Post Processing Update

January 2018

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Feedback from Users Meeting 2017

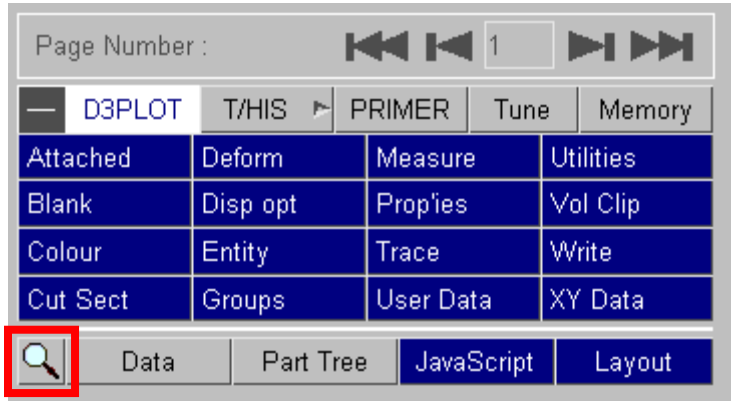
	Increasing use of Composite Materials	Improved Graphical output	User experience	Integration between different software packages	Advanced functionality	Comprehensive LS-DYNA support
Quick Find			✓			
Display enhancements		✓	✓			
Material local axes	✓				✓	✓
Material extra variables	✓		✓		✓	✓
Support multi-integration point solids					✓	✓
Part-to-part contouring			✓			
Attached enhancements			✓			
Support for *SET			✓	✓		
T/HIS Link			✓	✓		
Enhanced rendering		✓				

Quick Find

Quick Find

Quick Find has also been added to D3PLOT and T/HIS.

It works in the same way as in PRIMER and is accessed with shortcut key ‘#’ or by pressing the magnifying glass.

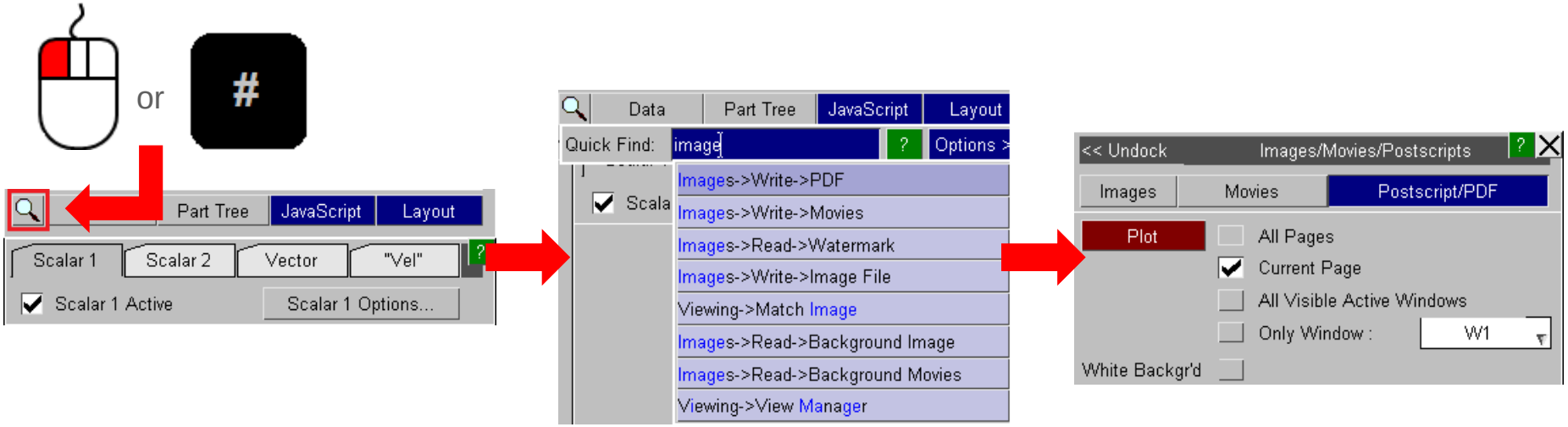


Quick Find

A ‘Quick Find’ feature has been added to allow users to search for and then quickly go to menus / functionality in D3PLOT.

It can be accessed by clicking on the magnifying glass next to the Data button or by pressing the ‘#’ key.

Typing in the textbox brings up a list of found items that match the entered text. Items in the list can be selected by clicking on them or by using the up and down arrow keys and pressing enter. The selected item will then perform the task, e.g. open a menu.



Quick Find

A ‘fuzzy’ matching method is used to match the entered text with the searchable items. It judges that something has matched when the characters of the entered text appear in the same order as the item that can be searched for.

For example if you type ‘mptp’ then ‘Tools->***M***easure->***P***art ***T***o ***P***art’ would be a match, but ‘Tools->***M***easure->***P***oin***t*** Angle’ wouldn’t because the final ‘p’ doesn’t match. (Note that the search is case insensitive.)

Additionally, if the entered search pattern contains spaces and the characters do not all match in the same order, then D3PLOT will look to see if the words can be swapped to find a match.

For example ‘back image’ would find ‘Image->Background’ even though the words do not appear in that order.

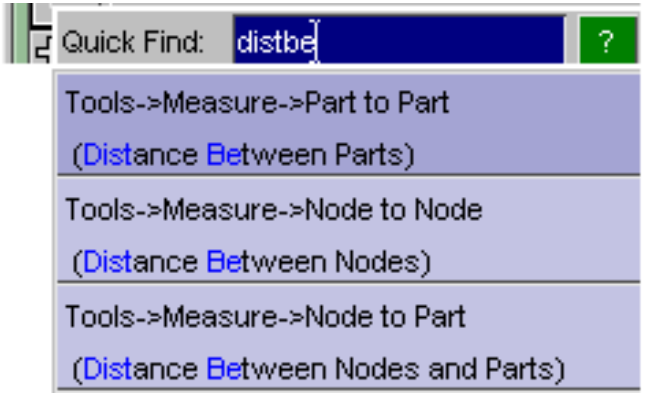
This is intended to make it easier to find items as you do not need to know the precise search term.

The found items are listed in order of how closely they match the entered text so items that more closely match appear nearer the top of the list. It determines this by assigning a score to each match, with higher scores given to items that contain consecutively matched characters and if the characters appear at the start of words.

Quick Find

The default search term associated with a menu item is the trail of menus/buttons you would need to manually open/press, e.g. to get to measure part to part you would need to go to Tools, then Measure then Part to Part, hence the search term ‘Tools->Measure->Part to Part’.

In addition, some menus have alternative search terms associated with them. For example Measure Part to Part can also be found from the alternative text ‘Distance Between Parts’:



This can be useful for cases where you don’t know or can’t remember under which menu some functionality lives.

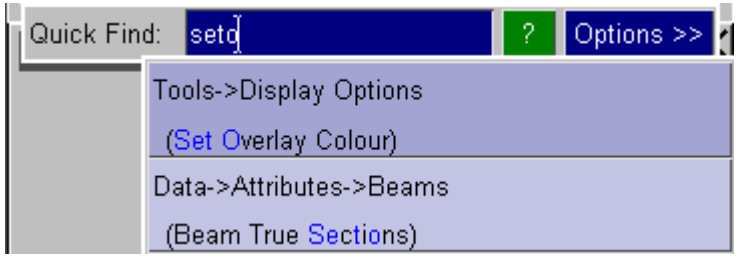
Note that the alternative text appears in brackets under the default search term so you can see how you would get to the menu manually.

If you can’t find menus that you know exist in D3PLOT it is likely that you are using different terminology to what we expect. If so, please contact Oasys Ltd and we can add alternative text based on what you are entering as your search text.

Quick Find

Alternative text associated with a menu may also describe some of the features on a menu. For example the overlay colour of elements is set in the Display Options menus, but if you didn't know this it would be hard to find.

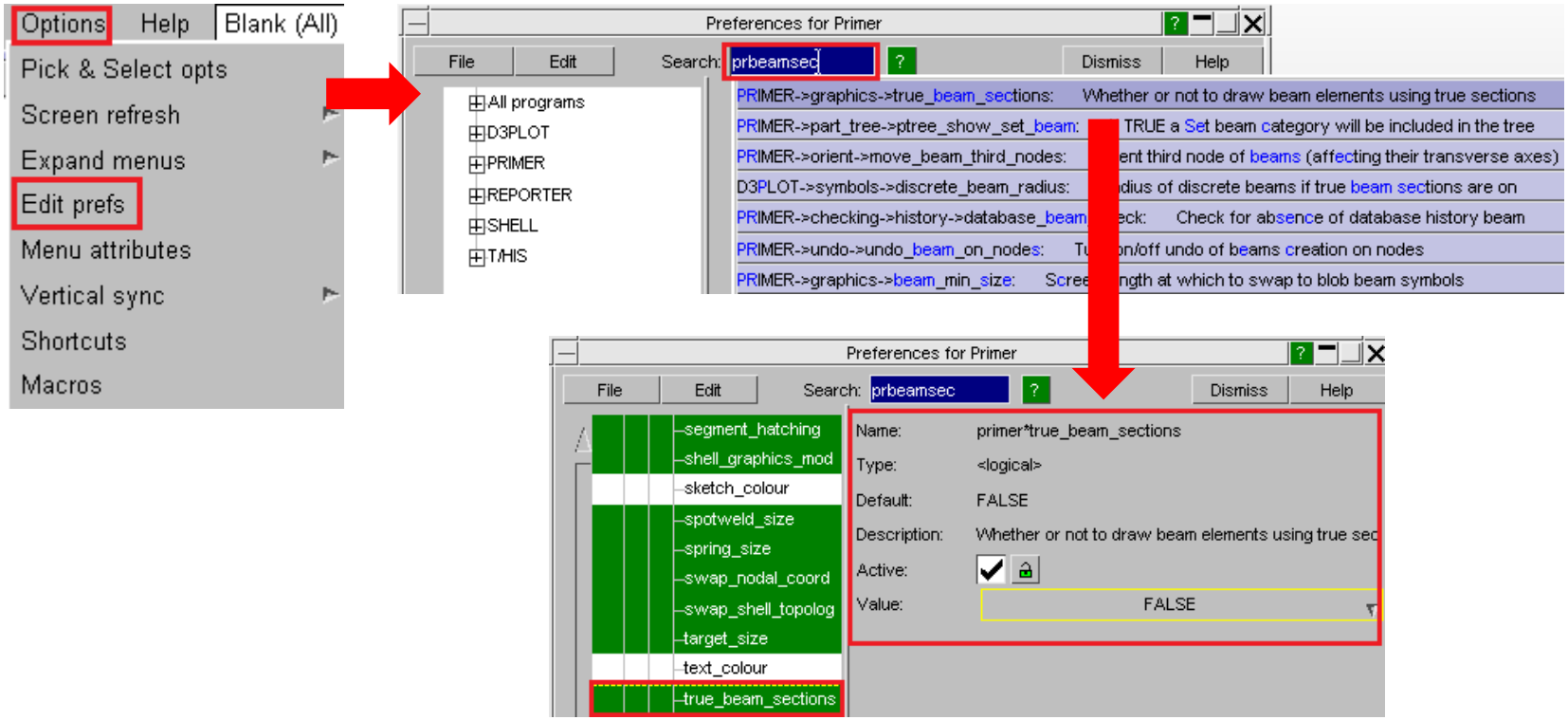
In this case the alternative text 'Set Overlay Colour' is associated with this menu:



As you can see the alternative text 'Beam True Sections' is also associated with this menu as the switch to select this option is also on the Display Options menu.

Quick Find

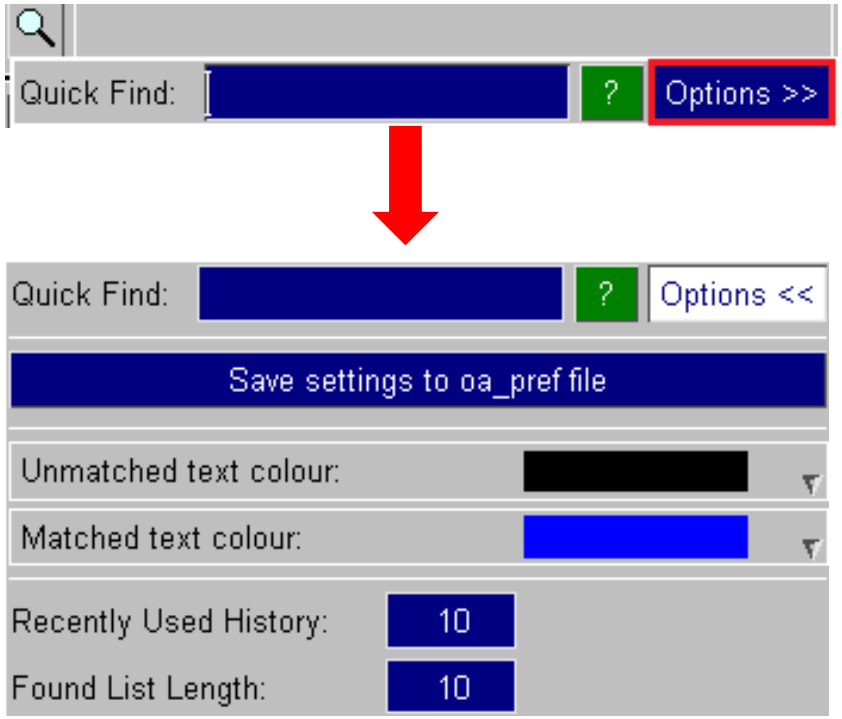
In addition to the main Quick Find button in D3PLOT the Preferences Editor now also contains a search facility to help find preferences.



This works using the same ‘fuzzy’ matching method as the main Quick Find menu. The search terms contain the name of the program, the name of the nodes on the tree, the preference name and the description of it.

Quick Find

There are a few options that can be set to alter how Quick Find works. These can be accessed by pressing the ‘Options >>’ button:



Save the settings to the oa_pref file.

Set the text colours.

Recently selected items are saved by D3PLOT and appear higher in the list of available options. By default the last ten selected items are saved, but this can be changed here. To turn it off set it to zero.

The number of found items displayed in the list can also be changed here.

Display Enhancements in D3PLOT

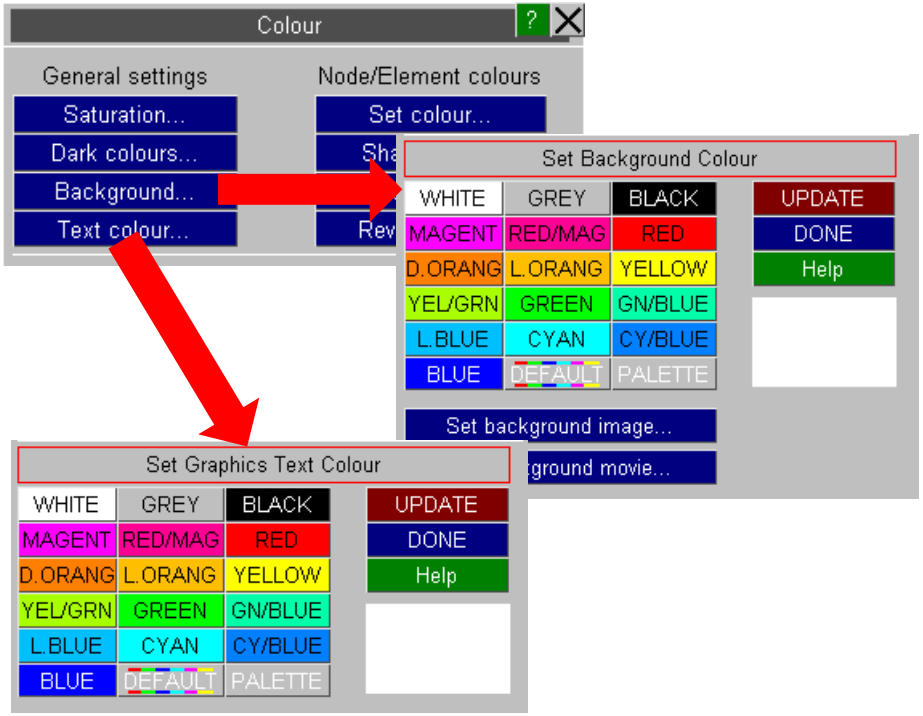
Display Enhancements

- Colour settings menu consolidated and additional options for background colour
- Contouring enhanced:
  - Up to 16 contour colours
  - Contour colours can be saved to oa_pref
  - Automatic transparency based on data values

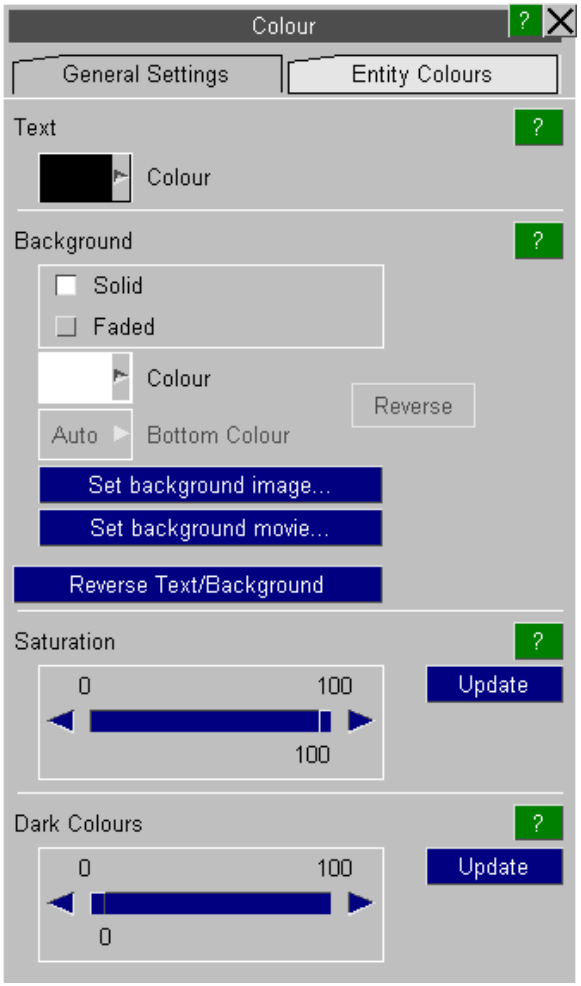
Colour Settings

Colour Settings

In Version 15 the “Colour” menu has been modified to bring most of the commonly used options into 1 menu.



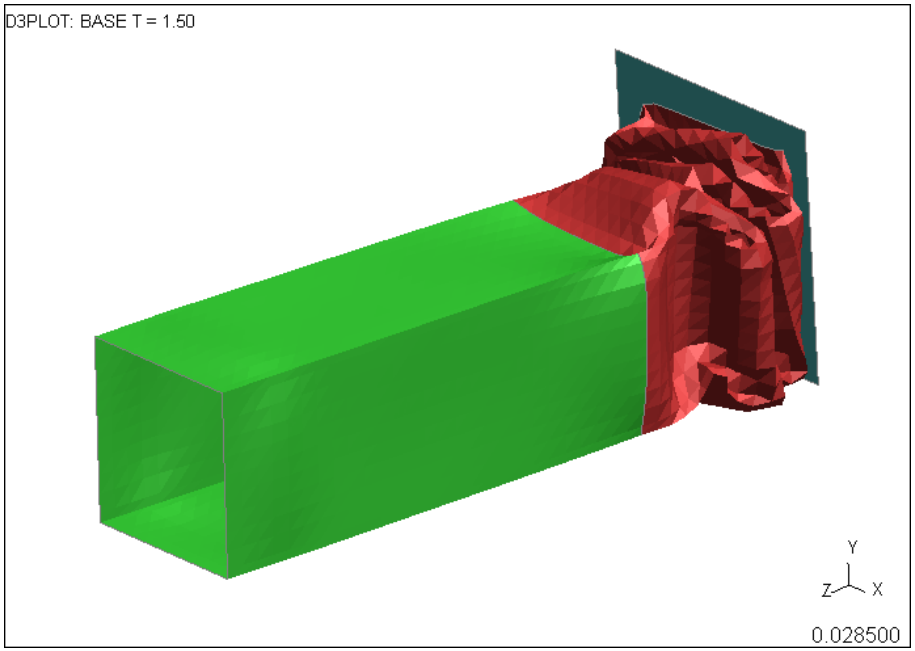
Version 14

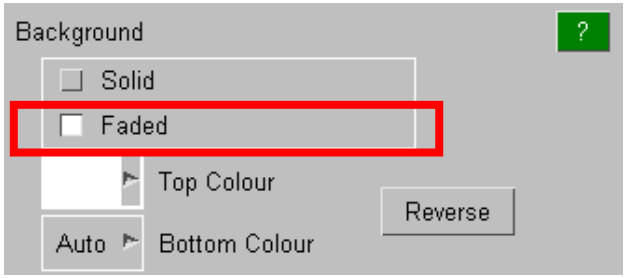


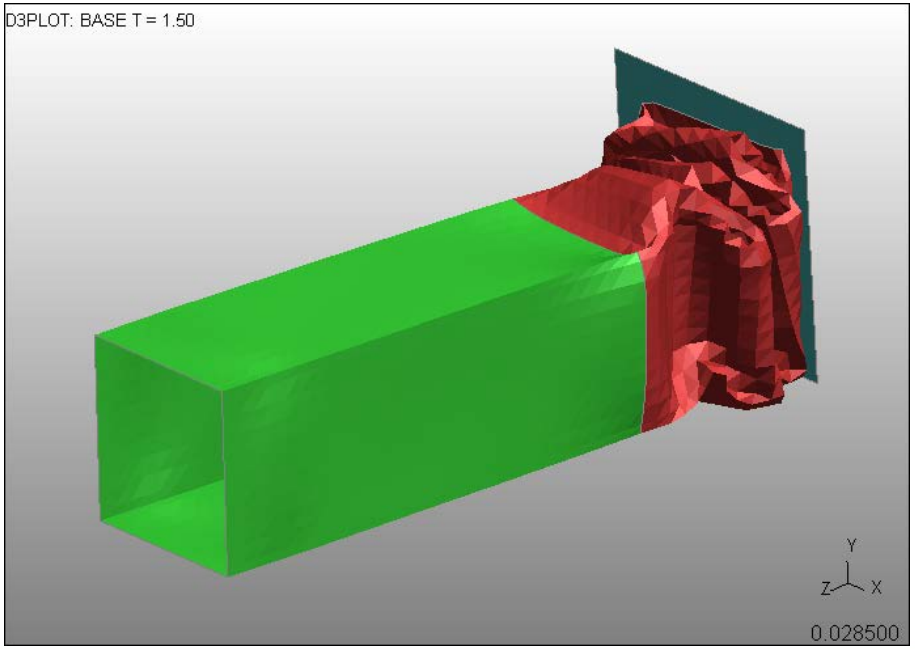
Version 15

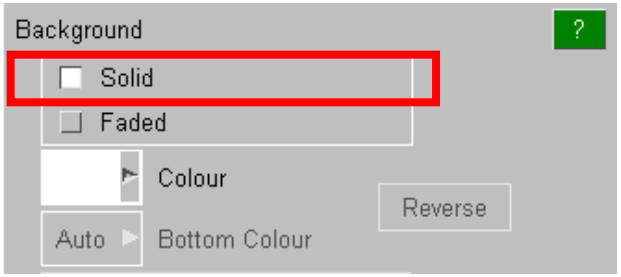
Colour Settings - Background

In Version 15 the background can now be set to either a Solid colour (default) or a Faded colour



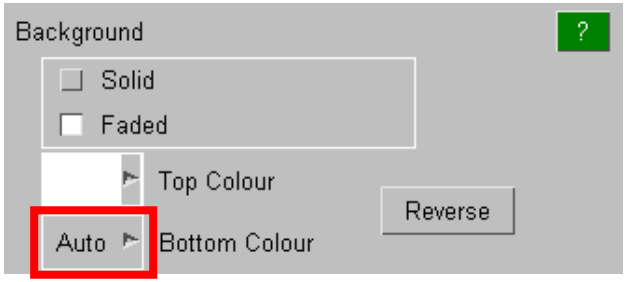


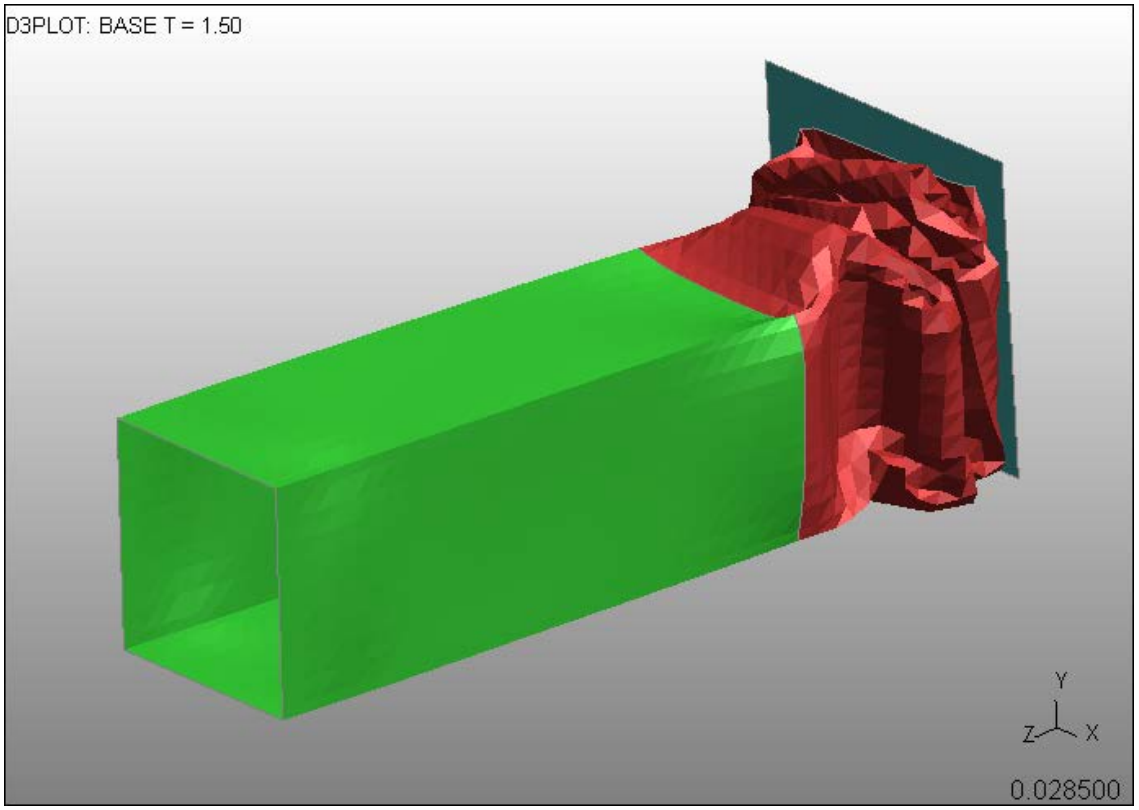




Colour Settings - Background

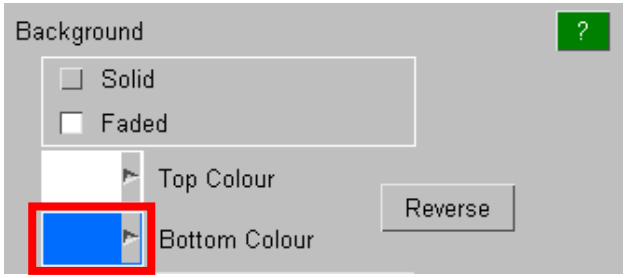
By default when a Faded background is used the bottom of the screen is automatically set to 50% of the background colour.

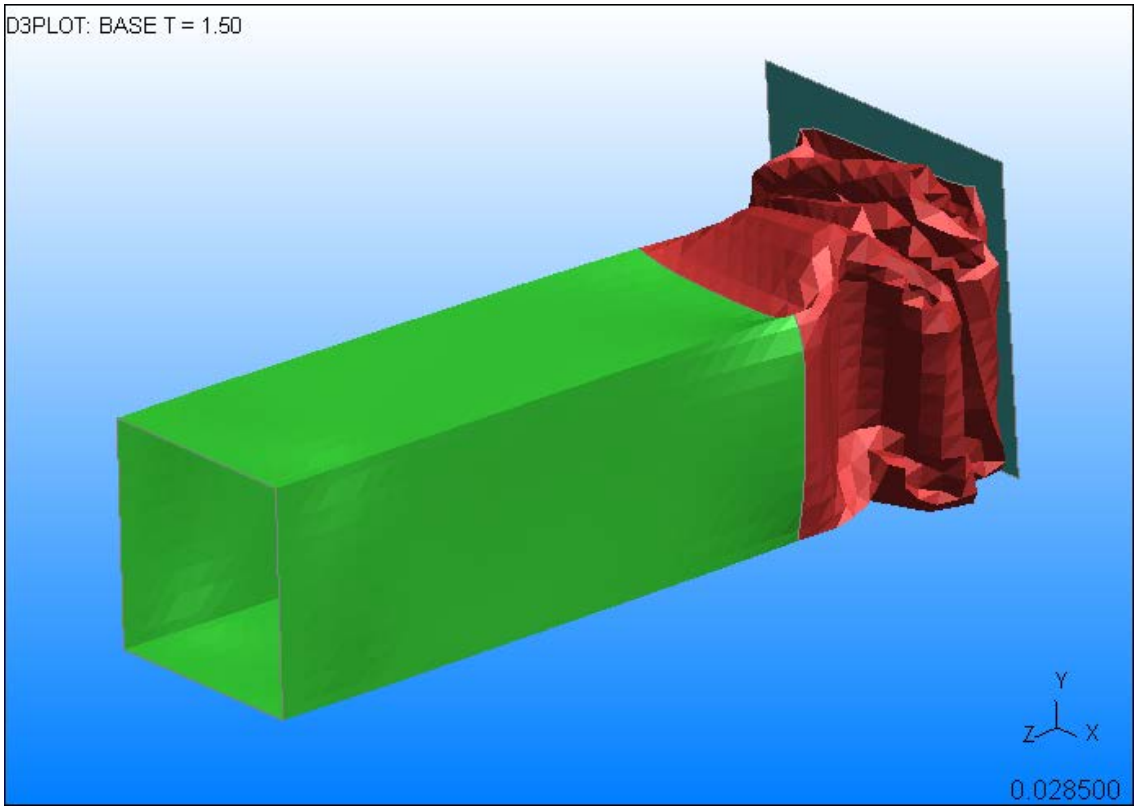




Colour Settings - Background

Alternatively a separate colour can be specified for the bottom of the screen





Two new preferences have also been added to control the new background options.

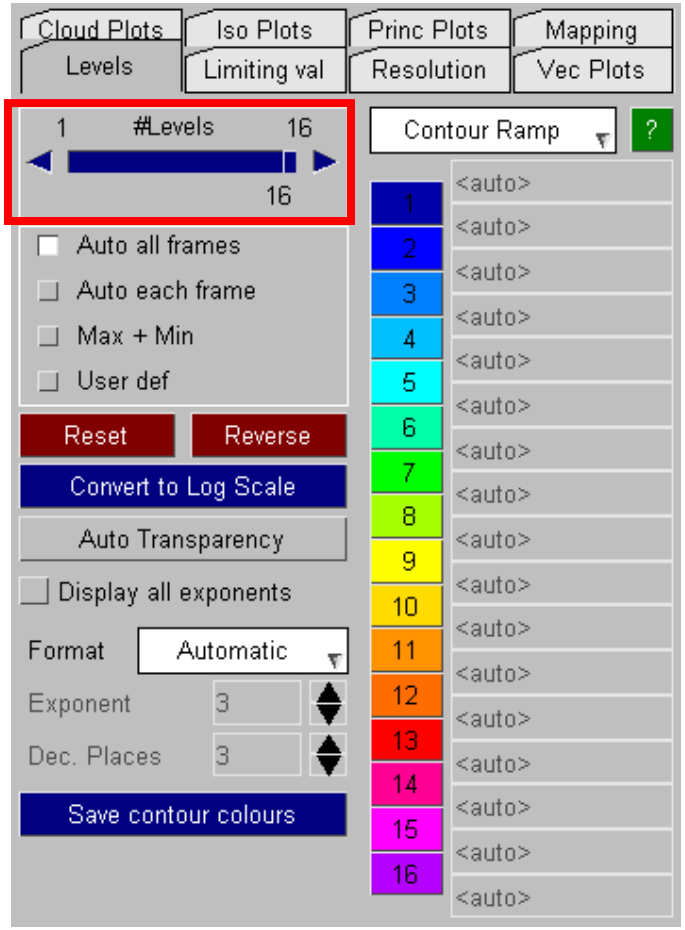
d3plot*background_mode

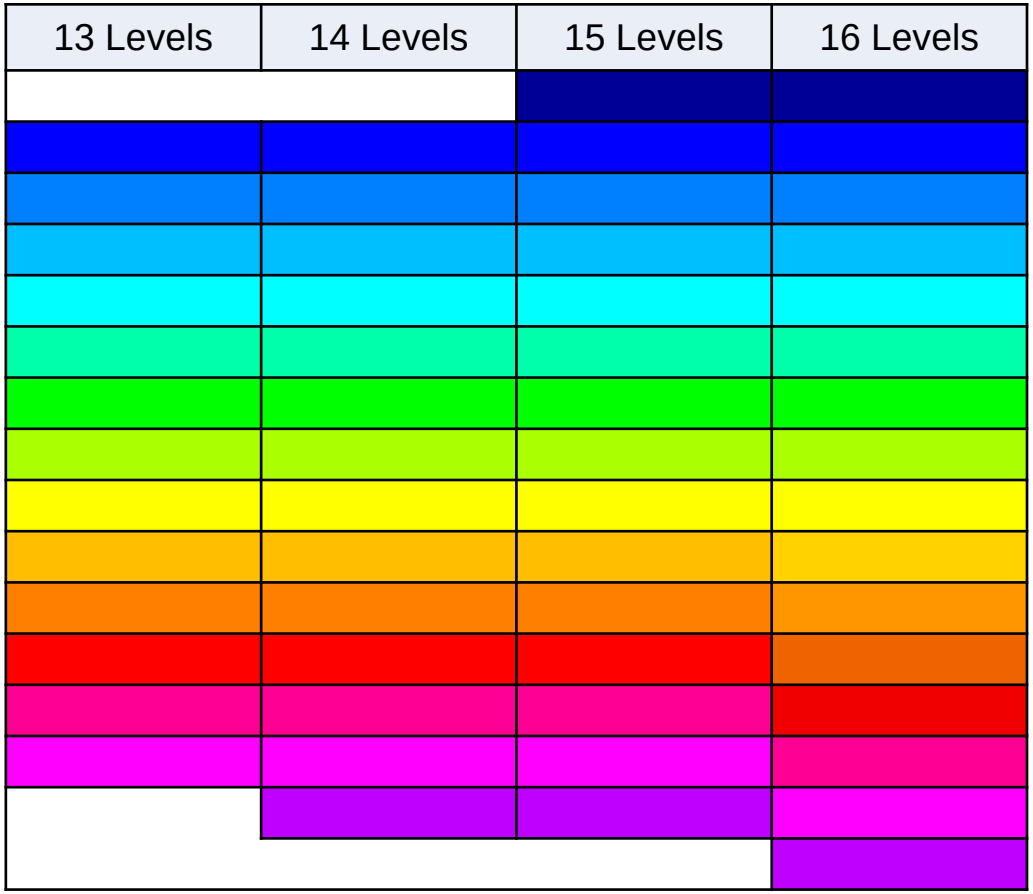
d3plot*background_bottom_colour

Contouring

Contouring – Contour Levels

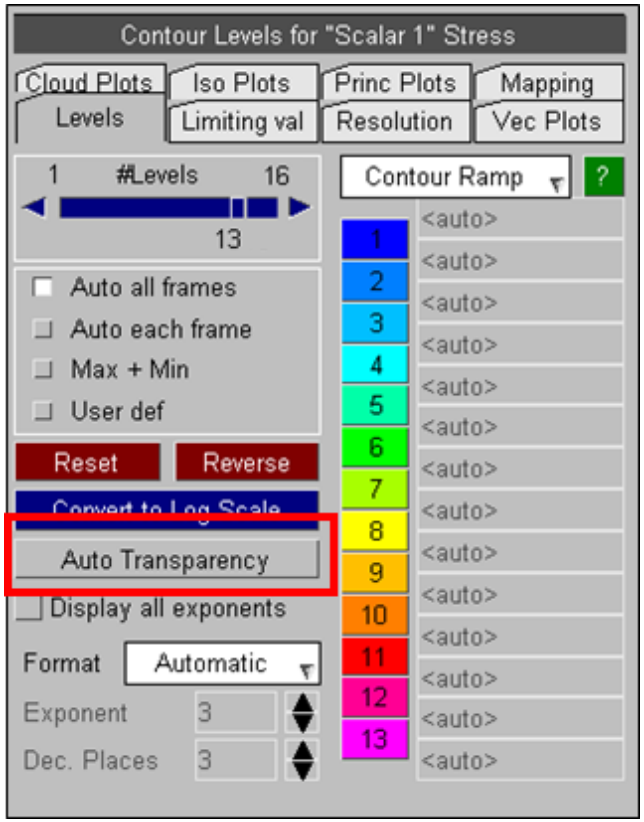
In Version 15 the maximum number of contour levels has been increased from 13 to 16.

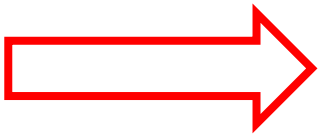


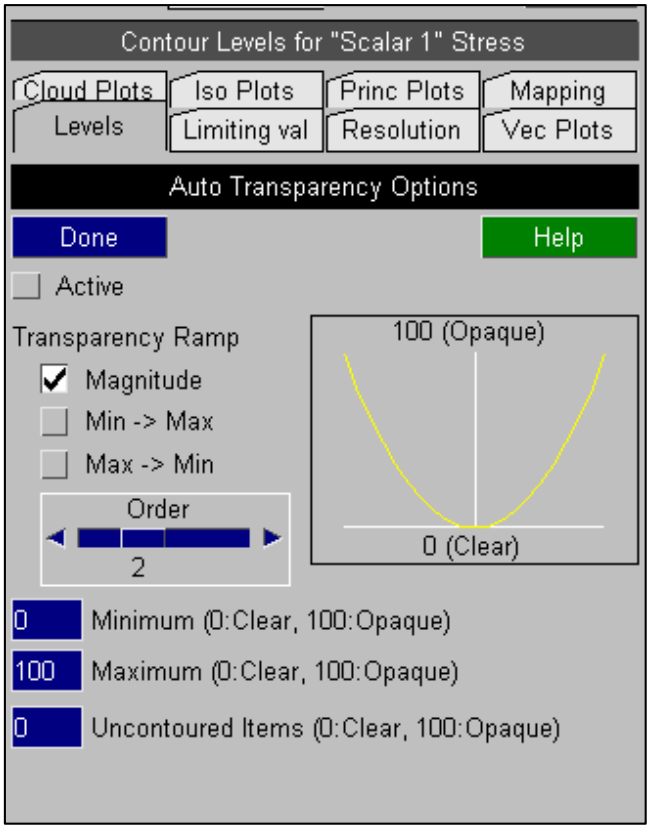


Contouring – Automatic Transparency

The “Levels” sub-menu within the Data Component menu contains a new “Automatic transparency” option.

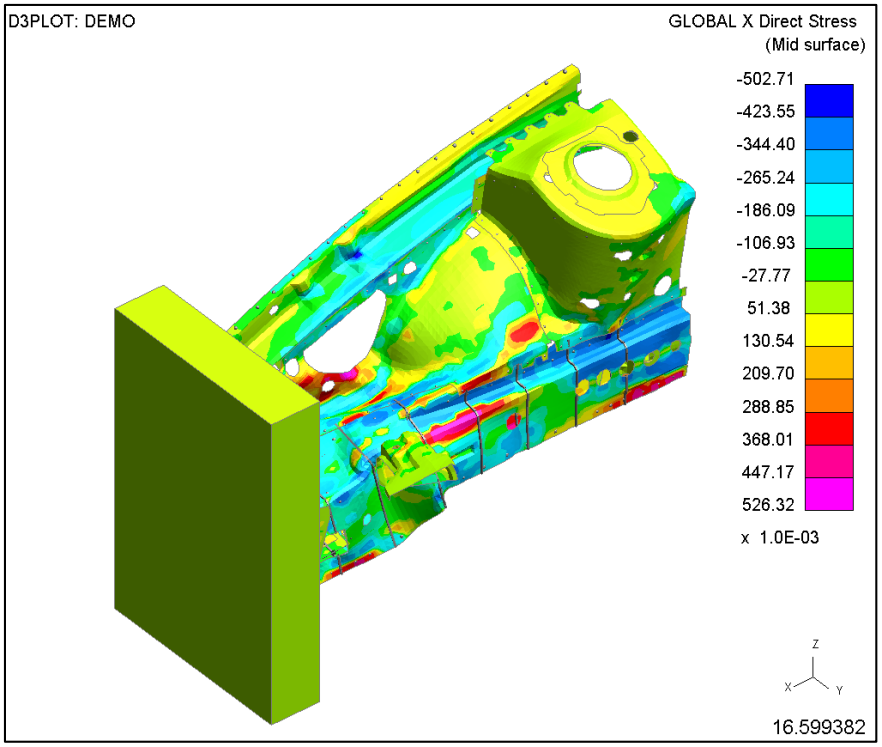




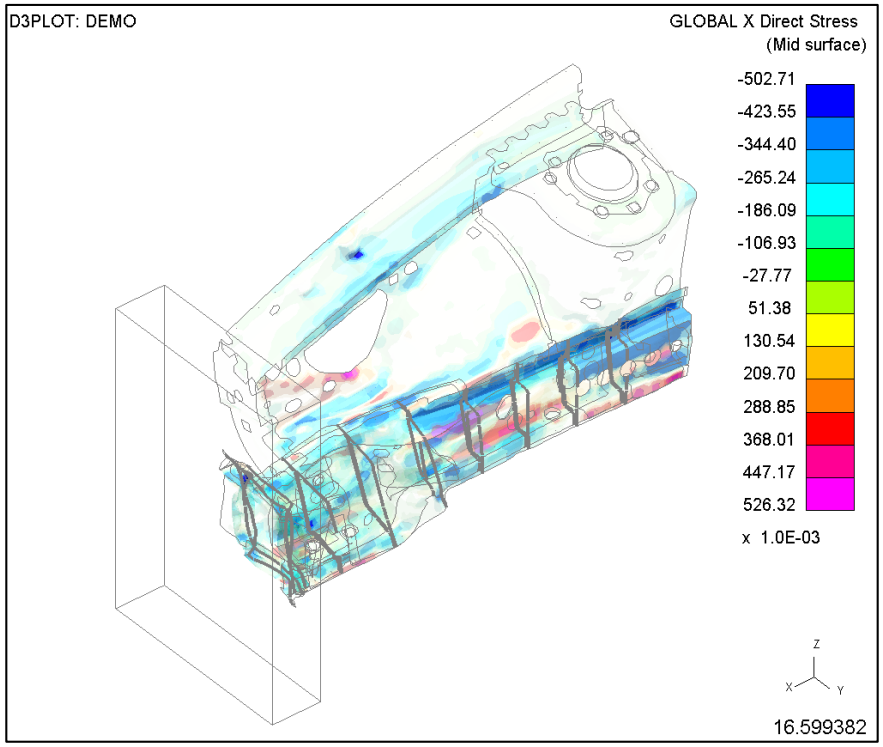


Contouring – Automatic Transparency

This option can be used to automatically adjust the transparency of entities in CT, SI and CL plots based on their data values.

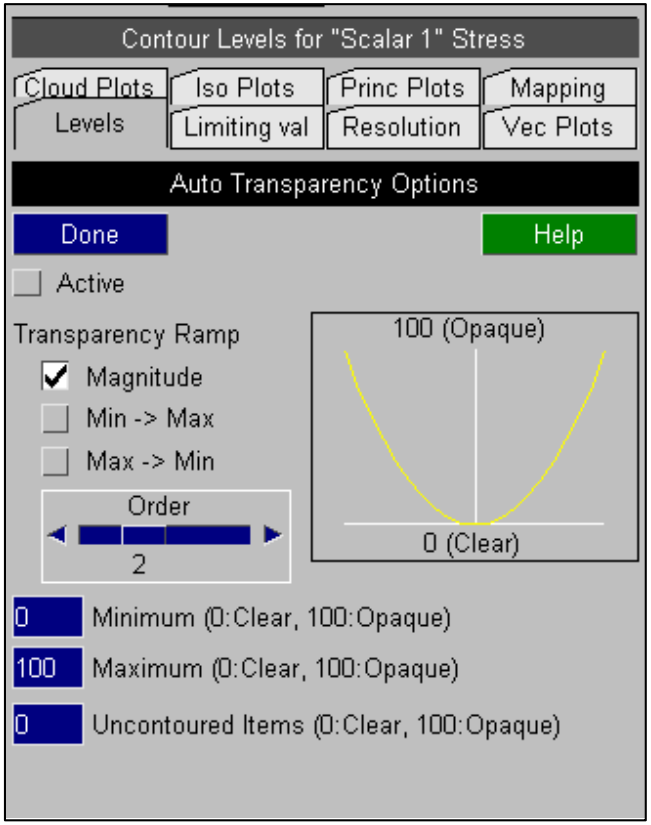


SI plot



SI plot + default Automatic transparency

Contouring – Automatic Transparency



The transparency levels can either vary with the magnitude of the data values or they can increase/decrease as values go from low to high.

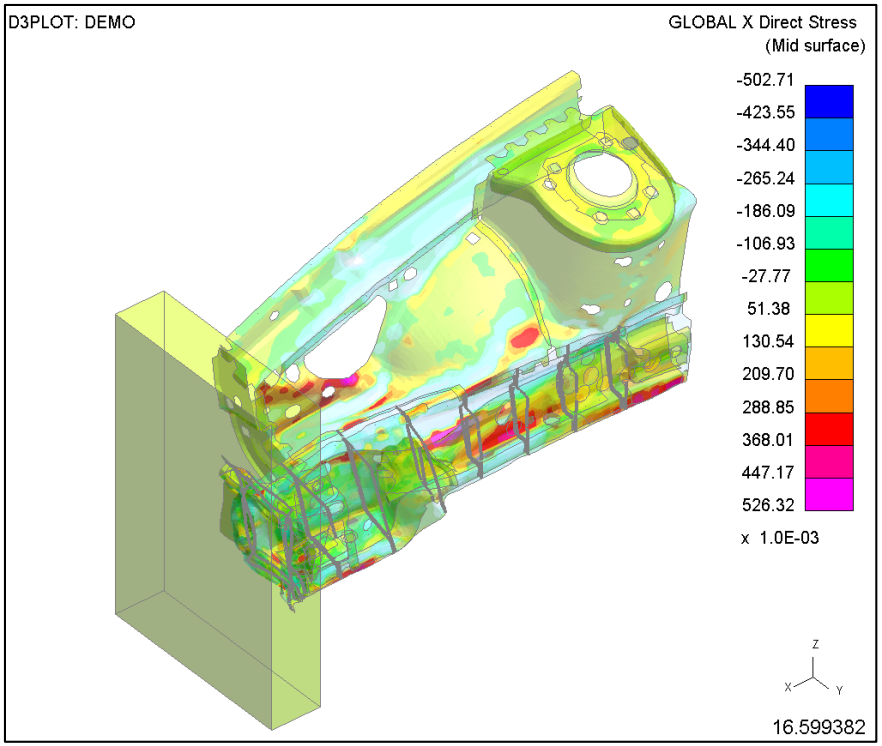
The shape of the transparency ramp can also vary from linear with X (order 1) to proportional to X^2, X^3, or X^4 so that as the order increased the transparency is biased towards the larger values.

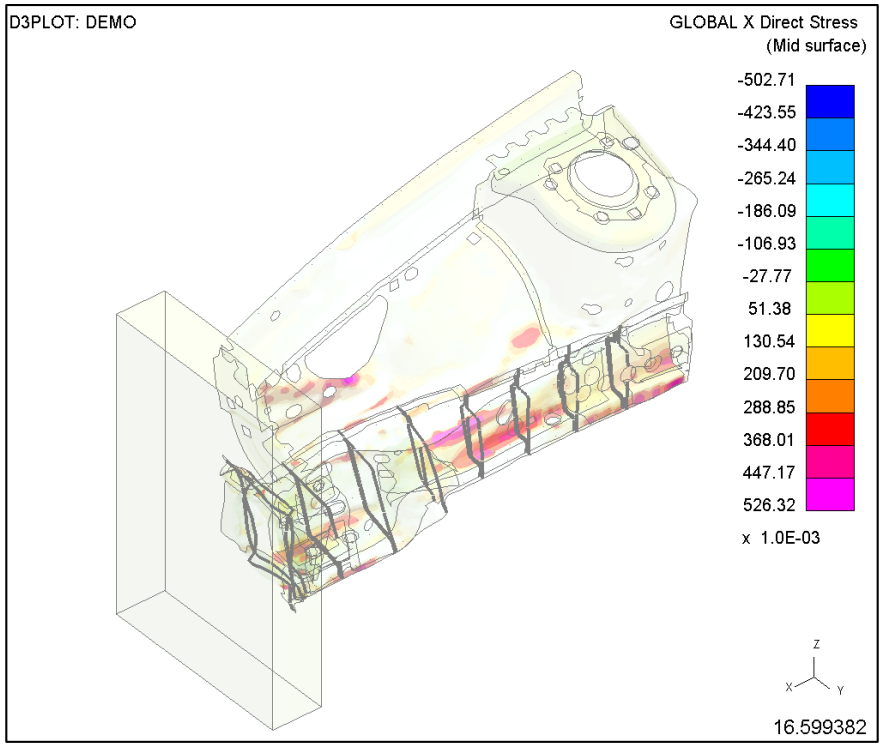
By default the transparency is scaled between 0 (clear) and 100 (opaque) but both the higher and lower limits can be modified.

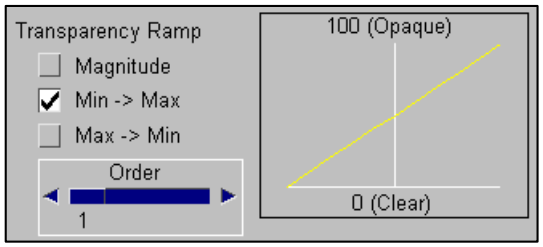
The transparency applied to items that are not be contoured can also be controlled.

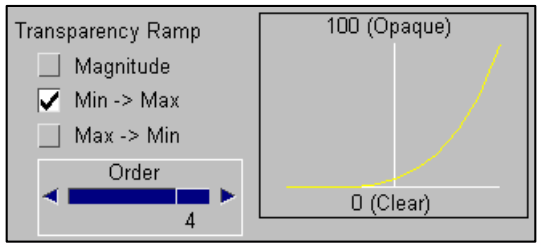
Contouring – Automatic Transparency

Transparency Ramp Options :



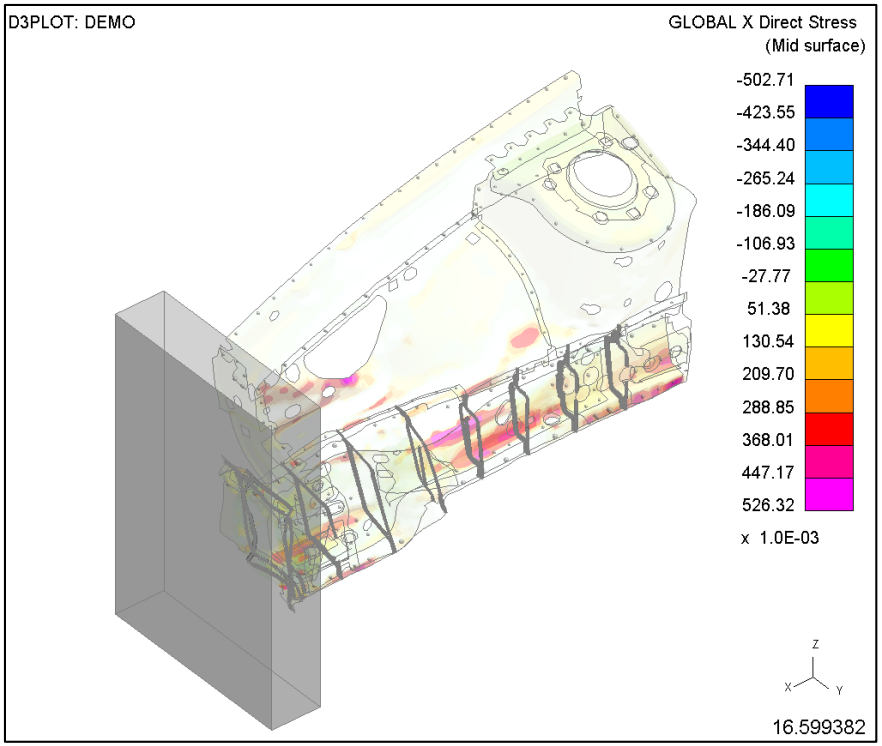




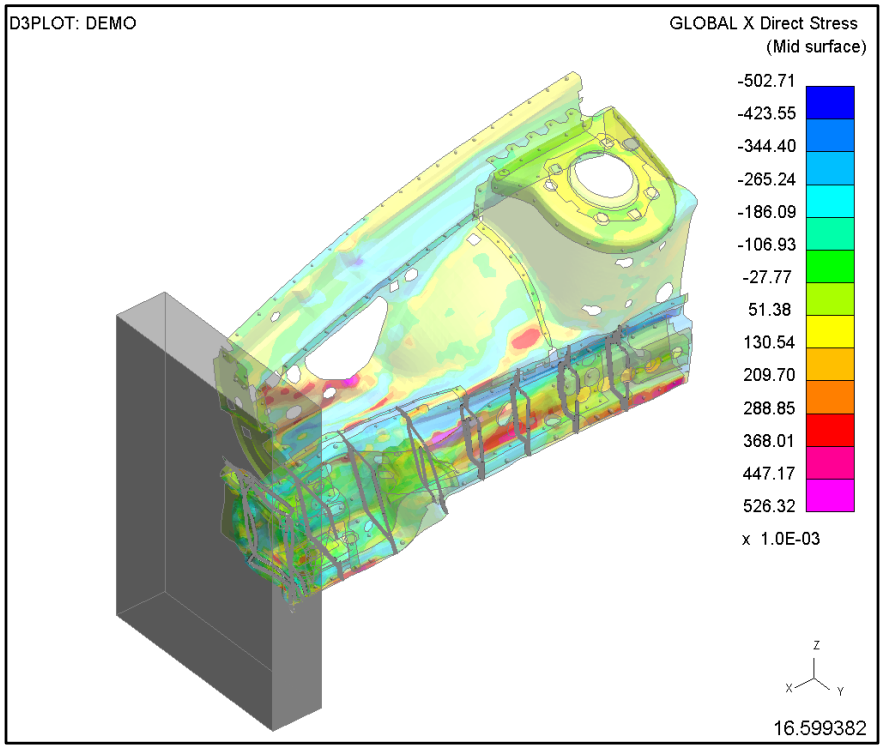


Contouring – Automatic Transparency

Transparency Range and Uncontoured Items



0	Minimum (0:Clear, 100:Opaque)
100	Maximum (0:Clear, 100:Opaque)
50	Uncontoured Items (0:Clear, 100:Opaque)

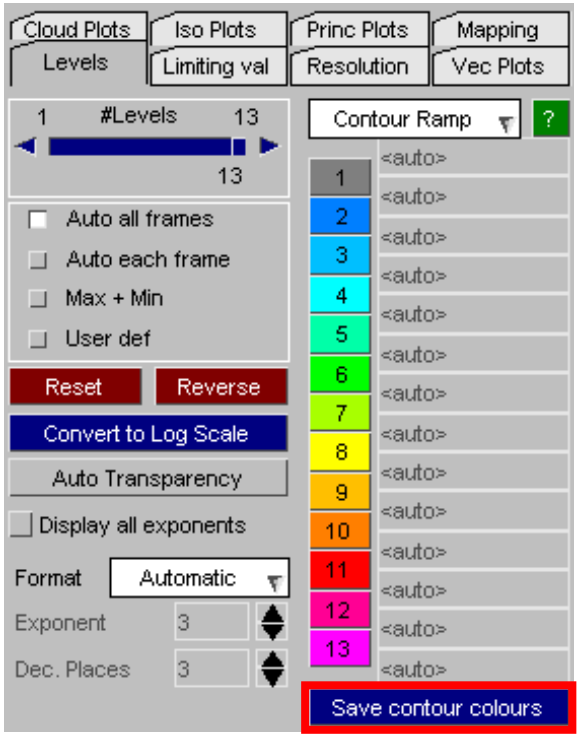


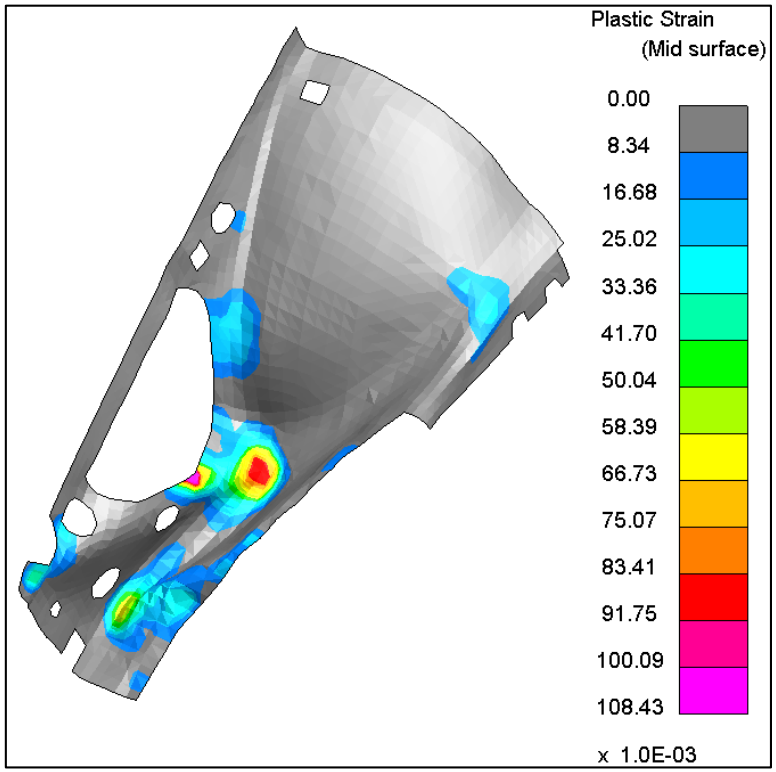
30	Minimum (0:Clear, 100:Opaque)
100	Maximum (0:Clear, 100:Opaque)
80	Uncontoured Items (0:Clear, 100:Opaque)

Contouring – Saving contour bar colours

Contour bar colours can now be saved to the oa_pref file and are reloaded in new sessions of D3PLOT.

This can be useful if you regularly set the colours to something other than the default, e.g. grey for the minimum value.

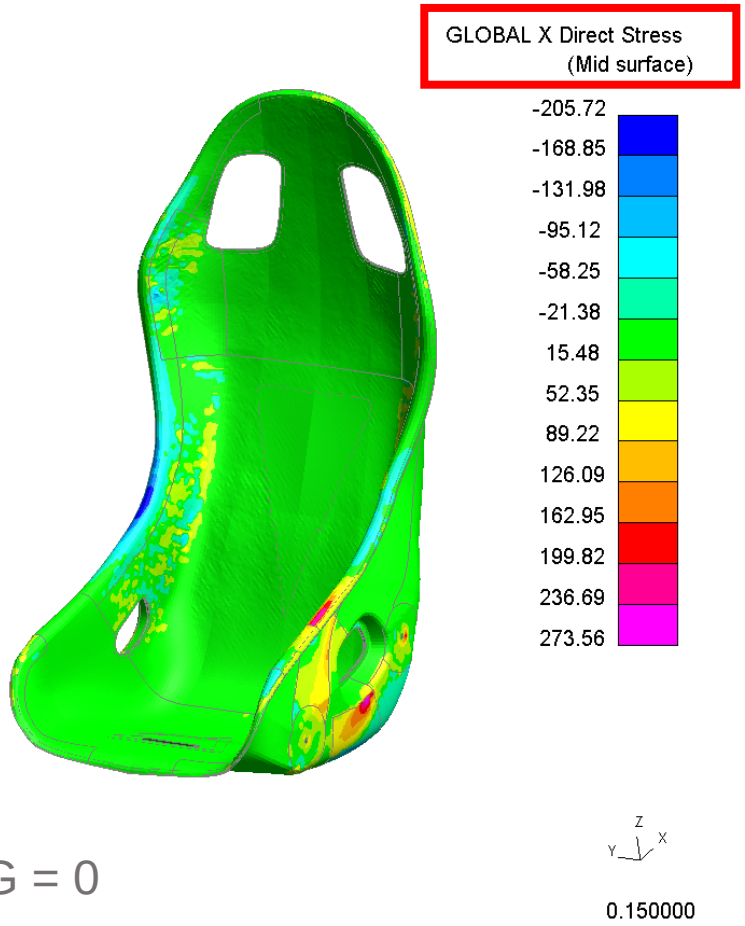




Support for Plotting Results In Material Axes Coordinate Systems

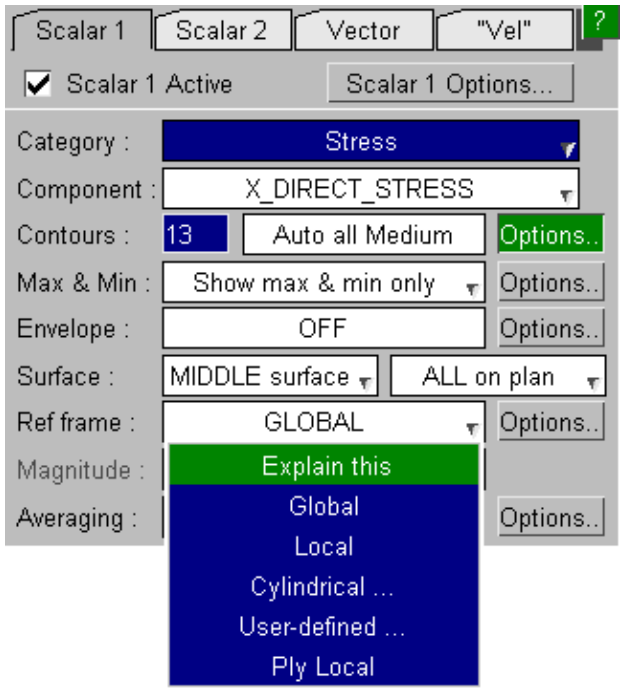
Material Axes

In LS-DYNA the default output option writes stresses and strains into the PTF (d3plot) binary files using the global coordinate system.



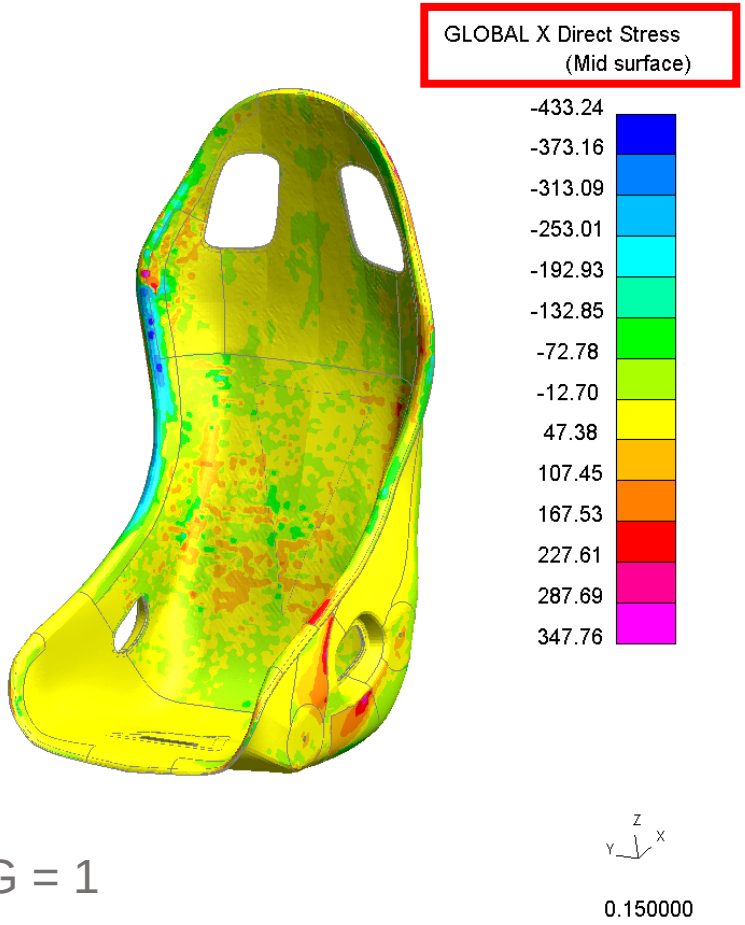
CMPFLG = 0

D3PLOT can then transform these results from the global coordinate system into one of the other systems that it supports.



Material Axes

The default output can be changed on *DATABASE_EXTENT_BINARY by setting CMPFLG=1.



CMPFLG = 1

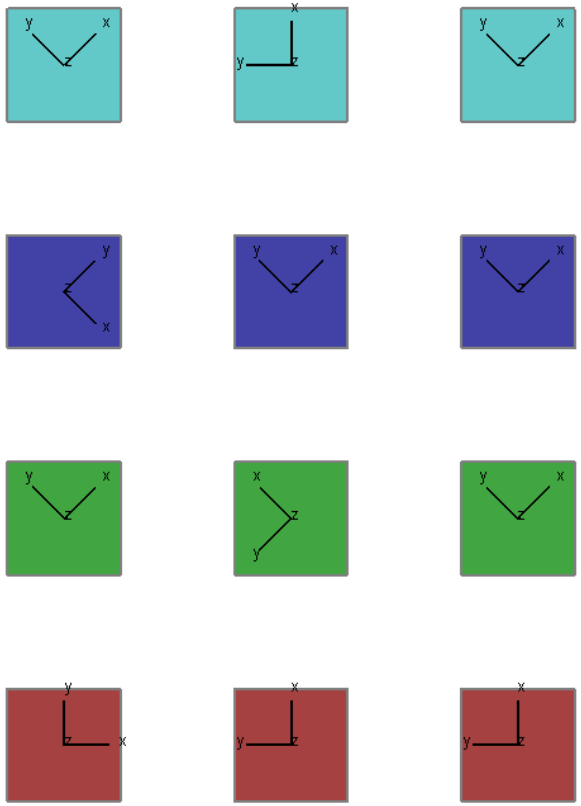
When this option is set the output for any elements defined using an Orthotropic material model are changed so that they are written out using the material axes coordinate system.

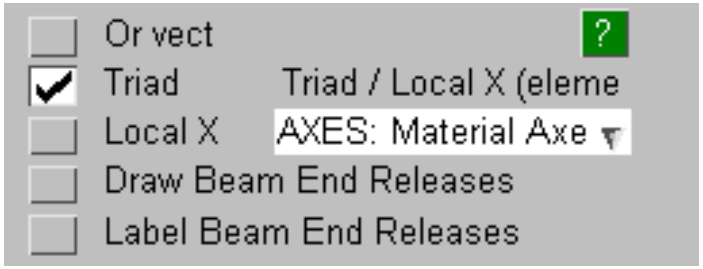
Nothing else is changed in the PTF file so there is nothing to indicate this change to a post processor so by default the post processor will still assume that the results are in the global system.

Any coordinate system transformations or calculations also assume that the results are starting in the global coordinate system.

Material Axes

PRIMER 15 supports the complex rules for calculating the material coordinate system and can sketch them via the entities panel.





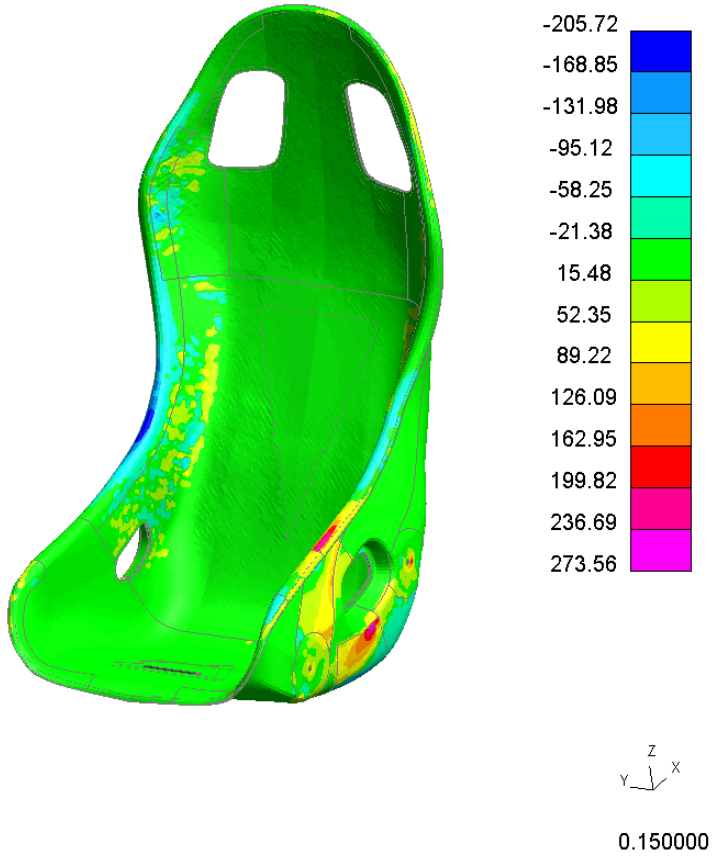
PRIMER v15 writes to the ZTF file information necessary for D3PLOT to correctly interpret material axes:

- CMPFLG value
- Material axis systems
- Material for each element and integration point

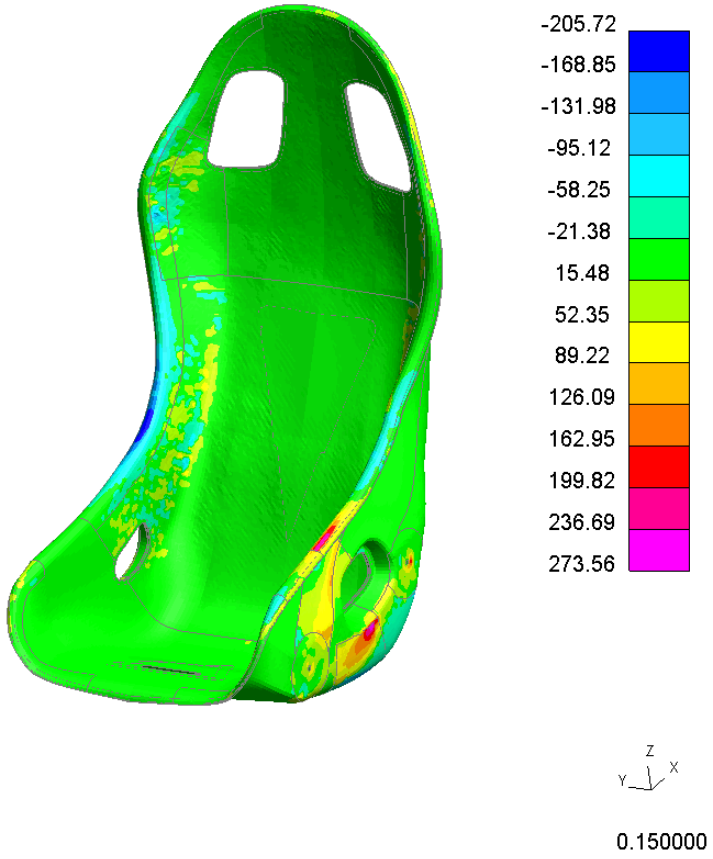
Material Axes

With a V15 ZTF file D3PLOT can correctly identify CMPFLG and will automatically transform the stress and strain values to the global coordinate system.

D3PLOT: M1: CMPFLG = 0

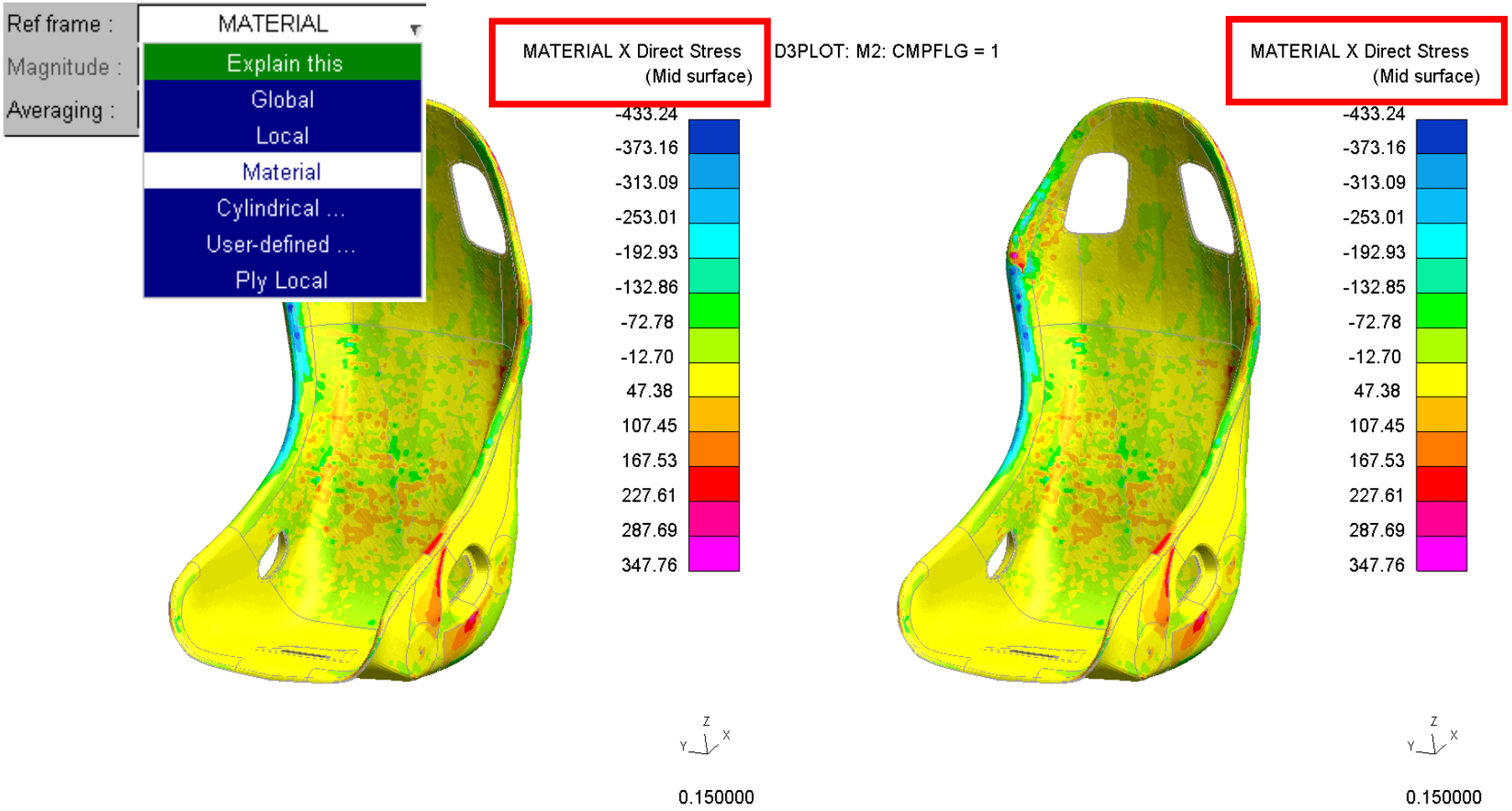


D3PLOT: M2: CMPFLG = 1



Material Axes

When D3PLOT detects a model with orthotropic material properties a new option to plot results using the material axes coordinate system is available.

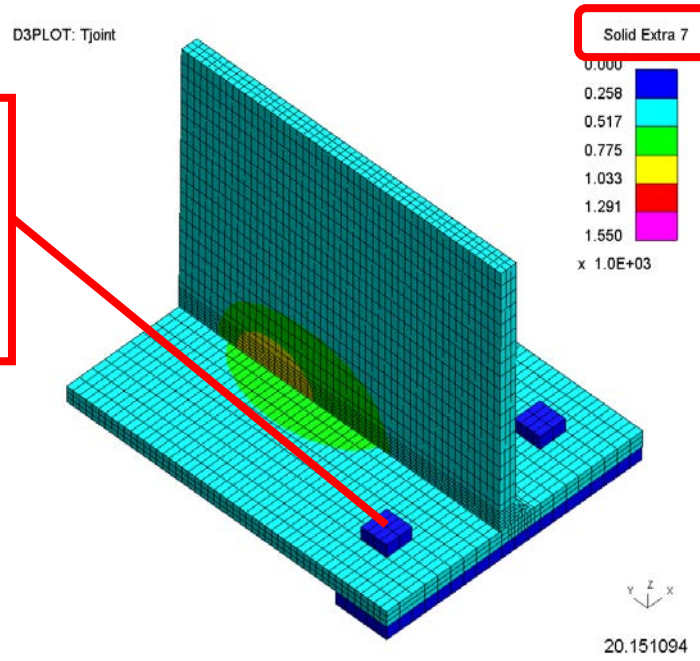


Material Extra Data

Material Extra Data

Extra variables written to PTF file for some materials by setting NEIPH or NEIPS on *DATABASE_EXTENT_BINARY. D3PLOT supports these with some limitations.

Elements of material (rigid) that does not output extra variable are contoured with 0.0



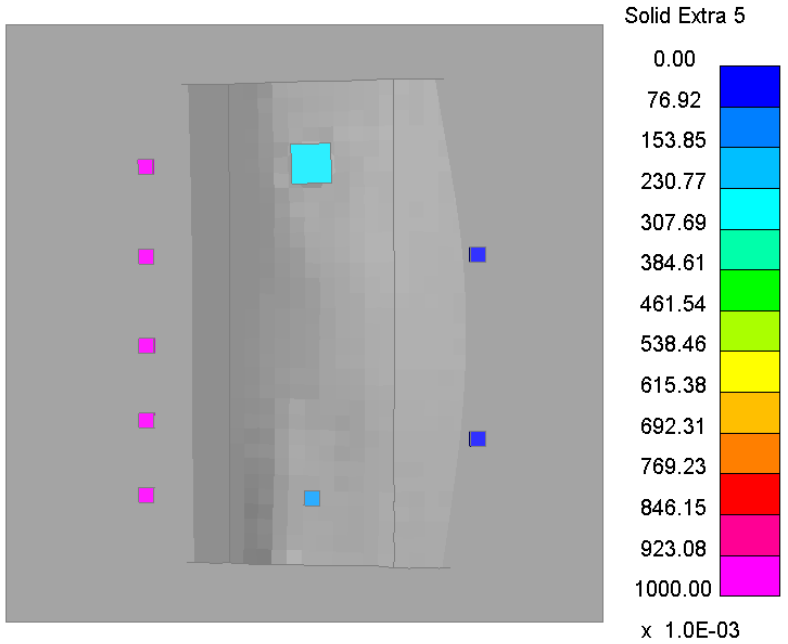
Component name is generic (Solid Extra 7)

Material Extra Data

Extra variables written to PTF file for some materials by setting NEIPH or NEIPS on *DATABASE_EXTENT_BINARY. D3PLOT supports these with some limitations.

Different variables on same plot can be confusing. For example plot on right shows Solid Extra 5 for 3 different materials:

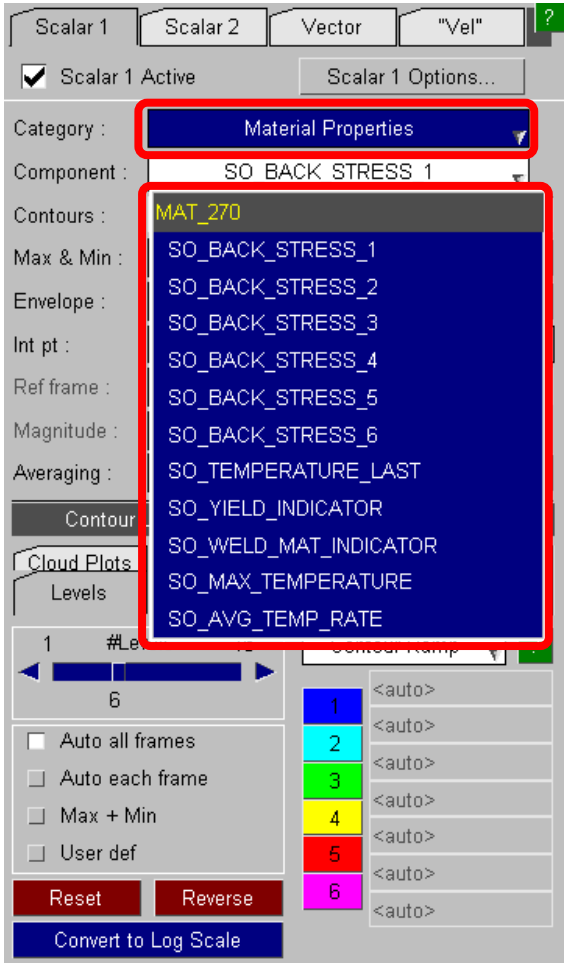
- Current Yield Stress for MAT_024 (cyan)
- Deformation Gradient for MAT_002 (pink)
- Back Stress for MAT_003 (blue)



Material Extra Data

Support for extra variables enhanced in D3PLOT v15.

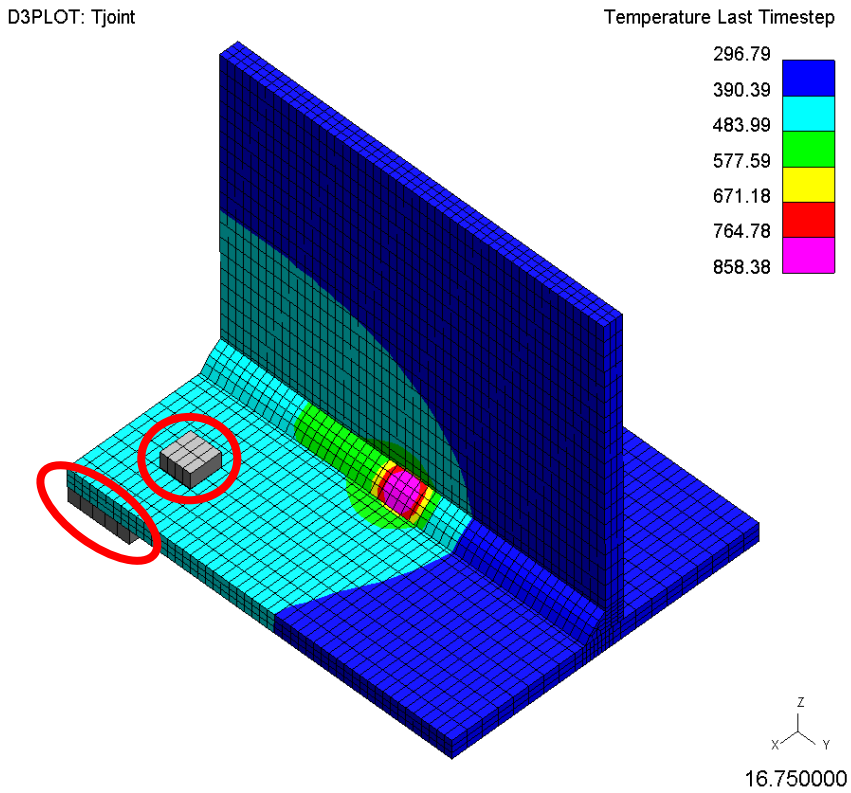
1. New “Material Properties” category with descriptive component names for extra variables, organised by material and element type if applicable



Material Extra Data

Support for extra variables enhanced in D3PLOT v15.

1. New “Material Properties” category with descriptive component names for extra variables, organised by material and element type if applicable
2. Elements that do not write selected extra variable are not contoured
3. Only elements of material corresponding to selected component are contoured



Material Extra Data

D3PLOT requires additional information to support “Material Properties” contouring:

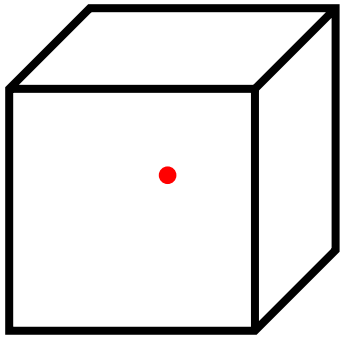
1. ZTF file is required to provide link between parts and materials
2. A new pre-populated CSV file (mat_prop.csv) provides material extra variable information – this can be edited by the user to allow new materials to be added or existing component names to be modified

Multi-Integration Point Solid Elements

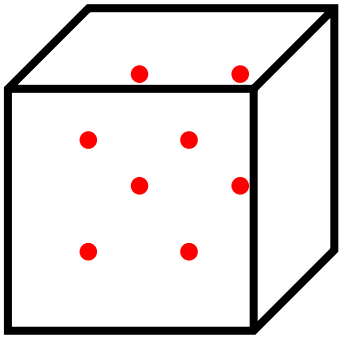
Multi-Integration Point Solids

When NINTSLD on the *DATABASE_EXTENT_BINARY card is set to 8, values for individual integration points are written for multi-integration point solid elements.

NINTSLD = 1



NINTSLD = 8

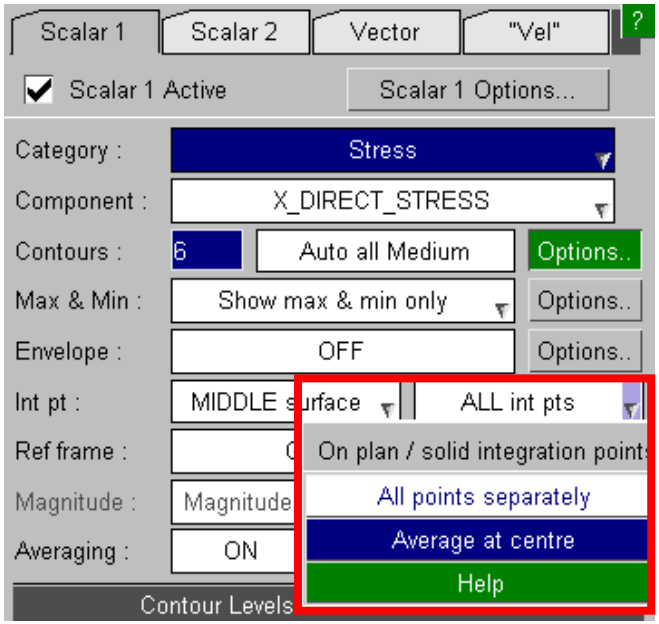


Previous versions of D3PLOT averaged multi-integration point solid element data to a single point, so it was not possible to plot each one at the same time to see the variation of data over an element.

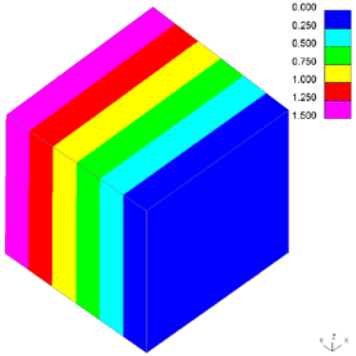
In V15 D3PLOT this is now possible if a ZTF file has been written.

Multi-Integration Point Solids - Plotting

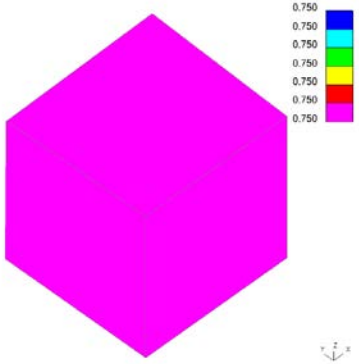
How the integration point data is plotted is controlled via the existing popup on the DATA menu, which previously only controlled on plan integration points for thin shells



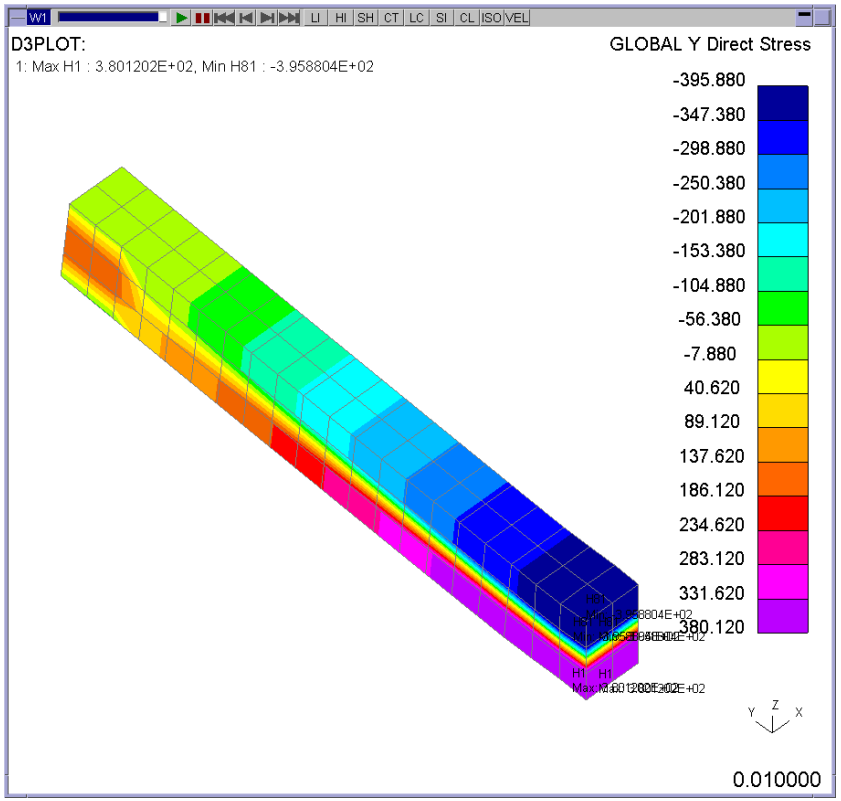
'**Plot all points separately**' (*default*) to see the data variation over the element:

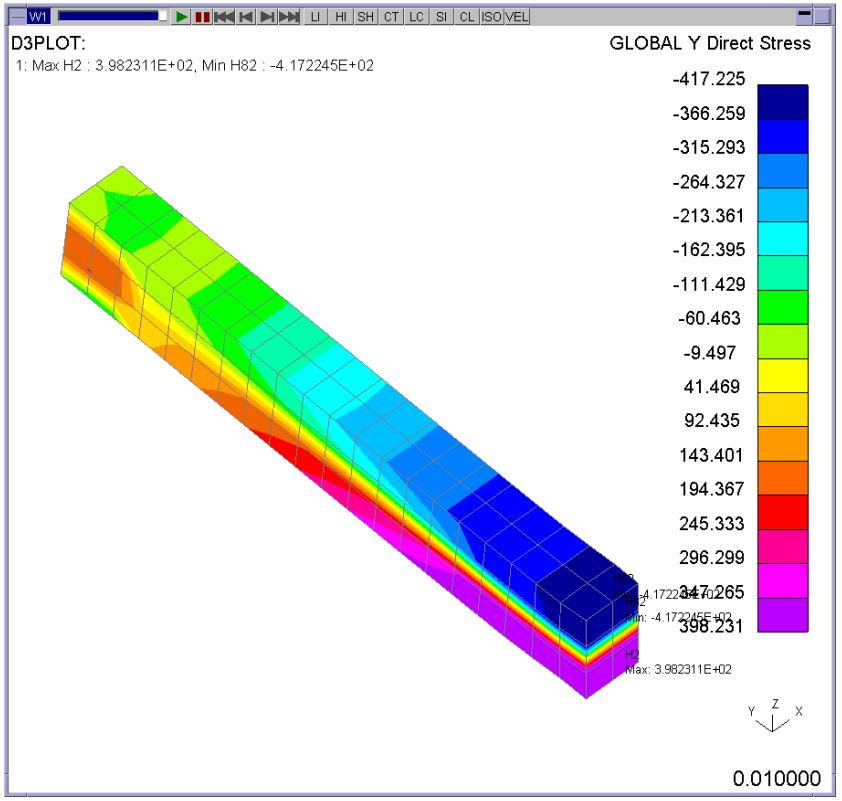


'**Average at centre**' to average the data to a single point on the element:



Multi-Integration Point Solids - Plotting



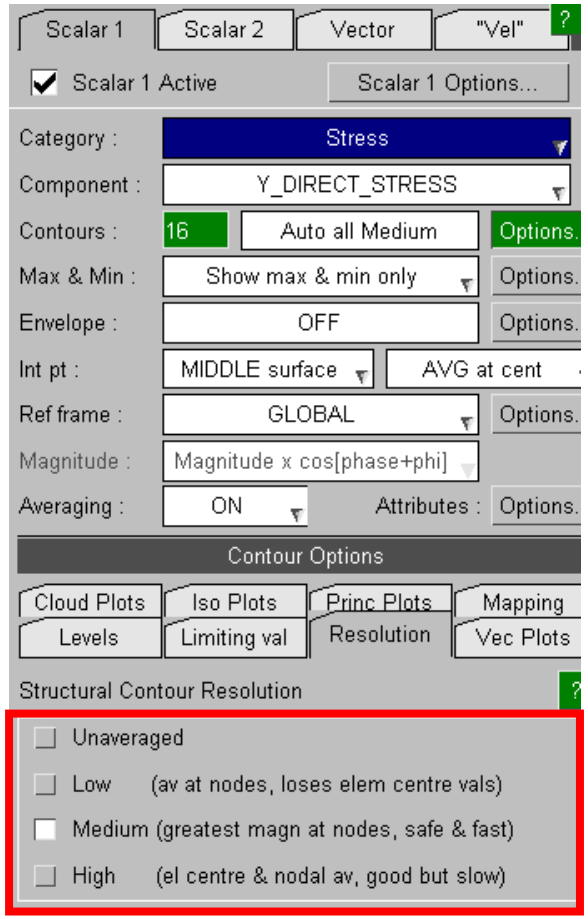


Averaged : min = -396

All : min = -417

Multi-Integration Point Solids - Plotting

For CT and SI plotting D3PLOT transfers element integration point values to nodes and contours using these. There are 4 different schemes for deciding how the nodal values are calculated:



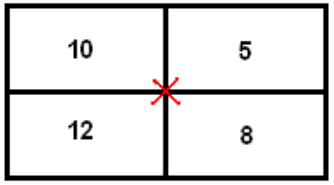
- **Unaveraged** No averaging of data at nodes.
- **Low** Data values from connected elements are averaged at nodes.
- **Medium** The data value with the highest magnitude from each connected element is used.
- **High** Data values from connected elements are averaged at nodes, values on edges are averaged and values on faces are averaged.

Multi-Integration Point Solids - Plotting

These diagrams show how each contour plotting scheme works with single and multiple integration points.

Low Resolution

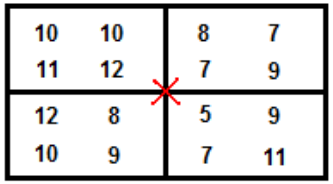
Single on plan point



Result at centre node is the linear average:

(10 + 5 + 12 + 8) / 4 = 8.75

Multiple on plan points

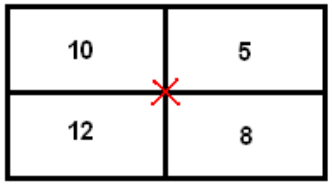


Results at centre node is the linear average of the closest on plan integration point on each connected shell:

(12 + 7 + 8 + 5) / 4 = 8.00

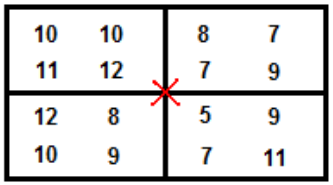
Medium Resolution

Single on plan point



Result at the centre node is the greatest magnitude value, here 12.

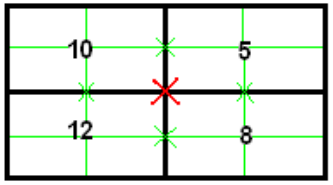
Multiple on plan points



Result at the centre node is the greatest magnitude value of the closest on plan integration point, here 12.

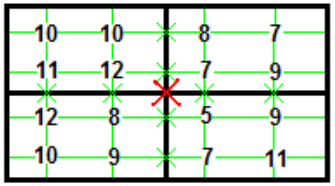
High Resolution

Single on plan point



Each element is sub-divided (green lines) with values averaged at mid-side points as well as nodes. Element centre values are kept.

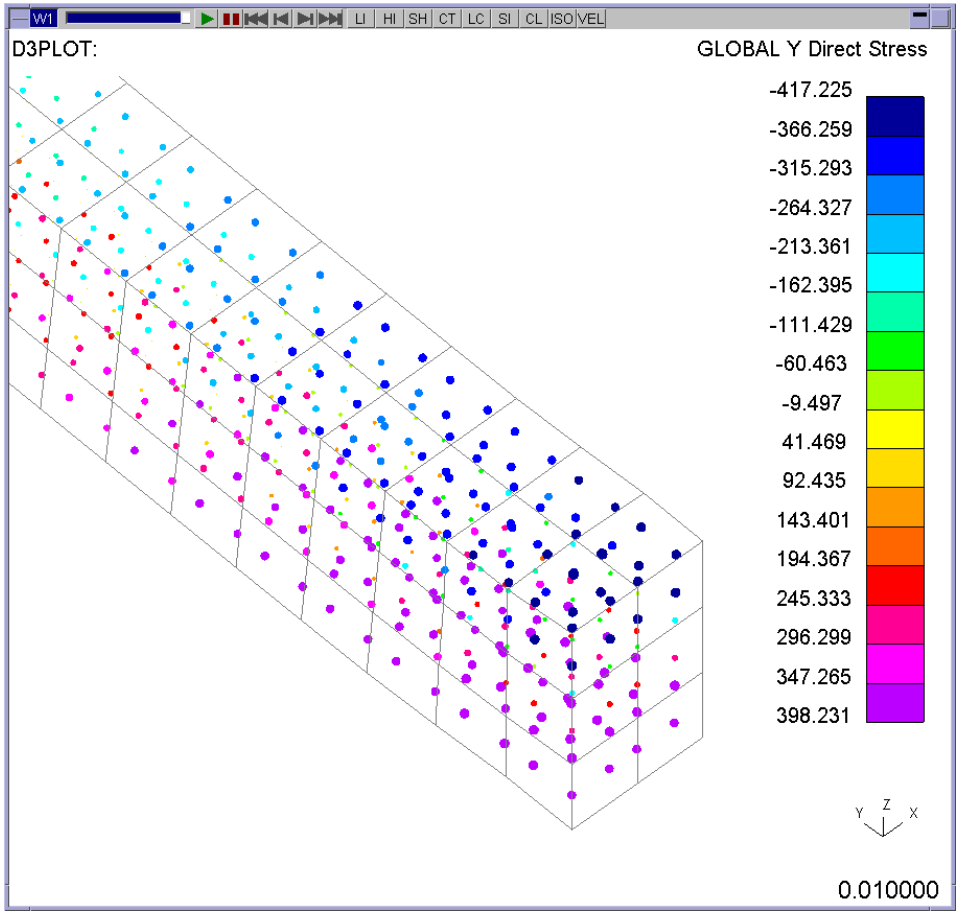
Multiple on plan points



Same as the single on plan point case, but each element is sub-divided into more, smaller sub-elements.

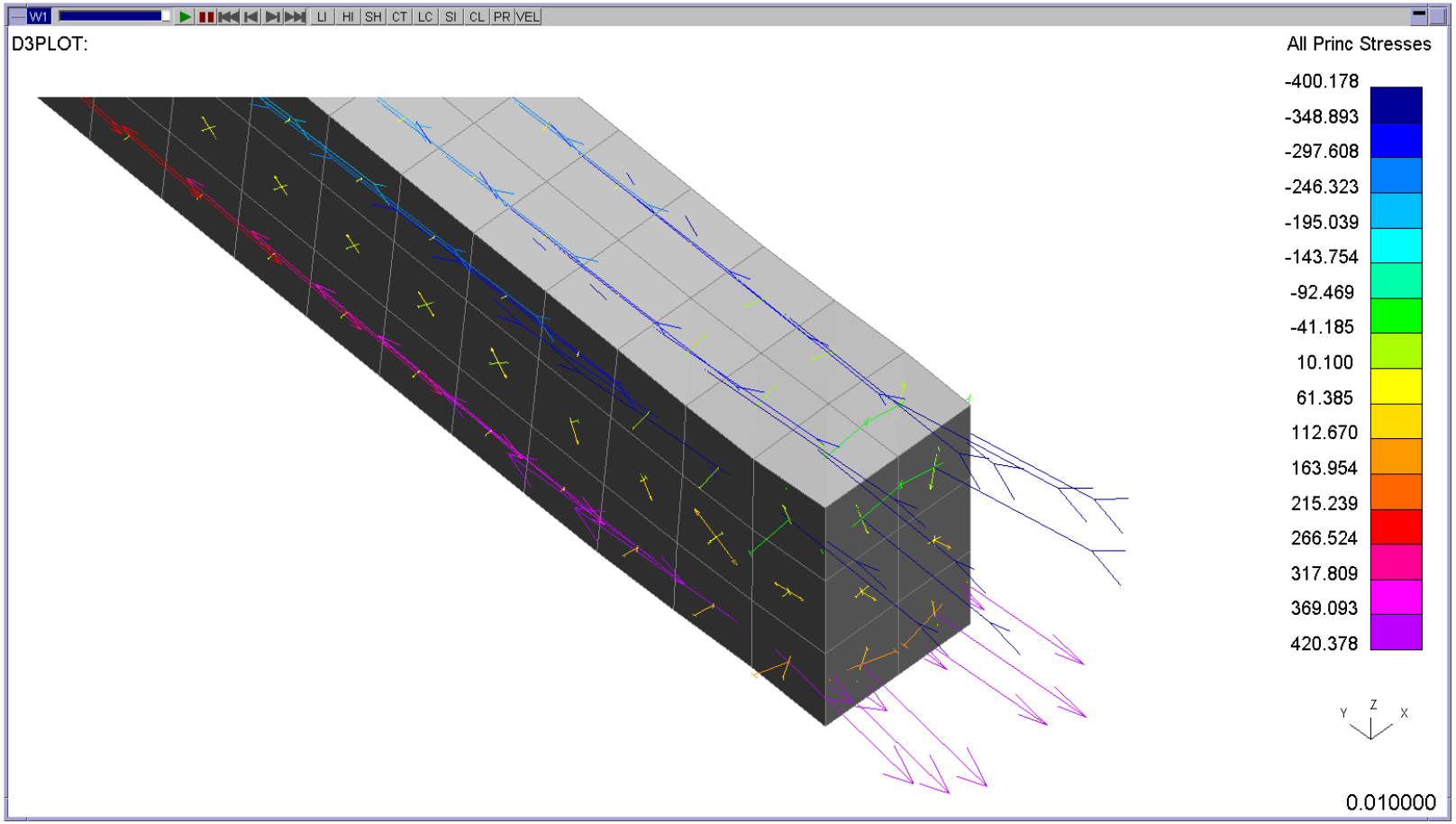
Multi-Integration Point Solids - Plotting

CL (Cloud) plots show data at each on plan point:

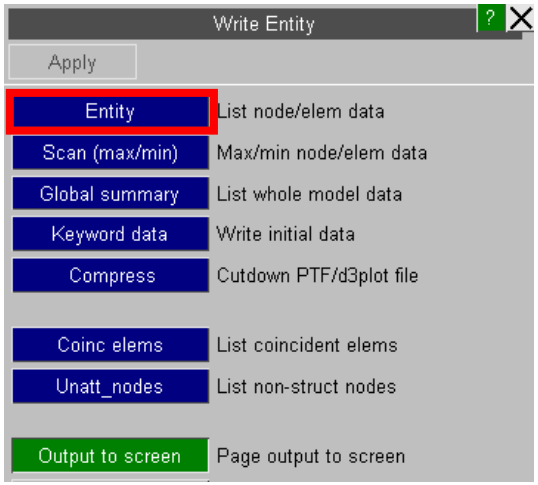


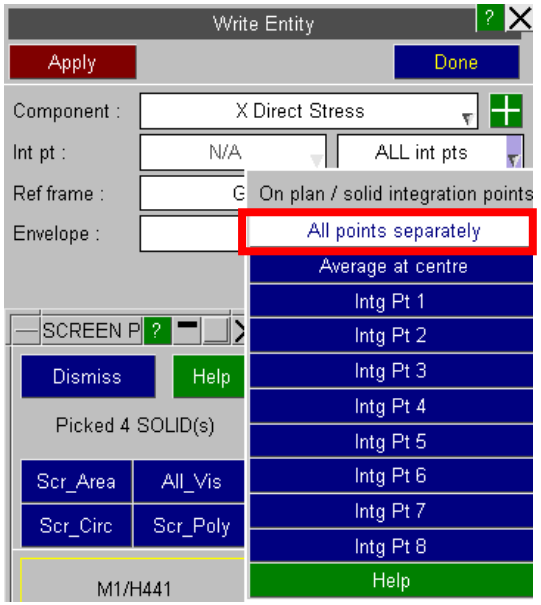
Multi-Integration Point Solids - Plotting

PR (Principal) plots always show data averaged at centre to avoid overly congested plots:



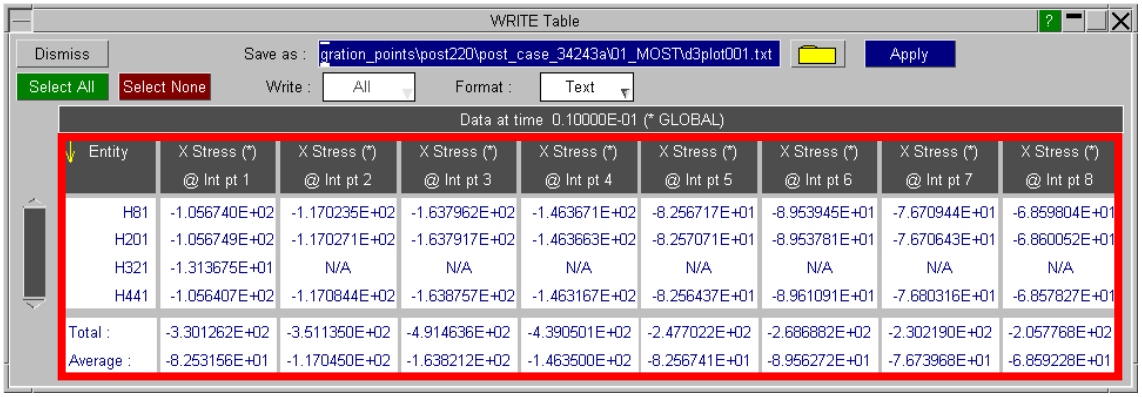
Multi-Integration Point Solids - Write Menu





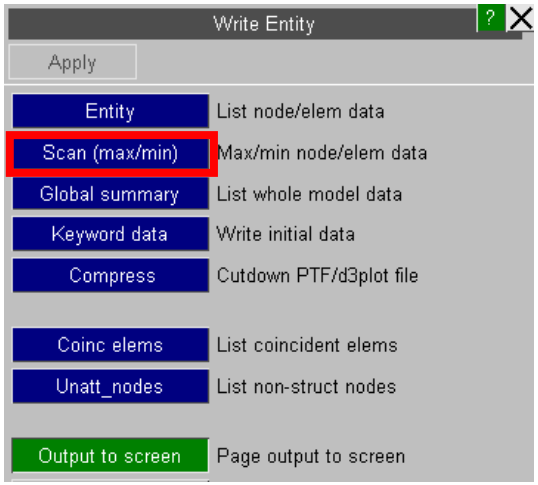
In the Write -> Entity menu the integration point data values can be output by selecting:

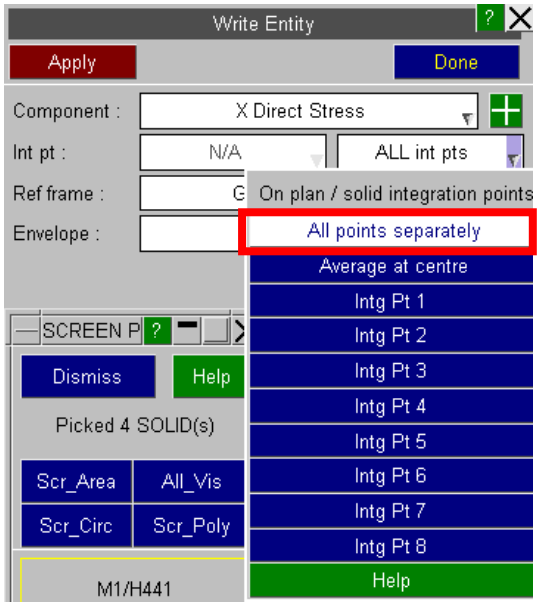
- All points separately (multiple values are output, one for each valid point). ‘N/A’ is written if the point does not have any valid data.
- Average at centre (single value).
- Individual integration point (single value).



Entity	X Stress (*) @ Int pt 1	X Stress (*) @ Int pt 2	X Stress (*) @ Int pt 3	X Stress (*) @ Int pt 4	X Stress (*) @ Int pt 5	X Stress (*) @ Int pt 6	X Stress (*) @ Int pt 7	X Stress (*) @ Int pt 8
H81	-1.056740E+02	-1.170235E+02	-1.637962E+02	-1.463671E+02	-8.256717E+01	-8.953945E+01	-7.670944E+01	-6.859804E+01
H201	-1.056749E+02	-1.170271E+02	-1.637917E+02	-1.463663E+02	-8.257071E+01	-8.953781E+01	-7.670643E+01	-6.860052E+01
H321	-1.313675E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A
H441	-1.056407E+02	-1.170844E+02	-1.638757E+02	-1.463167E+02	-8.256437E+01	-8.961091E+01	-7.680316E+01	-6.857827E+01
Total :	-3.301262E+02	-3.511350E+02	-4.914636E+02	-4.390501E+02	-2.477022E+02	-2.686882E+02	-2.302190E+02	-2.057768E+02
Average :	-8.253156E+01	-1.170450E+02	-1.638212E+02	-1.463500E+02	-8.256741E+01	-8.956272E+01	-7.673968E+01	-6.859228E+01

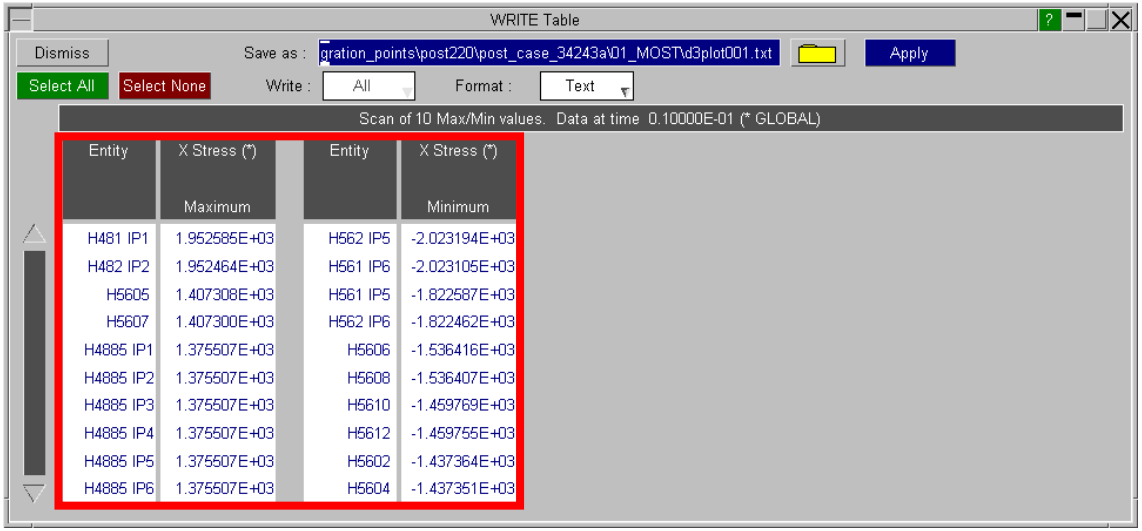
Multi-Integration Point Solids - Write Menu





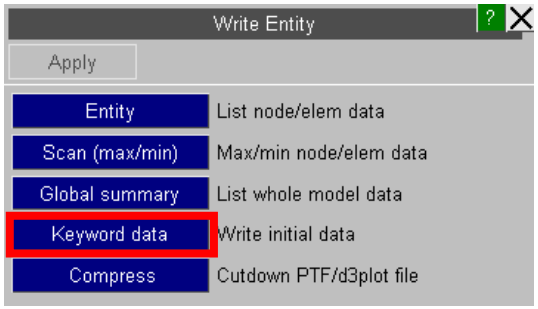
In the Write -> Scan menu the integration point data values can be selected by:

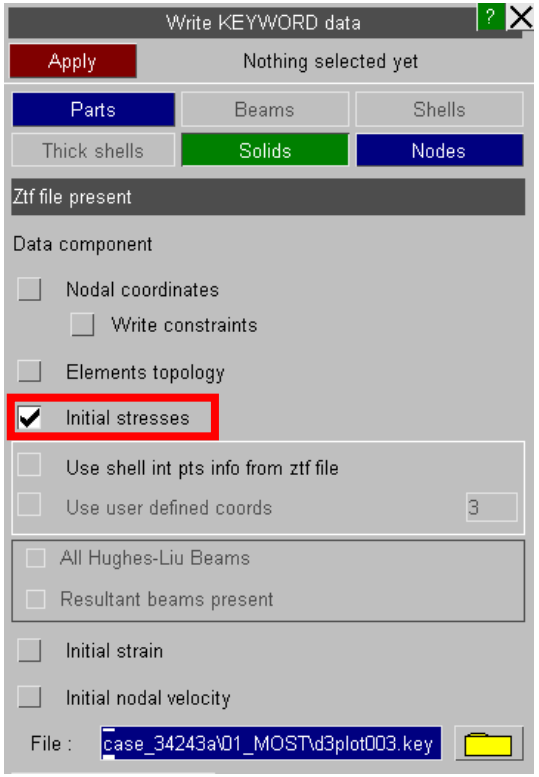
- All points separately (all integration point values are scanned).
- Average at centre (average values are scanned).
- Individual integration point (scan is only over selected integration point values).



Entity	X Stress (*) Maximum	Entity	X Stress (*) Minimum
H481 IP1	1.952585E+03	H562 IP5	-2.023194E+03
H482 IP2	1.952464E+03	H561 IP6	-2.023105E+03
H5605	1.407308E+03	H561 IP5	-1.822587E+03
H5607	1.407300E+03	H562 IP6	-1.822462E+03
H4885 IP1	1.375507E+03	H5606	-1.536416E+03
H4885 IP2	1.375507E+03	H5608	-1.536407E+03
H4885 IP3	1.375507E+03	H5610	-1.459769E+03
H4885 IP4	1.375507E+03	H5612	-1.459755E+03
H4885 IP5	1.375507E+03	H5602	-1.437364E+03
H4885 IP6	1.375507E+03	H5604	-1.437351E+03

Multi-Integration Point Solids - Write Menu





In the Write -> Keyword menu the *INITIAL_STRESS_SOLID card will write data for each solid integration point value in the correct format.

8 integration points

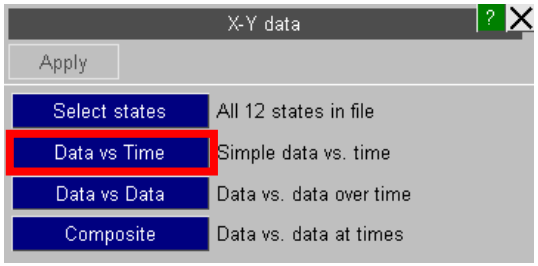
```
$       ++++++++ Data at time  0.10000E-01 ++++++++
*INITIAL_STRESS_SOLID
      81         8         0         1         0
  -1.056740E+02  -3.999279E+02  -5.364367E+01  -6.674905E+01   2.519008E+01
  -2.959418E+01   1.684758E-02
  -1.170235E+02  -3.980350E+02  -4.352995E+01  -1.473999E+01   7.486041E+01
   2.210392E+00   1.565592E-02
  -1.637962E+02  -3.939032E+02  -4.772751E+00   1.486076E+00  -5.030942E+01
   4.835351E+00   2.650631E-02
  -1.463671E+02  -3.736540E+01  -3.785714E+01  -2.806038E+01  -8.254647E+01
  -6.218109E+01   2.926632E-02
  -8.256717E+01  -3.869877E+02  -8.637155E+01  -7.753724E+01   6.494173E+01
  -9.720144E+00   3.931352E-02
  -8.953945E+01  -3.870795E+02  -8.532101E+01  -1.811087E+01   1.027167E+02
   4.501247E+00   3.605832E-02
  -7.670944E+01  -4.172234E+02  -6.490786E+01  -3.632784E-01   2.490181E+01
   1.331309E+01   4.460226E-02
  -6.859804E+01  -4.102326E+02  -8.020522E+01  -4.837147E+01  -7.304467E+00
  -2.850162E+01   4.824082E-02
     321         1         0         1         0
  -1.313675E+01  -1.672081E+02  -2.265936E+01   2.644436E+00   6.612805E+00
   9.350261E+00   4.599527E-02
    1003         1         0         1         0
  -9.494614E+02  -1.155571E+03  -9.494557E+02  -1.699043E-04   1.633174E+02
  -1.923468E-07   4.227194E-03
```

Solid H81

Solid H321

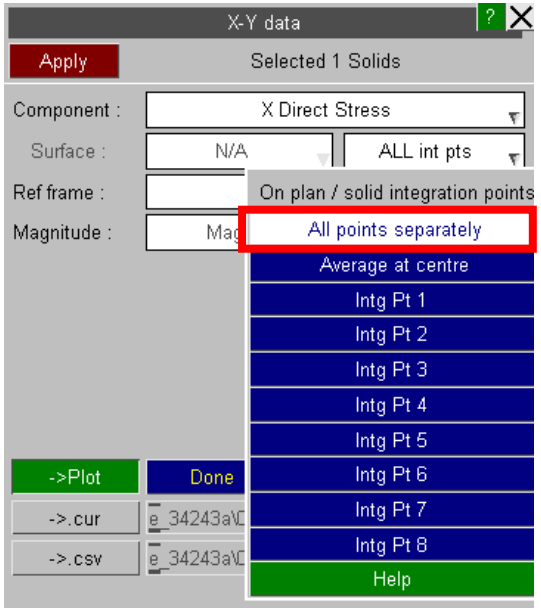
1 integration point

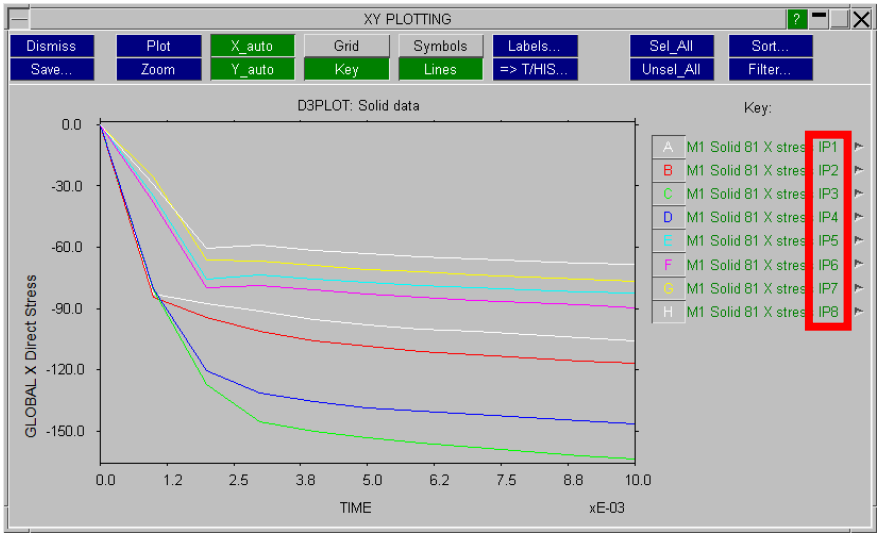
Multi-Integration Point Solids – XY Data Menu



In the XY DATA menu the integration point data values can be selected by:

- All points separately (multiple curves are output, one for each valid point). ‘N/A’ is written if the point does not have any valid data.
- Average at centre (single curve).
- Individual integration point (single curve).

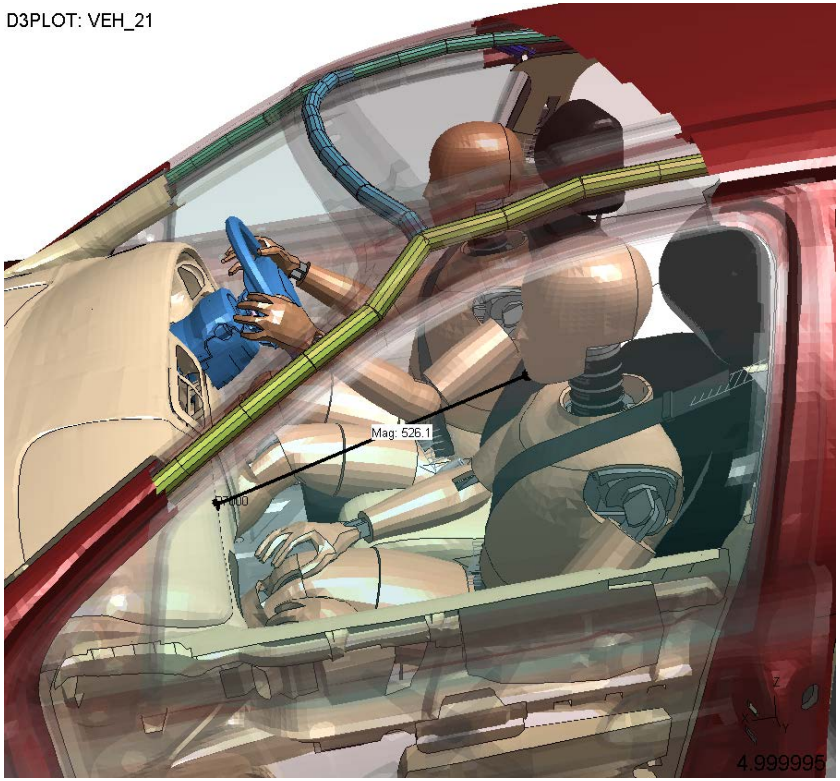




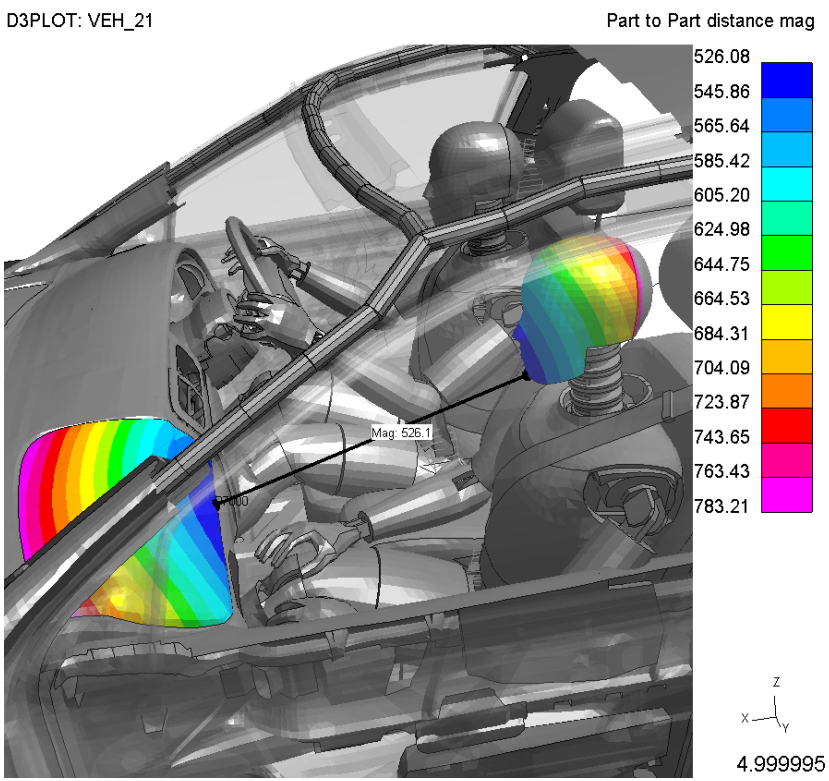
Part-to-Part Measure

Part-to-Part Measure

D3PLOT v14 can measure part-to-part distance. In D3PLOT v15 this can now be contoured.



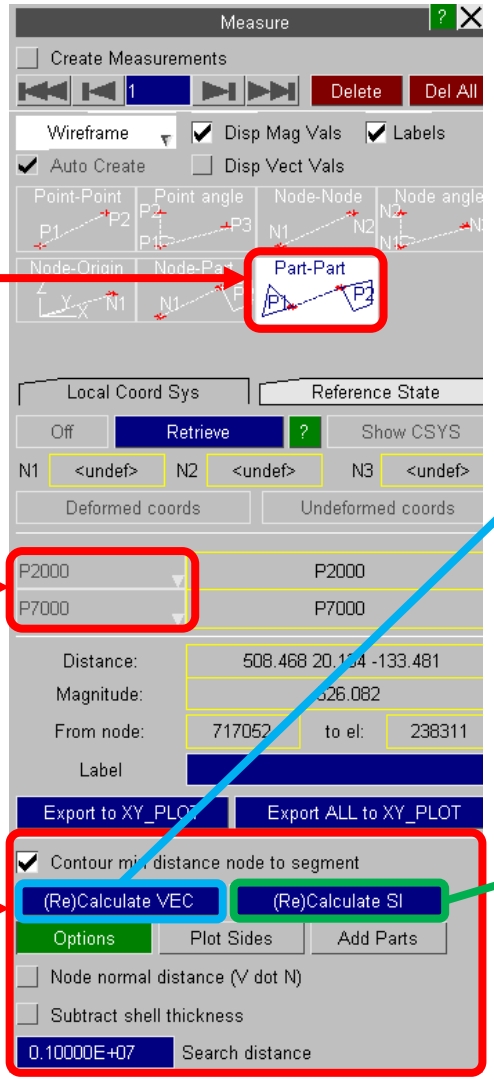
v14

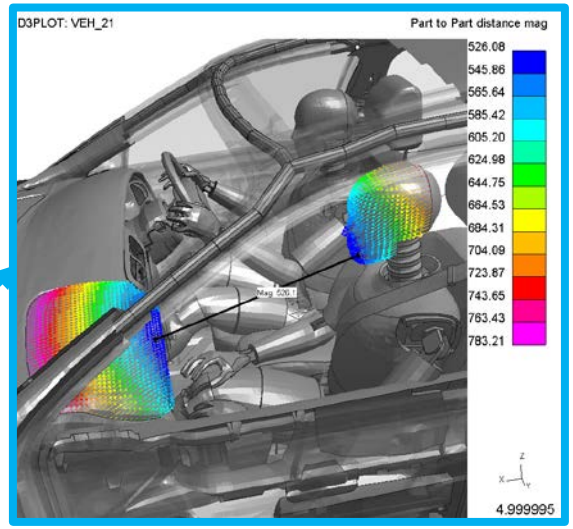


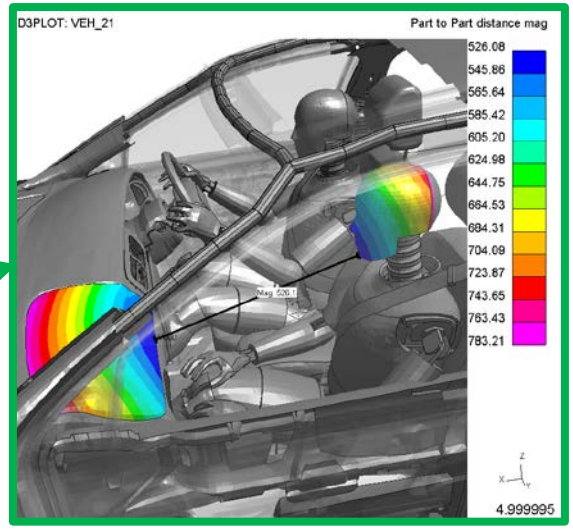
v15

Part-to-Part Measure

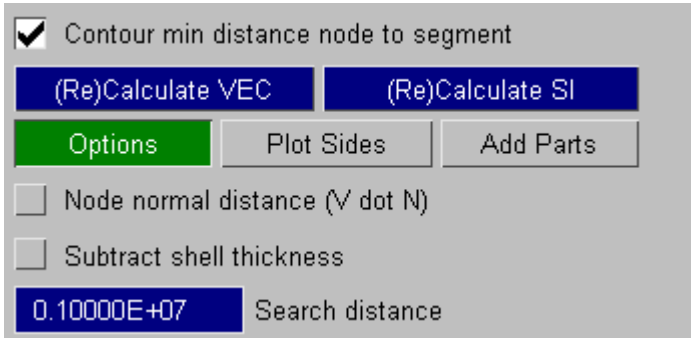
1. Select Part-Part in the Measure Menu
2. Select parts to measure between
3. Tick the new “Contour min distance node to segment” option to bring up new panel





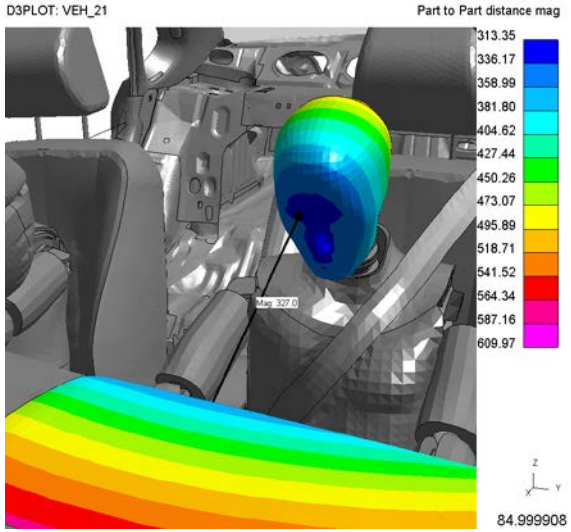


Part-to-Part Measure

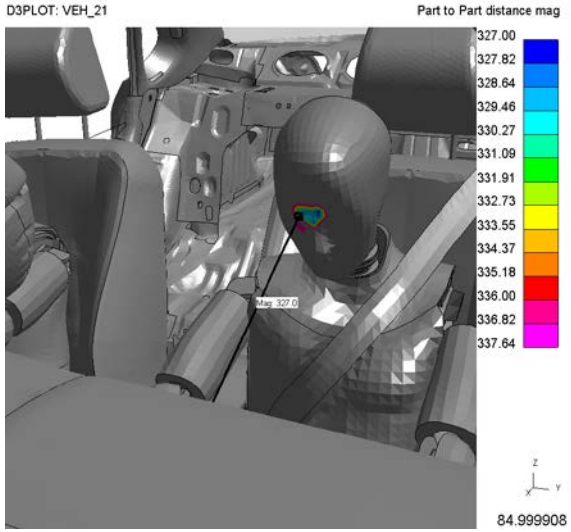


Options

- “Node normal distance” calculates values only for those node/segment combinations that are normal to one another
- Subtract shell thickness corrects calculated distance values by shell thickness

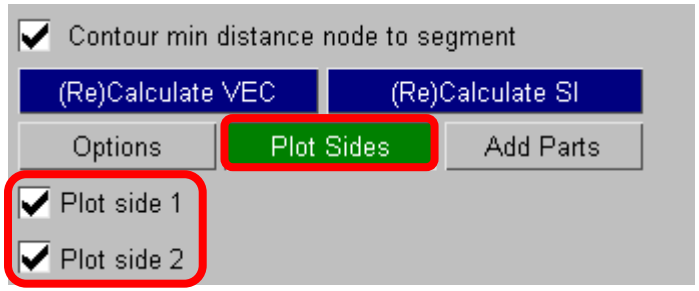


Without “Node normal distance” selected



With “Node normal distance” selected

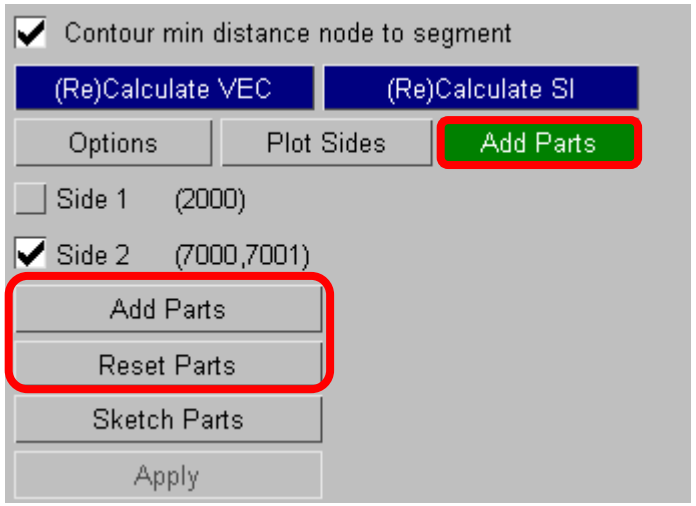
Part-to-Part Measure

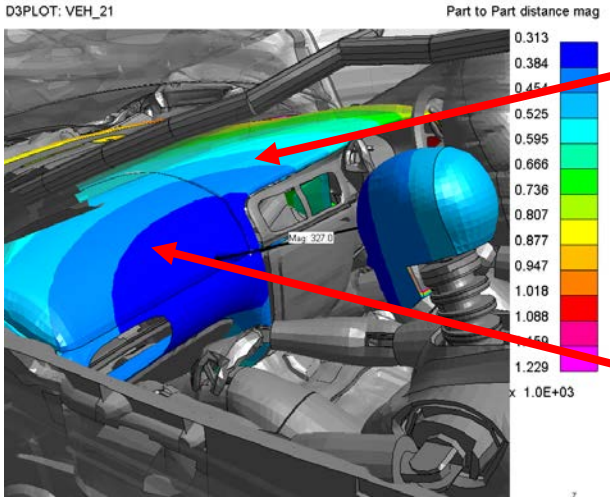


Plot Sides

Select whether contours/vectors are plotted on both parts or only on one selected part

Add Parts





Part 7001 now contoured too

Part 7000 was the original part picked

Select Side 1 or 2 and “Add Parts” that will be included in the distance calculation – here part 7001 has been added to the original selection of part 7000 on Side 2 – “Reset Parts” to return to original selection

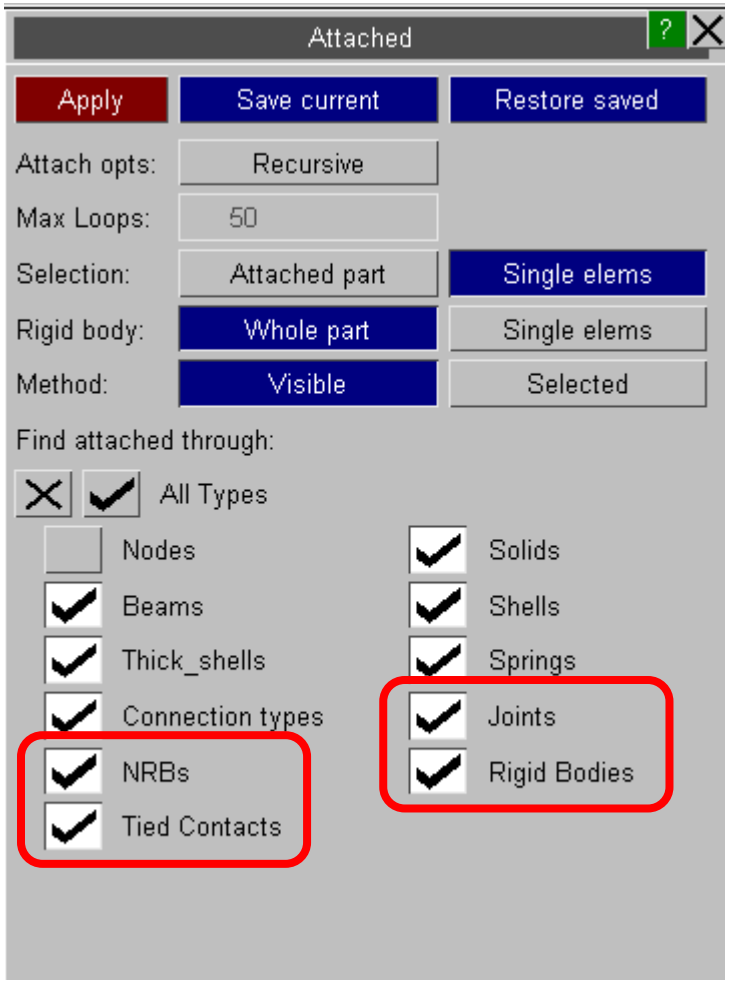
Attached

Attached – Types Added

In Version 15 attached elements and parts can now be found through the following additional types:

- Nodal rigid bodies
- Constrained joints
- Constrained rigid bodies
- Tied contacts

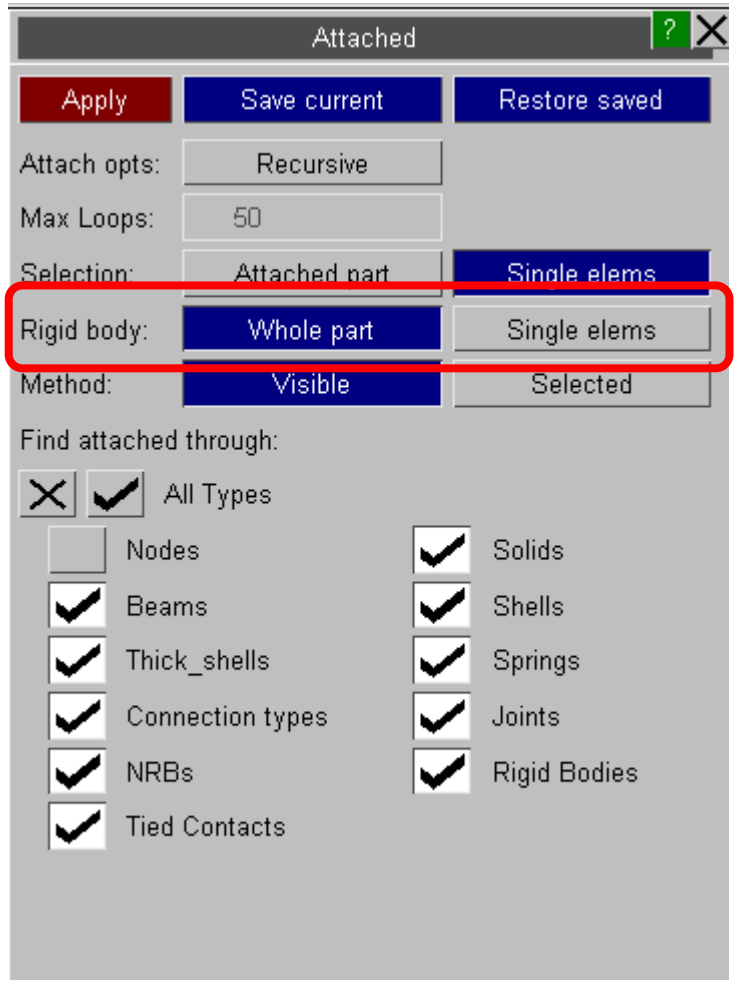
In order for these types to be available a ZTF file must be generated with v15



Attached – Types added

When rigid parts are found the user can select to either find “Single elements” or “Whole part”. “Whole part” will find non-contiguous rigid parts. It is necessary to have a ZTF file for this option.

Shortcut key “j” has been set to default to Attached->Apply using whatever the current settings in the attached panel are, similar to PRIMER. This can be changed in the oa_pref file.



Support for *SET in D3PLOT

*SET_XXXX

Support for *SET_XXXX definitions of the following types has been added to D3PLOT Version 15:

- *SET_PART
- *SET_BEAM
- *SET_SHELL
- *SET_DISCRETE
- *SET_NODE
- *SET_SOLID
- *SET_TSHELL

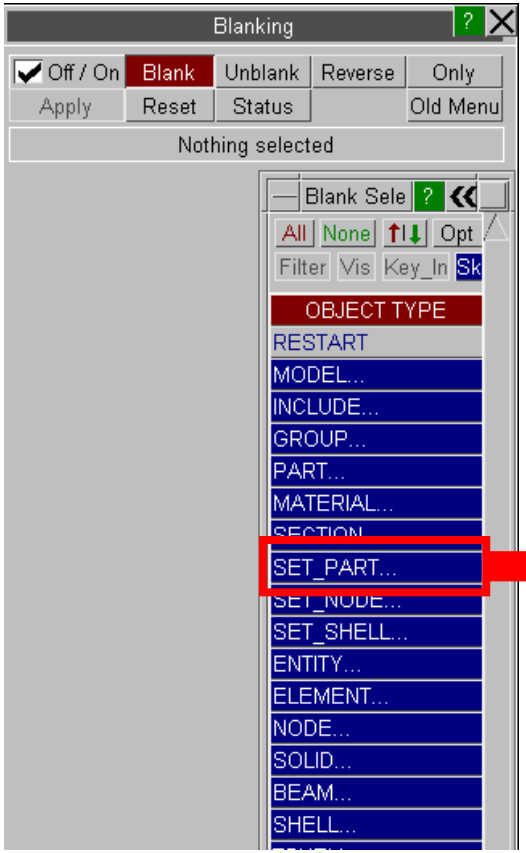
These set definitions can be used to select items in the following menus:

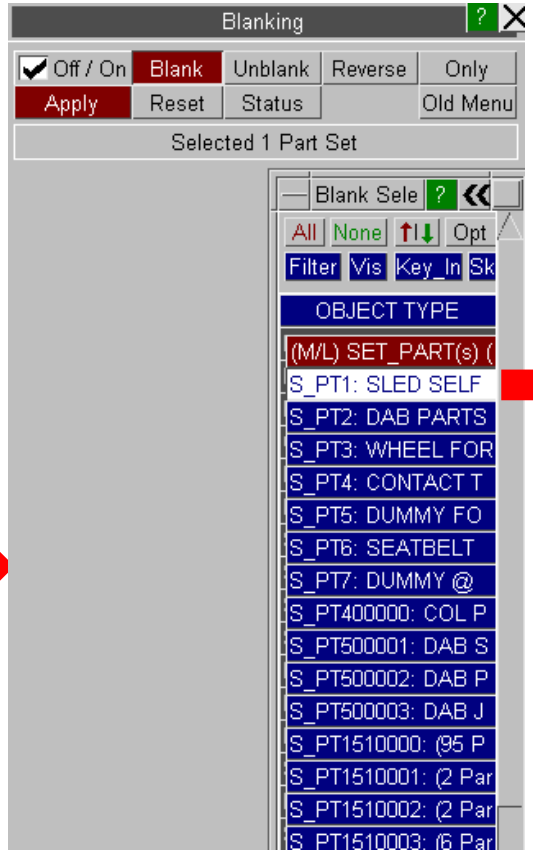
- Quick Pick
- Write
- Part Tree
- Blank
- XY Data

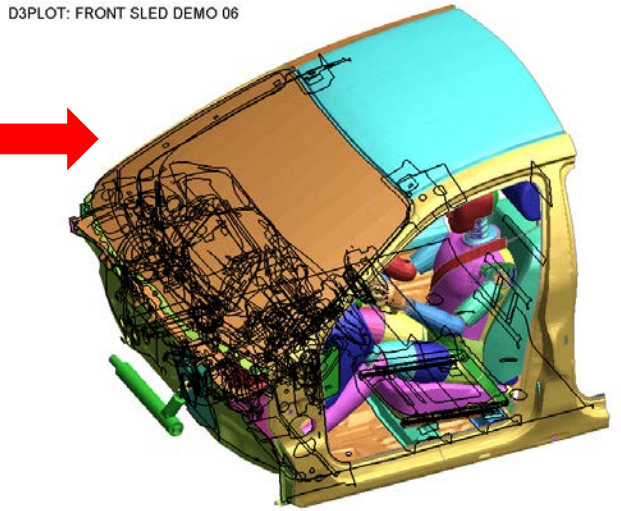
Set definitions are read from the ZTF, which must be generated in v15

*SET_xxxx – Blank / Write / XY-Data

In the new style object menus *SET definitions can be selected via the menu list or interactively by picking them on the screen.

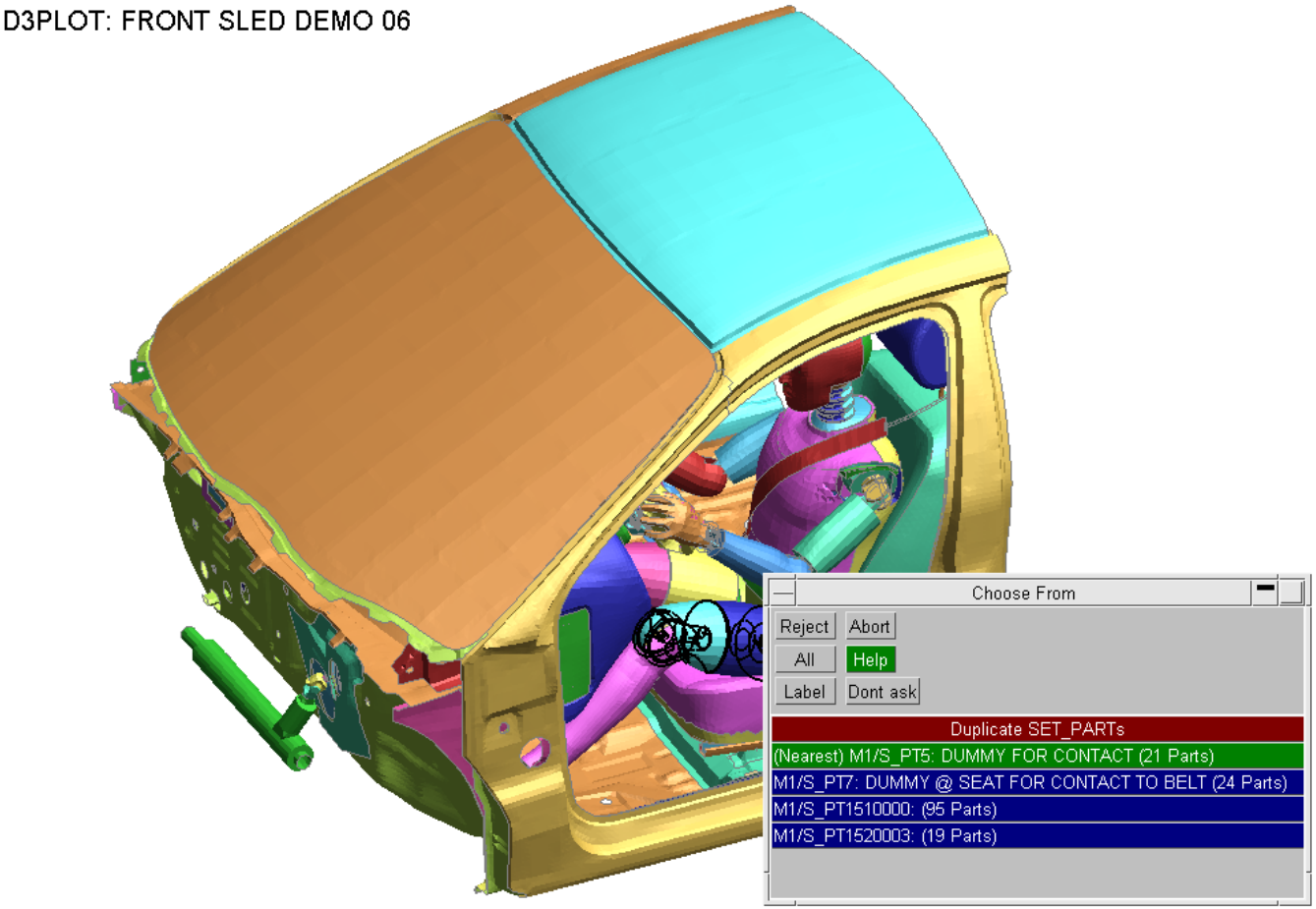






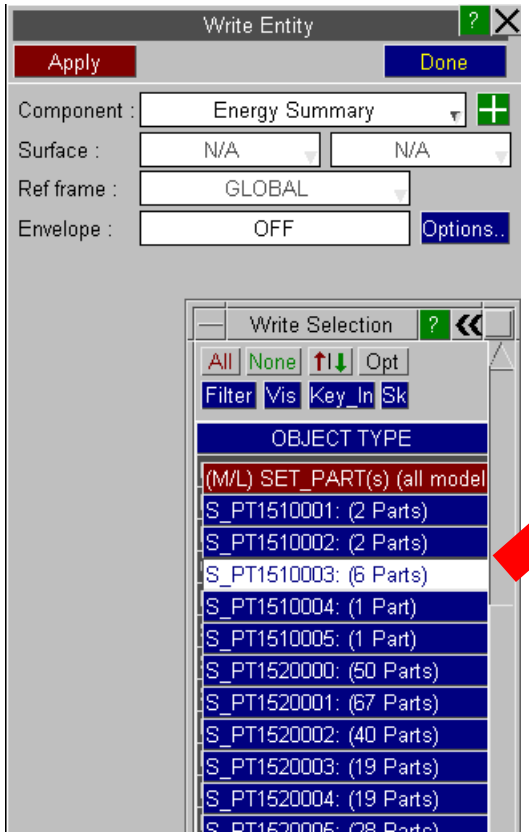
*SET_xxxx – Blank / Write / XY-Data

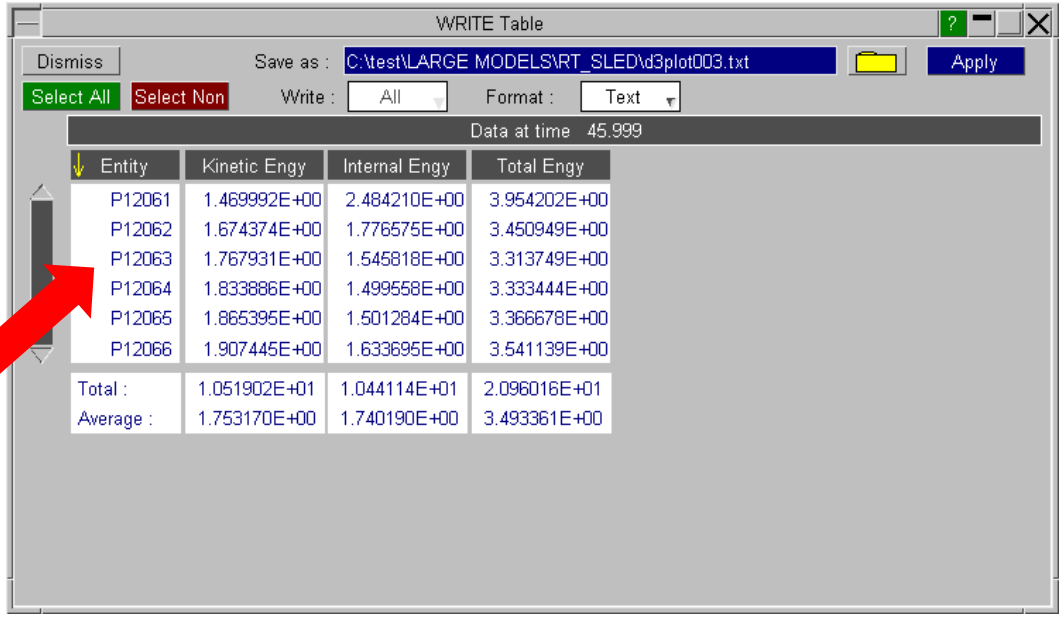
Often when picking sets interactively a choice of sets will be displayed as the item that has been selected could be in multiple *SET definitions.



*SET_xxxx – Write / XY-Data

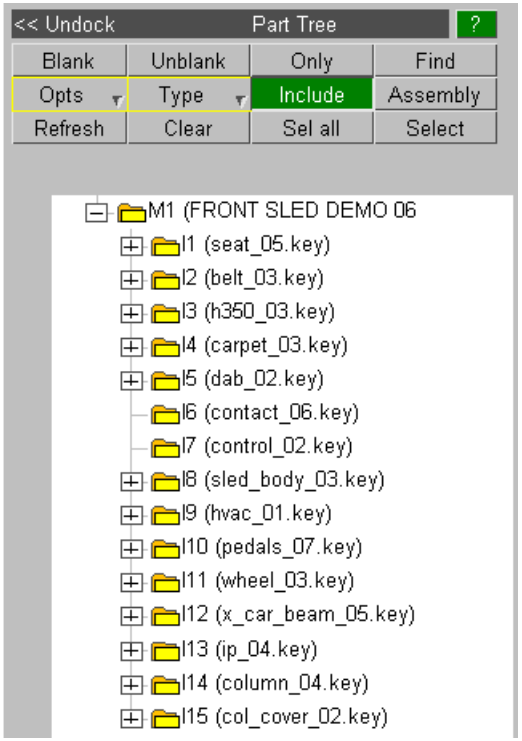
When sets are selected in the Write and XY-Data menu an entry in the Write table or a curve is created for each item in the *SET definition.



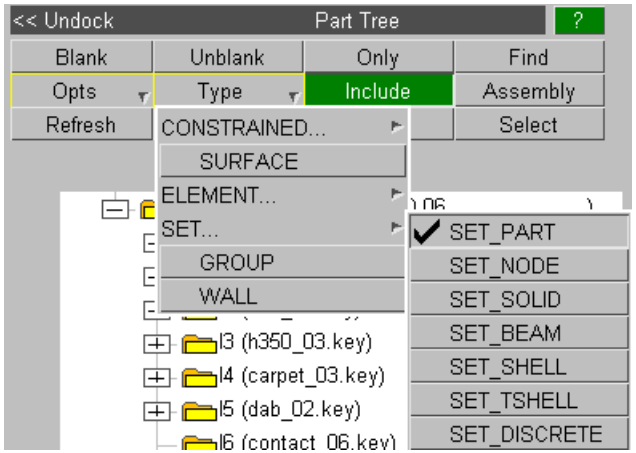


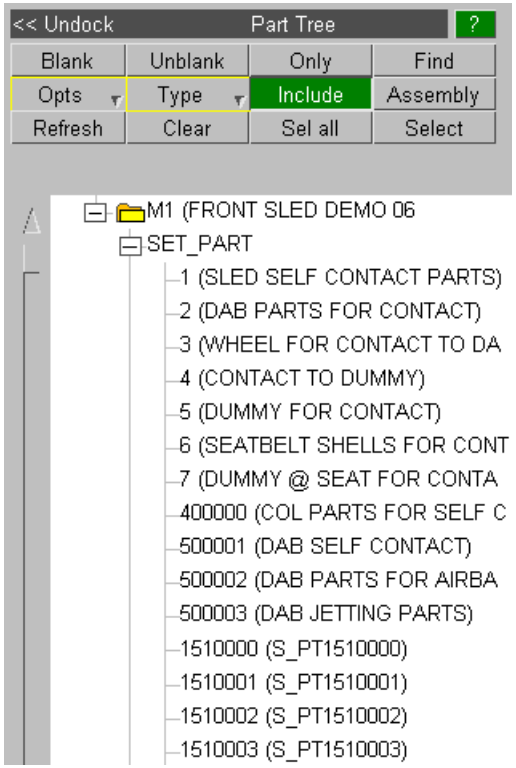
*SET_xxxx – Part Table

By default *SET definitions are not displayed in the Part Table



To view them use the Type popup menu to select the *SET types you want to display

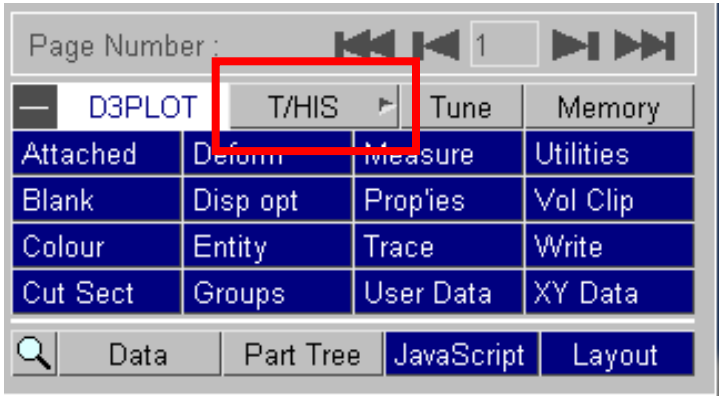




T/HIS Link from D3PLOT

T/HIS Link

For some time there has been the capability to run T/HIS from within D3PLOT using what is referred to as the T/HIS link.



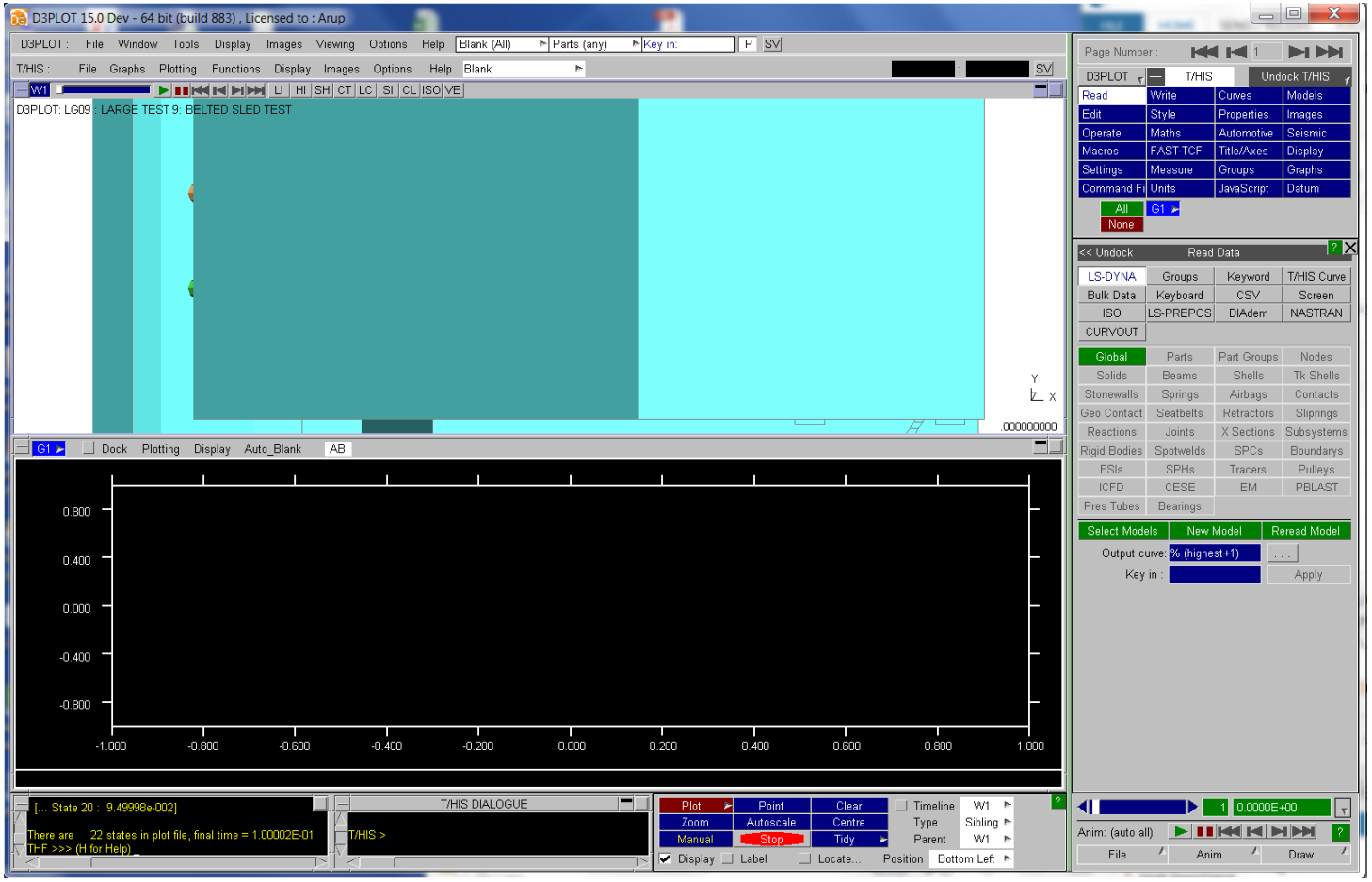
This option is activated by clicking on the T/HIS button at the top of the D3PLOT Tools Menu.

When this option is selected D3PLOT starts T/HIS and sends a list of the currently open models across to T/HIS so that T/HIS automatically opens the same set of models.

T/HIS Link

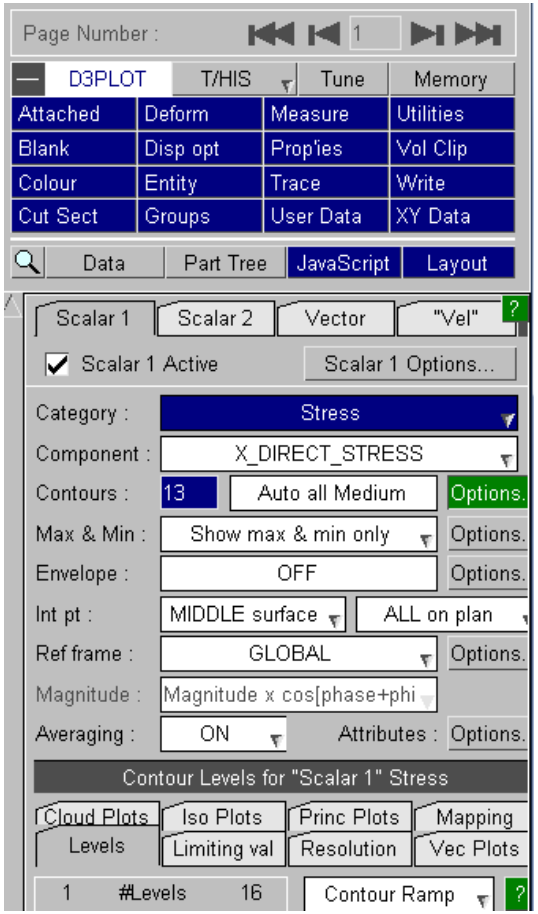
Once the “link” is up and running all of the T/HIS menus become available from within D3PLOT.

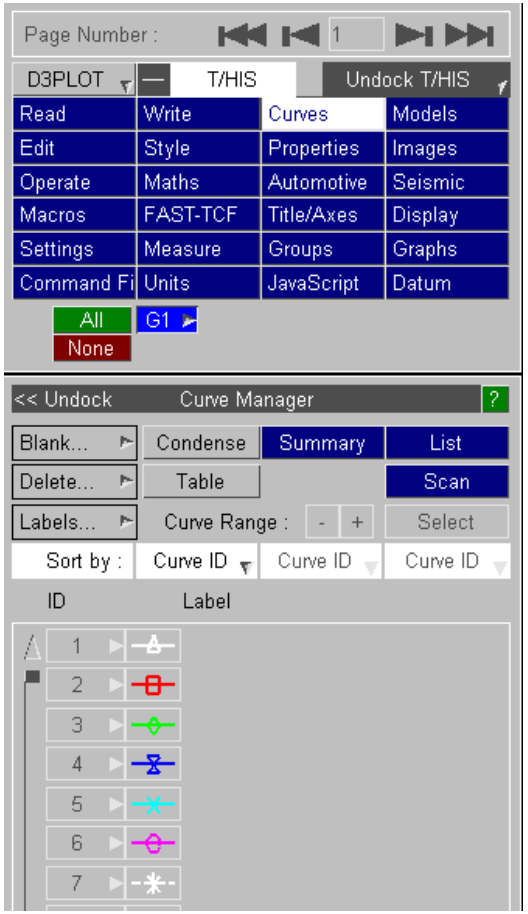
Any T/HIS graph windows appear within the D3PLOT session.



T/HIS Link

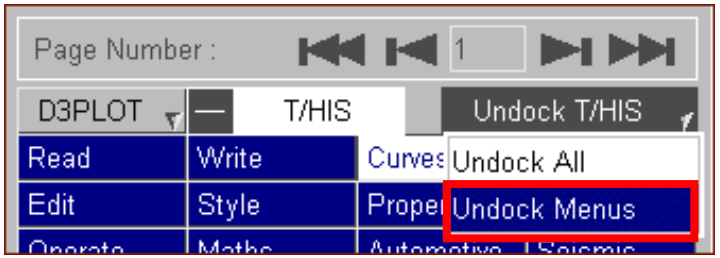
In previous versions of the software the D3PLOT and T/HIS menus occupy the same right hand area and you have to toggle between the D3PLOT and T/HIS menus by clicking on the D3PLOT and T/HIS buttons at the top of the menu.

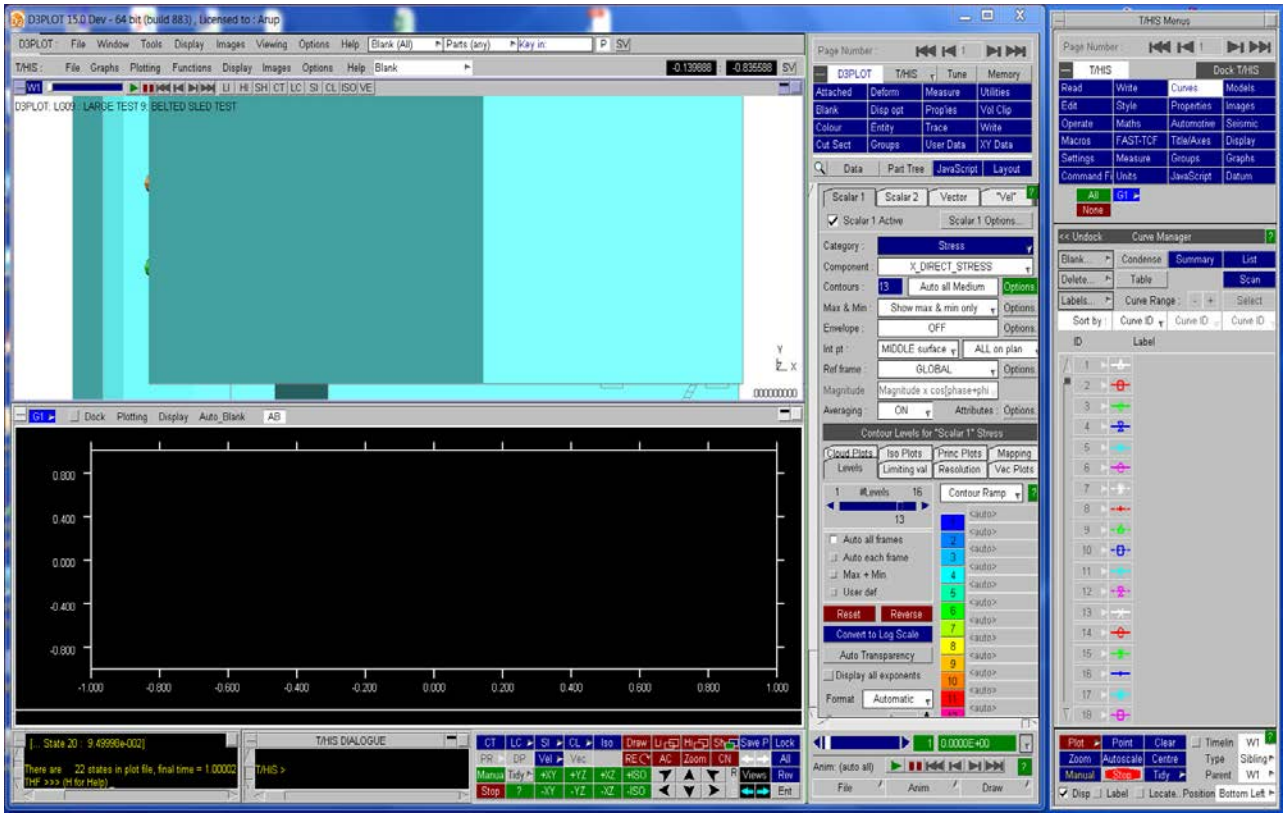




T/HIS Link

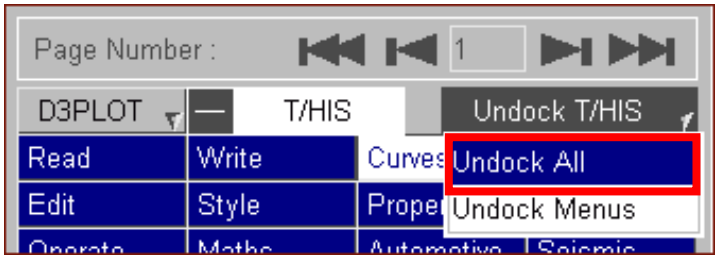
From version 15 onwards there is a new popup menu that can be used to undock just the T/HIS menus so that they become a floating window which can then be positioned anywhere.

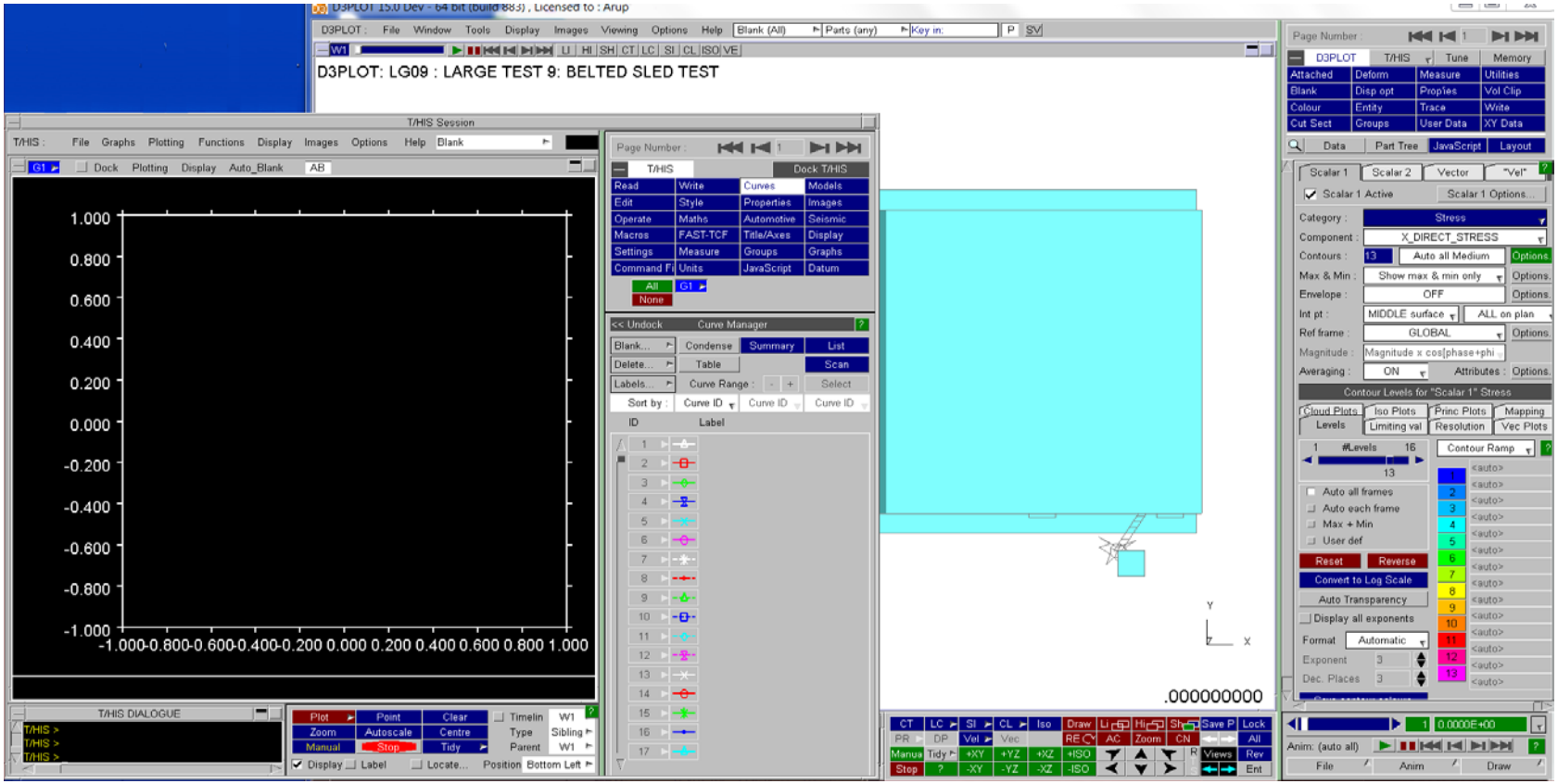




T/HIS Link

Alternatively all of the T/HIS graphs and menus can be moved into a separate floating window.



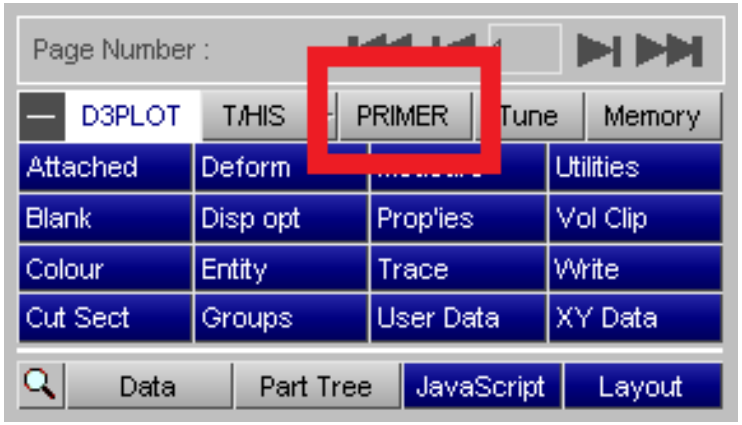


PRIMER Link

PRIMER Link

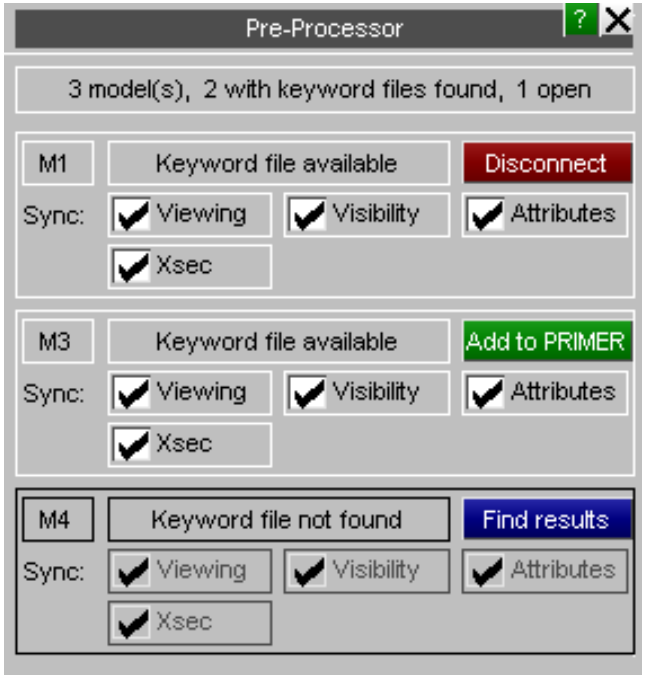
A new capability to link PRIMER and D3PLOT has been added in version 15

This option is activated by clicking on the PRIMER button at the top of the D3PLOT Tools Menu.



This operates in much the same way as the existing T/HIS link in that it opens a shared memory connection between D3PLOT and PRIMER that allows commands and data to be exchanged between the two codes. Since both are graphical it is also possible to synchronise viewing between them.

The PRIMER button launches the “Pre” status panel shown here, from which linkage is managed.



PRIMER Link

Add to PRIMER

D3PLOT has found the keyword file automatically.

Find Results

D3PLOT cannot find the keyword file, browse for it manually to add this model to the PRIMER session.

Disconnect

Model is currently linked with PRIMER, disconnect it. (Leaves it open in both programmes, but not synchronised.)

Synchronised attributes:

Viewing: The current view (orientation, scale, position) including dynamic viewing.

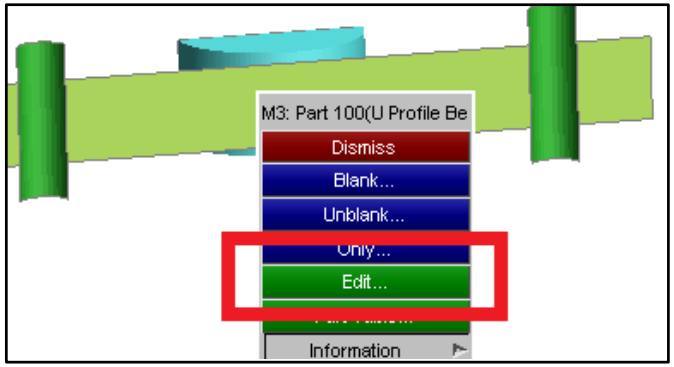
Visibility: The current blanking and entity visibility status.

Attributes: The colour, transparency and plotting mode.

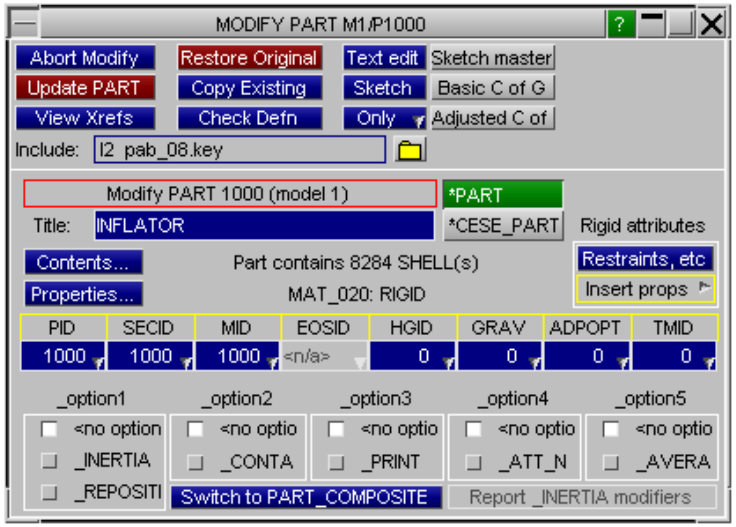
Xsec: Cut-section attributes, including dragging.

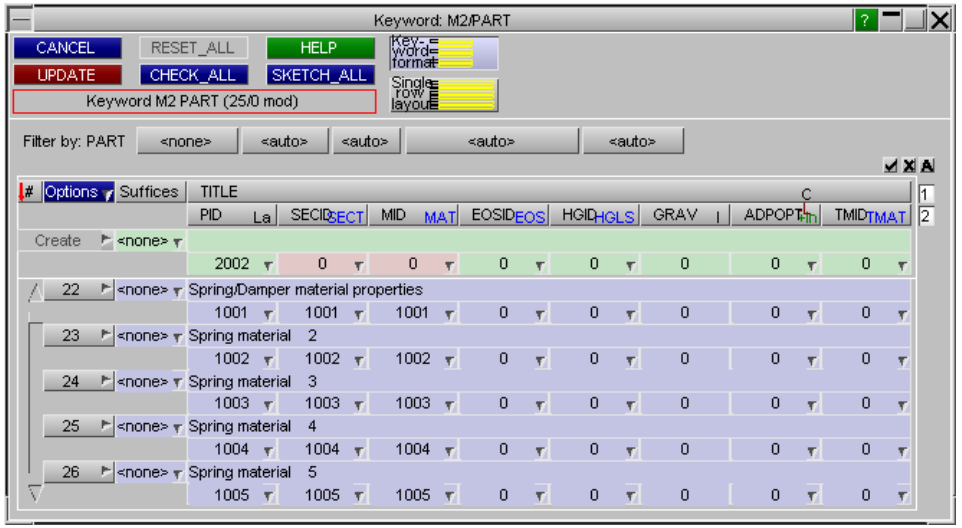
Linked functionality in “Quick Pick” : EDIT

Pick (an) item(s) in D3PLOT.



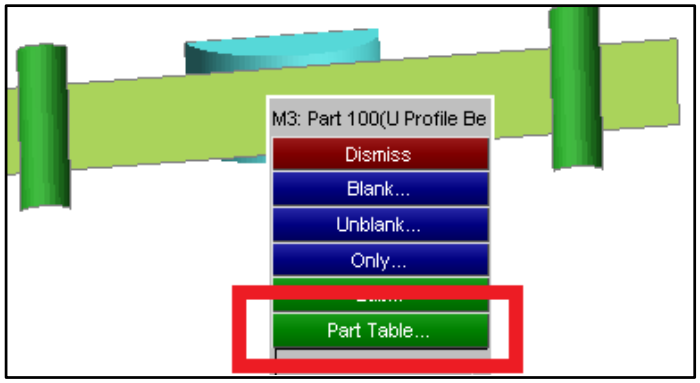
Launches a scalar editor (single item) or a keyword editor (multiple items) in PRIMER





Linked functionality in “Quick Pick” : Part Table

Pick (a) parts(s) in D3PLOT.



Launches the Part Table in PRIMER for the selected parts

PART TABLE

Dismiss | View... | Refresh | Write... | Clear | Sel all | Show all | Total Parts: 52 (0 selected)

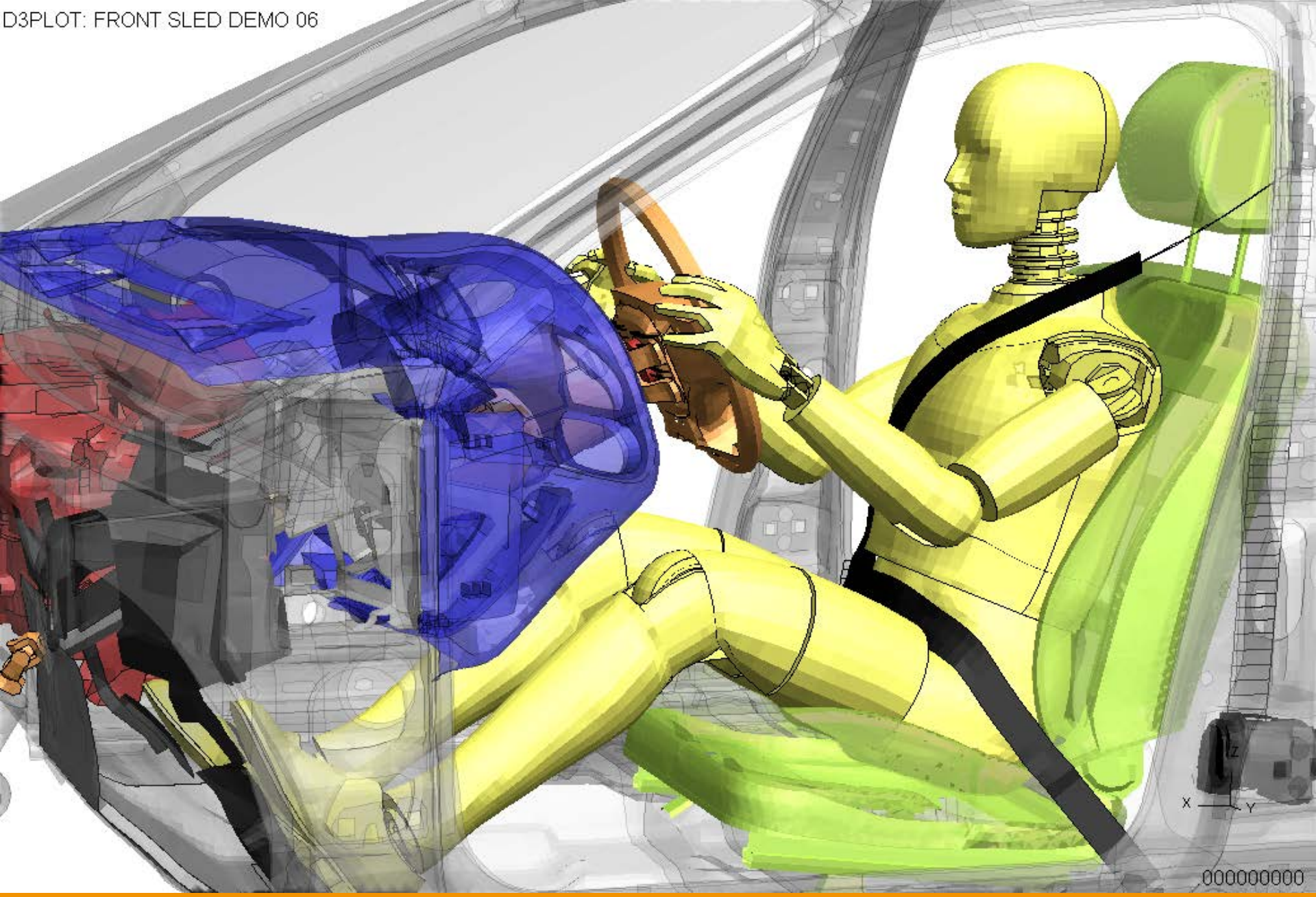
Table Changes: Undo | Apply | Select | Show sel

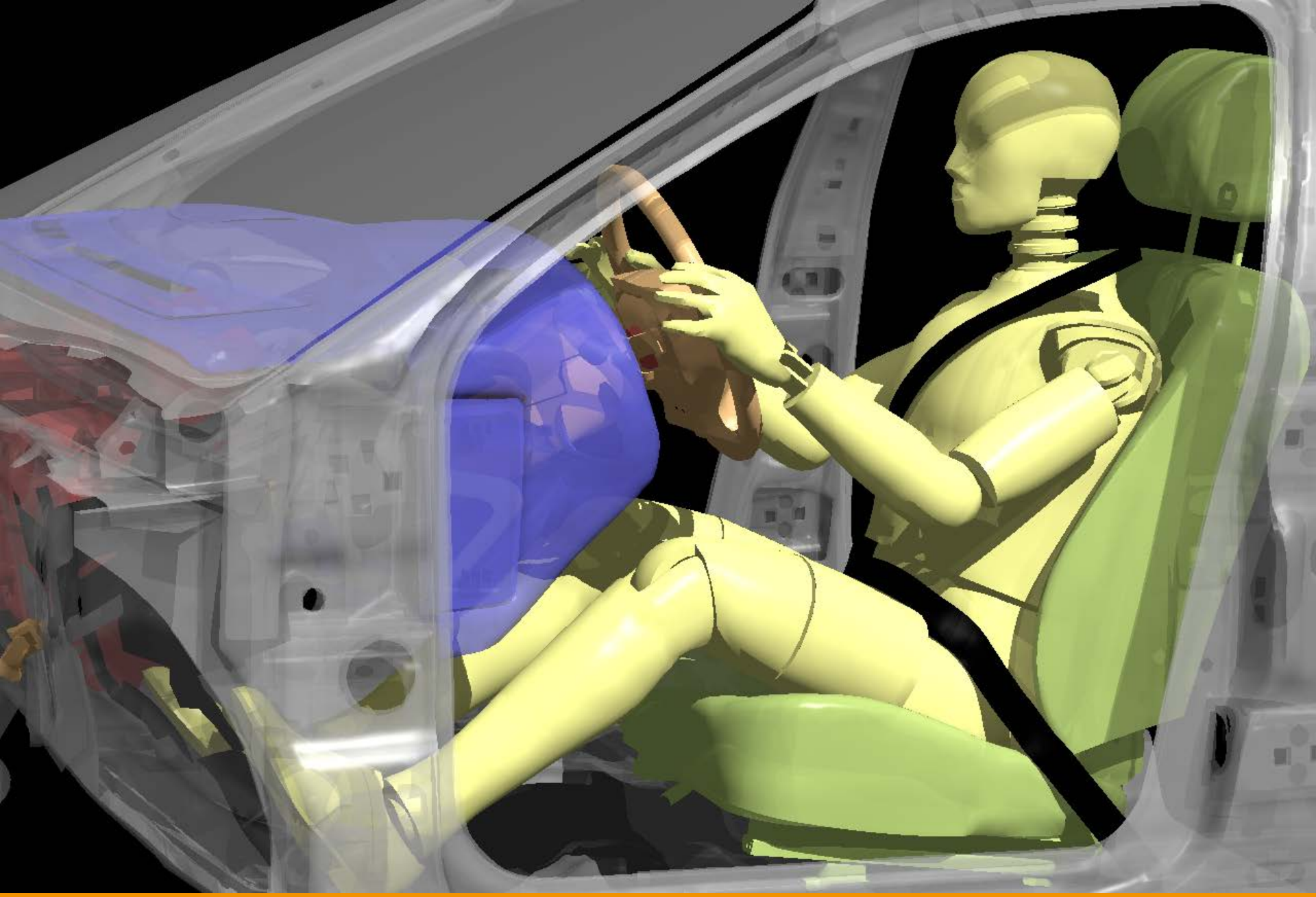
Part ID	Part title	Part type	Sect ID	Sect Gauge	Mat ID
M2/P1	Rigid body material	SHELL	1	1.000000	1
M2/P2	Rigid body material	SHELL	2	1.000000	2
M2/P3	Rigid body material	SHELL	3	1.000000	3
M2/P6	Rigid body material	SHELL	6	1.000000	6
M2/P7	Rigid body material	SHELL	7	1.000000	7
M2/P8	Rigid body material	SHELL	8	1.000000	8
M2/P9	Rigid body material	SHELL	9	1.000000	9
M2/P10	Rigid body material	SHELL	10	1.000000	10
M2/P13	Rigid body material	SHELL	13	1.000000	13
M2/P16	MATERIAL PROPERT	SHELL	16	1.000000	16
M2/P17	MATERIAL PROPERT	SHELL	17	1.000000	17
M2/P18	MATERIAL PROPERT	BEAM	18	<undefined>	18
M2/P19	MATERIAL PROPERT	SHELL	19	1.000000	19
M2/P1001	Spring/Damper materi	DISCRETE	1001	<undefined>	1001
M2/P1002	Spring material 2	DISCRETE	1002	<undefined>	1002

Enhanced Rendering

Enhanced Rendering

- Work is underway to improve output image quality
- In early stages, but development so far means D3PLOT v15 can now generate ascii files that can be read and rendered by POV-Ray
- Currently limited to:
  - D3PLOT
  - SH mode plots
  - “Plastic” materials


Z
X
Y
000000000



Enhanced Rendering

Aim for v15 is to reach the point where user can do the following:

- Press a button in D3PLOT to carry out whole rendering process, i.e. remove the manual step of opening POV-Ray separately to render model
- Provide the capability to apply simple ray-tracing material properties to the model, e.g. based on material names (currently everything rendered as “plastic”)

Other Enhancements

Other Enhancements – D3PLOT

- Improved visualisation of SPG parts
- Multiple model support in XY Data
- New data components
  - Signed von Mises
  - Lode angle
  - Extra time history variables for beam elements
  - Processor ID for airbag particles
  - Rotation about user-defined point and axis
- New measure options
- Improvements to image quality with transparent parts
- Visualisation of Nodal Rigid Bodies
- New preference options
- Data mapping improvements
- Blob plot enhancements
- Dynamic label formatting
- Properties file stores exploded part information

Other Enhancements – T/HIS

- Curve history improvements
- Curve operations enhancements
- Improved preference saving
- Scripting support for latest Visual Studio version
- Javascript additions
- New preference options

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