ADAS/AD – Achieving GSR Compliance Efficiently

AVL Webinar, April 2022

Today’s Presenters

Bastian Prugger

- AVL Legal Consultant for ADAS/AD law
- Member UNECE GRVA Expert Groups

Halil Ors

- ADAS/AD Team Lead Engineering

Heiko Scharke

- Senior Global Product Manager ADAS/AD Testing Solutions

Today’s Agenda

1 **Introduction**

About AVL and ADAS/AD

2 **ADAS/AD Legislation in the EU**

Reasons and Motivation, EU law in perspective, The new GSR

3 **Systems engineering**

Handling and Application of GSR features

4 **Verification Processes**

Application of a generic process to GSR testing

Introduction

About AVL and ADAS/AD

Facts and Figures

Global Footprint

Represented in 26 countries

45 Affiliates at over 93 locations

45 Global Tech and Engineering Centers (including Resident Offices)

1948

Founded

11,000

Employees Worldwide

12%

Of Turnover Invested in Inhouse R&D

70+

Years of Experience

65%

Engineers and Scientists

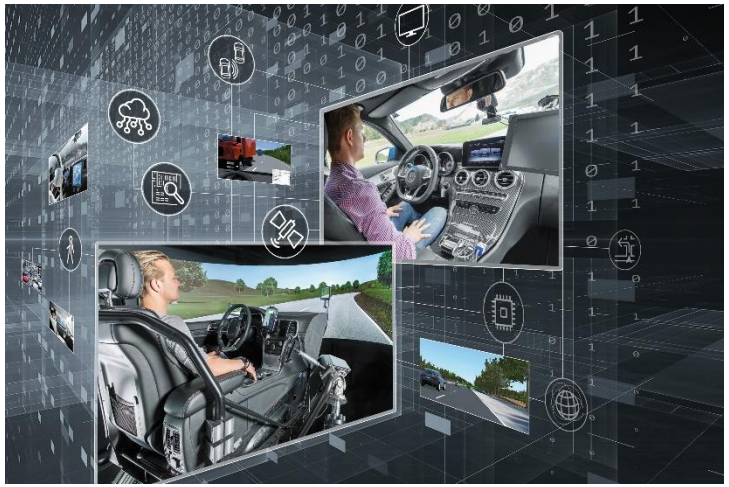
2,500

Granted Patents in Force

97%

Export Quota

AVL ADAS and Autonomous Driving



SYSTEM DESIGN, CALIBRATION AND TESTING SERVICES

Target and KPI definition, integration, performance optimization, verification and validation – from virtual to the proving ground and the real world.

TAILORED SOFTWARE AND CONTROLS DEVELOPMENT

Independent, tailored software and controls development for proof-of-concept and series production, including functional safety, cybersecurity and V2X.

TOOLS AND METHODS FOR DEVELOPMENT AND TESTING

Scenario-based open verification and validation toolchain for ADAS/AD components, systems and features, integrated into the customer’s virtual and real test environments.

ADAS/AD Legislation in the EU

Reasons & Motivation
EU law in perspective
The new GSR

Public

ADAS/AD Legislation in the EU

Reasons & Motivations

EU‘s Vision Zero

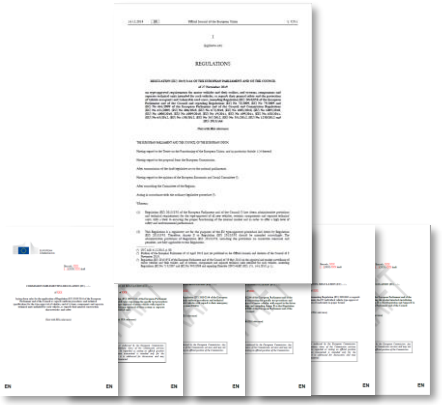
- New approach to road safety
- *No loss of life is acceptable*
- Safe System at EU level
- Taking advantage
- Global debate

Further considerations

- Customer safety demand
- Increasing availability
- Closing the gap
- Taking the lead
- § Law as driver and enabler

New GSR

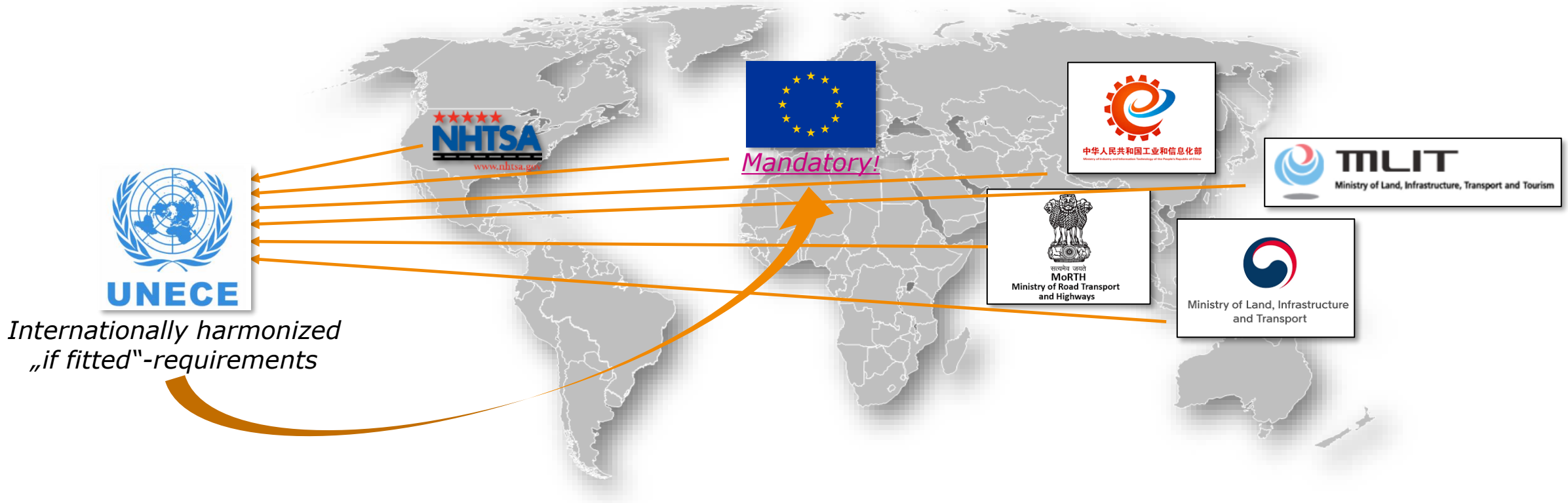
Regulation (EU) 2019/2144



A drastic shift in EU‘s road safety policy as well as other urgent needs has led to the adoption of a new regulation called „new GSR“. It is part of EU‘s type approval legislation and makes various ADAS/AD features mandatory from July 2022.

ADAS/AD Legislation in the EU

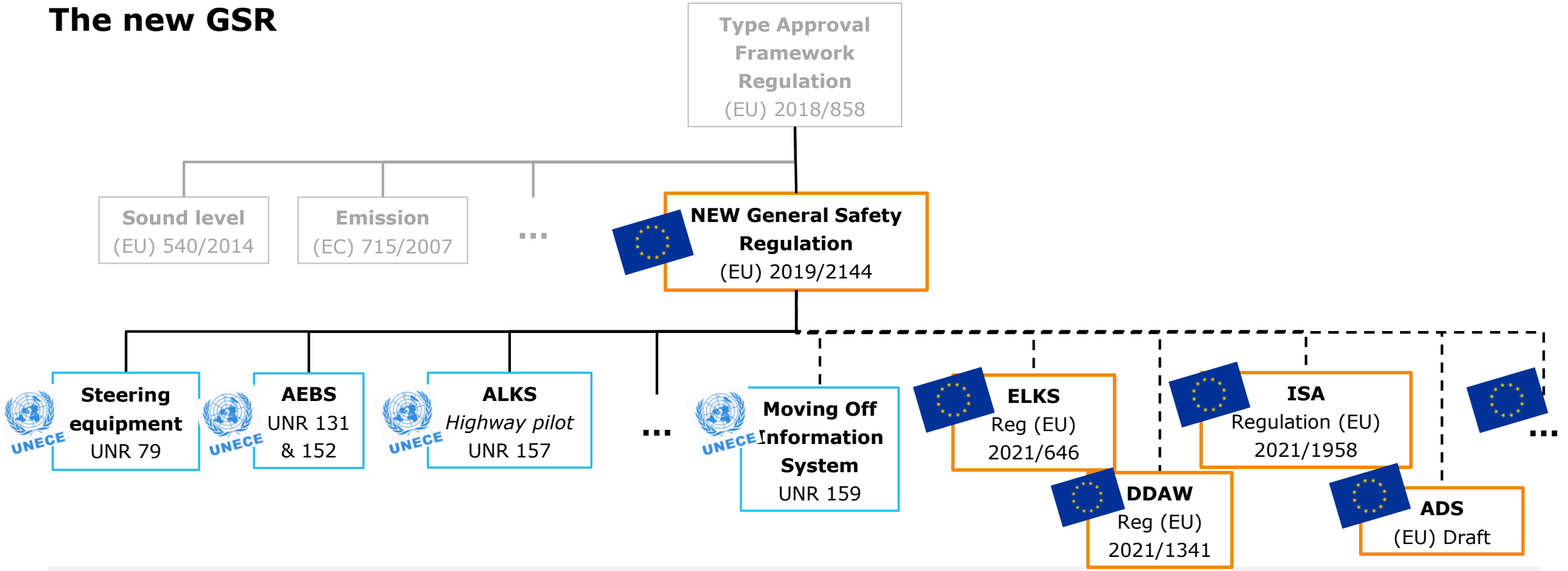
EU Law in perspective



Many different legal initiatives can be observed around the world. The EU takes a pro-active role in the international harmonization of type approval law and makes it mandatory within its market.

ADAS/AD Legislation in the EU

The new GSR

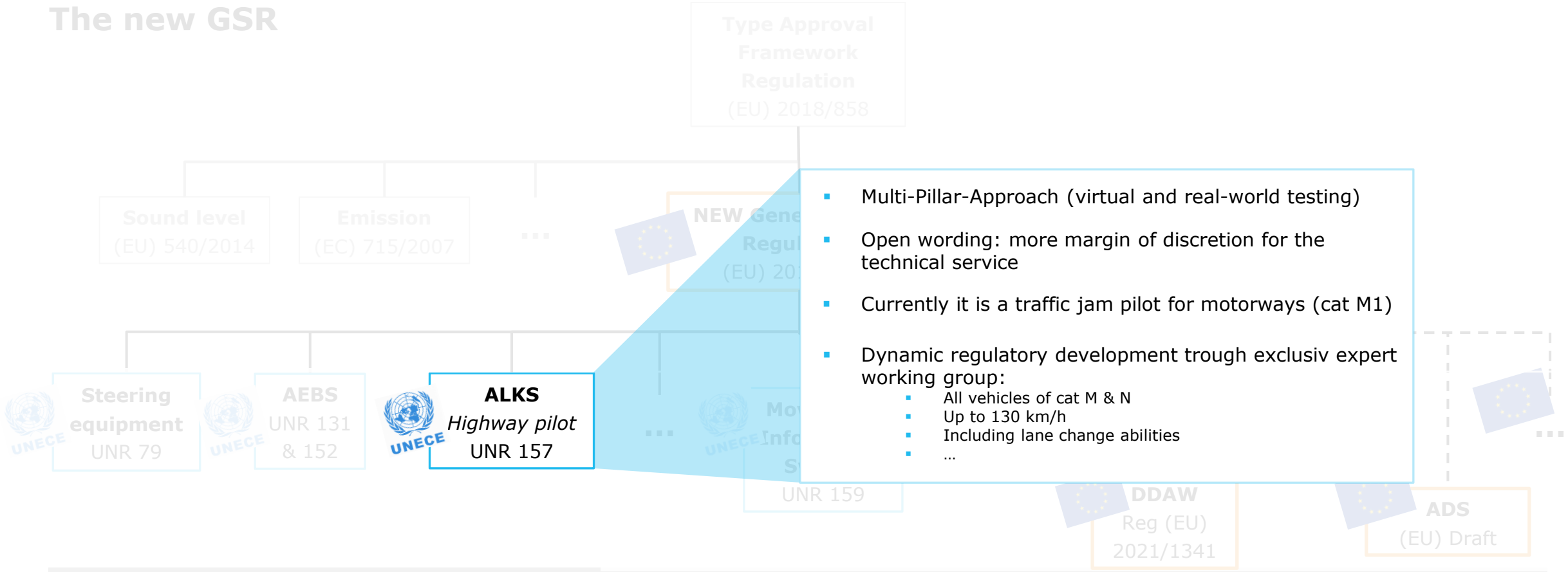


When appropriately available, international type approval law is applied through the new GSR.

If not (yet), the EU implements its own legal specifications. This especially is the case for some GSR features.

ADAS/AD Legislation in the EU

The new GSR



- Multi-Pillar-Approach (virtual and real-world testing)
- Open wording: more margin of discretion for the technical service
- Currently it is a traffic jam pilot for motorways (cat M1)
- Dynamic regulatory development trough exclusiv expert working group:
  - All vehicles of cat M & N
  - Up to 130 km/h
  - Including lane change abilities
  - …

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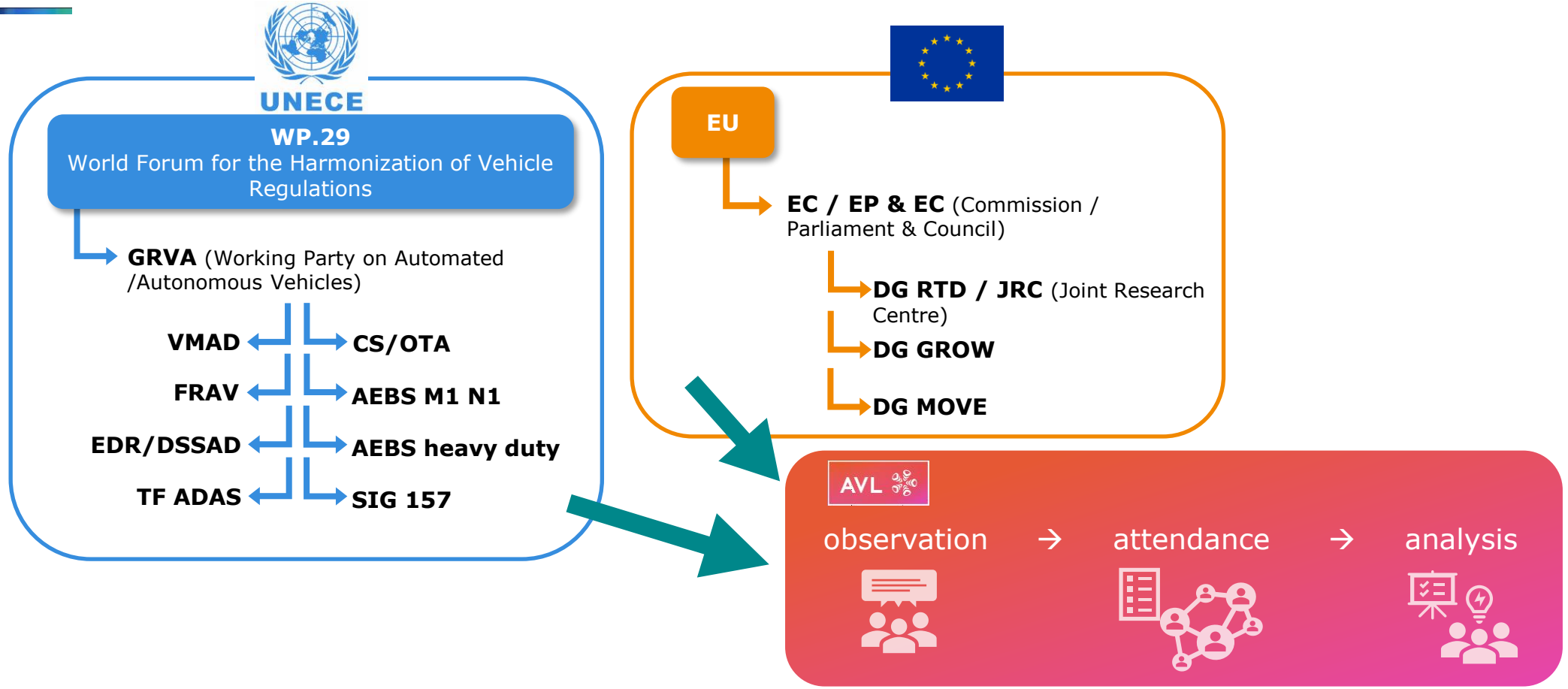
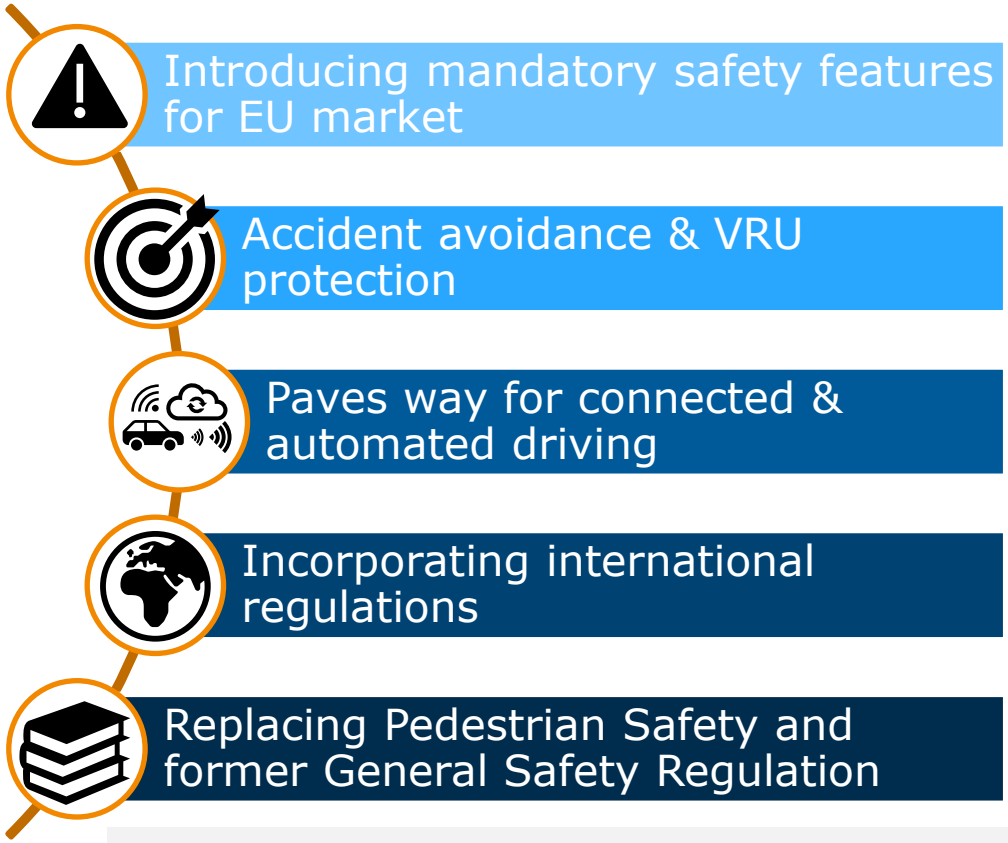
ADAS/AD Legislation in the EU



For us, achieving GSR-compliance means: closely monitoring legal discussions, early reviewing drafts and anticipating future legislation as well as providing that legal intelligence to engineering departments through tailor-made support.

ADAS/AD Legislation in the EU

The new GSR

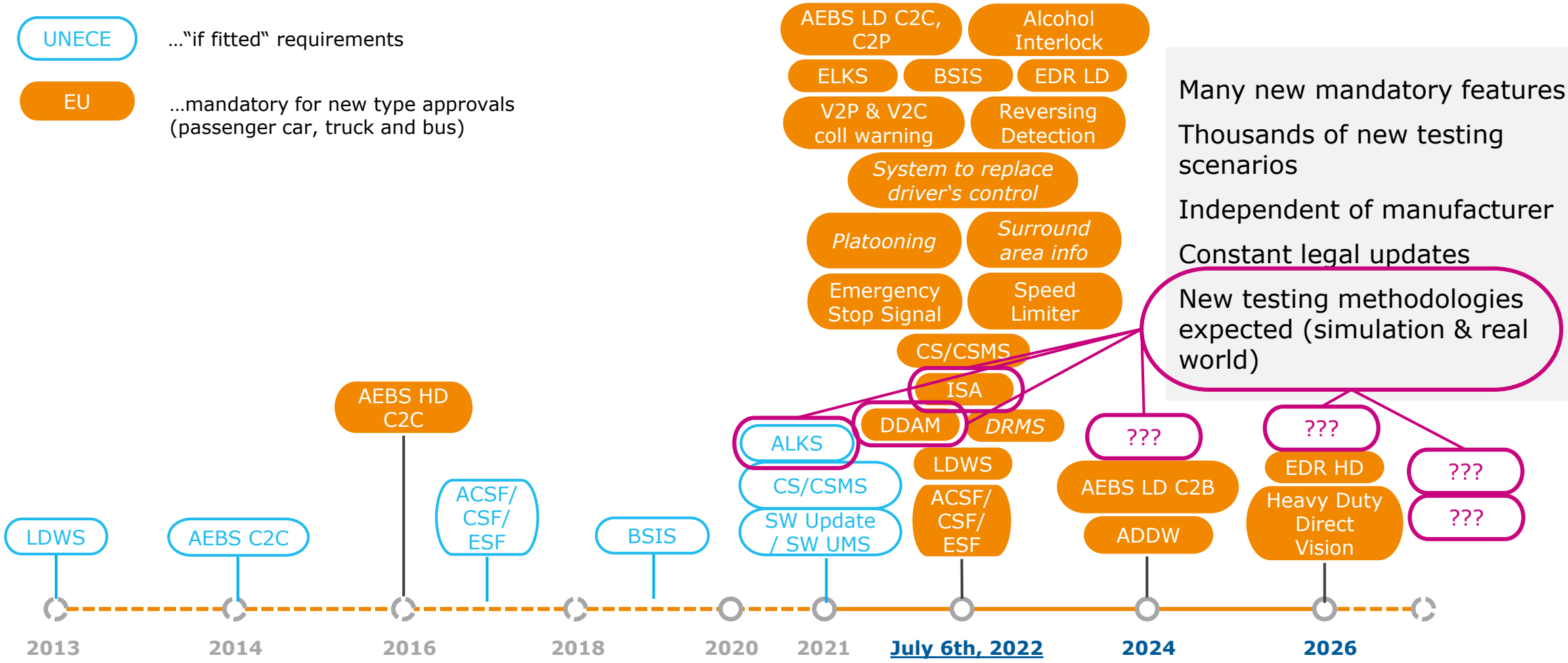


- ✓ Advanced active, passive & general safety features
- ✓ First law to make ADAS/AD features mandatory
- ✓ ~22 ADAS/AD related features (M1 – N3)
- ✓ Multi-pillar approach in preparation (virtual & real-world testing)
- ✓ Modular & flexible

The new GSR introduces new legal obligations for the development of ADAS/AD that affect all manufacturers. New concepts such as virtual and real-world testing will soon be implemented giving opportunities to the automotive industry.

ADAS/AD Legislation in the EU

The new GSR



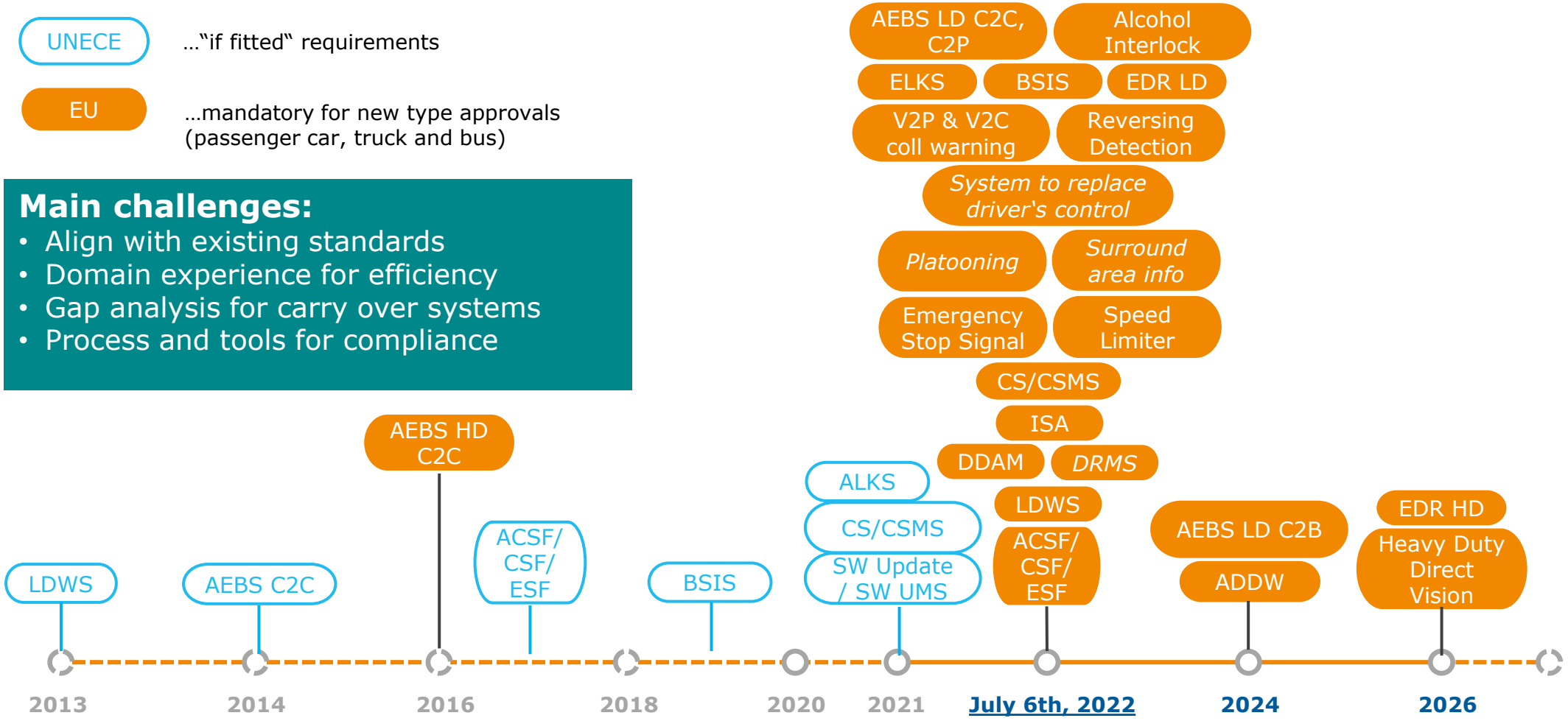
ADAS/AD Legislation in the EU

The new GSR

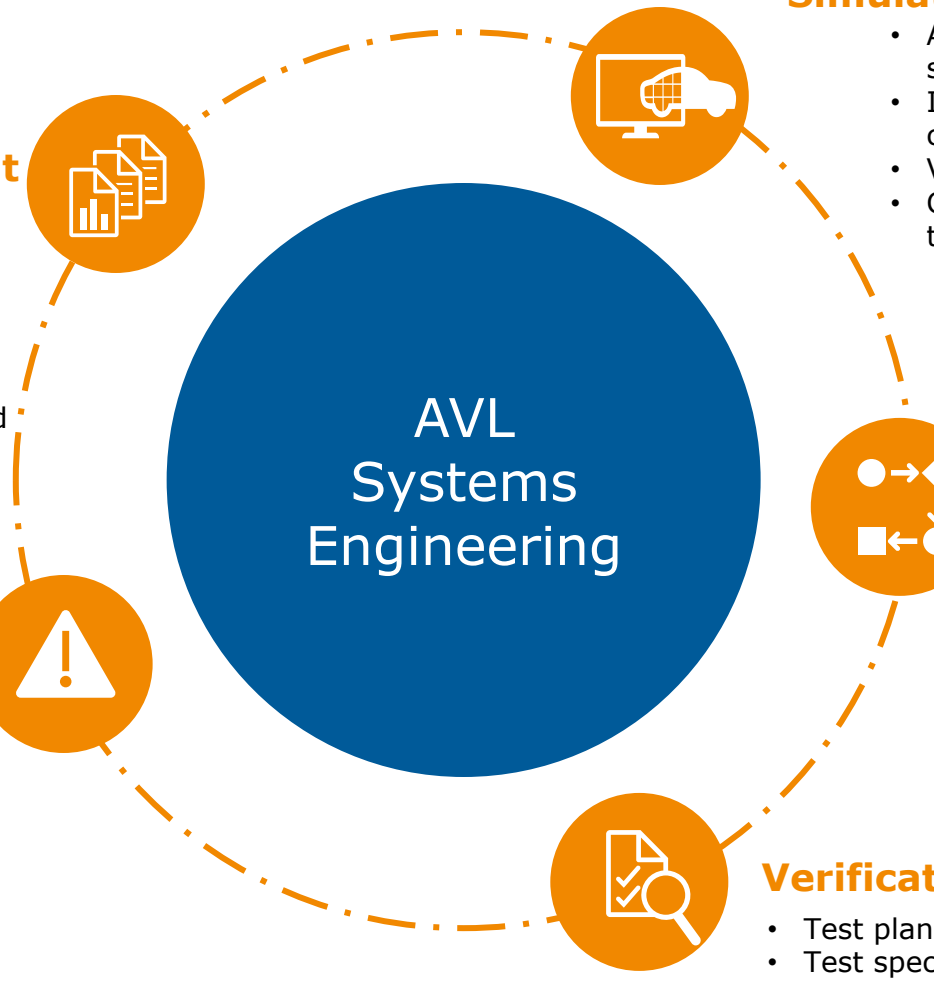
UNECE …"if fitted" requirements

EU …mandatory for new type approvals (passenger car, truck and bus)

Main challenges:
- Align with existing standards
- Domain experience for efficiency
- Gap analysis for carry over systems
- Process and tools for compliance



ADAS System Engineering Areas



System Design and Requirements Management

- Stakeholder, standards and legislation
- Vehicle/system use case definition
- Requirement development and management
- Functional component requirements
- Interface definitions with vehicle and infrastructure
- Modeling, design and specification

Simulation & Analysis

- ADAS/AD sensor architect/ functionality studies
- Integration into powertrain and vehicle concept
- Vehicle energy simulation
- Co-simulation (with AVL and non-AVL tools)

Process management

- Function based release management
- Configuration management
- Change and concern management
- Process establishment and quality assurance

Safety Engineering

- Functional Safety (ISO 26262)
- SOTIF (ISO/PAS 21448)
- FMEA, FMEDA, FTA, and STPA
- Vehicle safety concepts

Verification & Validation

- Test planning & management
- Test specification, preparation and execution

Focus Areas for GSR

System Design and Requirements Management

- Stakeholder, standards and legislation
- Vehicle/system use case definition
- Requirement development and management
- Functional component requirements
- Interface definitions with vehicle and infrastructure
- Modeling, design and specification

Optional for GSR 2024

Safety Engineering

- Functional Safety (ISO 26262)
- SOTIF (ISO/PAS 21448)
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Optional for GSR 2024

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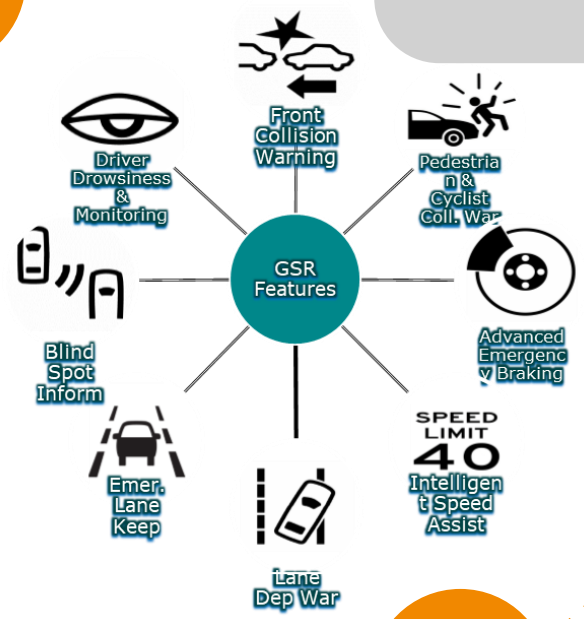


Process management

- Function based release management
- Configuration management
- Change and concern management
- Process establishment and quality assurance

Verification & Validation

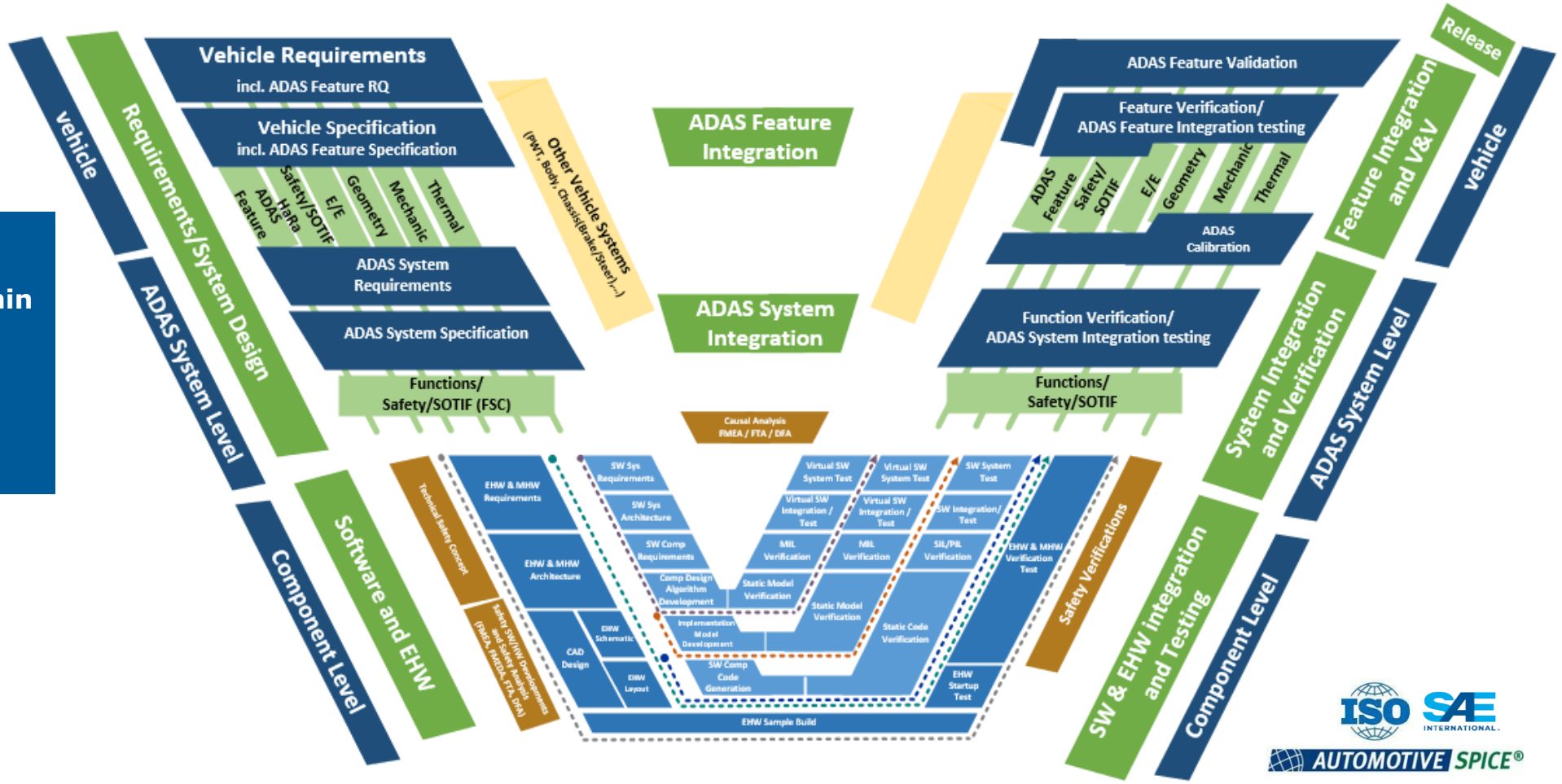
- Test planning & management
- Test specification, preparation and execution

Icon source: ISO-2575

ADAS Development Process at AVL

ADAS development:

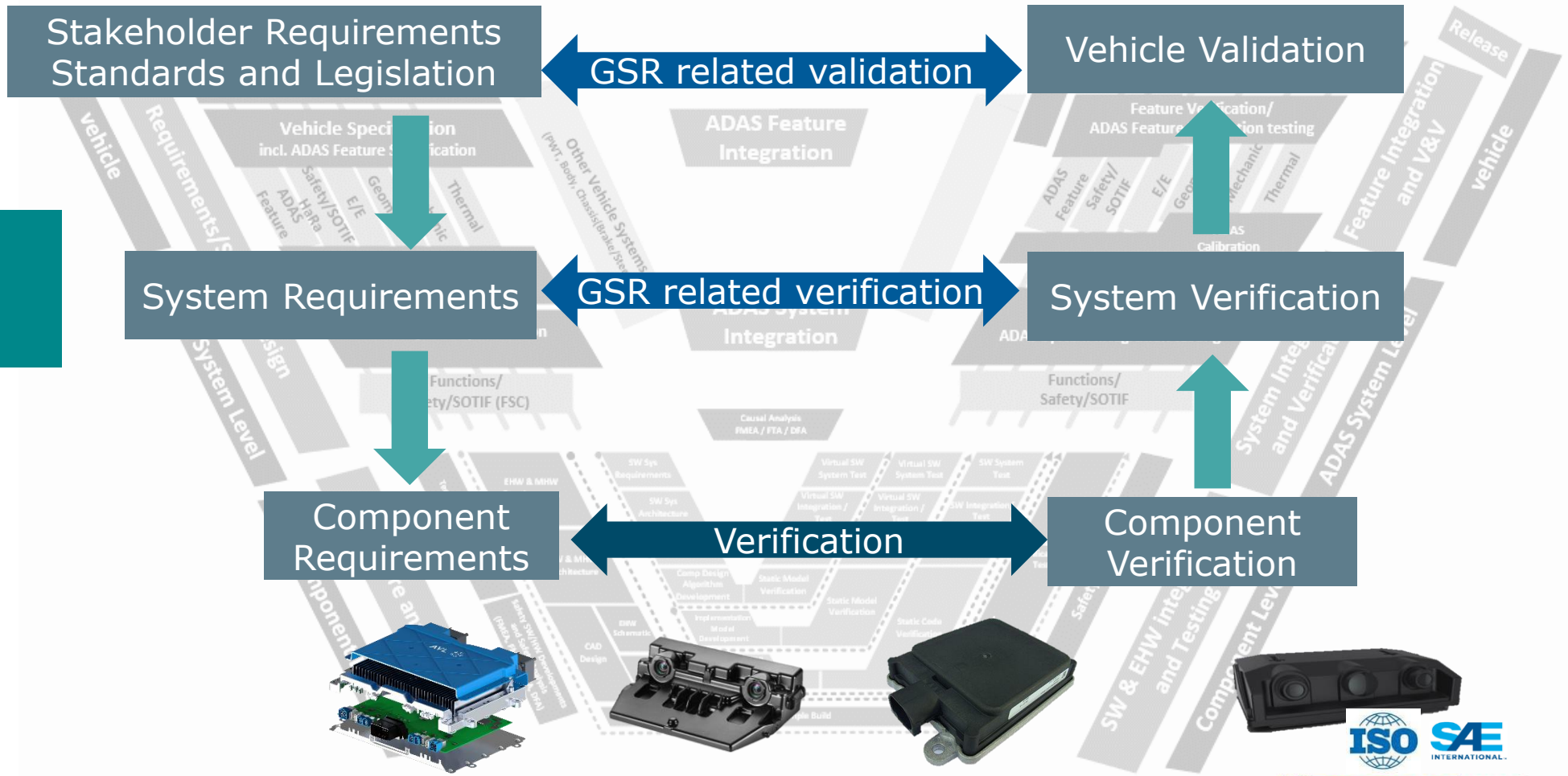
- **Standalone or embedded within complete vehicle projects**
- **Passenger cars**
- **Commercial vehicle**



AVL offers ADAS/AD within the **complete vehicle development process**. Therefore, expert knowledge for **all interfacing** technologies (powertrain, chassis, E/E, software, safety, communication, cyber security, …) and quality assurance is available.

Tailoring for GSR

- **Experience in mandatory standards and legislation**
- **Predefined** packages for **GSR**



Sensor images: AVL, Denso, Continental, ZF

Tailoring for GSR

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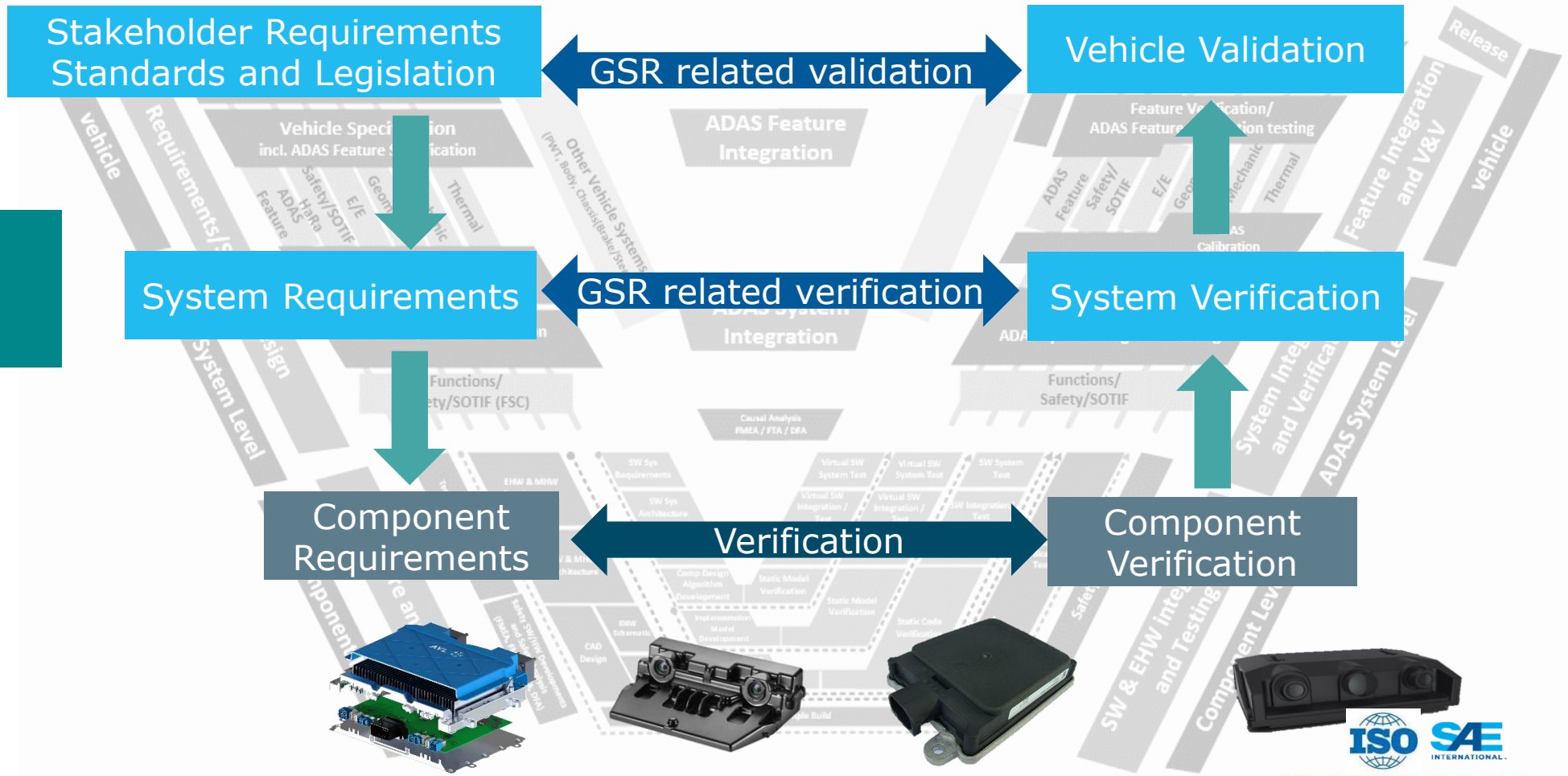
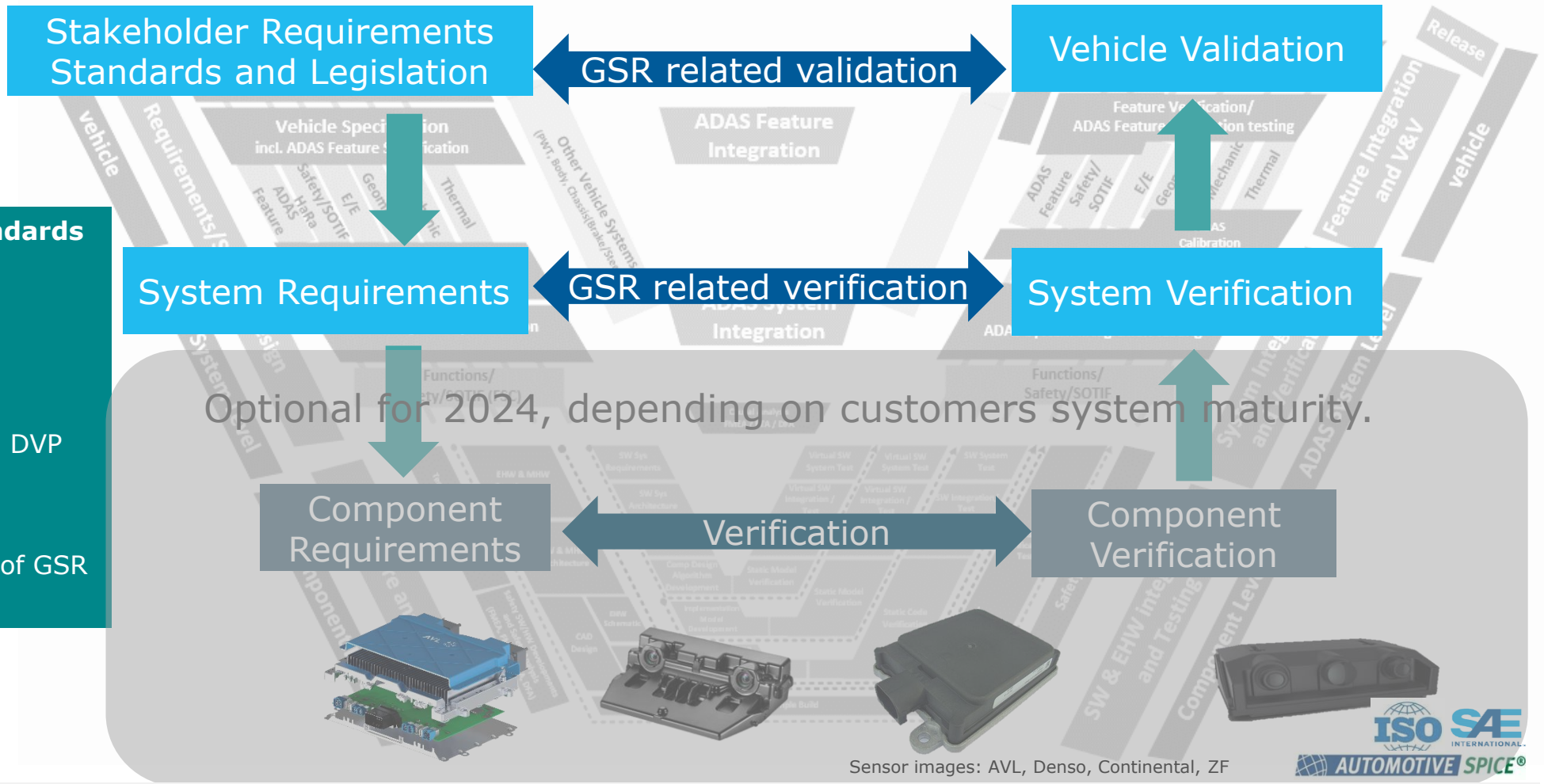


Sensor images: AVL, Denso, Continental, ZF

Tailoring for GSR 2022 - 2024

- **Experience in mandatory standards and legislation**
- **Predefined** packages for **GSR**
- **Depending on project scope:**
  - Review and definition of requirement for GSR related DVP on system level
  - Supervising related testing activities
  - Support serial development of GSR related ADAS features.



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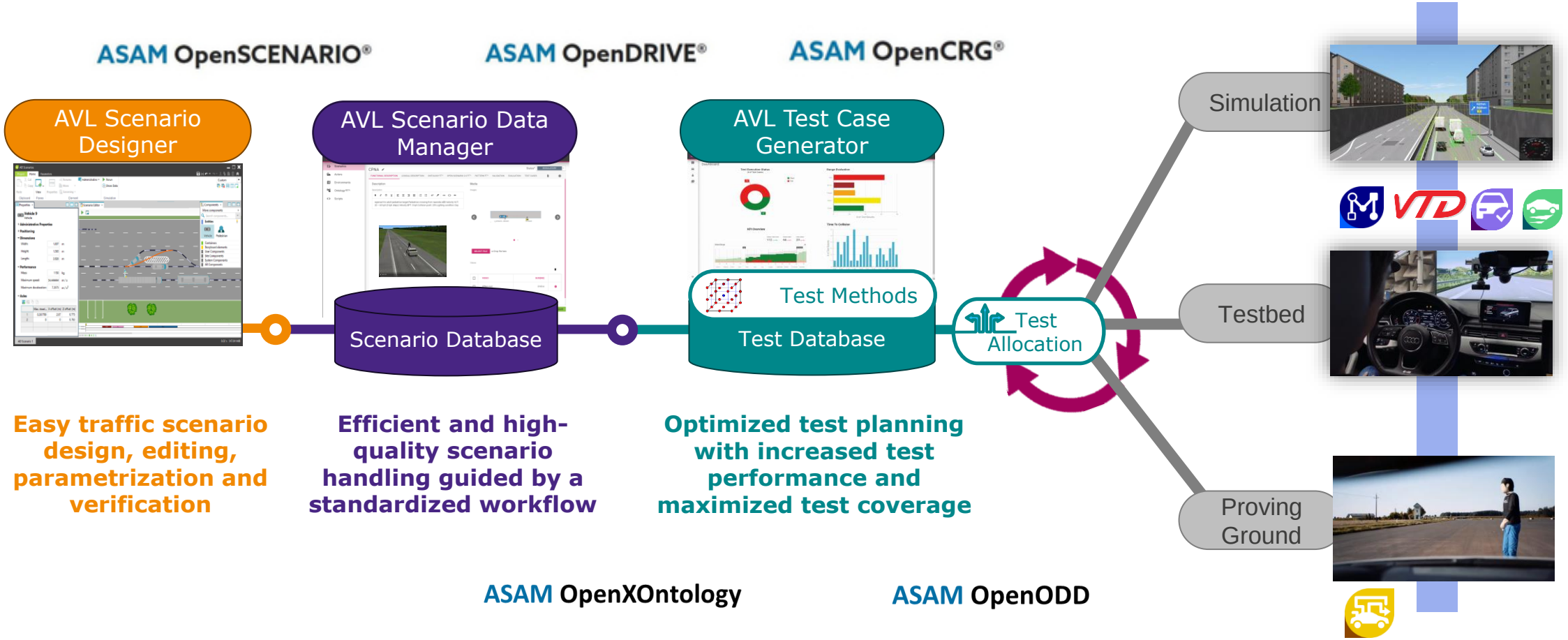
AVL offers a tool-chain to **fulfill traceability according to ISO26262 and Automotive SPICE** from requirement to software and hardware development as well as final system verification and validation.

AVL SCENIUS™
Scenario-based Test Preparation, Planning, Execution



Safety Argumentation, Data Consistency, Seamless Interfaces, Traceability

AVL SCENIUS™ - Scenario Data Packages

Euro NCAP Package

Complete NCAP test plan and test cases, such as C2C, VRU, LSS

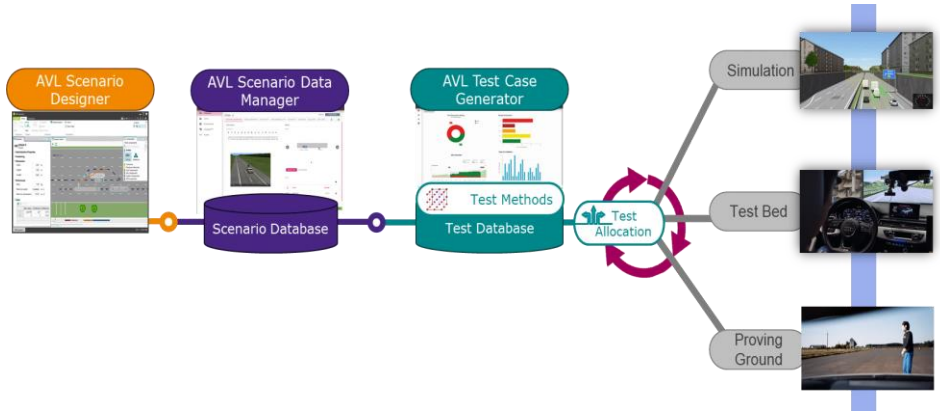
General Safety Regulation Package

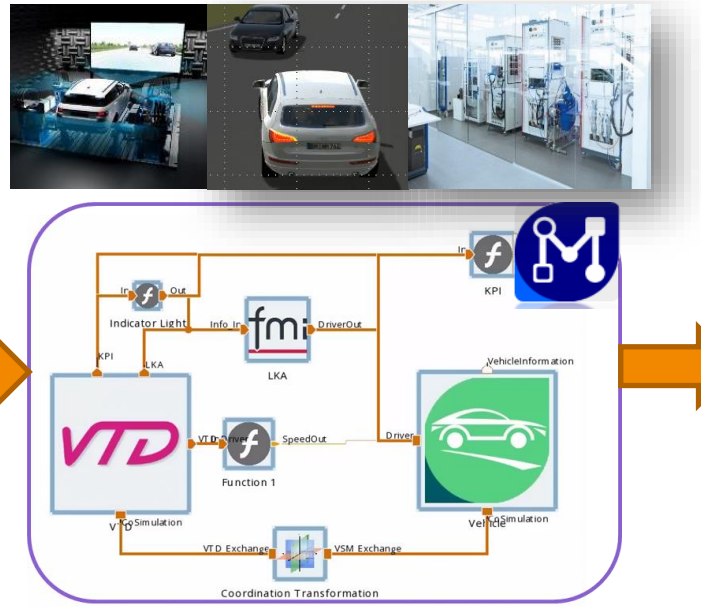
Scenarios to for UNR 89, 130, 131, 151, 152, 157 etc.

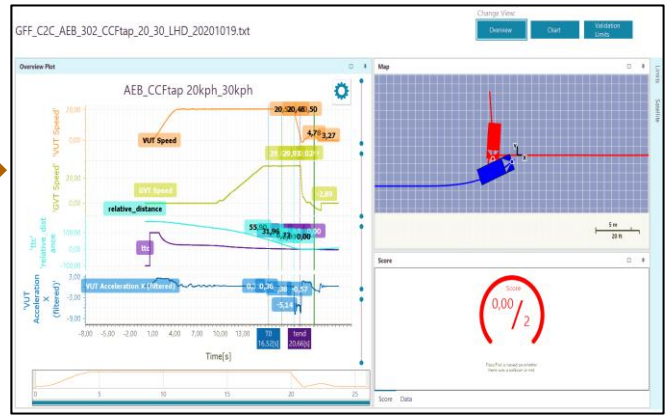
Road & Highway L1/L2/L3 Package

Various selected scenarios for typical ADAS/AD systems, such as highway pilot, ISR, BS, AEB, Parking etc.

AVL SCENIUS™
Scenario Execution and Evaluation







AVL SCENIUS™
Preparation, Planning

AVL Model.Connect™
Co-Simulation
Execution Environment

AVL Smart ADAS Analyzer™
Test Validation and KPI
Calculation

AVL System Engineering Benefits for GSR

Understanding legislation

- GSR
- UNECE
- Country specific

Knowledge on standards

- Process related
- Component level
- Safety

Complete vehicle competence

- Passenger car
- Commercial vehicle
- Project specific build

ADAS domain know-how

- Competitor analysis
- Driving comfort benchmark DB
- L0-4 features development

AVL contribution -> shorter lead time

- Continuous review and evaluation done
- Derive technical requirements to be GSR compliant
- Existing database and toolchain ready for testing

AVL contribution -> standard compliance

- Long-term experience
- Experts in various departments
- Tool driven traceability

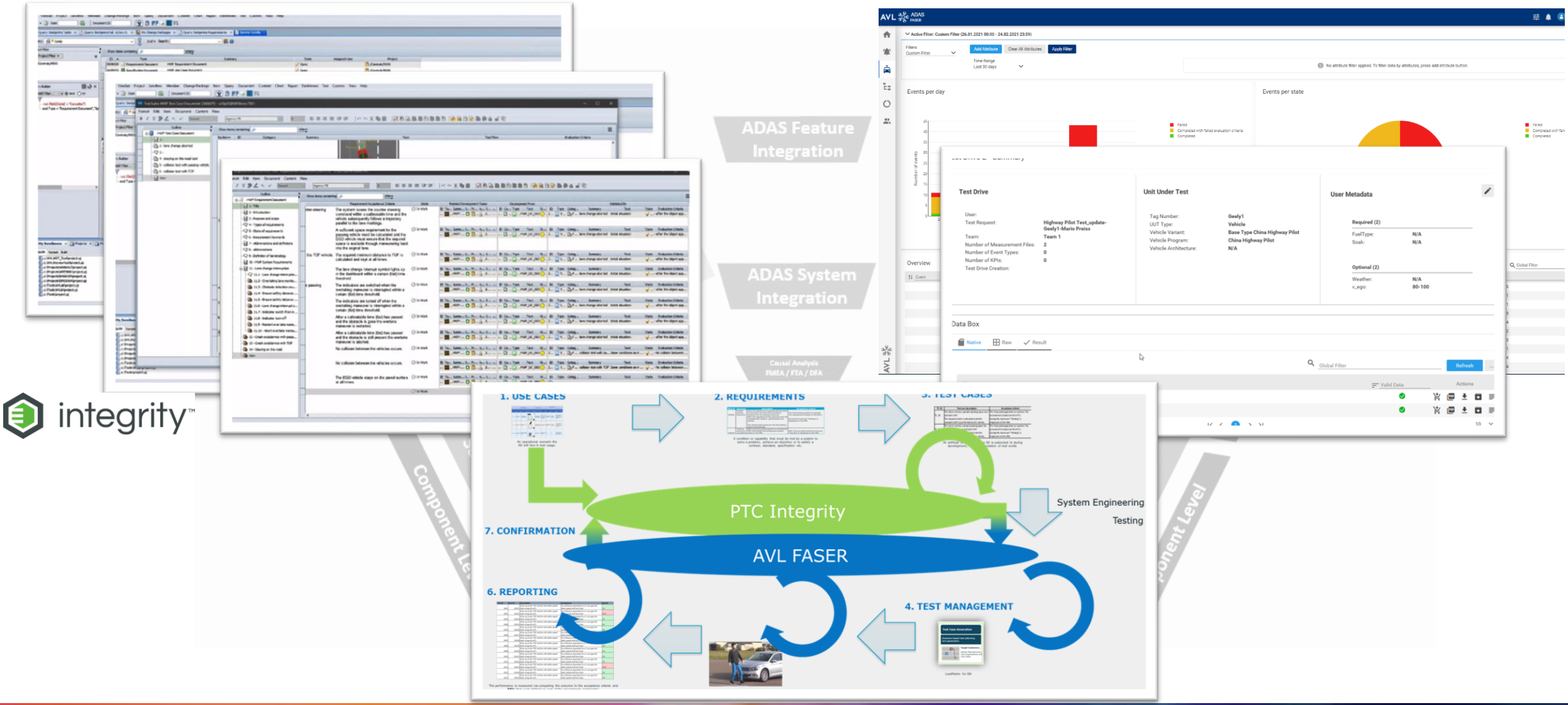
AVL contribution -> all-in-one solution

- Support component and interface issues
- Setup test vehicles
- Prototype build-up

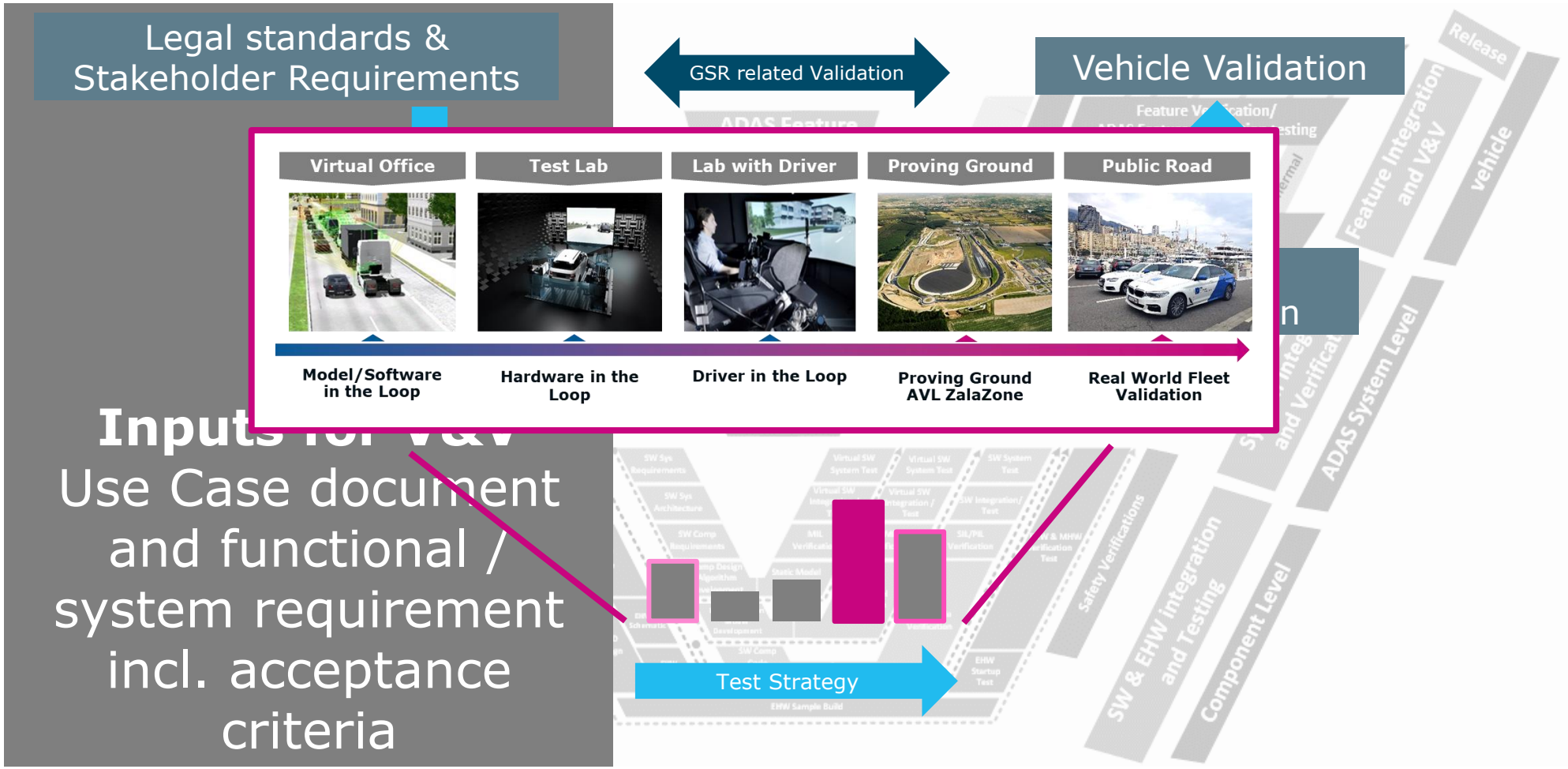
AVL contribution -> on demand ADAS expertise

- Project experience beyond GSR
- Testing infrastructure
- Tech centers available worldwide

GSR Compliance by tool-based Traceability



Generic Verification & Validation Process



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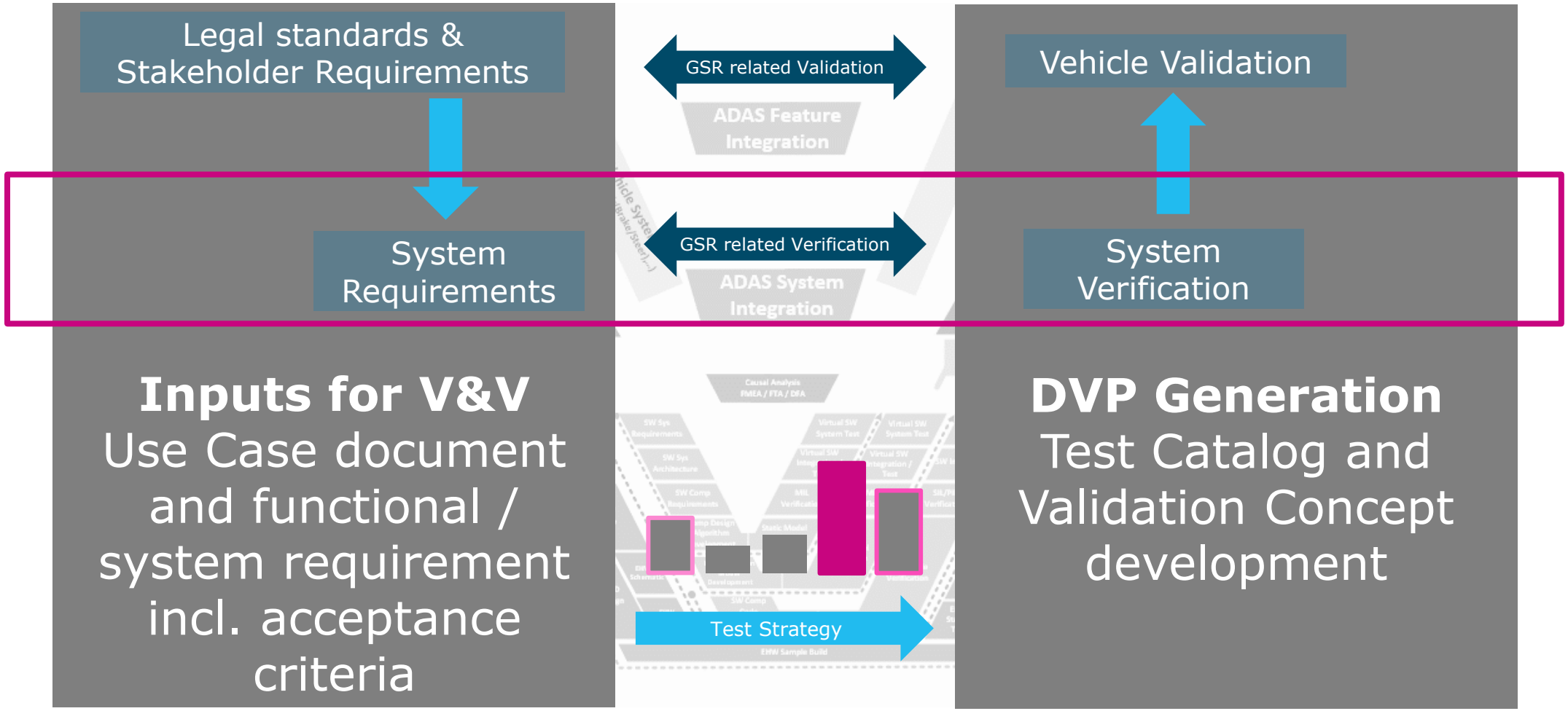
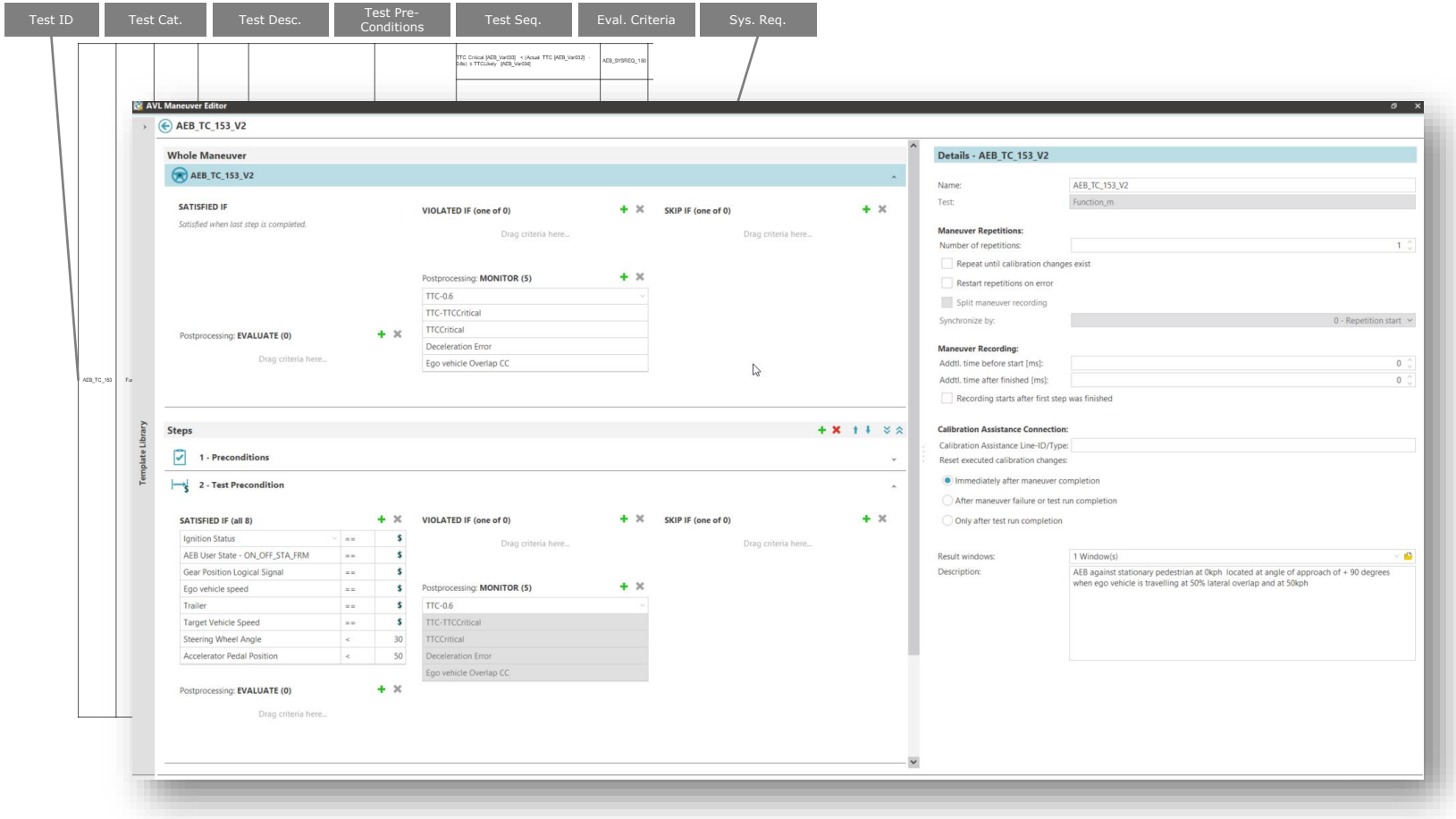


Proving Ground DVP Generation

Verification Catalog for Proving Ground Testing

1. Test Groups derived from Use Cases
2. Test Cases incl. variants and parameter
3. Creation of machine-readable test cases incl. preconditions, analytics and reporting (AVL-SMS™)

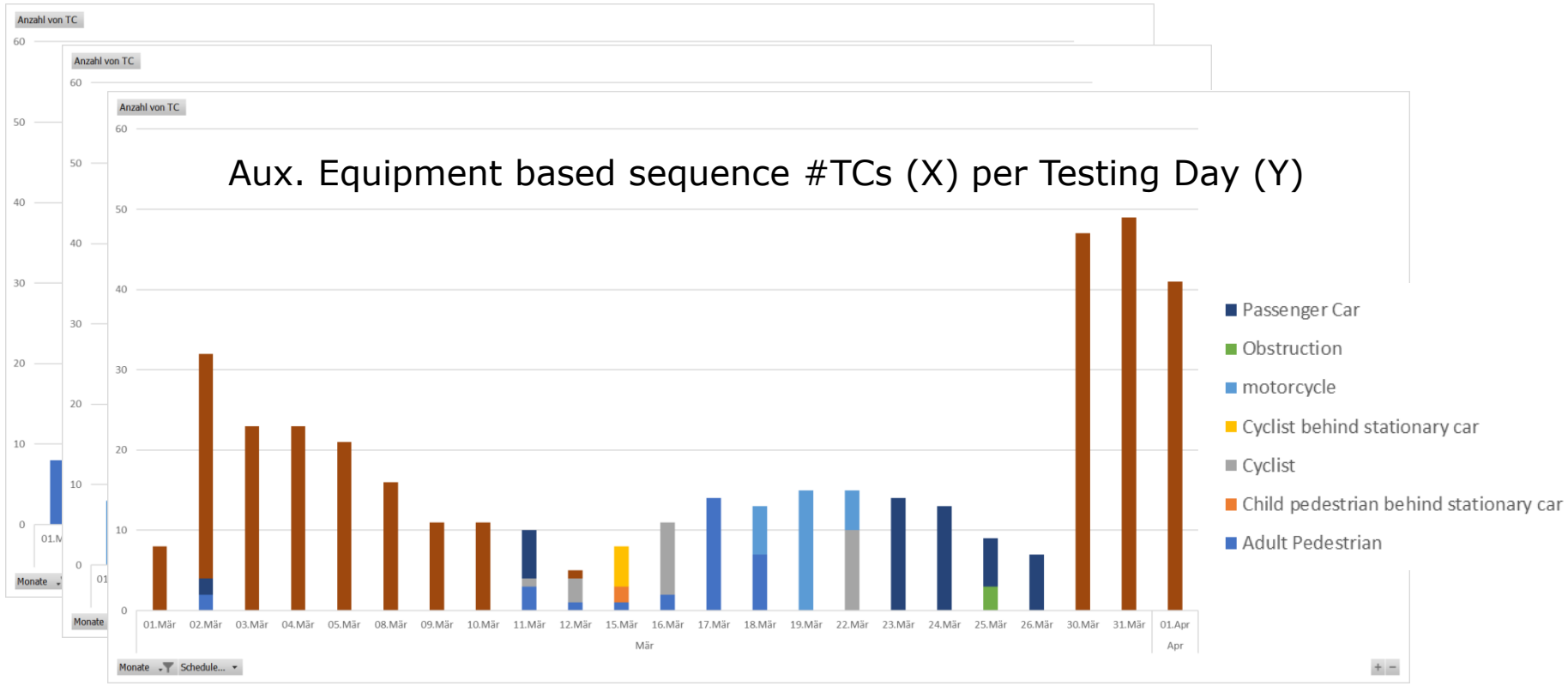


Machine-readable format enables interoperability between testing domains and methods

Proving Ground
Test Program Optimization

Test Catalog for Proving Ground

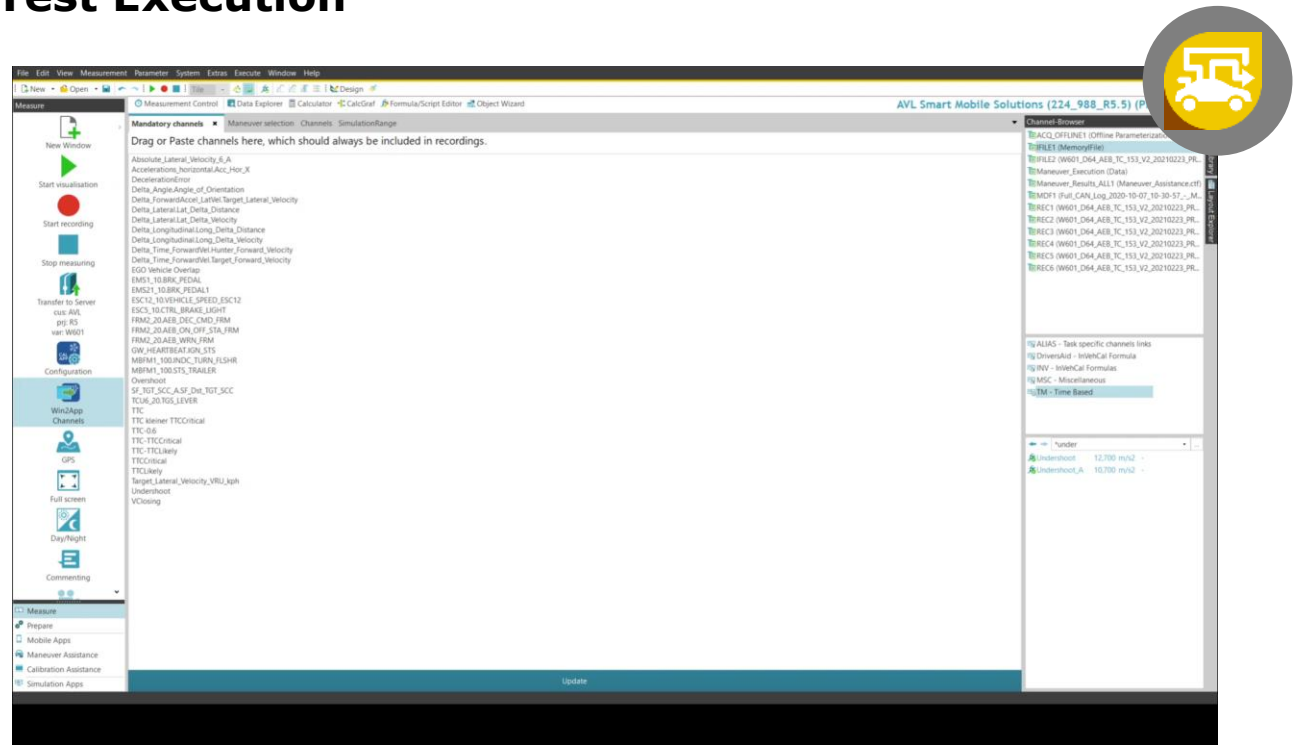
- Features
- Test Category
- Auxiliary Equipment



Sophisticated planning is essential for efficiency

Proving Ground
Test Program Execution

Assisted Test Execution

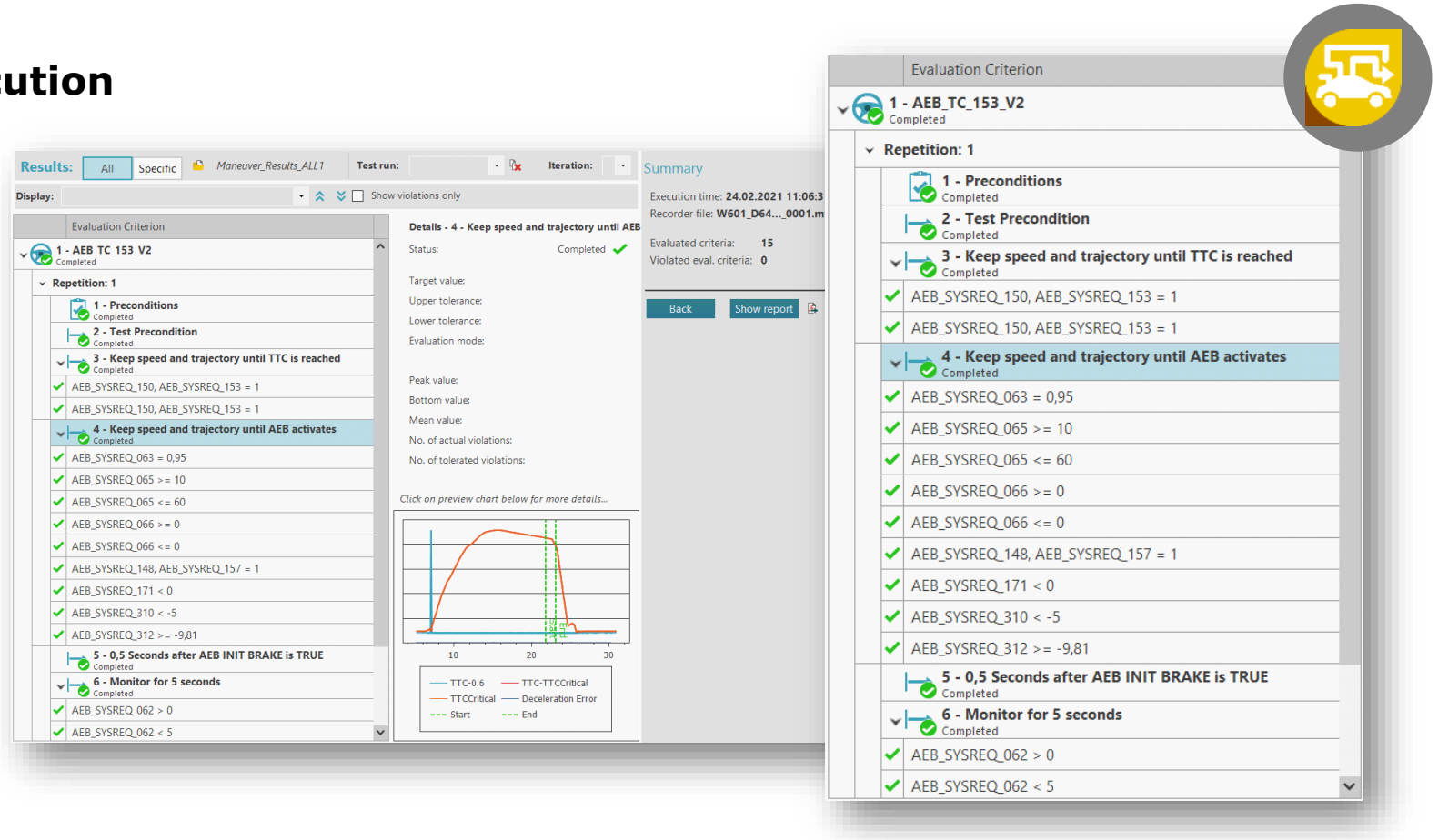


AVL – Smart Mobile Solution™

Ensuring high level of quality and less repetition loops (40% faster)

Proving Ground
Test Program Execution

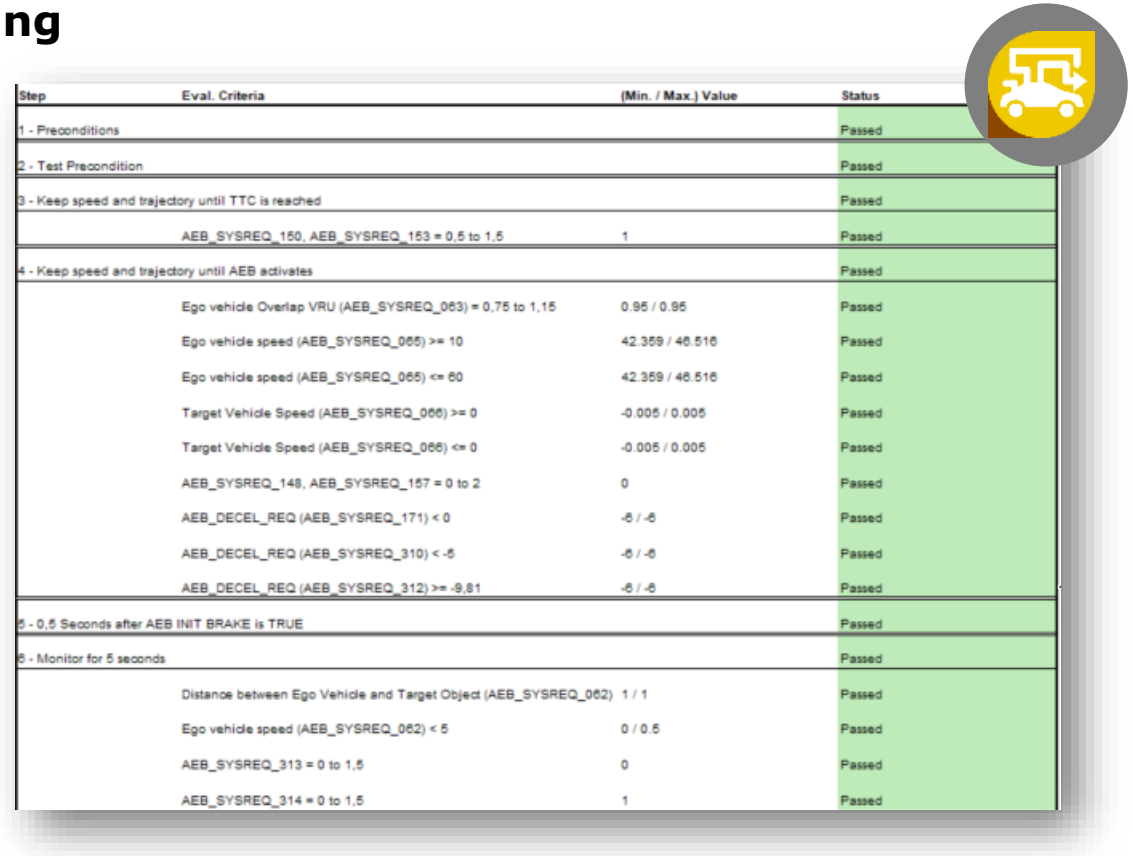
Assisted Test Execution



Constant in-vehicle feedback if test needs to be re-executed

Proving Ground
Test Program Execution

Test Analytics and Reporting

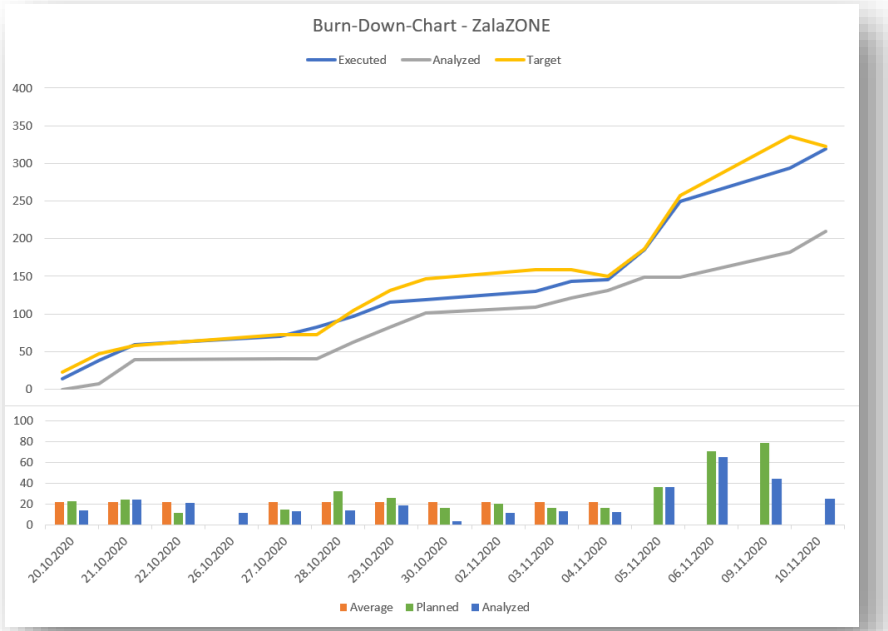


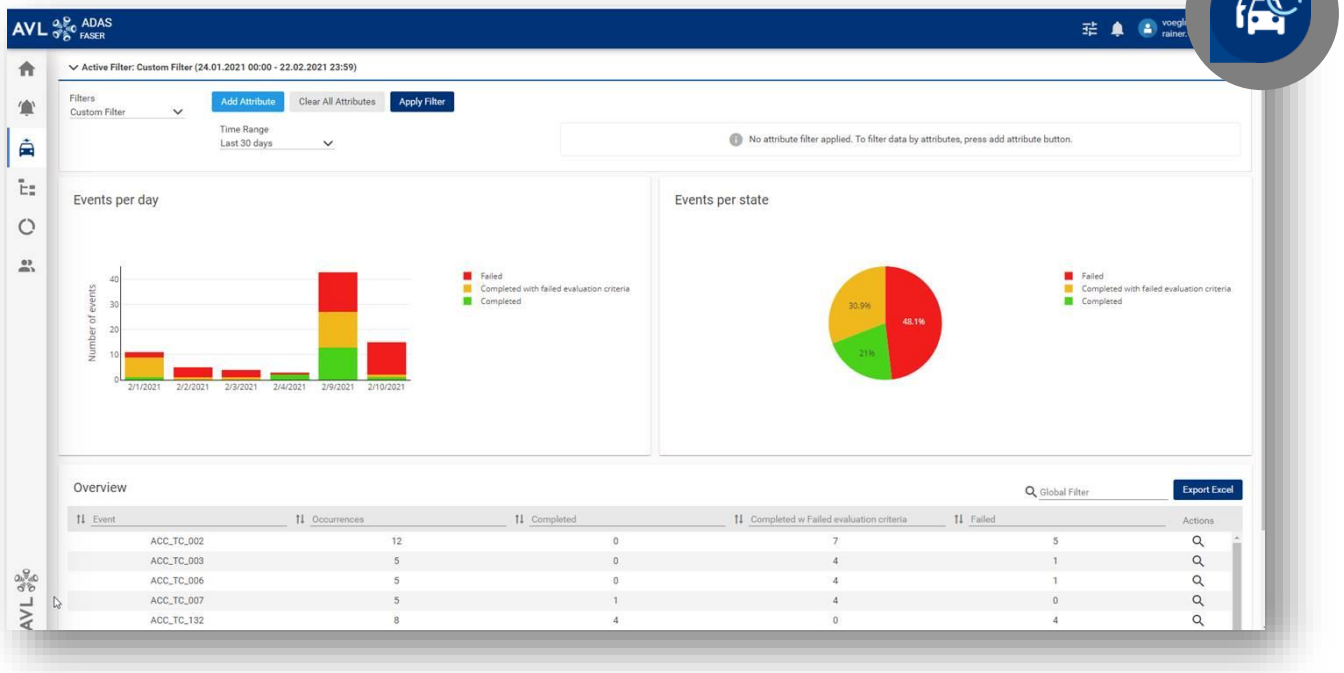
Step	Eval. Criteria	(Min. / Max.) Value	Status
1 - Preconditions			Passed
2 - Test Precondition			Passed
3 - Keep speed and trajectory until TTC is reached			Passed
	AEB_SYSREQ_150, AEB_SYSREQ_153 = 0,5 to 1,5	1	Passed
4 - Keep speed and trajectory until AEB activates			Passed
	Ego vehicle Overlap VRU (AEB_SYSREQ_063) = 0,75 to 1,15	0.95 / 0.95	Passed
	Ego vehicle speed (AEB_SYSREQ_065) >= 10	42.359 / 46.516	Passed
	Ego vehicle speed (AEB_SYSREQ_065) <= 60	42.359 / 46.516	Passed
	Target Vehicle Speed (AEB_SYSREQ_066) >= 0	-0.005 / 0.005	Passed
	Target Vehicle Speed (AEB_SYSREQ_066) <= 0	-0.005 / 0.005	Passed
	AEB_SYSREQ_148, AEB_SYSREQ_157 = 0 to 2	0	Passed
	AEB_DECEL_REQ (AEB_SYSREQ_171) < 0	-6 / -6	Passed
	AEB_DECEL_REQ (AEB_SYSREQ_310) < -5	-6 / -6	Passed
	AEB_DECEL_REQ (AEB_SYSREQ_312) >= -9,81	-6 / -6	Passed
5 - 0,5 Seconds after AEB INIT BRAKE is TRUE			Passed
6 - Monitor for 5 seconds			Passed
	Distance between Ego Vehicle and Target Object (AEB_SYSREQ_062)	1 / 1	Passed
	Ego vehicle speed (AEB_SYSREQ_062) < 5	0 / 0.5	Passed
	AEB_SYSREQ_313 = 0 to 1,5	0	Passed
	AEB_SYSREQ_314 = 0 to 1,5	1	Passed

Online performance and requirement coverage evaluation for reporting

Proving Ground
Test Program Status Monitoring

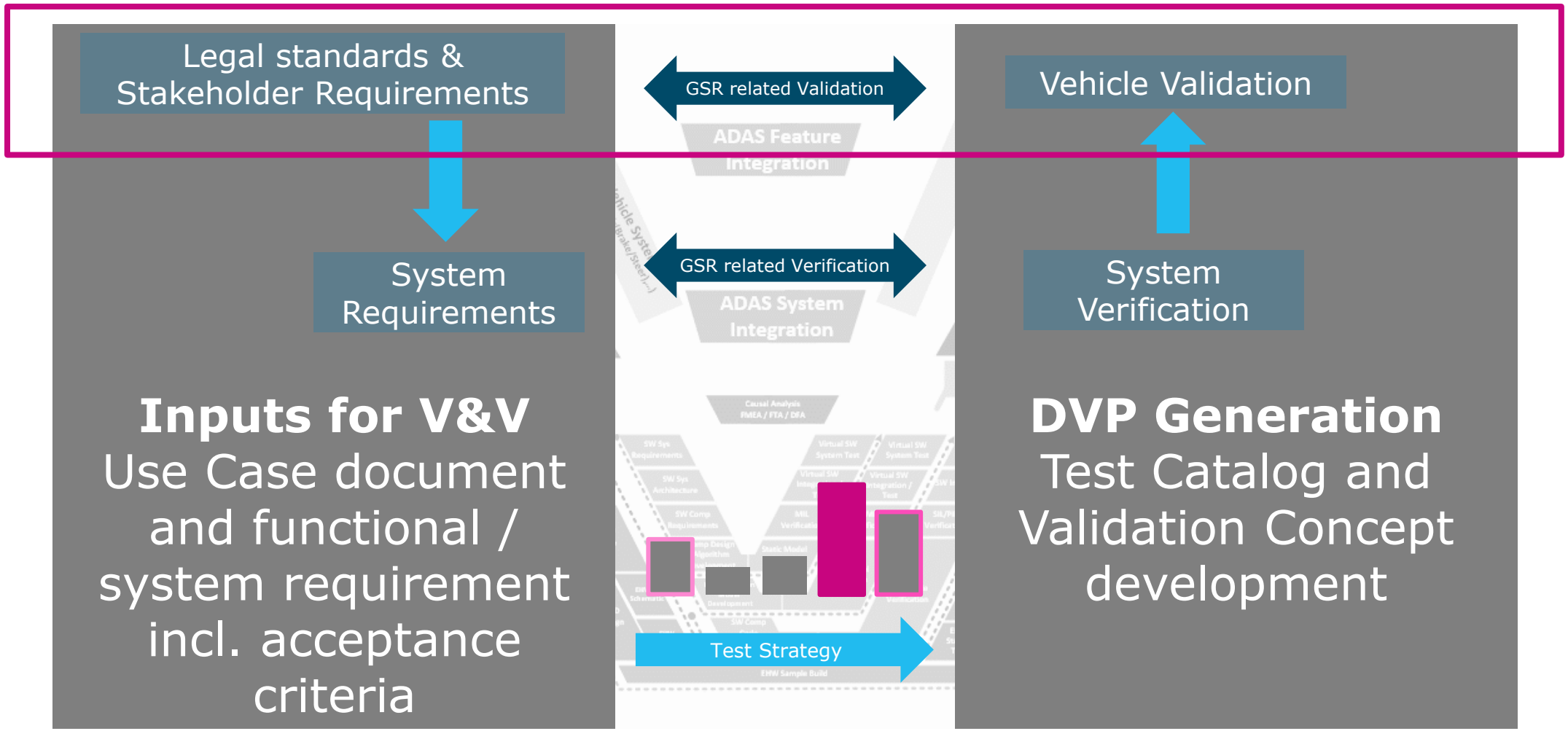
Online Monitoring via OTA Status Transfer





Up-to-date information to all project stakeholders available

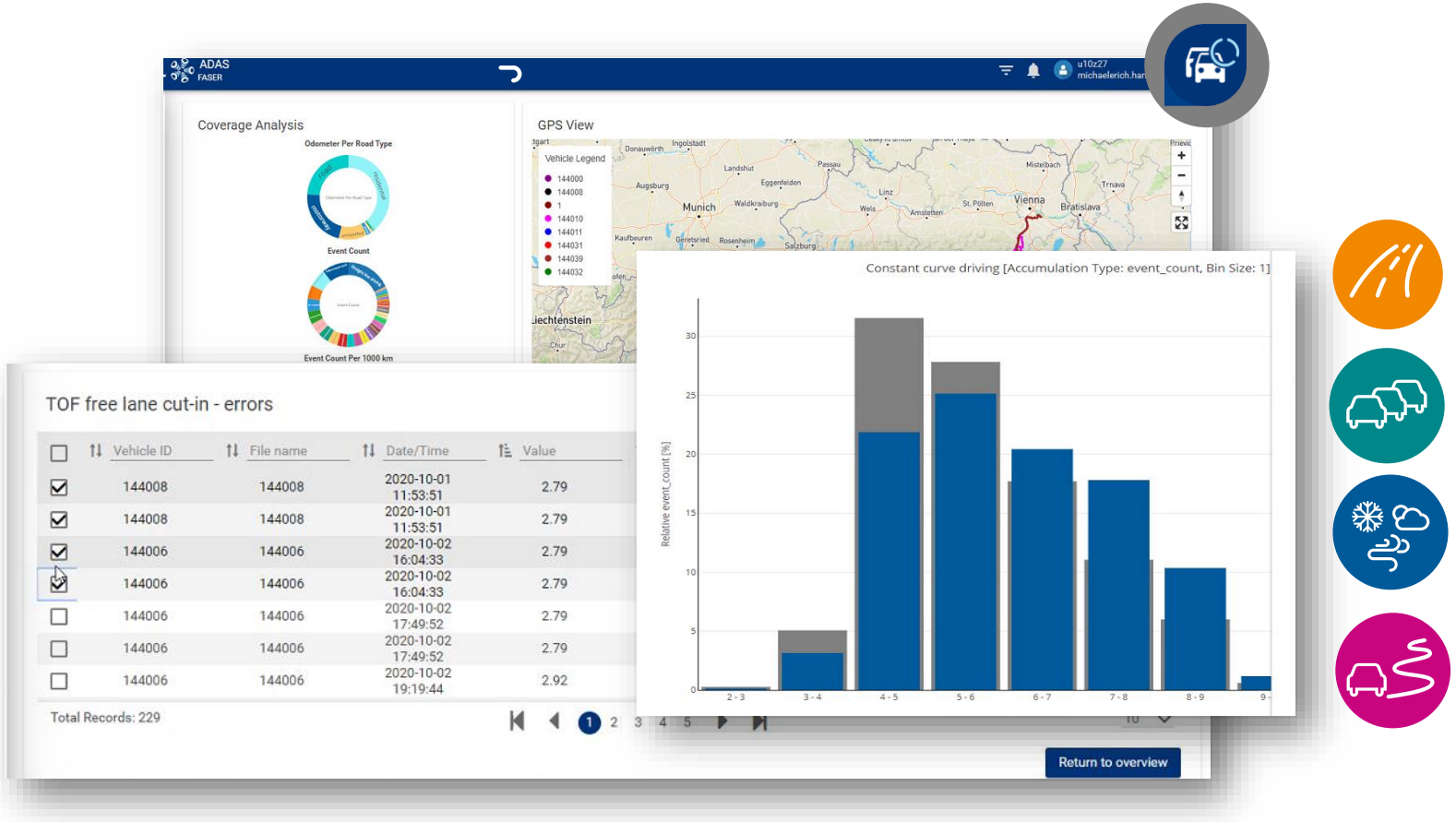
Generic V&V Process



Public Road Analytics and Reporting

Fleet Monitoring for Public Road Testing

1. Route Definition and Optimization
2. Monitoring in real-time
3. Detailed analysis of vehicles' routes incl. performance issues
4. Comparison analysis



Most efficient usage of fleet data

Ecosystem for in-vehicle Testing

Auxiliary equipment

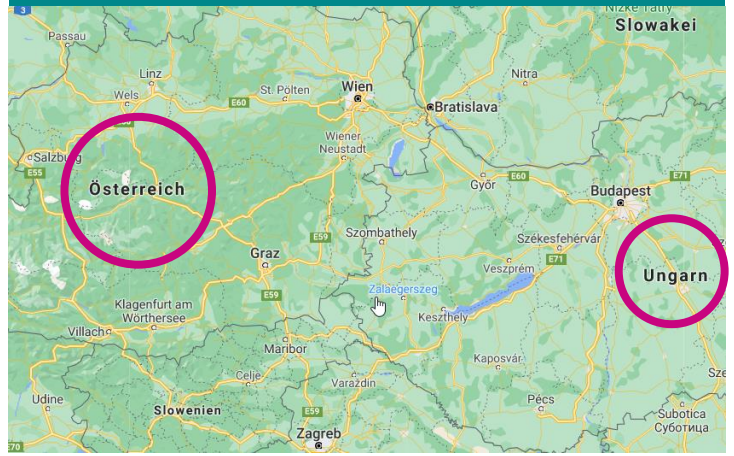
- Scenario testing with EuroNCAP homologated equipment
- VRU: Pedestrian & Bicycle
- GVT: Global & Balloon Vehicle Target

Proving Ground

- AVL-ZalaZONE: Dedicated Proving Ground facility for ADAS/AD Testing
- Various other Proving Ground capabilities

Public Road

- AVL Ground–Truth testing equipment
- Authorized Motorways for ADAS/AD development vehicles in AT and in HU

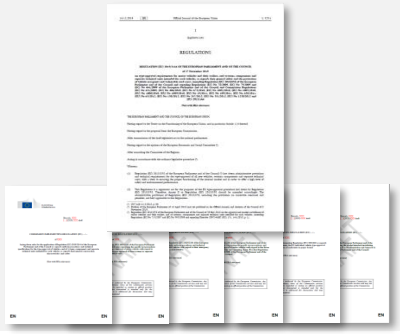


Non-human resources with high diversity for offering turn-key solution

The Added Values –
Compliance and Efficiency in Achieving ADAS GSR

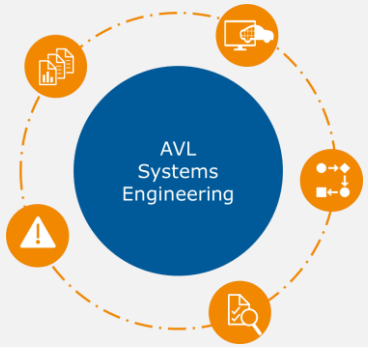
Legal

- Continuous monitoring & legal expertise
- Tailored support for your projects
- Regulatory forecasts and trends analyses



System Engineering

- Shorter lead time
- Compliant to standards
- All-in-one solution
- On demand ADAS expertise



Verification & Validation

- Verification Catalog for Proving Ground Testing
- High level of quality and less repetition
- Highly diverse testing environments available

Contact

LOCATION

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