



Altair Safety Report Manager

Table of Contents

Altair Safety Report Manager	4
ASRM GUI Overview	5
Impact Type & Units selection Sec	tion5
Overlay selection section	5
No. of Processes selection & save	session file section6
Modules list	
Output directory selection	
Main section	6
Input directory, data type & cor	figuration section6
Input Validation check	7
Search function	7
Change curve attributes & publ	sh session8
Configuration section	
Modules	
Animation	
Animation New	
Battery Section Force	
BOM	
Contour Plot	
Dash Intrusion Contour Plot	
Dash Intrusion Cross Section	
Deformed Shape	
Displacement Plot	
Door Aperture Deformation	
Energy Distribution	
Engine Mount Failure	
Exploded View	
Fuel Tank Interaction	
Fuel Tank Zone X Assessment	
Fuel Tank Zone Y Assessment	
Load Path	
Measure Plot	
MPDB Intrusion	
Occupant	
ODB Intrusion	

Pedal Column Motion	43
Plastic Strain	45
Run Statistics	46
SORB Intrusion	49
Structural Assessment	53
Structural Vehicle Kinematics	54
Structure Plastic Strain	55
User Defined Output	56
Vehicle Kinematics Vertical	57
Vehicle Kinematics XY Displacement	59
Vehicle Yaw Pitch Roll	60
Weld Failure	62
Wheel Kinematics	65





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.

	M Altair Safety Report Manager								×
1	Impact Type: Front • Regulation: FMVSS 208 • Protocol: FUII Frontal • Units: mm/ms/kg •		Main Overlay 1 Overlay 2 Overlay Title: Previous session file:	3 Overlay 4 • CAE Data main_iter_	Dyna	▼ O Test Data	HDF	6	Input Check
2	# of Overlay: 0 v Config same as Main		Analysis results directory:						kan search
3	# of Processes: 14 v		Config excel file:	D					🕅 Save As
	More options		Tracking system nodes (N1, N2, N3):		*	¥	 Apply to Modules 		
	Select Module	Overlay	< Animation >						
4	Animation Battery Section Force Collision Detection Dash Intrusion Contour Plot Dash Intrusion Conso Section Dash Intrusion Cross Section Dor Aperture Deformation Deformed Shape Dor Aperture Deformation Energy Distribution En	false true false false false false true false false false true true true true	Tracking System N1 N2 N3 Title Corr	nponents I4		View Node H Node H	• • ×		
	1 of 28 selected								
5	Report output directory:							1	🥯 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	*
Regulation:	FMVSS 208	*
Protocol:	Full Frontal	*
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.

# of Overlay:	0) *	 Main	Overlay 1	Overlay 2	Overlay 3	Overlay 4	
		Same as main	Title:					

• 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.

# 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 report & log files from the ASRM run will be created.

Main section

Input directory, data type & configuration section

In this section, user should 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):	v Apply to Modules

7

Input Validation check

Input Check button would run a quick validation check to verify if the inputs defined for selected modules 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					
2	Dash Intrusion Contour Plot	false	Tracking_System				
	Dash Intrusion Cross Section	true	NI		~	Node	14
1	Deformed Shape	false				Node	
	Energy Distribution	true	N2	80000008	۷	Node	16
	Engine Mount Failure	false	N3	15838433	~	Node	14
1	Exploded View	false				14000	
100	 Load Path 	true	Body Side Type	Components			
10	Occupant	true	Body Side Assembly/Components	150364 150365	*	Components	14
	Pedal Column Motion	true	DASH Assembly				
	Run Statistics	false	Туре	Assemblies			
			Assembly/Comp Name/ID		*	Components	14
10	Structural Assessment	false					
1 of 21	selected			L.			-

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 and the 3D animation results 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.





l	Found files to loa	ad :::::										×
CAE Data> Dyna> Plot File: CAE Data> Dyna> Result (Animation) File: CAE Data> Dyna> Solver Input File:												
l	Search here			Q, ¥	Search here			Q, ¥	Search here			Q. ¥
l	Name	Size	Date modified	Туре	Name	Size	Date modified	Туре	Name	Size	Date modified	-
L	binout0002	10288 KB	06/12/21 07:44 PM	File	d3plot	80027 KB	06/12/21 08:10 PM	File	Vec.k	239798 KB	06/12/21 02:52 P	M
L	binout0007	432 KB	06/12/21 07:45 PM	File					Acc_BL_V1.1y_Setkey	y 34 KB	06/12/21 07:47 P	M
L	binout0000	18297 KB	06/12/21 07:42 PM	File					IIHS_ODB_lstc.key	8333 KB	06/12/21 07:47 P	M
L	🗎 binoutzip	21581 KB	31/05/24 09:09 AM	ZIP Fil	I				IIHS_ODB_Main.k	7 KB	14/05/24 11:24 A	М
L	Ł			\$					Ł			>
l	□ 🗹 Add		selecte	ed 1 of 4	Add		selecte	d 1 of 1	Add		selected 1	of4
l									Load Sele	acted Acc	ept Close	,

Change curve attributes & publish session

This section is mainly used for the overlay scenario.

The change curve attributes option for 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				\times
🔽 m1_hg	olate Only Show	Hide	Show All	
m2_hg	ayer Color		Layer Line Thickness	٣
S	ymbol Color		Symbol Size	
s	ymbol	On	© Off	
N	lotes Font	A		
N	lotes Position	*		
L	egend	On	© Off	
L	egend Font	Α		
В	arGraph Category Font	A	BarGraph Gap	

After changing the curve & note related attributes using the overlay setting dialog, user can click on Publish session icon <a> 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 **Search** 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	* Node	H		
N2		15839164	* Node	М		
N3		15838433	* Node	M		
Title				`	View	+
7	✓ Assemblies II				Тор	* ×
9	✓ Components II				Iso	* ×



(Beneral)

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

Dummy Model 50th	* Du	mmy Version config	* Resi	e		
i+¿Driver Restraint Type		w				
Driver ID						
Driver Injury Criteria	Subcase	Datatype	Request	Component	Filter	
HEAD_ACC_X	nodout	1	-			
HEAD_ACC_Y HEAD_ACC_Z HEAD_ACC_RES NECK_UPPER_MOMENT_Y	ebstat abstat_cpm deforc disbout elout gistat pforc		H3-50TH_DUA H3-50TH_DUA H3-50TH_DUA H3-50TH_DUA H3-50TH_DUA H3-50TH_DUA H3-50TH_DUA H3-50TH_DUA	MMY1_HEAD_ACCELEROME MMY1_HEAD_ACCELEROME MMY1_HEAD_ACCELEROME MMY1_CHEST_ACCELEROME MMY1_CHEST_ACCELEROME MMY1_CHEST_ACCELEROME MMY1_CHEST_ACCELEROME MMY1_PELVIS_ACCELEROME	TER_X 2000001 TER_Y 2000002 TER_Z 2000003 ETER_X 2000004 ETER_Y 2000005 ETER_Z 2000006 ETER_X 2000007 ETER_Y 2000007	
NECK UPPER FORCE X	nodout			WT.		
NECK_UPPER_FORCE_Z	1	-	+		-	Y
CHEST_DEFLECTION		+ [w
CHEST_ACC_X		+)+ ()•(+	¥
CHEST_ACC_Y		+ [+ [)+[)+[w
CHEST_ACC_Z		4	H.		-	-

Modules

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

- Animation
- Animation New
- Battery Section Force
- Contour Plot
- Dash Intrusion Contour Plot
- Dash Intrusion Cross Section
- Deformed Shape
- Energy Distribution
- Engine Mount Failure
- Exploded View
- Load Path
- Measure Plot
- MPDB Intrusion
- Occupant
- ODB Intrusion
- Pedal Column Motion
- Rocker Pulse
- Run Statistics
- SORB Intrusion
- Structural Assessment
- Structural Vehicle Kinematics
- Structure Plastic Strain
- User Defined Outputs
- Vehicle Kinematics Vertical
- Vehicle Kinematics XY Displacement
- Weld Failure
- Wheel Kinematics



Animation

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

Run Module	Overlay	Configuration
Animation	false ^	
E Oash Intrusion Contour Plot	false	
E 💮 Dash Intrusion Cross Section	true	Testing Burger
E 💮 Deformed Shape	false	Tracking System
Energy Distribution	true	N1 15849041 v Node H
Engine Mount Failure	false	N2 15839164 Node 10
Exploded View	false	
📰 🍥 Load Path	true	N3 15838433 v Node 16
🛅 🍥 Occupant	true	
📰 🍥 Pedal Column Motion	true	Title View
🛅 🍥 Run Statistics	false	7 V Assemblies II Q 3 Top V X
E 🙆 Structural Assessment	false	9 Assemblies 14 Iso v X
E G Structural Vehicle Kinematics	false	
🗐 🍙 Structure Plastic Strain	false	
1 of 20 selected		٤
Output directory: C/temp/s/IIHS_front/lihs_front_te	est	

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

ring, Inc. Proprie

Time = 0.000000

Output report:

Animation - Top View 3





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 >	3			
😽 Animation Page 🕶 🔲 👻 🖟 Add	IJ			
Search here Q 🗸		 Standard 		
Entity (2)		Title:	window title	
p1 IIHS_MDB_Side_Impact		 FE Entities 		
p1w1 window title	(3	FE Entities:	Components (1125)	5
p1w2 window title	٦	View Set		
		View:	lso	*
		Secondary Zoom Factor:		1.0
		🕶 🗹 Tracking		
		Name:	tracking1	
	3	Track:	Plane	*
		Plane Type:	OXY	*
		N1N2N3:	🔩 N1 2453176 N2 2444863 N3 3496459	
	d	Displacements (Global X)	:	
	9	Displacements (Global Y)	c	
		🗹 Displacements (Global Z)	:	
		Lock Rotations:		
		Window Track:		
		✓ Align with Global (T=0):		
selected 1 of 3		• Section		

- 1) 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.



y x

IIHS MDB Side Impact





13





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
- 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	Overlav < Battery Section Force > 1
Battery Section Force	true
Collision Detection	true
Deformed Shape	false Forces Filter v (2)
Door Aperture Deformation	true
Energy Distribution	true
Exploded View	false Battery v Components 14 C
Fuel Tank Interaction	false
🗆 🍥 Fuel Tank Volume Change	true
🗆 🍥 Fuel Tank Zone X Assessment	true
🗆 🍥 Fuel Tank Zone Y Assessment	true Battery Sections Floor Sections
Plastic Strain	false Rattery Section 1
Dear Parrier Face Overlan	
I of 20 selected	
	- Annual de Const
Run Module Ov	< Battery Section Porce>
Battery Section Force tru	Battery, Floor Sections Battery Intrusions (8)

Run Module	Overlay	< Battery Section Force:							
Battery Section Force	true 🔶	Battery, Floor Sections	Battery Intrusions 8)					
Collision Detection	true				、 、				
Geformed Shape	false	Filter		~ (9					
Door Aperture Deformation	true								
Energy Distribution	true	Intrusions	PointA		Point B		Dir	+	î
Exploded View	false	Interview Local							
Given Strength Fuel Tank Interaction	false	Intrusion Loc 1	*	Node	N	* Node	N Z		
🗆 🍥 Fuel Tank Volume Change	true	Intrusion Loc 2	*	Node 14	N	 Node 	H N Z	* ×	
Fuel Tank Zone X Assessment	true								
🗆 🎡 Fuel Tank Zone Y Assessment	true								
Plastic Strain	false								
Dear Barrier Face Overlap	foleo Y								
1 of 20 selected		¢							>

- 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

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.

ition		Datanamor		
mponent		IZZcog		
perties	(2)	lines	3	
terials	\bigcirc	lumpedmass	U	
		mass		
		material		
		materialid		
		materialid moduleid		
eview No	ole	materialid moduleid		4
eview No Sel	Label	materialid moduleid		(4) _ ±
eview No Sel 모	Label Component-mass	materialid moduleid		(4) 👤
eview No Sel	Label Component-mass	materialid moduleid		4
eview No Sel ⊽	Label Component-mass	materialid moduleid		(4) 👤 🛨

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:



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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.



Inputs:

- 1) 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









Dash Intrusion Contour Plot

This module generates an overview of Dash Intrusion. Based on the inputs entered, it applies X displacement contour (relative to a fixed coordinate system) on the DASH assembly and finds the node ID with the max intrusion.

< Dash Intrusion Contour Plot >	
Tracking_System	
N1	Node I4
N2	Node H
N3	Node II
Body Side Type	Components
Body Side Assembly/Components	Components H
DASH Assembly	
Туре	Assemblies
Assembly/Comp Name/ID	Assemblies H
Intrusion value @	· (4)
Max Contour Value	6
Min Contour Value	3

Inputs:

- 1) Node IDs 1, 2 & 3 for defining the tracking system
- 2) Body side assembly IDs used to capture the tracking system nodes
- 3) DASH assembly ID required for plotting Dash Intrusion contour plot
- 4) The step at which intrusion value is calculated. It is either the last step or the step at which max intrusion happens.
- 5) The minimum & maximum threshold value to be used when applying the displacement contour

Output report:



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Dash Intrusion Cross Section

This module lets you create Dash Intrusion Cross sections. It will create cross sections (Pre crash & Post crash) at various user defined positions.

Run Module	Overlay	Configuration
C Animation	false ^	
Dash Intrusion Contour Plot	false	
Dash Intrusion Cross Section	true	
Deformed Shape	false	Dash i ype Assemblies
Energy Distribution	true	Dash List 7 🗸 Assemblies 🕅 1
Engine Mount Failure	false	Ū
Exploded View	false	3Node ID to fix
🗐 🍥 Load Path	true	
🗐 🍥 Occupant	true	N1 24023/51 V Node 14
🗐 🍥 Pedal Column Motion	true	N2 24029756 v Node 14 2
Run Statistics	false	N3 24033153 V Node 14
		Passenger seat y coordinate v Node 🖂 3
Structural Assessment	false	
E 🌍 Structural Vehicle Kinematics	false	Driver seat y coordinate
Structure Plastic Strain	false	User defined cross section Y value
User Defined Output	true	
Vehicle Kinematics Vertical	true	0.6 V Node 14 X 5
Vehicle Kinematics XY Disp	true	-200 v Node H ×
Mhaal Kinematice	faleo Y	
I of 20 selected		

- 1) DASH assembly ID
- 2) Node ID 1, 2 & 3 for defining tracking system
- 3) Passenger seat Y coordinate (optional)
- 4) Driver seat Y coordinate (optional)
- 5) User defined cross section locations (Y value) at which the sections are cut







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)

Run Module	Overlay	Configuration						
E 💿 Animation	false							
Dash Intrusion Contour Plot	false							
🗐 🎯 Dash Intrusion Cross Section	true	Templan Pastan						
Deformed Shape	false	Tracking System	-		-			
Energy Distribution	true	N1	152877	5 - Node	34			
📰 🍥 Engine Mount Failure	false	N2	210888	0 - Node	0			
Exploded View	false			1 1000				
🖹 🍥 Load Path	true	N3	210899	7 * Node	14			
🖻 🍥 Occupant	true		1					
📰 🍥 Pedal Column Motion	true	Title ()		6	Type	View (4)		4
🗐 🍥 Run Statistics	false	Detorm_1	9 24 25 56 57	- Assemblies	Assemblies	ISO	v	×
🗐 🍥 Structural Assessment	false	Deform_2	24 25 56	~ Assemblies	Assemblies	LEFT	*	×
E Structural Vehicle Kinematics	false	Deform_3	24 25 56	* Assemblies	14 Assemblies	TOP		ж
E Structure Plastic Strain	false	100						
E 💮 User Defined Output	true							
📰 🎯 Vehicle Kinematics Vertical	true							
📰 🎯 Vehicle Kinematics XY Disp	true							

Inputs:

1) Node ID 1, 2 & 3 for defining tracking system

Deformed Shape – Deform_1_ISO

- 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

- 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 >						
Animation	false							
E 🙆 Deformed Shape	false	050.100						
Door Aperture Deformation	true	CFC 100						
Energy Distribution	true							
Exploded View	false	✓ Components	H Components	ofImpactor				
🗐 🍥 Fuel Tank Zone X Assessment	false			9				
🗏 🍥 Fuel Tank Zone Y Assessment	false						-	
Plastic Strain	false	Door Elems	Subcase	Ү Туре	YRequest	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	l	*	*	*	* ×	
Run Statistics	false							
🗐 🍥 User Defined Output	true							
Contraction Velocity Separation	true							
1 of 14 selected	13							

- 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



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24

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.



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





Engine Mount Failure

This module checks whether the user defined engine mount parts fracture or remain intact during the crash simulation. For the fractured parts, it finds the time at which they fracture and captures an image which highlights the time at which part separation happens.

in Module	Overlay		Configuration							
C Animation	false	^								
Dash Intrusion Contour Plot	false		Facility & Trans Assembly	10	Let	A		ิด		
Dash Intrusion Cross Section	true		Engine & Trans Assembly	10	× .	Assemblies	14	U		
E 🙆 Deformed Shape	false		Title	ID				Туре	+	
Energy Distribution	true	1	1 HS Engine Mount	520009	~	Component	14	Component	V	0
Engine Mount Failure	false	I N	E la cingine modifi	520003	1	component	14	component		9
Exploded View	false		RHS Engine Mount	520012	¥	Component	14	Component	×	
📰 🍥 Load Path	true		Transmision Mount	520008	~	Component	14	Component	~	
🗏 🍥 Occupant	true		Transmission woon	020000	+	component	14	component	^	
📰 🍙 Pedal Column Motion	true		beam_1	46023296	*	Element	н	Element	х	
- 0	_		beam_2	46023608	~	Element	H	Element	×	
Run Statistics	false									
			beam_3	40001519	*	Element	Н	Element	×	
Structural Assessment	false		hears 4	42503605		Element	14	Element	-	
Structural Vehicle Kinematics	false		Denu_4	42000000		Element	14	Clement	<u>^</u>	
C Structure Plastic Strain	false									
🗐 🍥 User Defined Output	true									
Vehicle Kinematics Vertical	true									
📰 🍥 Vehicle Kinematics XY Disp	true	П								
Mhool Kinomatice	foleo	¥								

- 1) Engine assembly or component ID
- 2) Label for the engine mount part
- 3) Engine mount part ID

Title	Comp/Beam	ID	Separation Time
LHS Engine Mount	Solid	520009	55.0
RHS Engine Mount	Solid	520012	Intact
Transmision Mount	Solid	520008	90.0
beam_1	Beam ID	46023296	5.0
beam_2	Beam ID	46023608	5.0
beam_3	Beam ID	40001519	10.0
beam_4	Beam ID	42503605	15.0
beam_5	Beam ID	42514010	55.0
beam_6	Beam ID	52006509	75.0
beam_7	Beam ID	14110721	80.0
beam_8	Beam ID	14110739	80.0
beam_9	Beam ID	40002216	80.0





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	Tite Ture
Dash Intrusion Cross Section	true	
Deformed Shape	false	1) DASHCOWL 9 Y Assemblies 14 Assemblies × (2)
Energy Distribution	true	
Engine Mount Failure	false	Assembles Assembles X
Exploded View	false	UPPERBODY 57 × Assemblies II Assemblies ×
🔲 🍥 Load Path	true	
🗐 🎡 Occupant	true	
1 of 20 selected		

- 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:

Test 1







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 🌍 Deformed Shape	false	Eller					
E 🏐 Door Aperture Deformation	true	ritter					
Energy Distribution	true						
Exploded View	false	Impactor	~ Components	Components			
🔽 🥘 Fuel Tank Zone X Assessment	false			7.			
📰 🎡 Fuel Tank Zone Y Assessment	false	Wheel	Components	Components			
E 🌍 Plastic Strain	false	Fuel Tank	~ Components	Components			
E 🎯 Rear Barrier Face Overlap	false				0		
🗐 🍈 Rear Bumper Plastic Strain	false	RearRail	Components	Components	2		
🗐 🍈 Rear Rail Crush	false	Chassis	~ Components	Components	-		
E 💮 Run Statistics	false						
E 🎒 🖾 User Defined Output	true	Exhaust	Components	Components			
Content 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







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					
E Oor Aperture Deformation	true	ritter					
Energy Distribution	true				ii.		
Exploded View	false	Impactor	v Components	Components			
E 🏐 Fuel Tank Zone X Assessment	false			7.			
Fuel Tank Zone Y Assessment	false	Wheel	* Components	Components			
Plastic Strain	false	Fuel Tank	v Components	Components			
🗐 🎡 Rear Barrier Face Overlap	false			-	0		
🗐 🍈 Rear Bumper Plastic Strain	false	RearRail	V Components	Components	2		
🗐 🍥 Rear Rail Crush	false	Chassis	v Components	Components	-		
Run Statistics	false						
User Defined Output	true	Exhaust	* Components	Components			
Velocity Separation	true	Motor	✓ Components	Components			
		Title Subcase		Туре	Request	Component	4
1 of 14 selected		Element 1	~		v [v	<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	Overlay	Configuration									
🗉 🍈 Animation	false										
E 🌍 Dash Intrusion Contour Plot	false	Ehu	1000	10							
🗐 🌐 Dash Intrusion Cross Section	true	r mar	1000	11							
E 🍥 Deformed Shape	false	Title	Position 1		Position 2	Position 3	Position 4	Position 5	Position 6		0
Energy Distribution	true		Front		Mid	Rear					+ (2)
E G Engine Mount Failure	false	Dating	11000340	12	100016	W (second	121	101	1071		0
Exploded View	false	Planoria	(100010	-	100010	- 100010	- 0				0
🕑 💽 Load Path	true	Rail RHS	100011		100017	× 100019	*	¥	×.		×
🛅 🍙 Occupant	true	Cubbana LHC	500017	6	600011	× 500000	61	- UT	61		
E Column Motion	true	Colorente La lo			200011	- Leases					
-		Subframe RHS	500018	¥.	500012	÷ 500004	1	8	X		×
E 🕢 Run Statistics	false	Shotgun UHS	100042	×	100044	∞ 240004	+)•((+)		×
E 💮 Structural Assessment	false	Shotgun RHS	100043	4	100045	- 240008	14	L.	+	-	×
🛅 🌐 Structural Vehicle Kinematics	false		Canada and								
E 🌍 Structure Plastic Strain	false	PIOCKIEV PIPIS	100038								×
📰 🌐 User Defined Output	true	A-Piller LHS	240001	-		+	-	H-1	14° [-	×
E 🌍 Vehicle Kinematics Vertical	true	4.000.000	242002								
📰 🍈 Vehicle Kinematics XY Disp	true	APPENT	240002								1.8
E 💮 Wheel Kinematics	false	DriveshaltUHS	555000	Υ.		× 555001	- 1	14 I)×[×
		Accker LHS	100026	w)×[1-1)+())×[-	×
		Rocker RHS	100038	÷		H.	(m.	÷.	H.		×
of 20 selected											

Cross Section Locations



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	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

Cross Section Force Plot







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	
	 FE Entities 		
🛼 p1w1 Impactor - Headrest LH 🛛 🕄	FE Entities:	Components (13)	8
p1w2 window title	View Set		
	View:	Left	•
	Secondary Zoom Factor:	1.	ð
	 Measure 		٦
	Name:	Impactor - Headrest LH	
	Type:	Minimum Distance	•
	Pick Entities:	Measures(1)	1
(4)	Y Axis Quantity:	Mag	•
	Live Link:		
	Value Format	Fixed	-
	Value Precision:	0	•
	Angle Unit	Degrees	-
	Contour		٦
	Data Type:		•
	Data Component:		,
	Layer:		,
(5	Resolved in:		•
, , , , , , , , , , , , , , , , , , ,	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.







MPDB Intrusion

This module offers a complete automated post processing solution of the MPDB Frontal Compatibility Assessment load case. This is done as part of the Euro NCAP offset frontal impact test procedure updated in 2020.

This new test uses a new barrier called MPDB (Mobile offset Progressive Deformable Barrier) weighting 1,400 kg (with the trolley weight) which impacts a testing vehicle at a speed of 50 km/h, a zero-degree angle, and a 50 percent overlap. A test vehicle also impacts the trolley at a speed of 50 km/h. (100 km/h approach speed). The anthropomorphic test device (ATD) in the front seats will be changed from Hybrid-III 50th percentile male to THOR (Test Device for Human Occupant Restraint) 50th percentile male.

The tool helps the user to determine the assessment area of the PDB in dependence of the vehicle dimensions and other framework conditions. It calculates the standard deviation value of the test area thereby allowing to assess the indentation homogeneity/geometry. It also has the capability to calculate and create the Occupant Load Criterion and Modifier plots







1) The impact side (left or right)

2) The intrusion values to be reported & contoured (node based or element based). If elementbased option is selected, then nodal results are averaged

3) Reference coordinate system, which is a right-handed, three-axis orthogonal coordinate system that is used for intrusion measurements

4) The 4 corner node IDs that define the front face of the mpdb barrier

5) The barrier component IDs, the outer cladding component ID and the vehicle width to be considered for assessment area evaluation

6) The time step at which the intrusions (normal projection distance from the reference plate to the barrier) are reported, the SAE filter class to be applied on the acceleration curve plotted for the above request & the precision required for OLC algorithm (0 means <= 0.1%; 1 means <= 0.001%)

7) The subcase, datatype, request ID & the component from time history file used for OLC calculation

8) The lower & upper limits for SD & OLC parameters used in the modifier plot. This should be changed only when there is a change in regulation.

9) GRID pattern selection. This option, when turned ON displays the barrier deformation (intrusion contour) on the reference plate as a grid projection.

Outputs:







Contour Plot Element_values(Scalar value)

600.000 480.000

160.000 0.000 No Result

Max = 456.492 SHELL 950588881 Min = 150.891 SHELL 950588963

z

1

320.000

GRID projection



36



Occupant

Occupant module generates following summary report based on user selected info.

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

The occupant GUI is designed in such a way that if offers flexibility to support various types and versions of dummies as per the supported impact and regulation types. A snapshot of the GUI is as shown below.

Select Module	Overlay	< Occupant>						
Deformed Shape	false	1st Rw Lft 1st Rw Rght	1) (2)			_		
Displacement Plot	false	Dummy Model HUM HII	5F y Dumm	v Version config	* Reset			
Door Aperture Deformation	true					9		
Energy Distribution	true	1st Rw Lft Restraint Type	Belted	· (4)				Î
Engine Mount Failure	false							
Fuel Tank Interaction	false							\sim
Fuel Tank Zone X Assessment	true							(5)
Fuel Tank Zone Y Assessment	true	1st Rw Lft Injury Criteria	Subcase	Datatype	Request	Component	Filter	Y
Load Path	true	HEAD_ACC_X		*	۷	پ	v	*
Occupant	true	HEAD ACC Y		*	*	v		~
Pedal Column Motion	true	10001						
Plastic Strain	false	HEAD_ACC_Z		*	*	*	¥	*
Given Statistics	false	HEAD ACC RES		•	v	v		~
Structural Assessment	false							
Structural Vehicle Kinematics	false	NECK_UPPER_MOMENT_Y	(*	v	۲	~	*
Structure Plastic Strain	false	NECK UPPER FORCE X		•	v	v	v	¥
User Defined Output	true							
Vehicle Kinematics Vertical	true	NECK_UPPER_FORCE_Z		*	*	*	~	*
Vehicle Kinematics XY Disp	true	CHEST_DEFLECTION		*	*	v	*	v
Vehicle Yaw Pitch Roll	true v							
1 of 28 selected	13 13	CHEST_ACC_X		*	*	*	×	× •

Inputs:

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

2) **Dummy model** selection option. Currently for the Front impact type, FMVSS 208 regulation & fullfrontal protocol, we support Hybrid III 5th & 50th percentile dummy types.

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 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) **Dummy restraint type**. Currently for the FMVSS 208 regulation & full-frontal protocol, two restrain types are supported namely Belted & Unbelted.

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 **Search** button. After loading the file, user can start defining the appropriate subcase, datatype, request & component types for each of the injury criteria.

Note:

In addition to above inputs, there is **1**st **Rw Lft ID & 1**st **Rw Rght 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.



Occupant Summary

Occupant	1st Rw Lft	Internal	1st Rw Rght	Internal
Iteration	main_iter_		main_iter_	
Dummy model	HUM_HIII_5F		HUM_HIII_5F	
Restraint type	Belted		Belted	
HIC (15ms)	228.41	480	228.41	480
HIC (36ms)	427.29	-	427.29	-
Upper Neck Tension +Fz (N)	1326.03	1880	1326.03	1880
Upper Neck Compression - Fz (N)	15.12	1810	15.12	1810
NTE	0.23	0.67	0.23	0.67
NTF	0.50	0.67	0.50	0.67
NCE	0.00	0.67	0.00	0.67
NCF	0.07	0.67	0.07	0.67
Chest Cumdur (3ms) (g)	43.84	49	43.84	49
Chest Deflection (mm)	176.99	40	176.99	40
Left Femur Compression -Fz (N)	672.57	5310	672.57	5310
Right Femur Compression - Fz (N)	697.17	5310	697.17	5310



Driver Head Acceleration Head Accel-X Head Accel-Y 1.0 0.3 -0.4 -1.1 -11 (9) XV P29 -25 -39 -46 -53 -60 0 1.8 -1.8 -2.5 -3.2 -3.9 -4.6 -5.3 Max 0.347 @ 31.04 Min -52.369 @ 65.68 Max 0.298 @ 98.56 Min -5.478 @ 60.56 -6.0 60 Time(ms) Head Accel-Res 60 Time(ms) Head Accel-Z 12.0 54 48 42 (5) \$22 Dear 30 24 18 12 6 10.6 9.2 7.8 6.4 5.0 3.6 3.6 2.2 0.8 Max 52.857 @ HIc15: 218.241 HIC36: 408.263 -0.6 -2.0 60 Time(ms) 24 48 24 60 Time(ms)



ODB Intrusion

This module is used to measure vehicle intrusion as per IIHS – Offset Barrier crash test protocol. The tests are conducted at 64.4 ± 1 kph (40 ± 0.6 mph) and 40 ± 1 percent overlap. The test vehicle is aligned with the deformable barrier such that the right edge of the barrier face is offset to the left of the vehicle centerline by $10\pm1\%$ of the vehicle width as shown below.



Vehicle Overlap with Deformable Barrier

A total of 14 measurement locations are used in general (on the driver-side interior & exterior of the vehicle) and their longitudinal, lateral & vertical displacements with respect to a user defined coordinate system are measured.

The following are the locations for measuring vehicle intrusion.





Steering column (one point), lower instrument panel (two points), brake pedal (one point), toepan (three points), left footrest (one point), seat bolts (typically four points, each of the 4 bolts that anchor the driver seat to the vehicle floor), A-pillar (one point) and B-pillar (one point marked at the same vertical coordinate as the lower A-pillar mark).

In addition, user can enter the scale factor along with the criteria values. User can also enter as many additional measurement locations as needed.

Select Script module	Overlay	< ODB Intrusion >		_						
Generation	false	Seat_Correction	Yes	· (1)						*
Dash Intrusion Contour Plot	false	Output Type	Last	<u> </u>						-
Dash Intrusion Cross Section	true									
Deformed Shape	false	Ref coordinate syste	m							
Door Aperture Deformation	true	Origin	10010144	w.						
Energy Distribution	true	VZ plana	10012032	10						
Engine Mount Failure	false	TE prarie	TOUTEOUE							
Exploded View	false	Z axis	10028358	÷						
Fuel Tank Zone X Assessment	true	Seat mounts								
Fuel Tank Zone Y Assessment	true	Excel right	10101530							
Load Path	true	rioningn	10191529							
ODB Intrusion	true	Front left	10191551							
Pedal Column Motion	true	Repricht	10101523	4						
Plastic Strain	false	rvear ngm	1019152.5							
		Rearleft	10190862	÷						
Generative Run Statistics	false	Measurement point z	one Label	Request	Scal	e Factor FAC	Good	Accepta	ble Marginal	Poor
Given Structural Assessment	false	Toepan_Zone	♥ Foot Rest	24062967	¥	0.8	140	150	250 300	5
Structural Vehicle Kinematics	false	Toepan_Zone	♥ Dash Left	11681663	v	0.8	140	150	250 300	
Structure Plastic Strain	false									
User Defined Output	true	Toepan_Zone	Dash Center	24062963	Ψ	0.8	140	150	250 300	
Vehicle Kinematics Vertical	true	Toepan_Zone	 Dash Right 	11681642	¥	0.8	140	150	250 300	
Mahiela Kinomatice XV Dien	Inter 9		L. Paul and a						ana)	
1 of 26 selected	12 12	Toepan_Zone	Brake Pedal	56000756	~	0.8	140	150	250 300	

Inputs:

1) The seat correction option, whether seat correction should be considered or not when calculating the intrusions

2) The timestep at which intrusions should be measured (last timestep or dynamic max timestep)

3) Reference coordinate system, which is a right-handed, three-axis orthogonal coordinate system that is used for intrusion measurements

- 4) The request IDs for the four seat bolts (front and rear left & right locations)
- 5) The request IDs for all the measurement locations where intrusions will be measured





Location	Scale Factor	Intrusion (mm)		
		Last	Scaled	
Foot_Rest	0.80	56	45	
Dash_Left	0.80	27	22	
Dash_Center	0.80	52	41	
Dash_Right	0.80	27	22	
Brake_Pedal	0.80	91	73	
IP_Left	0.80	4	3	
IP_Right	0.80	2	2	
A_B_Pillar	0.80	1	0	

Occupant Kinematics Modifier

Seat Attachment Relative	7.8
Vert. Displ. ≥ 60 mm	

Structural Integrity	Not Assessed
Fuel/HEV System Integrity	Not Assessed

Seat Mount Plots LROSEAT

DashCenter Plots















Pedal Column Motion

This module is used to generate a summary report for brake pedal and steering column.

1) A summary table capturing deflection value (X, Y, Z min & max displacement values) and time for both brake pedal & steering column

2) An image capturing the location of brake pedal & steering column parts

3) X, Y, Z and resultant displacement plots for both brake pedal & steering column

< Pedal Column Motion >					
					^
Title	Value				
Tracking_System		_			
N1	TRC				
N2	TRC	(1)			
N3	TRC	Ū			
		_			
Measurement_Points					
Curve Name	X Disp	Y Disp	Z Disp	Res Disp	_
Steering_Wheel	TRC	TRC	TRC 1	III TRC	_(2)
Steering_Wheel Brake_Pedal	TRC	TRC	TRC	TRC	2) 3
Steering_Wheel Brake_Pedal	TRC TRC	TRC	TRC	TRC	(2) (3)
Steering_Wheel Brake_Pedal Tracking Module	TRC	TRC		TRC	2) 3
Steering_Wheel Brake_Pedal Tracking Module BODY SIDE	TRC	Components	TRC TRC	TRC	2) 3
Steering_Wheel Brake_Pedal Tracking Module BODY SIDE	TRC TRC Components I	Components	TRC TRC	TRC	2
Steering_Wheel Brake_Pedal Tracking Module BODY SIDE View with Nodes Modul	TRC	Components	4	TRC	23
Steering_Wheel Brake_Pedal Tracking Module BODY SIDE View with Nodes Modul DASH ASSEMBLY	TRC TRC Components II	Components (4 5	TRC TRC	2)
Steering_Wheel Brake_Pedal Tracking Module BODY SIDE View with Nodes Modul DASH ASSEMBLY CROSS CAR BEAM	TRC TRC Components I	Components (Assemblies (TRC TRC TRC	TRC	2)

- 1) The 3 nodes N1, N2 & N3 defining tracking system
- 2) The steering column name and the corresponding request ID required for plotting
- 3) The brake pedal name & request ID required for plotting
- 4) The body side component IDs required for capturing tracking system nodes
- 5) DASH assembly ID
- 6) Cross car beam assembly ID



		r1_m1_front		
	(2	Steering_Wheel		Break_Pedal
Node ID	58359757		56000756	~
	Deflection [mm]	Time [ms]	Deflection [mm]	Time [ms]
X Min	-0.02	3.68	-8.47	48.32
X Max	21.44	105.64	138.52	95.76
Y Min	-11.41	109.12	-16.01	117.12
Y Max	3.46	57.76	3.45	50.72
Z Min	-59.28	113.20	-2.03	55.76
Z Max	0.69	44.96	59.55	95.60
X @ T Max	21.44	129.92	138.52	129.92
Y @ T Max	11.41	129.92	16.01	129.92
Anchor Node ID	15849041	15839164	15838433	







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 Animation Barrier Face Overlap Deformed Shape	false false false	Tde	Components	2)	Ма	3 aValue	Adjacent Comps/Assy	4		View	5	E	÷
Door Aperture Deformation	true (1	1) B Pillar Inne	140060 140059 140133	v Components	14 5		140417	* Components	14	Let		٠	×
Energy Distribution Exploded View	true false	B Pillar Out	140417	- Components	11 4		140417	* Components	14	Let		1	×
Fuel Tank Zone X Assessment	false	Rocker Out	125178 125175	~ Components	11 5			- Components	H	lso		¥	×
🗆 🍚 Fuel Tank Zone Y Assessment	false	RockerInn	125178 125160	- Components	11 2			- Components	H	iso		٠	×
Coad Path	true	Roof Inner	190027 190119 190161	~ Components	11		140417 160059	~ Components	14	lso		٣	×
O Plastic Strain	false	Roof Outer	190023 190022	* Components	11		140417 160059	~ Components	H.	lso		*	×
G Run Statistics G Structural Intrusions	false	A Pillar Inne	140047 274123	~ Components	14 6		69	+ Assemblies	H			٣	×
🗆 🍈 User Defined Output	true	A Pillar Out	140044	- Components	16 7			- Components	14			٣	×
Weld Failure	true	Front Door	200028 200024 200031	* Components	14 8		140028 210041	* Components	14	Let		*	×
1 of 17 selected		Rear Door	210046 210043 210044	- Components	9		200021	* Components	Н	Let		*	×
	1.00	£											

- 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.

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						
E 🙆 Animation	false	Model info start	yes *					^
Dash Intrusion Contour Plot	false	Program Name	2020 Mustano					
E Oash Intrusion Cross Section	true	riogrammanie	coco_moneng					
E Offermed 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	0				
📰 🍥 Load Path	true	Body Style	Coupe					
E 🙆 Occupant	true	Engine/Transmission	EL MR					
E 💮 Pedal Column Motion	true	Engine/ manshission	52.46					
		Test Speed	35					
Run Statistics	false	Driveline	FWD					
E 💮 Structural Assessment	false	Impactor Assembly/Component	5 v Assemblies H	(2)				
Structural Vehicle Kinematics	false		X Y	-	Z			
E 💮 Structure Plastic Strain	false	Front Wheel Coordinates	1438 -85	3	468	× Node	3	
📰 🍥 User Defined Output	true			•	100	14000		
E 💮 Vehicle Kinematics Vertical	true	Rear Wheel Coordinates	4154 -87	8	464	 Node 	(4)	
E 💮 Vehicle Kinematics XY Disp	true							
E 💮 Weld Failure	true							
E 💮 Wheel Kinematics	false							
		Maximum N Curves	10	9				
1 of 21 selected				-				



Model Info Summary & Run Quality Report

Program Name	Test]			
Gateway	abcd]			
Run Discription	Side Impact test run]			
Restraint Status	Belted]			
Body Style	Sedan	At and the		Pecult	Target
Engine/Transmission	V4	6/22884	Run Quality	Result	laiget
Test Speed	35 Kph		Termination Time	0.2 ms	0.2 ms
Driveline	AWD		Termination Type	Normal	
Run Name	Main.k			Termination	
Engineer	tejasr		Mass Added @ T=0 [%]	0.44 %	< 1 %
Model Run Date	09/18/2021		Mass Added @ 1-0 [A]	0.44 //	~170
Test Mode	Side CIASI - IIHS OLD (Pre 2021) MDB		Total Mass Added [%]	0.96 %	< 3 %
Gross Vehicle Weight	1826.09 kg	O · D b	Total Mass Added [kø]	0.03 kg	
Impactor Weight	0.00 kg		1010111000110000 [1:8]	0.00 Kg	
Total Weight	1826.09 kg		Energy -> Hourglass [%]	3.45 %	< 10 %
Vehicle Front Axle Weight	1016.54 kg		Energy -> Ratio [%]	1.00 %	1 >= Energ
Vehicle Rear Axle Weight	809.55 kg				Ratio < 1.0
Solver Version	mpp s R7.1.2	1 📕			
Number of CPU	8 CPU	1			
Run Time	21 hr. 41 min 54 sec	1			

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%



47



Material Internal Energy Summary

Material Internal Energy - Exploded View (Top 10)









This module is used to measure the vehicle intrusion as per IIHS – Small Overlap Barrier crash tests. The test vehicle is aligned with the rigid barrier such that the right edge of the barrier face is offset to the left of the vehicle centerline by $25 \pm 1\%$ of the vehicle width.

A total of 18 measurement locations are used in general (on the driver-side interior & exterior of the vehicle) and their longitudinal, lateral & vertical displacements with respect to a user defined coordinate system are measured.

The following are the measurement points & their locations for measuring vehicle intrusion.

Locations for Measuring Vehicle Intrusion – Driver side:



Locations for Measuring Vehicle Intrusion – Passenger side:



🛆 ALTAIR

Steering column (one point), left instrument panel (one point), brake pedal (one point), parking brake pedal (one point), footrest (one point), seat bolts (two points), left toe pan (one point), upper dash (one point), lower hinge pillar (three points), upper hinge pillar (three points) and rocker panel (three points).

In addition, user can enter the scale factor along with the criteria values for each of the measurement points. User can also enter as many additional measurement locations as needed.

A detailed report is generated automatically. The report consists of an intrusion chart and a summary table displaying the intrusion values (actual & scaled values) for all the measurement points along with SORB rating info (Lower & upper occupant compartment rating as well as overall rating). The report also consists of relative displacement plots for all the points.

< SORB Intrusion >	•									
Impact_Side Left Impact-	Driver 👻 (1)									
Seat_Correction	Yes	2)								^
Output_Type	Dyn_Max	3								
Ref coordinate system										
Origin	1004 ~									
YZ plane	1012 ~	(4)								
Z axis	1020 ~									
Seat mounts		-								
Rear Right	1028	ē								
RearLeft	1036 ~	9								
Measurement point zone	Sub-zone	Label	Requests	Scale Factor	Internal (Good	Acceptable	Marginal	Poor	+
Measurement point zone	Sub-zone	Label Lower Hinge Pillar	Requests 20498293 20498869 204	Scale Factor	Internal C	Good 150	Acceptable 225	Marginal 300	Poor 400	+ ⊠6
Measurement point zone Lower_Occupant_Com Lower_Occupant_Com	Sub-zone V HingePillar V Footrest V	Label Lower Hinge Pillar Foot Rest	Requests 20498293 20498869 204 20286848	Scale Factor	Internal 0 140	Good 150 150	Acceptable 225 225	Marginal 300 300	Poor 400 400	* × 6
Measurement point zone Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com	Sub-zone V HingePillar V Footrest V Footrest V	Label Lower Hinge Pillar Foot Rest Left Toepan	Requests 20498293 20498869 204 20286848 20283261	Scale Factor	Internal (140) 140 140	Good 150 150 150	Acceptable 225 225 225 225	Marginal 300 300 300	Poor 400 400 400	* × ×
Measurement point zone	Sub-zone HingePillar v Footrest v Footrest v Footrest v	Label Lower Hinge Pillar Foot Rest Left Toepan Brake Pedal	Requests 20498293 20498869 204 20286848 20283261 19001434	Scale Factor	Internal 0 140 140 140 140	Good 150 150 150 150	Acceptable 225 225 225 225 225	Marginal 300 300 300 300	Poor 400 400 400 400 400 400	+ × 6 × ×
Measurement point zone Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com	Sub-zone HingePillar • Footrest • Footrest • Footrest • Footrest •	Label Lower Hinge Pillar Foot Rest Left Toepan Brake Pedal Parking Brake	Requests 20498293 20498869 204 20286848 20283261 19001434 1044	Scale Factor 1	Internal 0 140 140 140 140 140	Good 150 150 150 150 150	Acceptable 225 225 225 225 225 225 225	Marginal 300 300 300 300 300	Poor 400 400 400 400 400 400	* × × × ×
Measurement point zone Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com	Sub-zone HingePillar v Footrest v Footrest v Footrest v V Footrest v V Footrest v V Rootrest v V Rootrest v	Label Lower Hinge Pillar Foot Rest Left Toepan Brake Pedal Parking Brake Rocker Panel	Requests 20498293 20498869 204 20286848 20283261 19001434 1044 20490054 20486478 204	Scale Factor • 1 • 1 • 1 • 1 • 1 • 1 • 1 • 1 • 1 • 1	Internal 0 140 140 140 140 140 140 35	Good 150 150 150 150 150 50	Acceptable 225 225 225 225 225 225 225 225 100	Marginal 300 300 300 300 300 150	Poor 400 400 400 400 400 400 400	+ × × × × ×
Measurement point zone Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Upper_Occupant_Com	Sub-zone + HingePillar + + Footrest + + Footrest + + Footrest + + Footrest + + RockerPanel + + SteeringColumn +	Label Lower Hinge Pillar Foot Rest Left Toepan Brake Pedal Parking Brake Rocker Panel Steering Column	Requests 20498293 20498669 204 20285848 20283261 19001434 1044 20490054 20486478 204 17022875	Scale Factor • 1 • 1 • 1 • 1 • 1 • 1 • 1 • 1 • 1 • 1 • 1	Internal 0 140 140 140 140 140 140 140 140 140 14	3000d 150 150 150 150 150 50 50	Acceptable 225 225 225 225 225 225 100	Marginal 300 300 300 300 300 150	Poor 400 400 400 400 400 400 400 400	* × × × × ×
Measurement point zone Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Upper_Occupant_Com Upper_Occupant_Com	Sub-zone HingePillar v Footrest v Footrest v Footrest v RockerPanel v SteeringColumn v HingePillar v	Label Lower Hinge Pillar Foot Rest Left Toepan Brake Pedal Parking Brake Rocker Panel Steering Column Upper Hinge Pillar	Requests 20498293 20498869 204 20285261 19001434 1044 20490054 20486478 204 17022875 20501673 20502280 205	Scale Factor	Internal 0 140 140 140 140 140 140 140 140 140 150	Good 150 150 150 150 150 50 50 75	Acceptable 225 225 225 225 225 225 225 100 100 100	Marginal 300 300 300 300 300 150 150 150	Poor 400 400 400 400 400 400 400 400 400	* × × × × × ×
Measurement point zone Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Lower_Occupant_Com Upper_Occupant_Com Upper_Occupant_Com Upper_Occupant_Com	Sub-zone HingePillar v Footrest v Footrest v Footrest v RockerPanel v SteeringColumn v HingePillar v Footrest v	Label Label Lower Hinge Pillar Foot Rest Left Toepan Brake Pedal Parking Brake Rocker Panel Steering Column Upper Hinge Pillar Upper Dash	Requests 20498293 20498669 204 20286848 20283261 19001434 1044 20490054 20486478 204 17022875 20501673 20502280 205 39005891	Scale Factor	Internal O 140 140 140 <td>3000d 150 150 150 150 150 50 50 75 75</td> <td>Acceptable 225 225 225 225 225 100 100 125 125</td> <td>Marginal 300 300 300 300 150 150 150 175</td> <td>Poor 400 400 400 400 400 400 400 400 400 400</td> <td>* 6 × × × × × × × × × ×</td>	3000d 150 150 150 150 150 50 50 75 75	Acceptable 225 225 225 225 225 100 100 125 125	Marginal 300 300 300 300 150 150 150 175	Poor 400 400 400 400 400 400 400 400 400 400	* 6 × × × × × × × × × ×

- 1) The impact side (left or right impact side with driver or passenger)
- 2) The seat correction option, whether seat correction should be considered or not when calculating the intrusions
- 3) The timestep at which intrusions should be measured (last timestep or dynamic max timestep)
- 4) Reference coordinate system, which is a right-handed, three-axis orthogonal coordinate system that is used for intrusion measurements
- 5) The request IDs for the two seat bolts (Rear left & right locations)
- 6) The request IDs for all the measurement locations where intrusions will be measured



Outputs

Intrusion Chart:



Summary table with SORB rating:

Location	Scale Factor	Intrusion (mm)		
		Last	Scaled	
Lower Hinge Pillar	0.80	137.10	109.68	
Foot Rest	0.85	130.14	110.62	
Left Toepan	0.75	115.90	86.93	
Brake Pedal	0.82	6.37	5.22	
Parking Brake	0.85	110.86	94.23	
Rocker Panel	0.90	82.59	74.33	
Steering Column	0.80	88.85	71.08	
Upper Hinge Pillar	0.65	103.14	67.04	
Upper Dash	0.70	43.24	30.27	
Left Instrument Panel	0.91	97.39	88.62	

Occupant Kinematics Modifier

Occupant Kinematics Modifier	Structure Modifi	iers	SORB Rating		
Seat Attachment Relative 0.10	Structural	Not Assessed	Lower Rating	GOOD	
Vert. <u>Displ</u> , ≥ 60 mm	Integrity		Upper Rating	ACCEPTABLE	
	Fuel/HEV System Integrity	Not Assessed	Overall Rating	ACCEPTABLE	
	-,				



Relative Displacement plots:











LowerHingePillar Plots





Structural Assessment

This module is used to create Effective Plastic Strain (EPS) contour on Dash & Door assemblies and locates & highlights various measurement points such as Left IP, Right IP, Footrest etc.

	< Structural Assessment >	
	Tracking_System	
	N1	Node H
	N2	Node II (1)
	N3	Node II
	•	
	Body Side Assemblies/Components	- Assemblies II Assemblies 2
	Dash Assemblies/Components	Components II Components 3
	Door Assemblies/Components	Components H Components 4
	Plastic Strain @ Time	Last 5
	Measurement Points	
	Curve Name	X Dispplacement
(6 Left IP	
	Right IP	TRC ×
	Foot Rest	TRC ×
	Left Toepan	TRC ×
	Center Toepan	TRC ×
	Right Toepan	TRC ×
	A-Pillar Door	TRC ×
l	B-Pillar Door	TRC ×

- 1) The 3 nodes N1, N2 & N3 (request Ids) required for defining tracking system
- 2) The body side component IDs required for capturing tracking system nodes
- 3) The Dash assembly ID required for highlighting measurement points
- 4) The Door assembly ID required for highlighting A-Pillar & B-Pillar nodes
- 5) The time step at which plastic strain contour should be applied
- 6) Measurement point name
- 7) Measurement point channel info (TRC) from Time History file (binout)





Structural Vehicle Kinematics

This module lets you create plots such as lateral velocity and lateral vs longitudinal displacement for user selected nodes from the Time History file.

< Stru	ctural Vehicl	e Kinematics >		
Filter	r [180	· 1	
Title		Y Velocity	Y Displacement X Displacement 🖶	
2	.HS Rocke	III TRC		
L	HS Rocke	III TRC	TRC TRC ×	

- 1) The filter class to be used
- 2) The label used as curve name when plotting
- 3) The data type, request and component info for each of the user selected locations from the time history file







Structure Plastic Strain

This module allows to plot plastic strain for front structures that include BIW & subframes. The plastic strain result data type is contoured, plastic strain limit is set as per user input and four specific images are captured in Left, Right, Top & Bottom views.

Run Module	Overlay	Configuration
E 💮 Deformed Shape	false ^	A
Energy Distribution	true	Title
🗐 🎯 Engine Mount Failure	false	Tracking Surtage
Exploded View	false	Tracking_oysiem
🗏 🍥 Load Path	true	N1 15849041 V Node H
🛅 🍥 Occupant	true	N2 15839164 V Node H
🗐 🍥 Pedal Column Motion	true	
		N3 15838433 v Node H
Run Statistics	false	
1		Plastic Strain @ Time Last
Structural Assessment	false	
C Structural Vehicle Kinematics	false	
🗵 🍥 Structure Plastic Strain	false	Plastic Strain Limit % 5
🗐 🍥 User Defined Output	true	
Chicle Kinematics Vertical	true	
E 💮 Vehicle Kinematics XY Disp	true	o Components 14 Assemblies 4
Wheel Kinematics	false	
1 of 20 selected	*	

Inputs:

- 1) The 3 node IDs (request ID) required for defining tracking system
- 2) The time step (Last / Max) at which plastic strain contour should be applied
- 3) The plastic strain limit to be used as upper limit for contour legend
- 4) The BIW assembly or component ID

Structure Observations Front Structure EPS - Left







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 M	odule	Overlay	Configuration									
ШĢ	Dash Intrusion Contour Plot	talse 4	#Title	Subcase	Y Type	VRemest	V Component	Filter	Note	X Axis Scale	Y Axis Scale	Window
B 6	Dash Intrusion Cross Section	true /										
8	Deformed Shape	false	1 udo_1	nodout	v hobon v	 Local_r_kr_in_bpir 100 	v ry_displacement	* CFC 60	v Yes	w.	1	1
	Energy Distribution	true	utio 2	rodost	+ addout	+ Localy 6y in boly 100	+ n. displacement	= CFC 60	+ No	*	1	1
	Engine Mount Failure	false										
B 6	Exploded View	false	udo_3	gister	 gistat 	~ gistat	 hourglass_energy 	* CFC 60	v No	w.	1	1
8	Load Path	true	udo 4	gistet	- alstet	+ gistet	v internal_energy	+ CFC 60	v No		1	1
	Occupant	true										
	Pedal Column Motion	true	udo_5	metsum	* matsum	 BR-Stopper_2mm 29 	0 v x_momentum	* CFC 60	 Yes 	w.	1	1
	Run Statistics	false	udo_6	metpum	v metsure	* JRJT-19(87)-A(2)886	v z,momentum	* CFC 60	v Yes	v	1	1
			udo_7	rubdovt	+ dodout	1005_1	v dircos_22	 CFC 60 	 Yes 	*	1	1
	Structural Assessment	false	units II	anter:	k ather	- NAME AND DESCRIPTION	la la terre	- CEC 60	w Max		1	
	Structural Vehicle Kinematics	falso	000,0	roore		· renoteces insom	- your					
80	Structure Plastic Strain	false	udo_9	refore	+ refore	 SteeringColumn2Sumo 	v x_moment	+ CFC 60	 Yes 	*	1	1
	User Defined Output	true	with 18	and an	v setter	x Turnel 1 10050	k k centrald	× CEC 60	w Yes		1	
B (Vehicle Kinematics Vertical	true		14040			- Journals					
B 6	Vehicle Kinematics XY Disp	true										
00	Wheel Kinematics	false										
1 of 20 s	riected		4									

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 Kinematics Vertical

This module generates a vertical (Z) displacement plots for LHS & RHS Rocker A-Pillar & B-Pillar node IDs (request IDs), The report contains following info.

1) A summary table capturing Z displacement min & max values along with time step values for LHS & RHS Rocker A-Pillar & B-Pillar node IDs

2) Images isolating BIW & LHS & RHS Rocker parts

3) LHS & RHS Z displacement plots along with average plots for both A-Pillar and B-Pillar node IDs

< Vehicle Kinematics V	artical >
Title	Z Displacement
RHS Rocker B-Pillar	
RHS Rocker A-Pillar	
LHS Rocker B-Pillar	
LHS Rocker A-Pillar	
LHS Rocker Comp ID	100511 Component II (5)
RHS Rocker Comp ID	100510 Component I (6)
C iles	
Filter	
BIW	789 • Assemblies II Assemblies

- 1) RHS Rocker B-Pillar request ID from Time History file (binout)
- 2) RHS Rocker A-Pillar request ID from Time History file (binout)
- 3) LHS Rocker B-Pillar request ID from Time History file (binout)
- 4) LHS Rocker A-Pillar request ID from Time History file (binout)
- 5) LHS Rocker component ID
- 6) RHS Rocker component ID
- 7) The cfc filter class to be used
- 8) BIW component or assembly IDs









Vehicle Kinematics XY Displacement

This module generates following summary report for the Rocker A-Pillar and B-Pillar LHS & RHS nodes.

1) It plots X & Y direction Acceleration, Velocity, Displacement plots along with average plots.

2) It creates a summary table with the max values for the above plots.

< Vehicle Kinematics	XY Disp >					
Title	X Acceleration	X Velocity	X Displacement	Y Acceleration	Y Velocity	Y Displacement
RHS Rocker B-Pilla	TRC	TRC	TRC	TRC	TRC	
RHS Rocker A-Pilla	TRC	TRC	II TRC	TRC	I TRC	TRC 2
LHS Rocker B-Pillar	I TRC	TRC	TRC	TRC	I TRC	TRC 3
LHS Rocker A-Pillar	TRC	TRC	TRC	TRC	TRC	
Filter		· 5				

Inputs:

- 1) RHS Rocker B-Pillar request ID from Time History file (binout)
- 2) RHS Rocker A-Pillar request ID from Time History file (binout)
- 3) LHS Rocker B-Pillar request ID from Time History file (binout)
- 4) LHS Rocker A-Pillar request ID from Time History file (binout)
- 5) The cfc filter class to be used when plotting for above request IDs

Outputs:





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 ritante
Plastic Strain	false	LHS Base Node 21093646 V Node H
Dun Statistica	false	LHS X-axis Node 21091007 v Node 14
- Win Statistics	laise	LHS XY-plane Node 21021810 + Node 14
Structural Assessment	false	
Structural Vehicle Kinematics	false	RHS Coordinate Frame
Structure Plastic Strain	false	DHR Rass Node
User Defined Output	true	RHS base Node 21029001 V Node 11
Vehicle Kinematics Vertical	true	RHS X-axis Node 21025712 V Node II
Vehicle Kinematics XY Disp	true	
Vehicle Yaw Pitch Roll	true	RHS XT-plane Node 21093472 V Node 11
Weld Failure	false	
Wheel Kinematics	false	Rotation Sequence ZYX 3 Plot Quantities Yaw-Pitch-Roll •
1 of 26 selected		

- 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



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 withall 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 theweld 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 weldcontaining the linked components.

	false				
Deformation Door Aperture Deformation Energy Distribution	false true	1D Weld	Subcase Ytyp	e Ycomp	
Exploded View	false	Axial	elout v bea	m v axial	v
Fuel Tank Volume Change	false	Shear	elout y bea	m v chaar e	10
Fuel Tank Zone X Assessment	false	onear	elour bea	in	$ \cup$
🗆 💮 Fuel Tank Zone Y Assessment	false	Resultant	elout v bea	m v shear_t	*
Plastic Strain	false	Solid Weld			
Rear Barrier Face Overlap	false	Axial	swforc + swfo	rc v axial	*
Rear Bumper Plastic Strain	false				
🗆 🎯 Rear Rail Crush	false	Shear	swforc 👻 swfo	rc 👻 shear	2
Run Statistics	false	Resultant	swforc v swfo	rc v resultant_moment	*
Spare Tire Bolt Force	false				
User Defined Output	true	4.000			
Velocity Separation	true	Impactor			
🗹 🍥 Weld Failure	true	2 × Asse	nblies 14 (3)		
		Assembly to consider			
		0 Accou			
		- Asse	4		
		Weld Material Card Selection	+		
of 17 selected	HR HD	MATI 196	S S		



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 reportgeneration
- 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

100.00	
95.00	
85.00	
75.00	
65.00	
55.00	
45.00	
35.00	AL.
25.00	
15.00	
5.00	at 1 a
0.00	



1)R2FB-529299-A|13|BRKT QTR PNL TO WHL/H5|0.65mm 2)FNA7537534|1|XXXX-X279A33-A (SUPT BDY SD PNL TO WHL/H5 LH)|0.95mm

Wheel Kinematics

The wheel kinematics module lets you generate report containing images (bottom or top view) highlighting suspension, wheel & rocker at various user defined time steps.

< Wheel Kinemati	cs >
Rail	500600 500601 500162 - Components II Components 1
Chassis	27 Assemblies Assemblies 2
Side Sill	100510 150320 150349 👻 Components 🛿 Components 3
Tire	545016 545012 Components II Components 4
View	воттом
Time	40 45 50 55 60 65
Tracking System	
N1	15849041 Node I€
N2	15839164 Node II (7)
N3	15838433 Node I◀

Inputs:

- 1) Rail assembly or component IDs
- 2) Chassis assembly or component IDs
- 3) Side Sill assembly or component IDs
- 4) Tire assembly or component IDs
- 5) View to be used when capturing images
- 6) The time steps at which the images should be captured
- 7) The 3 node IDs defining the tracking system from animation file

40.00ms 6

