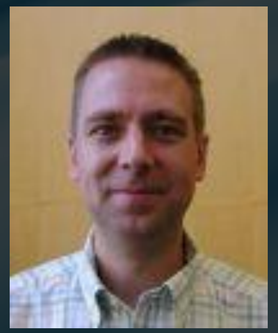
Autodesk® Moldflow®: Customizing Your Result Plots for Better Clarity



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Class Summary

- The Moldflow analysts role is to not only run quality simulations, but also to interpret the results and present them clearly. This presentation is about looking beyond the default plots and customizing the results to improve result clarity for yourself and your audience.

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Why and How

- Why do we need clarity in our results
  - Help us to better understand what's happening in part/mold/process
  - Help to convince others what's happening in…

- How do we communicate with our customers?
  - Reports
    - Communicator
    - HTML reports
    - PowerPoint
    - Word
  - Meetings
    - Formal
    - Informal

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Learning Objectives

At the end of this class, you will be able to:

- Change the display
- Modify result plots
- Create custom plots
- Use plot automation
- Using plots to communicate
- Apply examples shown

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Change the Display

- Tile windows
- Split windows
- Refresh
- Locking
- Overlay
- Cutting plane

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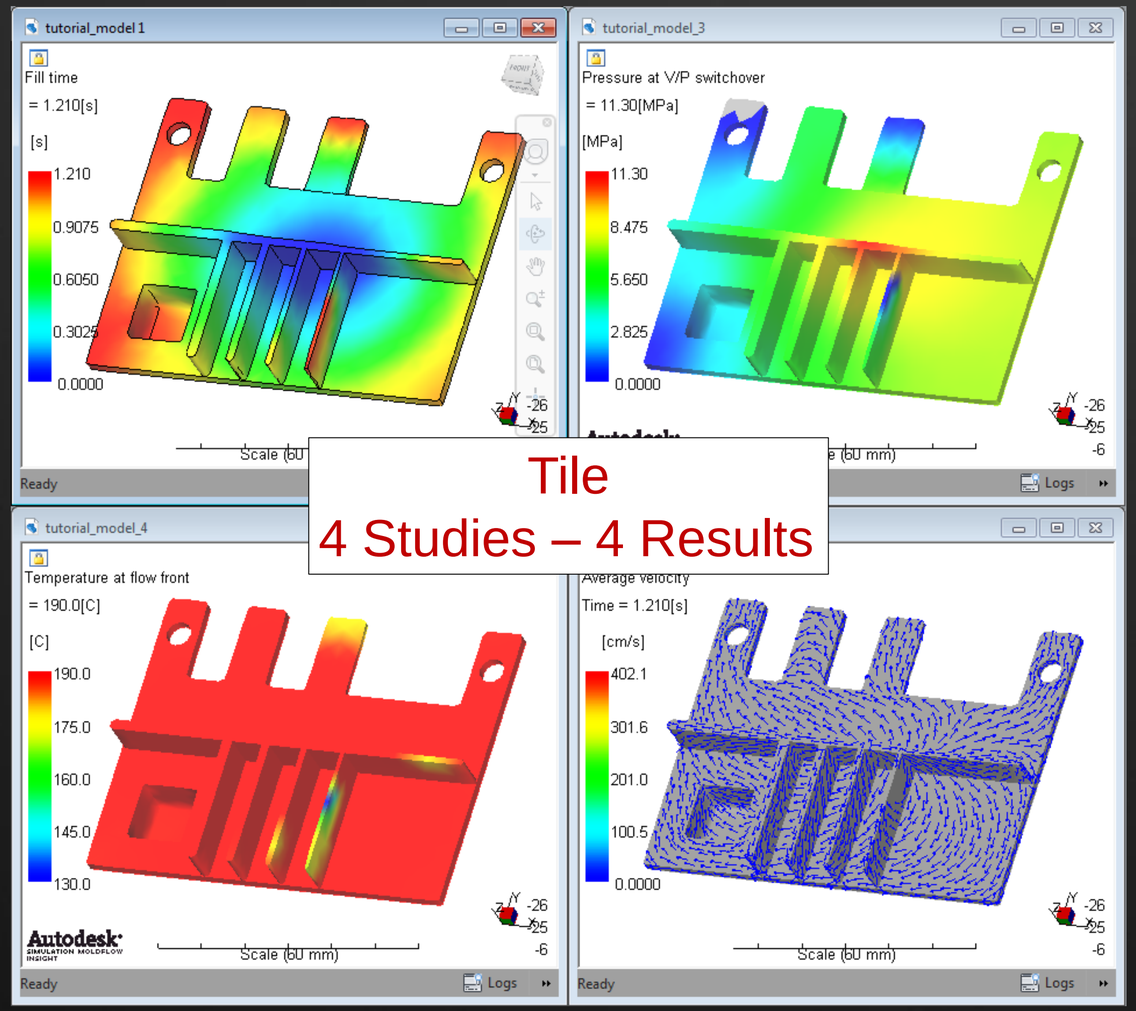
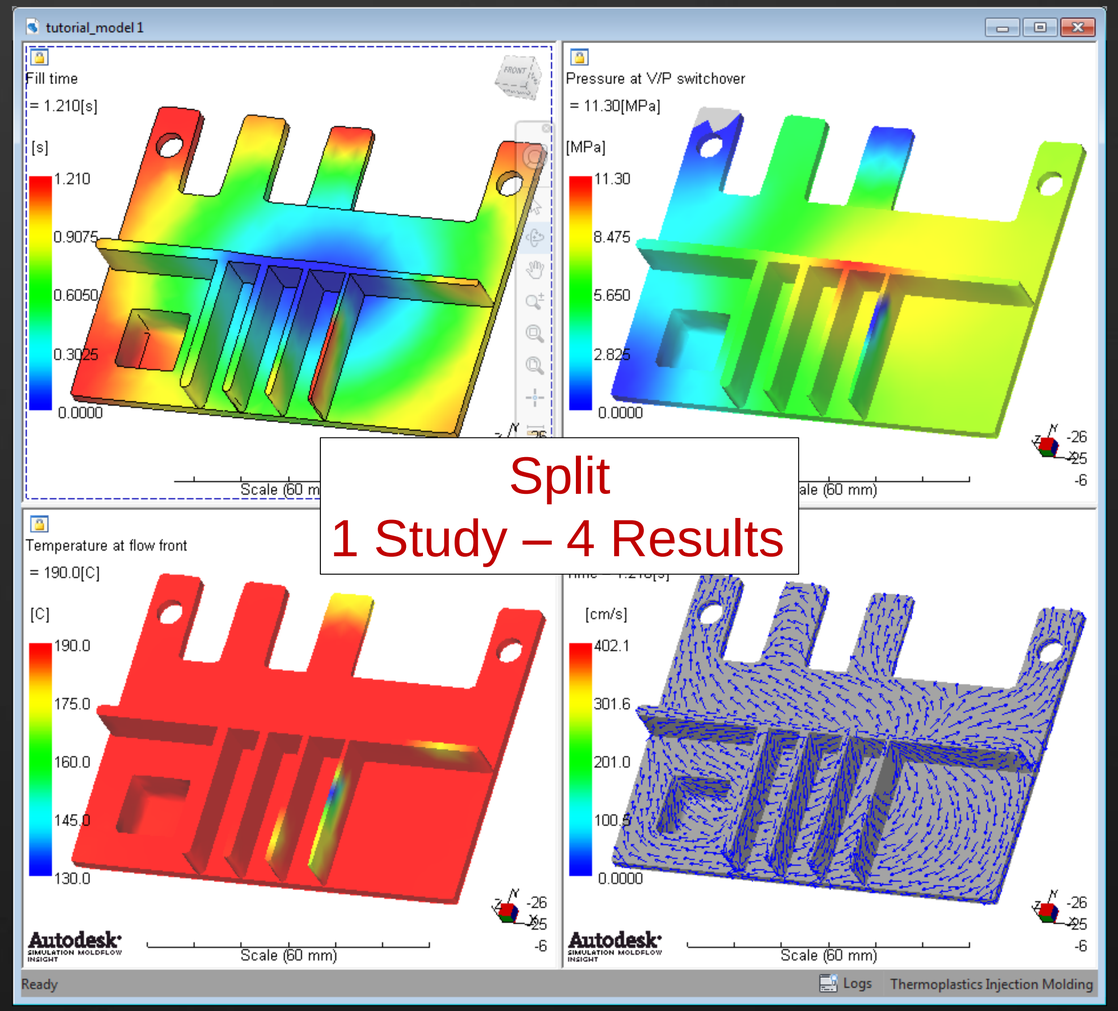
Quiz: What's the difference between these 2 pictures?



Tile
4 Studies – 4 Results



Split
1 Study – 4 Results

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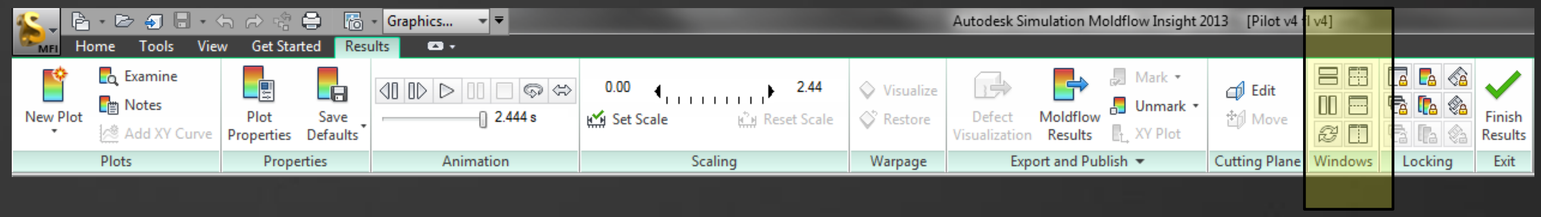
Display Options



- Tile
  - View multiple studies at the same time
    - Useful to compare results
- Split
  - View multiple results in the same study
    - Fill time, Pressure, Bulk Temperature, Volumetric shrinkage
    - 4 deflection results
- Refresh – it will sometimes fix the corrupt results display

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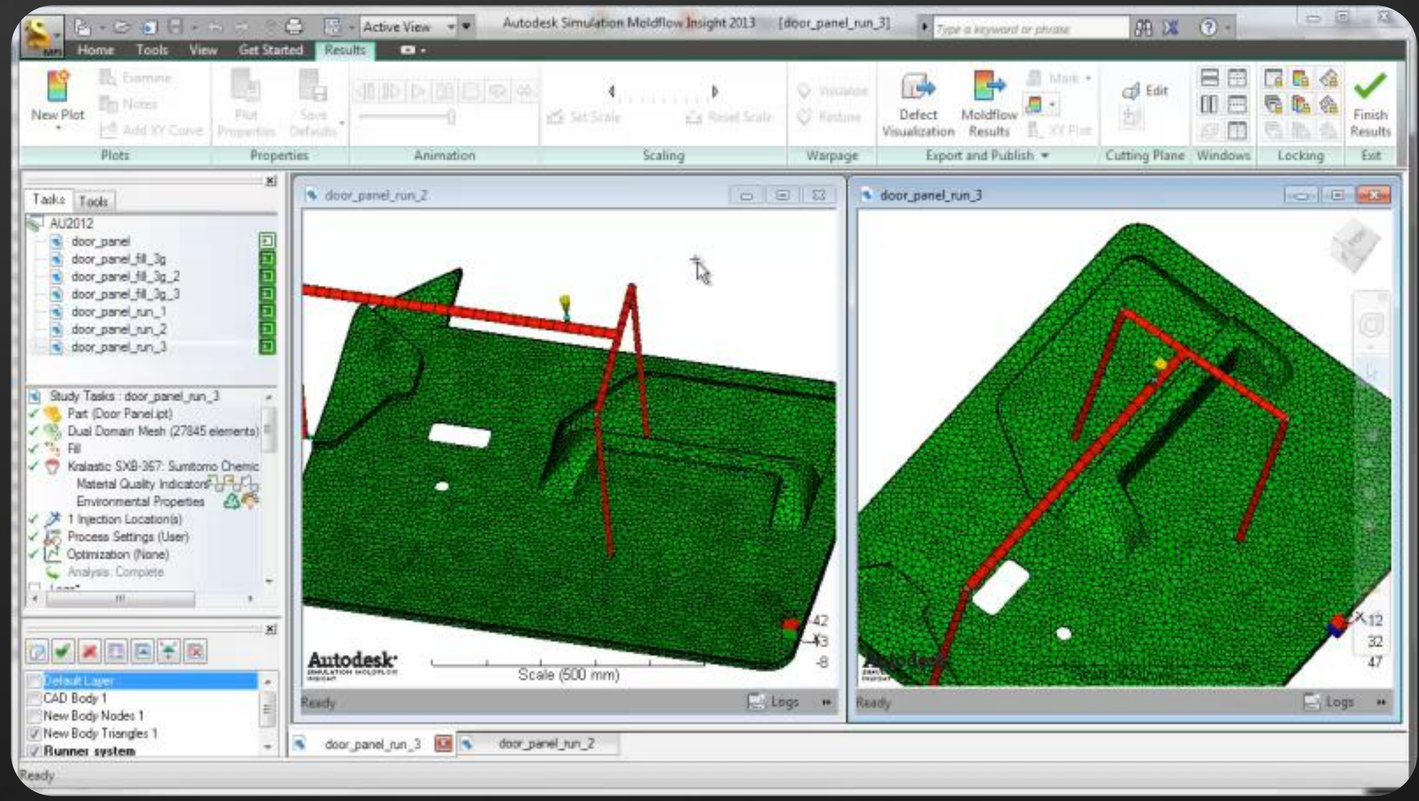
Locking

- Lock View
  - Link the rotation and zoom
- Lock Plot
  - Link the plots and properties
- Lock Animation
  - Link the animation of results



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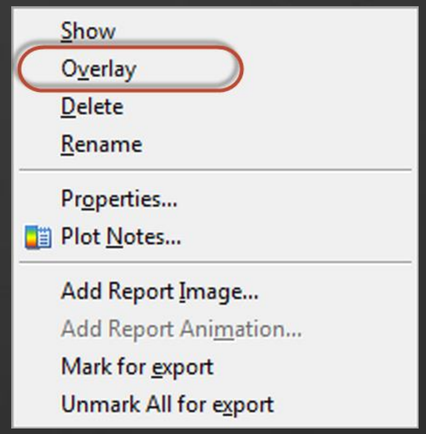
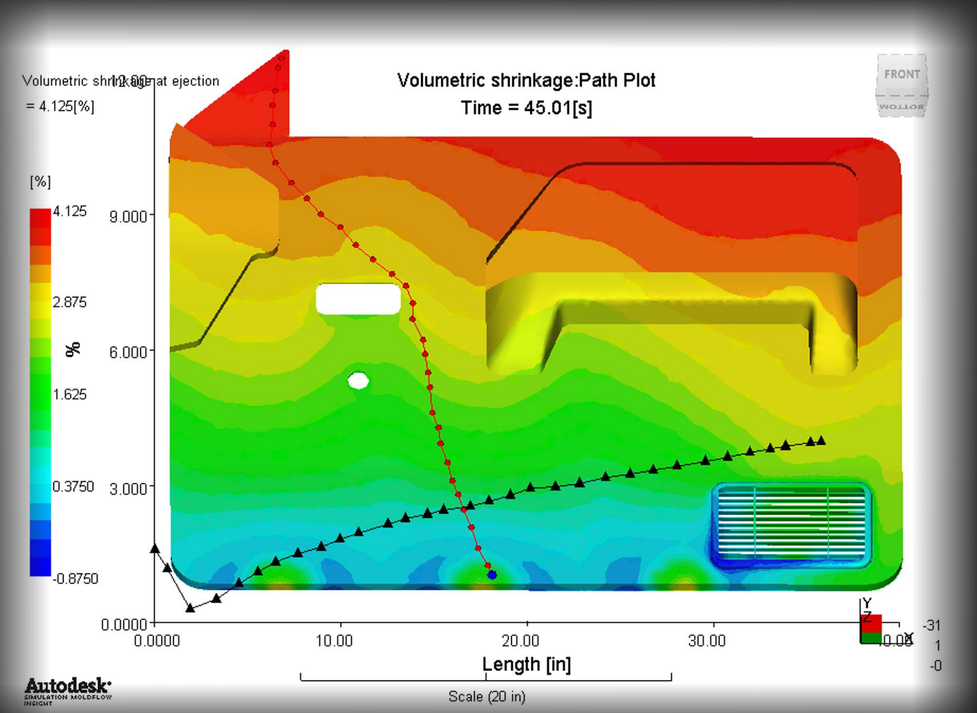
Overlay

- Multiple results in one window
  - More than 2 can be overlaid, but gets confusing
- Procedure
  - Display one result
  - Highlight the second result
  - Right click and select overlay
  - Activate first result if necessary
- Gotchas
  - Use only one shaded image
  - May need to change surface display





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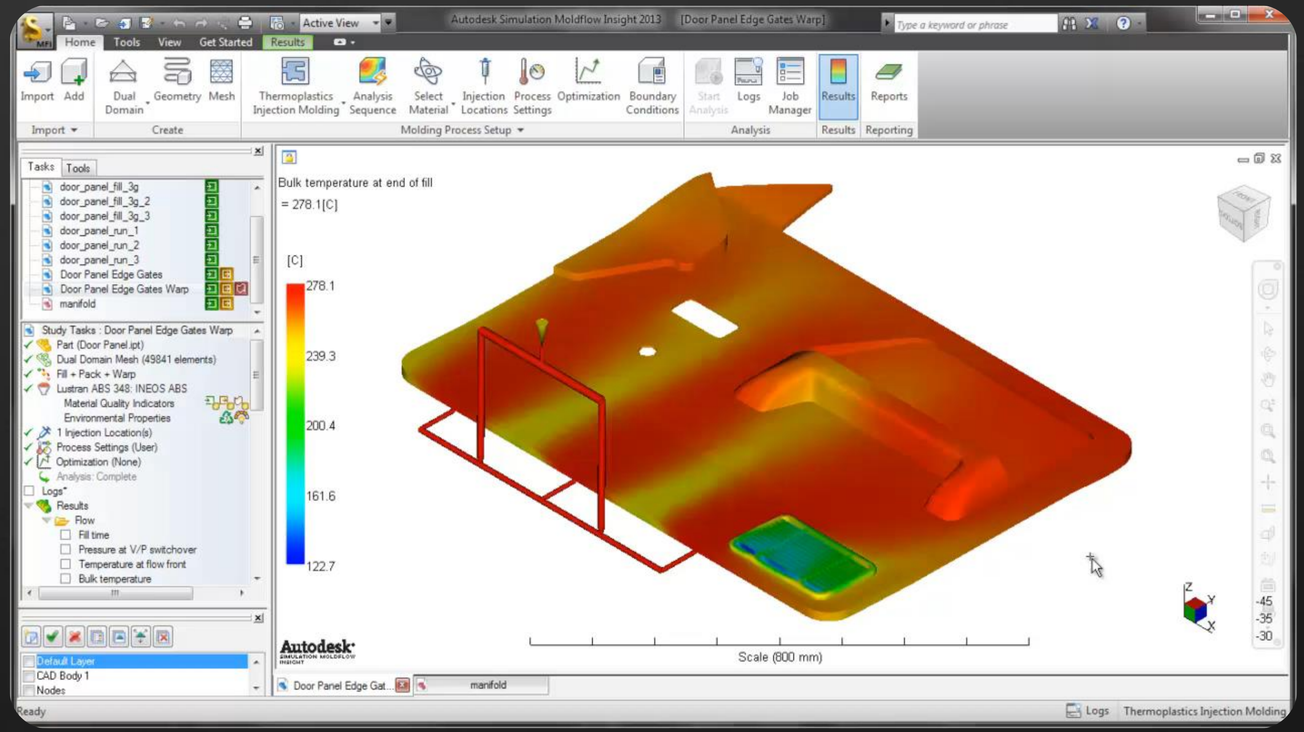
Cutting Planes

- More than one plane can be active at one time
- New planes can be created
  - The screen is the new plane



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Modifying Result Plots

- Plot properties
- Change plot types

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Why Change Default Plot Properties?

- Make results easier to see
- Expose issues not visible without modifying properties
- Make results have more engineering value
- Make the results “pretty” for your customer
- Make the Examine tool output easier to interpret

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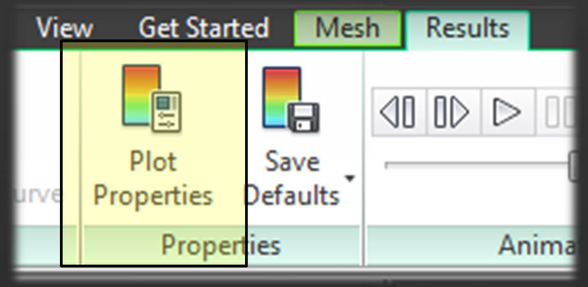
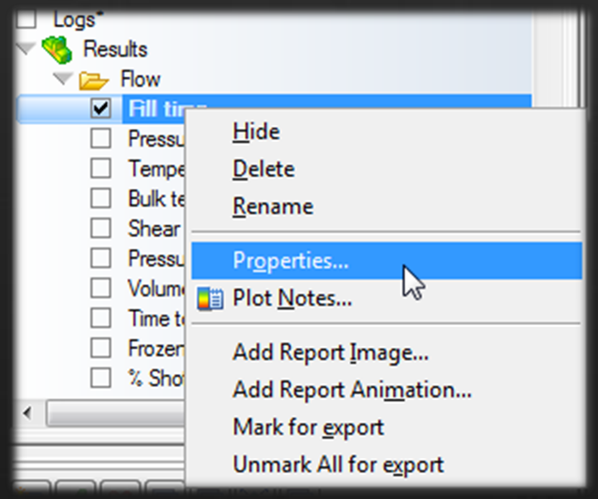
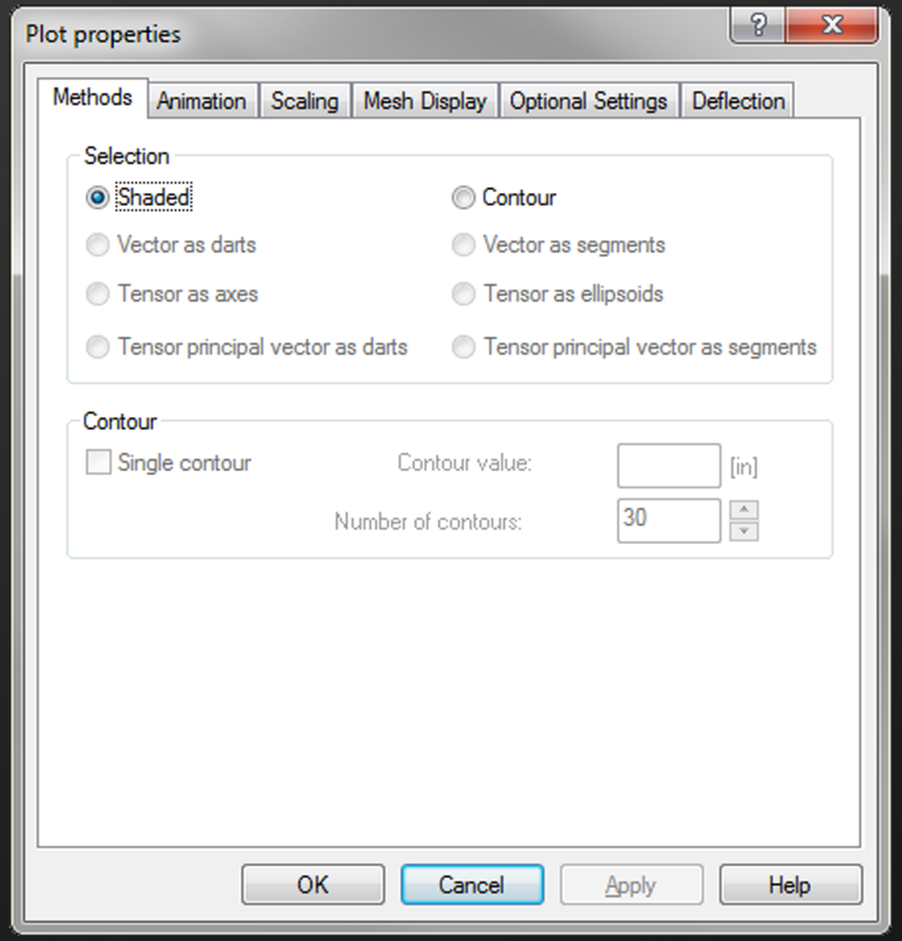
Plot Properties Categories

- Methods
- Animation
- Scaling
- Mesh Display
- Optional Settings
- XY Properties (1)
- XY Properties (2)
- Deflection
- Tensor
- Highlight



or





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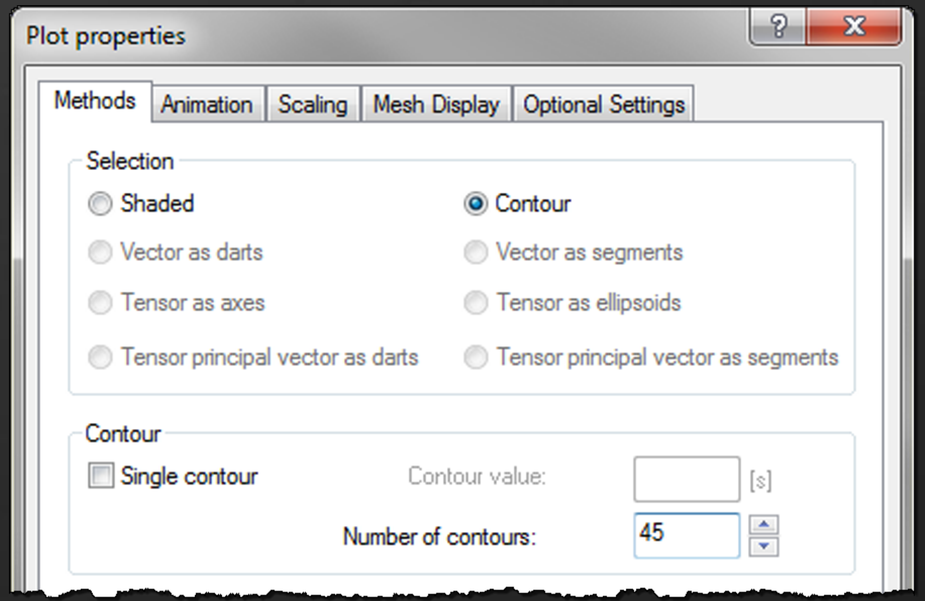
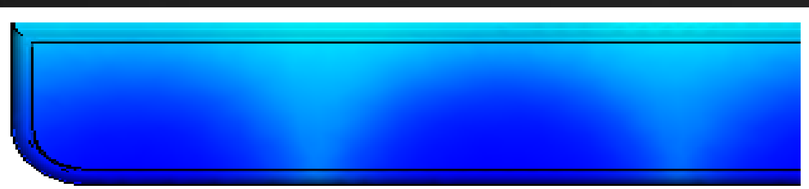
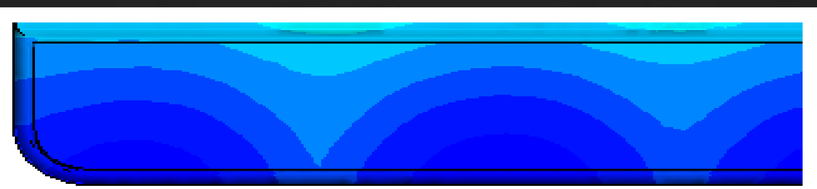
Methods Properties

- Sets the style of display
- Normally
  - Shaded or Contour
- Some results use other methods
  - Vector
  - Tensor

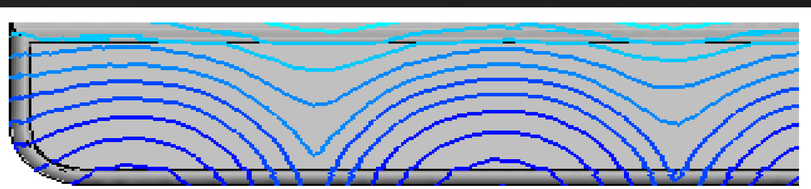




Shaded - Smooth



Shaded - Banded



Contour

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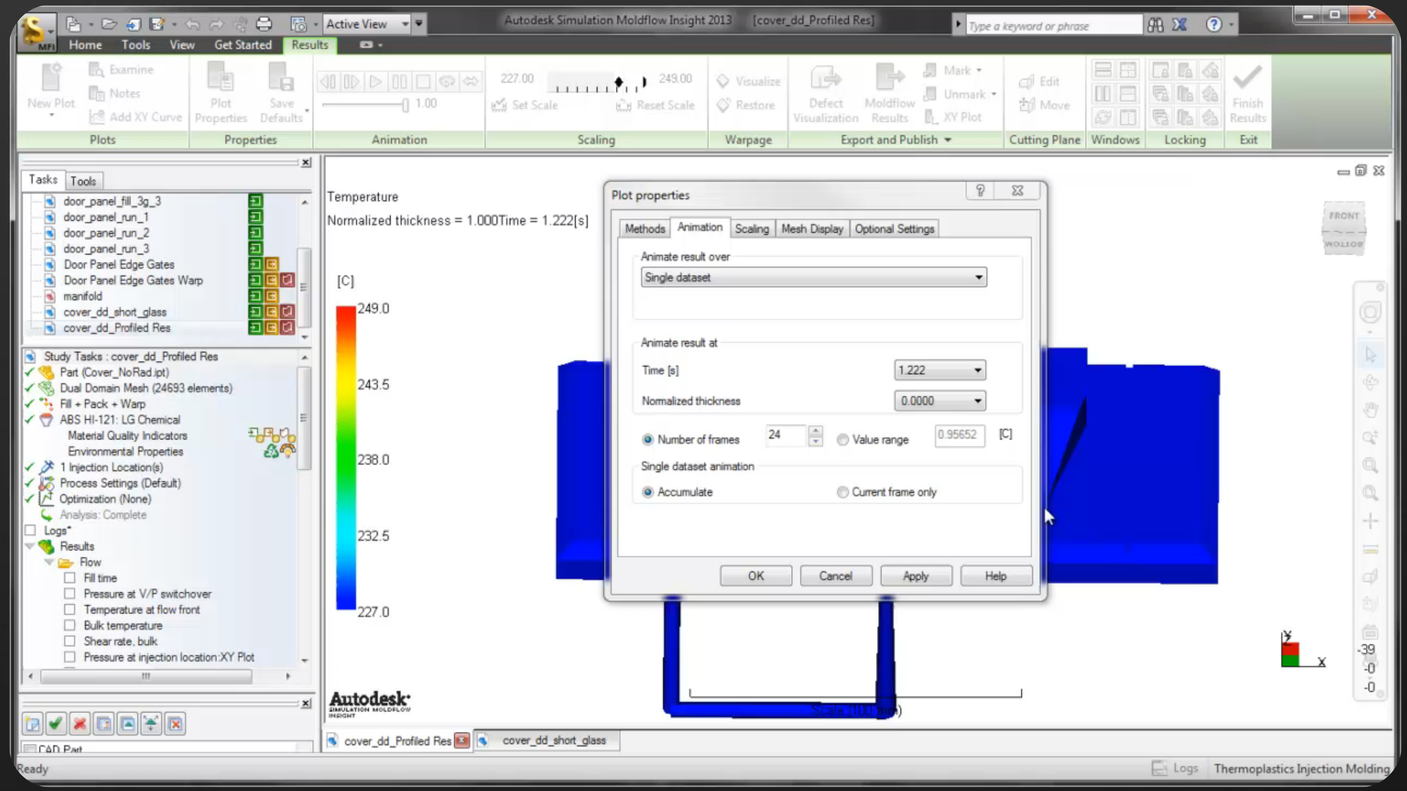
Animation Properties

- Animate result over
  - Depends on the result
  - Possible methods
    - Single dataset
    - Time
    - Normalized thickness
- Animate result at
  - Depends on the result
  - Possible methods
    - Time
    - Normalized thickness



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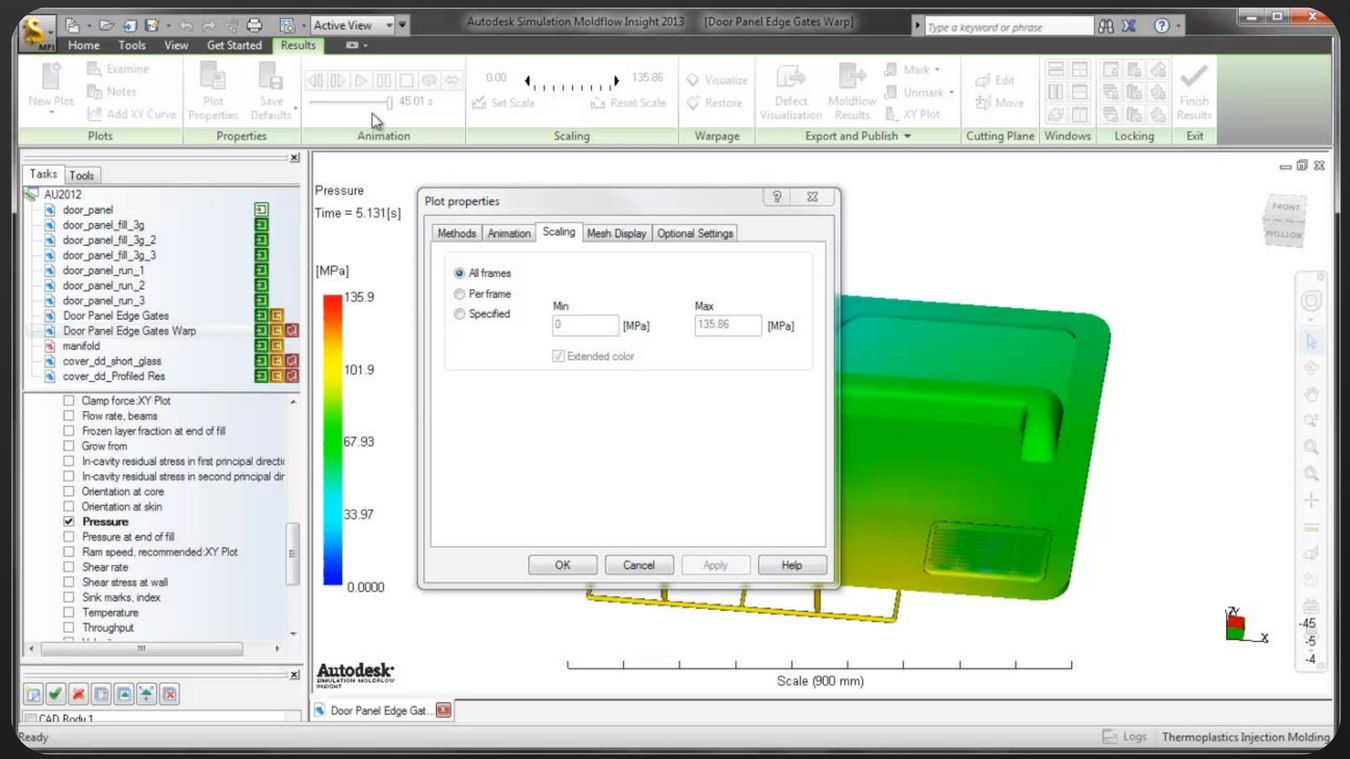
Scaling Properties

- All frames
  - Results scaled to min/max of all time steps (Frames)
- Per Frame
  - Min/max of currently displayed frame
- Specified
  - User controlled scale



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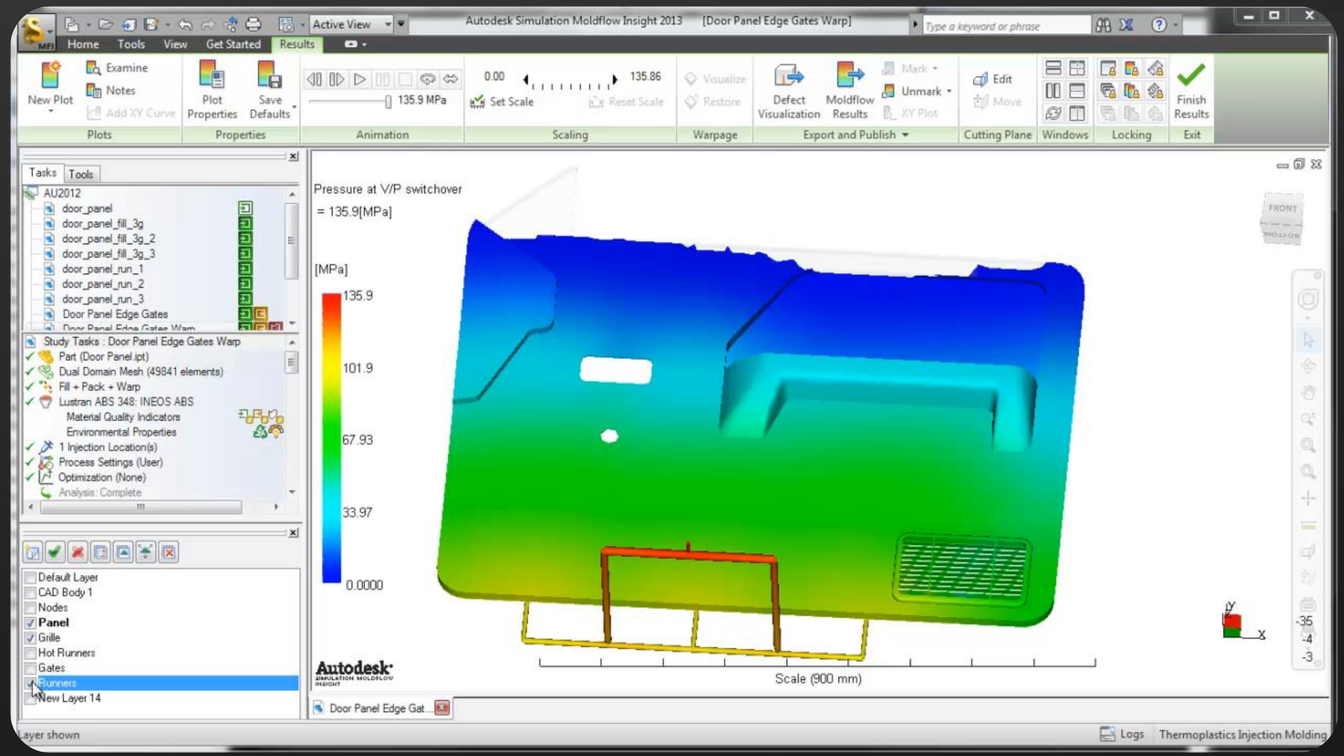
Scale by Layers

- Results automatically scale by visible layers



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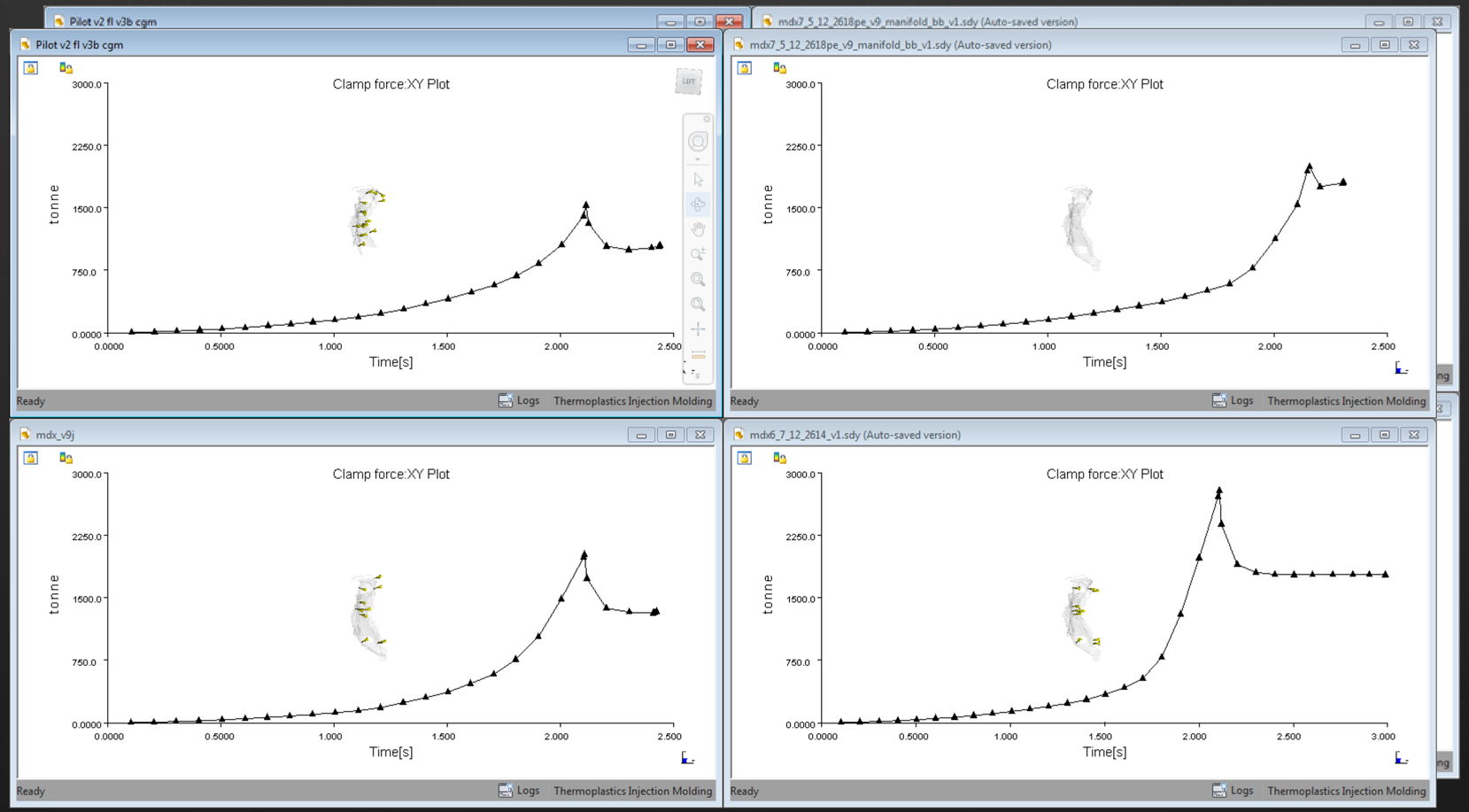
Quiz: Which of these has the highest required tonnage?

Sometimes the scale is hard to read in a report



A common scale helps to clarify results

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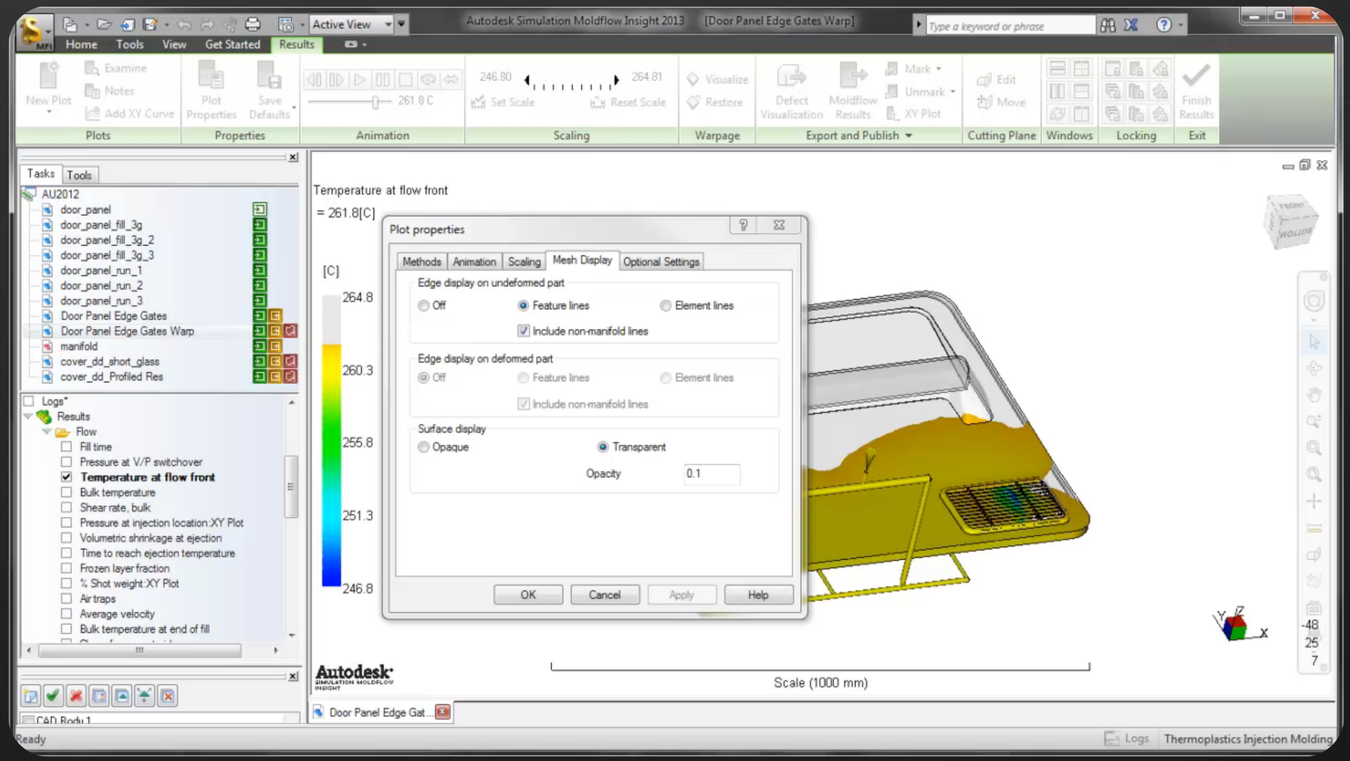
Mesh Display Properties

- How the model will be displayed
  - In most cases, edge display is off
- Filling
  - Solid (most common)
  - Transparent
  - May need to adjust when overlaying results



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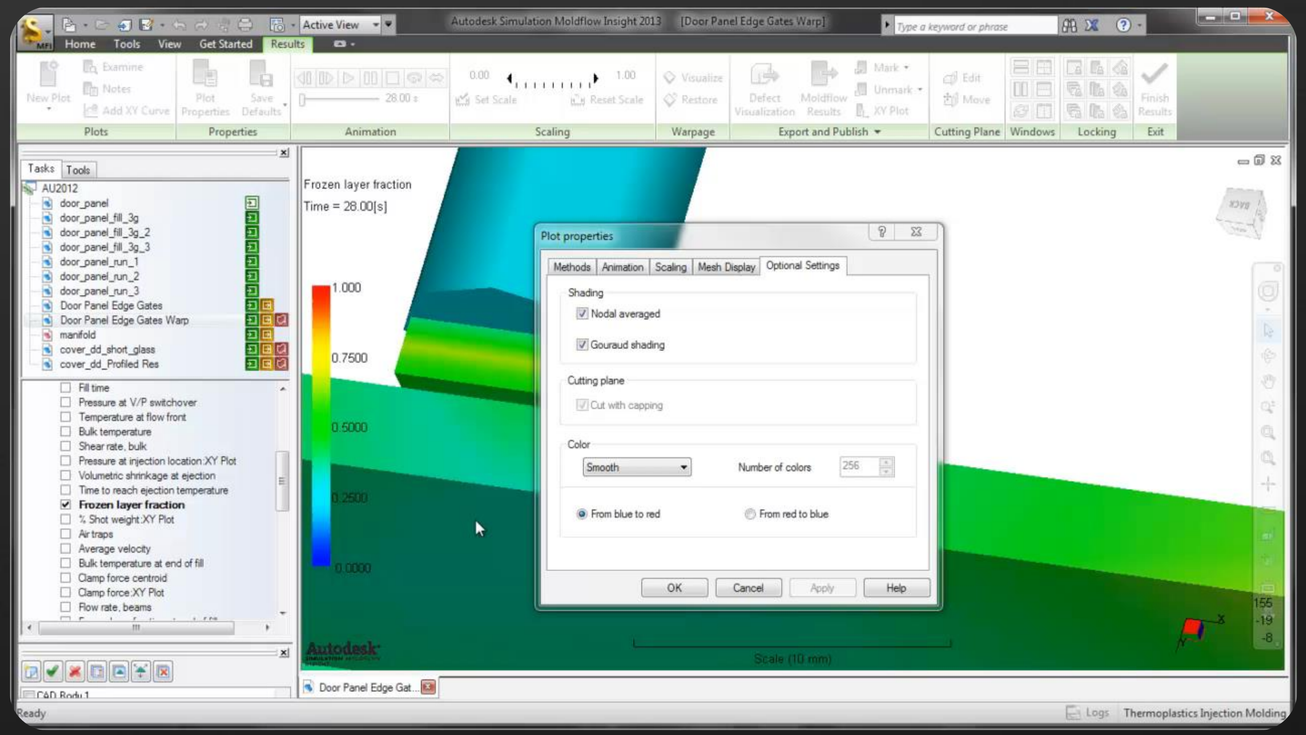
Optional Settings – Nodal Averaged

- To see elemental results as elements
  - Turn off Nodal averaged
  - May need to change animation setting



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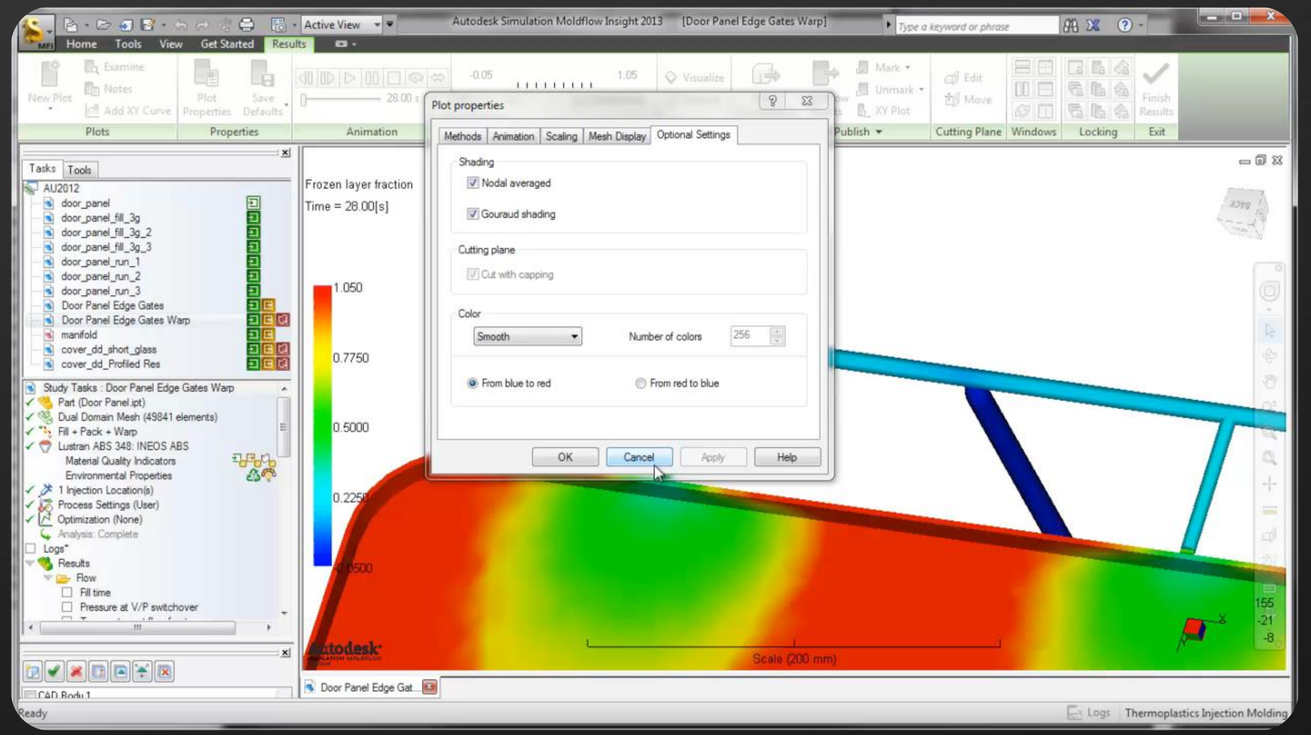
Optional Settings – Color

- The default color is smooth (256 colors)
- Changing to banded colors makes it easier to interpret gradients



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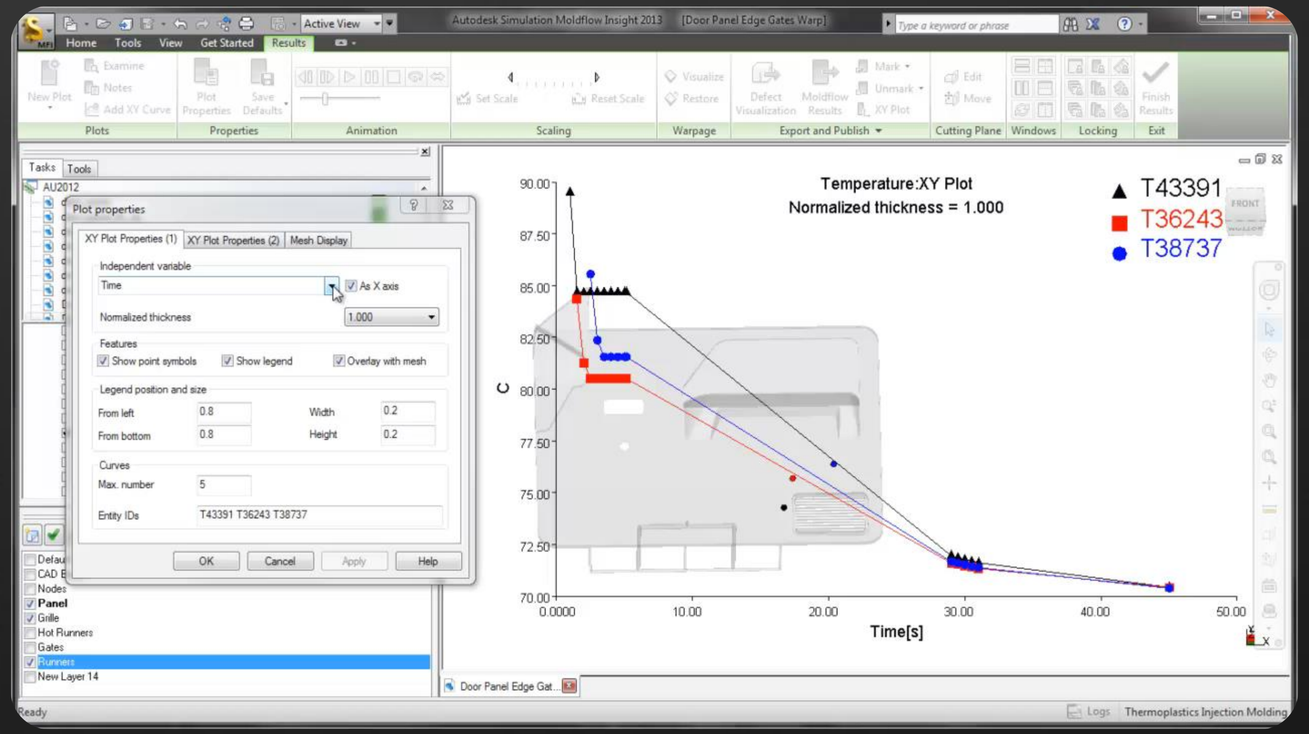
XY Plot Properties

- Independent variable
  - If profiled result, it can be set
    - Time
    - Normalized thickness
- Set axis of independent variable
- Axis scale



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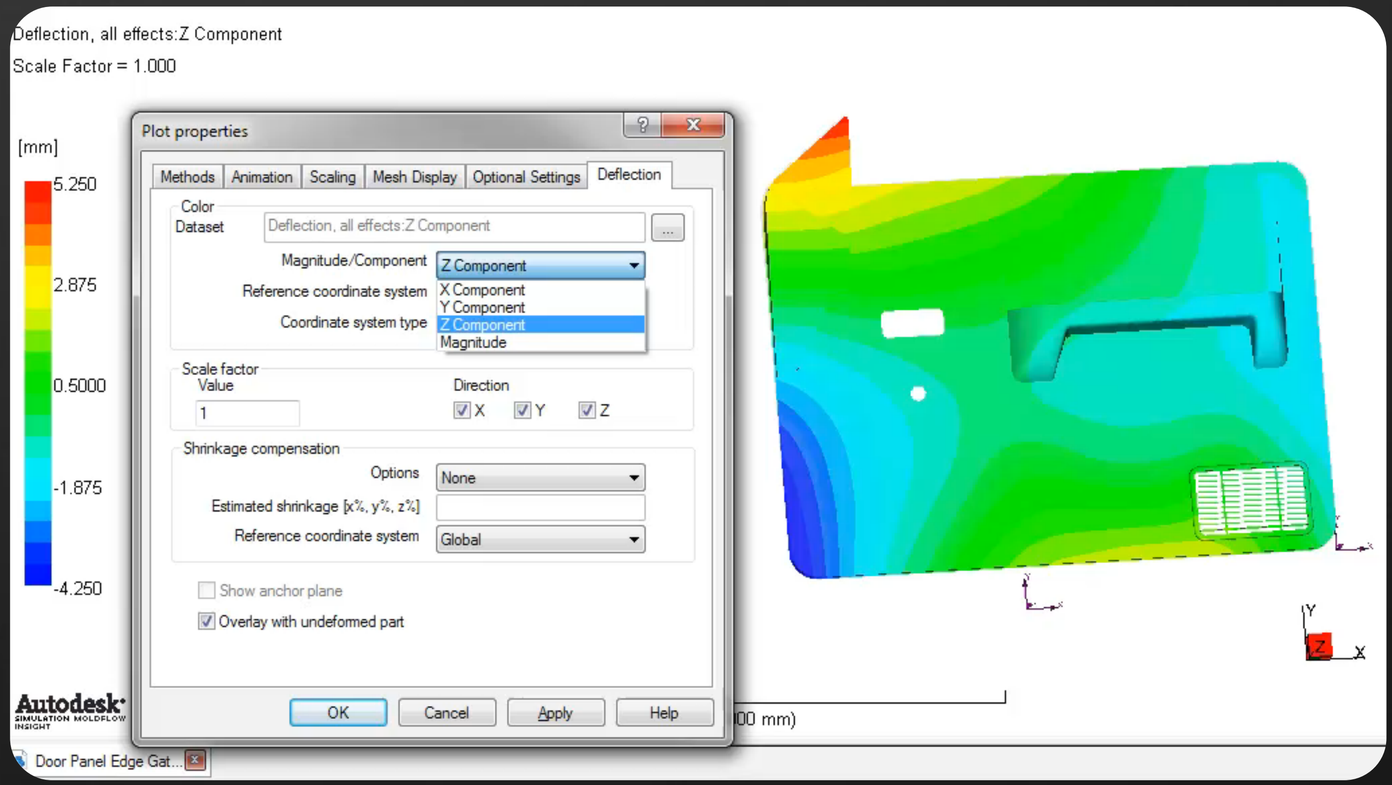
Deflection

- Color
  - Dataset
  - Magnitude/Component
  - Reference coordinate System
  - Coordinate system type
- Scale factor
  - Magnitude
  - Direction to apply scale to
- Shrinkage compensation
- Anchor plane display
- Undeformed part display



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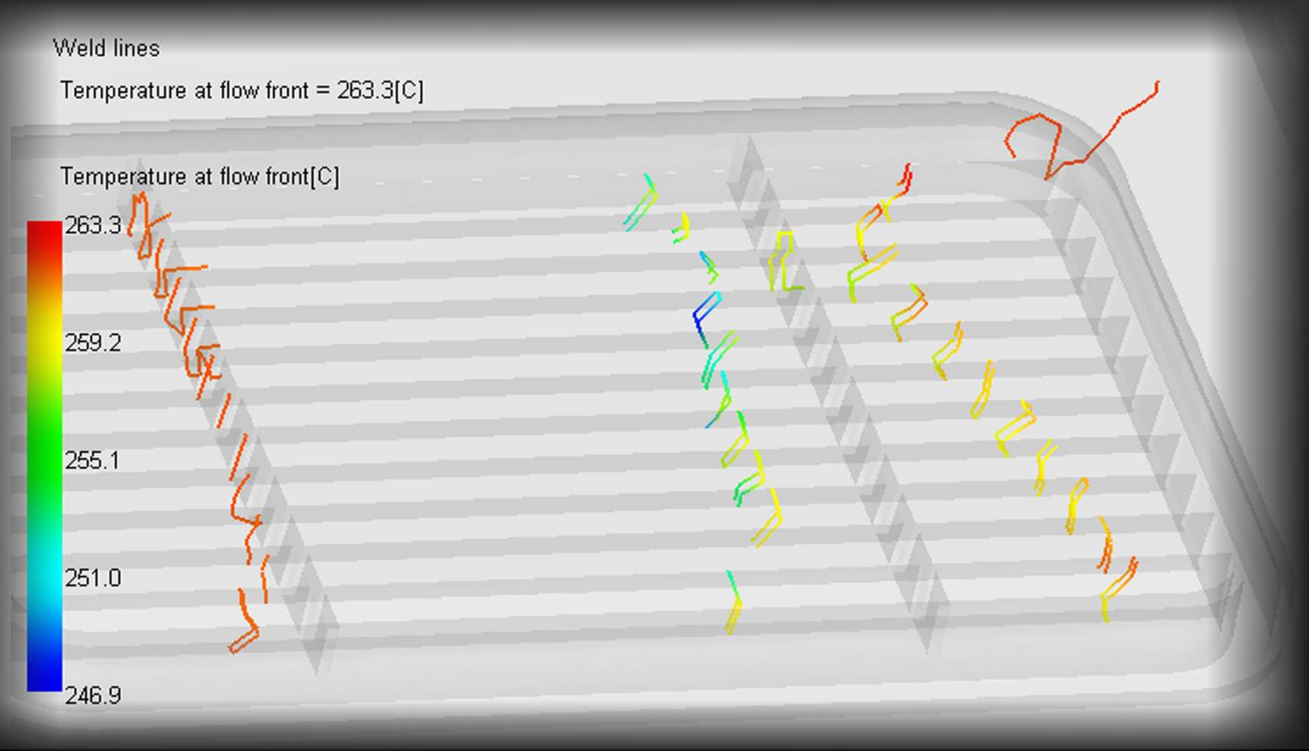
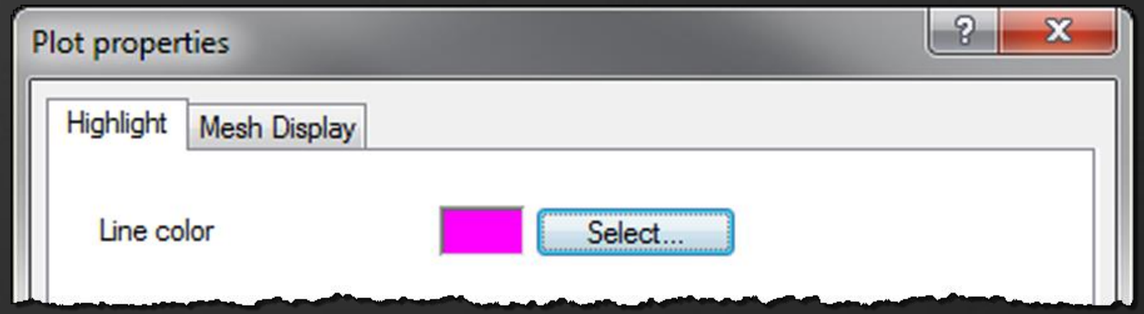
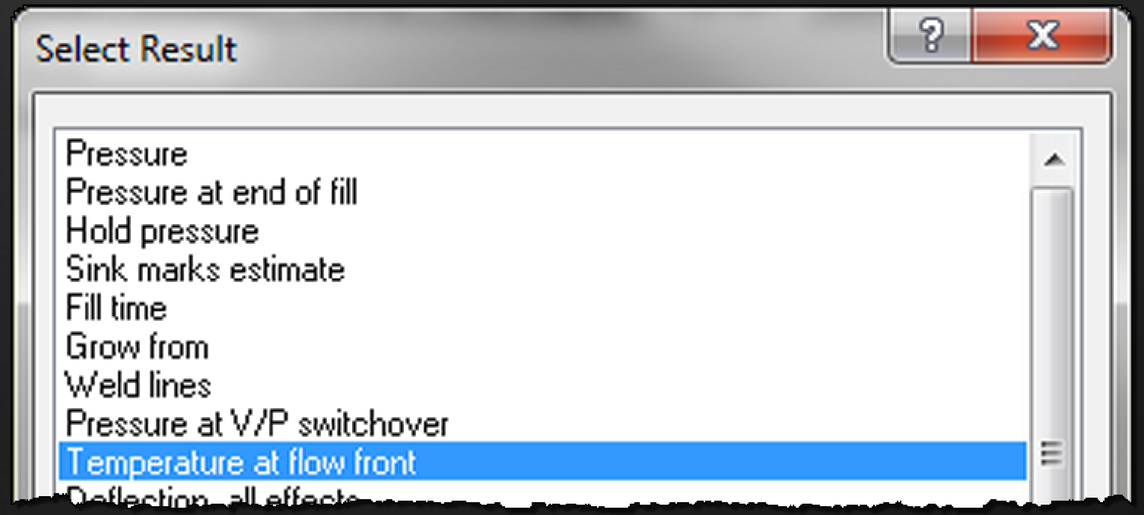
Highlight

- Set the color for the highlight
- Dataset for weld lines







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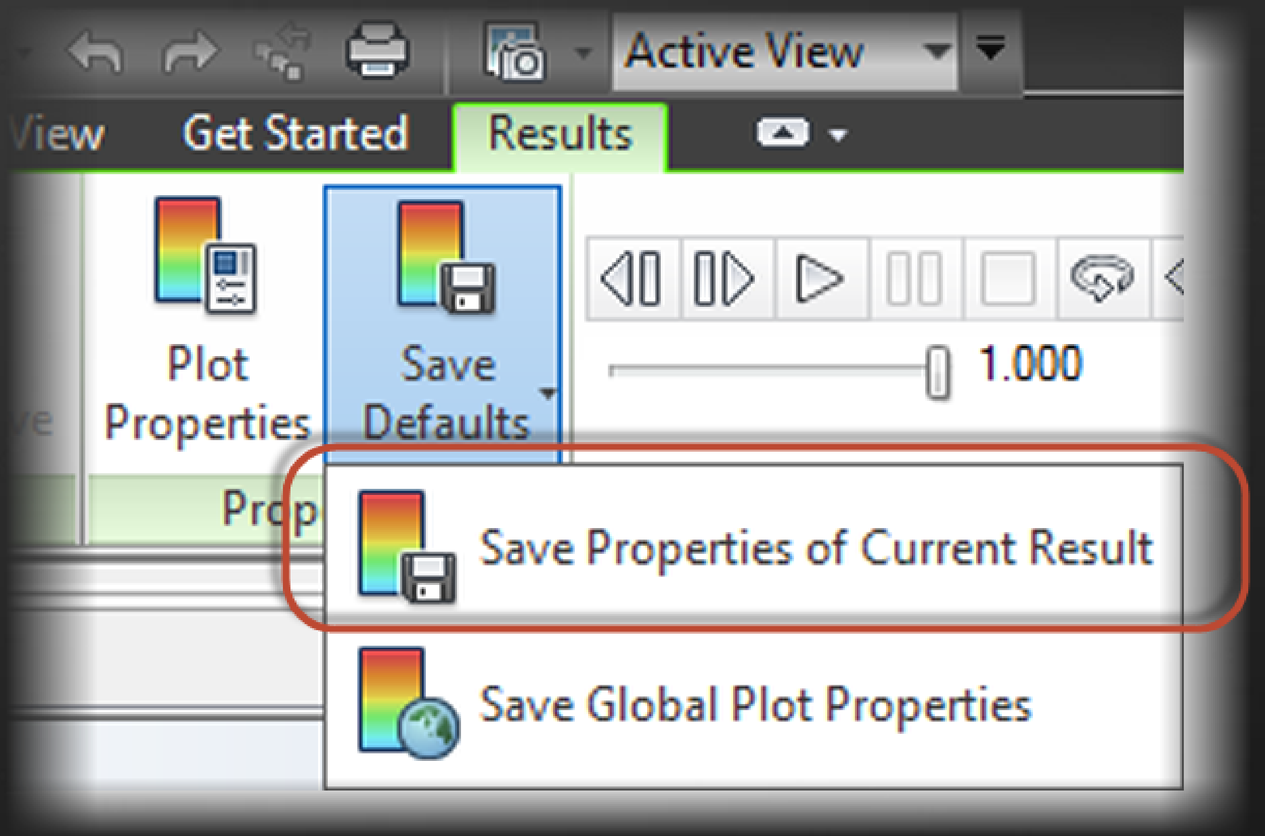
Saving Plot Properties

- Plot property defaults can be saved
  - Specific plot
  - Global
- Next time the plot is created it has the new properties

- Examples:
  - All Fill Time plots will be banded
  - All Weld Line plots will be single color



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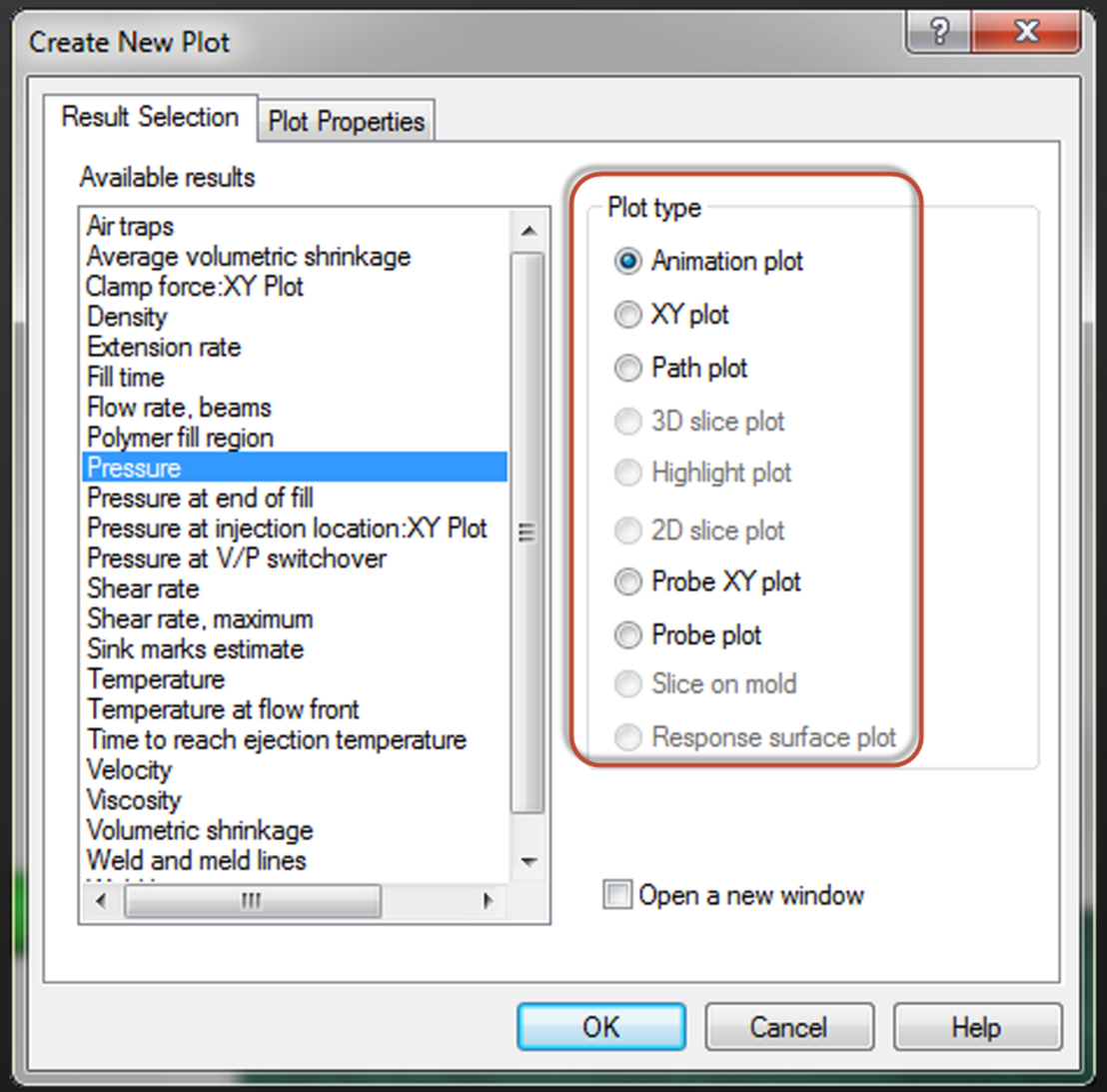
Change Plot Types

- Why change plot types
  - Make results easier to understand
  - Compare results better
  - Easy to output to spreadsheets
- The types available depends on the result



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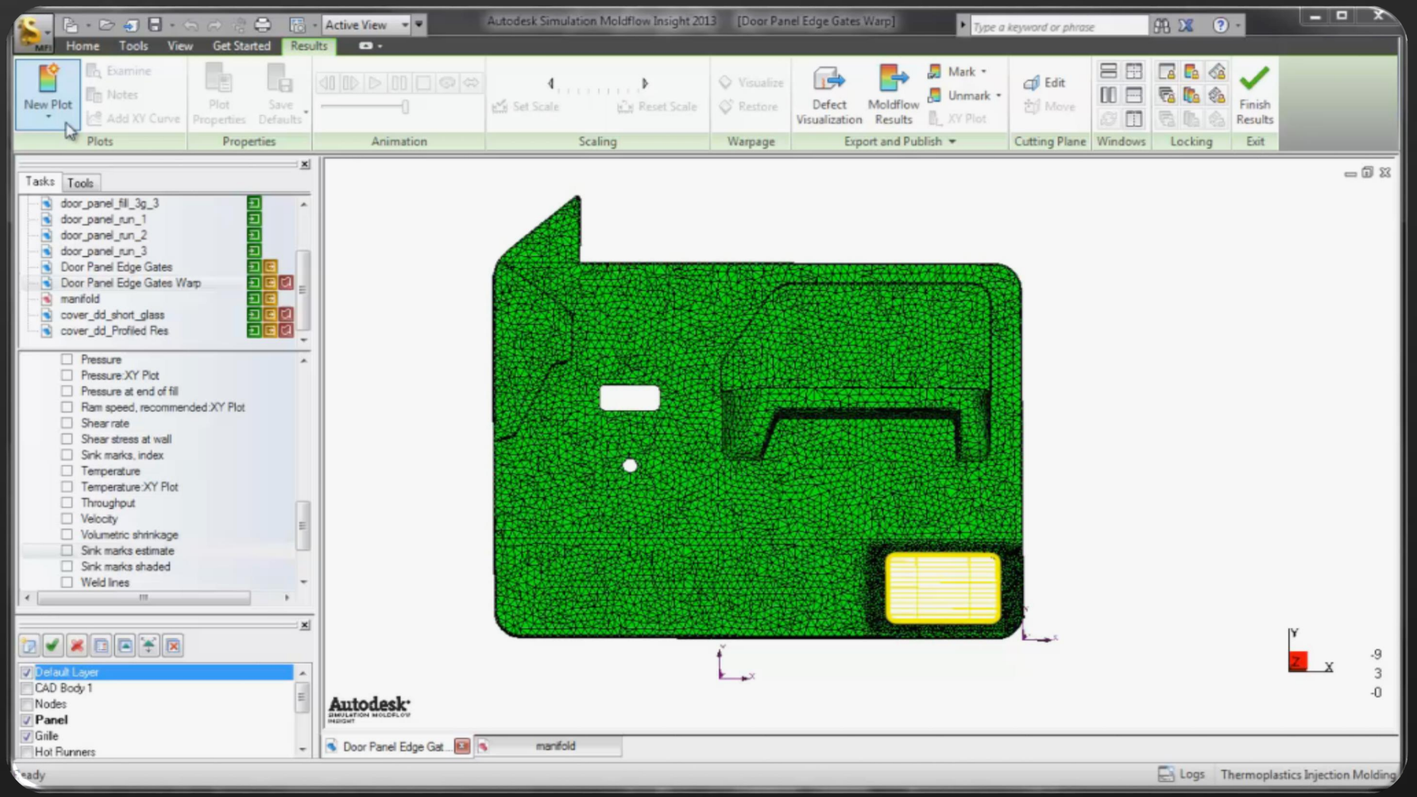
Changing a Plot Type

- Create a new plot to change the type
- From
  - Results tab
  - Results section of the study tasks list



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Create Custom Plots

- Calculated plots
- Custom plots

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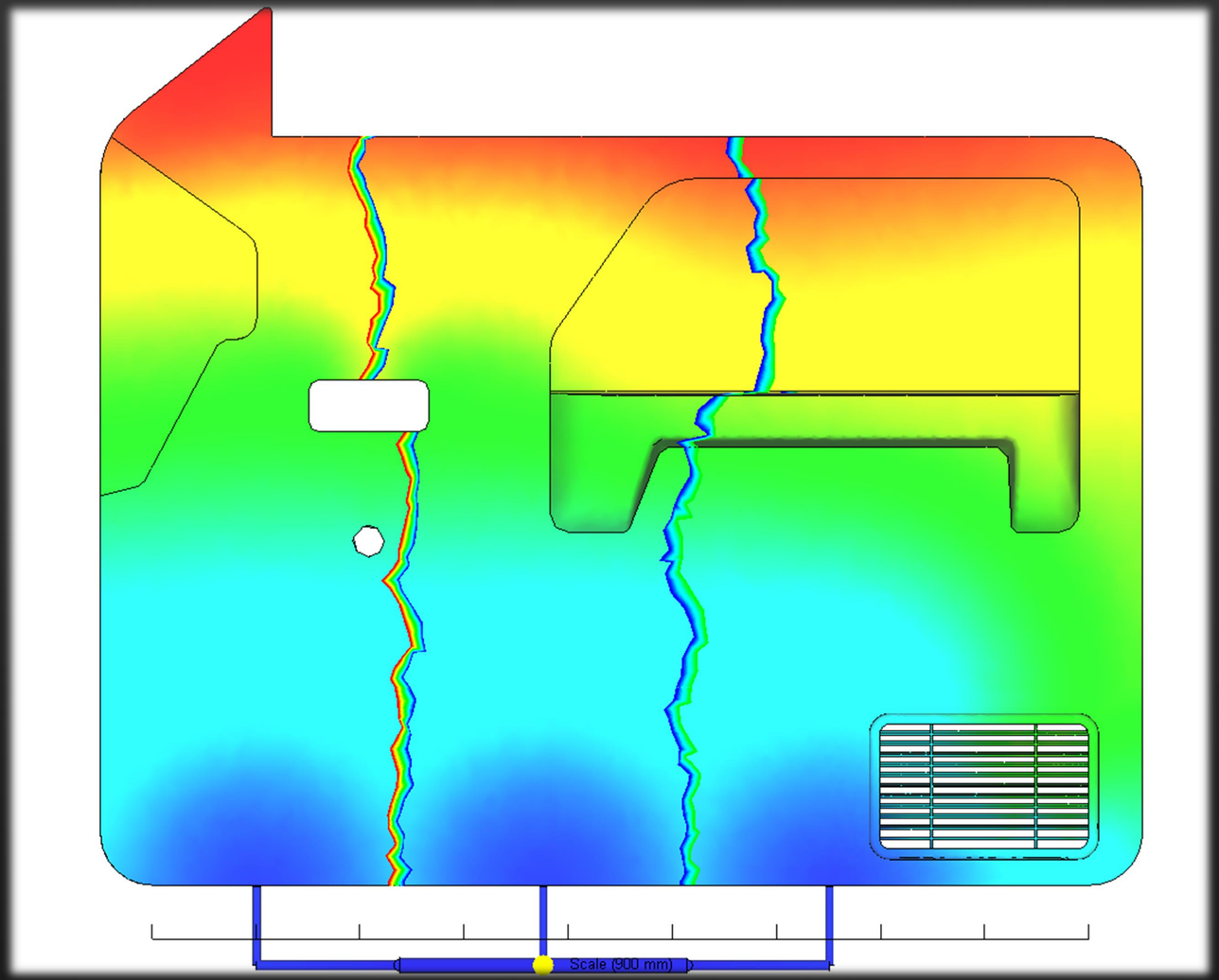
Quiz: What is this Result?



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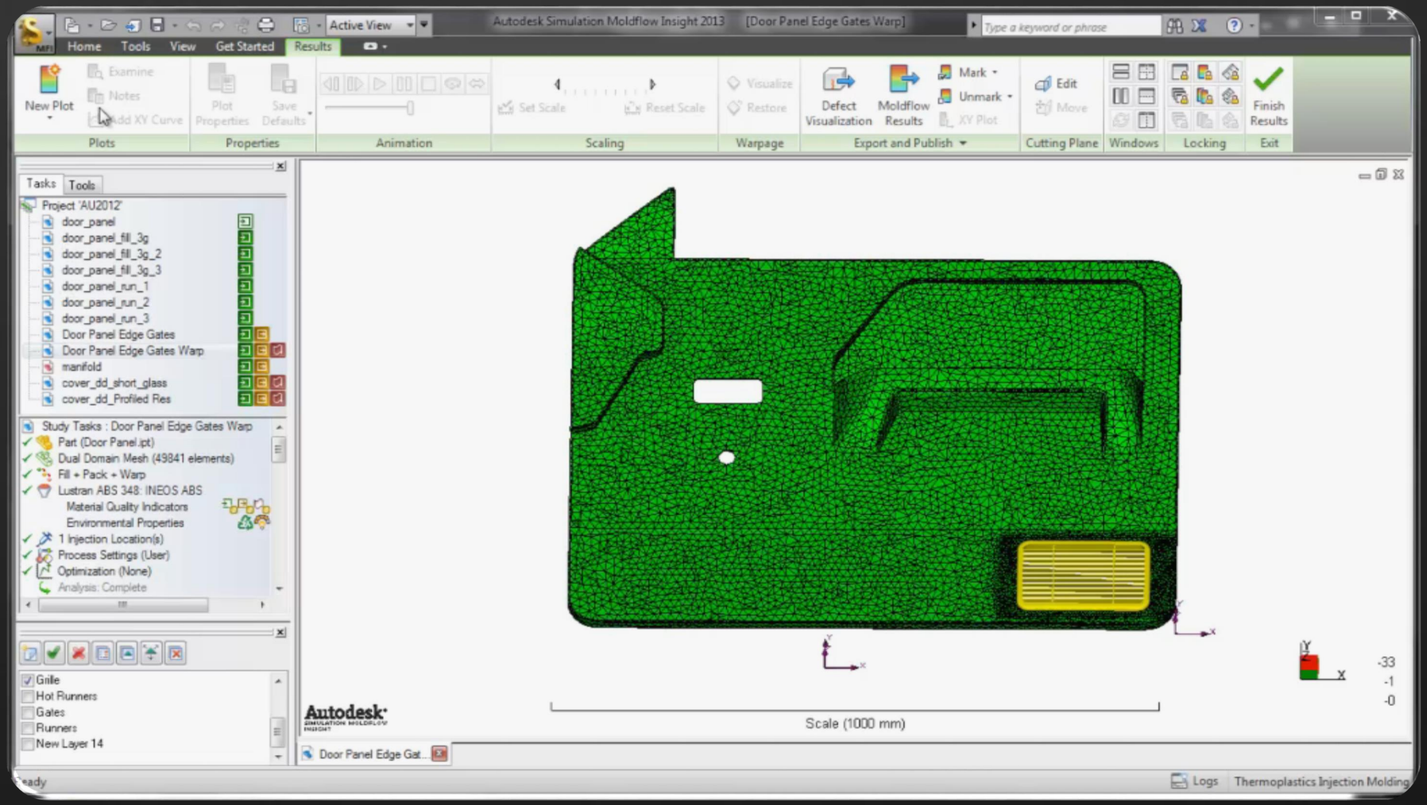
Calculated Plots

- Allows you to create a new plot based on one or two existing plots
- Several functions and operators are available



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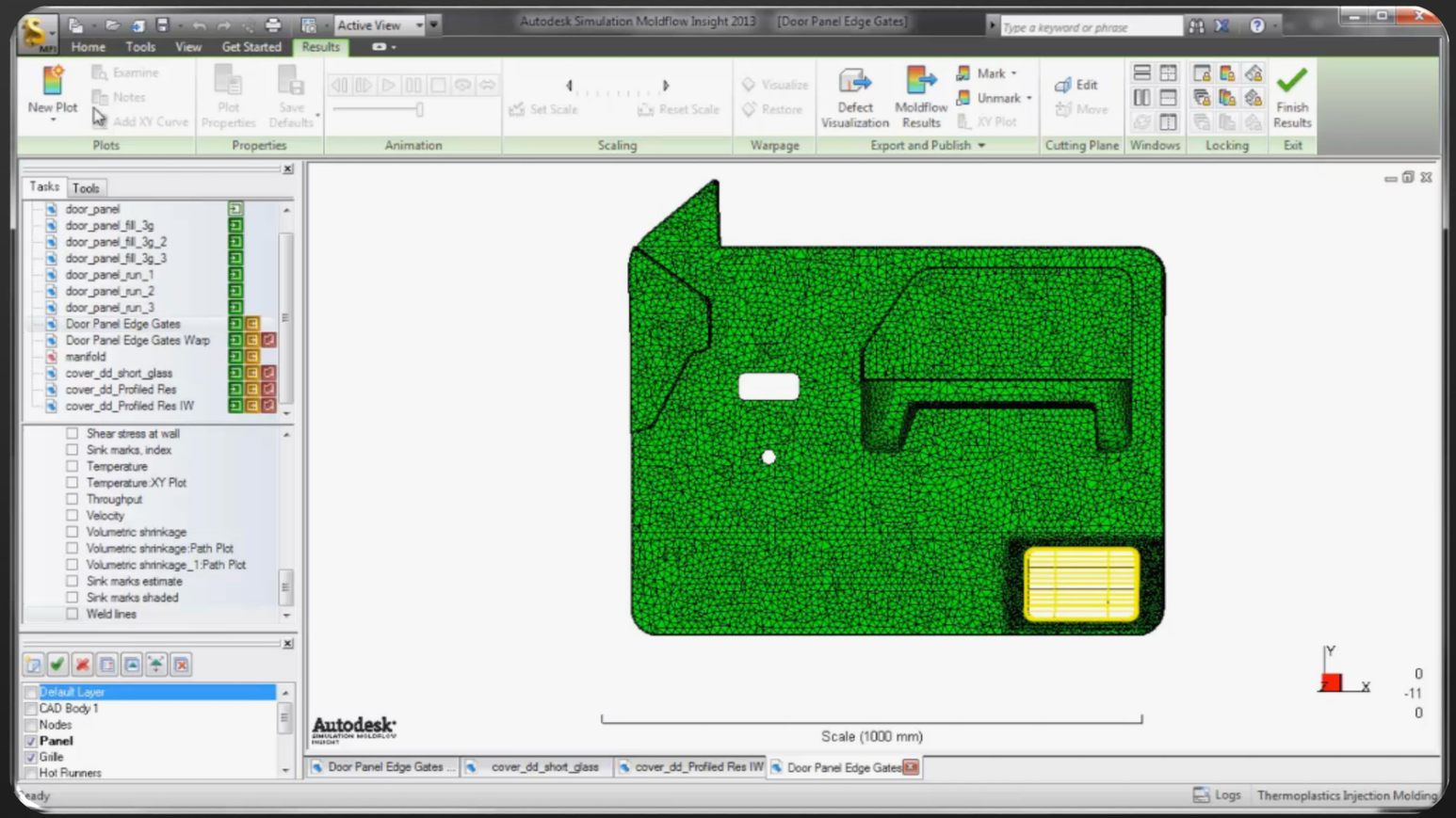
Custom Plots

- Results where the definition can be altered by the user



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Use Plot Automation

- API
- Command line
- Macros

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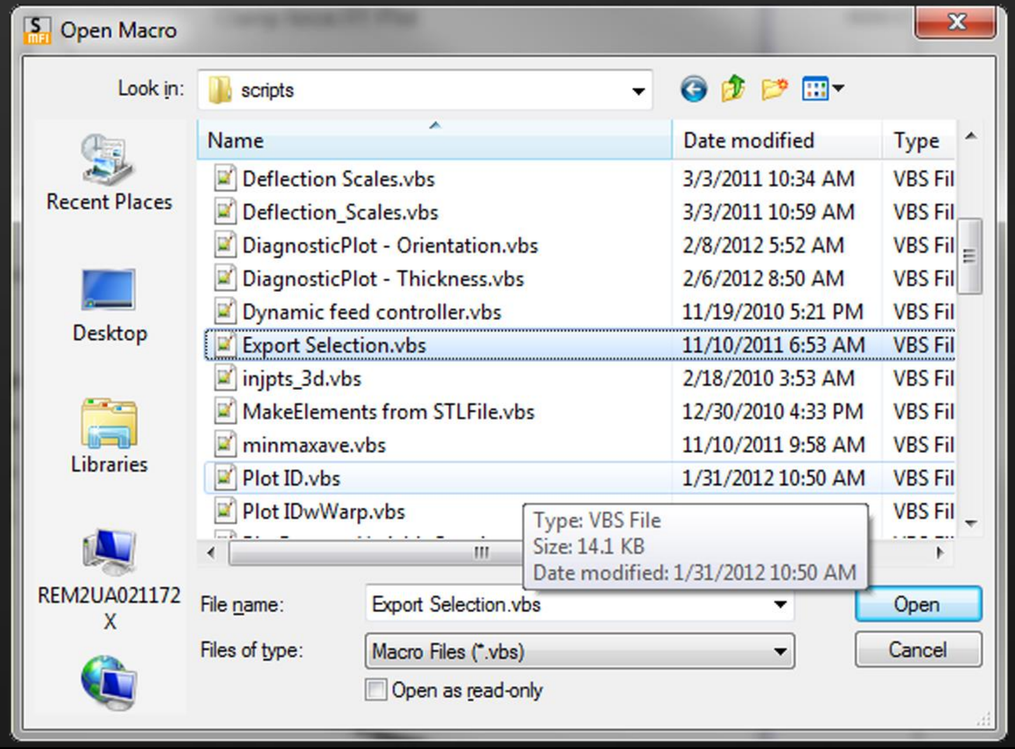
Plot Automation – API

- The Application Programming Interface
  - An Object Linking and Embedding (OLE) programming interface
  - Enables functionality of Synergy to be automated
- Control Synergy commands by
  - Command line
  - Macros (scripts)
  - External programs such as Excel
- What can you do with the API?
  - Only limited by your imagination
    - Well almost!



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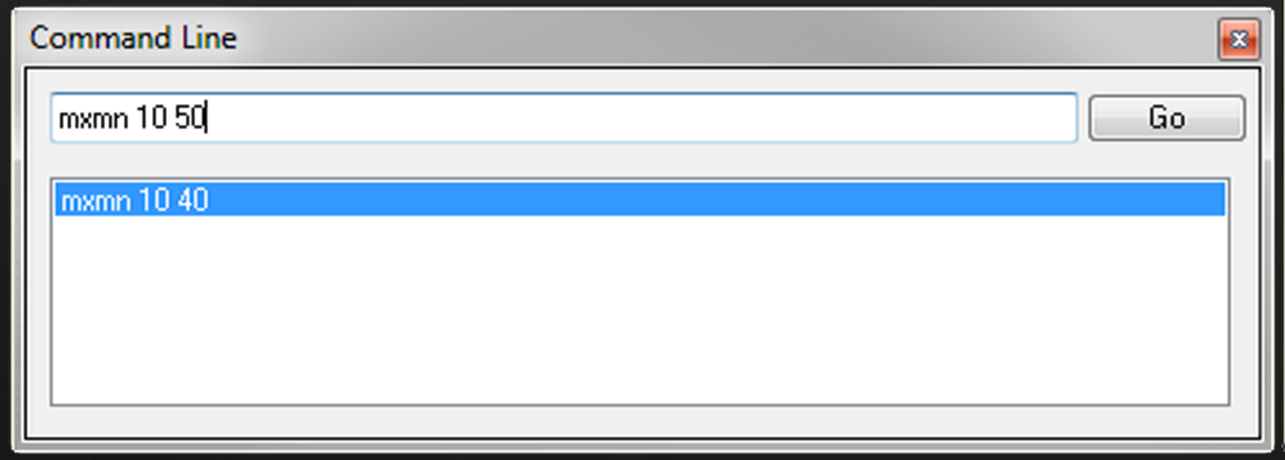
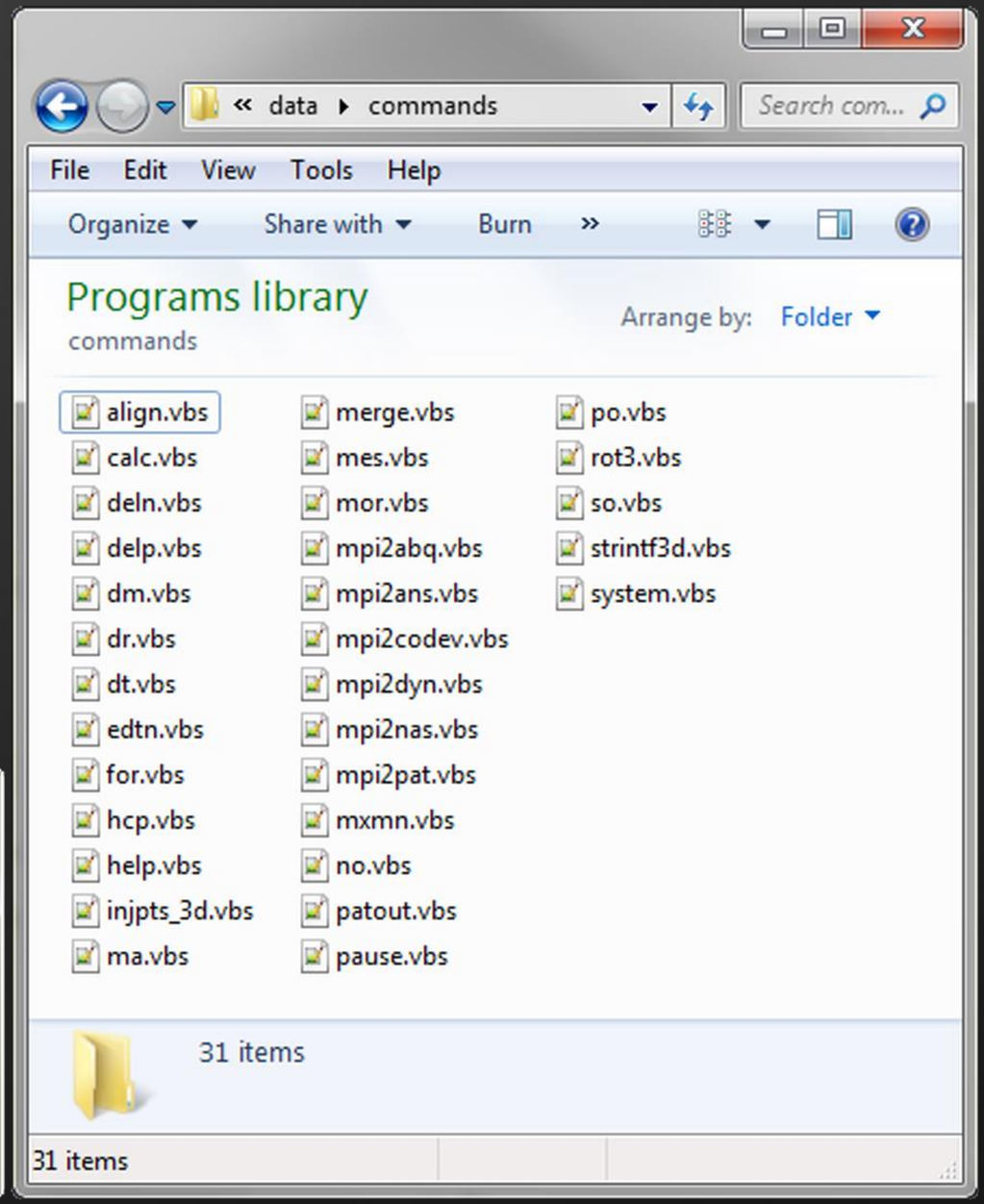
Command Line

- List of scripts in a “commands” folder
- Typically have input parameters
- Default locations
  - C:\Program Files\Autodesk\Simulation Moldflow Insight 2013\data\commands
  - ..\My ASMI 2013 Projects\commands





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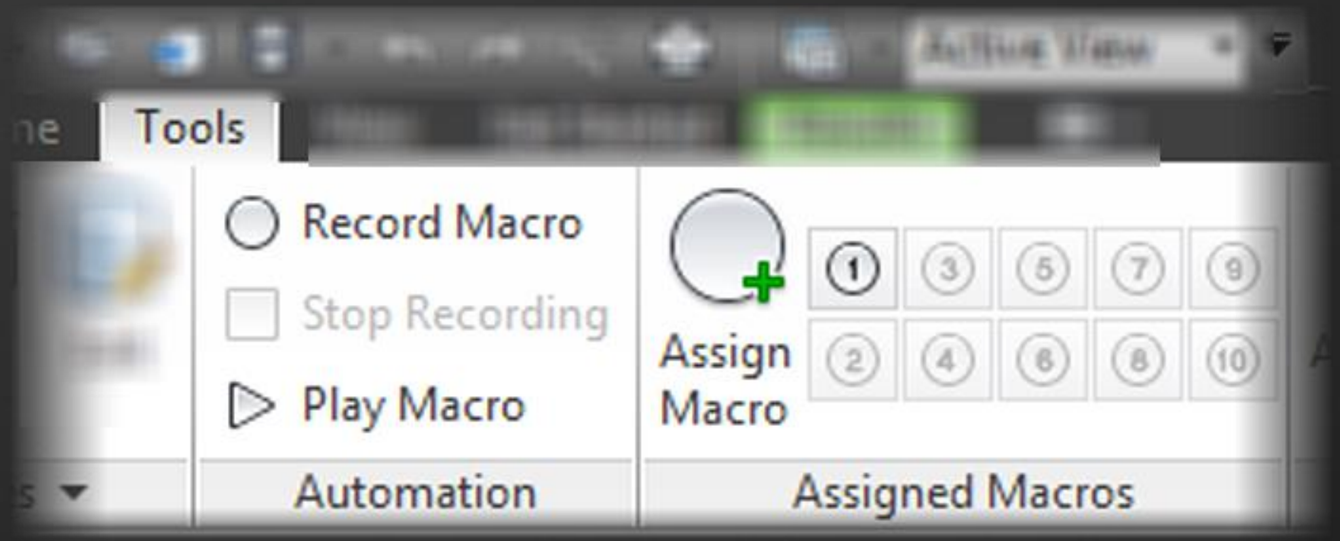
Macros

- Scripts manually executed
- Don’t have input at execution
- Default location of scripts
  - ..\My ASMI 2013 Projects\scripts
- Scripts can be in any folder
- Execute with Play Macro on Tools tab
- Can assign macros to a button for one click access



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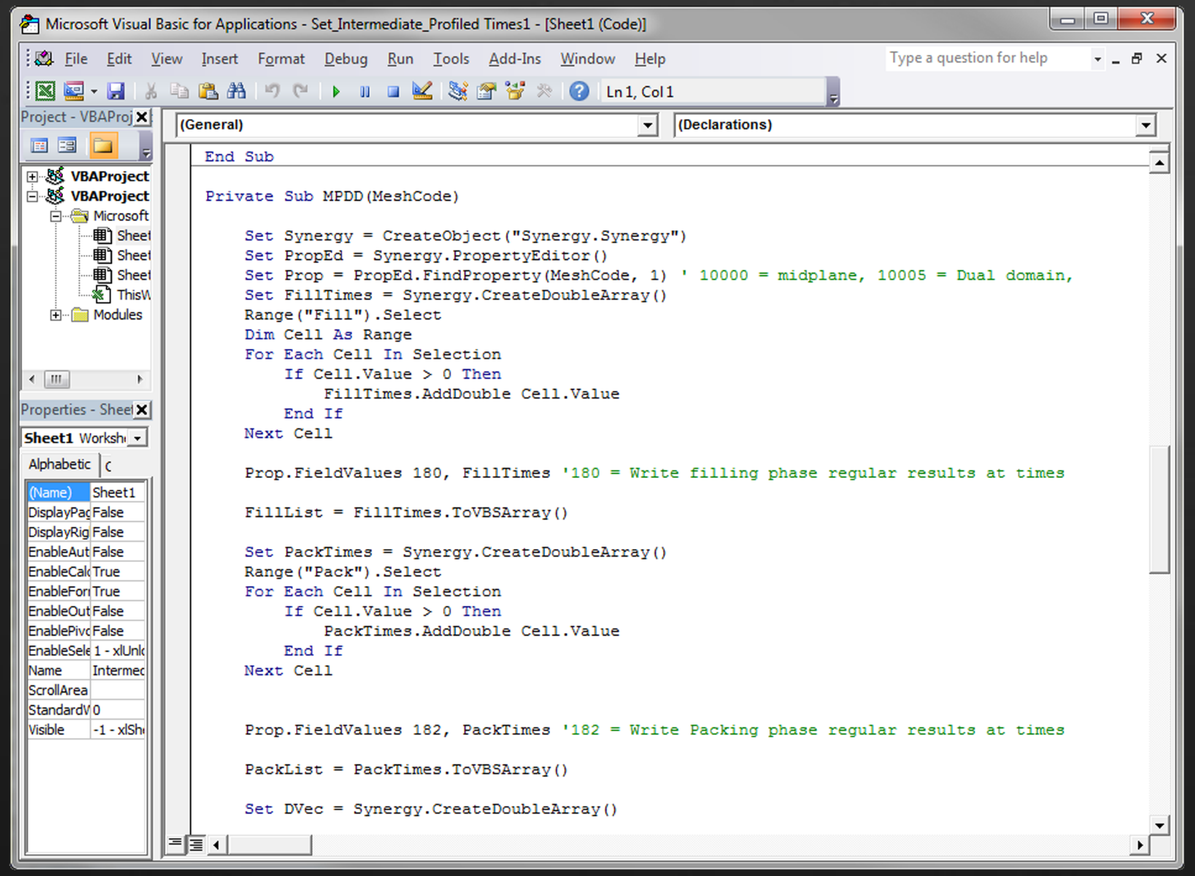
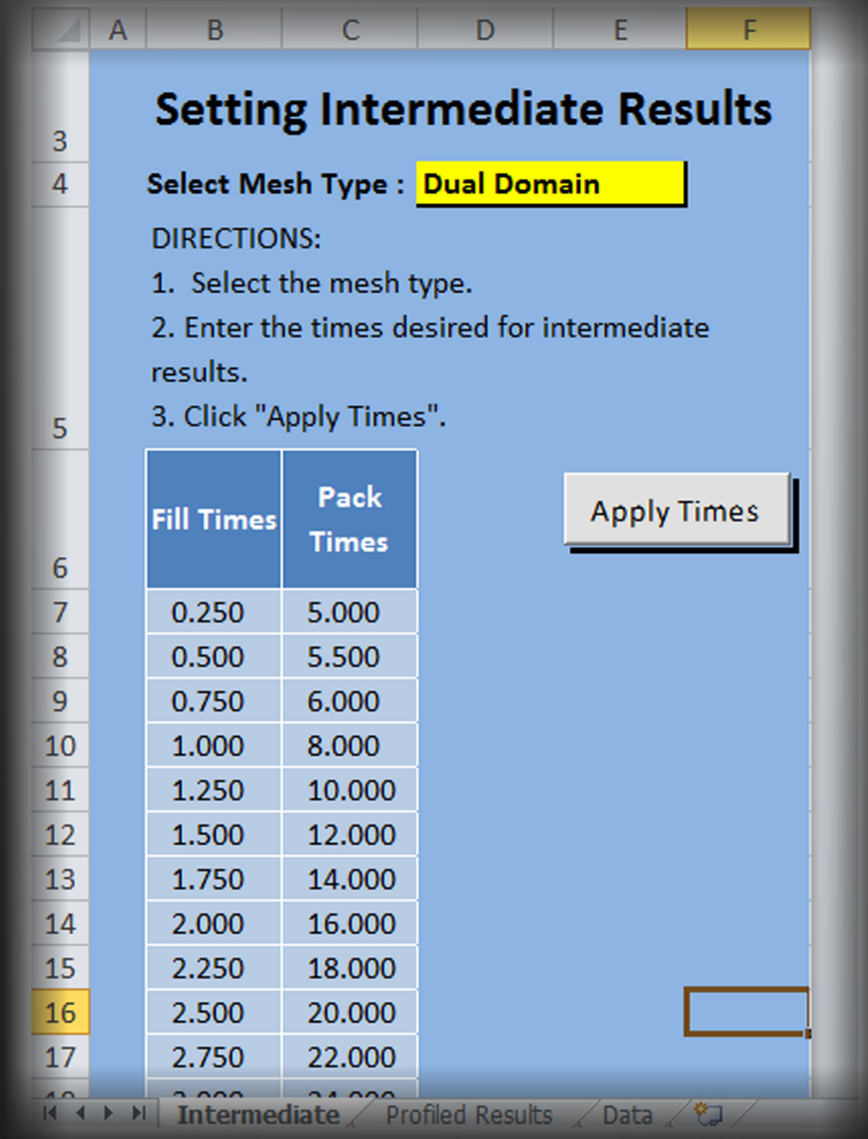
Macros in Other Applications

- Scripts written in Excel





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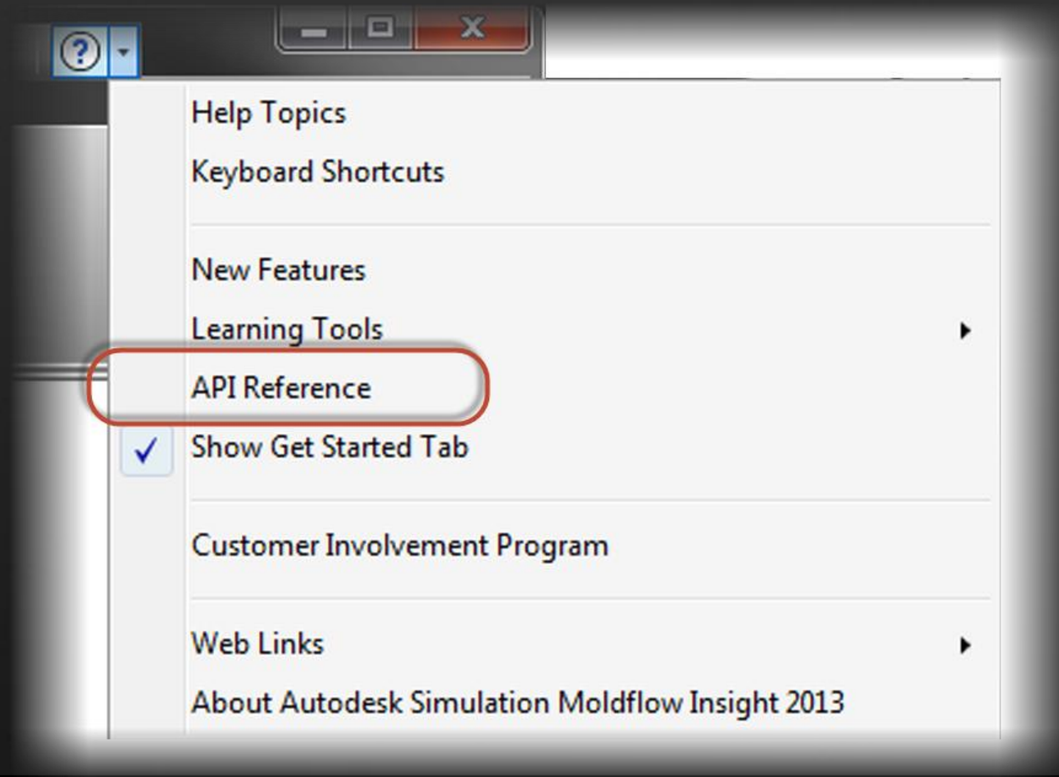
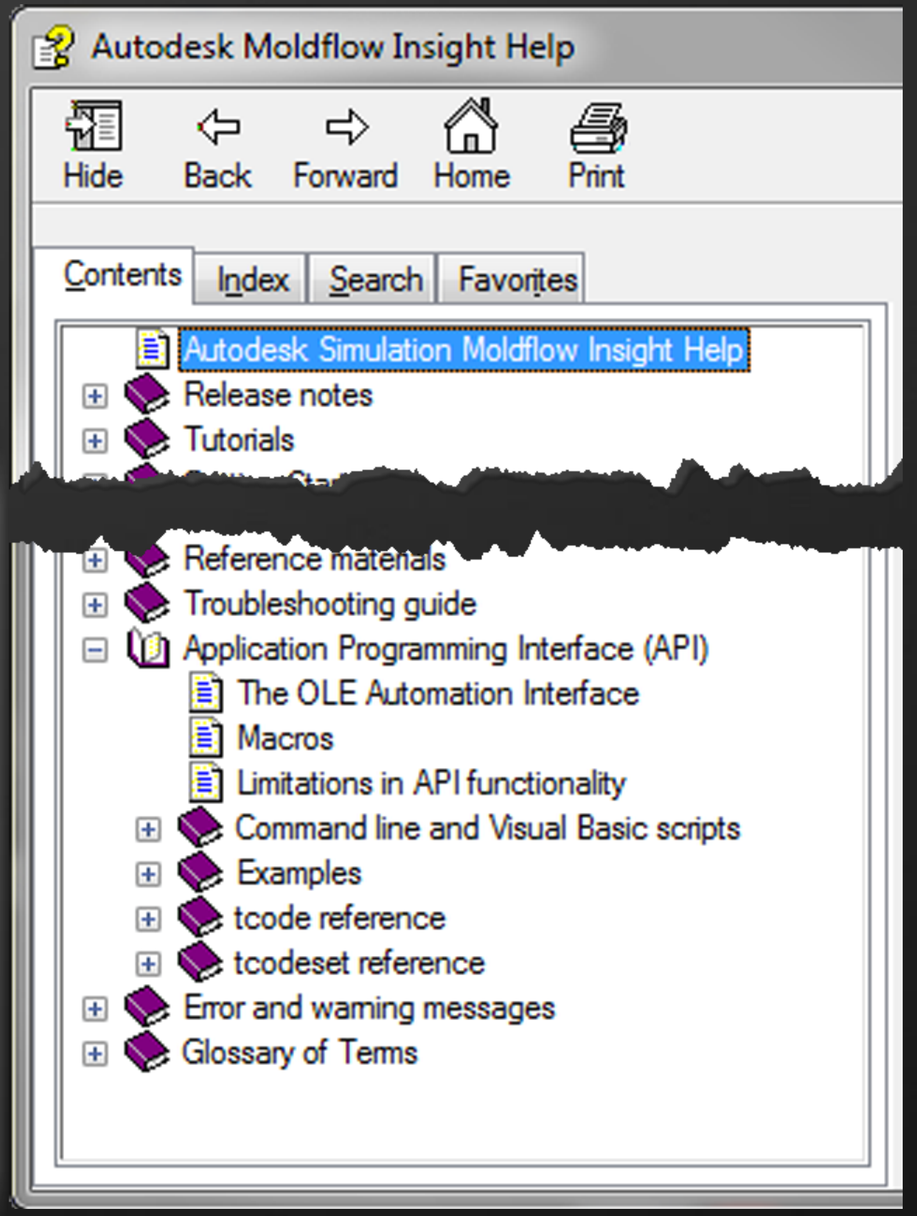
API Help

- API Reference
- Insight help contents - Application Programming Interface (API)





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Using Plots to Communicate

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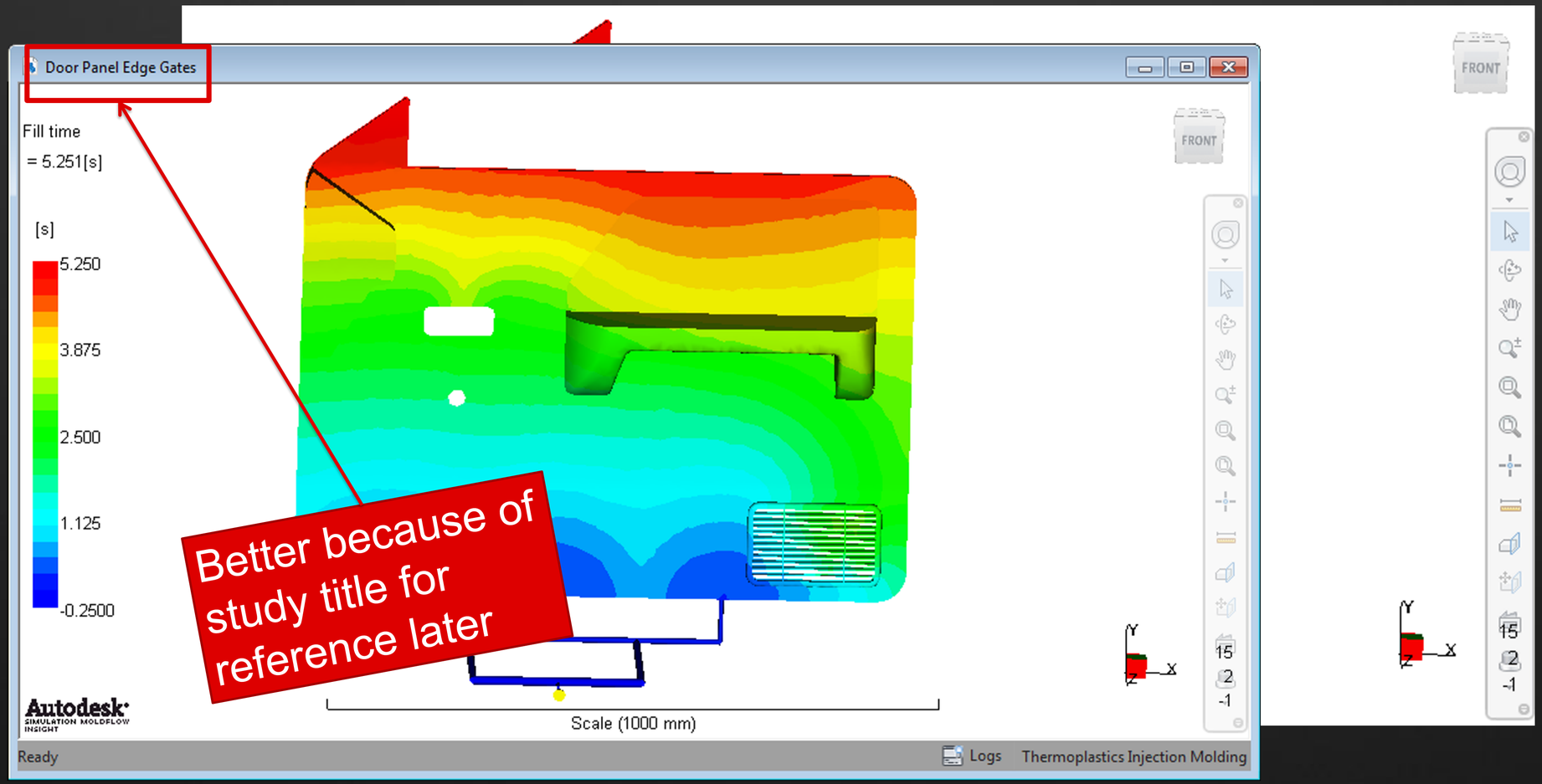
Quiz: What is the Problem with this Picture in a Report?



Sometimes clarity comes months, or even years after the report was written

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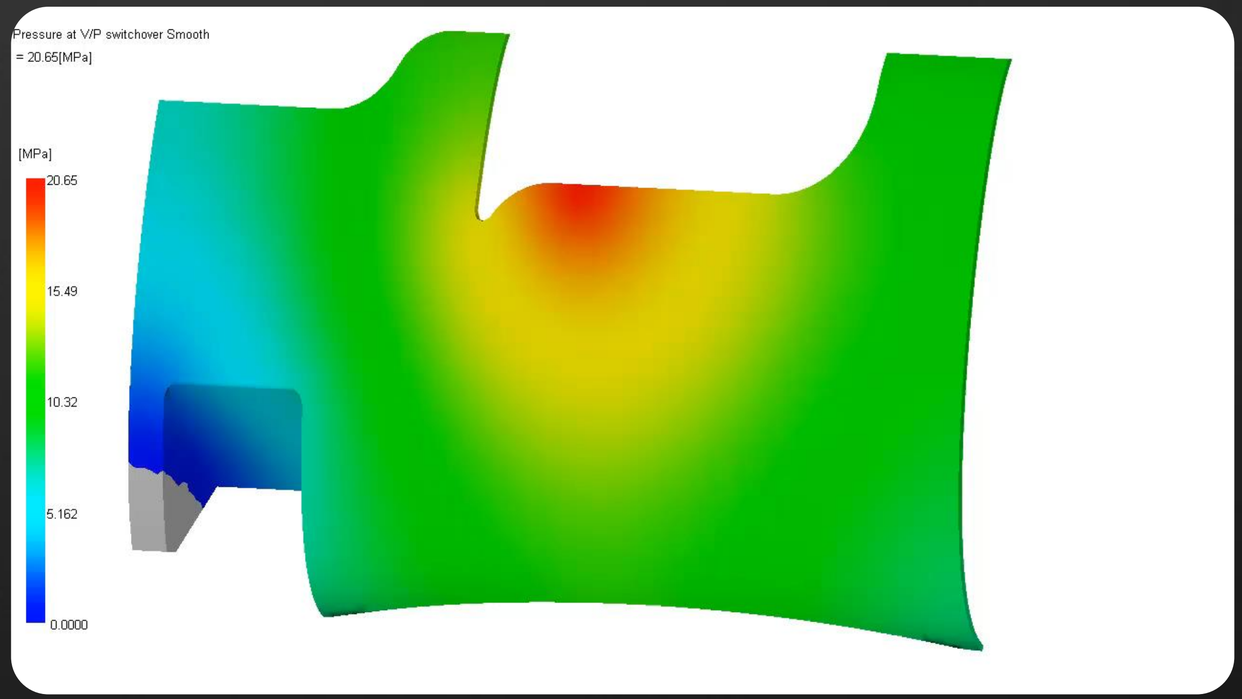
Shaded: Smooth vs Banded

- Shaded Smooth
  - Default for most results
  - Difficult to see gradients
  - Examine gives you precise values
- Shaded Banded
  - Easier to see gradients
  - Examine can give rounded easy to use values



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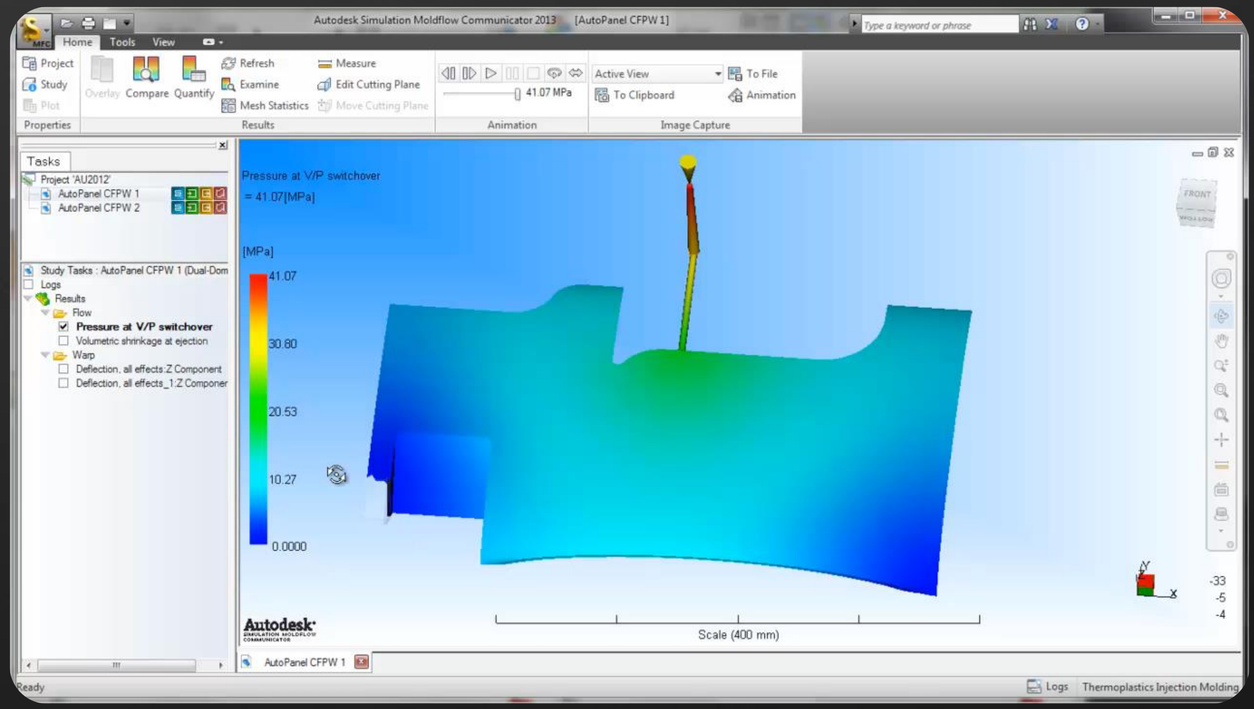
Viewing Results in Communicator

- Communicator is a great way to improve clarity to customers
  - They can rotate, pan and animate
- Results are exported with result plot modifications saved
- Can view 2 communicator studies at the same time (compare)
- Current hurdle with Communicator is file size. If they were small enough to email (>6Mb) I would be more likely to send out.



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Examples

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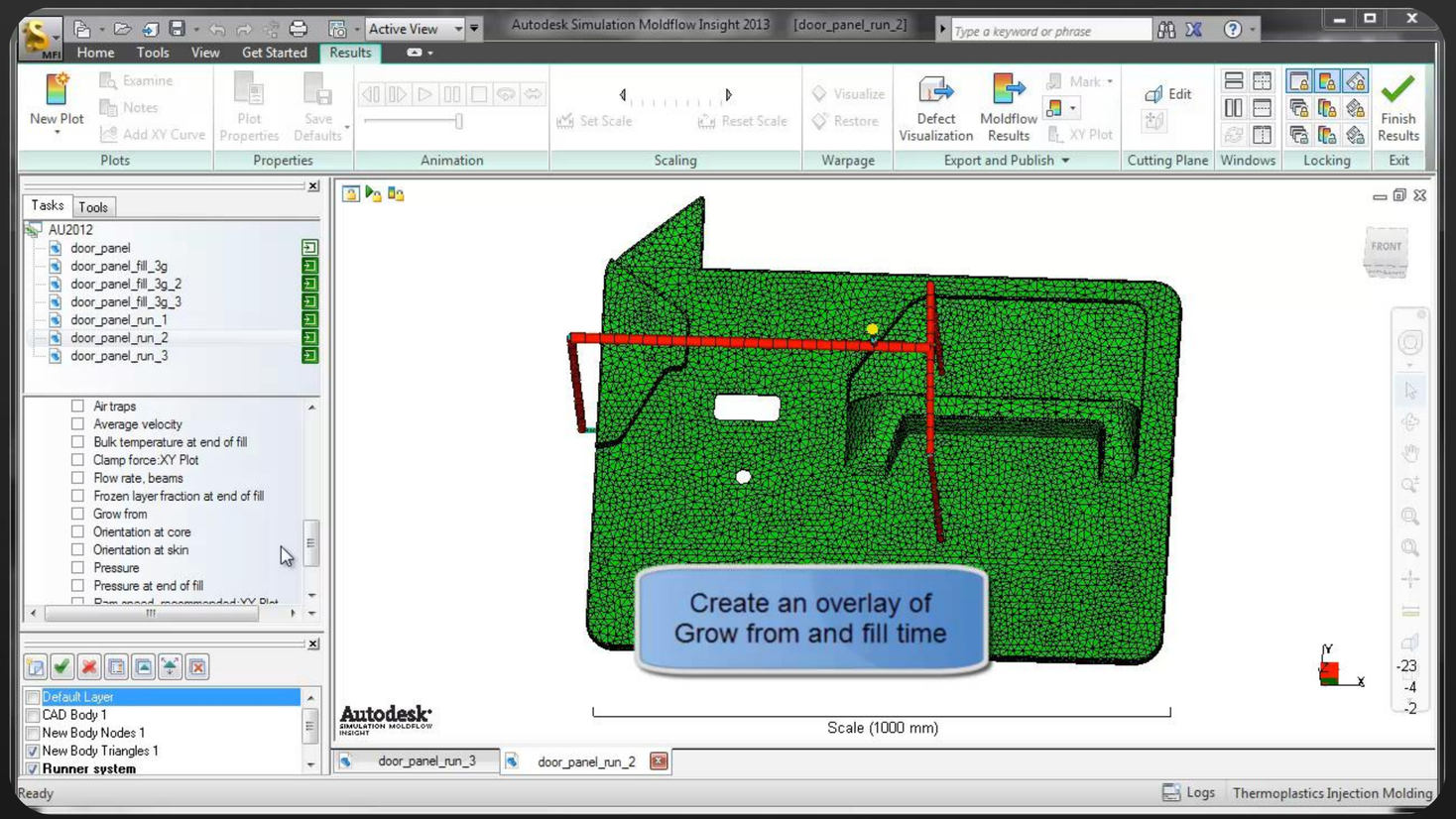
Example: Change the Display Overlay

- Display two results simultaneously on the model
  - Fill Time overlaid onto Grow From (contour)



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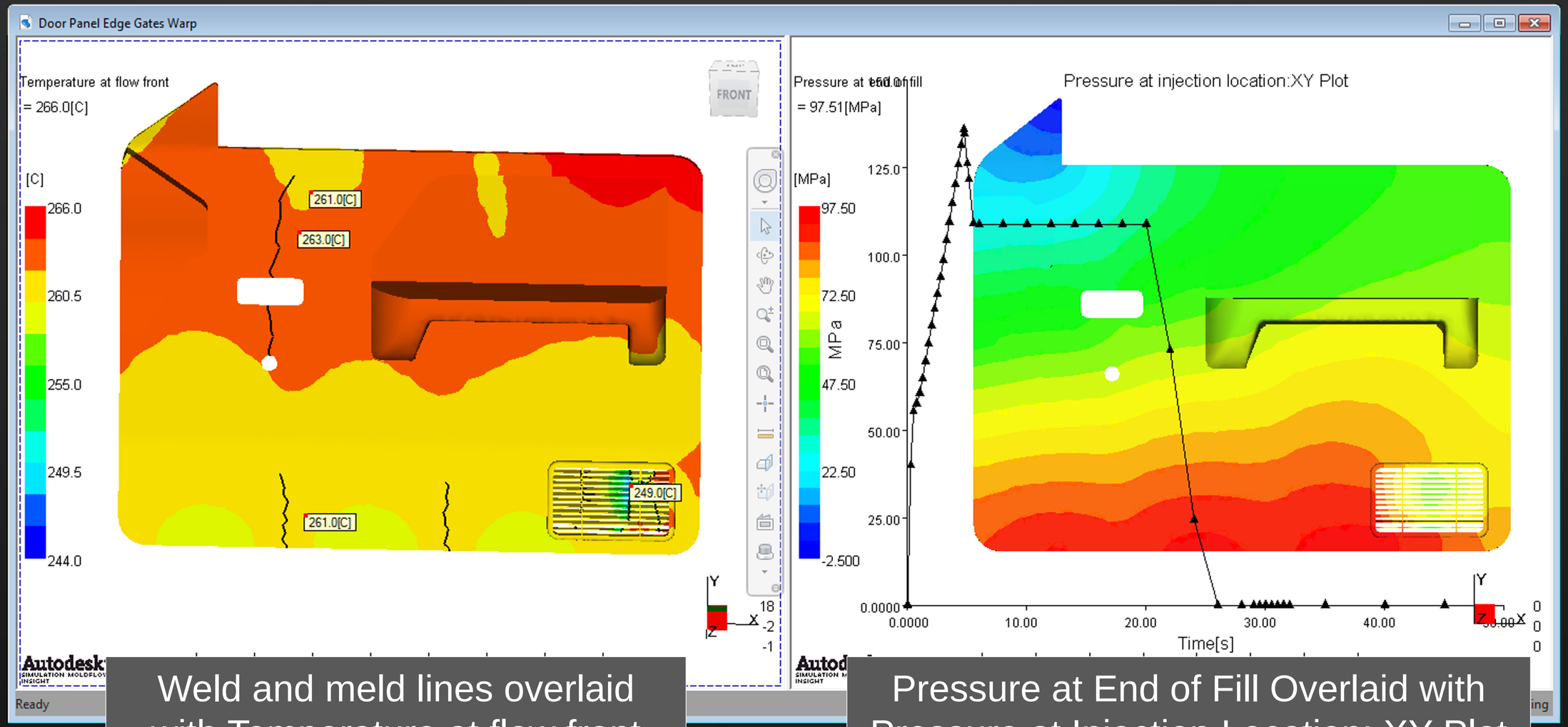
Example: Change the Display Overlay



Weld and meld lines overlaid with Temperature at flow front

Pressure at End of Fill Overlaid with Pressure at Injection Location: XY Plot

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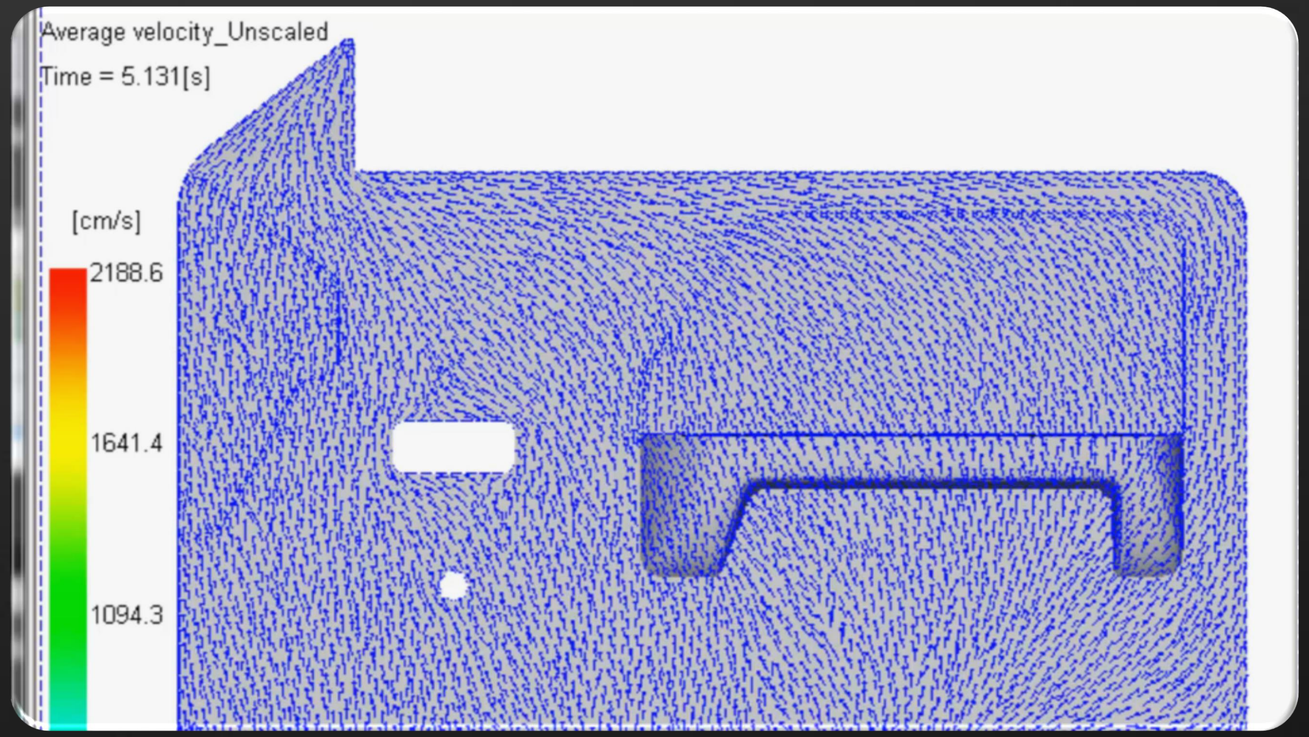
Example: Modifying Result Plots
Scaling to see useful results

- Average velocity
  - Useful information is at lower values.
  - Reduce maximum value to see variation necessary



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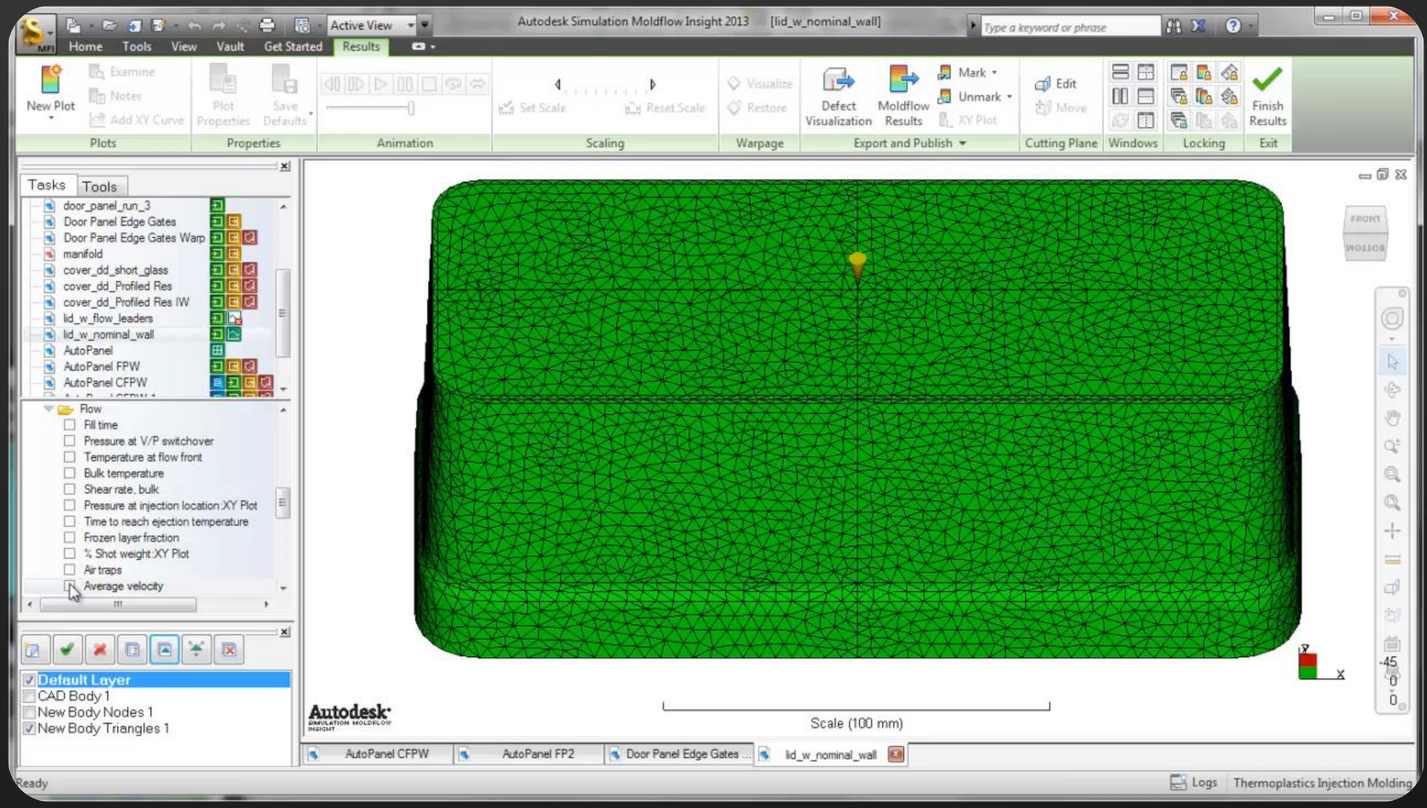
Example: Change the Display Overlay

- Fill time and average velocity
- See
  - Underflow
  - Velocity changes



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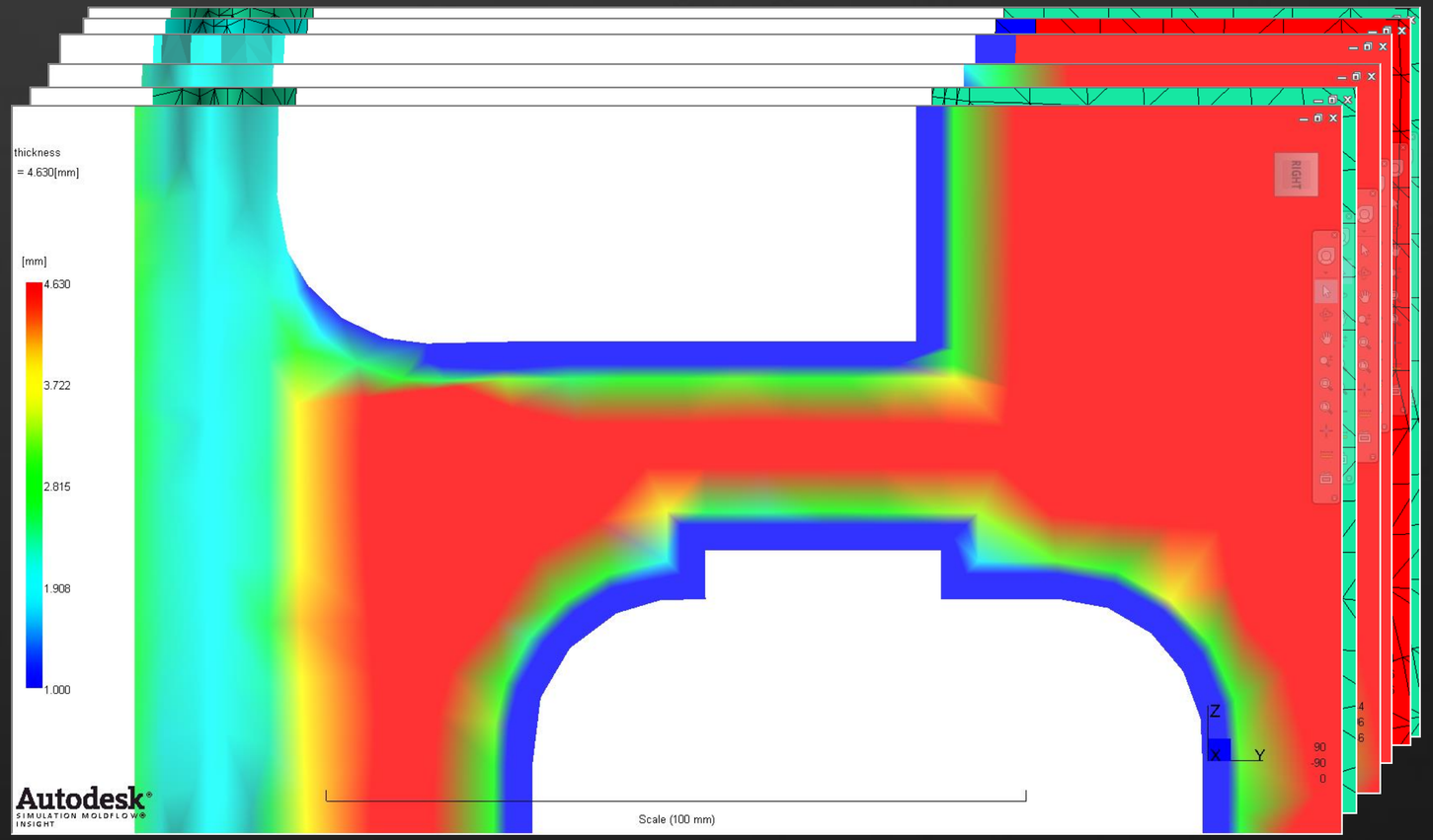
Example: Use Plot Automation Thickness Plot as a Result

- Command Line = calc thickness:mm @DIAG:thck:0:1000
  (Also available as script in help files)

- This allows you to turn nodal averaging on and off
- As a result it can now be included in a Communicator file for a customer to see



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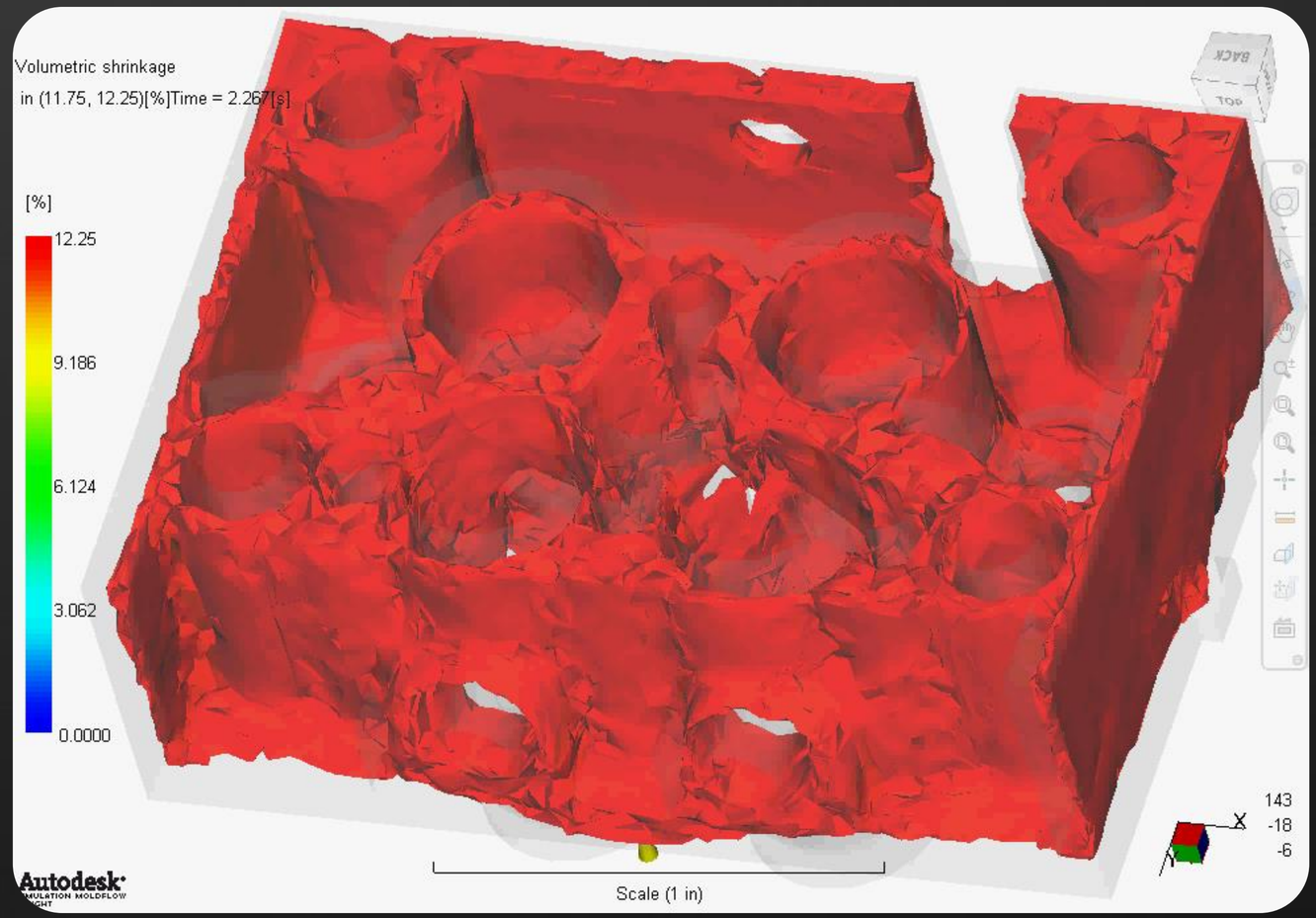
Example: Customizing Default Plot Volumetric shrinkage display

- Volumetric shrinkage 3d – scale for positive values, animation animate
- Change from time to single data set. Set value range to 1 or half, current frame only. (must change to contour instead of shaded.)



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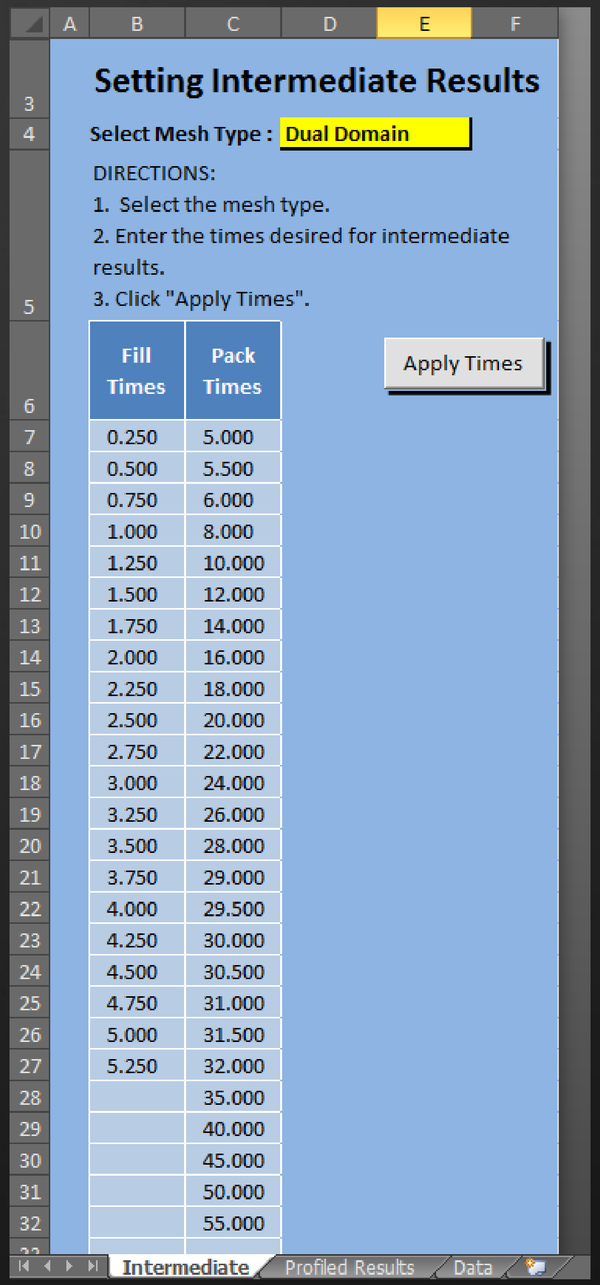
Example: Use Plot Automation - API Setting Intermediate Results

- Setting intermediate results – Excel spreadsheet

- Easy way to set intermediate times for results to be saved. Useful for looking in greater detail at specific events (ie weld line creation)



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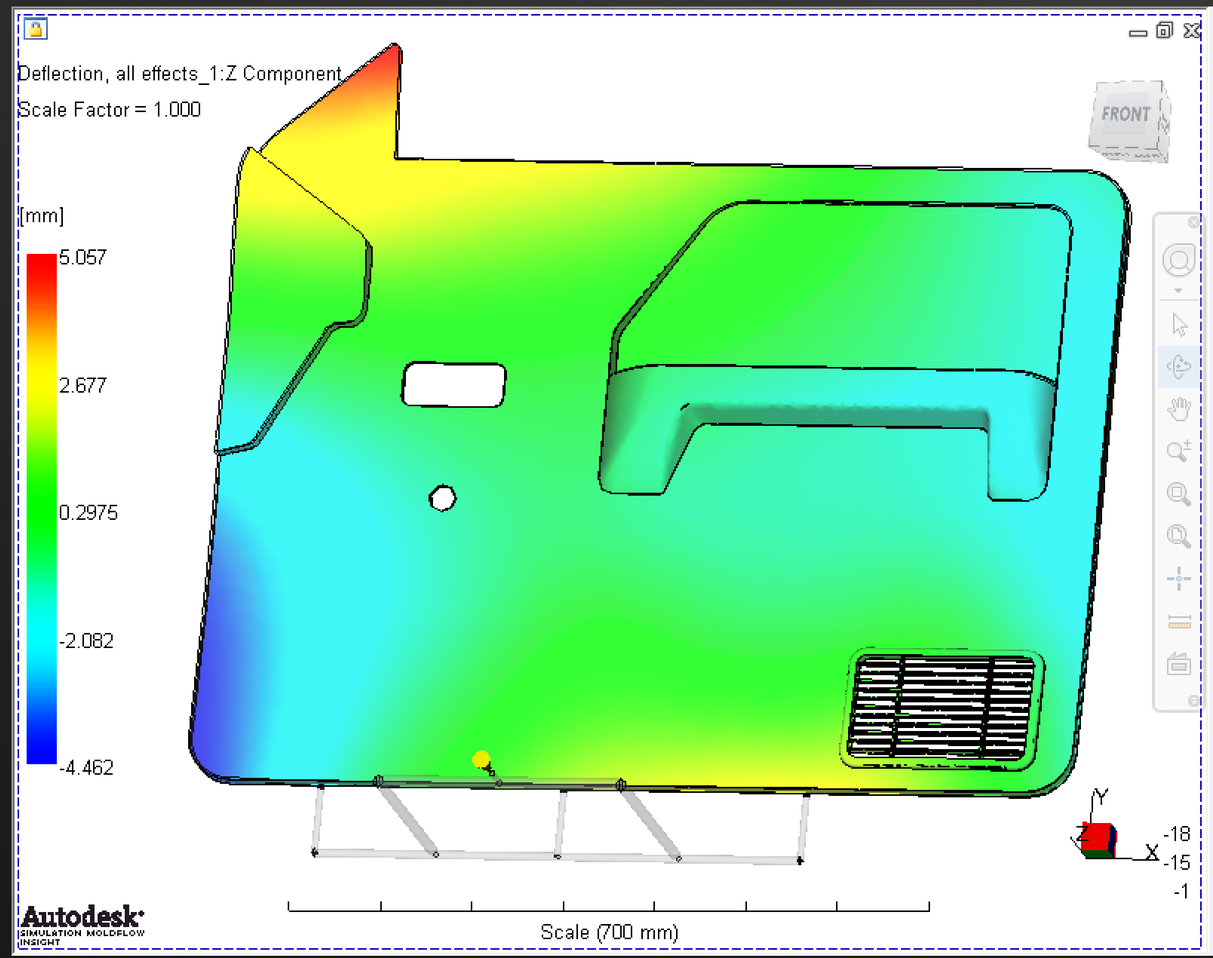
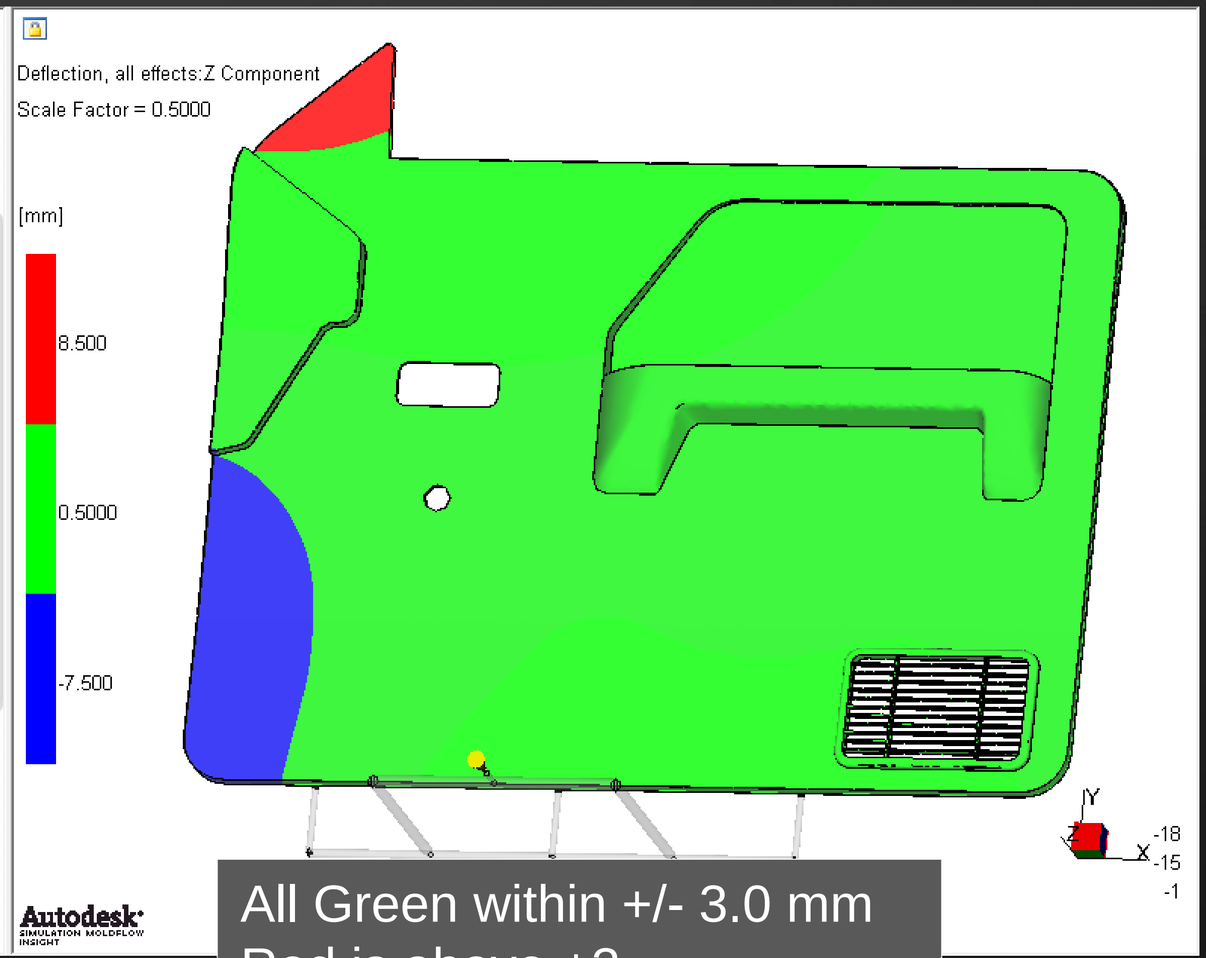
Example: Changing Display Options - Combining Scale and # of Bands to Show Overall Warpage





All Green within +/- 3.0 mm
Red is above +3
Blue is below -3

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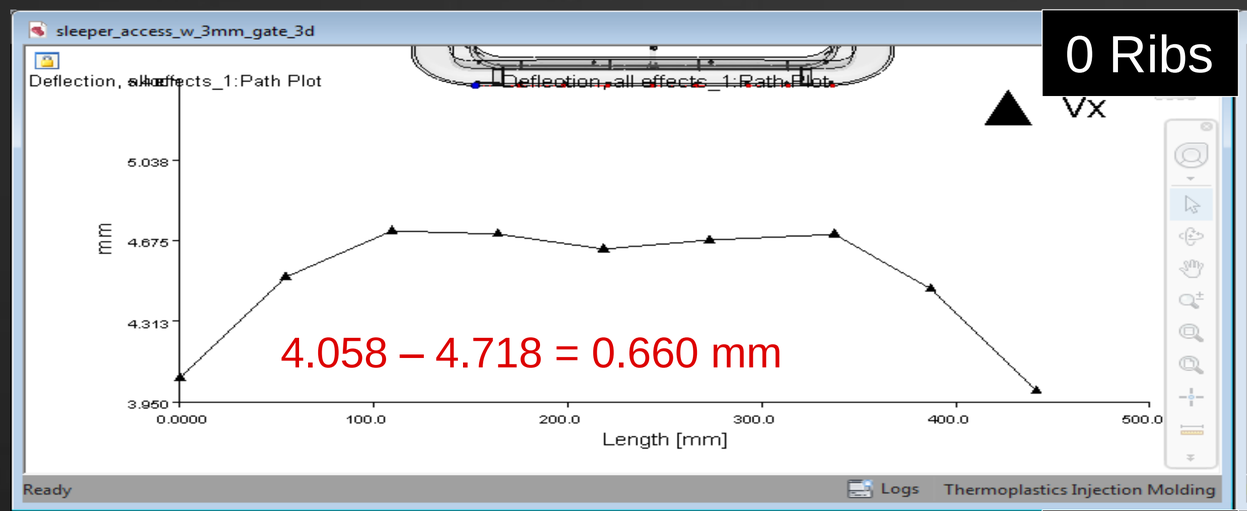
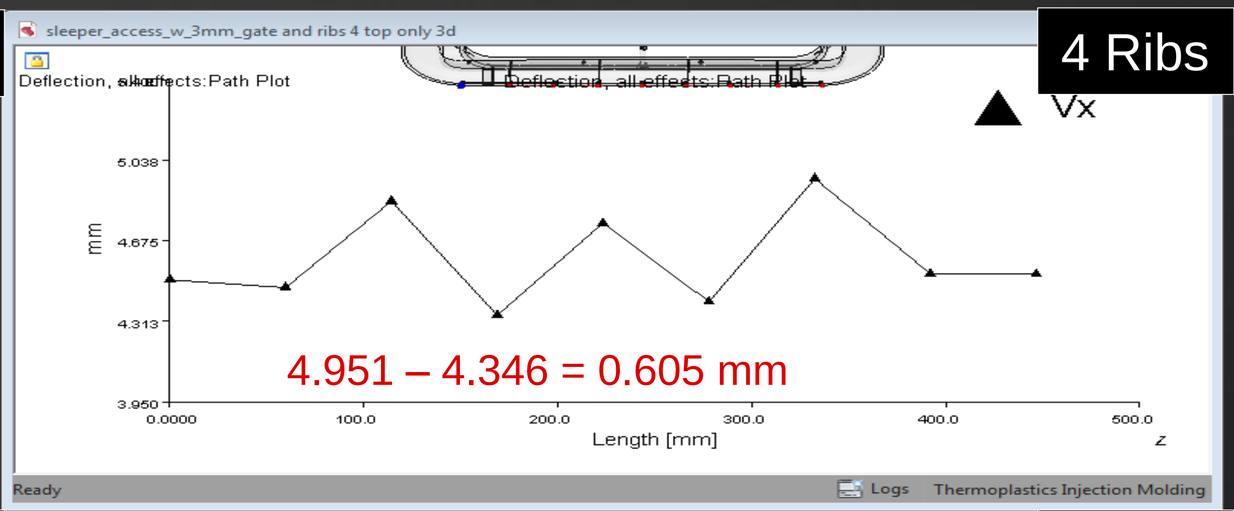
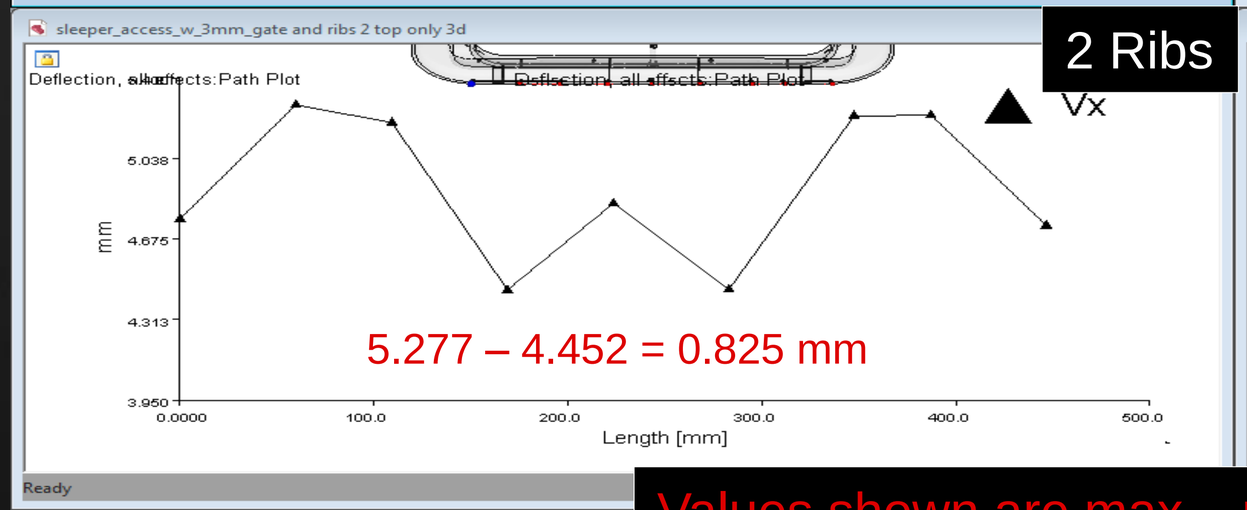
Example: New Plot Path Plot X Direction



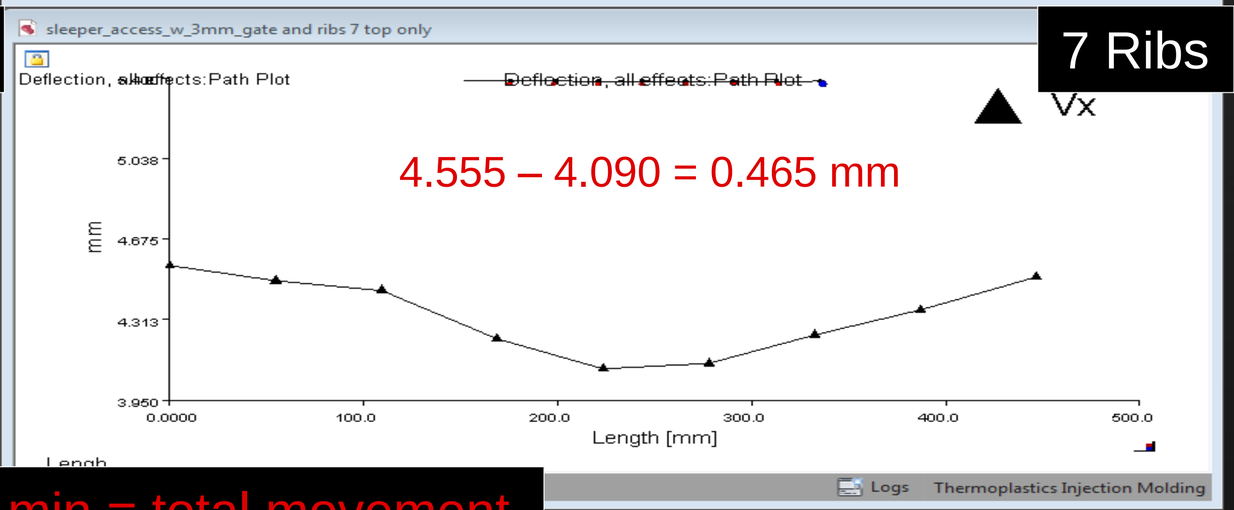
0 Ribs



4 Ribs



2 Ribs



7 Ribs

Values shown are max – min = total movement

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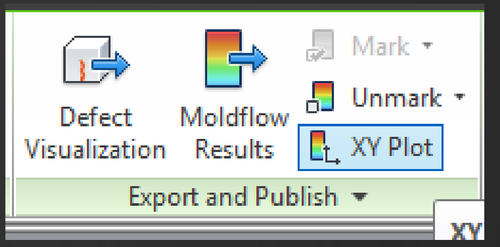
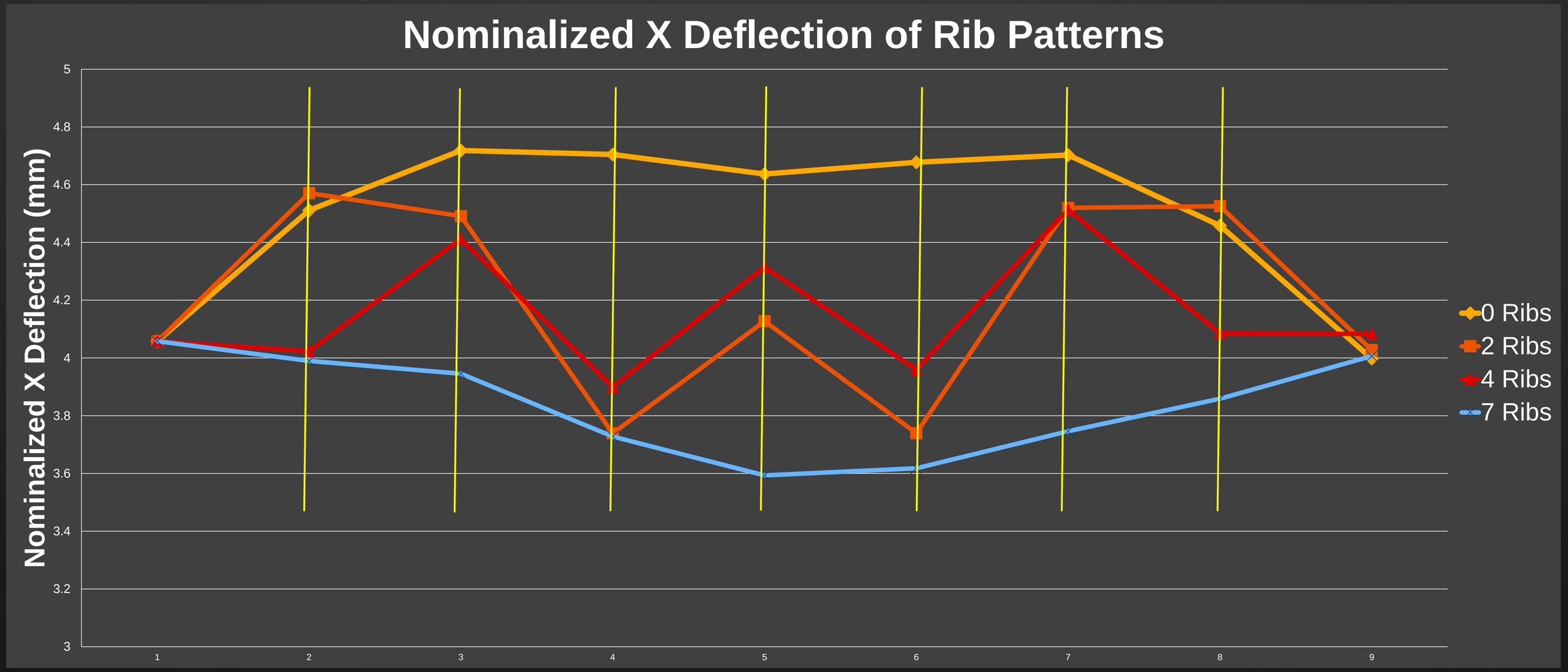
Example: New Plot
Path Plot X Direction – Nominalized in Excel





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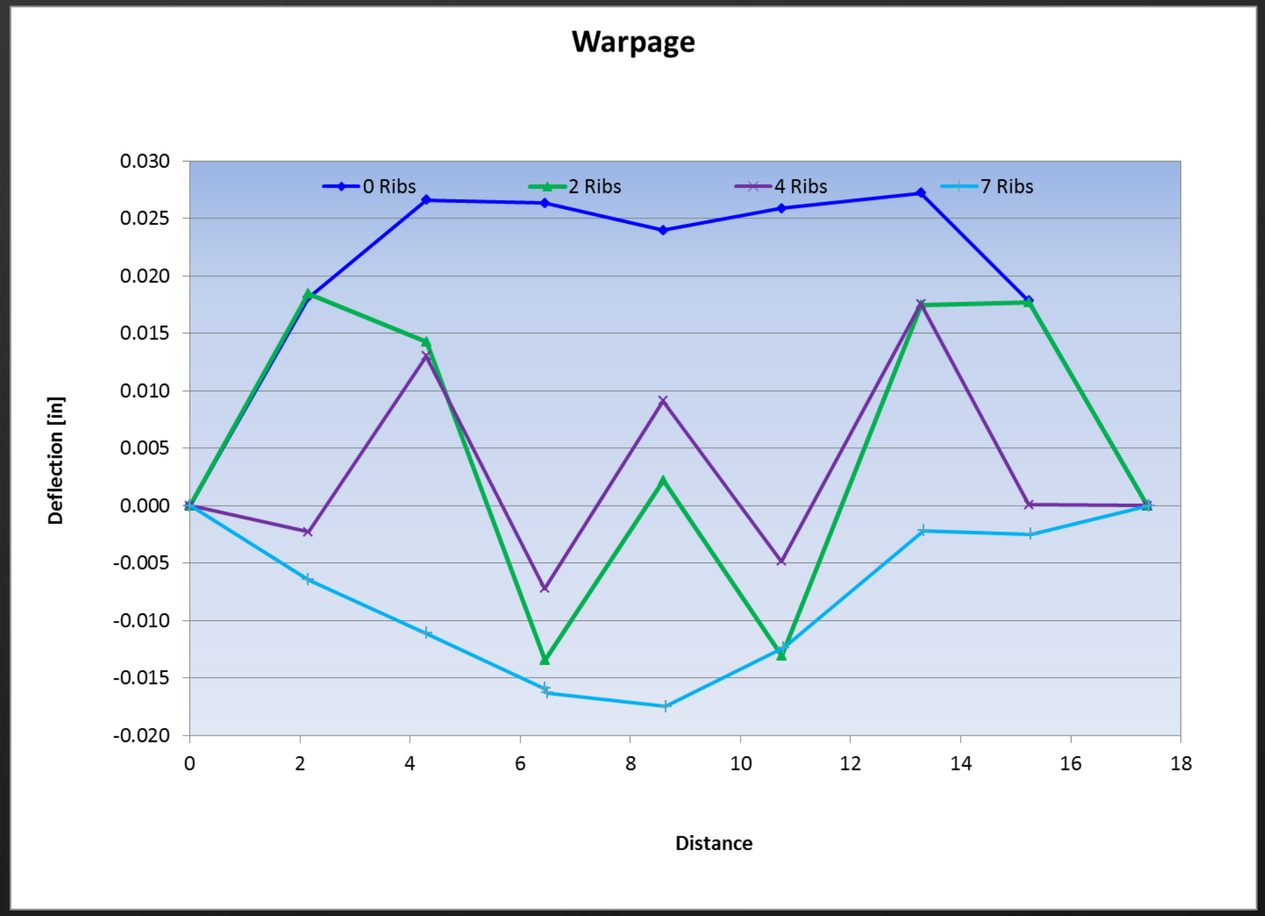
Example: Use Plot Automation - API XY Plot Creator

- Excel Macro to make extraction and plotting of XY charts easier

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
5		Max	0.000		Max	0.624		Max	0.436		Max	0.323		Max	0.000	
6		Diff	0.000		Diff	0.832		Diff	0.934		Diff	0.566		Diff	0.475	
7		Std Dev			Std Dev	0.289		Std Dev	0.335		Std Dev	0.215		Std Dev	0.174	
8		Avg			Avg	0.364		Avg	-0.012		Avg	-0.008		Avg	-0.245	
1		Save XY Plot Text File						Import XY Plot Text File						Test Code		
2		Dataset Start line 10			Dataset Start line 10			Dataset Start line 10			Dataset Start line 10			Dataset Start line 10		
3																
4		Min	0.000		Min	-0.208		Min	-0.498		Min	-0.242		Min	-0.475	
5		Max	0.000		Max	0.624		Max	0.436		Max	0.323		Max	0.000	
6		Diff	0.000		Diff	0.832		Diff	0.934		Diff	0.566		Diff	0.475	
7		Std Dev			Std Dev	0.289		Std Dev	0.335		Std Dev	0.215		Std Dev	0.174	
8		Avg			Avg	0.364		Avg	-0.012		Avg	-0.008		Avg	-0.245	
9																
10					Dist [mm]	0 Ribs		Dist [mm]	2 Ribs		Dist [mm]	4 Ribs		Dist [mm]	7 Ribs	
11					0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
12					54.574	0.435		54.574	0.436		54.574	-0.078		54.574	-0.172	
13					109.148	0.624		109.148	0.295		109.148	0.291		109.148	-0.297	
14					163.721	0.592		163.721	-0.442		163.721	-0.242		163.734	-0.428	
15					218.295	0.506		218.295	-0.077		218.295	0.153		164.893	-0.438	
16					272.869	0.528		272.869	-0.498		272.869	-0.222		219.467	-0.475	
17					337.366	0.532		337.366	0.237		337.366	0.323		274.041	-0.353	
18					386.978	0.271		386.978	0.212		386.978	-0.138		338.537	-0.104	
19					441.606	-0.208		441.606	-0.270		441.606	-0.160		388.150	-0.119	
20														442.778	-0.063	
21																



CASCADE engineering
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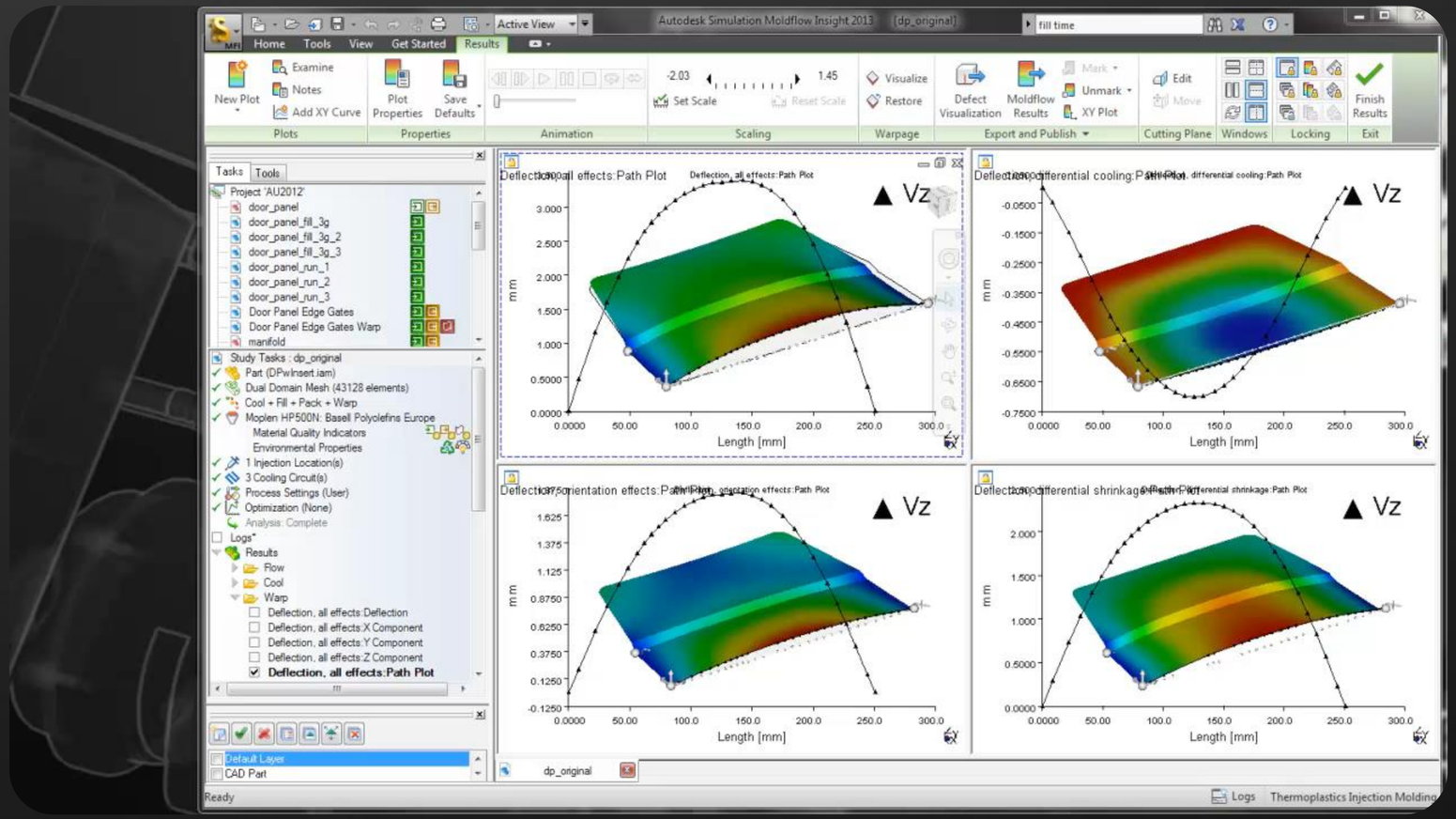
Example: Use Plot Automation - API Using Excel with API

- Excel template create for plotting XY data from Synergy
- Helps
  - Export from Synergy
  - Import txt file of XY data
  - Automatically graphs data



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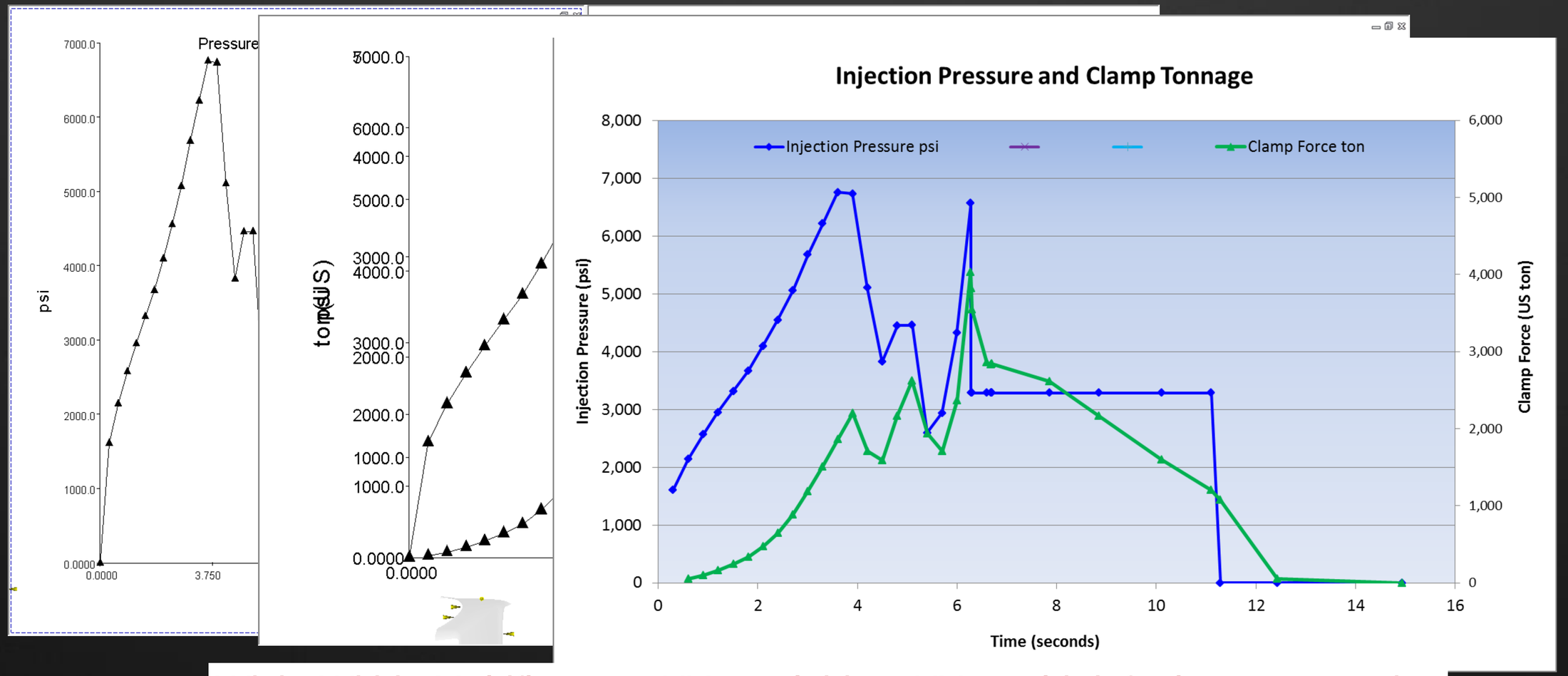
Example: Changing Display Options
Injection Pressure overlaid with Clamp Tonnage



Wish: Within Moldflow any XY overlaid on XY would default as a two axis chart with two colors.

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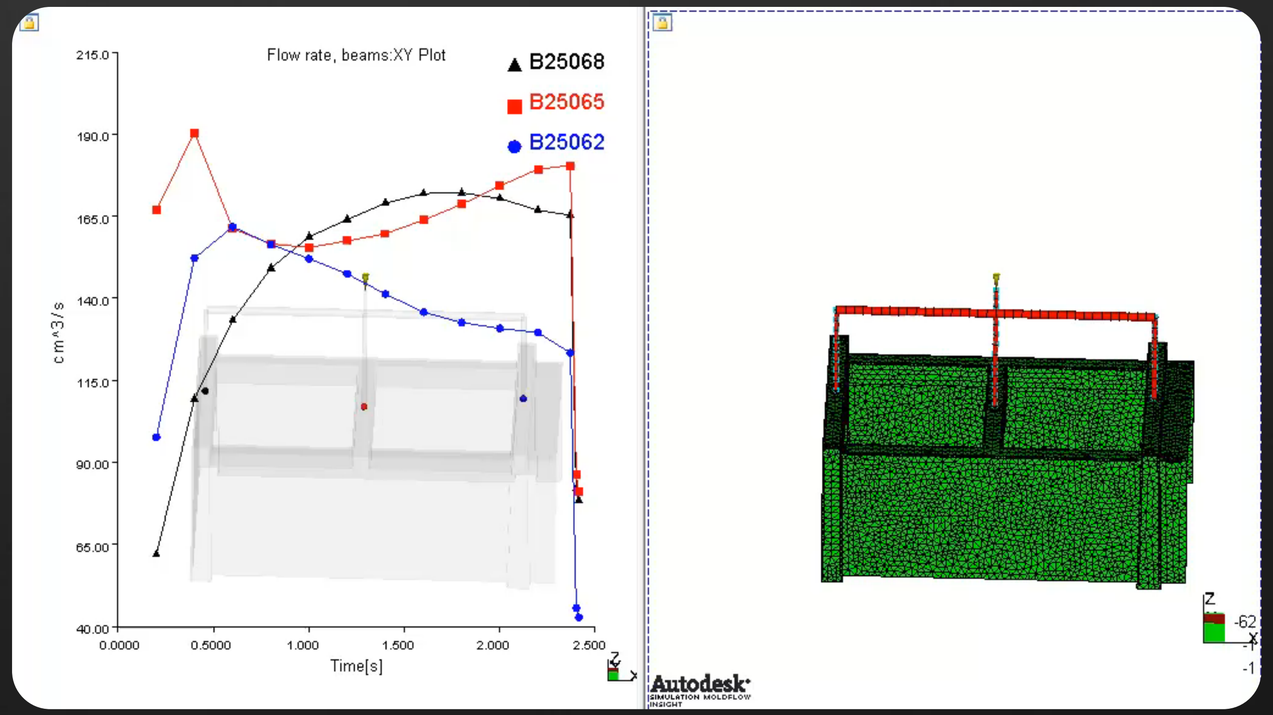
Example: Changing Display Options Split screen with XY Plot and Path Plot

- Animate XY data when looking at multi-drop systems to understand flow through each drop

- Helps to design a more balanced system



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Example: Use Plot Automation - API Jay's Cool Tool

- Easy way to set plots with uniform bands for clarity in presenting results
- Go ahead Jay, show 'em what they've won

Opaque Background and Feature Lines

Off All Plot | Off Active Plot | On Active Plot

Set Nodal Averaging Active Plot

Off | On

Simple Result Scale Active Plot

Maximum	118	Set Scale	Contour Line
Minimum	103	Reset Scale	Banding
Extended Color (T/F)	F		Shaded

Scale All Deflection Variants

Maximum	3.96	Set Scale
Minimum	-5.41	
Extended Color (T/F)	T	Reset Scale
Component	Z	

Set Asymmetric Banded Scale Active Plot

Original settings		Settings w even Query	
Maximum	20.00	Maximum	20.50
Minimum	0.00	Minimum	-0.50
Difference	20.00		
Manually set increment	1.00	Half increment	0.50
Number of bands	20.00	Number of bands	21.0
Extended Color (T/F)	F	Orig Scale	Query Scale

Set Symmetric Banded Scale Active Plot

Original settings		Settings w even Query	
Symmetric Value	15.00		
Maximum	15.00	Maximum	15.5
Minimum	-15.00	Minimum	-15.5
Difference	30.00		
Manually set increment	1	Half increment	0.5
Number of bands	30	Number of bands	31
Extended Color (T/F)	F		Set Scale

Set Asymmetric Banded Scale for All Deflection Variants

Original settings		Settings w even Query	
Maximum	0.05	Maximum	0.08
Minimum	-0.65	Minimum	-0.68
Difference	0.70		
Manually set increment	0.05	Half increment	0.03
Number of bands	14.00	Number of bands	15.0
Extended Color (T/F)	T	Set Scale	
Component	Z	Reset Scale	

Show part or results within a tolerance Green is within tolerance

Maximum	2.00	Set Tolerance	Reset Plot
Minimum	-2		

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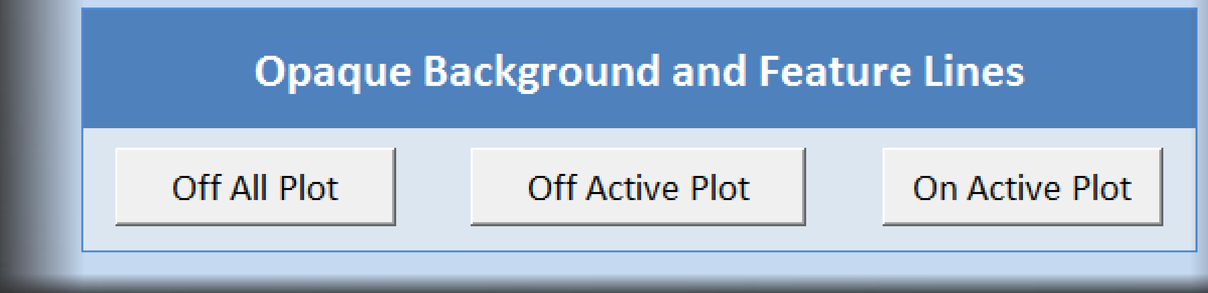
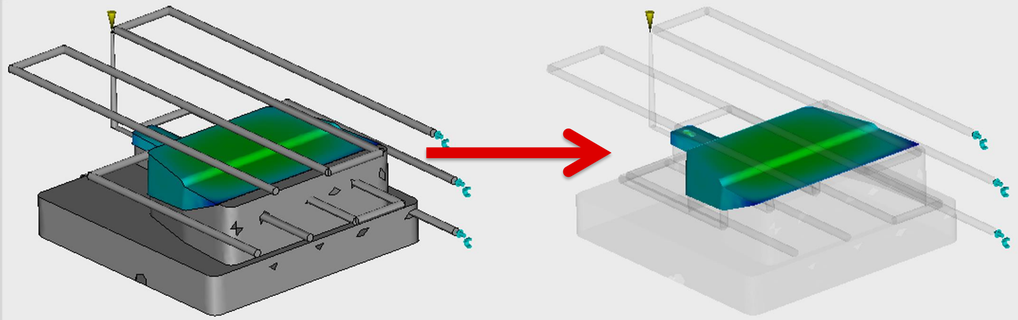
Example: Use Plot Automation - API Plot Background

- Makes all plots in the study have a transparent background and turns off feature lines.
- Does the above to the active plot
- Makes the active plot have a solid background and feature lines





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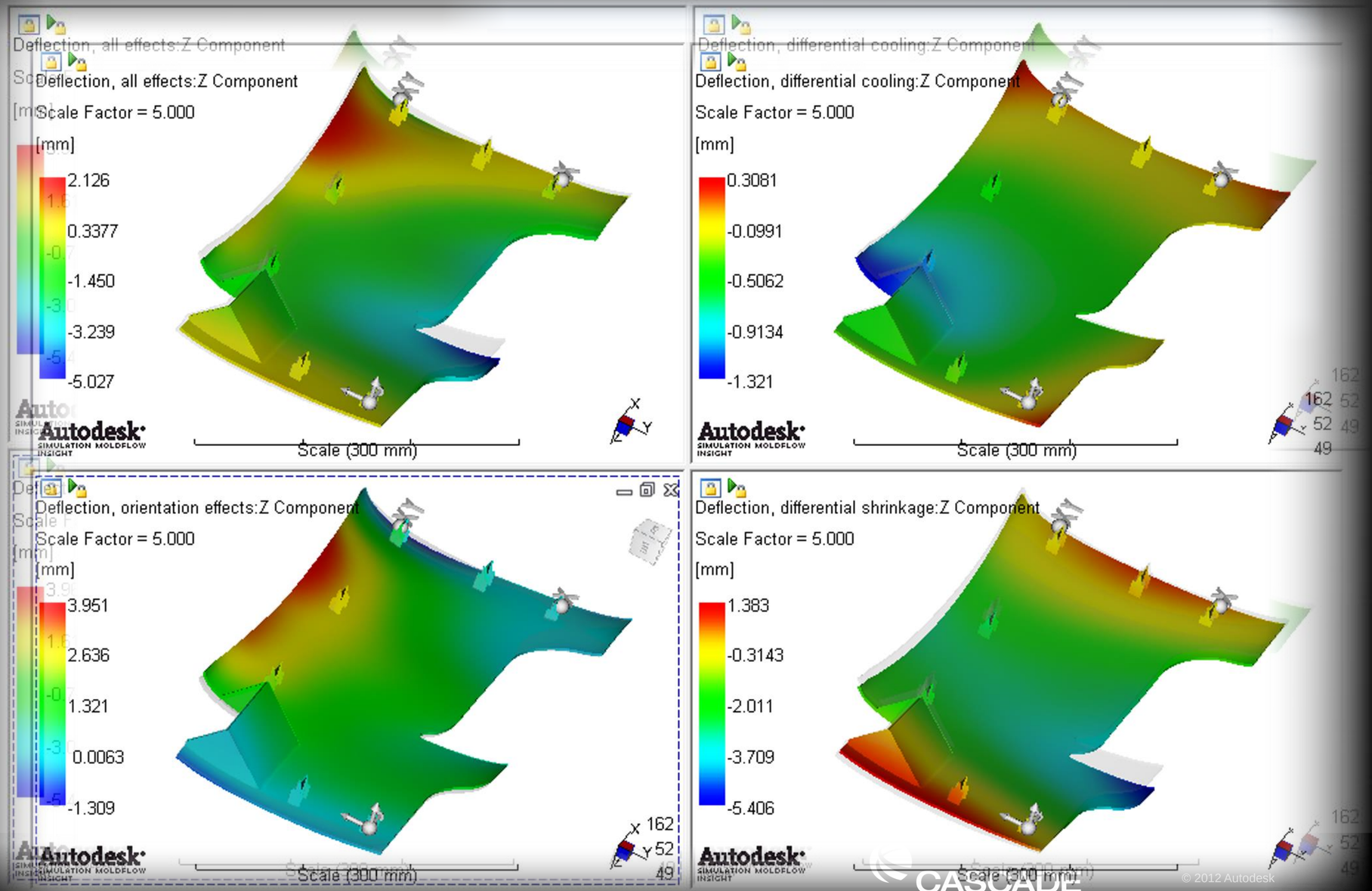
Example: Use Plot Automation - API Deflection Scale

- Set the deflection scale on all deflection plots at one time



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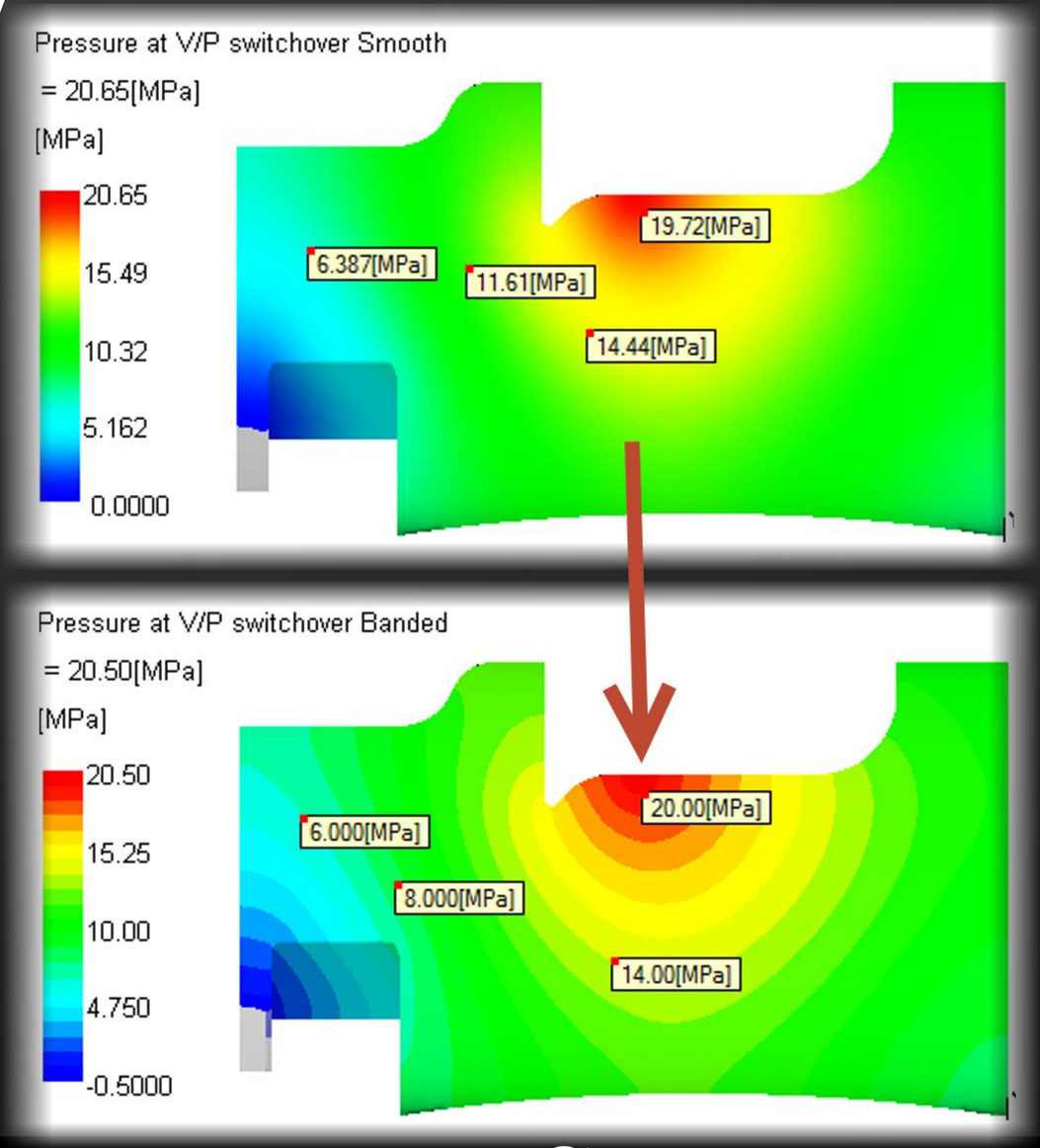
Example: Use Plot Automation - API Banded and Scaled Display

- Set scale and band increment
- Ensure # of bands a whole number
- Version for all deflection plots too

Set Asymmetric Banded Scale Active Plot			
Original settings		Settings w even Query	
Maximum	20.00	Maximum	20.50
Minimum	0.00	Minimum	-0.50
Difference	20.00		
Manually set increment	**1.00**	Half increment	0.50
Number of bands	20.00	Number of bands	21.0
Extended Color (T/F)	F	Orig Scale	Query Scale



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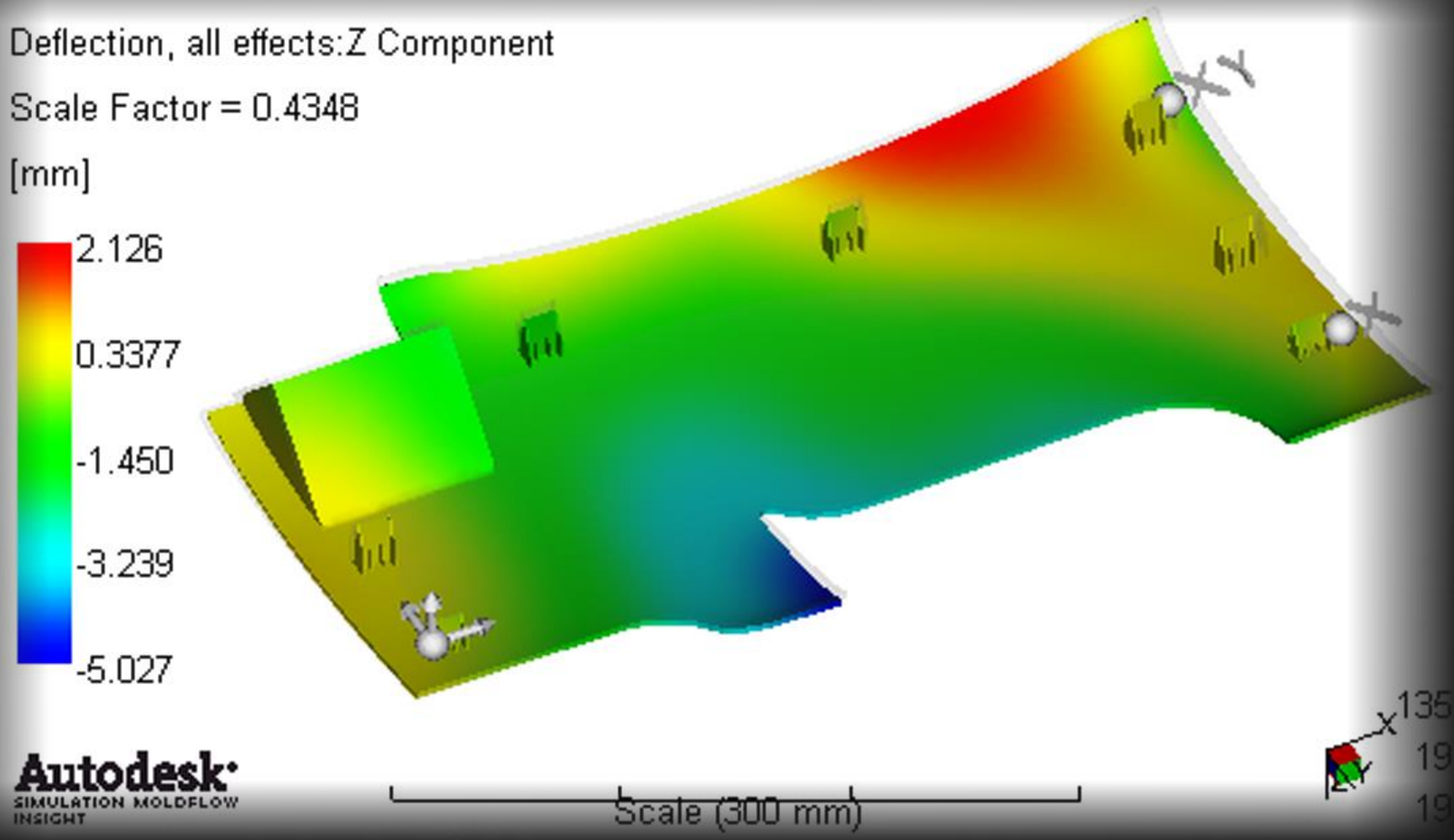
Example: Use Plot Automation - API Within Tolerance?

- What portion of this part is NOT within tolerance +/- 2.0 mm?



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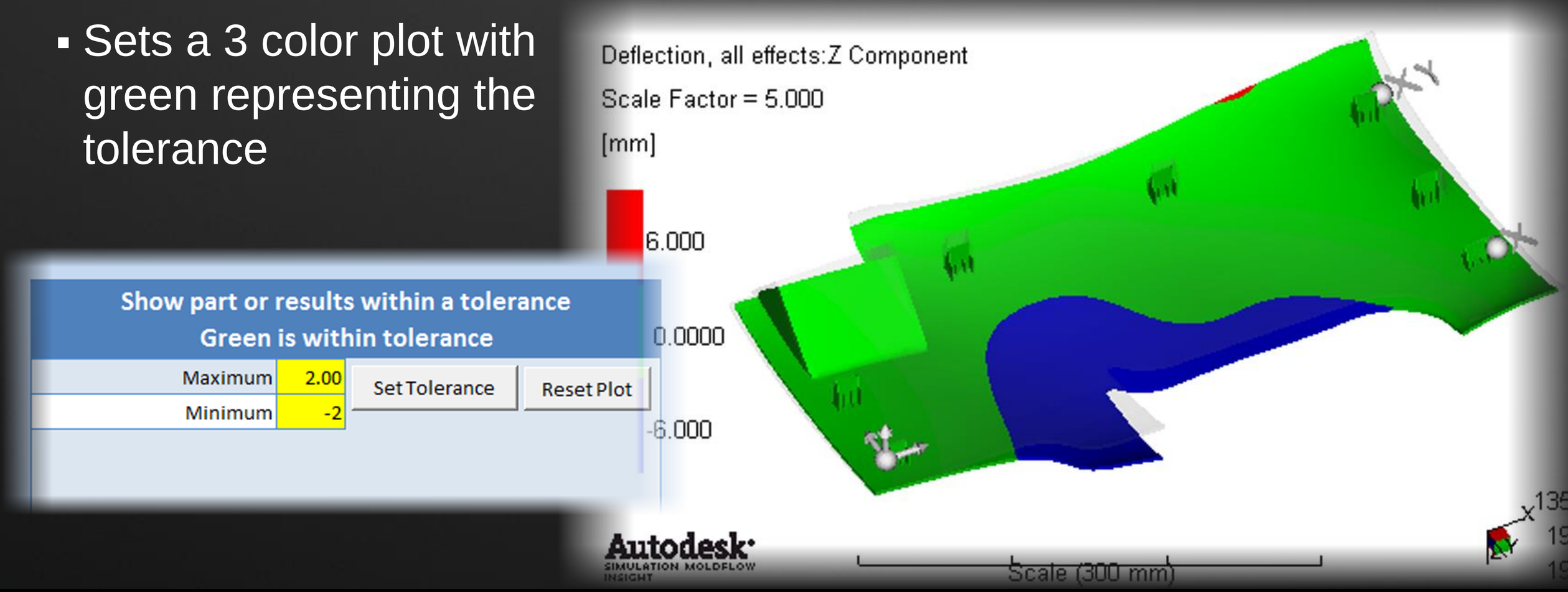
Example: Use Plot Automation - API Within Tolerance

- Set tolerance limits
- Sets a 3 color plot with green representing the tolerance



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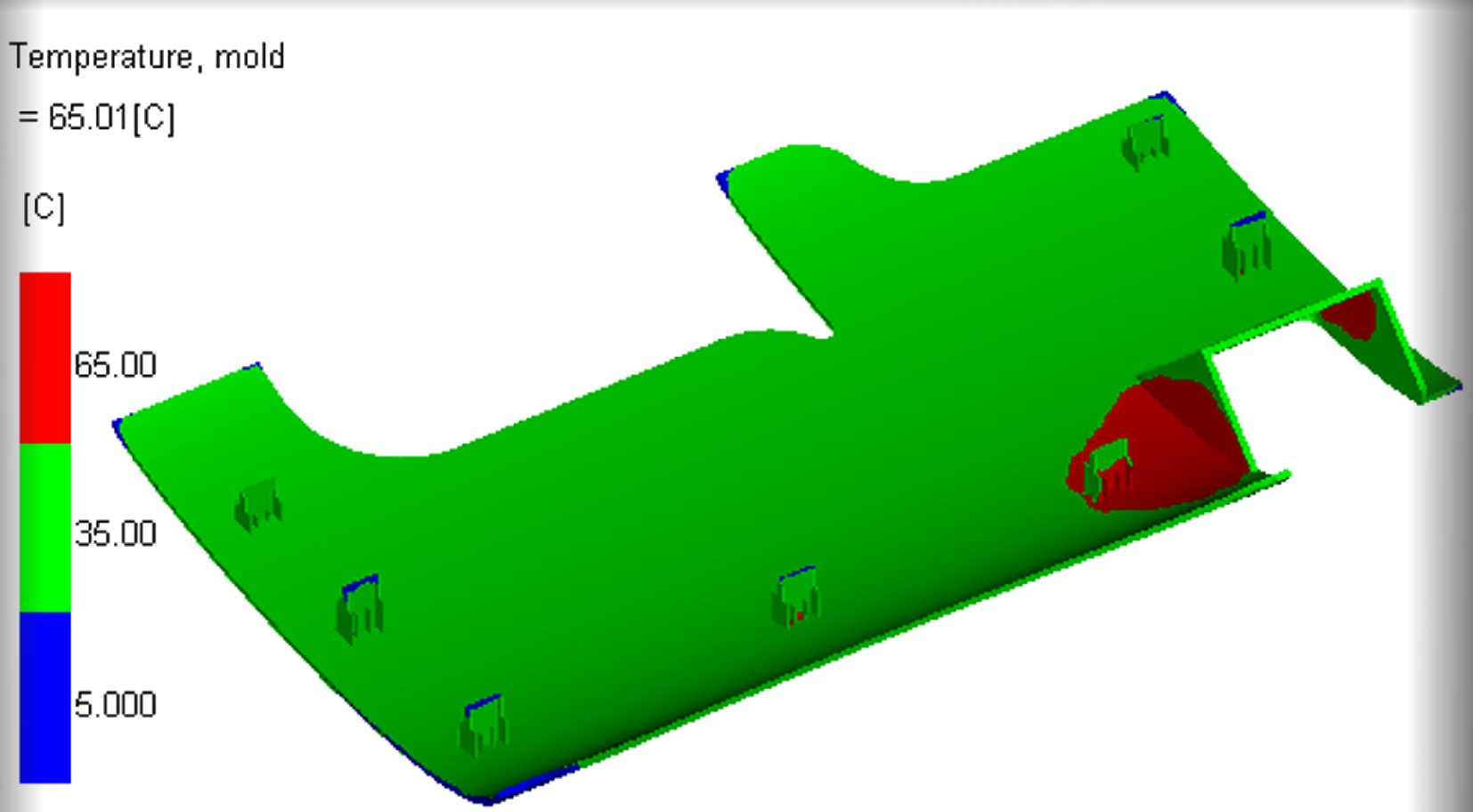
Example: Use Plot Automation - API Within Tolerance

- Works for any result



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Example: Use Plot Automation – API Summary

- Mesh display
  - Background & feature lines
- Nodal Averaging
- Scaling
  - Normal
  - All Deflection plots at once
  - Banded & scaled plots
    - One for all deflection plots at once
  - Symmetric banded & scaled for deflection plots
- 3 bands within tolerance

Opaque Background and Feature Lines

Off All Plot	Off Active Plot	On Active Plot

Set Nodal Averaging Active Plot

Off	On

Simple Result Scale Active Plot

Maximum	118	Set Scale	Contour Line
Minimum	103	Reset Scale	Banding
Extended Color (T/F)	F		Shaded

Scale All Deflection Variants

Maximum	3.96	Set Scale
Minimum	-5.41	
Extended Color (T/F)	T	Reset Scale
Component	Z	

Set Asymmetric Banded Scale Active Plot

Original settings		Settings w even Query	
Maximum	20.00	Maximum	20.50
Minimum	0.00	Minimum	-0.50
Difference	20.00		
Manually set increment	1.00	Half increment	0.50
Number of bands	20.00	Number of bands	21.0
Extended Color (T/F)	F	Orig Scale	Query Scale

Set Symmetric Banded Scale Active Plot

Original settings		Settings w even Query	
Symmetric Value	15.00		
Maximum	15.00	Maximum	15.5
Minimum	-15.00	Minimum	-15.5
Difference	30.00		
Manually set increment	1	Half increment	0.5
Number of bands	30	Number of bands	31
Extended Color (T/F)	F		Set Scale

Set Asymmetric Banded Scale for All Deflection Variants

Original settings		Settings w even Query	
Maximum	0.05	Maximum	0.08
Minimum	-0.65	Minimum	-0.68
Difference	0.70		
Manually set increment	0.05	Half increment	0.03
Number of bands	14.00	Number of bands	15.0
Extended Color (T/F)	T	Set Scale	
Component	Z	Reset Scale	

Show part or results within a tolerance Green is within tolerance

Maximum	2.00	Set Tolerance	Reset Plot
Minimum	-2		

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Questions / Comments ?

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Examples

- What are *your* favorite customizations to clarify results?
  -
  -
  -

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