

Simulation Database – Detect And Search Deformation Patterns

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Agenda



- Introduction & Motivation
- Eventdetection Database
 - Example Cases

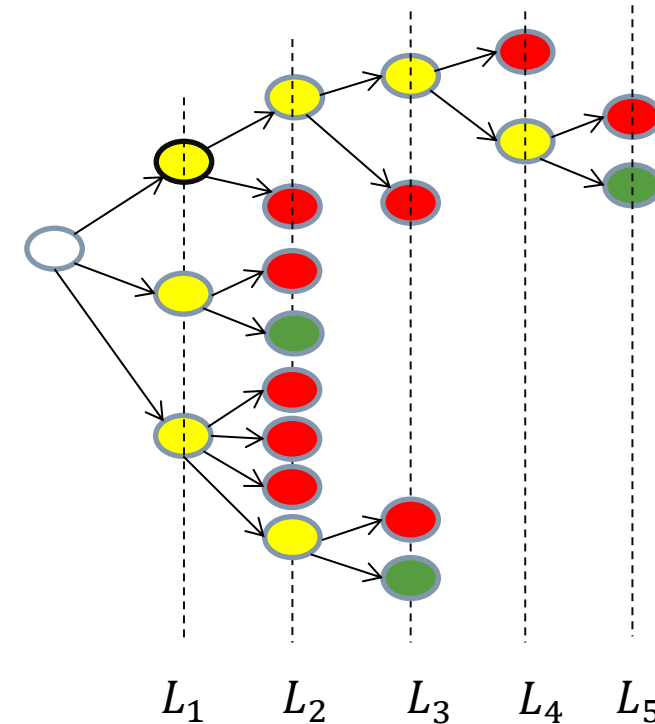


Introduction & Motivation

Development History

-An abstract representation

- Contains Several branches
- Includes dead nodes
- Intermediate design changes
- Branches run several levels deep

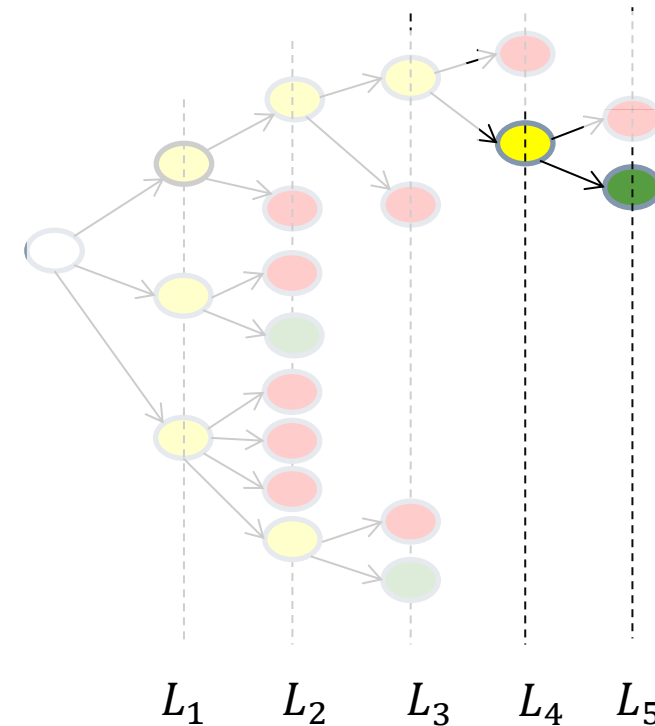




Introduction & Motivation

Common Analysis Approach

- Often simple simulation to simulation based comparison
- Last result and immediate predecessor only
- What about previous development history?

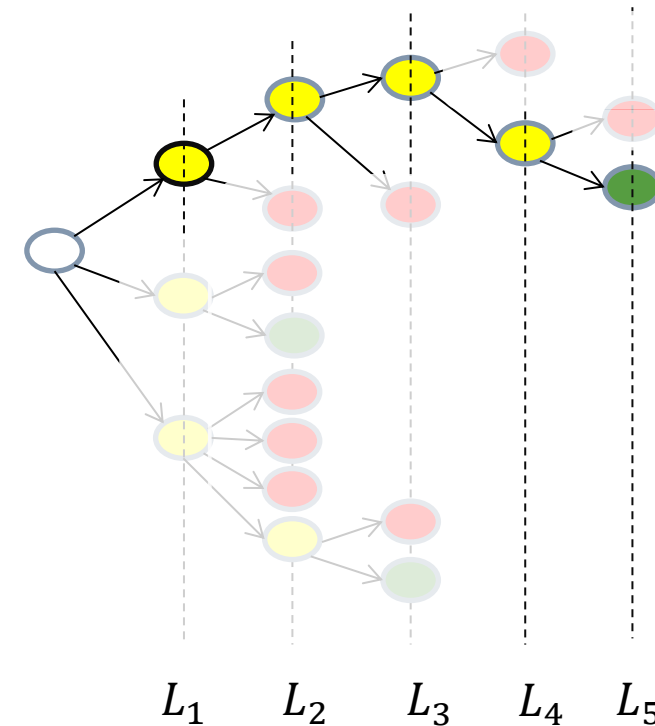




Introduction & Motivation

EventDetection WorkFlow

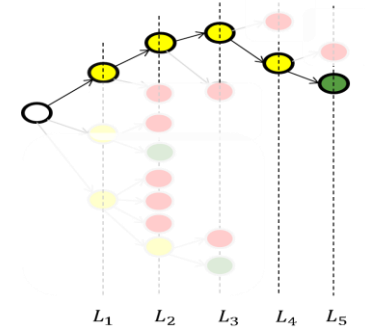
- Automatic comparison with whole development tree
- Dead branches can be included or excluded as desired
- Unknown events are automatically being detected



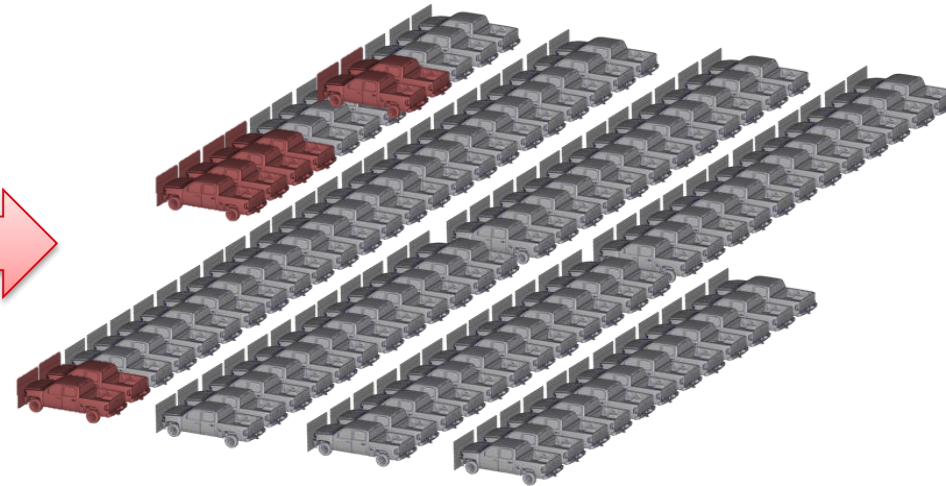
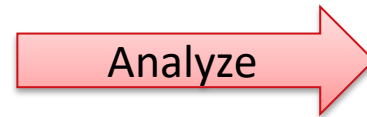


Introduction & Motivation

- Idea



New Simulation



Analyze against pertinent **subset** of already archived Simulations

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Agenda

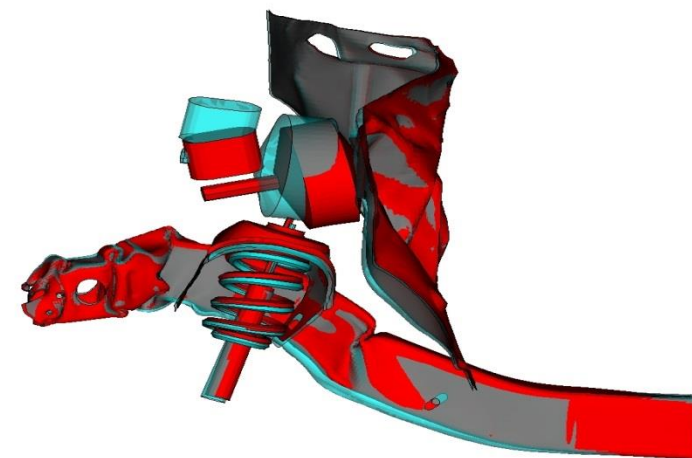


- Introduction & Motivation
- **Eventdetection Database**
 - Example Cases



Eventdetection Database

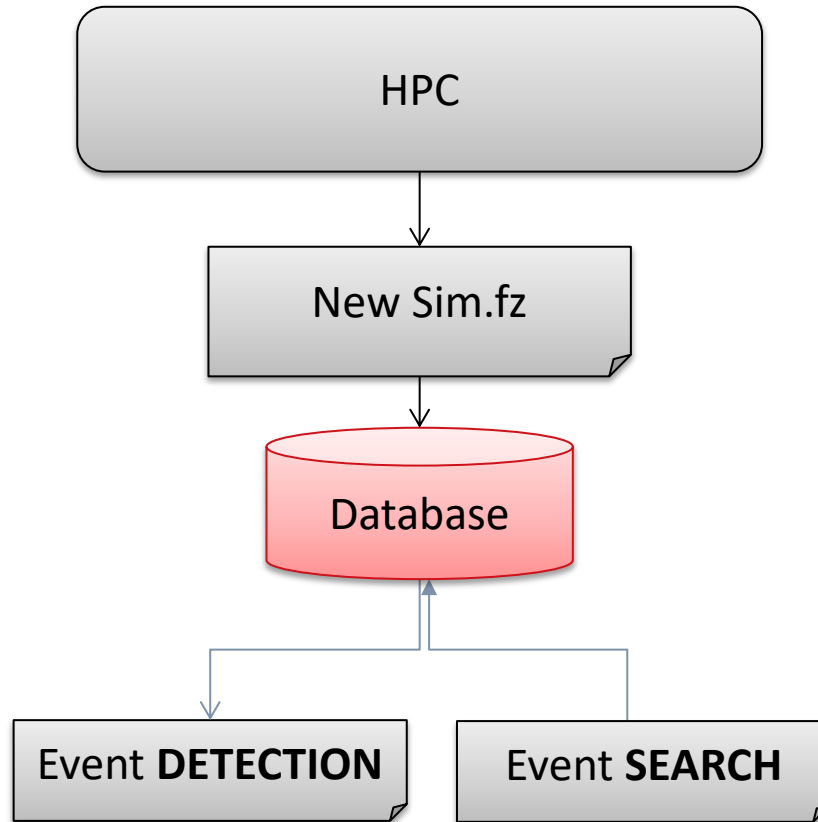
- What is an Event
 - Unknown/Unwanted behaviour
- An Event mainly consists of:
 - Location
 - List of involved parts and time steps
 - Outlier Score
 - History
 - List of previous simulations
 - Event type (Geometry or Post-Value name)





Eventdetection Database

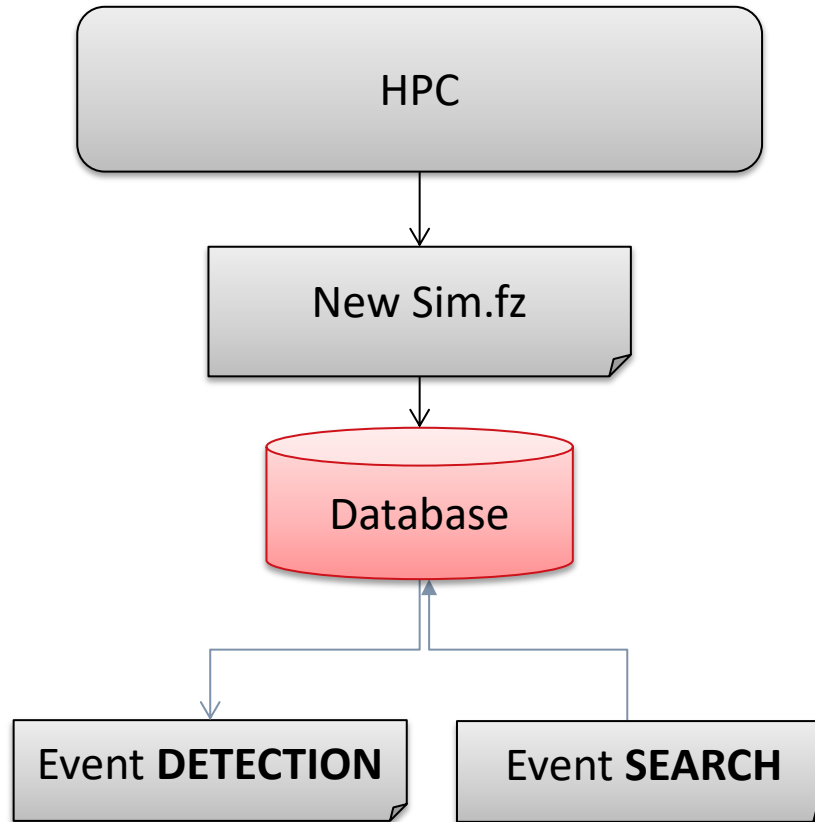
Workflow



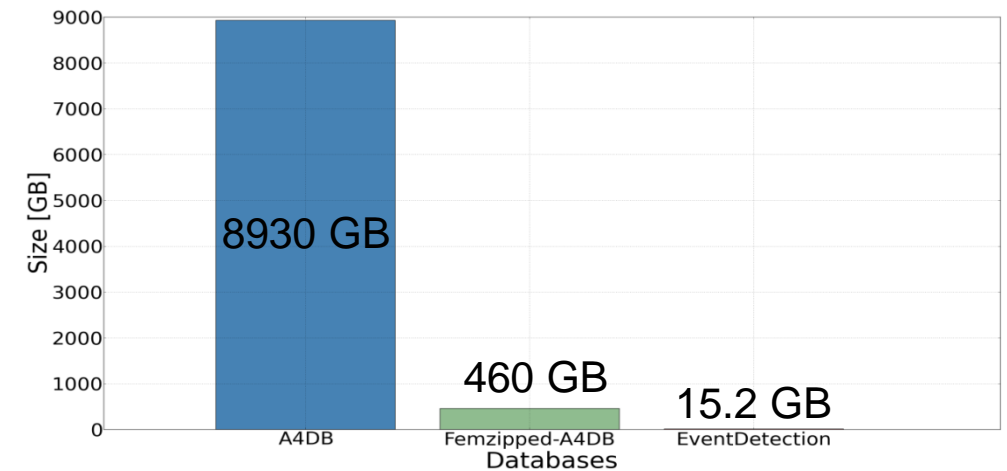


Eventdetection Database

Workflow



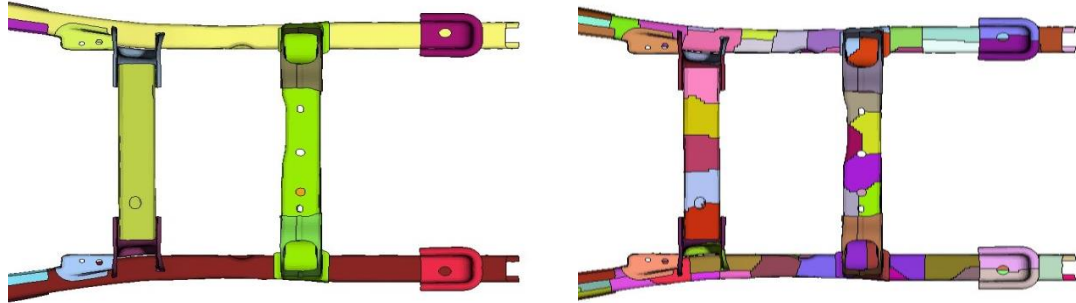
- 558 femzipped A4DB (.a4db.fz) full-vehicle crash runs
 - 352 Side crash cases
 - 206 Pole crash cases
- Each model consisting of ~ 5 Million nodes
- Analysing 14/ 64 variables



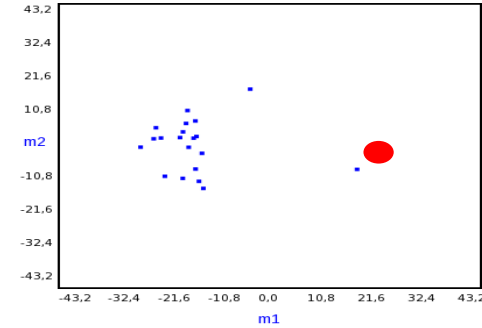


Eventdetection Database

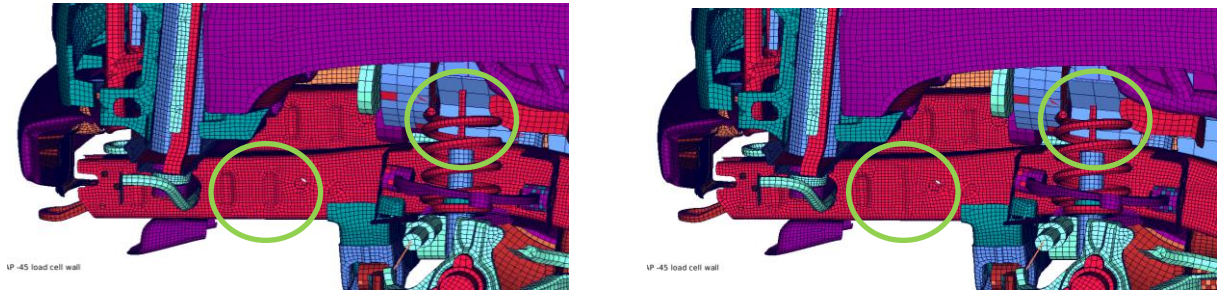
Challenges



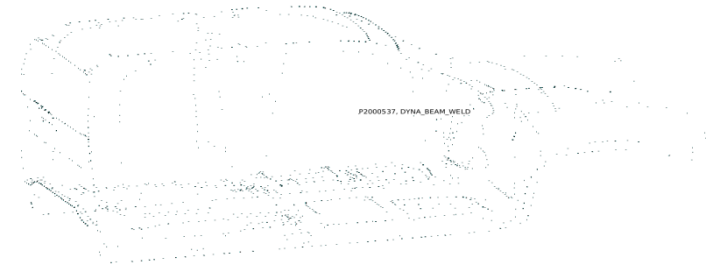
Detect local effects



Outlier and known behaviour



Changing geometry/design



Connector parts

Agenda



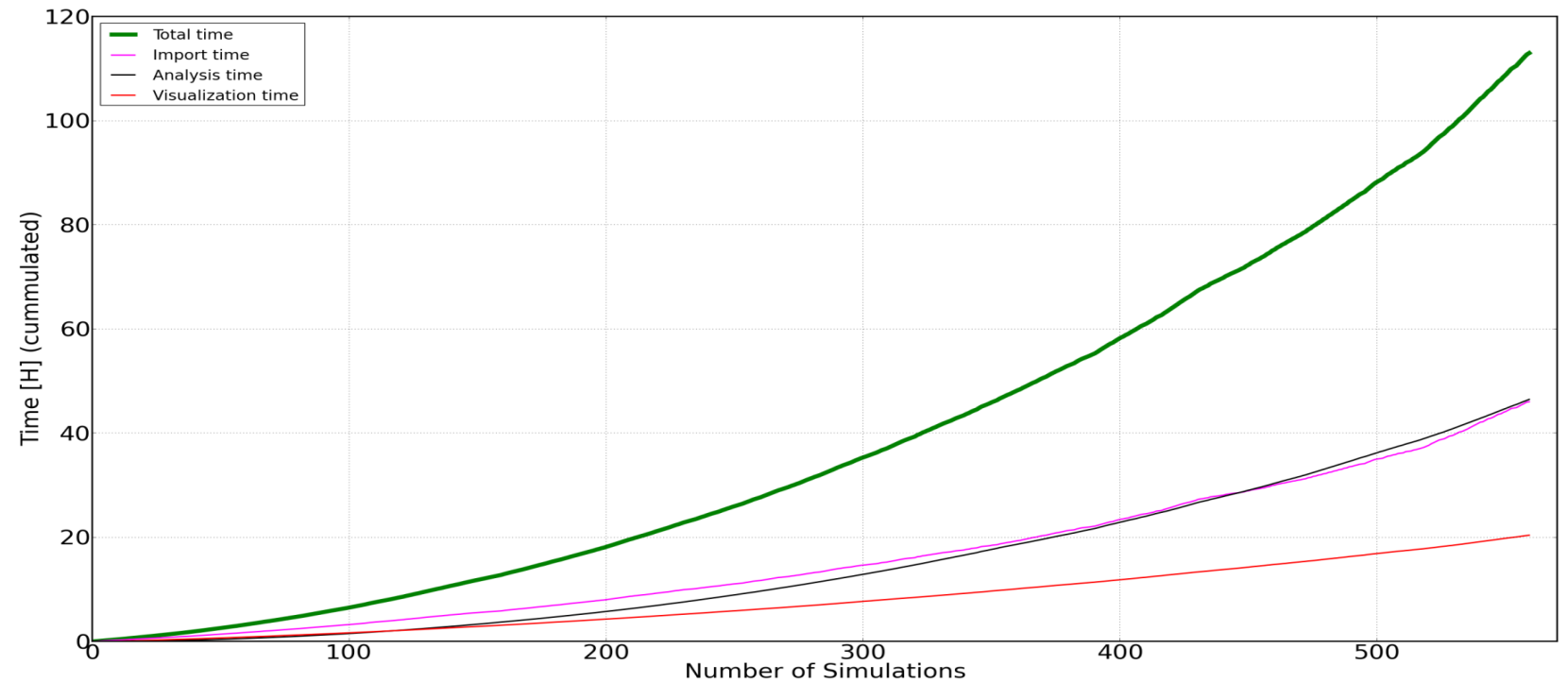
- Introduction & Motivation
- Eventdetection Database
 - **Example Cases**

Eventdetection Database

Search

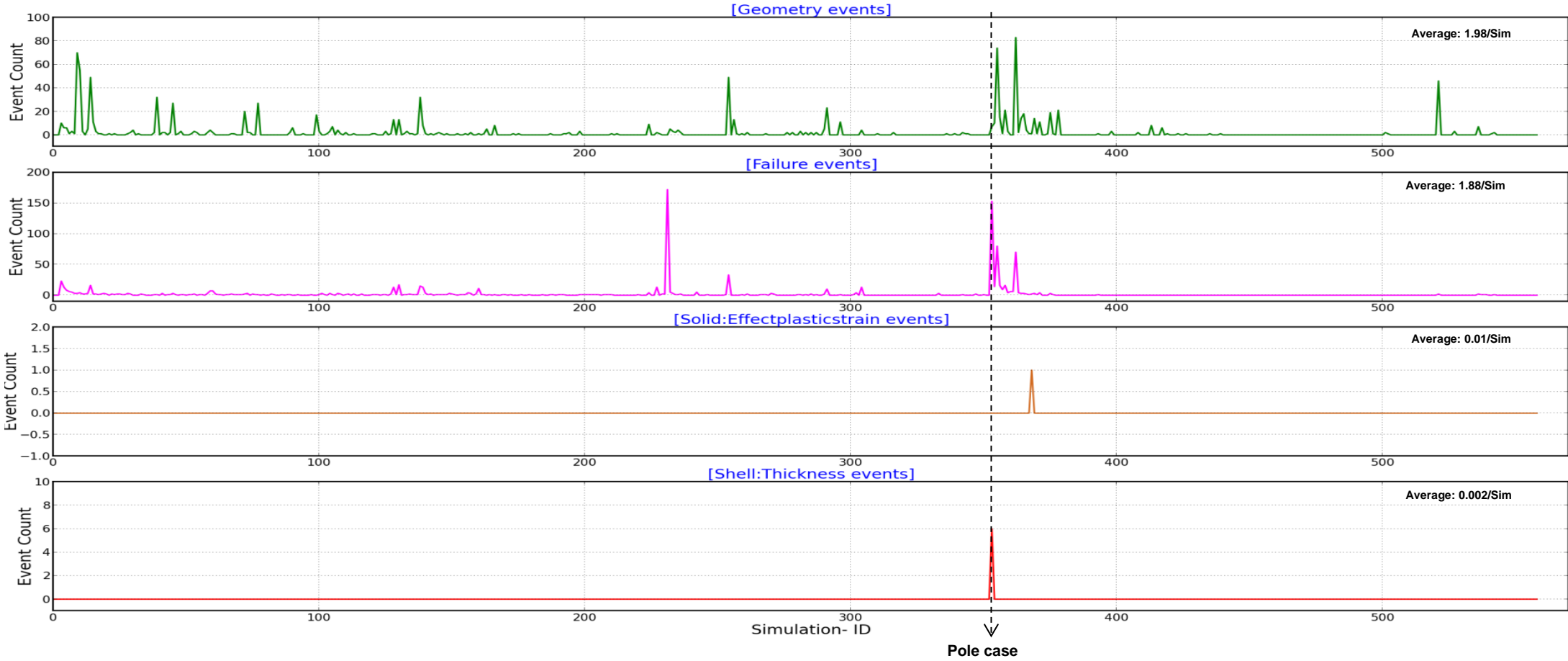


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Eventdetection Database

Search

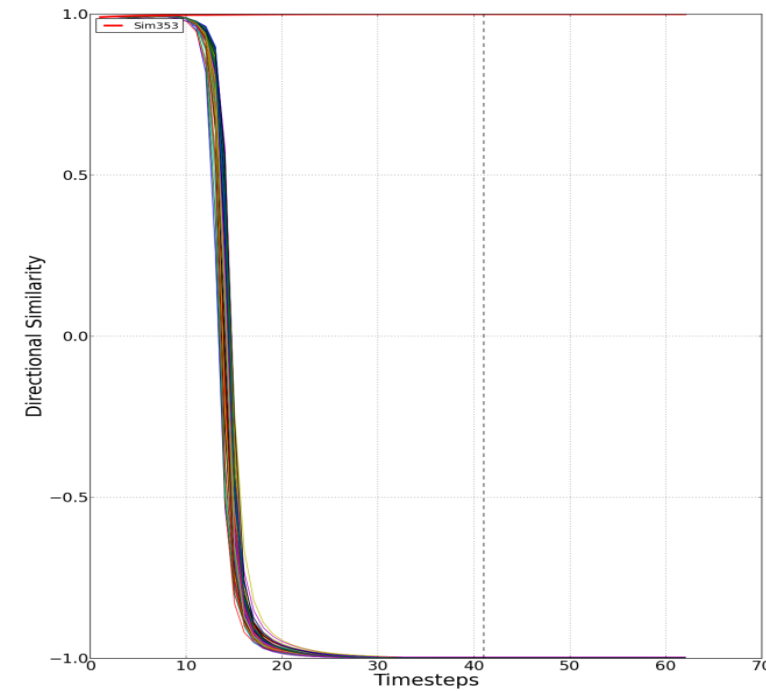
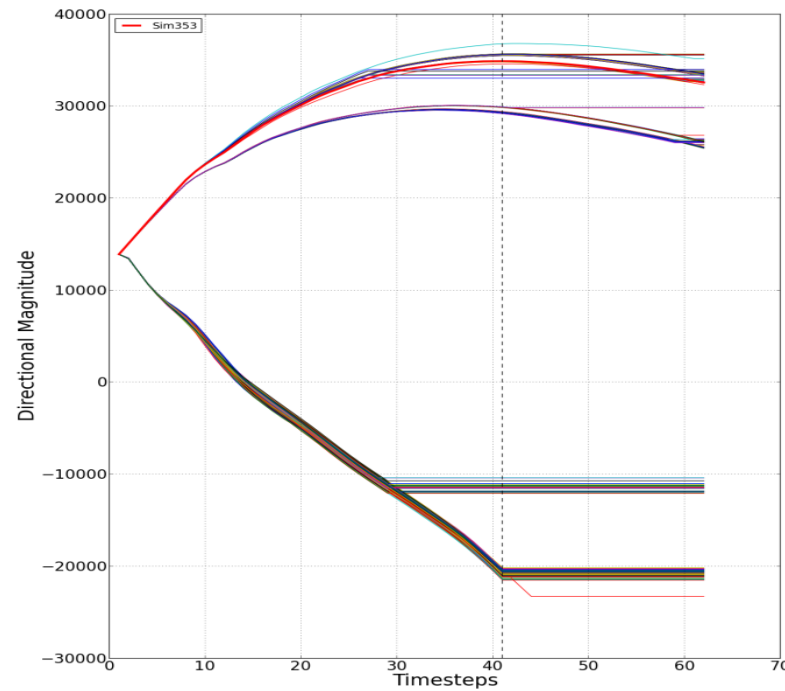




Eventdetection Database

Search

- Event Queried : {SIM : 353, Single PID, State: 41, Variable: nodal_geometry _y}
- Inference: Clear bifurcation of behaviour in Pole and Side crash cases
- Time to query event* : **38 s**

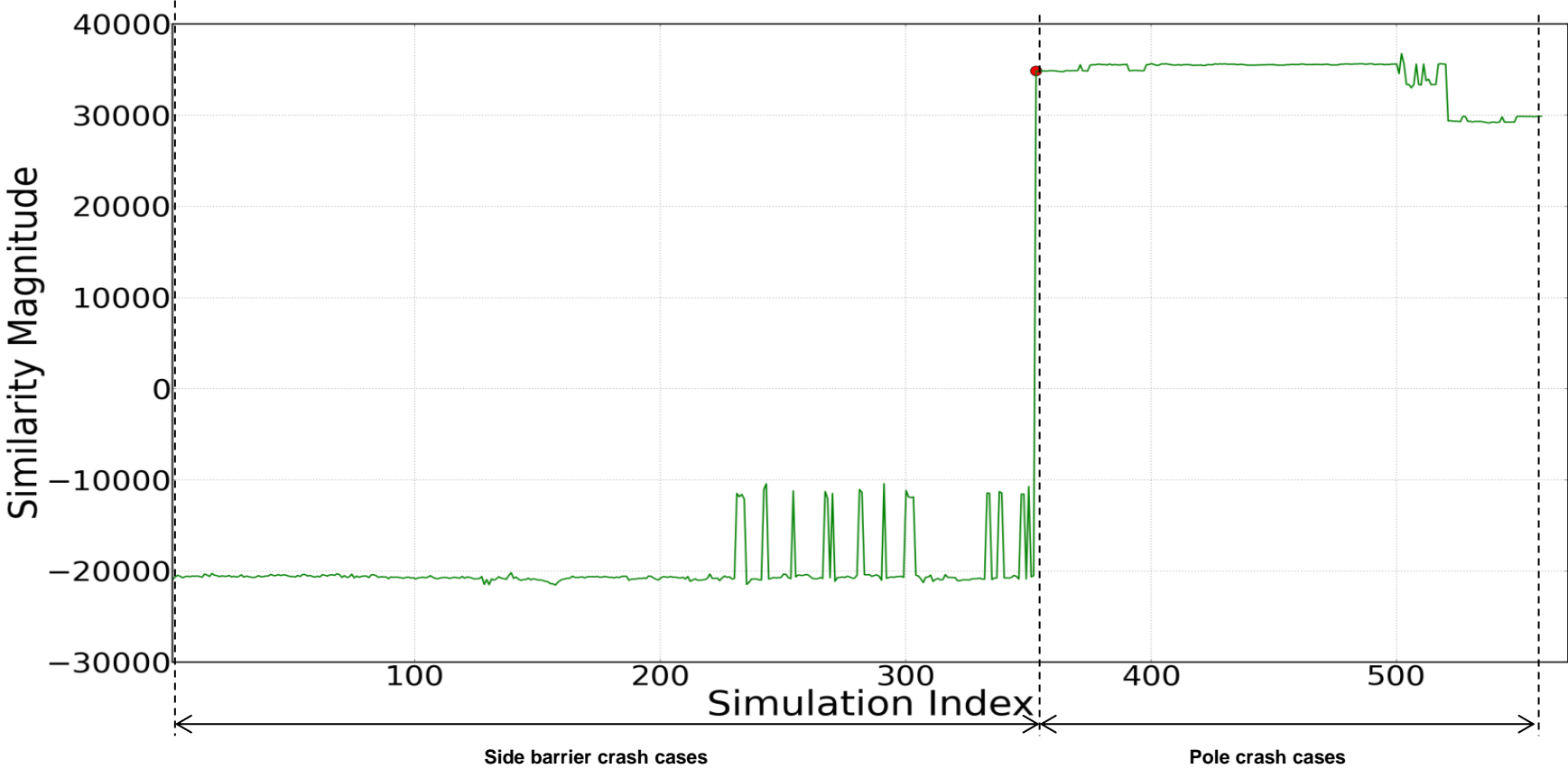


*interactive mode

Eventdetection Database Search



- Event Queried : {SIM : 353, Single PID, State: 41, Variable: nodal_geometry _y}

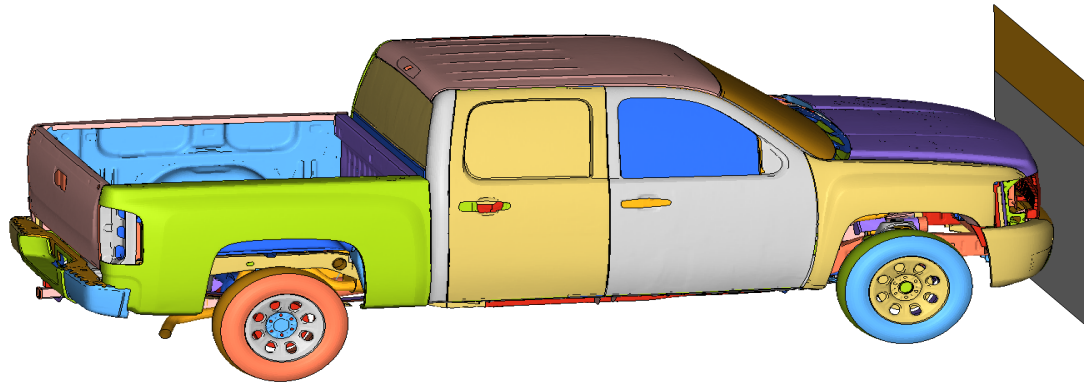




Eventdetection Database

Detect

Chevrolet Silverado

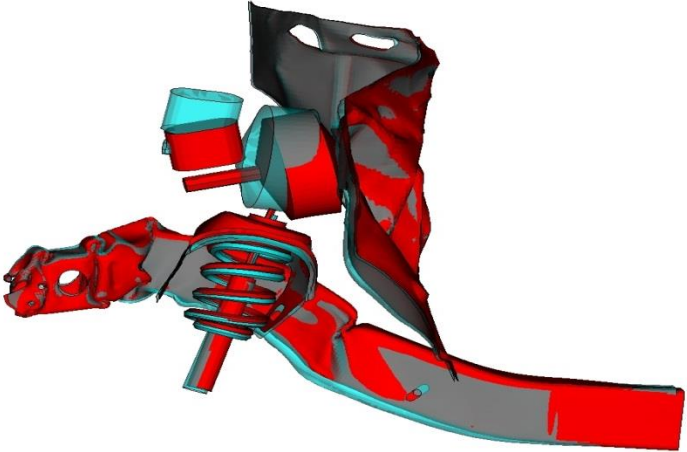
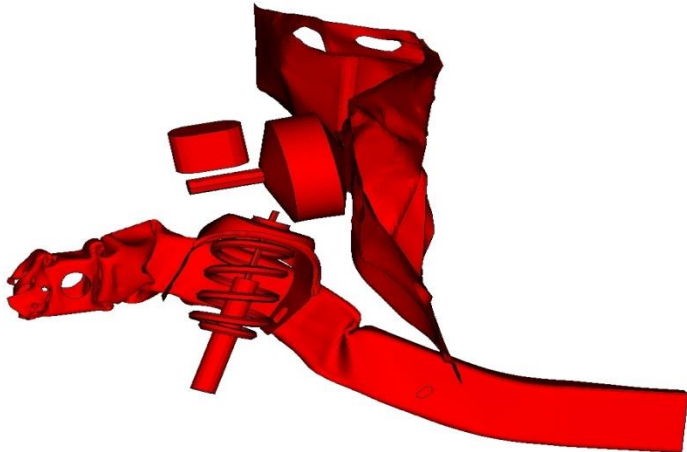
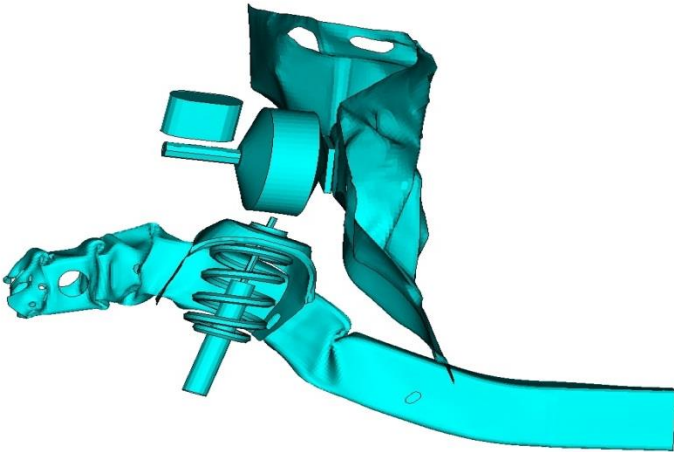
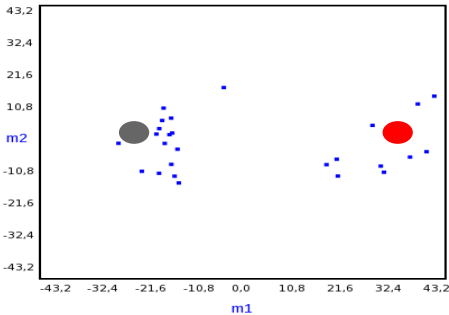


Model	Chevrolet Silverado
Year	2007
Number of Parts	679
Finite-Elements	929,131

"The model has been developed by The National Crash Analysis Center (NCAC) of The George Washington University under a contract with the FHWA and NHTSA of the US DOT" <http://www.ncac.gwu.edu/vml/models.html>

Eventdetection Database

Detect



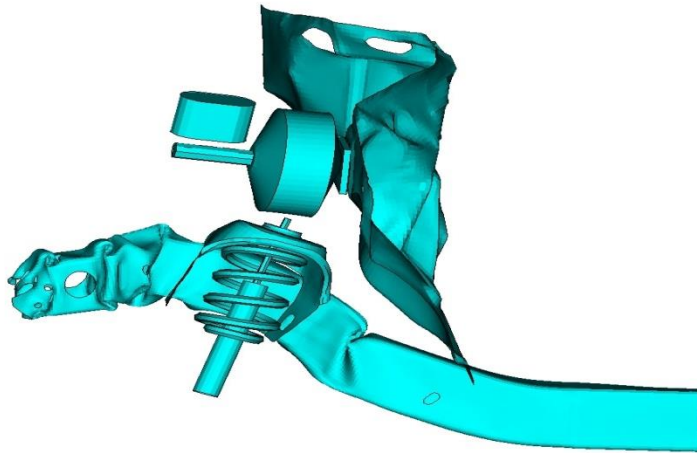
30 Simulation runs show a dominating bifurcation

Eventdetection Database

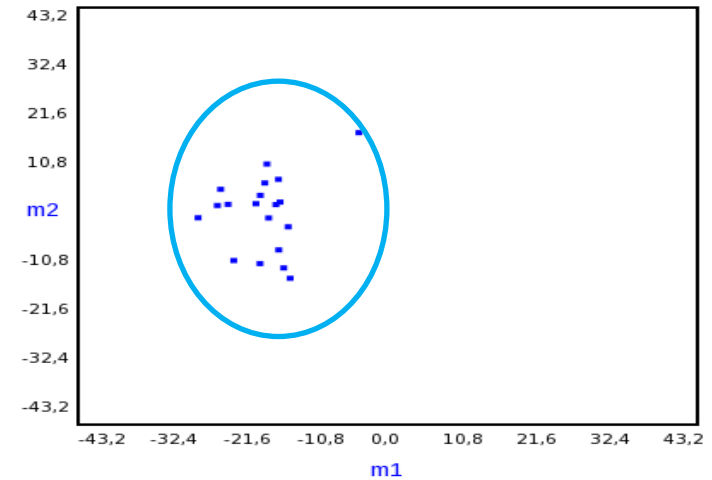
Detect



Test scenario



Trend of deformation of already archived simulations

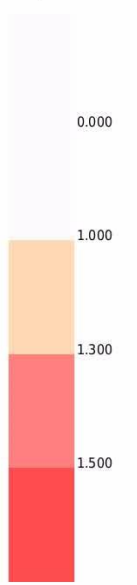


Test case: At first compress simulations with similar behaviour

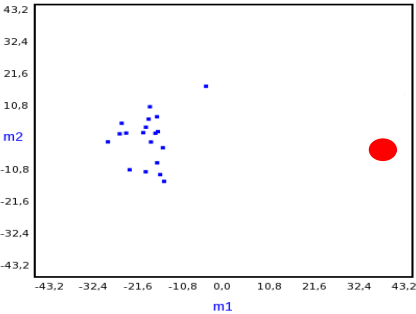
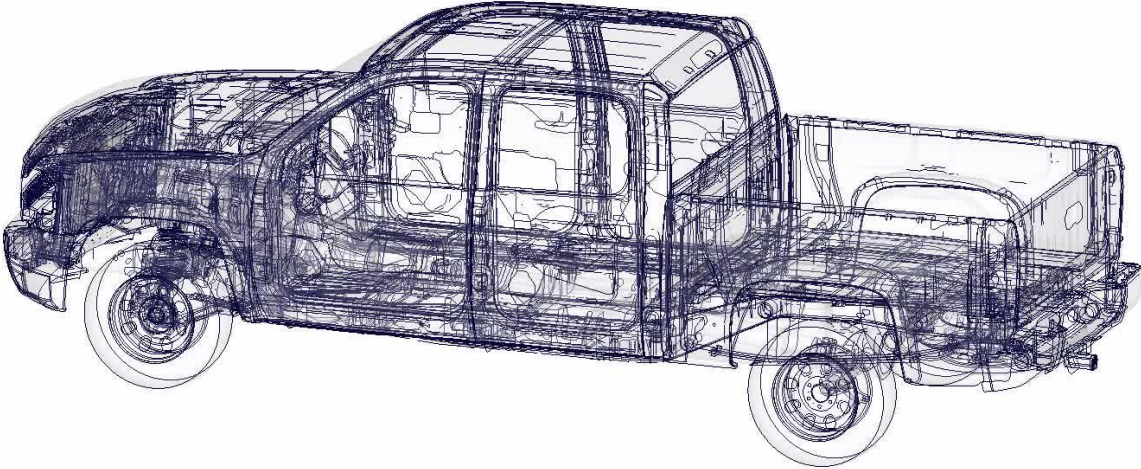


Detect

Temperature (Node)



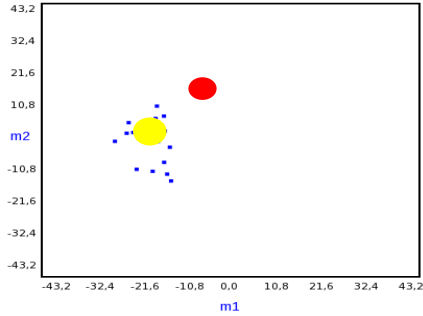
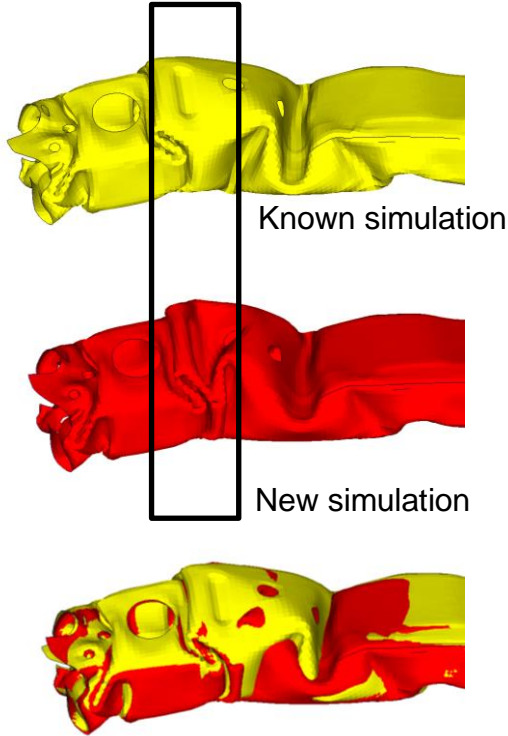
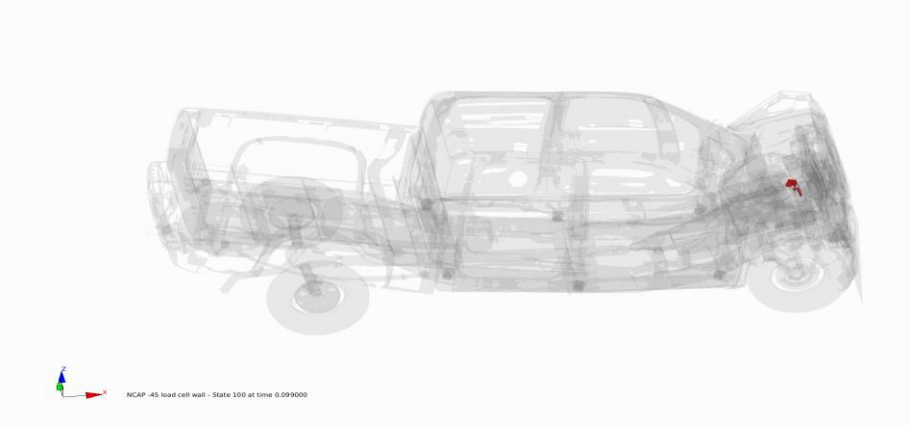
Slot 1: NCAP -45 load cell wall - State 1 at time 0.000000



Automatic **Outlier Score** Visualization

Eventdetection Database

Detect



Automatic **Event Generation**
Parts Grouped According to Events

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Eventdetection Database

Detect



CAViT | Yaris Demo

Confidential Information

Projects and Collections

- Projects
 - Yaris
- Collections
 - NAFEMS (1)

Scenarios

- Front (671 / 671)
- Side (120 / 120)
- Rear (0 / 0)

Name	Comment	Label	Date	Discipline
1630_YARIS_IIHS_SOL_Pol...	DOE Barrier Move Y	SOL US LEFT	2021-07-28T16:28:58	CRASH
1630_YARIS_IIHS_SOL_Pol...	DOE Barrier Move Y	SOL US LEFT	2021-07-28T16:29:16	CRASH
1630_YARIS_IIHS_SOL_Pol...	DOE Barrier Move Y	SOL US LEFT	2021-07-28T16:29:43	CRASH
1630_YARIS_IIHS_SOL_Pol...	DOE Barrier Move Y	SOL US LEFT	2021-07-28T16:30:12	CRASH
1630_YARIS_IIHS_SOL_Pol...	DOE Barrier Move Y	SOL US LEFT	2021-07-28T16:30:33	CRASH
1636_YARIS_USNCAP_RW...		USNCAP Rigid Wall with 5...	2021-08-05T16:49:57	CRASH
1641_YARIS_USNCAP_RW...		USNCAP Rigid Wall with 5...	2021-09-03T17:25:29	CRASH
1646_YARIS_USNCAP_RW...	thickness change sim	USNCAP Rigid Wall with 5...	2021-08-30T15:28:52	CRASH
1652_YARIS_USNCAP_RW...	Test with OLC Evaluation	USNCAP Rigid Wall with 5...	2021-09-03T09:41:08	CRASH
1653_YARIS_USNCAP_RW...	Test with OLC Evaluation	USNCAP Rigid Wall with 5...	2021-09-03T14:50:40	CRASH
1654_YARIS_USNCAP_RW...		USNCAP Rigid Wall with 5...	2021-09-06T09:06:47	CRASH
1657_YARIS_IIHS_SOL_Pol...	Testing Apps pool from To...	ROB - SOL US LEFT	2021-09-07T17:04:05	CRASH

Selected: 1 Total items: 791

Test	Even...	I	Event Name	Score	Components	Tool Name
1646_YARIS_USNCAP_RW...	20	0	SC_max_pl_strain.(Shell_Solid)...	0.40012645721435547	Shell Part 1094	SimCompare
1646_YARIS_USNCAP_RW...	7	0	SC_Displacement-X_7	0.265270471572876	Shell Part 1163	SimCompare
1646_YARIS_USNCAP_RW...	10	0	SC_Displacement-X_10	1	Shell Part 1600001	SimCompare
1646_YARIS_USNCAP_RW...	38	0	SC_max_pl_strain.(Shell_Solid)...	0.19050928950309753	Shell Part 2900001	SimCompare
1646_YARIS_USNCAP_RW...	31	0	SC_max_pl_strain.(Shell_Solid)...	0.3560391664505005	Shell Part 1000001	SimCompare
1646_YARIS_USNCAP_RW...	33	0	SC_max_pl_strain.(Shell_Solid)...	1	Shell Part 1600001	SimCompare
1646_YARIS_USNCAP_RW...	6	0	SC_Displacement-X_6	0.20117999613285065	Shell Part 1118	SimCompare
1646_YARIS_USNCAP_RW...	4	0	SC_Displacement-X_4	0.1674109697341919	Shell Part 1096	SimCompare
1646_YARIS_USNCAP_RW...	10	0	SC_max_pl_strain.(Shell_Solid)...	0.558907687664032	Shell Part 2050001	SimCompare



SDM integration

- Integration into CAViT

Eventdetection



The screenshot displays the CAViT software interface for a 'Yaris Demo' project. The main window shows a 3D wireframe model of a car. On the right, a 'Confidential Information' panel is open, showing a table of detected events. Below the table, a list of project entries is visible. At the bottom, a 'Filter' section shows a grid of thumbnail images representing different views of the car model.

Time	Discipline
6:28:58	CRASH
6:29:16	CRASH
6:29:43	CRASH
6:30:12	CRASH
6:30:33	CRASH
6:49:57	CRASH
7:25:29	CRASH
5:28:52	CRASH
9:41:08	CRASH

Item ID	Description	Configuration	Date	Event Type
1653_YARIS_USNCAP_RW...	Test with OLC Evaluation	USNCAP Rigid Wall with 5...	2021-09-03T14:50:40	CRASH
1654_YARIS_USNCAP_RW...		USNCAP Rigid Wall with 5...	2021-09-06T09:06:47	CRASH
1657_YARIS IIHS SOL Pol...	Testing Apps pool from To...	ROB - SOL US LEFT	2021-09-07T17:04:05	CRASH

SDM integration

- Integration into CAViT



Thank You!

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