

# FORGE<sup>®</sup>

TRANSVALOR  
AMERICAS  
MATERIAL FORMING SIMULATIONS

## THERCAST<sup>®</sup>

# Simulation Solution of Rolling Process

- State of the Art -

# AGENDA

Transvalor Americas  
Who We Are

What we have to offer

Benefits of using simulation

Live Demo

# TRANSVALOR AMERICAS – WHO WE ARE



Who we  
are

# ABOUT

## TRANSVALOR

- Transvalor was founded more than 30 years ago as a pioneer in the world of computer-aided Material Forming Simulation.
- Our flagship product, FORGE®, is a fixture in Material Forming Operations World-wide.
- We provide industry-leading 3D solutions for Process design and analysis technologies to the Material Forming Industries.
- Today we stand as a world leader in our industry.

## TRANSVALOR AMERICAS

- Outcome of Transvalor S.A.' Strategic Growth and Globalization
- Wholly owned Subsidiary
- C-Corporation Headquartered in Delaware
- Main Office in Chicago
- Distribution and Customer Services

# OUR DNA

ROOTED IN RESEARCH

DRIVEN BY  
INNOVATION

DESIGNED FOR  
RESULTS



OVER 100  
SCIENTISTS

TRANSVALOR

INDUSTRIALIZATION  
DISTRIBUTION  
SUPPORT SERVICES

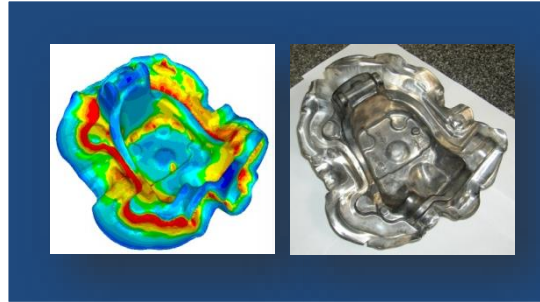
**FORGE<sup>®</sup>**  
**COLDFORM<sup>®</sup>**  
**THERCAST<sup>®</sup>**  
Rem3D<sup>®</sup>

BROAD  
PRODUCTS  
PORTFOLIO

# MATERIAL FORMING SIMULATION SOLUTIONS

## FORGE<sup>®</sup>

Bulk metal processes for  
Hot and Cold forming



## COLDFORM<sup>®</sup>

Bulk metal processes for  
cold forming only



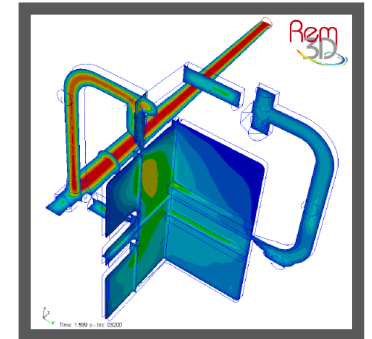
## THERCAST<sup>®</sup>

Continuous Casting and  
Ingot Casting processes



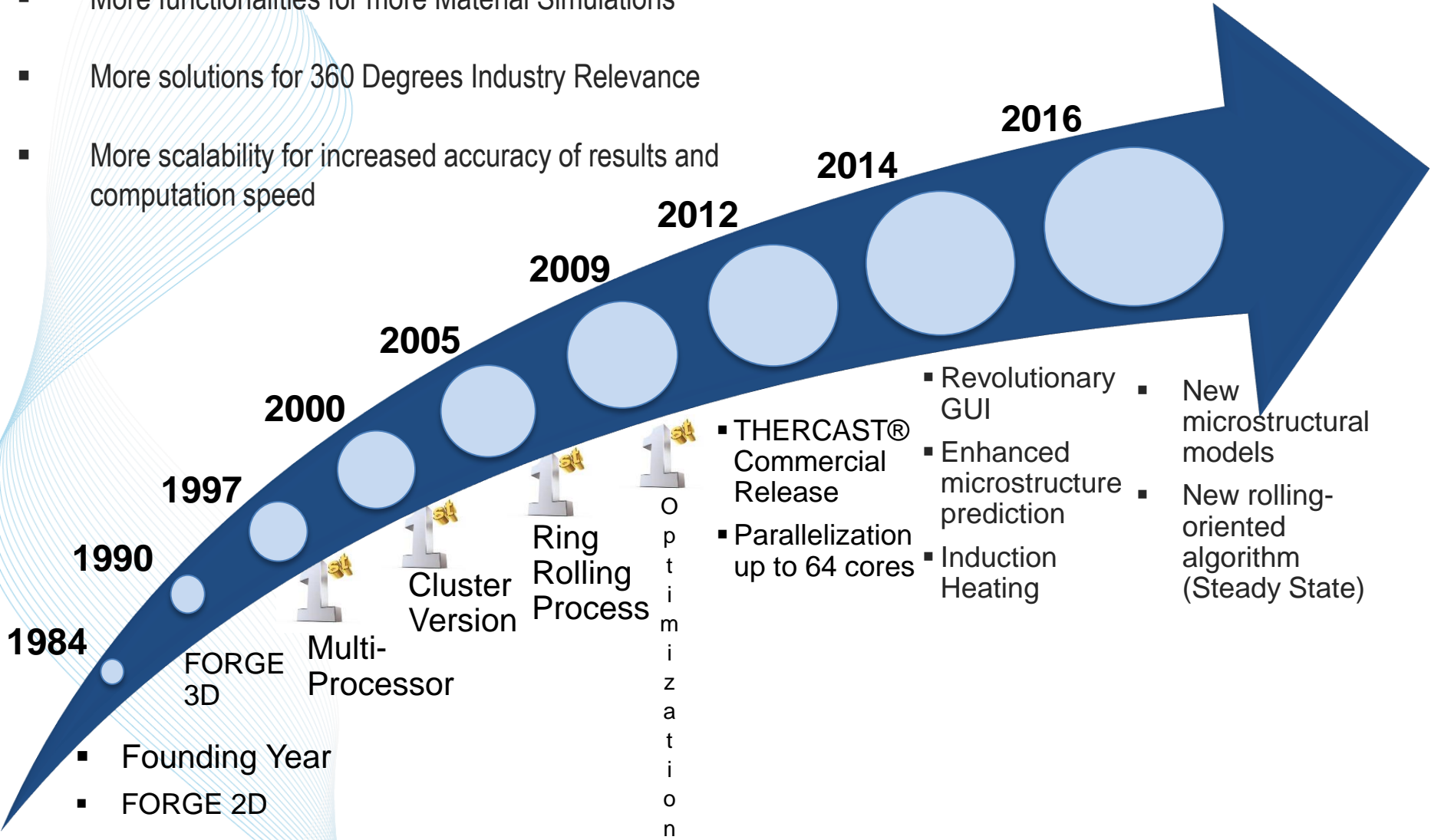
## Rem3D<sup>®</sup>

Injection Molding



# OUR JOURNEY

- More functionalities for more Material Simulations
- More solutions for 360 Degrees Industry Relevance
- More scalability for increased accuracy of results and computation speed



- 1984**
- Founding Year
- FORGE 2D

FORGE 3D

Multi-Processor

Cluster Version

Ring Rolling Process

Optimization

- THERCAST® Commercial Release
- Parallelization up to 64 cores

- Revolutionary GUI
- Enhanced microstructure prediction
- Induction Heating

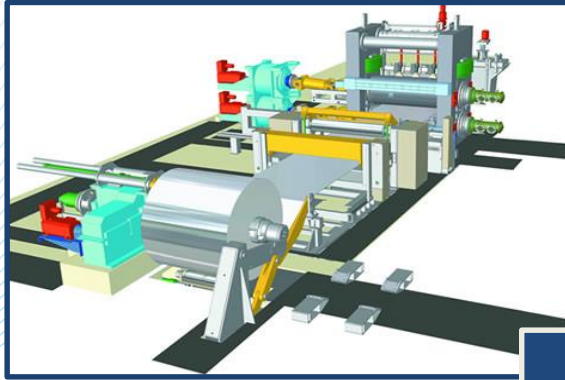
- New microstructural models
- New rolling-oriented algorithm (Steady State)

# AMERICAN CUSTOMERS & UNIVERSITIES



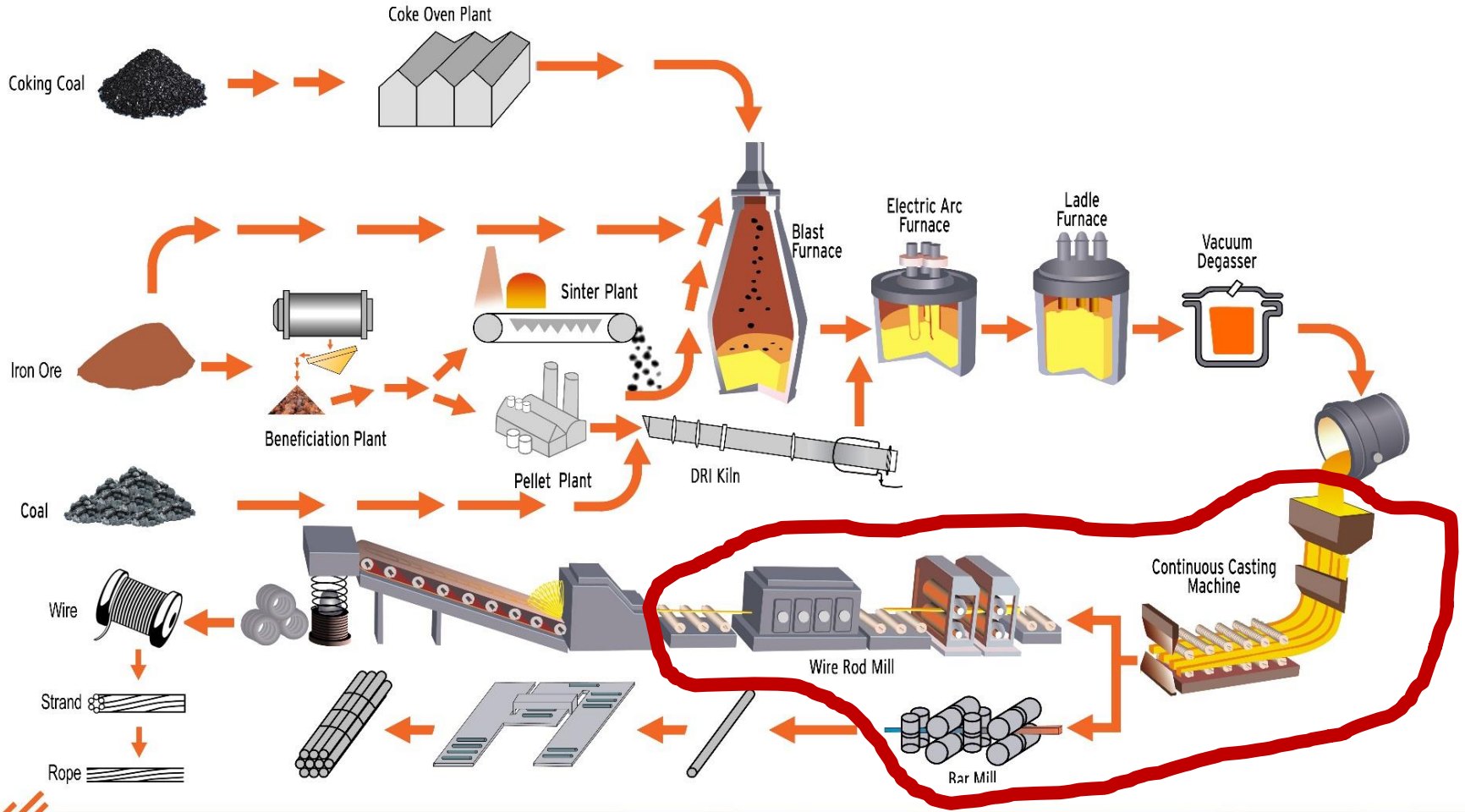


# What we have to offer



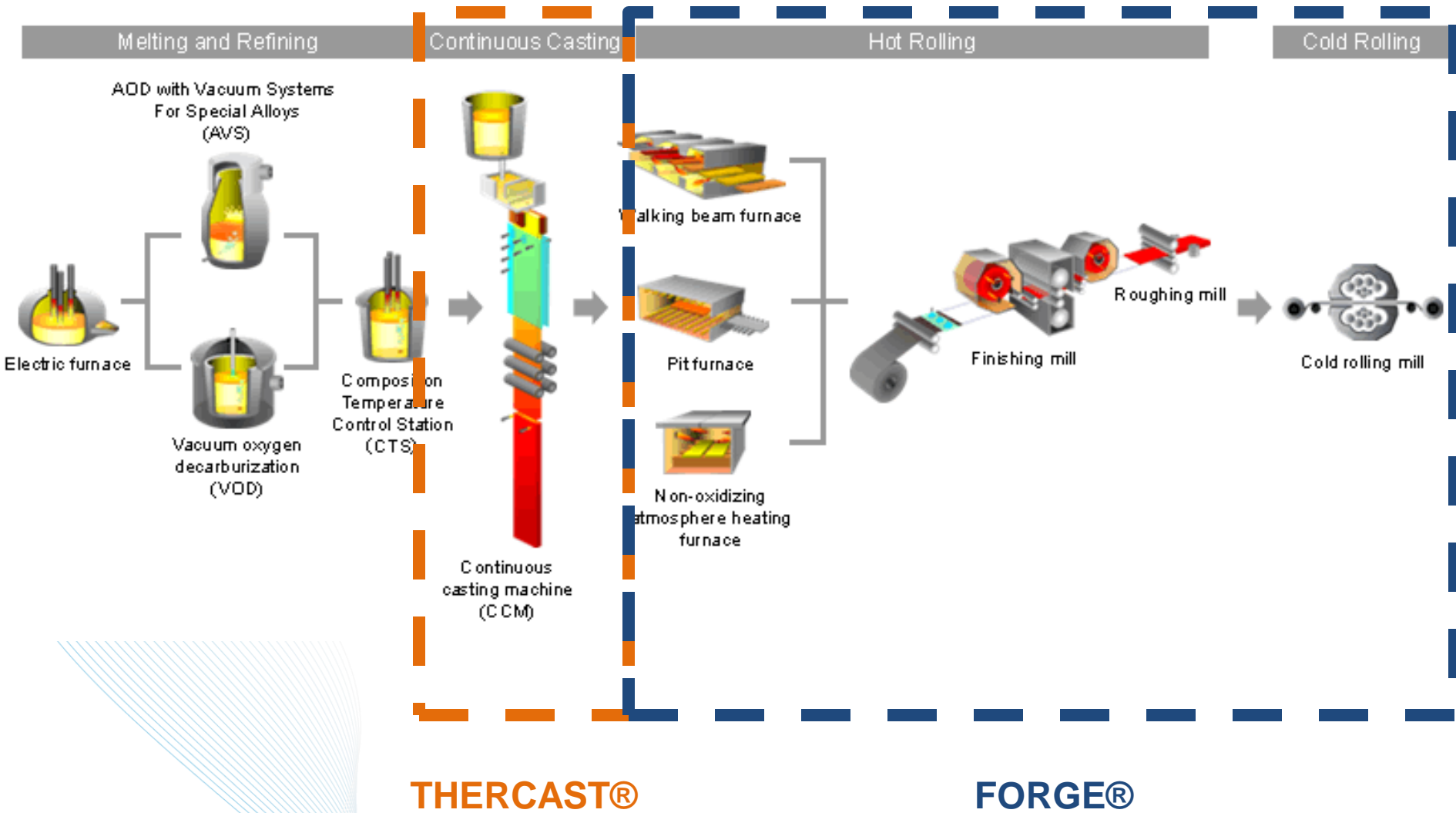
What we  
have to offer

# From Ladle to Finisher Rolling



**COVERED BY TRANSVALOR  
SOLUTIONS**

# From Ladle to Finisher Rolling



# End to End Solution

LIQUID

SOLID

PRODUCT

## THERCAST®

## FORGE®

### THERCAST®

- Solidification
- Segregation
- Porosities
- Molds Validation
- Casting Speed optimization
- Secondary Cooling optimization (Spray Nozzles)
- Tundish Analysis & Optimization

### FORGE®

- Deformation
- Profiles Analysis
- Defects Detection
- Temperature Evolution
- Rolls Force & Torque
- Results transportable from THERCAST® to FORGE®
- Microstructural Analysis

# Benefits of using simulation



Benefits of  
using  
simulation

# Benefits of using simulation



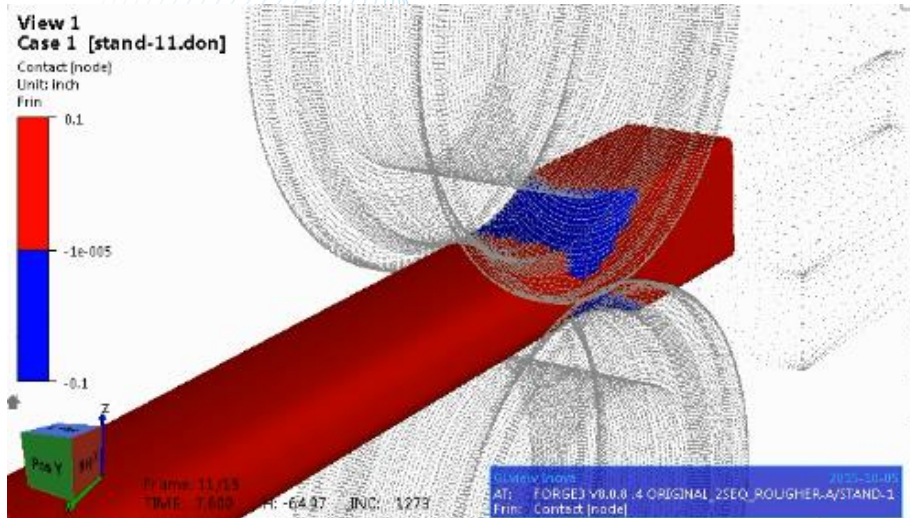
# Results available from your desktop

- Shape evolution (Profiles)
- Contact Product/Rolls
- Temperature evolution
- Forces applied on Rolls
- Torques applied on Rolls
- Strain evolution and profiles (centered line)

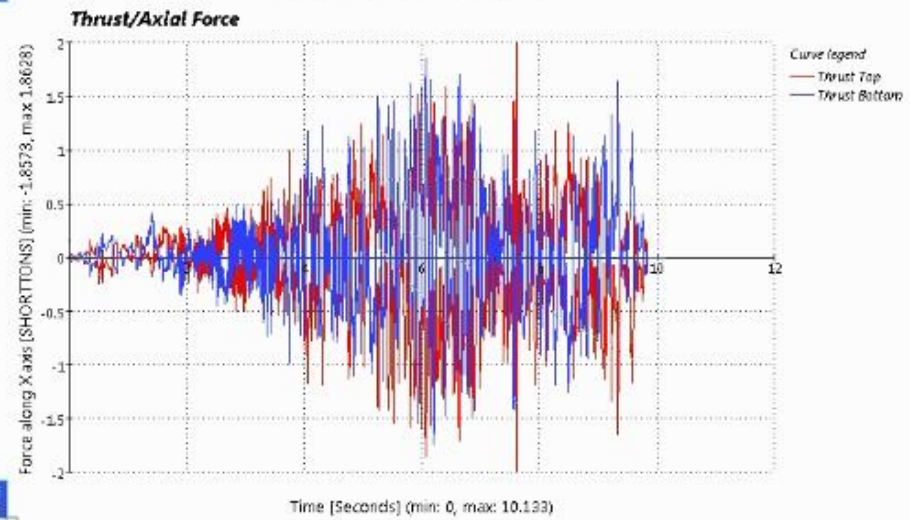
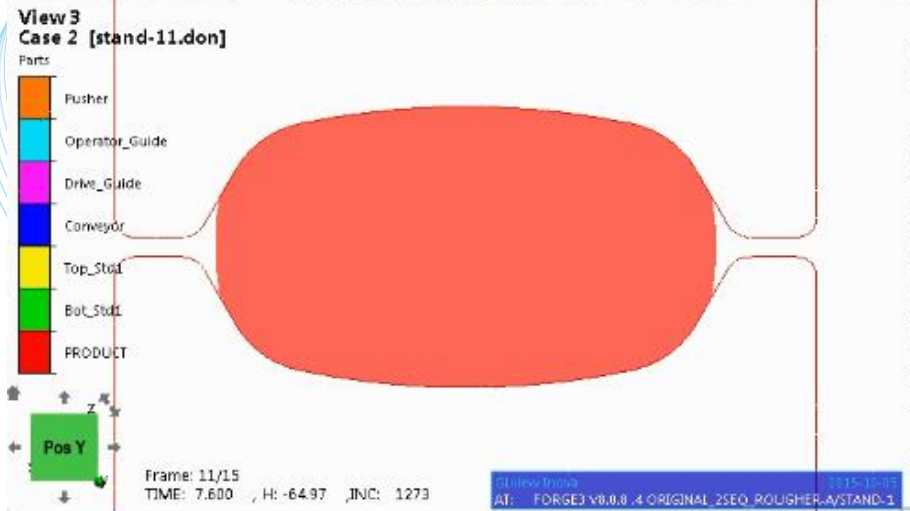
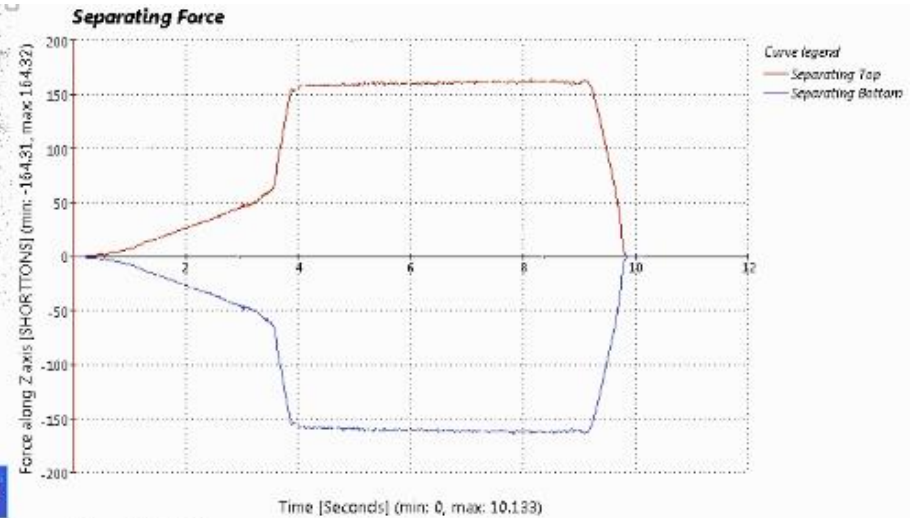
- Easy access to the results in Post processor
- Customizable Dashboards
- Fast trials comparison
- Quick response to design challenges
- Fast assessment of the quality of the product
- No waste, no material & production cost

# Example of Dashboard

## Contact Product/Rolls



## Separating Force for Top and Bottom Rolls



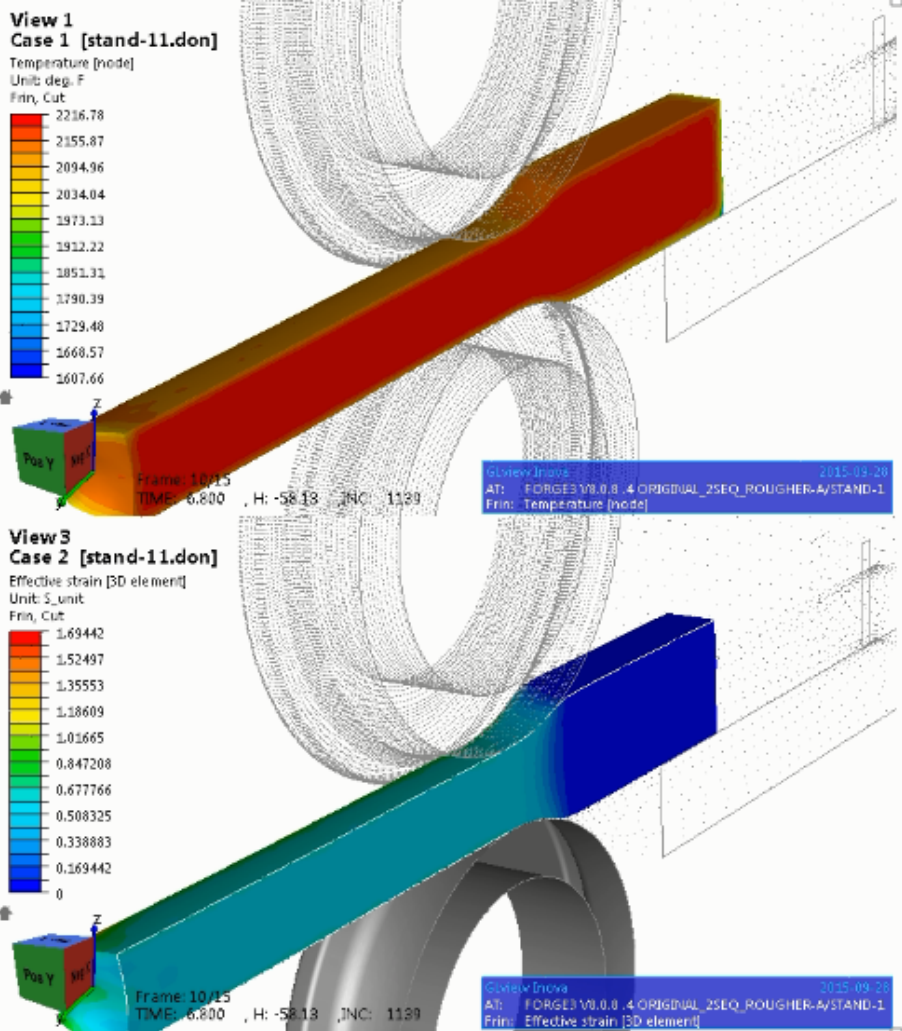
## Shape/Profile evolution

## Thrust/Axial Force for Top and Bottom Rolls



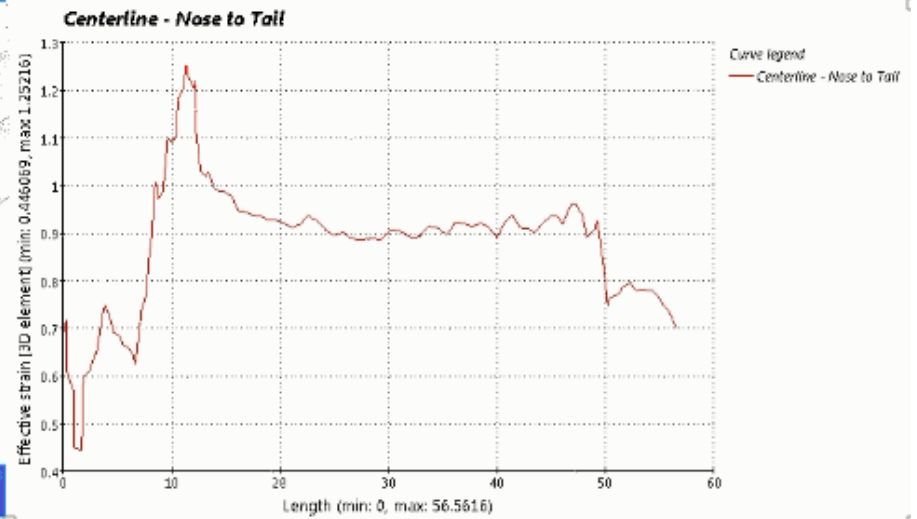
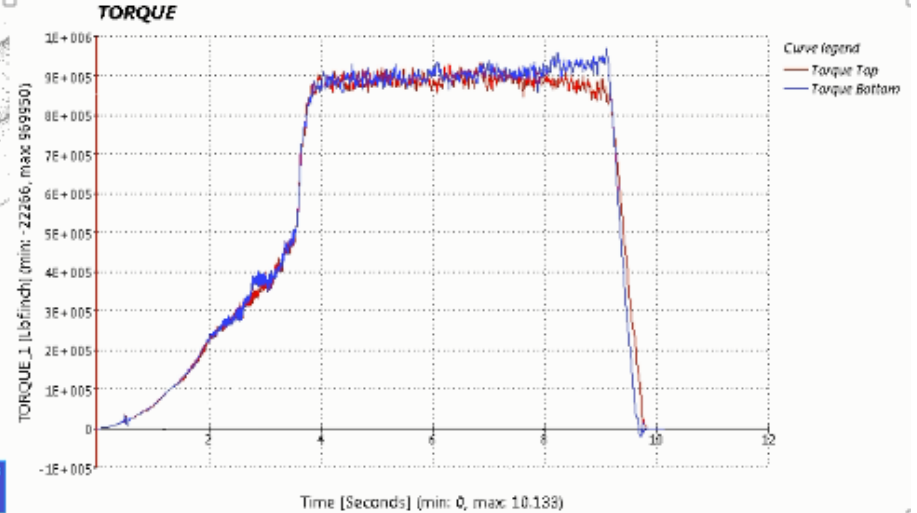
# Example of Dashboard

## Temperature Evolution



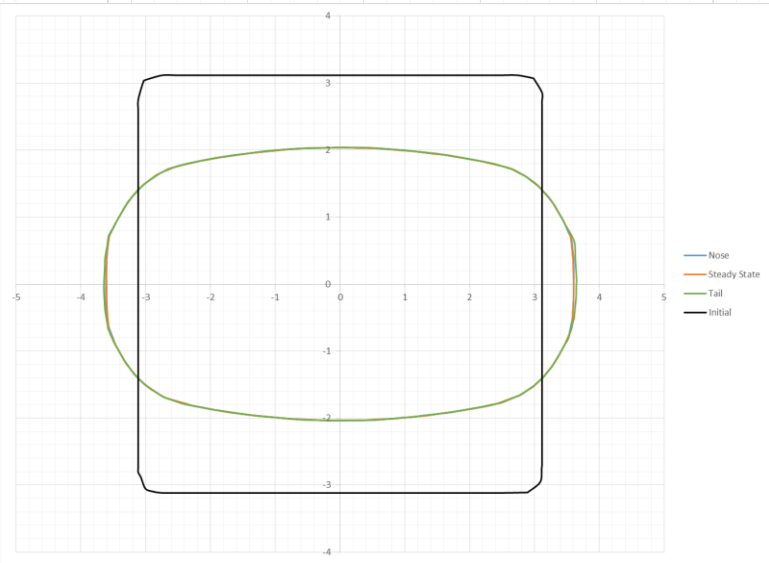
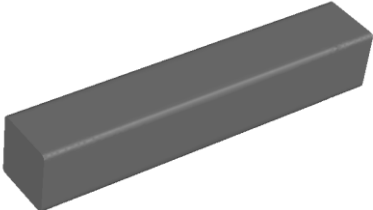
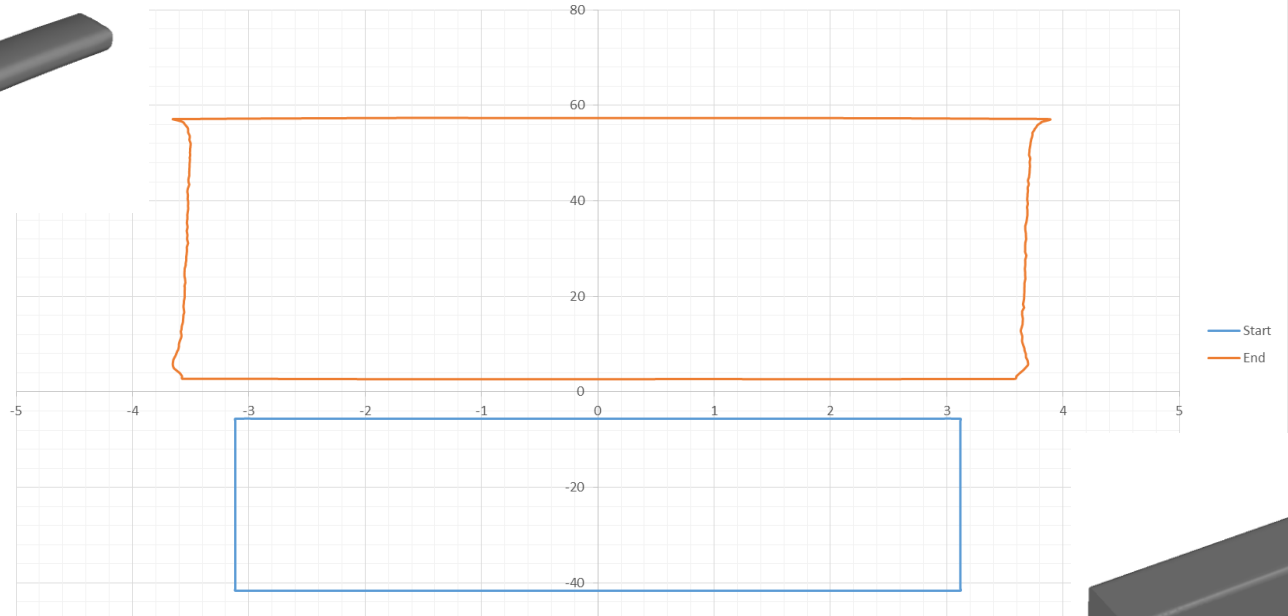
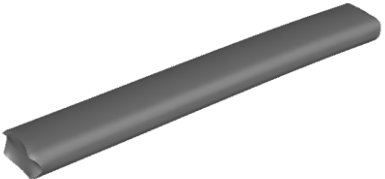
## Strain evolution

## Torque applied on Top and Bottom Rolls

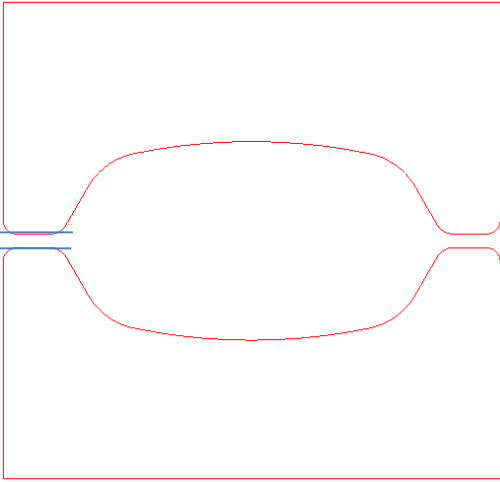


## Strain profile on Centerline from Nose (Left) to Tail

# Profiles Analysis



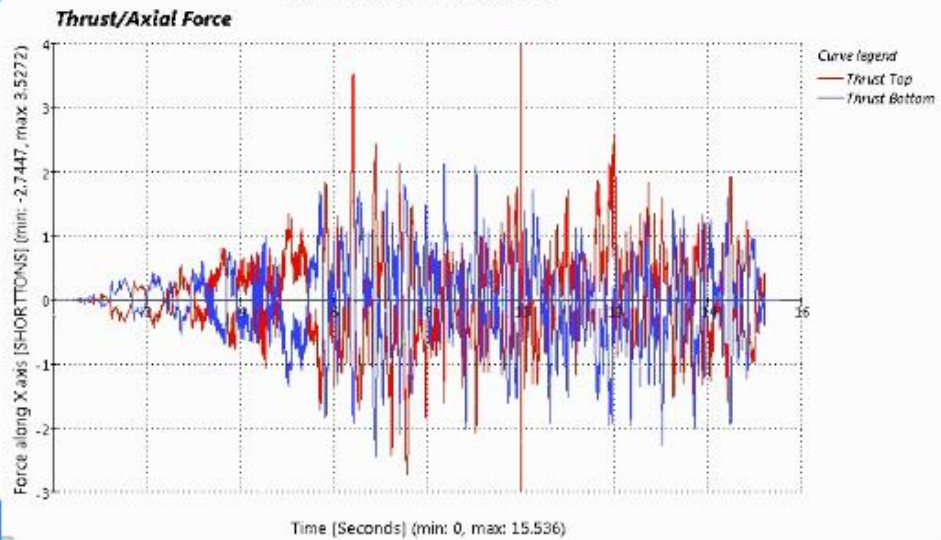
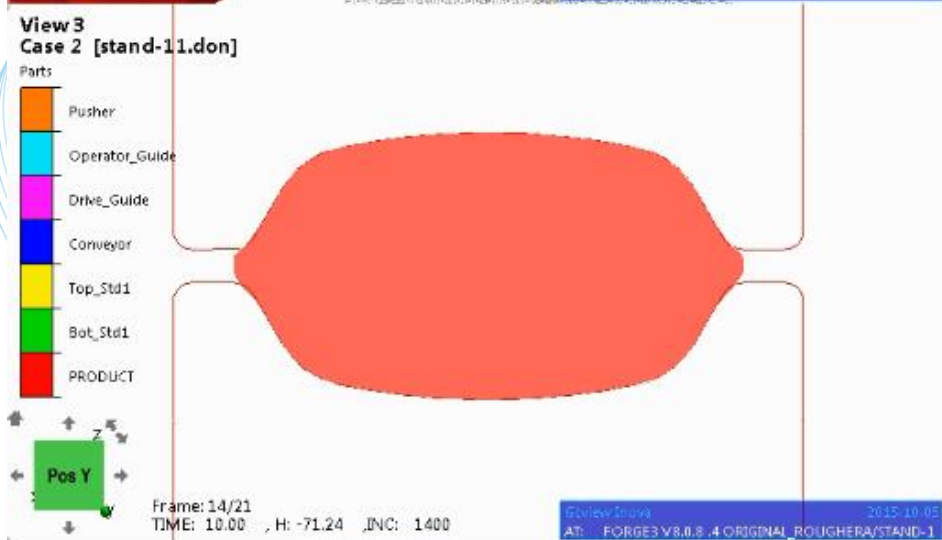
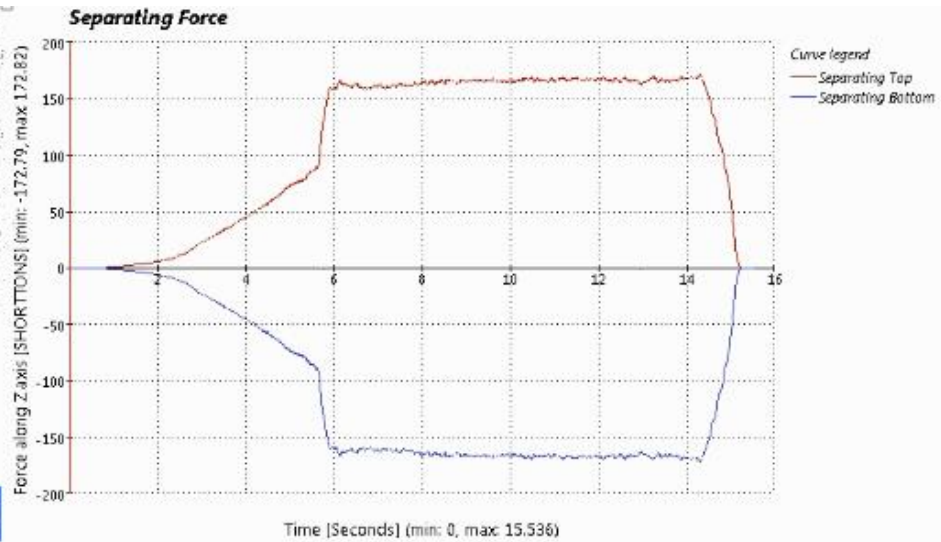
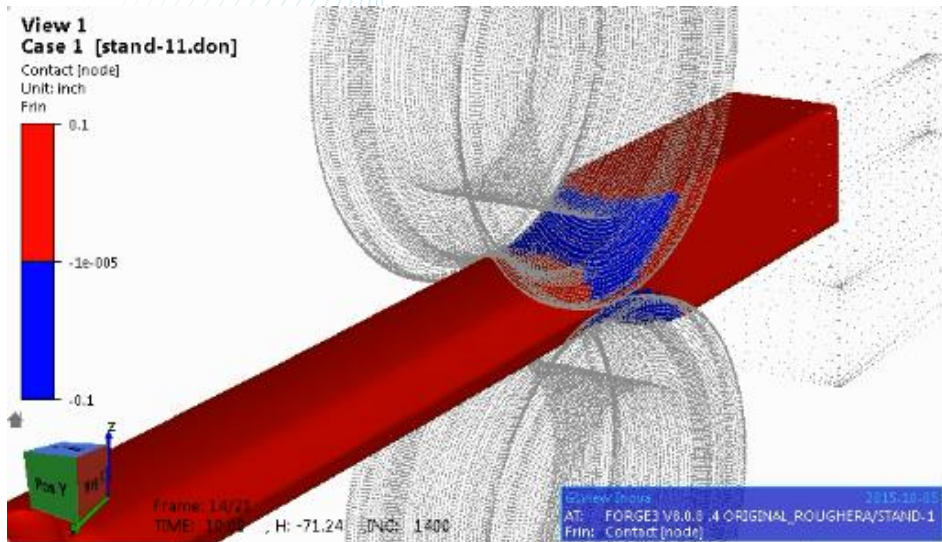
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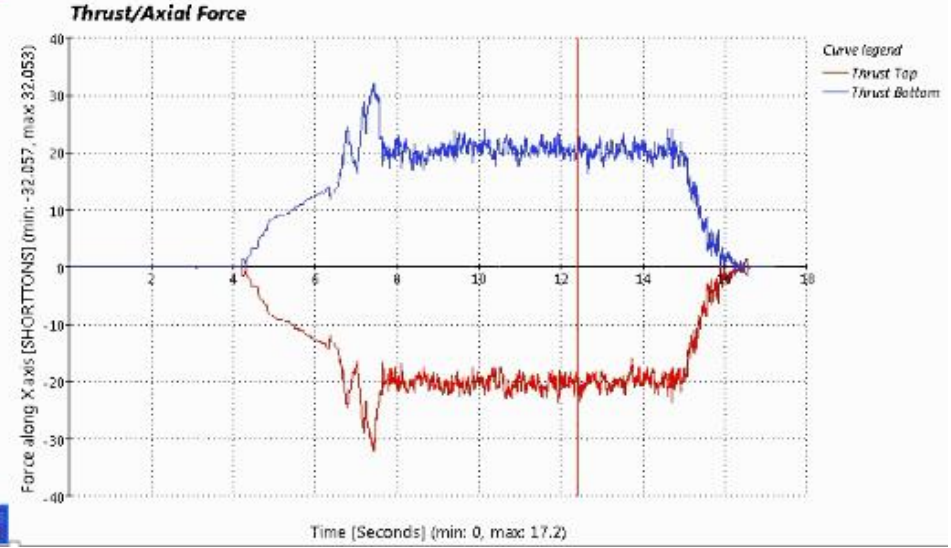
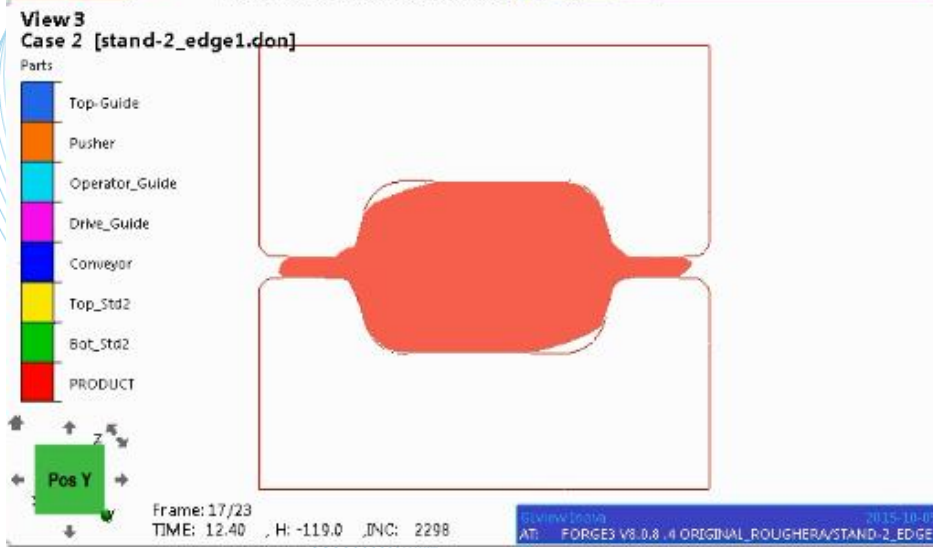
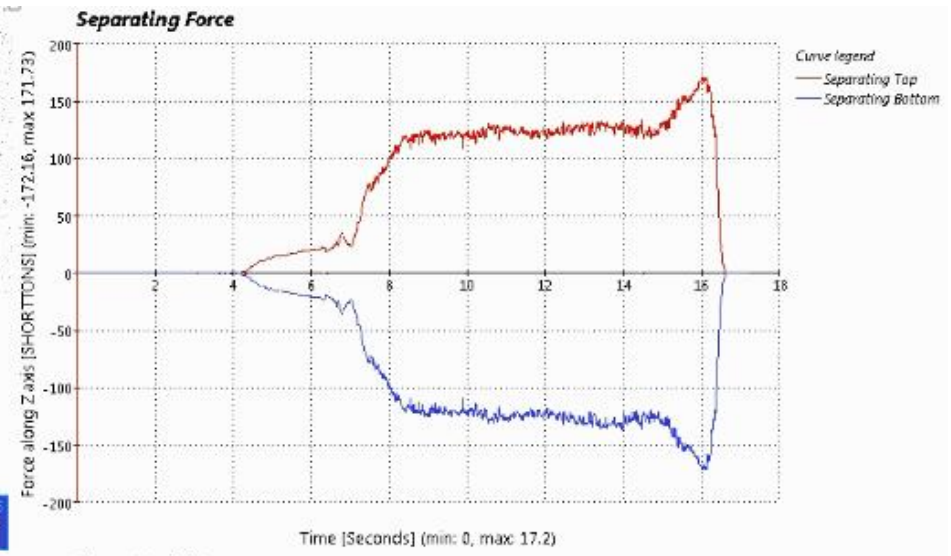
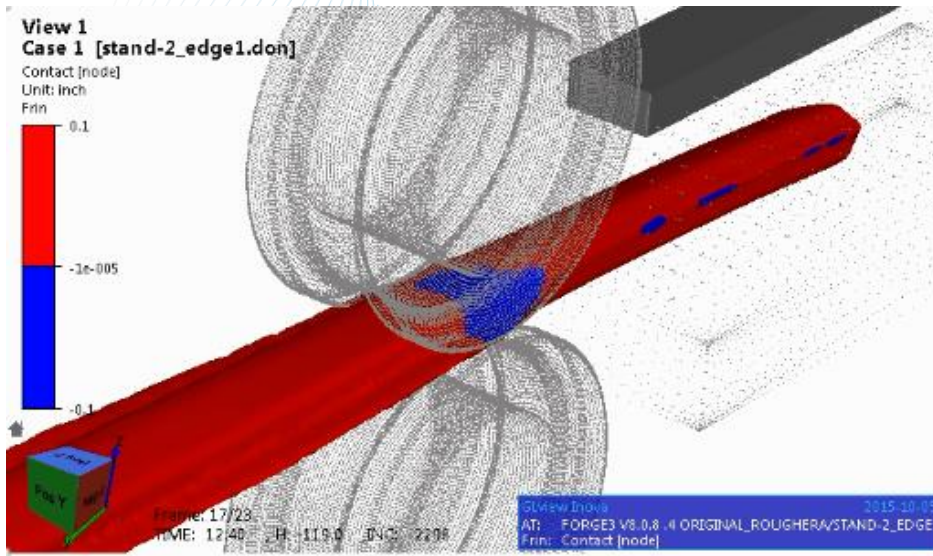
# Defects Detection from your desktop

- Rolls Spacing
- Heat gradient from furnace
- Square to oval – Profiles Evolution
- Square to oval with casting shape defect – Profiles Evolution & Comparison
- Entry twisting

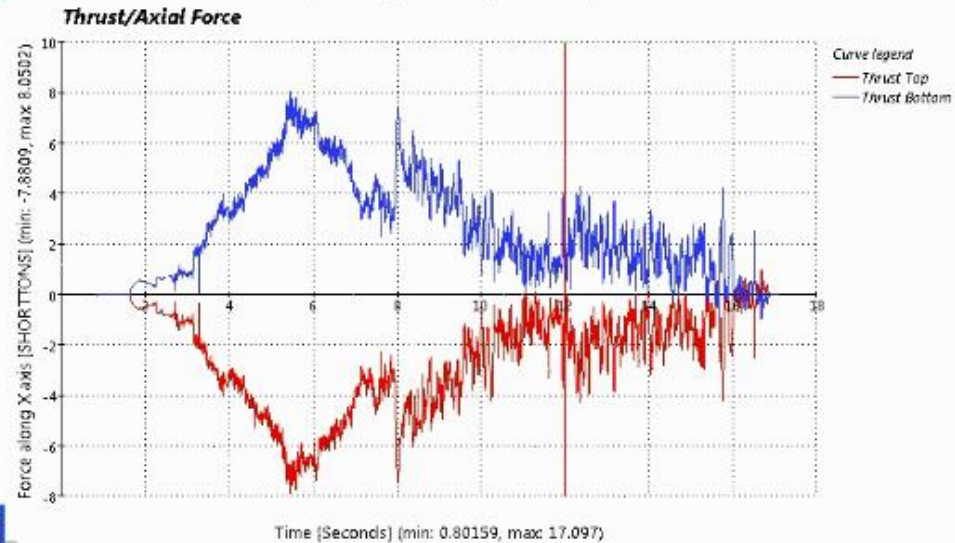
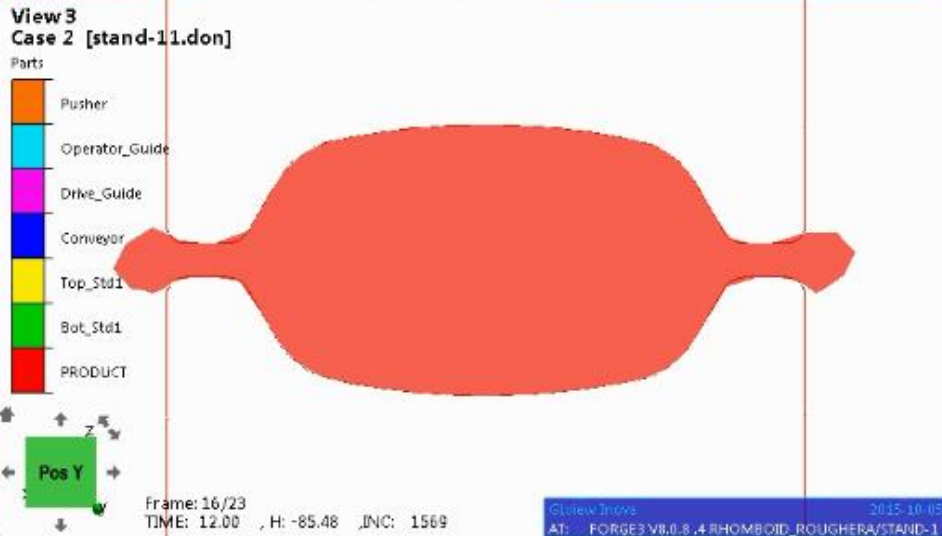
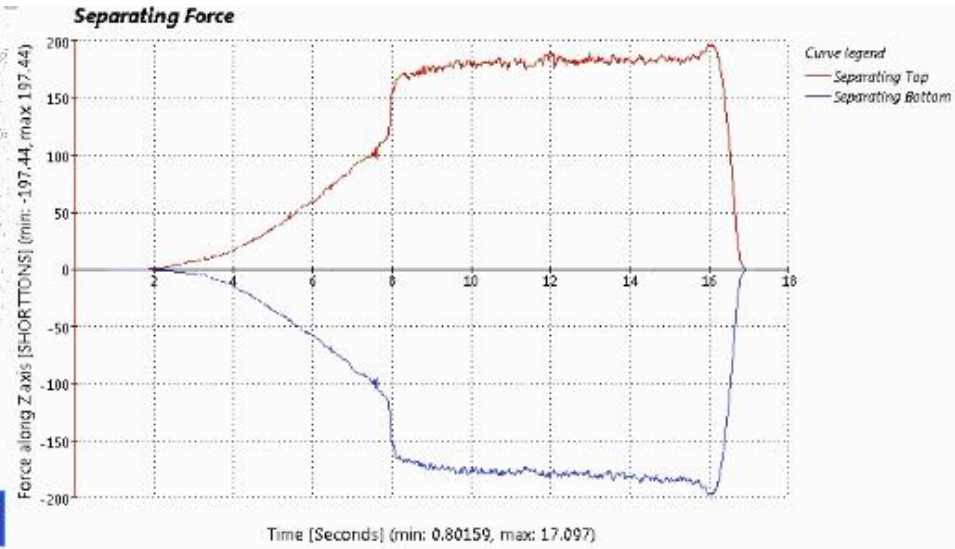
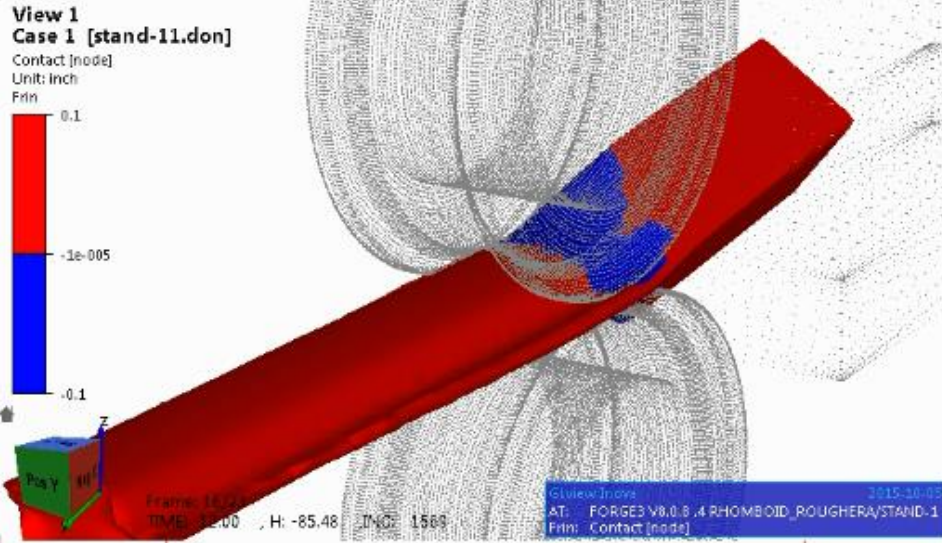
# Rolls Spacing Defect



# Rolls Spacing Defect – Stand 2 | 90deg rotation

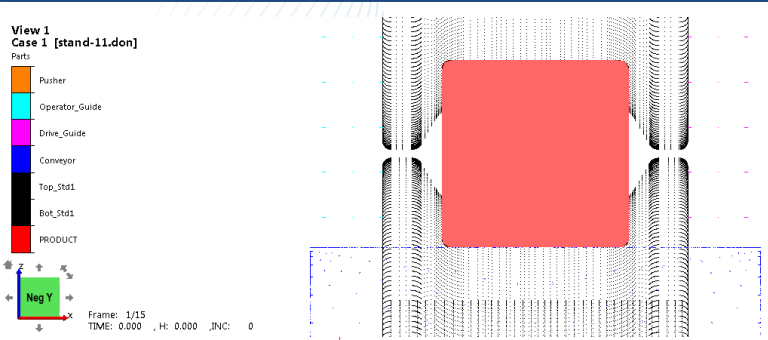


# Rolls Spacing Defect – Rhomboid Billet

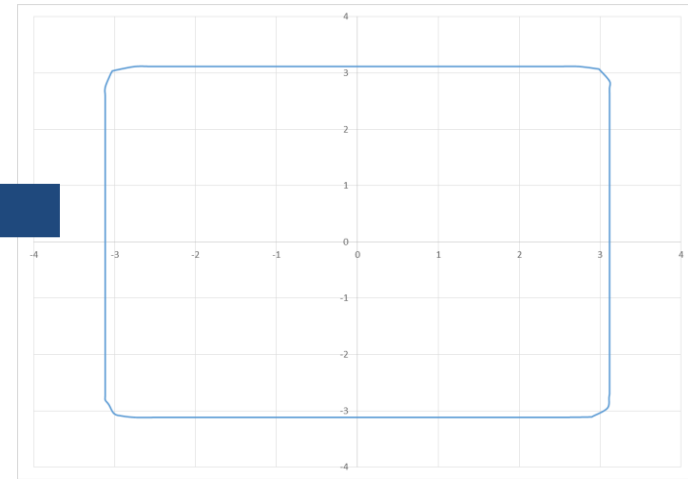




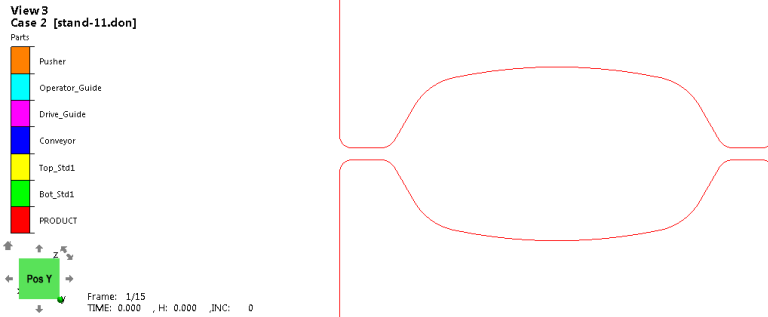
# Rhomboid (As-cast) Shape Defect – Square to Oval



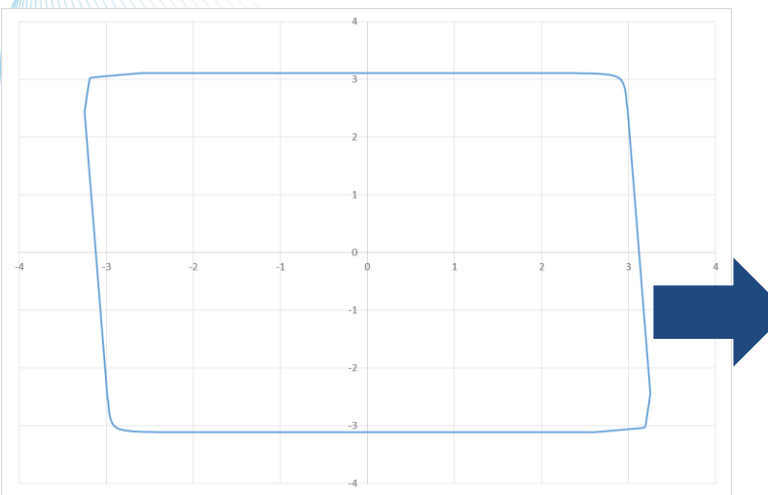
View From Tail



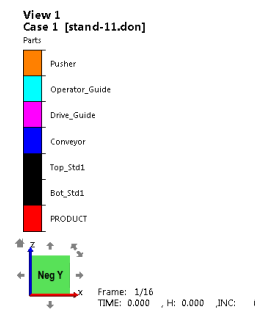
Initial Billet Profile



View From Nose



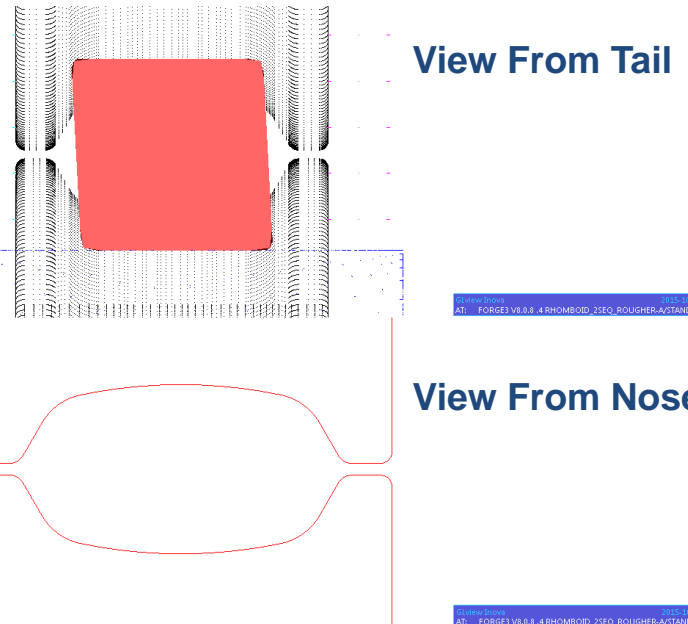
Initial Billet Profile



View From Tail



View From Nose

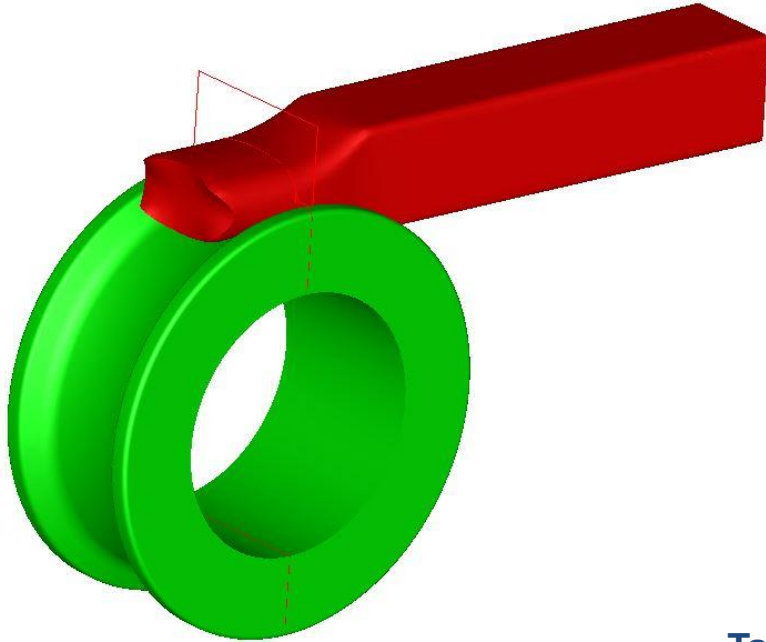


View From Nose

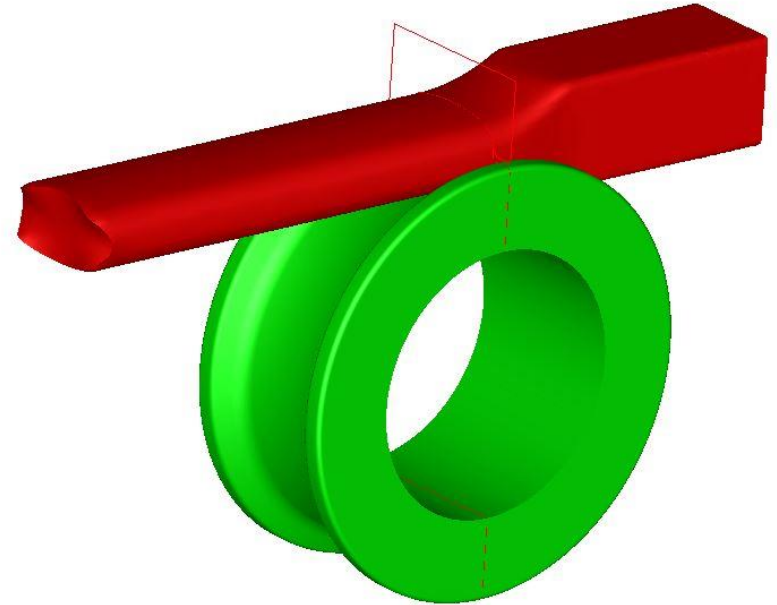


# Rhomboid (As-cast) Shape Defect – Profile Evolution

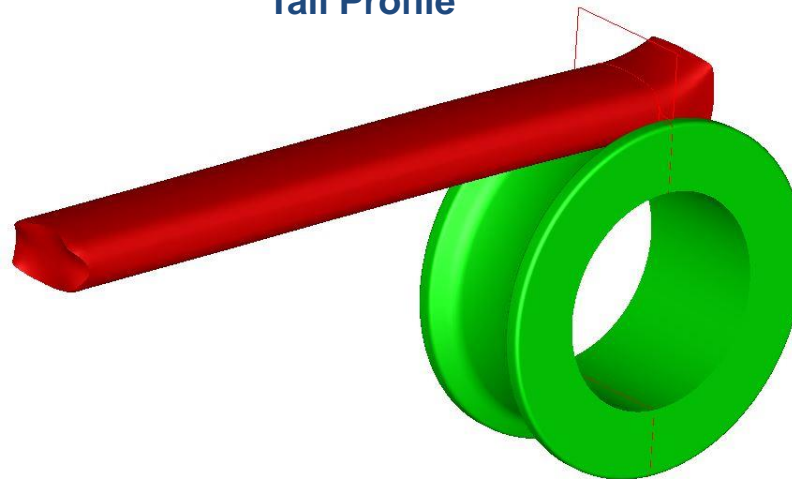
Nose Profile



Steady State Profile

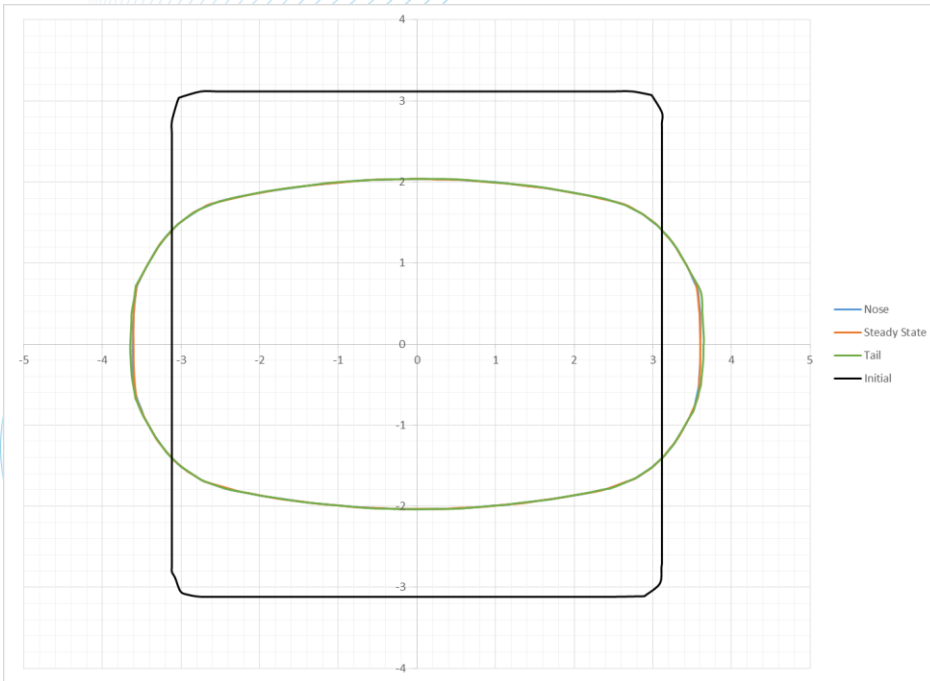


Tail Profile

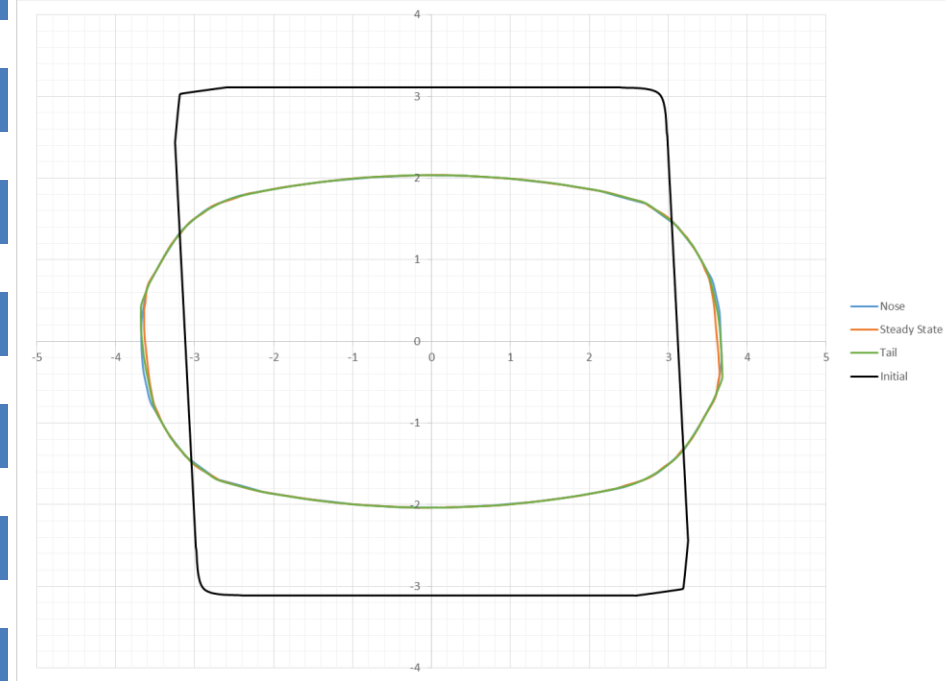


# Rhomboid (As-cast) Shape Defect – Profile Evolution

## Square Initial Billet Profile

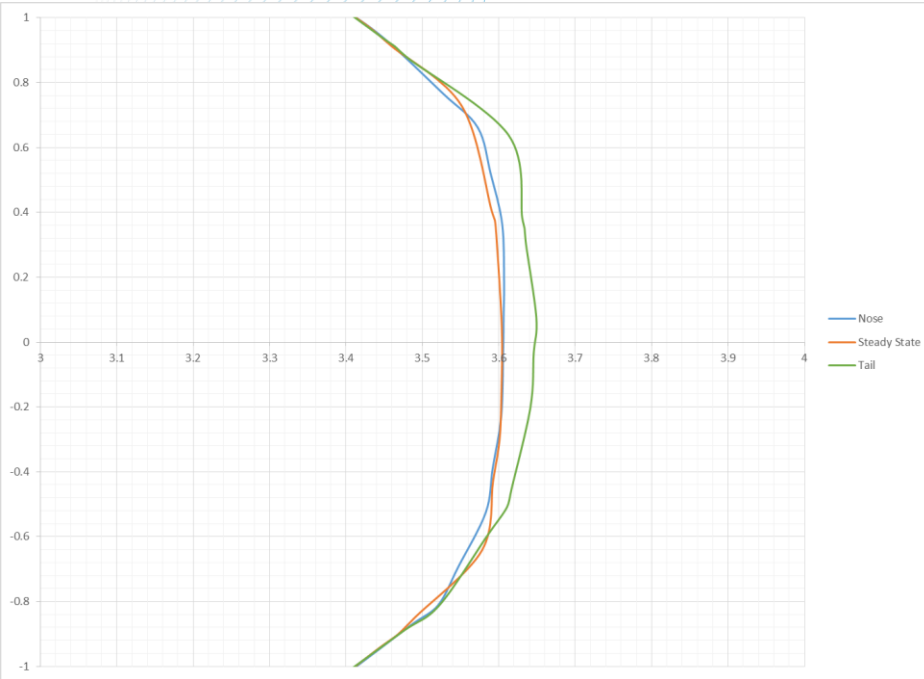


## Rhomboid Initial Billet Profile

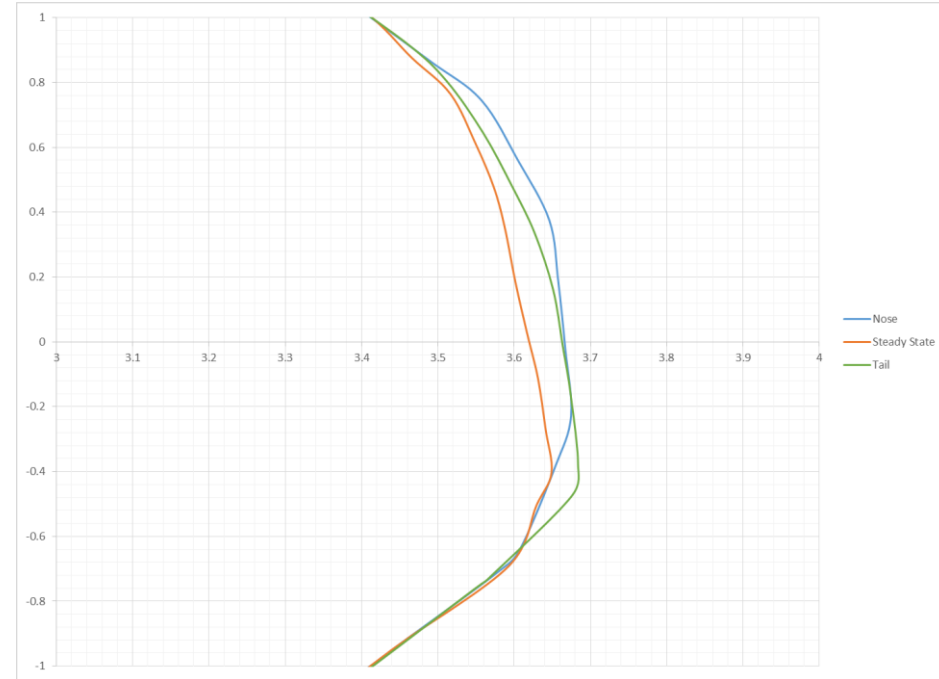


# Rhomboid (As-cast) Shape Defect – Profile Evolution Zoom

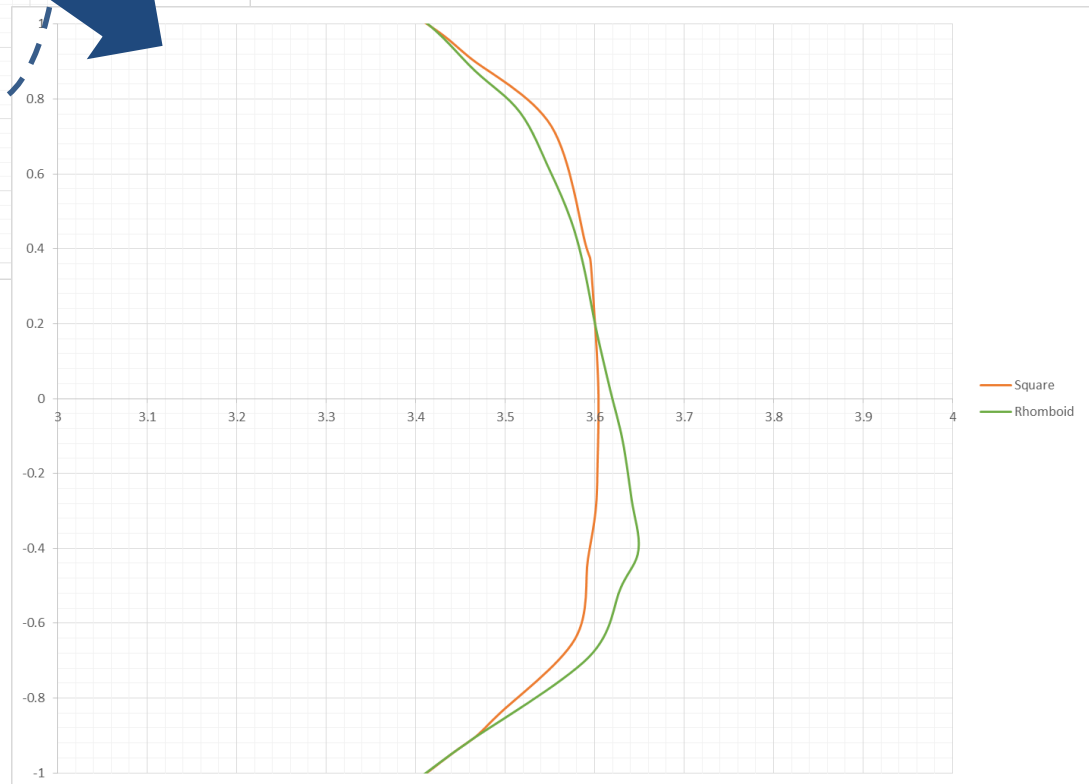
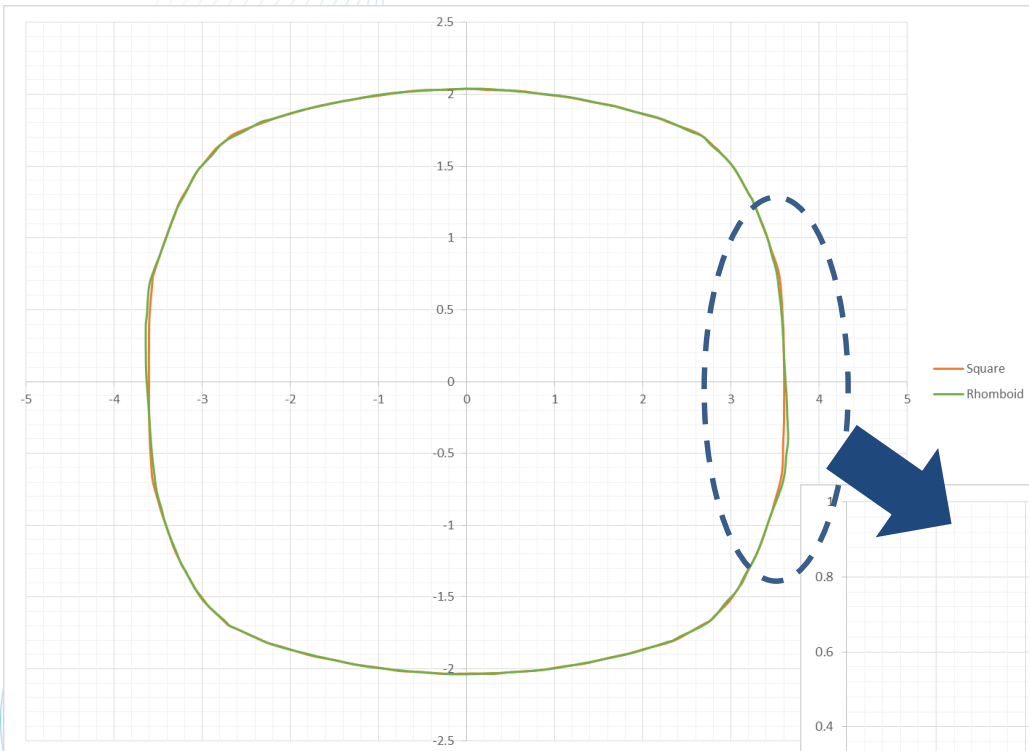
## Square Initial Billet Profile



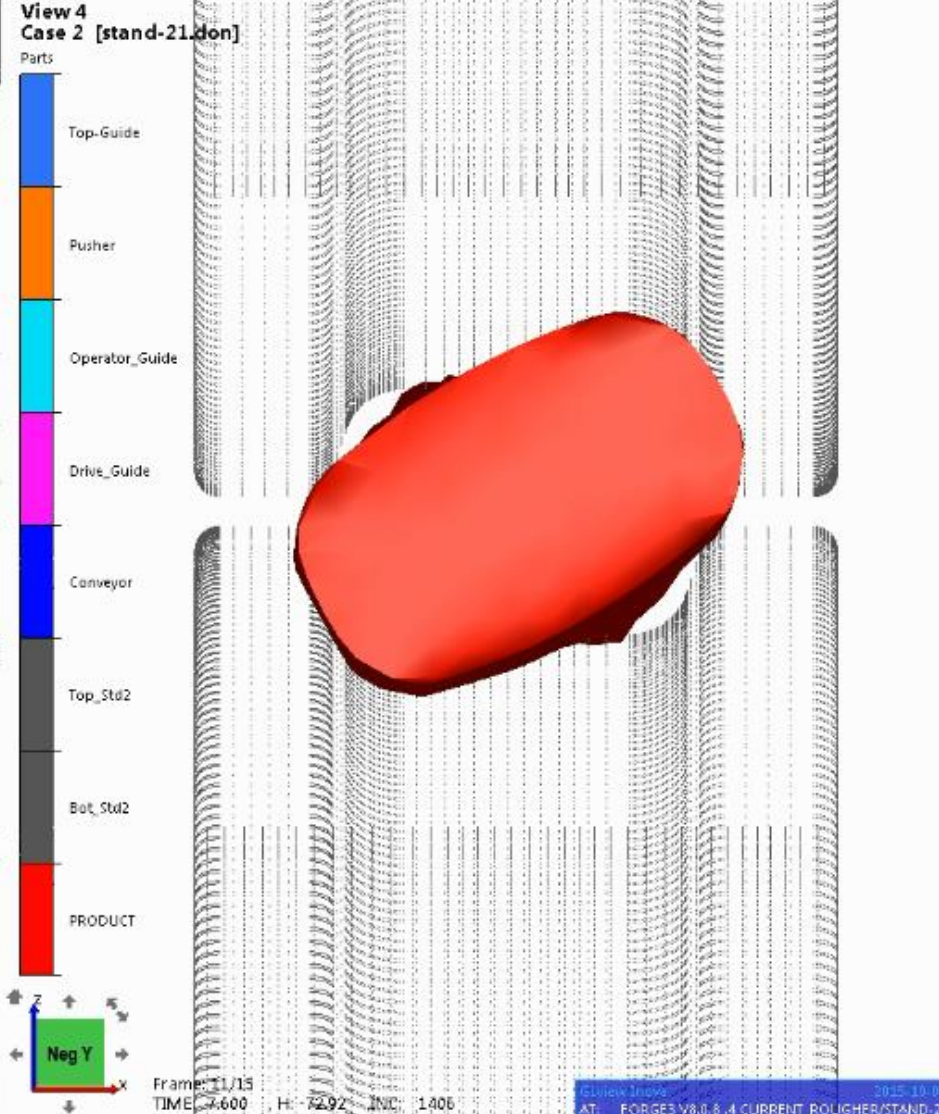
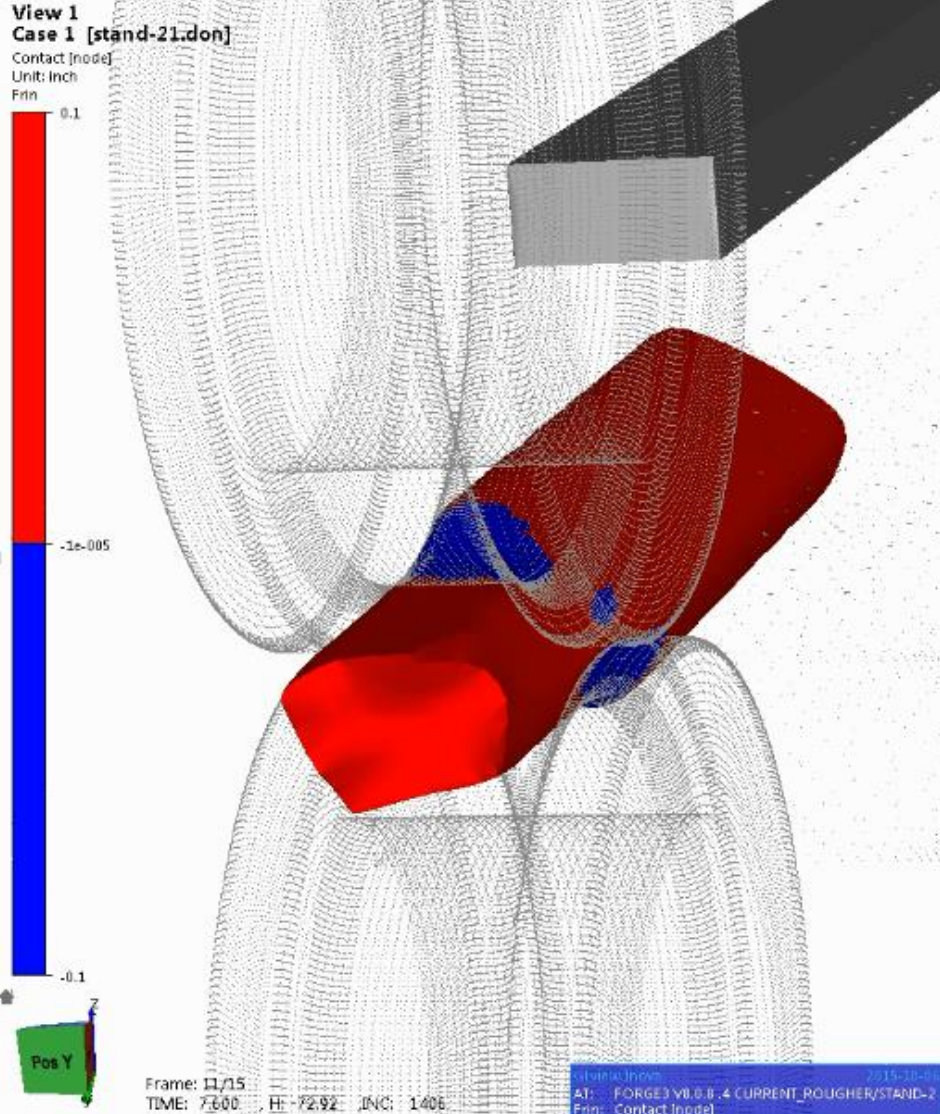
## Rhomboid Initial Billet Profile



# Rhomboid (As-cast) Shape Defect – Profiles Comparison



# Entry Twisting Defect



# Design validation from your desktop

- Represent the current situation (or start with new project)
- Test another design
- Compare the results
- Validate the new design
- Make modifications
- Run in production

# Design validation – Case Study

Simulate Current Design



Simulation New Design

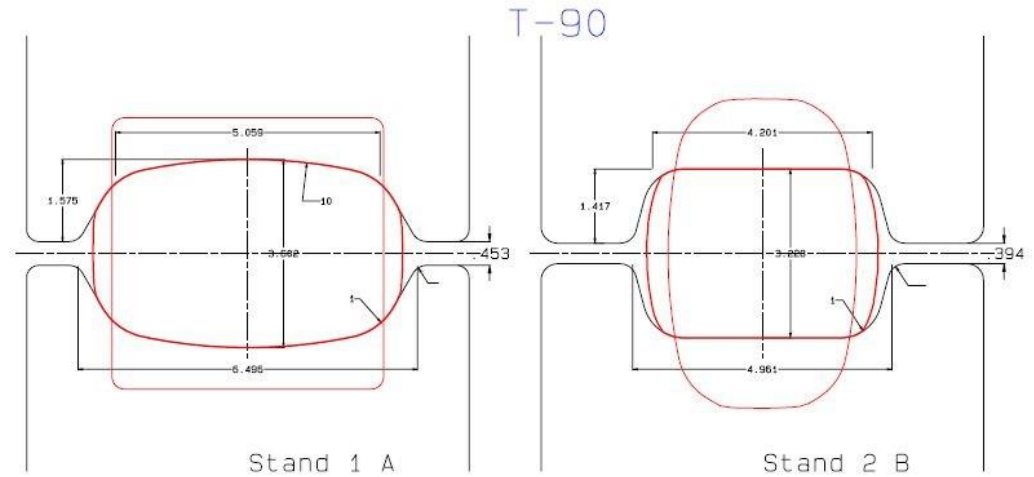


Compare Results

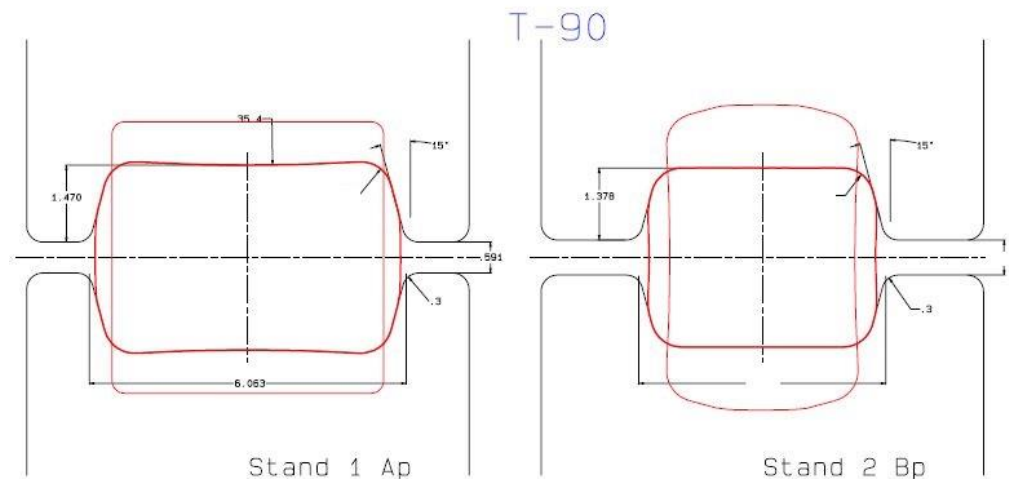


Decide the implementation in Production

Current



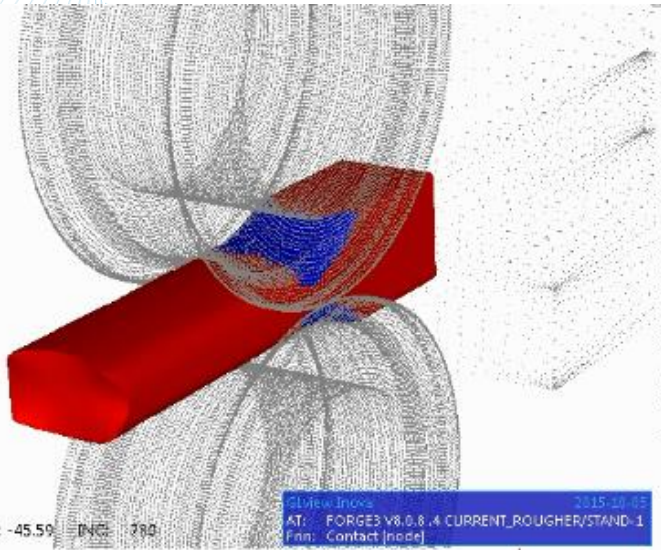
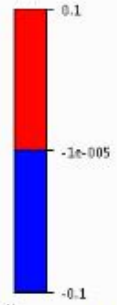
Proposed



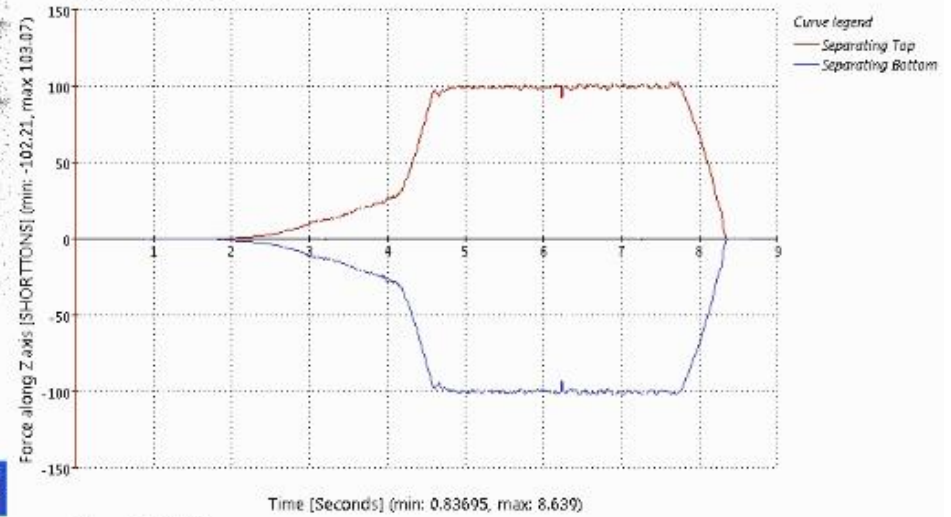
# Design validation – Current Situation | Stand 1

**View 1**  
Case 1 [stand-11.don]

Contact [node]  
Unit: Inch  
Fmin

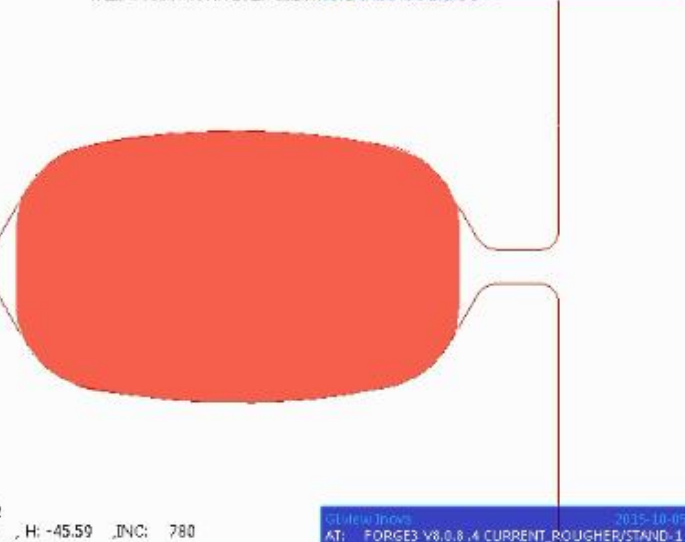
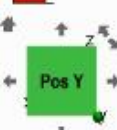


**Separating Force**

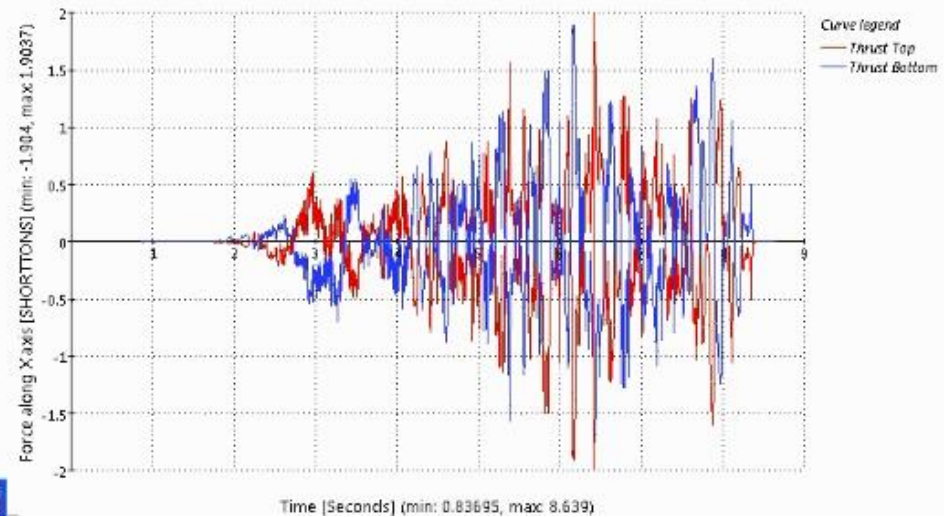


**View 3**  
Case 2 [stand-11.don]

- Parts
- Pusher
  - Operator\_Guide
  - Drive\_Guide
  - Conveyor
  - Top\_Std1
  - Bot\_Std1
  - PRODUCT

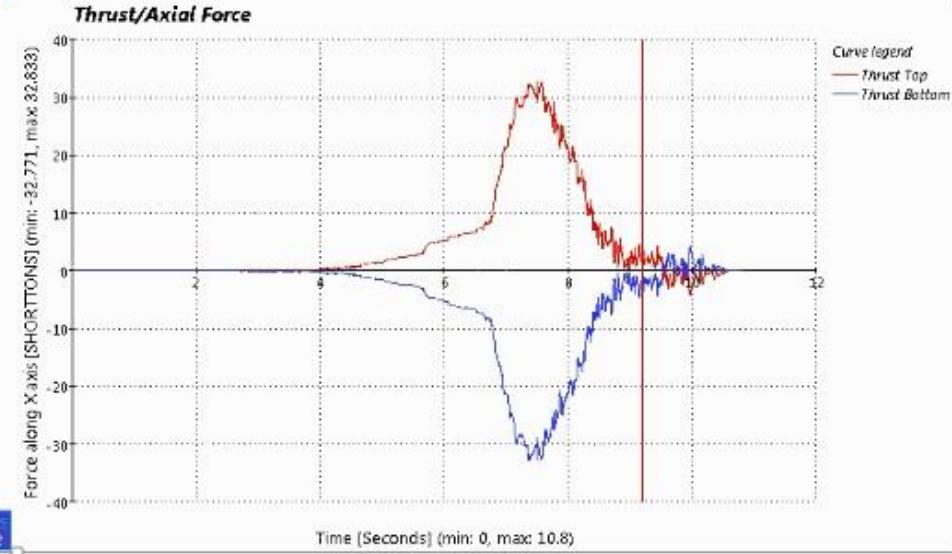
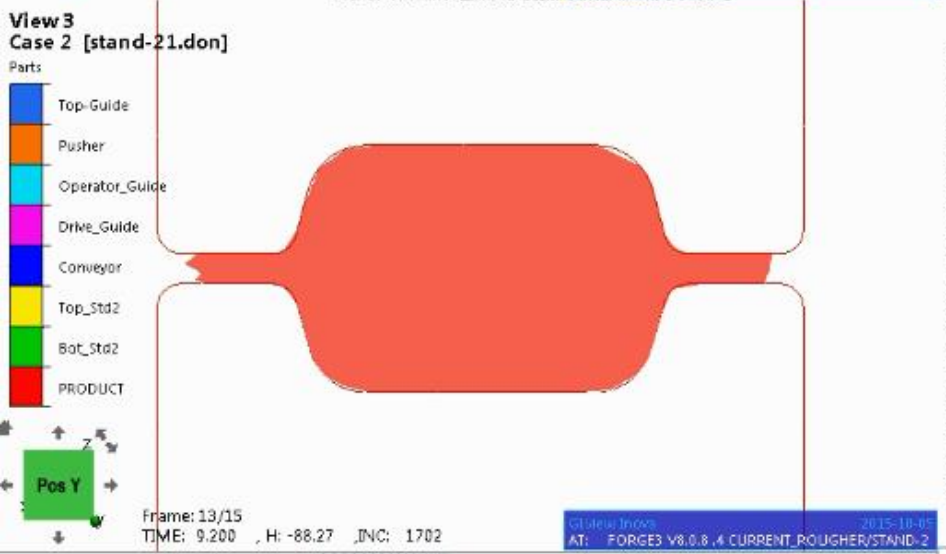
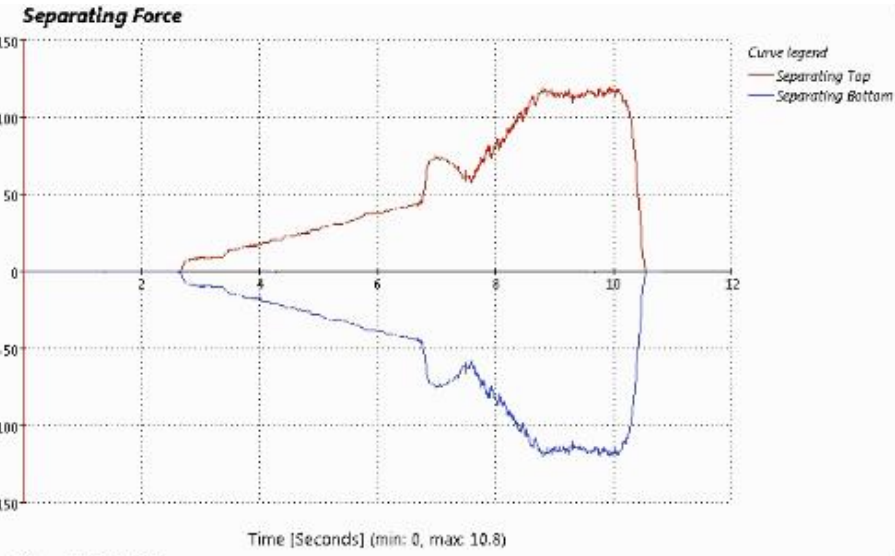
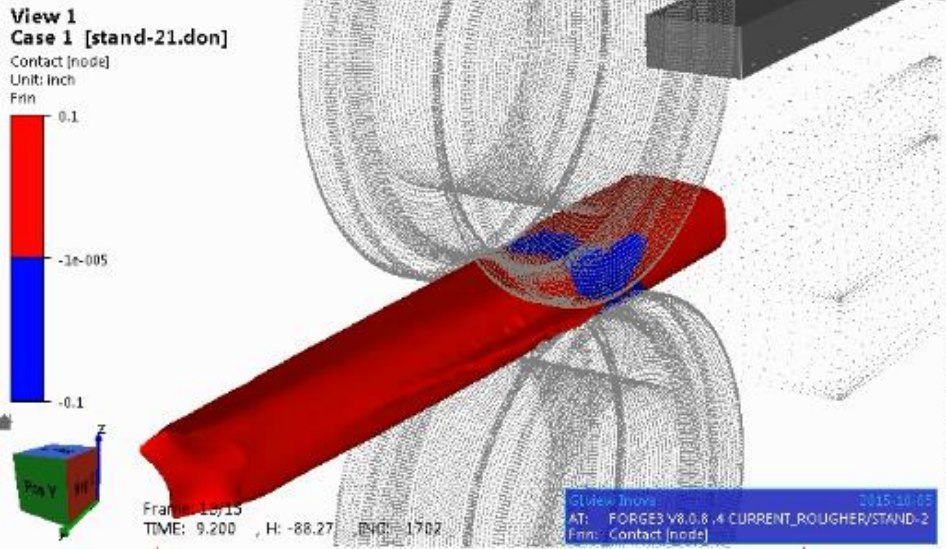


**Thrust/Axial Force**

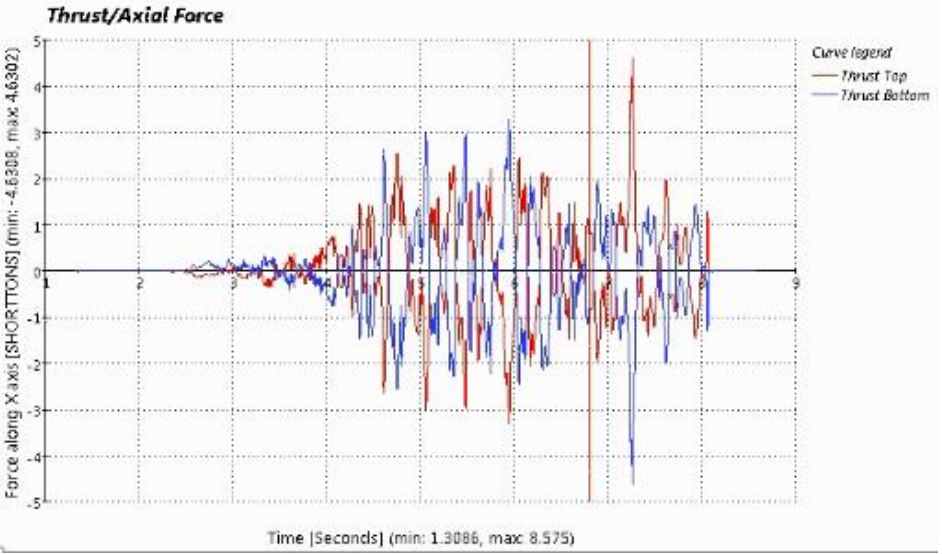
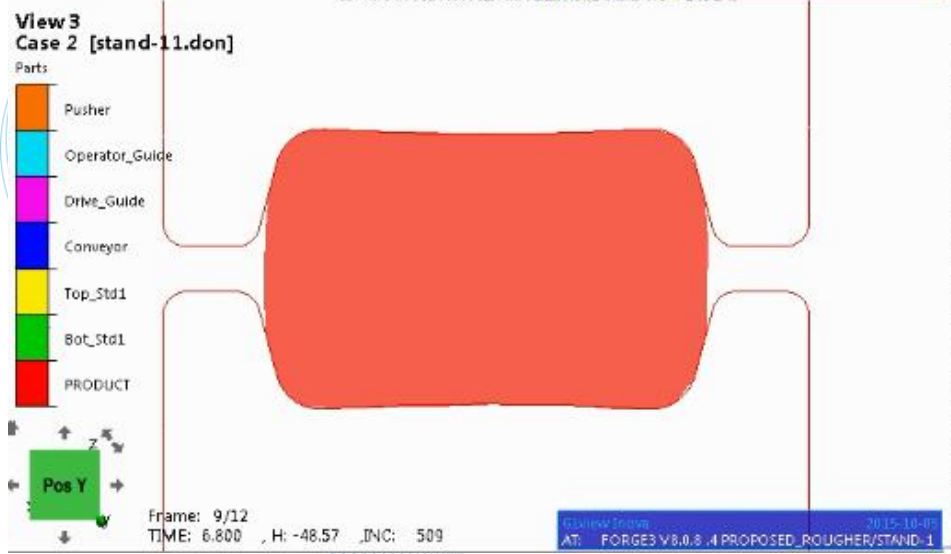
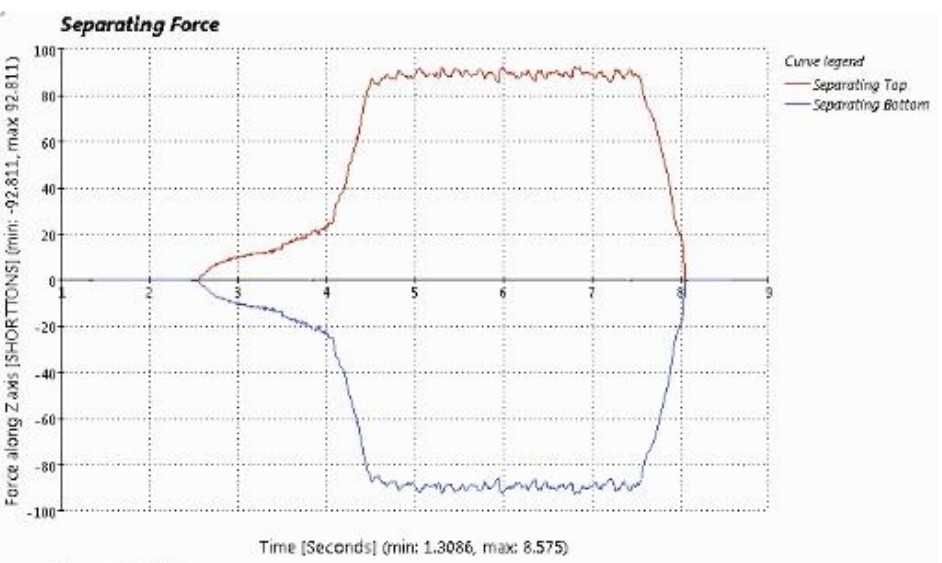
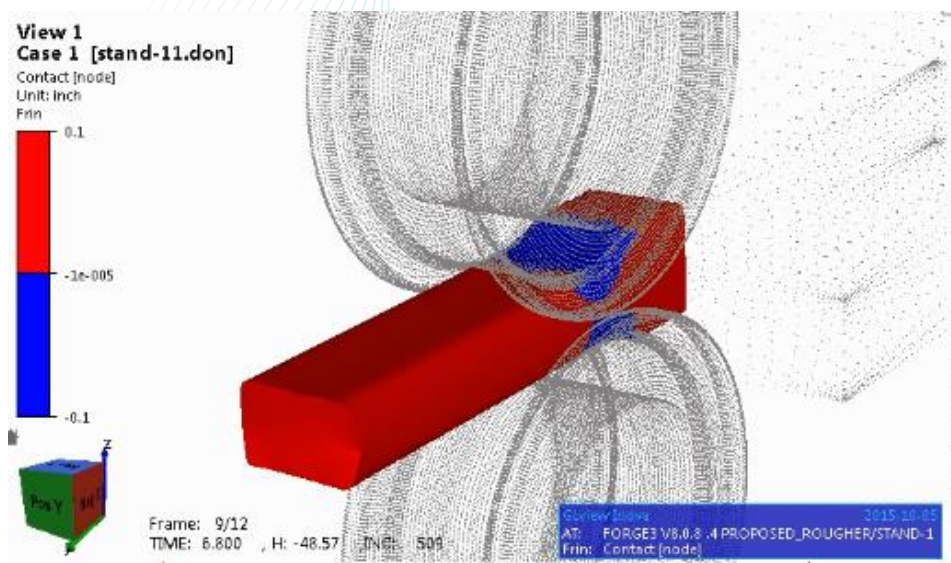




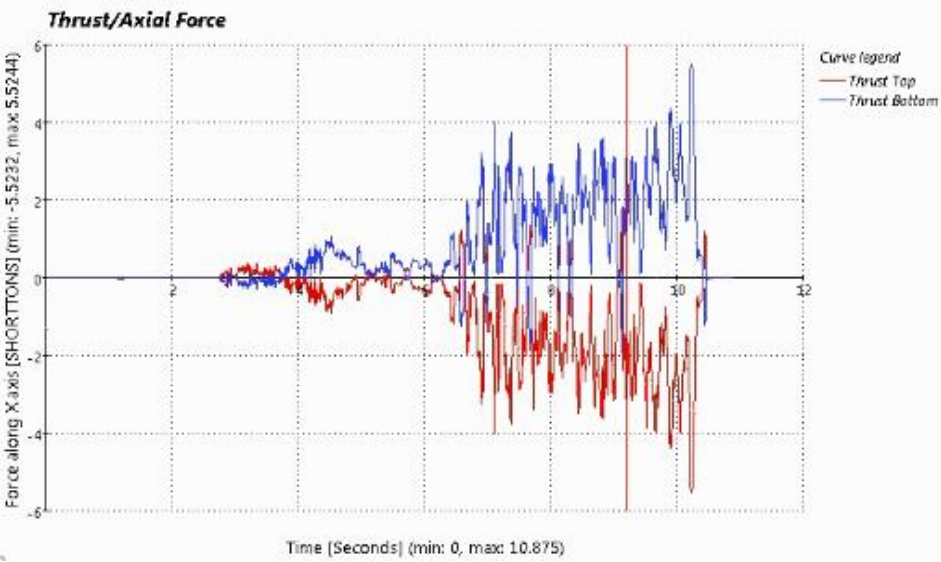
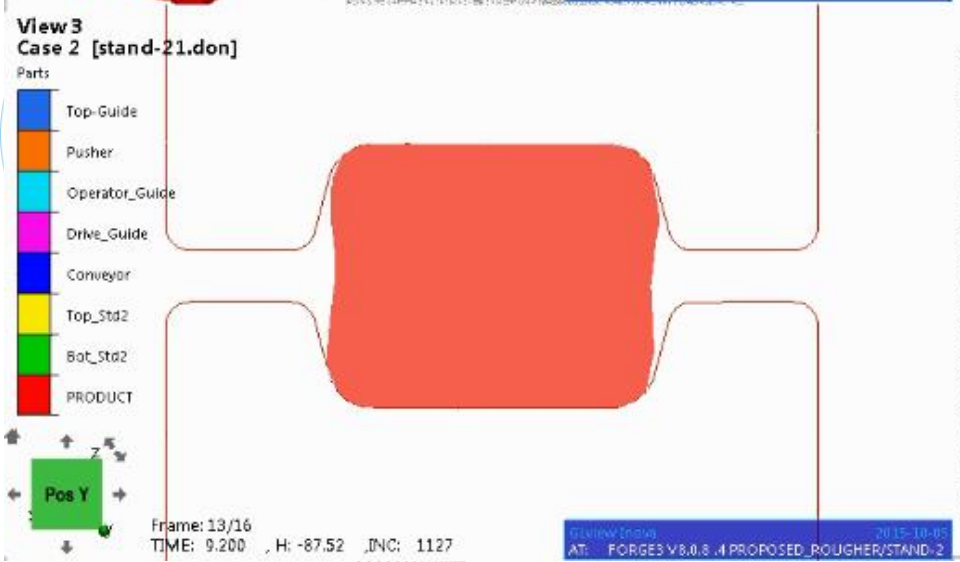
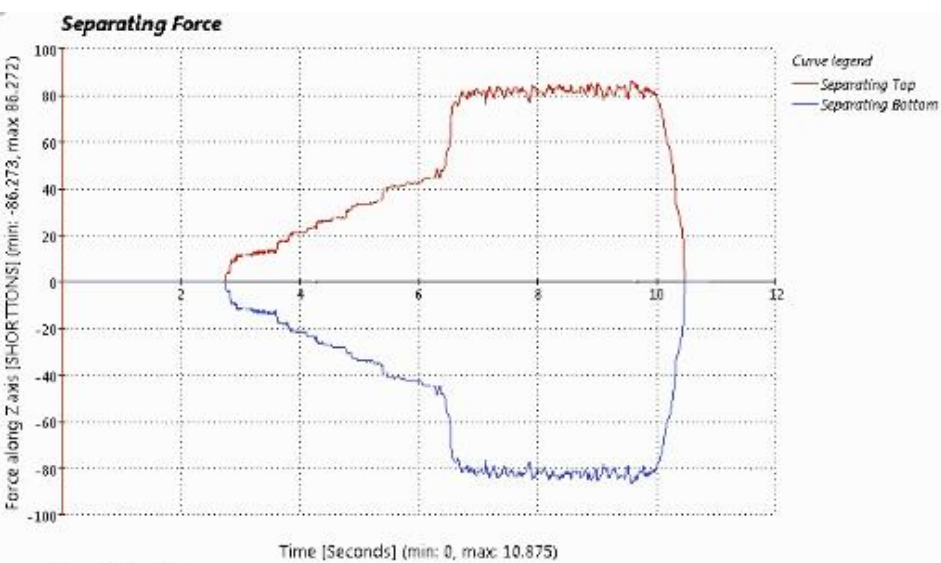
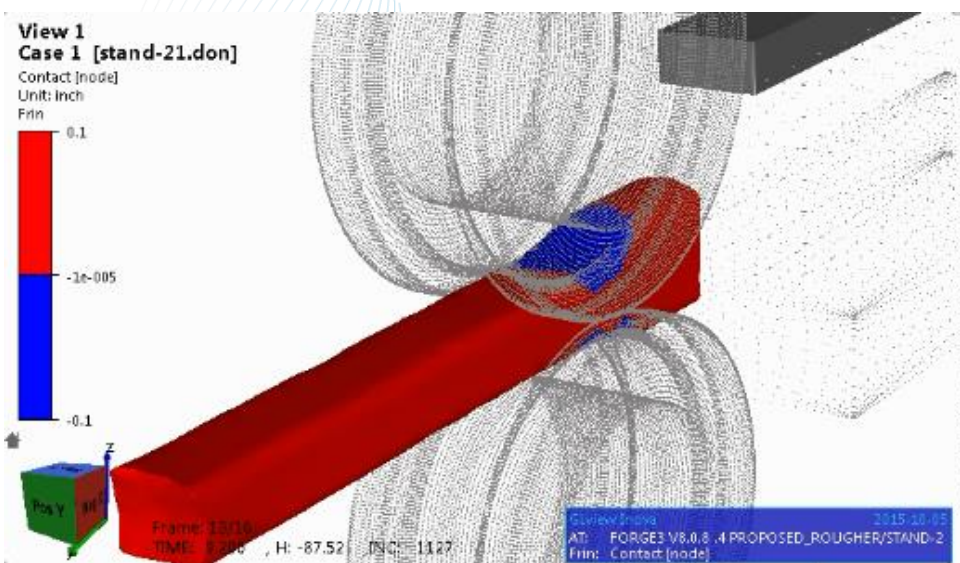
# Design validation – Current Situation | Stand 2



# Design validation – Modification Rev1 | Stand 1

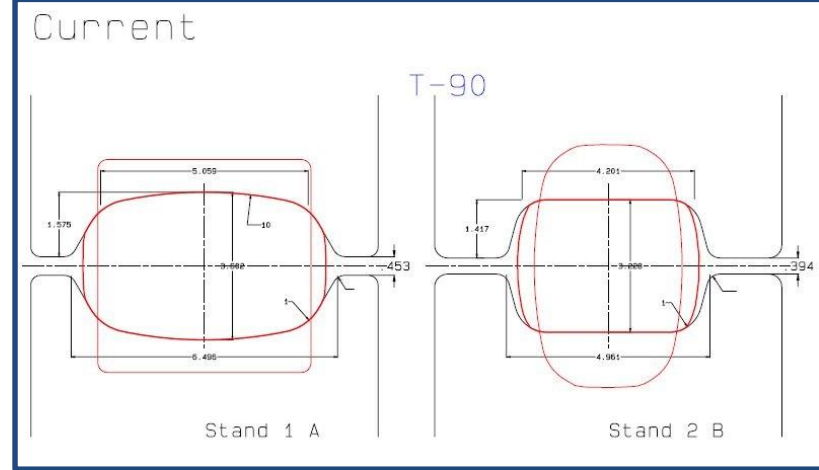
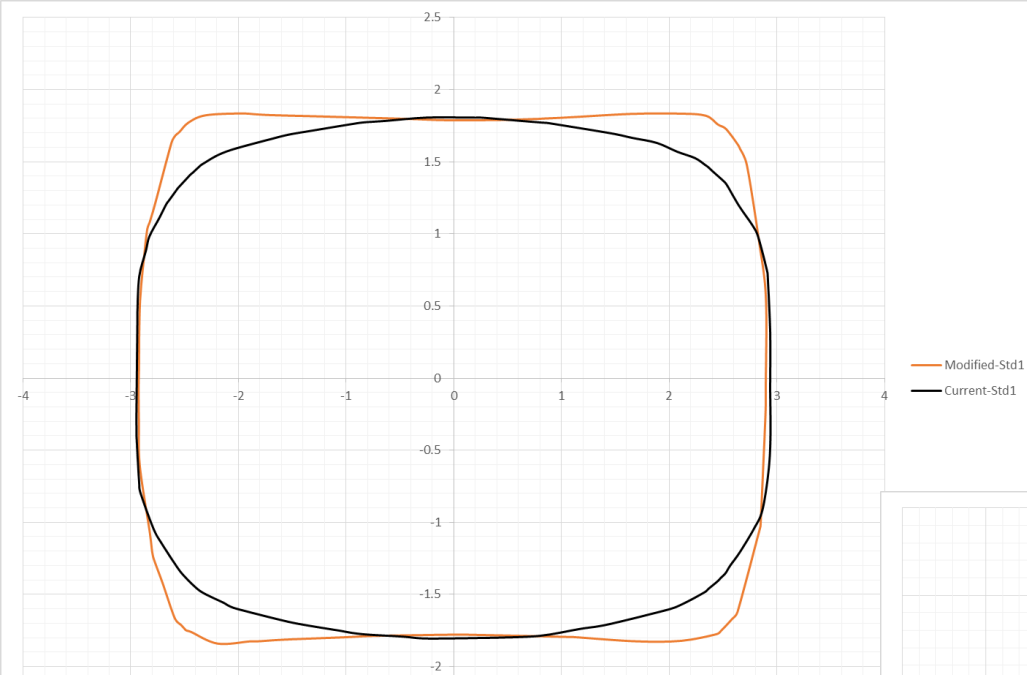


# Design validation – Modification Rev1 | Stand 2

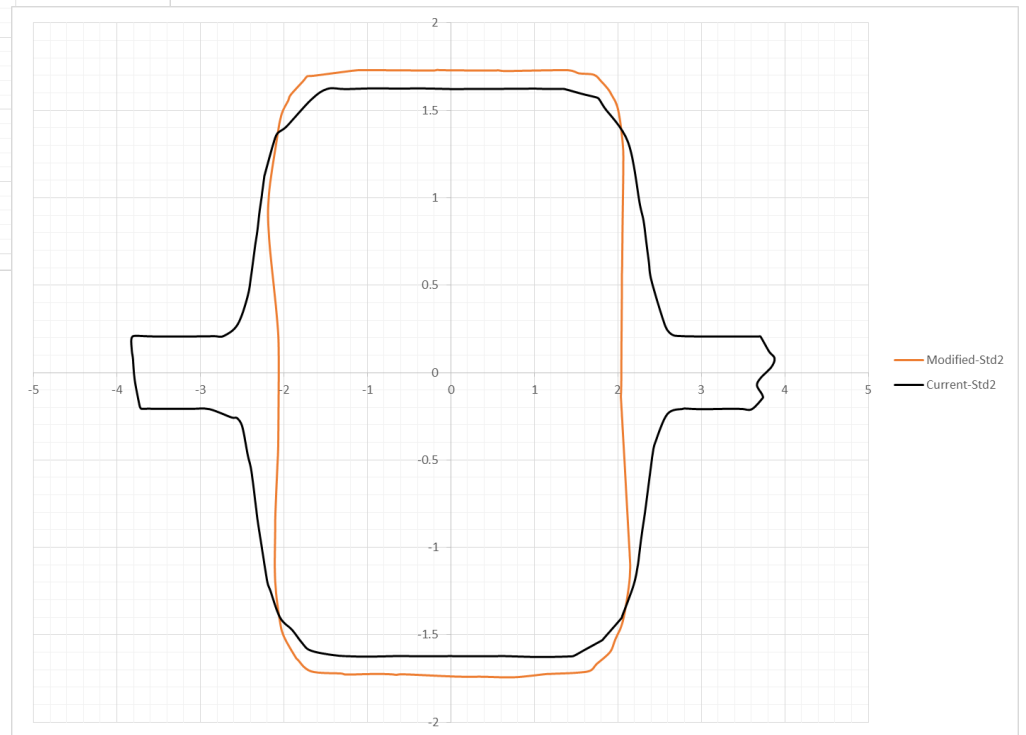
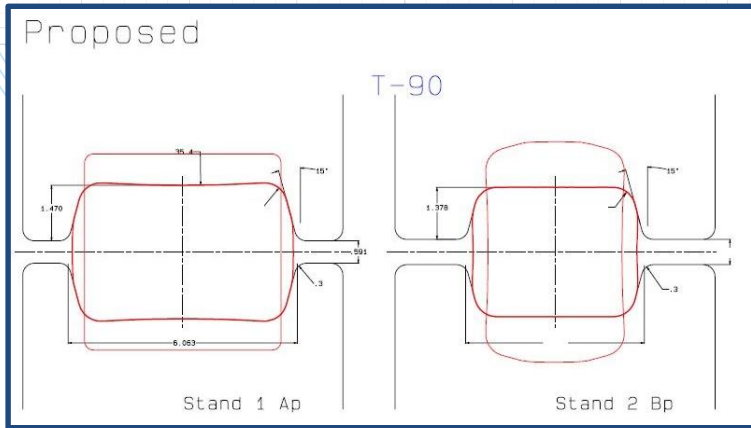


# Design validation – Profiles Comparison

## STAND #1



## STAND #2



# Case Study – Revision Validation Time

**CURRENT**

STAND1  
2h16min



STAND2  
5h39min



Total  
7h55min

**MODIFIED**

STAND1  
0h55min



STAND2  
1h50min

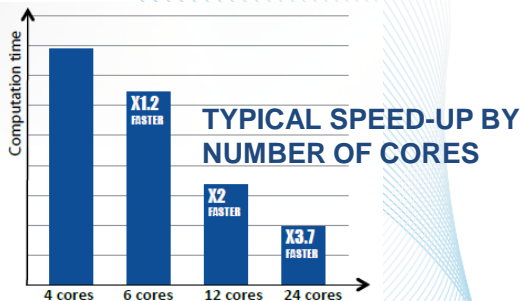


Total  
2h45min

Calculations done on ThinkPad laptop on 4 cores with 8GB RAM only.

Speed up observed with desktop computer is about 20%.

**ROUGHER DESIGN VALIDATED IN A WORK DAY  
+  
USER DOES NOT INTERVENE DURING  
CALCULATION**





# Live Demo



**TRANSVALOR**  
**AMERICAS**  
MATERIAL FORMING SIMULATIONS

# THANK YOU FOR YOUR ATTENTION

Many thanks to Dave Fournie (Gerdau) for providing rolls designs, and assistance for this presentation