Enabling Big Data Analysis in SDM Systems
Add-on based Integration of ML Methods

M. Liebscher, F. Leichsenring, M. Thiele - *SCALE*
N. Abdelhady, D. Borsotto - *SIDACT*
D. Kracker - *Dr. Ing. h.c. F. Porsche AG*

Artificial Intelligence und Machine Learning in der CAE-basierten Simulation
NAFEMS Konferenz - 23. - 24. Oktober 2023, München

Integration of Advanced third-party Data Analysis Approaches into SDM Systems

Leichsenring, F., Liebscher, M., Thiele, M. - *SCALE GmbH*
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Kracker, D. - *Dr. Ing. h.c. F. Porsche AG*

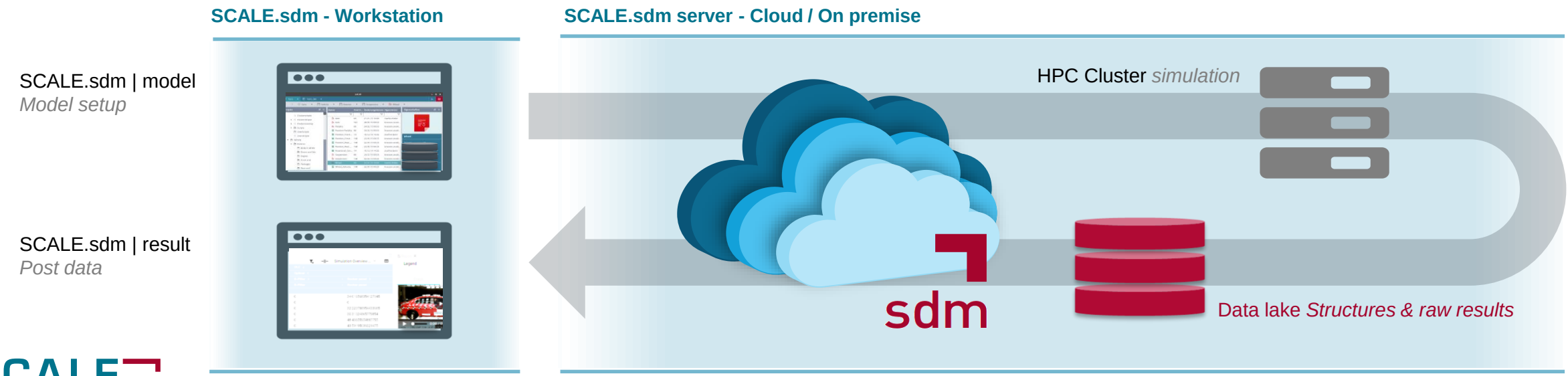
18th - 19th October 2023 LS-DYNA Conference, Baden-Baden

SCALE
IT-Solutions for CAE

Motivation

Large Data sets available in SDM Systems

- Huge number of simulations every day
- Some OEMs with > 1.5 Million simulations per year
  (just crash domain only)
- Data stored at central place



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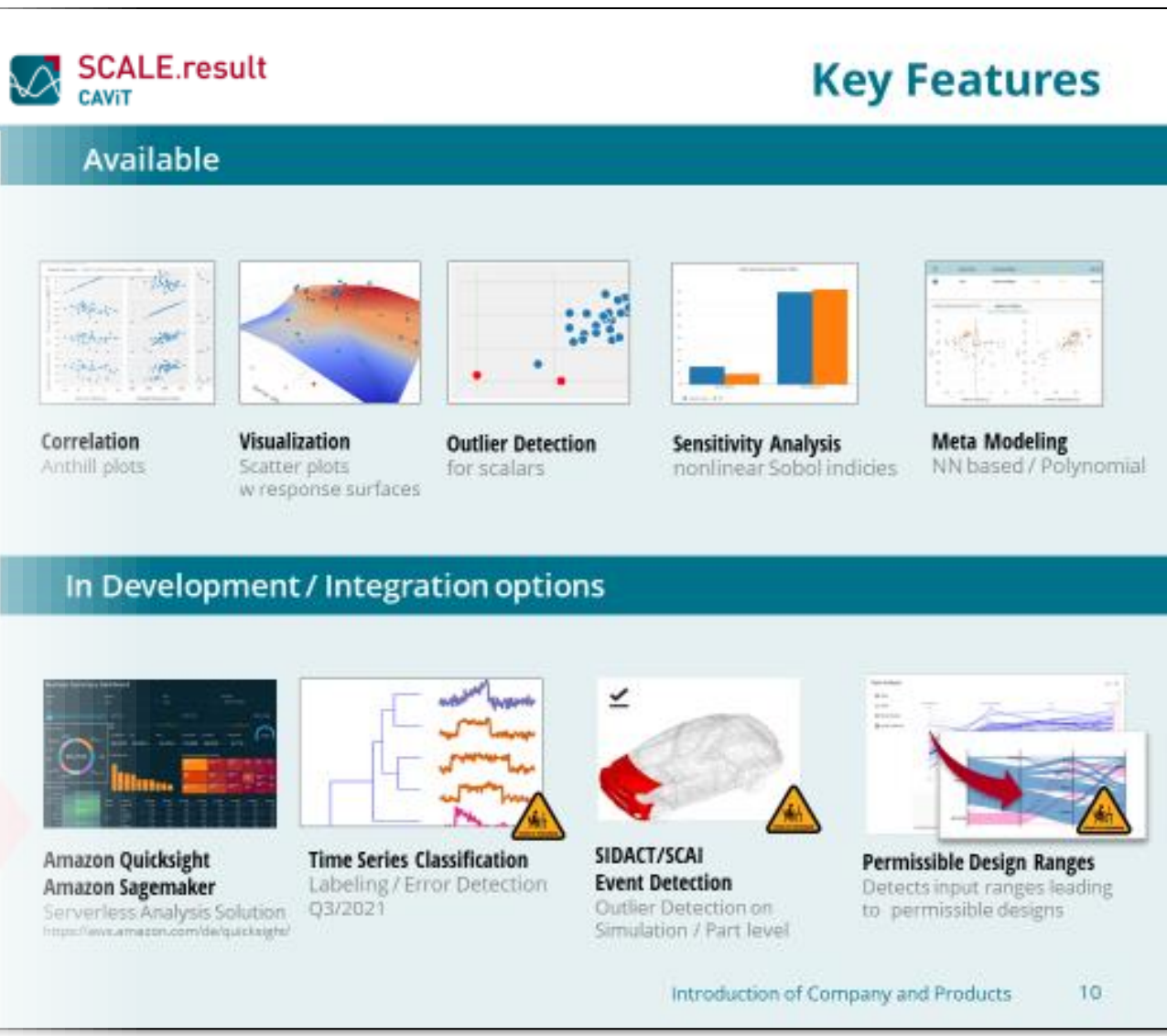
Motivation

Advanced ML/AI Methods:

- often custom / proprietary
- SDM provides standard methods
- Domain-specific methods required
  (specific methodologies are often required but not part of standard software or implementations)
- ML/AI Methods custom developed
  (in-house, proprietary or even open-source based)



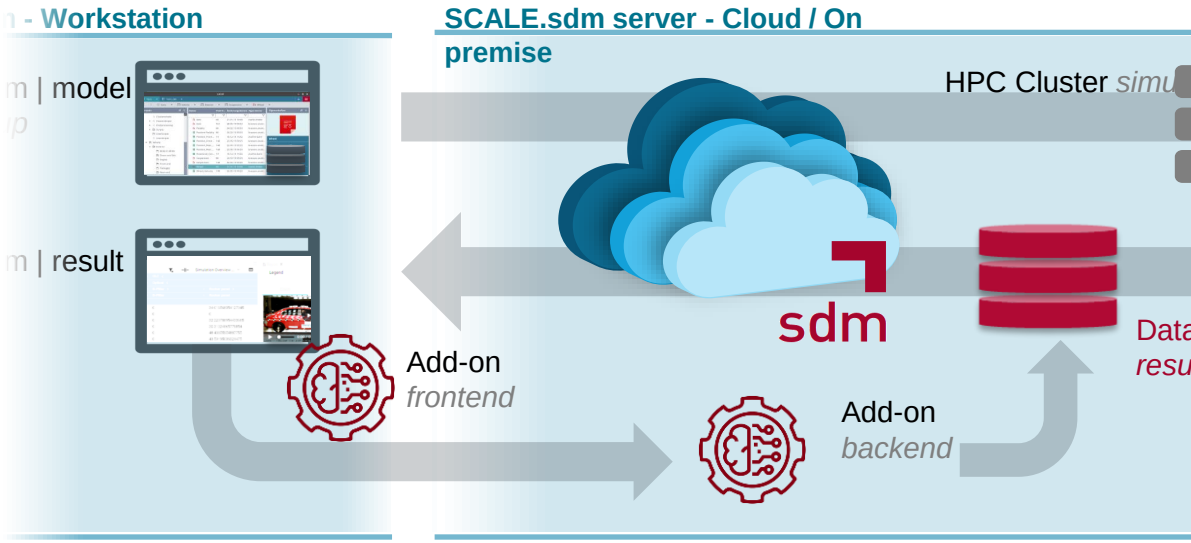
Motivation

Problem

- Application of AI/ML methodologies implies scanning large data sets
- Implementation close to data required vs. custom implementation

Solution @ SCALE.sdm

- Add-on concept available
- Distribution of own code to **backend** and **frontend** side in SCALE.sdm possible
- Full structured access to data within server environment



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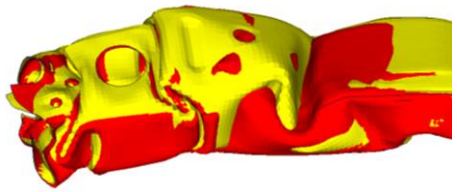
Example SIDACT Event Detection: ML based anomalie detection

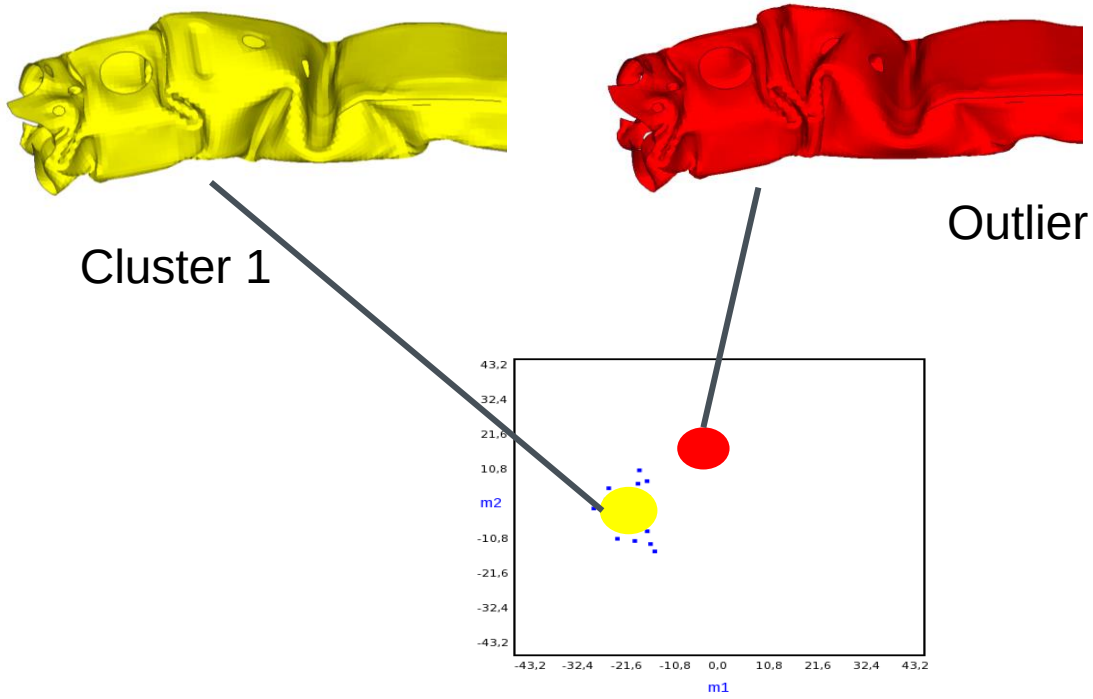
What is an event?

- Unknown/unwanted behavior
- anomalies in field variables

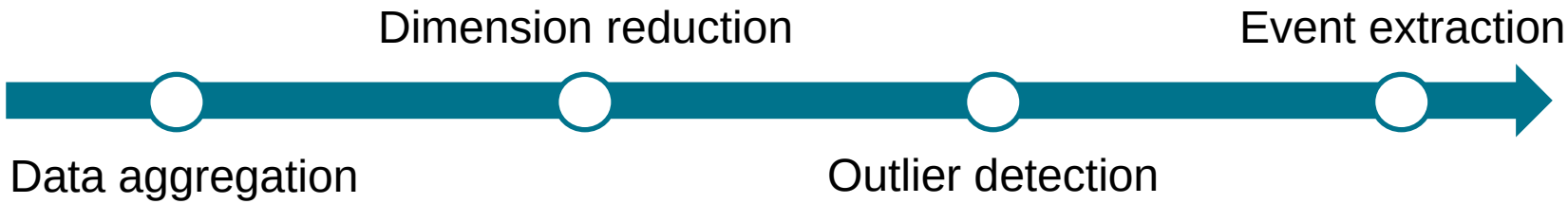


Event Properties

- Location/Parts
- Outlier Score
- Event type

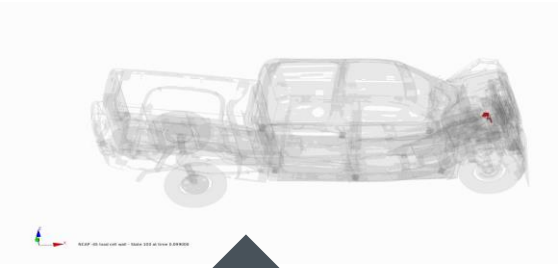


Basic Workflow

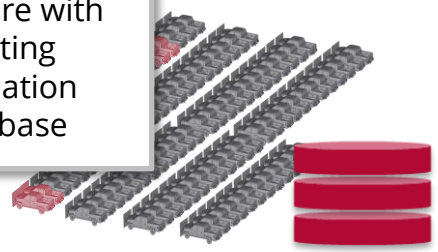


Example SIDACT Event Detection: ML based anomalie detection

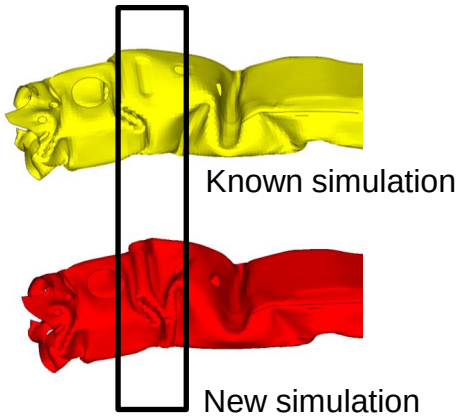
Scan all incoming simulations

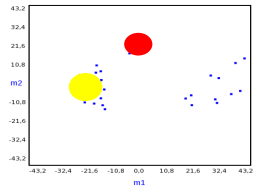


Compare with existing simulation database

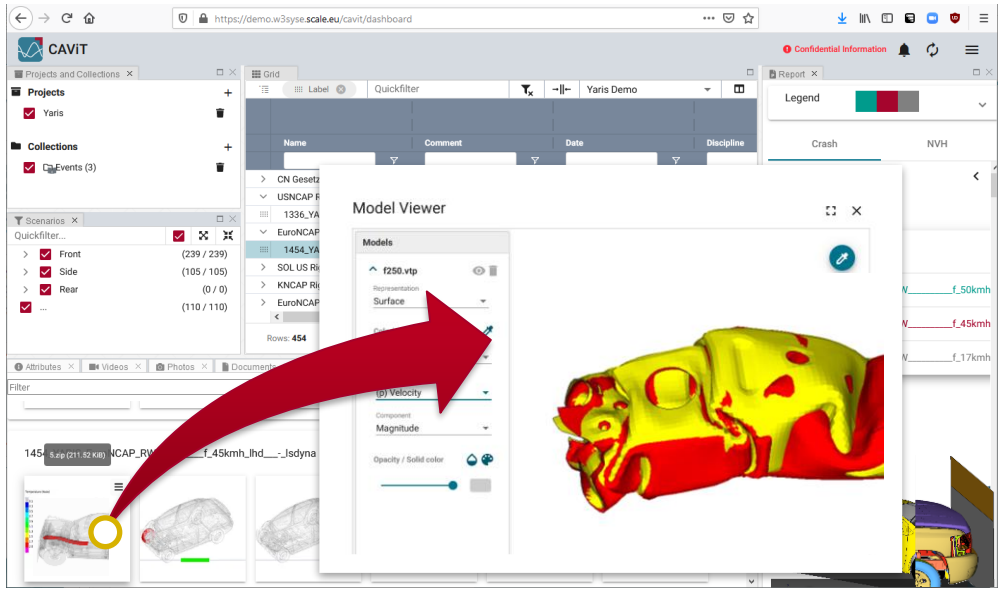


Detect anomalies *(events)*





Integrate Process and Evaluation in SCALE.sdm



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SIDACT GmbH

SIDACT Event Detection Add-on

SIDACT GmbH

Develops and ships

SIDACT Event Detection Add-on

3rd party – delivered as zip package

Add-on upload

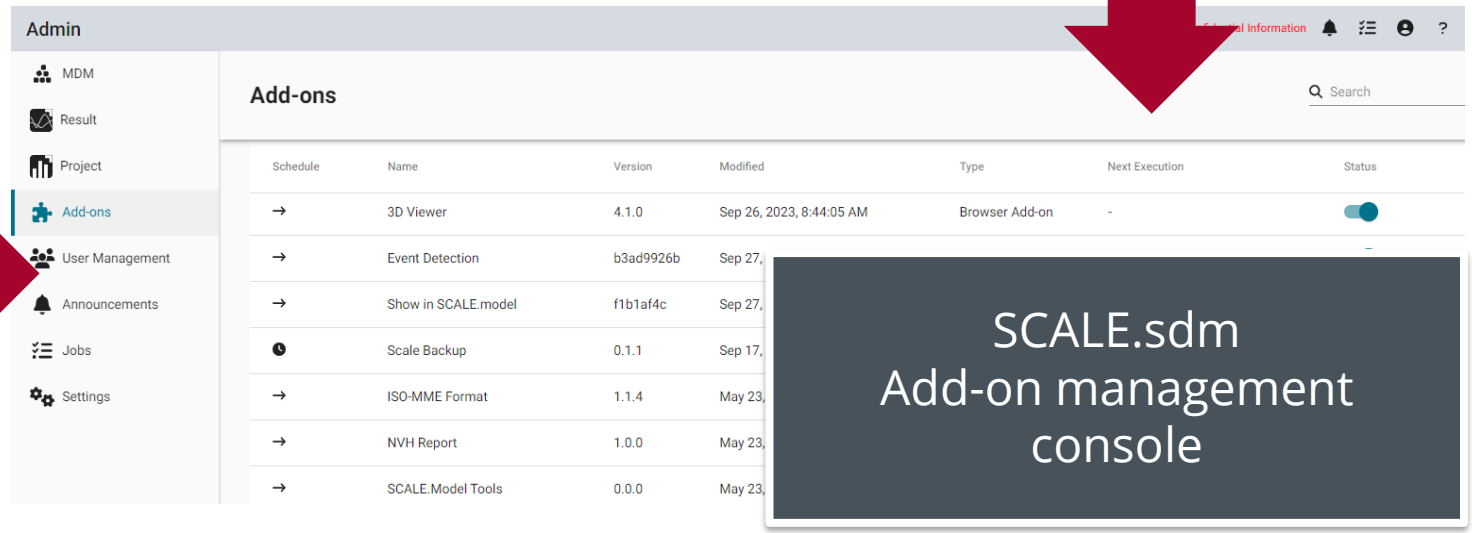
Frontend

SCALE.sdm | result

Post data

Backend

sdm



SCALE.sdm
Add-on management console

SIDACT Event Detection Add-on

SIDACT GmbH

Develops and Ships

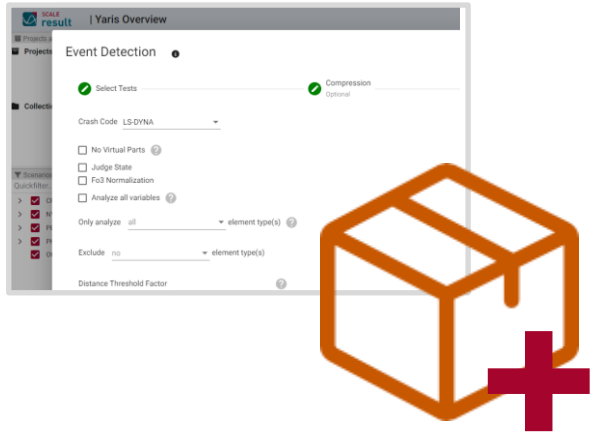
Frontend
Sub package

Backend
Sub package

Frontend

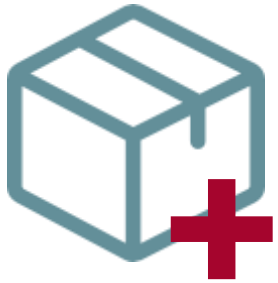
SCALE.sdm | result
Post data

Extents frontend



Backend

Extents backend



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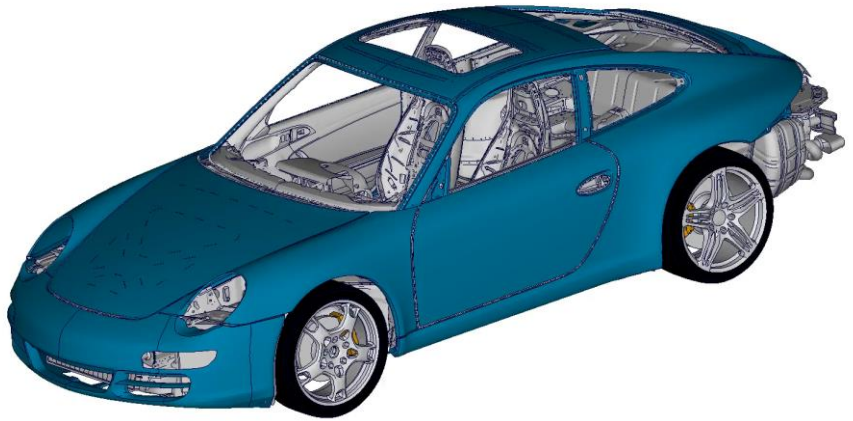
SIDACT Event Detection Add-on

Porsche 911 Example

Loadcase USNCAP Rigid Wall

- Vehicle Speed 56 km/h
- 100% frontal

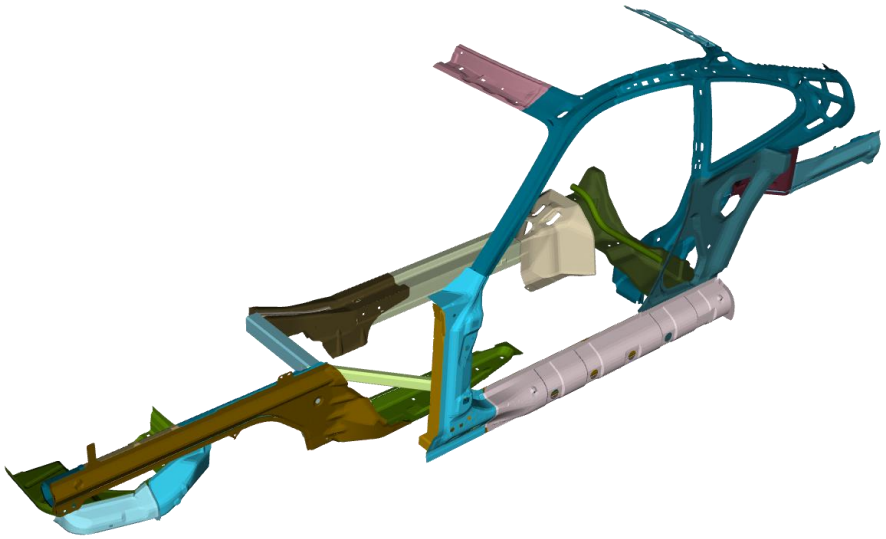


Design of experiments

- sheet metal thickness of **38** parts

  `[0.8,2.5];[1.5,5.0] mm`

- **60** simulation runs



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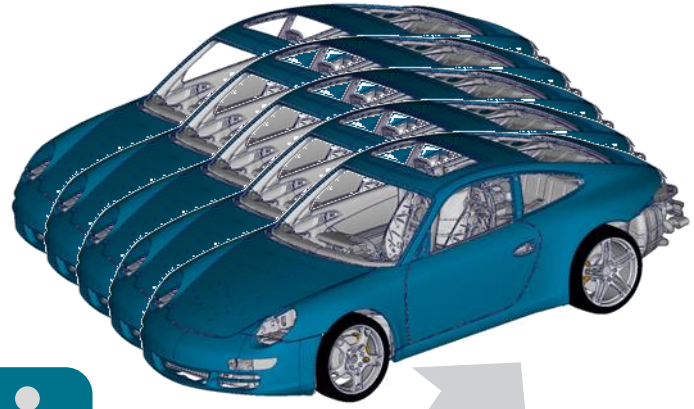
The model has been provided by Dr. Ing. h.c. F. Porsche AG which is greatefully acknowledged.

SIDACT Event Detection Add-on

Porsche 911 Example



Summary

- events detected in **20** of 60 runs
- outlier factor range `[1.5,1.98]`

DOE / Sampling

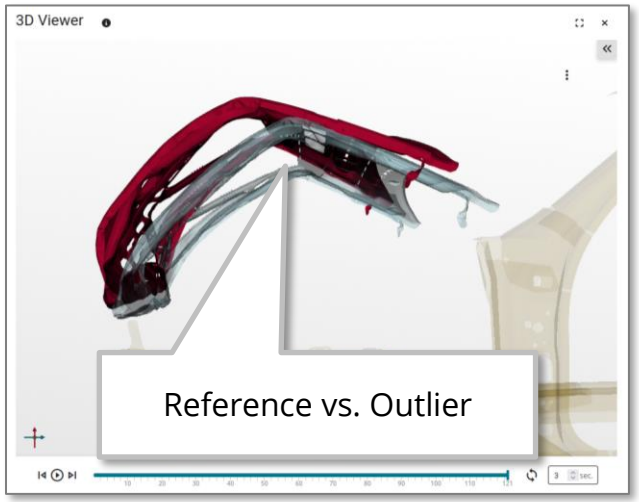
Scan all incoming simulations

Detect anomalies *(events)*

optimal sampling of parameters

Event run 175 (Hood area)

Event with max. score



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Visualization in SCALE.result CAViT

Porsche 911 Example

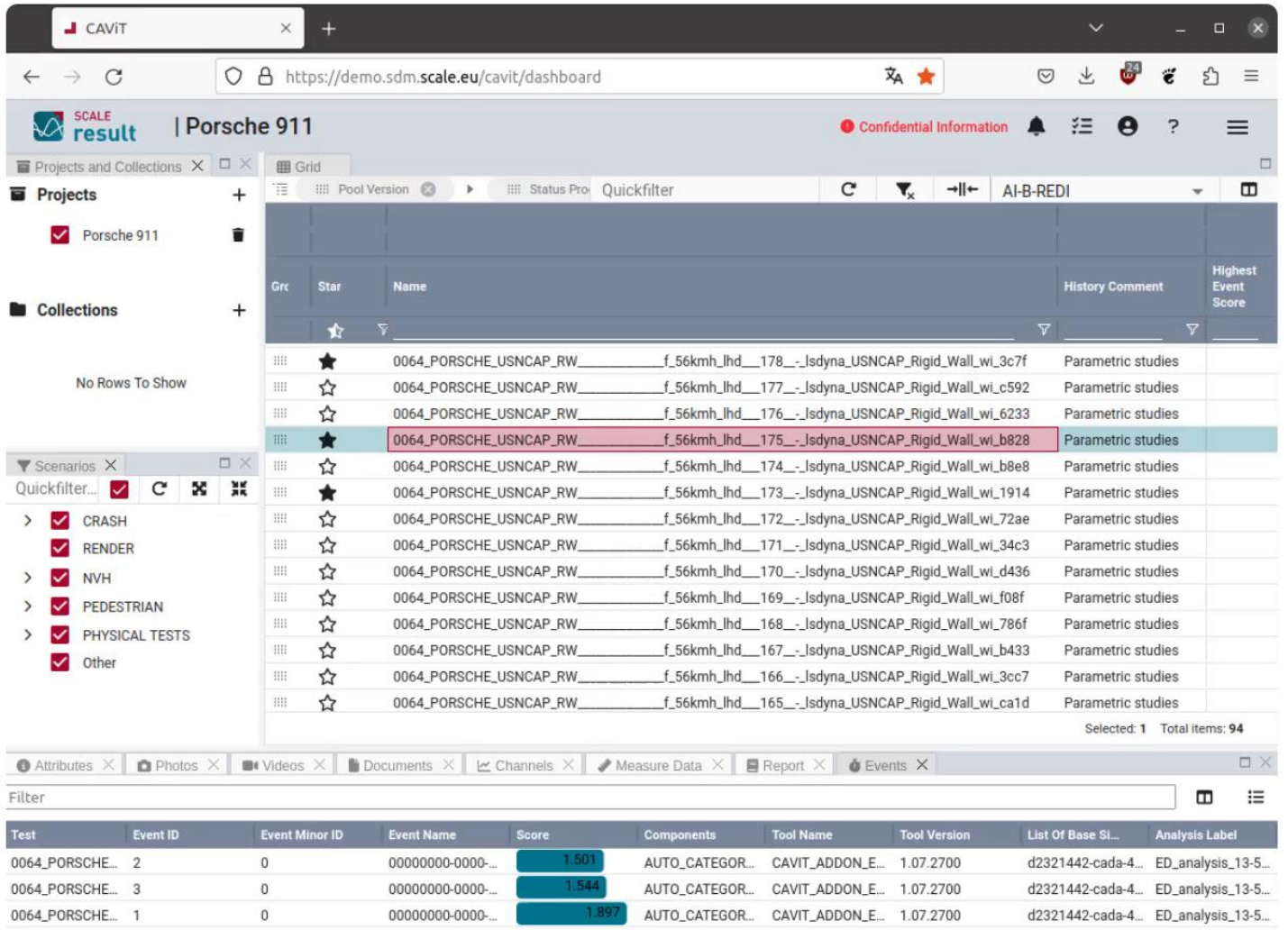
CAT & CAE
Compare simulation and physical tests

Evaluation
Visualize and evaluate all key results

Assess Results
Assess with respect to project targets

Reporting
Comprehensive and interactive reports

Data Analysis
Machine Learning and Data Mining



SCALE

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Porsche 911 Example

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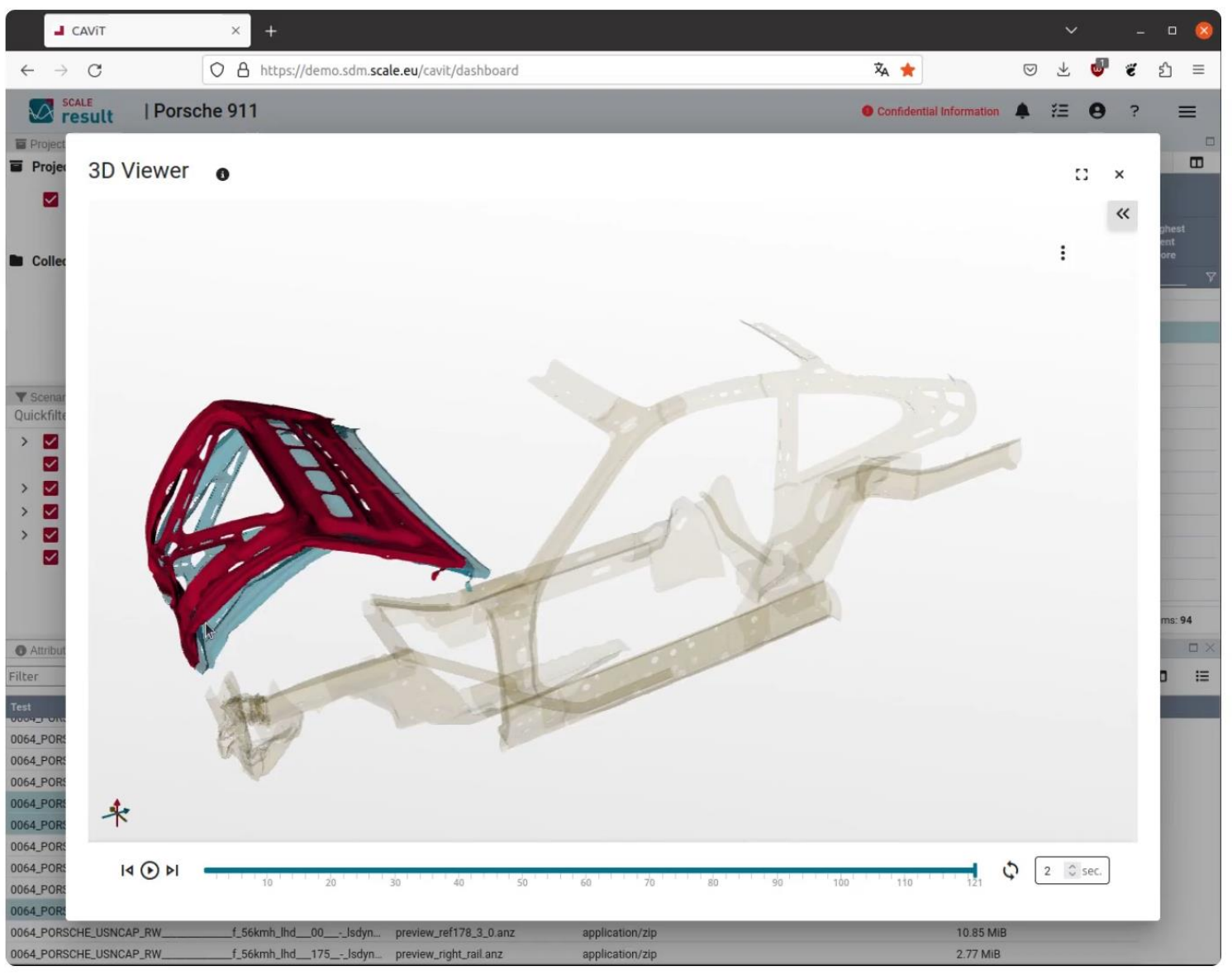

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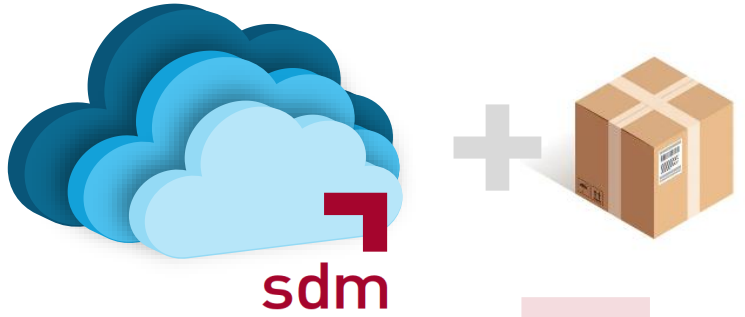
Summary

- SDM Systems provide structured data sets
- Application of AI/ML methodologies implies scanning large data sets
- Often Domain-specific custom ML-methods
  (specific methodologies are often required but not part of standard software or implementations)
- Add-on concept enables
  custom ML-methods and UI extensions in SDM-Systems
- Example Application: Event Detection by SIDACT



CAT & CAE
Compare simulation and physical tests

Data Analysis
Machine Learning and Data Mining

Event detection
Anomaly detection by SIDACT GmbH

Thanks for your attention!

Request
Demo Login

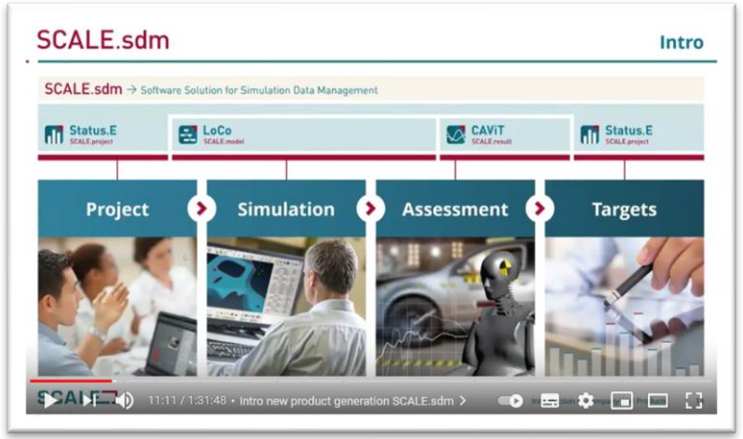
info@scale.eu

SCALE

Further Information

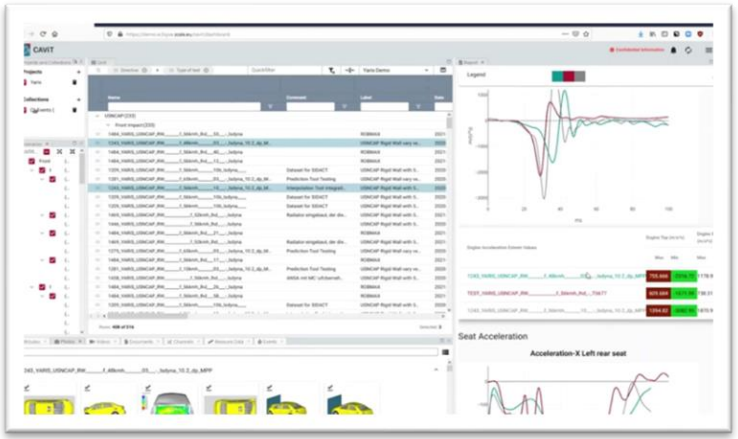
Product Overview and Demo

All SCALE.SDM modules [~100min]



Online Demo

demo.sdm.scale.eu



Youtube

http://y2u.be/3UO0EuvfjR0

http://y2u.be/oFO8IbpyFdE

Request a Login

info@scale.eu