



# 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 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							$\times$
	Impact Type:	Front v		Main Overlay 1 Overlay 2 Overlay	3 Overlay 4				G 🍐
$\sim$	Regulation:	FMVSS 208 v			O CAE Data Dyna	✓ O Test Data	HDF 👻	6	•
(1)	Protocol:	Full Frontal						9	
	Units:	mm/ms/kg		l itle:	main_iter_				Input Check
				Previous session file:					
(2)	# of Overlay:	0							<b>~</b>
0		Config same as Main		Analysis results directory:	<b>\$</b>				Search
3	# of Processes:	14 *		0	[m]				E o
U				Config excel file:	0				17 Save As
		More options		Tracking system nodes (N1, N2, N3):	¥	*	<ul> <li>Apply to Modules</li> </ul>		
				Trim curves in X					
	Select Module		Overlay	< Animation >					
	🗹 🍥 Anima	ation	false						
	Battery Section Force true								
	Collis	Collision Detection false		Tracking System (7)					
	🗌 🎡 Dash	Intrusion Contour Plot	false	NI		Noda 14			
	Dash	Intrusion Cross Section	true	NI .		Node			
		med Snape	false	N2		Node I4			
		Aperture Deformation	true	N3		Node I4			
9	Energy	av Distribution	true						
	🗆 🍈 Engir	ne Mount Failure	false	<b>T</b> 14		15			
	🗆 🍈 Explo	oded View	false	Title		View	<b>T</b>		
	🗆 🍈 Fuel	Tank Interaction	false	✓ Com	ponents H		* ×		
	🗆 🍈 Fuel	Tank Zone X Assessment	true						
	E Section Fuel	Tank Zone Y Assessment	true						
	Load	Path	true						
	1 of 28 selected	pant	true						
	or 20 solected								
P	Report output dire	ctory:						1	Now
ଅ		· .						-	•

### 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

#### 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				
1	Animation	false					
2	Dash Intrusion Contour Plot	false	Tracking_System				
1	Dash Intrusion Cross Section	true	NI		~	Node	14
E	Deformed Shape	false				Node	1.00
	Energy Distribution	true	N2	80000008	*	Node	14
	Engine Mount Failure	false	N3	15838433	~	Node	Tel.
1	Exploded View	false				Node	
10	i Load Path	true	Body Side Type	Components			
E	Occupant Occupant	true	Body Side Assembly/Components	150364 150365	~	Components	14
E	Pedal Column Motion	true	DASH Assembly				
m	Run Statistics	false	Туре	Assemblies			
			Assembly/Comp Name/ID		*	Components	14
1	Structural Assessment	false					
1 of 2	1 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.





Jaron noro				
Name	Size	Date modified	Туре	
testT01	253198 KB	27/01/23 03:42 PM	File	
r □ E Data> Radioss> Solver Inpr	ıt File:			selected 1 o
aarch here				
earch here	Size	Date modified	Type	
Name	Size	Date modified 27/01/23 03:37 PM	Type RAD File	
Name Etat_0000.rad Etat_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 幅 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.

📔 Overlay Setting				$\times$
✓ m1_hg	Isolate Only Sho	w Hide	Show All	
m2_hg	Laver Color	-	l aver l ine Thickness	*
	Sumbel Celer	-	Sumbel Size	
	Symbol Color	-	Symbol Size	
	Symbol	On	Off	
	Notes Font	Α		
	Notes Position	*		
	Legend	On	© Off	
	Legend Font	Α		
	BarGraph Category Font	А	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.</a>

### 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.



	9

Tracking System					
N1		15849041 🗸	Node 14		
N2		15839164 ~	Node 14		
N3		15838433 ~	Node H		
Title				View	÷
7	✓ Assemblies II			Тор	* ×
9	✓ Components II			lso	* ×

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

« uccupant »						
Driver Passenger						
Dummy Model 50th	* Dur	amy Version Config	* Res	et		
i+¿Driver Restraint Type		*				
Driver ID						
Driver Injury Criteria	Subcase	Datatype	Request	Component	Filter	
HEAD_ACC_X	nodout	7	-			
HEAD_ACC_Y	ebstat ebstat		H3-50TH_DU	MMY-1_HEAD_ACCELEROME MMY-1_HEAD_ACCELEROME	ETER_X 2000001 ETER_Y 2000002	Ê
HEAD_ACC_Z	deforc disbout	•	H3-50TH_DU	MMY-1_HEAD_ACCELEROME MMY-1_CHEST_ACCELEROM	ETER_2 2000003	
HEAD_ACC_RES	elout gistat		* H3-50TH_DU	MMY-1_CHEST_ACCELERON MMY-1_CHEST_ACCELERON	ETER_Z 2000005	
NECK_UPPER_MOMENT_Y	inforc matsum	•	* H3-50TH_DU	MMY-1_PELVIS_ACCELERON	ETER_Y 200008	
NECK_UPPER_FORCE_X	nodout.	<u> </u>	)*[	191	×	*
NECK_UPPER_FORCE_Z		<b>}</b>	)+ [	)+ [	*	*
CHEST_DEFLECTION		+ [	)+ [	)• [	•	Ŧ
CHEST_ACC_X		)+ [	)+ [	)• [		*
CHEST_ACC_Y		+	\~ [	)+[		-
CHEST ACC Z		4	4	4	4	-



### Modules

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

- Animation New
- Belt Forces
- BOM
- Collision Detection
- Contour Plot
- Deformed Shape
- Energy Dissipation
- Energy Distribution
- Floor Bolt Force
- Front Impact Description
- Front Seat Angle Assessment
- Front Seat Dynamic Assessment
- Load Path
- Loadcase Description
- Measure Plot
- Rear Impact Angular Change
- Rear Impact Description
- Recliner Moment
- Run Statistics
- Static Headrest Displacement
- Static Headrest Summary
- User Defined Output
- Weld Failure
- Whiplash Summary

# 



### 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 *			
Entity (2)	Title:	window title	
p1 IIHS MDB Side Impact	<ul> <li>FE Entities</li> </ul>		
p1w1 window title	FE Entities:	Components (1125)	5
p1w2 window title	<ul> <li>View Set</li> </ul>		
	View:	lso	*
	Secondary Zoom Factor:		1.0
	🔹 🗹 Tracking		
	Name:	tracking1	
:	Track:	Plane	*
	Plane Type:	OXY	*
	N1N2N3:	🔩 N1 2453176 N2 2444863 N3 3496459	
0	Displacements (Global X)	c	
	Displacements (Global Y)	Γ.	
	🔽 Displacements (Global Z)	c	
	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.







### Belt Forces

This module is used to create shoulder and lap seat belt force plots for following seat configurations viz. Left, Right, Mid, 2 seats & 3 seats.

< Belt Forces >			
Seat Configuration	eft	· 1	
		Filter	
Left Shoulder Seat Belt	II TRC		~2
Left Lap Seat Belt	III TRC		~ <u>3</u>

- 1) Select the seat configuration that you are interested in
- 2) Select the respective channel (type, request & component) for the shoulder force
- 3) Select the respective channel (type, request & component) for the lap force





### 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.

BOM Selec	ction 1 5938 - Co	mponents H		
Entities component properties materials	5 2	Datanames IZZcog lines lumpedmass [mass material materialld moduleid	3	
Preview N	ote			4
Cal	label			
۲ Sei	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



### **Collision Detection**

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



### Inputs:

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 collisionset. Likewise, users can define multiple collision sets





### **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.



ontour Plot >			
Contour Page 🔻 🖽 👻 🙀 Add			
🛿 Contour Page 🛛 🖏 Section Page 🚺	Standard		
🚪 Hotspot Page 🛛 💰 Zoom Page	Title:	window title	
m p1 carrier LH	FE Entities		
p1w1 window title	(3) FE Entities:	Components (1)	54
p1w2 window title	<ul> <li>View Set</li> </ul>		
– 🌆 p1w3 window title	View:	Rear	~
Digital p1w4 window title	Secondary Zoom Factor		1.0
p2 LH Headrest Vertical Lock	- Z Contour		
p2w1 window title	Data Type:	Strain	*
p2w2 window title	Data Component:	P1 (major)	*
p3 Lin Headlest Top Plastic Cover	Layer:	Lower	*
	Resolved in:	Analysis System	*
powz window ule	Average Method:	None	*
	Legend Threshold:		0.012
m p4w2 window title	Section		
	Name:	section1	
	Orientation:	Normal to screen	~
	Base Node:	• node (0)	R.
	Deformable:		
	Clip Above:		
	Cross Section Only:		
	Show Grid lines:		

### 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.
- 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.

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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					
Animation	false	<u>^</u>					
Dash Intrusion Contour Plot	false						
🗐 🎯 Dash Intrusion Cross Section	true	Templing Conton					
Deformed Shape	false	Tracking System	-				
Energy Distribution	true	N1	15287	725 - Node	34		
📰 🎯 Engine Mount Failure	false	N2	2108	810 V Node	0		
Exploded View	false						
🖹 🍥 Load Path	true	N3	21085	1957 v Node	14		
🖻 🍥 Occupant	true						
📰 🍥 Pedal Column Motion	true	Title (D)		0	Turne	View (	4
Run Statistics	false	Detorm_1	9 24 25 56 57	- Assemblies	14 Assemblies	so	
and with a second contract of		A CONTRACTOR OF A CONTRACTOR OFTA CONTRACTOR O				n	
		The second second	Distance and	<ul> <li>Internet control controls</li> </ul>		a second	
Structural Assessment	false	Deform_2	24 25 56	* Assemblies	Assemblies	LEFT	* ×
Structural Assessment     Structural Vehicle Kinematics	false false	Deform_2 Deform_3	24 25 56	Assemblies     Assemblies	Assemblies	TOP	* ×
Structural Assessment     Structural Vebicle Knematics     Structural Vebicle Strain	false false false	Deform_2 Deform_3	24 25 56	Assemblies     Assemblies	Assemblies	TOP	* x * x
Structural Assessment Structural Vehicle Kinematics Structural Vehicle Kinematics User Defined Output	false false false true	Detorm_2 Detorm_3	24 25 56 24 25 56	Assemblies     Assemblies	Assemblies	TOP	* x * x
Structural Assessment Structural Vehicle Knomatics Structure Plastic Strain User Defined Output	false false false true true	Detorm_2 Detorm_3	24 25 56	Assemblies     Assemblies	Assemblies		* [x] * [x]
Structural Assessment Structural Vehicle Kinematics Structure Plastic Strain User Defined Output Vehicle Kinematics Vertical	false false false true true true	Deform_2 Deform_3	24 25 56		Assemblies	I LEFT	* [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









### **Energy Dissipation**

This module is used to create Energy Dissipation report for Seat as per ECE-R17 regulation. It contains an animation of pendulum impact on the Headrest and a plot of pendulum acceleration. The GUI and the inputs are as below.

< Energy Dissipation >					
Part Selection	97256-97259 97261-972 💌 Con	nponents II			
View Set	Left	♥ Plane	2		
Section	No Section - 3				•
Subcase	Туре	Request	Component	Filter	(4)
nodout	r nodout v	S9SEBAMIRI50 1620	58 v x_acceleration	✓ CFC 60	*
FPS		100 5			

- 1) Selection of Seat components (Components/Assemblies/Elements supported)
- 2) View set selection. The selected seat components (in step 1 above) will be oriented in the view set selected before capturing the animation.
- 3) Section definition (optional). If defined, a section cut will be applied based on the inputs and then the animation will be captured.
- 4) Subcase, Datatype, Request, Data Component, and filter selection from time history data. This info will be used to created the pendulum acceleration plot
- 5) FPS or Frames Per Second parameter is required for capturing the animation (avi file)







### **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.



- 6) Barrier assembly or component ID
- 7) Subsystem name
- 8) Subsystem assembly or component ID







### Floor Bolt Force

This module is used to create plots for bolt forces at each of the seat bolt locations. It contains axial, shear\_s & shear\_t plots along with resultant of shear\_s & shear\_t plot and a cross plot of axial force vs resultant shear force as shown below.

•	< Floor	Bolt Force >						
	Title	Axi	al Curve TRC	shear_s Curve TRC	shear_t Curve TRC	Bolt Limit Curve	+	
	M	3	II TRC	II TRC	I TRC	M8	* ×	1
	M	10	TRC	TRC	TRC	M10	* ×	

- 1) For each of the seat bolt location, enter a title to be used as slide title
- 2) Select the type, request & component (TRC) for axial curve, shear\_s & shear\_t curves
- 3) Select the bolt limit curve from the drop down.







### Front Impact Description

This module is used to create a summary report for Font Impact load case. The report consists of the following slides.

- Analysis summary slide capturing the load case, seat position, dummy type, test pulse, seat belt system
- A plot containing the Front Crash Pulse
- Front impact simulation animation in user selected views capturing the Sled, Belt, Seat & Dummy parts.

< Front Impact De	scription >
Sled	120006 120011  Components I
Belt	120007 184011 184013 🝷 Components 📕
Seat	99001 99061 99062 160 🖌 Components 📕 🛛
Dummy	181003 181004 181618 💌 Components I4
Sled Pulse	11 curves H
W1 view	left v Zoom Factor: 3
W2 view	top v Zoom Factor: 1
Tracking System	n
N1	2014827 Node I
N2	46028449 Node II
N3	33021844 Node I
FPS	10 5
	<b>v</b>

- 1) Select the parts representing the Sled, Belt, Seat & Dummy sub-systems
- 2) Select the Sled Pulse load curve
- 3) Select the two views for model orientations to be captured in the report
- 4) Select the 3 nodes defining the tracking system
- 5) Enter the Frames Per Second value used when capturing the animation



### Outputs:







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### Front Seat Angle Assessment

This module evaluates seatback deflection (in deg) as part of the Front Seat Whiplash Dynamic assessment for High Severity Pulse. The seatback deflection is assessed where a three point penalty will be applied to the overall score when seats have a rotation of 32 deg or greater. The report generated (PPT & HTML) consists of the following.

1) A summary table with angle calculated between recliner center node and seatback top node at user specified locations. The table also has average angle and comparing it with the capping limit.

2) Image of the dummy and the seat along with the measured angle at each of the specified locations

< Front Seat Ang	gle Assessment >							
Tracking Syste	em			_				
N1		Node	H					
N2		Node	I	1				
N3		Node	I					
Label	Recliner centre Node		:	Seatback Top Node			÷	]
Label	Recliner centre Node	Node	I	Seatback Top Node	Node	I	<b>+</b> ×	2
Label LHS Center	Recliner centre Node	Node	14	Seatback Top Node	Node	14	+ × ×	2

### The GUI is as shown below.

### Inputs:

1) Tracking system definition. Select 3 nodes on the ground panel that defines a tracking system.

2) **Recliner center node & Seatback Top node** selection. Select one node each for defining the recliner center node & seatback top node. These 2 nodes will be used for angle calculation. Users can select the node pairs at multiple locations. The average angle will be calculated if more than one location (node pair) is specified.



### EuroNCAP Whiplash Front Seat Angle Assessment Summary

Title	Values (deg)
LHS1	10.38
LHS2	8.45
Center	7.60
RHS1	9.60
RHS2	8.22
Capping Limit	32.00
Average Backseat Deflection	8.85
Max Backseat Deflection	10.38

Max BackSeat Angle : 10.380 Time at Max BackSeat Angle : 100.000





### Front Seat Dynamic Assessment

This module generates dynamic assessment report for the Front Seat Whiplash load case. This module is supported across multiple regulations such as EURONCAP, CNCAP, JNCAP etc. The injury criteria summary table and point scoring varies from one regulation to the other. The time history data input is from a simulation that is run to dynamically test a motor vehicle seat and head restraint assembly to assess the extent to which they reflect best practice in preventing soft tissue neck injuries. A BioRID UN rear crash dummy is used and is seated in a standardized position restrained by a three-point belt. The report generated (PPT & HTML) consists of the following.

1) Dynamic assessment detailed summary table with points scoring. The values reported in the table for all the injury criteria are based on the Head-to-Head Restraint contact force end time (T-HRC end time)

2) Performance plots (with limit datum lines) for each of the injury criteria

3) Head Restraint Contact Time (T-HRC start & T-HRC end). It is defined as the time of first contact between the rear of the ATD head and the head restraint, where the subsequent continuous contact duration exceeds 40ms.

4) Nkm Calculation. The Nkm criterion is based on a combination of moment and shear forces, using critical intercept values for the load and moment.

5) NIC Calculation. The NIC is based on the relative horizontal acceleration and velocity of the occipital joint relative to T1.

The GUI is designed in such a way that it 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.

eat		ി					-			
Dummy Model HUM_BioRI	D v	Dummy V	/ersion config		+	Reset	2			
Severity	Medium	¥	3							
Seat Injury Criteria	Subcase		Datatype		Request	d.	Component		Filter	
HEAD_ACC_X (4)	nodout	v	nodout	×	10000	~	x_acceleration	~	1000	-
HEAD_CONTACT_FORCE	rcforc	×	rcforc	¥	1012	×	x_force	~	600	
REBOUND_VEL	nodout	*	nodout	~	10000	~	x_velocity	~	600	
NECK_UPPER_FORCE_X	elout	~	beam	~	10000	v	axial	-	180	
ECK_UPPER_MOMENT_Y	elout	ļ.	beam	÷	10000	v	moment_s		180	ŀ
ECK_UPPER_FORCE_Z	elout	~	beam	v	10000	v	shear_t	Y	180	
ECK_LOWER_FORCE_X	elout	*	beam	¥	10001	~	axial	~	180	
ECK_LOWER_MOMENT_Y	elout	*	beam	~	10001	~	moment_s	*	180	
1_LEFT_ACC_X	nodout	~	nodout	*	10002	~	x_acceleration	~	180	
	an daud		nadout		10007		v acceleration		180	





#### Inputs:

1) **Dummy model** selection option. Currently for the Front Seat Dynamic Assessment, we support BioRID dummy type.

2) **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.

3) Pulse severity selection. There are 3 pulse severity options available namely Low, Medium, and High.

4) **Dummy Injury Criteria selection**. This option is enabled only when the dummy version is set to config. Users should first make sure to load the Time History file (T01 / binout / HDF / MME) 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.

•	Front Seat Dynamic Assessme	ent > Time History Plots					
	Seat						
	Dummy Model HUM_BioR	ID v Dummy	Version config	✓ Reset			
	Severity	Medium	*				
	Seat Injury Criteria	Subcase	Datatype	Request	Component	Filter	
	HEAD_ACC_X		•	¥		*	*
	HEAD_CONTACT_FORCE	deforc ^	•	<ul> <li>Head Acceleration</li> <li>Vertebra C4 10001</li> </ul>	10000	•	*
	REBOUND_VEL	glstat jntforc	•	Vertebra T1 Left Ha Vertebra T8 10003	nd Side 10002	*	~
	NECK_UPPER_FORCE_X	nodout	•	<ul> <li>Vertebra L1 10004</li> <li>Pelvis Acceleromet</li> </ul>	ler 10005	•	~
	NECK_UPPER_MOMENT_Y	rbdout	,	<ul> <li>Vertebra T1 Right H</li> </ul>	land Side 10007	*	٣
	NECK_UPPER_FORCE_Z	rcforc shtout *	•	+-POINT 10500		¥	~
	NECK_LOWER_FORCE_X		•	*	*	*	*
	NECK_LOWER_MOMENT_Y			•	•	¥	*
	T1_LEFT_ACC_X		•	¥	*	*	~
	T1_RIGHT_ACC_X			•	v	•	¥



### **EuroNcap** Whiplash Front Seat Dynamic Assessment Summary

Total points (Out of 3) 2.25

### **Detailed Summary**

High Severity Pulse	Higher Limit	Lower Limit	Capping Limit	main_iter_	Points
NIC (m2/s2)	13	23	25.5	20.50	0.250
NKM	-	-	0.78	0.21	
Upper Neck Shear +Fx (N)	30	210	364	20.32	1.000
Upper Neck Shear -Fx (N)	-	-	360	80.79	
Upper Neck Tension +Fz (N)	470	770	1024	208.83	1.000
Upper Neck My Extension (N*m)	-	-	30	16.99	
Upper Neck My Flexion (N*m)	-	-	30	2.75	
Lower Neck Shear Fx (ABS) (N)	-	-	360	188.09	
Lower Neck My Extension (N*m)	-	-	30	1.89	
Lower Neck My Flexion (N*m)	-	-	30	6.20	
T1 Acceleration (g)	-	-	17.8	13.78	
T_hrc start (ms)	-	-	92	81.90	
T_hrc end (ms)	-	-	-	150.00	
Rebound Velocity (m/s)	-	-	6	5.59	



### Neck Upper Force Fx



### Head to Head Restraint Contact Force



For CNCAP, the point scoring & the STAR rating is based on the following specification. There is a separate point scoring calculation for Front seat & Rear seat as shown in the table below. The values reported in the table for all the injury criteria are based on the Head to Head Restraint contact force end time (T-HRC end time)

Injury Front Seat Point		Rear Seat Point	Higher Limit	Lower Limit	Front Max Score	Rear Max Score
NIC	2 to 0	0.8 to 0	< 8 m²/s²	> 30 m²/s²	2	0.8
Upper Neck <u>Fx</u> +	1.5 to 0	0.6 to 0	< 340 N	> 730 N		
Upper Neck Fz+	1.5 to 0	0.6 to 0	< 475 N	> 1130 N	1.5	0.6
Upper Neck My	1.5 to 0	0.6 to 0	< 12 Nm	> 40 Nm		
Lower Neck Fx+	1.5 to 0	0.6 to 0	< 340 N	> 730 N		
Lower Neck Fz+	1.5 to 0	0.6 to 0	< 257 N	> 1480 N	1.5	0.6
Lower Neck My	1.5 to 0	0.6 to 0	< 12 Nm	> 40 Nm		
Max Seatback Deflection	0 to -2	0 to -0.8	< 25 deg	>= 25 deg	0	0
Dynamic Seat Displacement	0 to -5	0 to -2	< 20 mm	>= 20 mm	0	0
HRMD	0 to -2	0 to -0.8	Yes	No	0	0



### **CNCAP Whiplash Dynamic Assessment Summary**



Seal Location	TIOIL
Points	3.6
Modifier	0
Total Points (out of 5)	3.6
Score %	72
Star Rating	3
Total Points (out of 5) Score % Star Rating	3.6 72 3

85 %
75 %
65 %
60 %
< 60 %

#### **Detailed Summary**

Title	Higher Limit	Lower Limit	main_iter_	Points
NIC (m2/s2)	8	30	20.50	0.863
Upper Neck Shear +Fx (N)	340	730	23.06	1.500
Upper Neck Tension +Fz (N)	475	1130	220.80	1.500
Upper Neck My (N*m)	12	40	16.91	1.237
Lower Neck Shear +Fx (N)	340	730	190.75	1.500
Lower Neck Tension +Fz (N)	257 1480		220.80	1.500
Lower Neck My (N*m)	12	40	1.87	1.500
Dynamic Seat Displacement (mm)	20	20	0.01	0.000
Max Seatback Deflection greater than 25 deg	No	Yes	No	0
Seat headrest interferes with the headform of HRMD	No	Yes	No	0
T_hrc start (ms)	-	-	81.90	
T_hrc end (ms)	-	-	150.00	

### **Neck Upper Force Fx**





### Head to Head Restraint Contact Force



For JNCAP, the point scoring & the LEVEL rating is based on the following specification.

Injury	Weightage	Point	Higher Limit	Lower Limit	Max Score
NIC	1	4 to 0	< 8 m²/s²	> 30 m²/s²	4
Upper Neck Fx+		4 to 0	< 340 N	> 730 N	
Upper Neck Ez+		4 to 0	< 475 N	> 1130 N	
Upper Neck My Flexion		4 to 0	< 12 Nm	> 40 Nm	
Upper Neck My Extension	2	4 to 0	< 12 Nm	> 40 Nm	
Lower Neck Ex+		4 to 0	< 340 N	> 730 N	ð
Lower Neck Fz+		4 to 0	< 257 N	> 1480 N	
Lower Neck My Flexion		4 to 0	< 12 Nm	> 40 Nm	
Lower Neck My Extension		4 to 0	< 12 Nm	> 40 Nm	

Rati Side	Rating Scheme Frontal & Side Impact, Whiplash:								
	Level	Points							
5		≥ 10.5							
4		≥ 9							
3		≥ 7.5							
2		≥ 6							
1		< 6							



### 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

Overlay	Configuration										
false											
false	Ehu	1000	1								
true	Filler	1000									
false	Title	Position 1		Position 2		Position 3	Position 4	Position 5	Position 6		6
true		Front		Mid		Rear					+ (2
false	Datible	1100030	10	100016	10	100010	121	101	1071		- 6
false	Plantono	100010		100010		100010	- 0			-	6
true	Rail RHS	100011		100017		100019	×	¥	×.		×
true	Cubbrane 164	600017	-	600011		600000	LI	27	20	- 2	101
true	Straughter Puo	200017		3999711		200000			(F)		
	Subframe RHS	500018	Y	500012	1	500004		(H)	×[		×
false	Shotgun UHS	100042		100044	-	240004	)+(	)+(	+		×
false	Shotgun RHS	100043		100045		240008	141	L.	H.	1	×
false false	Pocker PHS	100038					)• (	) (	×(		×
true	A-Piller LHS	240001					4	1.	+	4	×
true	A-Pillar PHS	240002	-				×.	H.	¥.	-	×
false	DriveshaltUHS	\$55000	-			555001	-	(H)	×		x
	RockerUHS	100026	-		÷		- I- I	H.	)•{	je je	×
	Rocker RHS	100038	÷		-		(r)	4	+ I		×
	Overlay false false true false false false true true true false false false false false false false	Overage         Configuration           false         Filter           false         Subframe LHS           false         Subframe LHS           false         Subframe RHS           false         Rocker RHS           false         Drivephot LHS           false         Drivephot LHS           Rocker LHS         Rocker LHS           Rocker LHS         Rocker RHS	Overlag, Configuration           Talse           failse           Baile           Subhame LHS           Stotgun LHS           failse           Priour Pris	Coverage Configuration           false         False           false         False           false         Tifle           false         False           false         Subhane LHS           Subhane LHS         500017           false         Subhane LHS           false         Shotyan EHS           false         Pocker PHS           false         ChrwyshaftLHS           false         DhiveshtLHS           false         DhiveshtLHS           Pocker LHS         100026           Pocker LHS         100038	Coverage         Computation           false         False         1000         +         ①           false         Title         Position 1         Position 2         Position 2           false         Title         Position 1         Position 2         Position 2           false         False         Front         Mdd         Mdd           false         Real RHS         100010         ×         100017           false         Subhame LHS         500017         >         500011           false         Subhame LHS         500018         >         500012           false         Shotyon LHS         100042         ×         100044           false         Shotyon RHS         100038         ×         100045           false         Rocker PHS         100038         ×         100045           false         DriveyshaftLHS         24002         ×         1           false         DriveyshaftLHS         100026         ×         1           false         DriveyshaftLHS         100026         ×         1	Overlag         Configuration           false         False         1000         Image: Configuration           false         Tile         Position 1         Position 2           false         Tile         Position 1         Position 2           false         Front         Med           false         Foot         Med           false         Foot 100010         100016           false         Real PHS         100011         100017           false         Subhame PHS         500017         500012           false         Shotpun EHS         100042         100044           false         Shotpun EHS         100031            false         Shotpun EHS         100043         100045           false         Shotpun EHS         100031            false         Docker EHS         100031            false         Docker EHS         100035            false         DrivephattHS         555000            false         DrivephattHS         100026	Overlag         Configuration           false         Tile         10001         Image: Configuration of the configuration	Coversystem         Configuration           failse failse failse failse         Filter         1000         Image: Configuration of the second of the secon	Overlag         Configuration           failse         Totol 1         10001         Position 3         Position 4         Position 5           twe         Position 1         Position 2         Position 3         Position 4         Position 5           failse failse failse failse failse failse failse         Position 1         100010         100017         100010         1         1           failse failse failse failse failse         Sotgan EHS         100042         100044         2         2         1         1           failse failse failse failse         Position 1         100043         100045         2         2         1         1         1           failse failse         Pocker EHS         100011         1<	Overagination         Contention         Contentint         Contentint         Cont	Overlag         Control         Control         Overlag         Control         Overlag         Control         Overlag         Control         Overlag         Overlag         Position 1         Position 2         Position 3         Position 4         Position 5         Position 6           failse         Tile         Position 1         Position 2         Position 3         Position 4         Position 4         Position 6           failse         Foot         Med         Rear         Image: Control         Position 1         Position 1         Position 4         Position 4         Position 4         Position 6           failse         Rear PHS         100010         +         100017         +         100018         =         >

**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_m3	_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**







### Loadcase Description

This module generates a title slide (as per customer requirement). It can be included as a title slide for any of the Seat specific load cases such as Pendulum impact, Whiplash etc. It takes following info as user inputs

- 1) Project Name
- 2) CAE/DR
- 3) Customer Name
- 4) Design Level
- 5) Seat Position

< Loadcase Description >								
Project Name								
CAE/DR								
Customer								
Design Level								
Seat Position								

The above information will be included in a title slide as per the master PPT template.





### Luggage Retention

This module is used to validate the design of the rear seat backs as per ECE R17 (Economic Commission for Europe of the United Nations (UN/ECE)) regulation. The ECE R17 establishes uniform standards for approving vehicles based on their seats, anchorages and head restraints.

The module creates the following summary report from the selected simulation results data.

- Forward deflection of Head Restraint & the structure
- Plotting of Test pulse
- Capturing the ECE-R 17 with 80% of the permissible dynamic forward displacement

< Luggage Retention >								
Tracking System								
N1	2173454	Node H						
N2	2103436	Node H						
N3	2127224	Node H						
								0
Title	H Point	Seat Selection	Block Selection	Headrest	H plane	H+100 Plane	H+150 Plane	(2)
Point 1	16801138	Node H 99016 99031 99044-990	Components II 190000 190001	Components H 99306 99307 99318-993	Components H 120037	▼ Components H 120038 ▼ 0	Components M 120039	▼ Components I
Point 2	16800933	Node H 99016 99031 99044-990		Components H 9960799618-99620996	Components H 120037		Components H 120039	- Components I
Point 3	16800951	Node N 99016 99031 99044-990		Components H 99306 99307 99318-993	Components H 120037		components H 120039	▼ Components I
Test Pulse Curve	26	Curve H						
· · · · · ·								

- 1) 3 nodes that define the tracking system
- 2) H point location, Seat, Block & Headrest parts along with the parts defining the H plane, H+100 plane & H+150 plane at 3 different locations
- 3) Test pulse curve ID from the solver input deck



Outputs:



37





### 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 🗸	<ul> <li>Standard</li> </ul>		
Entity (2)	Title:	Impactor - Headrest LH	
	<ul> <li>FE Entities</li> </ul>		
p1w1 Impactor - Headrest LH	FE Entities:	Components (13)	Ŀ,
p1w2 window title	<ul> <li>View Set</li> </ul>		
	View:	Left	~
	Secondary Zoom Factor:		1.0
	<ul> <li>Measure</li> </ul>		
	Name:	Impactor - Headrest LH	
	Туре:	Minimum Distance	~
	Pick Entities:	Measures(1)	Dg
(4	Y Axis Quantity:	Mag	~
:	Live Link:		
	Value Format	Fixed	~
	Value Precision:	0	~
	Angle Unit	Degrees	~
	Contour		
	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.











### Rear Impact Angular Change

This module is used to find the angular change of backrest for the following seat configurations during rear impact simulation. The configurations supported are Left, Right, Mid, 2 seat & 3 seat. A summary slide is generated highlighting the angular change of backrest for the selected seat configuration and creating an angular deviation plot across the simulation steps.

< Rear Imp	act Angular Change >					
Seat Confi	guration 3	*	1			
View Set	User Defined	✓ Zoom Factor	or:	1.0 2		
Seat	120005 120013 120014	▼ Compone	ents 14 3			
	Angle N1			Angle N2		
LeftSeat	40012266	Node	I	40011741	Node	14
Mid Seat	42006446	Node	I	42013368	Node	м (4)
Right Seat	44007740	Node	K	44007973	Node	H

- 1) Select the required seat configuration
- 2) Select the view and the zoom factor to be used for orienting the seat
- 3) Select the seat parts
- 4) Select the two nodes (on top & bottom of the seat backrest) for calculating the angular deviation







### Rear Impact Description

This module is used to create a summary report for Rear Impact load case. The report consists of the following slides.

- Analysis summary slide capturing the load case, seat position, dummy type, test pulse, seat belt system
- A plot containing the Rear Crash Pulse
- Rear impact simulation animation in user selected views capturing the Sled, Belt, Seat & Dummy parts.

< Rear Impact De	scription >
Sled	120006 120011 - Components I
Belt	120007 184011 184013 👻 Components 📕
Seat	99001 99061 99062 160 🗸 Components 🛛
Dummy	181003 181004 181618 👻 Components 📕
Sled Pulse	11 curve H
W1 view	Top V Zoom Factor: 1
W2 view	Right v Zoom Factor: 1
Tracking System	1
N1	2095994 Node I
N2	2096011 Node II
N3	2103856 Node I
FPS	25 5

- 5) Select the parts representing the Sled, Belt, Seat & Dummy sub-systems
- 6) Select the Sled Pulse load curve
- 7) Select the two views for model orientations to be captured in the report
- 8) Select the 3 nodes defining the tracking system
- 9) Enter the Frames Per Second value used when capturing the animation



### **Outputs:**









### **Recliner Moment**

This module is used to create recliner moment plots at user selected seat bolt locations. At each selected location, recliner torque left and right channels are plotted as shown below.

< Recliner Mom	ent>				
Bolt Selection	Upper Bound Low	er Bound LHS Bolt Channel	RHS Bolt Channel	filter	+
Bolt1	0.2	-0.2 📑 TRC	TRC	CFC 600	~ × 1
Bolt2	0.4	-0.4 📑 TRC	TRC	CFC 180	¥ ×
Bolt3	0.3	-0.3 TRC	TRC	CFC 180	* ×

- 1) For each of the seat bolt location, enter a title to be used as slide title
- 2) Enter the upper & lower bound limits for the recliner torque
- 3) Select the type, request & component (TRC) for left & right hand bolt channels along with the filter class to be applied





### **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	<ul> <li>Node</li> </ul>	(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	Al and the		Pacult	Target
Engine/Transmission	V4	C/2988	Run Quality	Result	larger
Test Speed	35 Kph		Termination Time	0.2 ms	0.2 ms
Driveline	AWD		Termination Type	Normal	
Run Name	Main.k			Termination	
Engineer	tejasr		Mars Added @ T=0 [%]	0.44.%	< 1%
Model Run Date	09/18/2021		Mass Added @ 1-0 [//j	0.44 %	~170
Test Mode	Side CIASI - IIHS OLD (Pre 2021) MDB		Total Mass Added [%]	0.96 %	< 3 %
Gross Vehicle Weight	1826.09 kg	C · D b	Total Mass Added [kø]	0.03 kg	
Impactor Weight	0.00 kg		1010111000110000 [1:8]	0.05 Kg	
Total Weight	1826.09 kg		Energy -> Hourglass [%]	3.45 %	< 10 %
Vehicle Front Axle Weight	1016.54 kg		Energy -> Ratio [%]	1.00 %	1 >= Energy
Vehicle Rear Axle Weight	809.55 kg				Ratio < 1.01
Solver Version	mpp s R7.1.2				
Number of CPU	8 CPU	1			
Run Time	21 hr. 41 min 54 sec	]			

### 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)









### Seat Belt Anchorage Description

The Seat Belt Anchorage is part of the ECE R14 & FMVSS210 regulations. These are tests to ensure sufficient strength of all anchorage points. In these tests high forces are applied to the seatbelts over loading devices. All components of the system such as seats, seat & belt anchorages must resist the defined loads without damage. The loads are applied slowly and are sustained over a long period of time.

The module creates the following summary report from the selected simulation results data.

- A plot containing the applied loads on Thorax, Pelvis & COG mass
- An image of seat, seat belts & anchorages, shoulder & pelvis blocks and their angle of rotation
- An animation of the seat & the impactor parts along with the minimum distance measure between the H-point & Headrest point

< Seatbelt Anchorage Desc	ription >				
COG Z bar node selection:	9065680 LCID	Node	М		2
Thorax	9001003	curves	н	9063629	Elements II
Pelvis	9001005	curves	н	9063628	Elements I4
COG Bar	9001009	curves	М		
Seat Selection	8000000 8000021-800	▼ Compone	ents I	10	
Impactor Selection	9001001-9001009 90010	▼ Compone	ents I	4	
H-Point Selection	888065818	Node	М		
Headrest Selection	806501022	Node	М	4	

- 1) A node defining the center of gravity of the seat assy
- 2) Load curve IDs & the corresponding 1D bar/beam elements at the Thorax, Pelvis & COG bar defining the applied loads
- 3) Seat and the Impactor parts
- 4) H-point & Headrest point node locations



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### Outputs:





F Thorax	1500 >> 13500 >> 16200
F Pelvis	1500 >> 13500 >> 16200
F COG	500 >> 6867 >> 8240

Boundaries:
 Thorax Pull Rope End – constrain Y and Z translation
 2 Pelvis Pull Rope End – constrain Y and Z translation
 3 COG Pull Rope End – constrain Y and Z translation
 4 COG Rear Tube – constrain Y and Z translation









### Static Headrest Displacement

This module is used to generate a report which is part of the Static Headrest Test. The GUI and the inputs required are as below. For each of the selected impactor-headrest location, the report consists of a curve representing distance b/w impactor and displaced reference plane and force vs displacement curve as shown below.

< Static Head	lrest Displacement >					
Title	Measure Node A		Measure Node B	Head Sphere F	Force> : Curve Filter	1
Static Head	87002933	Node	₩ 87001307	Node II 🗊 TRC		*
Static Head	87005325	Node	₩ 87003699	Node II TRC		*
Static Head	87202933	Node	₩ 87201307	Node II II TRC		*

### Inputs:

- Enter the Title which will be used for the slide title & curve names
- Select a Reference Plane node (node A) and an Impactor node (node B). These 2 nodes will be used to create a measure of type **Distance Between** (measured along X direction) and a curve will be created using the measure.
- Select Head Sphere Force request from the time history data.

### Note:

The report includes separate slides for different impactor & headrest locations (Left / Center / Right). The user should select appropriate reference plane & impactor nodes and the respective TRC inputs for each of the impactor & headrest locations.

A standard report will be generated as shown below.







### Static Headrest Summary

This module is used to generate a report for Static Headrest Test. The GUI and the inputs required are as below.

< Static Headrest Summary	/>				
					ብ
Title	Seat Part Selection	Impactor part Selection	View Set	Impactor Force Curve Curve Filter	U
Left	8030002 95137 95138 9 💌 Components I	▲ 187006 187007 187008 - Components I	▲ Left	✓ ITRC	*
Center	95201 95203 95204 910 💌 Components I	▲ 187023 187024 187025 ▼ Components I	▲ Left	✓ II TRC	*
Right	8030002 95407 95419 9 💌 Components I	▲ 189006 189007 189008 ▼ Components Ⅰ	▲ Left	✓ II TRC	*
FPS 100	2				

### Inputs:

- Selection of Seat and Impactor parts (Components/Assemblies/Elements supported) to be included in the report.
- View set selection. The selected seat components (in step 1 above) will be oriented in the view set selected before capturing the animation.
- Impactor Force Curve Type, Request & Component selection from the time history data.
- FPS or Frames Per Second parameter is required for capturing the animation (avi file)

### Note:

The report includes separate slides for different seat locations (Left / Center / Right). The user should select appropriate seat & impactor parts and the respective TRC inputs for each of the seat locations.









### 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 A	lockde	Overlag	Configuration									
	Dash Intrusion Contour Plot	false	#Title	Subcase	Y Type	VRemest	Y Component	Filter	Note	X Aris Scale	Y Axis Scale	Window
	Dash Intrusion Cross Section	tue	2				1.6		110			
	Deformed Shape	false	udo_1	nodost	wobon v	<ul> <li>Local r_Rr_in_bpir 100</li> </ul>	v ry_displacement	* CPC 60	<ul> <li>Yes</li> </ul>	*	1	1
	Energy Distribution	true	utio 2	nodost	+ addout	+ Localy Av in boly 100	+ n displacement	= CFC 60	+ No	*	1	1
	Engine Mount Failure	false										
	Exploded View	false	udo_3	gister	- gistat	~ gistat	<ul> <li>hourglass_energy</li> </ul>	+ CFC 60	v No	*	1	1
	📄 Load Path	true	udo 4	aistet	- alstet	+ platet	v internal energy	- CFC 60	v No	*	1	1
	Occupant	true	1000		- Pro-							
	Pedal Column Motion	true	udo_5	metsum	<ul> <li>molsum</li> </ul>	<ul> <li>BR - Stopper_2mm 29</li> </ul>	V x_momentum	* CFC 60	v Yes	w.	1	1
	Run Statistics	false	udo_6	metsum	+ metsum	v JRJT-194873-4(2)896	v (z_momentum	* CPC 60	v Yes	¥.	1	1
			udo_7	rbdout	+ dodout	<ul><li>1005_1</li></ul>	+ dircos_22	- CFC 60	<ul> <li>Yes</li> </ul>	*	1	1
	Structural Assessment	false			la fastara	- And a state of the state	1.6.4	050.40	1. March			
	Structural Vehicle Kinematics	false	680,0	renore	* Indiano	* vendecode_iProm	+ y_torce	· 0/0 60	4 188	*		
E (	Structure Plastic Strain	false	edo_9	refore	+ rcforc	<ul> <li>SteeringColumn2Sumo</li> </ul>	v x_moment	+ CFC 60	<ul> <li>Yes</li> </ul>	*	1	1
	User Defined Output	true	udo 18	(and the	a anthre	v Terral 1, 100050	a la controld	L CEC 40	w Vas			
	Vehicle Kinematics Vertical	true	000_10	second.	- second	- Tarrent Teasto	* y_cennois	1000	141			· · · · ·
104	Vehicle Kinematics XY Disp	true										
	Wheel Kinematics	false										
			6									
1 of 20 1	refected	4									3	

### 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



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### 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.

Run Module	Overlay	<weld failure=""></weld>						
Animation     Deformed Shape     Door Aperture Deformation     Foeray Distribution	false false true	1D Weld	Subcase Y	'type	Ycomp			
Exploded View	false	Axial	elout v t	beam	v axial	*		
G of Fuel Tank Volume Change	false	Shear	elout 👻 t	beam	✓ shear_s	- 1		
Generation Stress Construction Stress S	false	Resultant	elout v t	beam	✓ shear_t			
Q Plastic Strain	false	Solid Weld						
Rear Barrier Face Overlap	false	Axial	swforc + s	swforc	<ul> <li>axial</li> </ul>	*		
Rear Bumper Plastic Strain     Ger Rail Crush	false	Shear	swforc 🛩	swforc	+ shear	2		
Run Statistics	false	Resultant	swforc 🛩 s	swforc	<ul> <li>resultant_moment</li> </ul>	~ Ŭ		
Spare Tire Bolt Force     Spare Tire Bolt Force     Spare Tire Bolt Force     Spare Tire Bolt Force	false true							
Velocity Separation	true	Impactor						
🖬 🍥 Weld Failure	true	2 v Asser	iblies 14 (3)					
		Assembly to consider						
		9 ~ Asser	nblies 14 (4)					
		Wald Material Card Selection	-					
1 of 17 selected	HØ HD	MATL 196	<b>S</b>					





### 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



#### 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







1)R2FB-S29299-A|13|BRKT QTR PNL TO WHL/HS|0.65mm 2)FNA7537534|1|XXXX-X279A33-A (SUPT BDY SD PNL TO WHL/HS LH)|0.95mm





### Whiplash Summary

This module generates a specific report (as per customer requirement) and includes following information (slides)

- 1) A Title slide.
- 2) A result description summary slide that includes info such as author, customer, project, part / component info, test / load case info, result rating etc.
- 3) A pulse slide capturing the pulse curve, a static image of the seat & dummy positioned on it and a summary table with info such as H-point, head angle, pelvis angle & backset distance.
- 4) A backset distance slide capturing the cut section of head & head restraint and the backset distance.

< Whiplash Summary >			
Dummy Head	▼ Components	K	
Dummy Restraint	▼ Components	н	(1)
Accelerometer Origin Node ID	Node I		െ
Head Angle Node ID	Node I		
Project Name			
Seat Position			বি
Seatback Angle			9
Headrest Position			

- 1) Dummy head & head restraint component IDs
- 2) Accelerometer node ID and Head angle node ID. These 2 nodes will be used to calculate the head angle.
- 3) User inputs for project name, customer name, seat position etc.

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### **Outputs:**





