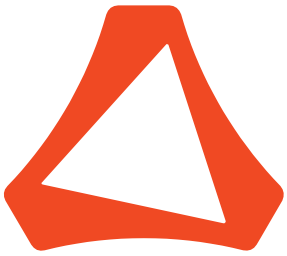

ALTAIR

ONLY FORWARD

Altair Safety Report Manager 2022.3

Side Impact Modules

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2022.3

March 17, 2023

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When contacting Altair support, specify the product and version number you are using along with a detailed description of the problem. It is beneficial for the support engineer to know what type of workstation, operating system, RAM, and graphics board you have, so include that in your communication.

Location	Telephone	E-mail
Australia	+61 3 9866 5557	anzsupport@altair.com
Brazil	+55 113 884 0414	br_support@altair.com
Canada	+1 416 447 6463	support@altairengineering.ca
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Malaysia	+60 32 742 7890	aseansupport@altair.com
Mexico	+52 55 5658 6808	mx-support@altair.com
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Altair Safety Report Manager

The Altair Safety Report Manager (aka ASRM) is a fully customizable automatic report generation utility for crash & safety regulations. It allows users to create a First Sight Report PPT for the selected impact type & regulation. The PPT report which consists of plots & animations that are generated based on various inputs entered by the user.

A standard report is delivered for each mode with the following info and contents.

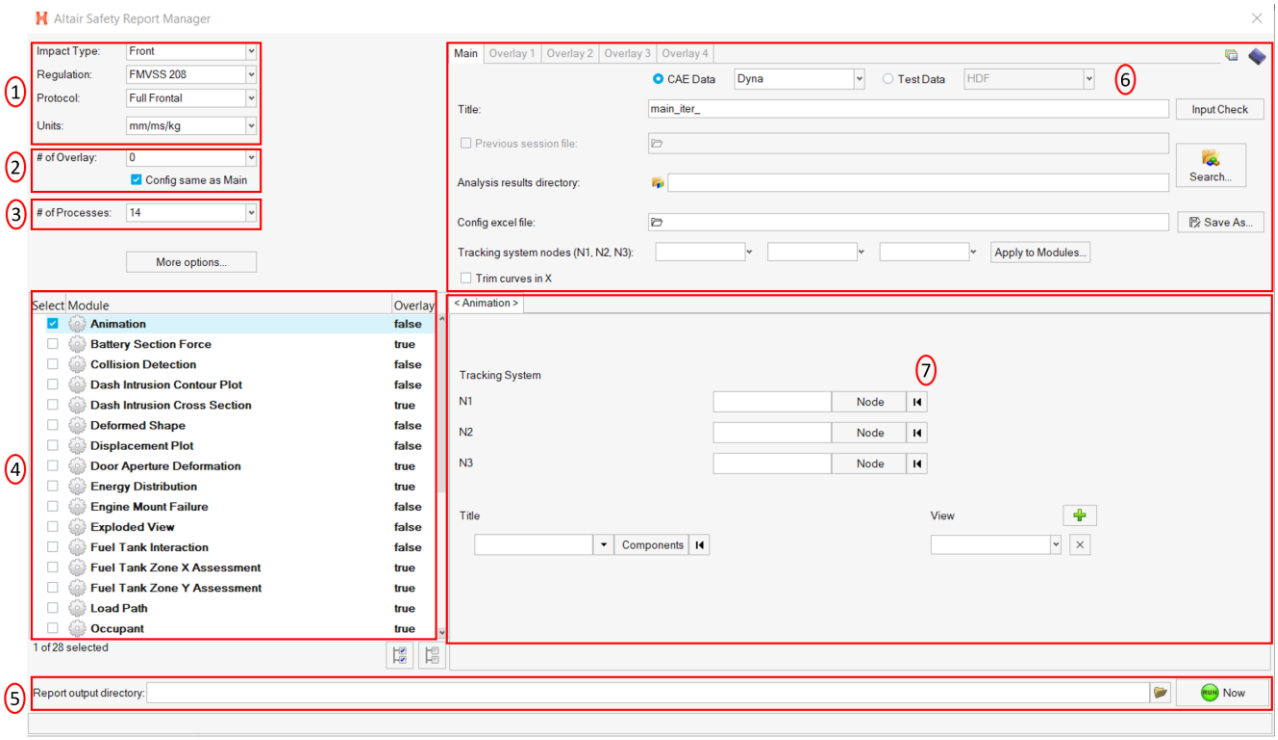
- Model information
- Run quality statistics
- Occupant requirements
- Structure requirements
- Structure overview
- User defined plots

In addition, HyperView template & session files are created at the end of report generation which contains all plots/animations for closer analysis. It has the capability to overlay plots from different iterations. It is also possible to overlay plots with test data in HyperView.

The ASRM utility can also be run on HPC after job completion.

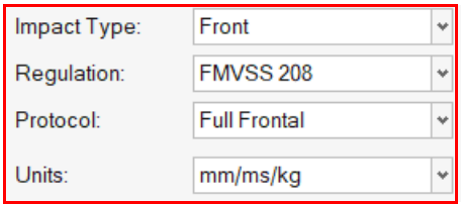
ASRM GUI Overview

Below is a snapshot of the ASRM GUI. To understand the ASRM workflow better, the GUI is divided into various sections as highlighted & numbered in the below picture. The main functionality of all the sections is briefly described below.



Impact Type & Units selection Section

In this section, user will be able to select the Impact Type, Regulation, and the Protocol for which he / she wants to generate the PPT report. Based on this selection the modules list (section #4) gets updated.



Overlay selection section

In this section user will be able to select the overlay option. Following scenarios are supported.

- When you want to generate report for a single run then you would set overlay option to 0. Therefore, overlay tabs (in section #6) is disabled.

- When you want to run in overlay mode, then you must pick appropriate number of overlay runs. The overlay tabs get enabled based on the number selected. User can select up to 4 iterations for overlay.

Please note that only those modules which run in HyperGraph (that create curves / graphs) are supported for overlay mode. There is a specific overlay status column next to modules list that indicates the overlay support for each module.

No. of Processes selection & save session file section

This section allows user to enter the no. of processes to be used when executing the utility. ASRM has the capability to run the report generation in parallel based on the no. of processes selected.

It also saves TPL files and session files at the end of the report generation. Users can also choose to export curves (curves created from the respective plotting modules) into **Excel** format. Click on the **More options…** button to select these options.

Modules list

This section allows users to select the modules to be run for report generation. User must make sure to select the module that he / she wants to include in the report generation.

Output directory selection

In this section user will select the output directory path. This is where all the output files such as the session files, images, animations, PPT & log files from the ASRM run will be created.

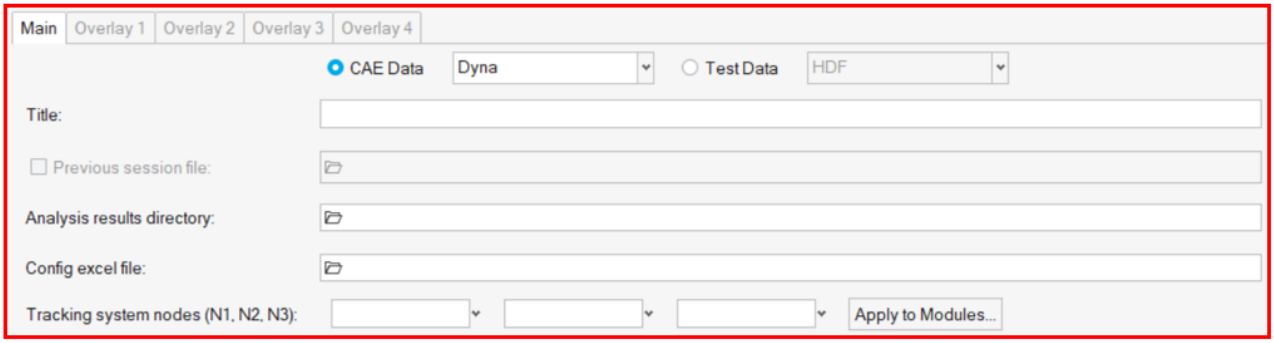
Main section

Input directory, data type & configuration section

In this section, user will be able to select the following.

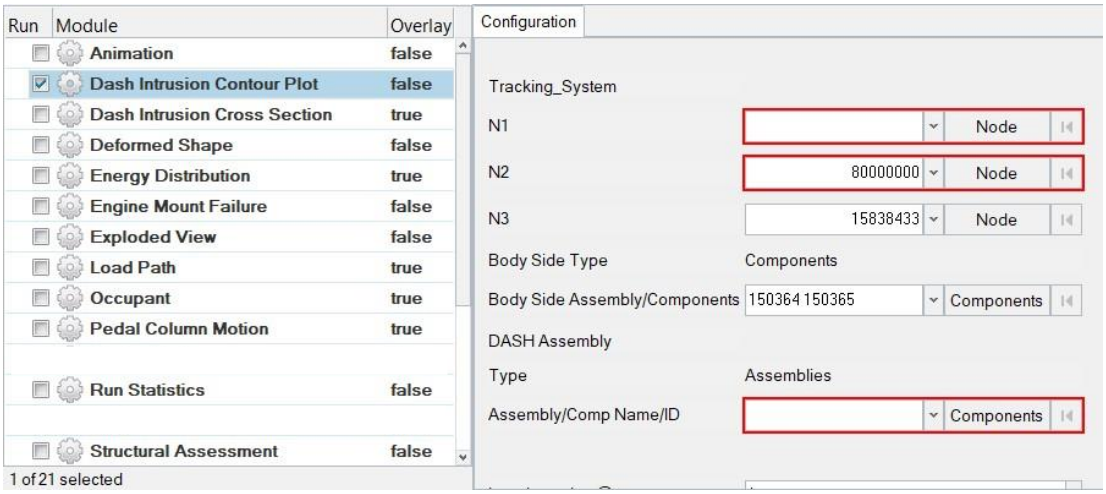
- Type of data being used for generating the report. It could be CAE simulation data or physical test data.
- Title for the report which will be used for creating results directory as well as prefix for curve names & summary tables
- Results directory path where the solver input file, results files such as animation & time history files or test data are located.
- Config file path (if it exists already)

- Define global tracking system using 3 nodes (requests from Time history file). This is an optional input. Once the global tracking system is defined, it can be easily applied to other modules where tracking system is an input. Click on **Apply to Modules…** button, a selection dialog pops up, select the modules to apply the 3 nodes, and click **Apply&Close** button.



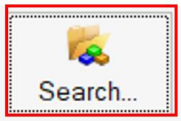
Input Validation check

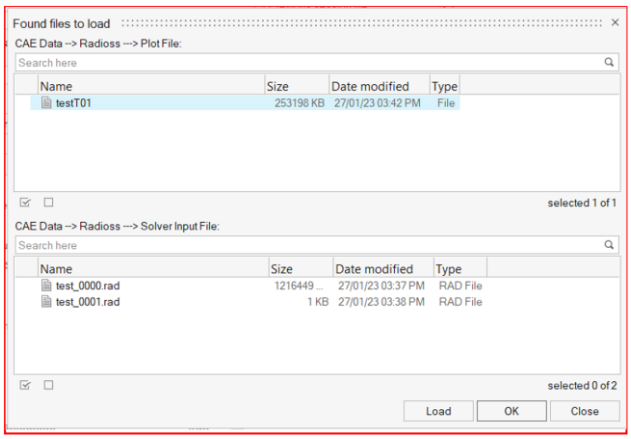
Input Check button would run a quick validation check to verify if the inputs defined for various modules selected is valid. The verification is done on the results files available in the input directory specified. Any invalid inputs and missing input found from validation check will be highlighted in RED in the ASRM GUI as shown below.



Search function

Search button will let users to select and import the 2D time history file (CAE (T01 / binout) or physical test data (HDF / ISO MME)) as well as main solver input file into the current session. This is required for defining the inputs for all the modules. An additional dialog called **files to load** will be displayed to select the files as shown below.

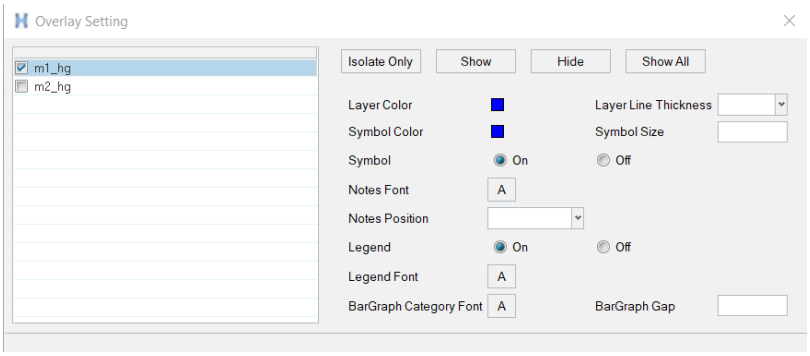




Change curve attributes & publish session

This section is mainly used for the overlay scenario.

The change curve attributes option  brings up an overlay setting dialog as shown below. This will allow to change various curve & note related attributes for the overlay session per layer basis.

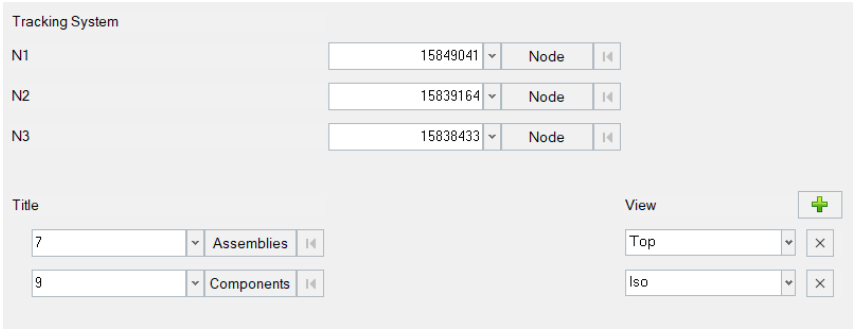


After changing the curve & note related attributes using the overlay setting dialog, user can click on Publish session icon  which would publish a report for the overlay session.

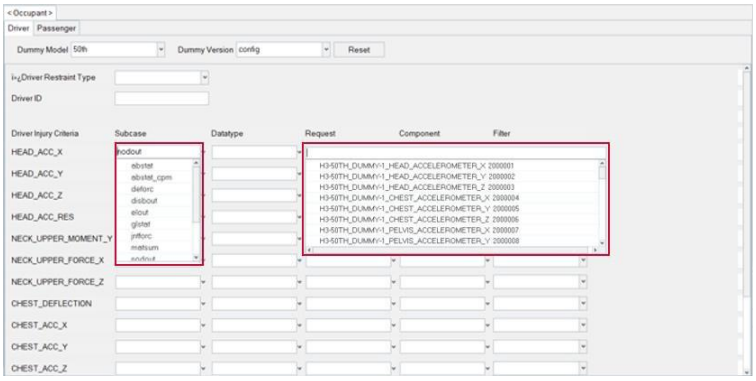
Configuration section

This is the section wherein the inputs required for all the modules will be entered & displayed. For defining the inputs, firstly make sure to load both the 3D (solver input file) file as well as Time History file using the Load button. Then start defining the inputs for the modules.

FE entities such as nodes, components or assemblies can be selected from graphics screen from the loaded solver input file.



Inputs from the Time History files (subcases, requests & components) can be selected from the drop-down context dialog as shown below.



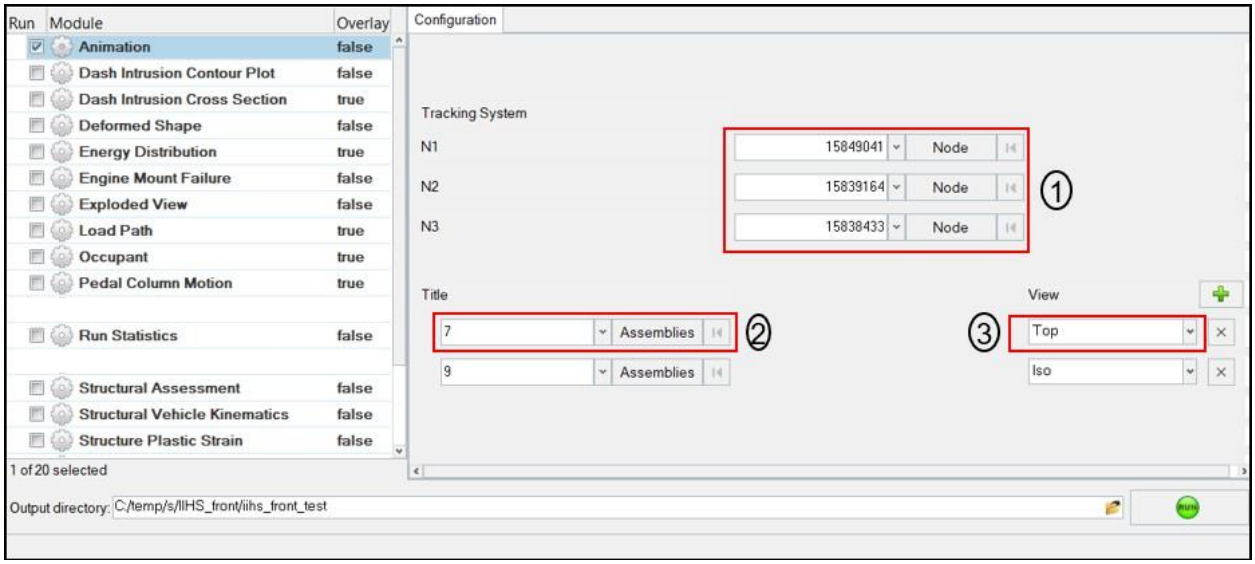
Modules

Following is the list of modules supported by ASRM utility for side impact type.

- Animation
- Barrier Face Overlap
- Battery Section Force
- Collision Detection
- Deformed Shape
- Displacement Plot
- Door Aperture Deformation
- Energy Distribution
- Exploded View
- Fuel Tank Interaction
- Fuel Tank Zone X Assessment
- Fuel Tank Zone Y Assessment
- Load Path
- Occupant
- Plastic Strain
- Run Statistics
- Structural Intrusions
- User Defined Outputs
- Vehicle Yaw Pitch Roll
- Velocity Separation
- Weld Failure

Animation

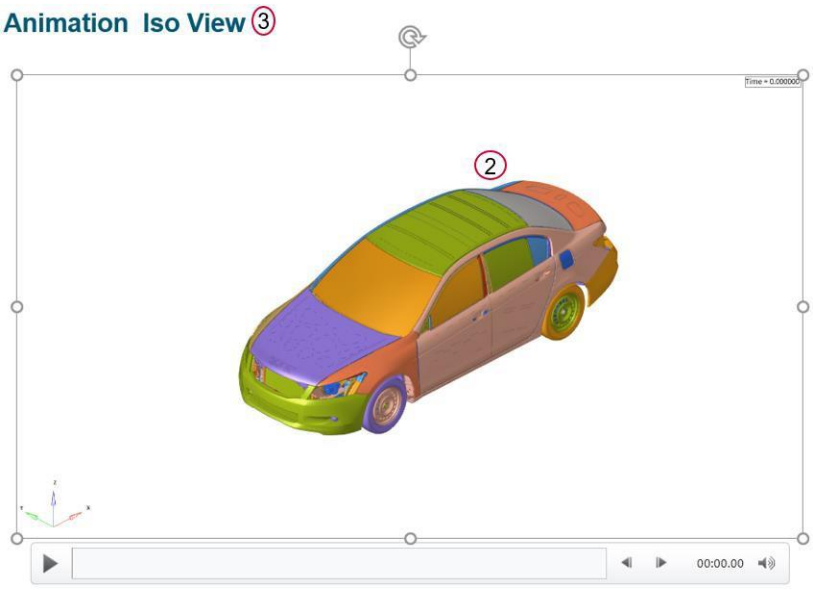
Animation module lets you create gif animations of the selected parts (or assemblies) in the user selected standard views.



Inputs:

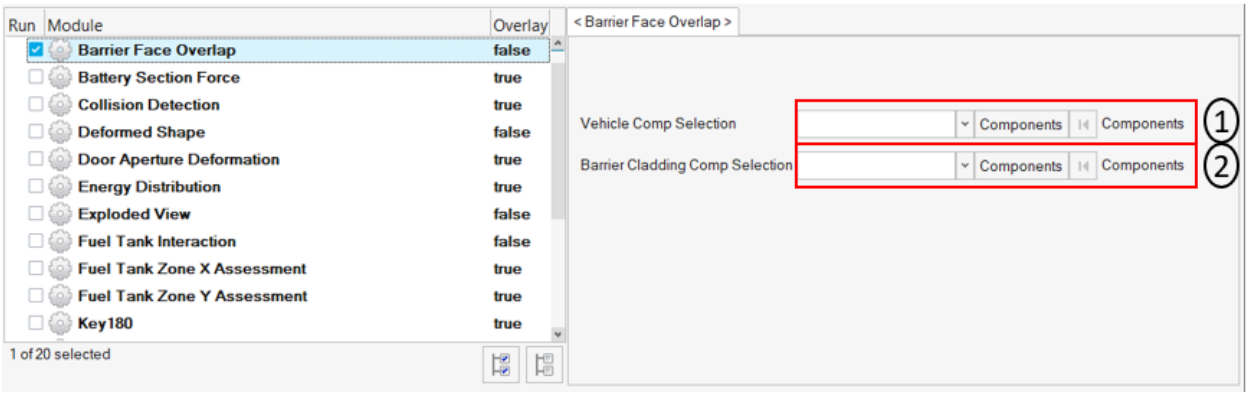
1) Node ID 1, 2 & 3 for defining tracking system
2) Part ID or Assembly ID to be used when capturing gif animations
3) One of the standard views to be used when capturing the gif animations for the part or assy ID selected in step #2

Output report:



Barrier Face Overlap

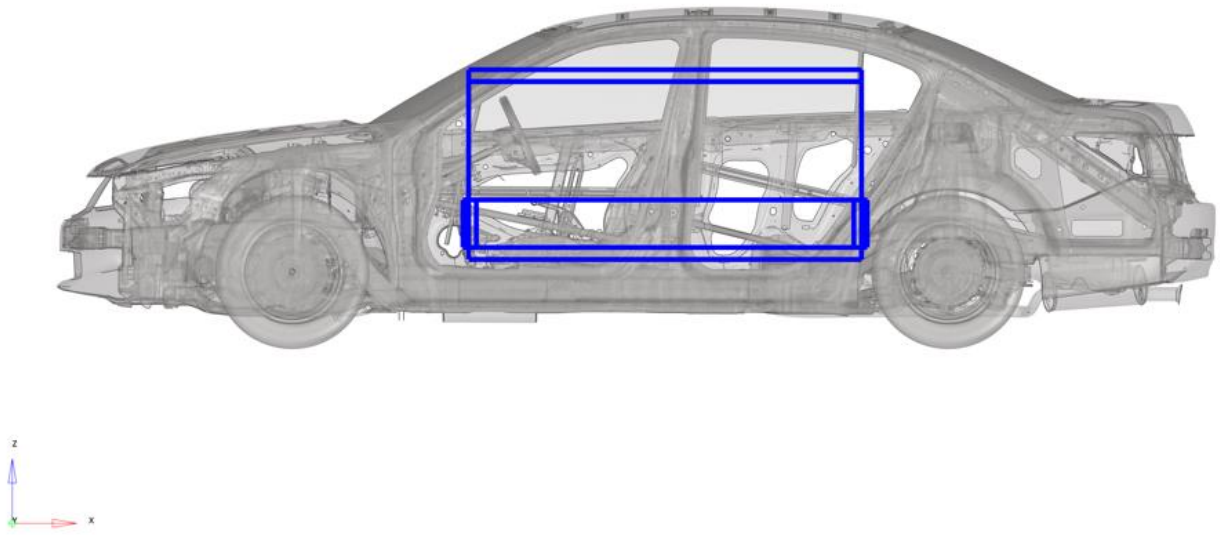
Barrier Face module lets you create an image of the MDB Barrier Face, and the vehicle as shown below. This will help visualize how the barrier is positioned relative to the vehicle parts such as upper body & occupants so that any deviation or offset can be easily found out.



Inputs:

1) Vehicle component selection. This includes all the vehicle parts such as upper body, occupants, door beams etc. They are displayed in grey, transparent color.
2) Barrier cladding components selection. This includes the front cladding parts on the barrier. A component set is created for the selected cladding parts & displayed as shown in the image.

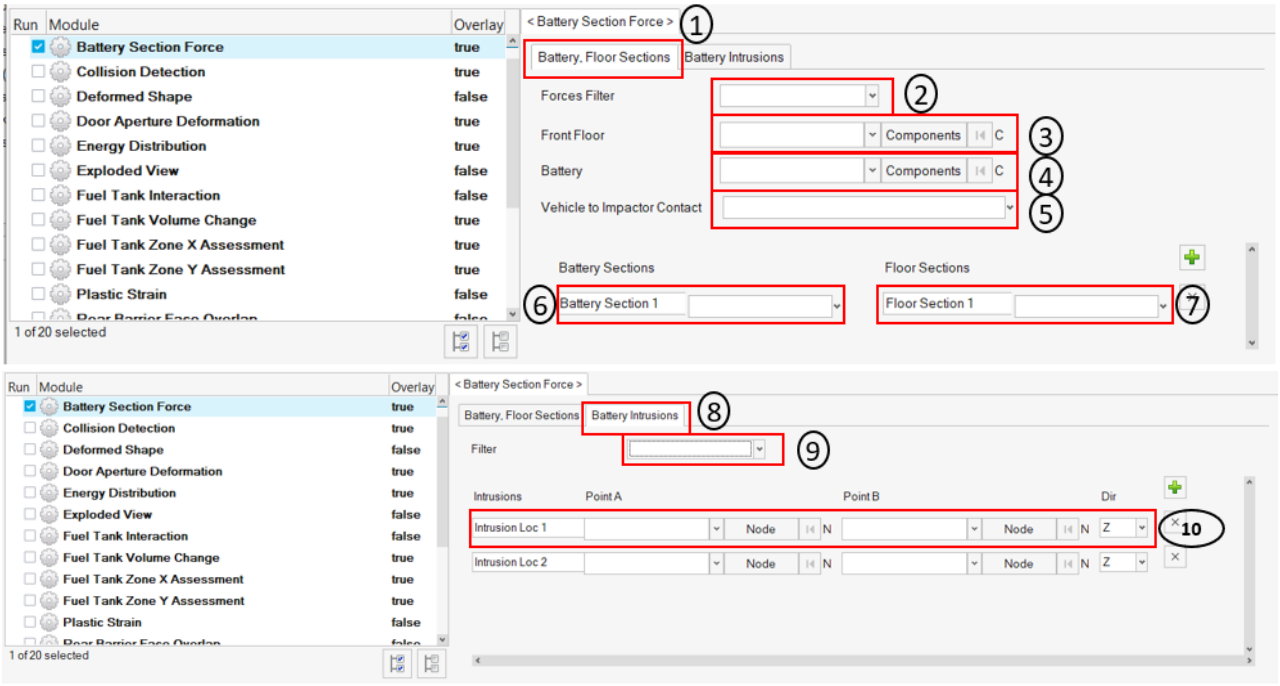
Output report:



Battery Section Force

Battery Section Force module lets you create a summary report of battery and floor cross member section forces and battery intrusion measurements. The report consists of following.

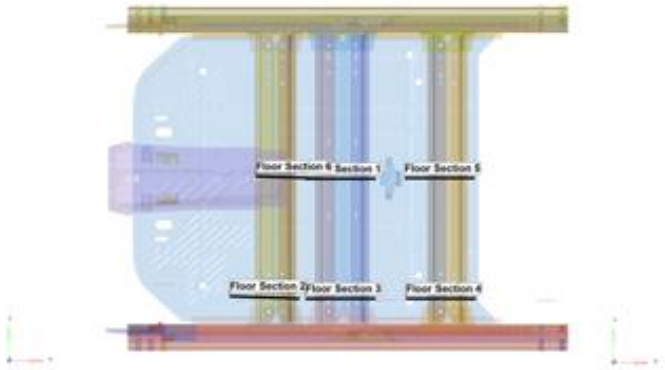
1) Images consisting of floor and the battery parts along with cross section members
2) A summary table showing the cross-member forces for all the user defined battery & floor sections
3) A summary table showing the battery intrusion measurements at various user selected locations
4) Images of the plots showing the battery & floor section forces along with the total floor & battery crossmember forces. Battery intrusion plots are also created at all the user selected locations.

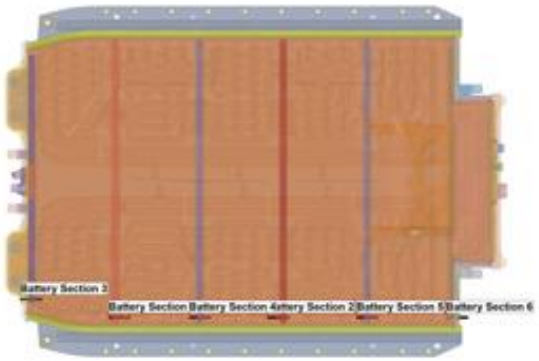


Inputs:

1) For battery & floor sections, following inputs are required.
    a. Filter class to be used for applying the filter to battery & floor cross member section forces plots
    b. Front floor & battery components or assemblies
    c. Vehicle to Impactor contact request
    d. User defined battery & floor sections
2) For battery intrusion measurements, following inputs are required.
    a. The source & target intrusion measurement locations. It could be either Node, Element or Component.
    b. The measurement direction (X/Y/Z)

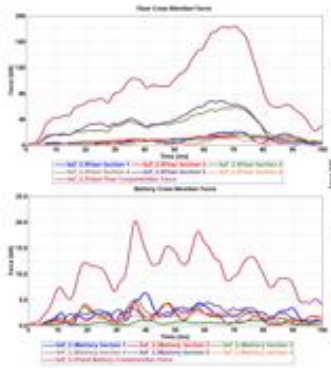
Output report:

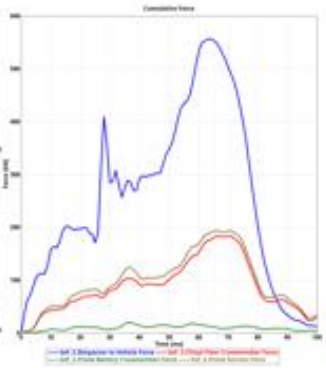


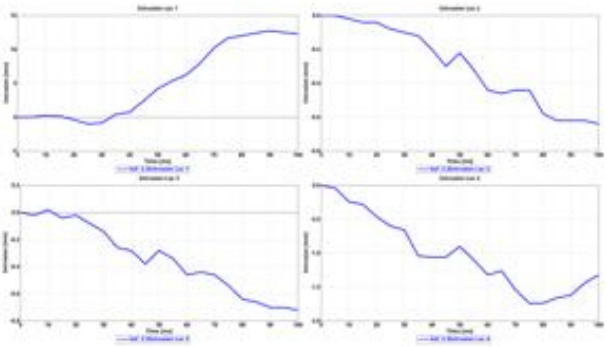


Battery Cross Member Force		Floor Cross Member Force	
Title	Force [kN]	Title	Force [kN]
Battery Section 1	6.37	Floor Section 1	20.89
Battery Section 2	4.44	Floor Section 2	16.18
Battery Section 3	1.07	Floor Section 3	15.36
Battery Section 4	5.10	Floor Section 4	58.88
Battery Section 5	4.56	Floor Section 5	68.69
Battery Section 6	2.56	Floor Section 6	14.13

Battery Intrusion	
Title	Intrusion [mm]
Intrusion Loc 1	12.78
Intrusion Loc 2	0.64
Intrusion Loc 3	0.72
Intrusion Loc 4	1.74

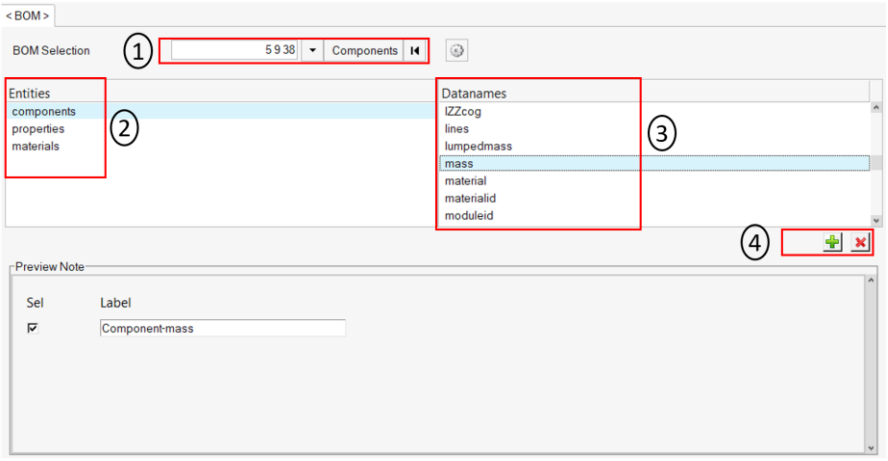






BOM

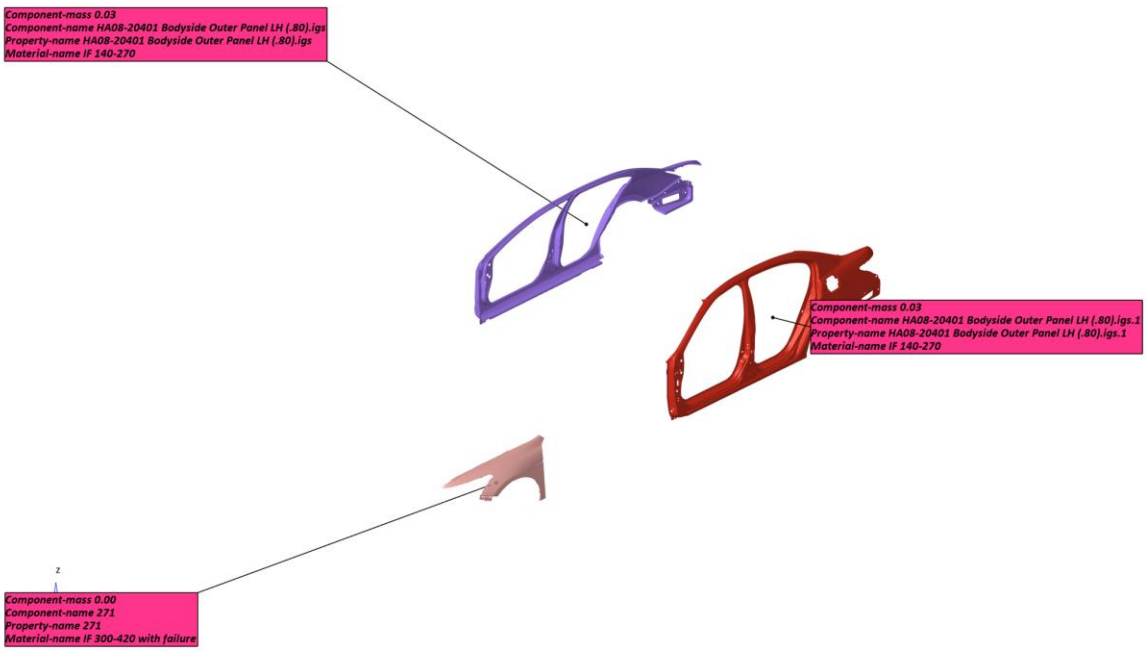
BOM module is an advanced exploded view module. It has the capability to include data name attributes as annotations in the report. Users can pick from several data names (around 100) related to components, property, and material entity attributes. The selected BOM info can be easily attached as annotations to the components in the exploded view.



Inputs:

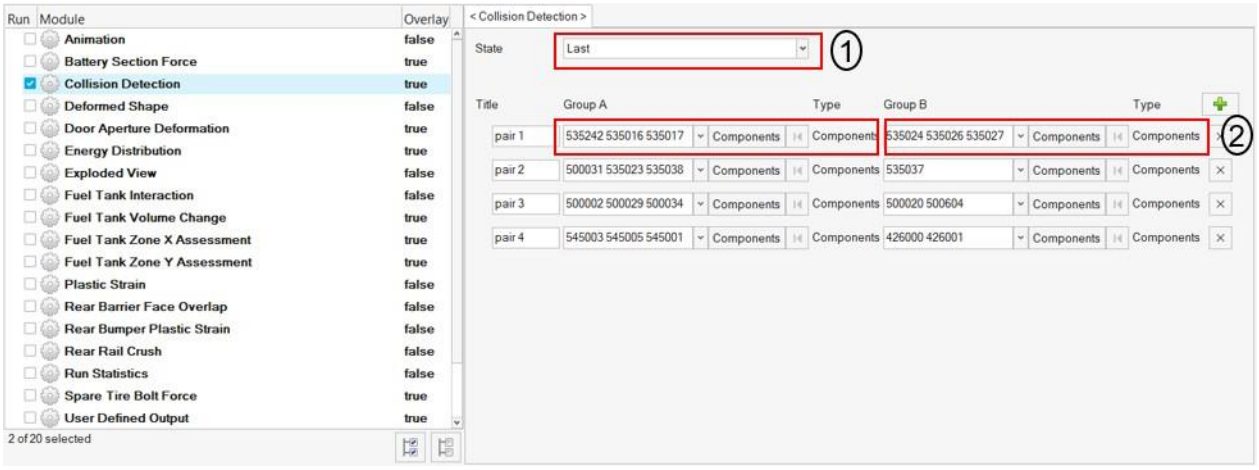
1) Select the assembly IDs or components IDs that should be included in the BOM report
2) Select the entity type for which the data name attribute should be searched
3) Select the appropriate data names from the list
4) Click on + icon to add the selected attribute

Output report:



Collision Detection

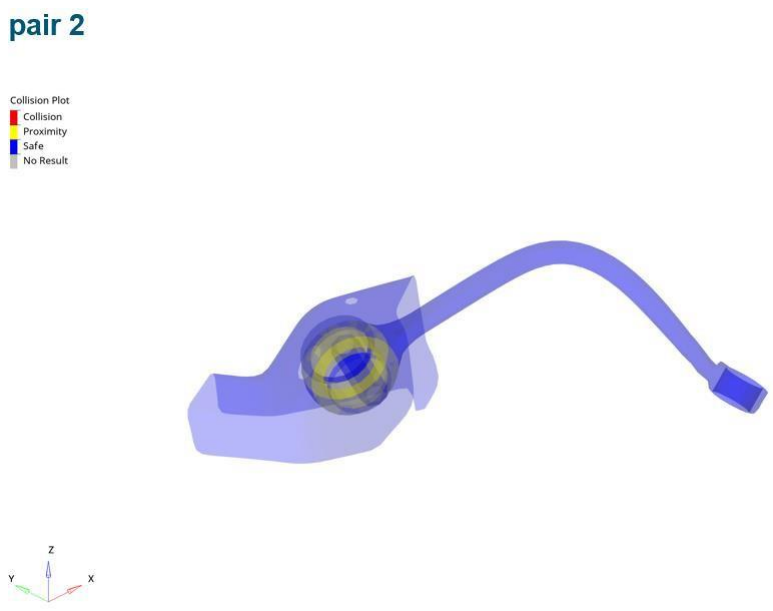
Collision detection module is used to perform collision interference checking. This module lets users to define a collision set by selecting a pair or groups of components (parts) and then detect penetration between the two pairs. Users can define multiple collision sets. This capability allows users to quickly perform design reviews.



Inputs:

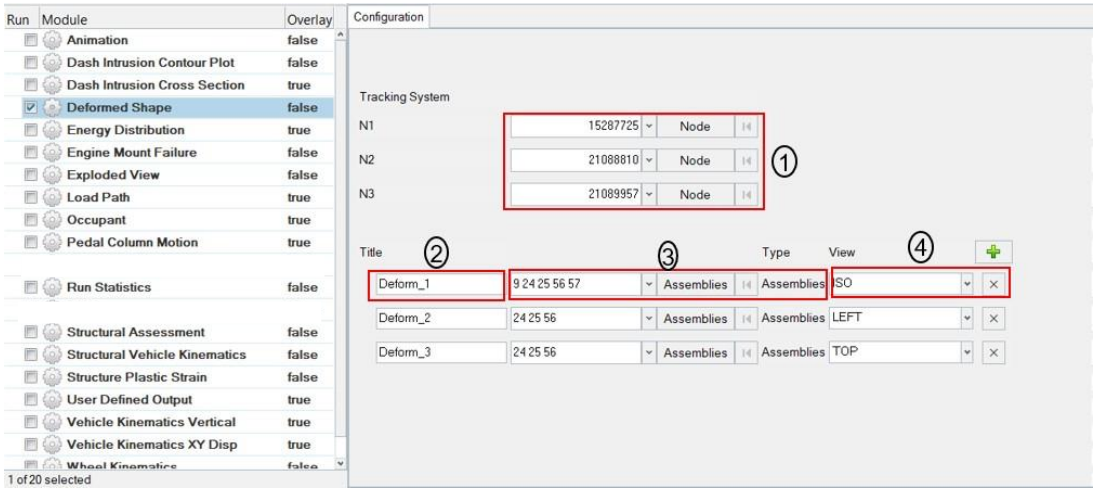
5) Select the time step state at which the collision detection is performed
6) Select the components (parts) for each of the two Groups A & B. This forms one collision set. Likewise, users can define multiple collision sets

Output report:



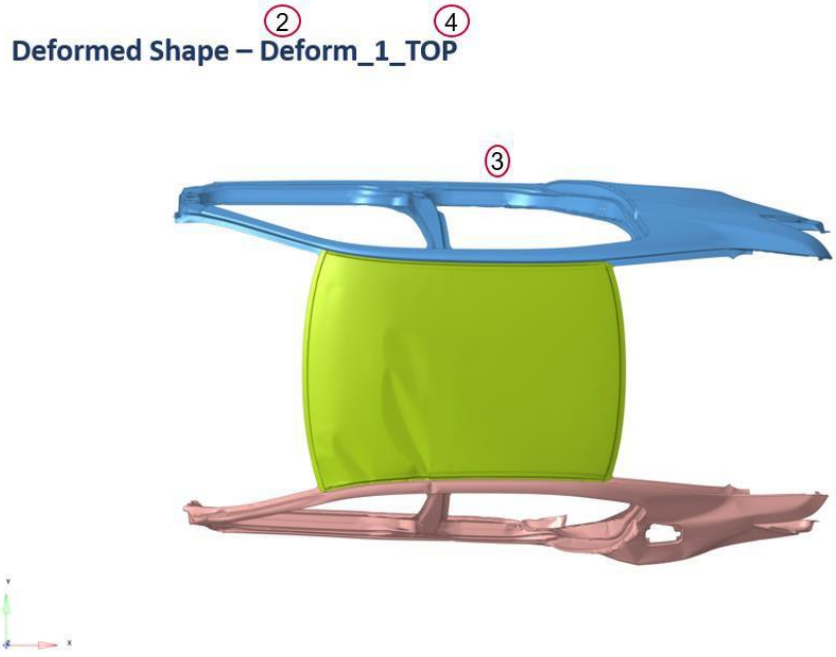
Deformed Shape

This module is used to create deformed shape of the user selected part sets (components or assemblies) in standard views (Left, Right, Top, Bottom, Front, Rear & Isometric views)



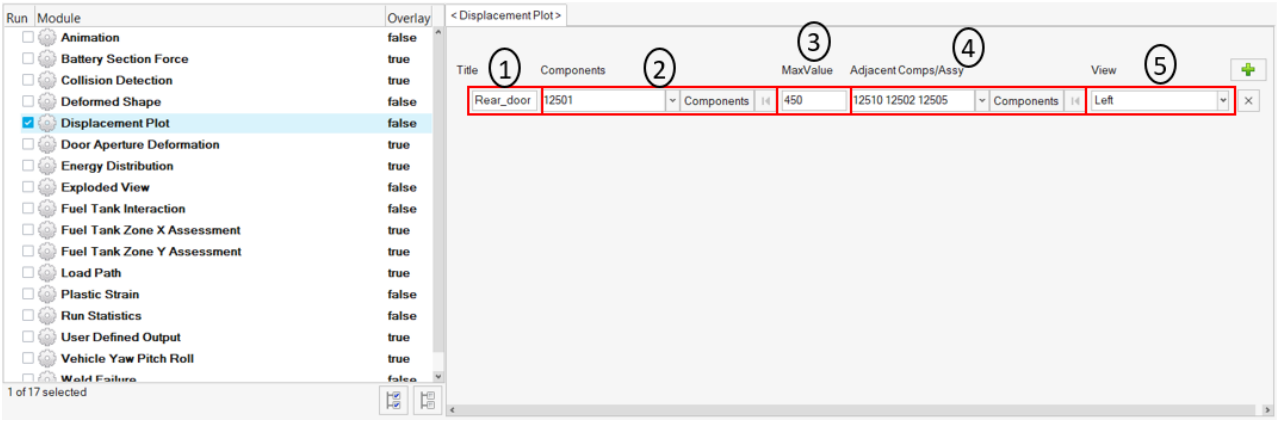
Inputs:

1) Node ID 1, 2 & 3 for defining tracking system
2) Label to be used for the slide title
3) Assembly IDs that will be considered for deformed shape
4) The view to be used for deformed shape image capture



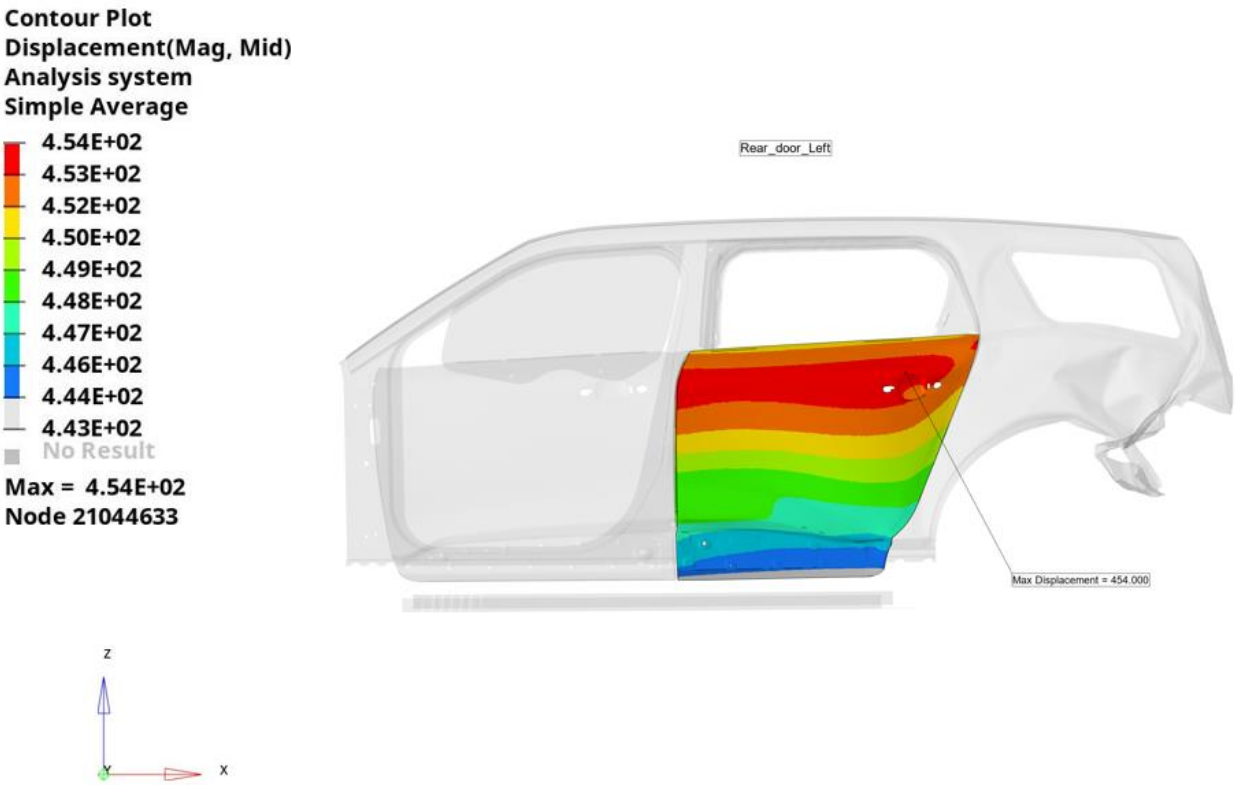
Displacement Plot

This module is used to generate a summary report of displacement contour for the user selected components.



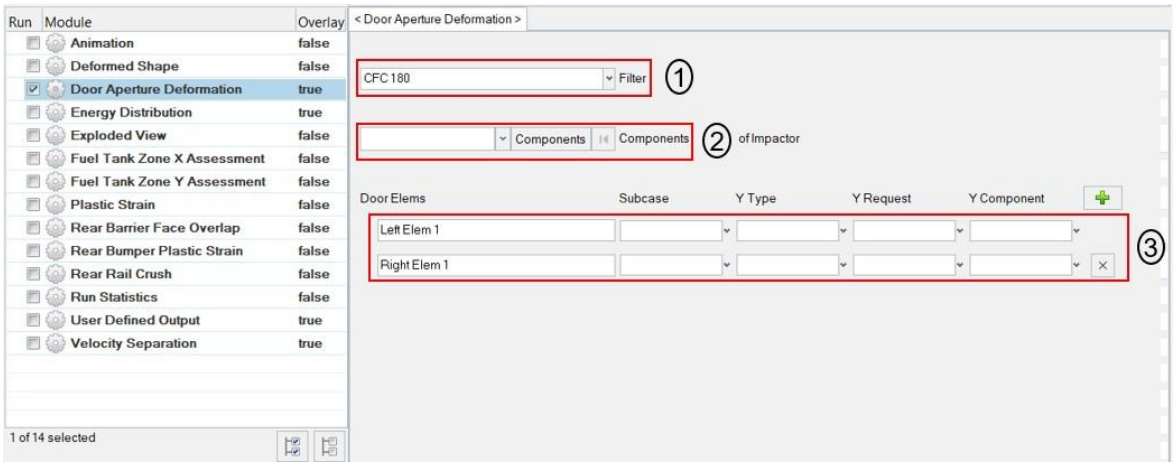
Inputs:

1) The component label
2) The component IDs used for creating displacement contour plots
3) The displacement upper limit that is set when applying the contour
4) The adjacent (or neighboring) components to be included in the image (transparent mode)
5) The standard view that should be set when capturing the image



Door Aperture Deformation

This module is used to record the maximum door deformation using spring elements.

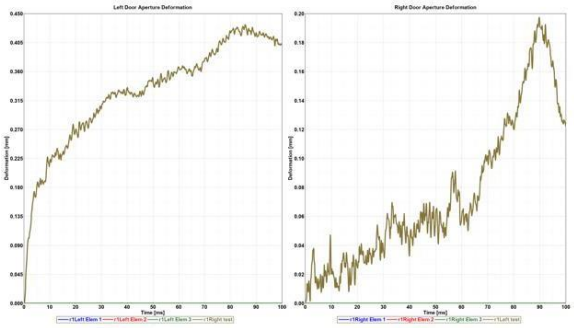


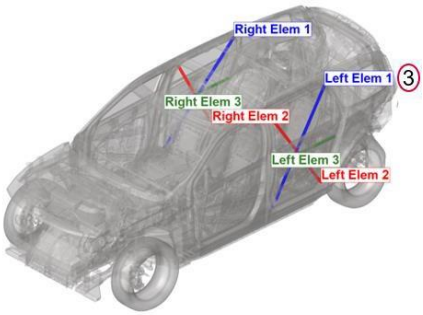
Inputs:

1) Filter class if required to filter the deformation curve
2) Impactor assembly or component ID which will be hidden from the image
3) The left & right door spring element request info (from time history file) for plotting the deformation curves

3

Left Door Aperture		Right Door Aperture	
Title	Peak Deformation [mm]	Title	Peak Deformation [mm]
Left Elem 1	0.00	Right Elem 1	0.00
Left Elem 2	0.00	Right Elem 2	0.00
Left Elem 3	0.00	Right Elem 3	0.00
Right test	0.43	Left test	0.20



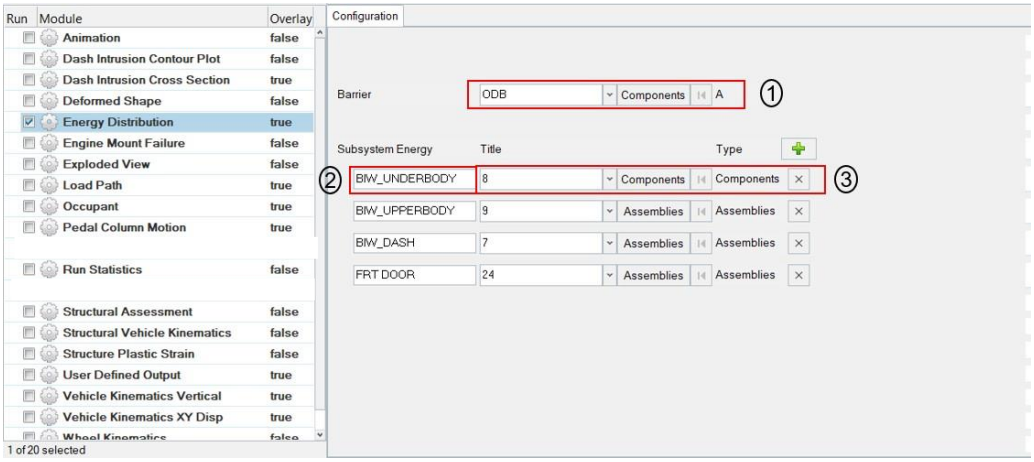


Energy Distribution

The Energy Distribution module is used to create energy distribution plots (bar graphs) for the barrier (system level) as well as for user selected sub systems such as BIW-upperbody, BIW-underbody etc.

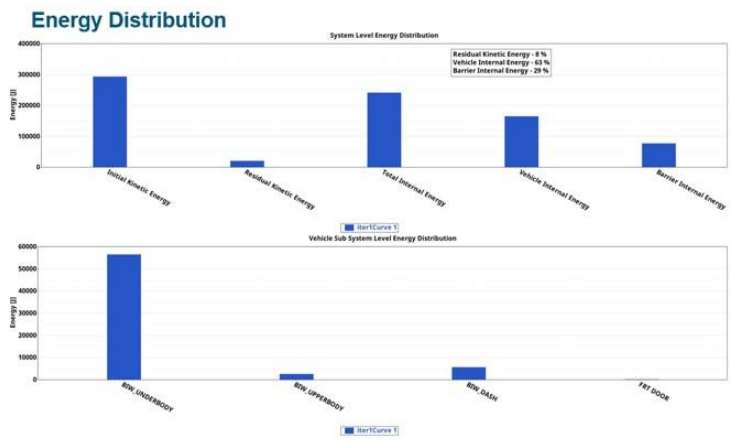
For the barrier, energy plots are created for Initial kinetic energy, residual kinetic energy, total internal energy, vehicle internal energy and barrier internal energy.

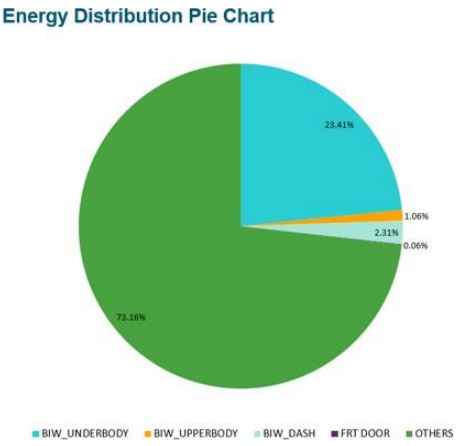
A pie chart is also created showing energy distribution for residual kinetic energy along with vehicle & barrier internal energy.



Inputs:

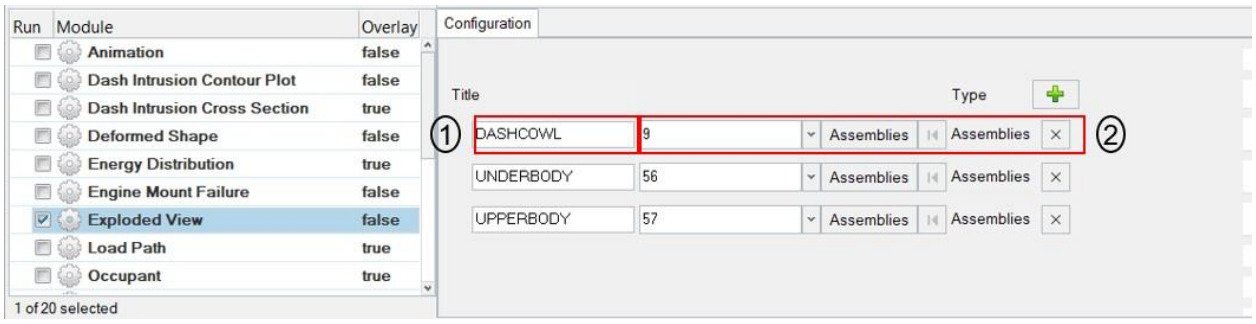
1) Barrier assembly or component ID
2) Subsystem name
3) Subsystem assembly or component ID





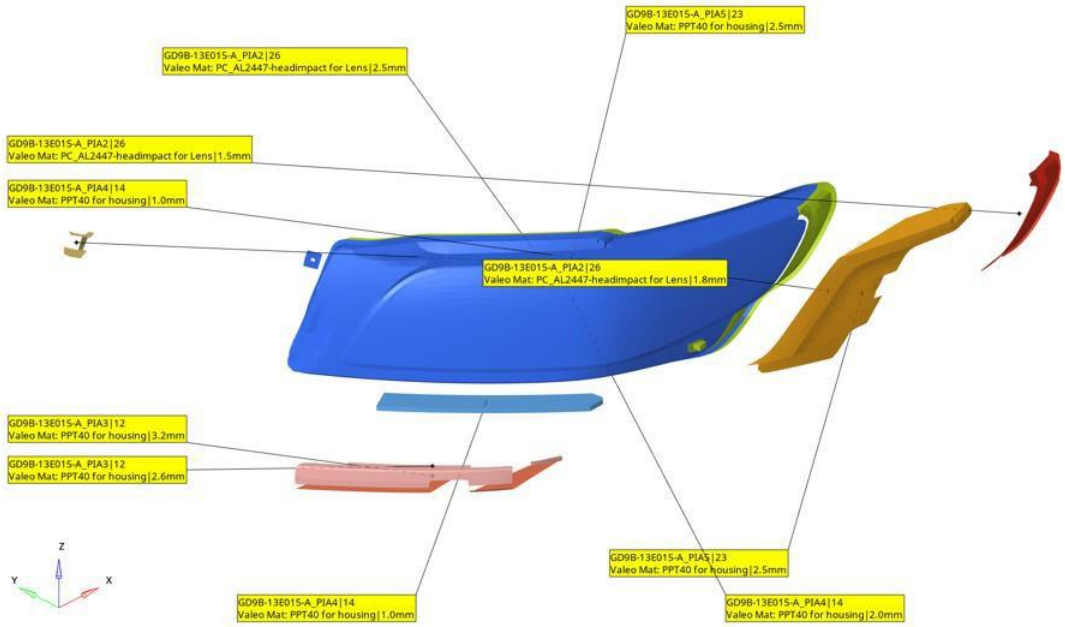
Exploded View

Exploded view lets you create images of parts in exploded view. For each user selected assembly, the parts are isolated (10 parts per slide) and exploded view is drawn and image is captured. Each part in exploded view is tagged with an annotation. It contains the part name, the material name and the assigned thickness.



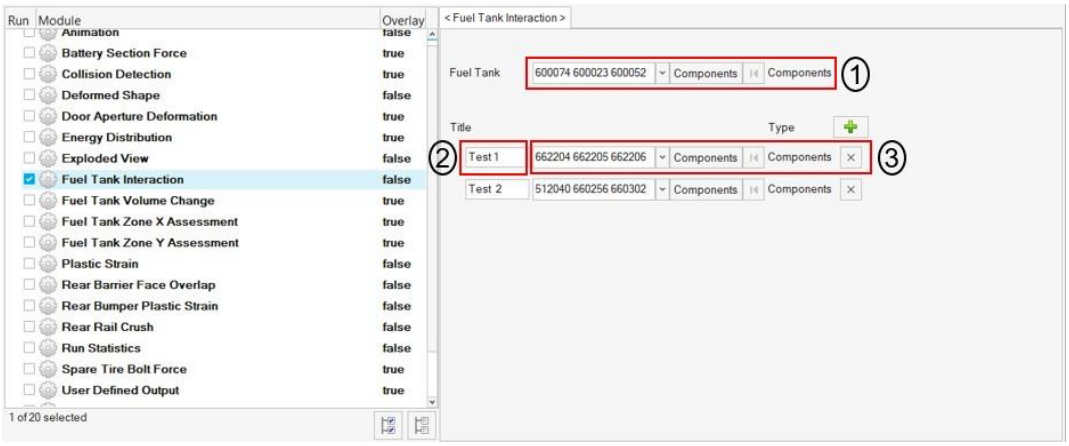
Inputs:

1) Title for the assembly that is considered for exploded view
2) Assembly or Component ID used for exploded view



Fuel Tank Interaction

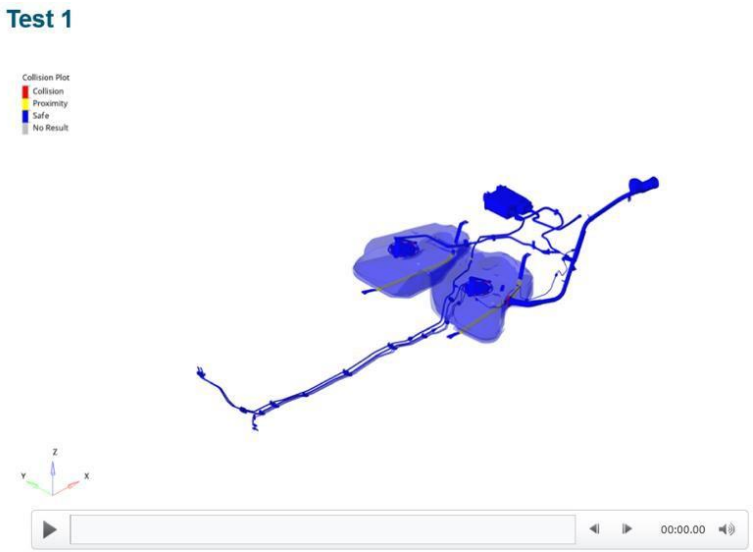
This module is used to perform collision interference checking between the fuel tank assembly and the parts around it. The inputs are fuel tank assembly and the surrounding parts which might collide or meet with the fuel tank assembly during the simulation. The module will check and find out if penetration exists between the two groups. Accordingly, the components are colored, and an animation file (avi) is captured and embedded into the PPT. Users can define multiple parts.



Inputs:

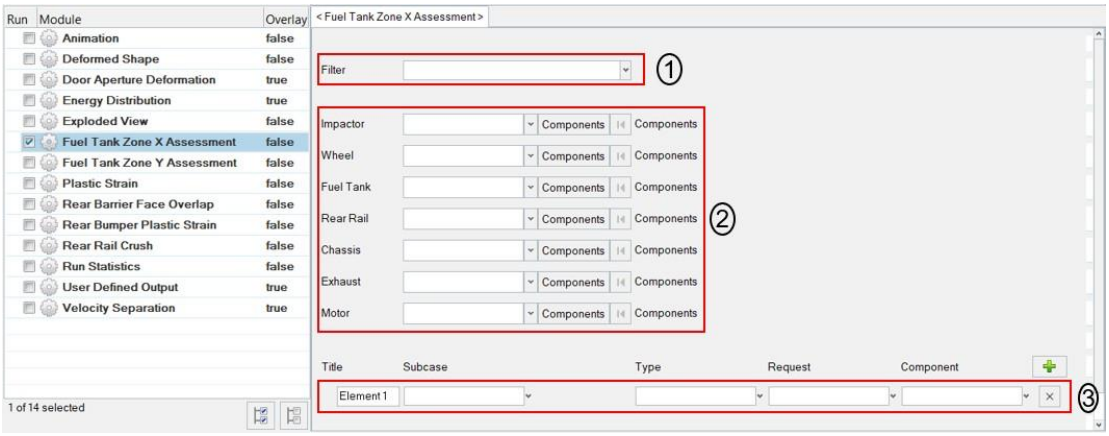
1) Select the fuel tank assembly (components or assembly)
2) Enter a title that is used as slide title in the PPT report
3) Select the components (assemblies) that might come in contact with the fuel tank assembly

Output report:



Fuel Tank Zone X Assessment

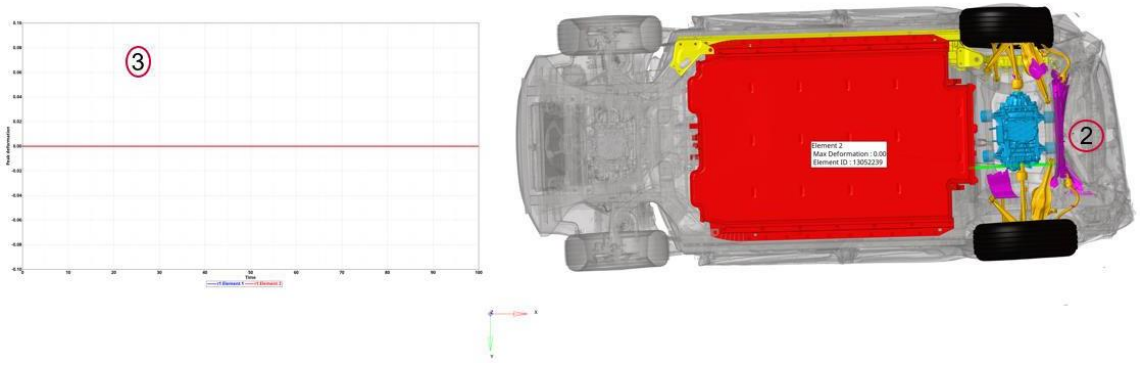
This module is used to evaluate the deformation of fuel tank zone spring elements. It computes the deformation between fuel tank zone cross members along X direction by measuring the spring element deformations.



Inputs:

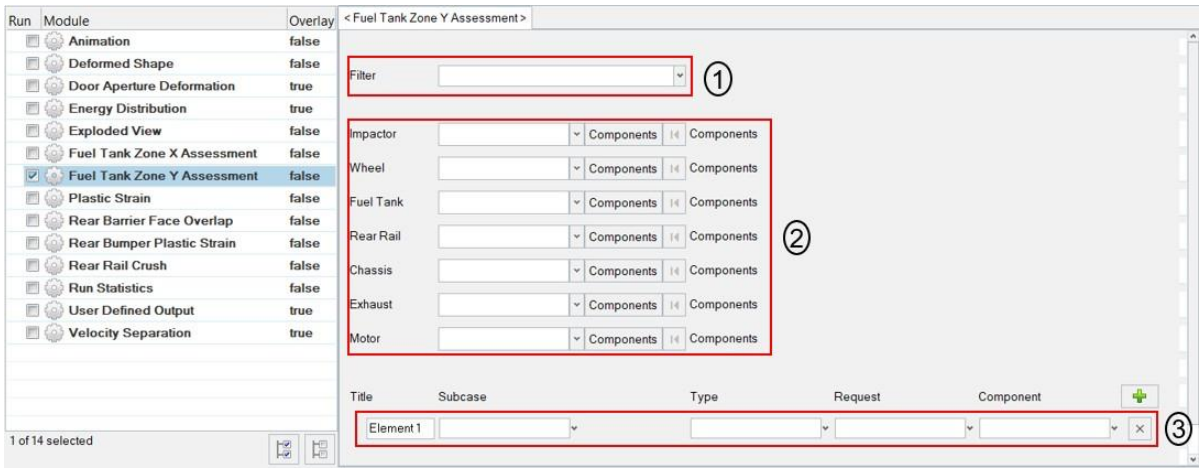
1) Filter class to be used if required to filter the deformation curve
2) Fuel tank zone cross members comp ID / Assy ID
3) The spring element request info (from time history file) for plotting the deformation curves

Fuel Tank Zone X Assessment	
Title	Peak Deformation
Element 1	0.00
Element 2	0.00



Fuel Tank Zone Y Assessment

This module is used to evaluate the deformation of fuel tank zone spring elements. It computes the deformation between fuel tank zone cross members along Y direction by measuring the spring element deformations.

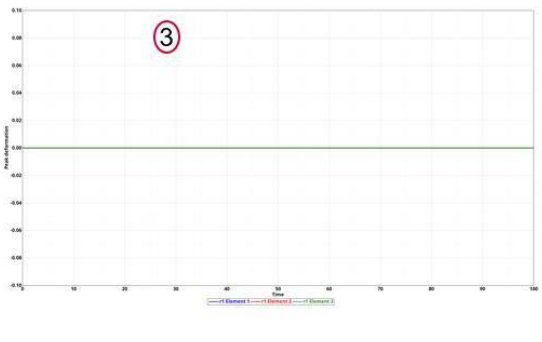


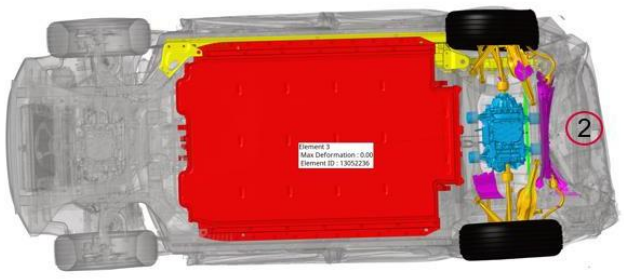
Inputs:

1) Filter class to be used if required to filter the deformation curve
2) Fuel tank zone cross members comp ID / Assy ID
3) The spring element request info (from time history file) for plotting the deformation curves

3

Fuel Tank Zone Y Assessment	
Title	Peak Deformation
Element 1	0.00
Element 2	0.00
Element 3	0.00





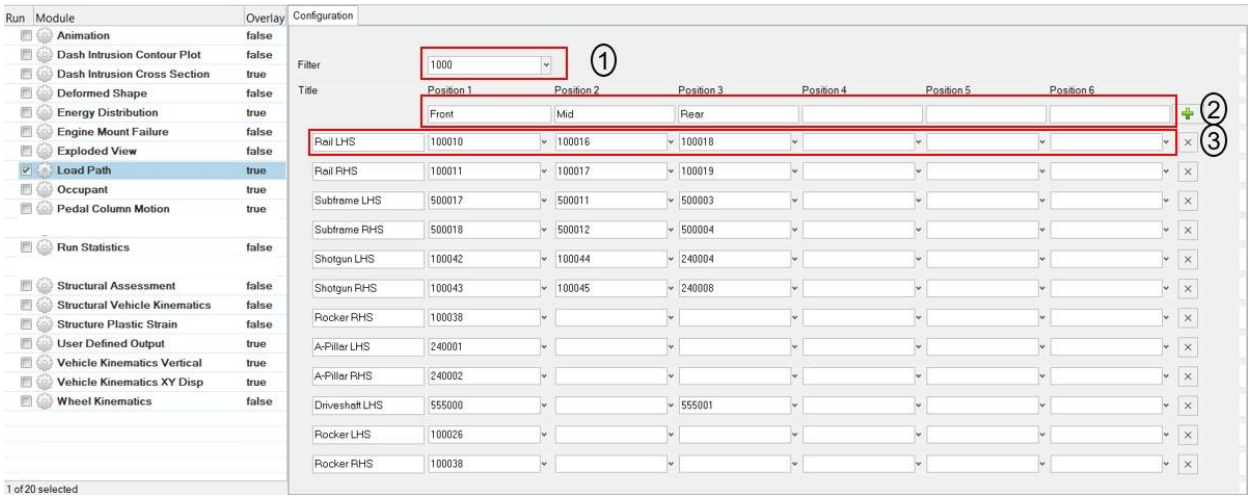
Load Path

The Load Path module lets you create following report summary.

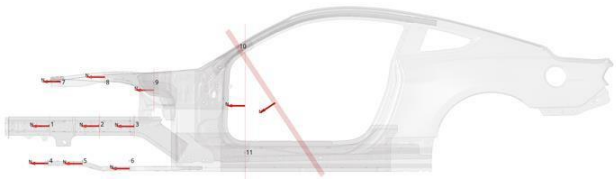
1) It creates an image of the vehicle and identifies the location of each cross section that is defined by the user in the config file

2) It creates a Load Path Section Forces and Properties summary table

3) It also creates Load Path section forces plots for all the cross sections



Cross Section Locations

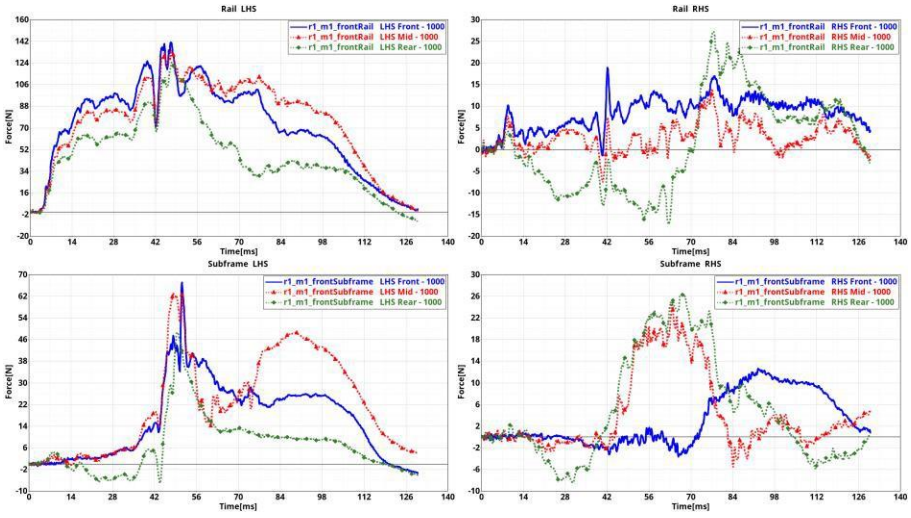


1	Rail Front
2	Rail Mid
3	Rail Rear
4	Subframe Front
5	Subframe Mid
6	Subframe Rear
7	Shotgun Front
8	Shotgun Mid
9	Shotgun Rear
10	A-Pillar Front
11	Rocker Front

Load Path Summary

#	Title	Peak Load [LHS] (KN)	Area(mm2)	Ix (mm4)	Iy (mm4)	J (mm4)	Sx (mm3)	Sy (mm3)	Peak Load [RHS] (KN)	Area (mm2)	Ix (mm4)	Iy (mm4)	J (mm4)	Sx (mm3)	Sy (mm3)
		r1_m1_front													
1	Rail Front	141.00	38.37	178846.17	51224.93	-43216.83	847.13	693.77	18.93	38.37	165168.37	51224.92	-45234.58	847.13	693.77
2	Rail Mid	135.32	36.67	104454.26	65096.91	40738.48	792.97	679.60	14.11	36.63	63340.71	79026.63	17641.33	791.38	681.85
3	Rail Rear	125.37	39.52	124027.32	71430.19	-43017.08	880.11	776.17	27.44	39.52	184206.11	55540.15	-48580.74	880.11	776.17
4	Subframe Front	67.17	17.45	3589.02	8405.00	0.00	214.27	280.17	12.62	17.45	3589.02	8405.00	0.00	214.27	280.17
5	Subframe Mid	63.52	17.81	4033.52	8729.89	-0.58	228.13	290.98	24.74	17.81	4033.10	8729.89	0.54	228.20	290.98
6	Subframe Rear	49.07	17.45	3589.01	8405.06	0.00	214.27	280.17	26.45	17.45	3589.01	8405.06	0.00	214.27	280.17
7	Shotgun Front	23.95	64.34	74444.15	272987.83	-22519.68	699.06	1554.85	4.45	64.34	59385.91	278937.03	-34549.85	699.07	1554.85
8	Shotgun Mid	21.84	38.94	34520.59	143438.48	7054.20	791.54	961.01	20.31	38.94	47275.78	121756.20	39462.78	791.55	961.32
9	Shotgun Rear	31.99	131.04	2977343.36	4236128.96	3173750.07	4893.40	2722.56	35.47	136.25	2157098.05	1226453.29	-446369.53	3312.09	4441.09
10	Rocker Front	115.19	120.65	8934548.12	336710.24	-176468.24	12426.70	3454.34	17.31	120.65	9795451.07	904324.39	999808.24	12426.70	3454.34

Cross Section Force Plot



Occupant

Occupant module allows users to create occupant safety report for various regulations and crash modes. It generates following summary report based on user selected info.

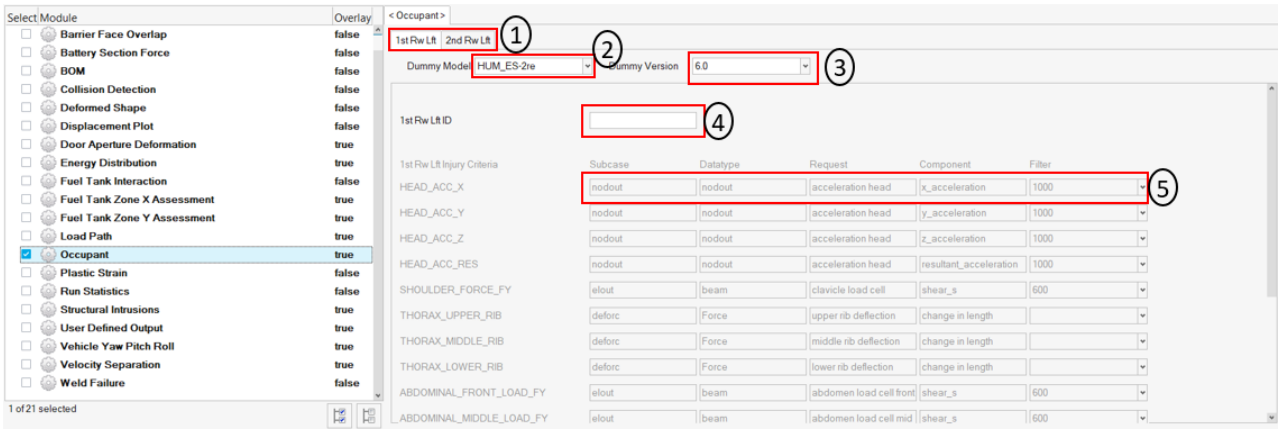
1) Occupant summary table
2) Bar graphs comparing the Driver/Passenger results against the regulation criteria
3) Occupant performance plots

ASRM has the capability to generate occupant report for the following side impact regulation and crash modes. For each regulation, the corresponding dummy types & versions supported is also listed in the below table.

Crash Regulation	Crash Mode	Structure	Occupant
CNCAP	MDB	Yes	1st Row Left – WSID 5.0, 6.0, 7.0 2nd Row Left – SBLD 4.0.2, 4.3.1
ECE R95	MDB	Yes	1st Row Left – ES2Re 6.0, 7.0, 8.0.2
EURONCAP	MDB	Yes	1st Row Left – WSID 5.0, 6.0, 7.0 2nd Row Left – Q10; 2nd Row Right – Q6
EURONCAP	Pole	Yes	1st Row Left (left impact) - WSID 5.0, 6.0, 7.0 1st Row Right (right impact) – WSID 5.0, 6.0, 7.0
FMVSS 214	MDB	Yes	1st Row Left - ES2RE (v6.0, 7.0, 8.0.2) 2nd Row Left - SID IIs (SBLD v4.0.2, v4.3.1)
FMVSS 214	Pole	Yes	1st Row Left – ES2RE (v6.0, 7.0, 8.0.2) / SID IIs (SBLD v4.0.2, v4.3.1)
IIHS	MDB	Yes	1st Row Left - SID IIs (SBLD 4.0.2, 4.3.1) 2nd Row Left – SID IIs (SBLD 4.0.2, 4.3.1)
LATIN NCAP	Pole	Yes	1st Row Left – ES2Re 6.0, 7.0, 8.0.2
LINCAP	MDB	Yes	1st Row Left – ES2RE (v6.0, 7.0, 8.0.2) 2nd Row Left – SID IIs (SBLD 4.0.2, 4.3.1)
USNCAP	MDB	Yes	1st Row Left - ES2RE (v6.0, 7.0, 8.0.2) 2nd Row Left - SID IIs (SBLD v4.0.2, v4.3.1)
USNCAP	Pole	Yes	1st Row Left – ES2Re (6.0, 7.0, 8.0.2) / SID IIs (SBLD 4.0.2, 4.3.1)

Following is the list of default units used in occupant module for various quantities.

- Acceleration - g
- Force - kN
- Moment - N*m
- Velocity - m/s
- Length - mm



Inputs:

1) **Tabs** allowing users to define occupant (driver & passenger) info independently

2) **Dummy model** selection option. Currently following dummy types are supported.

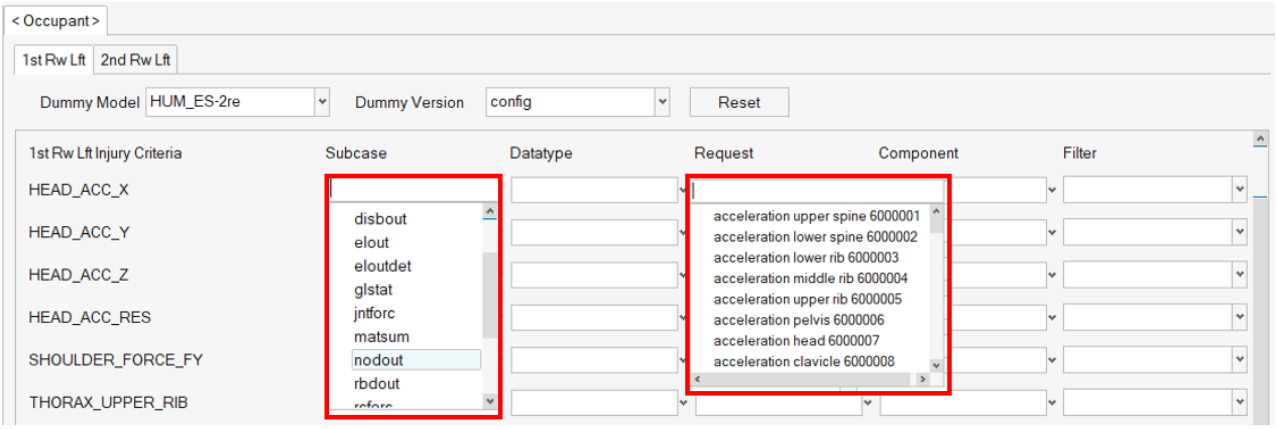
For the Side impact type, IIHS regulation & MDB protocol, we support SID-IIs dummy types.

For the Side impact type, LINCAP regulation, the tool supports ES2re dummy type for Drivers and SID-IIs dummy type for passengers.

3) **Dummy version** selection. Users can either select a particular version number from the drop down or set it to config option. When selecting a version number, all the subcase, datatype, request & component types along with filters are predefined for the user based on defaults config file. When user selects the config option then it is user's responsibility to define all the inputs. This is especially needed when using a newer dummy version.

4) **Driver ID / Passenger ID**. This option is enabled or used only when the dummy version is set to anything other than config. This is needed by the tool so it can differentiate between driver & passenger request IDs when plotting the occupant injury curves.

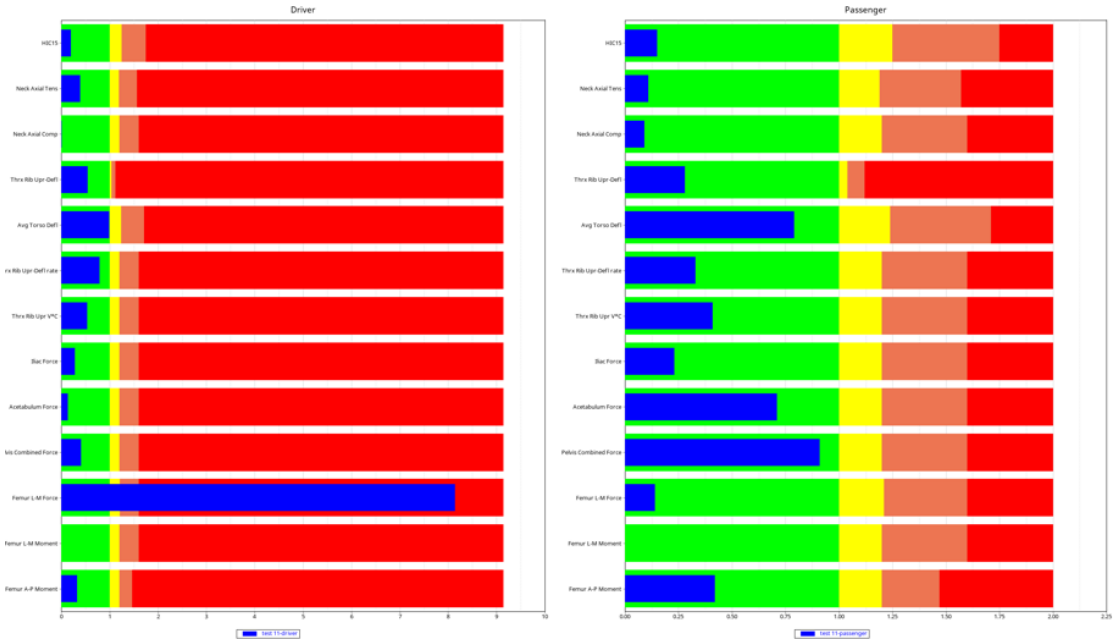
5) **Driver / Passenger Injury Criteria selection**. This option is enabled only when the dummy version is set to config. User should first make sure to load the Time History file (binout) by clicking the Load button. After loading the file, user can start defining the appropriate subcase, datatype, request & component types for each of the injury criteria.



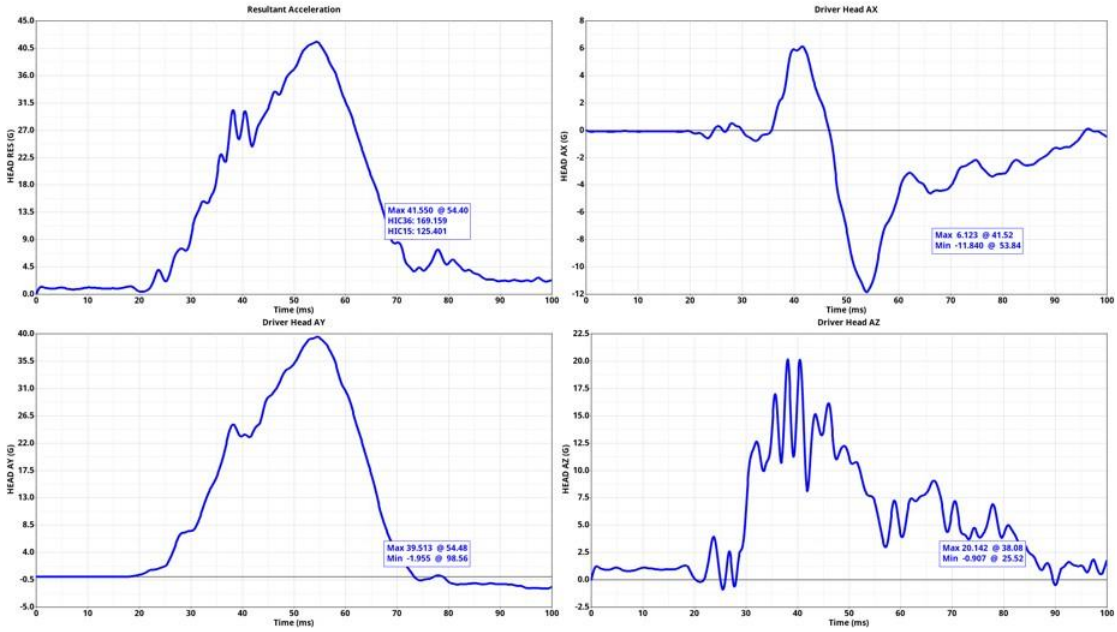
Occupant Summary

Occupant Results	Front - SID-IIs	Rear - SID-IIs		GOOD	ACCEPTABLE	MARGINAL	POOR	Internal
HIC(15ms)	22.59	121.61		623	779	935	935	610
Upr Neck Tension (kN)	0.78	1.19		2.1	2.5	2.9	2.9	2
Upr Neck Comp (kN)	0.08	0.20		2.5	3	3.5	3.5	2.4
Upr Neck Bending MX (N-m)	10.88	23.32		-	-	-	-	67
Head Kinematics	NA	NA		See Table	See Table	See Table	See Table	-
Shoulder Defl (mm)	5.43	16.42		-	-	-	60	-
Shoulder Force Fy (kN)	0.36	1.03		-	-	-	-	2.5
Shoulder Disp spike in Load?	NA	NA		-	-	-	Yes	-
Thorax Rib Upr Defl (mm)	23.16	21.66		51	53	55	55	-
Thorax Rib Mid Defl (mm)	25.40	28.86		51	53	55	55	-
Thorax Rib Lwr Defl (mm)	24.39	33.84		51	53	55	55	-
Abdmn Rib Upr Defl (mm)	19.39	30.07		51	53	55	55	-
Abdmn Rib Lwr Defl (mm)	21.66	26.99		51	53	55	55	-
Avg Rib Defl	22.80	28.28		34	42	50	50	-
Thrx Rib Upr Defl Rate (m/s)	3.50	2.86		8.2	9.84	11.48	11.48	-
Thrx Rib Mid Defl Rate (m/s)	2.92	2.01		8.2	9.84	11.48	11.48	-
Thrx Rib Lwr Defl Rate (m/s)	2.73	2.86		8.2	9.84	11.48	11.48	-
Abdmn Rib Upr Defl Rate (m/s)	3.44	2.49		8.2	9.84	11.48	11.48	-
Abdmn Rib Lwr Defl Rate (m/s)	3.50	2.09		8.2	9.84	11.48	11.48	-
Thorax Rib Upr V*C (mm)	0.00	0.00		1	1.2	1.4	1.4	-
Thorax Rib Mid V*C (mm)	0.00	0.00		1	1.2	1.4	1.4	-
Thorax Rib Lwr V*C (mm)	0.00	0.00		1	1.2	1.4	1.4	-
Abdmn Rib Upr V*C (m/s)	0.00	0.00		1	1.2	1.4	1.4	-
Abdmn Rib Lwr V*C (m/s)	0.00	0.00		1	1.2	1.4	1.4	-
Lumbar Spine Fy (kN)	0.33	0.94		-	-	-	-	2
Lumbar Spine Mx (N-m)	62.80	92.03		-	-	-	-	114
Pelvis Iliac Force Fy (kN)	0.71	1.59		4	4.8	5.6	5.6	-
Pelvis Acetabulum Force Fy (kN)	0.76	1.51		4	4.8	5.6	5.6	-
Pelvis Combined Force Fy (kN)	1.46	3.04		4	4.8	5.6	5.6	-
Upr Femur Fy (3msec-kN)	1.22	2.62		-	-	-	-	3.9
Lwr Femur Fx (3msec-kN)	0.10	0.16		2.8	3.4	3.9	3.9	-
Lwr Femur Fy (3msec-kN)	0.20	0.12		2.8	3.4	3.9	3.9	-
Lwr Femur Mx (3msec-Nm)	139.47	164.37		254	305	356	356	-
Lwr Femur My (3msec-Nm)	26.41	24.50		254	305	322	356	-

Bar Graph

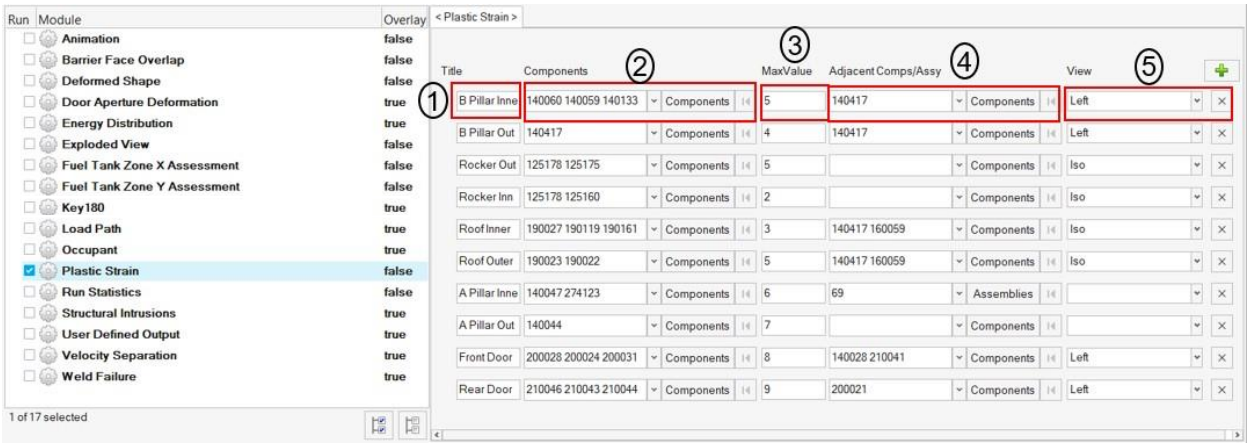


Driver Head



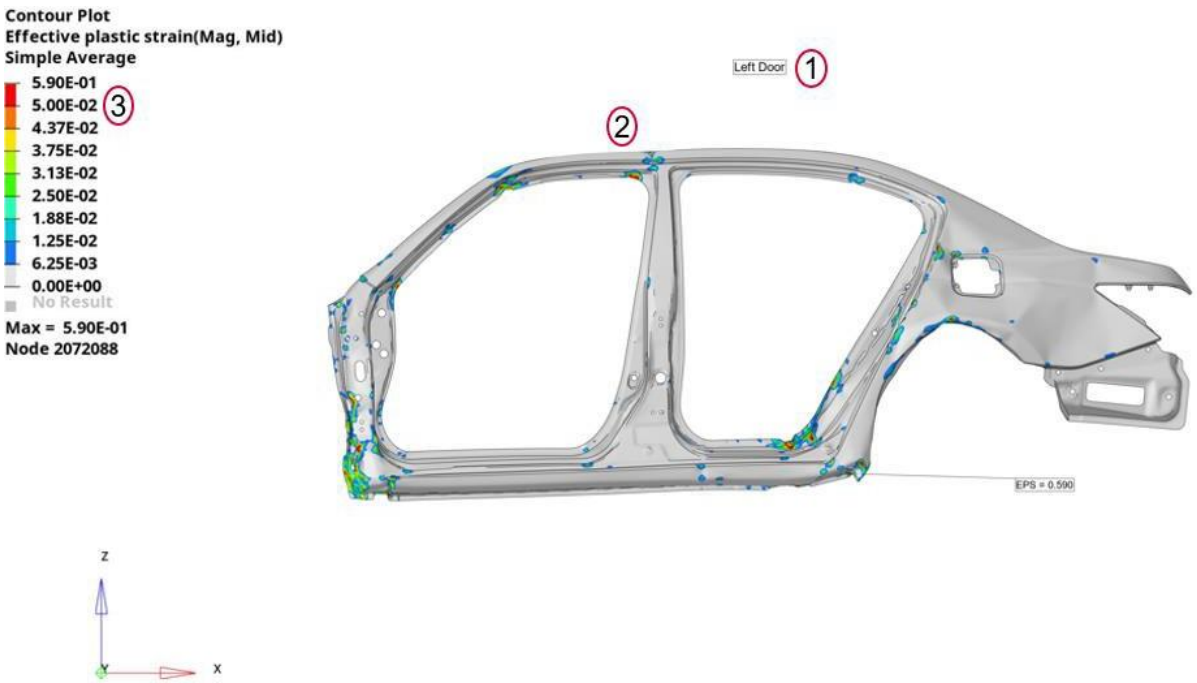
Plastic Strain

This module is used to generate a summary report of plastic strain for the components on the outer side of the vehicle structure.



Inputs:

1) The component label
2) The plastic strain component IDs to be plotted
3) The plastic strain limit that is set when applying the contour (Enter the percent value)
4) The adjacent (or neighboring) components to be included in the image (transparent mode)
5) The standard view that should be used when capturing the image



Run Statistics

This module creates following summary info based on the inputs entered.

1) Model Information summary containing Program Name, Gateway, Run description, vehicle weight, solver version, run time etc.

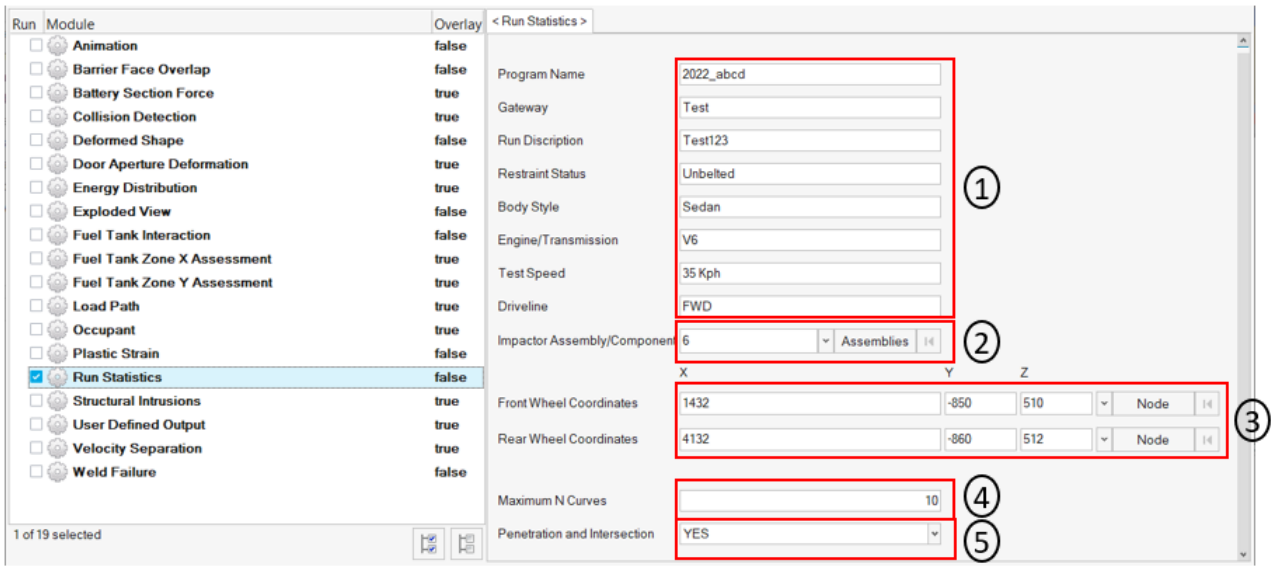
2) Run Quality report which consists of termination time, termination type, mass added, energy ratio etc.

3) Plots consisting of global energy plots, added mass & time step plots and energy ratio plots

4) An image containing vehicle mass & geometric measurements

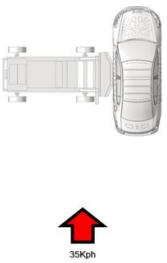
5) Material Internal Energy plots for the user defined Top N parts

6) Penetration & intersections info for the model if the flag is set to Yes



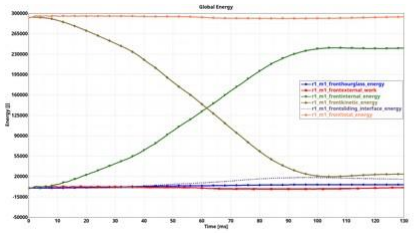
Model Info Summary & Run Quality Report

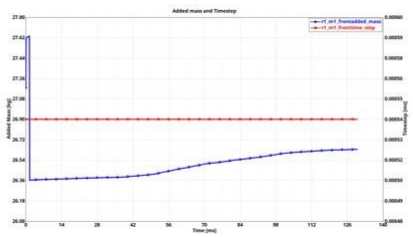
Program Name	Test
Gateway	abcd
Run Discription	Side Impact test run
Restraint Status	Belted
Body Style	Sedan
Engine/Transmission	V4
Test Speed	35 Kph
Driveline	AWD
Run Name	Main.k
Engineer	tejasr
Model Run Date	0 9 / 1 8 / 2 0 2 1
Test Mode	Side IIHS MDB
Gross Vehicle Weight	3.13 kg
Impactor Weight	0.00 kg
Total Weight	3.13 kg
Vehicle Front Axle Weight	1.59 kgs
Vehicle Rear Axle Weight	1.51 kgs
Solver Version	mpp s R7.1.2
Number of CPU	8 CPU
Run Time	21 hr 41 min 54 sec

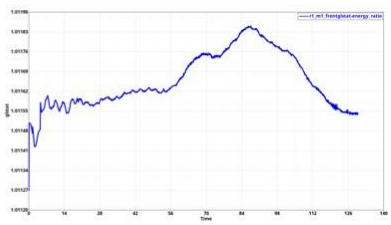


Run Quality	Result	Target
Termination Time	130.0 ms	130.0 ms
Termination Type	Normal Termination	
Mass Added @ T=0 [%]	1.49 %	< 1 %
Total Mass Added [%]	1.51 %	< 3 %
Total Mass Added [kg]	27.636 kg	
Energy -> Hourglass [%]	2.525 %	< 10 %
Energy -> Ratio [%]	1.0119 %	1 >= Energy Ratio < 1.01

Global Energy, Added Mass, Time Step & Energy Ratio Plots

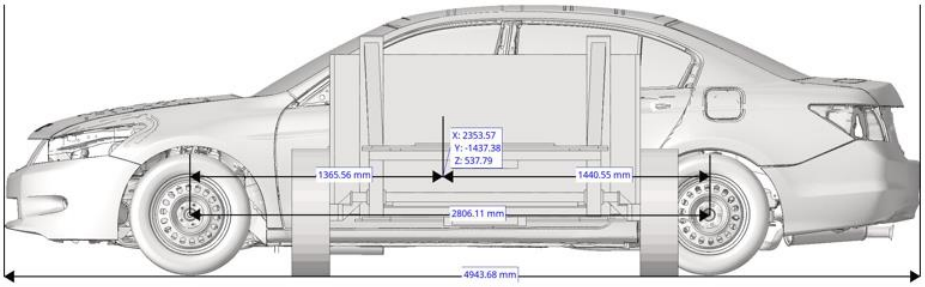




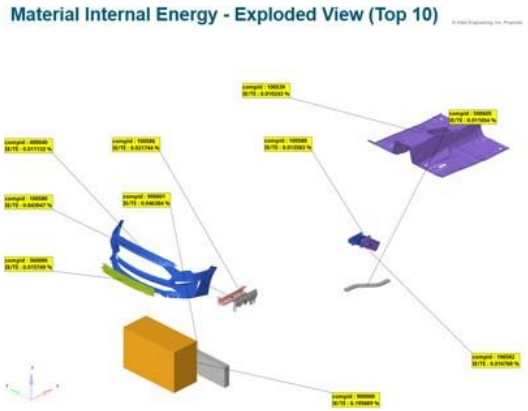


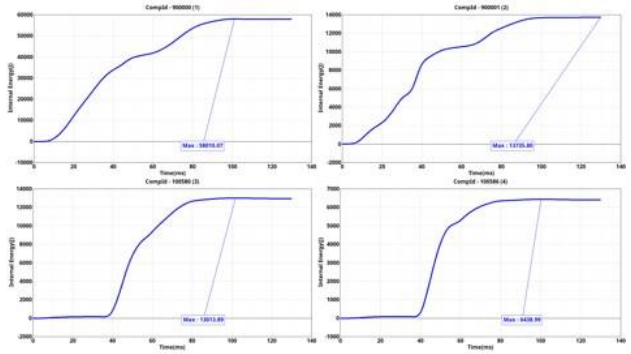
Vehicle Mass & Geometric Measurements

Vehicle Mass (kg)	1826.09 kg
Front Axle weight %	55.67%
Rear Axle weight %	44.33%



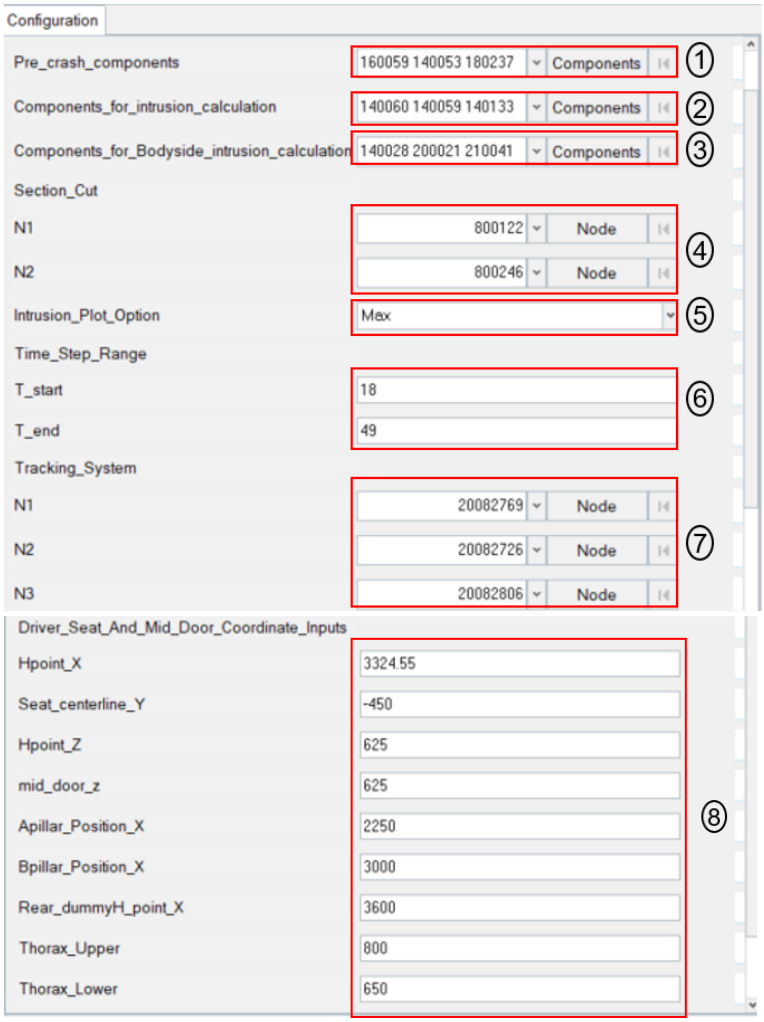
Material Internal Energy Summary





Structural Intrusions

This module primarily computes structural intrusion as per IIHS regulation.

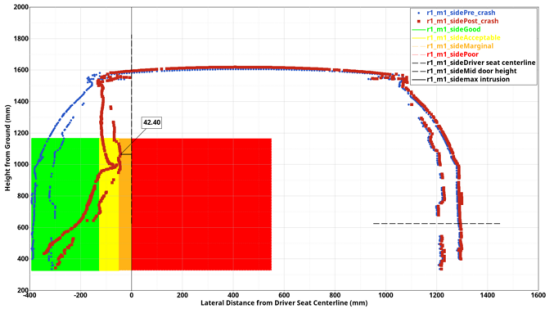


Inputs:

1) The component IDs representing pre-crash components
2) The component IDs required for intrusion calculations (Bpillar Inner & Outer parts)
3) The component IDs for plotting body side intrusions (Front & rear Fender, Front & rear door parts)
4) The 2 IDs required for Bpillar section cut
5) The intrusion plotting option (Max step or Last step)
6) Time step start & end range for plotting (or tracing) the Bpillar section cut profile
7) The 3 node IDs required for defining tracking system
8) Various driver seat and mid door coordinate inputs required for creating structural intrusions, Bpillar Inner & body side intrusion plots

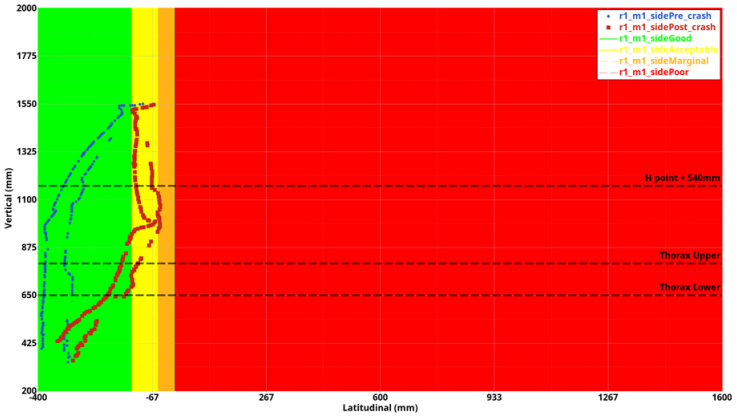
IIHS Side MDB Intrusion Plot

Structural Results	Max Intrusion	GOOD	ACCEPATABLE	MARGINAL	POOR	FAC PDG
B-Pillar Intrusion Relative to Seat Centerline	-42.4	-125	-50	0.0	0.0	0

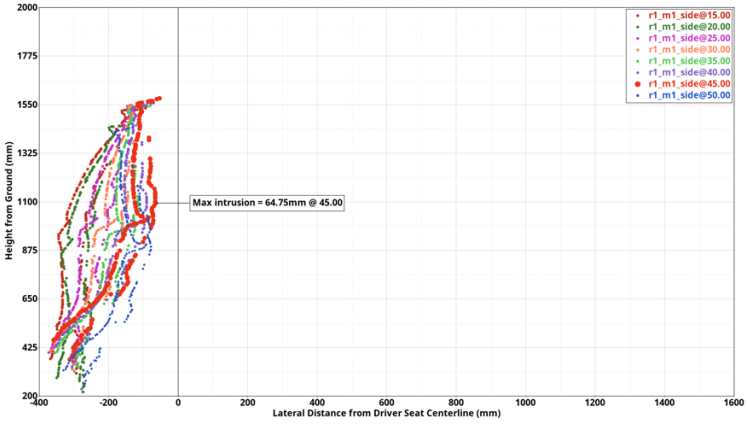


BPillar postcrash position(mm)	-492.4
Driver seat centerline precrash position(mm)	-450.0
Bpillar distance beyond precrash position of driver seat centerline(mm)	-42.4
*Rounded value used for rating structure(mm)	-42.4
Structure rating	Marginal

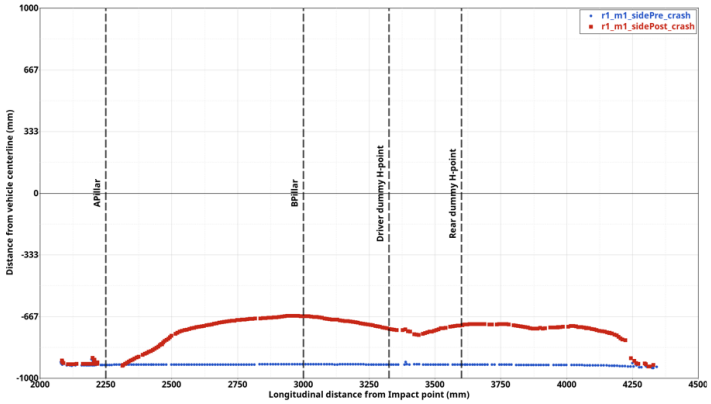
BPillar Inner



User Defined Intrusion

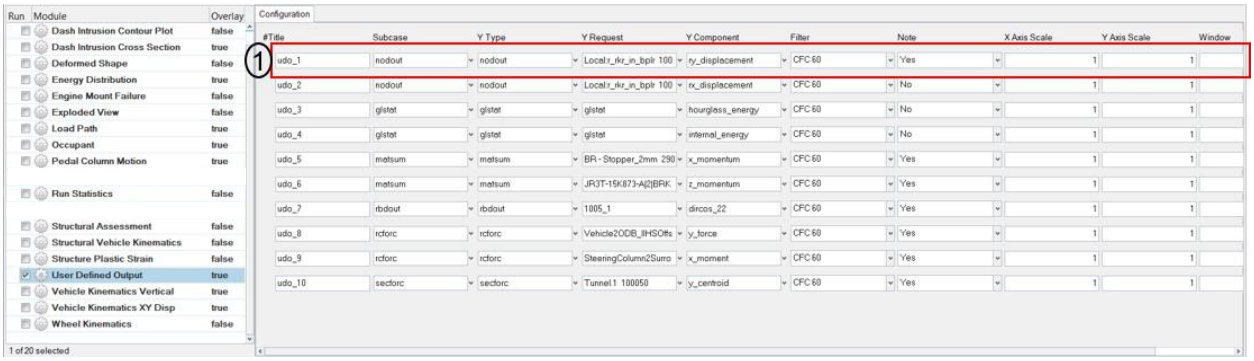


IIHS Bodyside MDB Intrusion Plot



User Defined Output

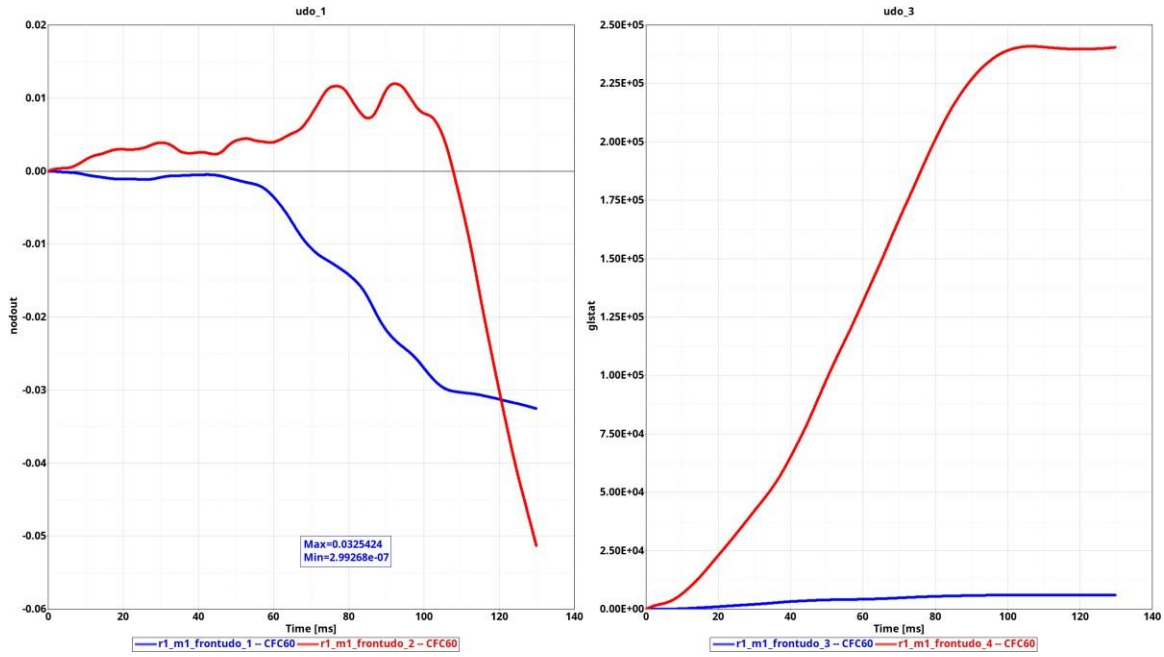
As the name suggests this module allows users to plot program specific Time History data. The plots are created based on user defined list of inputs as shown in the UI below.



Inputs:

For each user defined plot, following set of inputs are required.

- Label to be used as plot header
- Subcase name, Y Type, Y Request & Y Component from the Time History file
- Filter class to be used
- Note with Min & Max value is required to be created
- X & Y axes scale factors if required to be used
- Window number to be used when plotting the curves
- Y axis unit to be used for plotting the Y vector

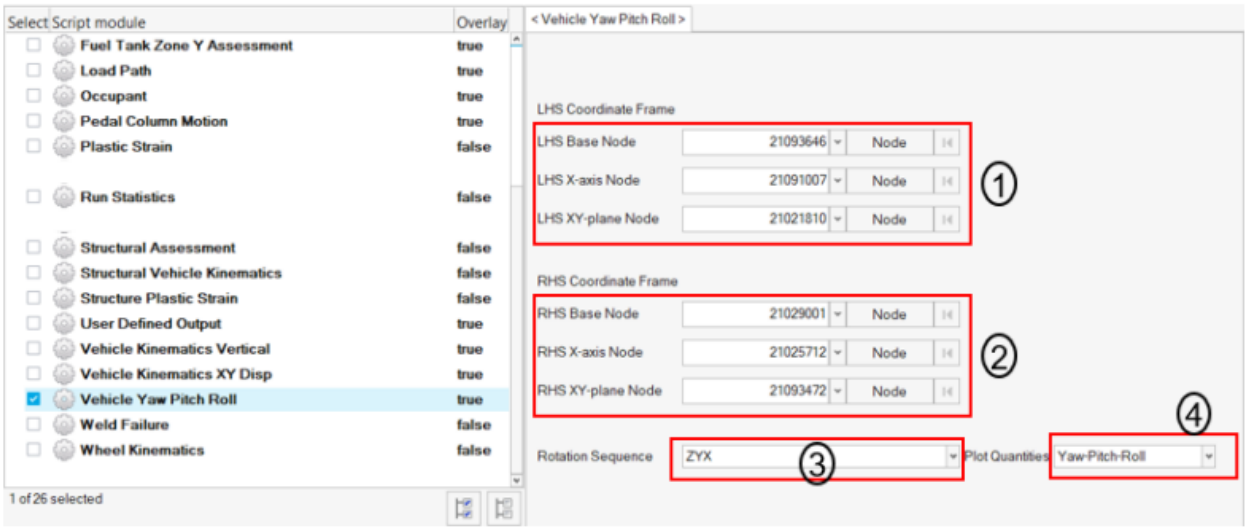


Vehicle Yaw Pitch Roll

This module generates the summary report capturing the vehicle rotations (yaw, pitch & roll) for the user selected coordinate frames. The module requires input selection of 2 nodes to define just the X-axis definition, or 3 nodes to define the X-axis and the XY-plane.

The Yaw, Pitch and Roll angles are calculated using Euler angles with the definition at Time=0.0 taken as the starting orientation. The default for the rotation sequence is "ZYX" and the user has the option to change to any of 5 other pre-defined sequences. User can also select between plotting 2 of the 3 angles or all 3 angles. If input is defined for the Left-Hand Side and Right-Hand Side coordinate systems, the average of the two is also plotted.

1) It plots LHS, RHS & Average yaw, pitch & roll plots based on the inputs defined
2) It also creates a summary table with the yaw, pitch & roll values (in degrees)



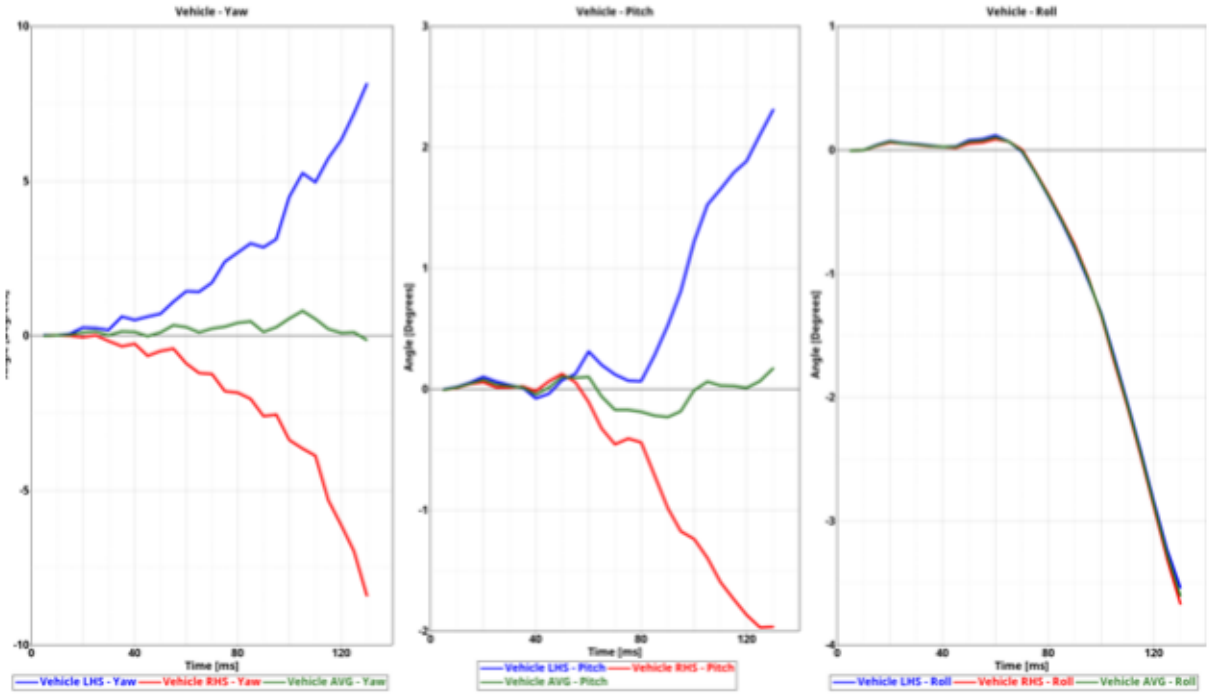
Inputs:

1) 3 nodes defining LHS coordinate frame (3D model)
2) 3 nodes defining RHS coordinate frame (3D model)
3) Rotation sequence (ZYX, ZXY, XYZ, XZY, YZX & YXZ)
4) Quantity to be plotted

Outputs:

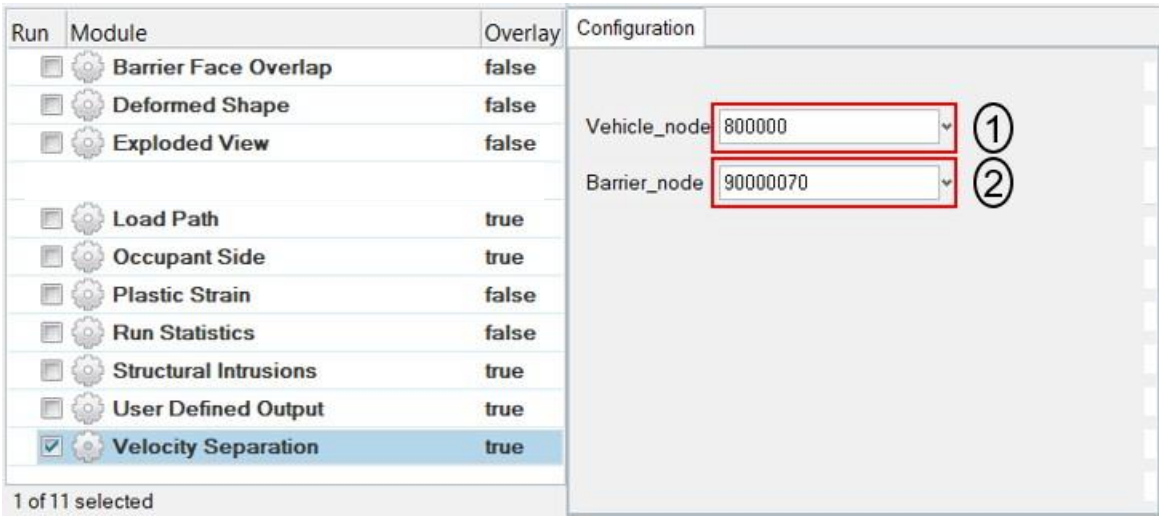
Vehicle Yaw / Pitch / Roll			
Side	Yaw [degrees]	Pitch [degrees]	Roll [degrees]
LHS	8.138	2.313	3.538
RHS	8.402	1.967	3.669
AVG	0.804	0.228	3.603

Vehicle YawPitchRoll Plot



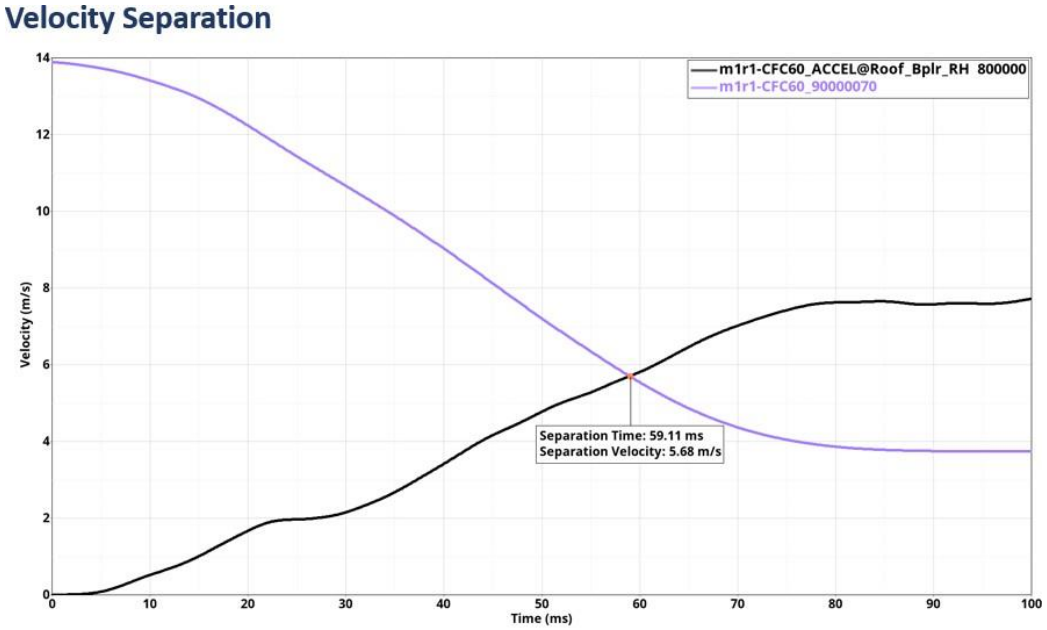
Velocity Separation

This module generates velocity plots for the selected vehicle and the barrier nodesduring impact. Then finds out the time & velocity at which separation happens.



Inputs:

1) Vehicle node (request ID) ID from Time History file (binout)
2) Barrier node (request ID) ID from Time History file (binout)



Impact Separation Time	59.11
Impact Separation Velocity	5.68

Weld Failure

This module generates a detailed report of all the welds ruptured based on the user selected weld material. Following weld types are supported.

a. 1D beam spot welds

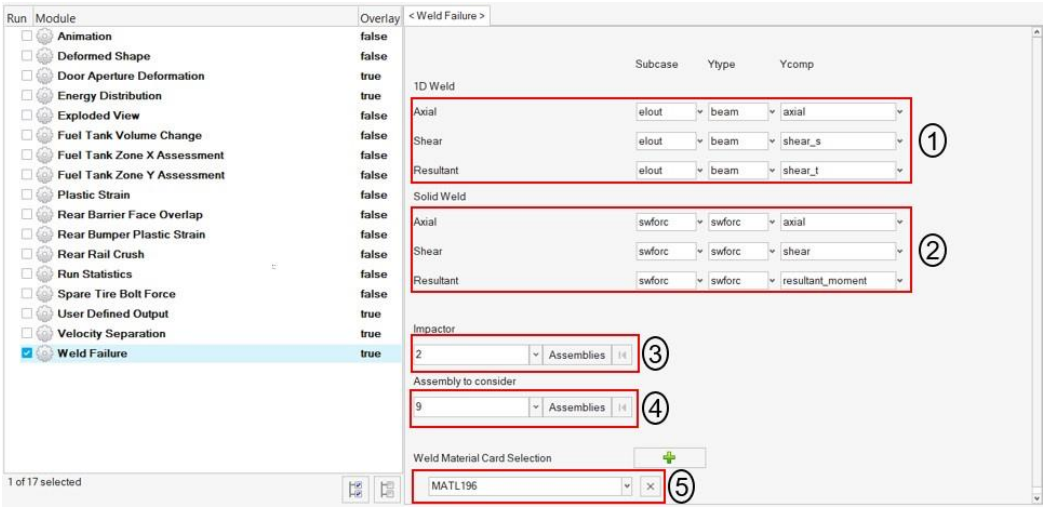
b. Single hexa spot welds

c. Hexa nuggets (cluster of hexa elements)

d. Hexa adhesives

The detailed PPT report generated can be categorized into following different sections.

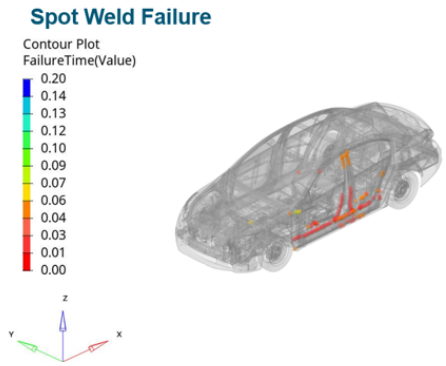
- First two slides give you the global viewpoint. It contains the complete view of the vehicle with all the ruptured welds color coded as per the failure time contour & another slide showing the cumulative graph of the ruptured welds across the simulation time steps.
- The subsequent slides capture the detailed report for each of the ruptured weld for each of the weld type found in the model.
- For 1D beam spot weld & single hexa spot weld types, the report contains an isolated view of the weld & its linked components & a graphs showing the axial, shear & resultant plots across the time steps.
- For hexa nuggets & hexa adhesive weld types, the report contains detailed view of the weld containing the linked components.

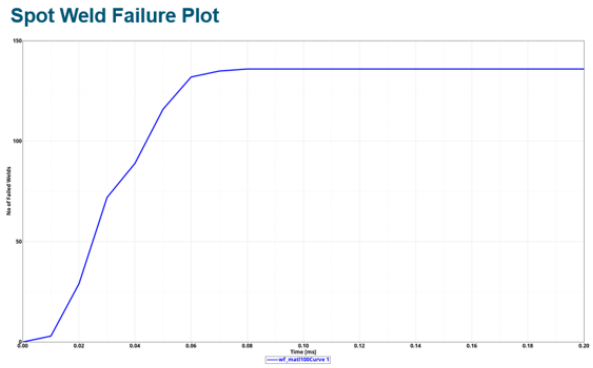


Inputs:

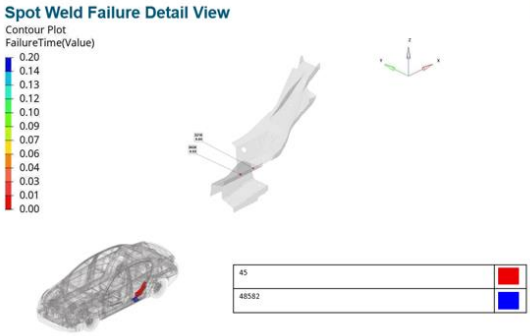
1) The time History info (binout) to be used for 1D beam spot welds axial, shear & resultant graphs
2) The time History info (binout) to be used for single hexa spot welds axial, shear & resultant graphs
3) Impactor assembly / component ID
4) Assembly ID / Component ID list (optional) to be used to find ruptured welds for report generation
5) Weld material ID used to find the ruptured welds

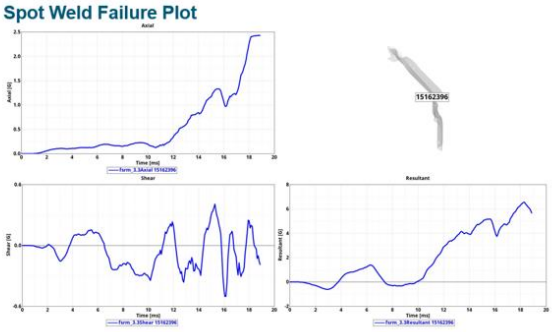
Global viewpoint:



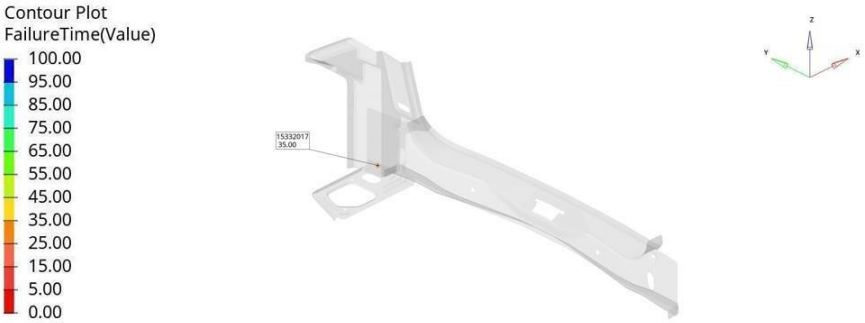


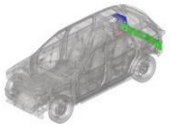
1D beam spot weld / Single hexa spot weld report





Hexa nuggets report:





R2FB_S11146_A|EXT|FLR|PAN|SD|RR|0.8mm	
R2HB-S27944-A|10|REINF RR LP OPG LWR|0.8mm	
R2HB-S40492-A|22|PNL LWR BK I|S|0.7mm	

Hexa adhesives report: