

Cut Section

Model courtesy of the NHTSA website:

www.ncac.gwu.edu



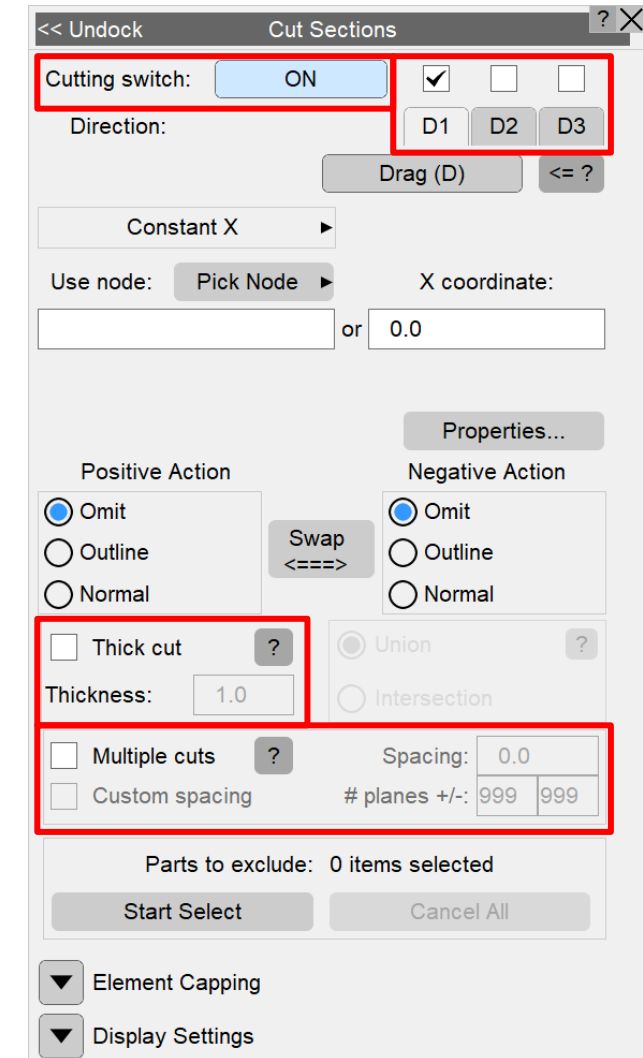
What is Cut Section?

- A cut section, sometimes referred to as a “cutting plane”, is a flat plane that cuts through the model.
- A cut section may be located anywhere in space and oriented at any angle.
- Cut sections allow users to more easily investigate model contents.
- Cutting planes in up to 3 directions can be easily turned on/off as well as modified/dragged through the model interactively.



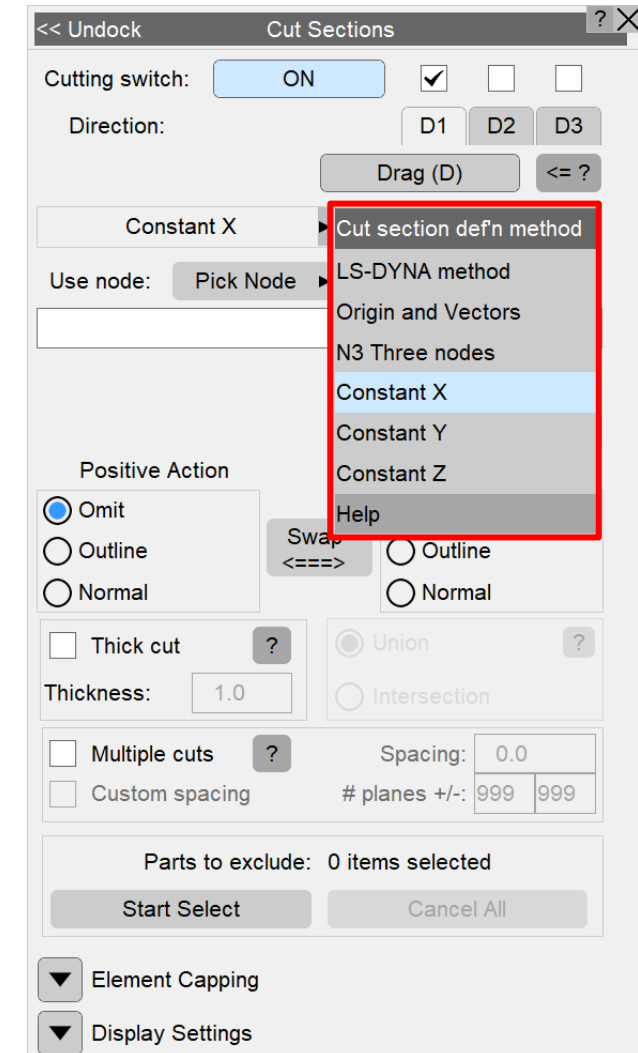
Cut Section Options

- “Cutting Switch” turns on/off the cut section or multiple cut sections all at the same time.
- Only cut direction D1 is active by default, but cut planes can be defined in up to 3 directions D1, D2, D3.
- Using the “Thick cut” button allows the user to define “slice” through the model of a particular width.
- By default only a single cut section plane is drawn, but the user can choose to have multiple parallel cuts drawn on the structure in each of the up to 3 directions.



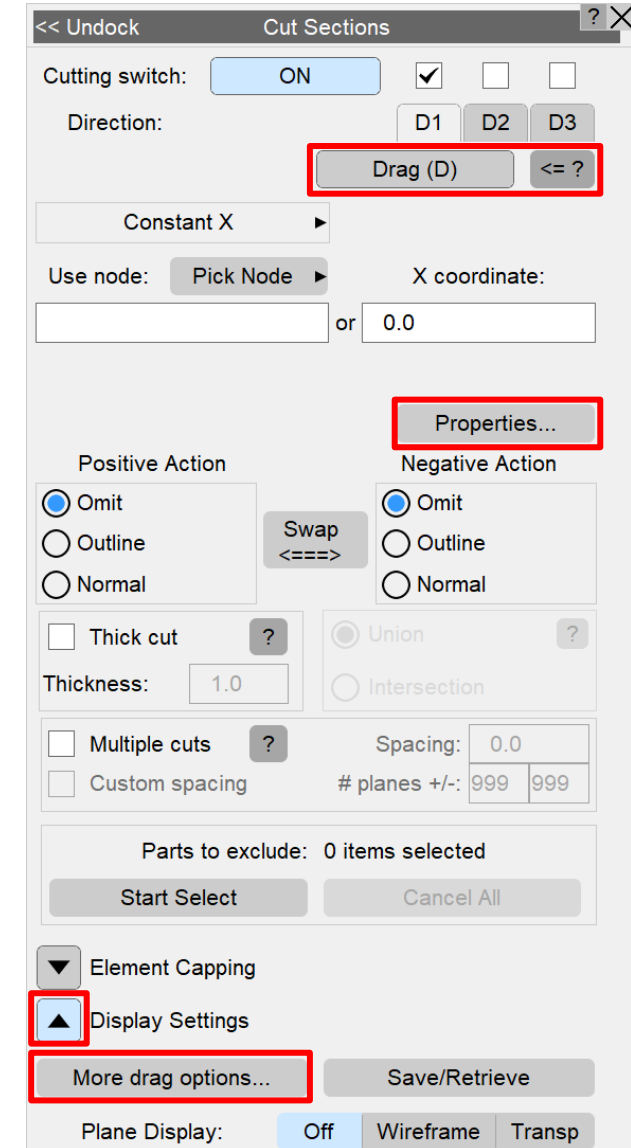
Defining a Cut Section

- There are 6 possible methods to define a cut section:
 - LS-DYNA method – Origin Coordinate, normal vector (N) 'head' coordinate, and in-plane axes.
 - Origin and Vectors – Define an origin coordinate, normal vector and in plane vector.
 - N3 Three Nodes – Nodes at the origin, head of normal vector and in the XY plane.
 - Constant X/Y/Z – Aligned with the global X/Y/Z axes with the origin at a given position on the axis.



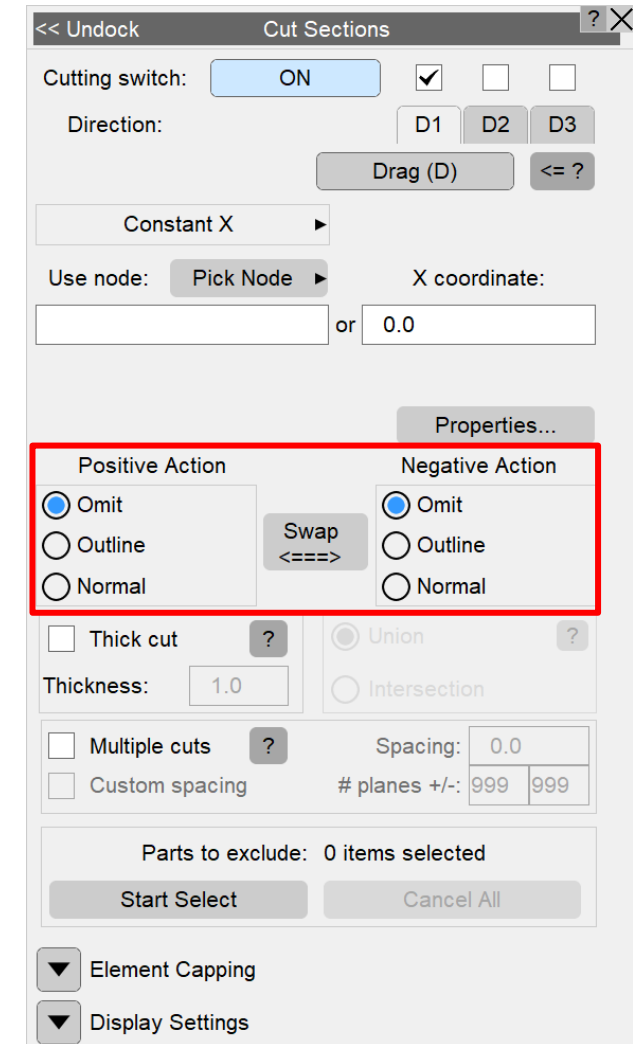
Dragging Cut Section

- The “drag” cut section operation allows the user to translate the cut along the plane normal (local Z vector) or to rotate it about its local X or Y axes.
- The default operation when dragging is invoked is:
 - Left mouse – Translate in plane local X.
 - Middle mouse – Rotates about plane local X.
 - Right mouse – Rotates about plane local Y.
- Other dragging degrees of freedom are available through “More drag options” under “Display Settings”.
- “Properties” will calculate various elastic and plastic properties based on the current cut section.



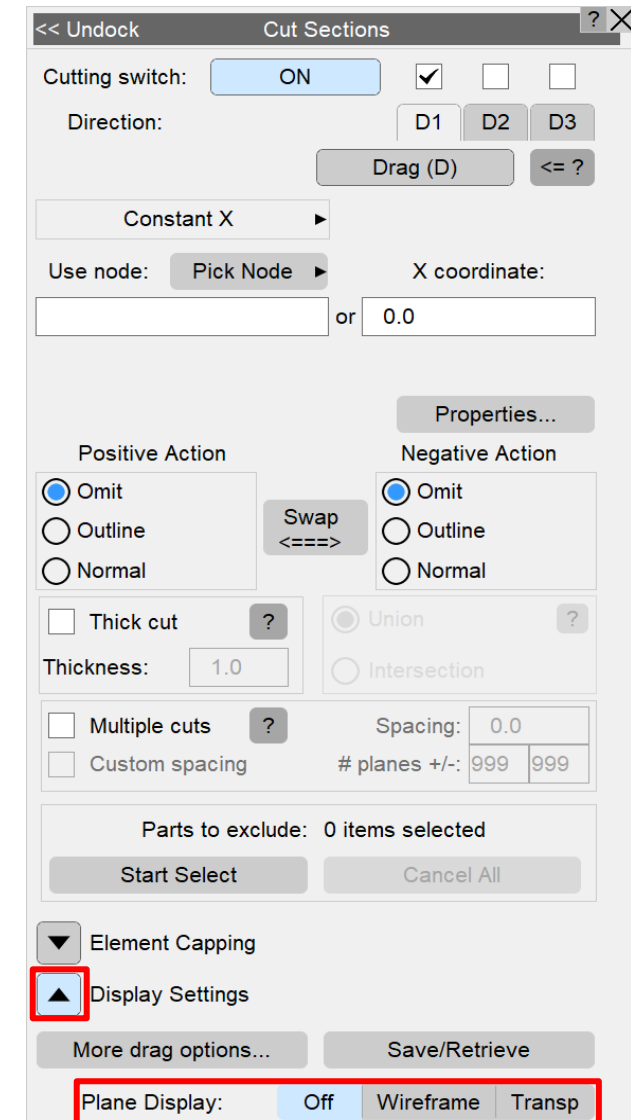
Positive and Negative Action

- This controls how the model on either side of the plane is rendered.
- By default the cutting plane itself is always rendered in the current display mode, but for each side of the cutting plane you must choose how the image is to be rendered:
 - Omit – means that it will not be drawn at all.
 - Outline – means that it will be drawn in a wireframe outline, in the edging mode of the current display mode.
 - Normal – Means it will be drawn in the current display mode.
- Note that “Swap” simply swaps the positive and negative display modes and redraws.



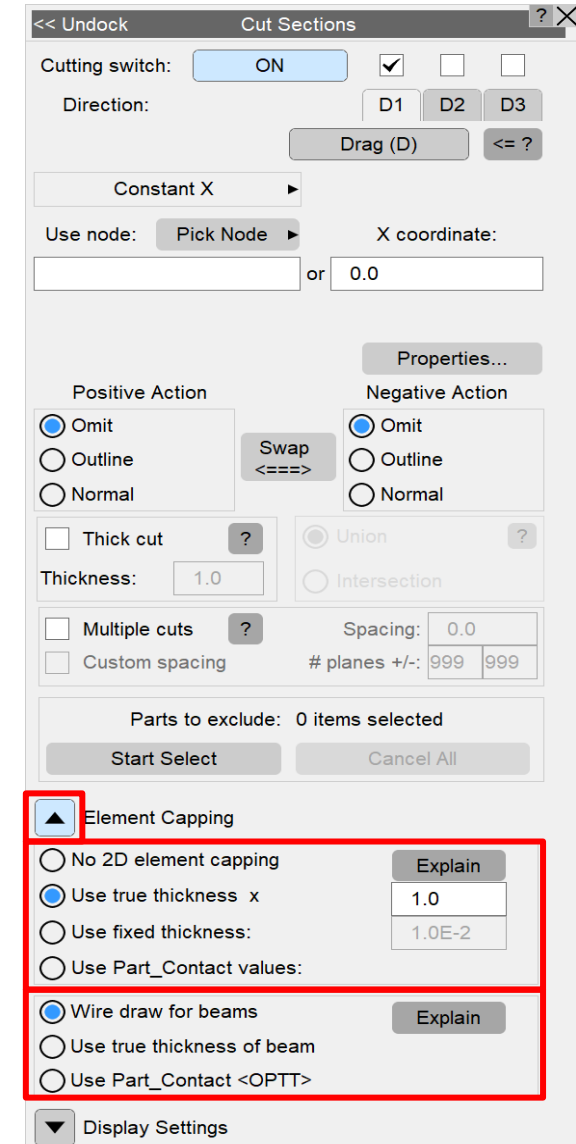
Plane Display

- This option under “Display Settings” changes how the plane itself is displayed. It is possible to draw the plane in one of the two modes:
 - Wireframe – Draws the plane boundaries and a diagonal as a wireframe overlay on the plot.
 - Transparent – Draws the plane as a partially transparent rectangle, occupying model space and intersecting the structure.

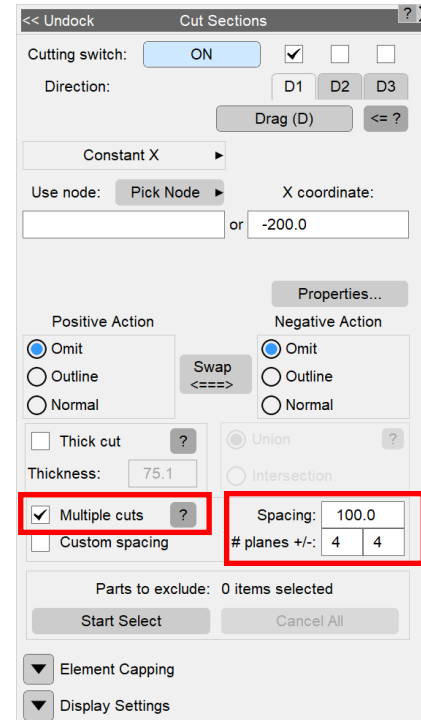
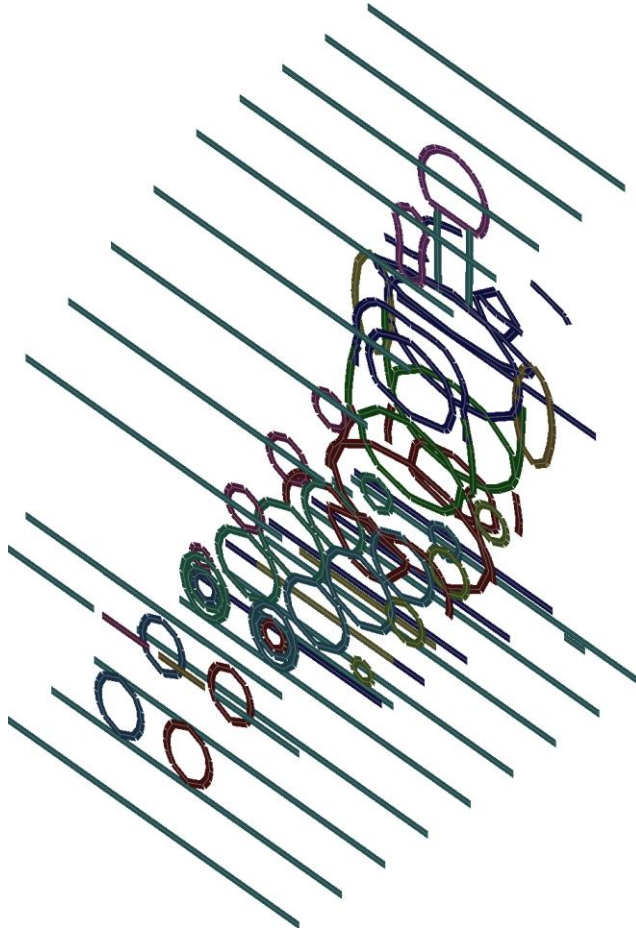


2D Element Capping

- 2D element capping controls how the cut edges of 2D elements (shells) are displayed.
- When shell elements are cut it is possible to draw their cut edges in four modes:
 - No 2D capping – The cut is simply displayed as a line but no thickness.
 - True thickness (x factor) – Extracts the true shell thickness, multiplies it by a user specified factor and uses that value.
 - Fixed Thickness – Uses a constant value of thickness in the model space units for all shells.
 - Use Part_Contact values – For shells on a Part Contact card contact thickness and scale factor are taken into account.
- Beams may be drawn as true section or circular section with diameter defined by OPTT on Part Contact

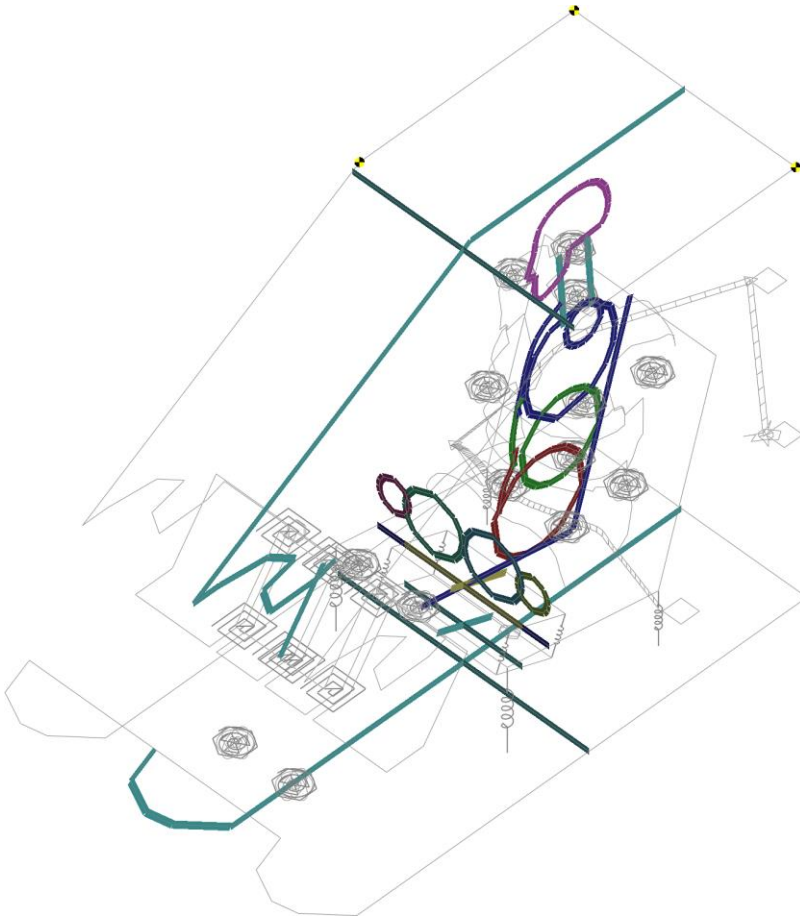


Multiple parallel cuts

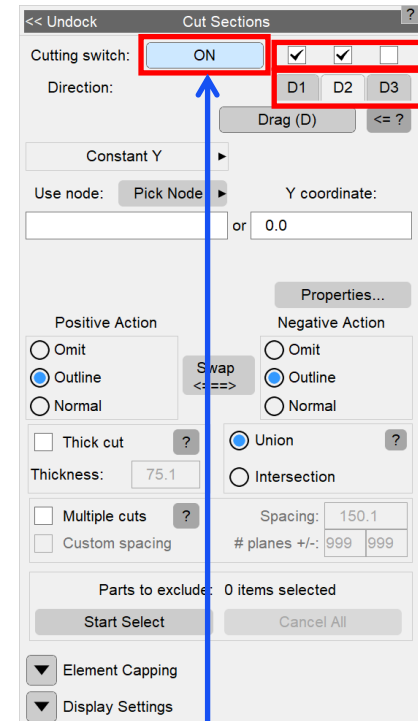


Multiple cuts will offset the cut plane by multiples of the given Spacing, where the numbers of positive and negative planes can be defined as well.

Multiple cut directions



Up to three cut directions can be turned on or off here individually.

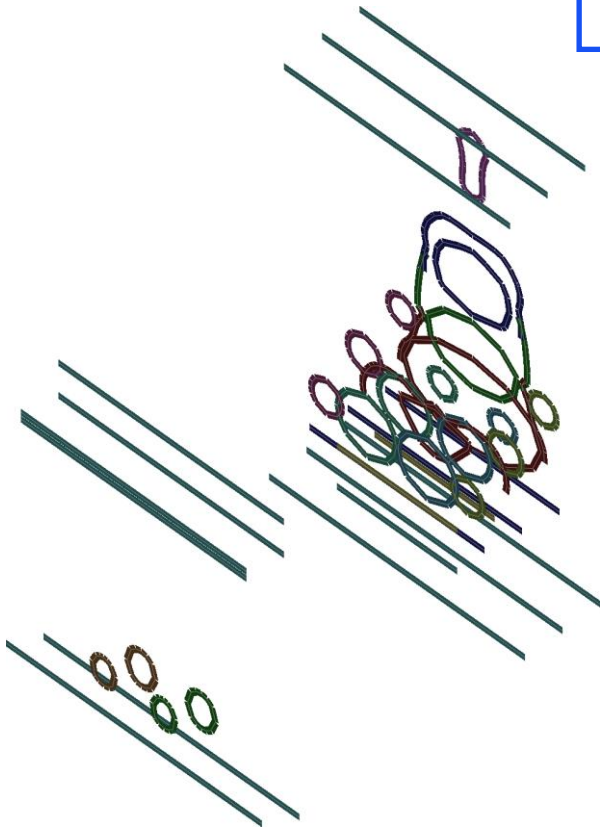


Each direction has got its own definition method (constant X, Y, Z etc.) and positive and negative actions. To view or modify these properties for one cut direction, select the **D1**, **D2** or **D3** tab here.

The cutting switch applies to all directions together.

Custom spacing

Custom spacing allows to define any sequence of offsets relative to the cut origin, which is not necessarily uniformly spaced.



CUT SECTION CUSTOM SPACING

Positions relative to local cut origin Done

Number of parallel planes 5

Add position:

Sort positions

1	▶	-700.0
2	▶	-600.0
3	▶	0.0
4	▶	100.0
5	▶	200.0
6	▶	undefined
7	▶	undefined
8	▶	undefined
9	▶	undefined
10	▶	undefined
11	▶	undefined
12	▶	undefined
13	▶	undefined
14	▶	undefined

<< Undock Cut Sections ? X

Cutting switch: ON ☒ ☐ ☐

Direction: D1 D2 D3

Drag (D) <= ?

Constant X ▶

Use node: Pick Node ▶ X coordinate: or -200.0

Properties...

Positive Action

☒ Omit ☐ Outline ☐ Normal

Swap <====>

Negative Action

☒ Omit ☐ Outline ☐ Normal

☐ Thick cut ? Union ?

Thickness: 75.1

☒ Multiple cuts ?

☒ Custom spacing

Edit spacing

Parts to exclude: 0 items selected

Start Select Cancel All

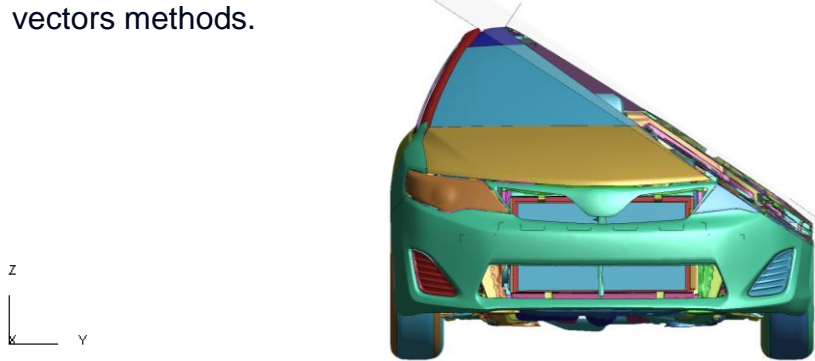
▼ Element Capping

▼ Display Settings

Cut Section – Definition method

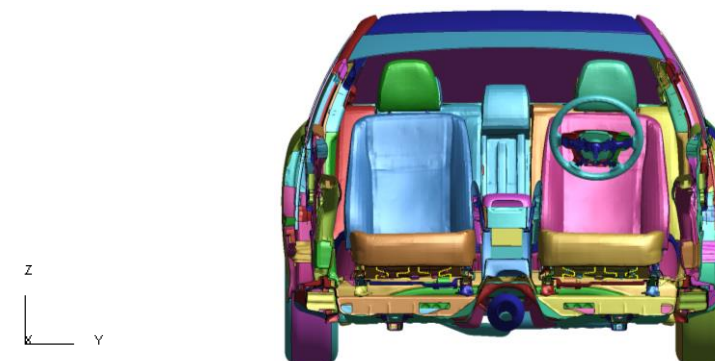
General Plane:

A general plane at any location/angle can be created by using the 3 nodes, LS-DYNA and the origin and vectors methods.



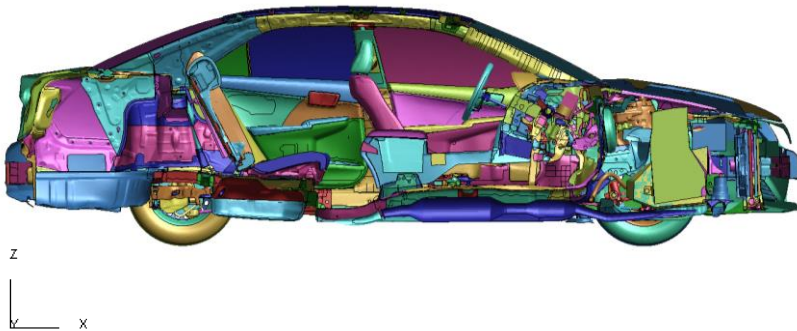
Constant X:

A node is picked where the cut section plane is formed along the x co-ordinate of the picked node.



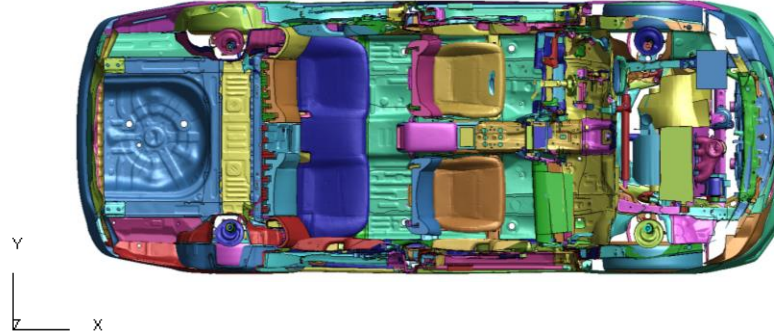
Constant Y:

A node is picked where the cut section plane is formed along the y co-ordinate of the picked node.



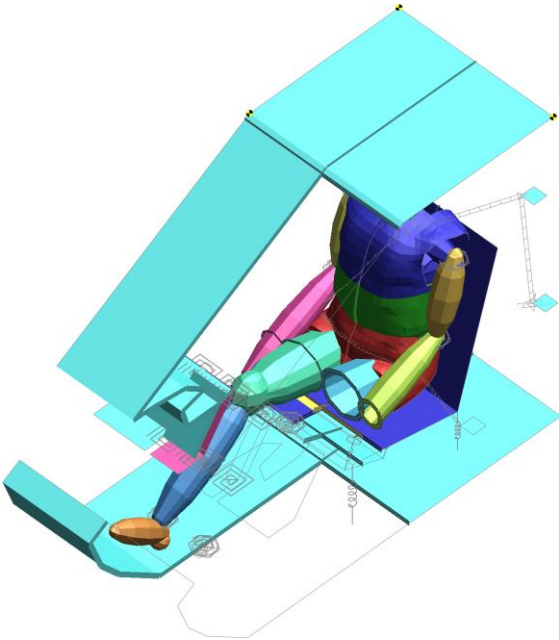
Constant Z:

A node is picked where the cut section plane is formed along the z co-ordinate of the picked node.

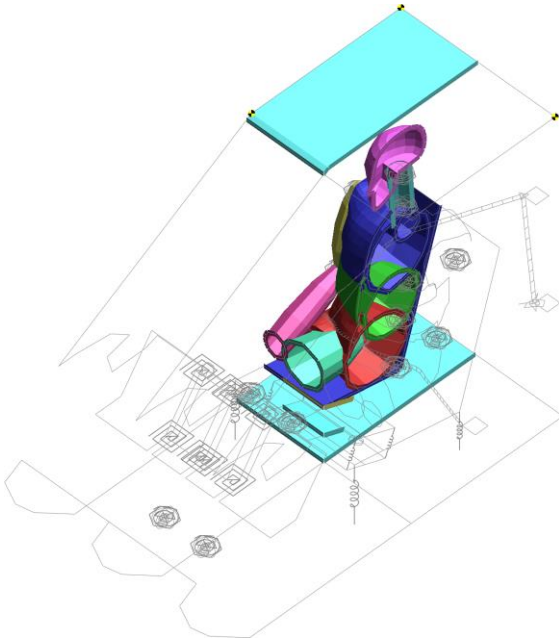


Union and intersection

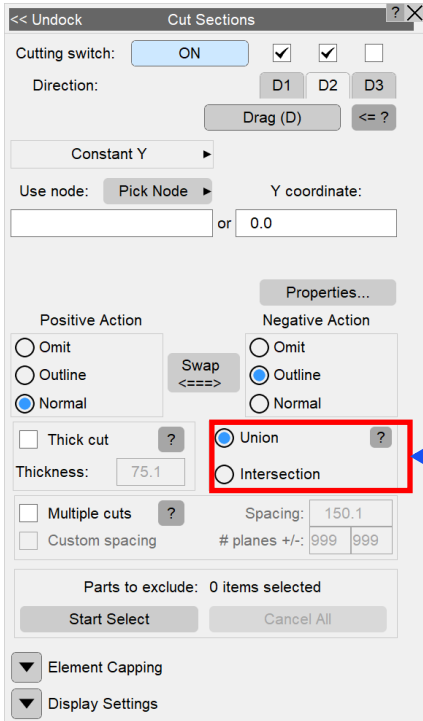
Positive and negative actions for multiple directions can be combined in either union or intersection mode.



Union



Intersection



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