Hi-Drive
FINAL EVENT
25 NOVEMBER 2025

HI-DRIVE OPERATIONS: TESTING PERFORMANCE AND RELIABILITY OF ADFS FOR EXTENDING AND DEFRAGMENTING ODDS

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#Vehicles, Enablers & Operations

Operations Objectives

TESTS

Conduct tests on open **roads**, on **tracks** and supported by **simulation** focusing on:

- **Technologies for CAD systems:** Connectivity – V2V and V2I –, accurate positioning, digital infrastructure and cybersecurity
- **Challenging situations:** Cross-border corridors, edge and critical driving scenarios, and arctic low visibility conditions

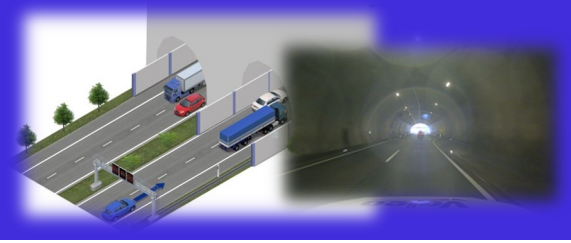
DATA

- Design **data engineering tools** and **database structures** to manage and process data from the experiments.
- Collect data during the tests and **make** this **data available**.

AD function and **Enabling technology**

Digital Infrastructure
Connectivity
Cybersecurity
High Precision Positioning
ML techniques

in …



ODD challenging conditions
low visibility conditions
traffic challenging conditions
cross-border corridors

25 Partners in the Operations Subproject

Hi-Drive Operations

Advanced ADF testing

+ **Hi-Drive Enabler**

- **Connectivity (V2X)**
- **High-precision positioning**
- **Context learning via ML**
- **Cybersecurity**

=

Advanced AD functions

Test on test track

in closed/controlled environments
Simulation based enabler tests.

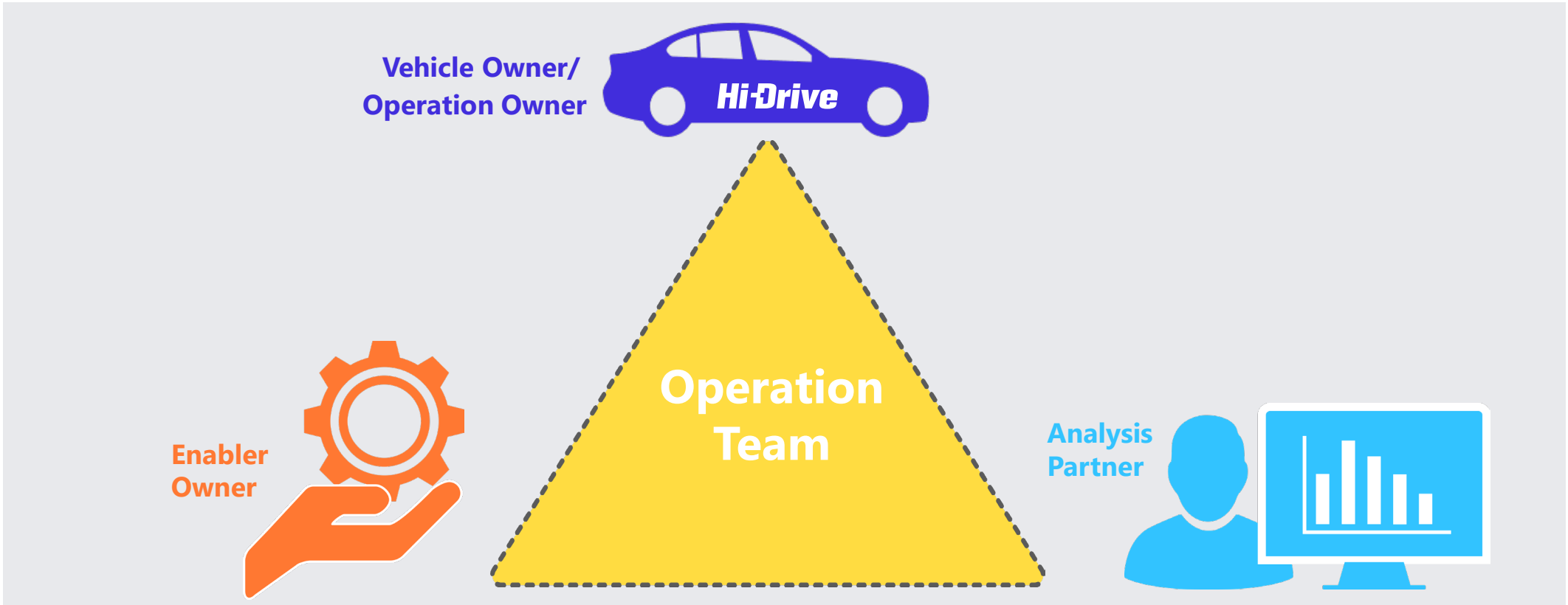
Test on public road

incl. manual driving, automated driving with enabler on/off

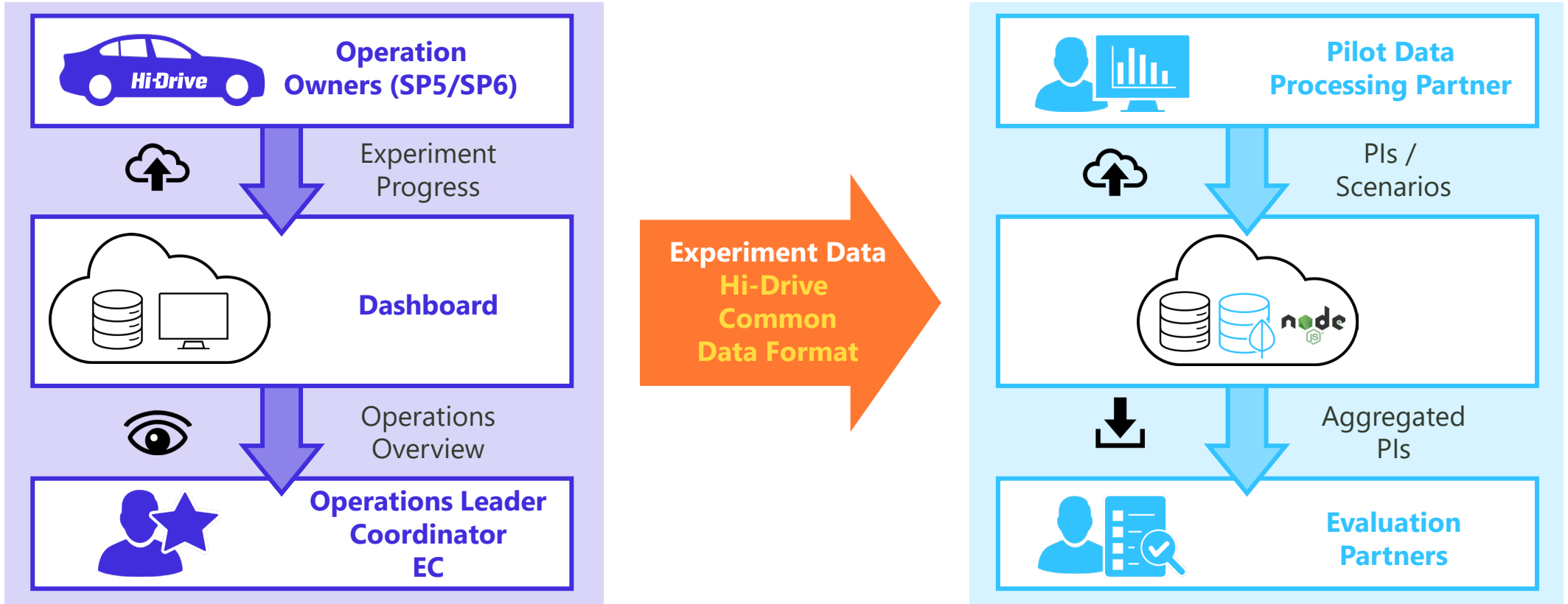
User focused studies

Different user-oriented studies
Simulator, test track, public roads, etc.

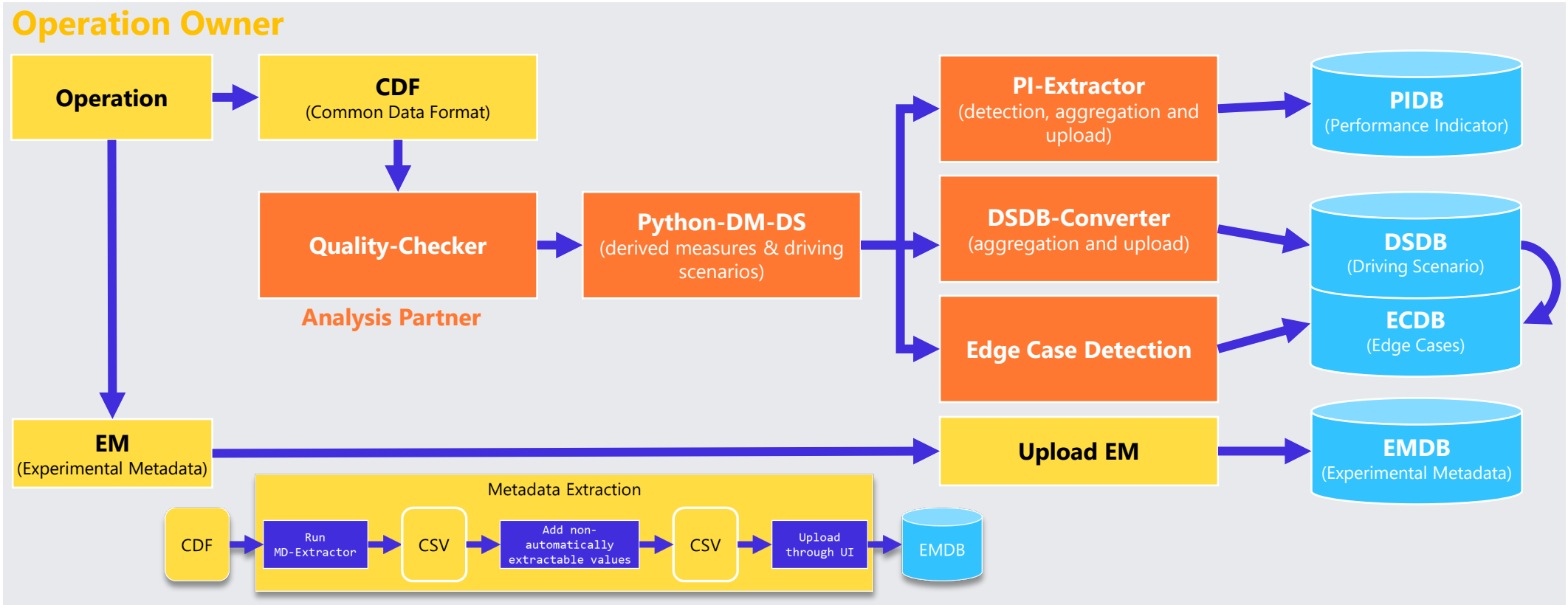
Operations triangular teams



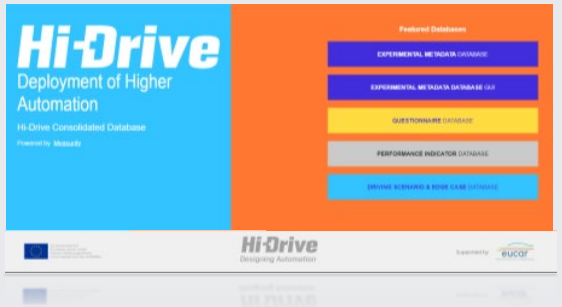
Multi-team Hi-Drive Data Process

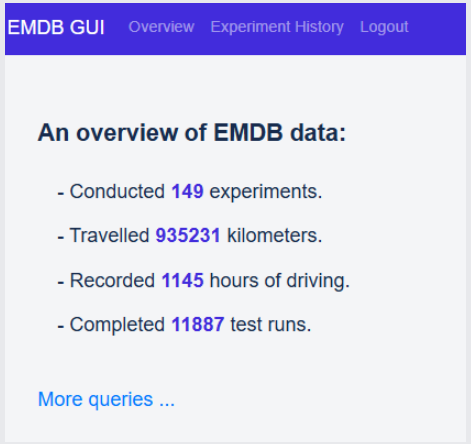


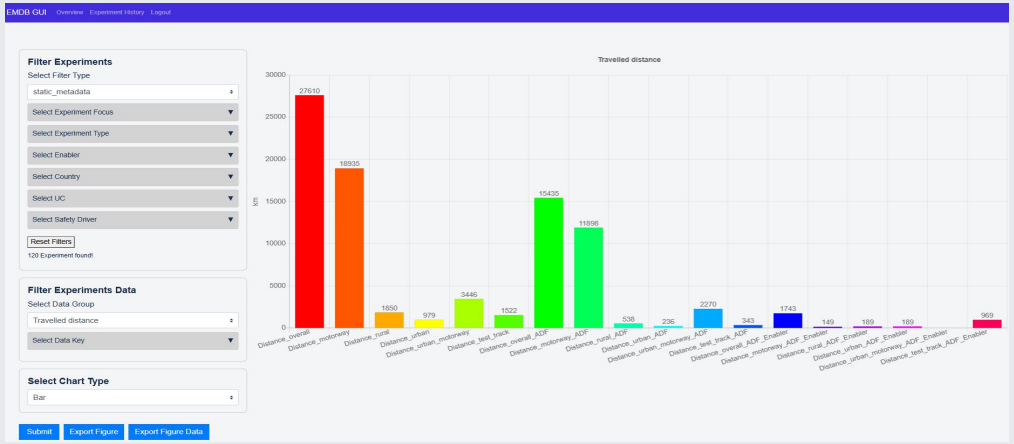
Data engineering tools and Databases



Experiment Metadata Database (EMDB): GUI extraction





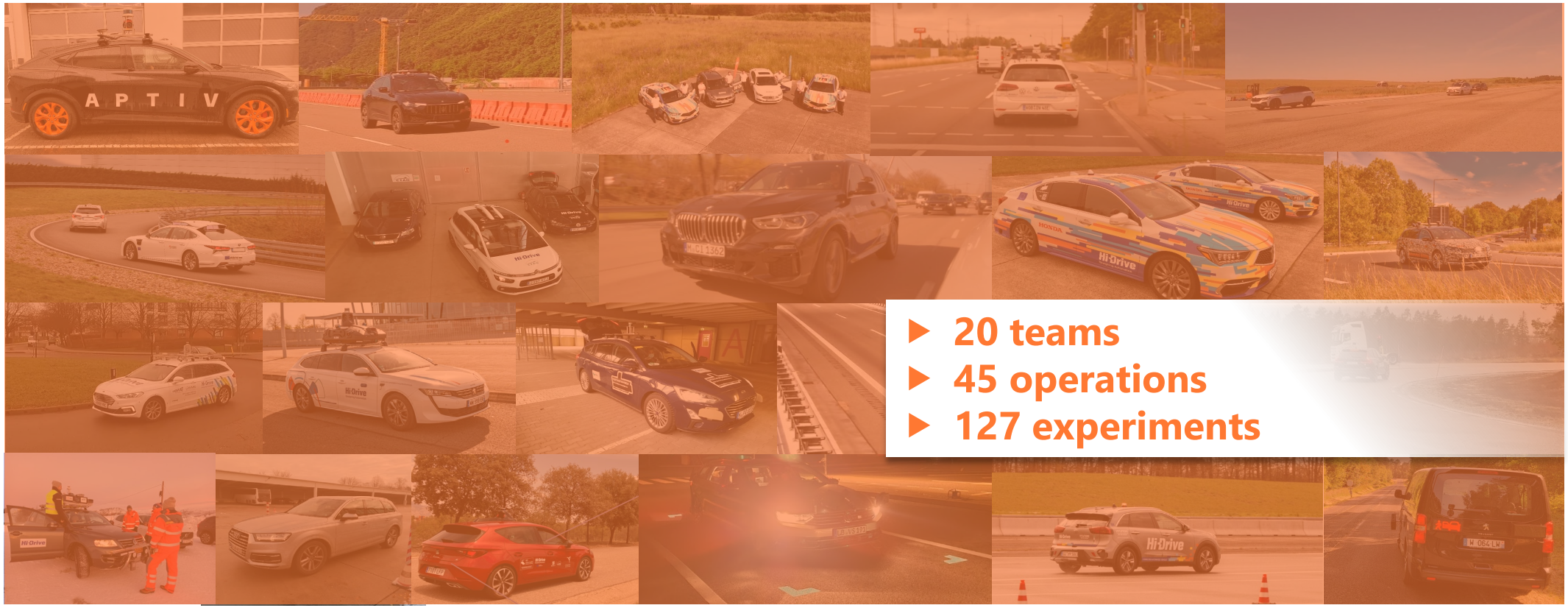


Filter: SP5 focus		
April 2024	June 2024	December 2024
34 experiments	**77** experiments	**127** experiments
20943 kilometers	**>25000** kilometers	**~27000** kilometers
236 hours	**>350** hours	**~450** hours
2389 test runs	**~4400** test runs	**~6000** test runs

The UI allows users to:

- **Overview:** overview of uploaded data
- **Query**: filter based on meta data
- **Visualize:** bar plots, pie charts, …
- **Download**: csv, graphs

Europe Wide Large Scale Operations



- 20 teams
- 45 operations
- 127 experiments

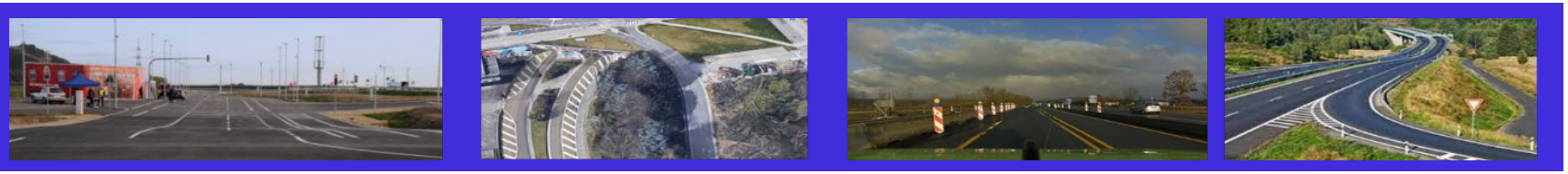
Challenging ODDs covered by Operations

Motorway

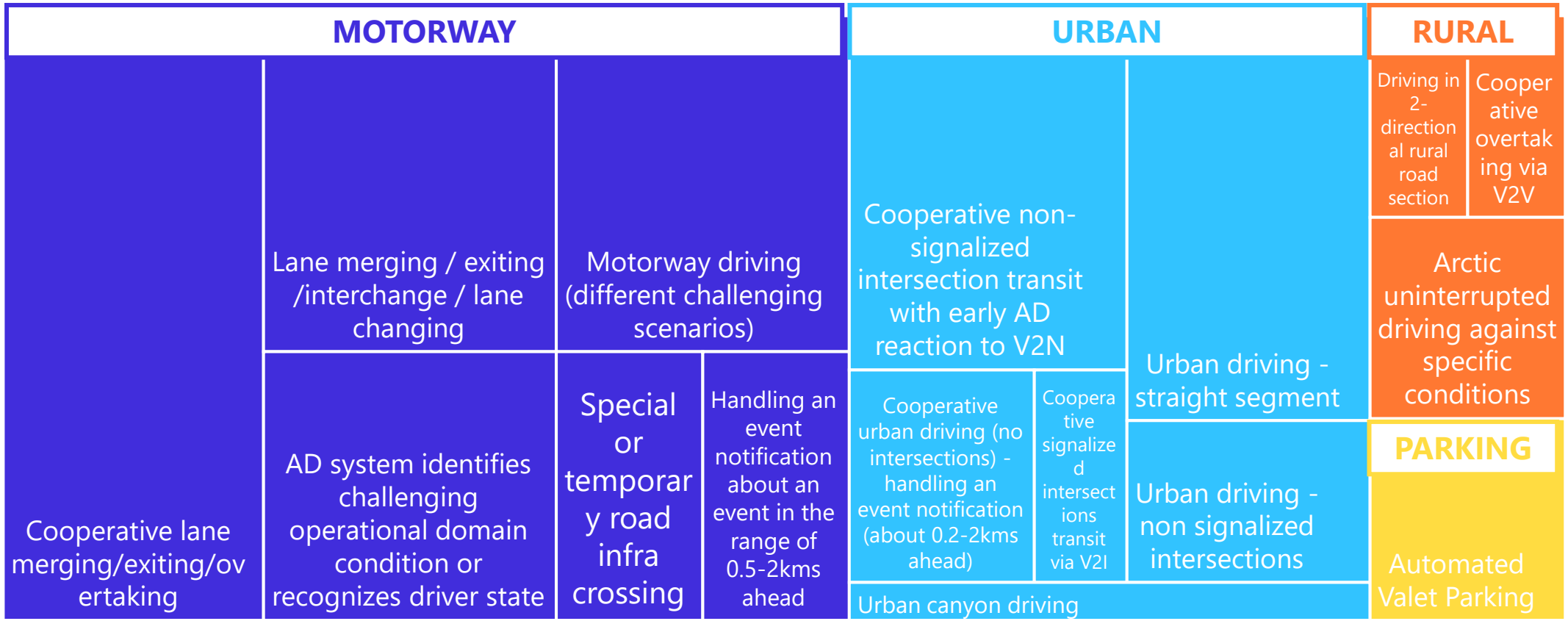
Urban

Parking

Test-track



Hi-Drive Use Cases catalogue | clusters per UC class



Cooperative UCs & Challenging ODDs (handpicked operations)

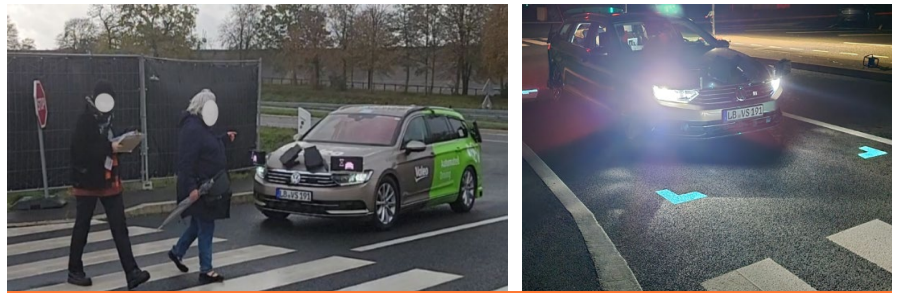
Highway Chauffeur function,
lane merging, on-ramp to motorway

Vehicle at **signalized intersections**
with connectivity enabler

Vehicle in
adverse weather

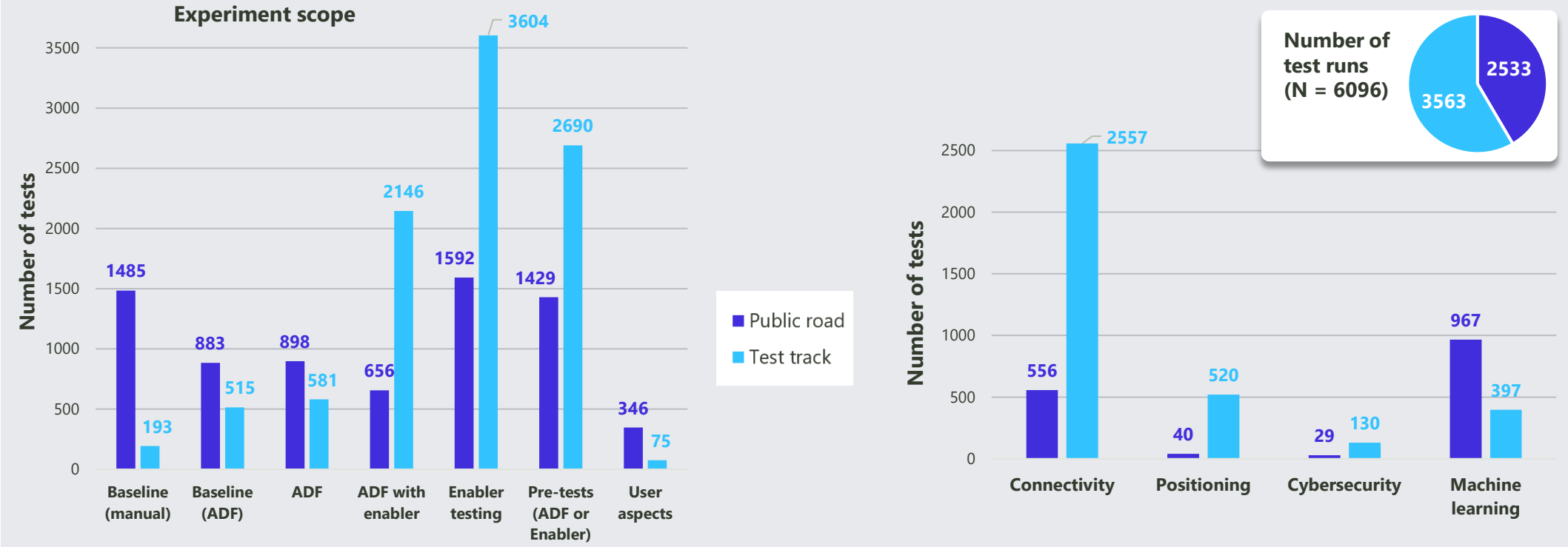
Vehicle inside
tunnel

Vehicle on
Motorway Construction Site



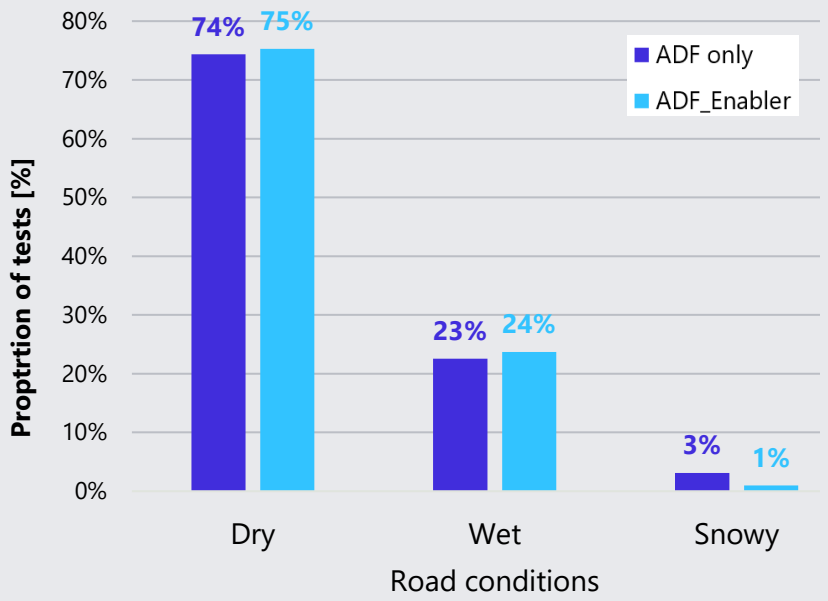
AV and pedestrians:
pedestrian crossing and **parking situation**

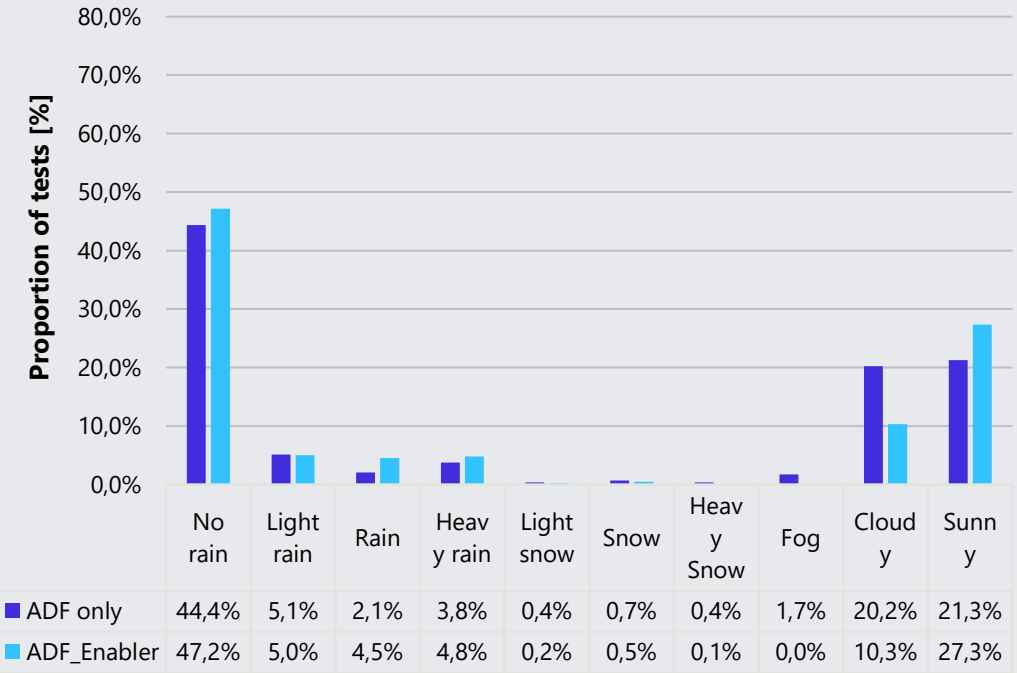
Operations selected findings
Number of Test Runs vs experiments scope vs enabling technology



Test drives on test track do not deliver a high mileage - but allow to test dedicated aspects!

Operations selected findings
Encountered weather & road conditions





	No rain	Light rain	Rain	Heavy rain	Light snow	Snow	Heavy Snow	Fog	Cloudy	Sunny
ADF only	44,4%	5,1%	2,1%	3,8%	0,4%	0,7%	0,4%	1,7%	20,2%	21,3%
ADF_Enabler	47,2%	5,0%	4,5%	4,8%	0,2%	0,5%	0,1%	0,0%	10,3%	27,3%

During the operations AD and AD+Enabler were tested in all kinds of conditions.

Operations

Hi-Drive

Challenges

- Approval to test on public roads
- Diversity in enabler and AD functions combinations and number of operations
- Timing and execution of experiments
- Data complexity, data handling due to size, interfaces, tools, etc.
- Restrictions by time and resources
- Interoperability, common practices, regulations…

Trials on Public Roads

Cross-border Corridors Testing

Test Tracks and Simulations

Data Engineering Tools

Data Collection

Common Databases (CDB)

Showcases and Demonstrations

Hi-Drive Operations facts

Hi-Drive

45 Operations

37 Vehicles

1800 Participants

20 Operation owners

11 Countries

60 Enablers

38 Use Cases

Hi-Drive
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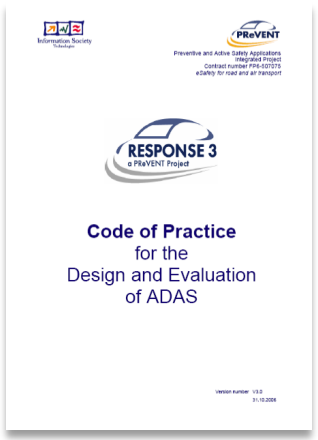
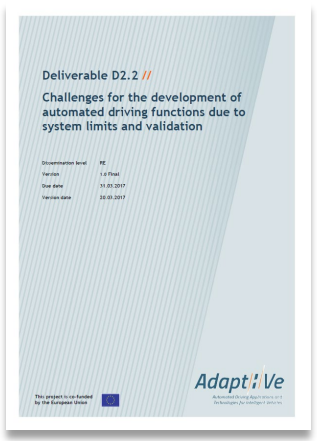
WWW.CODEOFPRACTICE.EU
HI-DRIVE CODE OF PRACTICE FOR CADF

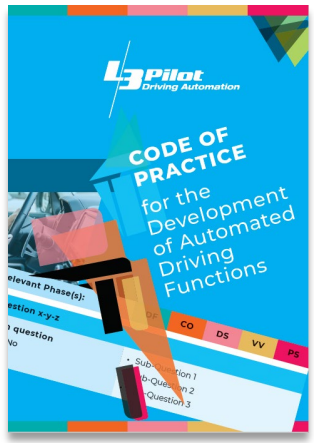
Abhijit Bahirat | Aptiv
Philippe Stehlik | eict

#Vehicles, Enablers & Operations

What is the Code of Practice? A story that started in the 2000s!







2008	2014-2017	2017-2021	2021-2025
RESPONSE 3 „CoP ADAS“	*RESPONSE 4 „Legal aspects of AD“*	*CODE OF PRACTICE for the dev. of ADFs*	*CODE OF PRACTICE for the dev. of CADFs*

The Code of Practice for CADF

OBJECTIVES

- Present a comprehensive overview of key factors for safe development of automated driving
- Evolution of the L3Pilot CoP-ADF onto a universally accessible, comprehensible and searchable website

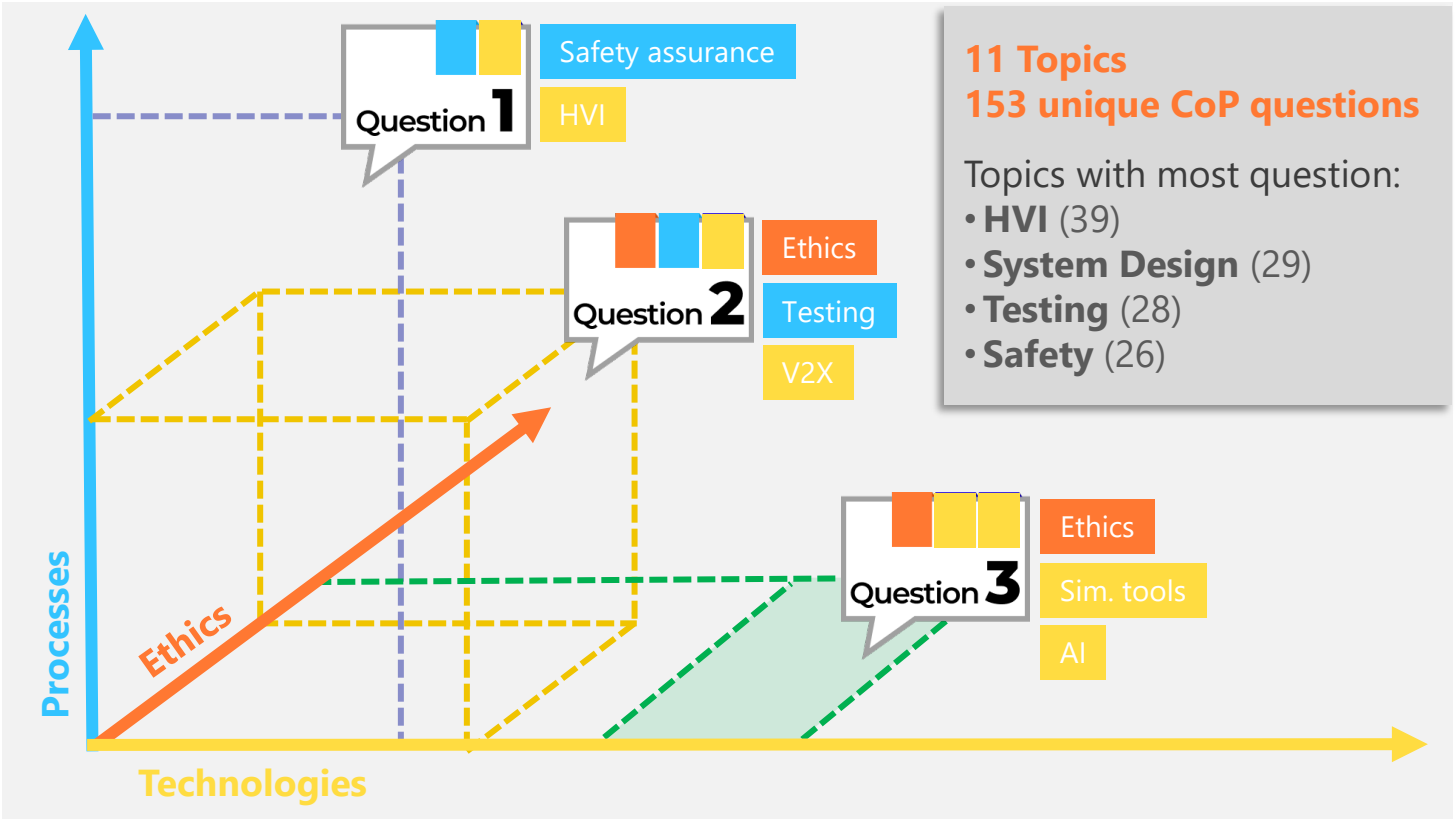
- Focus of the CoP for CADF is on SAE Level 3 and 4 applications.
- Break down of the large and complex automate driving development into **ethic**, **process** and **technology** related topics.
- Questions within the topics are used instead of recommendation to stay technical neutral on the solution. Overall, there are 153 questions.
- Publication of CoP on website: ***www.codeofpractice.eu.***

Link to Hi-Drive CoP

Expressing the multiple dimensions of a CoP question

Topics

- System Design
- Safety Assurances
- Requirement and ODD
- Testing
- V2X Communication
- Artificial Intelligence
- Human-Vehicle Integration
- Data Collection and Management
- Simulation tools
- Scenario database
- Ethics



11 Topics
153 unique CoP questions

Topics with most question:
- **HVI** (39)
- **System Design** (29)
- **Testing** (28)
- **Safety** (26)

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Topic 1
Vehicles, Enablers & Operations

1	Automated Driving in Urban Areas	VW
2	V2X Hazard Warnings & Dynamic Junction Signage	Stellantis - CRF
3	Simulation and Deep Learning for Perception, Decision Making and Driver Monitoring	UniGe | Vedecom
4	Localisation & Object Detection in Urban Environments	Stellantis
5	Repeated Use Study - from Hi-Drive to Product	BMW
6	ADS Operation on Public Roads + Simulator	fka
7	Extending and Enhancing Automated Driving ODD Through V2X	Hyundai
8	Expanding ODD: V2V for Highway Entrance Automation	fev.io
9	Automated Merging at Highway On-Ramps Based on V2V Communication	Honda
10	Learning the Road: Radar ML for Automated Driving	Aptiv
11	Demonstration of a Teleoperator Workplace	DLR
12	Cybersecurity Design for V2X	VCC / Comsignia
13	HotSpot Map – Location Based Services for Connected and Automated Driving	Bosch
14	Resilient Navigation and Localisation in Arctic Winter Conditions	VTT
15	Automated Urban Driving with V2V Communication	TME
16	V2V and I2V Communication, Sensor Fusion, Positioning, and Cybersecurity Enablers	CTAG
17	I2V Information to Extend the ADF in a Traffic Lights Area	SEAT
18	www.codeofpractice.eu - Hi-Drive Code Of Practice for CADF	Hi-Drive