	Geometry Selection					
Contact	2 Faces	1 Face				
Target	2 Faces	1 Face				
Contact Bodies	Right Endplate Aluminum Casing	Right Endplate Polyurethane			Left Endplate Inner Steel slice	
Target Bodies	Hexcel	Right Endplate Outer Steel slice	Right Endplate Inner Steel Slice	Hexcel		
<b>Definition</b>						
Type	Bonded					
Scope Mode	Automatic					
Behavior	Symmetric					
Suppressed	No					
<b>Advanced</b>						
Formulation	Pure Penalty					

Normal Stiffness	Program Controlled
Update Stiffness	Never
Thermal Conductance	Program Controlled
Pinball Region	Program Controlled

**TABLE 20**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	Contact Region 51	Contact Region 52	Contact Region 53	Contact Region 54	Contact Region 55
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	1 Face	4 Faces	1 Face	2 Faces	
Target	1 Face	4 Faces	1 Face	2 Faces	
Contact Bodies	Right Endplate Inner Steel Slice	Backplate Aluminum Casing			
Target Bodies	Hexcel	Backplate Polyurethane	Backplate Outer steel slice	Back Plate Inner Steel slice	Left Hinge
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				
<b>Advanced</b>					
Formulation	Pure Penalty				
Normal Stiffness	Program Controlled				
Update Stiffness	Never				
Thermal Conductance	Program Controlled				
Pinball Region	Program Controlled				

**TABLE 21**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	Contact Region 56	Contact Region 57	Contact Region 58	Contact Region 59	Contact Region 60
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	2 Faces	1 Face			
Target	2 Faces	1 Face			
Contact Bodies	Backplate Aluminum Casing		Backplate Polyurethane		
Target Bodies	Right Hinge	Hexcel	Backplate Outer steel slice	Back Plate Inner Steel slice	Left Hinge
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				
<b>Advanced</b>					
Formulation	Pure Penalty				
Normal Stiffness	Program Controlled				

Update Stiffness	Never
Thermal Conductance	Program Controlled
Pinball Region	Program Controlled

**TABLE 22**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Connections > Contact Regions**

Object Name	Contact Region 61	Contact Region 62	Contact Region 63	Contact Region 64	Contact Region 65
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Contact	1 Face				
Target	1 Face				
Contact Bodies	Backplate Polyurethane		Backplate Outer steel slice		Back Plate Inner Steel slice
Target Bodies	Right Hinge	Hexcel	Left Hinge	Right Hinge	Hexcel
<b>Definition</b>					
Type	Bonded				
Scope Mode	Automatic				
Behavior	Symmetric				
Suppressed	No				
<b>Advanced</b>					
Formulation	Pure Penalty				
Normal Stiffness	Program Controlled				
Update Stiffness	Never				
Thermal Conductance	Program Controlled				
Pinball Region	Program Controlled				

## Mesh

**TABLE 23**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Mesh**

Object Name	Mesh
State	Solved
<b>Defaults</b>	
Physics Preference	Mechanical
Relevance	-35
<b>Advanced</b>	
Relevance Center	Coarse
Element Size	Default
Shape Checking	Standard Mechanical
Solid Element Midside Nodes	Program Controlled
Straight Sided Elements	No
Initial Size Seed	Active Assembly
Smoothing	Low
Transition	Fast
<b>Statistics</b>	
Nodes	160363
Elements	26466

## Static Structural

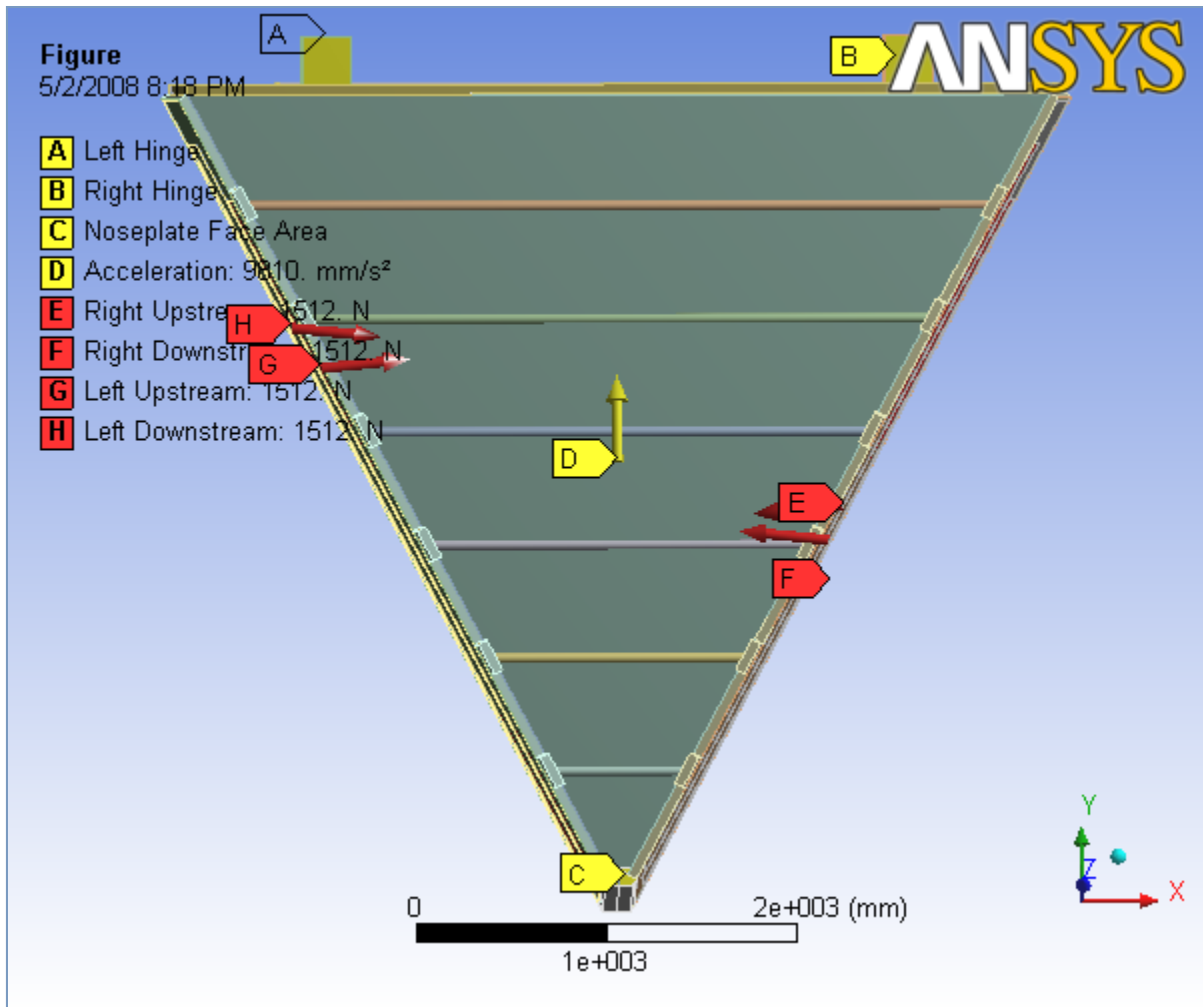
**TABLE 24**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Analysis**

Object Name	<i>Static Structural</i>
State	Fully Defined
<b>Definition</b>	
Physics Type	Structural
Analysis Type	Static Structural
<b>Options</b>	
Reference Temp	22. °C

**TABLE 25**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Analysis Settings**

Object Name	<i>Analysis Settings</i>
State	Fully Defined
<b>Step Controls</b>	
Number Of Steps	1.
Current Step Number	1.
Step End Time	1. s
Auto Time Stepping	Program Controlled
<b>Solver Controls</b>	
Solver Type	Direct
Weak Springs	Program Controlled
Large Deflection	Off
Inertia Relief	Off
<b>Nonlinear Controls</b>	
Force Convergence	Program Controlled
Moment Convergence	Program Controlled
Displacement Convergence	Program Controlled
Rotation Convergence	Program Controlled
Line Search	Program Controlled
<b>Output Controls</b>	
Calculate Stress	Yes
Calculate Strain	Yes
Calculate Results At	All Time Points
<b>Analysis Data Management</b>	
Solver Files Directory	C:\Documents and Settings\Jinnuri\Desktop\website\AI slit\New Constraints\Analysis 3 \Analysis 3 Simulation Files\Static Structural\
Future Analysis	None
Save ANSYS db	No
Delete Unneeded Files	Yes
Nonlinear Solution	No

**FIGURE 1**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Figure**



**TABLE 26**

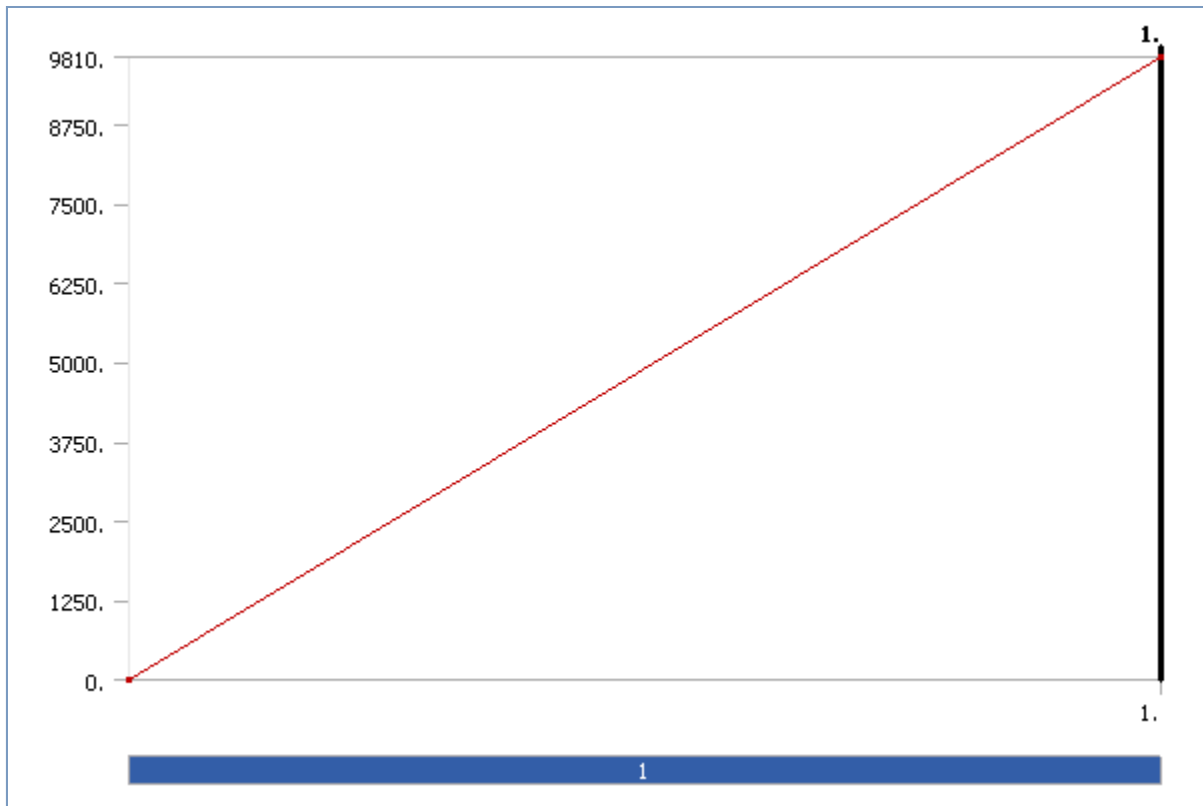
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Accelerations**

Object Name	<i>Acceleration</i>
State	Fully Defined
<b>Scope</b>	
Geometry	All Bodies
<b>Definition</b>	
Define By	Vector
Magnitude	9810. mm/s <sup>2</sup> (ramped)
Direction	Defined
Suppressed	No

**FIGURE 2**

**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Acceleration**

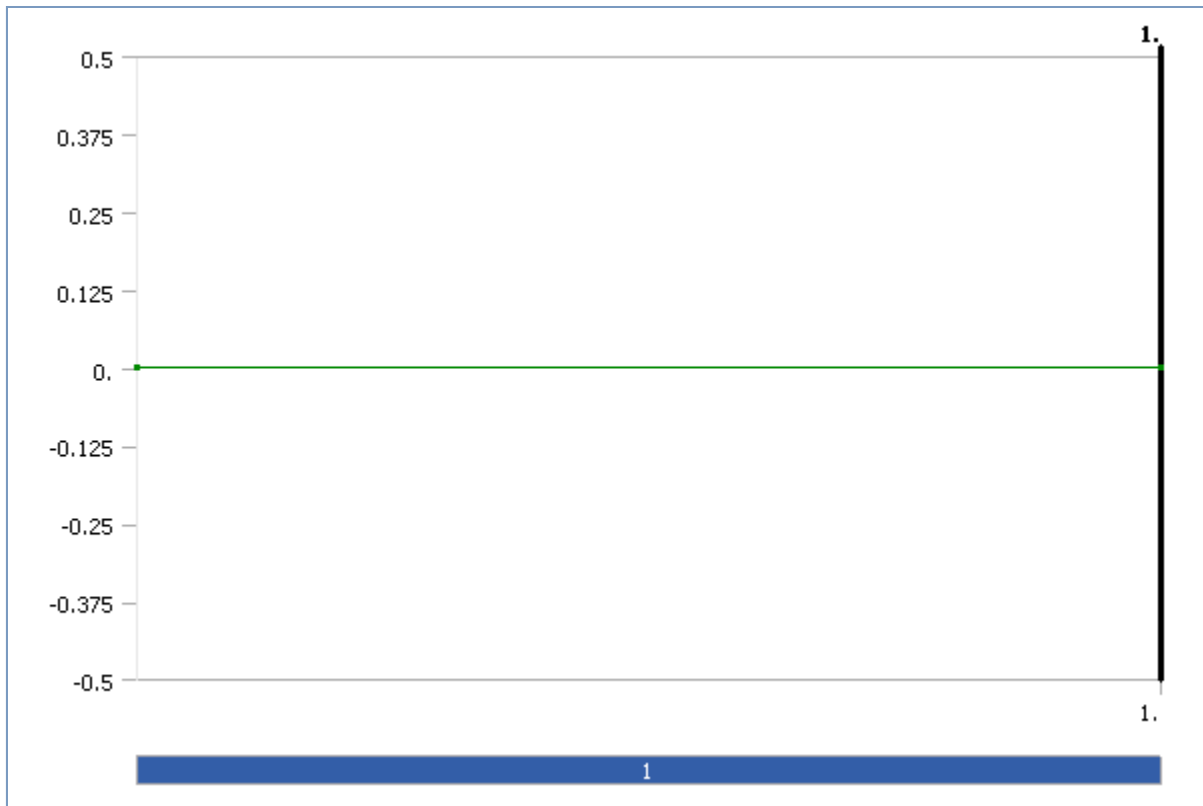




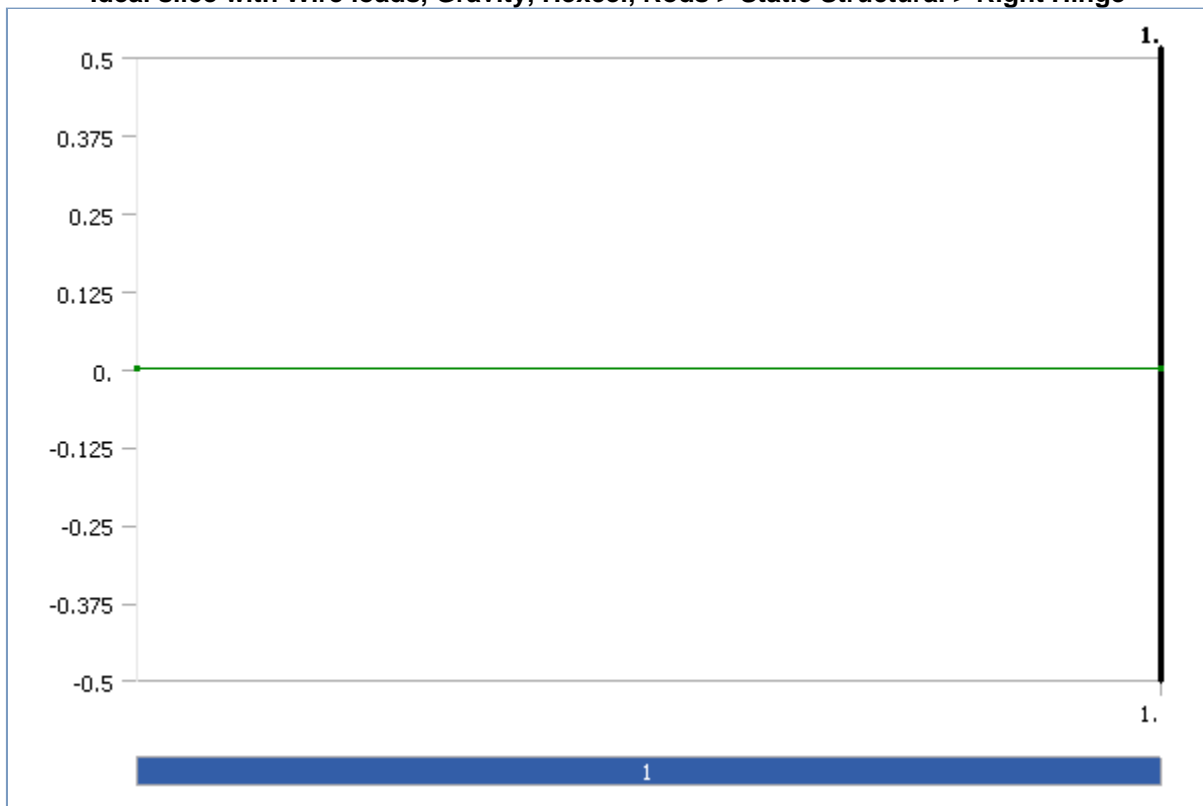
**TABLE 27**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Loads**

Object Name	<i>Left Hinge</i>	<i>Right Hinge</i>	<i>Noseplate Face Area</i>	<i>Right Upstream</i>	<i>Right Downstream</i>
State	Fully Defined				
<b>Scope</b>					
Scoping Method	Geometry Selection				
Geometry	5 Faces		1 Face		
<b>Definition</b>					
Define By	Components			Vector	
Type	Displacement			Force	
X Component	Free	0. mm (ramped)			
Y Component	0. mm (ramped)	Free			
Z Component	0. mm (ramped)				
Suppressed	No				
Magnitude				1512. N (ramped)	
Direction				Defined	

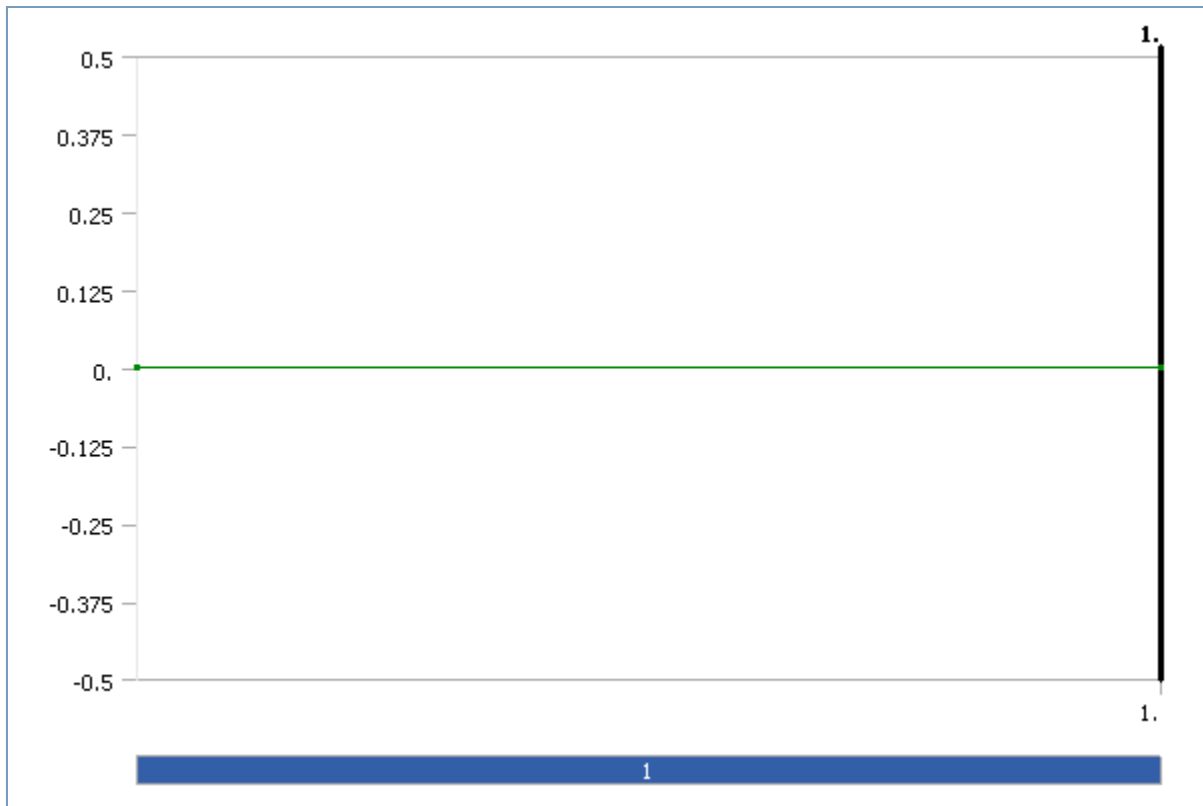
**FIGURE 3**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Left Hinge**



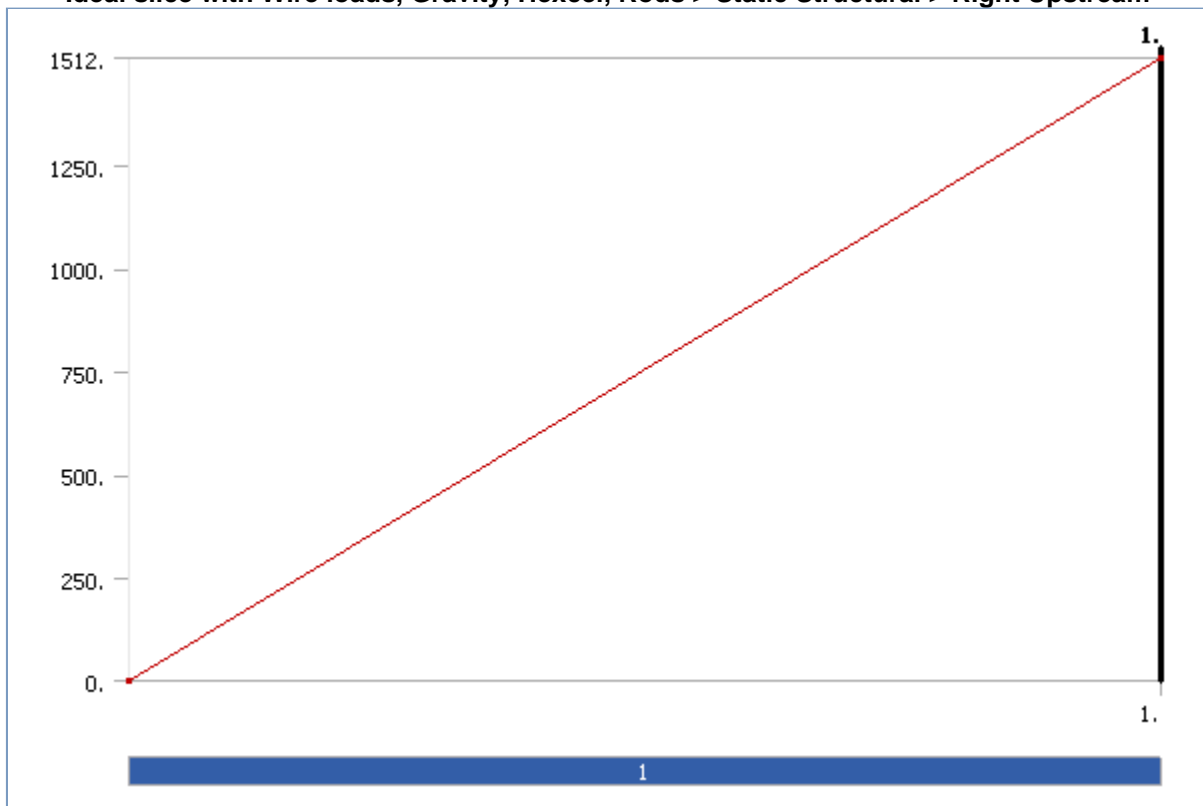
**FIGURE 4**  
Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Right Hinge



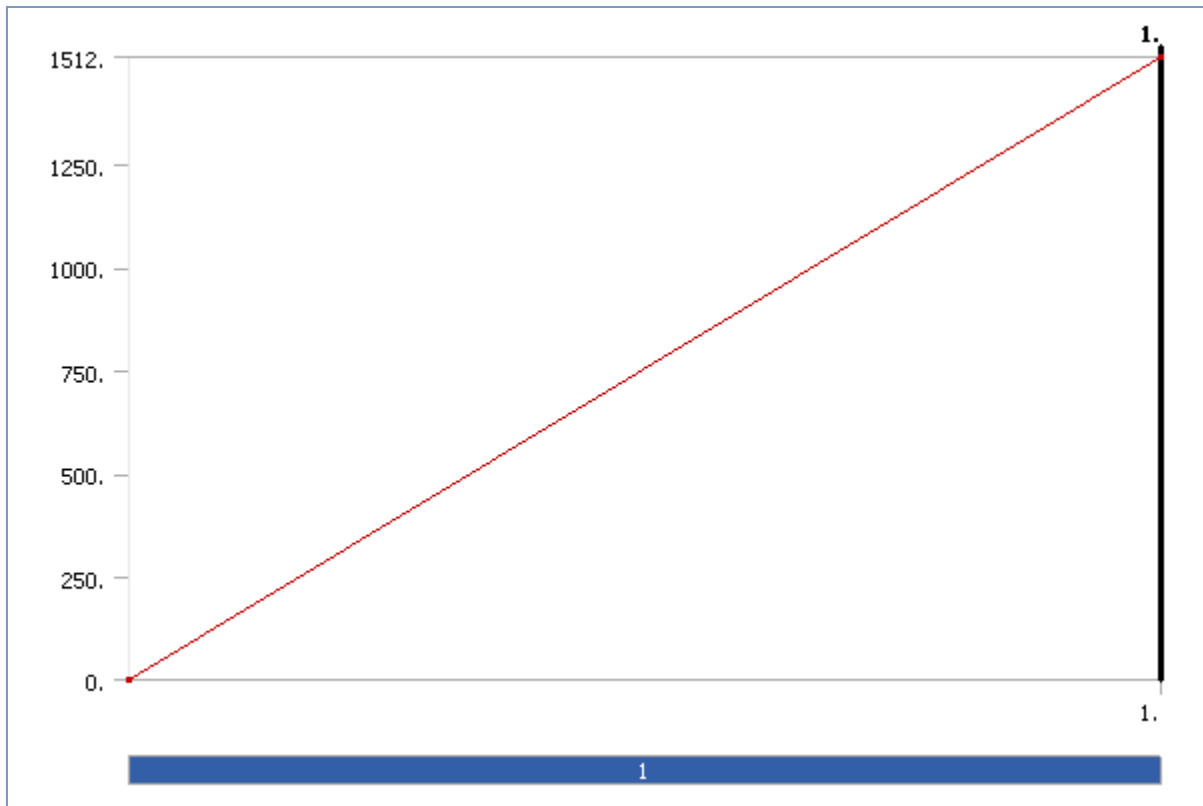
**FIGURE 5**  
Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Noseplate Face Area



**FIGURE 6**  
Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Right Upstream



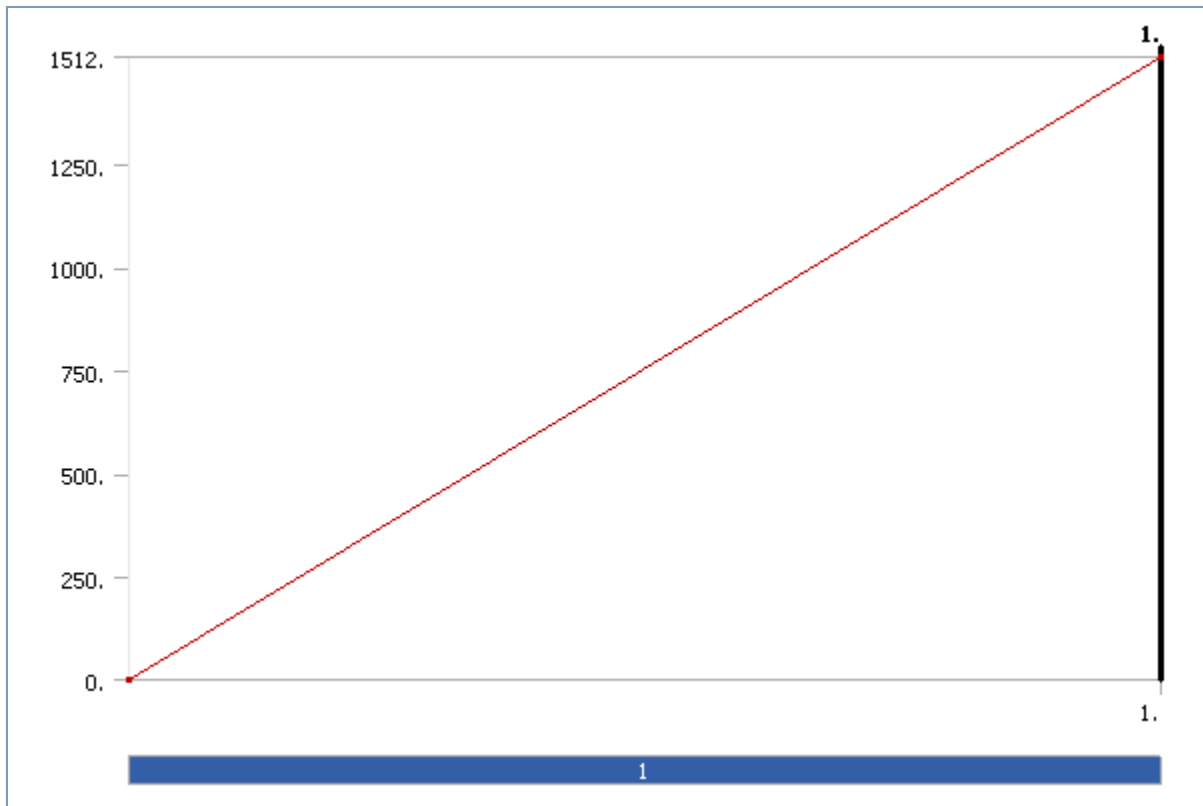
**FIGURE 7**  
Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Right Downstream



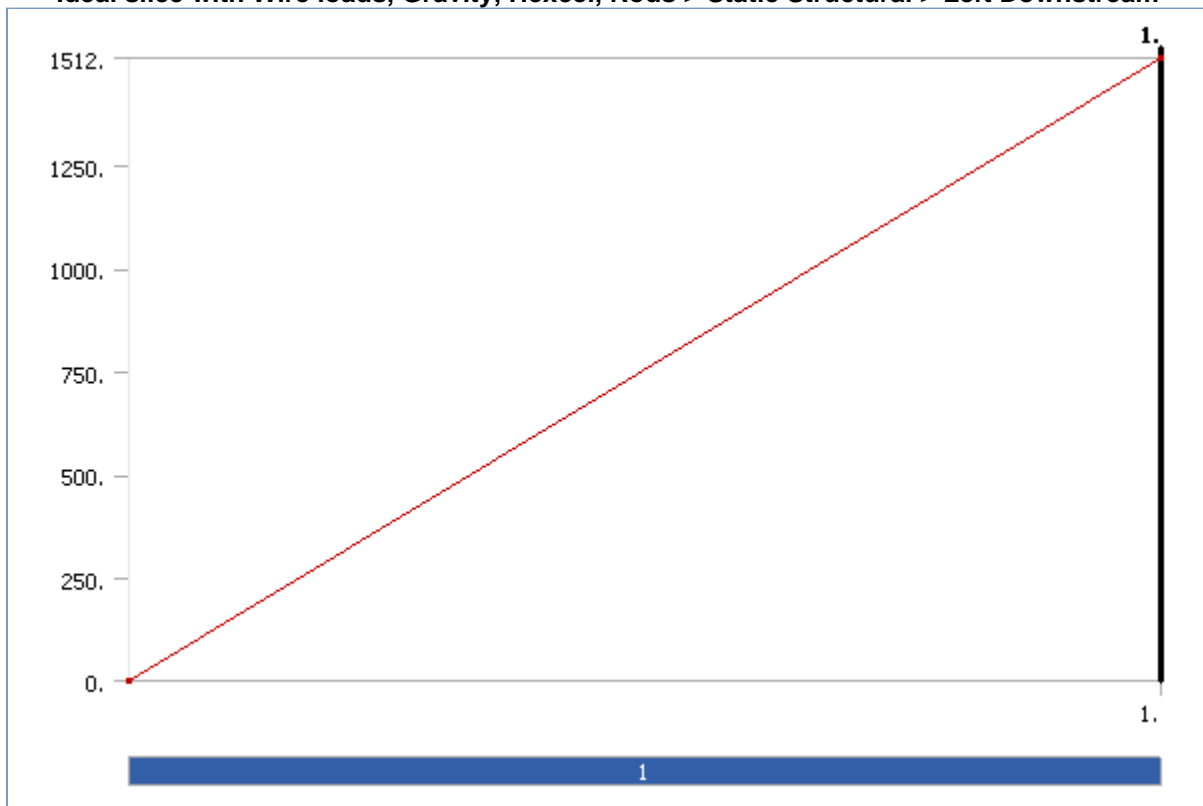
**TABLE 28**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Loads**

Object Name	<i>Left Upstream</i>	<i>Left Downstream</i>
State	Fully Defined	
<b>Scope</b>		
Scoping Method	Geometry Selection	
Geometry	1 Face	
<b>Definition</b>		
Define By	Vector	
Type	Force	
Magnitude	1512. N (ramped)	
Direction	Defined	
Suppressed	No	

**FIGURE 8**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Left Upstream**



**FIGURE 9**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Left Downstream**



**Solution**

**TABLE 29**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution**

Object Name	<i>Solution</i>
State	Solved
<b>Adaptive Mesh Refinement</b>	
Max Refinement Loops	1.
Refinement Depth	2.

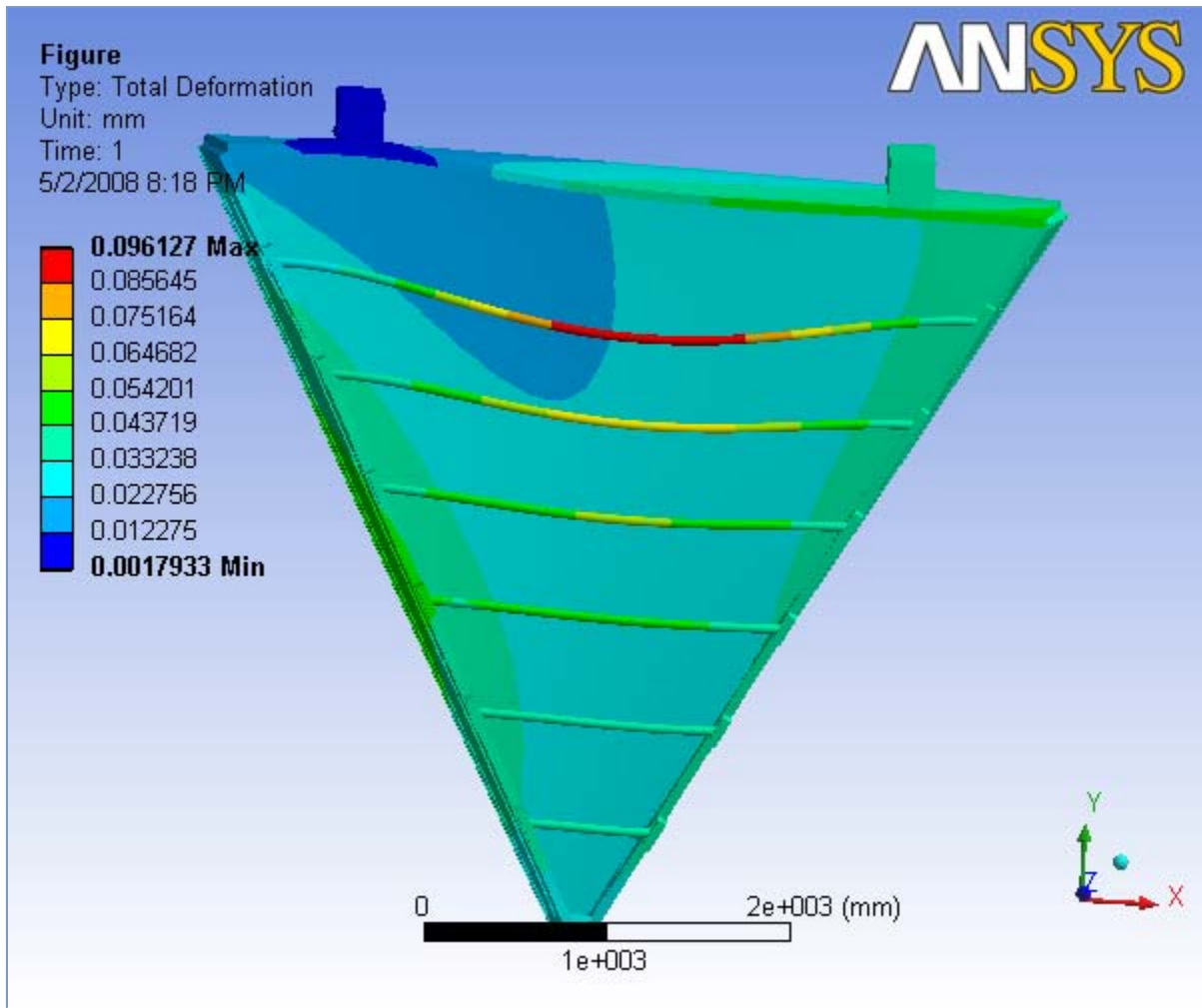
**TABLE 30**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution > Solution Information**

Object Name	<i>Solution Information</i>
State	Solved
<b>Solution Information</b>	
Solution Output	Solver Output
Newton-Raphson Residuals	0
Update Interval	2.5 s
Display Points	All

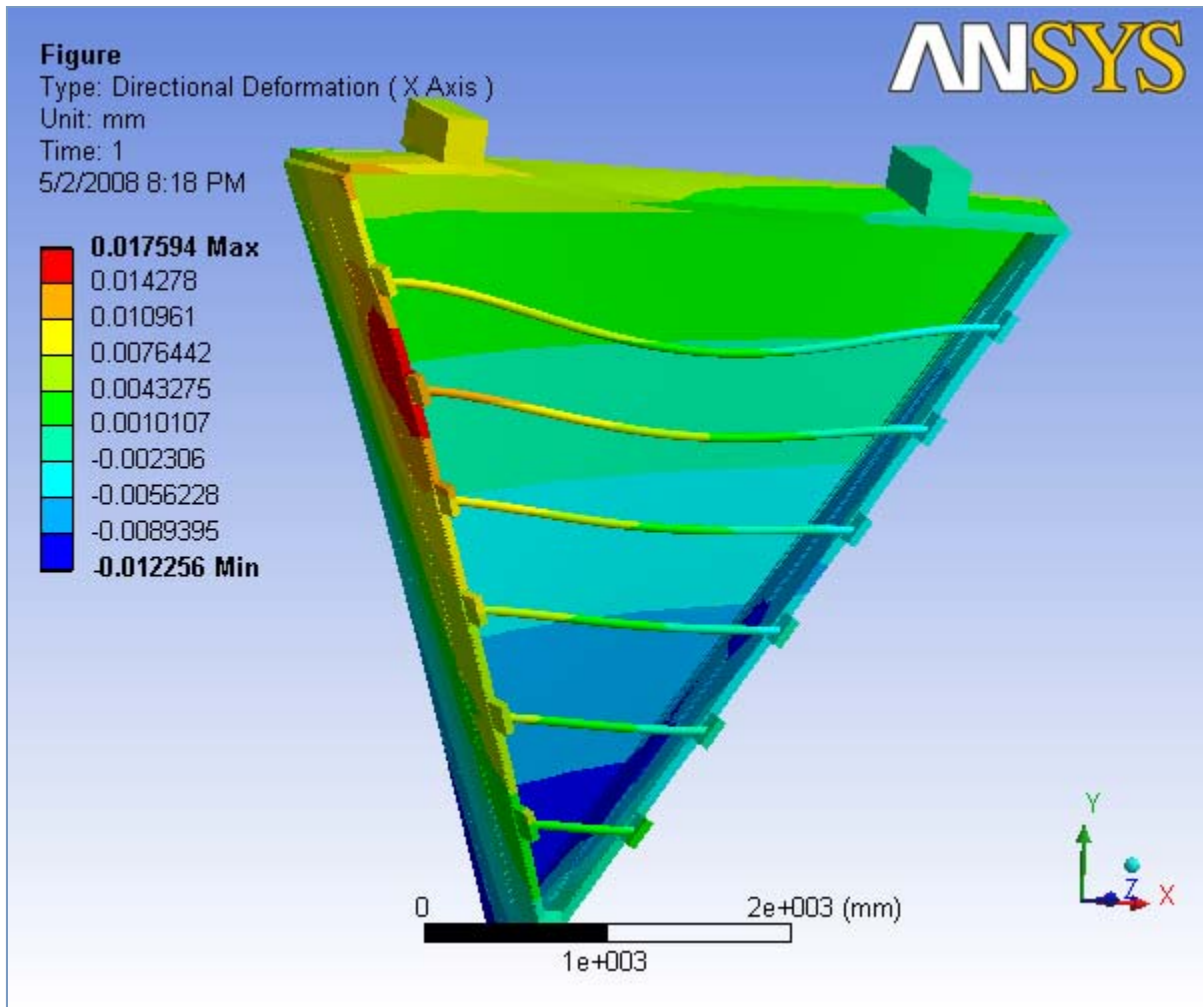
**TABLE 31**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution > Results**

Object Name	<i>Total Deformation</i>	<i>X - Directional Deformation</i>	<i>Y - Directional Deformation</i>	<i>Z - Directional Deformation</i>	<i>Equivalent Stress</i>
State	Solved				
<b>Scope</b>					
Geometry	All Bodies				
<b>Definition</b>					
Type	Total Deformation	Directional Deformation			Equivalent (von-Mises) Stress
Display Time	End Time				
Orientation		X Axis	Y Axis	Z Axis	
Shell					Top/Bottom
<b>Results</b>					
Minimum	1.7933e-003 mm	-1.2256e-002 mm	-9.323e-002 mm	-1.126e-002 mm	1.4152e-005 MPa
Maximum	9.6127e-002 mm	1.7594e-002 mm	1.3128e-002 mm	3.6417e-002 mm	2.9928 MPa
Minimum Occurs On	Left Hinge	Right Endplate Outer Steel slice	Rod 6	Backplate Aluminum Casing	Left Hinge
Maximum Occurs On	Rod 6	Left Endplate Outer Steel slice	Left Hinge	Left Endplate Outer Steel slice	Nose Plate
<b>Information</b>					
Time	1. s				
Load Step	1				
Substep	1				
Iteration Number	1				

**FIGURE 10**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution > Total Deformation > Figure**

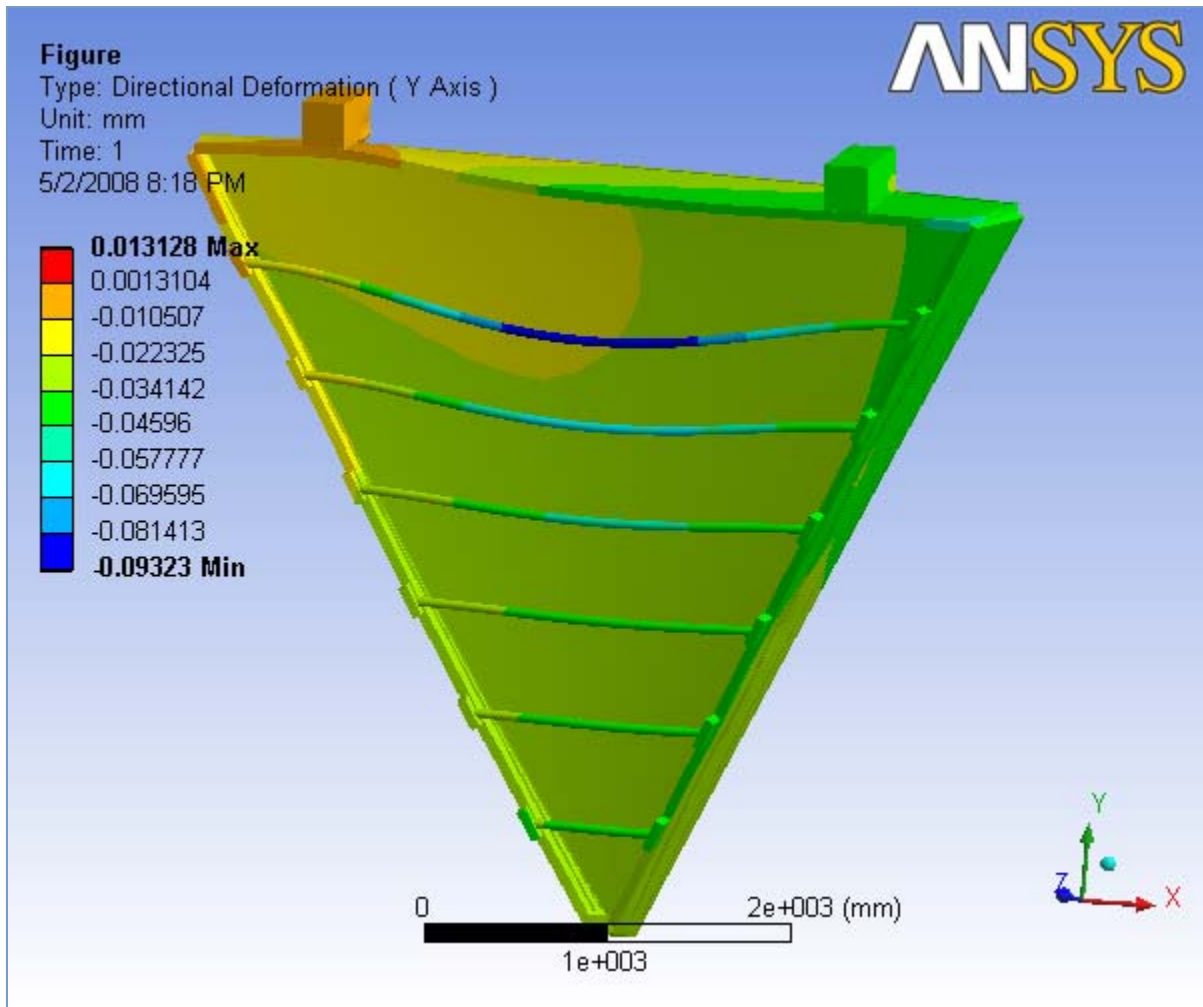


**FIGURE 11**  
 Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution > X - Directional Deformation > Figure

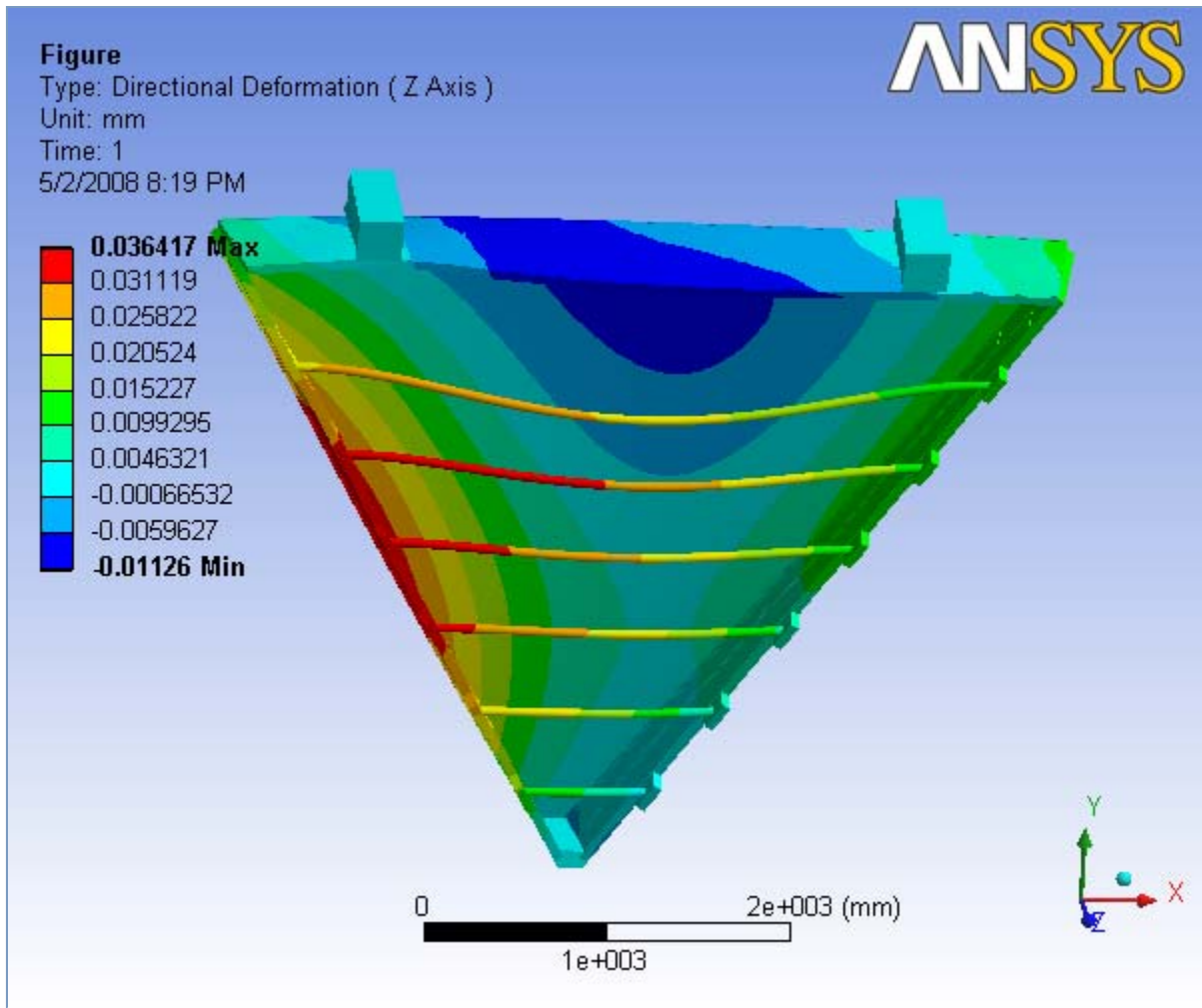


**FIGURE 12**  
 Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution > Y - Directional Deformation > Figure

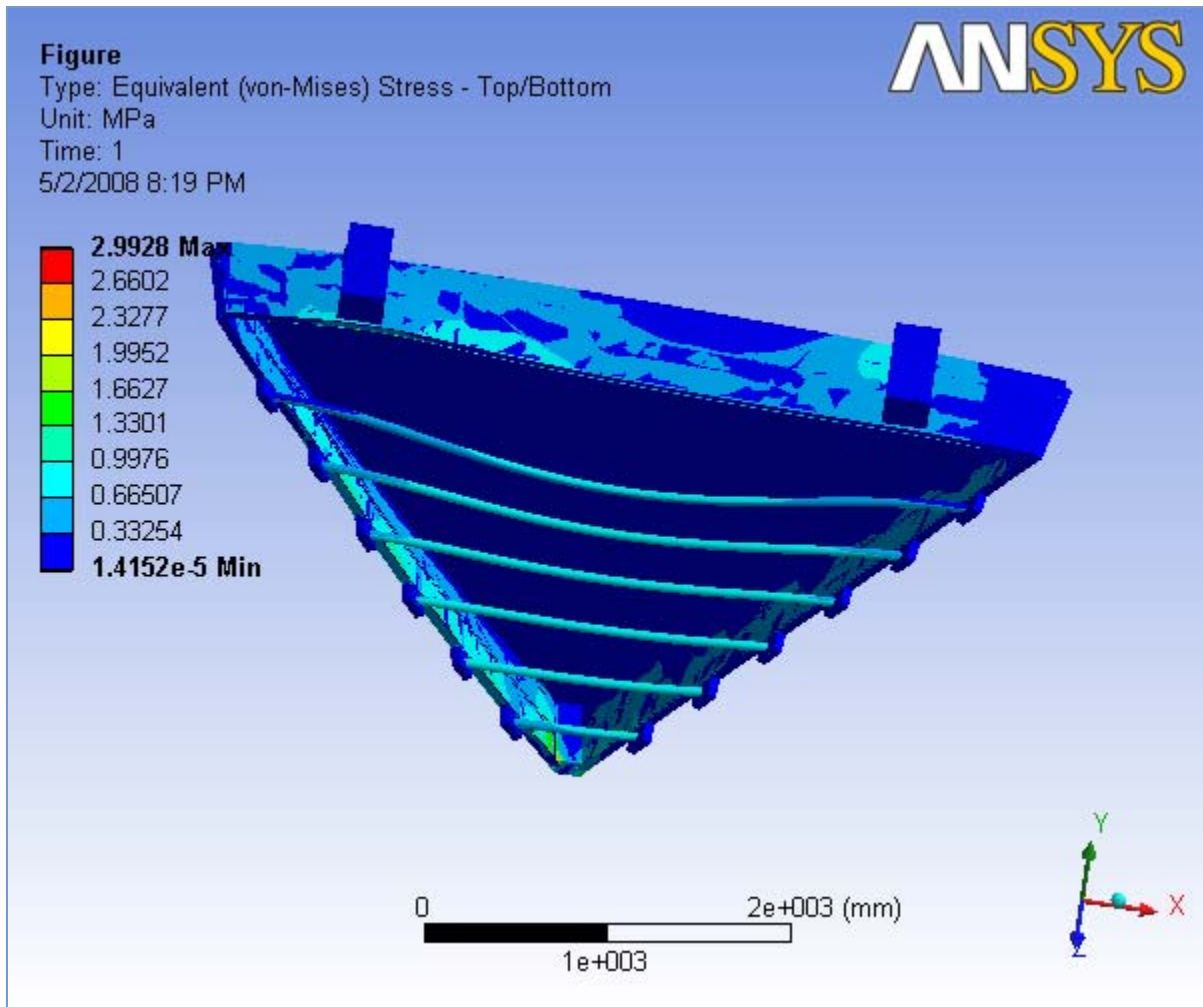




**FIGURE 13**  
 Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution > Z - Directional Deformation > Figure



**FIGURE 14**  
 Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution > Equivalent Stress > Figure

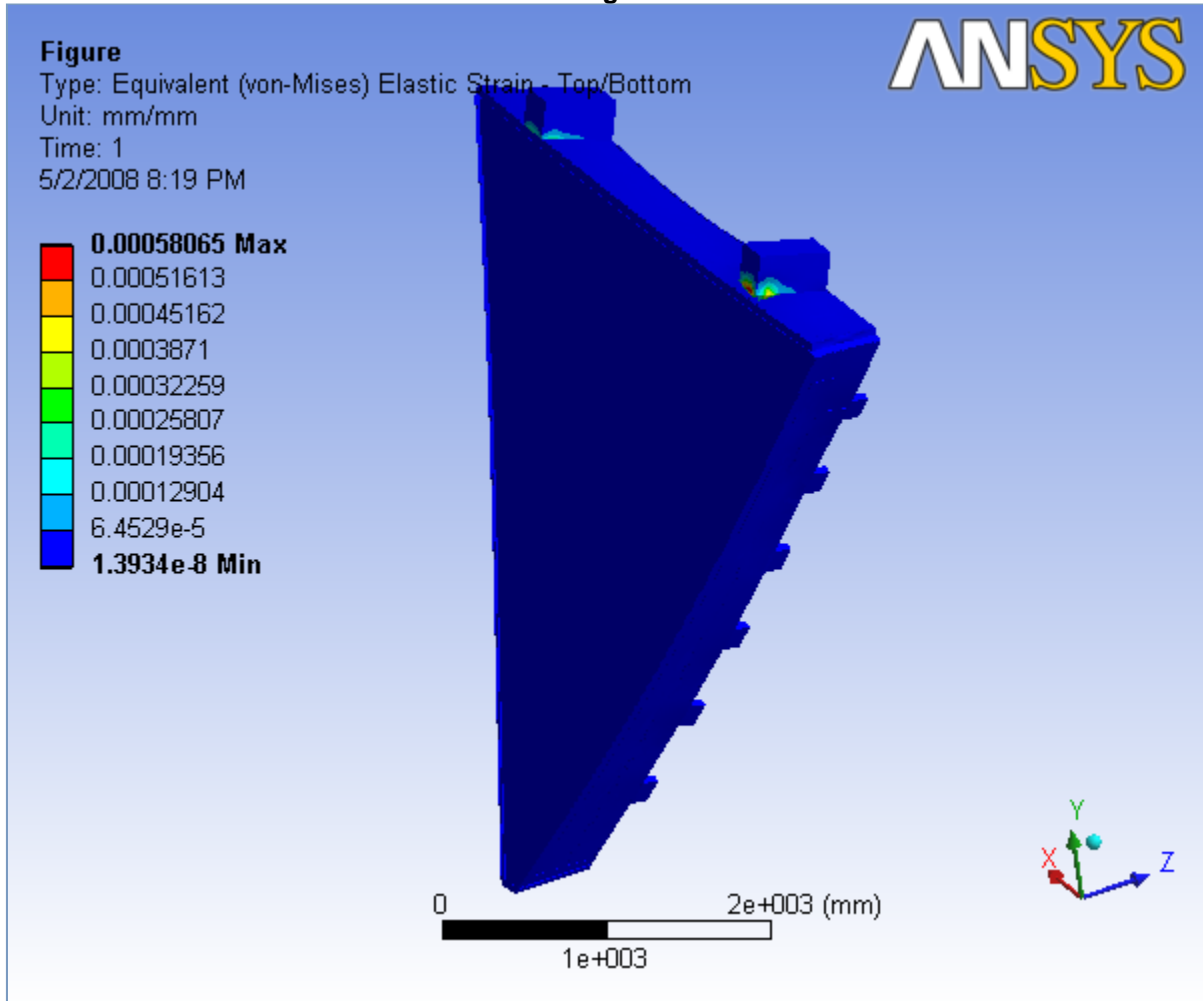


**TABLE 32**  
**Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution > Results**

Object Name	<i>Equivalent Elastic Strain</i>
State	Solved
<b>Scope</b>	
Geometry	All Bodies
<b>Definition</b>	
Type	Equivalent (von-Mises) Elastic Strain
Shell	Top/Bottom
Display Time	End Time
<b>Results</b>	
Minimum	1.3934e-008 mm/mm
Maximum	5.8065e-004 mm/mm
Minimum Occurs On	30 deg Ref line
Maximum Occurs On	Left Hinge
<b>Information</b>	
Time	1. s
Load Step	1
Substep	1
Iteration Number	1

**FIGURE 15**

Ideal slice with Wire loads, Gravity, Hexcel, Rods > Static Structural > Solution > Equivalent Elastic Strain > Figure



## Material Data

### Aluminum

**TABLE 33**  
**Aluminum > Constants**

<b>Structural</b>	
Young's Modulus	68900 MPa
Poisson's Ratio	0.33
Density	2.7e-006 kg/mm <sup>3</sup>
Thermal Expansion	2.3e-005 1/°C
<b>Thermal</b>	
Thermal Conductivity	0. W/mm·°C
Specific Heat	0. J/kg·°C
<b>Electromagnetics</b>	
Relative Permeability	0.
Resistivity	0. Ohm-mm

### Polyurethane

**TABLE 34**  
**Polyurethane > Constants**

<b>Structural</b>	
Young's Modulus	66. MPa
Poisson's Ratio	0.3
Density	2.4e-007 kg/mm <sup>3</sup>
Thermal Expansion	6.12e-005 1/°C
<b>Thermal</b>	
Thermal Conductivity	0. W/mm·°C
Specific Heat	0. J/kg·°C
<b>Electromagnetics</b>	
Relative Permeability	0.
Resistivity	0. Ohm·mm

## **Stainless Steel**

**TABLE 35**  
**Stainless Steel > Constants**

<b>Structural</b>	
Young's Modulus	1.93e+005 MPa
Poisson's Ratio	0.3
Density	8.e-006 kg/mm <sup>3</sup>
Thermal Expansion	0. 1/°C
<b>Thermal</b>	
Thermal Conductivity	0. W/mm·°C
Specific Heat	0. J/kg·°C
<b>Electromagnetics</b>	
Relative Permeability	0.
Resistivity	0. Ohm·mm

## **Carbon Fiber**

**TABLE 36**  
**Carbon Fiber > Constants**

<b>Structural</b>	
Young's Modulus	1.5e+005 MPa
Poisson's Ratio	0.3
Density	5.8e-007 kg/mm <sup>3</sup>
Thermal Expansion	0. 1/°C
<b>Thermal</b>	
Thermal Conductivity	0. W/mm·°C
Specific Heat	0. J/kg·°C
<b>Electromagnetics</b>	
Relative Permeability	0.
Resistivity	0. Ohm·mm

## **Hexcel**

**TABLE 37**  
**Hexcel > Constants**

<b>Structural</b>	

Young's Modulus	1.4805e+005 MPa
Poisson's Ratio	0.33
Density	2.8833e-008 kg/mm <sup>3</sup>
Thermal Expansion	0. 1/°C
<b>Thermal</b>	
Thermal Conductivity	0. W/mm·°C
Specific Heat	0. J/kg·°C
<b>Electromagnetics</b>	
Relative Permeability	0.
Resistivity	0. Ohm·mm