

Crushing of a Soda Can

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Advanced Energy Variation Methods

Under

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Introduction/Objective

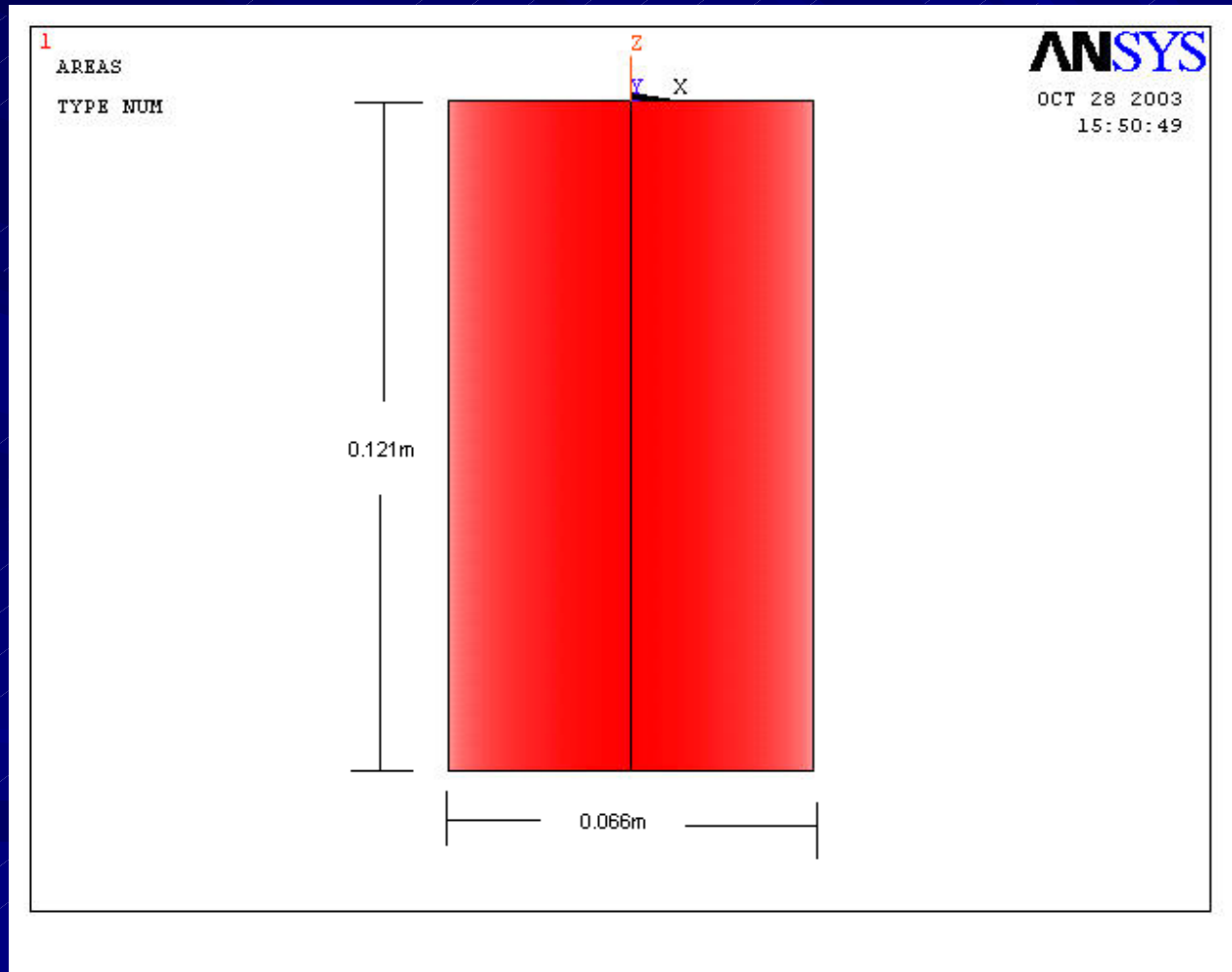
- The objective of this presentation is to see the transient finite element analysis on the Crush of a Soda Can
- Finite element analysis to see the Vonmises Stresses under a Certain Axial Load will be presented
- Finite element analysis to see displacements under a certain Axial Load will also be presented.
- This will lead to an Understanding of crushing on a Soda Can.

Soda Can Geometry

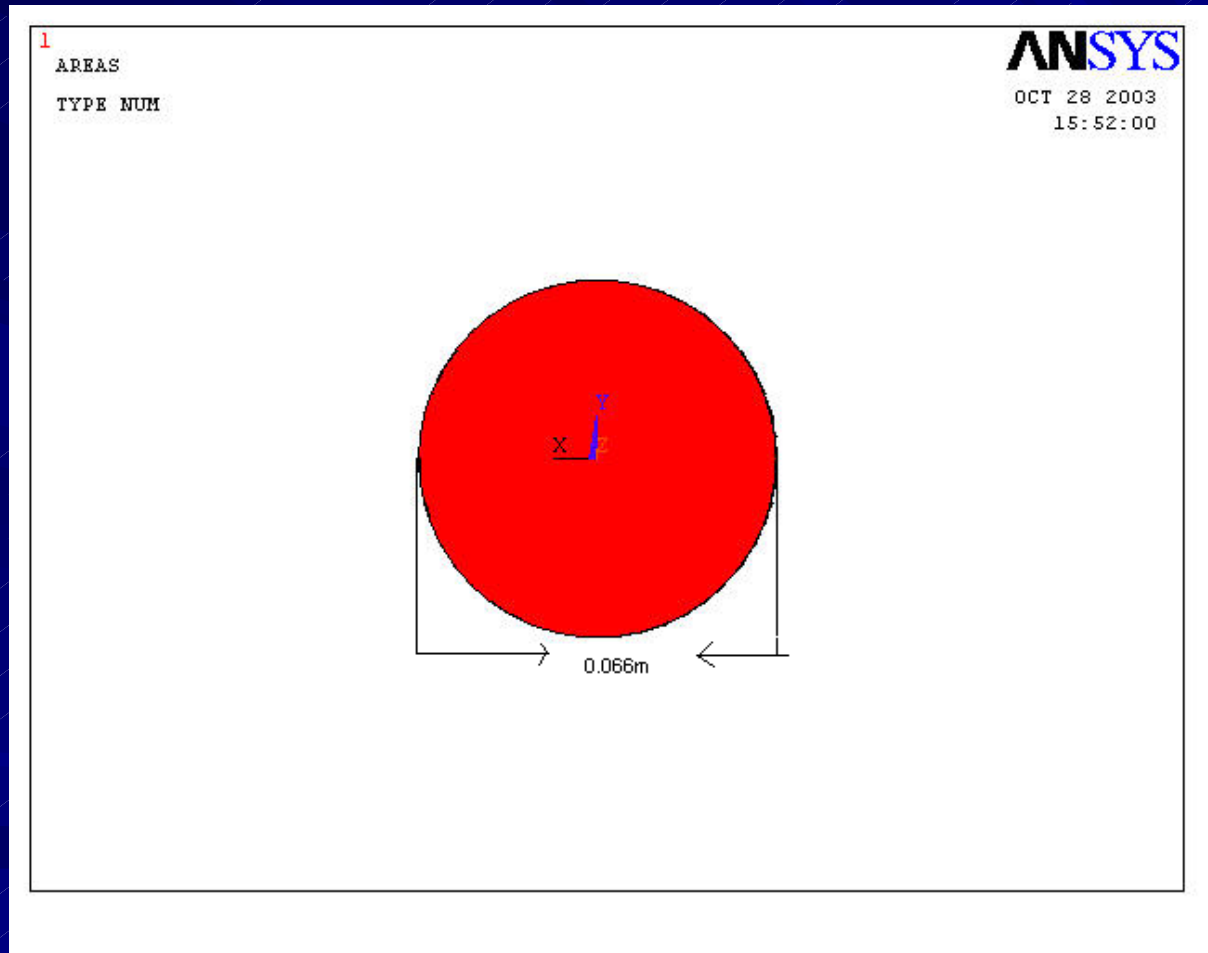
- Radius of the Can – 3.3 centimeters
- Height of the Can – 12.1 centimeters
- Thickness of the Can - .25 centimeters
- Thickness on the lid of the can - 0.3 centimeter.
- Thickness on the bottom of the can – 0.3 centimeters

Dimensions were drawn from Coca Cola Soda Can

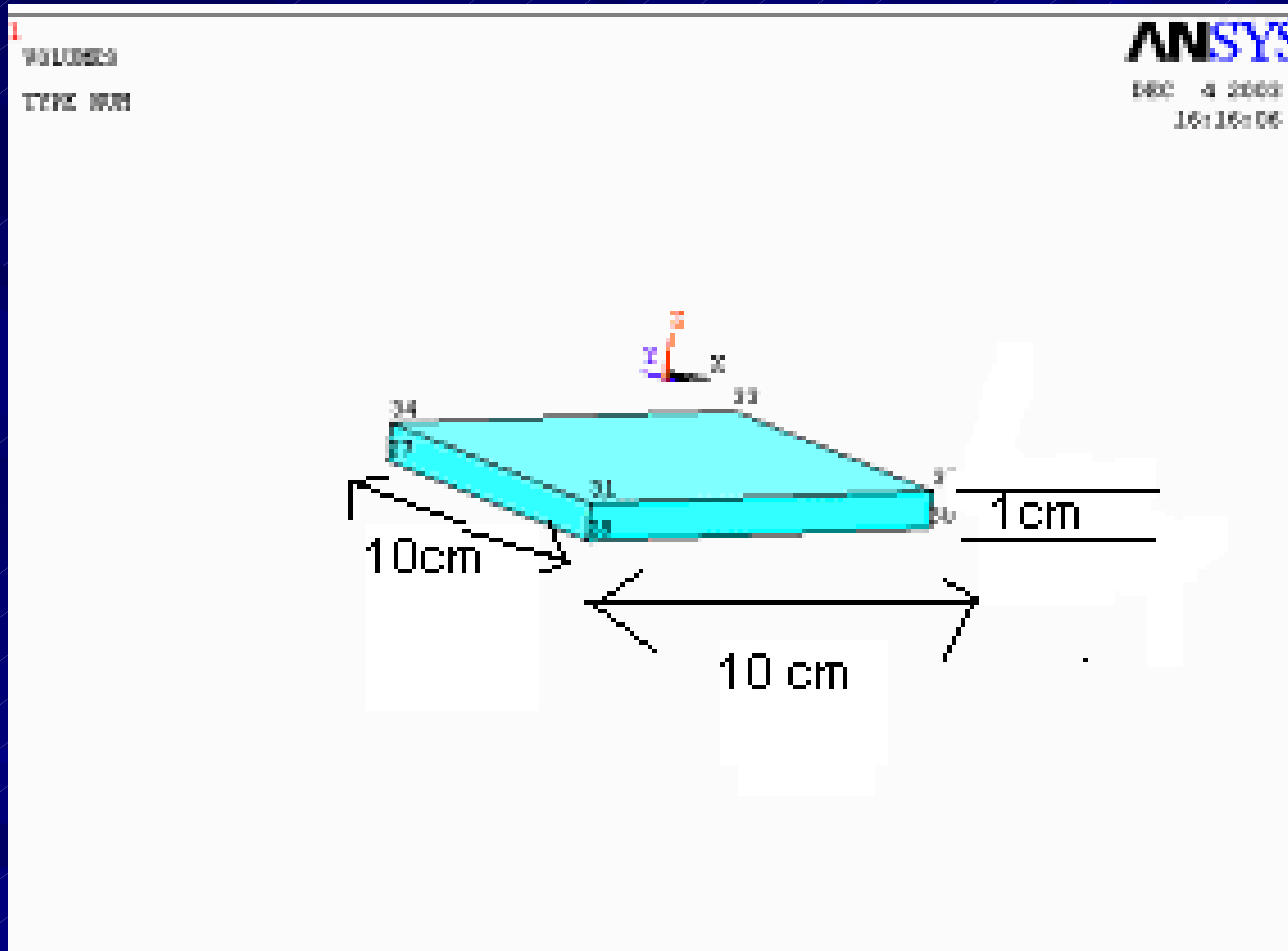
2-D Front View of the Soda Can



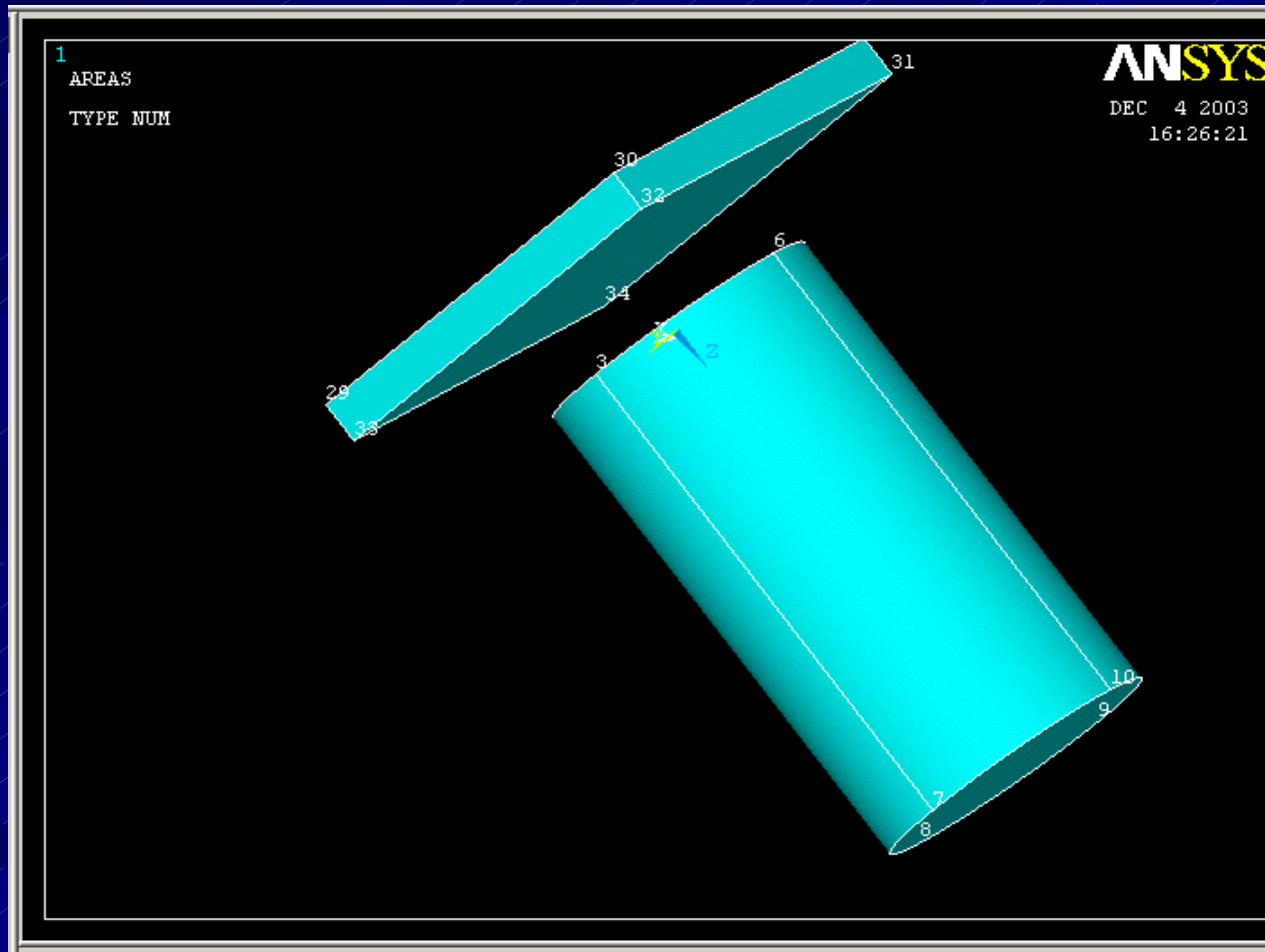
2-D Top View of the Soda Can



3-D view showing Rigid Wall with Dimensions



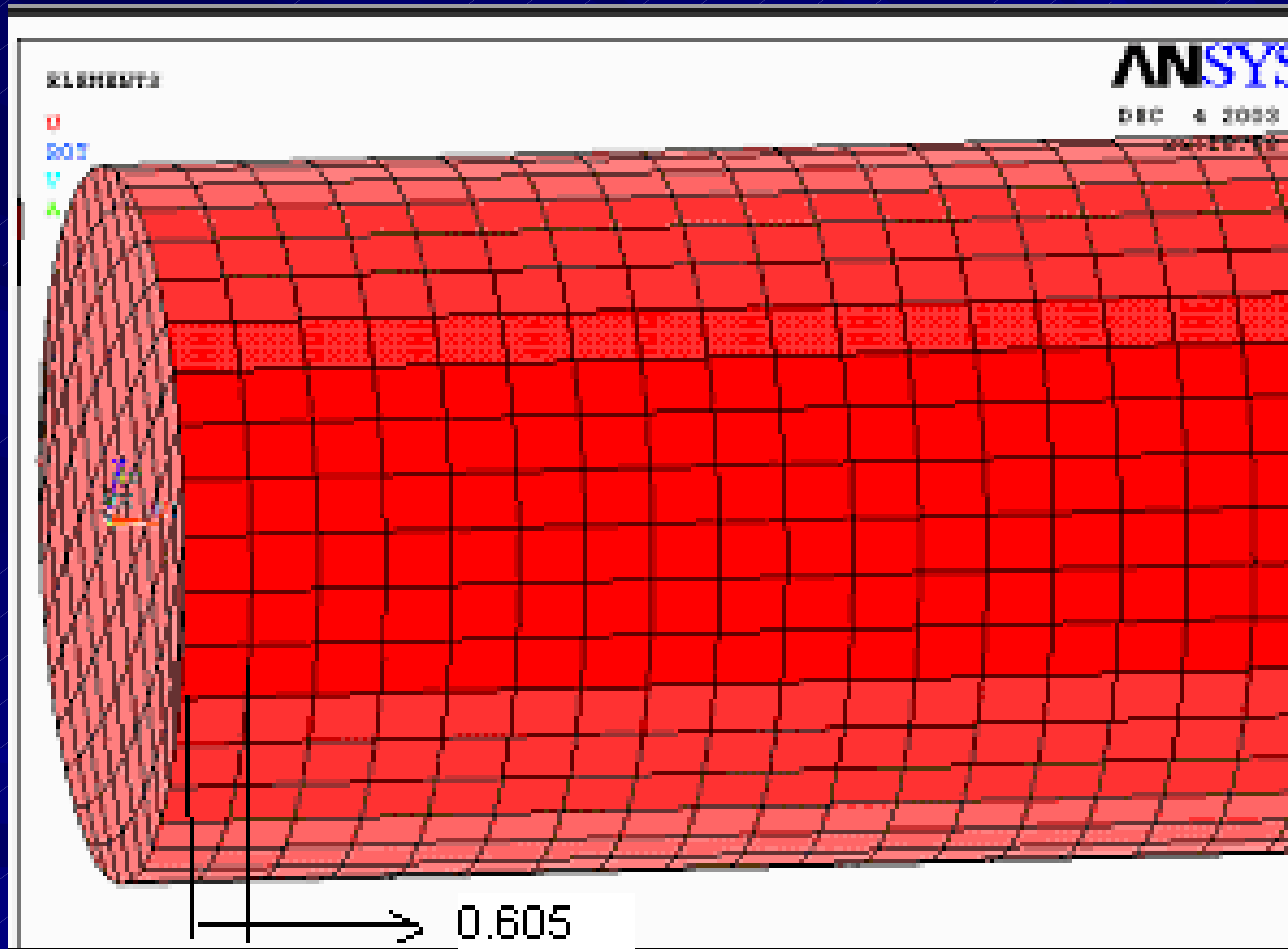
3-D View showing Can and Rigid Wall



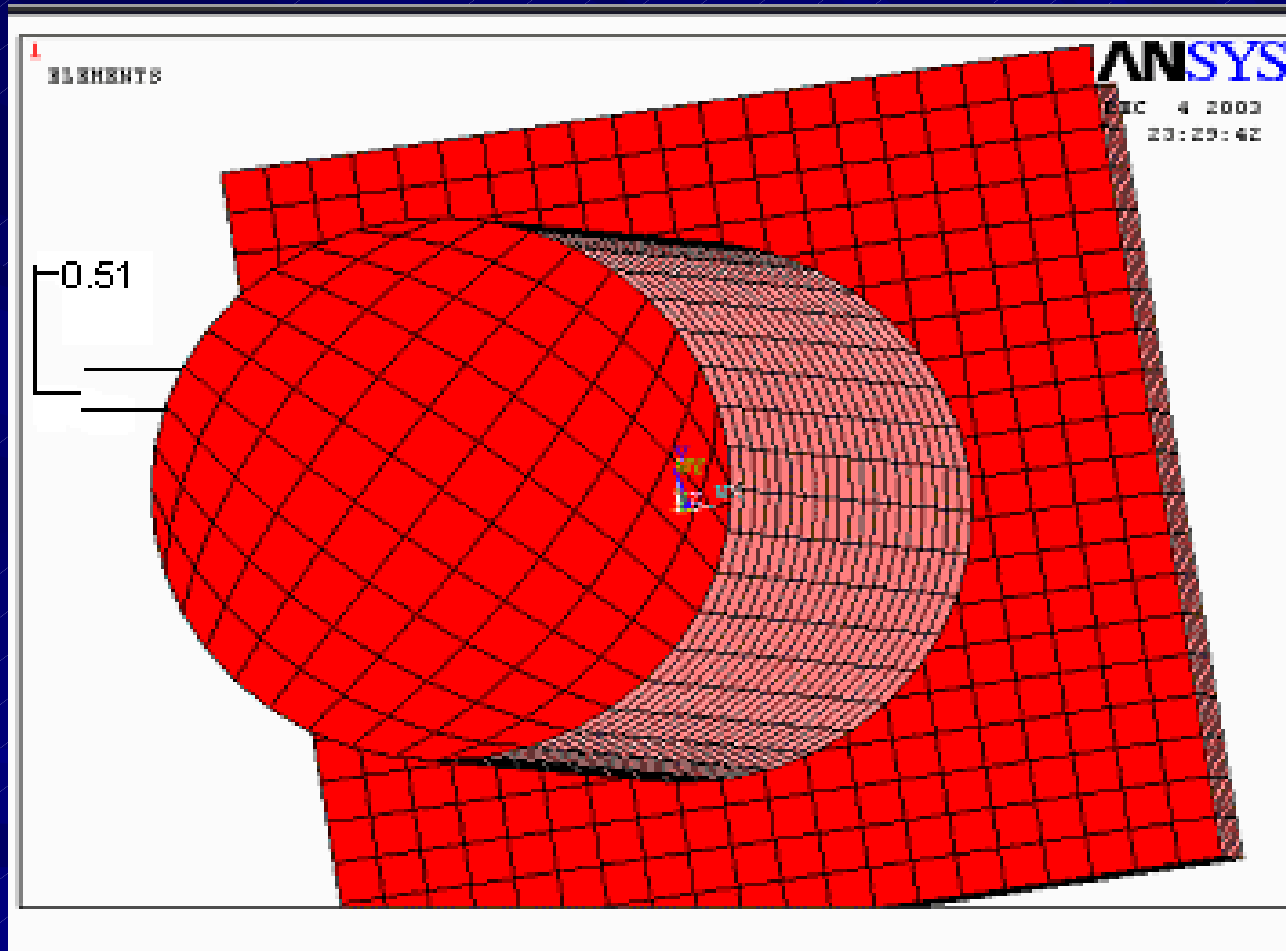
Meshing Details

- Aspect Ratio – 1:2
- Height of the can – 20 elements
- Circumference of the can – 10 elements
- Model Defined for Can – Shell in nature
- Model defined for Rigid Wall – solid

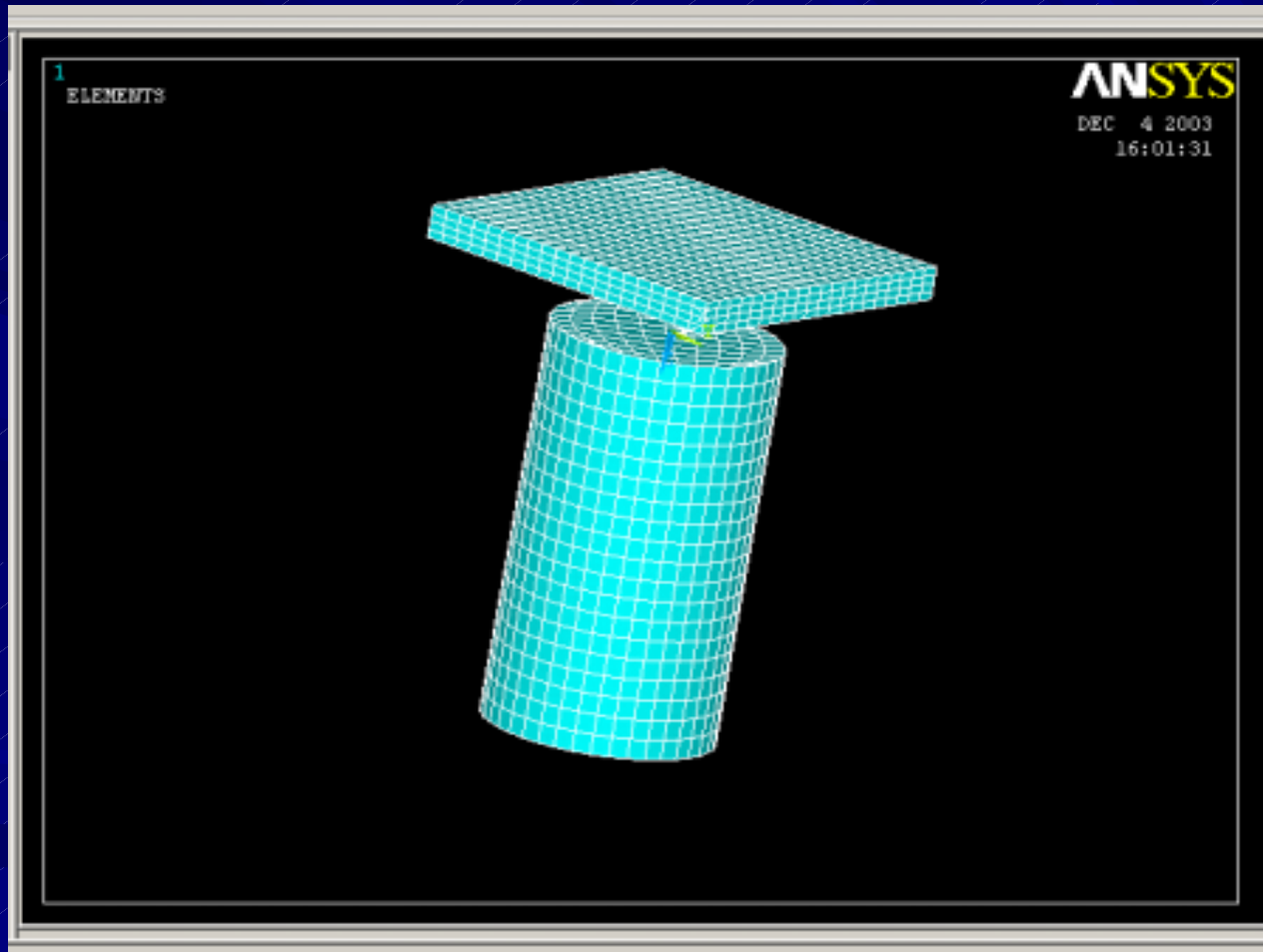
3-D View Showing Dimension of Height Line Element on Soda Can



3-D View Showing Dimension of Circumference Element on Can



3-D View



Material Models

- *MAT_PLASTIC_KINEMATIC- Soda Can
- *MAT_RIGID – Rigid Wall

Mechanical Properties of the can

Density(kg/m ³)	Young's Modulus (Mpa)	Yield Strength(Mpa)	Poisson's Ratio	Tangent Modulus(Mpa)
2700	75000	60	0.33	28000

Mechanical Properties of the Rigid Wall

Poisson's Ratio	Elastic Modulus(Gpa)	Density (kg/m3)
0.3	220E+9	7150

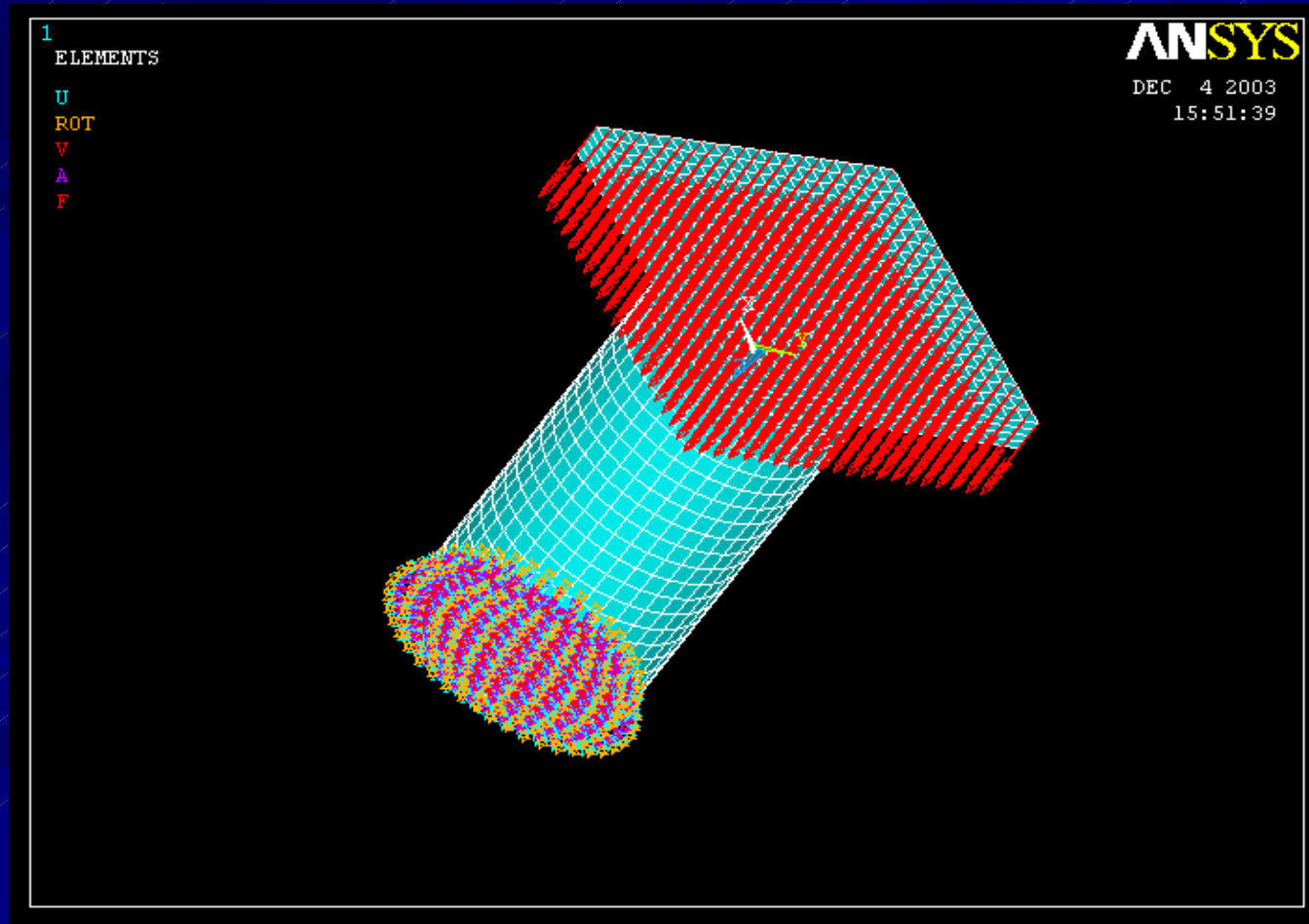
Contact Interfaces

- Surface to surface contact between Rigid Wall and the Soda Can

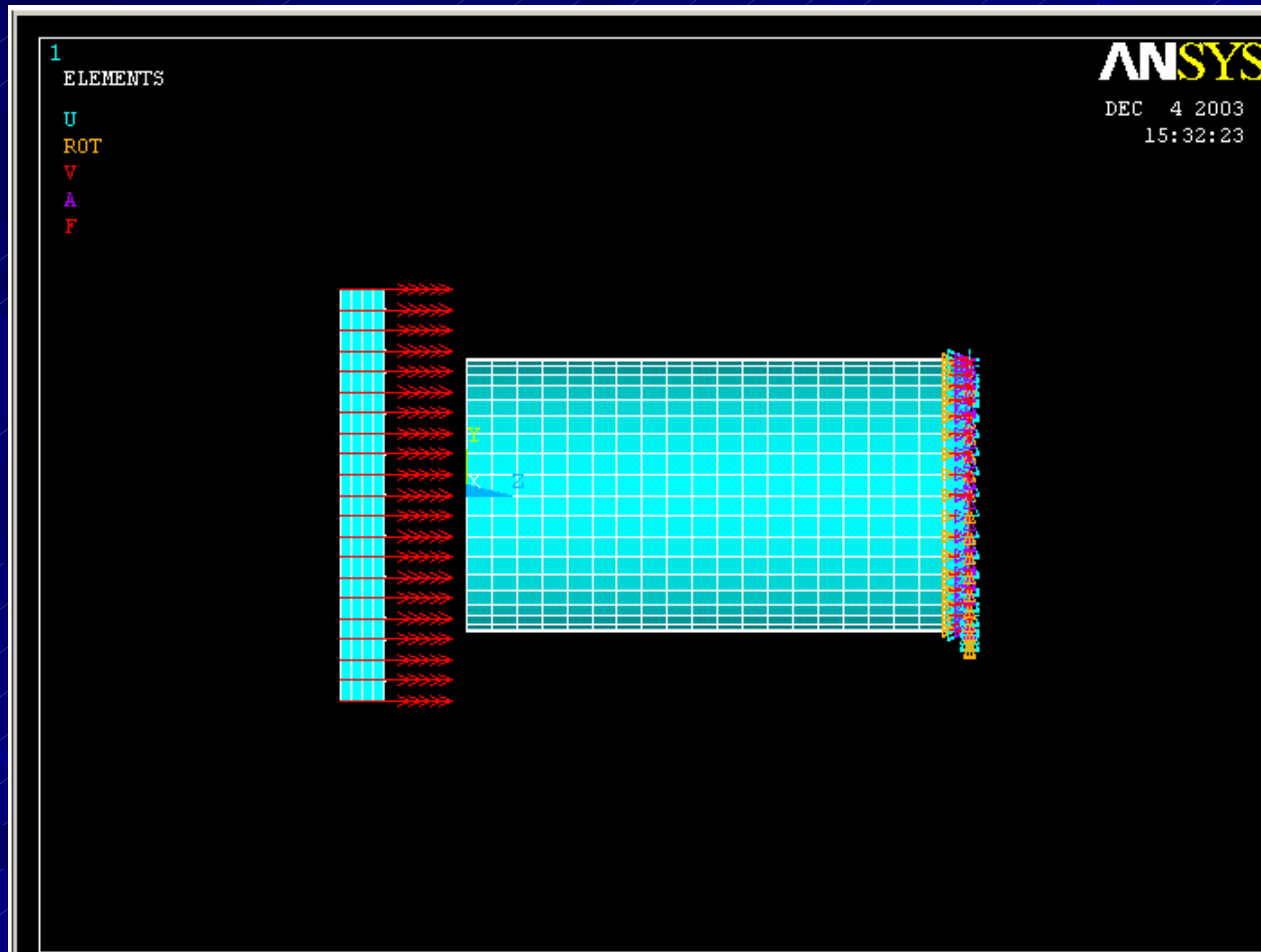
Load Curve

Load (N)	Time (sec)
0	0
0.00035	1.000E3
1.000E-3	5.000E3
9.000E-3	1.000E4

Isometric View Showing Forces on Rigid wall and constraints on the bottom of the can



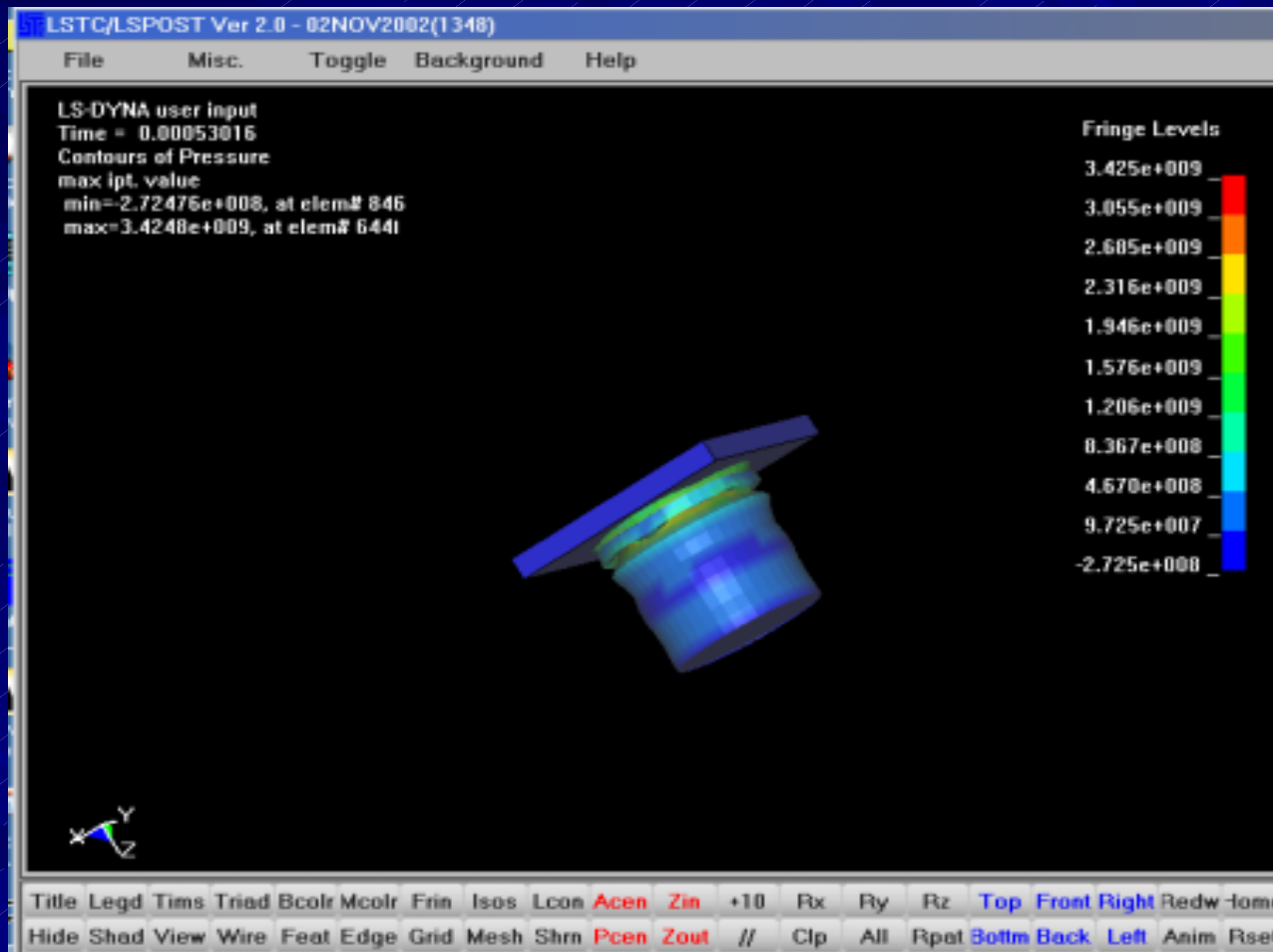
Isometric View with all the applied Conditions



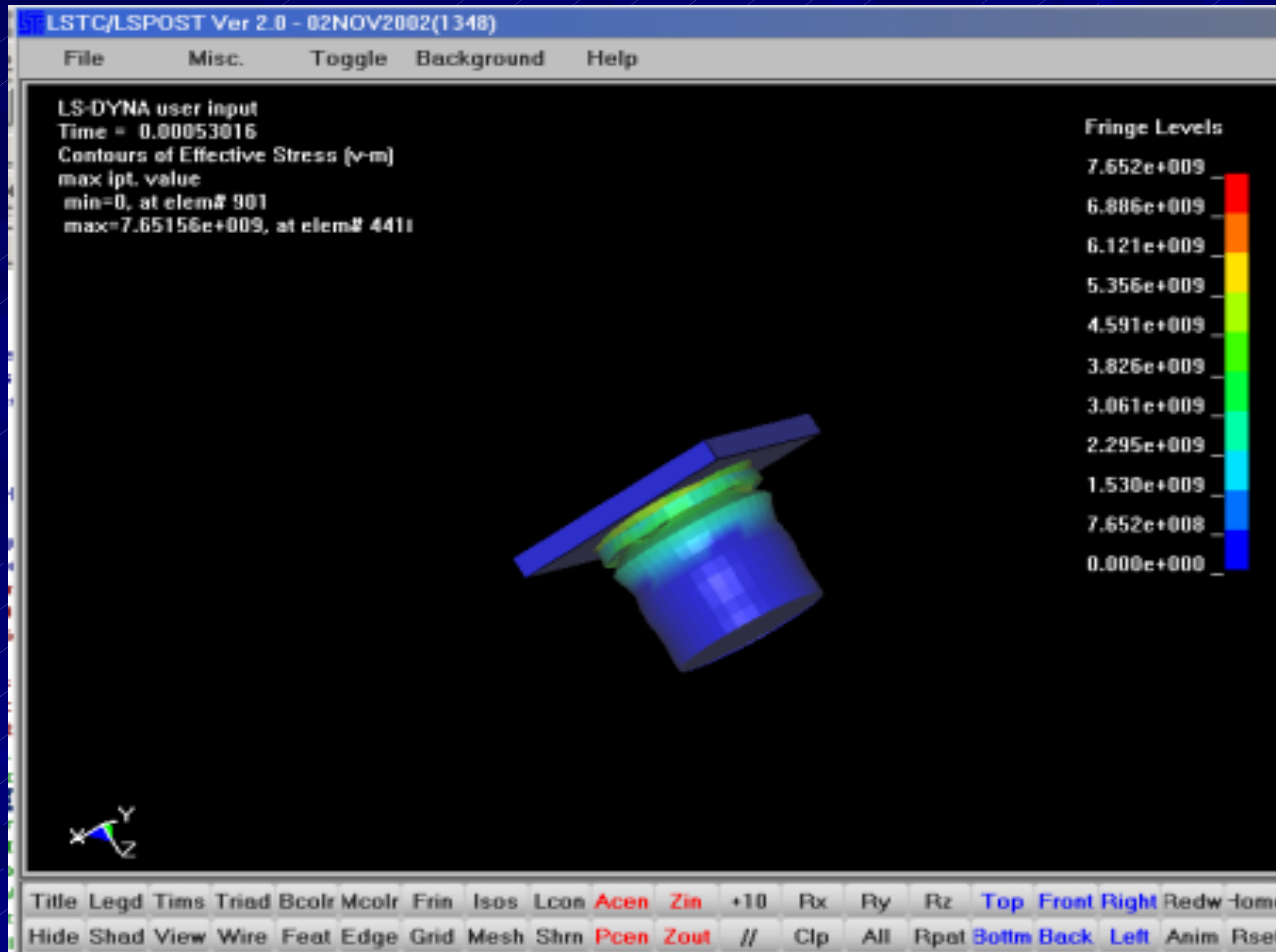
Results

- The Crush of the Soda Can was occurred at following Values
- Vonmises Stress – $7.652\text{E}+9$ Pascal.
- Pressure - $3.426\text{E}+9$ Pascal.
- Z- Stress - $7.42\text{E}+9$ Pascal.
- Z – Displacement - 0.07425 meter.
- Time step – 0.00053 sec.
- X- displacement - $-9.0\text{e}-7$ meters.

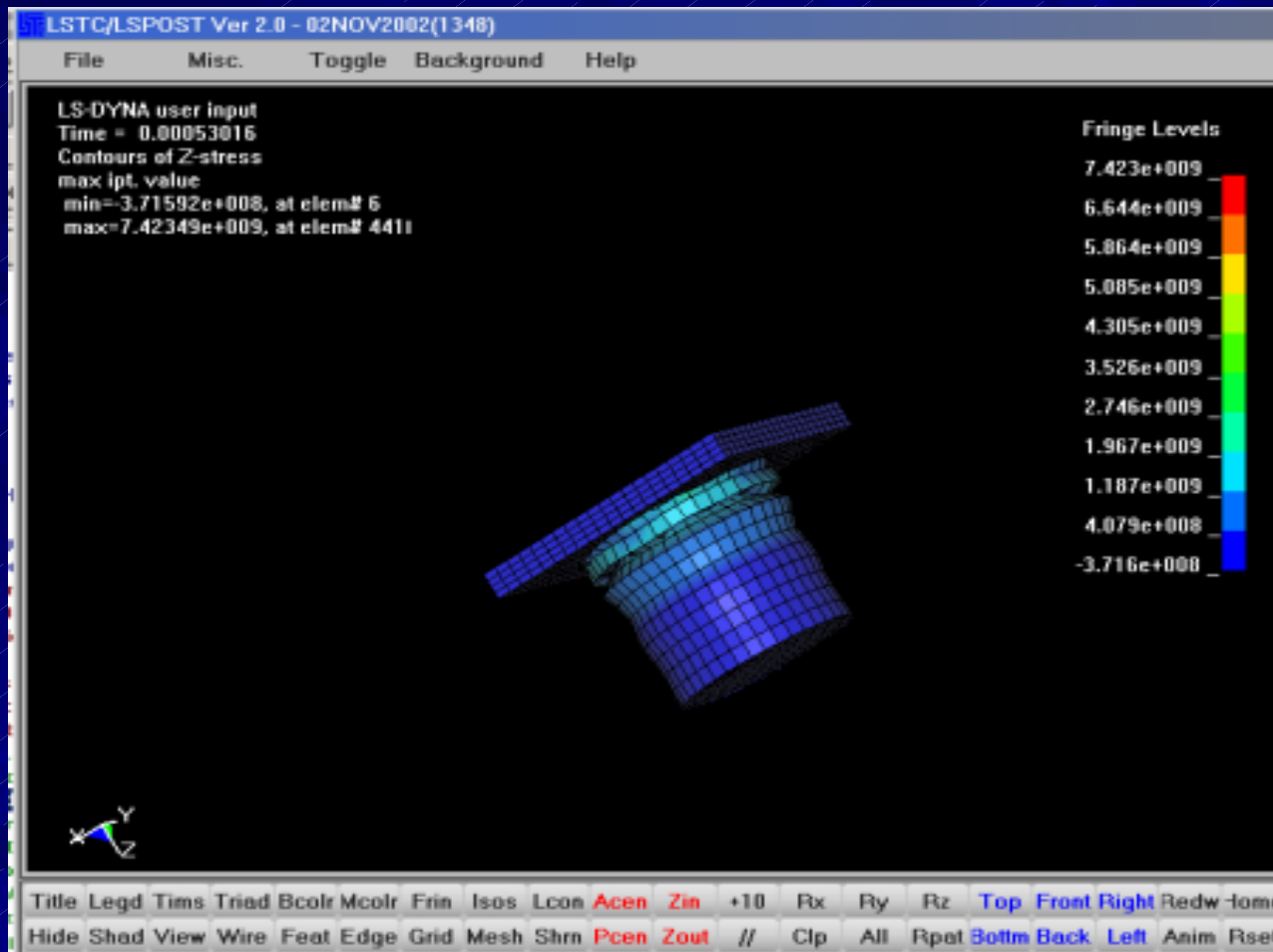
Results Showing Pressure



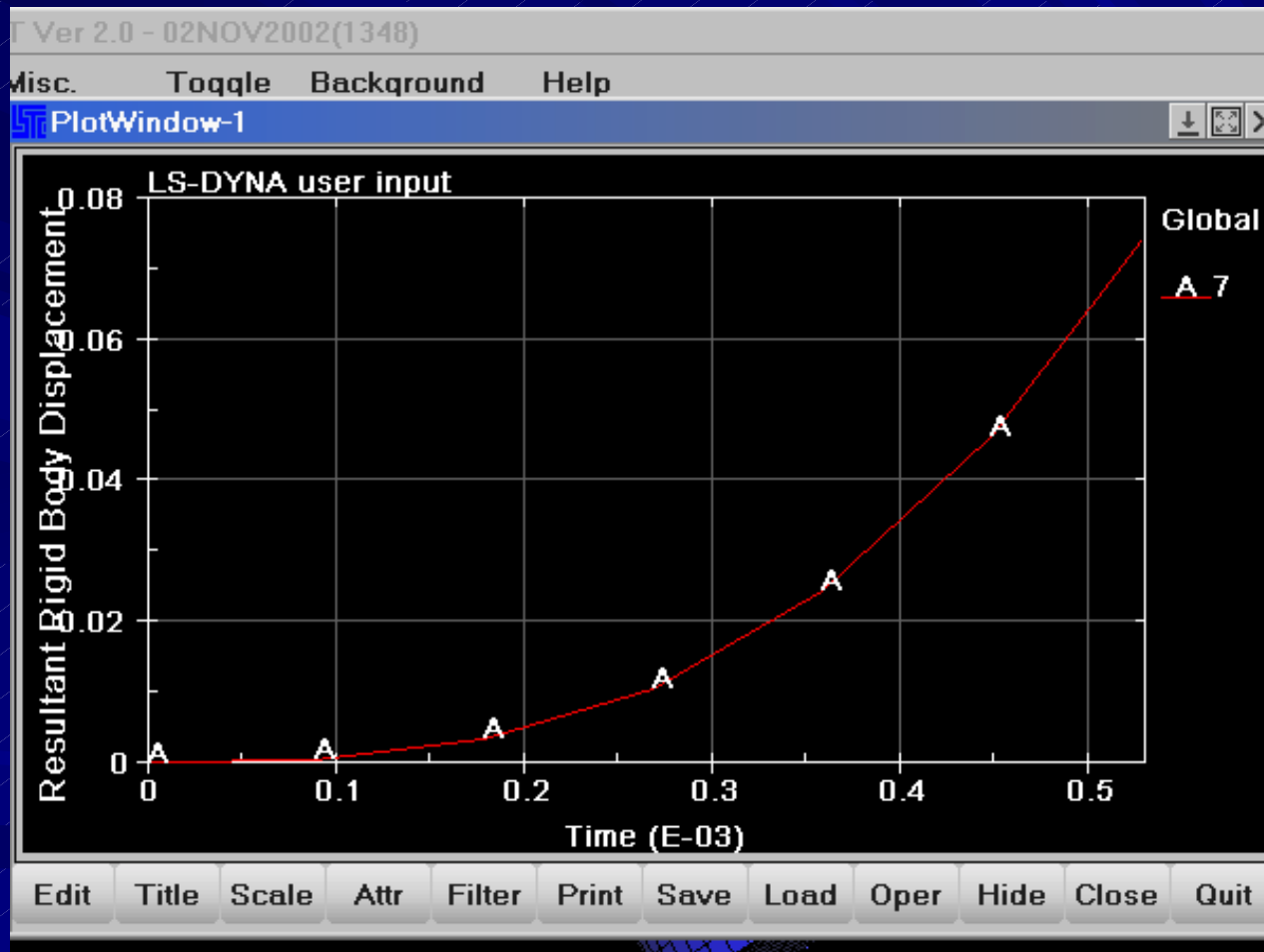
Showing Vonmises Stress



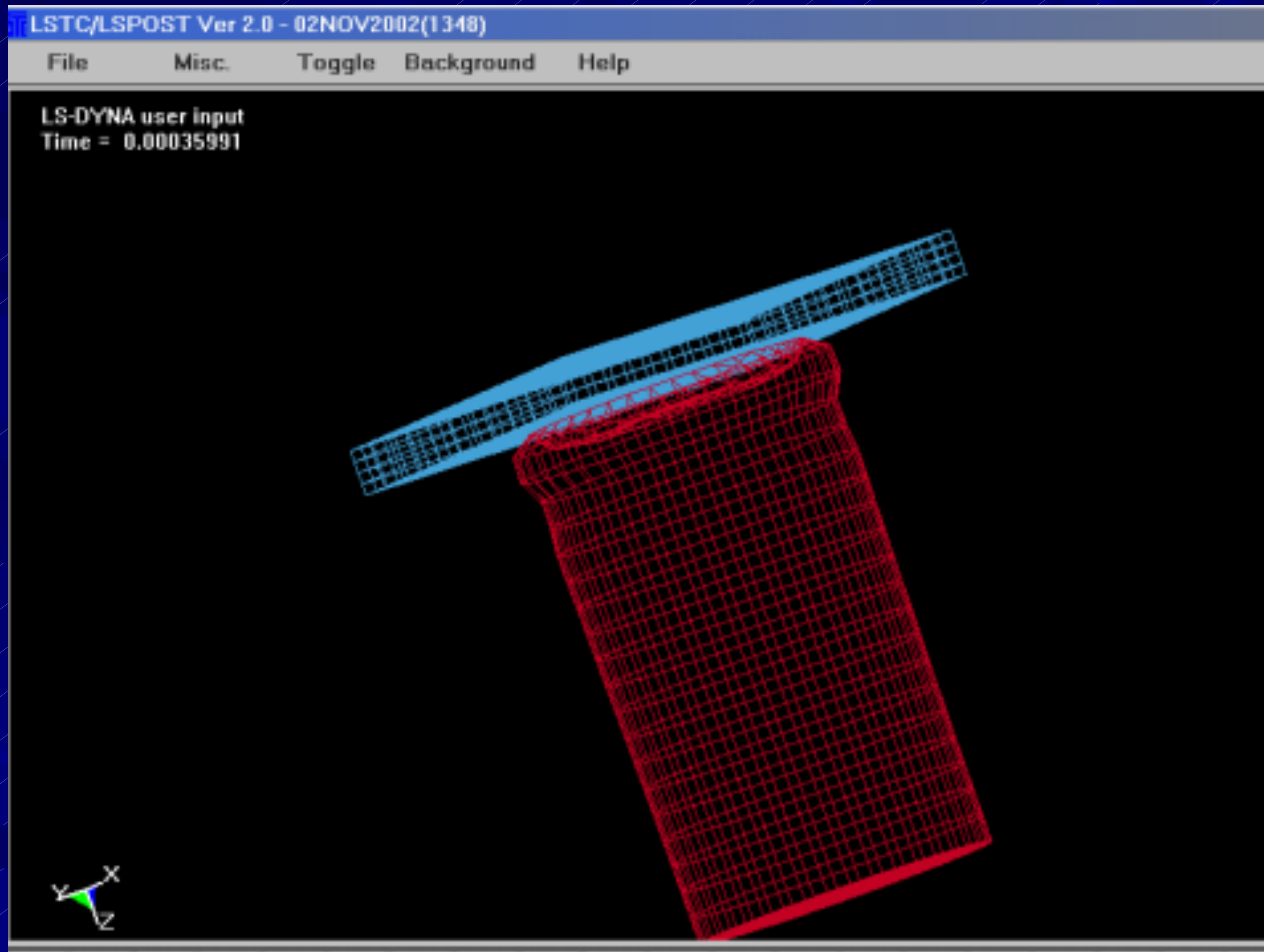
Showing Z-Stress



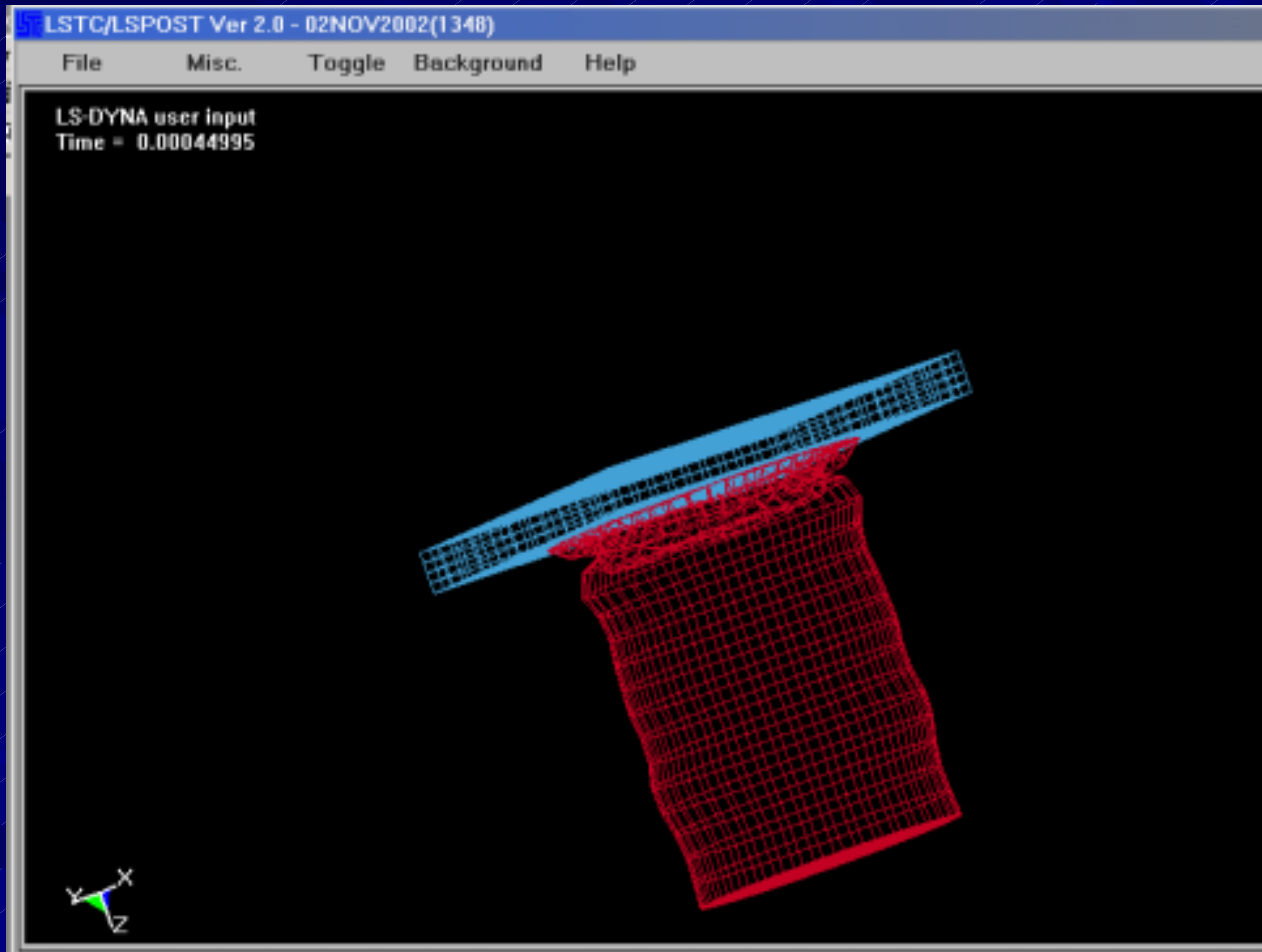
Plot Showing Resultant displacement



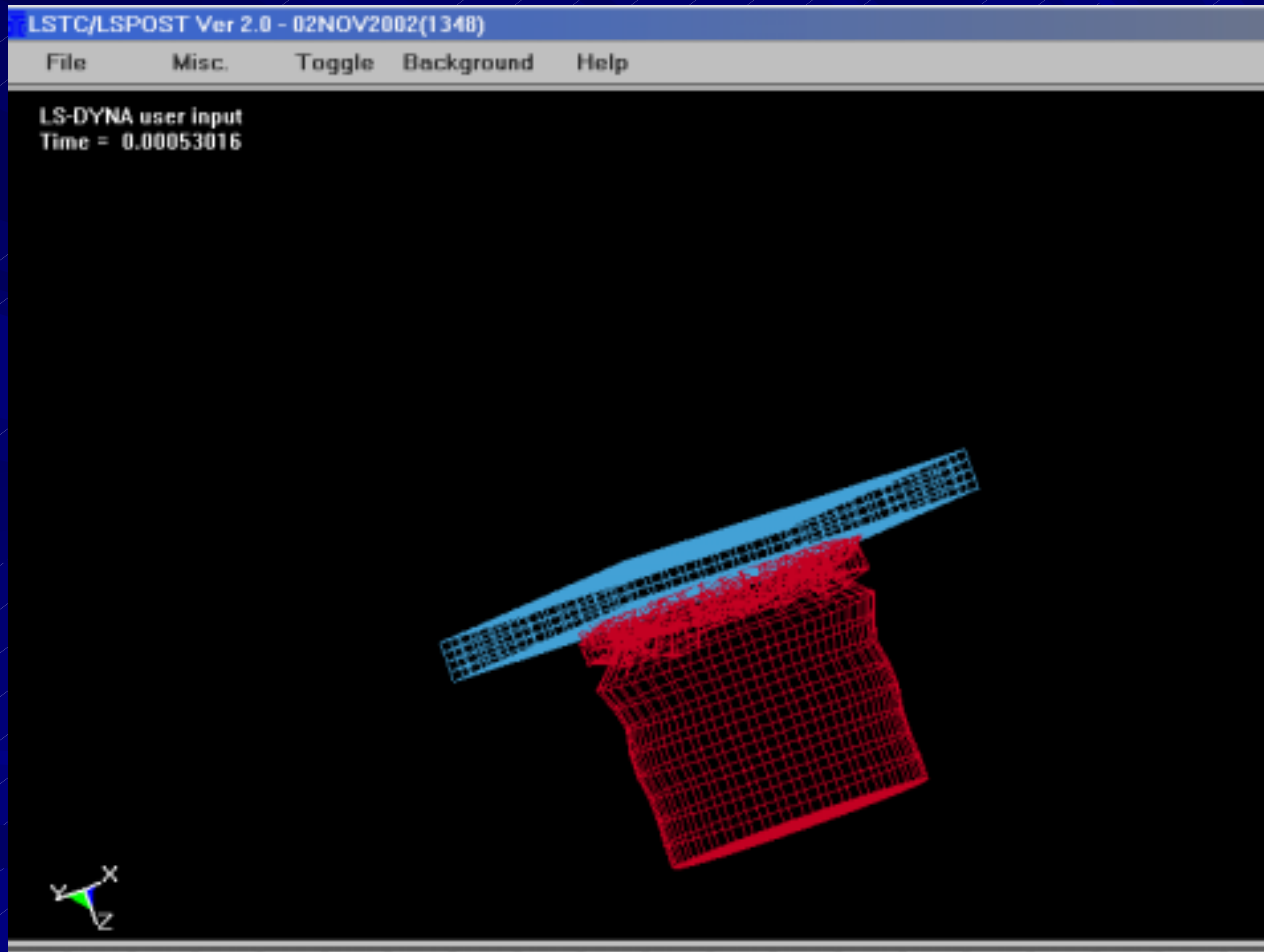
Initial Crush of the Can



Crush at the Center of the Can



Final Crush of the Can



Conclusions

- Made the Can to buckle realistically
- The Thickness on the lid of the Can can be made such that half of it lies above the neutral and other half below the neutral axis ,this might have stiffen the lid of the can.
- This could be a precursor for crushing of Soda Cans

Acknowledgements

Dr Brendan.J.O,Toole