# *Recent developments in OASYS* Primer

October 2004

Miles Thornton

ARUP


- Engineering consultancy – 7000 staff worldwide
- “Arup” is our founder’s name, Ove Arup
- “Oasys” = Ove Arup Systems

## Aims of Oasys software

- 100% compatible with LS-DYNA – data is never lost or corrupted
- LS-DYNA-specific – no other solver is supported, all efforts go into optimum working with LS-DYNA
- LS-DYNA-expert – our knowledge and experience built into software. The software should understand and work with the complexity of LS-DYNA.
  - Example: more than 2000 error checks are included, based on our knowledge of LS-DYNA.
- Even complex tasks should be quick and error-free – specialist tools for each job
- Responsive to customer requests:
  - Fix any bugs quickly
  - Add users requests into new versions
  - We use a database system to log and track these requests
- REDUCE ERRORS AND WASTED TIME

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## New in Version 9.1 Beta 1

- Faster and better graphics
  - Typically 4-5 times faster in Shaded mode
  - Transparency, colour, plotting mode can be set for all entities
- Redesigned User Interface
  - More intuitive, less mouse movement
  - Quick-pick and short-cut keys
- More access to Part data
  - Part Tree – hierarchical view of model; new Assembly capability
  - Table for viewing/editing part data
  - Quick-pick options for viewing data and accessing editing menus
- New capability
  - Rigidify function and rigid patch creation
  - Cross-references viewer
  - Spotwelder improvements (and auto-welding)
  - (find attached improvements)
  - (finding how a model has been modified)
  - Various small enhancements

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# User Interface

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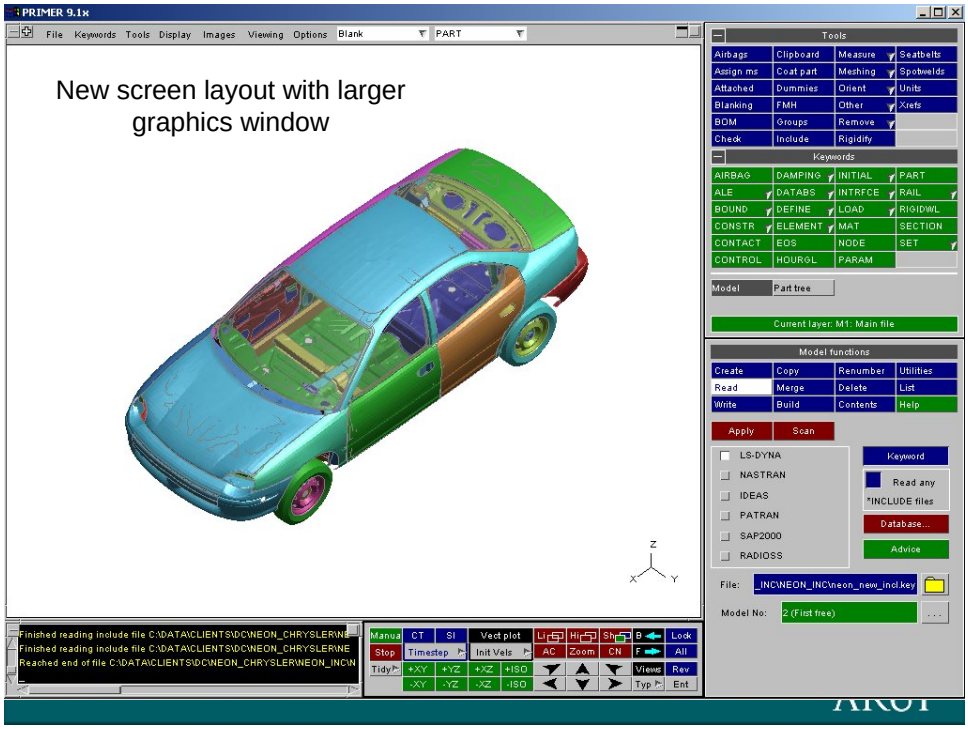
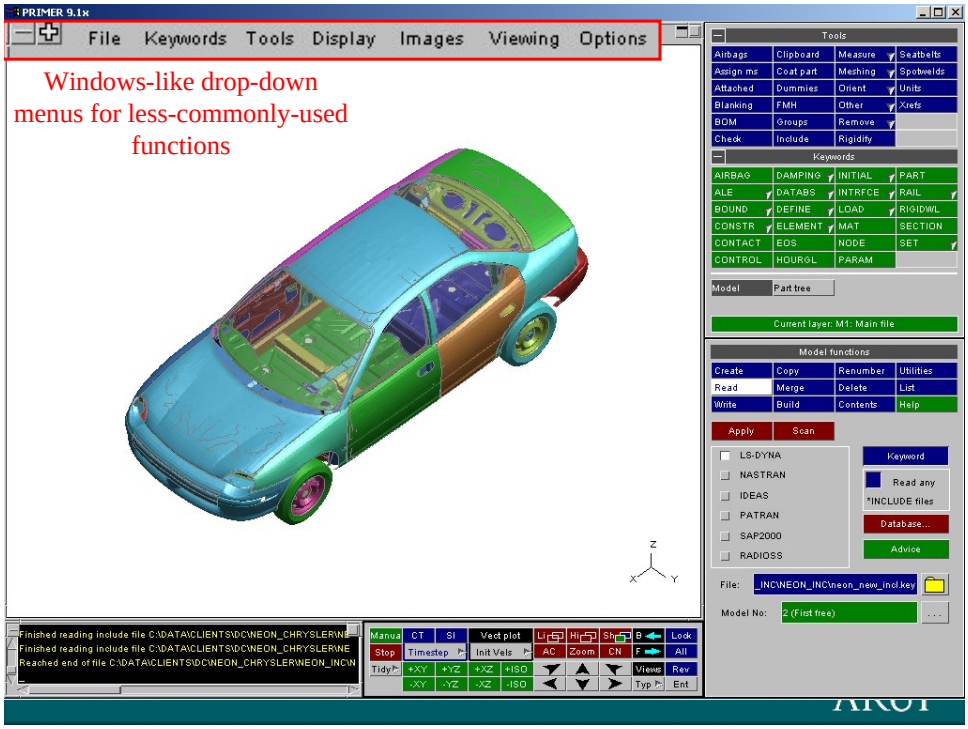
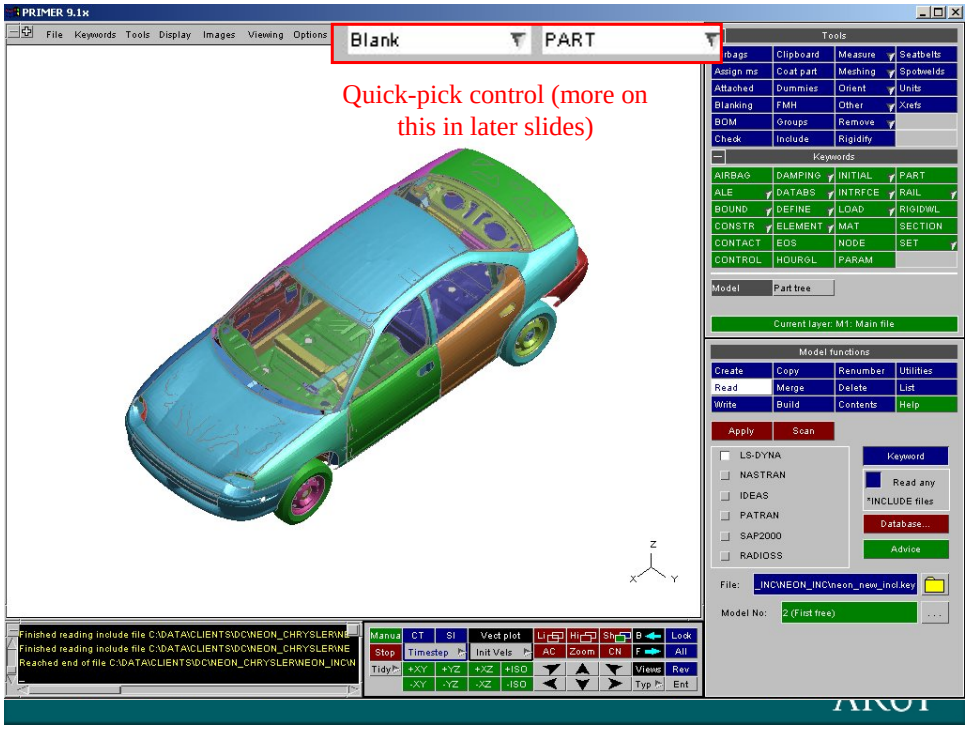
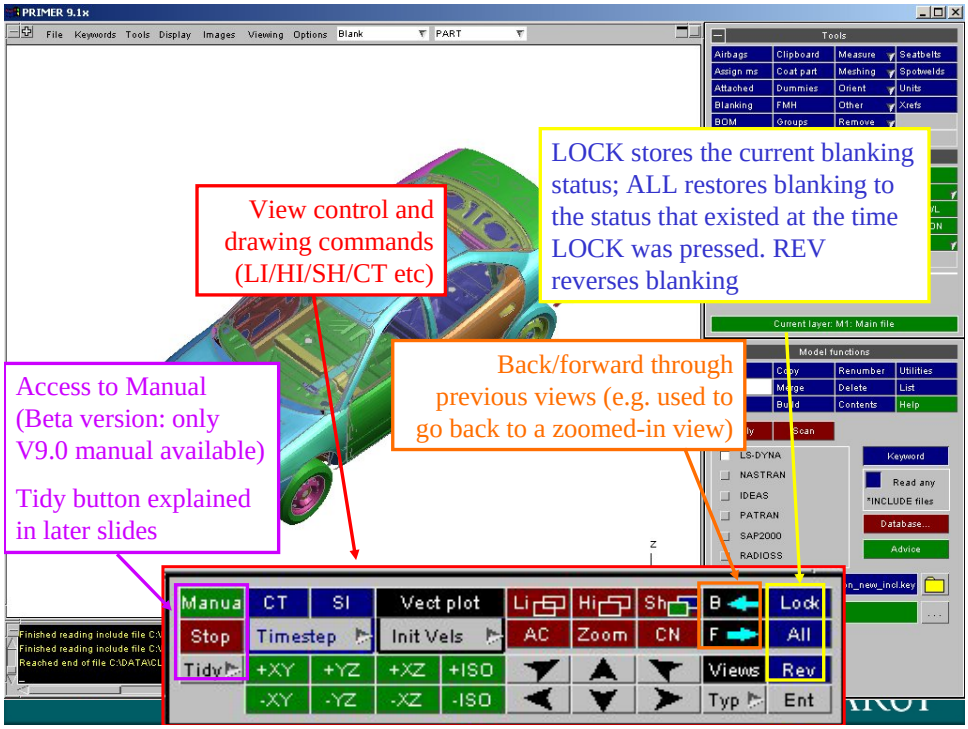
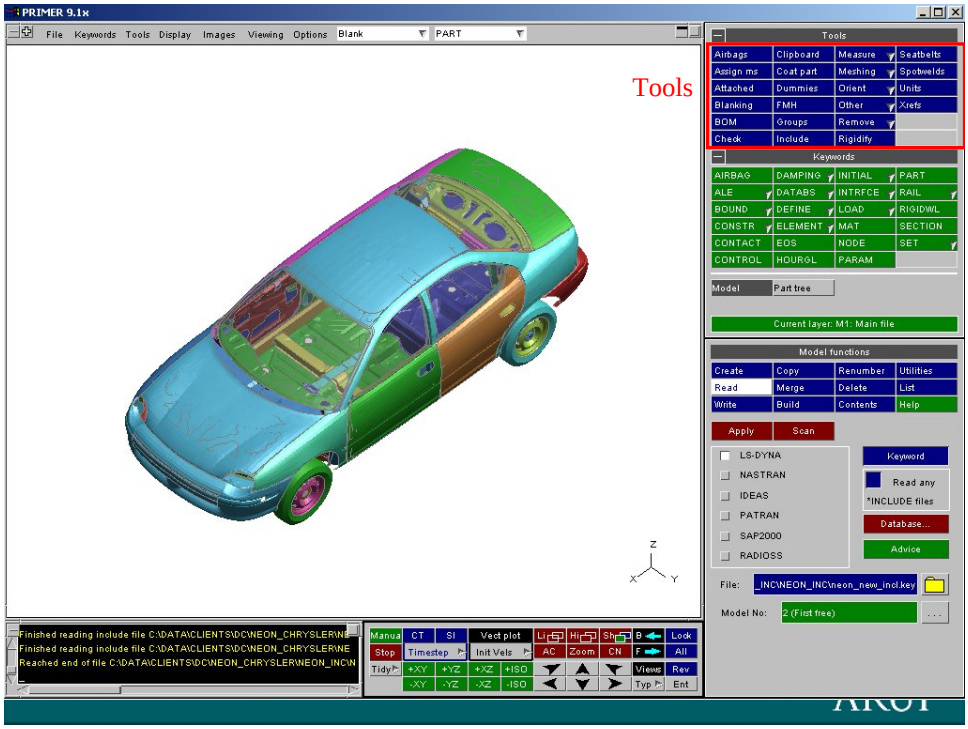
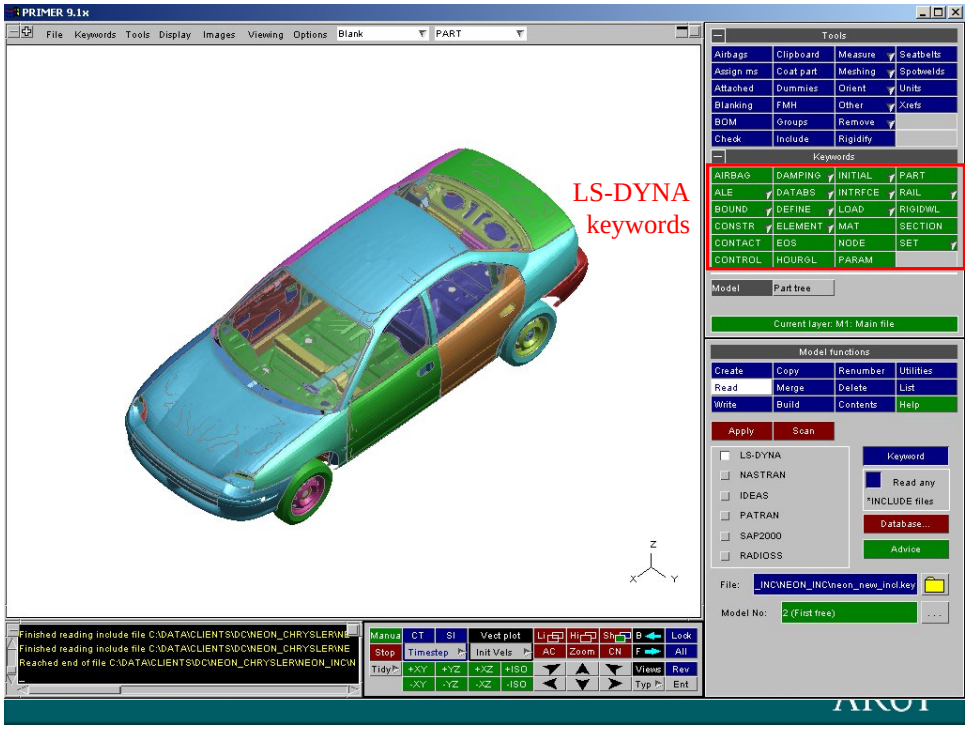


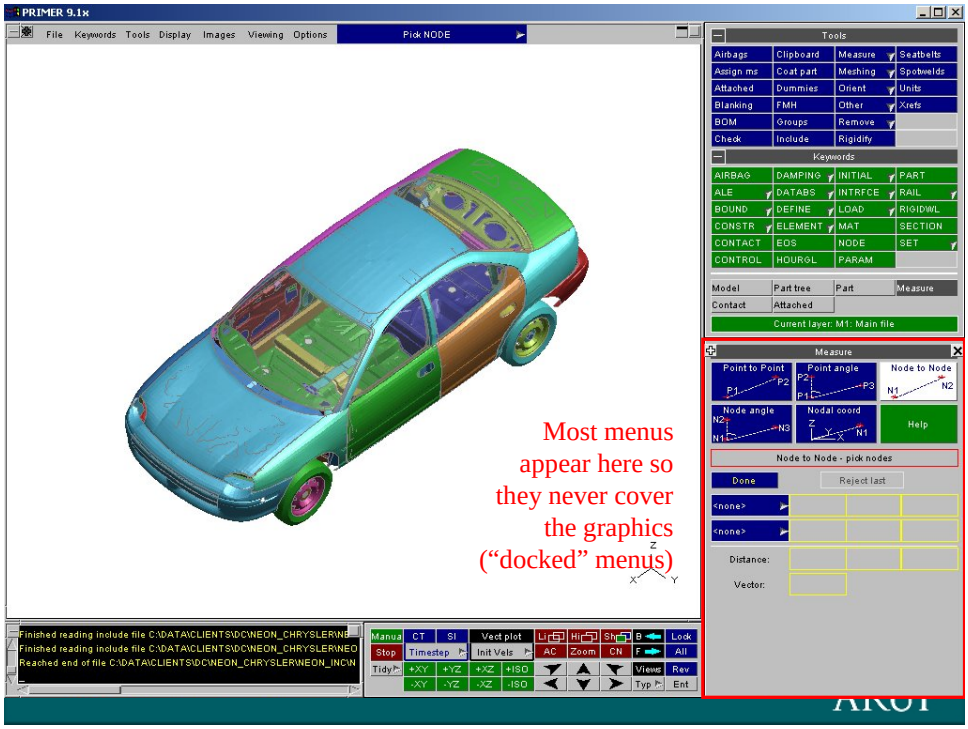


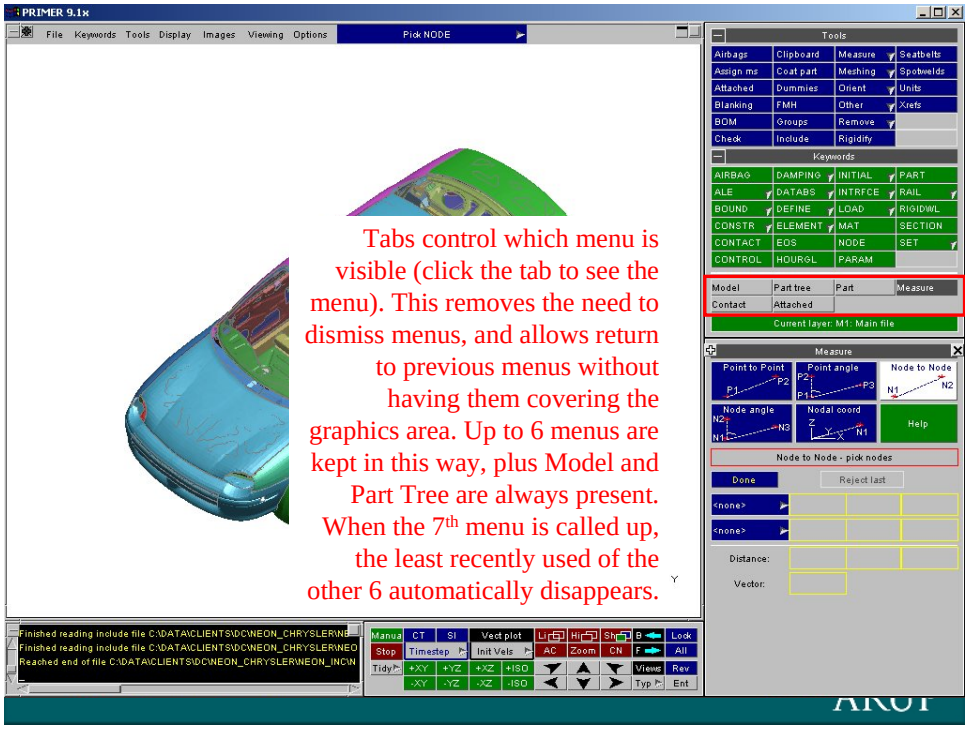



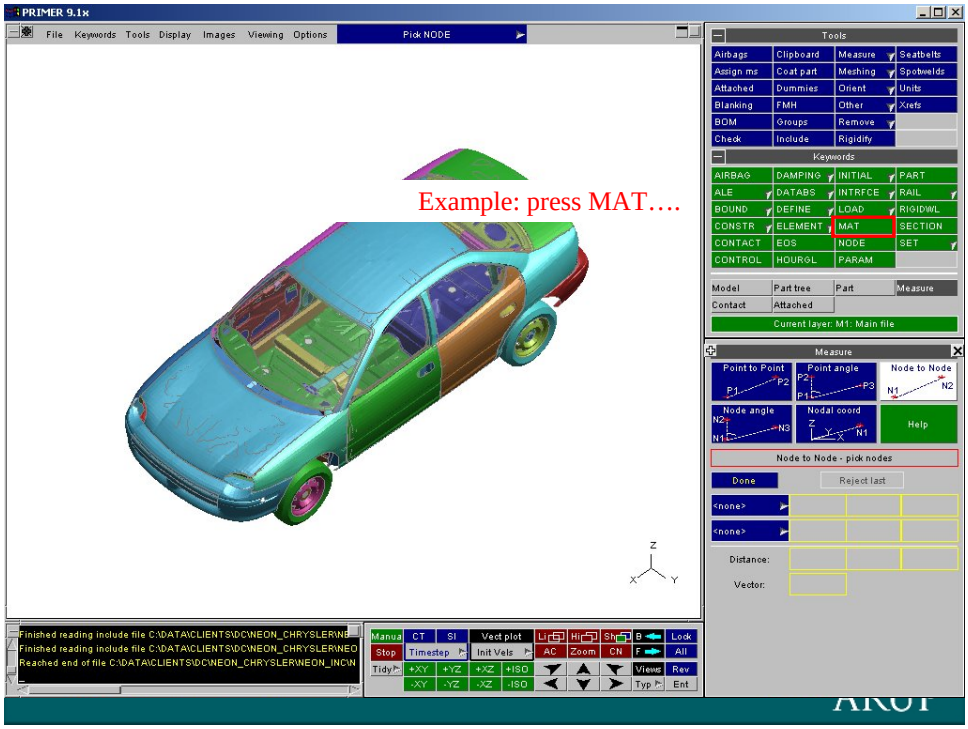

View control and drawing commands (LI/HI/SH/CT etc)
LOCK stores the current blanking status; ALL restores blanking to the status that existed at the time LOCK was pressed. REV reverses blanking
Back/forward through previous views (e.g. used to go back to a zoomed-in view)
Access to Manual (Beta version: only V9.0 manual available)
Tidy button explained in later slides
Manua
Stop
Tidy
CT
SI
Timestep
Vect plot
Init Vels
Lock
All
Views
Rev
Ent
Typ

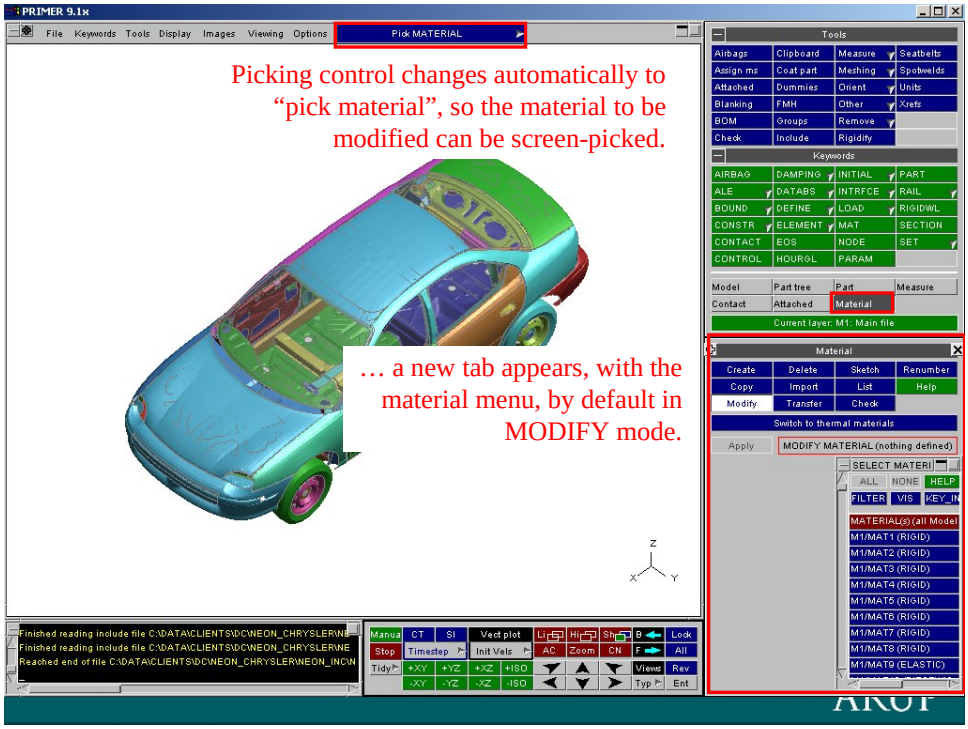

Tools

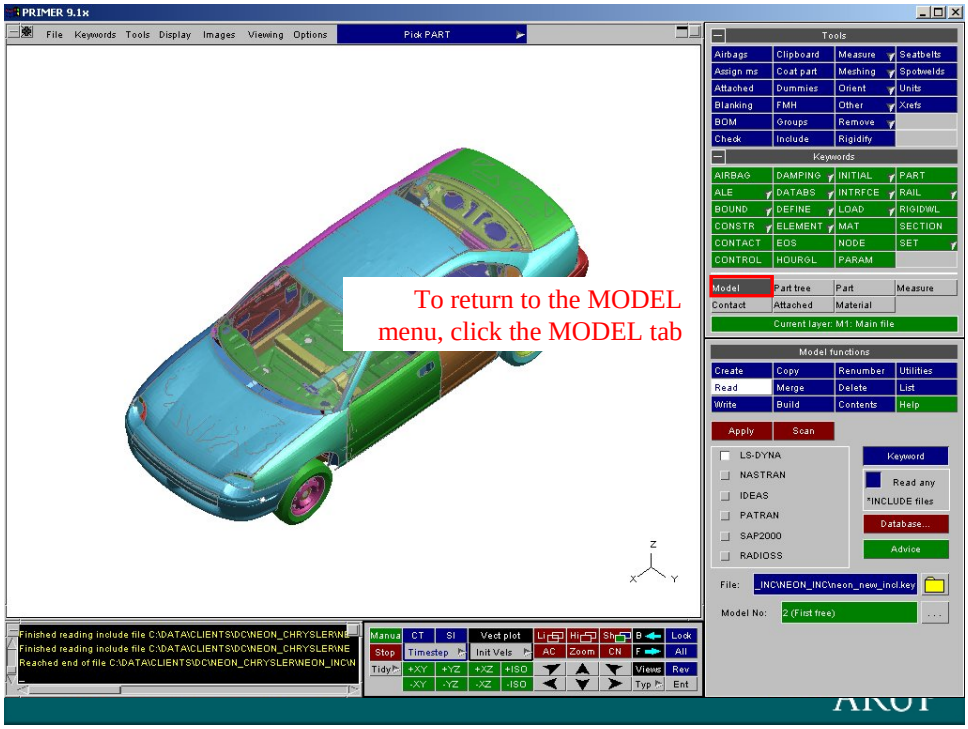

PRIMER 9.1x
LS-DYNA keywords


PRIMER 9.1x
Most menus appear here so they never cover the graphics ("docked" menus)


PRIMER 9.1x
File Keywords Tools Display Images Viewing Options
Pick NODE
Tools
Airbags Clipboard Measure Seatbelts
Assign ms Coat part Meshing Spotwelds
Attached Dummies Orient Units
Blanking FMH Other Xrefs
BOM Groups Remove
Check Include Rigidity
Keywords
AIRBAG DAMPING INITIAL PART
ALE DATABS INTRFCE RAIL
BOUND DEFINE LOAD RIGIDWL
CONSTR ELEMENT MAT SECTION
CONTACT EOS NODE SET
CONTROL HOURGL PARAM
Model Part tree Part Measure
Contact Attached
Current layer: M1: Main file
Measure
Point to Point
Point angle
Node to Node
Node angle
Nodal coord
Help
Node to Node - pick nodes
Done
Reject last
Distance:
Vector:
Tabs control which menu is visible (click the tab to see the menu). This removes the need to dismiss menus, and allows return to previous menus without having them covering the graphics area. Up to 6 menus are kept in this way, plus Model and Part Tree are always present. When the 7th menu is called up, the least recently used of the other 6 automatically disappears.


PRIMER 9.1x
File Keywords Tools Display Images Viewing Options
Pick NODE
Tools
Keywords
Model Part tree Part Measure
Contact Attached
Current layer: M1: Main file
Measure
Node to Node - pick nodes
Done
Reject last
Distance:
Vector:
Example: press MAT….


Picking control changes automatically to "pick material", so the material to be modified can be screen-picked.
… a new tab appears, with the material menu, by default in MODIFY mode.


To return to the MODEL menu, click the MODEL tab

## Tabbing and Shortcut keys

- Use the tab key to move through text boxes within a menu
- New shortcut keys: buttons on keyboard that access commonly used functions. Not case sensitive.
  - **?** = list of available shortcut keys
  - **ESC** = dismiss the menu that the mouse is over
  - **RETURN** (or middle mouse button) = APPLY
  - **1,2,3,4,5,6,7,8** = XY, XZ, etc standard views
  - **A** = Autoscale
  - **B** = **b**lanking menu; **R** = **r**everse all blanking; **U** = **u**nblank all
  - **E** = **e**ntity visibility menu
  - **H**, **L** and **S** = perform **H**idden line, **L**ine and **S**haded plots
  - **M** = **m**easure node-to-node
  - **Z** = **z**oom (drag across rectangular area)
  - **+** and **–** = zoom in and out
  - **T** = **t**idy all floating menus; **C** = **c**lose all floating menus

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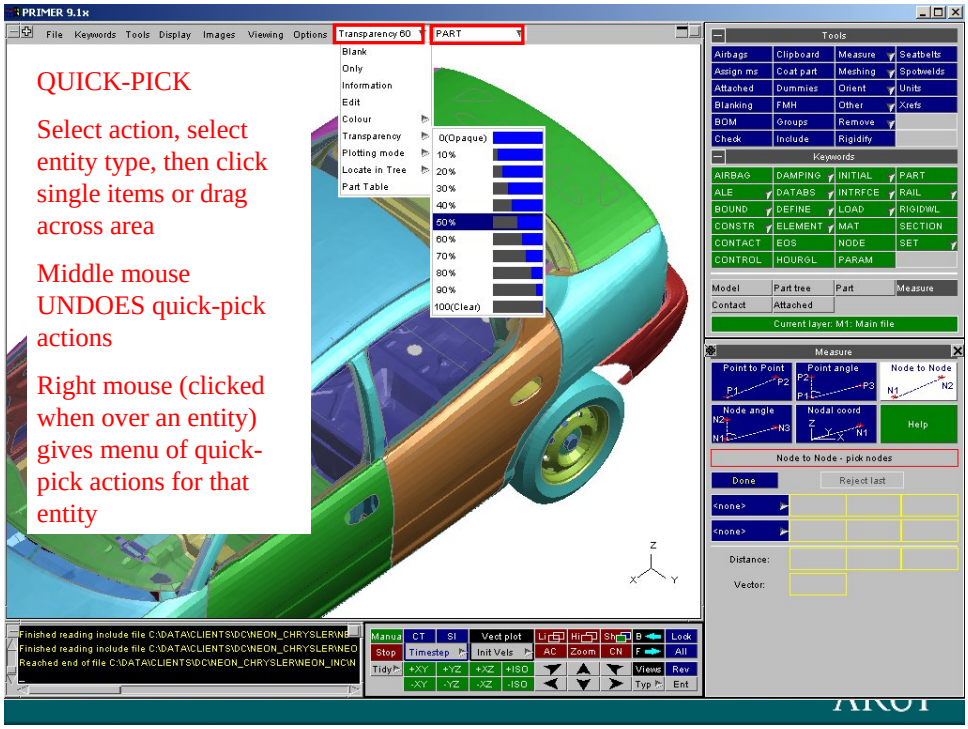

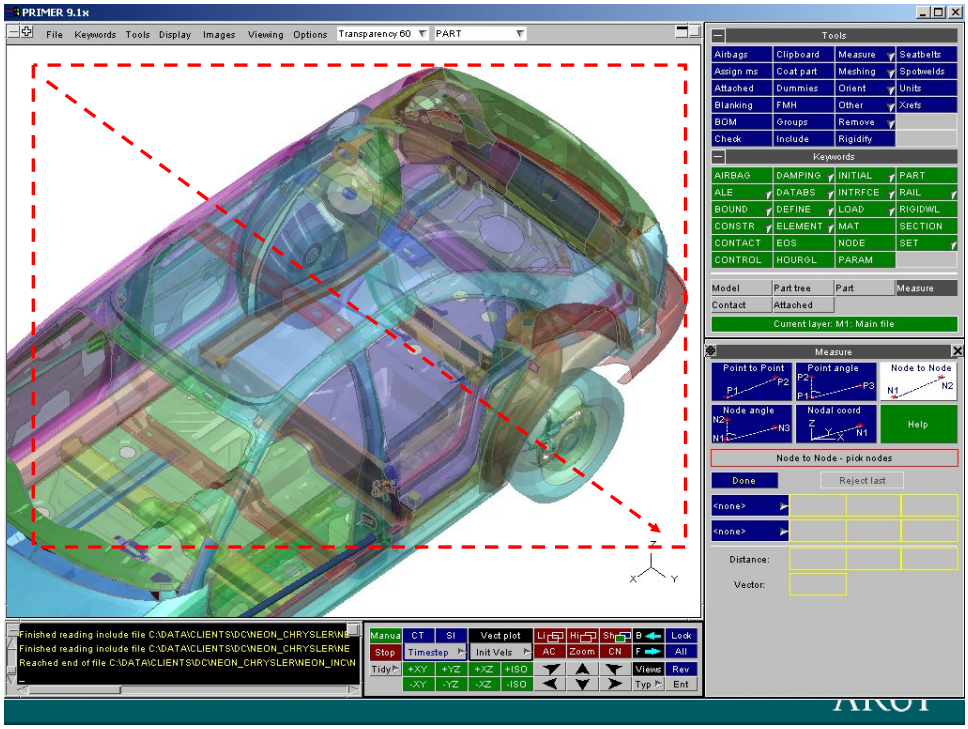
PRIMER 9.1x
File Keywords Tools Display Images Viewing Options Transparency 60 PART
Tools
Airbags Clipboard Measure Seatbelts
Assign ms Coat part Meshing Spotwelds
Attached Dummies Orient Units
Blanking FMH Other Xrefs
BOM Groups Remove
Check Include Rigidity
Keywords
AIRBAG DAMPING INITIAL PART
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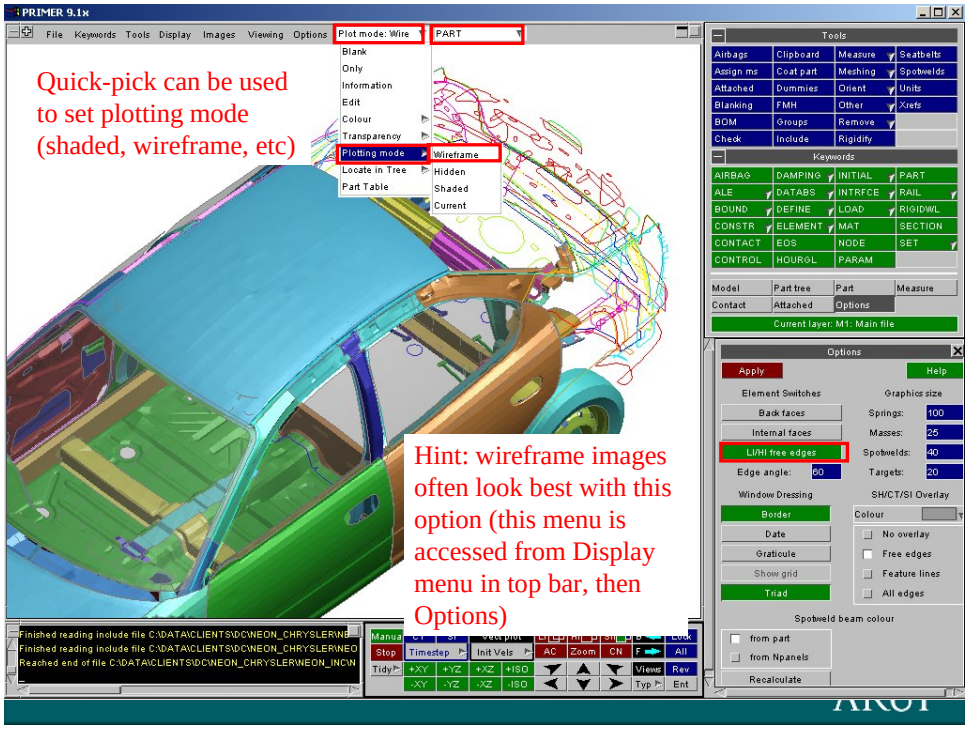
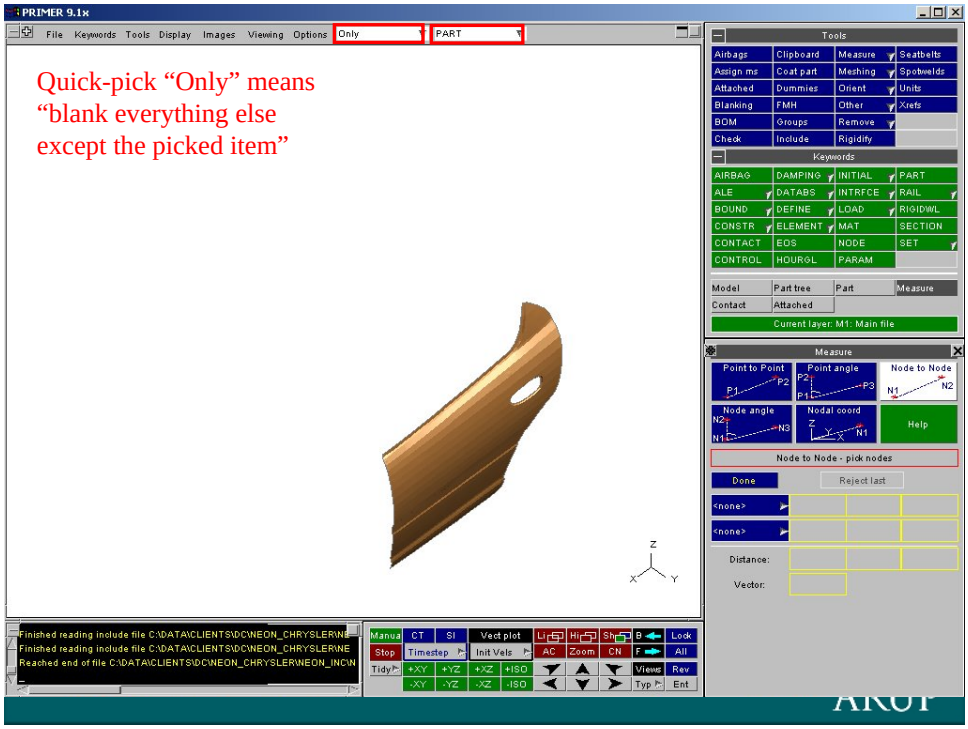
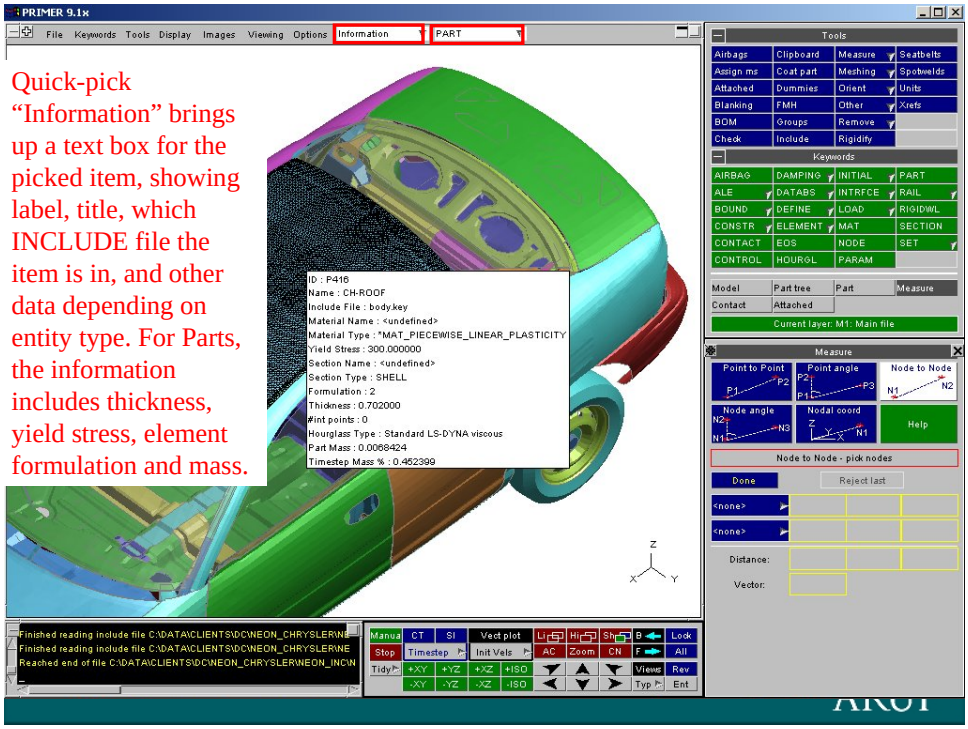
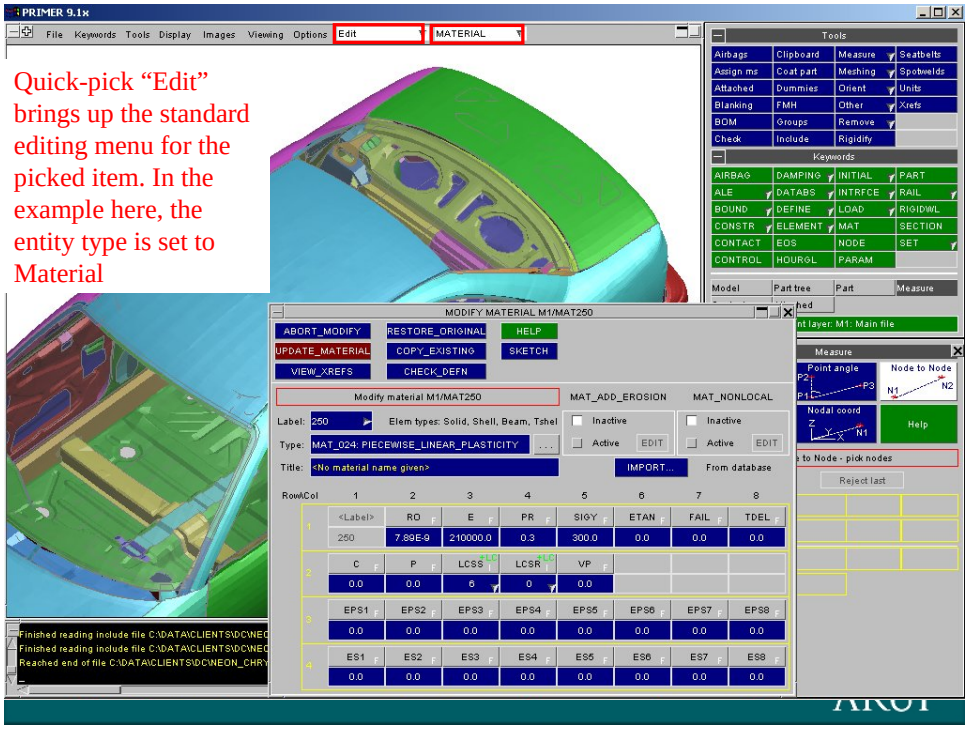
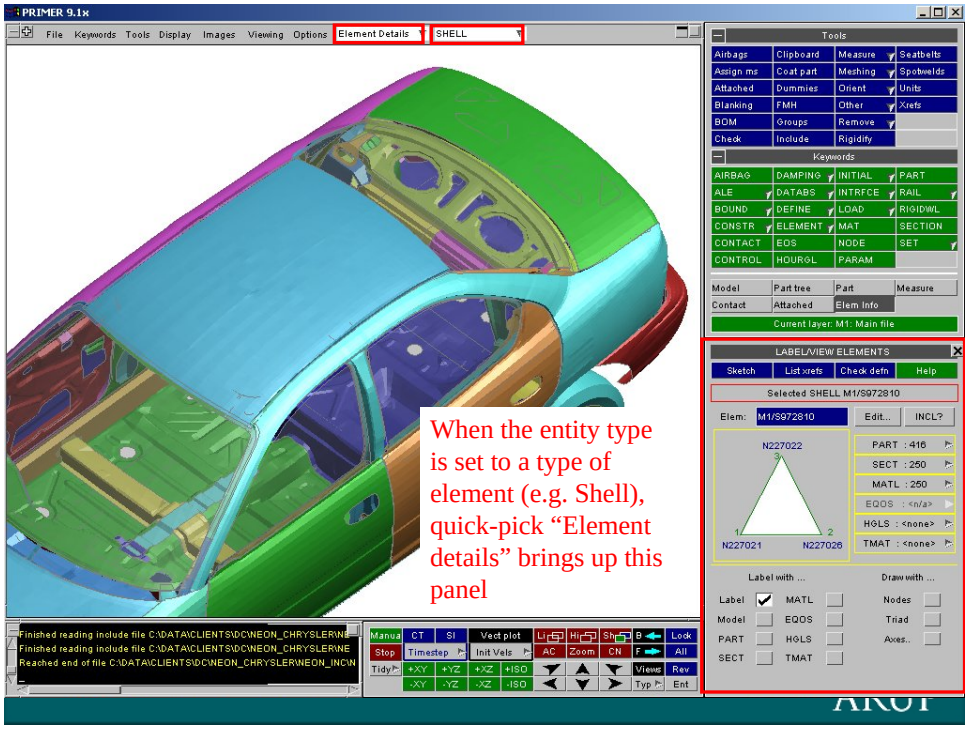
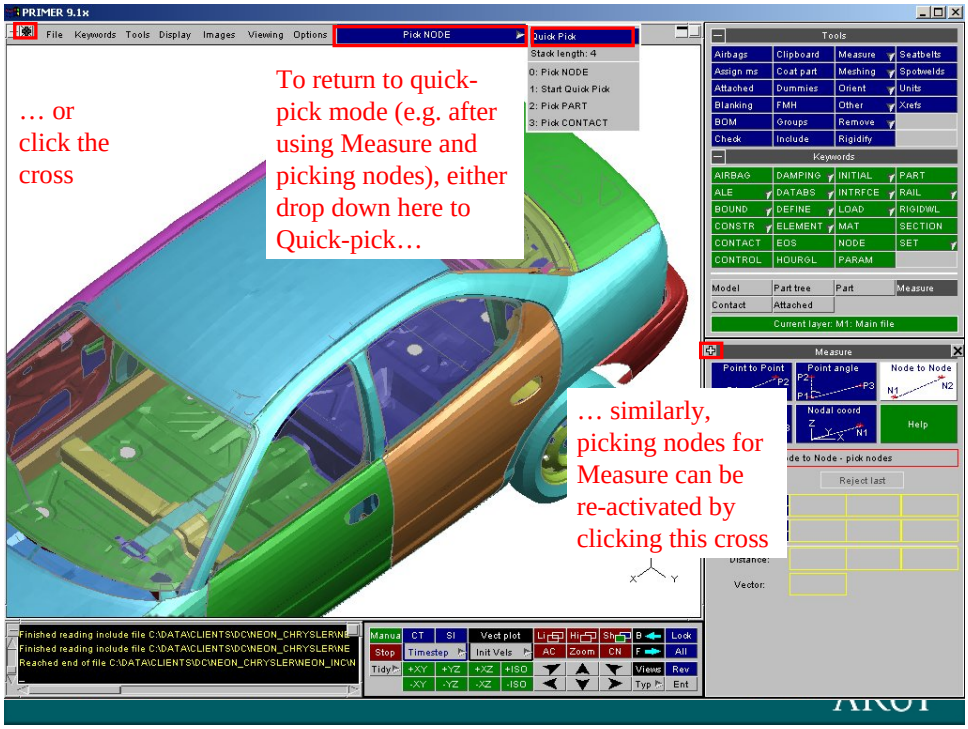

PRIMER 9.1x
File Keywords Tools Display Images Viewing Options Plot mode: Wire PART
Blank
Only
Information
Edit
Colour
Transparency
Plotting mode
Locate in Tree
Part Table
Wireframe
Hidden
Shaded
Current
Quick-pick can be used to set plotting mode (shaded, wireframe, etc)
Hint: wireframe images often look best with this option (this menu is accessed from Display menu in top bar, then Options)
Tools
Keywords
Model Part tree Part Measure
Contact Attached Options
Current layer: M1: Main file
Options
Apply
Help
Element Switches
Graphics size
Back faces
Internal faces
LI/HI free edges
Edge angle:
Springs:
Masses:
Spotwelds:
Targets:
Window Dressing
SH/CT/SI Overlay
Border
Colour
Date
Graticule
Show grid
Triad
No overlay
Free edges
Feature lines
All edges
Spotweld beam colour
from part
from Npanels
Recalculate

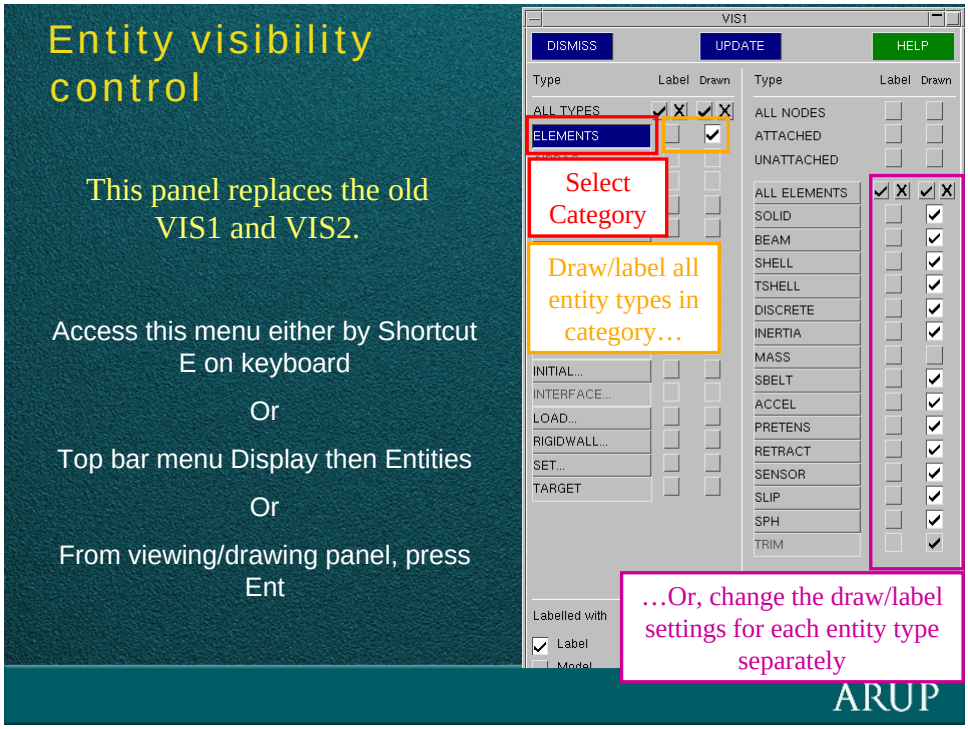


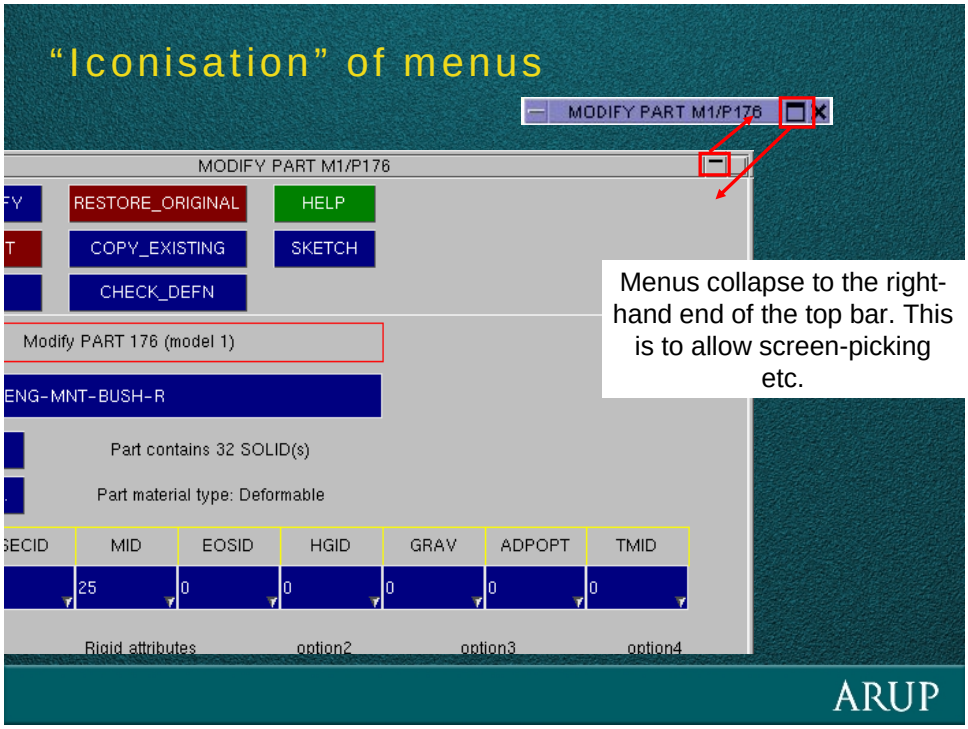



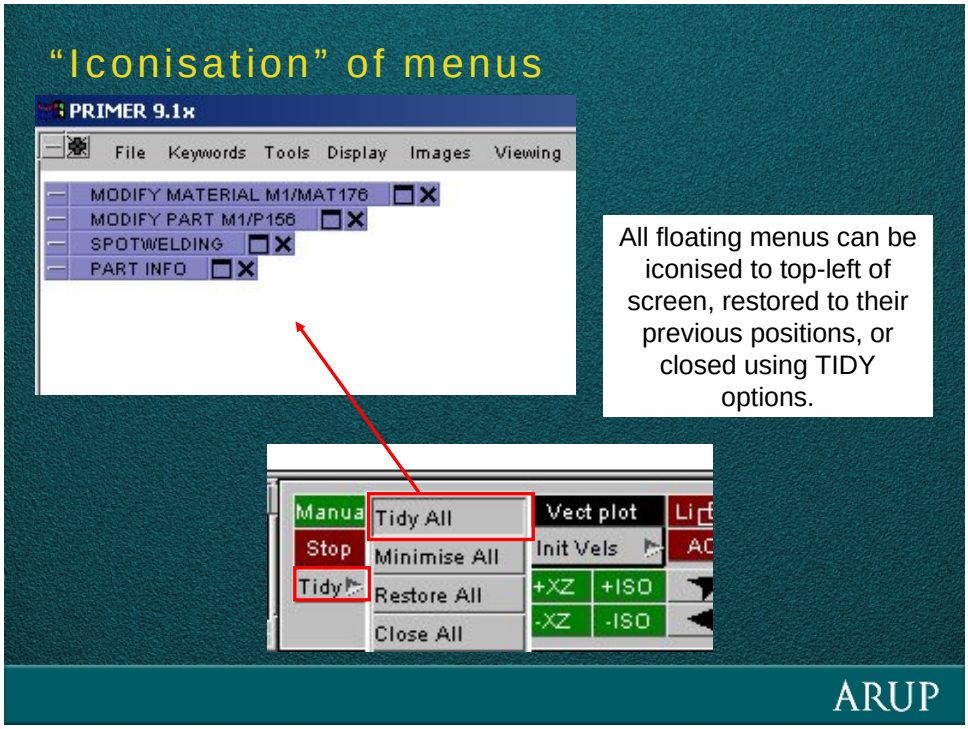


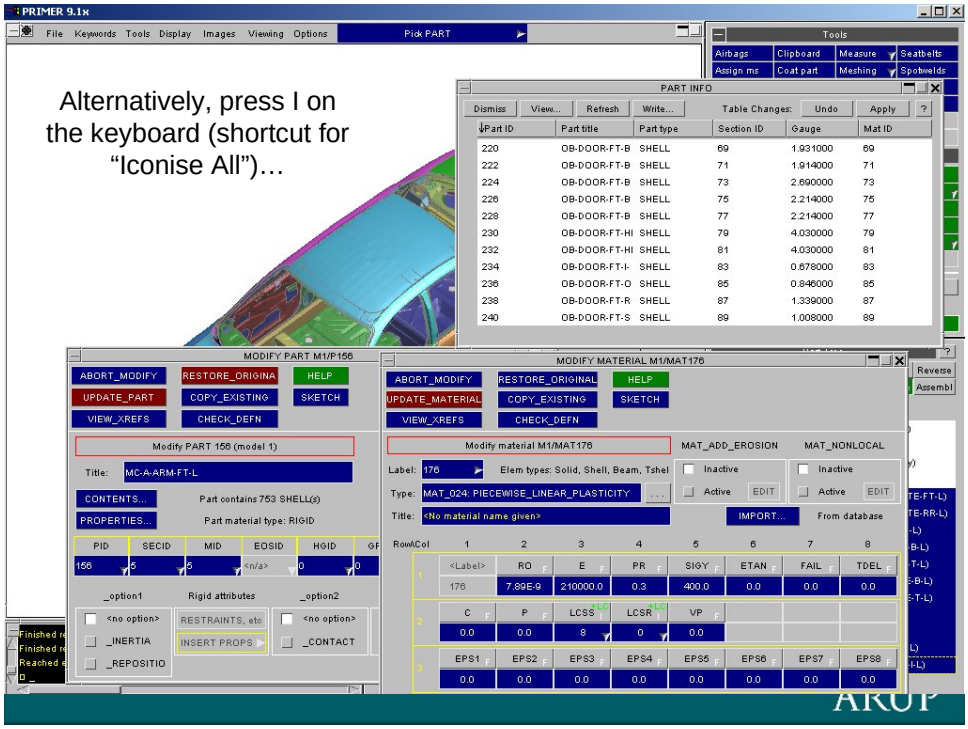



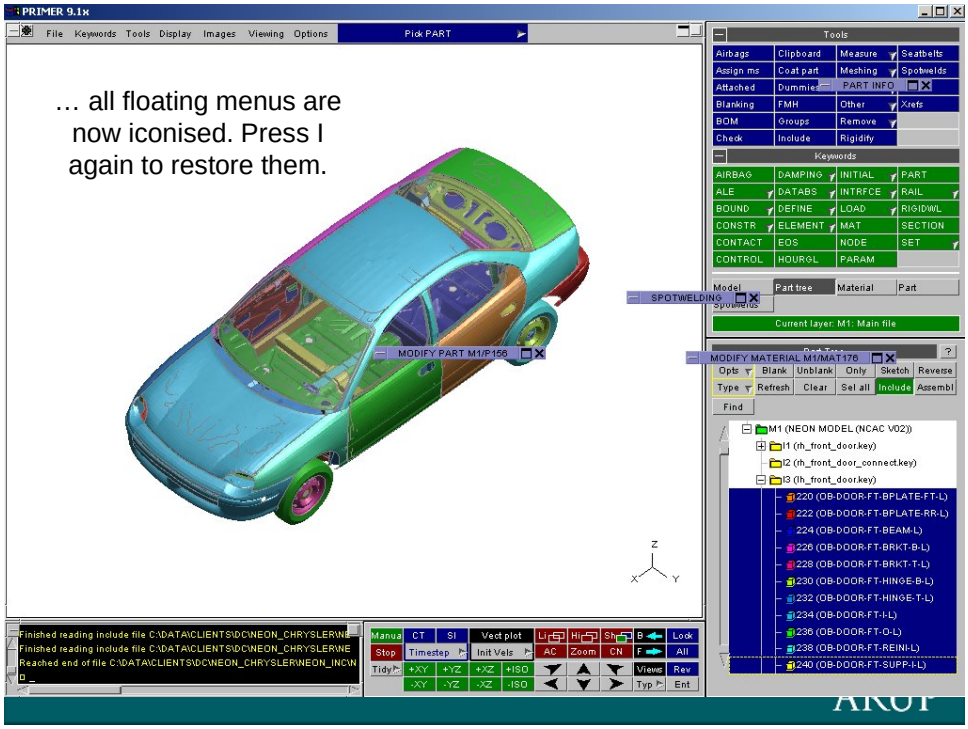





Alternatively, press I on the keyboard (shortcut for “Iconise All”)…

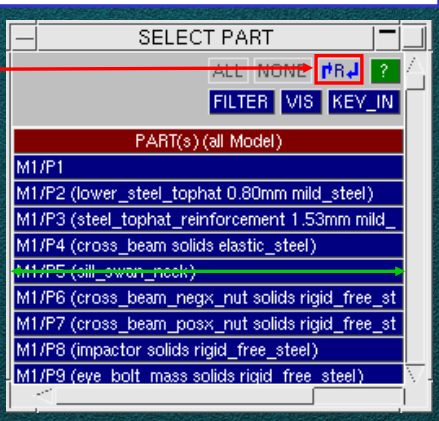

… all floating menus are now iconised. Press I again to restore them.

## Refresh of Object Menus

Primer can have many menus open at the same time. This could potentially lead to confusion if, for example, a part were deleted in one menu but then still appeared in the "object menu" (list of items for selecting) in another menu. These lists are now automatically refreshed in most cases where data is created, edited or deleted.

A new button enables manual refreshing of the object menu where necessary.

These menus automatically grow wider when the mouse moves in, so the titles can be seen more fully

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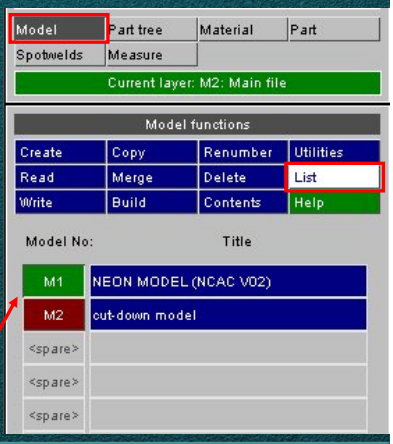
## Summary of methods of blanking

- Shortcut keys U (unblank all), R (reverse blanking) and B (blanking menu)
- Quick-pick (drag across area or click on each item)
- Lock and All buttons within viewing panel allow storing of blanking status (e.g. to view a subset of the model)
- Blank, Unblank and Only in Part tree, then click on parts, Include files or assemblies
- Right click on parts, Include files or assemblies in Part Tree
- Part Table, tick Blanking column under View
- Can also switch entity types on/off (shortcut E or Display Entities)
- Can also switch models on/off (Model tab, then List)

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## Summary of methods to find which INCLUDE file an item is in

- If you can see the item on the screen,
  - Use Quick-pick “Information”, click on the item
  - Alternatively, if the item is a part, use Quick-pick “Locate in Tree” to see it in the Part Tree under its Include file
- If you know the name or ID of a part
  - Part Tree “Find”
- KEYWORD => PART => LIST – text box contains INCLUDE file information
- From Element Details panel
  - Press INCL
- Or,
  - Put the item on the clipboard, right-click and LOCATE

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## Find attached

**Demonstration**

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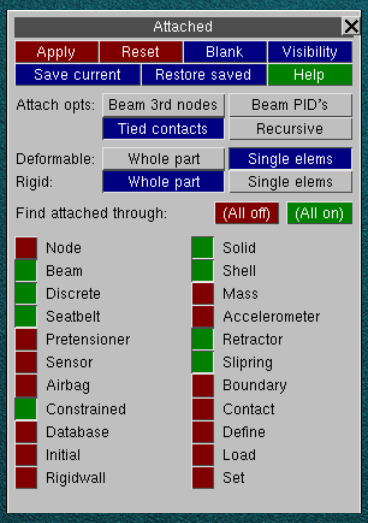
## Find attached - Introduction




**Attached** works in a slightly different manner to previous versions of Primer. It is now separate from the entity visibility so it is possible to find one type of entity attached without effecting the visibility of other types of entity

The default state of the attached menu is set to find any **structural connections**

The new menu offers several extra options:

**Tied contacts** switch allows attached to find elements through tied contacts

**Recursive** switch will loop through attached until nothing more can be found

Options are available to find a **whole part** or step through **single elements** for both rigid and deformable parts in one iteration

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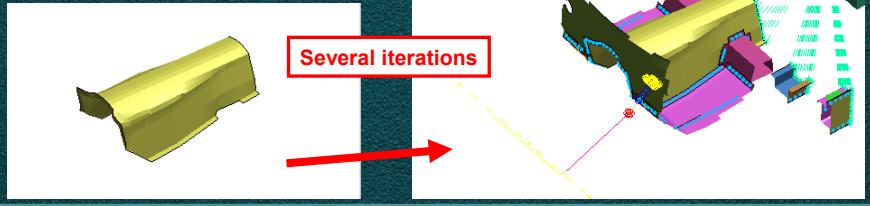
## Find attached - Default

Pressing **Apply** in the default mode will find any structural connections in the model. Tied contacts are found by default and use routines from the Primer contact penetration checker

Other entities can also be found by turning their switches on in the panel: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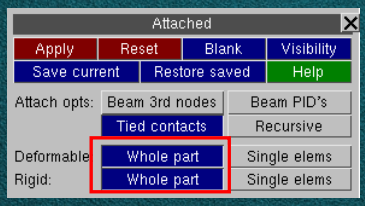
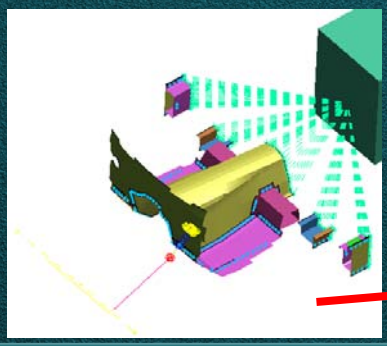
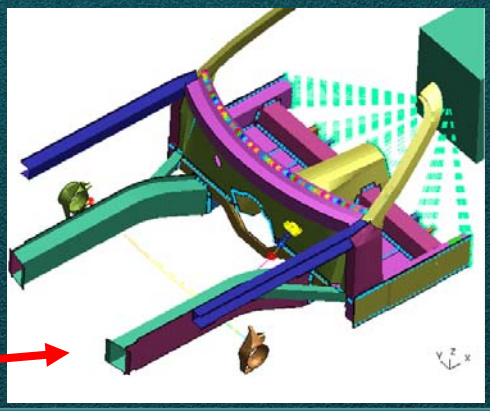
## Find attached – Whole parts




**Whole part** option allows the user to skip the element-by-element iterations, and find a whole part instead





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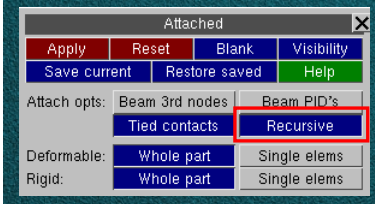
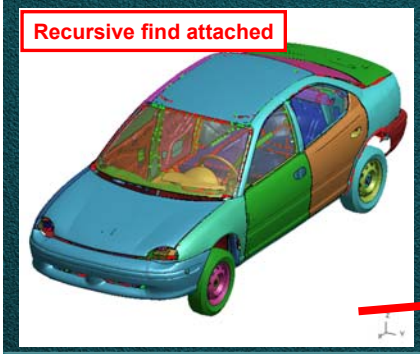
## Find attached - Recursive



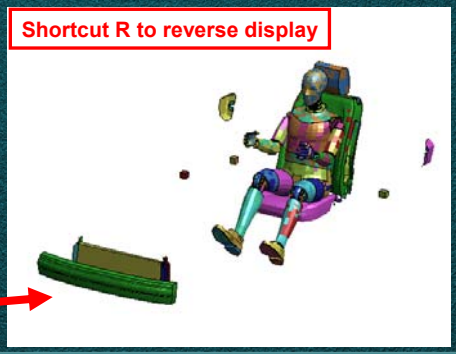

**Recursive** option will loop through attached iterations until Primer cannot find any more entities

Reversing the model display (shortcut **R**) will display any unattached entities

**Recursive find attached**



**Shortcut R to reverse display**



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# Part tree

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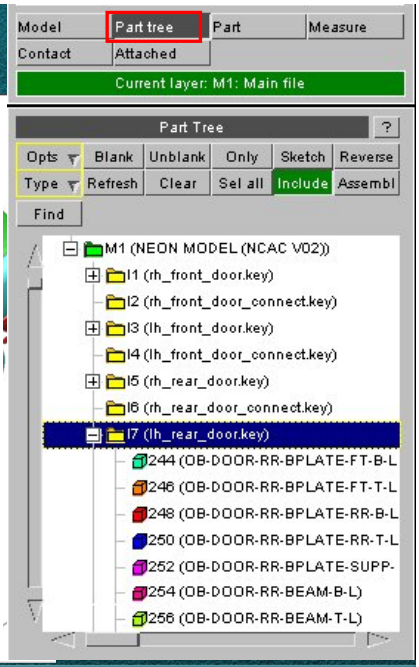
## Part tree

The Part Tree is a new facility allowing viewing of the model structure and access to blanking and other functions. By default, the tree view is organised by Include files, then Parts.

Select then drag and drop (or multiple-select with shift and/or CTRL, then right-click and cut/paste) to move parts to a different Include File. This performs the same action as Clipboard MOVE TO INCLUDE with Find Referenced Items – nodes and elements are moved as well as Part, Section and Material data.

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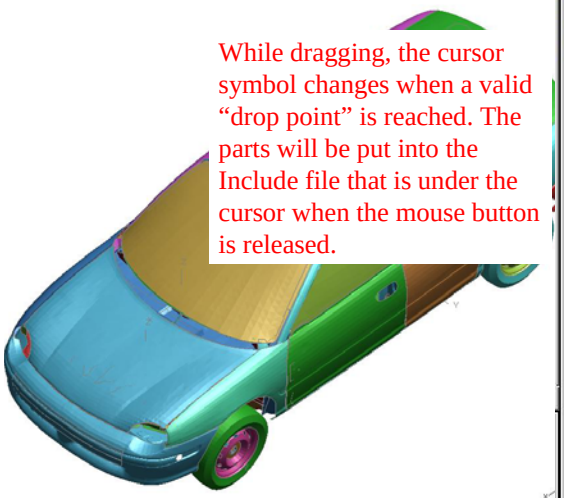
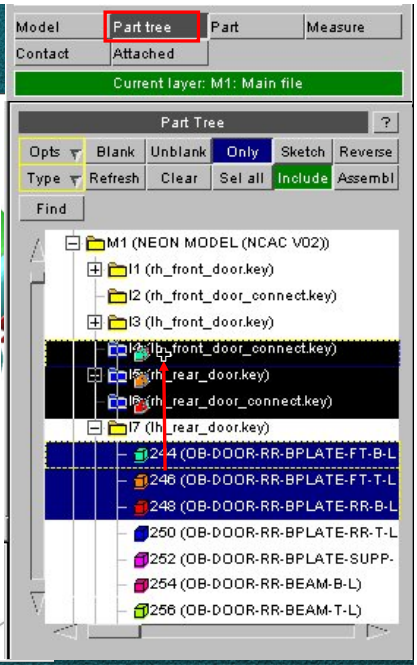
## Part tree



While dragging, the cursor symbol changes when a valid “drop point” is reached. The parts will be put into the Include file that is under the cursor when the mouse button is released.

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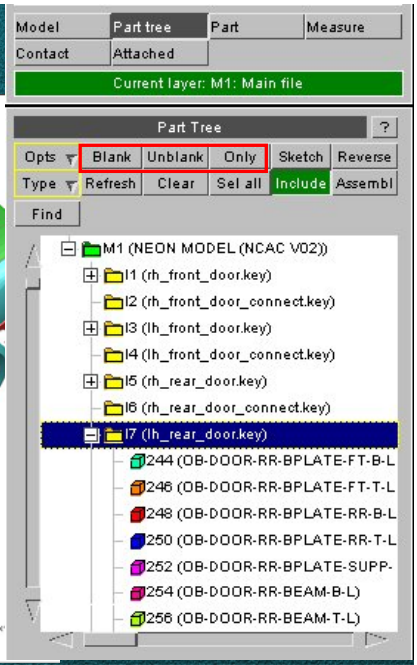
## Part tree – blanking

1. Select blanking function

2. Click on Include files or Parts (shift-click or CTRL-click for multiple selection)

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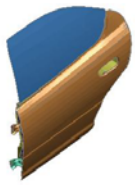
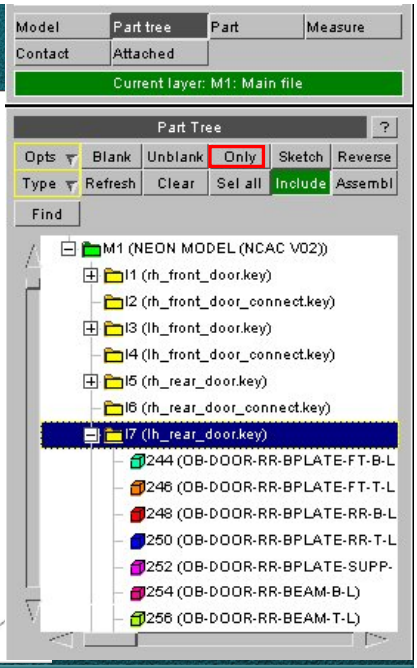
## Part tree – blanking

ONLY displays only the selected items (in this case, an INCLUDE file)



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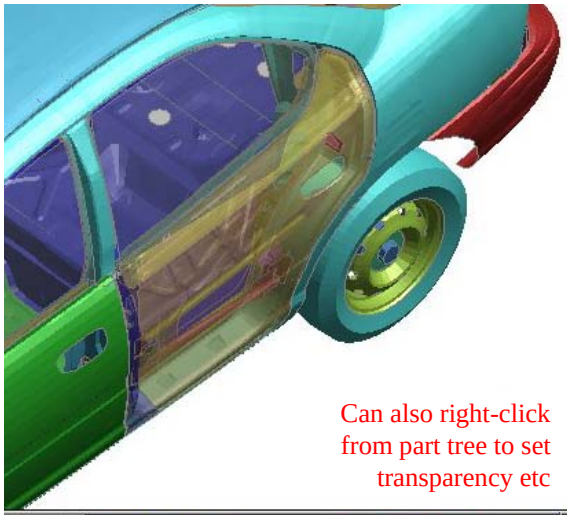

Can also right-click from part tree to set transparency etc




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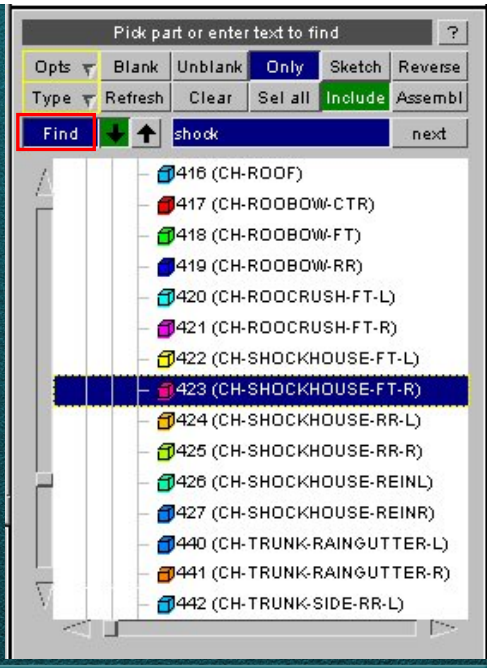
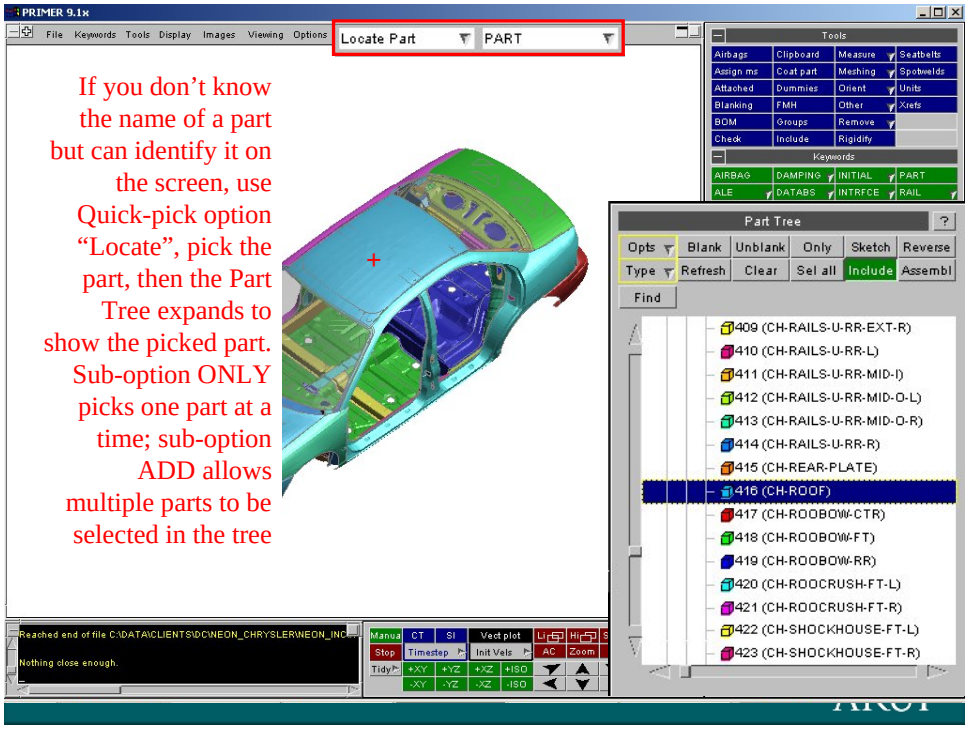
## Part Tree "Find"

"Find" searches by name or Part ID




ARUP



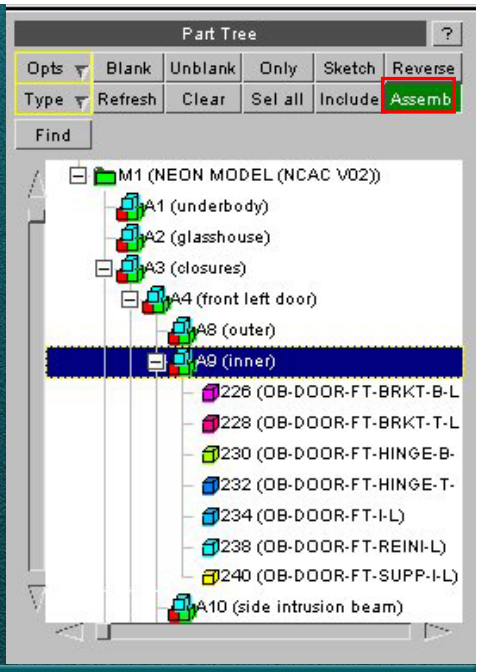

If you don't know the name of a part but can identify it on the screen, use Quick-pick option "Locate", pick the part, then the Part Tree expands to show the picked part. Sub-option ONLY picks one part at a time; sub-option ADD allows multiple parts to be selected in the tree

## Assemblies

Assemblies are user-defined groupings of parts, that can be used for blanking or selecting for other operations.

The two main difference compared with Sets or Groups are:

- Assemblies can be hierarchical – assemblies can contain assemblies.
- No part can be defined in more than one assembly

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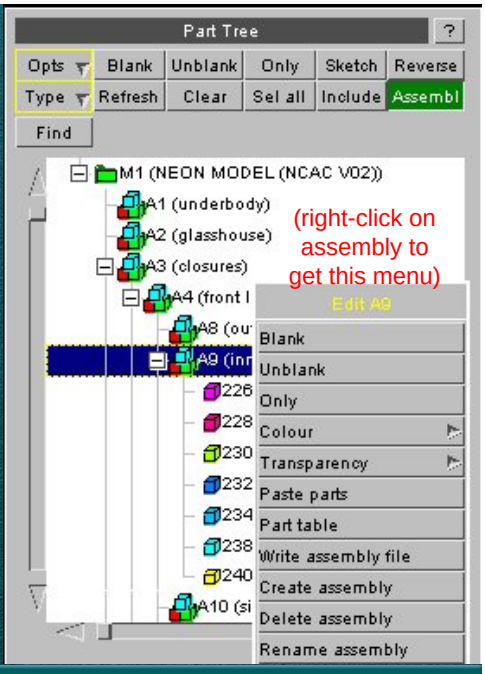
## Assemblies

This tree structure can be created in the Part Tree menu: right-click on the model or existing assembly to create a “child” assembly. This can then be renamed.

Parts can be dragged into each assembly (or cut and pasted). Example: unblank only the parts required; use quick-pick “Locate Add” to highlight the parts in the Part Tree; right-click cut; on the assembly, right-click paste.

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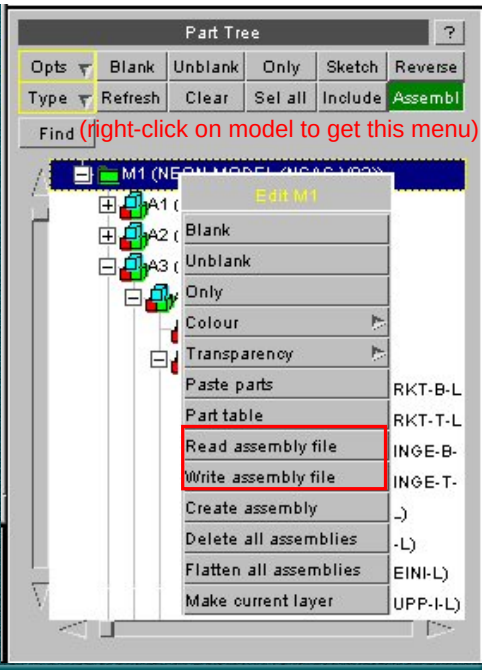
## Assemblies

The assembly structure can be written to and read from a separate file. This method is used to allow a single definition of the assembly hierarchy to be kept centrally and used for many models.

When the keyword file is written, a comment is written with each *PART to indicate which assembly the part is in. However, the keyword file does not contain the assembly hierarchy.

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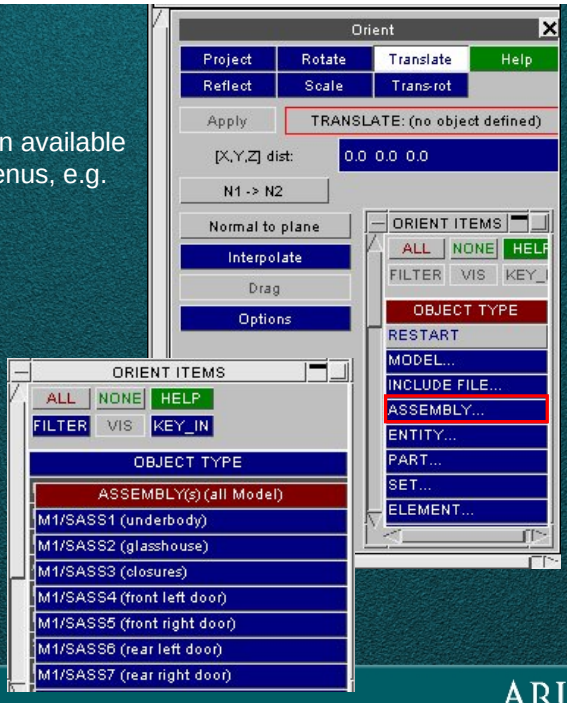
## Assemblies

The assemblies are then available for selection in other menus, e.g. ORIENT

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# Cross-Reference Viewer

**Demonstration**

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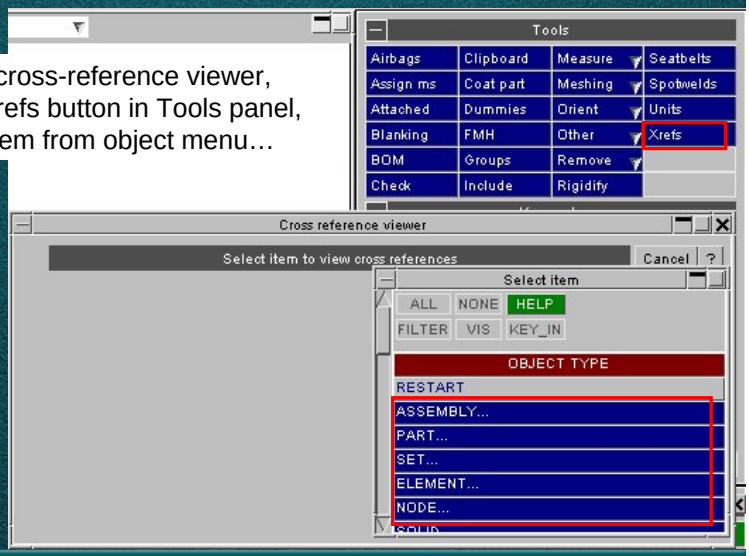
## Cross-reference viewer

To start the cross-reference viewer, EITHER use Xrefs button in Tools panel, then select item from object menu…

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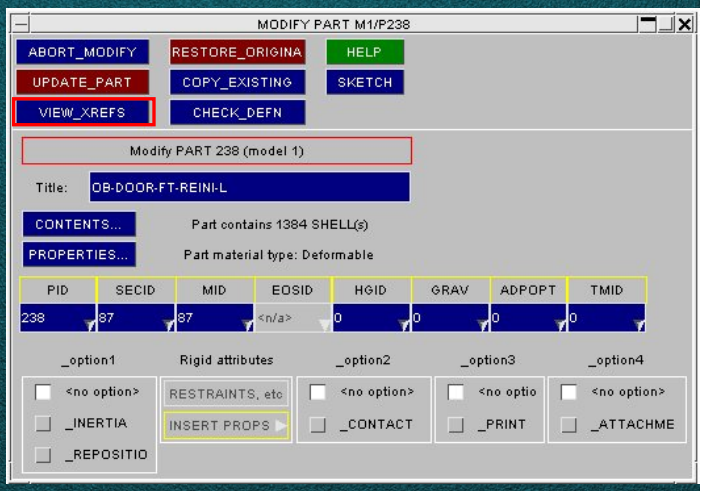
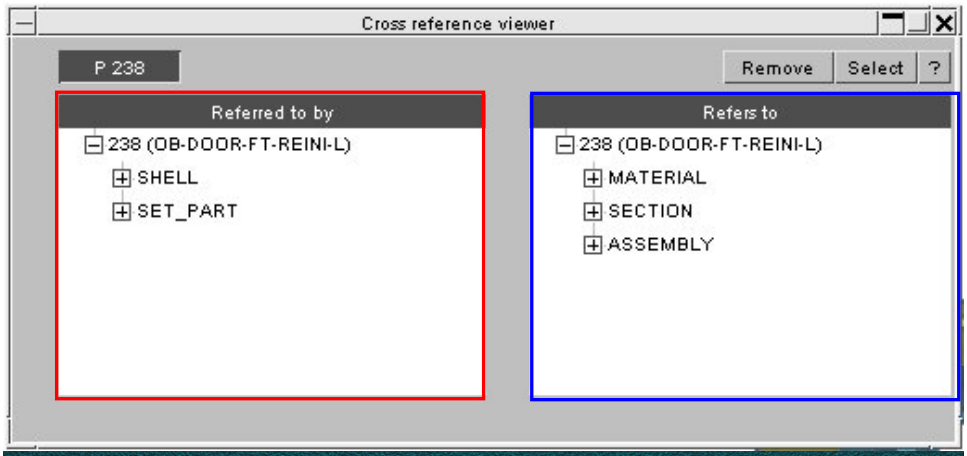
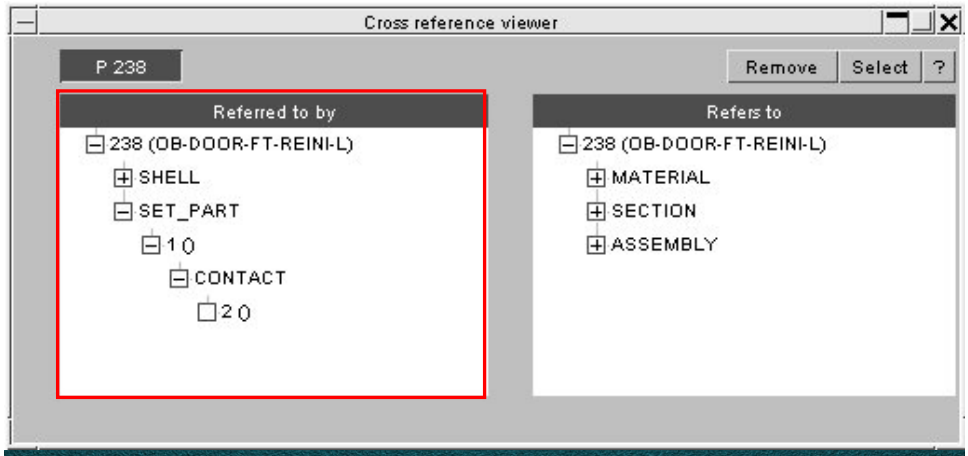
… or press VIEW_XREFS from edit panels




This side shows entities that refer to the selected item. In this example, a part was selected; all keywords containing a reference to that part are shown.

This side shows entities that are referred to by the selected entity, e.g. *PART refers to a material ID and a section ID




Expand a category to show individual entities of that type; click on an entity to see references to that entity. Here, Part 238 is referred to by Part Set 1, which is referred to by Contact 2. The left side of the view works “up the tree”, while the right side works “down the tree” – both starting from the picked item.

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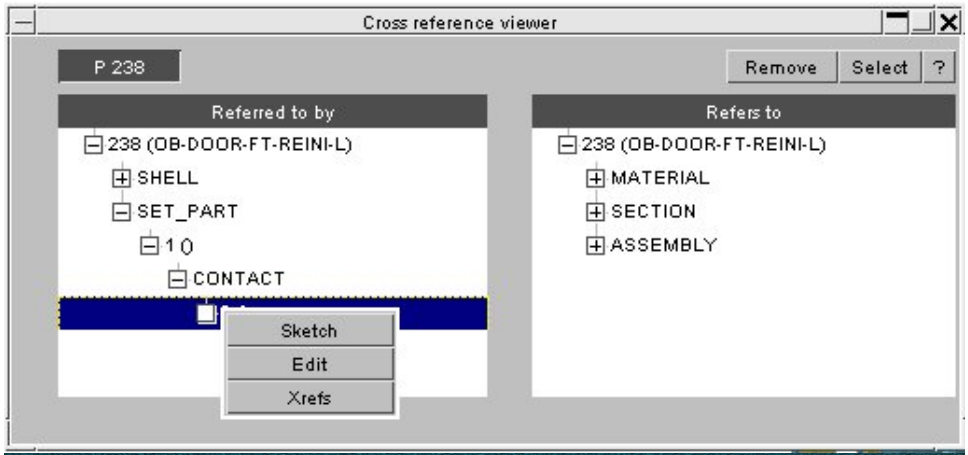


To see both up and down the tree from one of the entities displayed (e.g. Contact 2), right-click the entity and select “Xrefs”…

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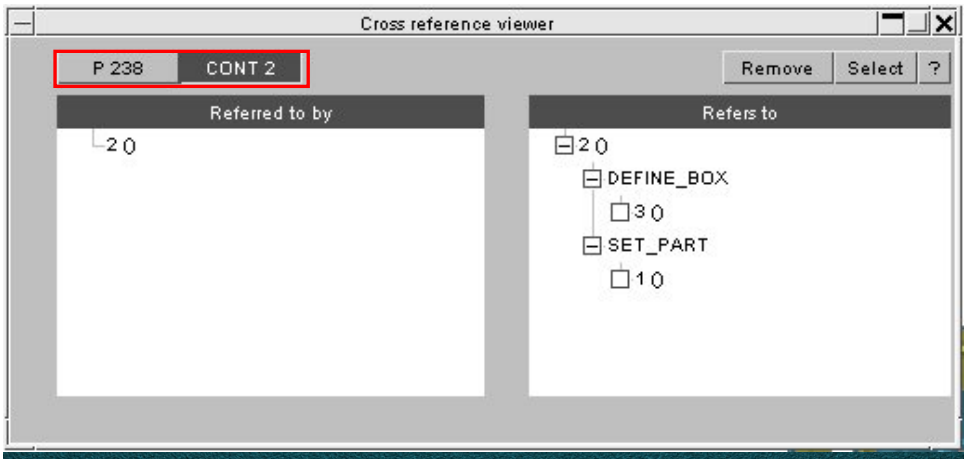


The references to and from Contact 2 are now displayed.

Return to the original view (references to the picked part) by using the tabs

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## Part table

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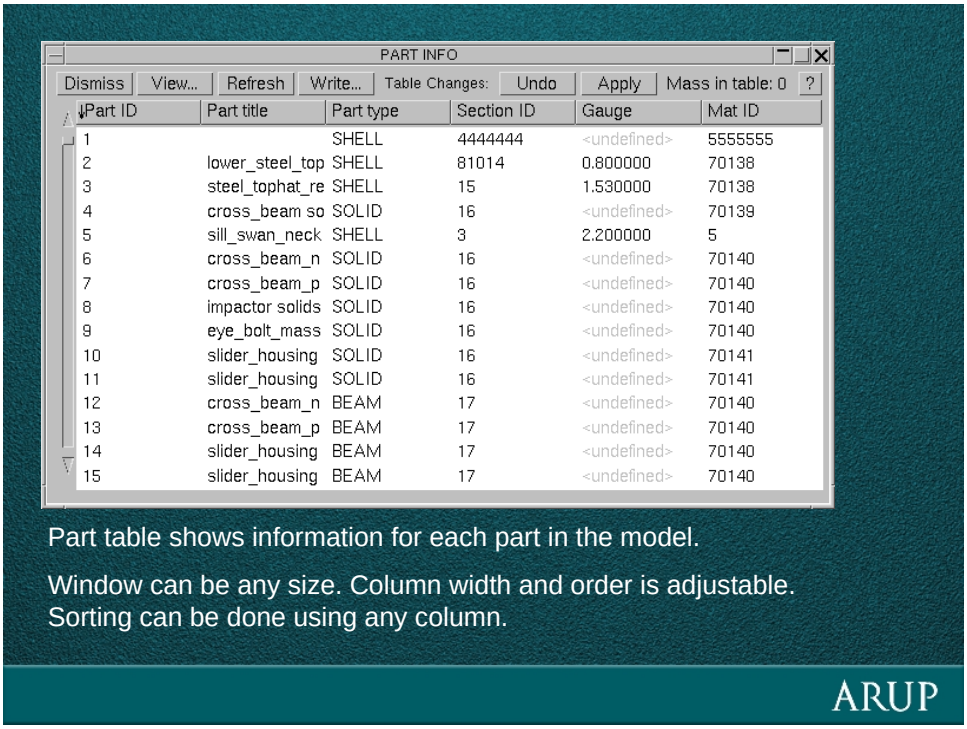


Part table shows information for each part in the model.

Window can be any size. Column width and order is adjustable. Sorting can be done using any column.

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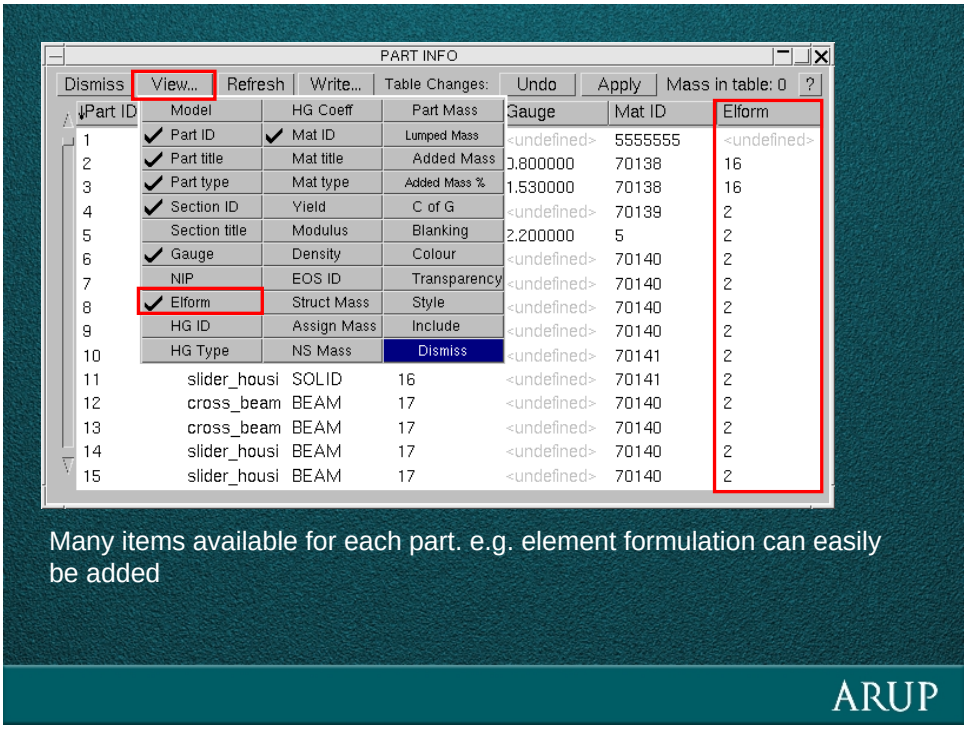


Many items available for each part. e.g. element formulation can easily be added

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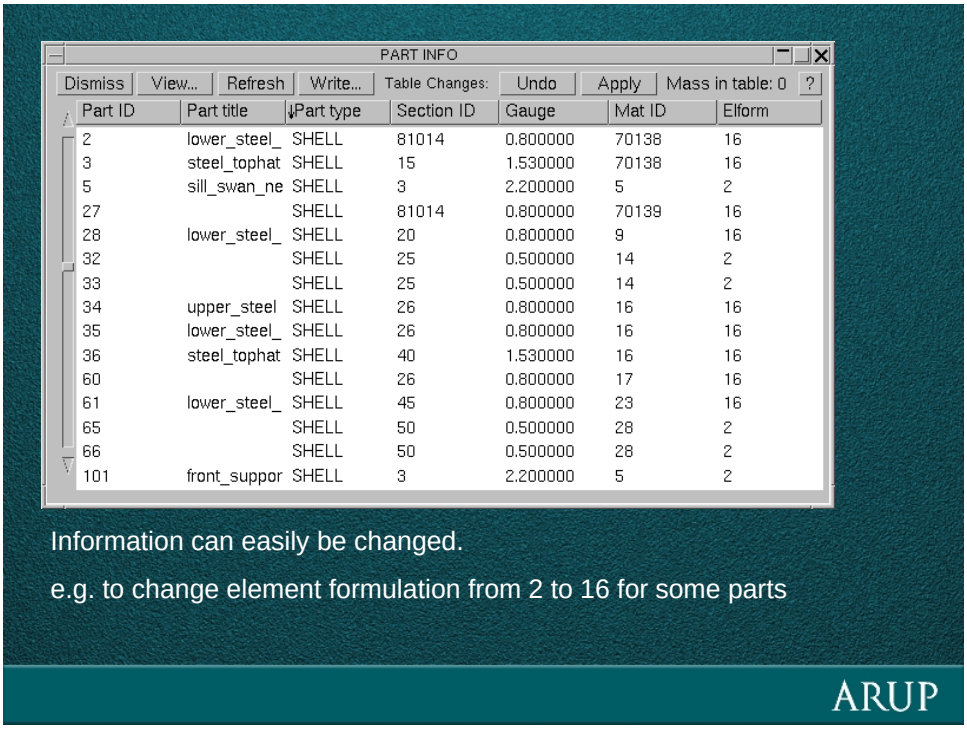


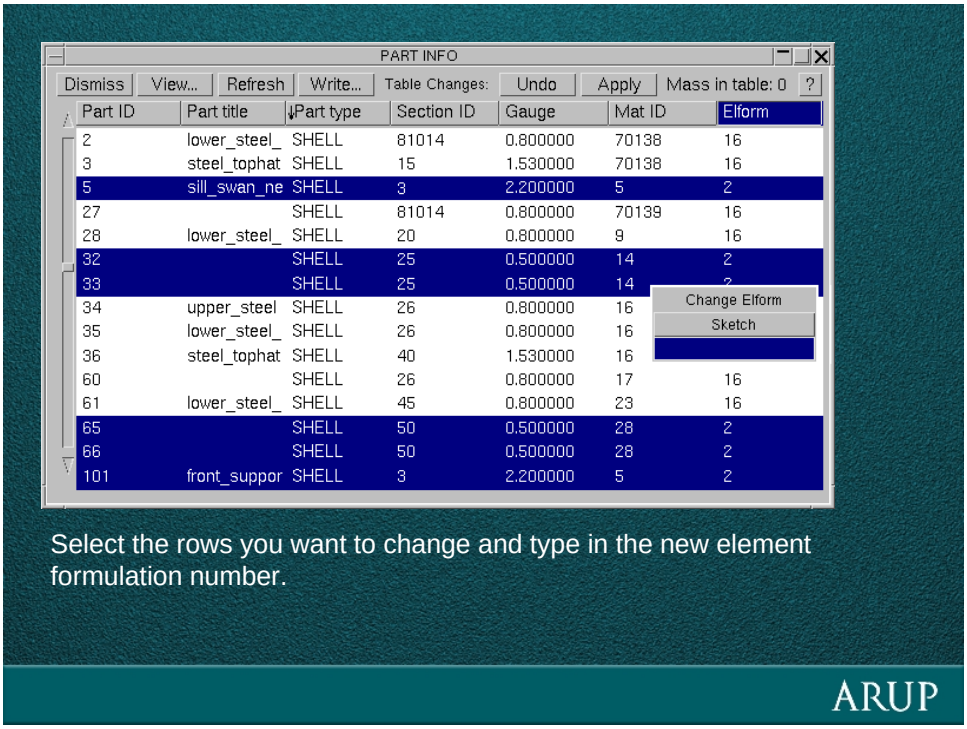

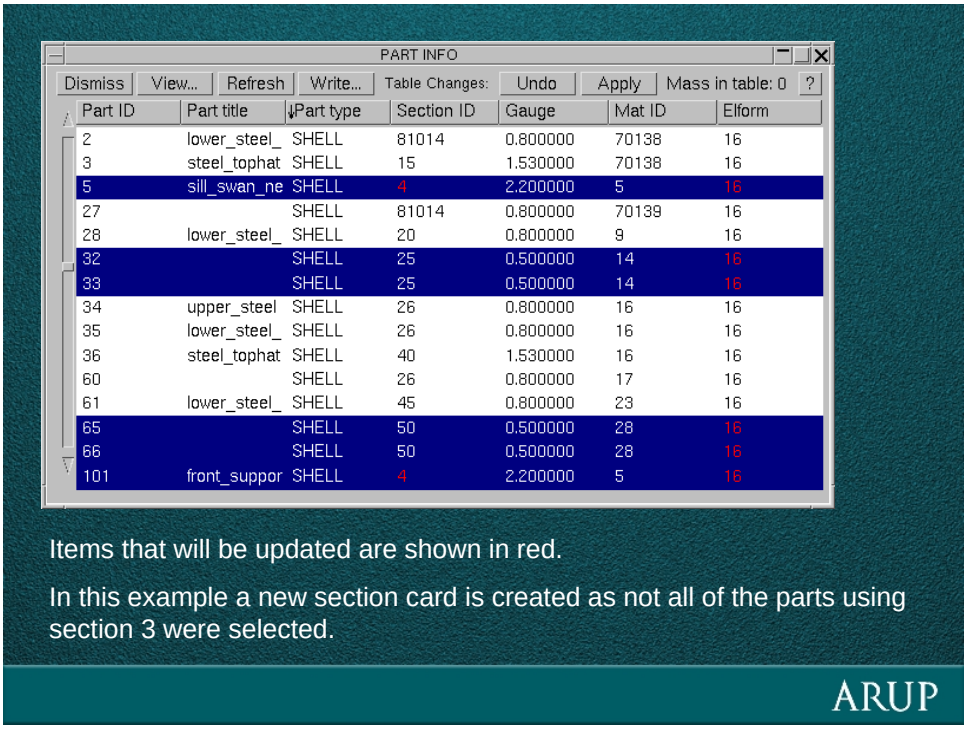


Items that will be updated are shown in red.

In this example a new section card is created as not all of the parts using section 3 were selected.

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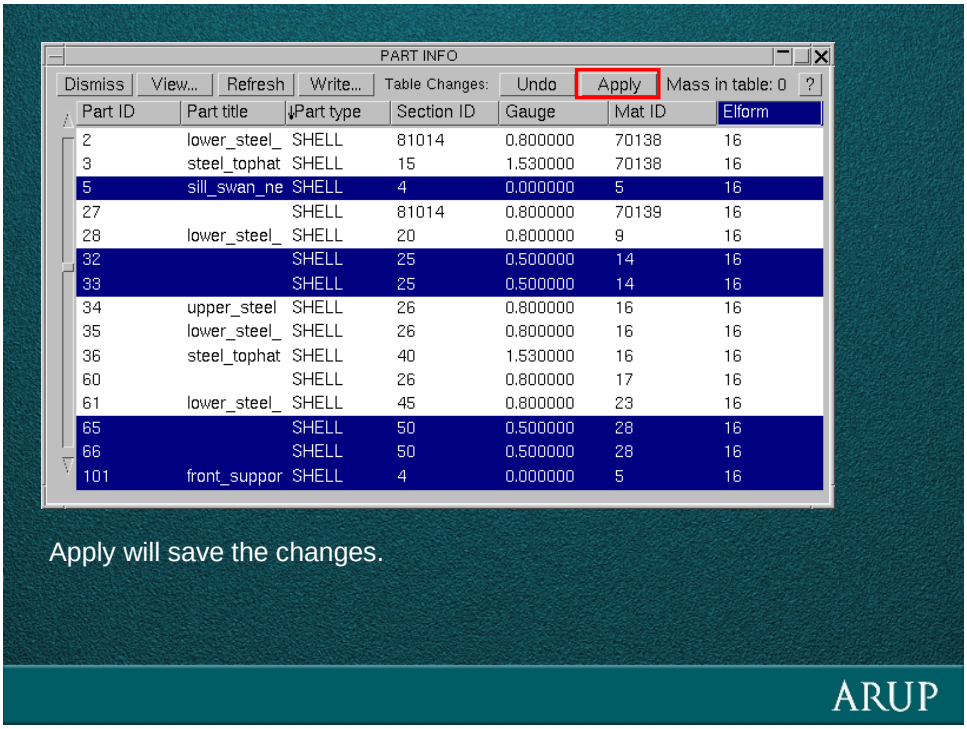


Apply will save the changes.

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# Spotwelding

**Demonstration**

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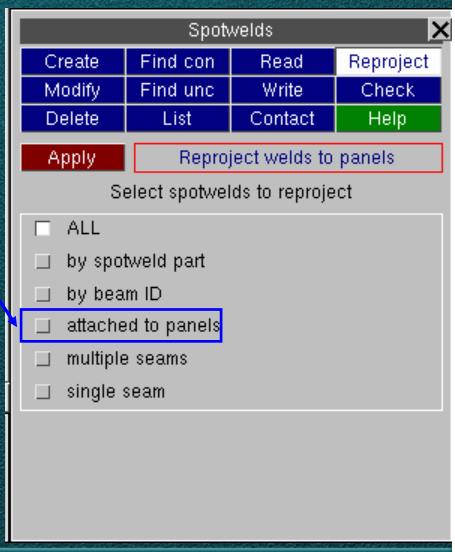
# Selecting Spotwelds – new options

Attached to panels selects all welds that are attached to any of the parts (panels) selected

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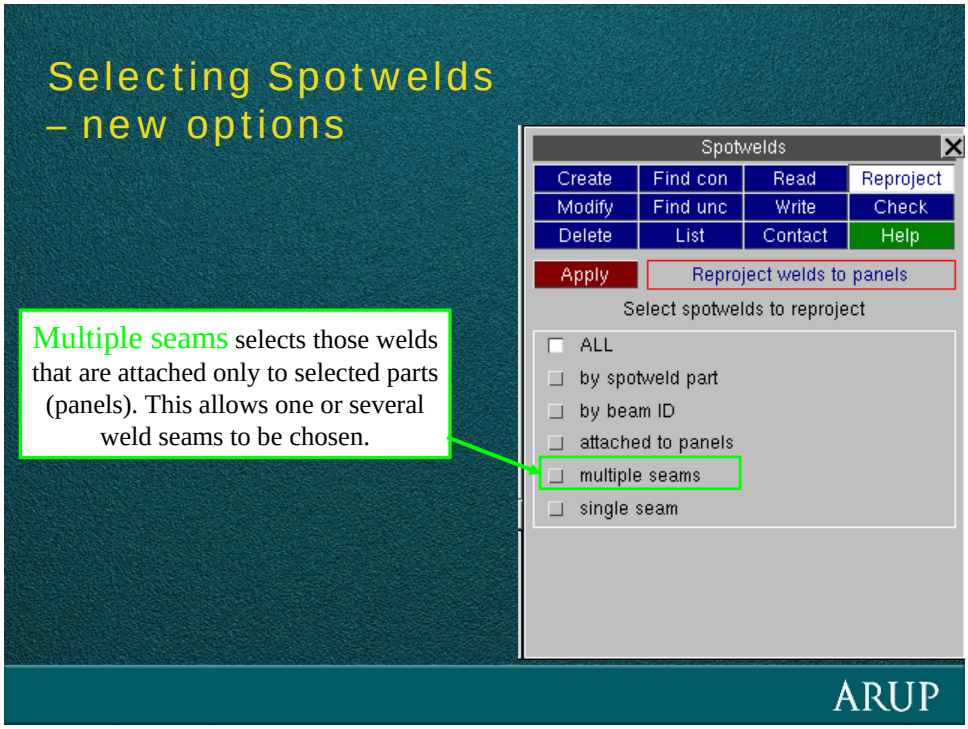
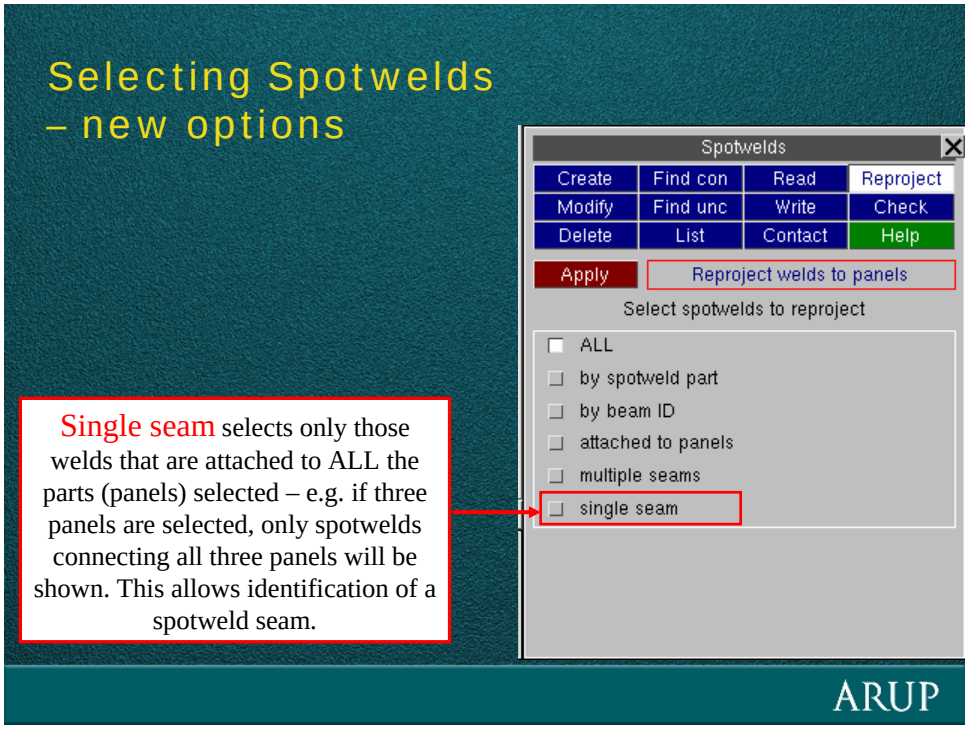
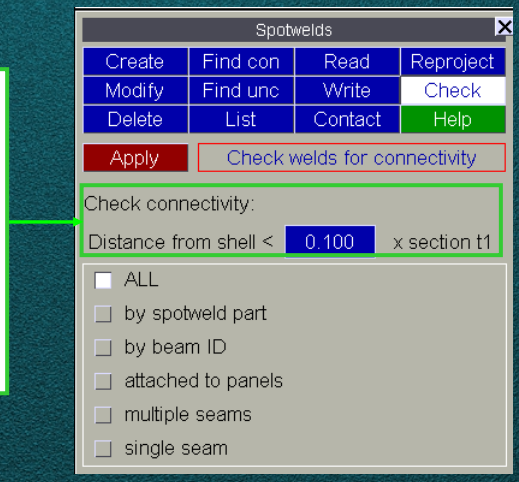


## Spotwelding

Check panel will now also check that spotweld nodes are sufficiently close to the panel mid-planes to stick to the panels. In some cases, the test used may be more demanding than that used by LS-DYNA.

If any spotwelds fail the test, the fixing panel appears.

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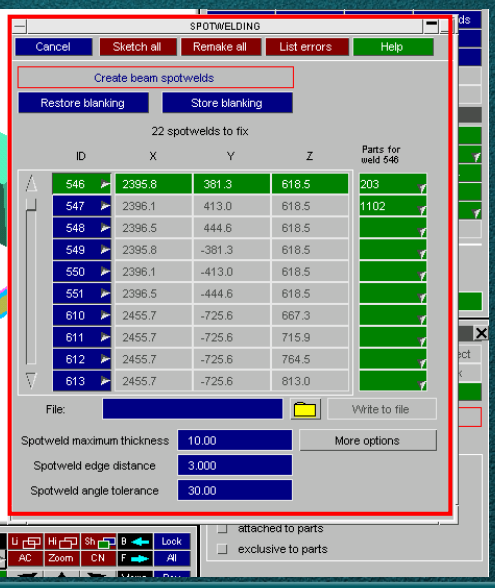
## Spotwelding

After reprojecting or checking welds, the “fix” panel is displayed for welds that need attention

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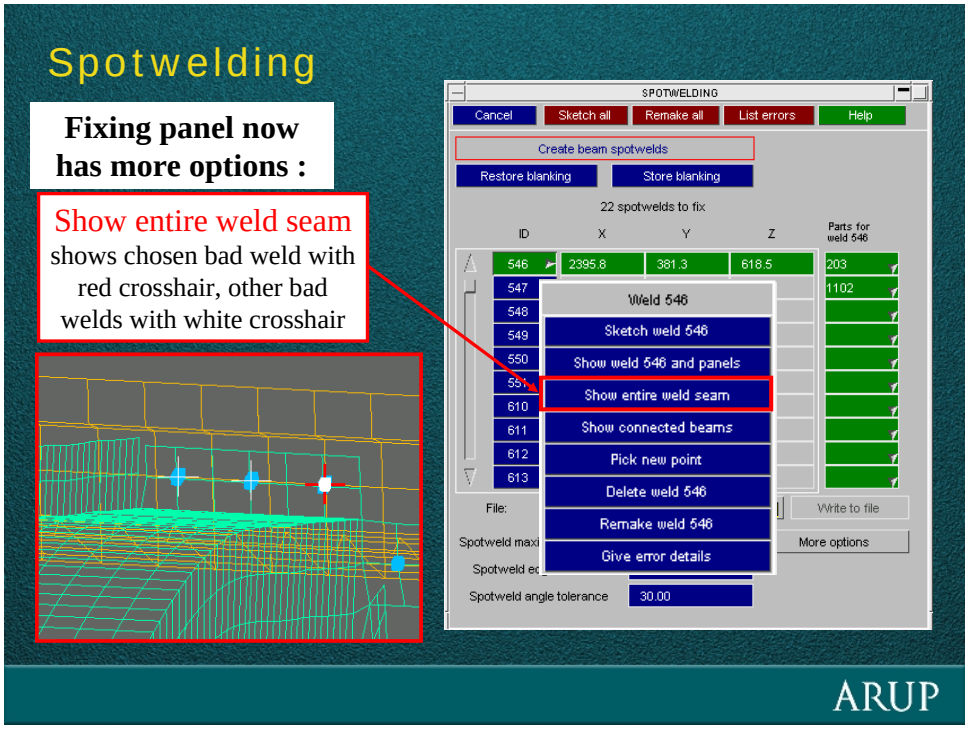
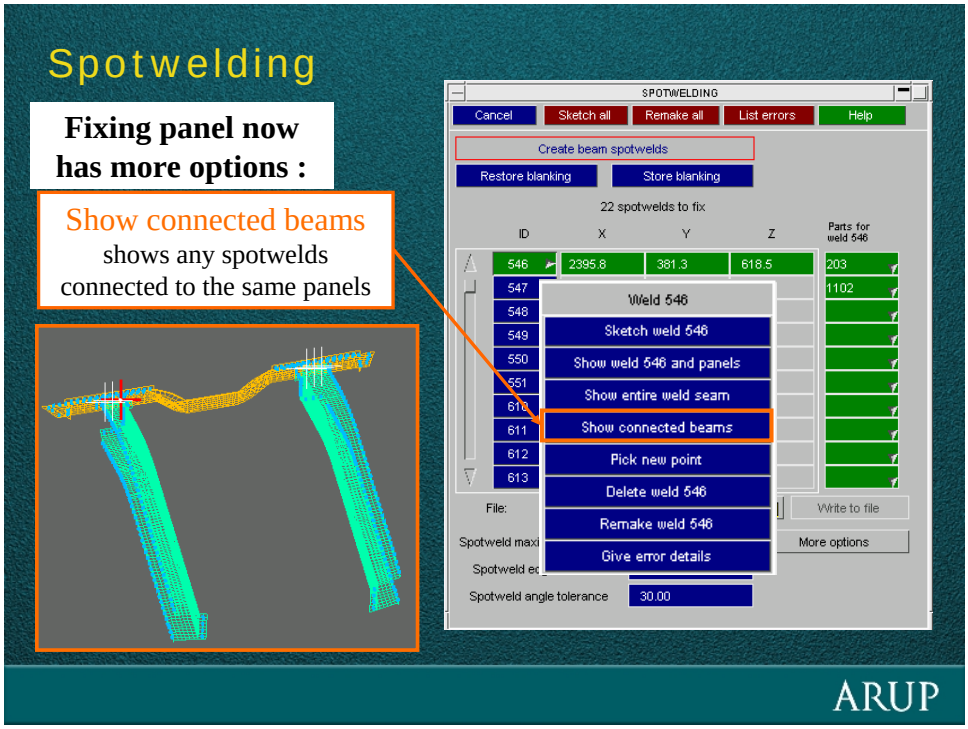
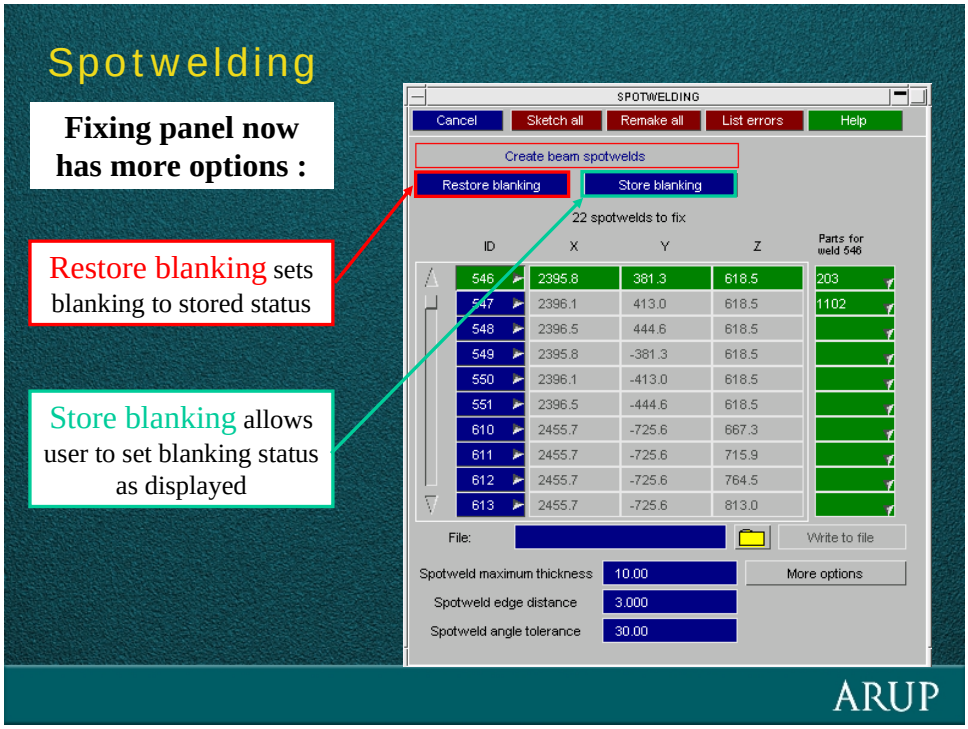
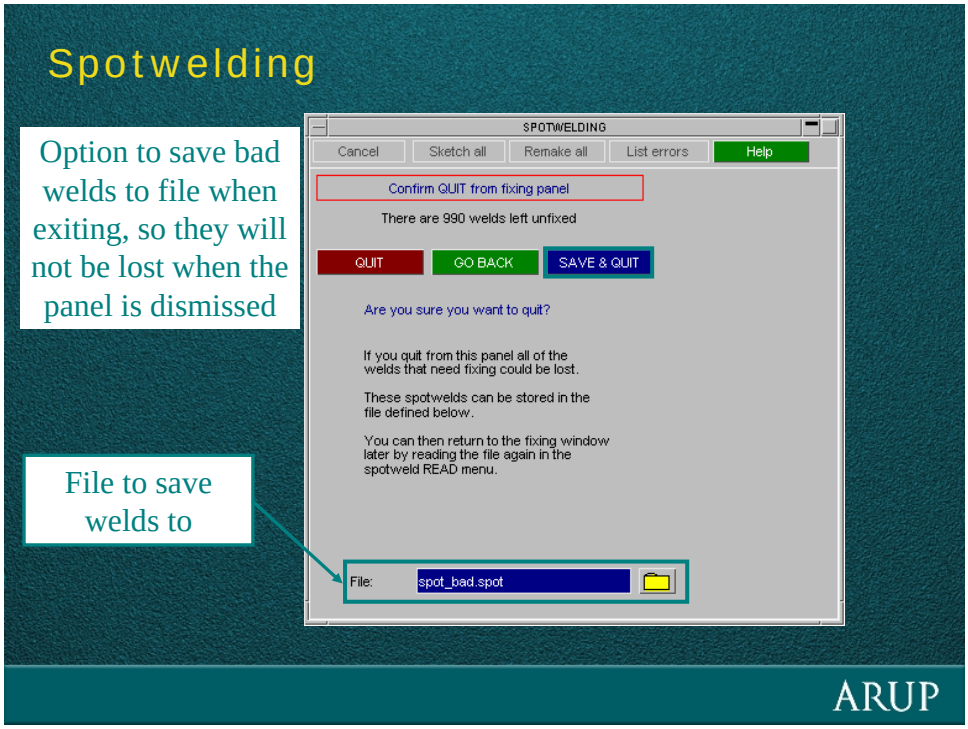
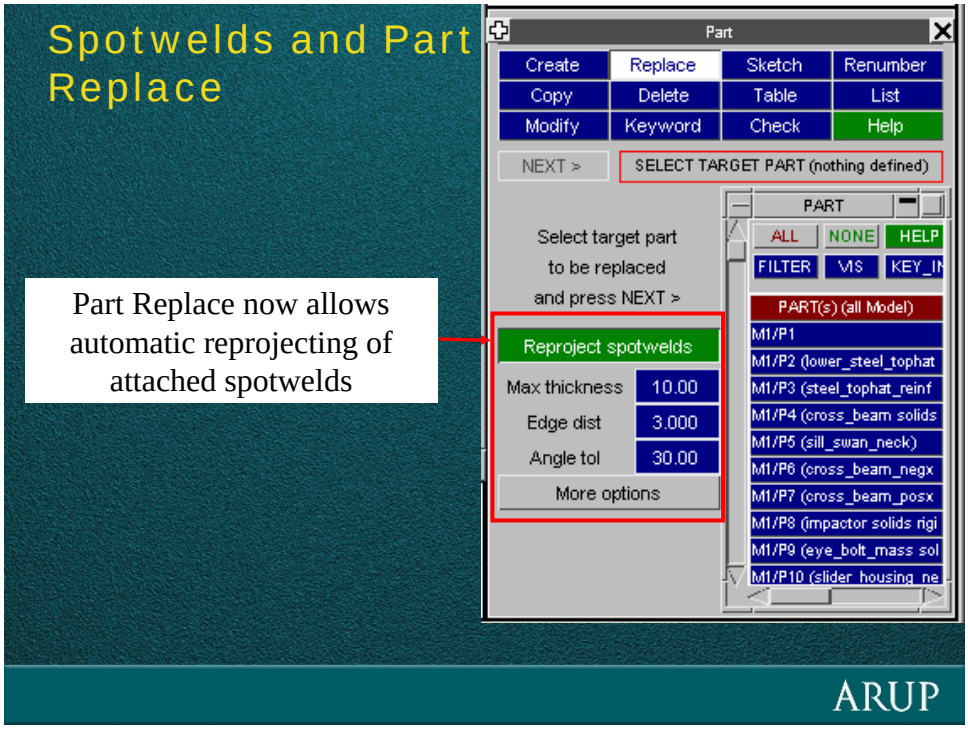


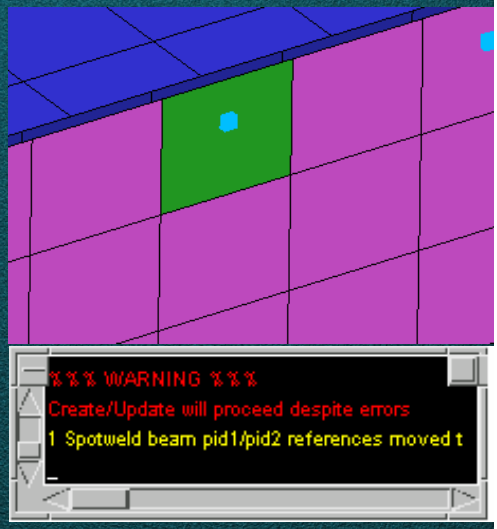


## Spotwelds still stick after Shell PID change

If the Part ID of shell elements is changed (e.g. creation of a rigid patch), the PID references on the spotweld beams (ELEMENT_BEAM_PID) are now automatically changed to ensure that the spotwelds still stick to the same elements.

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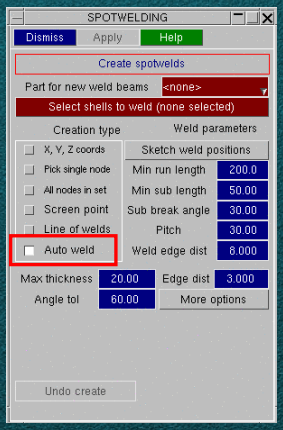
## Autowelding – introduction




New **Auto weld** function in Primer intelligently finds potential weld points between selected shells and then attempts to weld at all of the calculated points

Weld runs are determined by flagging shells that are close together with similar normal vectors, and then using the model free edges on these flagged shells as “weld runs”

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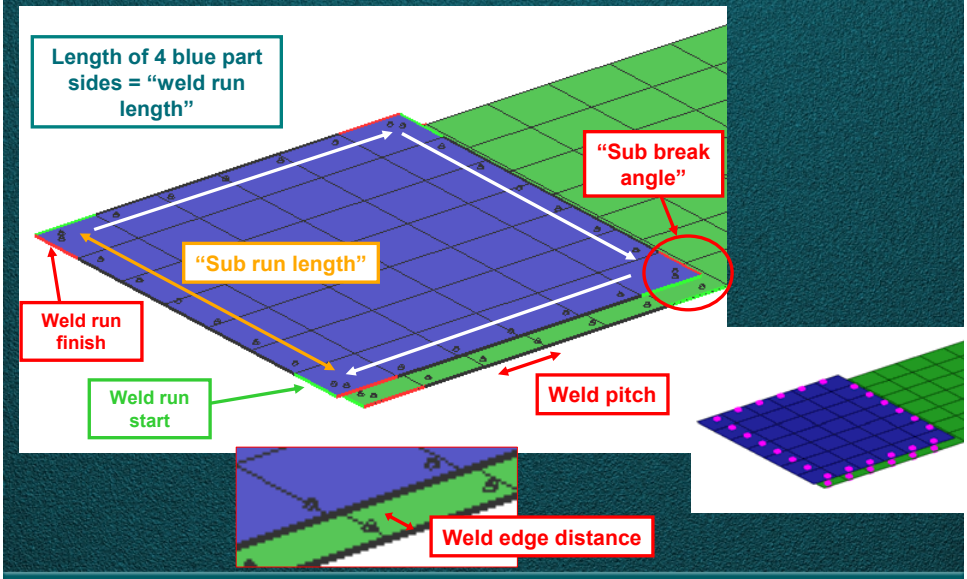
## Autowelding – explanation

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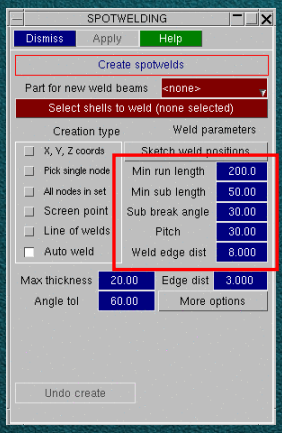
## Autowelding – user parameters




Primer allows the user to adjust several parameters to determine how the weld runs and points are calculated:

**Min run length** – all weld run lengths found must be greater than this length

**Min sub length** – weld runs are split up using the angle between each edge, the sub lengths must all be greater than this value

**Sub break angle** – determines the angle at which weld runs are broken up into sub lengths

**Pitch** and **Weld edge dist** – tell Primer how far along, and how far in from the edge run to weld

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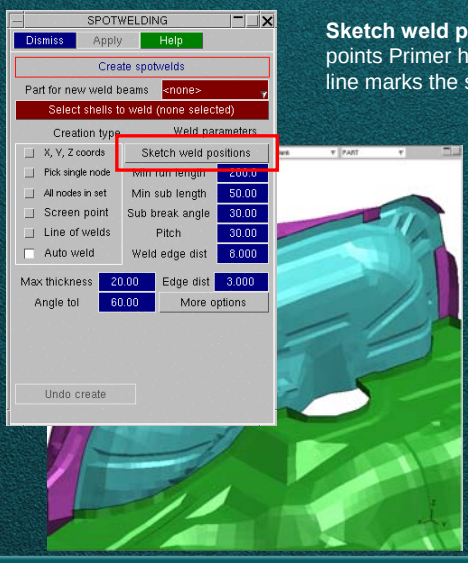
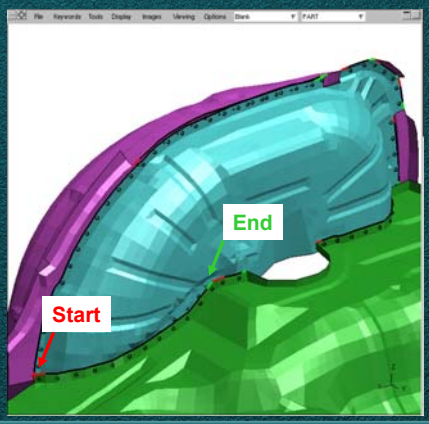
## Autowelding – Sketch positions




**Sketch weld positions** will sketch **all** the potential weld points Primer has calculated to attempt to weld. A **green** line marks the start of a run, and a **red** marks the end

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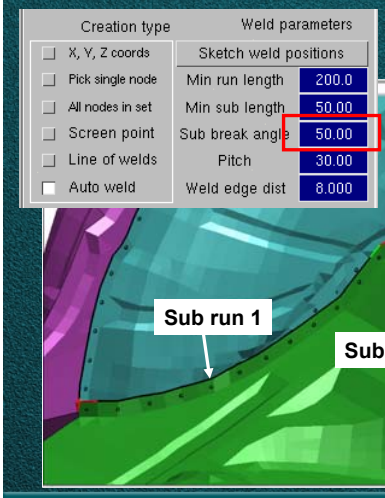
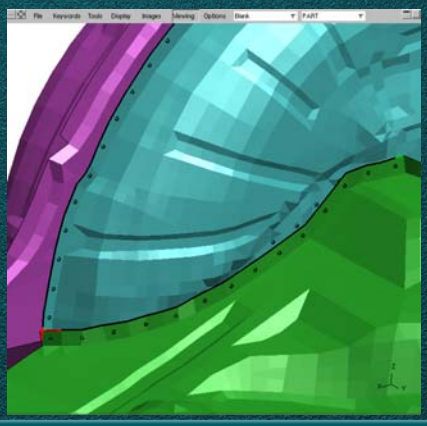
## Autowelding – parameters

By adjusting the **sub break angle** from 30 to 50 degrees, the two sub runs displayed on the left can be combined into one, resulting in a better distribution of weld points



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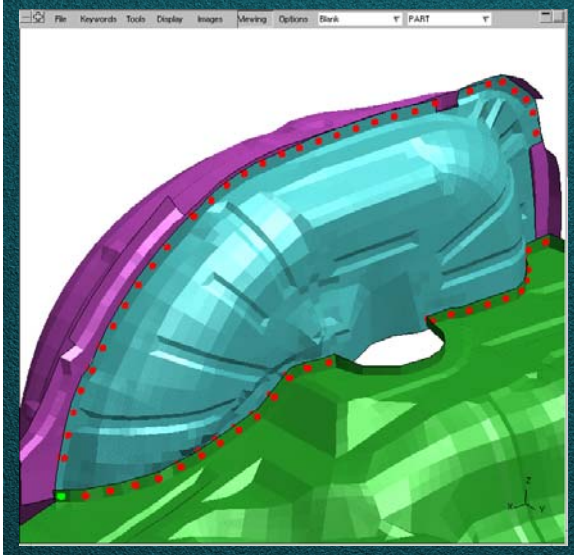
## Autowelding



The red dots are the successful 2-panel welds, and the green dots are the 3-panel welds

Even though there were weld runs (and therefore weld points) that were next to each other, the auto weld routine checks for proximity and will not weld any points that are too close to each other

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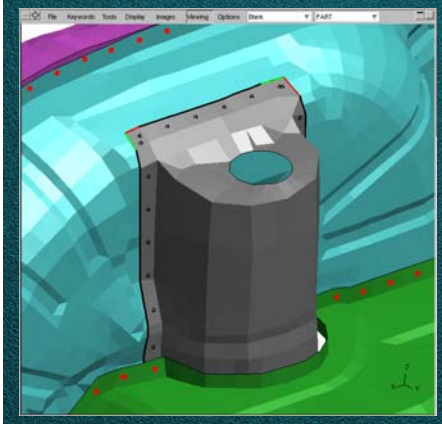
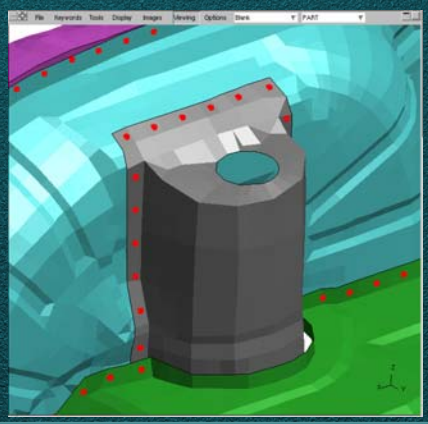
## Autowelding



Extra panels can easily be auto-welded in a model with current welds. The only step needed here was to define the shells to weld between the grey and cyan part



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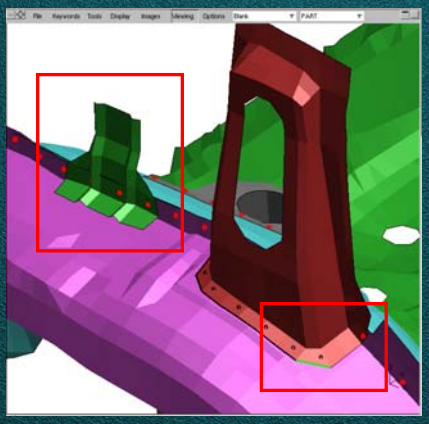
## Autowelding – parameters



Here, the red panel has a weld run that has stopped short of the edge because the **Sub break angle** is too small

The green panel has no potential points because the **Min run length** is too large

| Creation type | | Weld parameters | |
|---|---|---|---|
| X, Y, Z coords | | Sketch weld positions | |
| Pick single node | | Min run length | 200.0 |
| All nodes in set | | Min sub length | 50.00 |
| Screen point | | Sub break angle | 50.00 |
| Line of welds | | Pitch | 30.00 |
| Auto weld | | Weld edge dist | 8.000 |

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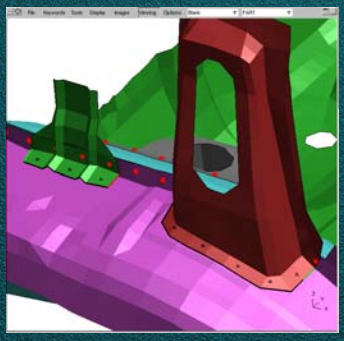
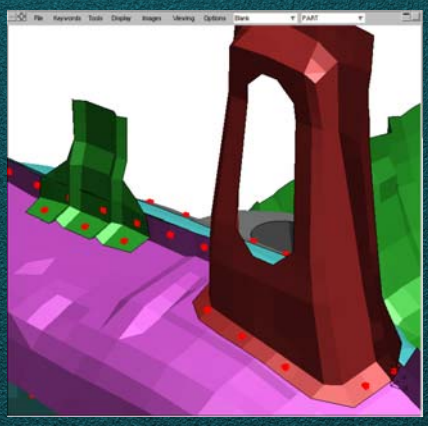
## Autowelding – parameters



By adjusting the parameters to the settings below left, Primer can find good auto-weld points without the user needing to manually create the welds



| Creation type | | Weld parameters | |
|---|---|---|---|
| X, Y, Z coords | | Sketch weld positions | |
| Pick single node | | Min run length | 50.00 |
| All nodes in set | | Min sub length | 50.00 |
| Screen point | | Sub break angle | 90.00 |
| Line of welds | | Pitch | 40.00 |
| Auto weld | | Weld edge dist | 8.000 |

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## "Rigidify" function

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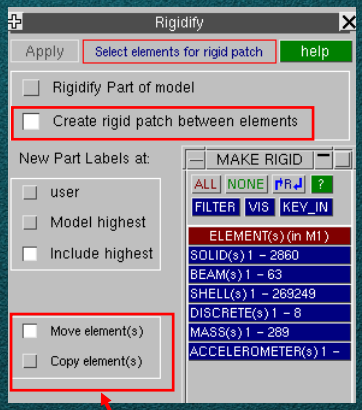
## Rigidify - creating rigid patches




Pick elements for each rigid patch and press Apply

Move or copy elements to new rigid part

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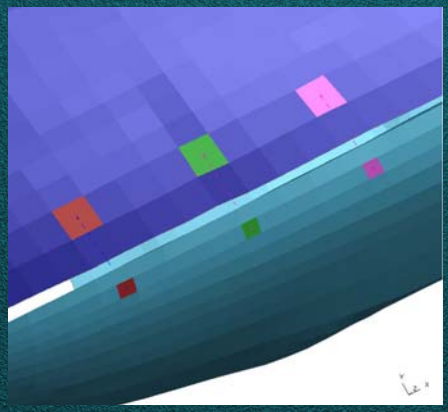
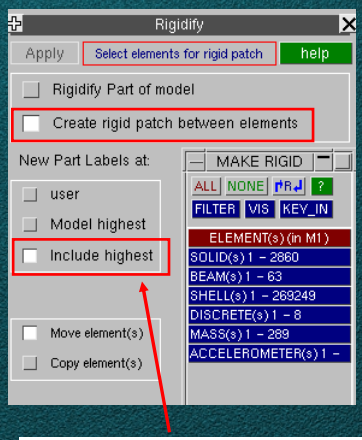
## Rigidify - creating rigid patches






Selected elements moved into new rigid parts and RB merge

New parts labelled at highest+1 in include file

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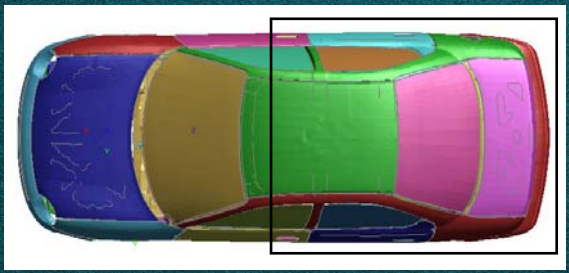
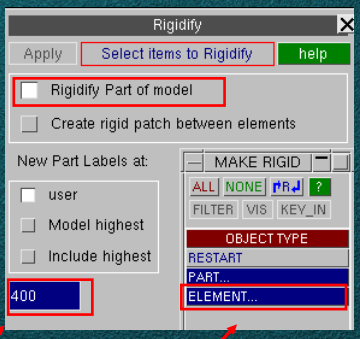
## Rigidify - Making part of a model rigid






Selected elements will be moved into new rigid parts created starting at user defined label

Select elements by screen area

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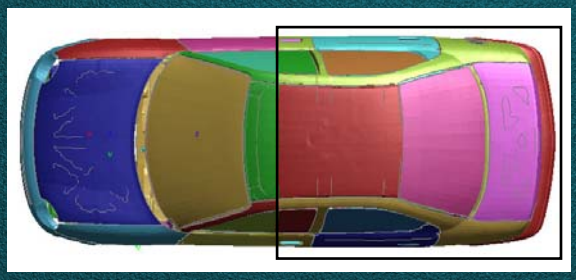
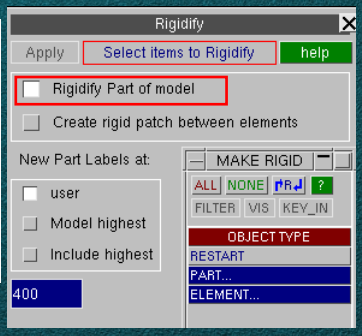
## Rigidify - Making part of a model rigid






Selected elements have been moved into new rigid parts. Thickness, density and elastic modulus are copied from original parts. Rigid body merges are created to join the new rigid parts together. The master rigid body is a new "dummy" part that does not itself have any elements.

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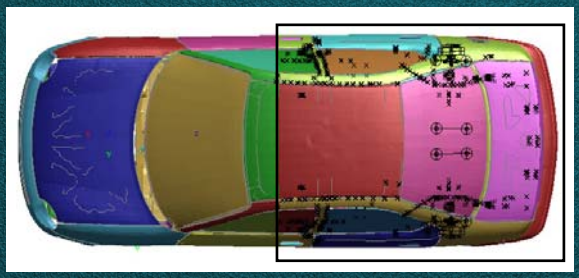
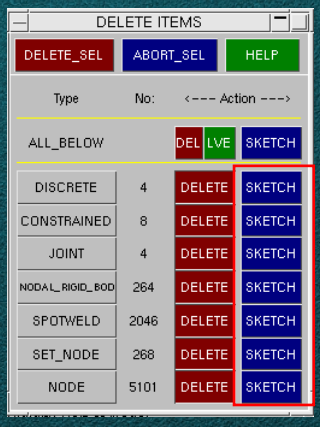
## Rigidify - Making part of a model rigid






On completion, delete function automatically called to remove invalidated constraints

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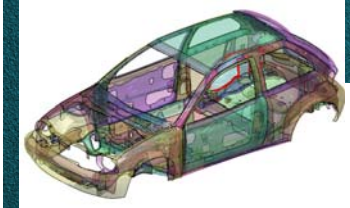
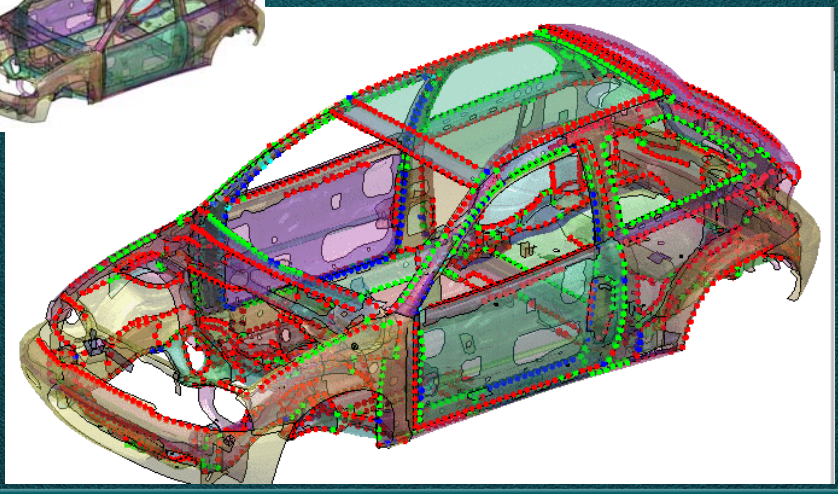
## Autowelding – potential

Primer can also weld an entire car in one go, although we don't recommend this as good practice!





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## Mesh independent airbag folding

**Demonstration**

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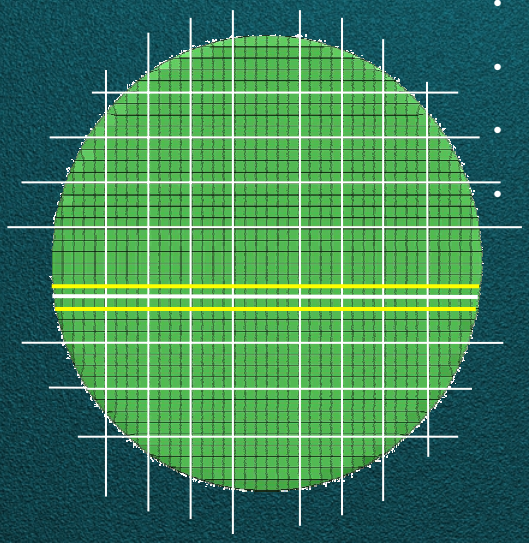
## Traditional folding process



- Time taken to work out fold pattern on initial flat shape
- Time taken to mesh, including constant-width “tram-lines”
- Need to start again if fold pattern is changed.
- Takes several hours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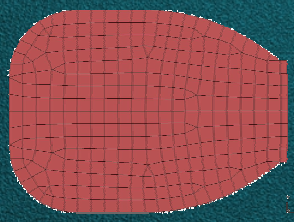
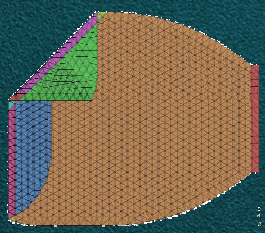
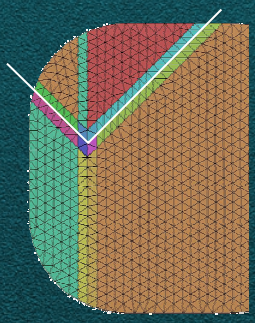
## Mesh-independent folding process



EITHER define size of circular airbag OR start with any arbitrary mesh that defines the outline shape





Primer re-defines the mesh appropriate to each fold. The “tramlines” parallel to each fold are automatically generated. Reference geometry is automatically updated to the new mesh.

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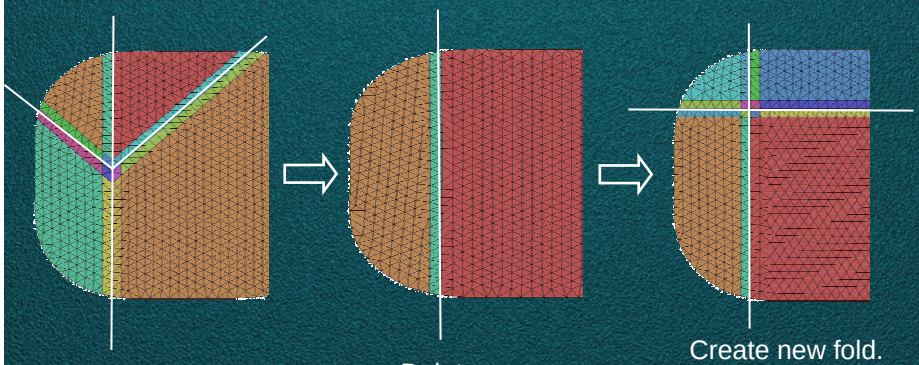
## Changing a fold



Delete unwanted fold…

Create new fold. Mesh is automatically changed.

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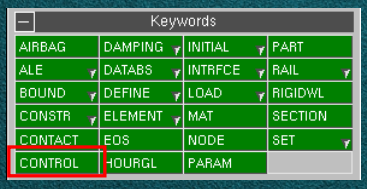
## Set DT2MS



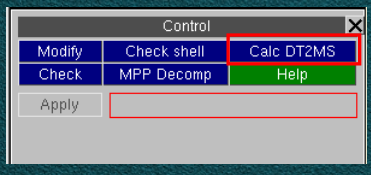

**CONTROL >> Calc DT2MS**

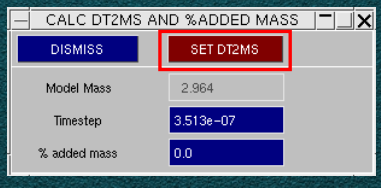
**Enter timestep and % added mass is calcd**

**Or**

**Enter % added mass and timestep is calcd**

**Press SET DT2MS to set the timestep**

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## 64bit versions

32bit executables limited to approx 2Gb.

Manipulating huge models may require more Memory. 64bit executables give this.

64 bit executables available for
- HP PA-RISC
- HP Itanium
- SGI Irix
- IBM AIX
- SUN Solaris

Windows 64bit: awaiting official release of OS.
Linux 64bit: under development

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## Version 9.1 Beta 1 available now

Contact DYNAmore for details

## Version 9.1 available in November

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