

SCALE



Master Complexity Drive Innovation

SCALE Result – Integrated Virtual & Physical Testing

THE FUTURE

Managing requirements and experimental data, as well as establishing effective collaboration between testing and simulation departments are significant challenges.

SCALE empowers engineering teams with a structured, scalable solution for organizing, correlating, and tracing both test and simulation data across all testing activities.

It ensures efficiency, transparency, and consistency at every stage of the process – keeping the focus where it matters most: reliable engineering validation.



What Makes SCALE Result Different?

-  **Single Source of Truth**
A central hub for all physical test and simulation results.
-  **Engineering Collaboration**
Unite simulation experts and testing engineers on a single, shared data platform.
-  **Reporting and Virtual-Physical Correlation**
Automate reporting and comparison: Validate your simulation accuracy with real-world test data.
-  **AI Integration**
AI-powered insights and automation for faster, smarter engineering decisions.
-  **End-to-End Traceability**
Link requirements with test and simulation data – ensuring full transparency and confident decision-making.
-  **Requirement-Driven Monitoring**
Align test and simulation results with requirements – achieve clear validation and early issue detection.

OF ENGINEERING

Collaboration

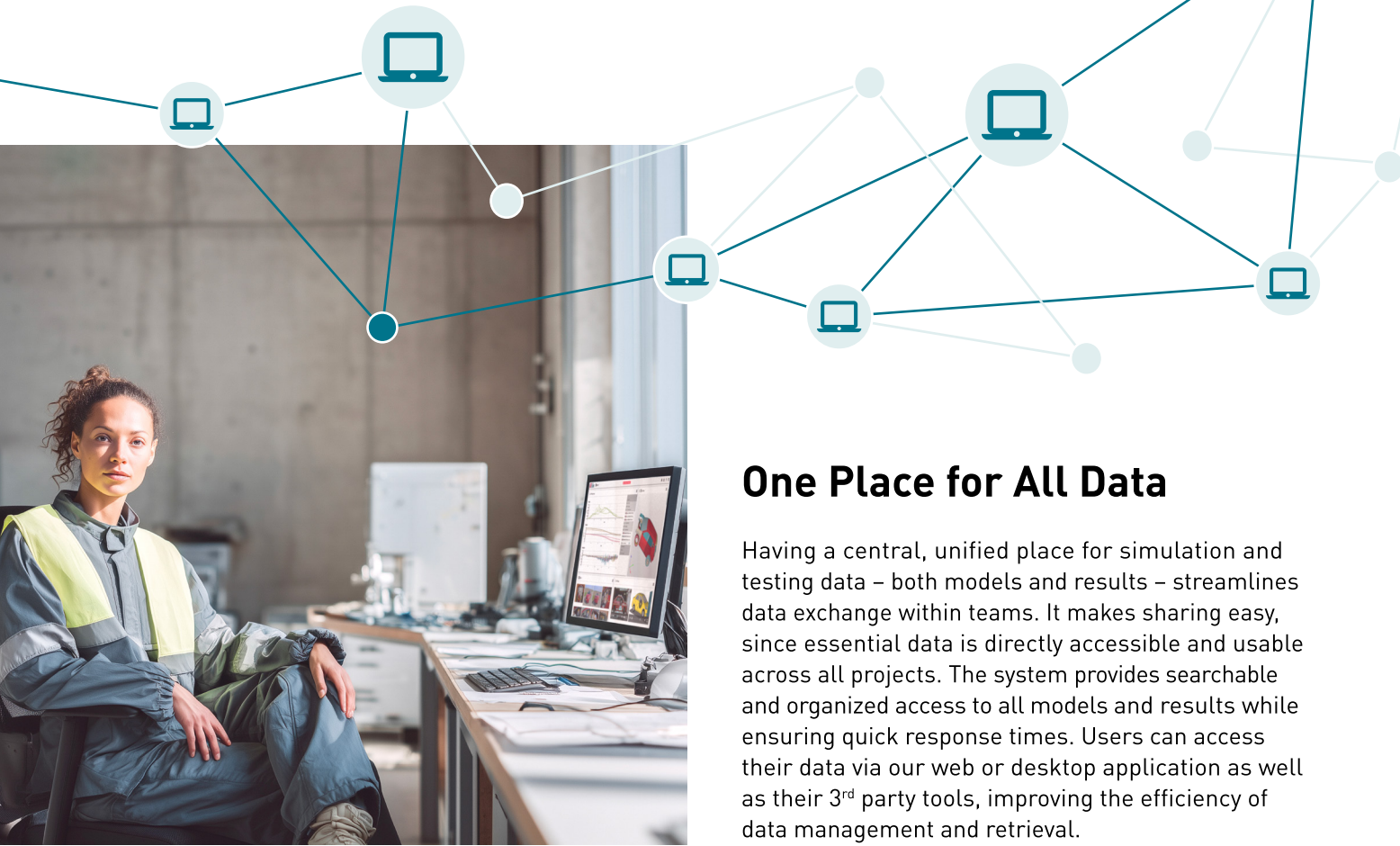
Manage Simulation and Test Data Effectively

Highly connected, digital, and global workflows should promote collaboration across an organization's teams and departments, and with external partners.

Companies need a robust platform to unify all stakeholders, ensure efficient and transparent data access, and protect their knowledge. Such a system should also minimize the time spent searching for data and provide dashboards, monitoring, and oversight of the development process to effectively manage projects.

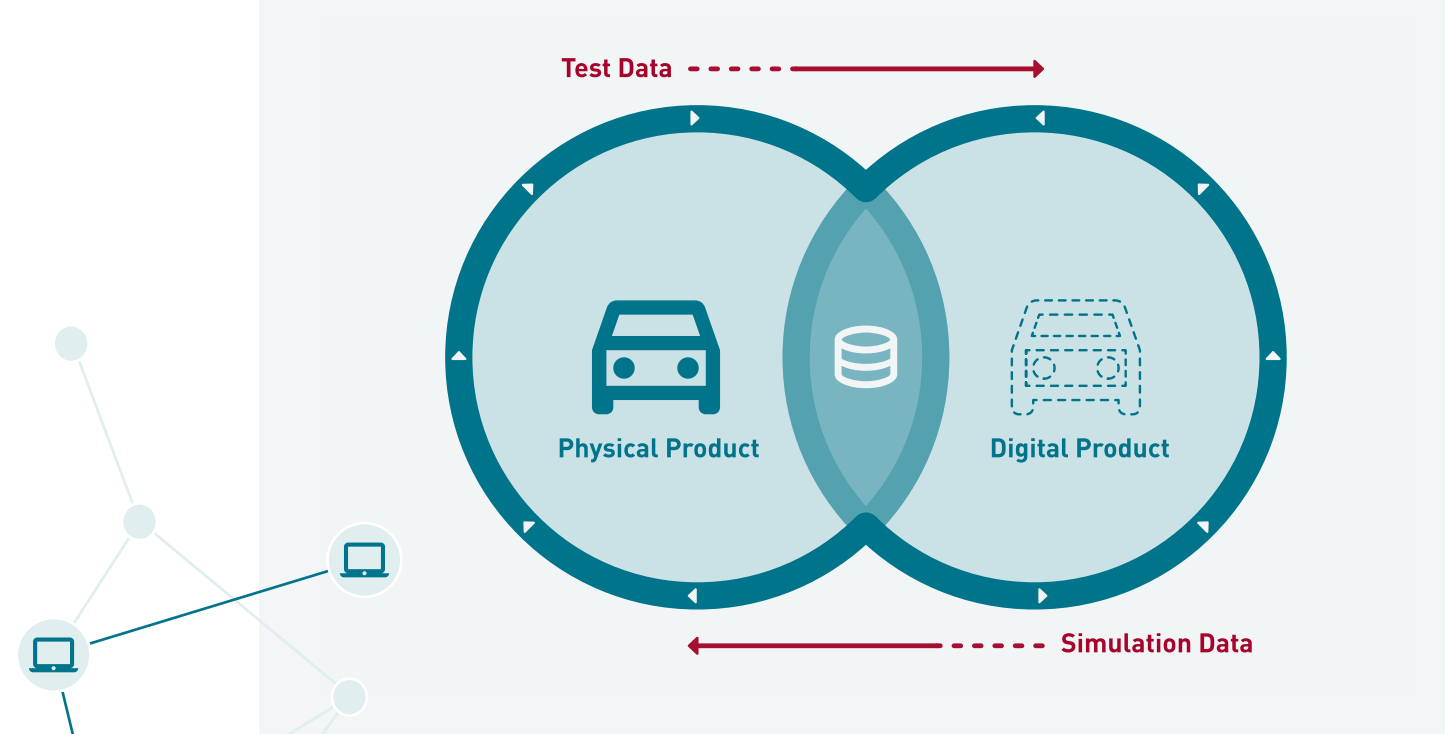
With SCALE's software platform, we can efficiently manage the wide variety of our vehicle models and load cases, and significantly improve collaboration with service providers, suppliers, and between the brands of the VW Group.

 Richard Luijckx, AUDI AG



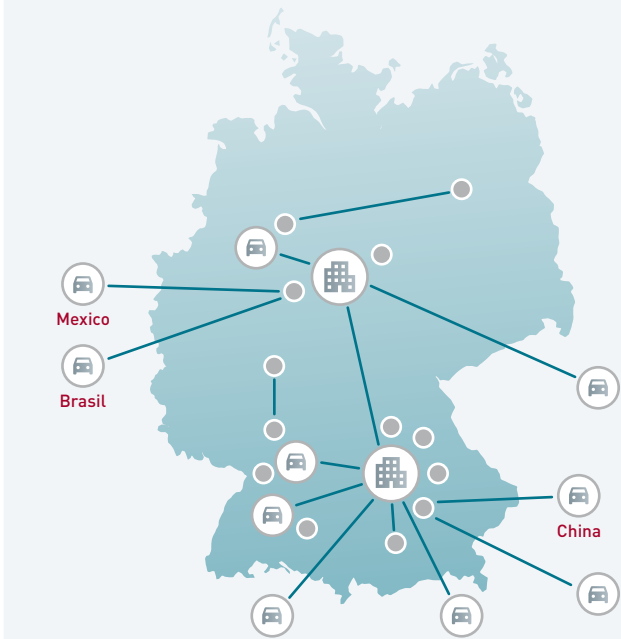
One Place for All Data

Having a central, unified place for simulation and testing data – both models and results – streamlines data exchange within teams. It makes sharing easy, since essential data is directly accessible and usable across all projects. The system provides searchable and organized access to all models and results while ensuring quick response times. Users can access their data via our web or desktop application as well as their 3rd party tools, improving the efficiency of data management and retrieval.



Accelerate the Digital Twin Loop

SCALE Result synchronizes virtual models with real-world test data, uniting simulation and testing engineers on a single platform. By interlocking parameters with physical measurements, it ensures absolute consistency. Benefit from automated correlation and a holistic asset history that bridges the gap between teams, accelerating data-driven decisions and model optimization.



Collaborating with CAE processes and data across several brands of the VW Group, NAFEMS DACH Conference 2024

Success Story Driving Efficient Collaboration

The Client's Challenge
Teams used to work independently, with different methods for storing and managing their data. This lack of consistency made it difficult to share and integrate models, even for common components.

Actions
SCALE's simulation and test data management platform was introduced to standardize and unify simulation models across departments and brands. Despite initial adaptation challenges, it established a shared framework that improved collaboration.

Results
With centralized data access, teams can now start projects quickly using shared data pools. New disciplines are easily integrated, leading to streamlined, automated project execution.

 **Customer:** AUDI AG
Industry: Automotive

Analysis and Reporting

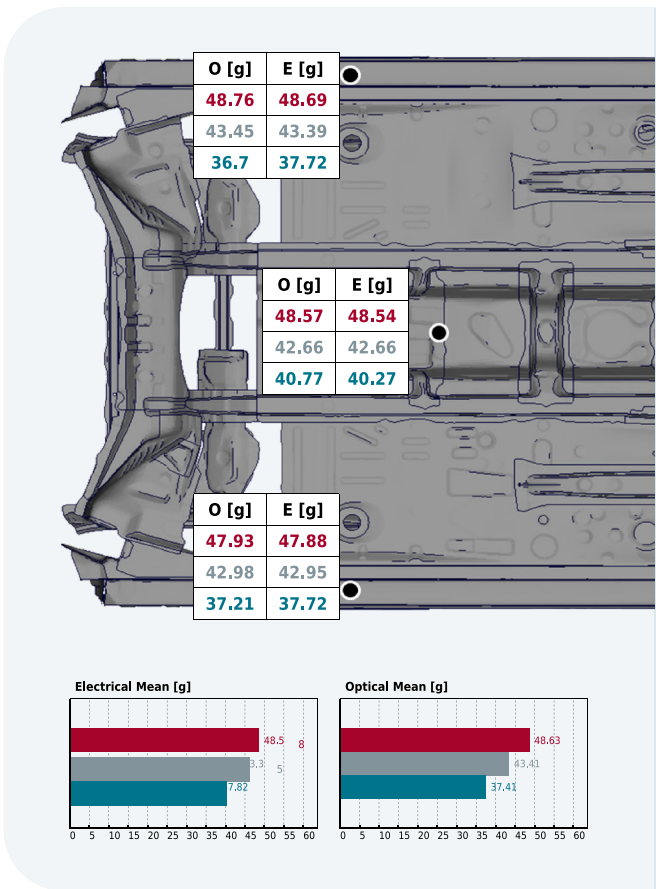
Uncover Insights for Smarter Decisions

In today's fast-paced world, making data-driven decisions quickly and accurately is essential. Integrate and visualize data from various simulations and physical tests with standardized, predefined reports, ensuring efficient and reproducible evaluations. This approach guarantees that decisions are based on clear, reliable information, moving beyond vague assumptions. Advanced data analysis enhances predictions and informs actions, while robust compliance monitoring ensures adherence to regulations.



» We successfully use SCALE Result in the field of vehicle safety for modeling and monitoring project requirements. SCALE's solutions allow us to traceably map test and simulation results, as well as requirements, in one system and apply them for detailed comparative analyses.

 Marcel van den Hove, AUDI AG



Success Story

Central Solution for Data Management

The Client's Challenge
Disjointed systems and fragmented processes made it difficult to manage and analyze simulation data, leading to inefficiencies and delays.

Actions
SCALE Result was implemented as the central solution, integrating simulation data management and analysis into one unified platform.

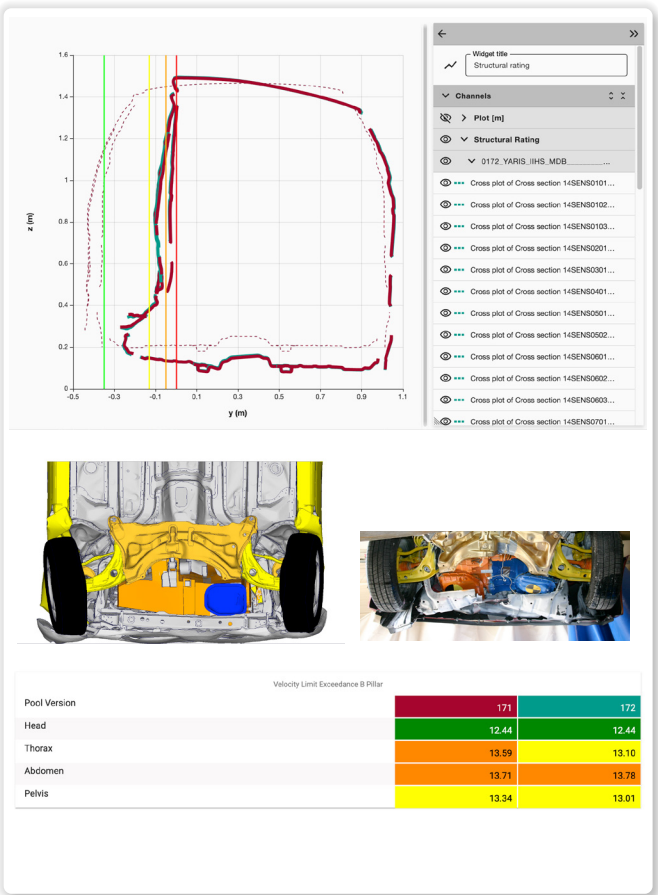
Results
The system has significantly improved efficiency and collaboration by centralizing data management and streamlining analysis, delivering tangible benefits in the client's operations.

 **Customer:** AUDI AG
Industry: Automotive

Unlock Extensive Reporting Capabilities

Turn your test and simulation results into clear, interactive reports directly in SCALE Result – no exports, no extra tools. Customize layouts with charts, text, and images, compare live data across tests, and save reusable templates for your team. Finished reports are easy to share or export for presentations.

With fully dynamic content, your reports always reflect the latest data from selected tests and simulations. This makes it simple to explore results interactively, collaborate efficiently, and communicate insights clearly across your team.



AI and ML Integration

Accelerate Development

Integrating Artificial Intelligence (AI) and Machine Learning (ML) into your workflows can be challenging due to the domain-specific and proprietary nature of many analyses. SCALE Result as a post data management solution simplifies this by providing a platform that supports easy integration of ML and AI approaches. Utilize advanced data analysis to evaluate experimental designs, perform cause-and-effect analyses, and make accurate predictions. Our solution facilitates these processes, reducing development time and enhancing precision.

Data Analysis for Deeper Insights

Identify trends, correlations, and outliers with precision using integrated data analysis and visualization capabilities. Advanced methods support the exploration of complex relationships and non-linear sensitivities, enabling a deeper understanding of underlying data behavior.

Automated post-processing and AI-assisted modeling streamline evaluation, making it easy to compare data sets and uncover deviations early. Predictive modeling techniques, including neural networks and polynomial regression, further enable the creation of surrogate models for efficient analysis and forecasting.

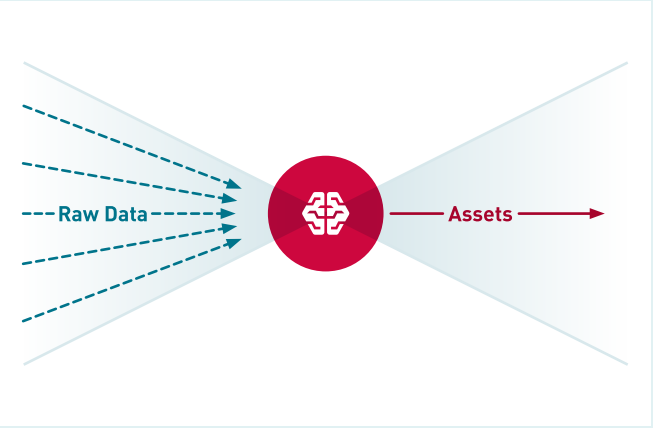


AI/ML Application Examples



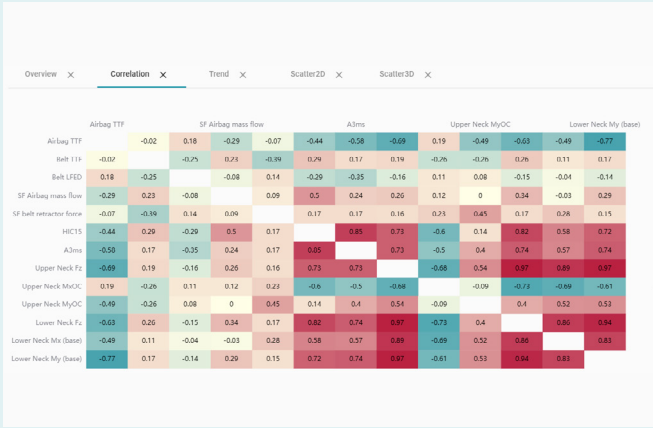
Detect Outliers and Anomalies in Your Data

Hidden anomalies can distort your insights and lead to costly mistakes. By detecting outliers early, you ensure data integrity, prevent fraud, and optimize performance. Transform "noise" into actionable intelligence – securing your business and uncovering hidden trends before they impact your bottom line. Precision starts with knowing what doesn't belong.



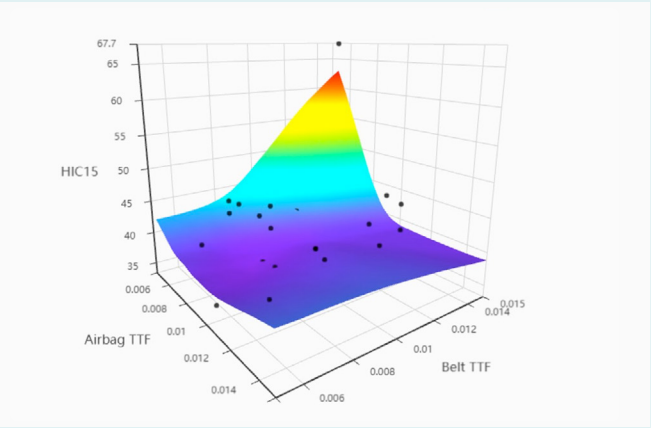
Automate Data Integrity and Labeling

AI-based data checks allow you to effortlessly filter out faulty data. They identify errors in curves and images, ensuring superior quality through automatic labeling. Benefit from consistent naming for instant retrievability and seamless automated reports. Eliminate manual labor and save massive time while transforming raw data into professional, structured assets.



Reveal Relationships in Complex Data

Correlation matrices visualize relationships between variables using the Pearson correlation coefficient. They show the strength and direction of linear dependencies, from positive to negative or no correlation, enabling quick identification of key patterns and supporting better engineering decisions.



Compare Test Data and Model Output in 3D

With 3D scatter plots, test data and meta model outputs are visualized in a shared space, enabling direct comparison across selected input and output variables. This helps assess model behavior and its agreement with real test data, even in complex multi-variable systems.

Systems Engineering

Streamline Your Project Management

Managing complex systems with multiple stakeholders is challenging. Projects need a holistic approach, clear goals, and precise, real-time progress tracking. SCALE provides a framework for transparent and reliable documentation throughout the product development lifecycle, ensuring consistency, accountability, and alignment at every stage.



At ZF LIFETEC, we use SCALE Result for our end-to-end systems engineering process. We see high potential in the SCALE software solution for the global provision of data and evaluation processes.

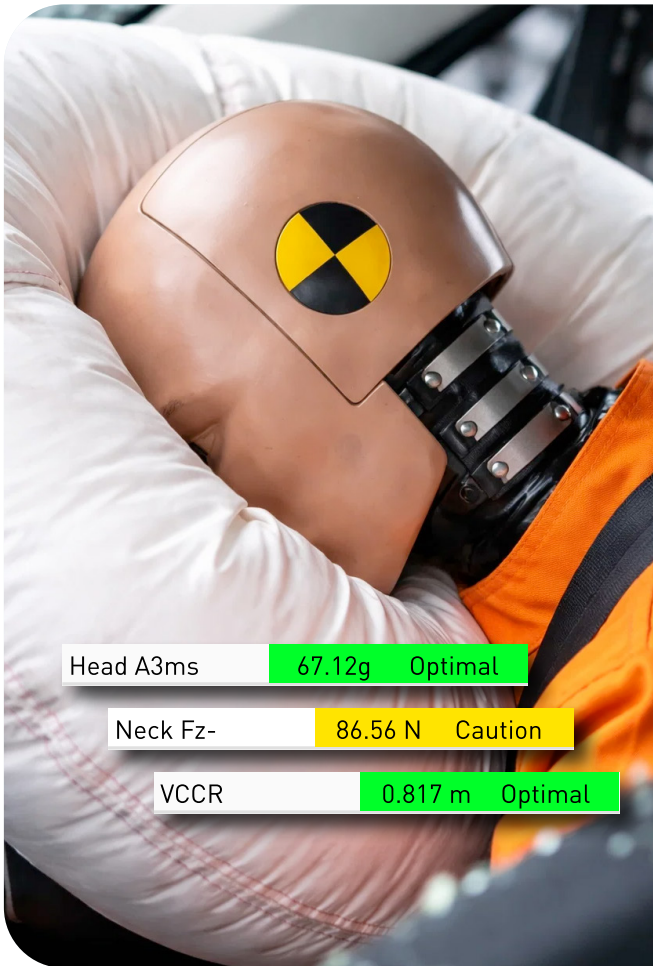


Arne Wolf, ZF LIFETEC



Stay on Top of Every Detail

Set project milestones, define load cases, and assign responsibilities. Simulation and testing results are automatically matched to targets, keeping the status up-to-date for accurate tracking. Comprehensive monitoring ensures transparency and traceability, allowing you to easily spot delays or unmet requirements.



Success Story

A Central Hub for Systems Engineering

The Client's Challenge
Managing product requirements, milestones and system integrations was fragmented across various services, affecting continuity and development efficiency.

Actions
SCALE Result was implemented as a central data hub, which interacts with third-party data sources for product development parameters, and which unifies the management of requirements and milestones into a single platform, which is accessible at all ZF LIFETEC locations.

Results
The solution is poised to significantly enhance efficiency and global collaboration by centralizing product data and requirements management and tracking, offering strong potential for optimizing systems engineering processes.



Customer: ZF LIFETEC
Industry: Automotive Supplier

Ensure Precision and Clarity in Your Requirements

Clearly define projects and manage load cases with precision. Systematically represent stakeholder requirements and link them to clear technical targets. This makes reporting current values for targets, based on simulation or testing results, seamless and traceable for all team members.

Requirement		Status	Assessment		Comment	User
Requirement	Value		Assessment		Comment	User
Frontal_FMVSS_208_56km/h_starr_0°_100%_LL_1H3						
Chest Acc-3ms-cum	50.003 G		Acceptable			jdoe
Chest Deflection -	-50.1 mm		Good			jdoe
Containment			Not available			
Femur Force le Z-			Not available			
Femur Force ri Z-	-444 kN		Poor		Wrong sensor...	asmith
Head HIC 15ms	501		Good			asmith
Neck Force Z-	-3.1 kN		Good			jdoe
Neck Force Z+			Not available			
Neck Nij NCE	0.8		Acceptable		Better next ti...	jdoe
Neck Nij NCF	0.79		Good			asmith
Neck Nij NTE			Not available			
Neck Nij NTF			Not available			
1.0.00.R.O.FIREWALL_ZONE_M1_MAX_DISPLACEMENT_X						
Frontal_FMVSS_208_LL_Wand26_0m_1H3p_3HFp						
Frontal_FMVSS_208_LL_Wand40_0m_1H3p_3HFp						
1.0.00.R.O.FIREWALL_ZONE_M1_MAX_DISPLACEMENT_X						
Frontal_FMVSS_208_LL_Wand26_0m_1H3p_3HFp						
Frontal_FMVSS_208_56km/h_starr_0°_100%_LL_Fahrzeug_schwer_H3						

Thresholds Femur Force ri Z-

-∞ ≤ x < -10.009 kN	-10.009 kN ≤ x < -8.007 kN	-8.007 kN ≤ x < ∞
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Open Platform

Achieve Seamless Integration and Customization

In a world where processes are unique and IT landscapes are complex, flexibility and integration are the key. Our platform offers a highly customizable solution, allowing for easy expansion and development by third parties. With open interfaces and support for current technologies, we ensure smooth connectivity with existing systems and processes.

-  **Tailor Solutions Specifically to Your Needs**

Tailor your platform with customizable features and workflows, supported by open, well-documented interfaces. Easily expand both frontend and backend with add-ons to suit your evolving needs.
-  **Integrate CAE and In-House Tools**

Easily integrate pre- and post-processors, as well as any CAE and in-house tools, for seamless collaboration across your entire individual workflow.
-  **Open APIs Allow Integration with Ease**

Our versatile API access enables smooth integration and customization, empowering you to extend your platform as your business grows.



 **The SCALE Result API provides us with flexible, high-performance access to our data and its meta information within SCALE Result. This interface enables us to break new ground in data analysis, ensure data consistency, and enhance process automation.**

 Simulation Specialist, Vehicle Safety – German Automotive OEM

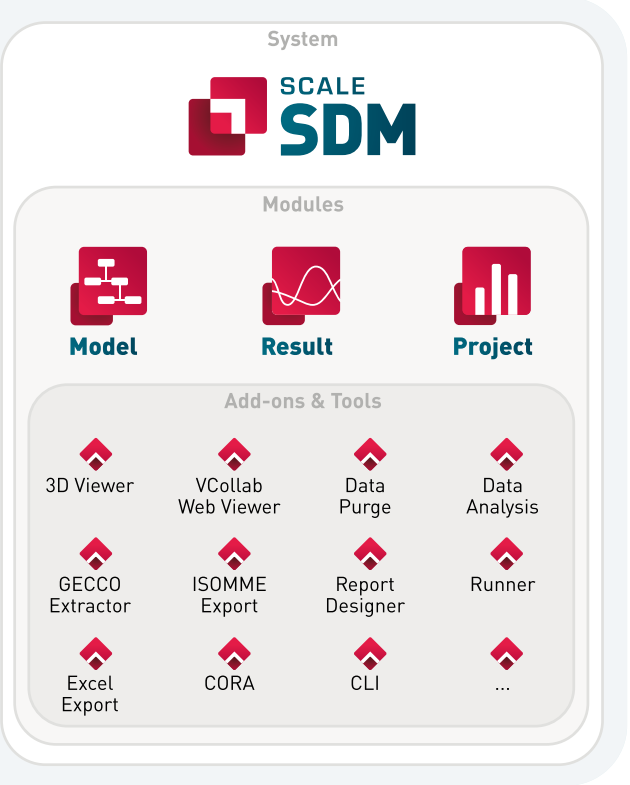
Modular Platform Design

How It All Fits Together

System: SCALE.sdm
The unified foundation for managing simulation and test data – consistent, efficient, and traceable.

Modules
From project coordination and model versioning to result evaluation – the Project, Model, and Result modules provide a solid foundation for structured, traceable, and data-driven development processes.

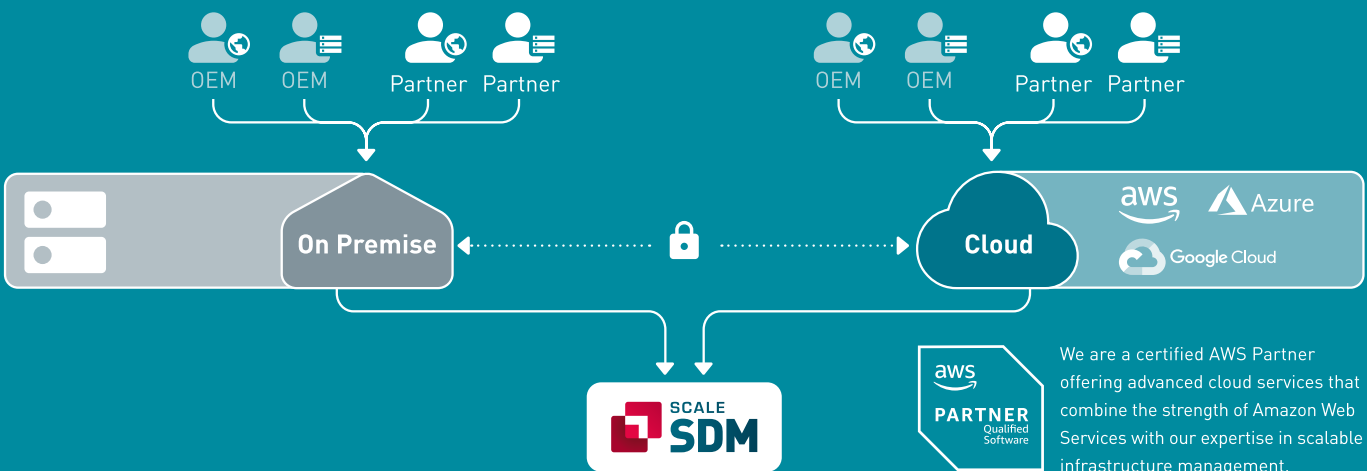
Add-ons & Tools
Extend SCALE.sdm with optional add-ons and tools tailored to your needs – from advanced visualization to powerful reporting and analysis.



Operation

Deploy Solutions with Flexibility

Our cloud-native platform offers scalable solutions, deployable on-premises or with cloud providers like AWS, Azure, or Google. Infrastructure as Code (IaC) streamlines setup and management, ensuring faster deployment and consistent environments. Comprehensive monitoring is included, and Software as a Service (SaaS) options are available for added flexibility.

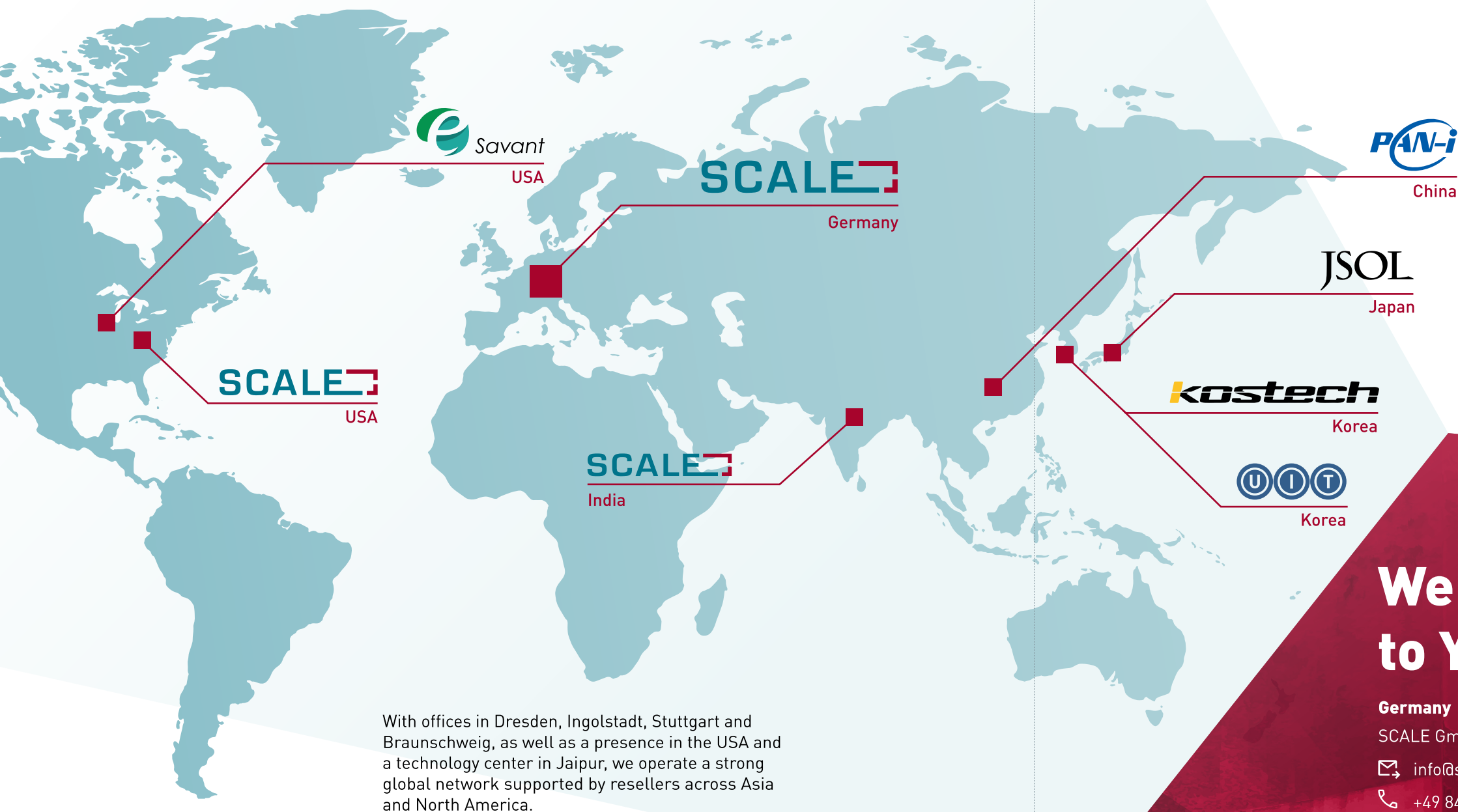


About us

Your Trusted Partner Throughout the Entire CAE Journey

We offer a broad range of IT services, including custom software development, CAE support, and data management. Our expertise covers process management, workflow enhancement, data analysis, and numerical optimization for product design.

We actively engage in research on Machine Learning and AI applications across industries such as automotive, aviation, and material engineering, in collaboration with leading German universities and research institutes. Our success is driven by a team of experienced CAE engineers and skilled computer scientists.



With offices in Dresden, Ingolstadt, Stuttgart and Braunschweig, as well as a presence in the USA and a technology center in Jaipur, we operate a strong global network supported by resellers across Asia and North America.

Services

We focus on your needs and collaborate to develop tailored solutions that help you achieve your goals. Our technical assistance optimizes your CAE environment.

Consulting.

Enhance your CAE processes with our expertise. We translate your requirements into technical concepts and implement advanced SDM and TDM systems. Explore the possibilities of AI applications with our dedicated support.

Certified Security.

We are a trusted development partner for leading automotive companies, having achieved TISAX Level 3, the highest standard of information security – ensuring exceptional data protection and reliability.

We Are Looking Forward to Your Inquiry!

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TAKE THE NEXT STEP