

# Software-in-the-Loop 2026

Faktor 10 – Mythos oder machbar? Factor 10 – Myth or Feasible?



## Termin

Mi. 02.12.2026, 09:00 Uhr –  
Do. 03.12.2026, 16:30 Uhr

## Teilnahmegebühren

**Präsenz-Teilnahme**

Für HDT-Mitglieder 1.445,00 €\*

1.585,00 €\*

## Veranstaltungsort

H4 Hotel München Messe  
Konrad-Zuse-Platz 14  
81829 München



Weitere Informationen und die  
Möglichkeit zur Online-Buchung  
**Ihrer Teilnahme finden Sie auf der**  
[Veranstaltungs-Webseite](#).

Stand: 15.09.2026, 13:09 Uhr

# Software-in-the-Loop 2026

## Inhalt

Software-in-the-Loop in der industriellen Praxis: Erfahren Sie, wie SIL als skalierbare Standard-Plattform für die Entwicklung und Absicherung komplexer Software- und Fahrzeugsysteme etabliert wird. Im Fokus stehen Architekturentscheidungen, Toolchain-Design und organisatorische Voraussetzungen für den nachhaltigen Einsatz von SIL – on-premise und in der Cloud. Diskutieren Sie Ansätze zur Modellierung auf unterschiedlichen Abstraktionsebenen, szenariobasierte Absicherung, Coverage-Metriken und Test-Orchestrierung. Weitere Schwerpunkte sind Interoperabilität und Standards (z. B. FMI/FMU), Co-Simulation sowie der Transfer und die Korrelation von Testfällen zwischen SIL und HIL inklusive Traceability, Safety und Compliance. Lernen Sie, wie KI-basierte Methoden virtuelles Testen, Analyse und Szenariengenerierung effizienter machen. Praxisberichte liefern konkrete KPIs, Lessons Learned und belastbare Aussagen zu Aufwand, Qualität und ROI.

Dr. Ing. Christian Köllner (Vector) und Dr. Karsten Krügel (dSPACE) sind als Tagungsleiter für die fachliche Gestaltung der Tagung verantwortlich

Bitte beachten Sie, dass die Konferenzsprache Englisch ist.

## Topic

Software-in-the-loop in industrial practice:

Learn how SIL is being established as a scalable standard platform for the development and validation of complex software and vehicle systems. The focus is on architecture decisions, toolchain design, and organizational requirements for the sustainable use of SIL – on-premises and in the cloud. Discuss approaches to modeling at different levels of abstraction, scenario-based validation, coverage metrics, and test orchestration.

Other key topics include interoperability and standards (e.g., FMI/FMU), co-simulation, and the transfer and correlation of test cases between SIL and HIL, including traceability, safety, and compliance. Learn how AI-based methods make virtual testing, analysis, and scenario generation more efficient. Practical reports provide concrete KPIs, lessons learned, and reliable statements on effort, quality, and ROI.

As Conference Chairs, Dr. Ing. Christian Köllner (Vector) and Dr. Karsten Krügel (dSPACE) are responsible for curating the conference program.

Please note that the conference language is English.

## Zum Thema

Software-in-the-Loop (SIL) entwickelt sich rasant zur **Standardplattform für virtuelle Tests und Validierung** in der Softwareentwicklung. Sie bildet das Rückgrat moderner Entwicklungs- und Absicherungsprozesse – insbesondere in sicherheitskritischen Branchen wie Automotive, Luftfahrt, Industrieautomation und Medizintechnik. Um SIL als zentrale Plattform zu etablieren, braucht es eine klare **Vision und Roadmap**, unterstützt durch eine skalierbare **Architektur** und strategisch ausgerichtete **organisatorische**

### Weichenstellungen.

Im Zentrum steht die **Skalierung und der Betrieb der SIL-Toolchain** – ob *on-premise* oder in der *Cloud*.

Erfolgsentscheidend sind eine durchdachte **Governance-Struktur**, flexible **Kostenmodelle**, gezieltes **Workforce-Enablement** sowie ein effektives **Change Management**, um Entwicklungsteams nachhaltig auf die Transformation vorzubereiten.

Ebenso wichtig ist die **Modellierung und Coverage**. Über abgestufte **Abstraktionsebenen**, realitätsnahe **szenariobasierte Absicherung** und aussagekräftige **Coverage-Metriken** lassen sich Testumfänge bewerten und optimieren. Eine automatisierte **Orchestrierung** sichert Effizienz, Wiederholbarkeit und Nachvollziehbarkeit der virtuellen Tests.

Zukunftsweisend ist zudem eine hohe **Interoperabilität**. Offene **Schnittstellen**, **Co-Simulationen** und die Einbindung anerkannter **Standards** wie **FMI/FMU (Functional Mock-up Interface/Unit)** sowie konsistente **Datenmodelle** gewährleisten die Vernetzung von Tools, Plattformen und Systemen – eine Grundvoraussetzung für durchgängige Entwicklungsprozesse.

Die **Brücke zwischen SIL und HIL (Hardware-in-the-Loop)** ist ein weiterer Schlüssel zum Erfolg. Die **Korrelation und der Transfer von Testfällen**, vollständige **Traceability** sowie die Einhaltung von **Safety- und**

**Compliance-Vorgaben** ermöglichen eine sichere und harmonisierte Absicherung zwischen virtueller und realer Testumgebung.

Ein innovatives Zukunftsfeld ist die Verbindung von **Künstlicher Intelligenz und SIL (AI & SIL)**: KI-gestützte Funktionen können virtuell getestet werden, während KI selbst zur **Effizienzsteigerung im Test, in der Analyse und in der Szenariengenerierung** beiträgt. Dadurch entstehen adaptive, lernfähige Testumgebungen mit deutlich verkürzten Entwicklungszyklen.

Auch **Security, Safety und Quality** sind integrale Bestandteile moderner SIL-Setups. **Cybersecurity-Tests, Safety-Argumentationen, Compliance-Nachweise** und **Auditierbarkeit** stellen sicher, dass Produkte höchsten Sicherheits- und Qualitätsstandards entsprechen.

Praxisberichte und Business Cases belegen den **ROI von Software-in-the-Loop**: Durch Kennzahlen (**KPIs**), **Zeit- und Kosteneinsparungen**, dokumentierte **Lessons Learned** und die Vermeidung typischer **Anti-Patterns** zeigen Unternehmen, wie sie mit **SIL-basierter Absicherung** ihre Reifegrade erhöhen, Markteinführung beschleunigen und Qualitätsrisiken minimieren können.

#### **On the subject**

Software-in-the-Loop (SIL) has rapidly become the **standard platform for virtual testing and validation** in software-driven development. It serves as the foundation of modern **virtual validation workflows**, especially in safety-critical sectors such as **automotive engineering, aerospace, industrial automation, and medical technology**. Establishing SIL as a standard requires a clear **vision and roadmap**, supported by a **robust architecture** and the right **organizational frameworks** to ensure seamless integration.

At its core, success depends on **scalability and operations**. A flexible **toolchain** that runs both **on-premise and in the cloud** is essential, along with well-defined **governance models**, transparent **cost structures**, workforce training, and proactive **change management**.

Equally vital are **modeling and coverage** aspects. Leveraging multiple **abstraction levels, scenario-based validation**, measurable **coverage metrics**, and intelligent **orchestration** ensures traceable, reproducible, and efficient testing throughout the entire software lifecycle.

**Interoperability and standards** play a key role as well. Open **interfaces, co-simulation environments**, and adherence to standards such as **FMI/FMU (Functional Mock-up Interface/Unit)**, along with unified **data models**, guarantee compatibility and connectivity across tools, systems, and simulation environments.

Bridging **SIL and HIL (Hardware-in-the-Loop)** environments is essential for full validation coverage. This includes **correlation and transfer of test cases, traceability**, and compliance with **safety and regulatory standards**, ensuring consistent results across digital and physical test domains.

In the era of artificial intelligence, **AI & SIL** marks a transformative frontier. Virtual testing of **AI-driven functions** and the **use of AI** for test automation, smart analysis, and **scenario generation** significantly improve efficiency, adaptability, and test coverage in virtual environments.

Furthermore, **security, safety, and quality** form the backbone of trusted SIL setups. **Cybersecurity testing, safety argumentation, compliance verification**, and **audit readiness** strengthen the reliability and certification confidence of complex systems.

Real-world examples and ROI analyses highlight the tangible benefits of **Software-in-the-Loop testing**: well-defined **KPIs**, measurable **time and cost savings**, practical **lessons learned**, and identification of **anti-patterns** demonstrate how organizations can **accelerate validation, reduce risks, and increase product maturity** with SIL-based strategies.

#### **Zielsetzung**

Was wäre, wenn SIL Ihre Testeffizienz verzehnfacht, den Reifegrad deutlich früher absichert und Produkte schneller in den Markt bringt? Erleben Sie, wie Software-in-the-Loop in realen Industrieprojekten skaliert – und wie daraus messbarer Nutzen entsteht: weniger Aufwand, höhere Qualität und fundierte, belastbare Entscheidungsgrundlagen.

#### **Objective**

What if SIL increased your testing efficiency tenfold, ensured maturity much earlier, and brought products to market faster? Experience how software-in-the-loop scales in real-world industrial projects—and how this translates into measurable benefits: less effort, higher quality, and sound, reliable decision-making.

## Programm

02.12.2026

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09:00–18:00      The full conference program is expected to be available shortly.  
Please note that, for organizational purposes, all presentations are currently listed under the second day of the conference. The final schedule, including the allocation of presentations across the conference days, will be announced shortly.

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03.12.2026

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08:30–16:30

Highlights from the planned program:

**Seamless simulation. Faster development. Reimagine Virtual ECUs by using FMI and additional Layered Standards**

Tim Pfitzer, Robert Bosch GmbH and Benedikt Menne, dSPACE

**From SiL Adoption to Industrialization: Scaling Software-in-the-Loop**

Matthieu Rullier, Stellantis

**Usage of V-ECU in vehicle simulation platform at Renault Group: target and achievements**

Jean-Marie Quelin, Ampere France and Nicolas Laurent, Renault Group

**Integrated Software-in-the-Loop**

Jayanthi Viswanathan, Daimler Truck

**Making Interoperability Real: A Multi-Level XiL Ecosystem with FMI and SSP**

Matthieu Rullier and Mehmet Emre Buyukceri, Stellantis

**Scaling Software-in-the-Loop for Virtual Validation**

Marcel Arenz and Philipp Escher, ZF Active Safety GmbH

**Virtual Integration of distributed Body&Comfort Systems based on AUTOSAR**

Dr. Thomas Ringler, Mercedes-Benz AG

**Standardizing Software-in-the-Loop (SiL) for the Automotive Industry: Current Results and Future Directions from the VDA Project Group SiL Standardisation**

Amir Sardari, Robert Bosch GmbH / VDA Project Group SiL Standardisation

**From Heilig's Blechle to the Container: How Virtual Testing combines vehicle and cloud**

Nic Eckstein, Bertrandt Group

**MeDaC: MetaData Configurator - An Agentic AI-Powered, Tool-Agnostic Virtual ECU Generation Acceleration Platform**

Kushal Koppa S Swamy, Robert Bosch GmbH

**From SiL Acceleration to Virtual System Integration and Validation in the Cloud**

Ulrich Schulmeister, Bosch Mobility

**Making V-ECU Generation & Simulation a Standard: Level 3 Virtualization Integrated into Existing Software Toolchains**

Dr. Okan Ecin, Porsche AG

**From Residual Risk to Synthetic Scenarios: AI-Assisted Scenario Generation for Traceable Autonomous Driving Validation**

Alessandro Giacomazzo and Daniele Molinari, Ambarella

**Virtual Lighting Validation Using vECU- and FMU-Based Toolchains for Scalable Variant Coverage**

Dr. Tim Gocke and Christian Albert, BMW Group

**From Subjective Feel to Virtual KPI: Driving Experience Optimization Across the X-in-the-Loop Chain**

Prof. Dr. Peter E. Pfeffer, Munich University of Applied Sciences

**Virtual Validation at Scale – Software-in-the-Loop Testing utilizing the SiL Kit**

Dr. Georg Hummel and Jonathan Schneider, BMW Group

**Virtual full-vehicle releases through the simulation of complex E/E architectures using virtual ECUs (vECUs) – requirements and setup of an end-to-end SiL toolchain for modern SDV architectures**

Sven Meyer, IAV GmbH and Dr. Tim Wagner, Volkswagen AG

## Referenten

DK

### Dr. Karsten Krügel

dSPACE GmbH

2019 – present: Head of Business Development at dSPACE Group SE & Co. KG

2013 – 2019: Senior Product Manager for Virtual Validation and Software Architecture at dSPACE GmbH

2010 – 2013: Product Manager for Virtual Validation at dSPACE GmbH

2006 – 2010: Product Engineer at dSPACE GmbH

2002 – 2006: Research Assistant at the University of Münster

DK

### **Dr. Ing. Christian Köllner**

Since 2025: Vice President SIL | Virtualization Tools

2013–present: Various roles at Vector Informatik

2013: PhD in Electrical Engineering

2007–2013: Research Assistant at FZI Research Center for Information Technology, focusing on embedded systems

2001–2007: Computer Science studies at the University of Karlsruhe

AS

### **Amir Sardari**

Robert Bosch GmbH / VDA Project Group SiL Standardisation

Amir Sardari is a Senior Expert in Software & System Engineering and Virtualization Strategist at Robert Bosch GmbH. With nearly 18 years of experience in automotive research and development, he has worked across a broad range of vehicle domains, including Chassis Systems, ADAS, Powertrain, Electrification, and Mobility Electronics. His current focus is on virtualization and Software-in-the-Loop (SiL) engineering. Amir serves as the lead of the VDA Project Group for SiL Standardization, where he collaborates with automotive OEMs, suppliers, tool vendors and industry working groups to establish common standards for SiL ecosystems.

DR

### **Dr. Thomas Ringler**

Mercedes-Benz AG

Dr. Thomas Ringler studied Electrical Engineering at the University of Stuttgart and has been working for more than 20 years in AUTOSAR methodology and toolchain development at Mercedes-Benz R&D. As development engineer he is leading a project on the virtual integration of distributed Body & Comfort functions based on AUTOSAR.

BM

### **Benedikt Menne**

dSPACE

Benedikt Menne has over 15 years of experience in automotive function development, with a particular focus on Software-in-the-Loop (SiL), virtual validation, and model-based development processes. His expertise lies in the design, standardization, and implementation of simulation and integration solutions for the early verification and validation of ECU functions.

As Product Owner for dSPACE VEOS, he has concentrated since its inception on contributing to the FMI-LS-BUS standard and its market establishment, as well as the integration of this technology within the dSPACE SIL/HIL toolchain. He is also working on implementing end-to-end workflows for virtual validation and co-simulation. His expertise encompasses combining standardized FMI-based approaches with modern simulation and test environments to shorten development times and sustainably improve the quality of software-defined vehicle functions. His goal is to create interoperable and scalable simulation solutions for efficient use in customer scenarios.

TP

### Tim Pfitzer

Robert Bosch GmbH

Tim Pfitzer (BOSCH) has been working at Robert Bosch GmbH for over 7 years, specializing in ECU software virtualization, SiL architecture, and strategic development.

JV

### Jayanthi Viswanathan

Daimler Truck

**Experience:** 24 years in the Aerospace and Automotive industry, with deep verification expertise across multiple products.

**Current Position:** Deputy General Manager, Daimler.

#### Role / Responsibilities:

Leading the **Virtual Verification (iSIL) Team** in Bangalore, responsible for virtual verification activities using the **dSPACE VEOS** environment. The team creates a virtual verification platform and configures it for various vehicle variants for integration maturity. The team ensures virtual verification as a prime path for current vehicle projects and seamlessly extends it to SDV in the iSIL framework.

MR

### Matthieu Rullier

STELLANTIS

Matthieu Rullier leads the Virtualization Team at Stellantis, driving the deployment of virtual ECU solutions at scale within the XiL ecosystem. He has over 8 years of experience in XiL, previously working on propulsion systems at a Tier 1 supplier.

MB

### Mehmet Emre Büyükçerçi

STELLANTIS

Mehmet Emre Büyükçerçi is an XiL Architect at Stellantis, specializing in virtual validation architectures and interoperability. He plays a key role in defining scalable XiL ecosystems. Emre brings around 15 years of experience in simulations, algorithm and XiL development across multiple Tier 1 suppliers, particularly in chassis and ADAS domains.

JQ

### Jean-Marie Quelin

AMPERE FRANCE

Engineer of 'Ecole Nationale Supérieur d'Arts et Métier'

Engineer of 'IF School, option internal combustion engine'

From gasoline engine combustion & emission development, tuning of engine & automated gearbox, tuning of OBD diagnosis to powertrain software validation.

Multicultural environment and activities with VOLVO Car, Renault Romania, Renault India, Nissan Spain and Nissan Japan.

Involved in European project 'ACOSAR' leading to DCP standard, FMI Advisory committee and FMU3 LS-BUS.

After ten years in HIL validation and responsible of Renault Group worldwide HIL powertrain roadmap, deploy software virtualization since four years for Ampere softwares.

Associated expert for electric powertrain virtualized software

NL

## Nicolas Laurent

Renault Group

Nicolas Laurent is a technology expert with over 25 years at Renault Group. He specializes in simulation platforms, AD/ADAS validation, and engineering IT systems. With a background in mechanical and software engineering from Centrale Méditerranée, he has led multiple innovative projects and teams, combining technical depth with strategic vision in complex automotive and industrial environments.

MA

## Marcel Arenz

ZF Group

ZF Group

8 years

Senior Simulation Engineer

May 2025 – Present (1 year, 2 months)

Koblenz, Rhineland-Palatinate, Germany

Simulation Development Engineer

July 2018 – June 2025 (7 years)

Koblenz University of Applied Sciences

Lecturer in Technical Thermodynamics

October 2023 – April 2025 (1 year, 7 months)

Adjunct Lecturer – Mechanical Engineering – Thermodynamics Module

ZF Group

1 year, 3 months

Master's Student

August 2017 – January 2018 (6 months)

Koblenz, Rhineland-Palatinate, Germany

- Development of a multiphysics simulation method at the component level
- Analysis of current coupling strategies for multiphysics simulation
- Correlation/validation with measurements
- Examination of sensitivity and tolerance studies

NE

## Nic Eckstein

Bertrandt Group

Nic Eckstein bridges the worlds of mechanical engineering, IT, and modern software development. Following his start in enterprise IT, he brought his expertise into EE testing at an early stage and helped drive the transition towards Software-in-the-Loop (SiL). Today, as a Team Manager, he is responsible for cloud platforms for embedded testing and shapes the business development of innovative testing solutions for the mobility of tomorrow.

KS

## Kushal Koppa S Swamy

Robert Bosch GmbH

Kushal Koppa Shivanandaswamy is a Solutions Architect at Bosch Global Software Technologies (BGSW), Bengaluru, India, with overall 16+ years of industrial experience from various domains inclusive with over 7 years of experience in automotive software engineering, specializing in Software-in-the-Loop (SiL), Virtual ECUs, virtualization, simulation, and Software-Defined Vehicle (SDV) technologies. Throughout his career, he has been instrumental in developing scalable virtualization platforms, AI-driven engineering solutions, and cloud-enabled simulation ecosystems that accelerate software development, integration, and validation for next-generation automotive systems. His experience in leading and delivering virtualization solutions for automotive domains, such as powertrains, BCM, ADAS, PK, and GWM is very valuable. He is a professional with a strong background also in embedded and aerospace domains with 9+ years of experience, and holds dual Master degrees with specialization in VLSI Design and Embedded Systems and Automotive Engineering.

Kushal leads strategic initiatives in Virtual ECU generation, simulation automation, metadata-driven engineering, and enterprise virtualization platforms, including MeDaC, VirtuGo, VirtuVerse.SDV Studio, and AI-powered simulation orchestration. His current work focuses on enabling virtualization-first engineering through AI, cloud technologies, and tool-agnostic simulation frameworks. He also mentored graduates and post graduate students in their dissertation programs.

He has authored multiple peer-reviewed technical publications in the fields of modelbased engineering, formal methods, safety-critical systems, aerospace systems, multicore architectures, and automotive virtualization. His publications include research presented through IEEE, Springer, Hindawi, and SAE International, including the SAE paper "A Virtual Environment for Early Development and Validation of Next Generation Digital Vehicle Entry Functions."

At the SiL Conference Munich 2026, Kushal will present his vision for AI-powered virtualization, scalable Software-in-the-Loop ecosystems, and next-generation virtual engineering platforms that are transforming automotive software development from hardware-dependent validation to continuous, cloud-enabled software engineering.

US

## Ulrich Schulmeister

Robert Bosch GmbH

- Vice President Technology and Engineering, Bosch Mobility, actively Leading the Bosch Mobility Program "Virtualisation 1st"

- Since more than 30 years in Bosch in a lot of responsibilities from Engine Calibration over Systems Engineering including Lead of Rolling Chassis and the complete time as Evangelist in Virtualizations

DE

### **Dr. Okan Ecin**

Porsche AG

- 2022 – present: Lead Engineer Virtual E/E Validation at Porsche AG
- 2017 – 2022: XiL Simulation Engineer at Porsche AG
- 2013 – 2017: Project Lead XiL Simulation Models at VAIVA GmbH
- 2009 – 2013: Research Assistant at the University of Duisburg-Essen

AG

### **Alessandro Giacomazzo**

**Alessandro Giacomazzo** is a Senior Software Engineer with over 15 years of experience in autonomous driving systems and simulation infrastructure. For the last four years, he has focused on simulation platforms, leading the strategic migration and integration of legacy systems into advanced dSPACE-based ecosystems. His work spans the full development of Software-in-the-Loop (SIL) and Hardware-in-the-Loop (HIL) simulation pipelines, managing core codebase integrations, and spearheading research in Generative AI for automated virtual environment synthesis. He specializes in building high-fidelity, scalable virtual testing solutions that drastically optimize operational efficiency and accelerate autonomous vehicle validation.

DM

### **Daniele Molinari**

Daniele Molinari is a Computer Science graduate and AI-focused Intern developing synthetic worlds for autonomous-driving simulation. His work centers on OpenDRIVE-based environment modeling and the integration of generated road networks into dSPACE ecosystem for large-scale virtual testing. Passionate about generative AI and LLMs, he explores how emerging AI techniques can support automated creation of diverse and realistic driving scenarios for next-generation simulation pipelines.

DG

### **Dr. Tim Gocke**

BMW Group

BMW Group

CA

### **Christian Albert**

BMW Group

BMW Group

PP

### **Prof. Dr. Peter E. Pfeffer**

Hochschule München - Munich University of Applied Sciences

Scientific Director of the chassis.tech plus Symposium  
Chairman of the examination board for FAM – Head of the automotive engineering laboratory  
Department of Mechanical, Automotive and Aeronautical Engineering  
Munich University of Applied Sciences

PE

**Philipp Escher**

ZF Active Safety GmbH

DH

**Dr. Georg Hummel**

BMW Group

JS

**Jonathan Schneider**

BMW Group

## Hinweise

Teilnehmenden der Konferenz Software-in-the Loop steht ein begrenztes Kontingent an Hotelzimmern zum Vorzugspreis zur Verfügung. Das Angebot gilt nach Verfügbarkeit bis zum 3.11.2026. Zugriff auf den Buchungslink erhalten Sie nach Anmeldung zur Konferenz.

A limited number of hotel rooms are available to participants of the Software-in-the-Loop conference at a special rate. This offer is valid subject to availability until November 3, 2026. You will receive access to the booking link after registering for the conference.