



Altair Safety Report Manager





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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 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.

	📕 Altair Safety	Report Manager									\times
പ	Impact Type: Regulation:	Front FMVSS 208 Full Second		Main Overlay 1 Overlay 2 Overlay	3 Overlay 4	Dyna	✓ O Test Da	a HDF	*	6	🖻 🔶
G	Units:	mm/ms/kg v		Title:	main_iter_						Input Check
0	# of Overlay:	0 ~		Previous session file:							K
0		Config same as Main		Analysis results directory:	W						Search
(3)	# of Processes:	14 *		Config excel file:	đ						🕞 Save As
		More options		Tracking system nodes (N1, N2, N3):		*	¥	 Apply 	y to Modules		
	Select Module		Overlay	< Animation >							
	🗹 🍥 Anima	ation	false 1								
	🗆 🍥 Batte	ry Section Force	true								
	🗆 🍥 Collis	sion Detection	false	Tracking System			\overline{O}				
	🗆 🍥 Dash	Intrusion Contour Plot	false	Tracking System			U				
	🗌 🍥 Dash	Intrusion Cross Section	true	N1			Node I				
	🗆 🍥 Defor	rmed Shape	false	N2			Node II				
~	🗆 🍥 Displ	acement Plot	false								
(4)	🗆 🍥 Door	Aperture Deformation	true	N3			Node I				
\sim	🗆 🍚 Energ	gy Distribution	true								
	🗆 🍥 Engir	ne Mount Failure	false	Title			v	iew	+		
	Explo	oded View	false								
	🗌 🍈 Fuel	Tank Interaction	false	- Con	ponents H				* ×		
	🗆 🎯 Fuel	Tank Zone X Assessment	true								
	🗌 🍥 Fuel	Tank Zone Y Assessment	true								
	Load	Path	true								
	Occu	pant	true ,								
	1 of 28 selected										
5	Report output dire	ctory:									🥶 Now

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 along with the source units used for running the simulation. Based on this selection the modules list (section #4) gets updated.

Impact Type:	Front	۷
Regulation:	FMVSS 208	۷
Protocol:	Full Frontal	۷
Units:	mm/ms/kg	*

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.

# of Overlay:	(2)	¥	Main	Overlay 1	Overlay 2	Overlay 3	Overlay 4	
	Same a	s main	Title:					

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.

# of Processes:	14	*
	More 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 & 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.

Main Overlay 1 Overlay 2 Overlay	3 Overlay 4
	O CAE Data Dyna ♥ ○ Test Data HDF ♥
Title:	
Previous session file:	
Analysis results directory:	
Config excel file:	
Tracking system nodes (N1, N2, N3):	✓ Apply to Modules

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.

Run Module	Overlay	Configuration			
Animation	false				
Dash Intrusion Contour Plot	false	Tracking_System			
Dash Intrusion Cross Section	true	N1		v Node	La
Deformed Shape	false			Hode	1.4
Energy Distribution	true	N2	8000000	✓ Node	14
Engine Mount Failure	false	N3	15838433	v Node	14
Exploded View	false		10000100	Houe	1.4
🔳 🏟 Load Path	true	Body Side Type	Components		
Occupant	true	Body Side Assembly/Components	150364 150365	~ Components	14
Pedal Column Motion	true	DASH Assembly			
Comparison Run Statistics	false	Туре	Assemblies		
		Assembly/Comp Name/ID		✓ Components	14
Structural Assessment	false				
1 of 21 selected					

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.





earch nere				
Name	Size	Date modified	Туре	
🗎 testT01	253198 KB	27/01/23 03:42 PM	File	
				selected 1
E Data> Dadiaga> Calvar Japa	ut File:			
E Data> Radioss> Solver Inplearch here	ut File:			
E Data> Radioss> Solver Inplearch here	ut File: Size	Date modified	Туре	
E Data> Radioss> Solver Inpi earch here Name test_0000.rad	Size 1216449	Date modified 27/01/23 03:37 PM	Type RAD File	
E Data> Radioss> Solver Inp earch here Name test_0000.rad test_0001.rad	Size 1216449 1 KB	Date modified 27/01/23 03:37 PM 27/01/23 03:38 PM	Type RAD File RAD File	

Change curve attributes & publish session

This section is mainly used for the overlay scenario.

The change curve attributes option is 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.

Noverlay Setting			×
✓ m1_hg	Isolate Only Sho	w Hide	Show All
m2_hg	Layer Color		Layer Line Thickness 🗸 👻
	Symbol Color		Symbol Size
	Symbol	On	© Off
	Notes Font	А	
	Notes Position	*	
	Legend	On	© Off
	Legend Font	A	
	BarGraph Category Font	t A	BarGraph Gap

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.



Tracking System	
N1	15849041 v Node 14
N2	15839164 v Node 14
N3	15838433 ¥ Node 14
l itle	View
7 Y Assemblies H	Top 👻 🗙
9 Y Components H	lso v x

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

<occupant></occupant>									
Driver Passenger									
Dummy Model 50h * Dummy Version config * Reset									
i+¿Driver Restraint Type		w							
Driver ID									
Driver Injury Criteria	Subcase	Datatype	Request	Component	Filter				
HEAD_ACC_X	hodout		4						
HEAD_ACC_Y HEAD_ACC_Z HEAD_ACC_RES NECK_UPPER_MOMENT_Y	ebstet sbittet_cpm deforc disbout elout gistet jottorc methum		 НЭ507Н_DU 	MMY-1_HEAD_ACCELEROM MMY-1_HEAD_ACCELEROM MMY-1_HEAD_ACCELEROM MMY-1_CHEST_ACCELERON MMY-1_CHEST_ACCELERON MMY-1_CHEST_ACCELERON MMY-1_PELVIS_ACCELERON MMY-1_PELVIS_ACCELERON	ETER_X 2000001 ETER_Y 200002 ETER_X 200003 AETER_X 200005 AETER_Y 200005 AETER_X 200005 AETER_X 200007 AETER_Y 200008				
NECK_UPPER_FORCE_X	nodout	2 C	1	JY [Y	¥.			
NECK_UPPER_FORCE_Z		+)• [)+[)•[w			
CHEST_DEFLECTION		+)+ ()+ [-	*			
CHEST_ACC_X		+)+ ()+ (+				
CHEST_ACC_Y		+	+)+ ()+[*			
CHEST_ACC_Z		4	P.C	~	-	+			



Modules

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

- Animation
- Animation New
- Battery Section Force
- Collision Detection
- Contour Plot
- Deformed Shape
- Displacement Plot
- Door Aperture Deformation
- Energy Distribution
- Exploded View
- Fuel Tank Interaction
- Fuel Tank Volume Change
- Fuel Tank Zone X Assessment
- Fuel Tank Zone Y Assessment
- Load Path
- Measure Plot
- Plastic Strain
- Rear Barrier Face Overlap
- Rear Bumper Plastic Strain
- Rear Rail Crush
- Run Statistics
- Spare Tire Bolt Force
- User Defined Outputs
- Vehicle Yaw Pitch Roll
- Velocity Separation
- Weld Failure





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

	Animation Dash Intrusion Contour Plot Dash Intrusion Cross Section Deformed Shape Energy Distribution Engine Mount Failure Exploded View	false false true false true false false	Tracking System N1 N2	n		15849041 v	Node	14			
	Dash Intrusion Contour Plot Dash Intrusion Cross Section Deformed Shape Energy Distribution Engine Mount Failure Exploded View	false true false true false false	Tracking System N1 N2	n		15849041 v	Node	14			
	Dash Intrusion Cross Section Deformed Shape Energy Distribution Engine Mount Failure Exploded View	true false true false false	Tracking System N1 N2	n		15849041 🗸	Node	14			
	Deformed Shape Energy Distribution Engine Mount Failure Exploded View	false true false false	N1 N2	m		15849041 🗸	Node	14			
	Energy Distribution Engine Mount Failure Exploded View	true false false	N1 N2			15849041 ~	Node	14			
	Engine Mount Failure Exploded View	false false	N2								
	Exploded View	false	1			15839164 -	Node	0			
IN 122 .	18.4				10			\cup			
III 197 1	Load Path	true	N3			15838433 ~	Node	14			
■ 💮 🤇	Occupant	true			L						
E 💮 F	Pedal Column Motion	true	Title					View			4
E 💮 F	Run Statistics	false	7	✓ Assemblies	@		3	Тор		-	×
E () :	Structural Assessment	false	9	✓ Assemblies	H			Iso		~	×
E () :	Structural Vehicle Kinematics	false									
E 💮 🗧	Structure Plastic Strain	false									
1 of 20 selec	cted		د .								18
Output direc	ctory: C:/temp/s/IIHS_front/iihs_front_te	st							1	-	

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:





Animation New

This module lets you capture animation of the selected parts (or assemblies) and offers flexibility in terms of page layout, view orientation, tracking and section cut. The GUI and the various inputs that are required to be defined are mentioned below.

< Animation New >	`		
animation Page 🕶 🔲 👻 🗔 Add)		
Search here Q 🗸	 Standard 		
Entity (2)	Title:	window title	
• p1 IIHS_MDB_Side_Impact	 FE Entities 		
- 🅞 p1w1 window title	FE Entities:	Components (1125)	La
p1w2 window title	 View Set 		
	View:	lso	~
	Secondary Zoom Factor:		1.0
	🕶 🗹 Tracking		
	Name:	tracking1	
	Track:	Plane	*
	Plane Type:	OXY	*
	N1N2N3:	a N1 2453176 N2 2444863 N3 3496459	
C	Displacements (Global X):		
	Displacements (Global Y):	:	
	Displacements (Global Z):		
	Lock Rotations:		
	Window Track:		
	Align with Global (T=0):		
selected 1 of 3	Section		

- Use this input to select the page & window layout that will be captured and included in the report. 2 layouts are supported i.e. 1 x 1 and 1 x 2. Select the layout and click on Add button to add the page layout into the entity list browser.
- 2) The **Entity** list browser is used to list and manage the pages included by the user and their respective layouts.
- 3) Enter the **Title** used for the slide title in the report, select the **Components** to be used for the current page and the **View Set** to be used to orient the components.
- 4) Define **Tracking system** & **Section cut** details along with its attributes to be applied while generating the 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.

	~
Run Module	Overlay < Battery Section Force > (1)
Battery Section Force	true A Battery Floor Sections Battery Intrusions
Collision Detection	true
Deformed Shape	false Forces Filter v (2)
Door Aperture Deformation	true
Energy Distribution	true Front Floor Components C 3
Exploded View	false Battery Components
Fuel Tank Interaction	false
🗆 🎃 Fuel Tank Volume Change	true Vehicle to Impactor Contact
Fuel Tank Zone X Assessment	true
Fuel Tank Zone Y Assessment	true Battery Sections Floor Sections
Plastic Strain	false
Dear Parrier Face Overlap	folden * 6 Battery Section 1 * Ploor Section 1 *
1 of 20 selected	
Run Module	Overlay Statisty Section Force >
Battery Section Force	true Battery, Floor Sections Battery Intrusions (8)
Collision Detection	true
Deformed Shape	false Filter
Ooor Aperture Deformation	tue
Energy Distribution	uter Intrusions Point A Point B Dir
	Intrusion Loc 1 V Node Id N V Node Id N Z X 10 <th10< th=""> 10 10</th10<>
German Volume Change	
Fuel Tank Zone X Assessment	
🗆 🍈 Fuel Tank Zone Y Assessment	true
Plastic Strain	false
1 of 20 selected	folen ¥
T OF 20 Selected	148 142 ×

- 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	5.30	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 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.

< BOM >			
BOM Selection	1 5938 - Components I	0	
Entities components properties materials	2	Datanames IZZcog lines lumpedmass mass material	3
Preview Note		materialid moduleid	(4) <u>+ ×</u>
Sel R	Label Component-mass		

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.

Run Module	Overlay	< Collision D	etection >									
Animation Section Force	false ^	State	Last		*]1)						
Collision Detection	true											
Geformed Shape	false	Title	Group A			Туре	Group B				Туре	+
Door Aperture Deformation	true	pair 1	535242 535016 535017	* Components	14	Component	535024 535026 535027	4	Components	14	Components	6
Energy Distribution	true								oomponana			E
Exploded View	false	pair 2	500031 535023 535038	* Components	14	Components	535037	~	Components	14	Components	×
Fuel Tank Interaction	false	pair 3	500002 500029 500034	* Components	14	Components	500020 500604	-	Components	н	Components	×
Fuel Tank Volume Change	true											
🗆 🎡 Fuel Tank Zone X Assessment	true	pair 4	545003 545005 545001	* Components	14	Components	426000 426001	-	Components	14	Components	×
🗆 🍚 Fuel Tank Zone Y Assessment	true											
Plastic Strain	false											
Rear Barrier Face Overlap	false											
C 🕼 Rear Bumper Plastic Strain	false											
🗆 🍈 Rear Rail Crush	false											
🗆 🍈 Run Statistics	false											
Spare Tire Bolt Force	true											
User Defined Output	true 🗸											
2 of 20 selected	LS LS											

Inputs:

- 1) Select the time step state at which the collision detection is performed
- 2) 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:

pair 2







Contour Plot

This is a generic module that allows users to define 4 different types of pages and layouts (namely **Contour** page, **Section** page, **Hotspot** Page & **Zoom** page) and include them in the report. It has the following capability.

- Ability to generate reports with any scalar result datatype contour.
- Ability to find Hotspots & report them.
- Ability to draw section cuts.
- Ability to capture images with user specified zoom factor.

The GUI and the various inputs that are required to be defined are mentioned below.

< Contour Plot >			
🚺 Contour Page 🔻 🖽 🔻 🛃 Add			
🚺 Contour Page 🛛 👼 Section Page 🚺	 Standard 		
🛃 Hotspot Page 🛛 🐇 Zoom Page	Title:	window title	
• p1 carrier LH	 FE Entities 		
- 🌆 p1w1 window title	FE Entities:	Components (1)	51
p1w2 window title	 View Set 		
- 🧑 p1w3 window title	View:	Rear	*
Description of the second s	Secondary Zoom Factor:		1.0
p2 LH Headrest Vertical Lock	• 🗹 Contour		
D 2 W 2 Window title	Data Type:	Strain	*
• B p3 LH Headrest Top Plastic Cover	Data Component	P1 (major)	*
- 🗞 p3w1 window title	Layer:	Lower	*
- sw2 window title	Resolved in:	Analysis System	*
 Imp 4 LH Front Cover 	Average Method:	None	*
- p4w1 window title	Legend Threshold:		0.012
Definition of the participation of the participatio	Section		
	Name:	section1	
	Orientation:	Normal to screen	*
	Base Node:	• node (0)	Ŀ}
	Deformable:		
	Clip Above:		
	Cross Section Only:		
	Show Grid lines:		
selected 1 of 14			

Inputs:

- Use this input to select the page & window layout that will be captured and included in the report. The layouts supported are different for different page types as mentioned below.
 - a. Contour page 1 x 1, 1 x 2 & 2 x 2
 - b. Section page $-1 \times 2 \& 2 \times 2$
 - c. Hotspot page 1 x 1
 - d. Zoom page 1 x 2 & 2 x 2.

Select the required layout and click on **Add** button to add the page layout into the entity list browser.



- 2) The **Entity** list browser is used to list and manage the pages included by the user and their respective layouts.
- 3) Enter the **Title** used for the slide title in the report, select the **Components** to be used for the current page type selected and the **View Set** to be used to orient the components.
- 4) Define the **Contour** & **Section** details (& all its attributes) to be applied while generating the report for the Contour module.



Output: Section page with 2 x 2 layout

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)

un Module	Overlay	Configuration					
C Animation	false						
Dash Intrusion Contour Plot	false						
Dash Intrusion Cross Section	true	Traching Contra					
Deformed Shape	false	Tracking System	n				
Energy Distribution	true	N1	1528	7725 - Node	14		
Engine Mount Failure	false	N2	2108	8810 V Node	0		
Exploded View	false			interest in the second se			
E 🙆 Load Path	true	N3	2108	19957 - Node	14		
🗐 🍥 Occupant	true						
E 🎯 Pedal Column Motion	true	Titto 6)	0	Tupo	View	(4)
)	(3)	type	ALGAN	
							1000
Run Statistics	false	Deform_1	9 24 25 56 57	- Assemblie	s 🖂 Assemblie	s ISO	• ×
Run Statistics	false	Deform_1	9 24 25 56 57	Assemblie Assemblie	s H Assemblie	s ISO	* ×
George Run Statistics George Structural Assessment	false false	Deform_1 Deform_2	9 24 25 56 57 24 25 56	Assemblies Assemblies	s 14 Assemblie s 14 Assemblie	s ISO s LEFT	* ×
Good Run Statistics Good Structural Assessment Good Structural Vehicle Kinematics	false false false	Deform_1 Deform_2 Deform_3	9 24 25 56 57 24 25 56 24 25 56 24 25 56	Assemblie Assemblie Assemblie Assemblie Assemblie	s 14 Assemblie s 14 Assemblie s 14 Assemblie	s ISO s LEFT s TOP	* × * ×
Que Run Statistics Que Run Statistics Que Structural Assessment Que Structural Vehicle Kinematics Que Structure Plastic Strain	false false false false	Deform_1 Deform_2 Deform_3	9 24 25 56 57 24 25 56 24 25 56 24 25 56		s 14 Assemblie s 14 Assemblie s 14 Assemblie	s SO s LEFT s TOP	* × * × * ×
Constant Statistics Constant Statistics Constant Structural Assessment Constant Structural Vehicle Kinematics Constant Structure Plastic Strain Constant Structure Strain Constant Structure Strain Constant Structure Structur	false false false false true	Deform_1 Deform_2 Deform_3	9 24 25 56 57 24 25 56 24 25 56 24 25 56	v Assemblie: v Assemblie: v Assemblie: v Assemblie:	s II Assemblie s II Assemblie s II Assemblie	s ISO s LEFT s TOP	* x * x * x
Run Statistics Structural Assessment Structural Vehicle Kinematics Structure Plastic Strain User Defined Output Vehicle Kinematics Vertical	false false false false true true	Deform_1 Deform_2 Deform_3	9 24 25 56 57 24 25 56 24 25 56 24 25 56	Assemblie Assemblie Assemblie Assemblie	s II Assemblie s II Assemblie s II Assemblie	s ISO s LEFT s TOP	* X * X
Run Statistics Structural Assessment Structural Vehicle Kinematics Structure Plastic Strain User Defined Output Vehicle Kinematics Vertical Vehicle Kinematics XY Disp	false false false true true true	Deform_1 Deform_2 Deform_3	9 24 25 56 57 24 25 56 24 25 56 24 25 56	Assemblie: Assemblie: Assemblie: Assemblie: Assemblie: Assemblie:	s II Assemblie s II Assemblie s II Assemblie	s LEFT s TOP	* X * X * X

- 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









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

Run	Module	Overlay	< Displacement Plot>	
	Animation	false ^		
	Battery Section Force	true		
	Collision Detection	true		r
	Deformed Shape	false	Rear_door 12501 v Components 14 450 12510 12502 12505 v Components 14 Left v 3	<
2	Displacement Plot	false		
	Door Aperture Deformation	true		
	Energy Distribution	true		
	Exploded View	false		
	Fuel Tank Interaction	false		
	Fuel Tank Zone X Assessment	true		
	Fuel Tank Zone Y Assessment	true		
	💮 Load Path	true		
	Plastic Strain	false		
	Run Statistics	false		
	i User Defined Output	true		
	Vehicle Yaw Pitch Roll	true		
1 = 6 17	Wold Failure	faleo Y		
1 of 1/	selected		•	>

Inputs:

1) The component label

X

- 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.

Run Module	Overlay	< Door Aperture Deformation >						
E 💮 Animation	false							
E Offormed Shape	false	050 199						
Door Aperture Deformation	true	CPC 180	Pinter U					
Energy Distribution	true							
Exploded View	false	~ Component	s H Components	of Impactor				
🗐 🍥 Fuel Tank Zone X Assessment	false	101	<u> </u>	Ξ				
📕 🍥 Fuel Tank Zone Y Assessment	false						-	
Plastic Strain	false	Door Elems	Subcase	Ү Туре	Y Request	Y Component	4	
🗐 🍈 Rear Barrier Face Overlap	false	Left Elem 1		*	*	*	*	
E 🙆 Rear Bumper Plastic Strain	false							(3)
🗐 🍈 Rear Rail Crush	false	Right Elem 1		*	*	*	* ×	
E G Run Statistics	false							
E 💮 User Defined Output	true							
Velocity Separation	true							
1 of 14 selected								

- 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



23

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.

Run	Module	Overlay	(Configuration					
	Animation	false	^						
	Dash Intrusion Contour Plot	false							
	Dash Intrusion Cross Section	true				1.1.		2	
	Deformed Shape	false		Barrier	ODB	V Components)	
	Energy Distribution	true							
1	Engine Mount Failure	false		Subsystem Energy	Title		Type	4	
	Exploded View	false	6	, ,,				-	-
	i Load Path	true	(2	BIW_UNDERBODY	8	~ Components	Components	×	
	Occupant Occupant	true		BIW_UPPERBODY	9	+ Assemblies	Assemblies	×	
	Pedal Column Motion	true							
				BIW_DASH	7	✓ Assemblies	Assemblies	×	
	Run Statistics	false		FRT DOOR	24	✓ Assemblies	Assemblies	×	
	Structural Assessment	false							
	Structural Vehicle Kinematics	false							
	Structure Plastic Strain	false							
1	Iser Defined Output	true							
	Wehicle Kinematics Vertical	true							
	Wehicle Kinematics XY Disp	true							
	Wheel Kinematice	foleo	۷						

Inputs:

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



Energy Distribution Pie Chart



BIW_UNDERBODY BIW_UPPERBODY BIW_DASH FRT DOOR OTHERS





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.

Run Module	Overlay	Configuration						
Animation	false ^							
Dash Intrusion Contour Plot	false	Tala				Turn	-	
Dash Intrusion Cross Section	true					туре		
E 🍥 Deformed Shape	false	(1) DASHCOWL	9	*	Assemblies	14 Assemblies	×	(2)
Energy Distribution	true		56	1.1	Assemblies	Assemblies		
Engine Mount Failure	false	ONDERBODI			Assemblies	Assemblies		
🖉 🍥 Exploded View	false	UPPERBODY	57	*	Assemblies	H Assemblies	×	
🔲 🎡 Load Path	true							
Cccupant	true							

- 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 Volume Change

This module is used to calculate the maximum percentage volume change for fuel tank across the simulation time steps. A graph of fuel tank volume over time will be plotted.

Run Module	Overlay	< Fuel Tank Vol	ume Change >				
Door Aperture Deformation	true	#Title	Subcase	Y Type	YRequest	Y Component	Filter Note
Energy Distribution	true			That	h. I	la f	(1)
Exploded View	false		<u></u>	×			
🗹 🍥 Fuel Tank Volume Change	false						
🗆 🍥 Fuel Tank Zone X Assessment	false						
🗆 🍥 Fuel Tank Zone Y Assessment	false						
🗆 🍈 Plastic Strain	false						
🗆 💮 Rear Barrier Face Overlap	false						
🗆 🍈 Rear Bumper Plastic Strain	false						
🗆 🎯 Rear Rail Crush	false						
Run Statistics	false						
Snare Tire Bolt Force	false *						
1 of 16 selected							

- 1) Enter the title for the plot
- 2) Select the subcase, Y type, Y request & Y component of fuel tank node ID from time history file
- 3) Select filter & note options if required





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.

Run Module	Overlay	< Fuel Tank Zone X Assessment >					
Animation	false						^
E G Deformed Shape	false	Eilter	12				
Door Aperture Deformation	true	T men	6				
Energy Distribution	true						
Exploded View	false	Impactor	- Components H	Components			
🔽 🍥 Fuel Tank Zone X Assessment	false			1			
🗐 🍥 Fuel Tank Zone Y Assessment	false	Wheel	Components 14	Components			
Plastic Strain	false	Fuel Tank	~ Components 14	Components			
Rear Barrier Face Overlap	false			1.	0		
🛅 🎡 Rear Bumper Plastic Strain	false	RearRail	Components 14	Components	2		_
🗐 🍥 Rear Rail Crush	false	Chassis	- Components 14	Components			
Run Statistics	false						
🗐 🍥 User Defined Output	true	Exhaust	Components 14	Components			
Velocity Separation	true	Motor	✓ Components	Components			
		Title Subcase		Туре	Request	Component	4
1 of 14 selected		Element 1	*		•	•	<u> </u>

- 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 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.

Run Module	Overlay	< Fuel Tank Zone Y Assessment >						
E 🍘 Animation	false							^
Deformed Shape	false	Either						
Door Aperture Deformation	true	ritter						
Energy Distribution	true					<i>1</i>		
Exploded View	false	Impactor	*	Components	Components			
E 🌍 Fuel Tank Zone X Assessment	false		1.1	-	7.			
Fuel Tank Zone Y Assessment	false	Wheel	*	Components	< Components			
Plastic Strain	false	Fuel Tank	-	Components	Components			
🗐 🎡 Rear Barrier Face Overlap	false		1		-	0		
🗐 🍥 Rear Bumper Plastic Strain	false	RearRail	~	Components	Components	(2)		
🗐 🍥 Rear Rail Crush	false	Chassis	-	Components	Components			
Run Statistics	false		1.1					
User Defined Output	true	Exhaust	~	Components	Components			
Velocity Separation	true	Motor	*	Components	Components			
		Title Subcase			Туре	Request	Component	+
1 of 14 selected		Element 1	*			*	*	<u> </u>

- 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







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

Run Module	Overia	y Configuration								
Animation Animation	false n Contour Plot false		-		N					
Dash Intrusion	n Cross Section true	Filter	1000	- 0)					
E O Deformed Sha	ape false	Title	Position 1	Position 2	Position 3	Position 4	Position 5	Position 6		-
Energy Distrit	bution true		Front	Mid	Rear				-	(2)
Engine Mount	Failure false	The second second	line and	1/1/10/00/00	1774		201	1/4	_	S
Exploded Vie	w false	Parters	100010	~ 100016	~ 100018	-		<u>,*1</u>		× (S)
🗵 💽 Load Path	true	PatPHS	100011	~ 100017	- 100019	H	H.	Ψ.		×
🗉 🍈 Occupant	true	C. Marca 1110	F00017	- F00011	- 600303	1.1	21			
🛅 🎧 Pedal Column	n Motion true	Subranie LHS	500017	(* S00071	* 500003					× .
100 million (100 m		Subframe RHS	500018	v 500012	÷ 500004	1	+ [)*[×
E Run Statistics	a false	Shotgun UHS	100042	× 100044	~ 240004)+ ()+ [- I		×
E Structural Ass	sessment false	Shotgun RHS	100043	v 100045	- 240008	14	U.	H	-	×
E 💮 Structural Veh	hicle Kinematics false		Common .							
E 🕢 Structure Plan	stic Strain false	Plocker PPIS	100038	*						×
🗐 🌐 User Defined	Output true	A-Piller LHS	240001	-	+	H	4	Ψſ	-	×
E 🌍 Vehicle Kinen	natics Vertical true	La Comunicación								
E Wehicle Kinen	natics XY Disp true	APROPPTS	240002							1.2
E 💮 Wheel Kinema	atics false	DriveshaltLHS	555000	¥.	~ 555001	-	×)*I		×
		Rocker LHS	100026)+(1-1)• [i ا		×
		Rocker RHS	100038	×	(+)	(r.	4	(+)	+	×
1 of 20 selected										

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)	ly (mm4)	J (mm4)	Sx (mm3)	Sy (mm3)	Peak Load [RHS] (KN)	Area (mm2)	lx (mm4)	ly (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	16516 8.37	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	18420 6.11	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	3589.0 2	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	4033.1 0	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	3589.0 1	8405.06	0.00	214.27	280.17
7	Shotgun Front	23.95	64.34	74444.15	272987.83	-22519.68	699.06	1554.8 5	4.45	64.34	59385. 91	278937.03	-34549.85	699.07	1554.8 5
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	121756.20 39462.78 791.55		961.32
9	Shotgun Rear	31.99	131.04	2977343.36	4236128.96	3173750.07	4893.4 0	2722.5 6	35.47	136.25	21570 98.05	1226453.29	-446369.53	3312.09	4441.0 9
10	Rocker Front	115.19	120.65	8934548.12	336710.24	-176468.24	12426. 70	3454.3 4	17.31	120.65	97954 51.07	904324.39	999808.24	12426.70	3454.3 4





Measure Plot

This is a generic module that allows users to apply various types of measures on the 3D animation results data, generate animations and measure plots and include them in the report. The GUI and the various inputs that are required to be defined are mentioned below.

< Measure Plot >		
👫 Measure Page 🕶 🔲 👻 🖓 Add 🚺		
Search here Q 🗸 🕶	 Standard 	
Entity (2)	Title:	Impactor - Headrest LH
→ main p1 Impactor - Headrest LH	 FE Entities 	
p1w1 Impactor - Headrest LH (3)	FE Entities:	Components (13)
p1w2 window title	 View Set 	
	View:	Left *
	Secondary Zoom Factor:	1.0
l I	• Measure	
	Name:	Impactor - Headrest LH
	Туре:	Minimum Distance +
	Pick Entities:	Measures(1) bt
(4)	Y Axis Quantity:	Mag 🗸
Y	Live Link:	
	Value Format:	Fixed *
	Value Precision:	0 ~
	Angle Unit	Degrees +
	Contour	
	Data Type:	¥
	Data Component	¥
	Layer:	¥
G	Resolved in:	*
G	Average Method:	None 👻
	Legend Threshold:	
	Tracking	
□ ☑ ∰ selected 1 of 3	Section	

- Use this input to select the page & window layout that will be captured and included in the report. 2 layouts are supported i.e. 1 x 2 and 2 x 2. Select the layout and click on Add button to add the page layout into the entity list browser.
- 2) The **Entity** list browser is used to list and manage the pages included by the user and their respective layouts.
- 3) Enter the **Title** used for the slide title in the report, select the **Components** to be used for the current measure and the **View Set** to be used to orient the components.
- 4) Define the **Measure** and all of its attributes to be applied such as measure type, measure entities, format & precision for the measure etc.
- 5) Optionally user can also enter the **Contour**, **Tracking** & **Section** details to be applied while generating the report for the Measure module.







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.

Run Module	Overlay	< Plastic Strain >				~							
Animation Barrier Face Overlap Deformed Shape	false false false	Title	Components		N	3 MaxValue	Adjacent Comps/Assy	4		View	5		4
Door Aperture Deformation	true (1	B Pillar Inne	140060 140059 140133	~ Components	16	5	140417	~ Components	н	Left		*	×
Energy Distribution Genergy Distribution Genergy Distribution	true false	B Pillar Out	140417	- Components	14 4	4	140417	~ Components	14	Left		*	×
🗆 🍈 Fuel Tank Zone X Assessment	false	Rocker Out	125178 125175	- Components	14	5		~ Components	PC.	lso		٣	×
Fuel Tank Zone Y Assessment	false	Rocker Inn	125178 125160	- Components	14	2		- Components	14	Iso		*	×
Load Path	true	RoofInner	190027 190119 190161	- Components	16	3	140417 160059	~ Components	14	lso		~	×
☐ @ Occupant ☑ ⓒ Plastic Strain	true false	Roof Outer	190023 190022	~ Components	16	5	140417 160059	~ Components	14	Iso		*	×
Run Statistics Structural latensions	false	A Pillar Inne	140047 274123	- Components	14	6	69	* Assemblies	14			*	×
User Defined Output	true	A Pillar Out	140044	Components	14	7		~ Components	14			*	×
Velocity Separation Weld Failure	true	Front Door	200028 200024 200031	~ Components	14 8	8	140028 210041	~ Components	14	Left		*	×
		Rear Door	210046 210043 210044	✓ Components	14	9	200021	~ Components	10	Left		٠	×
1 of 17 selected		t]											3

- 6) The component label
- 7) The plastic strain component IDs to be plotted
- 8) The plastic strain limit that is set when applying the contour
- 9) The adjacent (or neighboring) components to be included in the image (transparent mode)
- 10) The standard view that should be used when capturing the image







Rear barrier face module lets you create an image wherein the impactor front or barrier face is positioned relative to rear bumper.

Run	Module	Overlay	< Rear Barrier Face Overlap >
	Animation	false	
	Deformed Shape	false	
	Door Aperture Deformation	true	
	Energy Distribution	true	Rear Bumper Components 14 Components
	Exploded View	false	Impactor Components I Components
	💮 Fuel Tank Zone X Assessment	false	
1	Fuel Tank Zone Y Assessment	false	
	Plastic Strain	false	
~	🛞 Rear Barrier Face Overlap	false	
1	Rear Bumper Plastic Strain	false	
1	💮 Rear Rail Crush	false	
1	Run Statistics	false 🗸	
1 of 1	4 selected		

- 1) Rear bumper Component IDs / Assembly IDs
- 2) Impactor Component IDs / Assembly IDs







Rear Bumper Plastic Strain

This module is used to generate a summary report of rear bumper plastic strain contour at the user selected simulation step.

Run Module	Overlay	< Rear Bumper Plastic Strain >						
Animation	false							
Deformed Shape	false	Tracking System						
Door Aperture Deformation	true	N1	 Node 14 					
Energy Distribution	true	812						
Exploded View	false	NZ						
🗏 🍈 Fuel Tank Zone X Assessment	false	N3	* Node H					
🗐 🍈 Fuel Tank Zone Y Assessment	false							
Plastic Strain	false							
🗏 🎯 Rear Barrier Face Overlap	false	State	Time in ms or Last					
Rear Bumper Plastic Strain	false	Plastic Strain Limit	Value 3					
🗏 🎡 Rear Rail Crush	false							
Run Statistics	false							
User Defined Output	true	Rear Bumper Beam	Components H Components (4)					
Velocity Separation	true	Lower BIW	Components 14 Components 5					
1 of 14 selected	HØ HØ							

neering, Inc. Proprietary and Confide

Inputs:

- 1) 3 nodes defining the tracking system
- 2) User selected simulation step (time in ms or Last)
- 3) Plastic strain limit
- 4) Rear bumper beam Component IDs / Assembly IDs
- 5) Lower BIW Component IDs / Assembly IDs

Rear Bumper Plastic Strain at 55 ms 2

Contour Plot	
ffective plastic strain(Scalar valu	e, max)
5 0005-02	
4 4445-02	6
2 9905-02	and the second s
3 2325-02	
2 7785-02	
2.7762-02	
16675-02	
1 1115-02	
5 5565-02	
0.0005+00	
No Result	
Max = 1.000E+00	
LEMENT SHELL 47820770	
4	5
٨	
4	
X Y	

Rear Rail Crush

This module lets users to create a summary report of rear rail crush mode.

Run	Module	Overlay	< Rear Rail Crush >	
	Animation	false		^
1	Deformed Shape	false		
10	Door Aperture Deformation	true	Tracking System	
	Energy Distribution	true	N1	V Node 14
	Exploded View	false		
	Fuel Tank Zone X Assessment	false	N2	✓ Node 14 (1)
10	Fuel Tank Zone Y Assessment	false	N3	✓ Node 14
	Plastic Strain	false		
10	💮 Rear Barrier Face Overlap	false	· · · · · · · · · · · · · · · · · · ·	
E	Rear Bumper Plastic Strain	false	State	Time in ms or Last (2)
~	🙆 Rear Rail Crush	false		
	Run Statistics	false	Impact Side Rear Rail	x Components 16 Components
	User Defined Output	true	Impactorde Real Rail	
	Velocity Separation	true	Lower BIW	✓ Components I Components (4)
1 of 1	4 selected			

Inputs:

- 1) 3 nodes defining the tracking system
- 2) User selected simulation step (time in ms or Last)
- 3) Impact side rear rail Component IDs / Assembly IDs
- 4) Lower BIW Component IDs / Assembly IDs

r1 Rear Rail Crush at 100 ms (2)





Run Statistics

This module creates following summary info.

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

Run Module	Overlay	Configuration				
C Animation	false	Model info start	yes	~		
E 💮 Dash Intrusion Contour Plot	false	Program Name	2020 Mustana			
Dash Intrusion Cross Section	true	riogramitianie	2020_Muslang			
E 🍥 Deformed Shape	false	Gateway	UNV1			
Energy Distribution	true	Run Discription	A-Pillar with Failure EPS @ failure = 0.10%			
Engine Mount Failure	false			(1)		
Exploded View	false	Restraint Status	Unbelted			
🗐 🍙 Load Path	true	Body Style	Coupe			
🗐 🎡 Occupant	true	Engine/Transmission	EL 1/9			
🗏 🍚 Pedal Column Motion	true	Engine/ Hansmission	5L V0			
- 38-		Test Speed	35			
Run Statistics	false	Driveline	FWD	12.00		
			-			
Structural Assessment	false	Impactor Assembly/Component	5 × Assemblies	(2)		
Structural Vehicle Kinematics	false		x	Y	Z	
Structure Plastic Strain	false	Front Wheel Coordinates	1438	-853	468	V Node If 3
🗐 🍪 User Defined Output	true			11	N	
Vehicle Kinematics Vertical	true	Rear Wheel Coordinates	4154	-878	464	× Node I4 (4)
Vehicle Kinematics XY Disp	true					
🗏 🍚 Weld Failure	true					
Wheel Kinematics	false					
		Maximum N Curves		10 (5)		
1 of 21 selected						

Model Info Summary & Run Quality Report

Program Name	2021_test_vehicle	
Gateway	abcd	
Run Discription	A-Pillar with Failure EPS @ failure = 0.10%	
Restraint Status	Unbelted	
Body Style	Sedan	
Engine/Transmission	4L V6	
Test Speed	35 Kph	
Driveline	FWD	
Run Name	Main.k	
Engineer	tejasr	
Model Run Date	09/18/2021	
Test Mode	Front IIHS ODB	
Gross Vehicle Weight	1.65 kg	
Impactor Weight	-0.00 kg	
Total Weight	1.65 kg	
Vehicle Front Axle Weight	0.96 kgs	
Vehicle Rear Axle Weight	0.64 kgs	
Solver Version	mpp s R7.1.2	
Number of CPU	8 CPU	
Run Time	14 hr 32 min 57 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

Material Internal Energy - Exploded View (Top 10)







Spare Tire Bolt Force



This module is used to plot the spare tire bolt force (axial) across the simulation time steps.

Run Module	Overlay	< Spare Tire Bolt Force >								
🗆 🏠 Fuel Tank Volume Change	false 🔷	#Title	Subcase	Y Type	Y Request	Y Component	Filter	Note	4	
🗆 🍚 Fuel Tank Zone X Assessment	false			1.100			1.000			5
Fuel Tank Zone Y Assessment	false			*	*	*	*	~	* ×	(1)
Plastic Strain	false -									
🗆 🍈 Rear Barrier Face Overlap	false									
Rear Bumper Plastic Strain	false									
🗌 🍥 Rear Rail Crush	false									
Run Statistics	false									
🗹 🍥 Spare Tire Bolt Force	false									
User Defined Output	true									
Carlo Control	true									
1 of 16 selected										

- 1) Enter the title for the plot
- 2) Select the subcase, Y type, Y request & Y component of bolt (beam element ID) from time history file
- 3) Select filter & note options as appropriate



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.

Run Module	Overlay	Configuration									
📰 🍥 Dash Intrusion Contour Plot	false 4	#Title	Subcase	Y Type	Y Request	Y Component	Filter	Note	X Axis Scale	Y Axis Scale	Window
Dash Intrusion Cross Section	true /	2	- C C C C	1000		and the second second	a la construction	1 March	100		100
📰 🍥 Deformed Shape	false	udo_1	nodout	✓ nodout	V Localir_rkr_in_bplr 100	v ry_displacement	+ CFC 68	v Yes	*	1	1
Energy Distribution	true	udo 2	hodout	* nodout	 Localit rkt in bolt 100 	* ix displacement	+ CFC 60	+ No	*	1	1
🗏 🍥 Engine Mount Failure	false	(The f			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 (Conception					
Exploded View	false	udo_3	gistat	~ gistat	✓ glstot	hourglass_energy	 CFC 60 	v No	v	1	1
E 🙆 Load Path	true	udo 4	olstet	w platet	e elstet	v internal anerray	× CEC.60	No	U	1	1
🖹 🍥 Occupant	true	000_1	Grande	- Baron	. Grande	- menior_energy		I I I I I I		11.	
🗐 🍥 Pedal Column Motion	true	udo_5	motsum	- matsum	 BR-Stopper_2mm 290) ← x_momentum	+ CFC 60	- Yes		1	1
Dun Statistics	false	udo_6	motsum	~ matsum	* JR3T-15K873-A(2)BRK	+ z_momentum	+ CFC 60	+ Yes	*	1	1
E W Harotalaaca	hanave	udo_7	todout	v rbdout	< 1005_1	v dircos_22	+ CFC 60	- Yes		1	1
Structural Assessment	false					1. Francisco	050.00	1 Jaco			
Structural Vehicle Kinematics	false	900_8	rctorc	e ictorc	Vehicle2008_IIHSUBS	. A"touce	CFC 60	(*) Tes	•	1	1)]
E 💮 Structure Plastic Strain	false	udo_9	rcforc	* rcforc	 SteeringColumn2Surro 	* x_moment	~ CFC 60	- Yes	-	1	1
User Defined Output	true	. In 10	10 contract	ha Calendaria	T	la for annual a	0.000	Dista.	1011	-	
E 🌀 Vehicle Kinematics Vertical	true	000_10	sectorc	* secore	V Tunnet T T00050	. A Centroid	+ CrC 60	168	Ψ.		
E 🙆 Vehicle Kinematics XY Disp	true										
Wheel Kinematics	false										

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)

Select Script module	Overlay	< Vehicle Yaw Pitch Roll >
Fuel Tank Zone Y Assessment	true	A
Load Path	true	
Occupant	true	1 HS Coordinate Frame
Pedal Column Motion	true	Lino coordinate ritalite
Plastic Strain	false	LHS Base Node 21093646 ✓ Node II
Aun Statistics	false	LHS X-axis Node 21091007 - Node 🖂 1
	iuise	LHS XY-plane Node 21021810 ¥ Node 14
Structural Assessment	false	
Structural Vehicle Kinematics	false	RHS Coordinate Frame
Structure Plastic Strain	false	DHR Rese Node 21020001 - Node 16
User Defined Output	true	RHS base Node 21029001 V Node 11
Vehicle Kinematics Vertical	true	RHS X-axis Node 21025712 V Node 14
Vehicle Kinematics XY Disp	true	
Vehicle Yaw Pitch Roll	true	KHS XY-plane Node 21093472 V Node 14
Weld Failure	false	(4)
Wheel Kinematics	false	Rotation Sequence ZYX 3 VIolantities Yaw-Pitch-Roll V
1 of 26 selected	12 12]

- 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



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Velocity Separation

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

Run Module	Overlay	Configuration
🗏 🎯 Barrier Face Overlap	false	
🗏 🍥 Deformed Shape	false	
Exploded View	false	
		Barrier_node 90000070 ~ (2)
🗐 🌍 Load Path	true	
🔳 🍥 Occupant Side	true	
Plastic Strain	false	
Run Statistics	false	
Structural Intrusions	true	
User Defined Output	true	
Velocity Separation	true	
1 of 11 selected		

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



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.

Run Module	Overlay	< Weld Failure >			
Animation Deformed Shape Door Aperture Deformation Energy Distribution	false false true true	1D Weld	Subcase Ytype	Ycomp	
Exploded View	false	Axial	elout v beam	✓ axial	~
🗌 🎯 Fuel Tank Volume Change	false	Shear	elout v beam	✓ shear_s	- A
George Fuel Tank Zone X Assessment George Fuel Tank Zone Y Assessment	false false	Resultant	elout v beam	✓ shear_t	
🗆 🍈 Plastic Strain	false	Solid Weld			
Rear Barrier Face Overlap Bear Burnner Plactic Strain	false	Axial	swforc + swford	✓ axial	·
Carl Crush	false	Shear	swforc v swford	v shear	2
Generative Service Source Tire Bolt Force	false	Resultant	swforc + swford	 resultant_moment 	~
George Contraction Contraction George Contraction Georg	true				
Velocity Separation	true	Impactor			
Weld Failure	true	2 × Ass	emblies 14		
		9 × Ass	emblies 14 (4)		
		Weld Material Card Selection	+		
of 17 selected	12 13	MATL196	× (5)		

- 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:

Hexa Adhesive Failure Detail View

FailureTime(Value) 100.00 95.00		
85.00		
- 75.00		
65.00		
- 55.00		
45.00		
35.00		
25.00		
5.00		
0.00		
0.00		
A COLORING AND A COLO	1)R2EB-S29299-A1131BRKT OTR PNI TO WHI	/HS10.65mm



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