

# Thermal deformation snout reinforcement

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## 1. Introduction

Check thermal deformation with reinforcement snout added to the sector beam

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## 2. Description

20 deg C temp increase  
end plate reinforcement  
linear shear load at each ladder location

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### 3. File Information

**Model name:** beam

**Model location:** C:\Documents and Settings\Howard Wieman\My Documents\aps project\mechanical\ladder thermal thin 3\beam.SLDPRT

**Results location:** C:\Program Files\SolidWorks\COSMOS\work

**Study name:** 4 load snout end (-beam with snout-)

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### 4. Materials

No.	Shell Name	Material	Thickness
1	Shell-1	<a href="#">[SW]ladder carbon corrected</a>	0.2 mm

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### 5. Load & Restraint Information

Restraint	
<b>Restraint-1 &lt;beam&gt;</b>	on 16 Edge(s) fixed.
<b>Description:</b>	

Load	
<b>Pressure-1 &lt;beam&gt;</b>	on 1 Face(s) with Pressure <b>0.335 psi</b> normal to

	reference plane <b>Edge&lt; 1 &gt;</b> using equation $0 + 1x + 0y + 0xy + 0x^2 + 0y^2$ with respect to coord. system <b>F2</b>
<b>Description:</b>	
<b>Pressure-2 &lt;beam&gt;</b>	on <b>1 Face(s)</b> with Pressure <b>-0.361 psi</b> normal to reference plane <b>Front Plane</b> using equation $0 + 1x + 0y + 0xy + 0x^2 + 0y^2$ with respect to coord. system <b>F1</b>
<b>Description:</b>	
<b>Pressure-3 &lt;beam&gt;</b>	on <b>1 Face(s)</b> with Pressure <b>-0.361 psi</b> normal to reference plane <b>Front Plane</b> using equation $0 + 1x + 0y + 0xy + 0x^2 + 0y^2$ with respect to coord. system <b>F3</b>
<b>Description:</b>	
<b>Pressure-4 &lt;beam&gt;</b>	on <b>1 Face(s)</b> with Pressure <b>-0.338 psi</b> normal to reference plane <b>Front Plane</b> using equation $0 + 1x + 0y + 0xy + 0x^2 + 0y^2$ with respect to coord. system <b>F4</b>
<b>Description:</b>	

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## 6. Study Property

Mesh Information	
Mesh Type:	Shell mesh using surfaces
Mesher Used:	Standard
Automatic Transition:	Off
Smooth Surface:	On
Jacobian Check:	4 Points
Element Size:	2.7396 mm
Tolerance:	0.13698 mm
Quality:	High
Number of elements:	14918
Number of nodes:	29960
Time to complete mesh(hh:mm:ss):	00:00:06

Computer name:	WIEMAN-M90
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Solver Information	
Quality:	High
Solver Type:	FFEPlus
Option:	Include Thermal Effects
Thermal Option:	Input Temperature
Thermal Option:	Reference Temperature at zero strain: 298 Kelvin

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## 7. Contact

**Contact state: Touching faces - Bonded**

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## 8. Results

### 8a. Default Results

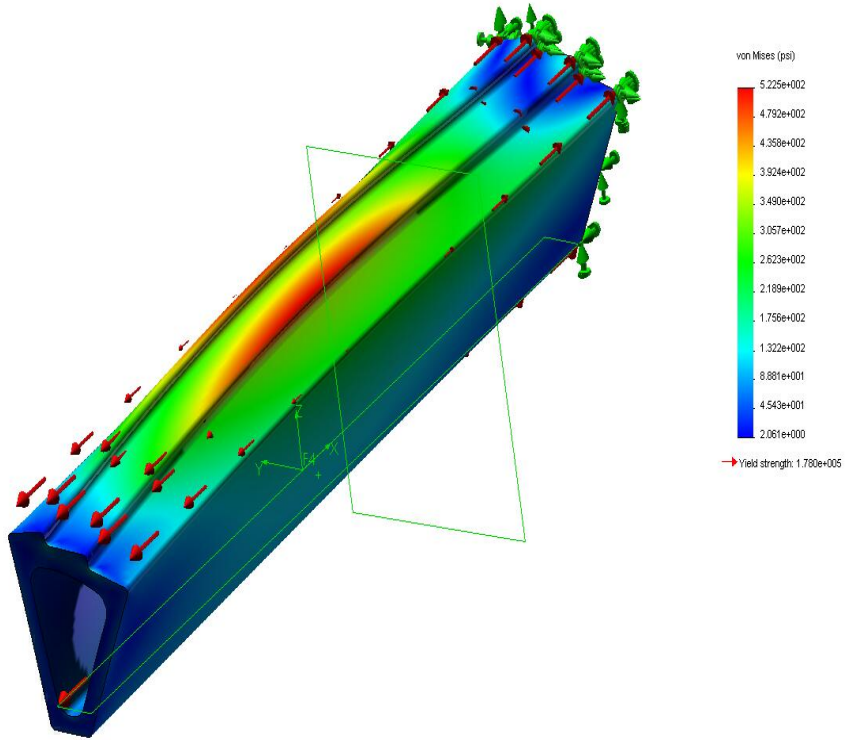
Name	Type	Min	Location	Max	Location
Stress1	VON: von	2.061 psi	(26.2378	522.534	(29.2185

	Mises stress	Node: 7755	mm, 68.8281 mm, 183.78 mm)	psi Node: 6600	mm, 77.3228 mm, 52.5589 mm)
Displacement1	URES: Resultant displacement	0 m Node: 1	(12.4299 mm, 81.6951 mm, -106 mm)	8.84974e- 006 m Node: 26060	(0.589842 mm, 63.0262 mm, 59.3933 mm)
Displacement2	UY: Y Displacement	- 6.58929e- 006 m Node: 5681	(44.8167 mm, 68.5022 mm, 183.78 mm)	8.0415e- 006 m Node: 6882	(21.0573 mm, 77.6267 mm, 44.3575 mm)
Displacement3	UZ: Z Displacement	- 1.34234e- 007 m Node: 10083	(29.8865 mm, 77.1376 mm, -77.2954 mm)	3.76098e- 006 m Node: 9611	(29.6744 mm, 77.2339 mm, 183.78 mm)

**beam-4 load snout end-Stress-Stress1**

JPEG

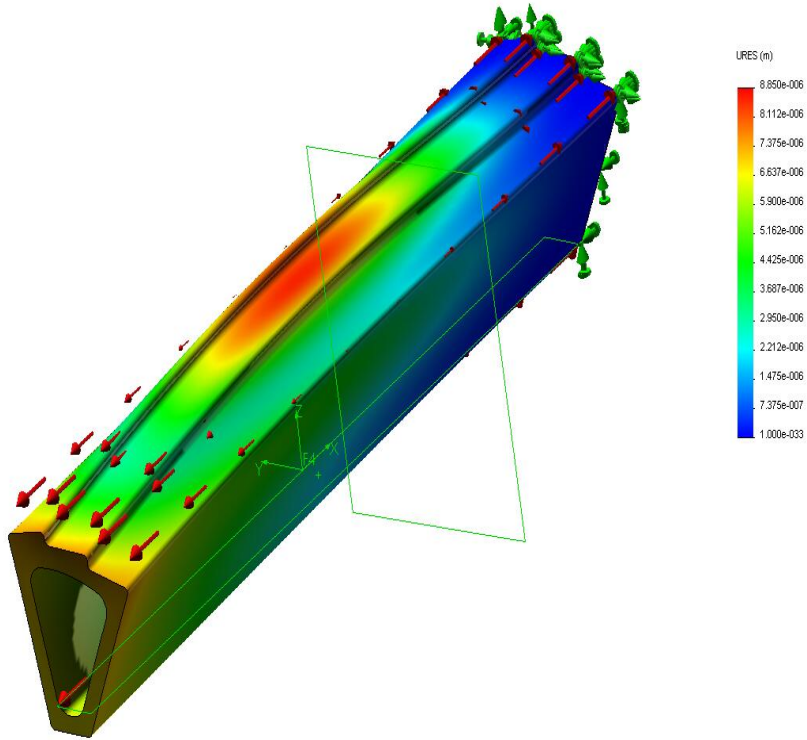
Model name: beam  
Study name: 4 load snout end  
Plot type: Static nodal stress (Top) Stress1  
Deformation scale: 973



**beam-4 load snout end-Displacement-Displacement1**

JPEG

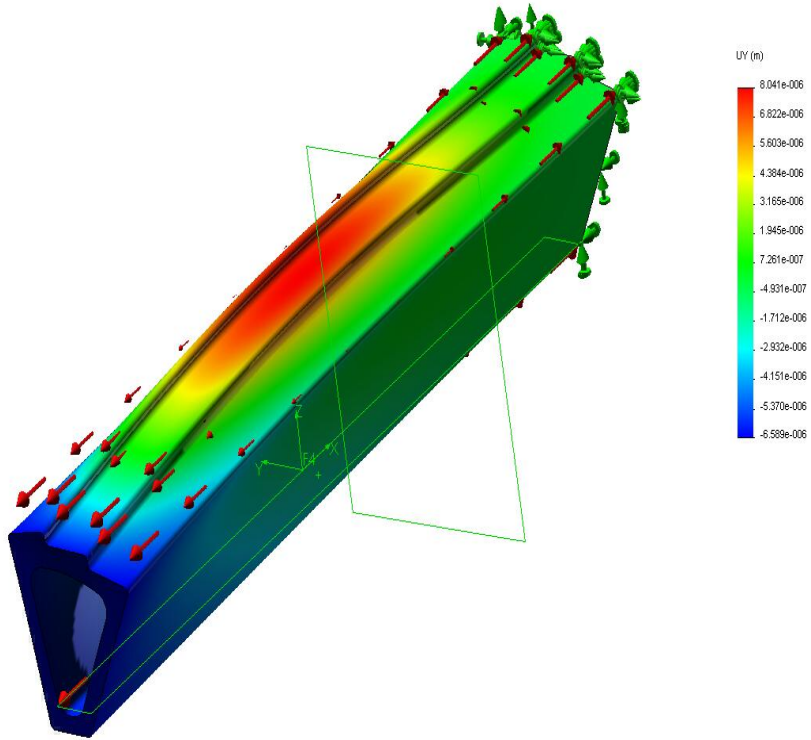
Model name: beam  
Study name: 4 load snout end  
Plot type: Static displacement Displacement1  
Deformation scale: 973



**beam-4 load snout end-Displacement-Displacement2**

JPEG

Model name: beam  
Study name: 4 load snout end  
Plot type: Static displacement Displacement2  
Deformation scale: 973

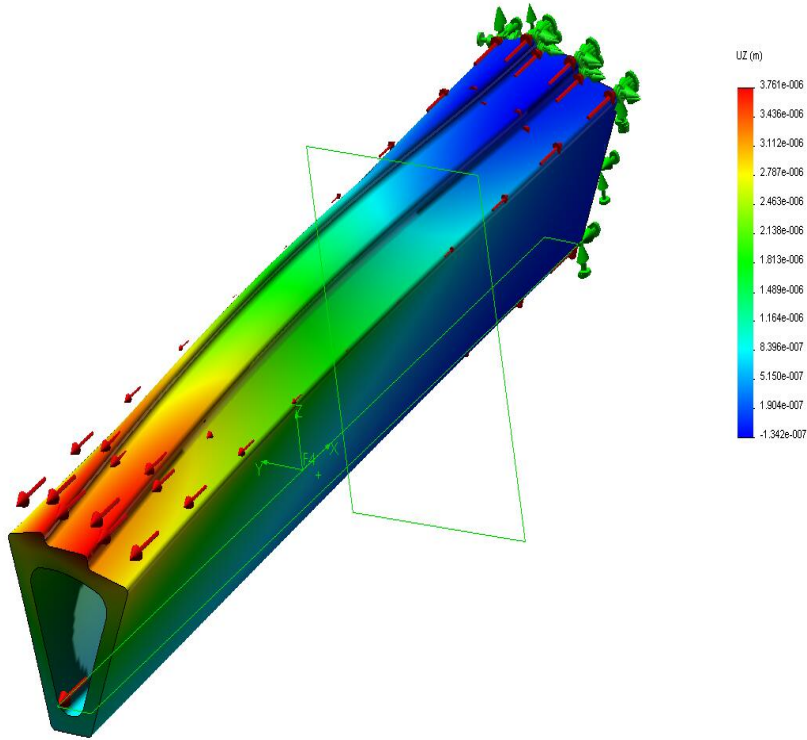


**beam-4 load snout end-Displacement-Displacement3**

JPEG



Model name: beam  
Study name: 4 load snout end  
Plot type: Static displacement Displacement3  
Deformation scale: 973



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## 9. Conclusion

end plate reduces maximum thermal deformation from 30 microns to 9 microns

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## 10. Appendix

**Material name:** [SW]ladder carbon corrected

**Description:**

**Material Source:** Used SolidWorks material

**Material Library Name:** carbon composite tube

**Material Model Type:** Linear Elastic Isotropic

Property Name	Value	Units	Value Type
Elastic modulus	1.3996e+011	N/m <sup>2</sup>	Constant
Poisson's ratio	0.33	NA	Constant
Shear modulus	7.0396e+010	N/m <sup>2</sup>	Constant
Mass density	1550.1	kg/m <sup>3</sup>	Constant
Tensile strength	1.8961e+009	N/m <sup>2</sup>	Constant
Yield strength	1.2273e+009	N/m <sup>2</sup>	Constant
Thermal expansion coefficient	1e-006	/Kelvin	Constant
Thermal conductivity	46	W/(m.K)	Constant
Specific heat	920	J/(kg.K)	Constant

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