VERIFICATION
VALIDATION
METHODS

PROJECT of the PEGASUS FAMILY

VALIDATION OF TEST INFRASTRUCTURE – FROM CAUSE TREES TO A VALID SYSTEM SIMULATION

Derivation of functional requirements for sensor system simulation following four consecutive steps, including the novel methods PerCollECT & CEPRA

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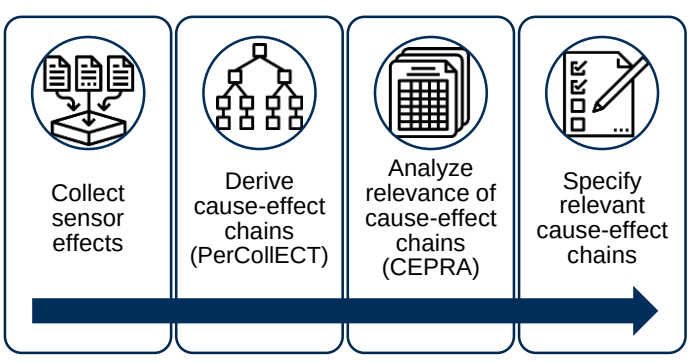
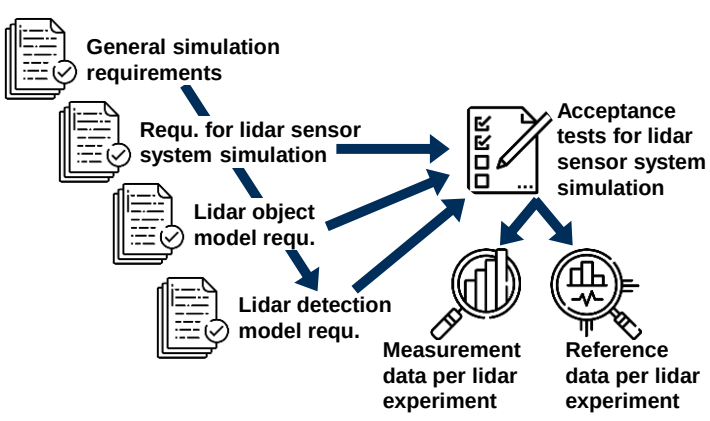


Icon sources: https://www.flaticon.com/authors/becris, https://www.flaticon.com/authors/Icongeek26, https://www.flaticon.com/authors/freepik



Ontology for cause-effect chains

Structuring the multitude of phenomena and their effects and causes alone is an enormous challenge, currently tackled by the collaboration on GitHub called PerCollECT, initiated by TUDa FZD and VW with the support of SET Level and VVM. It includes projects for camera, radar, lidar, and ultrasonic sensors.[1]

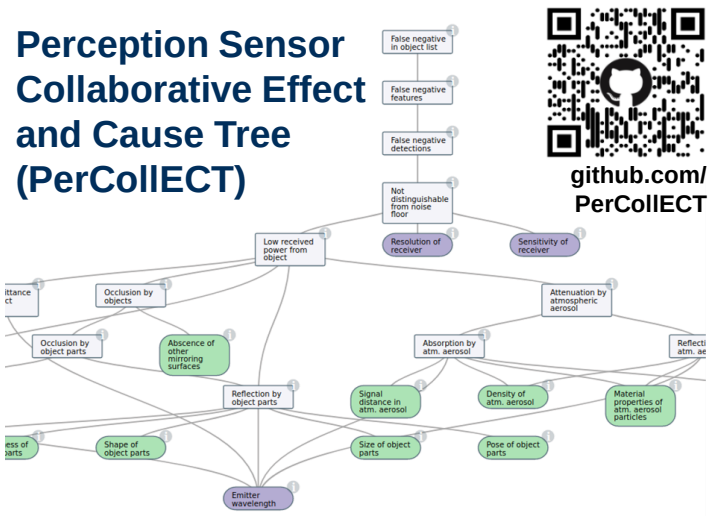
Relevance Analysis

In addition, an FMEA-like method called CEPRA is proposed to find out which of the underlying effects and causes of the phenomena are relevant to be included in the perception sensor models. [1]

Requirements on functional layers

When the relevant cause-effect chains and phenomena are identified, requirements on subsequent functional layers of the sensor system model are formulated including their acceptance tests and validation metrics.

Perception Sensor Collaborative Effect and Cause Tree (PerCollECT)



github.com/PerCollECT

Cause, Effect, and Phenomenon Relevance Analysis (CEPRA)

CEPRA ID	Phenomenon (P)	Effect chain (EC) of phenomenon	Causes of effect chains		P&EC occurrence (O) in ODD		P&EC impact (I) on SUT in ODD		Relevance of P&EC
			Environmental causes	Design parameters	[1, 10]	Rationale	[1, 10]	Rationale	O + I
Lid_CEPRA_005	False negative in object list	→ FN features → FN detections → Not dist. from noise → Low rec. power from o. → Reflection by obj. parts	• Materials • Roughness • Shapes • Sizes • etc.	• Emitter wavelength	9	*filled by sensor expert*	4	*filled by SUT expert*	**13**
Lid_CEPRA_008	False negative in object list	→ FN features → FN detections → Not dist. from noise → Low rec. power from o. → Attenuation by atm. aer. → Absorption by atm. aer.	• Signal distance • Density of atmosph. • Material of particles • Size of particles • etc.	• Emitter wavelength	8	*filled by sensor expert*	9	*filled by SUT expert*	**17**
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Automatically generated from PerCollECT — Filled by experts

[1] C. Linnhoff, P. Rosenberger, S. Schmidt, L. Elster, R. Stark, and H. Winner: *Towards Serious Perception Sensor Simulation for Safety Validation of Automated Driving – A Collaborative Method to Specify Sensor Models.* 24th Conference on Intelligent Transportation Systems (ITSC), 2021

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Projektpartner

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