

PRIMER 17.0

PRIMER 17.0 – Contents

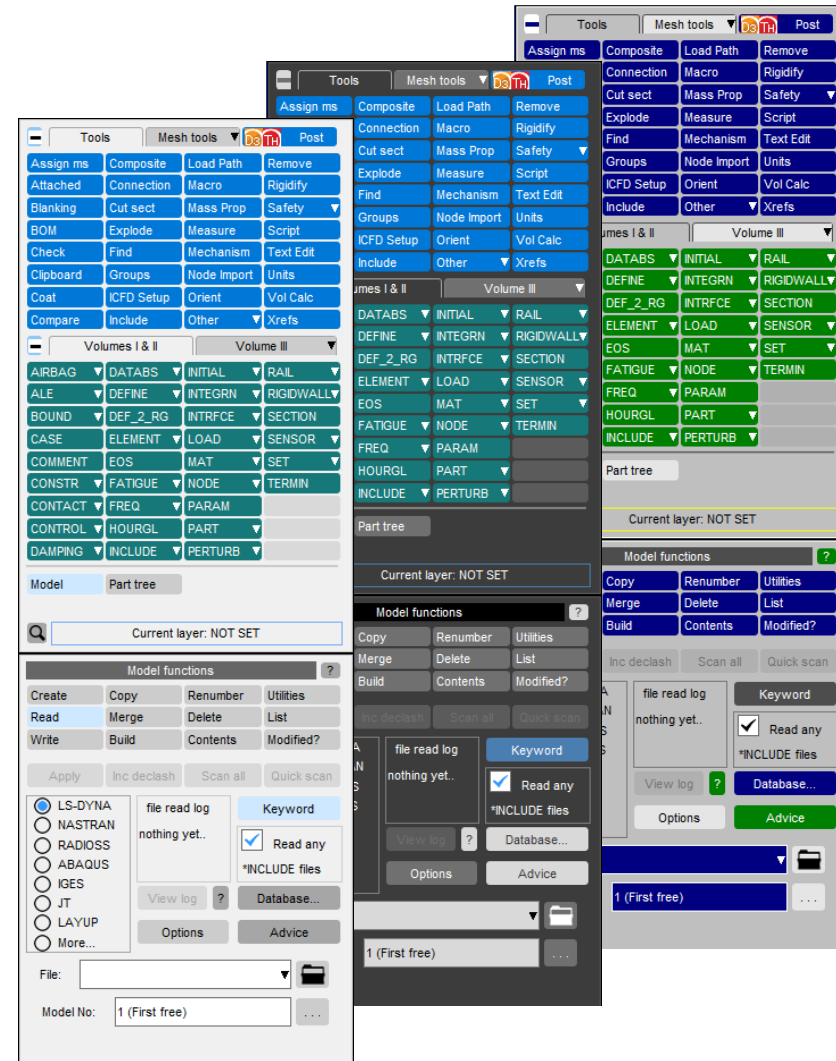
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User Interface Improvements

Themes

For a more comfortable and accessible experience:

- We have introduced three new theme options:
 - Light
 - Dark
 - Classic
- Buttons have been flattened with their corners rounded to give a more modern look and feel.

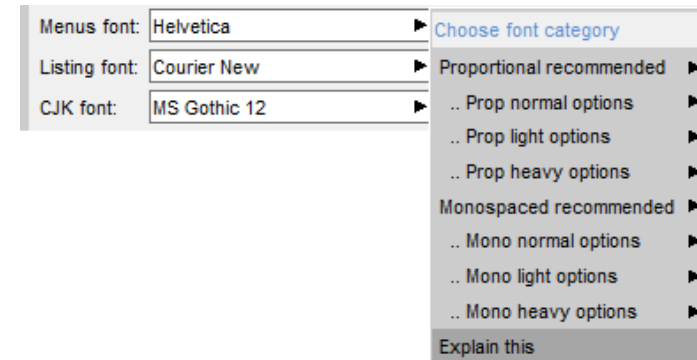
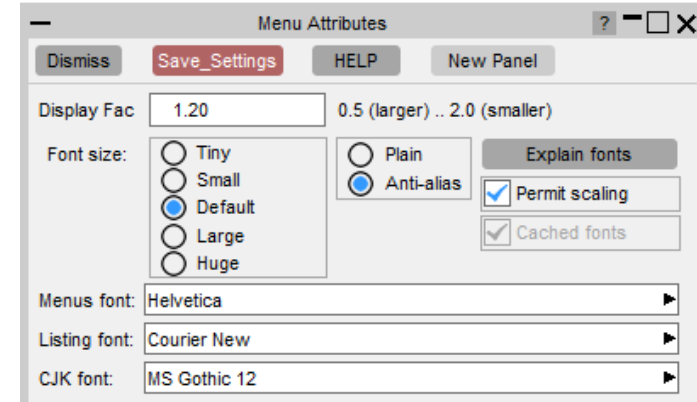


Improved Fonts

To make it easier to create publication-quality images and simplify the communication of your work:

- The range of font sizes is extended to cope with a wider range of displays.
- Font quality has been improved to include an 'anti-alias' option by default for better appearance.
- A wider range of fonts are now supported for menus.

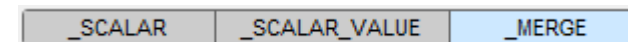
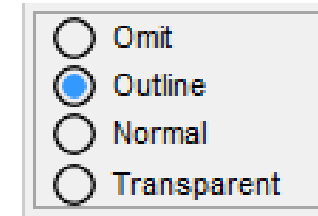
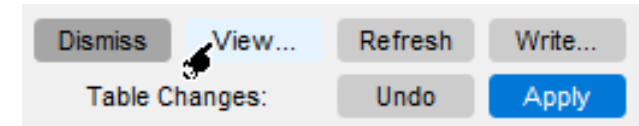
These options can be accessed via the Menu Attributes panel.



Buttons

To make buttons easier and more intuitive to use:

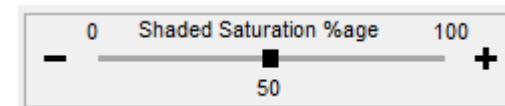
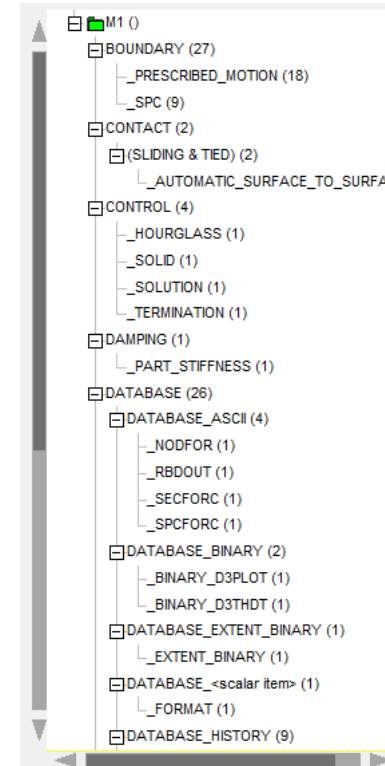
- Clickable buttons are now distinguishable on hover by a slight colour change.
- Radio buttons are now a standard size and shape to be more distinct from tickboxes and more recognisable as radio buttons.
- Button spacing has been adjusted for toggle button groups, so that users understand that they are linked together.



Scroll Bars and Sliders

To make navigating lists quicker and easier:

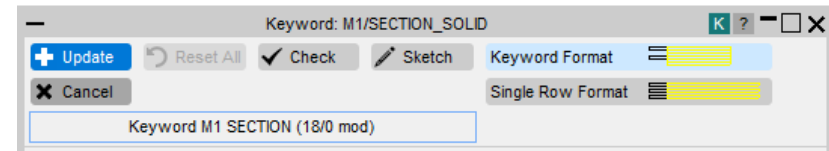
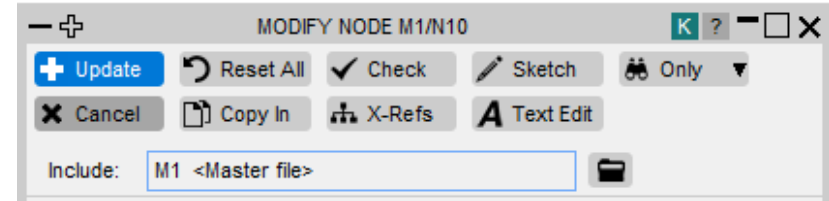
- Scroll bar length is now related to the number of list items visible.
- Left-clicking on an empty area of the scroll bar allows users to jump through sections of the list.
- Right-clicking on an empty area on the scroll bar allows the user to jump to that specific point in the list.
- Slider appearance has been improved to make them more distinct from scroll bars.



Panel Design

To improve speed of recognition and simplify the learning process for new users:

- The layout of Oasys PRIMER edit panels has been standardised so common buttons always appear in the same position at the top of the panel.
- Standard icons have been added to these common buttons.
- Text on buttons has also been standardised across the suite.



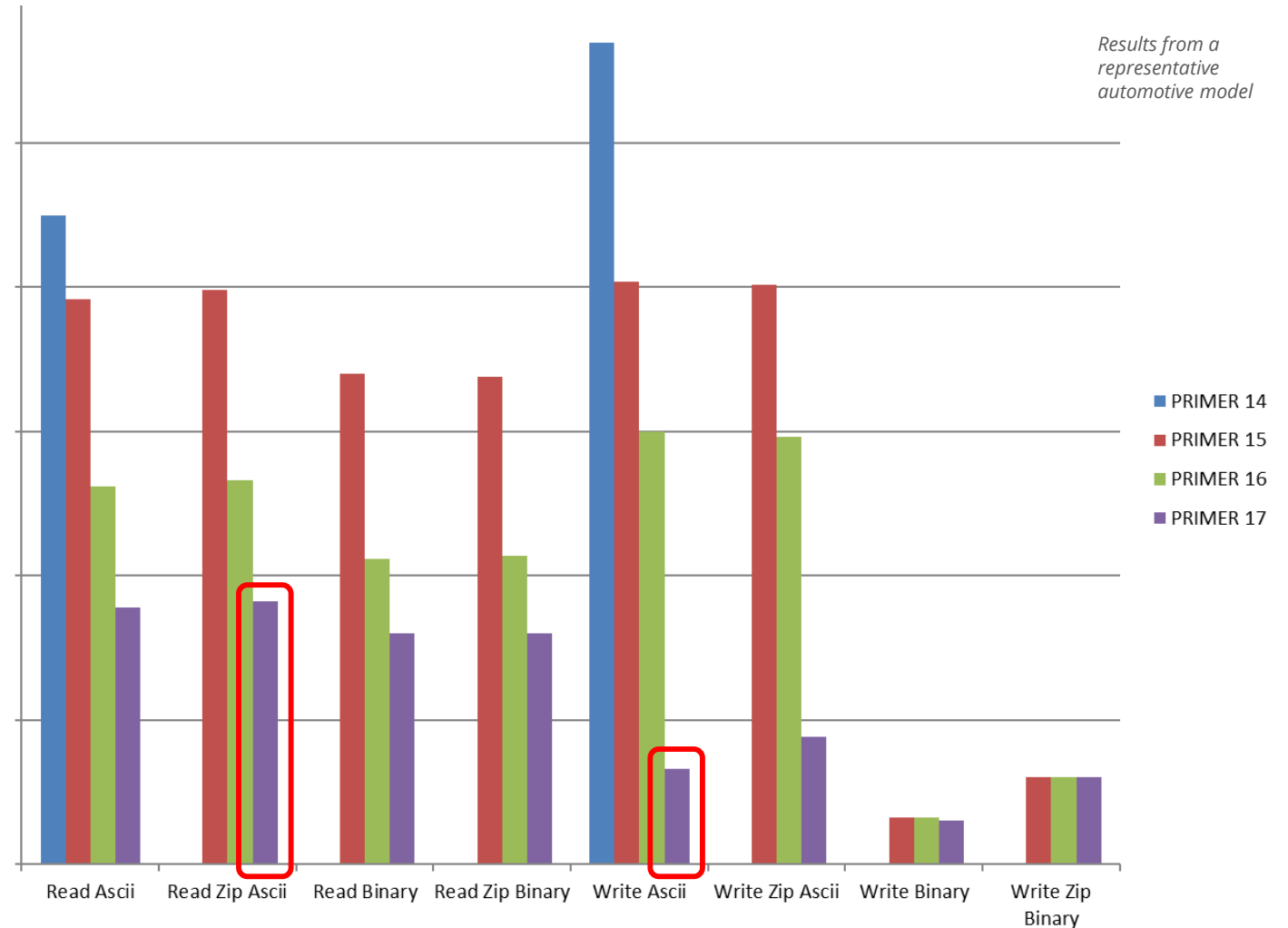
Changes to Keyword Input and Output

LS-DYNA Keyword Support

- PRIMER 17.0 keywords:
 - LS-DYNA up to R11 fully supported.
 - LS-DYNA R12 mostly supported (R12 not officially released at time of writing).
 - Support added across Vol 1, Vol 2 and Vol 3 of the LS-DYNA keyword manuals.

Faster Input and Output

- PRIMER 17.0 **reads** data about 30% faster, especially *ELEMENT_xxx cards.
- PRIMER 17.0 **writes** ASCII data between 250% and 400% faster.
- To achieve the faster write speed the formatting of floating point numbers has changed subtly.



Changes to Floating Point Output Formatting

The original “common” formatting was designed to give exactly the same output on all machine architectures, but it was slow and could modify the 8th sig fig of a single precision float. Output is now optimised for x86 architecture, resulting in the following changes:

- Numbers with trailing zeroes will now be truncated.

Was: 16.0000
Now: 16.0

- Numbers in the range 1e-2 to 1e-3 now use explicit rather than exponential format.

Was: 1.23457E-2
Now: .012345678 (This format permits 1 or 2 extra sig figs to be output in narrow fields)

- The 8th sig fig of a 32 bit (single precision) float may be up to +/-2 different from before.

Single precision floats are only accurate to 1 part in 16,777,216, so “7 and a bit” decimal digits, hence the difference. The new method is “accurate”, the old method adjusted the 8th sig fig for conformity on different hardware. In a typical mm units model this dimensional difference is less than the wavelength of light.

Changes to Compressed Filename Syntax

The naming convention for “.zip” compressed output files has changed.

- Before PRIMER 17.0, PRIMER converted filename “name.key” to “name.zip” when writing a “.zip” compressed archive.
- From PRIMER 17.0 onwards “name.key” will be changed to “name.key.zip” by default. (It is possible to revert to the old syntax using a preference.)
- PRIMER 16.0, 16.1 and 17.0 will still read either syntax.

This change has been made so that you can tell more easily what a “.zip” archive file contains without having to open it. This is particularly important when the contents are binary files.

The naming convention for Binary output files is confirmed as “.kby”.

- When first introduced binary files were written as “.key”, but this caused confusion so their official extension is now “.kby”. Compressed files will therefore be “name.kby.zip” etc.

Changes to Default Output Formats

There are three key settings that control the format of keyword output files.

1. The LS-DYNA data field format:

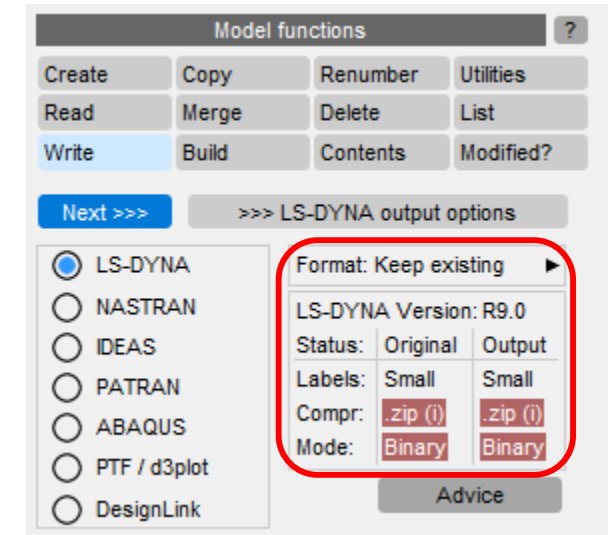
Small:	Fields typically 8 or 10 wide.
l10:	Fields less than 10 wide promoted to 10 wide.
Large:	Fields are all 20 wide

2. Compression

Uncompressed	Raw ASCII, i.e., readable
.gz compression	Compressed using "gzip" format
.zip compression	Compressed using "zip" format

3. Mode

ASCII	Conventional ASCII format.
Binary	PRIMER's proprietary binary format.



Model Write now summarises what will be written, with non LS-DYNA compatible settings highlighted in red.

In PRIMER 17.0 these all separately default to "keep existing" format meaning that each master and include file in the model will "remember" (individually) each setting #1 to #3 above and reuse it on output.

These settings can all be changed in the Model, Write menu, which now summarises them prior to output to make clearer what will be written. Checks remain to make sure that the model will fit into the chosen LS-DYNA format.

Support for “i10” Keyword Format

Some LS-DYNA “small” format cards limit the field width to 8 columns, e.g.:

*NODE

Card 1	1	2	3	4	5	6	7	8	9	10
Variable	NID	X		Y		Z		TC	RC	
Type	I8	F16		F16		F16		I8	I8	

This limits the label range of nodes to 1 to 99,999,999

*ELEMENT_SHELL

Card 1	1	2	3	4	5	6	7	8	9	10
Variable	EID	PID	N1	N2	N3	N4	N5	N6	N7	N8
Type	10 x I8 fields									

This limits nodes, parts and elements to 1 to 99,999,999

Since R9, LS-DYNA has offered an alternative “i10” format which is the same as the traditional small format, except that any data fields less than 10 wide are promoted to become 10 wide.

PRIMER now supports the “i10” input and output format, meaning two new “soft” label limit ranges:

I10 (32) Limits labels to 1 to 2,147,483,647 to fit the limits of single precision LS-DYNA

I10 (64) Limits labels to 1 to 9,999,999,999, but this requires double precision LS-DYNA

(“Long” format, where all fields are 20 wide, is also still supported.)

More Rigorous Data Field Overflow Checking

Narrow data fields can sometimes lead to unexpected errors.

PRIMER has always checked for *numerical* overflow, for example that labels destined for an 8 wide field lie in the range 1 to 99,999,999. However it has sometimes missed cases where character data might overflow a data field. For example:

A parameter name may be too wide.

*NODE format is I8, 3F16, 2I8 so if a node label is given a parameter more than 7 characters wide, let us say "head_node", then if unchecked you might get output like this:

&head_no10.0 The parameter name should have been "**&head_node**" but it has been truncated by the neighbouring X coordinate value.

- As part of Model Check PRIMER will now check and report whether output using the current keyword format will overflow any data fields. These checks are warnings rather than errors since changing to a wider output format (i10 or long) will generally fix the problem.
- If during the keyout operation a data field overflows, PRIMER will now terminate the keyout operation with an error. This should not happen if checks are performed and acted upon, but because an un-detected field overflow can pass unnoticed, giving an error that is very hard to diagnose, it is judged better to terminate the output in a way that cannot be ignored.

Promotion of Format on *ELEMENT Cards

As shown on the previous slide some heavily used *ELEMENT cards tend to use I8 fields in small format. For example:

*ELEMENT_SHELL

Card 1	1	2	3	4	5	6	7	8	9	10
Variable	EID	PID	N1	N2	N3	N4	N5	N6	N7	N8
Type	10 x I8 fields									

Promoting a complete input deck to a wider format (i10 or long) to handle field overflow on just a few cards is not efficient, and LS-DYNA provides an alternative syntax using “%” and “+” suffices on the keyword header.

***header %** Promotes all cards up to the next ***header** to “i10” format.

***header +** Promotes ditto to “long” format.

PRIMER makes a special case of *ELEMENT cards using I8 format and checks for numeric labels, character labels and ¶meter strings that might overflow the “small” card format.

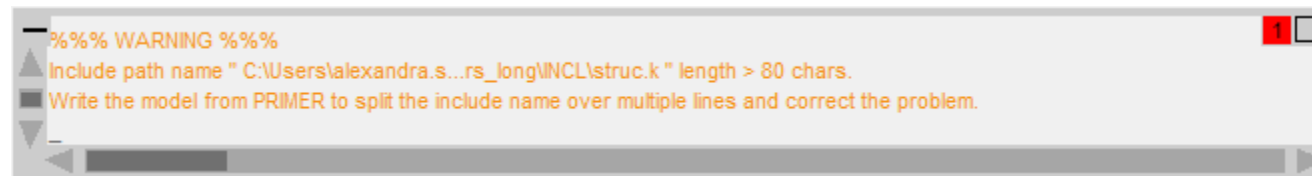
If any are found, it automatically promotes just that keyword in the relevant file to the smaller of “i10” or “long” formats that will accommodate the data. This behaviour can be suppressed if desired.

(This check does not extend to all output cards because it is computationally expensive to make it 100% reliable, and it would slow down keyword output. The enhanced field checking in Model Check will detect and warn about potential problems.)

Model Read Warning Messages

Model Read Warning Messages

- LS-DYNA doesn't accept include file paths if the length of the text present in a single line of keyword input is more than the specified limit (80 characters for small format and 160 characters for large format).
- The problem can be solved by writing out the model from PRIMER. This will split the include file path to multiple lines.
- PRIMER issues a warning message if the keyword file contains include file paths of length greater than the LS-DYNA specified value.



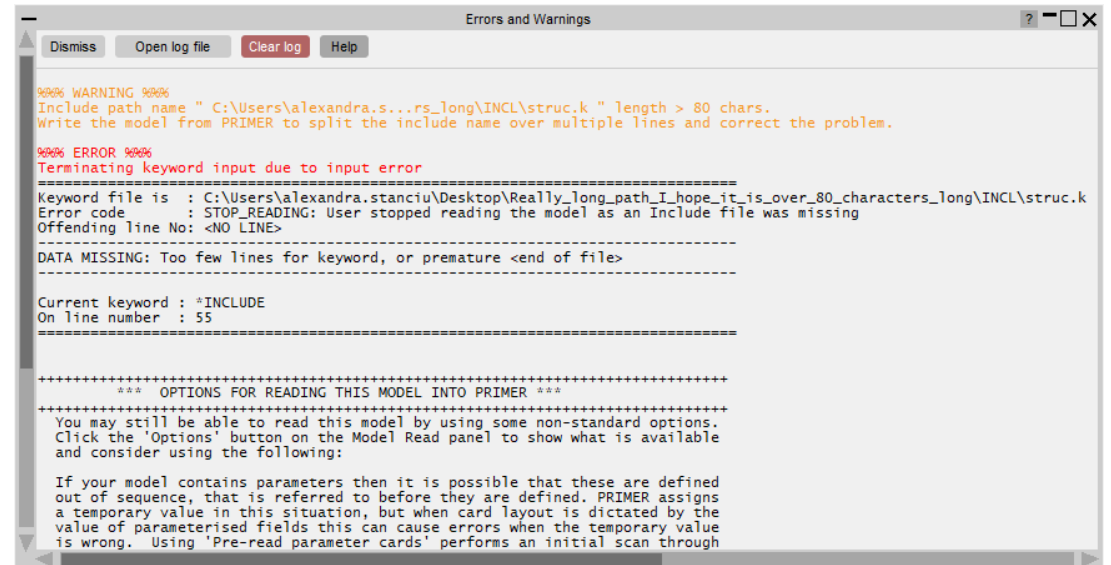
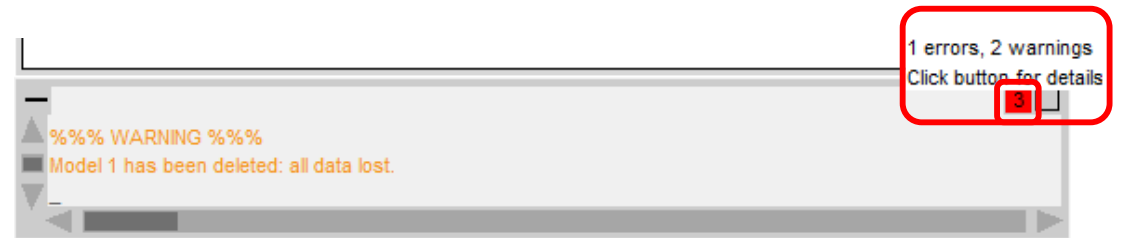
The screenshot shows a warning message in a software interface. The message is displayed in orange text on a light gray background. It reads: "%%% WARNING %%%
Include path name " C:\Users\alexandra.s...rs_long\NCL\struc.k " length > 80 chars.
Write the model from PRIMER to split the include name over multiple lines and correct the problem." The interface includes a scroll bar at the bottom and a small red square icon in the top right corner.

Notification and Recording of Errors

Error and Warning messages can scroll past too fast to be read and as a result can be missed.

These messages are now saved to a separate log and a red button has been added to the top of the dialogue window that counts the number of errors and warnings since the log was last inspected.

- Hovering the mouse over the red button gives a popup box summarising the number of new errors and warnings, shown above to the right.
- Clicking on the button maps a summary panel that allows you to scroll through the log:



Replay of Drag-Drop Files

Replay of Drag-Drop Files

- The checkpoint files will now support replay of the drag and drop of files into PRIMER graphics area.
- Also a new Macro command has been added for this purpose. You can call this command multiple times to drag-drop more than one file. Each of the files will be opened as a separate model in PRIMER:

```
DragDropFile("<file_index>|<number_of_files>") = "filename"
```

User Defined Materials

User Defined Materials

- You can now specify field titles and the type of the field for user defined materials (MAT_41-50) using CSV data files.
- The CSV file should contain the field name, field type and optionally whether the field is the Young's modulus or Poisson's ratio.
 - 1st column of the csv should tell PRIMER whether the field is of LMC type or LMCA type.
 - 2nd column of the csv file should contain the field header name for each field.
 - 3rd column should contain the field type. Currently, we support float, integer, load curves and tables.
 - 4th column (optional) should specify if a field is Young's modulus or Poisson's ratio.
- This CSV file is then read into PRIMER using preferences. Define the path of the CSV file in the oa_pref (mat_xx_user_defined). Example:
 - primer*mat_48_user_defined: C:\Users\..
 - primer*mat_45_user_defined: C:\Users\..

LMC1	PARAM	FLOAT	
LMC2	LCK1	TABLE	
LMC3	LCT1	LCUR	
LMC4	LCK2	TABLE	
LMC5	SLIM	INTEGER	
LMC6			
LMC7			
LMC8	LCK3	LCUR	
LMC9	E	FLOAT	YM
LMC10	PR	FLOAT	PR
LMCA1	LCKA1	TABLE	
LMCA2	CP	FLOAT	
LMCA3			
LMCA4	NUMINT	INTEGER	

User Defined Materials

- You can have more fields than defined in the CSV file but such extra fields will be treated as float fields with generic headers.
- If no CSV file is defined for specific material (MAT_xx), then that material will be processed in the default way with all field types as floats with default field headers.

CREATE MATERIAL in model 1

Include: M1 <Master file>

Label: 13616 Elem types: Solid, Shell, Beam, Tshell

Type: T_041-50: USER_DEFINED_MATERIAL_MODELS

Suffix: <none>

Title: <No material name given>

Row\Col	1	2	3	4	5	6	7	8
1	<Label>	RO F	MT I	LMC I	NHV I	IORTHO/ISP	IBULK I	IG I
	13616	0.0063	45	10	90	1	5	6
2	IVECT I	IFAIL I	ITHERM I	IHYPER I	IEOS I	LMCA I		
	1	1	1	1	1	1		
3	AOPT I	MACF I	XP F	YP F	ZP F	A1 F	A2 F	A3 F
	0.0	0	0.0	0.0	0.0	1.0	1.0	0.0
4	V1 F	V2 F	V3 F	D1 F	D2 F	D3 F	BETA F	
	0.0	0.0	0.0	0.0	1.0	0.0	0.0	
5	PARAM F	LCK1 I	LCT1 I	LCK2 I	SLIM I			LCK3 I
	10.0	12006	12008	12008	0			12007
6	E F	PR F						
	100.0	0.23						
7	LCKA1 I							
	12001							

User Defined Materials

CREATE MATERIAL in model 1

Include: M1 <Master file>

Create material in model 1

Label: 1 Elem types: Solid, Shell, Beam, Tshell,

Type: T_041-50: USER_DEFINED_MATERIAL_MODELS FLTR

Suffix: <none>

Title: <No material name given>

ADD_EROSIO EDIT ADD_PORE_A EDIT
 ADD_PERME EDIT ADD_ABAG_P EDIT
 ADD_FATIGUE EDIT ADD_GEN_DA EDIT
 ADD_DAM_DI EDIT ADD_DAM_GI EDIT
 PZELECTRIC EDIT ADD_INELAST EDIT

Suffixes:

Row\Col	1	2	3	4	5	6	7	8
1	<Label>	RO _F	MT _I	LMC _I	NHV _I	IORTHO/ISP	IBULK _I	IG _I
1	1	0.0063	45	10	90	0	5	6
2	IVECT _I	IFAIL _I	ITHERM _I	IHYPER _I	IEOS _I	LMCA _I		
2	1	1	1	1	1	4		
3	PARAM _F	LCK1 _I	LCT1 _I	LCK2 _I	SLIM _I			LCK3 _I
3	10.0	12009	12010	120012	0			12011
4	E _F	PR _F						
4	100.0	0.23						
5	LCKA1 _I	CP _F		NUMINT _I				
5	12011	13.0		2				

User defined material MAT_45 with CSV file.

CREATE MATERIAL in model 1

Include: M1 <Master file>

Create material in model 1

Label: 1 Elem types: Solid, Shell, Beam, Tshell,

Type: T_041-50: USER_DEFINED_MATERIAL_MODELS FLTR

Suffix: <none>

Title: <No material name given>

ADD_EROSIO EDIT ADD_PORE_A EDIT
 ADD_PERME EDIT ADD_ABAG_P EDIT
 ADD_FATIGUE EDIT ADD_GEN_DA EDIT
 ADD_DAM_DI EDIT ADD_DAM_GI EDIT
 PZELECTRIC EDIT ADD_INELAST EDIT

Suffixes:

Row\Col	1	2	3	4	5	6	7	8
1	<Label>	RO _F	MT _I	LMC _I	NHV _I	IORTHO/ISP	IBULK _I	IG _I
1	1	0.0063	45	10	90	0	5	6
2	IVECT _I	IFAIL _I	ITHERM _I	IHYPER _I	IEOS _I	LMCA _I		
2	1	1	1	1	1	4		
3	U_1 _F	U_2 _F	U_3 _F	U_4 _F	U_5 _F	U_6 _F	U_7 _F	U_8 _F
3	10.0	12009.0	12010.0	120012.0	0.0	0.0	0.0	12011.0
4	U_9 _F	U_10 _F						
4	100.0	0.23						
5	P_1 _F	P_2 _F	P_3 _F	P_4 _F				
5	12011.0	13.0	0.0	2.0				

User defined material MAT_45 without CSV file.

Seatbelt Mesh

Set All Segments

A new option named "Set all segments" has been added to the seatbelt mesh panel and will set all segments for the belt to the element settings of the current segment.

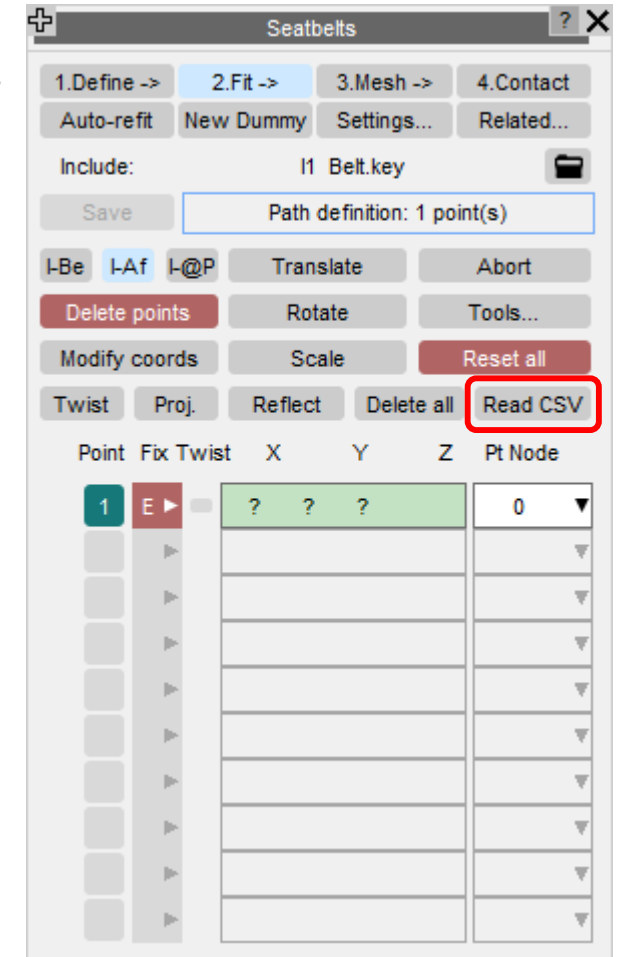
The screenshot shows the '3.Mesh' tab of the software interface. At the top, there are navigation buttons: '1.Define ->', '2.Fit ->', '3.Mesh ->', and '4.Contact'. Below these are 'Auto-refit', 'New Dummy', 'Settings...', and 'Related...'. The 'Include:' field contains 'I1 Belt.key'. The 'Current BELT defn:' is 'M1/BDEF10001'. The 'Mesh type' is set to 'O/N'. There are 'Reset mesh', '[E < 1]', and '[1 > 2]' buttons. A table shows segment settings for 'Pt 1: RETR' and 'Pt 2: SLIP'. The 'Set all segments' button is highlighted with a red box and a red arrow. Below it are 'Generate', 'Status', and 'Done meshing' buttons. The 'Meshing start labels' section contains dropdown menus for Nodes, Shells, SBelts, Retractors, Sliprings, 2D slip nset, Node sets, Shell sets, Nodal RBs, DB XSects, and Part Sets. A 'Reset all' button is at the bottom.

Nodes:	11251	Node sets:	10007
Shells:	10951	Shell sets:	10004
SBelts:	10097	Nodal RBs:	10008
Retractors:	10002	DB XSects:	10001
Sliprings:	10003	Part Sets:	10002
2D slip nset	10007		

Define Seatbelt from CSV

Define Seatbelt from CSV

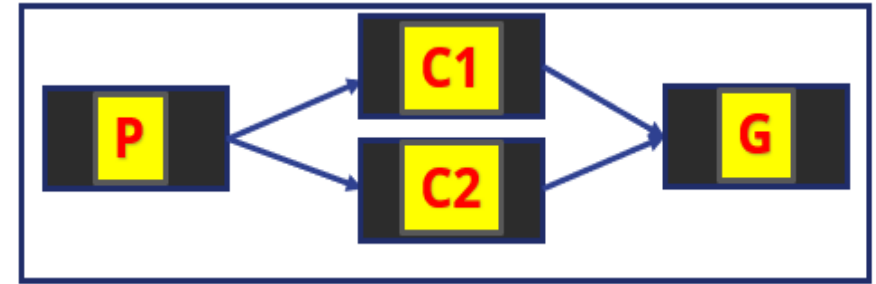
- A new “ReadCSV” button in the “Define Path” panel allows you to define the belt path via a CSV file (for example for applying measured points from a test).
- The format for the CSV columns is in the following order separated by a comma (,):
 - Node Coords : X, Y, Z,
 - Point NodeID,
 - Fixity Strings - separated by colon (:): sign.
Valid values - FIXED, KNOWN, RETRACTOR, B_POST_SLIPRING, FREE_SLIPRING, SLIPRING, TWIST, XSEC6.
 - Twist Node 1,
 - Twist Radial vector 1 : X, Y, Z,
 - Twist Normal vector 1 : X, Y, Z,
 - Twist Node 2,
 - Twist Radial vector 2 : X, Y, Z,
 - Twist Normal vector 2 : X, Y, Z
- Rules regarding the CSV input are:
 - One line in a CSV file corresponds to one Belt path point.
 - PRIMER will consider the empty strings for any of the inputs as zero.
 - A comment line may be included by starting the line with a \$ sign.



Mechanisms Style Connections for Dummy Assemblies

Mechanisms Style Connections for Dummy Assemblies

- Introduced in PRIMER 17.0, a child dummy assembly can have multiple parent assemblies, one parent with a regular X/Y/Z rotational connections, others with a PIN/LINE/HINGE connection.
- In the adjoining image – Parent P has two children C1 and C2 – which is normal for a Dummy. However grandchild G has two parents C1 and C2. This means that all the C1, C2 and G must be treated as a composite rigid body that rotates about Node A on Parent P, and must not be allowed to rotate independently.
- Options PIN, LINE and HINGE and are designed to permit assemblies to be "children" of multiple parents. This works as follows:
 - If an assembly is to be connected to two or more parents they must set the <DoF code> to be PIN for a single point connection node A, or LINE or HINGE for a two node connection using nodes A and B.
 - Because this implies circular and/or multiple connections it is not possible to position these assemblies using the **Rotate angles** method in the Dummies **Position** menu, therefore this option will be greyed out for those assemblies.
 - However the assemblies can still be positioned using the **Drag assembly** or **Move points** methods in the Dummies **Position** menu.



Del	Assembly	Jnt Stiff	Node A	DoF codes	Node B
<input type="checkbox"/>	33	1501207	1582289	XYZ	0
<input type="checkbox"/>	34	1501271	1632538	PIN	0
<input type="checkbox"/>					

DoF Codes, suggested values

- 0 : <None>
- 1 : X
- 2 : Y
- 3 : Z
- 12 : XY
- 23 : YZ
- 13 : XZ
- 123 : XYZ
- 1 : PIN
- 2 : LINE
- 3 : HINGE

Explain

Simulation Based Dummy Positioning

Simulation Based Dummy Positioning

- Simulation based dummy positioning can now be set up with less than 3 nodes in cable creation (previously 3 nodes per assembly had to be specified).
- You now have the options of 1 node, 2 node or FREE.
- The 1 node option allows PRIMER to calculate 1 node per assembly for cable creation during dummy positioning setup. Similarly, 2 node option will use 2 nodes per assembly (and hence 2 cables).
- The FREE option gives you freedom to put one, two, three or zero nodes per assembly for cables. If you click on 'Automatically determine nodes' while the FREE option is selected, then PRIMER will calculate 3 nodes per assembly.
- Command line support for the above has also been added in DS_DYNA_DUMMY and DYNA_DUMMY.

Assembly			Node 1	Node 2	Node 3
1: Lower Torso	I	R	1547673▼	1584834▼	1547777▼
2: Thorax	I	R	1563640▼	1576241▼	1569932▼
3: Head & Neck	I	R	1501463▼	1524714▼	1525019▼
4: Upper leg left	I	R	1500724▼	1592695▼	1522348▼
5: Upper leg right	I	R	1500516▼	1600799▼	1513546▼
6: Lower leg left	I	R	1519064▼	1519410▼	1586686▼
7: Lower leg right	I	R	1516332▼	1516678▼	1600754▼
8: Foot left	I	R	1521036▼	1521252▼	1520457▼
9: Foot right	I	R	1518304▼	1518520▼	1517725▼
10: Yoke left	I	R	1501253▼	1501278▼	1501270▼
11: Yoke right	I	R	1501387▼	1501412▼	1501404▼
12: Upper arm le	I	R	1507052▼	1507453▼	1507449▼
13: Upper arm ri	I	R	1507985▼	1508430▼	1508426▼

Dummy Positioning

Dummies ? X

Select node(s) per assembly for positioning

Cancel Previous Next

Automatically determine nodes Help

Ignore parts below mass: 1.0E-2 FREE

Consider encrypted materials ? 1node

2node

Assembly	Node 1	Node 2	Node 3
1: Lower Torso	I R 1547673		
2: Thorax	I R 1563640		
3: Head & Neck	I R 1501463		
4: Upper leg left	I R 1500724		
5: Upper leg right	I R 1500516		
6: Lower leg left	I R 1519064		
7: Lower leg right	I R 1516332		
8: Foot left	I R 1521036		
9: Foot right	I R 1518304		
10: Yoke left	I R 1501253		
11: Yoke right	I R 1501387		
12: Upper arm le	I R 1507052		
13: Upper arm ri	I R 1507985		
14: Elbow left	I R 1501554		
15: Elbow right	I R 1501690		

Panel with 1 node option and automatically determined nodes.

Dummies ? X

Select node(s) per assembly for positioning

Cancel Previous Next

Automatically determine nodes Help

Ignore parts below mass: 1.0E-2 FREE

Consider encrypted materials ? 1node

2node

Assembly	Node 1	Node 2	Node 3
1: Lower Torso	I 1547673	1584834	
2: Thorax	I R 1563640	1576241	
3: Head & Neck	I R 1501463	1524714	
4: Upper leg left	I R 1500724	1592695	
5: Upper leg right	I R 1500516	1600799	
6: Lower leg left	I R 1519064	1519410	
7: Lower leg right	I R 1516332	1516678	
8: Foot left	I R 1521036	1521252	
9: Foot right	I R 1518304	1518520	
10: Yoke left	I R 1501253	1501278	
11: Yoke right	I R 1501387	1501412	
12: Upper arm le	I R 1507052	1507453	
13: Upper arm ri	I R 1507985	1508430	
14: Elbow left	I R 1501554	1501564	
15: Elbow right	I R 1501690	1501700	

Panel with 2 nodes option and automatically determined nodes.

Dummies ? X

Select node(s) per assembly for positioning

Cancel Previous Next

Automatically determine nodes Help

Ignore parts below mass: 1.0E-2 FREE

Consider encrypted materials ? 1node

2node

Assembly	Node 1	Node 2	Node 3
1: Lower Torso	I R 1547673	1584834	1547777
2: Thorax	I R 1563640	1576241	1569932
3: Head & Neck	I R 1501463	1524714	1525019
4: Upper leg left	I R 1500724	1592695	1522348
5: Upper leg right	I R 1500516	1600799	1513546
6: Lower leg left	I R 1519064	1519410	1586686
7: Lower leg right	I R 1516332	1516678	1600754
8: Foot left	I R 1521036	1521252	1520457
9: Foot right	I R 1518304	1518520	1517725
10: Yoke left	I R 1501253	1501278	1501270
11: Yoke right	I R 1501387	1501412	1501404
12: Upper arm le	I R 1507052	1507453	1507449
13: Upper arm ri	I R 1507985	1508430	1508426
14: Elbow left	I R 1501554	1501564	1501567
15: Elbow right	I R 1501690	1501700	1501703

Panel with FREE option and automatically determined nodes.

Dummies ? X

Select node(s) per assembly for positioning

Cancel Previous Next

Automatically determine nodes Help

Ignore parts below mass: 1.0E-2 FREE

Consider encrypted materials ? 1node

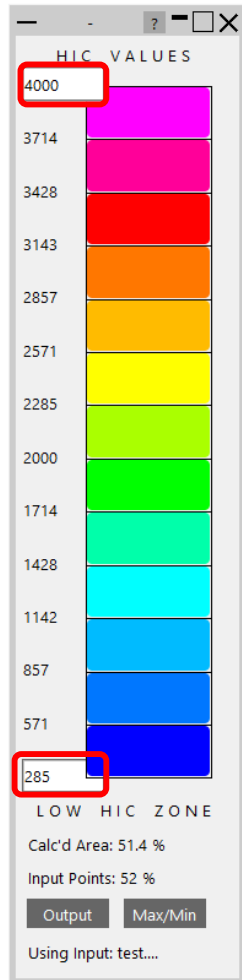
2node

Assembly	Node 1	Node 2	Node 3
1: Lower Torso	I R 1547673	1584834	1547777
2: Thorax	I R 1563640	1576241	
3: Head & Neck	I R 1501463	1524714	1525019
4: Upper leg left	I R 1500724		
5: Upper leg right	I R 1500516	1600799	1513546
6: Lower leg left	I R 1519064		
7: Lower leg right	I R 1516332	1516678	1600754
8: Foot left	I R 1521036	1521252	1520457
9: Foot right	I R 1518304	1518520	1517725
10: Yoke left	I R 1501253	1501278	1501270
11: Yoke right	I R 1501387	1501412	
12: Upper arm le	I R 1507052	1507453	1507449
13: Upper arm ri	I R 1507985	1508430	
14: Elbow left	I R 1501554		
15: Elbow right	I R 1501690	1501700	1501703

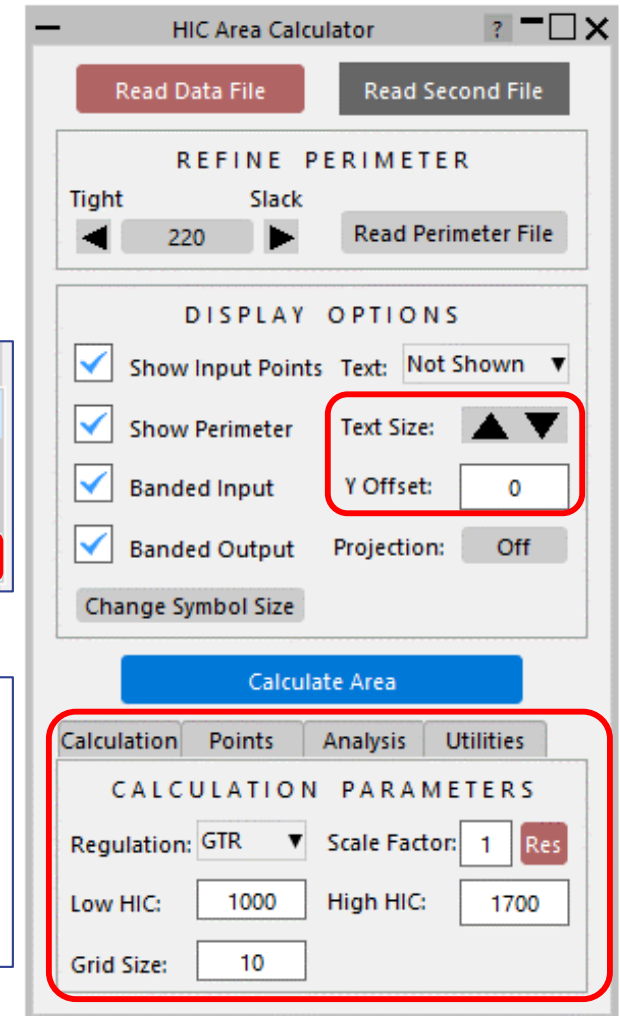
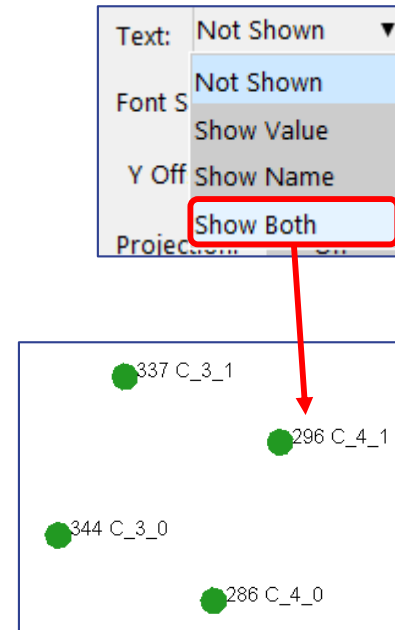
Panel with FREE option and user selected nodes.

HIC Area Calculator

UI Updates & New Text Display Options



- Now possible to show both name and value text fields at the same time.
- Ability to increase and decrease screen text size (dependent on screen resolution).
- GUI has been organised into 4 tabs:
 - Calculation – inputs for regulations.
 - Points – tools for modifying HIC data points.
 - Analysis – advanced analysis tools.
 - Utilities – other options.
- Contour bar max/min values can now be (more obviously) changed.



Calculation Tab

- Calculation tab contains regulation choice option and corresponding calculation limits.
- It is now possible to modify HIC limits by applying a scale factor.
- The scale factor is applied to the current regulation only, so to apply a scale factor to both regulations requires entering it twice (once per regulation).
- Scale factors are applied to the current limit values not the original default. This means a factor of 0.5 followed by 0.1 would result in a net factor of 0.05, not 0.1.
- Limits can be reset (scale factor undone) using the red 'Res' button.

Calculation Points Analysis Utilities

CALCULATION PARAMETERS

Regulation: ENCAP vE Scale Factor: 1 Res

Yellow HIC: 650 Orange HIC: 1000

Brown HIC: 1350 Red HIC: 1700

Calculation Points Analysis Utilities

CALCULATION PARAMETERS

Regulation: ENCAP vE Scale Factor: 0.8 Res

Yellow HIC: 520 Orange HIC: 800

Brown HIC: 1080 Red HIC: 1360

Apply
0.8
factor

Calculation Points Analysis Utilities

CALCULATION PARAMETERS

Regulation: ENCAP vE Scale Factor: 1 Res

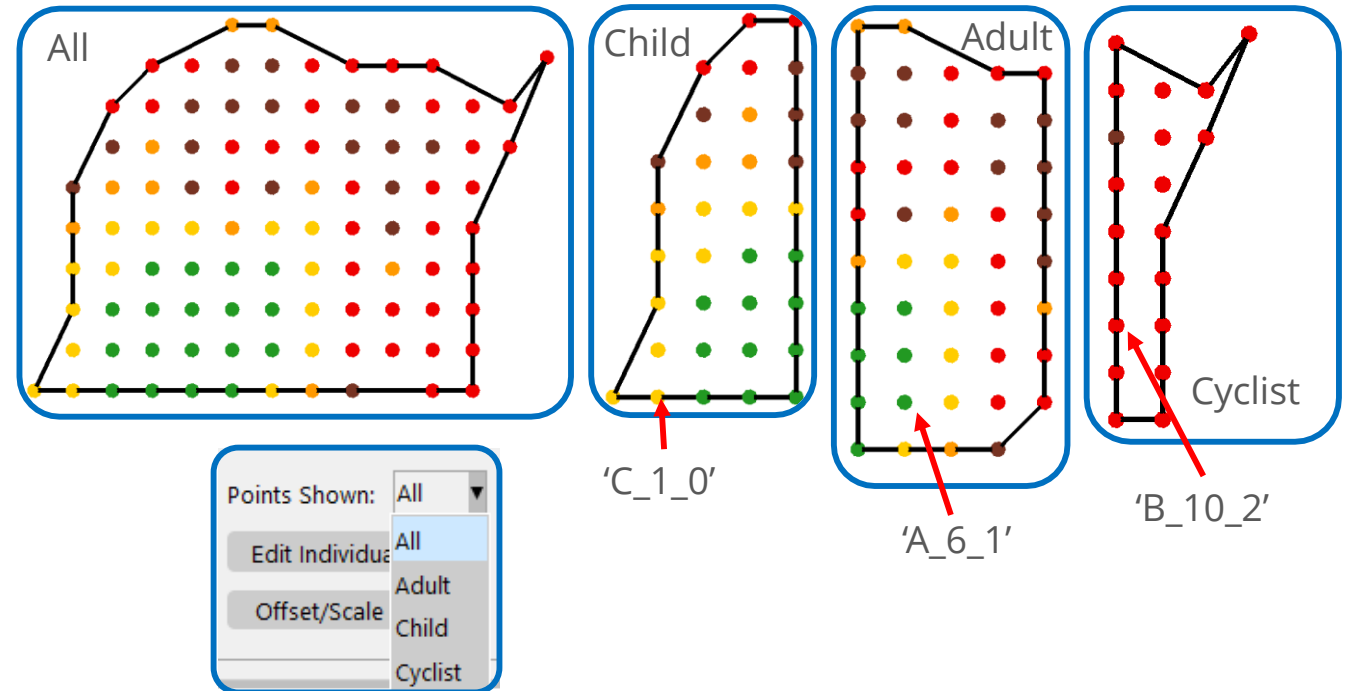
Yellow HIC: 650 Orange HIC: 1000

Brown HIC: 1350 Red HIC: 1700

Reset
button

Points Tab

- Points tab contains options for modifying HIC points.
- HIC points can be filtered by type:
 - Adult (names beginning with 'A').
 - Child (names beginning with 'C').
 - Cyclist (names beginning with 'B').
- New functionality:
 - Delete points.
 - Edit the HIC of multiple points at once.
 - Apply an offset or scale factor to HIC values.



If entry is between 0 and 5 it is applied as a scale factor.

If entry is greater than 5 or less than 0 it is applied as an offset.

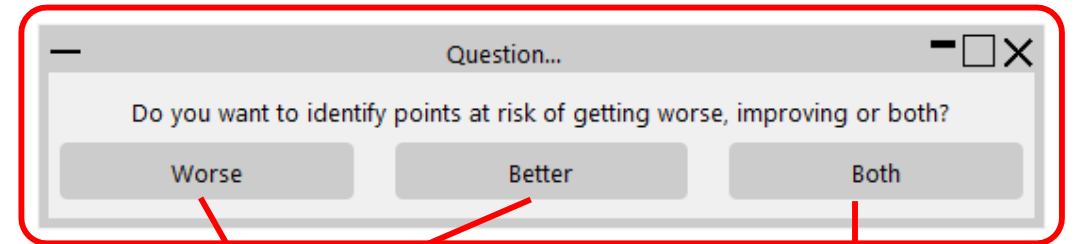
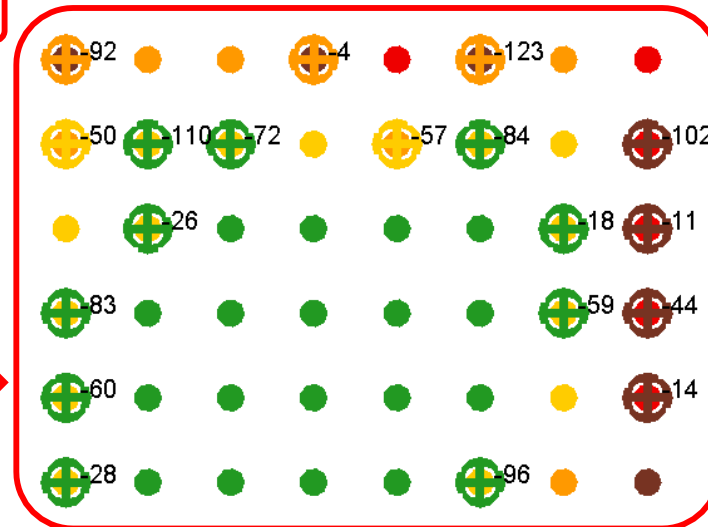
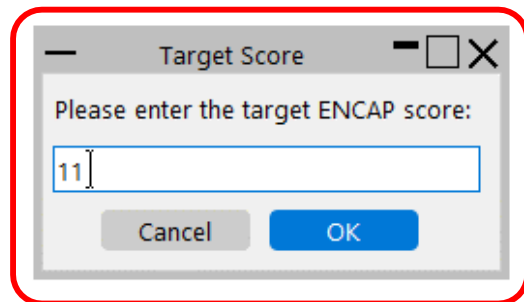
Pro tip:
The HIC Area Calculator prints the % of points scored, which could be applied to other total point allocations.

Factor: 67.6 %

Analysis Tab

- Calculation tab contains advanced analysis tools.
- Includes previous GTR tools for Area Sensitivity and Target % Area.
- New options are:

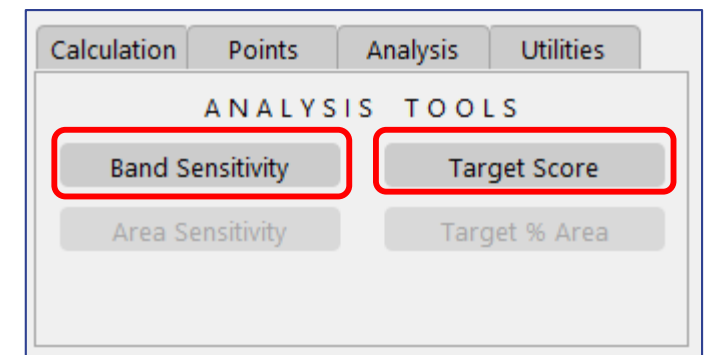
- Bi-directional Band Sensitivity
- Target NCAP Score



New for PRIMER 17.0

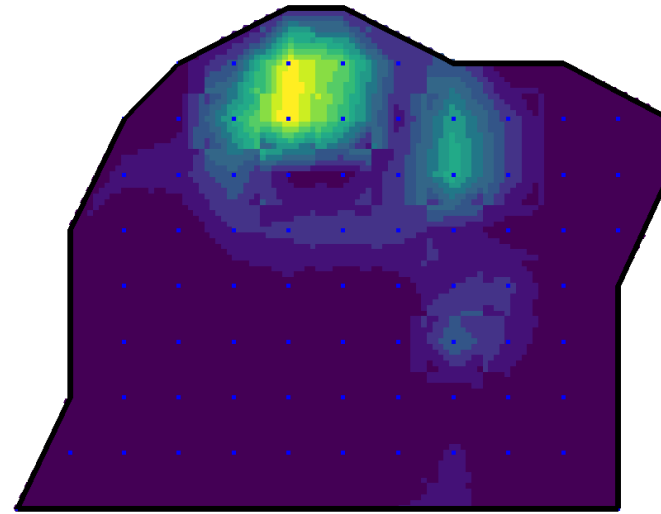
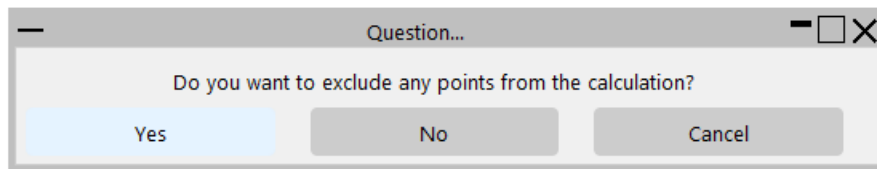
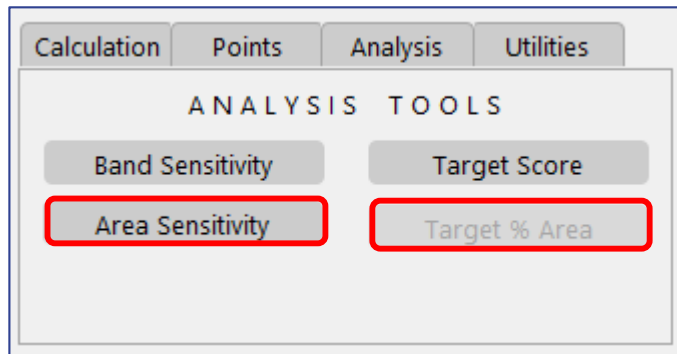
PRIMER 16.0 method

To achieve a score of 11.05 points, 29 impacts must change bands. The largest change is -123 HIC.

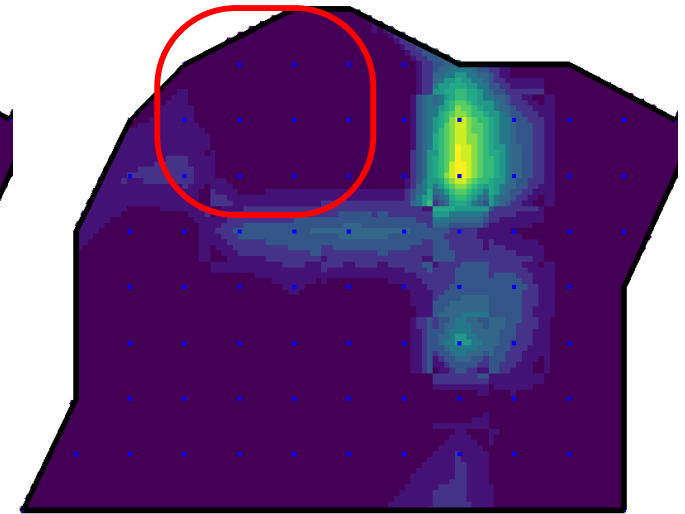


Calculation Tab – New Exclude Option

- Applicable to:
 - Area Sensitivity
 - Target Score
- It is now possible to identify points to be ignored from these calculations.
- This allows users to limit the focus of the calculations to specific areas of interest, or avoid areas that would not be feasible to change.



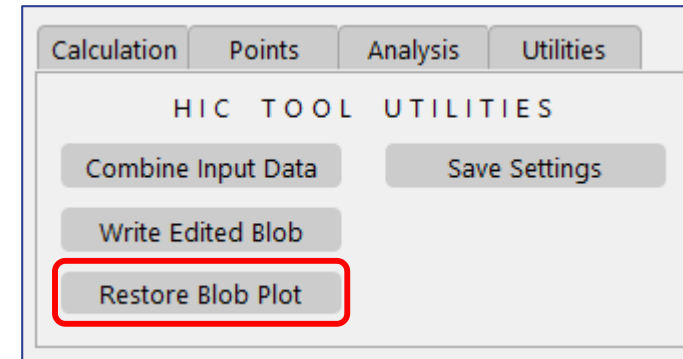
Area Sensitivity
without Exclusion



Area Sensitivity
with Exclusion

Utilities Tab

- Utilities tab contains other additional functionality.
- Previous options for:
 - Combining data with second input file.
 - Writing out a 'blob' file.
 - Saving settings.
- Plus new functionality:
 - Two additional preference values can be saved:
 - Delta for Band Sensitivity.
 - Delta for Area Sensitivity.
 - Ability to restore data back to the original blob.



Available preferences for HIC Area Tool (saved in oa_pref)

REPORTER Templates

Each time you run a pedestrian head impact simulation, you can automatically generate a report of the results using the new REPORTER templates for Euro NCAP and GTR assessment protocols. The templates interface with the HIC Area Calculator to show band and area sensitivity results.

The image displays four screenshots of the REPORTER templates for GTR and Euro NCAP head impact assessments. Each screenshot shows a car model with impact points, a grid of results, and a summary table.

GTR Head Impact Assessment

VAD (mm)	4	3	2	1	0	1	2	3	4
1700	7	1	1	1	1	1	1	1	7
1600	6	1	1	1	1	1	1	6	
1500	5	1	1	1	1	1	1	5	
1400	4	1	1	1	1	1	1	4	
1300	3	1	1	1	1	1	1	3	
1200	2	1	1	1	1	1	1	2	
1100	1	1	1	1	1	1	1	1	
1000	0	1	1	1	1	1	1	0	

Summary	
Combined Area (%)	93.70
Combined Points	88.10
Child Area (%)	100.00
Child Points	100.00

Euro NCAP Head Impact Assessment 2020 (AP VRU v10.0.2)

VAD (mm)	4	3	2	1	0	1	2	3	4
1700	7	1	1	1	1	1	1	1	7
1600	6	1	1	1	1	1	1	6	
1500	5	1	1	1	1	1	1	5	
1400	4	1	1	1	1	1	1	4	
1300	3	1	1	1	1	1	1	3	
1200	2	1	1	1	1	1	1	2	
1100	1	1	1	1	1	1	1	1	
1000	0	1	1	1	1	1	1	0	

Summary	
Predicted score (excluding blue points)	35.75
Default Green	2.00
Blue points score	1.00
Correction factor	2.75
Total Score	95.81

Total Score = Predicted Score + Default Green Score + Correction Factor + Default Green Score + Total Blue Points

Band sensitivity

Impacts that are within 50 HIC points of changing score are annotated with a cross-hair symbol of the appropriate colour. This is a convenient way of identifying impact points that could help improve the overall score.

Results	
Area (%)	93.70
Points	88.10

HIC values	
1700.00	Red
1500.00	Marginal
1000.00	Good
0	Green

Sensitivity values	
0.00	Green
0.05	Yellow
0.10	Orange
0.15	Red
0.20	Dark Red
0.25	Black
0.30	Dark Blue
0.35	Blue
0.40	Light Blue
0.45	Light Green
0.50	Green

Settings	
Perimeter lightness	440
Band sensitivity	50
Area sensitivity	50
Grid size	10

Euro NCAP head impact results

Impact scores	
9.00	Red
5.50	Orange
3.25	Yellow
1.00	Green
20.7	Normalized score

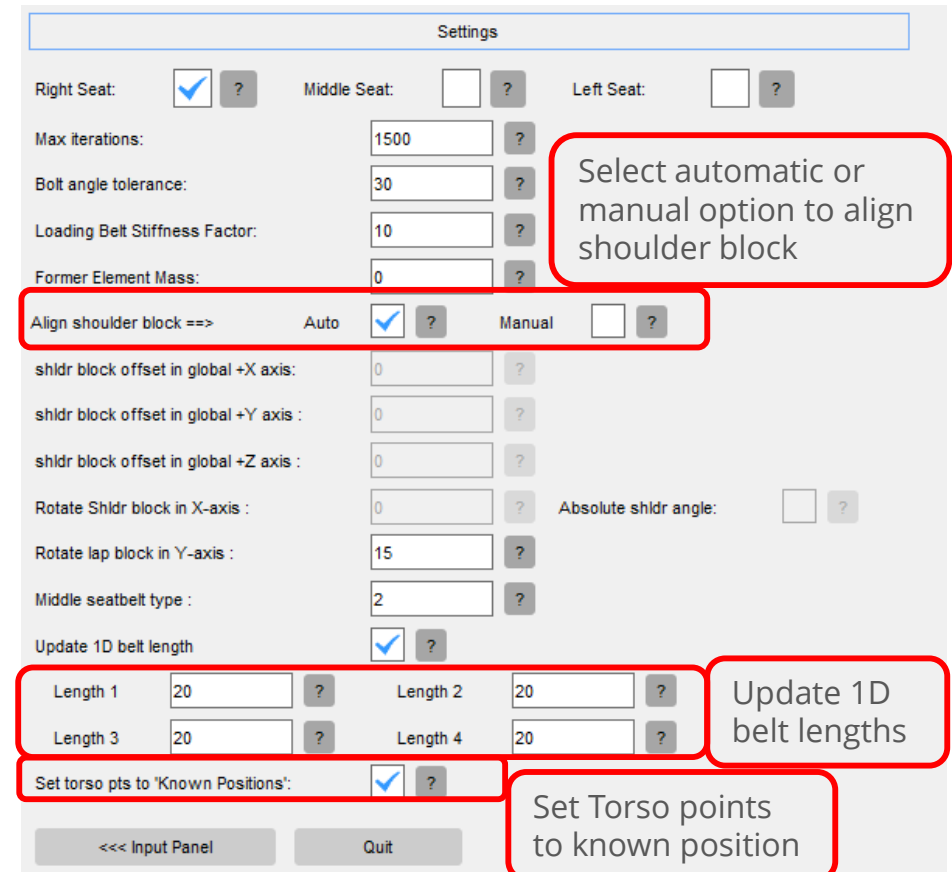
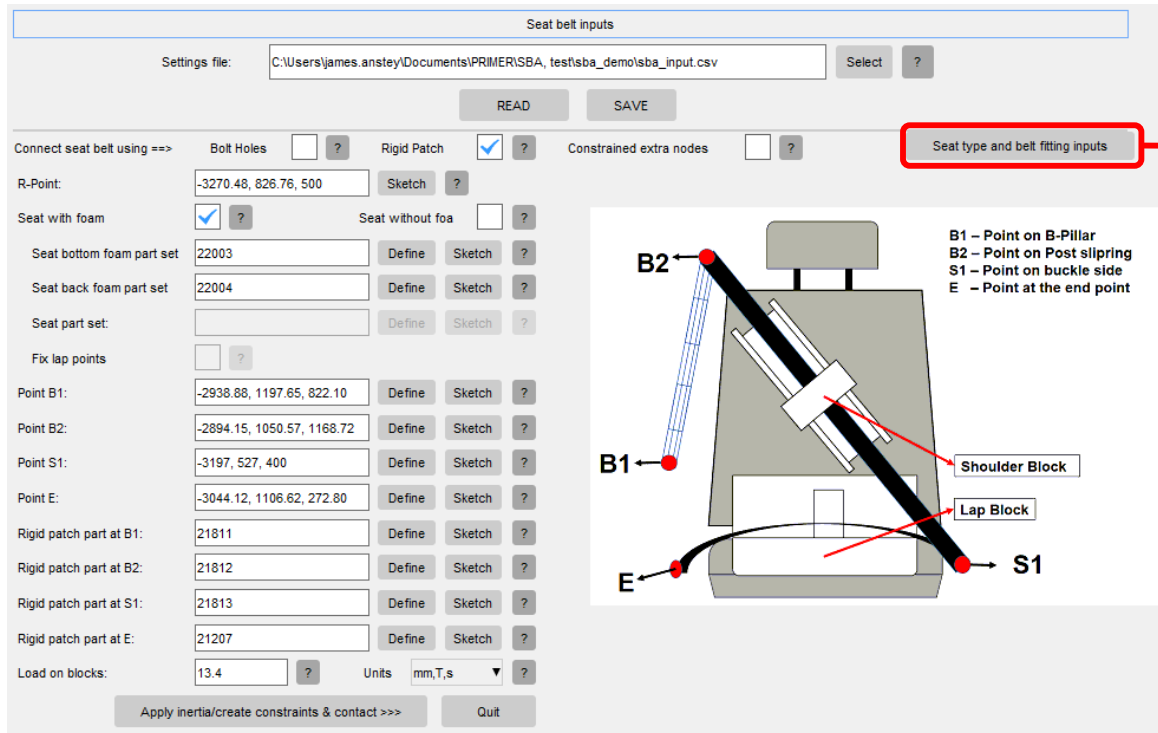
HIC values	
1700.00	Red
1500.00	Orange
1000.00	Yellow
650.00	Green
0	Dark Green

Settings	
Perimeter lightness	440.00
Band sensitivity	50.00

Seatbelt Anchorage Tool Updates

SBA Tool Updates

- Belt fitting stage improved to produce a better fit.
- Added an option to set Torso points to known positions which may aid belt fitting.
- Added an option to align shoulder block automatically or manually.
- Added an option to update 1D belt length.



SBA Tool Updates

- An option is added to install an inertia bar and apply the appropriate load to seat.

Seat belt inputs

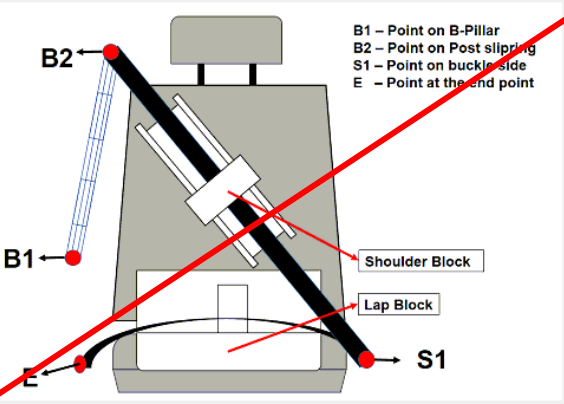
Settings file: C:\Users\james.anstey\Documents\PRIMER\SBA_test\sba_demo\sba_input.csv [Select] [?]
[READ] [SAVE]

Connect seat belt using ==> Bolt Holes [?] Rigid Patch [x] [?] Constrained extra nodes [?] Seat type and belt fitting inputs

R-Point: [-3270.48, 826.76, 500] [Sketch] [?]
Seat with foam [x] [?] Seat without foa [] [?]
Seat bottom foam part set: [22003] [Define] [Sketch] [?]
Seat back foam part set: [22004] [Define] [Sketch] [?]
Seat part set: [] [Define] [Sketch] [?]
Fix lap points [] [?]

Point B1: [-2938.88, 1197.65, 822.10] [Define] [Sketch] [?]
Point B2: [-2894.15, 1050.57, 1168.72] [Define] [Sketch] [?]
Point S1: [-3197, 527, 400] [Define] [Sketch] [?]
Point E: [-3044.12, 1106.62, 272.80] [Define] [Sketch] [?]
Rigid patch part at B1: [21811] [Define] [Sketch] [?]
Rigid patch part at B2: [21812] [Define] [Sketch] [?]
Rigid patch part at S1: [21813] [Define] [Sketch] [?]
Rigid patch part at E: [21207] [Define] [Sketch] [?]
Load on blocks: [13.4] [?] Units: mm,T,s [?]

[Apply inertia/create constraints & contact >>>] [Quit]

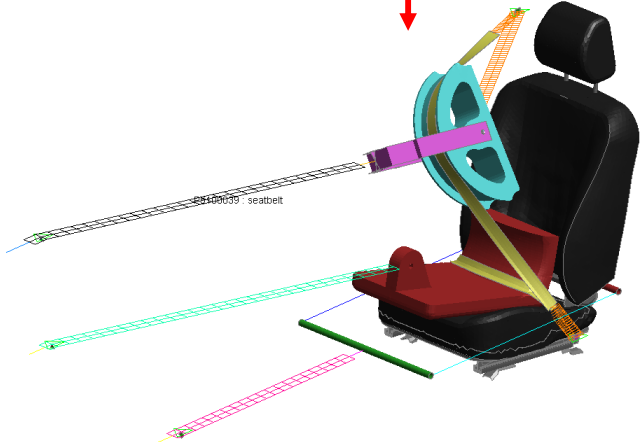


Inertia loading/vehicle constraint/contact

APPLY INERTIA LOADING
Apply inertia load: [x] [?]
Inertia load: [20] [?]
Scale inertia loading device: Auto [x] [?] Manual [] [?]
Inertia loading bar length: [] [?]
Gap b/w inertia loading bars: [] [?]
Recliner Node Set: [4081042] [Define] [Sketch] [?]
Recliner Part Set: [22007] [Define] [Sketch] [?]
CONSTRAIN THE VEHICLE
Create *BOUNDARY_SPC card: [x] [?]
Node Set for SPC: [1040, 4081039] [Define] [Sketch] [?]
CREATE CONTACT
Create *AUTO_SINGLE_SURFACE contact: [x] [?]
Exempted part set: [1028] [Define] [Sketch] [?]

3D diagram of a seat with labels: Loading Device, Recliner nodes to connect Loading device, Load, Length.

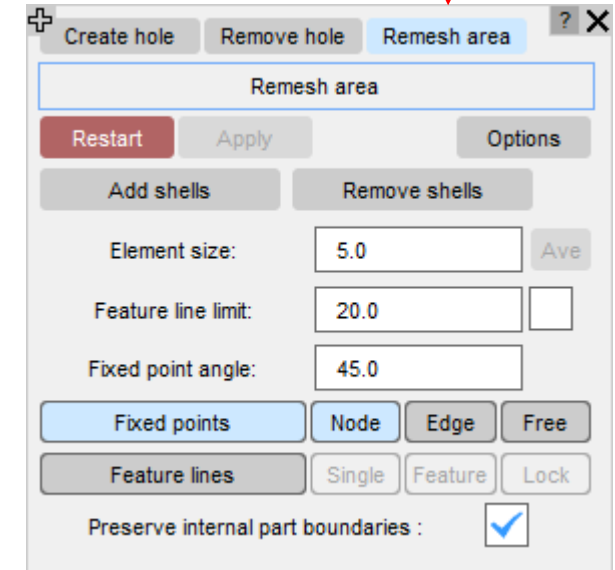
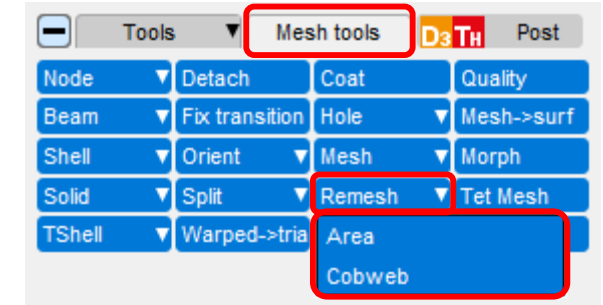
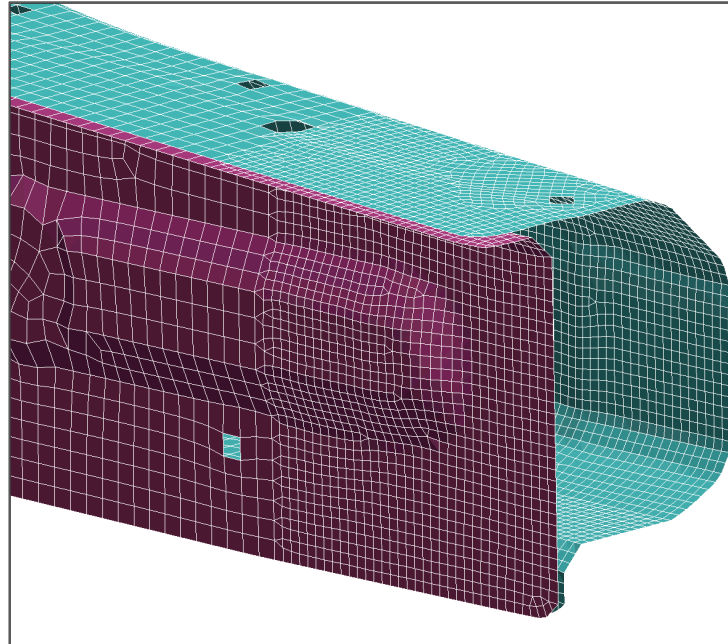
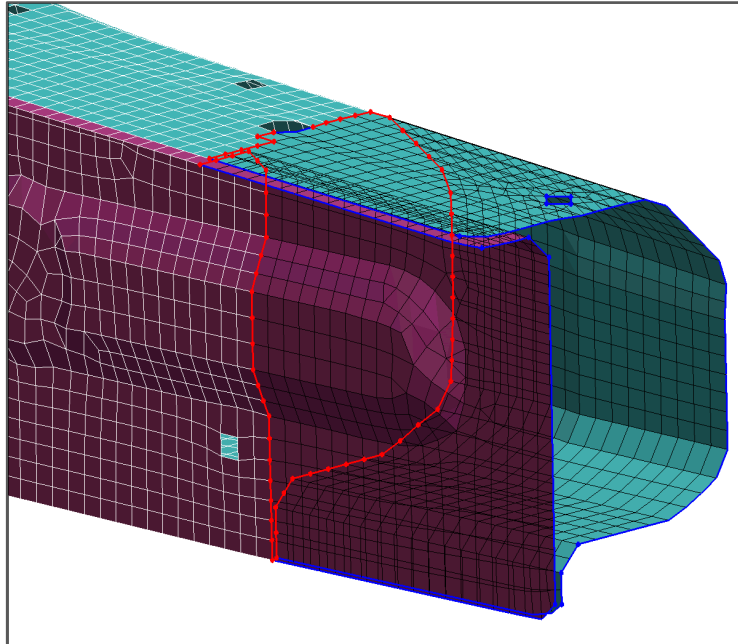
<<< Seat belt input [Calculate] [Quit]



Remesh Improvements

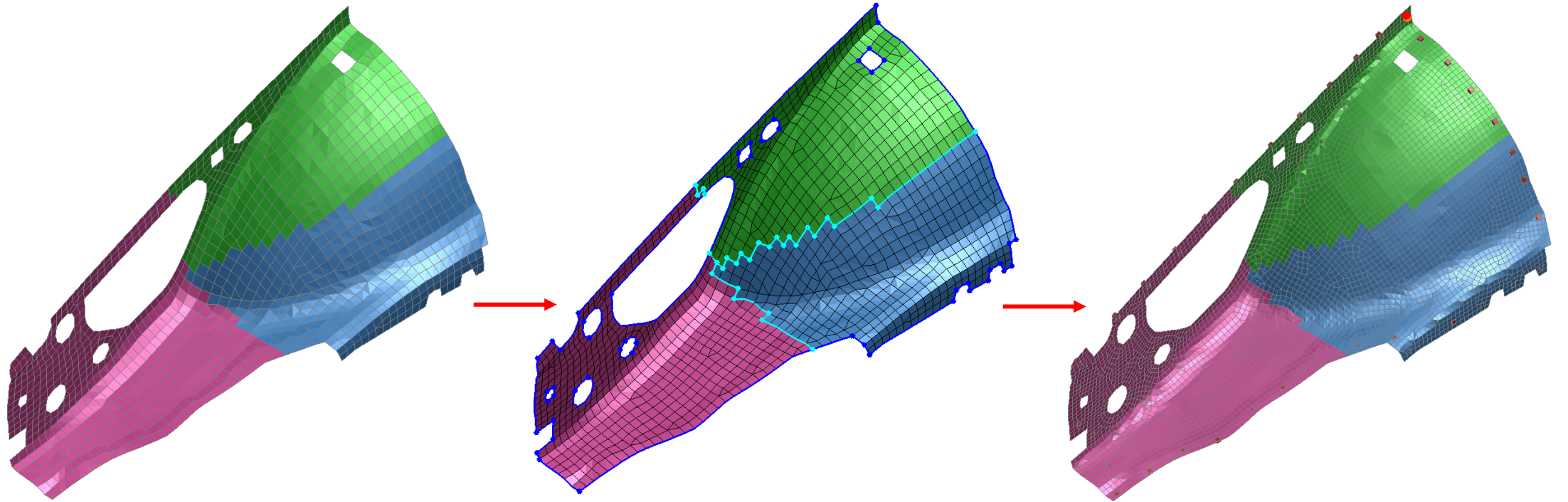
Remesh Improvements

- Added ability to remesh multiple parts in one operation.
- Also, visibility of the elements is maintained after remesh.



Remesh Improvements

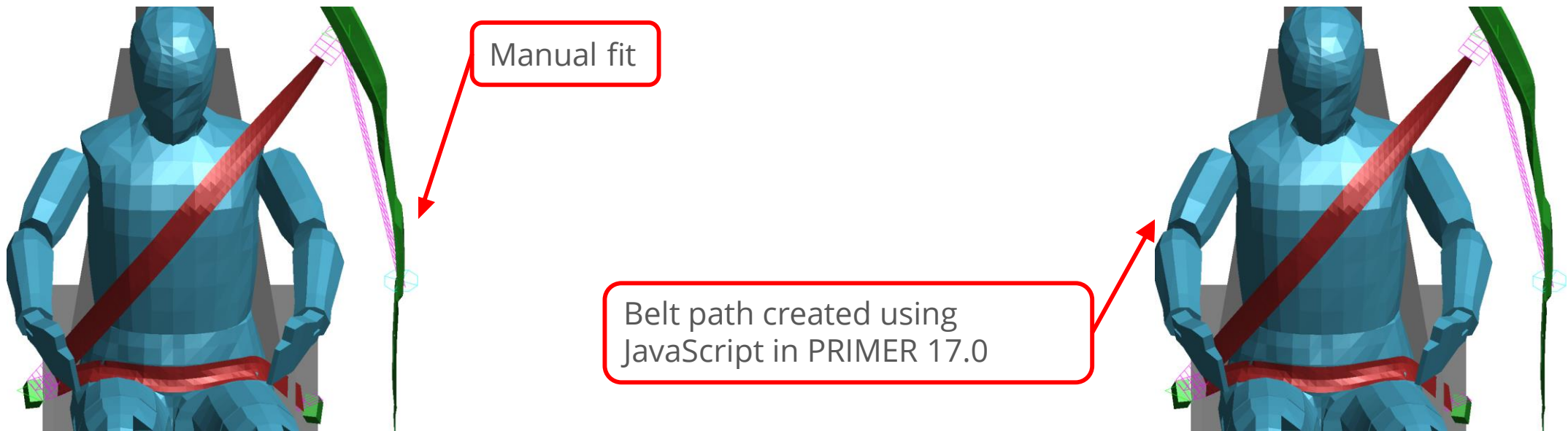
- Internal part boundaries are preserved after remesh.



JavaScript API

JavaScript API – Belt Class - Constructor Improvements

- The constructor for the Belt class in PRIMER 17.0 supports additional properties. It also uses default values that are more in line with those used by the Seatbelts menu, thereby resulting in a closer match.



- The constructor now also supports options to specify entity types and a list of entities (via a flag) that the new belt can fit around

Constructor

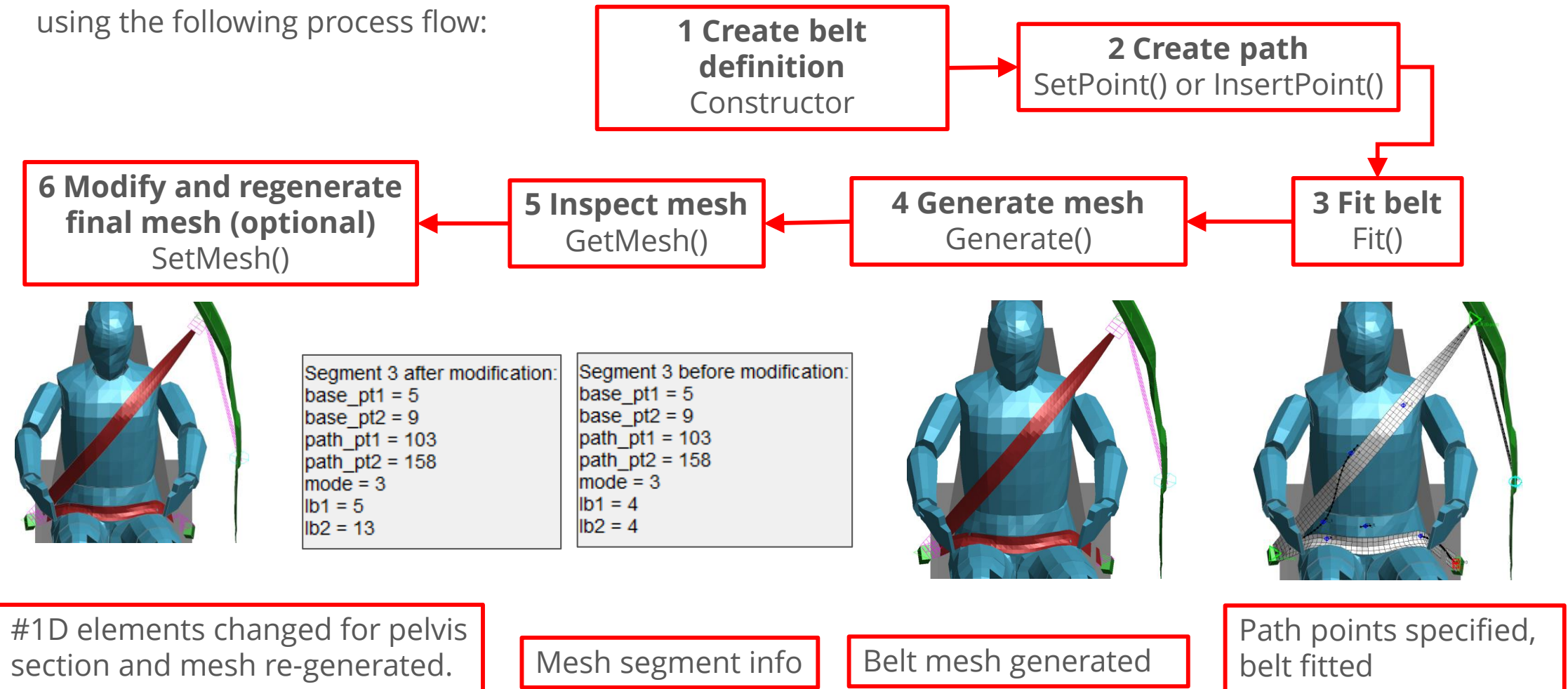
```
new Belt(model[Model], id[integer], title (optional)[string], structural_type (optional)[string], flag (optional)[integer])
```

JavaScript API – Belt Class – Other Improvements

- Some new properties are now supported by the Belt class. Additionally the following methods have been added:
 - InsertPoint() – adds points anywhere along the belt path.
 - Fit() – fits the belt around the occupant/seat.
 - Generate() – uses properties from an existing mesh (if one exists) and (re)generates it or creates a new default mesh if one doesn't exist.
 - GetMesh() – retrieves mesh segment properties.
 - SetMesh() method – modifies some mesh segment properties and regenerates the mesh.
- Using these new additions, it is now possible to create a fully-functional belt or to modify an existing one, to fit it and to regenerate the belt mesh.

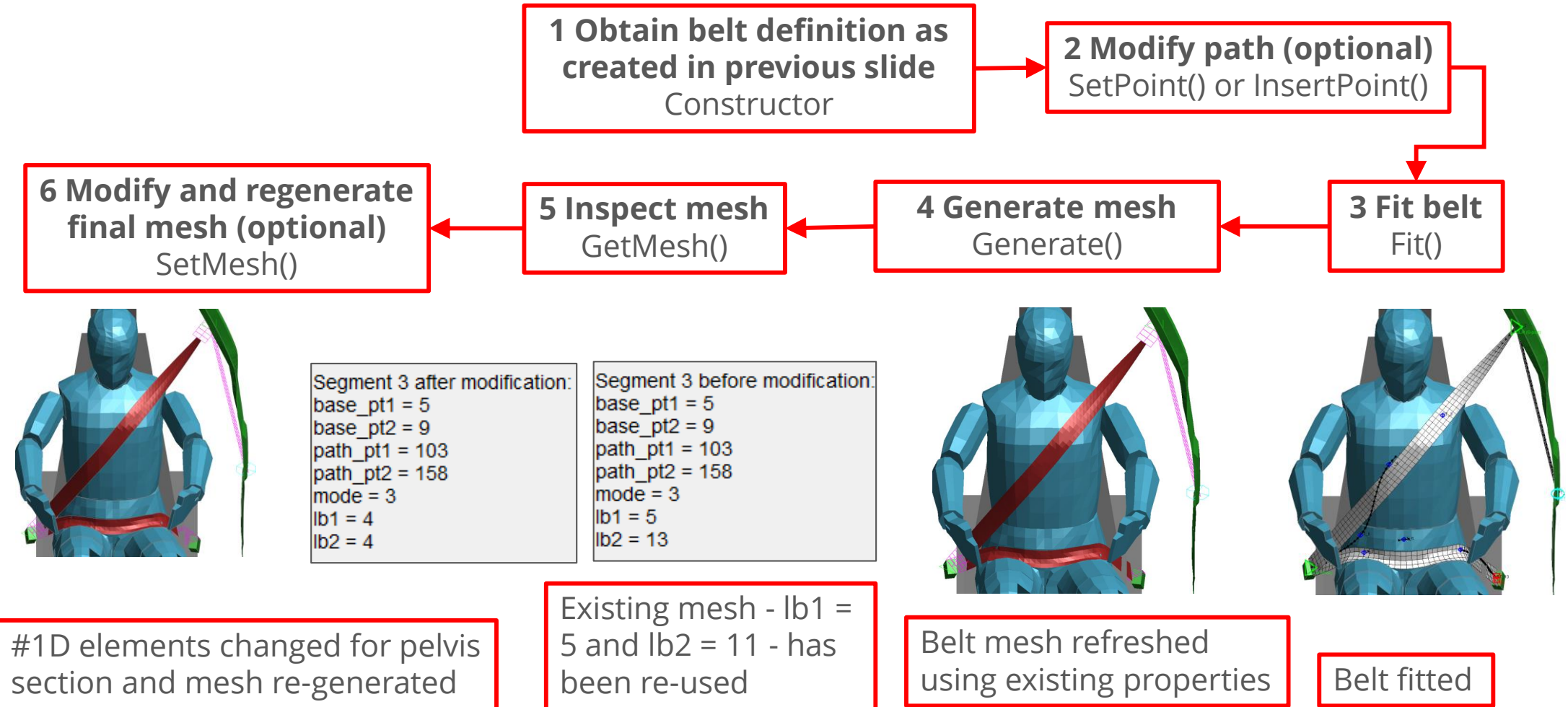
JavaScript API – Belt Class – Process Flow

- We can now create a belt, fit it, generate a mesh, inspect belt segment mesh properties, and modify the belt using the following process flow:



JavaScript API – Belt Class – Process Flow (cont.)

- The same process flow can be used to modify an existing belt:



JavaScript API

- Various JavaScript API enhancements include:
 - The number of flags that can be used in a script is limited. `FlagsAvailable()` function can be used to find out the number of flags that are available to be allocated. This function is available in the global class.
 - A new function `DialogueFunction()` has been added to the global class. This can be set to a JavaScript function that will be called when a message, warning or error is printed to the dialogue box. The function will be called with one argument which is a string containing the message.
This may be useful in a script to know if a particular dialogue message or warning has been printed.
 - `Visibility()` and `Labels()` functions are upgraded. They were intended to set the visibility and label visibility of entities respectively. But now the same function can be used to get the status of visibility and label visibility of entities.
 - A new slider widget is available for graphical user interfaces.
 - The `Curve` class now supports `*DEFINE_FUNCTION`.
 - The `onClick` event can now be used for label widgets.
 - The `MorphBox` constructor can now also be used to attach a new morph box to existing morph points (with user-defined coordinates), giving more flexibility on the geometry of the boxes.

JavaScript API

- Various JavaScript API enhancements include:
 - New member functions added in mechanism class to add and remove part, part set and node set in Mechanism->Assembly.
 - `m.AddPartToAssembly(index[integer], pid[integer])`
 - `m.AddPartSetToAssembly(index[integer], psid[integer])`
 - `m.AddNodeSetToAssembly(index[integer], nsid[integer])`
 - `m.RemovePartFromAssembly(index[integer], pid[integer])`
 - `m.RemovePartSetFromAssembly(index[integer], psid[integer])`
 - `m.RemoveNodeSetFromAssembly(index[integer], nsid[integer])`
 - `m.Autofix()` is added in Model class. This option can be used to perform model check and autofix all the fixable errors in the given model.
 - Keyword `DATABASE_ENVELOPE` is added to Database class.
 - You can now control overlay settings (No Overlay, free edges, feature lines, all edges) through properties in the Options class.
 - You now also have the ability to control colour settings (Background colour, text colour, Node colour....) in Display->Colour through properties in the Options class.

JavaScript API

- Various JavaScript API enhancements include:
 - Added new Model properties as following:
 - `m.compress`: To check if model is compressed or not, returns true if compressed.
 - `m.compressMode`: To check the mode of compression. Can be compared with model constants for compress mode (`Model.INDIVIDUAL_GZIP`, `Model.INDIVIDUAL_ZIP`, etc.).
 - `m.binary`: Returns true if model is in binary format.
 - `m.masterAscii`: Returns true if model is binary and master file is in ASCII.
 - `m.fileStartAscii`: Returns true if model is binary and beginning of the file (*CONTROL etc) is in ASCII.
 - Previously when encrypting a script the entire script was encrypted.
It is now possible to encrypt 'include files' and include them with 'Use'.
 - Arguments for methods that are integers are now checked more thoroughly. A warning is given if the number is not an integer and the number will be rounded to the nearest integer.
 - Arguments for methods that are numbers are now checked for validity. If the value is NaN (Not a Number) then an exception is now thrown.
 - Textbox Widgets can now be horizontally aligned via `Widget.LEFT`, `Widget.RIGHT` and `Widget.CENTRE`

JavaScript API

- New class function added in the BELT class for setting the start labels for new entities created for a Belt.
 - Belt.SetMeshinglabels (entity_type[constant], label_value[integer])
- Entity_type [constant] refer to:
 - 2D Slipring Set Node (MESH_2D_SLIPRING_SET_NODE)
 - Node (MESH_NODE)
 - NRBC (MESH_NRBC)
 - Retractor (MESH_RETRACTOR)
 - Seatbelt (MESH_SEATBELT)
 - Set Node (MESH_SET_NODE)
 - Set Part (MESH_SET_PART)
 - Set Shell (MESH_SET_SHELL)
 - Shell (MESH_SHELL)
 - Slipring (MESH_SLIPRING)
 - Xsec (MESH_XSEC)
 - Set All labels (MESH_ALL)

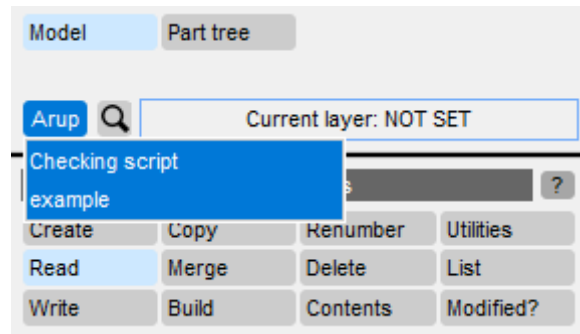
JavaScript API

- There have been a few instances where users have extended an existing class in PRIMER by adding their own property (for example adding a 'type' property to the Widget class). When we add new functionality to the API this potentially causes a conflict.
- For Oasys Ltd. to be able to extend and enhance the API in the future, any constant, property or method names beginning with a lowercase or uppercase letter are reserved.
If you need to add your own properties or methods to one of the existing classes then to avoid any potential future conflict you should ensure that the name begins with either an underscore (_) or a dollar sign (\$) or the name is prefixed with your own unique identifier.
- For example if company 'ABC' need to add a property called 'example' then to avoid any potential future conflict use one of:
 - `_example`
 - `$example`
 - `ABC_example`

Custom Tool Button for Scripts

- A custom tool button can be added to enable you to easily find and run your own scripts.
- It is controlled by the preferences `custom_tools_name` and `custom_tools_script_directory`.
- If the preference exists PRIMER will create a button next to the quickfind tool.
- PRIMER will search the directory for scripts and display them in a popup menu on the button.
- For example

```
primer*custom_tools_name:           Arup
primer*custom_tools_script_directory: C:\test\Arup_scripts
```



New Command Line Arguments

New Command Line Arguments

- If you specify a JavaScript and a command file to run using command line arguments using

```
primer17_0_64.exe -js=script.js -cf=command_file.cmf
```

then by default the script will be run first, followed by the command file.

- A new command line argument `-js_after_cf` has been added to alter this behaviour, i.e., using

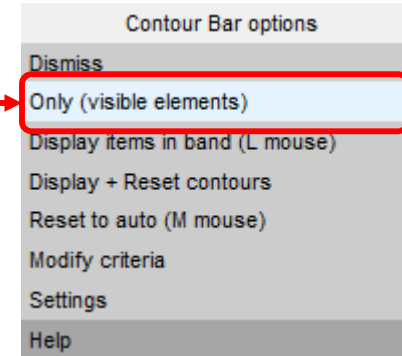
```
primer17_0_64.exe -js=script.js -cf=command_file.cmf -js_after_cf
```

then the command file will be run first, followed by the script.

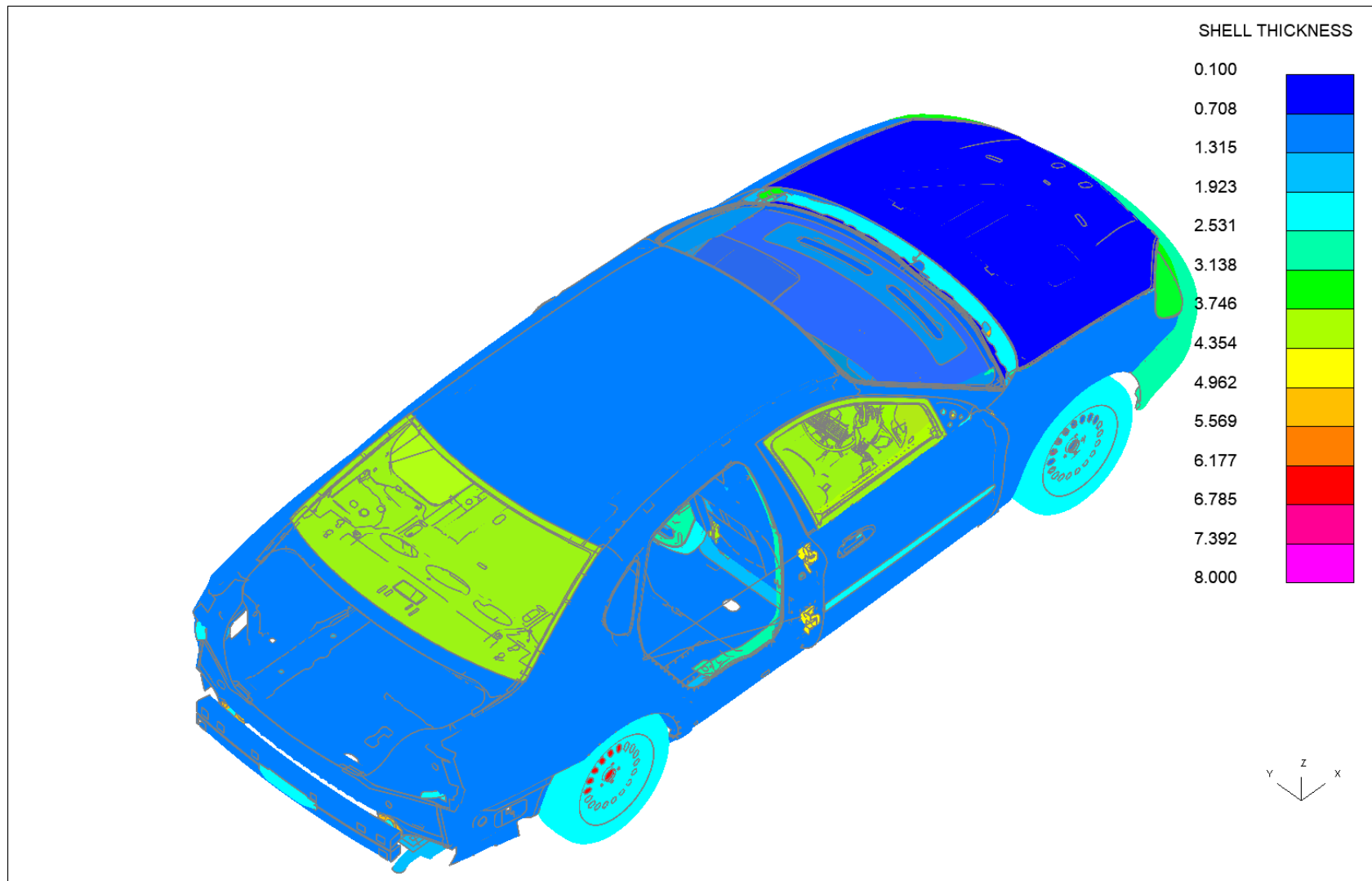
Contour Bar Options

Only (visible elements)

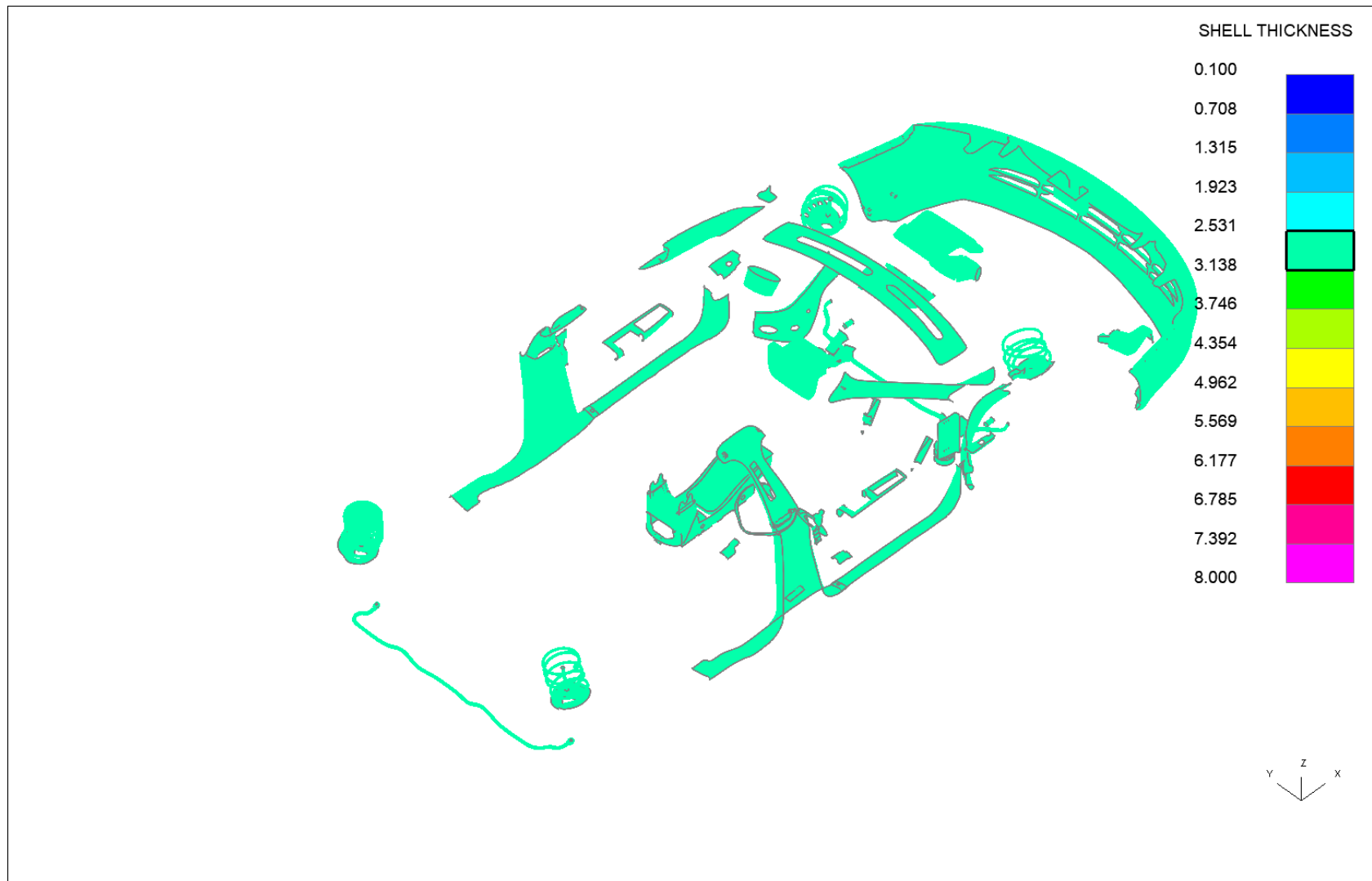
- A new option named 'Only (visible elements)' is made available on the drop down upon right mouse click of the contour bar in any CT/SI mode. True 'only' is applied to all visible (aka drawn) elements at that instant.



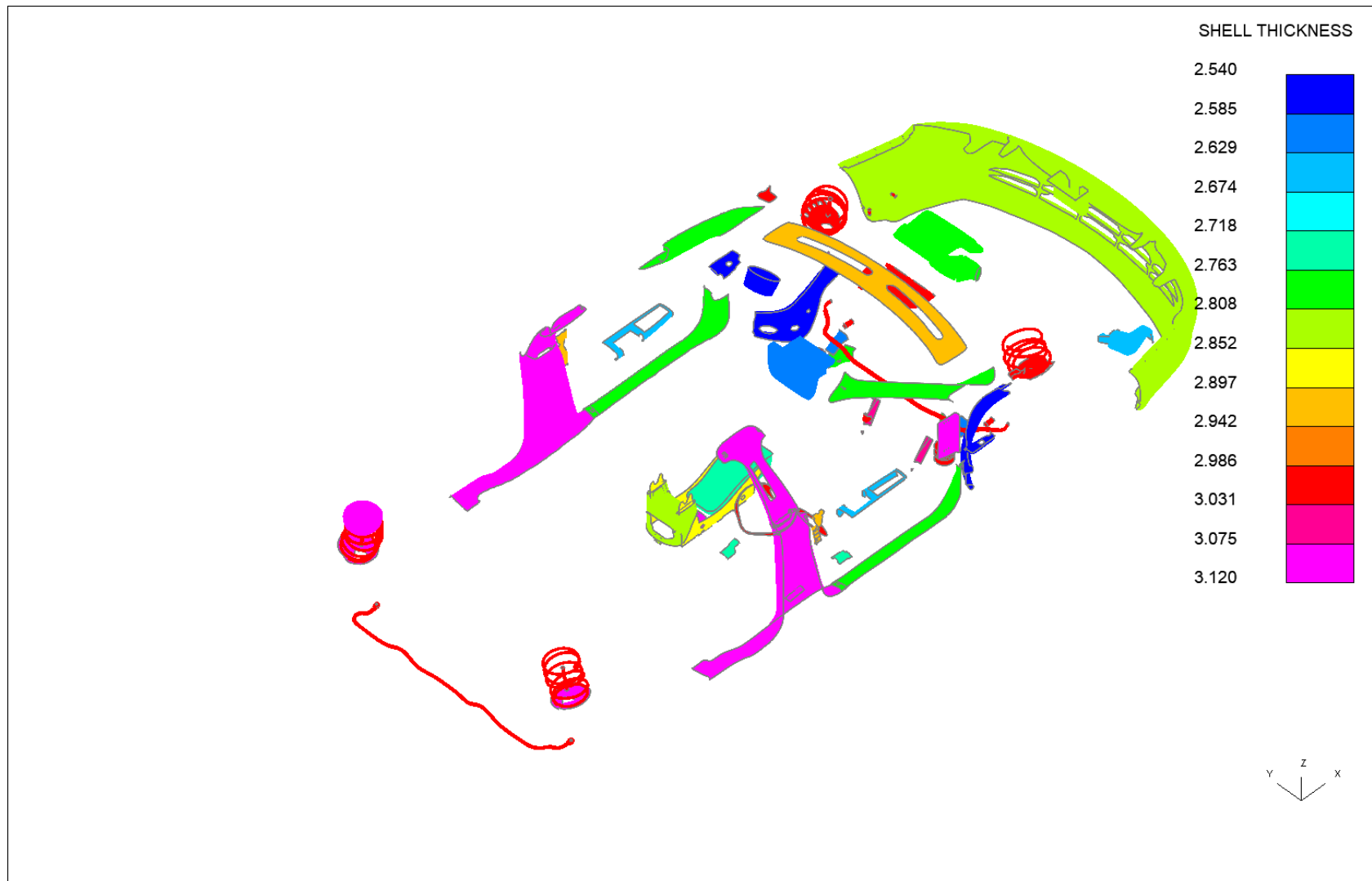
Only (visible elements) – Example (Shell Thickness CT Plot)



Only (visible elements) – Example (L mouse on Band)

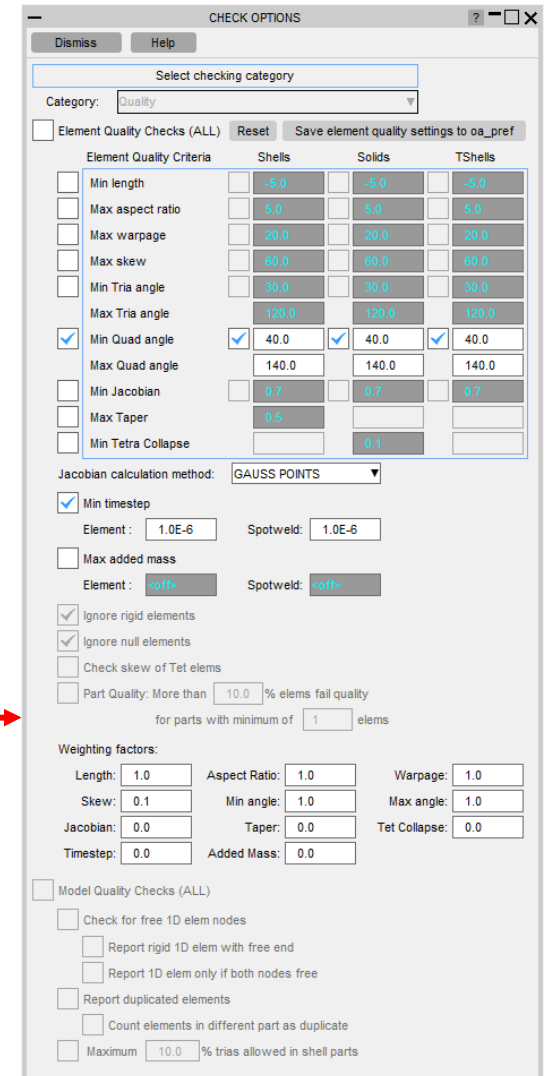
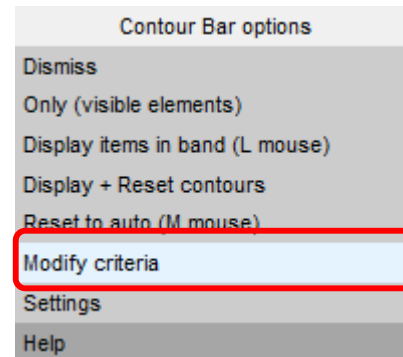


Only (visible elements) – Example (Only Applied)



Modify Criteria

- A new option named 'Modify Criteria' is made available on the drop down upon R mouse click of contour bar in the '**Elem Qual**' CT/ SI mode. It opens the Check Options panel with irrelevant options and buttons greyed out.



Measure Panel Additions

Measure Panel Additions

- The Measure panel now calculates the distance between two entities projected on the global coordinate planes.

The screenshot displays the 'Measure' panel with the following components:

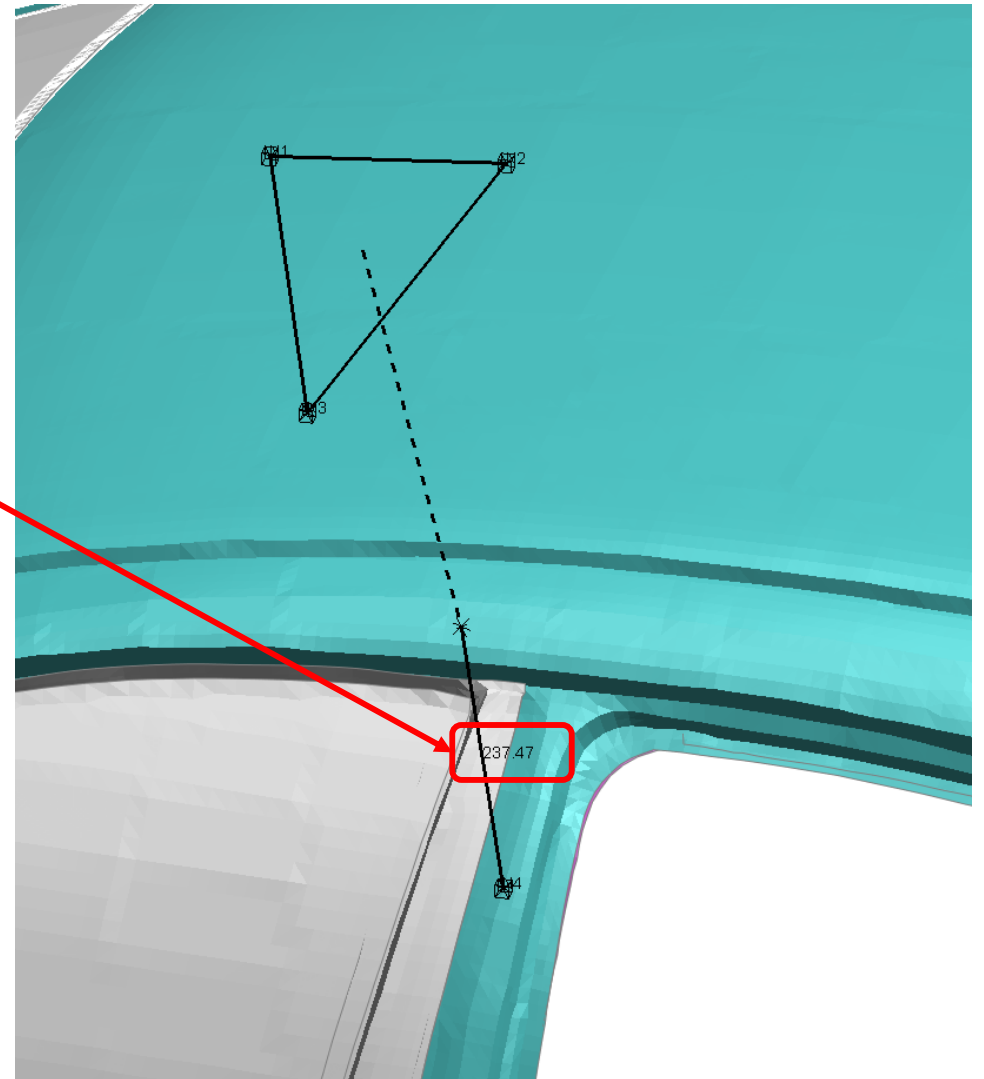
- Tools:** Point to Point, Point angle, Node to Node, Node angle, Nodal coord, Curve length, Node to Part, Part to Part, Node Curve len, Distance Plotter, Node to Plane.
- Current Operation:** Node to Node - pick nodes
- Buttons:** Done, Reject last, Refresh
- Table:**

N625811	▶	2718.1445	396.11566	771.32886
N638882	▶	2760.573	241.21597	785.74548
- Vector:** 42.428467 -154.89969 14.416626
 Unit vector
- Distance:** 161.25114 Undo move
- Angle between line and global coordinate system:**
XY: 5.1293664 YZ: 15.255298 ZX: -73.865379
- Projected distance on coordinate planes:**
XY: 160.60539 YZ: 155.56912 ZX: 44.810867

New Measure Mode: Node to Plane

- Pick 4 nodes:
 - First 3 nodes define the plane.
 - Shortest distance of 4th node to plane is calculated and indicated both in the **sketch** and in the **measure panel**.

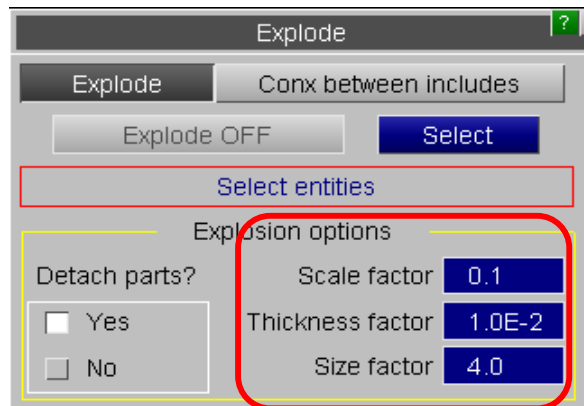
Node to Plane - pick nodes			
Done	Reject last	Refresh	
N2840710	▶	2337.5459	85.158455 1424.7385
N2842958	▶	2533.9414	70.159393 1450.0186
N2841558	▶	2471.7664	-335.57584 1427.5132
N2802031	▶	2715.0513	-678.71027 1207.7059
Vector:		30.922569	8.3130074 -235.29904
Distance:		237.46779	



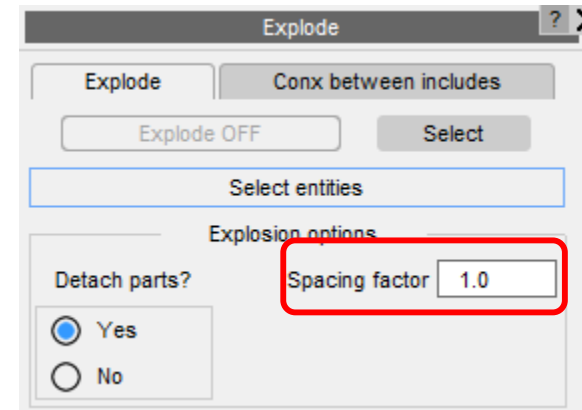
Explode Improvements

Explode: Spacing Factor

- Previous versions supported three different factors - scale factor, thickness factor and size factor - that could control the size of the exploded view. These factors have now been rationalised and a single all-encompassing 'spacing factor' (with a default value of 1.0) introduced. The new spacing factor can range between 0.0 and 10.0 with a larger value resulting in a more separated view.



PRIMER 16.0

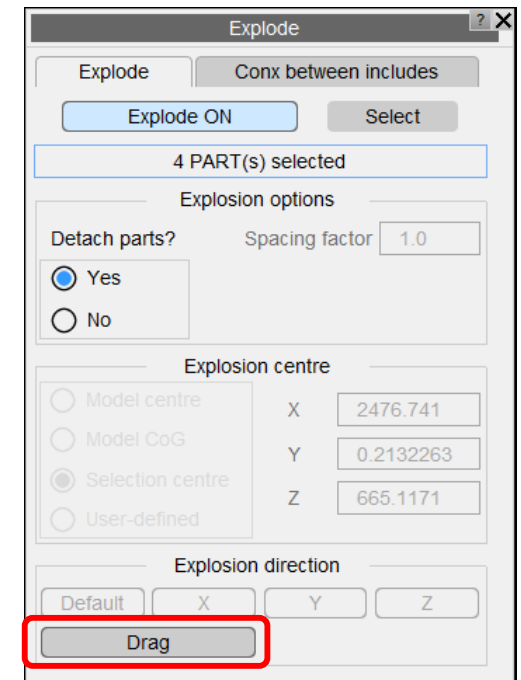
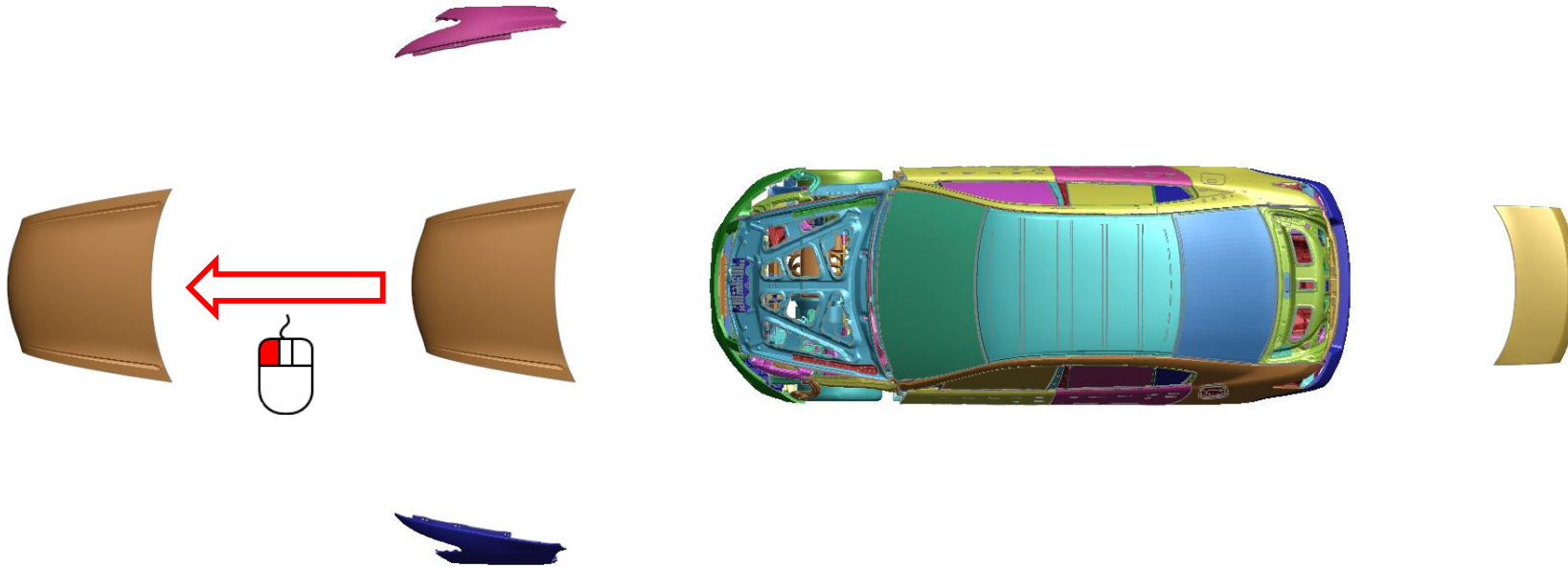


PRIMER 17.0

Note: Older macros that made use of the deprecated factors will, clearly, cease to work.

Explode: Drag

- A new “Drag” option has been added that allows you to pick and drag parts along the explosion direction (existing option). “Drag” is only available for parts and only when 'Detach parts' is set to 'Yes'.

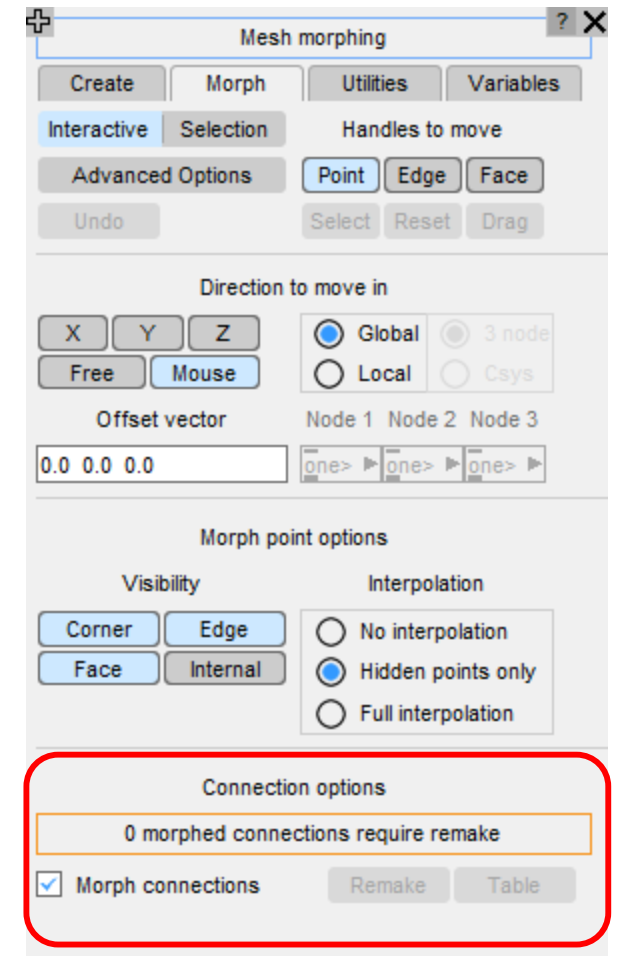


Morphing

Connection Morphing

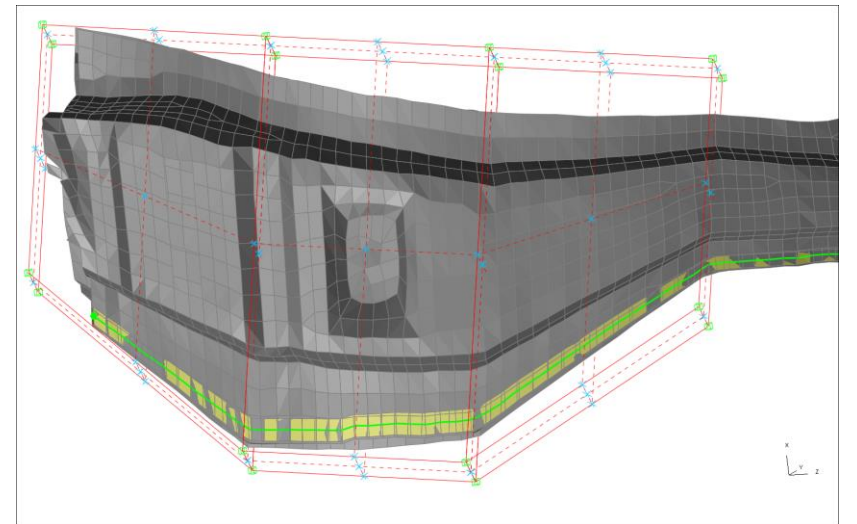
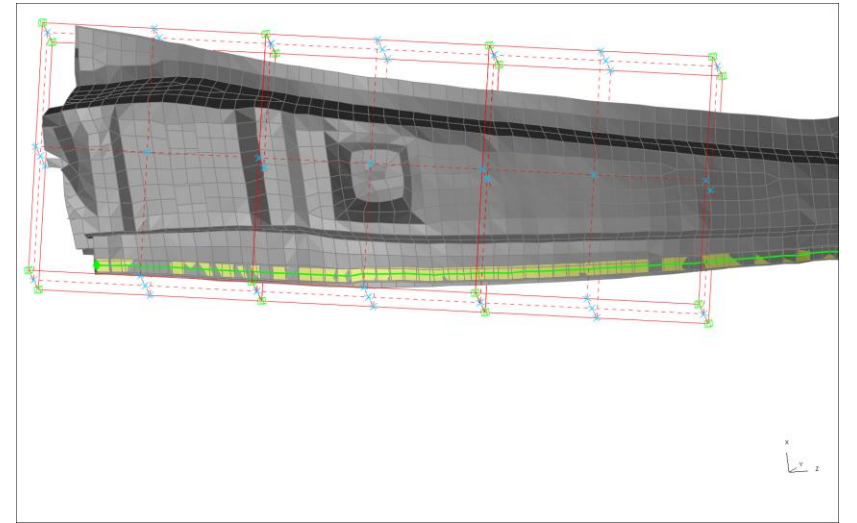
Connections can now be automatically repositioned when morphing a panel.

- PRIMER will automatically find these connections (provided they are initially attached).
- This can be turned on/off with a tickbox (the setting can be saved in the preference <morph_connections>).
- Morphed connections can be viewed in the Connections Table via the 'Table' button.
- Morphed connections can be remade via the 'Remake' button.



Connection Morphing

- Only connection points that lie within the morph box can be altered.
- Nodes created via HAZ weld remeshing will be automatically added to morph boxes.
- Nodes associated with Connections' FE counterparts are also automatically added to morph boxes (for example solids/nodes of strips of adhesive).



Connection Morphing

Supported in JavaScript API:

- Provided 'Morph Connections' is turned on PRIMER will find connections contained in any boxes being operated on and move them as appropriate (no additional function calls required).
- NOTE: MorphBox.ApplyMorphing() must be called before continuing any morphing operations interactively.

New functions:

- MorphBox.SetMorphConnections(<status>)- turns 'Morph Connections' on/off for the whole PRIMER session.
- MorphBox.FlagAllMorphedConnections(<model>, <flag>) – Flags all connections that have been morphed (since last remake) in <model> with <flag>.
- box.FlagMorphedConnections(<flag>) – Flags all connections that have been morphed by MorphBox box with <flag>.

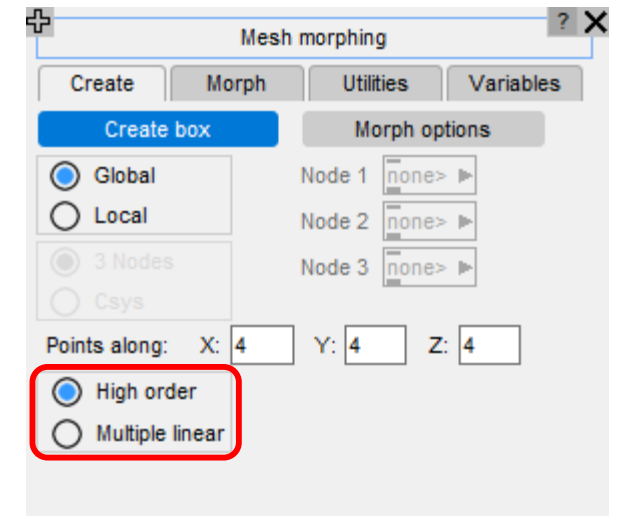
Connection Morphing

Support added for LS-OPT:

- Optional arguments can be passed when calling `-ls_opt` via `-ls_opt_arg`:
 - `-ls_opt_arg="OUTPUT: <filename>"` specifies the output filename.
 - `-ls_opt_arg="<filename>"` as above.
 - `-ls_opt_arg="REMAKE_CONX: <TRUE/FALSE>"` turns on/off the remaking of connections after morphing.
 - `-ls_opt_arg="REMAKE_CONX_ERROR: <TRUE/FALSE>"` treats the failure to remake an initially realized connection as an Error/Normal termination.

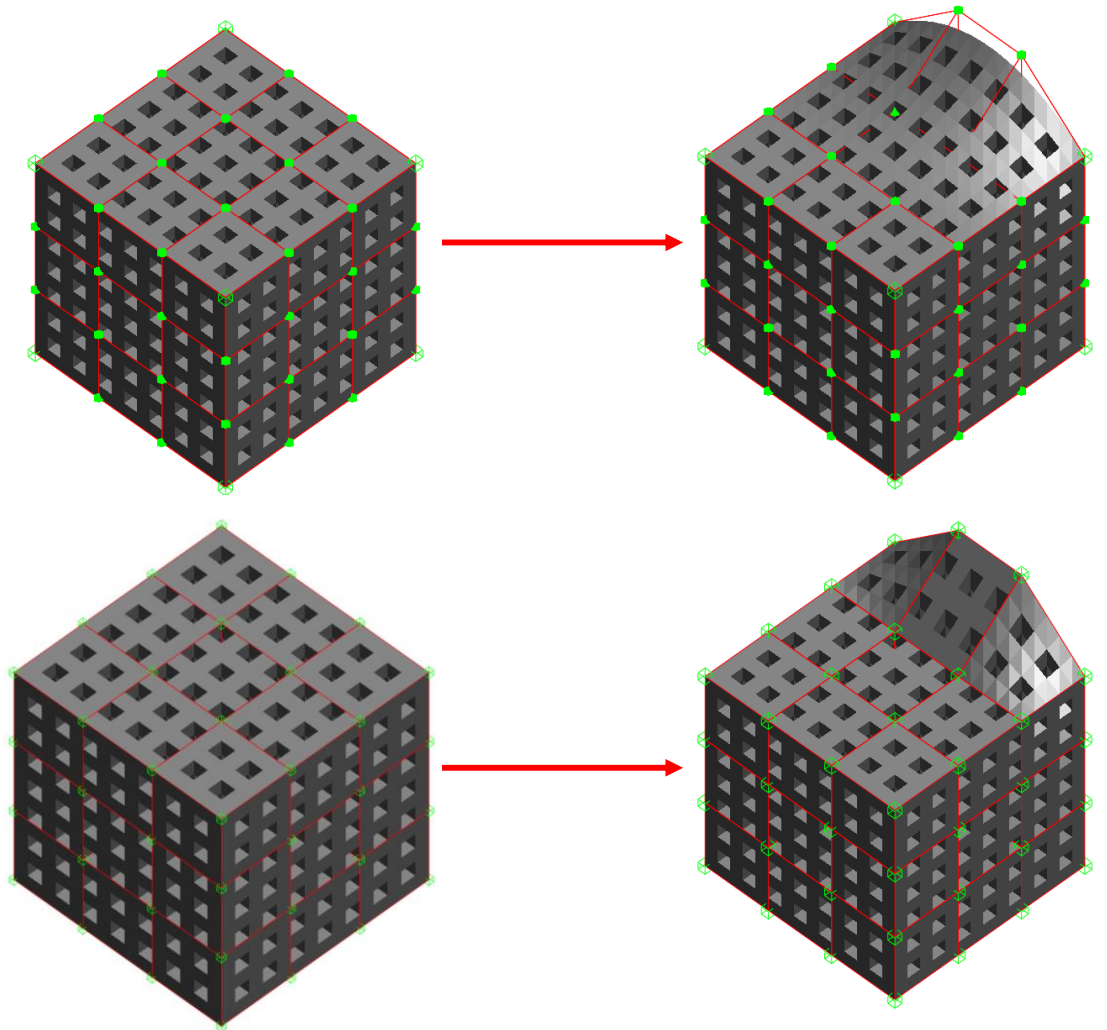
Multiple Adjacent Morph Boxes

- There is now a switch to create multiple linear morph boxes next to each other around a selection rather than one morph box of high order.
- With that option the morph boxes share the morph points in between.
- Although the initial configuration of adjacent linear boxes looks very similar to a high order box, the behaviour on the morphing is different as shown on the next slide.

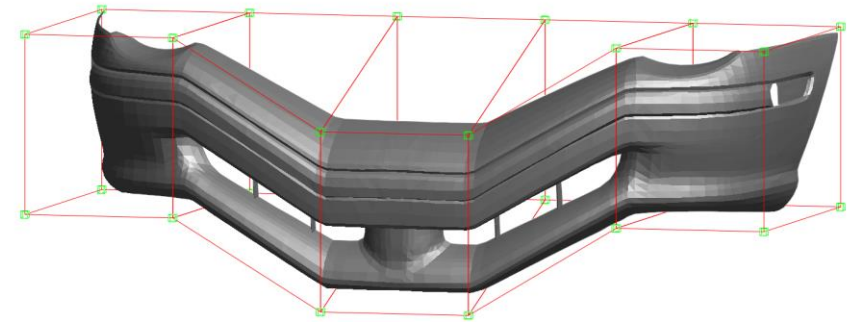
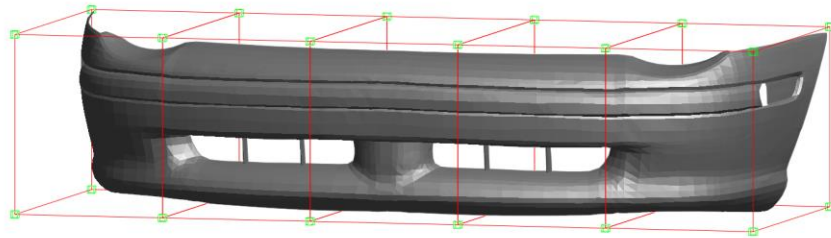
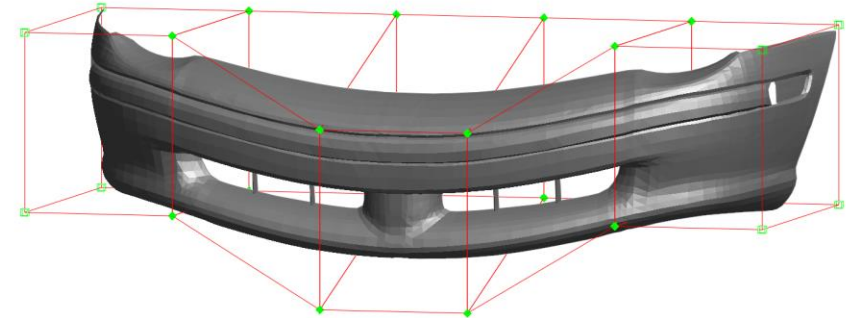
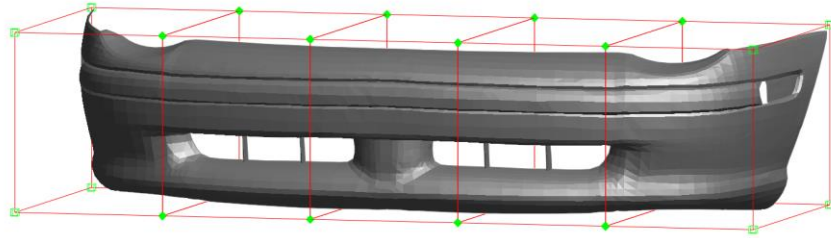


Multiple Adjacent Morph Boxes

- High order box:
 - Smoother result
 - Tangent directions given by vector between first two morph points on an edge, but nodes do not follow the morph points that closely.
- Multiple linear boxes
 - Nodes close to morph points follow morph points directly, but no continuity in tangent directions (sharper bending while morphing).



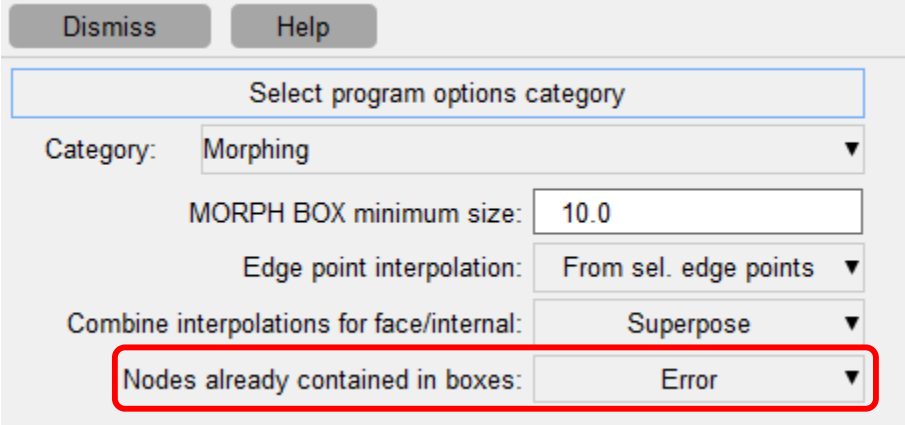
Multiple Adjacent Morph Boxes



Nodes Already Contained in Other Boxes

When creating a new morph box, the selected entities should not contain nodes already in other boxes. If they do, there are now two options:

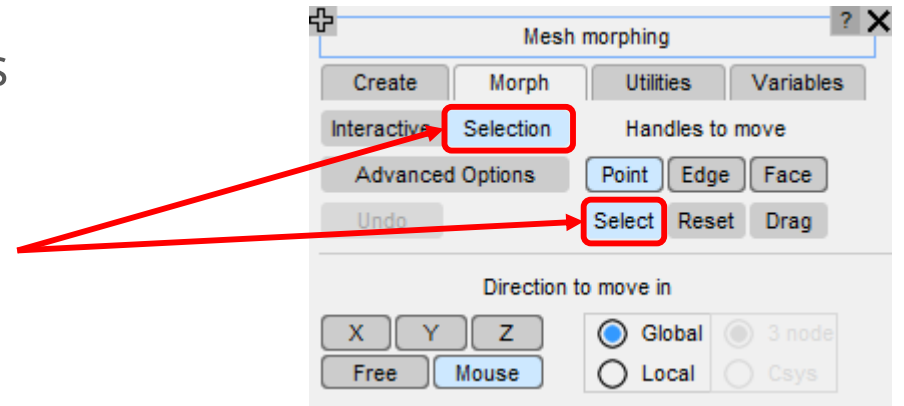
- PRIMER can give an error and stop the creation of the new box (as in PRIMER 16).
- PRIMER can skip the offending nodes and create the new box with all remaining selected nodes.



The screenshot shows a dialog box titled "Select program options category" with "Dismiss" and "Help" buttons at the top. The "Category" is set to "Morphing". Below this, there are several options: "MORPH BOX minimum size:" with a value of "10.0", "Edge point interpolation:" set to "From sel. edge points", and "Combine interpolations for face/internal:" set to "Superpose". The option "Nodes already contained in boxes:" is highlighted with a red rectangular box and is set to "Error".

General Improvements

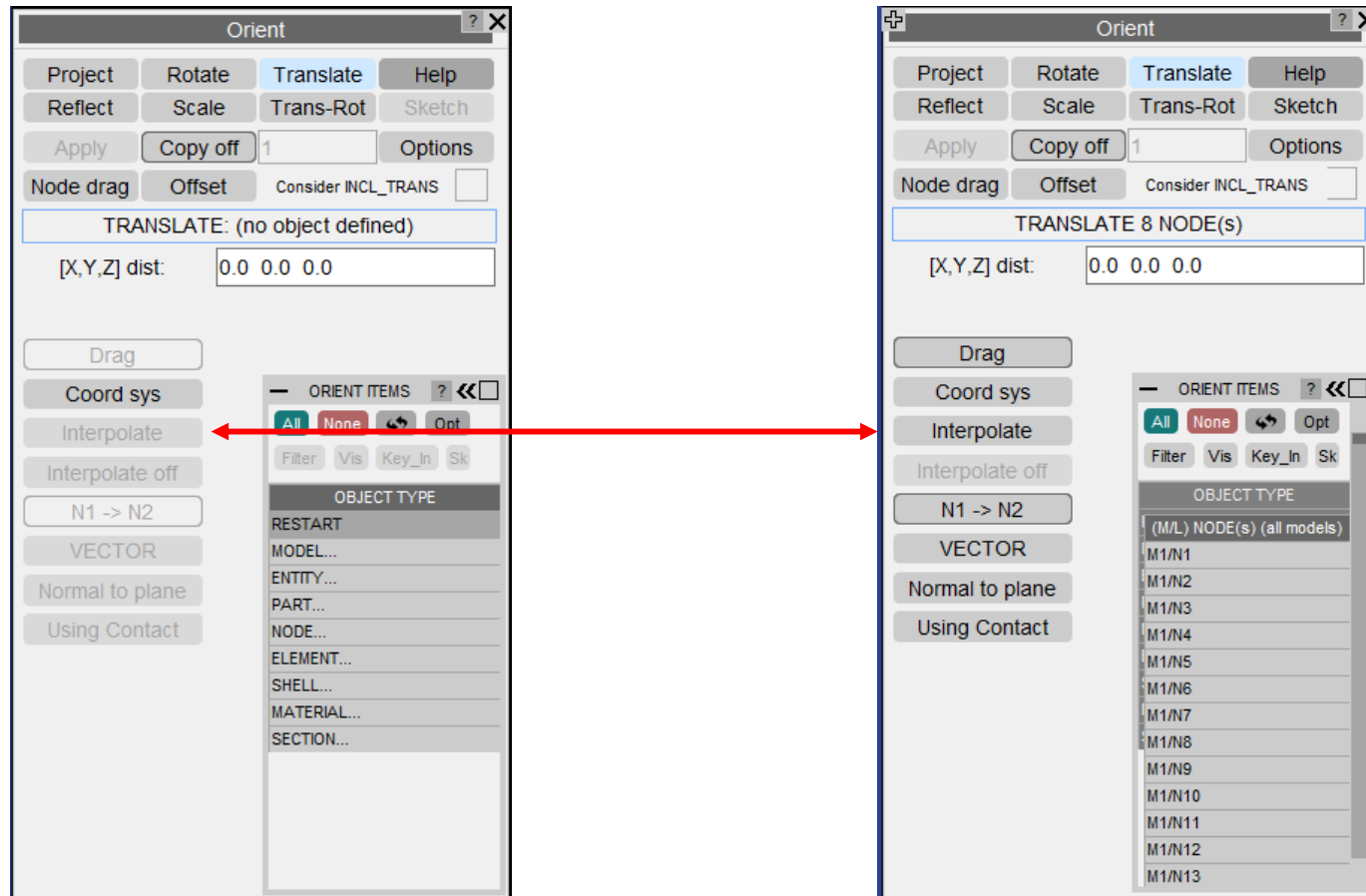
- Speed improvements when morphing large models
 - it is now significantly faster.
- Selection of drag handles by area has been added (via selection mode).



Orient Interpolation

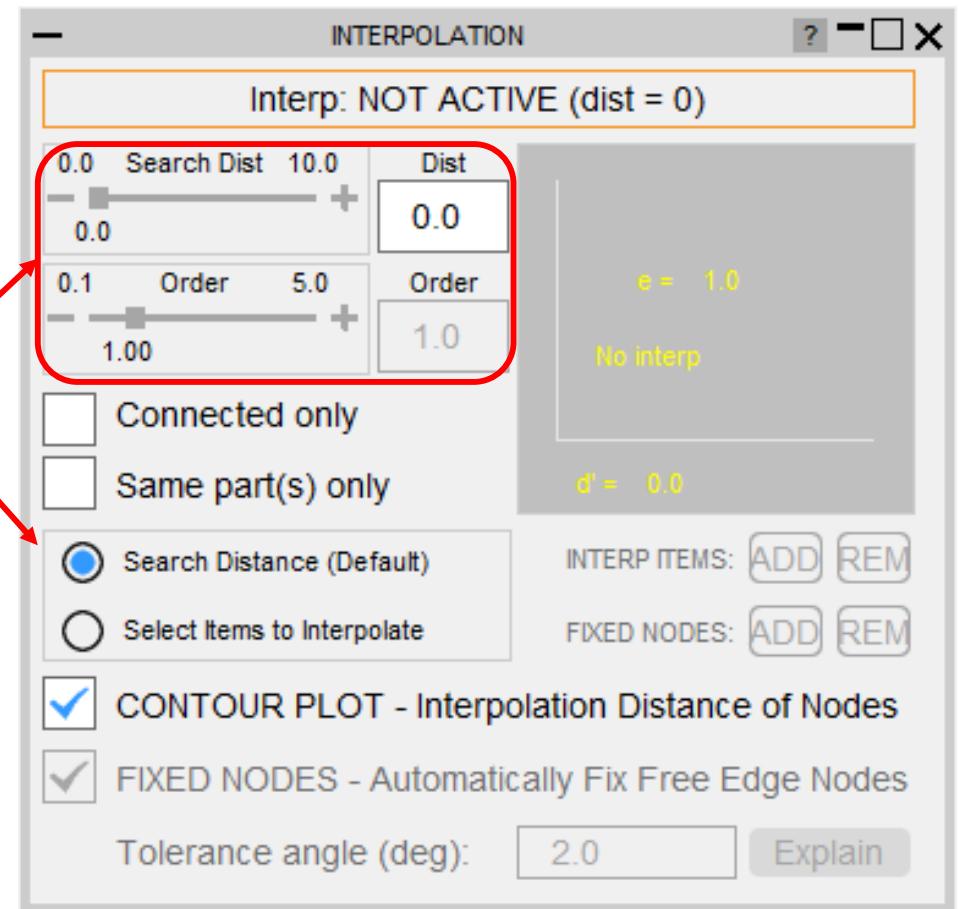
Orient Interpolation

- The Interpolate button (for TRANSLATE, ROTATE and SCALE) is only active after something has been selected for ORIENT.



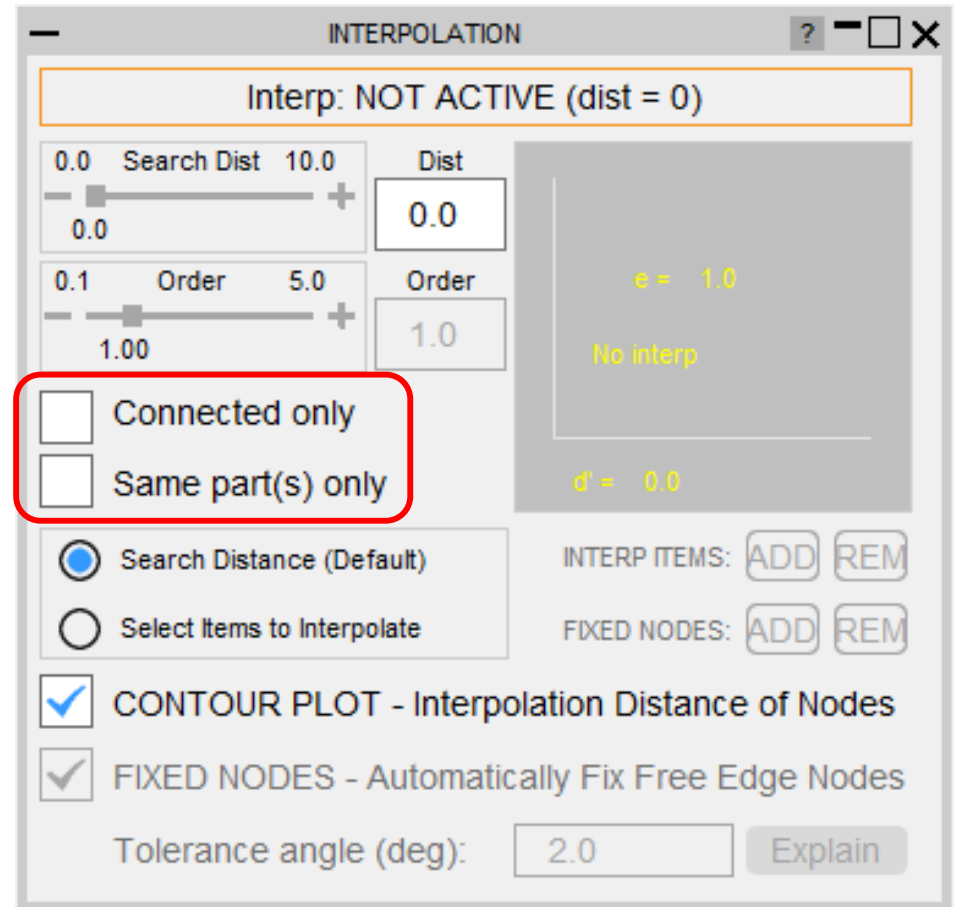
Orient Interpolation

- The Interpolation tool will now pop up as a new window.
- The default mode is the original “Search Distance” mode.
 - There are no major changes to this mode.
 - However, the sliders for Search Distance and Order are now more in sync with their respective textboxes.



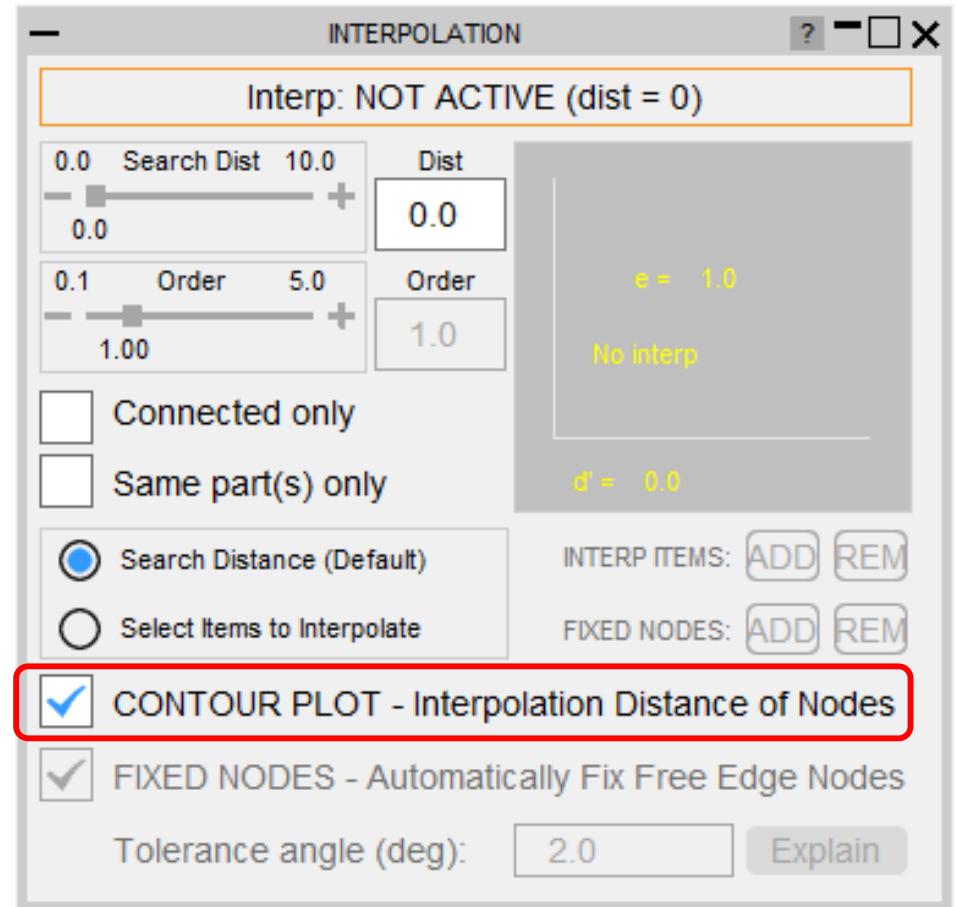
Orient Interpolation

- You can now use the “Connected only” and “Same parts(s) only” options even when the search distance is zero.



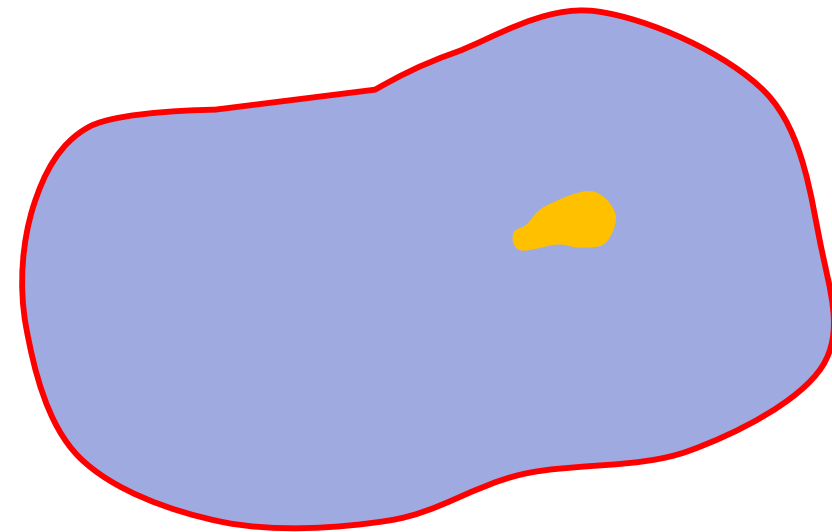
Orient Interpolation




- There is a new “CONTOUR PLOT” option for the “Search distance” mode. It plots the interpolation distance of every node within the search distance for the selected ORIENT operation.

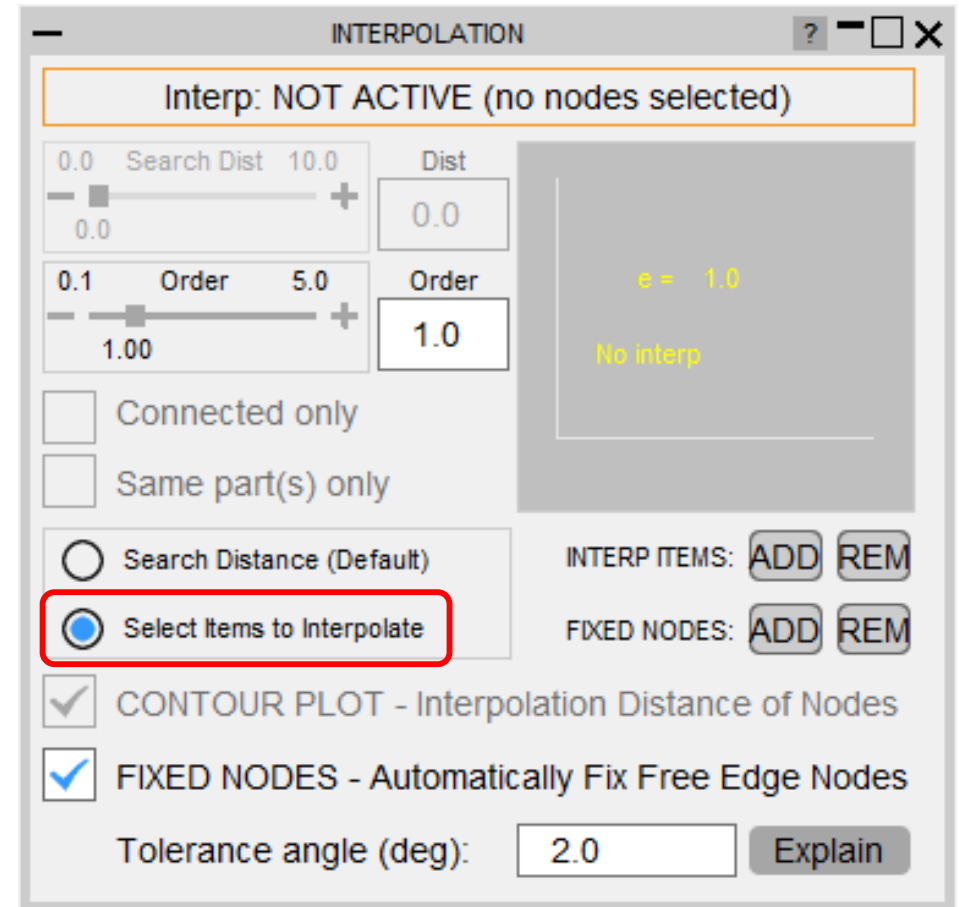


Orient Interpolation

- A new “Select Items” mode has been added.
- This mode is intended to be used in the following way:

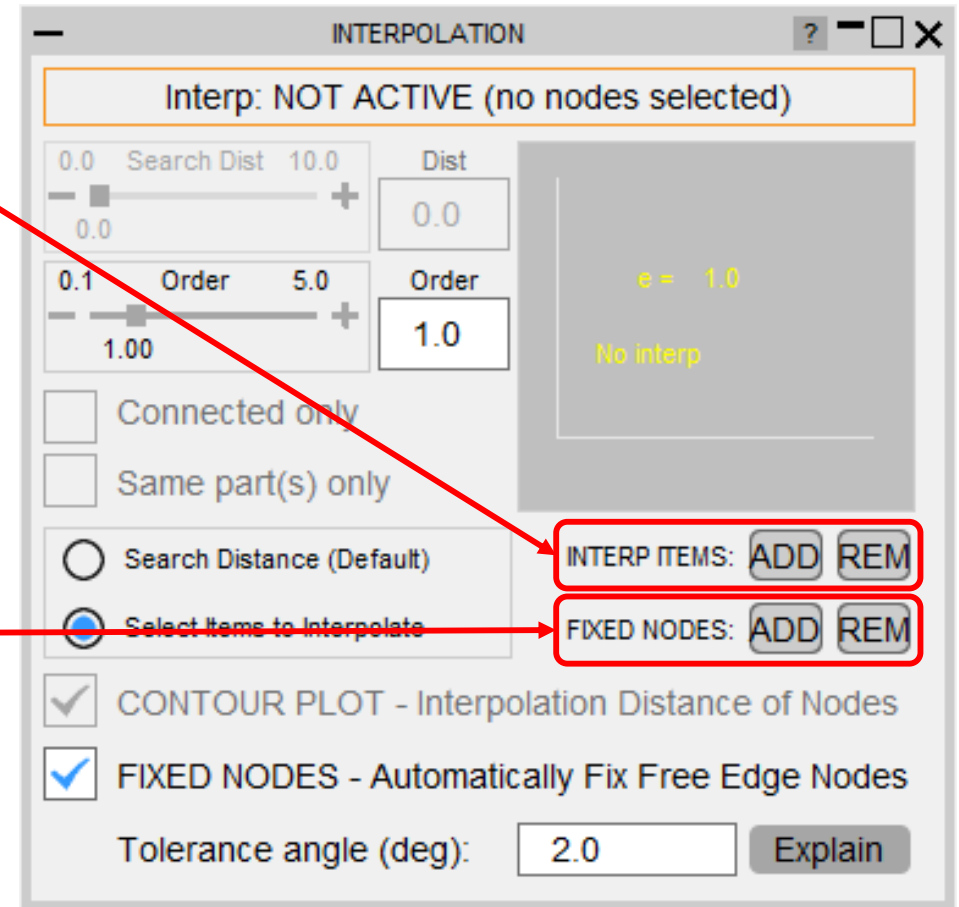


-  Orange area selected for orient
-  Red boundary is fixed and will not move
-  Blue area are will be interpolated – interpolation based on relative distance between oriented items (orange) and the fixed boundary (red)



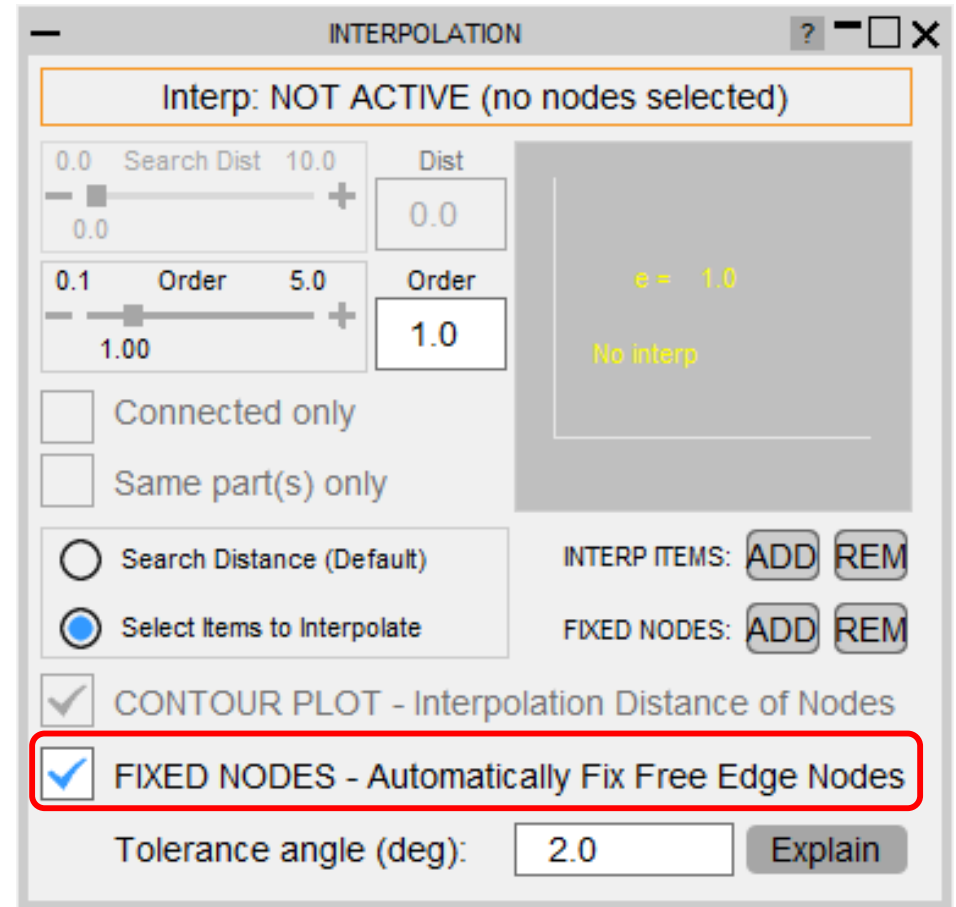
Orient Interpolation

- The ADD and REM buttons for INTERP ITEMS allows you to manually add/ remove nodes to interpolate via NODEs, SHELLs and PARTs.
 - Once a change is made, the interpolation nodes at the boundaries will be automatically identified and marked as fixed.
- The ADD and REM buttons for FIXED NODES allows you to manually add/ remove nodes that will remain fixed during interpolation.

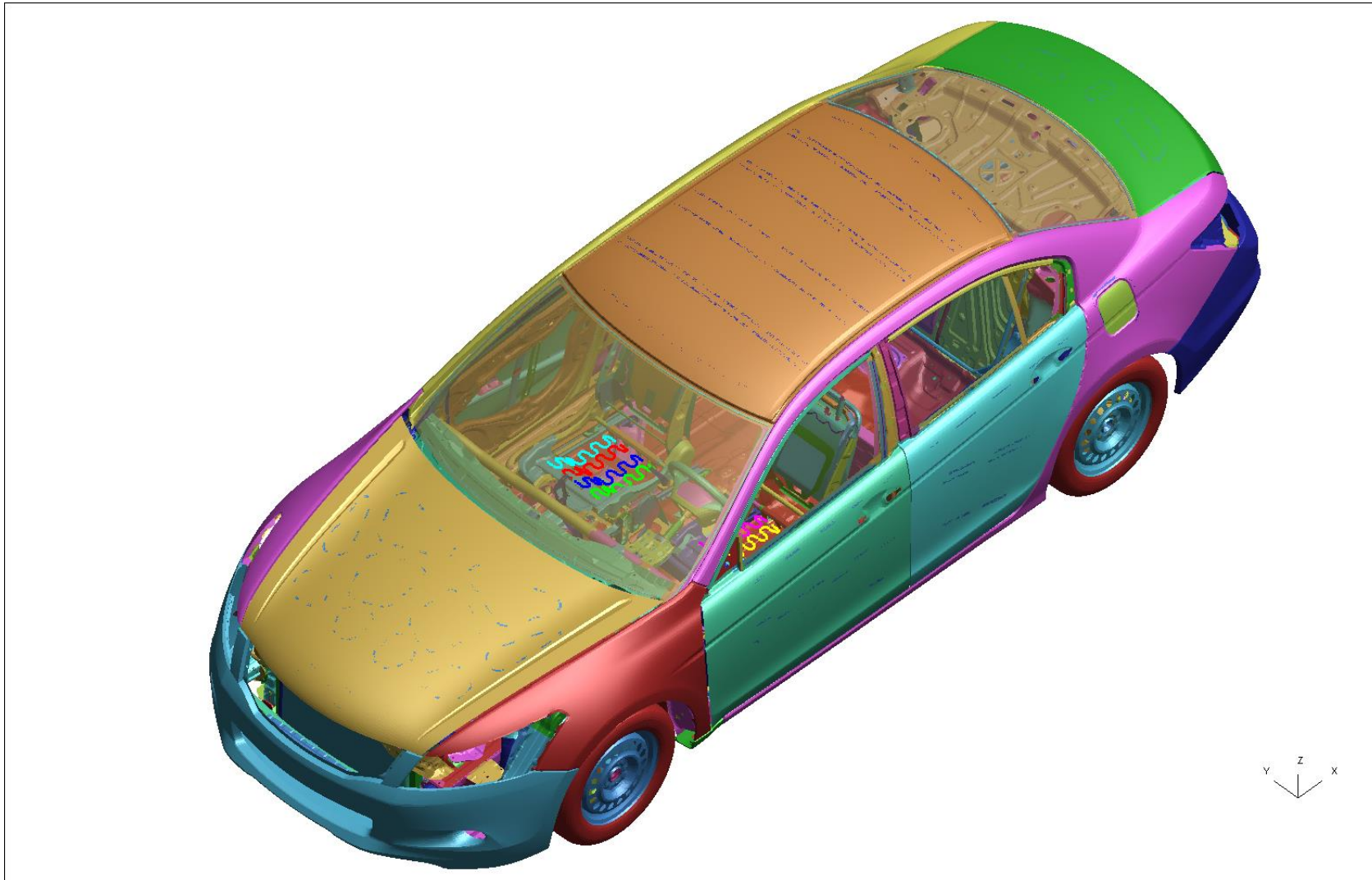


Orient Interpolation

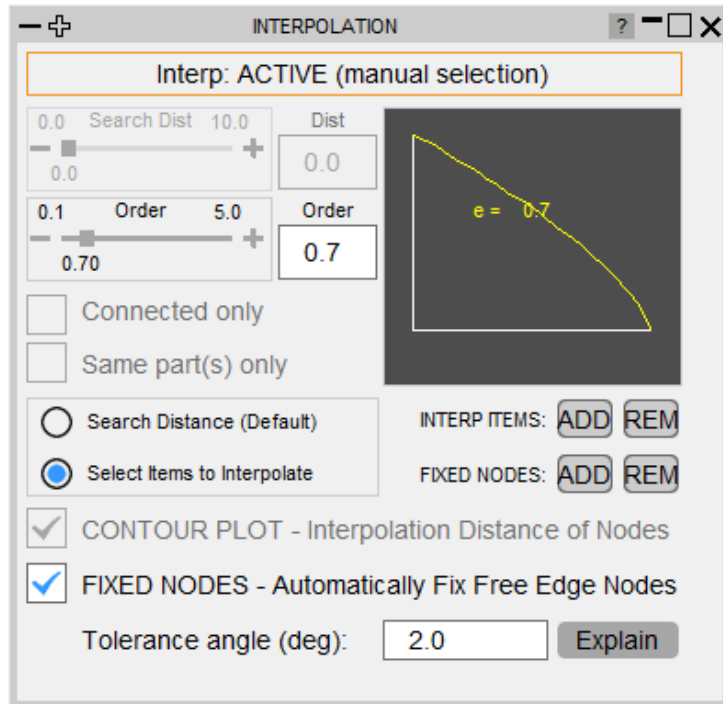
- There is a “Fix Free Edge Nodes” option for the “Select Items” mode.
- It will mark nodes (selected for interpolation) at free edges as fixed if ticked or unfixed if unticked, but it will ignore holes that are not at the boundary.



Orient Interpolation – Example (Initial Model)



Orient Interpolation – Example (Car Roof)



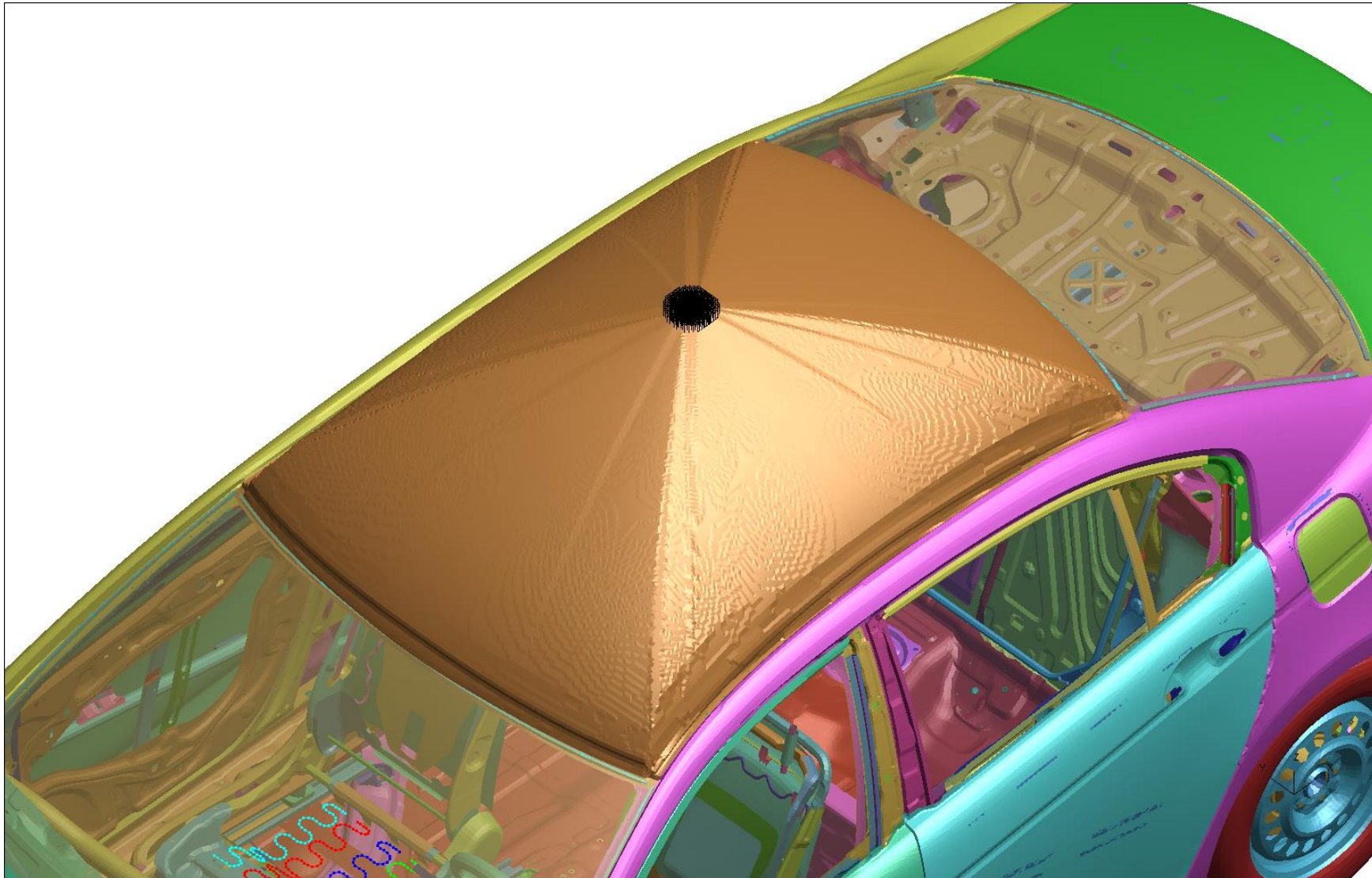
- Centre nodes selected for orient.
- Whole part selected for interpolation.
- Translate by (0, 0, 300).



Orient Interpolation – Example (Results)



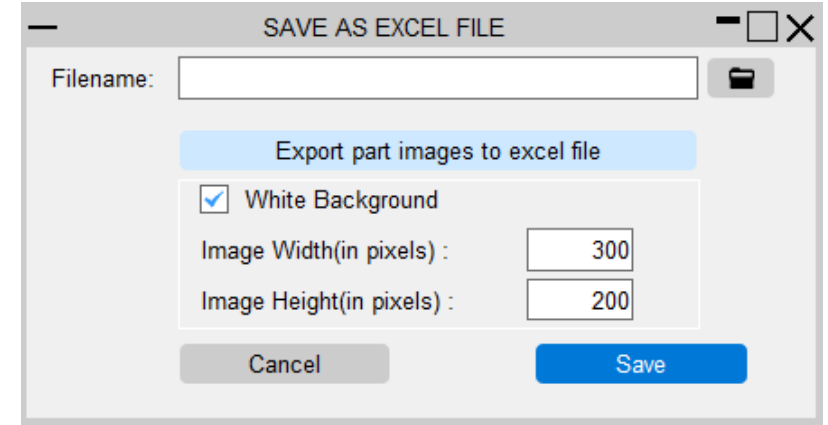
Orient Interpolation – Example (Results)



Part Compare Table

Part Compare Table

- A new option to write out the Part compare table as an Excel spreadsheet sheet (including part images) has been added to PRIMER.
- The part differences will be highlighted in red in the Excel spreadsheet.
- You can change the dimensions (in pixels) of the part images.

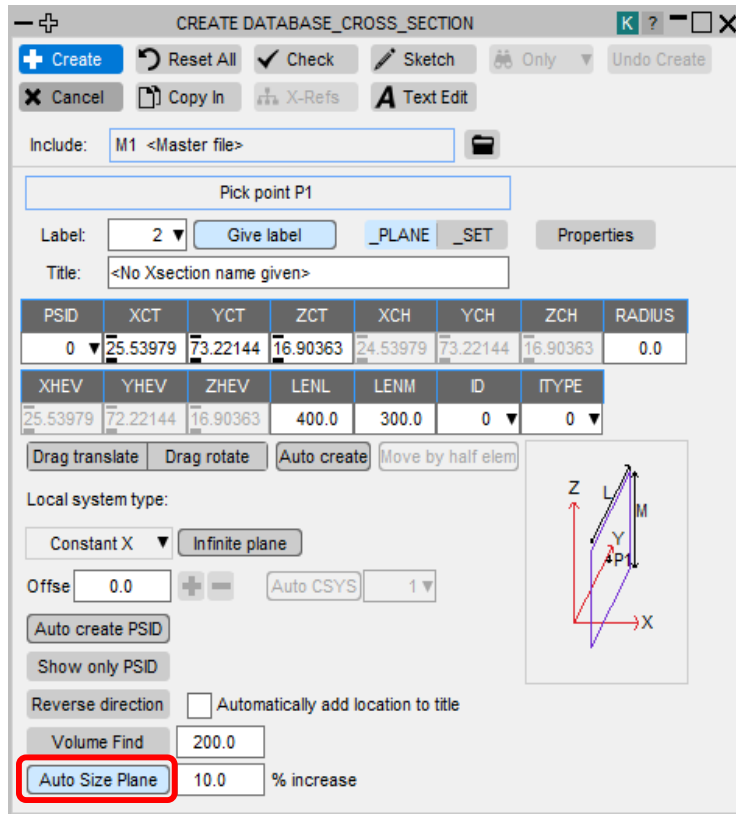


M1:demo.key Part Image	Part ID	Mat ID	Sect ID	Mat Dens	Part title	M2:demo_parts_mod.key Part Image	Part ID	Mat ID	Sect ID	Mat Dens	Part title
	1002	1002	1002	1E-07	H3-50 NECK - NULL SHELLS FOR CONTACT - NECK FRONT		1002	1005	1002	1E-07	H3-50 NECK - NULL SHELLS FOR CONTACT - NECK FRONT
	1003	1003	1003	1E-07	H3-50 NECK - NULL SHELLS FOR CONTACT - NECK REAR		1003	1002	1003	1E-06	H3-50 NECK - NULL SHELLS FOR CONTACT - NECK REAR

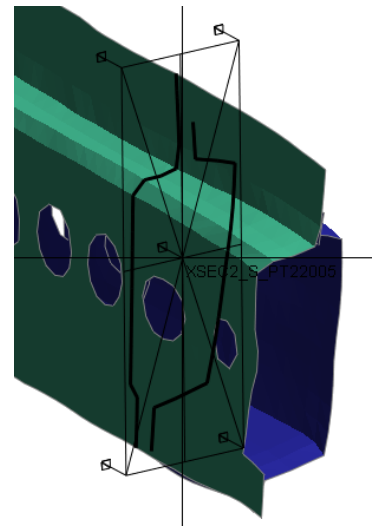
DATABASE_CROSS_SECTION

Auto Size Plane Dimensions

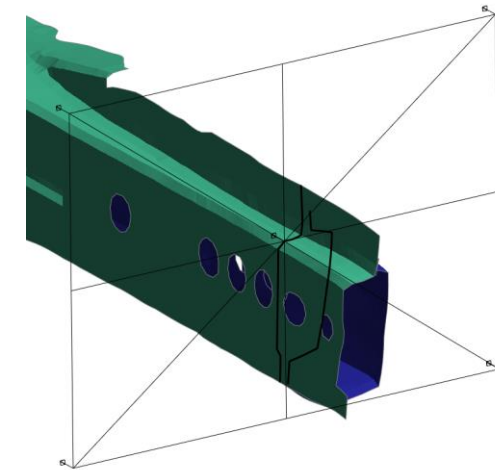
A new option has been added to the DATABASE_CROSS_SECTION edit panel to auto size the plane so that it is centred on the cut elements and the LENL and LENM dimensions are minimised to just encompass them.



With the option selected



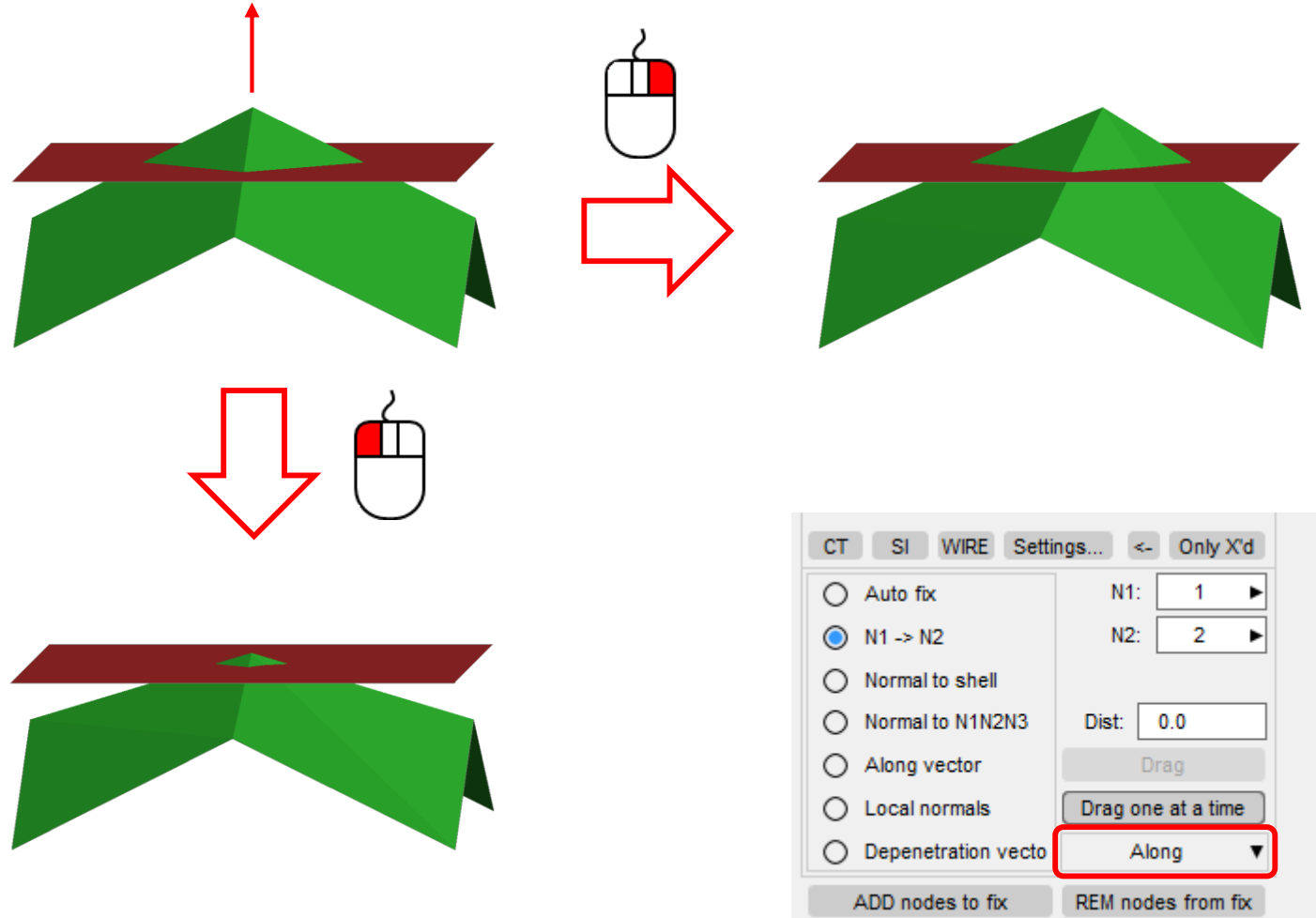
Without the option selected



Contact Penetrations

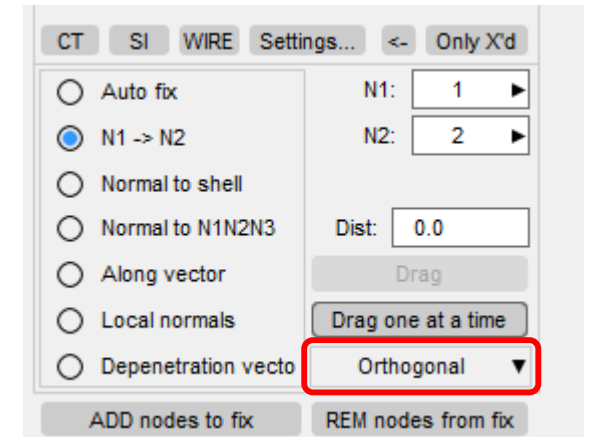
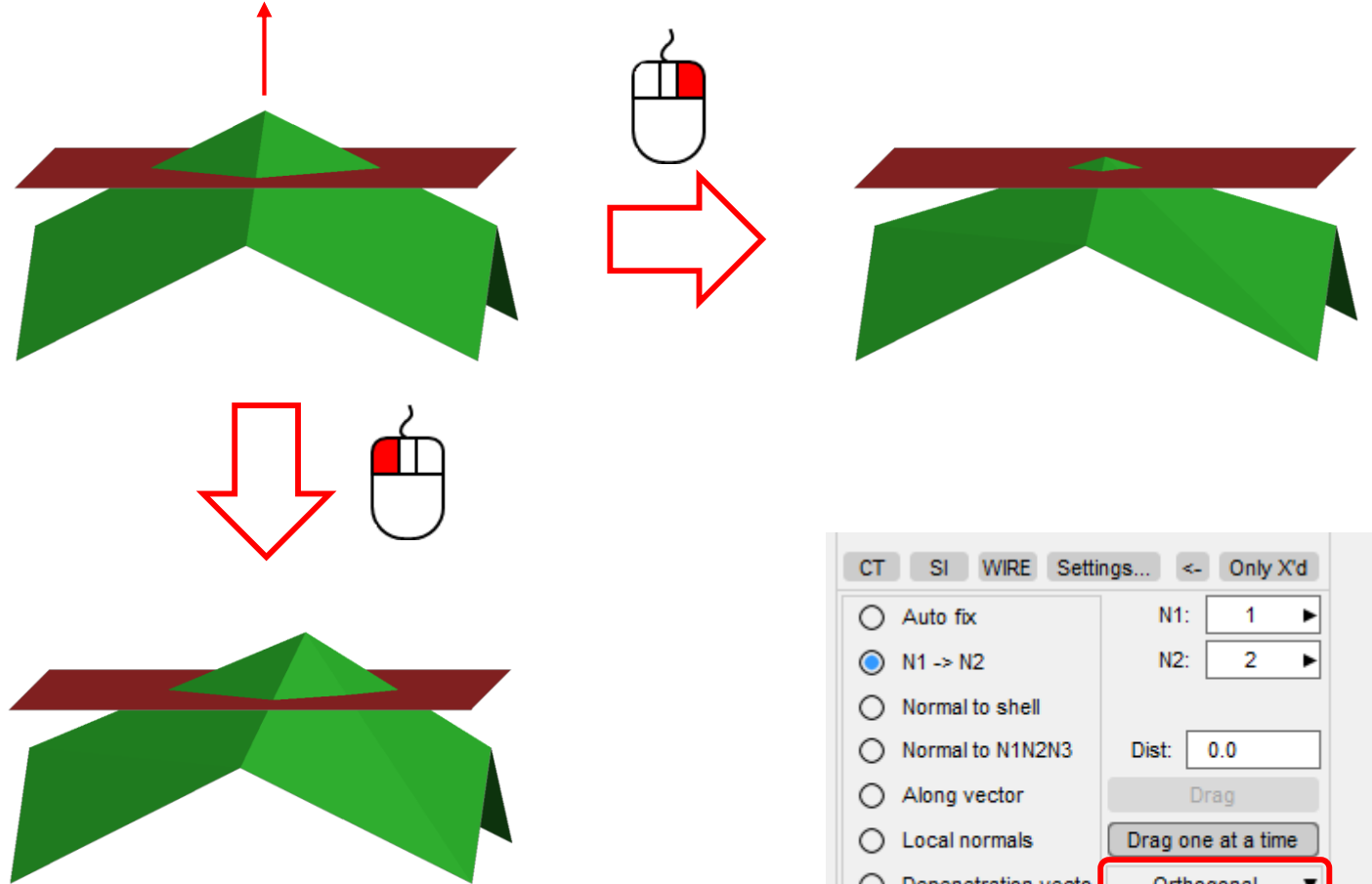
Contact Penetrations

- When dragging **Along** the selected direction is active, the right mouse button can now be used to drag orthogonally to that direction.
- This option has been renamed from **Parallel** in PRIMER 16.0 to **Along** in PRIMER 17.0 to make the wording more consistent.



Contact Penetrations

- When dragging **Orthogonal** to the selected direction is active, the right mouse button can now be used to drag along that direction.



Parameters

Character Parameters

- PRIMER now supports `_EXPRESSION` parameters of type C in addition to R and I. Currently character parameter expressions cannot reference other parameters in PRIMER, but are only used to define (constant) strings too long for parameters without `_EXPRESSION`.
- Also, PRIMER now reads models where `*INCLUDE` filenames are specified as character parameters.

```
␣
$ .=====
$ .PARAMETER .cards
$ .=====
$
*PARAMETER_EXPRESSION
$: . . . . . prmr . . . . . expression
C .file . . . . . include .key . . . . .
$
$
$ .=====
$ .INCLUDE .cards
$ .=====
$
*INCLUDE
&file
$
```

Model Merge

In the option **Merge & rename** PRIMER now also merges parameter expressions when all the following conditions are satisfied:

- Same name.
- Same expression string.
- Each referenced parameter in the first model is merged with the referenced parameter in the second model with the same name.

These conditions imply that the expressions have got the same value, so in PRIMER 17.0 they extend the parameter merging already available since PRIMER 15.0 for non-`_EXPRESSION` parameters.

NO PROBLEMS WITH CLASHES OR DUPLICATES: OK TO MERGE

No renumbering
 Increment slave model items always
 Increment slave model items only on clash
 Custom merge

*PARAMETER card ?
 No action
 Rename only
 Merge & rename

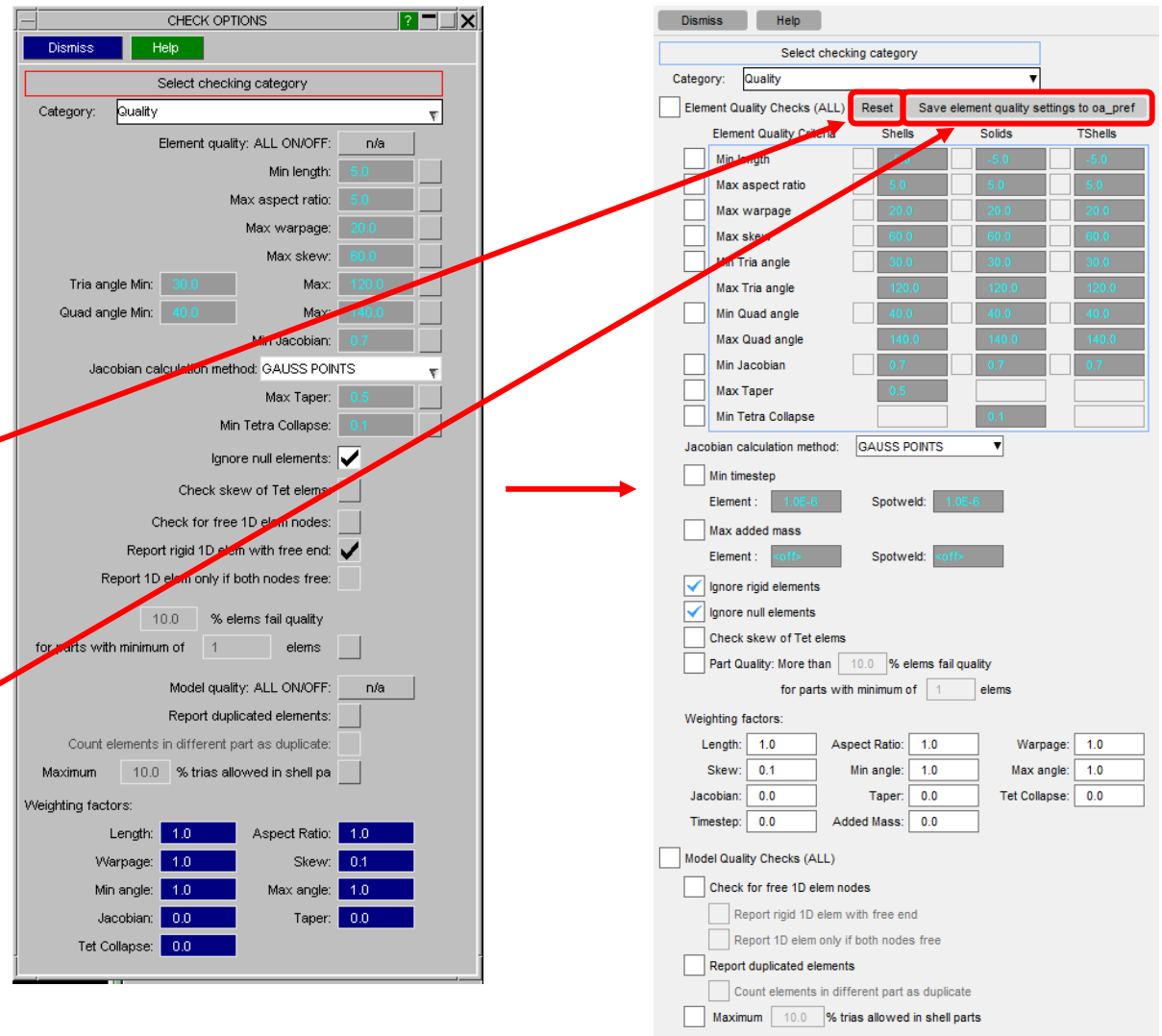
New labels for clashing items: Highest+1 in model

Merge _COLLECT sets:

Check Options Panel

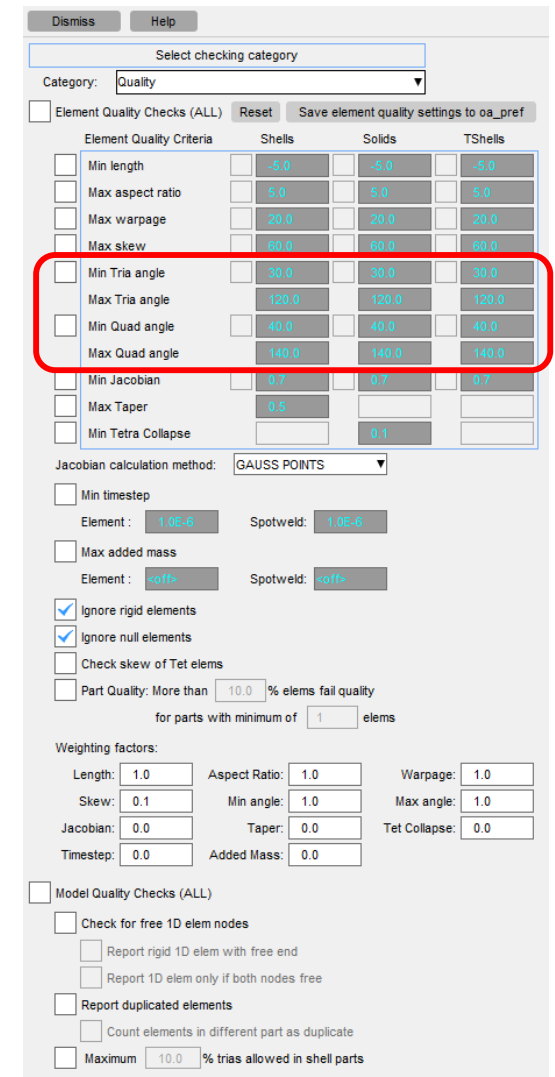
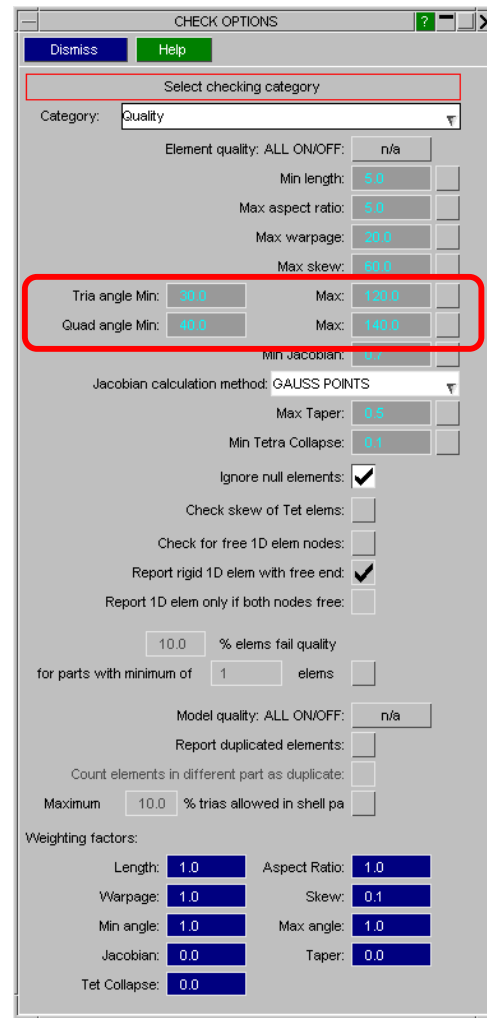
Check Options Panel

- The check options panel has been redesigned:
 - 2 new buttons for *Element Quality Checks*:
 - “Reset” restores options to initial state (options set on each start-up of panel).
 - “Save element quality settings to oa_pref” writes current options as preferences to your home oa_pref file.



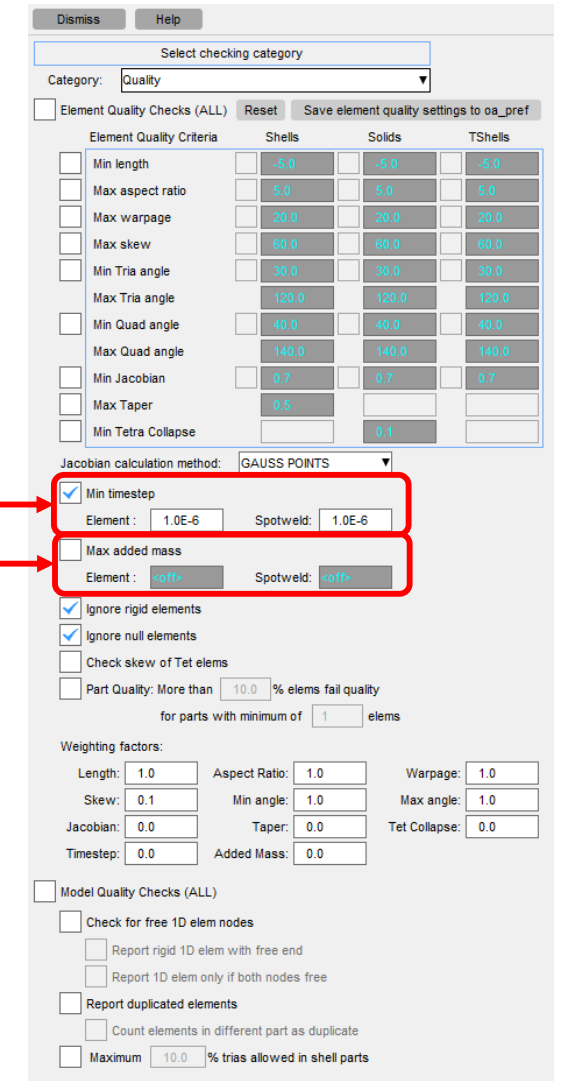
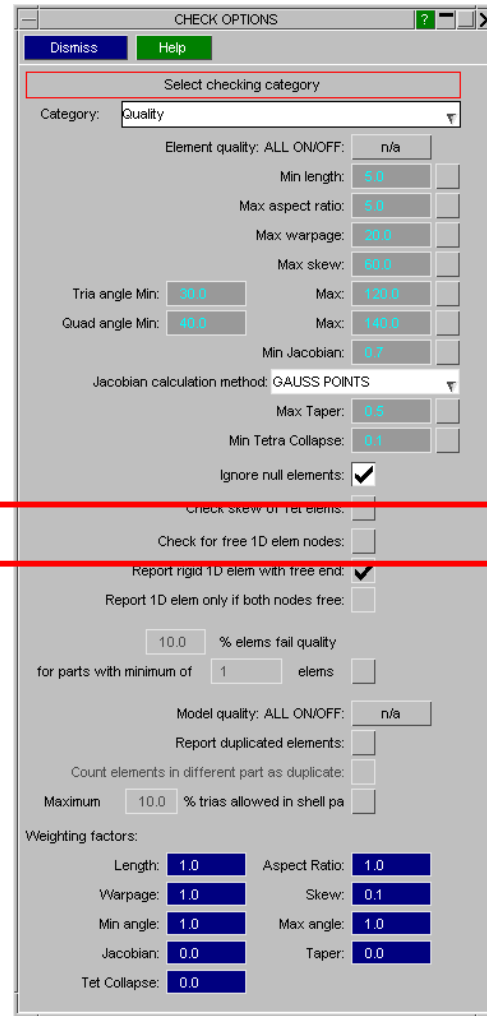
Check Options Panel

- The check options panel has been redesigned:
- Different element quality check values can now be set for different element types, for example you can set different angle limits for shells, solids and tshells.



Check Options Panel

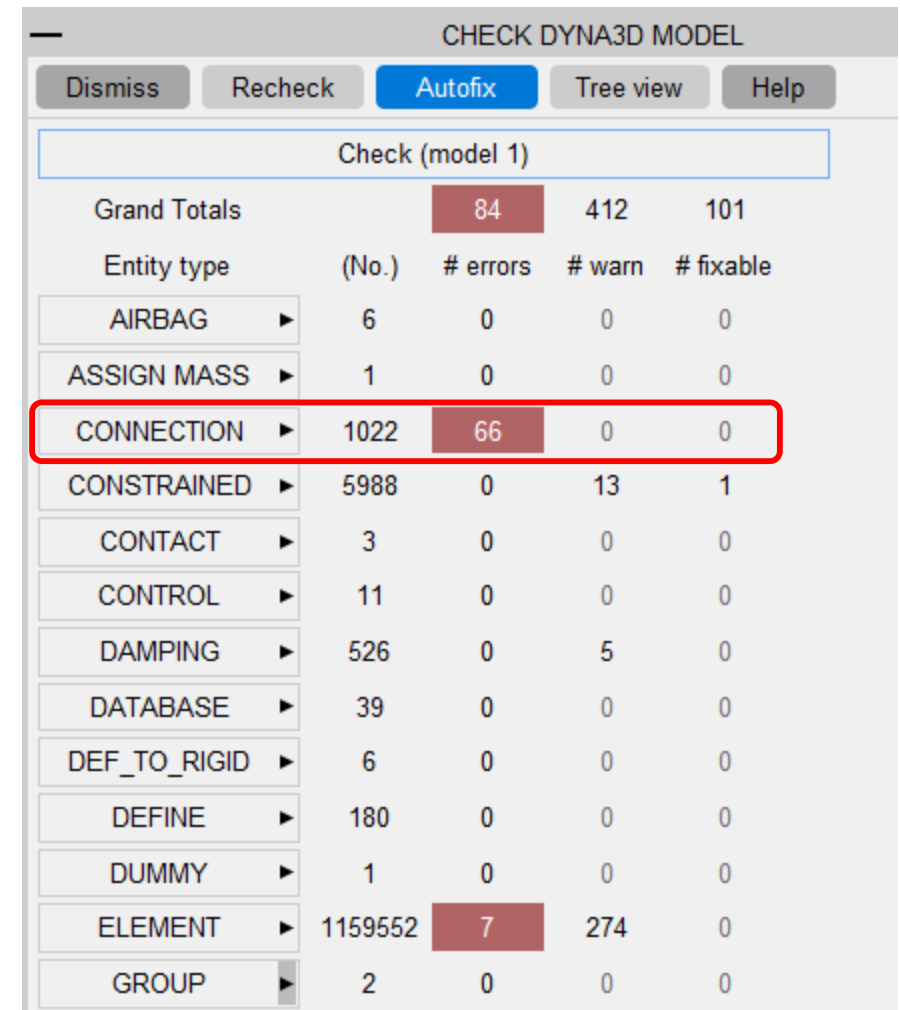
- The check options panel has been redesigned
- Timestep and added mass checks can now also be accessed via the Quality Category:



Speeding Up Connection Check

Speeding Up Connection Check on Large Model

- Optimizing bucket setup with sparse segment population gives speedup of connection check without excessive memory consumption. This benefits:
 - Model connection checking.
 - Setting up connection table.
 - Connection remake.
- Reduced time of connection check:
 - Very large production model: 225s to 147s.
 - Large production model: 84s to 32s.



CHECK DYNA3D MODEL

Dismiss Recheck Autofix Tree view Help

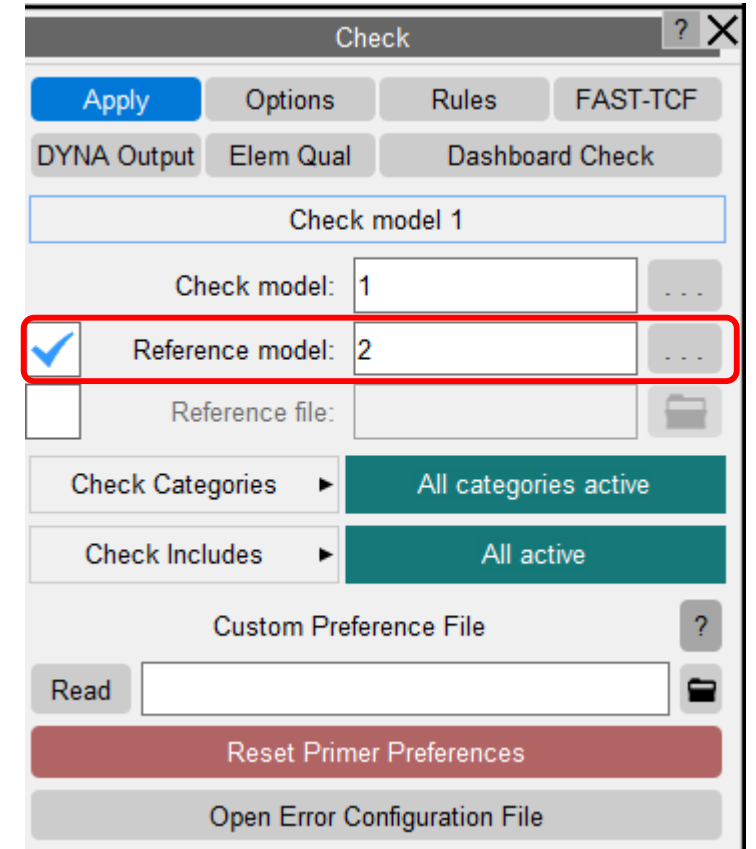
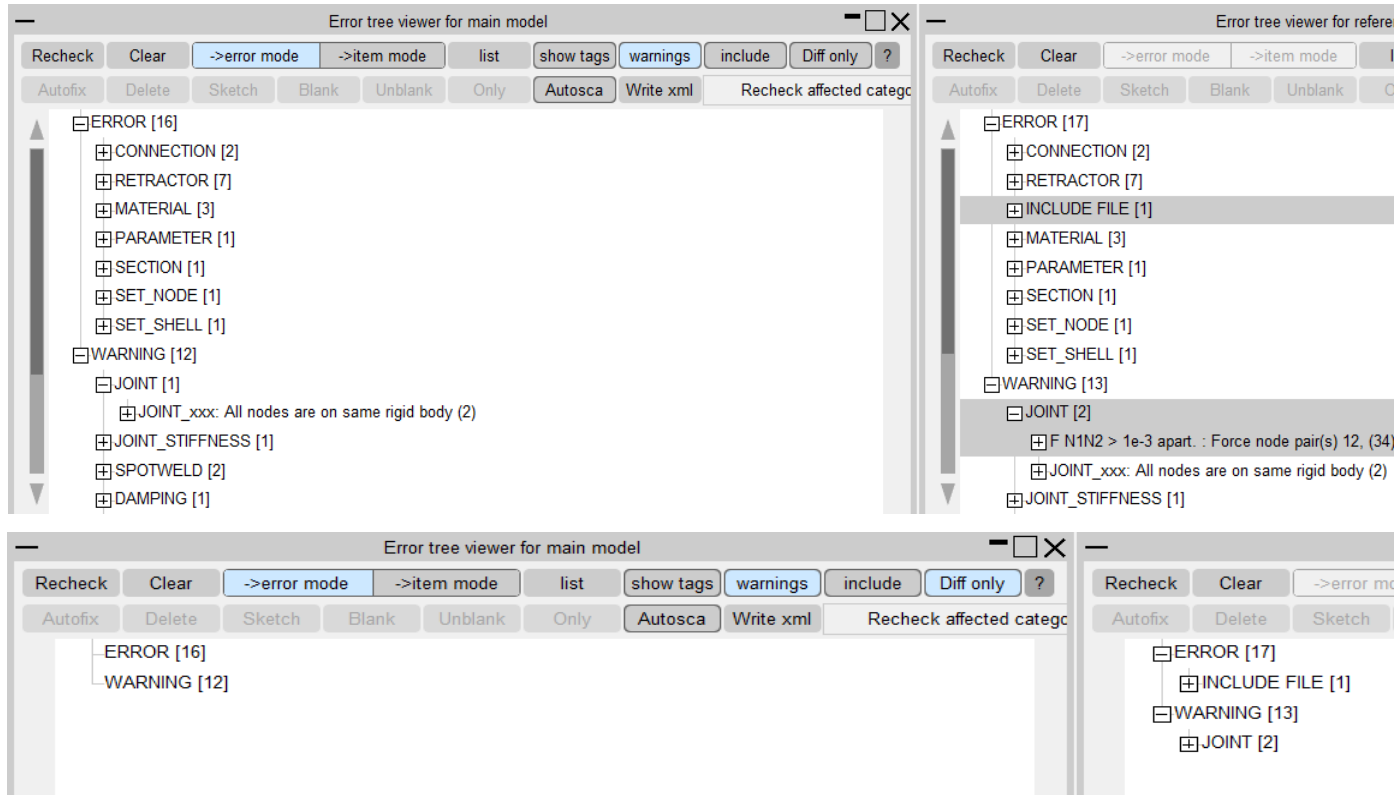
Check (model 1)

Entity type	(No.)	# errors	# warn	# fixable
Grand Totals		84	412	101
AIRBAG	6	0	0	0
ASSIGN MASS	1	0	0	0
CONNECTION	1022	66	0	0
CONSTRAINED	5988	0	13	1
CONTACT	3	0	0	0
CONTROL	11	0	0	0
DAMPING	526	0	5	0
DATABASE	39	0	0	0
DEF_TO_RIGID	6	0	0	0
DEFINE	180	0	0	0
DUMMY	1	0	0	0
ELEMENT	1159552	7	274	0
GROUP	2	0	0	0

Checking Two Models

Checking Model vs. Reference Model

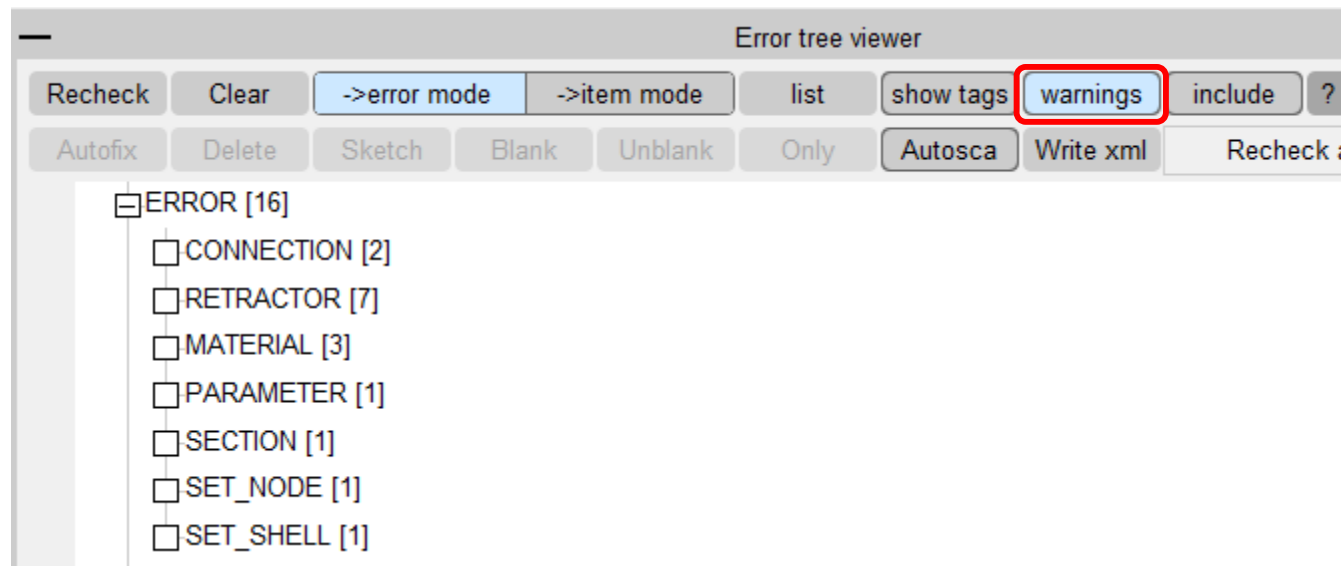
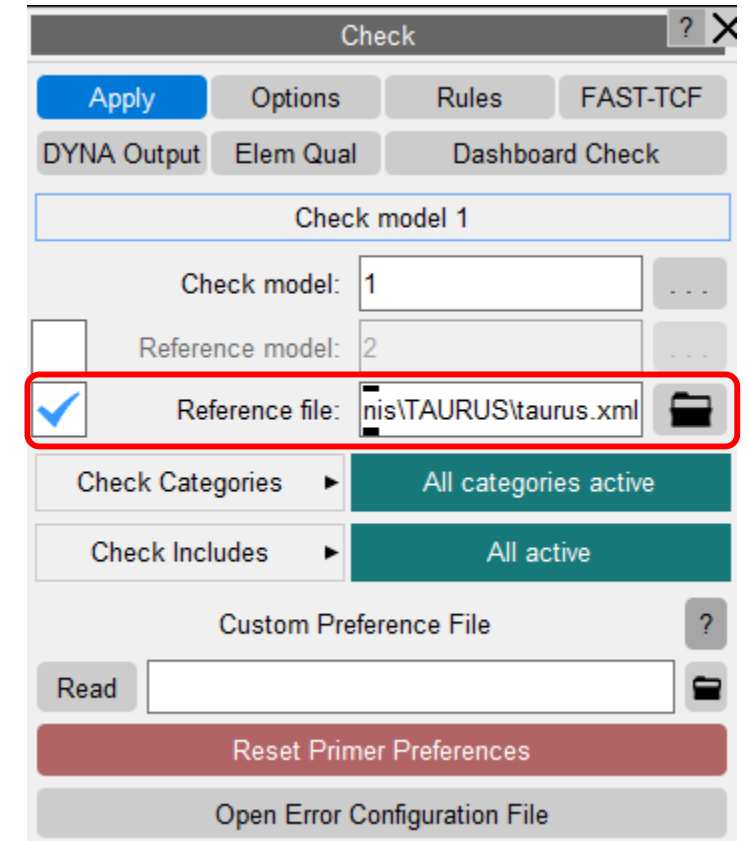
- A model can now be checked against a reference model – 2 check trees are displayed.
- The differences are highlighted. *Diff Only* mode only shows these differences.
- This is useful to tracking differences between models.



Checking against XML Reference File

Checking Models against xml Reference File

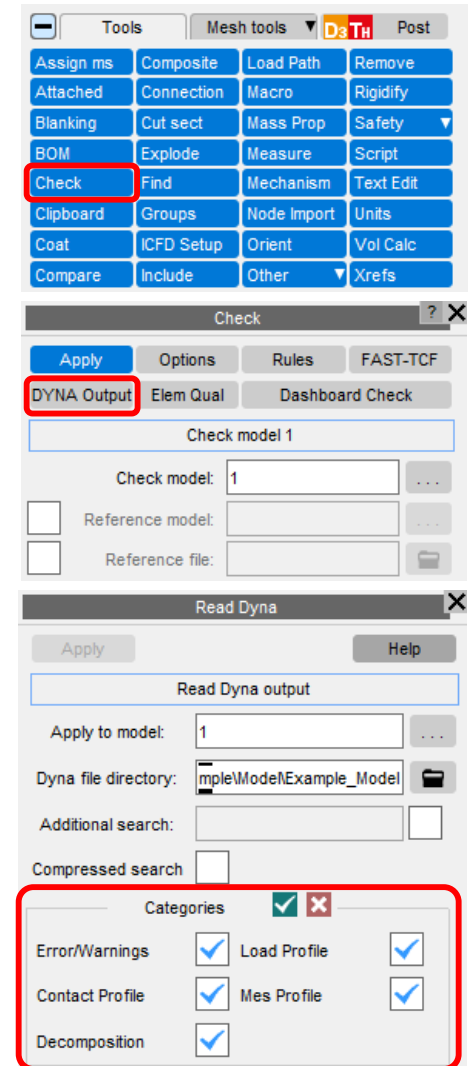
- Useful when working on large models.
- Check a model and use *Write xml* to save the check data to an xml file.
- When comparing checks, using the reference file saves the overhead of reading in a reference model & checking again.



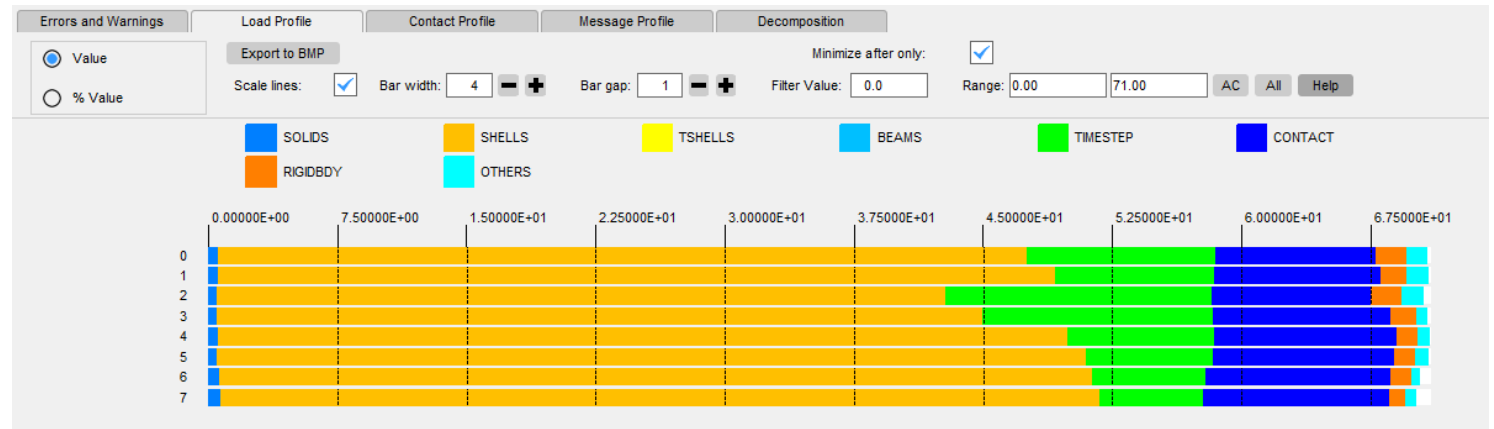
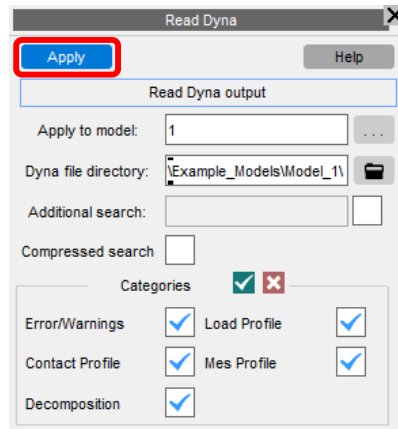
Load Profile Visualisation and Decomposition

Load Profile Visualisation

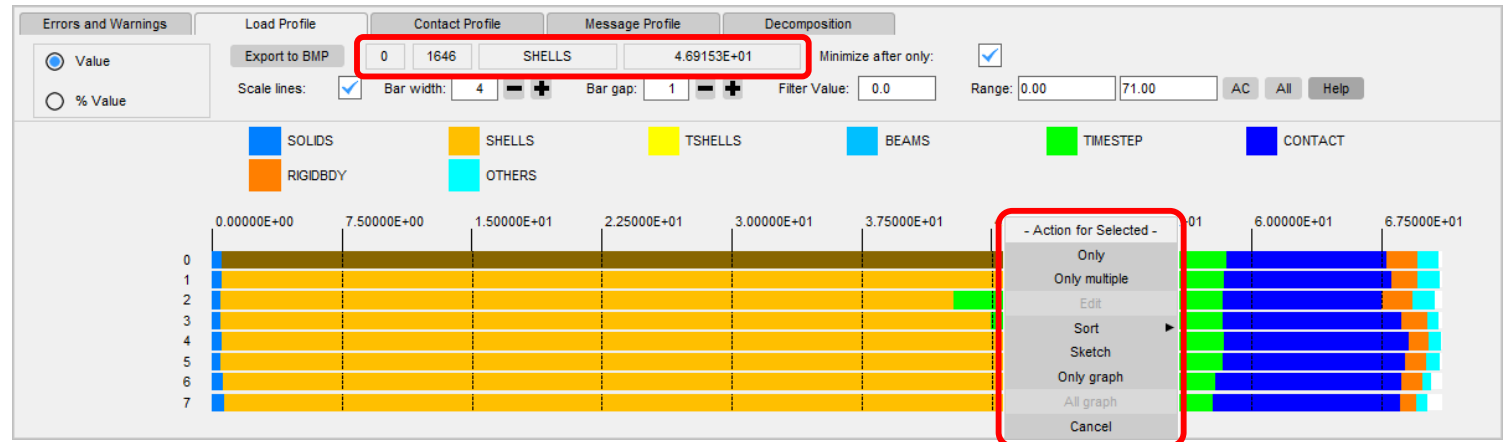
- It is possible to visualise the “load profile files” produced by LS-DYNA within PRIMER.
- The information files 'load_profile.csv' and 'contact_profile.csv' are generated with LS-DYNA analysis. Also, similar useful data is written to the individual message files (.mes).
- In Check->Dyna Output, four new options 'Load Profile', 'Contact Profile', 'Mes profile', and 'Decomposition' are available to read this information and display it.
- This load/cost information is shown in the bar charts. The X-axis is time or percentage time and the Y-axis indicates processor. Different coloured bars indicate different cost items.
- A decomposition file "decomp_parts.ses" which contains information on how the elements in the model have been decomposed is required to view elements and decomposition information. In order to generate a decomposition file, turn on *CONTROL_MPP_DECOMPOSITION_OUTDECOMP and set the TYPE field to 2. With this option included in the model upon initialisation a file "decomp_parts.ses" will be produced by LS-DYNA.
- Note all the above information can be generated by initialising your model in LS-DYNA – it does not require the model to run to the full termination time.



Load Profile Visualisation



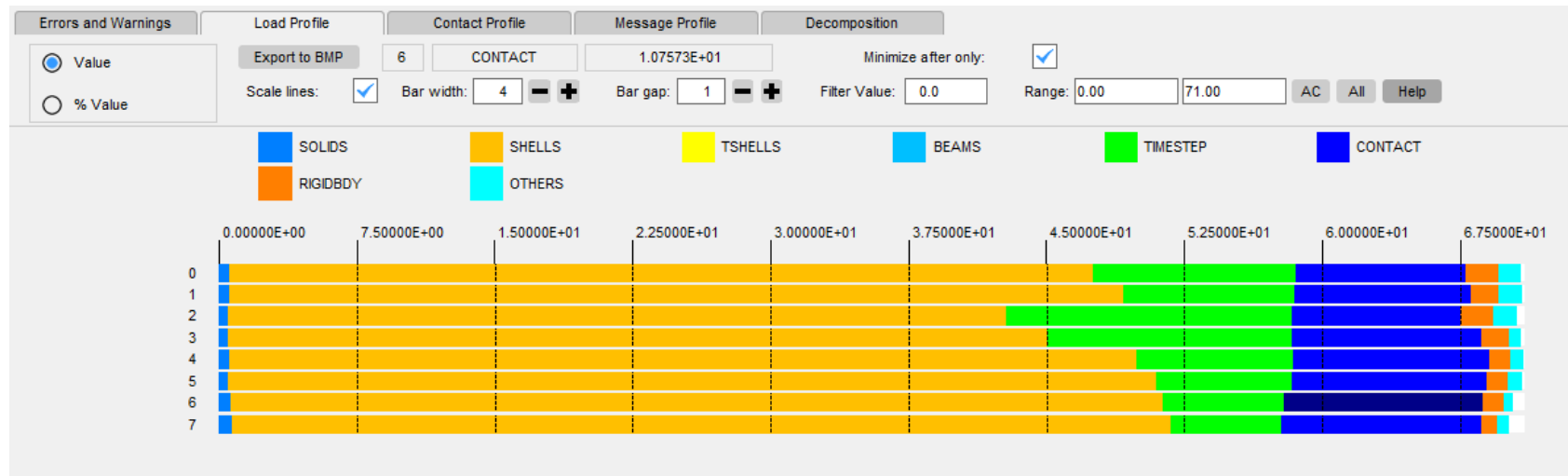
- Hovering the mouse over the graph will change the colour to show the cursor location and displays processor id, # of elements, type, and cost/time on top of the panel in the red feedback boxes.
- A right mouse button click gives a popup box to perform Only/sketch on entities and the ability to sort the graph order by the cost of the selected type.



Various interactive controls:

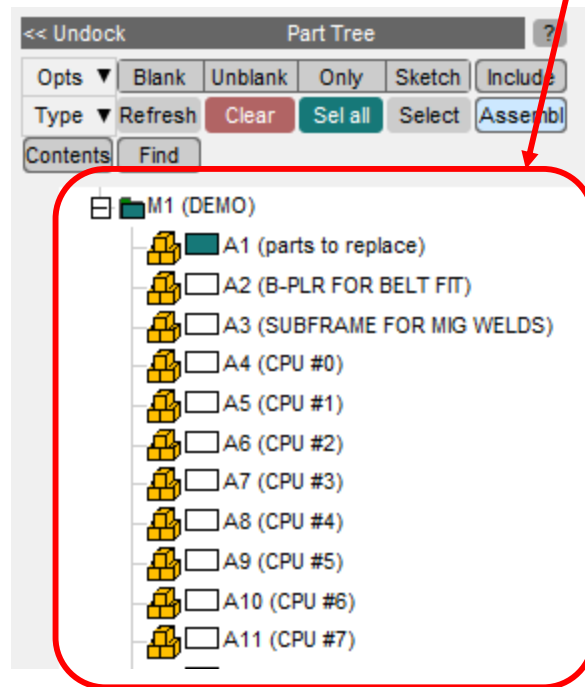
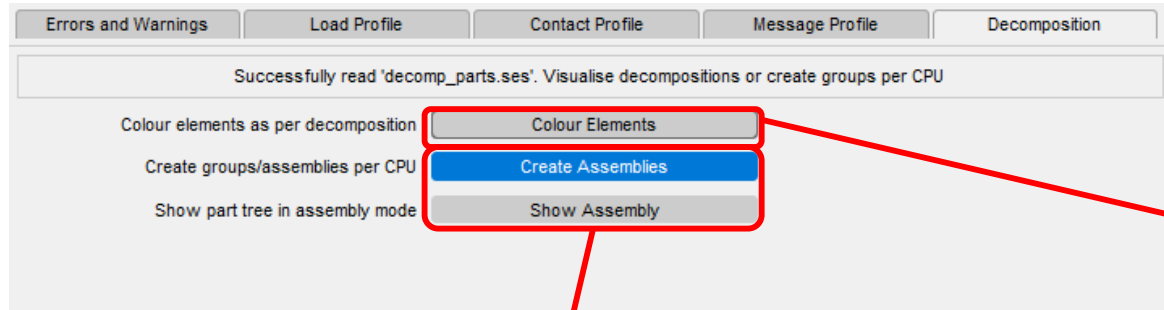
- Zoom by pressing SHIFT or CTRL with the right mouse button (hold & drag).
- Pan by pressing SHIFT or CTRL with the middle mouse button (hold & drag).

Load Profile Visualisation

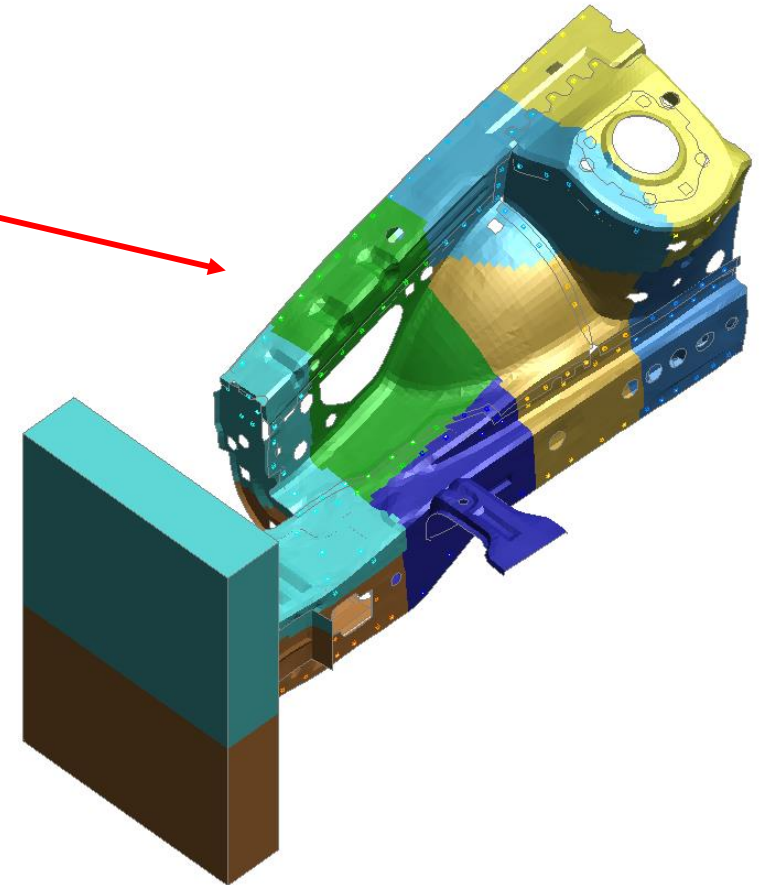


- **Change graph width and gap:** The graph's bar width and the gap between bars can be changed using '+' and '-' button which will allow you to accommodate a greater number of rows (useful when running on a large number of processors).
- **Blank graph categories:** If you wish to view only a specific category, move your mouse in the graph to the desired category and right click to bring a pop-up panel and select Only graph. It will blank the rows for all the other categories. Alternatively, you can left click on the square box of the desired entity at the top to blank other categories. If you wish to view more than one category, select multiple square boxes by holding CTRL plus LEFT mouse click.
- **Filter Graph by Value:** You can filter the graph by value. Enter a value in 'Filter Value' textbox and all the categories which have cost below the specified value will not be shown in the graph.
- Hit All to view all the categories and AC to auto scale the graph.

Decomposition Visualisation



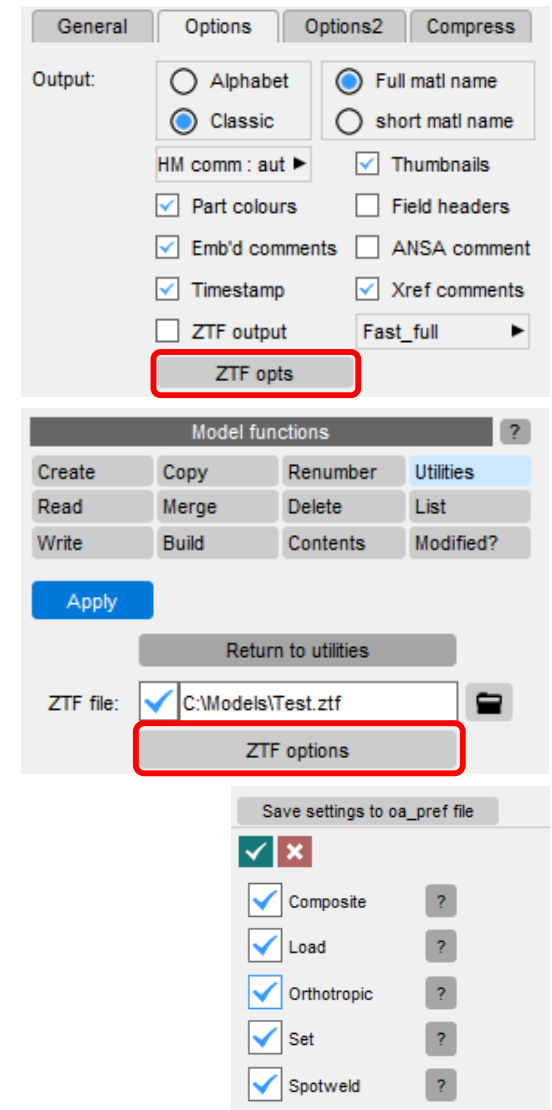
- “Colour elements” will change the colour of the elements in the model according to how the model was decomposed by LS-DYNA.
- “Create assemblies” will create an assembly for each CPU containing all the elements that are processed by that CPU after decomposition.
- “Show Assembly” will show the part tree in assembly mode so you can easily visualise the new assemblies.



ZTF Options

ZTF Options

- A ZTF file can be written to pass model information to D3PLOT and T/HIS to aid post processing.
- Specific ZTF categories may now be selected/de-selected when ZTF files are written. PRIMER may be instructed to manually write ZTF files from two possible locations:
 1. From the options tab during Model->Write.
 2. From the Model->Utilities menu.
- A new ZTF options menu, accessible from both the aforementioned locations, allows you to have control over both the size and the contents of the ZTF file.

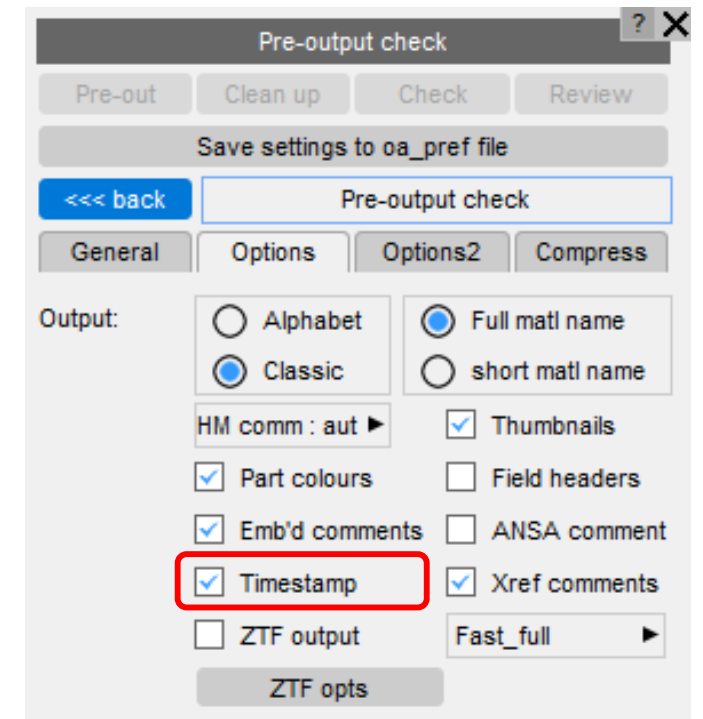


Timestamp Comments

Timestamp Comments

- Writing out of timestamp comments along with the PRIMER and LS-DYNA version comments can be controlled by the new option provided in the “Options” tab.
- The timestamp comments will be turned on by default.
- Preference named “write_timestamp_comments” can be used to change the default option in the panel.

```
*KEYWORD
$> .
$> .Primer17.0.dev.created.on: Thu May 30 11:54:22 2019
$> .LS-DYNA.version: R10.0
$> .
$> .end_saved_comments
$
```



Miscellaneous

Convert to Implicit

- A new option has been added that lets you retain material ID's and titles while converting the analysis from explicit to implicit.

Dismiss Apply Help

STATIC LINEAR
 STATIC NON-LINEAR
 EIGENVALUE

ACTIONS:

CREATE THE FOLLOWING CONTROL CARDS WITH RECOMMENDED VALUES:

CONTROL_IMPLICIT_GENERAL
CONTROL_IMPLICIT_SOLVER
CONTROL_IMPLICIT_SOLUTION
CONTROL_IMPLICIT_EIGEN NEIG:

MODIFY ELEMENT FORMULATIONS USING CTRL_IMPL_EIGENVALUE CARD:

SOLIDS
SHELLS
LABEL OFFSET:

MODIFY IHQ VALUE ON HOURGLASS CARDS:

SOLID HG CAR

CREATE ELASTIC MATERIALS FOR USE IN MODEL:

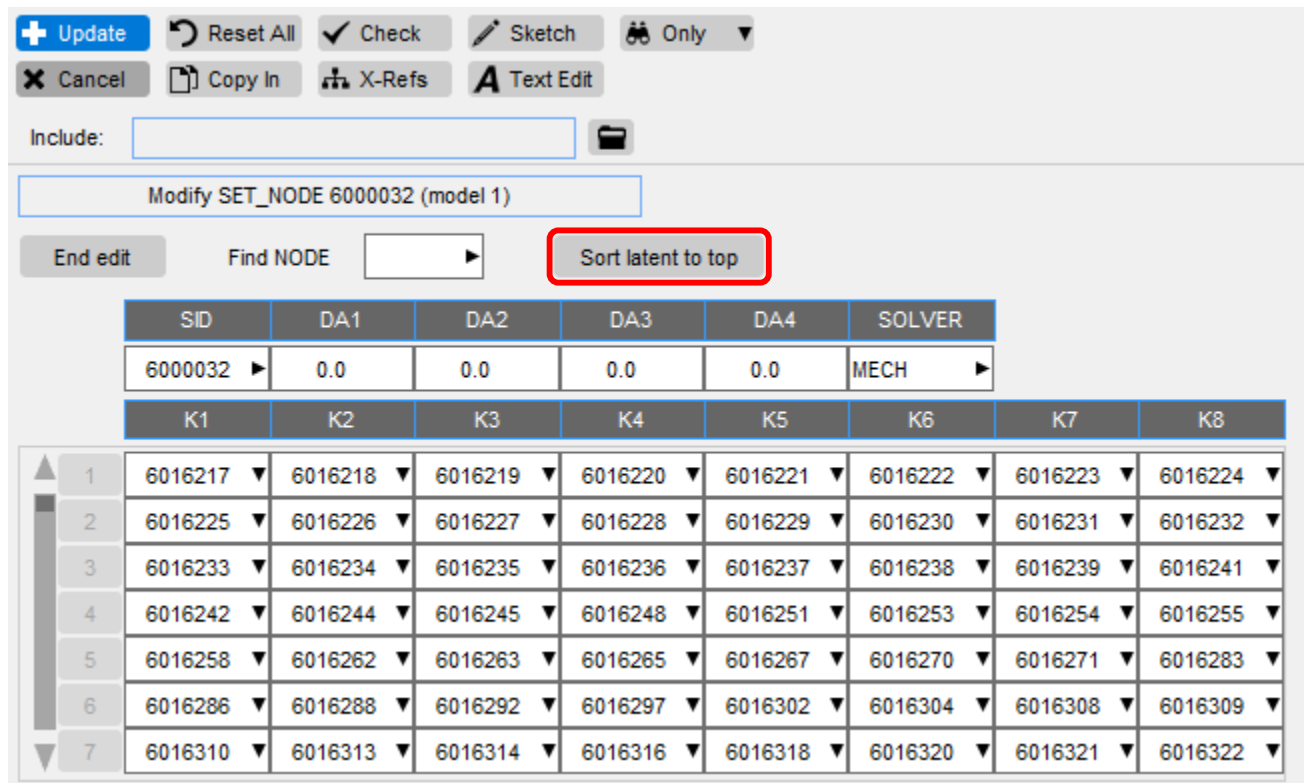
ELASTIC MATERIALS

Convert all materials except MAT 20
 Convert MAT 3, 24, 123 & 124 only

RETAIN MATERIAL ID
RETAIN MATERIAL TITLE

Sorting Latent Entries to Top of the SET

- Clicking on the “Sort latent to top” button brings all the latent entries to the top of the set.
- This button is available only for the LIST type of sets.
- The button is not available for segment, mm_grp and mode sets.



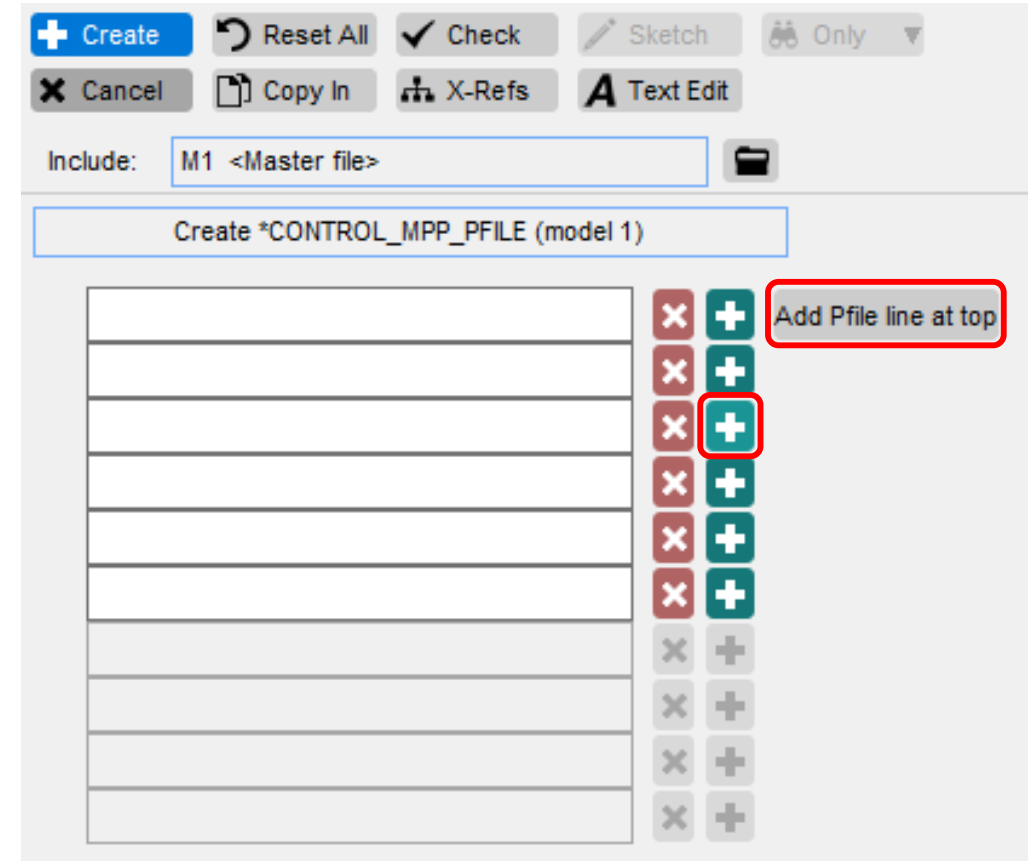
The screenshot shows the 'Modify SET_NODE 6000032 (model 1)' dialog box in the Oasys PRIMER software. The dialog includes a toolbar with buttons for Update, Reset All, Check, Sketch, Only, Cancel, Copy In, X-Refs, and Text Edit. Below the toolbar is an 'Include:' field and a 'Modify SET_NODE 6000032 (model 1)' title bar. The main area contains an 'End edit' button, a 'Find NODE' field, and a 'Sort latent to top' button, which is highlighted with a red box. Below the dialog is a table of set parameters.

	SID	DA1	DA2	DA3	DA4	SOLVER
	6000032 ▶	0.0	0.0	0.0	0.0	MECH ▶

	K1	K2	K3	K4	K5	K6	K7	K8
▲ 1	6016217 ▼	6016218 ▼	6016219 ▼	6016220 ▼	6016221 ▼	6016222 ▼	6016223 ▼	6016224 ▼
2	6016225 ▼	6016226 ▼	6016227 ▼	6016228 ▼	6016229 ▼	6016230 ▼	6016231 ▼	6016232 ▼
3	6016233 ▼	6016234 ▼	6016235 ▼	6016236 ▼	6016237 ▼	6016238 ▼	6016239 ▼	6016241 ▼
4	6016242 ▼	6016244 ▼	6016245 ▼	6016248 ▼	6016251 ▼	6016253 ▼	6016254 ▼	6016255 ▼
5	6016258 ▼	6016262 ▼	6016263 ▼	6016265 ▼	6016267 ▼	6016270 ▼	6016271 ▼	6016283 ▼
6	6016286 ▼	6016288 ▼	6016292 ▼	6016297 ▼	6016302 ▼	6016304 ▼	6016308 ▼	6016309 ▼
▼ 7	6016310 ▼	6016313 ▼	6016314 ▼	6016316 ▼	6016318 ▼	6016320 ▼	6016321 ▼	6016322 ▼

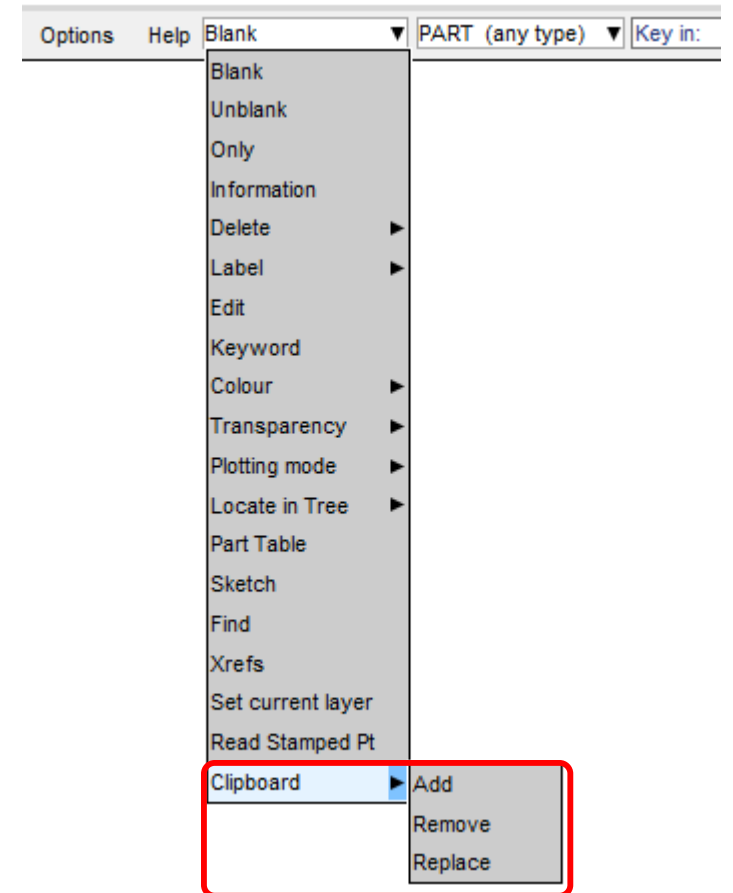
Adding a Line Anywhere in a Pfile

- A new 'plus' button has been added to add a line anywhere in a Pfile.
- Clicking on the button would insert below the line from which the button was clicked.
- The already existing 'Add Pfile line' has been reconfigured to 'Add Pfile line at top' to insert a line at the top.



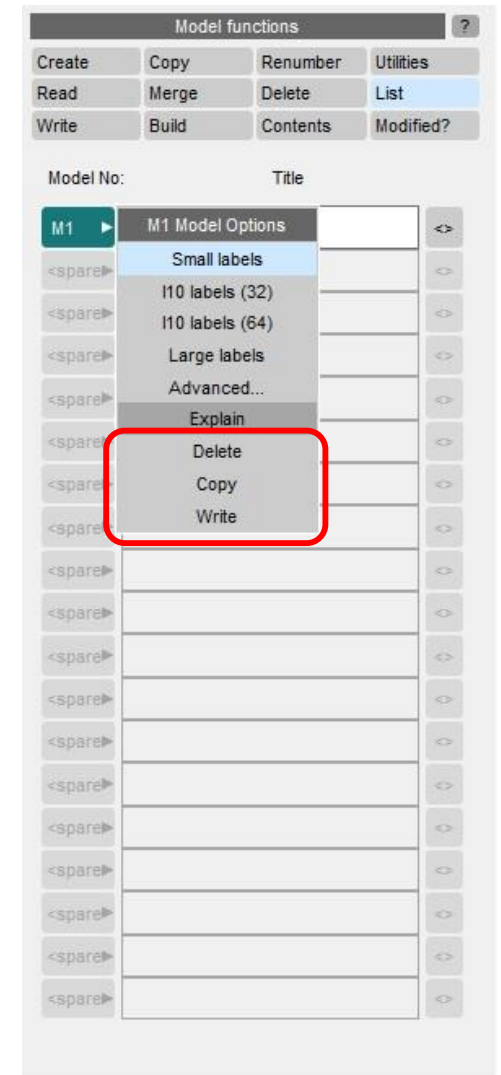
Clipboard in Quick Pick

- A new Clipboard option has been added to the available actions in the Quick Pick menu (the actions performed by the mouse when clicking on items in the graphics window).
- Using this option you can add, remove or replace entities to Clipboard interactively.
- This is useful when you want to write out or renumber only selected entities.



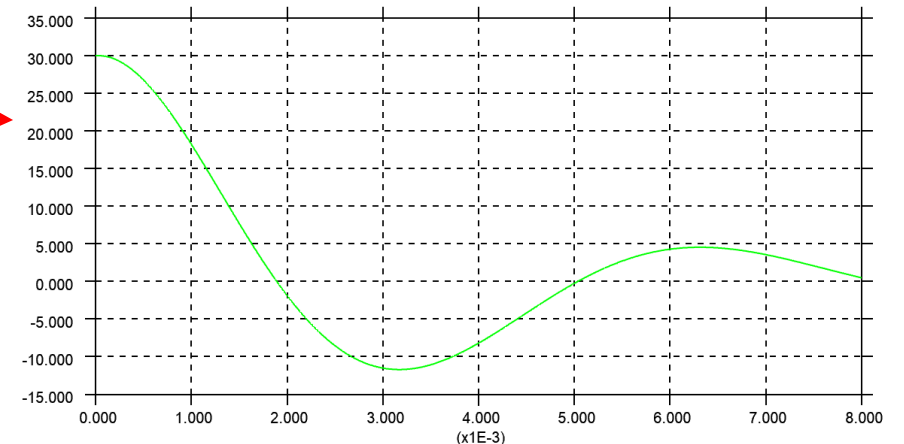
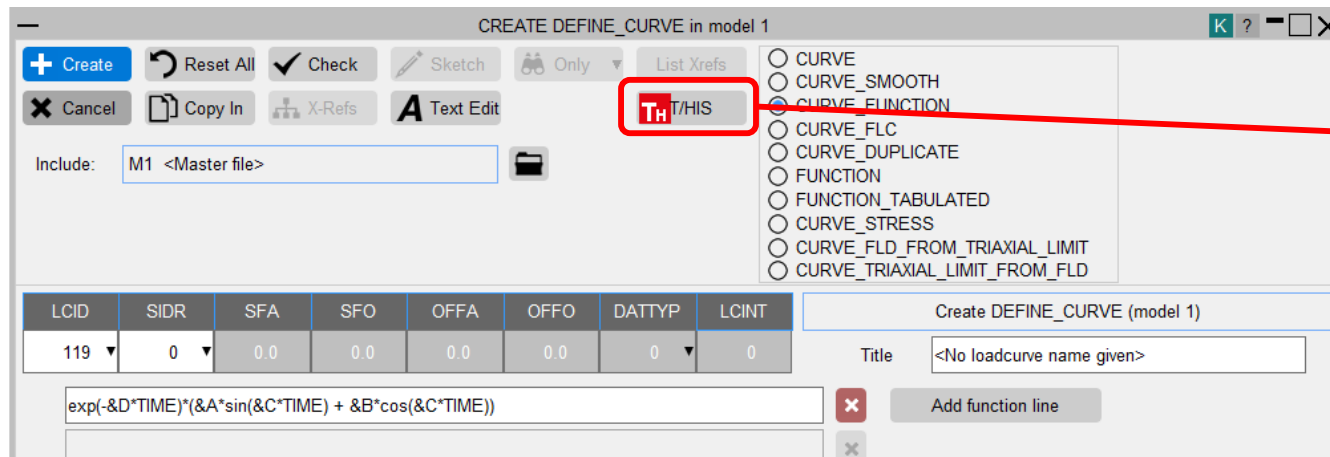
Model List Drop-down

- Under the model list, the model drop-down menu now has options to delete, copy and write the model.
- All the three options are performed immediately when clicked, and no confirmation would be asked.



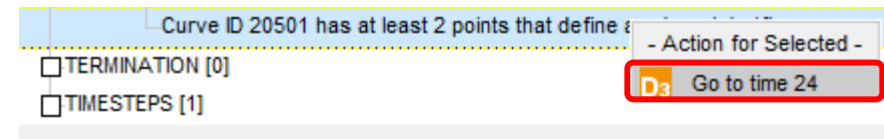
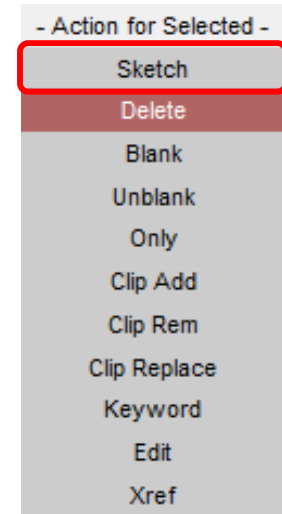
Sending *DEFINE_CURVE_FUNCTION definitions to T/HIS

- *DEFINE_CURVE_FUNCTION definitions can be sent to T/HIS for evaluation if the expression only depends on time and not on any other values that change during the LS-DYNA run.
- If the expression is suitable then the “T/HIS” button in the *DEFINE_CURVE_FUNCTION edit panel will become active.
- This will open T/HIS and display the curve, plotted from TIME = 0 until the termination time on the *DATABASE_CONTROL_TERMINATION card.
- The value of any parameters appearing in the expression will be maintained.
- The curve can be edited in T/HIS via “right-click->Edit equation...”, then sent back to PRIMER via “right-click->Update curve in PRIMER” to update the original load curve.



D3PLOT Link in DYNA Output Panel

- The DYNA output panel in PRIMER lists the errors and warnings from LS-DYNA runs/initialisations.
- Two options have been added in the DYNA output tree viewer if an integrated D3PLOT session is present.
- When you right-click on a message in the DYNA output tree, a popup will be opened which will contain “Sketch” option if the entity related to the message is sketch-able in PRIMER. If the message is related to either PART or ELEMENTS, the sketching will be done in the integrated D3PLOT session as well.
- If a message in the DYNA output tree is related to a D3PLOT state, there will an additional popup “Go to time”, which will change the D3PLOT state to the match the time of the error message.



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