

Überfahrversuche mit dem Biofidel-Vogel (Alpha) im Rahmen des Forschungsprojekts KI-MeZIS

Drive-over tests with the Biofidel bird (Alpha) as part
of the KI-MeZIS research project

Vortrag 4. Dummy.Crashtest.Konferenz, Münster

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- **Background – Status Quo automated driving**
- Roadmap and BMWK-Project KI-MeZIS
- KI-MeZIS – Driving-over testruns with a freight wagon
 - Introduction
 - Sensor concept
 - Test objects
 - Mounting
 - Driving-over videos

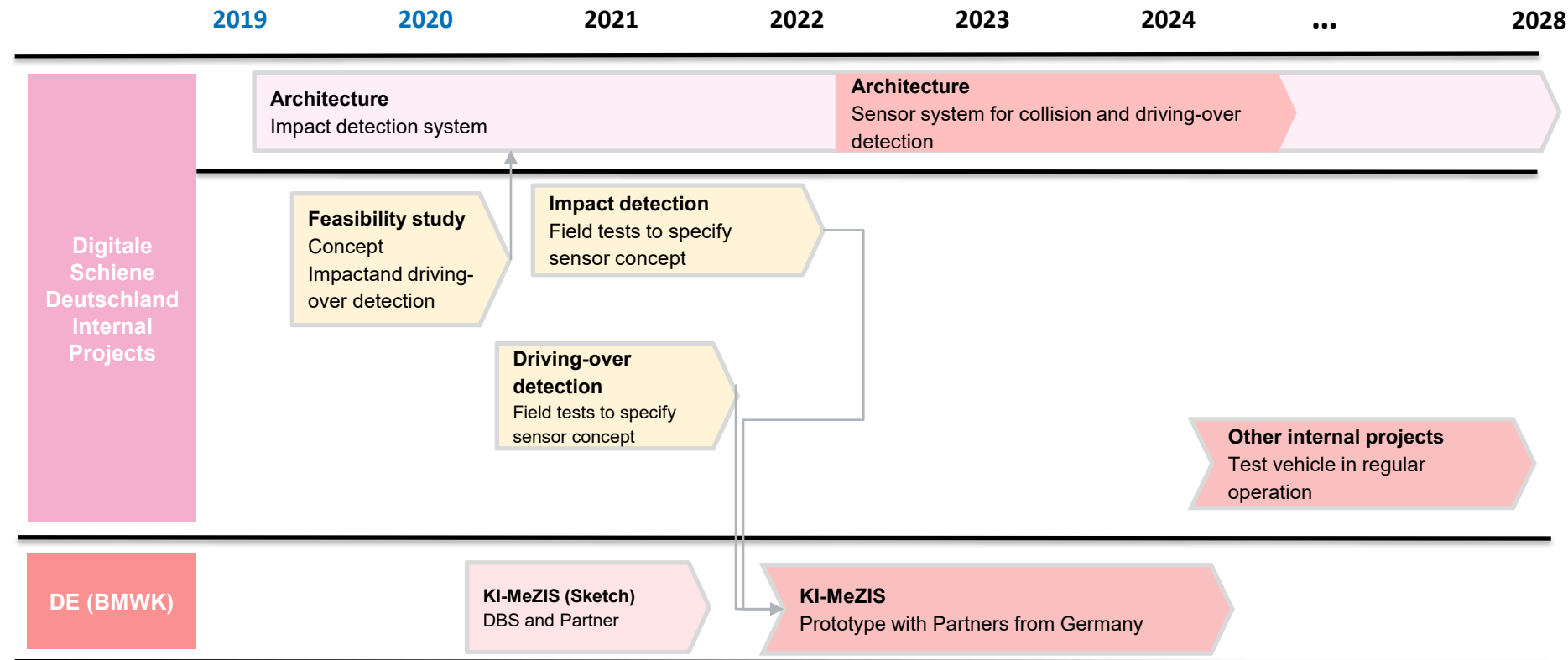
- Fully automated rail-bound transport systems are still a niche topic in the mainline sector
 - One known application: Rio Tinto in Australia
 - One new planned application: Suburban railway Copenhagen (S-tog København)
 - Fenced/enclosed system similar to Metro
 - Without intelligent sensors for environmental perception
- according to UITP [1], there were a total of 80 fully automated metro lines in 48 cities worldwide in December 2020
- The degree of automation (GoA) is defined by the UITP [2] and in the international standard IEC 62267 [3].

Grad of Automation	Type of train operation	Driving/Stopping the train	Door closure	Operation in event of disruption
GoA 1	ATP *1 + Driver	Driver	Driver	Driver
GoA 2	ATP + ATO *2 + Driver	Automatic	Driver	Driver
GoA 3	Driverless	Automatic	Train attendant	Train attendant
GoA 4	Unattended	Automatic	Automatic	Automatic
*1 ATP = Automatic Train Protection				
*2 ATO = Automatic Train Operation				

- **In Germany**
 - Skytrain
 - Subway/Metro U2 und U3 in Nuremberg
- **Research or development projects in Germany**
 - Deutsche Bahn and Siemens, Project „Digitale S-Bahn Hamburg“ (GoA 2 or GoA 4 partial functions) [4],
 - Deutsche Bahn, Project „Digitaler Knoten Stuttgart“ (GoA 2) [5],
 - Deutsche Bahn, Project „Sensors4Rail“ (GoA 4) [6],
 - Tram (streetcar) in Potsdam (tends to be GoA 4) [7],
 - Aachener Rail Shuttle (GoA 4) [8],
 - AVG and Thales – autonomous driving (GoA 3 and GoA 4) [9] and
 - Deutsche Bahn, Siemens Mobility And Bosch, Project „Automated Train“ (GoA 4 for initial staging runs) [10]
- **However:**
 - All of these systems can detect if there is something in the track area, but not if the rail vehicle has actually driven over it or “rammed/hit” the object
- **This gap led to two preliminary projects and the KI-MeZIS project funded by the BMWK**

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- 2019: Feasibility study for a concept for collision and driving-over detection
- 2020/2021: Test projects for driving-over and impact detection
- 2021: KI-MeZIS started



Bildquelle: DB InfraGo

- **What is KI-MeZIS about?**

- KI-MeZIS stands for “AI methods in condition monitoring and needs-based maintenance of rail vehicle structures” (*„KI-Methoden in der Zustandsüberwachung und bedarfsangepassten Instandhaltung von Schienenfahrzeugstrukturen“*)
- The content is not only the question, if and how an impact or driving-over can be detected
- As well as:
 - What damage can occur to the vehicle
 - How can these be assigned to specific sensor signals
- In other words, an artificial intelligence (AI) should in future be able to use sensor signals to decide next steps after a collision or driving-over.

- **Funded by BMWK technical program “New vehicle and system technologies”**

- **Project supervisor is TÜV Rheinland Consulting GmbH**

Gefördert durch:



aufgrund eines Beschlusses
des Deutschen Bundestages

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- **Team:** DB InfraGo, IFB, TU Berlin FG Schienenfahrzeuge, HVLE
- **Period:** March 2023 – April 2024
- **Goals:** Generation of sensor data to detect drive-over events at higher speeds and more objects compared to 2021
- **Challenges:**
 - Safety concept
 - Accelerate 25 t freight wagons up to 30 km/h
 - Drives alone over test objects
 - Must be braked: Development of a radio system for braking - protection car as backup
 - Suitable infrastructure
 - 500 m track length
 - Good accessibility, modification must be possible
 - Test scope of 180 test drives



Bildquelle: IFB



Bildquellen: IFB

- Bone – Finger
- Bone – Arm
- Bone – Head
- Roof batten 20 mm
- Catenary
- Flat steel 6 mm
- Flat steel 10 mm
- Steel wedge
- Braking shoe
- Birch wood
- Bicycle
- Shopping cart
- Concrete block
- Biofidel – bird
- Steel tube (60 mm)

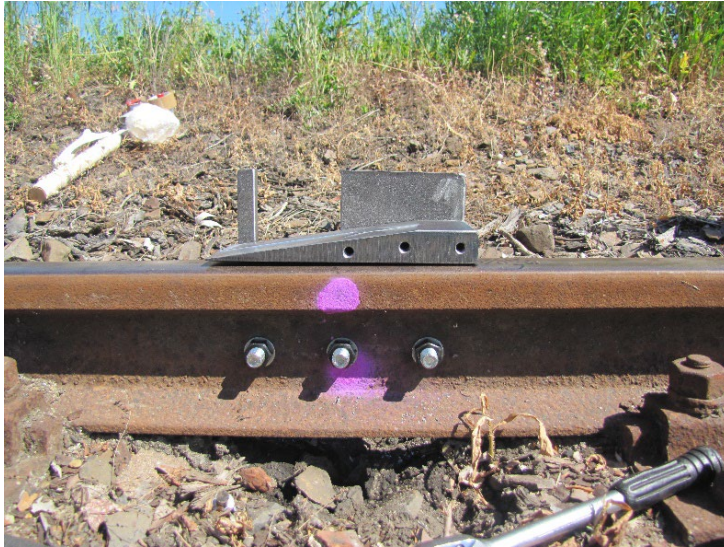


Bildquellen: IFB

Drive-over Tests

KI-MeZIS – Mounting of test objects

Digitale Schiene
Deutschland



Bildquellen: IFB



Videoquelle: IFB



Videoquelle: IFB





Videoquelle: IFB



Videoquelle: IFB





Videoquelle: IFB

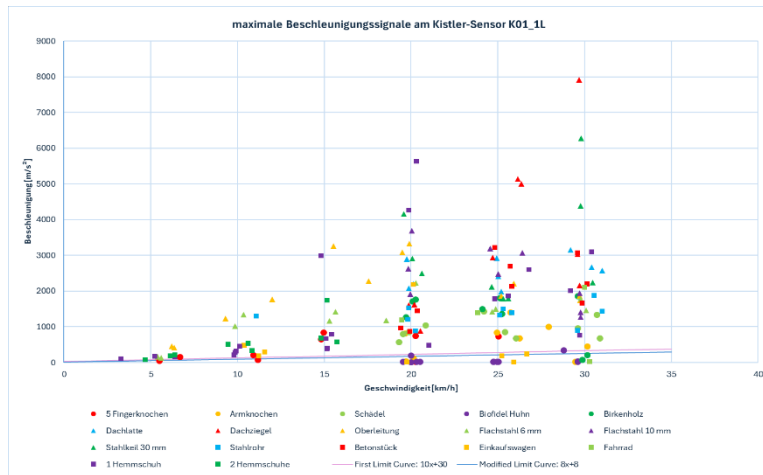


Videoquelle: IFB

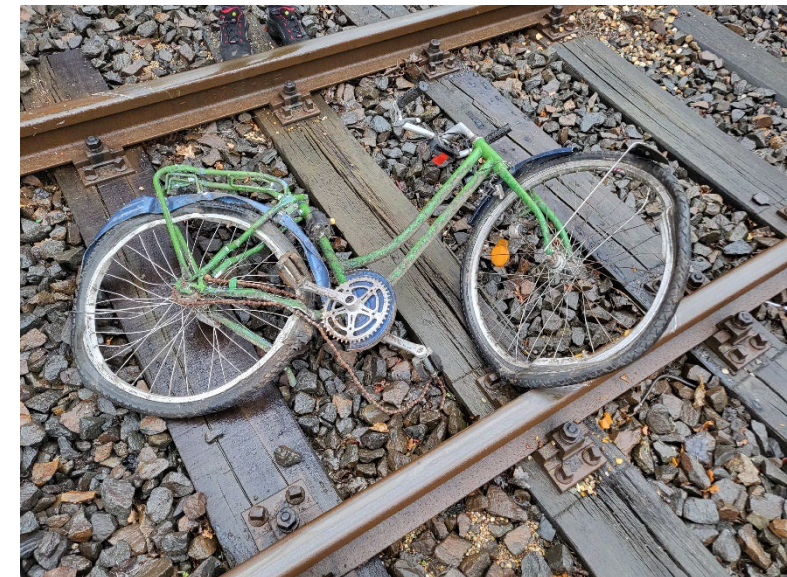


What happens next?

- Handover to project partners of sensor data
- Evaluation of the measurement data



- **Formulation of the summarized results**
- **Initiation of follow-up projects**



Bildquellen: IFB

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