Instrument Panel Pendulum Impact

What is the IPP function?

- The IP Pendulum function can be used to specify multiple Instrument Panel Pendulum impact models for ECE R21 or FMVSS201.

- This function is accessed under “Safety” → “IP Pendulum”.

- The IPP function supports interactive and batch model processing. Automated positioning and depenetration is available.

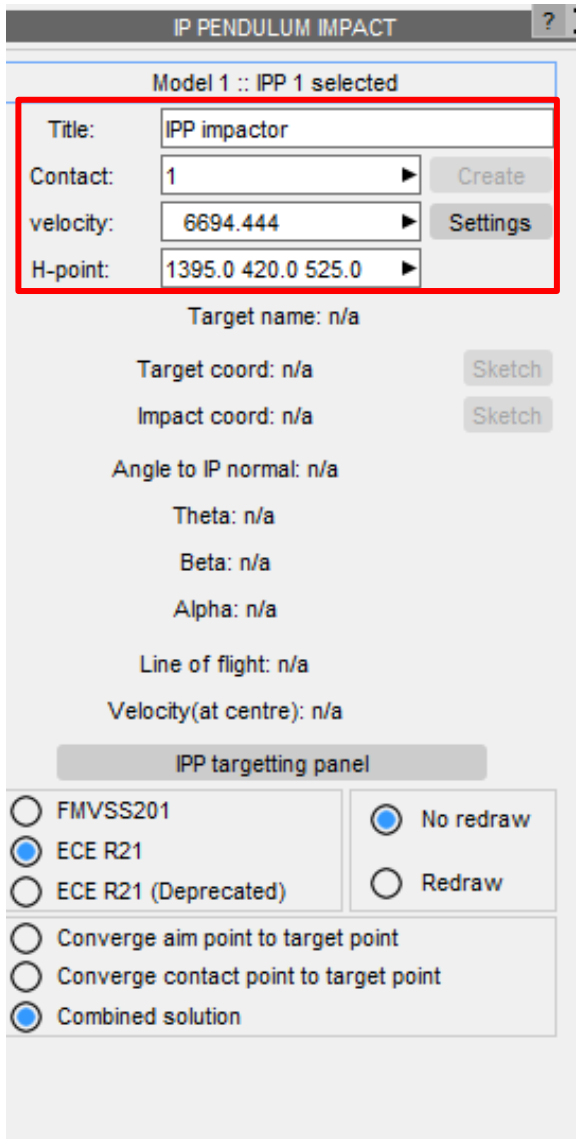
- The IPP impactor model for use with this tool can be found in $OA_INSTALL/primer_library/Arup_Pendulum — where $OA_INSTALL represents the directory where the software is installed.

General Description of the Panel

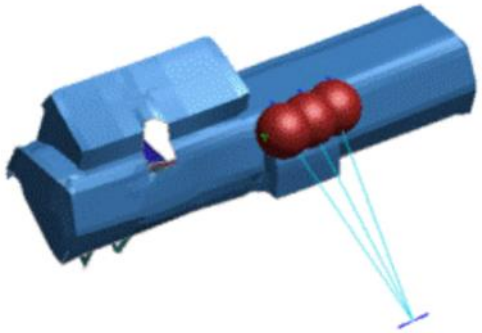
IP Pendulum Impact Panel

Note: the impactor must be added as an include into the model containing the trim to activate the IP Pendulum tool.

- **Contact** – A contact must be defined between the impactor and the vehicle dashboard.
- **Velocity** – This is the linear velocity at centre of the impactor.
- **H-Point** – Coordinates of H-Point to use in the setup. The base of the IPP pendulum model will be positioned to this point.

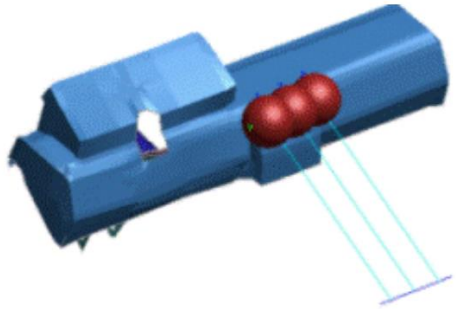


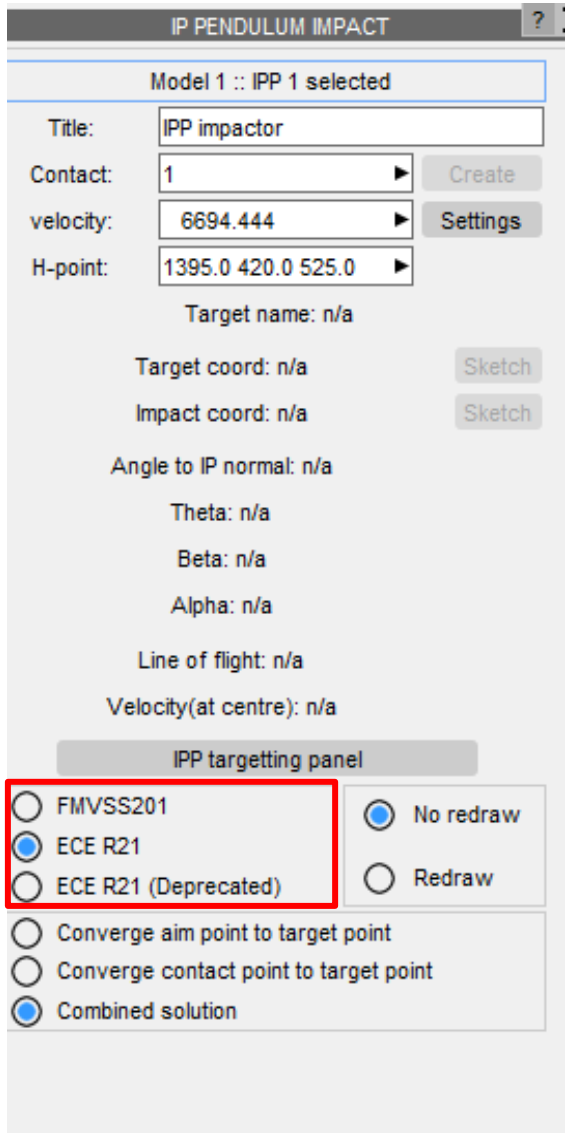
IP Pendulum Impact Panel



- **ECE R21** – In default mode a subsequent DEFINE_TRANSFORMATION is applied to rotate the line of flight onto the trim normal if the impact angle is more than 5 degrees.
- **ECE R21** (**Deprecated**) – The base of the pendulum is located at the H-point.

- **FMVSS201** – After achieving a position the base is translated in Y to align with each impact point.



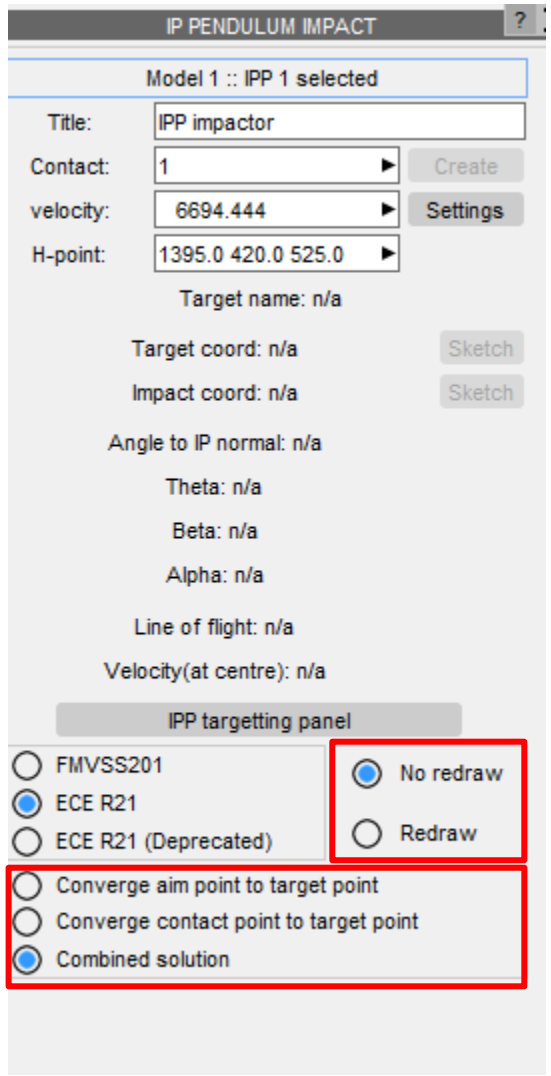


IP Pendulum Impact Panel

- **Converge aim point to target point** – The aim point of the impactor is aligned with the specified target point.

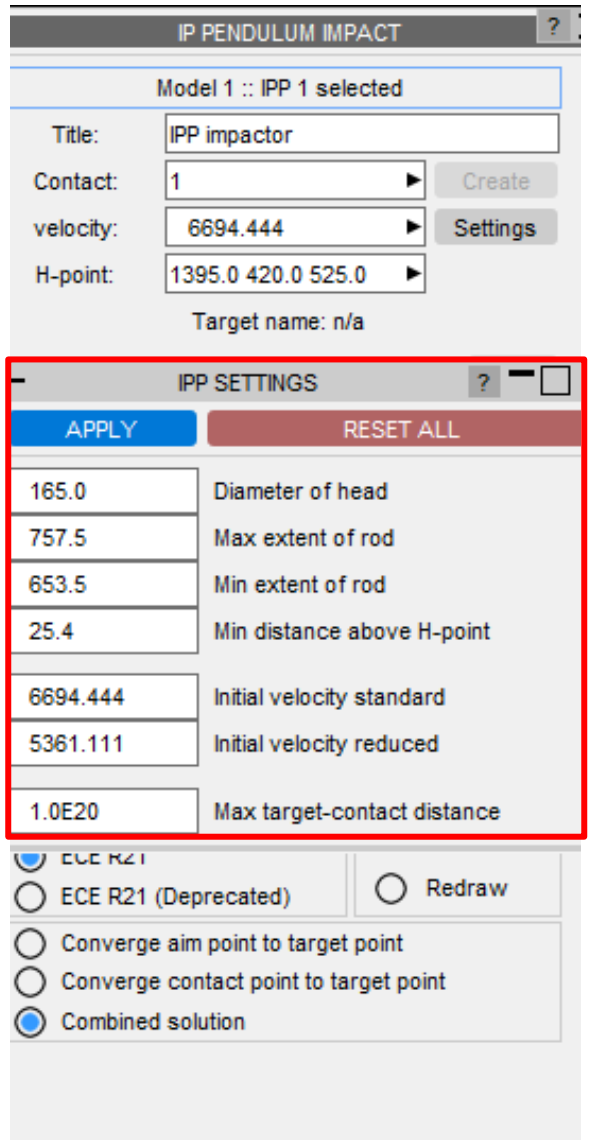
- **Converge contact point to target point** – The initial contact point between the impactor and the vehicle is aligned with the specified target point.

- **Combined solution** – Take into account both aim point and initial contact point when positioning to the specified target point – this tries to minimize both aim point to target distance and contact point to target distance.



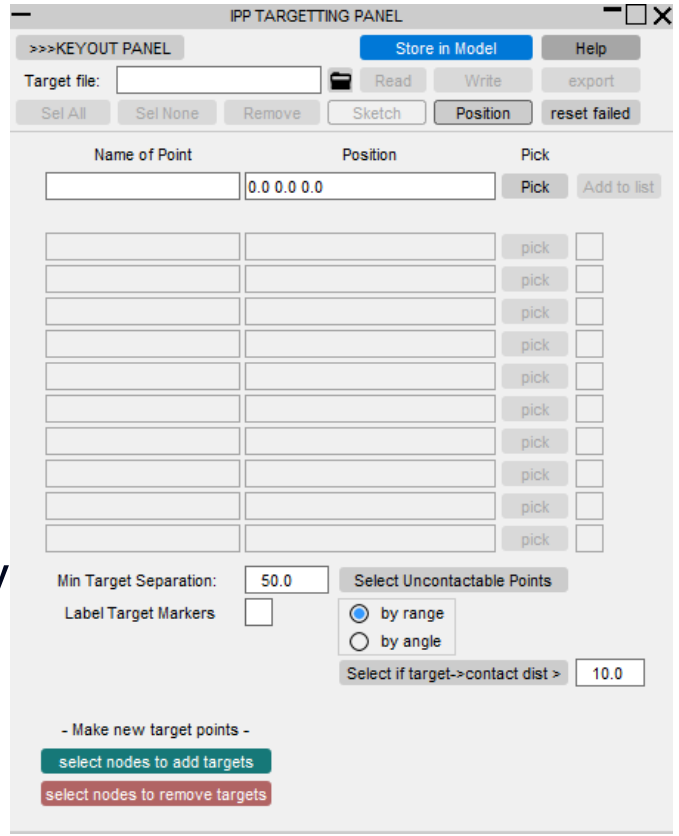
IPP Settings Panel

- Default settings are available for both ECER21 and FMVSS201. The settings are applied depending on the option selected.
- The max/min achievable distance between the H-point and target points are:
  - Rod max extent + head diameter/2
  - Rod min extent – head diameter/2
  - Targets that fall outside of these bounds are rejected as grossly out of range, as they can never be reached.
- For acceptable target points, the head will be positioned so that the contact point is as close as possible to the target point.
- The rod distance is then measured and the point rejected if it exceeds the max rod extent or is less than the minimum.
- **Initial Velocities** – Defaults are set in the post-end IPP *VELOCITY card.
- **Max target-contact distance option** – When positioning is complete the distance between the target point and the contact node will be measured and the point rejected if it exceeds the given value (default 1e20).



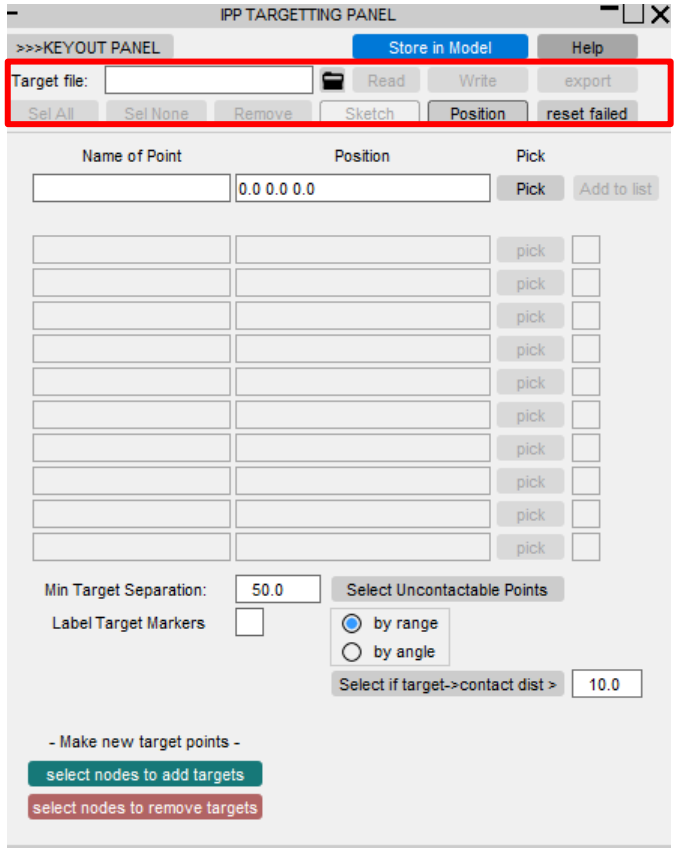
IPP Targeting Panel (Setup Panel)

- The IPP targeting panel displays existing targets within the model.
- A CSV file can be read in using the “Read” button to load new points.
- New target points can also be added using the “select nodes to add/remove targets” buttons – this will automatically determine a cloud of impact points on selected nodes using the “Minimum target separation” value and the pendulum reach specified in the settings on the previous panel.
- Prior to the positioning, target points appear on a light blue background if they are misaligned with the trim normal. This indicates that they probably cannot be contacted by the pendulum.
- A white background shows that the points are not yet positioned, green that they are successfully positioned, red that they failed to position.



IPP Targeting Panel (Setup Panel)

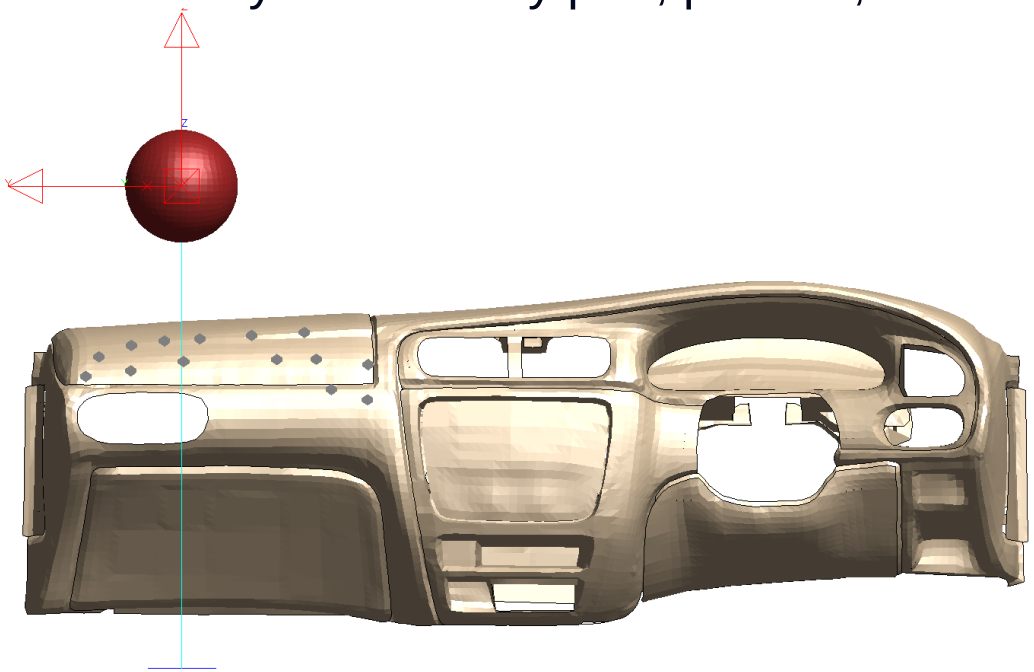
- **Write** – Writes the targeting information to a CSV file. This can be used to import at a later date, or for batch positioning.
- **Export** – Export detailed information on setup for each point after positioning.
- **Sel All** – Selects all the target points shown in the list.
- **Sel None** – Deselects any target points that are selected in the list.
- **Remove** – Removes any selected target points.
- **Sketch** – Sketches any selected target points.
- **Reset failed** – Resets the target points that have failed to position so you can try again.
- **Pick** – Allows the user to manually pick the node for target point.
- **Label Target Markers** – will configure sketch so each target point is labelled with the name.

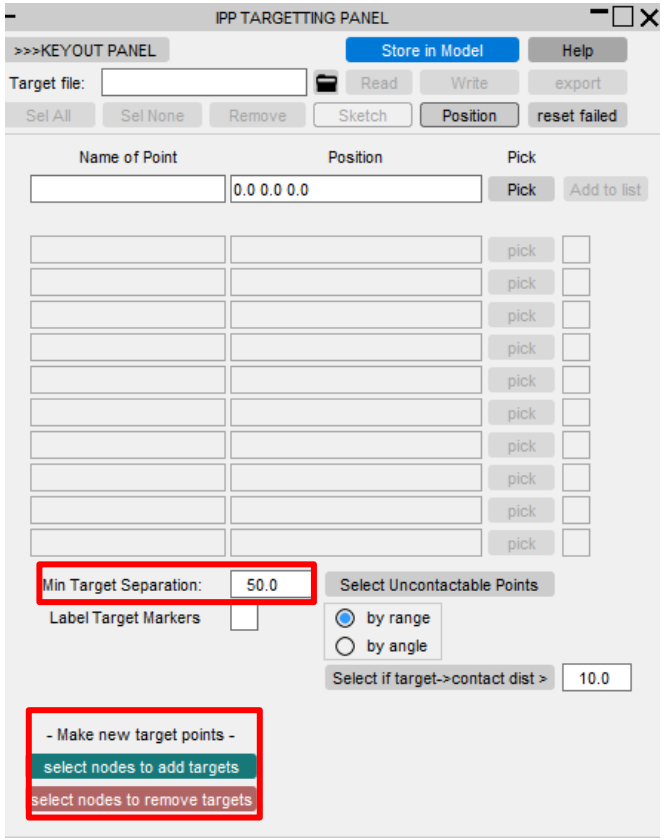


Automatically Selecting Targets

- **Select nodes to add targets** – By selecting a group of nodes (you can select by part, part set etc.) PRIMER will determine which points within the selection can geometrically be reached. Note the “Min target separation” setting is used to create a suitable cloud of target points. This value can be set by user.

- **Select nodes to remove targets** – By selecting this option you will be able to automatically remove all targets on selected nodes. Selection may be made by part, part set, etc.

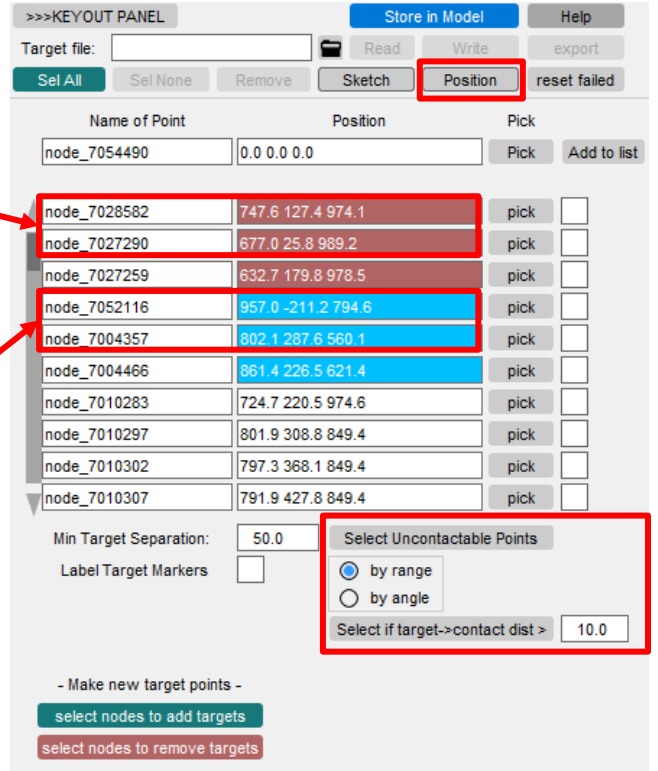




Grey dots indicate target points that have been identified.

Dealing with Uncontactable points

- **Select Uncontactable points** – Selects any target points that can not be contacted. You can select by two methods:
  - **By range** – Points are un-contactable by range if the distance from H-point to target point exceeds the maximum allowable. (red background)
  - **By angle** – Points are considered un-contactable by angle if the angle between the trim normal and the line of flight exceeds 45 degrees. Line of flight is taken to be the cross product of horizontal and line between H-point and target point. (light blue background)



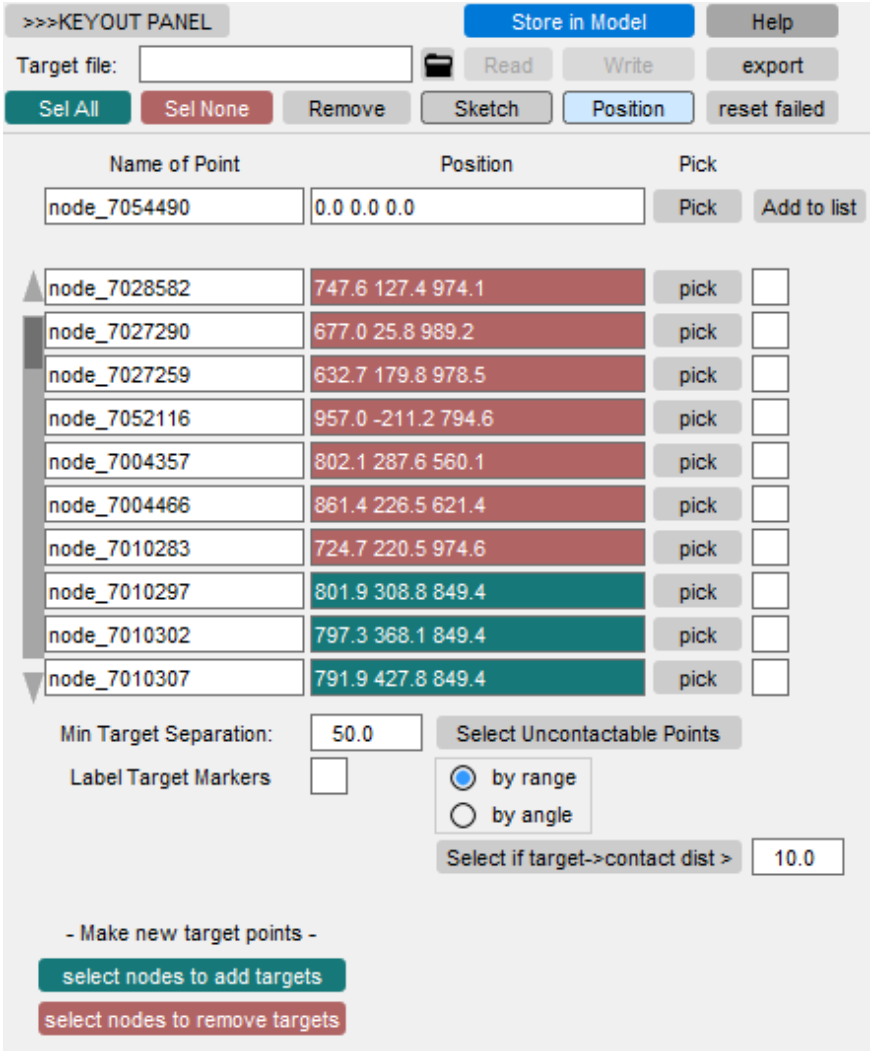
- **Select if target -> Contact dist >** - This function allows you to select positioned targets for removal when the distance from initial contact point to target point exceeds the specified value

Positioning of targets

- When the “Position” button is clicked, the impactor is positioned at selected target points and de-penetrated.

- Following this process, there may be some targets that the impactor could not reach and these will be highlighted red which can then be removed by selecting the points by range and by angle respectively.

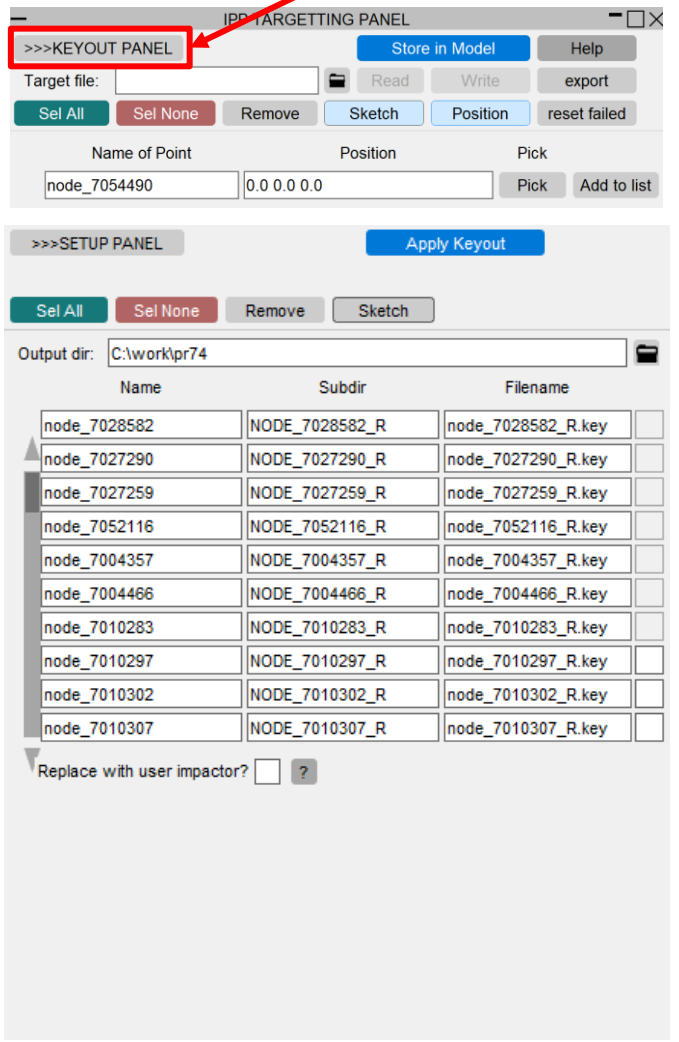
- A green background indicates that the targets were positioned successfully in reach of the impactor.



Keyout Panel

- All the positions can now be written to individual models.
- This can be done by switching to the “Keyout Panel”.
- File path, sub-directory names, and file names can be modified by users prior to keyout.
- **Replace with user impactor? –**
  - If the pref is set and the switch is active, PRIMER IPP build will be performed in the usual way but before the keyout, the IPP impactor will be replaced with the user impactor as specified by the preference.
  - The initial build may be done in ECE R21, ECE R21 (deprecated) or FMVSS201 (hinge point aligned in Y).
  - The user impactor will be oriented into position and moved to a point of contact along the line of flight (linear depenetration).

How to access the Keyout panel



Contact us

Oasys
LS-DYNA Environment

Global / UK
T: +44 121 213 3399
E: dyna.support@arup.com

India
T: +91 40 69019723 / 98
E: india.support@arup.com

China
T: +86 21 3118 8875
E: china.support@arup.com

USA
T: +1 415 940 0959
E: us.support@arup.com

Subscribe to
our newsletter:

Follow us on:

@Oasys LS-DYNA Environment

@Oasys LS-DYNA Environment

@Oasys

@Oasys

www.oasys-software.com/dyna/