

# High Performance Computing

## Implementation & Challenges

**Sumit Mukherjee**



# Who is Plastic Technologies, Inc.?

**The global thought and technology leader  
for plastic packaging**

- Confidential and independent development resource
- 50 Packaging Professionals
- 100+ Corporations/Brand Owners
- 100+ U.S. and International patents
- Locations in NA and Europe
- Broad spectrum of experience
- Knowledge of all markets





## Some of PTI's

- ✓ Contour bottle - shaped PET CSD package
- ✓ PET long-neck "Pasteurizable" beer bottle
- ✓ PEN and PEN-blend bottles
- ✓ Bio-Derived Resin Blow Molded bottle - PLA
- ✓ Bio-Derived resin PLA and cotton composite bottle
- ✓ Hand held ergonomic closure removal device – TorqTraQ® device
- ✓ Blow-molded multi-chamber bottle
- ✓ Opaque PET container
- ✓ First approved food grade PET material from curbside collection
- ✓ Blow-trim process heat-set container
- ✓ PET bottle produced from 100% curbside collection material - food-grade
- ✓ Compression-molded preform
- ✓ Recovery of plastic from commercial wire cable
- ✓ Agglomeration as a separation technology
- ✓ Upside-down ketchup bottle



# Innovation



DuPont Awards for Packaging Innovation

## Market research samples



**725K Hunt's Ketchup  
Bottles**



**300K Bobble Bottle  
Market Launch**



**1MM+ 16oz CSD  
Market Study**

# Internal Software Development: Virtual Prototyping™ Software

The screenshot shows the PTI website homepage. At the top left is the PTI logo. To its right is a search bar containing the URL <http://www.plastictechnologies.com/>. Further right is the slogan "We Package Solutions® ...through innovation, technology and service". Below this is a horizontal navigation menu with links for Home, Services, Products, Training, Partners, Company, and Contact. A large banner image shows a 3D virtual prototype of a yellow and blue container being processed by a blow molding machine. On the left side, there is a "Quick Links" section with two links: "Virtual Prototyping™ Modules" and "Finite Element Analysis". The main content area is titled "Technology Development" and "Virtual Prototyping™ Modules". It contains a paragraph describing the software's capabilities and a 3D surface plot showing temperature distribution. On the right side, there is a "Search" section with a "Google™ Custom Search" input field and a "Search" button. Below the search section is a "Engineering Services" section with three expandable items: "Material Development", "Product Development", and "Technology Development".

**Quick Links**

- » [Virtual Prototyping™ Modules](#)
- » [Finite Element Analysis](#)

**Technology Development**  
Virtual Prototyping™ Modules

PTI introduces its Virtual Prototyping™ modules that, in just a few mouse clicks, can design a preform for your container and take it on a virtual trip through a blow molding machine.

The output for this program is an excellent input for [FEA](#) models of the blow molding process.

**Search**

Google™ Custom Search

**Engineering Services**

- ▶ [Material Development](#)
- ▶ [Product Development](#)
- ▶ [Technology Development](#)

# VP™ Web Interface

- Email Us...

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- DXF Bottle Input
- Bottle Editor
- Preform Design Editor
- Preform Editor
- Modify Preform Weight
- IR2 Resin Input
- Resin Viewer
- Oven Profile Editor**

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- Temperature Calculation
- Blow Molding

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- Preform Design Optimization
- Heater Optimization

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- Crystallinity Calculation

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- To Rheology
- To Single Stage

Oven profile type:  SBO1-2  SBO2-3

Initial preform temperature (°C):

Overall power:  %

Lamp	Oven 1		%		Oven 2		%		Oven 3		%	
	0	kW	<input type="checkbox"/>	<input type="text" value="0"/>	0	kW	<input type="checkbox"/>	<input type="text" value="0"/>	0	kW	<input type="checkbox"/>	<input type="text" value="0"/>
9	0	kW	<input type="checkbox"/>	<input type="text" value="0"/>	0	kW	<input type="checkbox"/>	<input type="text" value="0"/>	0	kW	<input type="checkbox"/>	<input type="text" value="0"/>
8	0	kW	<input type="checkbox"/>	<input type="text" value="0"/>	0	kW	<input type="checkbox"/>	<input type="text" value="0"/>	0	kW	<input type="checkbox"/>	<input type="text" value="0"/>
7	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="46"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="46"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="46"/>
6	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="44"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="44"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="44"/>
5	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="40"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="40"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="40"/>
4	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="55"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="55"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="55"/>
3	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="55"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="55"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="55"/>
2	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="50"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="50"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="50"/>
1	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="50"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="50"/>	2	kW	<input checked="" type="checkbox"/>	<input type="text" value="50"/>

Cycle time (0-9 sec):

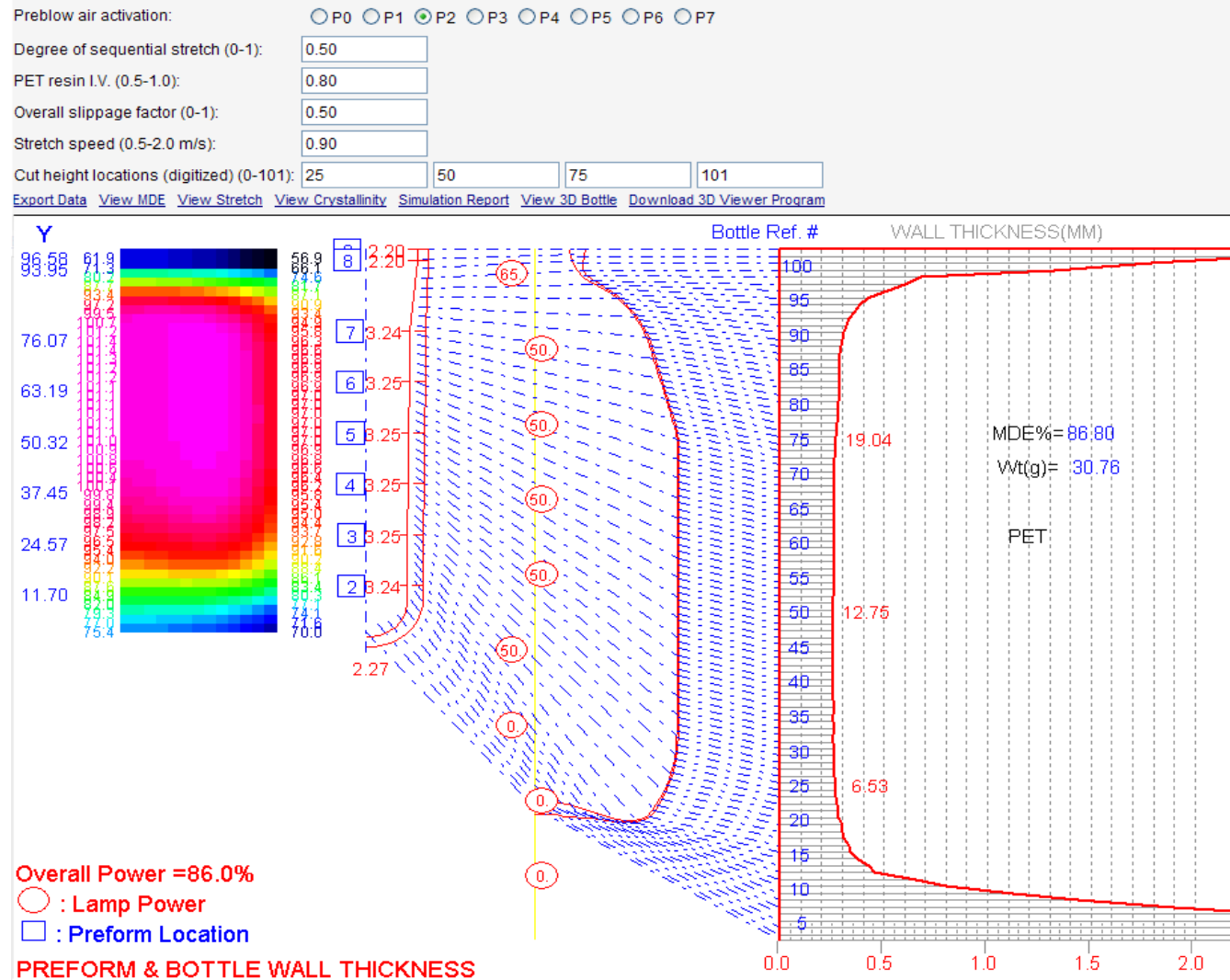
Bottles/hour/cavity:

Step ID	01	02	03	04	05	06
	Heat	Equilibrate	Heat	Equilibrate	Heat	Equilibrate
Air velocity (m/s)	<input type="text" value="3.00"/>	<input type="text" value="3.00"/>	<input type="text" value="3.00"/>	<input type="text" value="3.00"/>	<input type="text" value="3.00"/>	<input type="text" value="1.00"/>
Air temperature (°C)	<input type="text" value="45.0"/>	<input type="text" value="45.0"/>	<input type="text" value="45.0"/>	<input type="text" value="45.0"/>	<input type="text" value="45.0"/>	<input type="text" value="25.0"/>

- Setup a Web Interface with Menus for different Functionalities

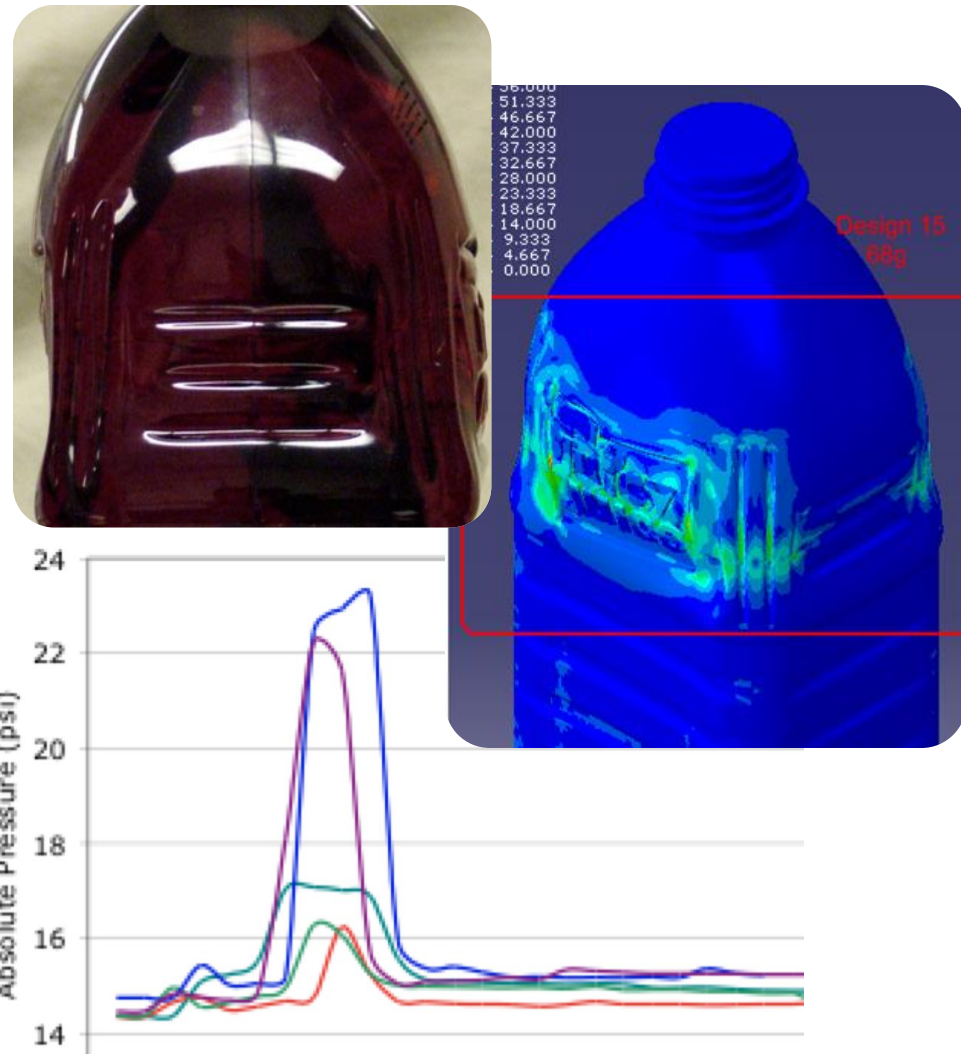
# VP™ Blow Molding Module

- Graphical Outputs
- Comprehensive automated report generated within minutes
- Export Data for FEA (Simulia)



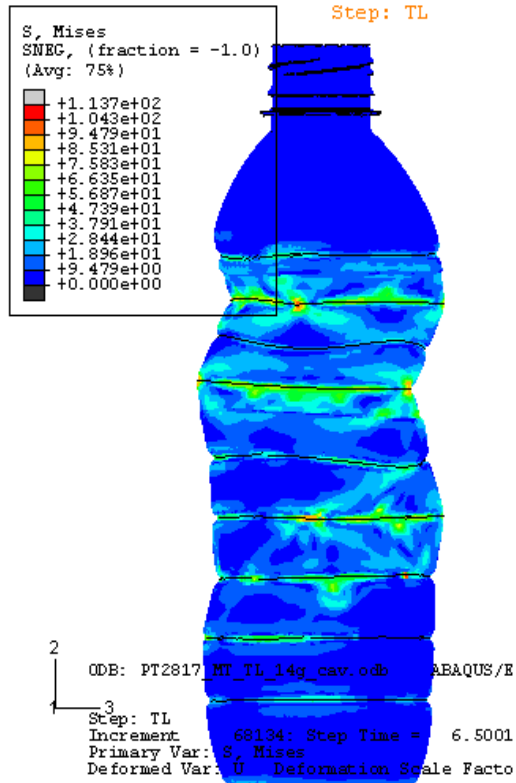
## Case Studies:

- Objective
  - Eliminate aesthetically unacceptable logo bulging without adding weight
- Solution
  - Analyzed line to determine root cause was a pressure filling issue
  - Utilized FEA to test and optimize design concepts
  - Validation testing, technology transfer, and commercialization assistance



# Light weight Bottle Performance

Simulated

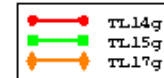
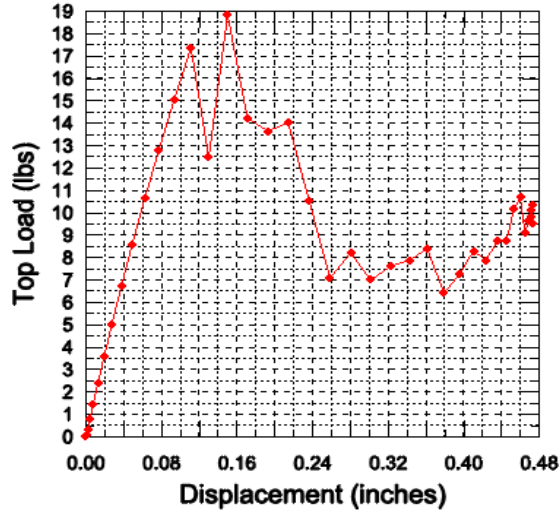


Actual

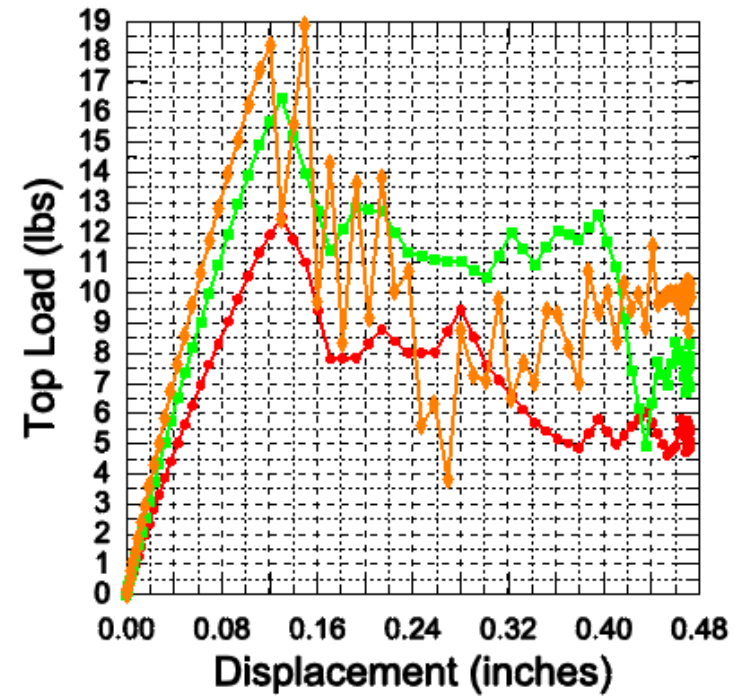


# Empty Top Load: PET Water Bottle

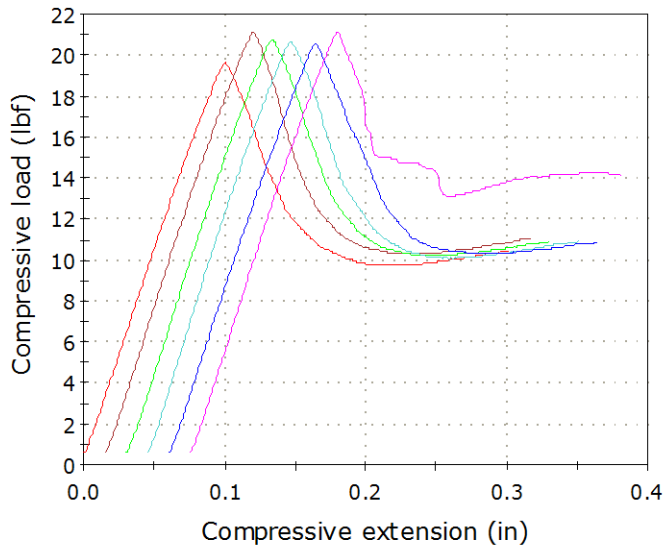
Simulated



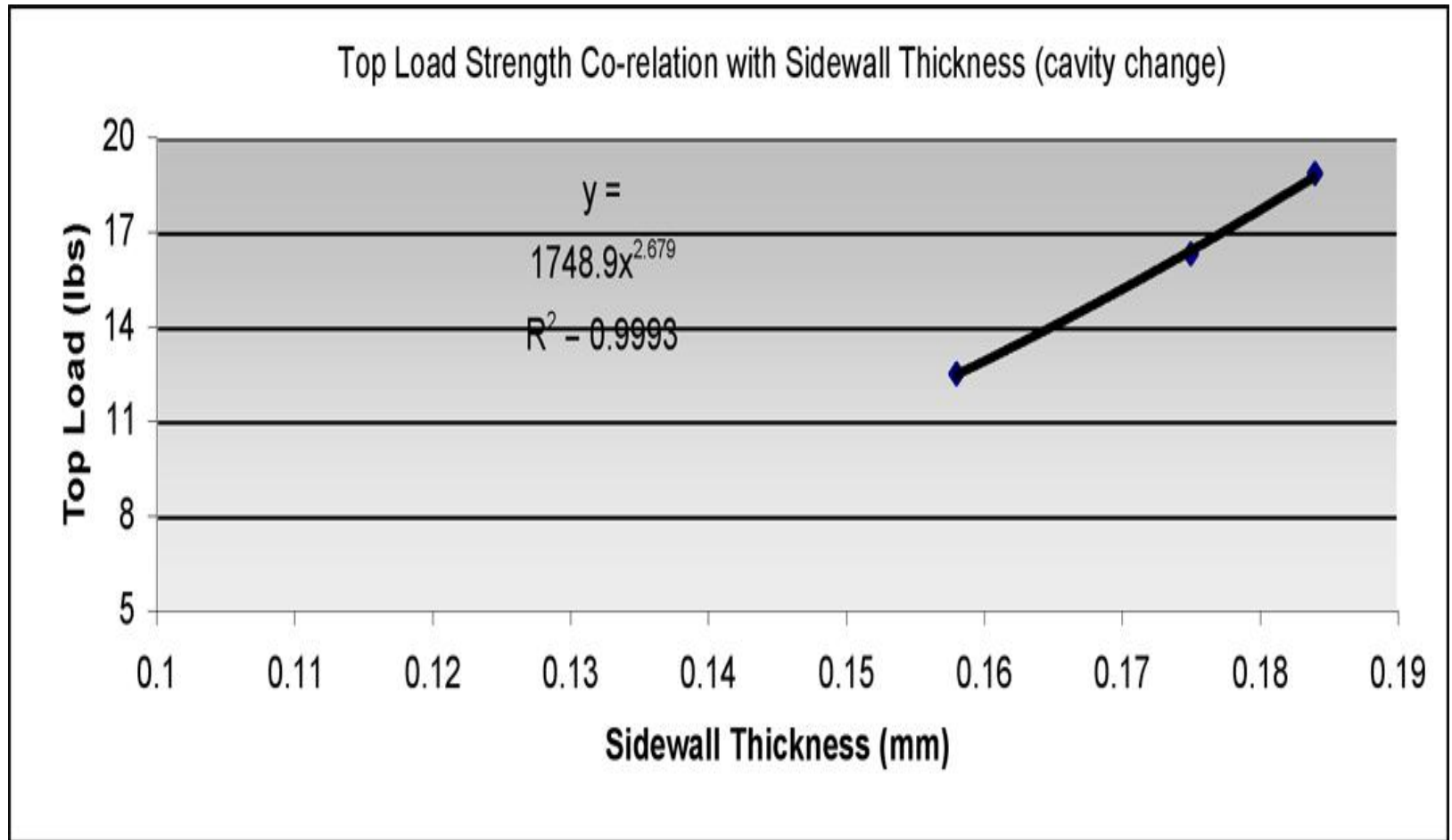
Comparison of Top Load Strength



Actual



# Develop Relationships to minimize iterations



- Use co-relation to better target your required container weight

# As a supplier... Need to provide what they need

## P&G's Global Business Services

*Transforming the way business is done*

### Virtualization

Replace physical product mock-ups with virtual reality applications

- **Consumers:** focus group mock-ups replaced by virtual designs
- **Customers:** virtual shelving & displays to test, learn and wow!
- **Engineering & Production:** product modeling tools

*Virtual Solutions Tools were used on all top tier Initiatives*



## Innovation in Small Firms

- Key Contributor to Growth & Profitability
- Development of Intellectual Property/trade secrets or license able technology
- More Holistic View, involvement in all aspects of business
- Engineering Simplifications vs. Brute Force
- Best use of available resources

# IT and Engineering Software

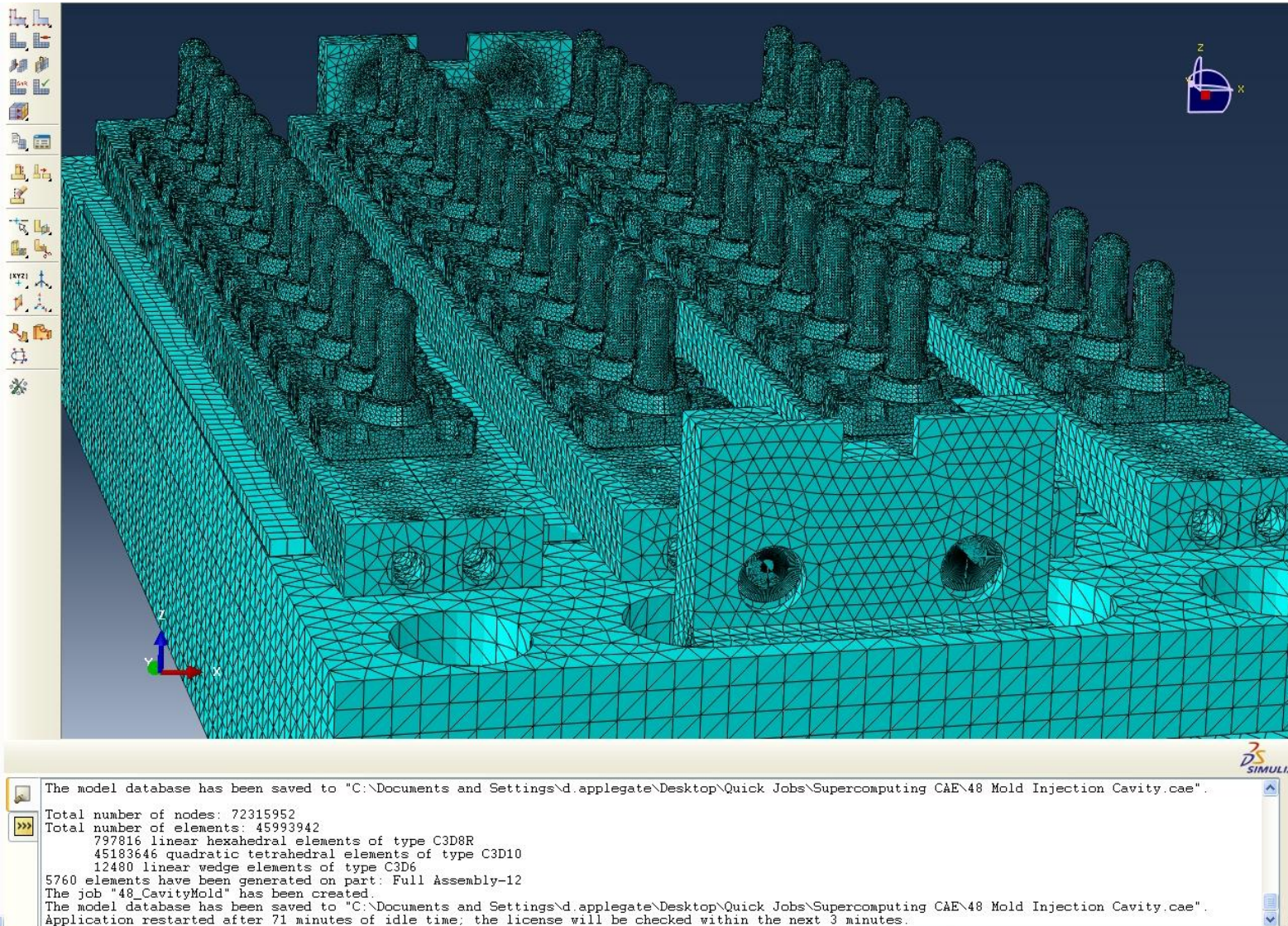
- Need to embed software engineers into the workflow of non IT based companies
- To improve efficiency and data mine knowledgebase
- Documentation and Case Studies
- Exploration beyond Experience

# Challenges

- Large Models
- Complex Setup & Analysis
- Intelligent Experimentation Needed
- Internal Competition



# Complex Large Models



The model database has been saved to "C:\Documents and Settings\d.applegate\Desktop\Quick Jobs\Supercomputing CAE\48 Mold Injection Cavity.cae".

Total number of nodes: 72315952  
Total number of elements: 45993942  
797816 linear hexahedral elements of type C3D8R  
45183646 quadratic tetrahedral elements of type C3D10  
12480 linear wedge elements of type C3D6  
5760 elements have been generated on part: Full Assembly-12  
The job "48\_CavityMold" has been created.  
The model database has been saved to "C:\Documents and Settings\d.applegate\Desktop\Quick Jobs\Supercomputing CAE\48 Mold Injection Cavity.cae".  
Application restarted after 71 minutes of idle time; the license will be checked within the next 3 minutes.

## Help Needed!

- Access to high performance computing at reasonable cost
- Ease of Access
- Eliminate Need to Upload / Download gigantic files

## Summary

- Developing Simulation Capabilities is Critical to Survival and having competitive edge
- Need to combine Engineering and Programming Skills
- Use available resources to determine and map need
- Need to develop models from available knowledge
- Need to protect Intellectual Property
- With proper feedback, accurate models can be developed
- User-friendly Interface & Speed
- Resource Challenge to keep pace with available technology