

Dutch Photonics Event 2025

Fiber-optic sensing for optimized asset and maintenance management in railway systems

Maarten van Balveren

Introduction

- » Branch office in Waddinxveen
 - » Originating from engineering company (Ingenieursbureau Coenecoop / Baas R&D)
 - » Since 2011 part of **voestalpine**
 - » Focus on **fiber-optic** diagnostic and monitoring solutions in **railway systems**



- » *Fiber-optic sensing for optimized asset and maintenance management in railway systems*

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Background

- » Assets in railway systems
 - » Track infrastructure
 - » Rolling stock
 - » Signaling and Control systems
- » Many fiber-optic sensing technologies are applied in railway systems, including:
 - » Distributed Acoustic Sensing (DAS)
 - » Fiber Bragg Grating (FBG)

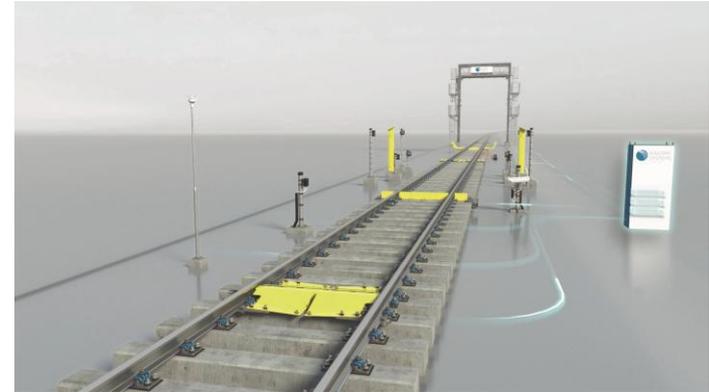


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Wayside Train Monitoring Systems

- » WTMS or **trackside train monitoring** systems capture the condition of passing trains
 - » Safety-critical and non-safety relevant
- » **Data** is typically **processed automatically**
 - » Often directly used in operational processes
- » Well established and **proven technologies**
- » Applied by railways **all over the world**
 - » Alarming and intervention
 - » Asset and maintenance management

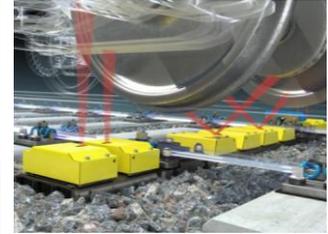


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zentrak Modular Diagnostics System

- » zentrak Modular Diagnostic System combines different measurement functions
- » Some functions based on optical techniques:
 - » Profile Validation (**laser**)
 - » Hot Axle Box / Wheel Detection (**infrared** sensors)
 - » Wheel Impact Load Detector (**fiber-optic** sensors)

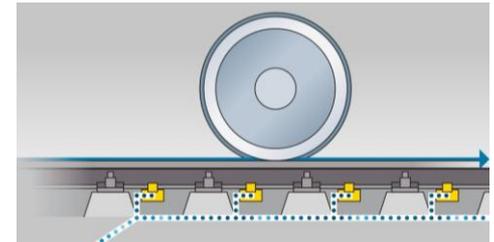
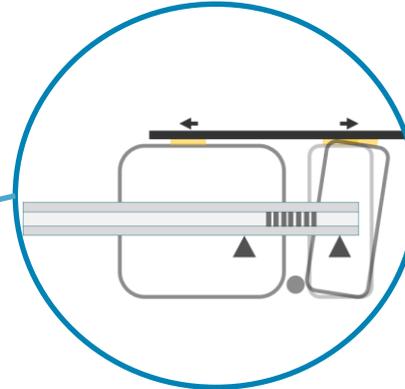
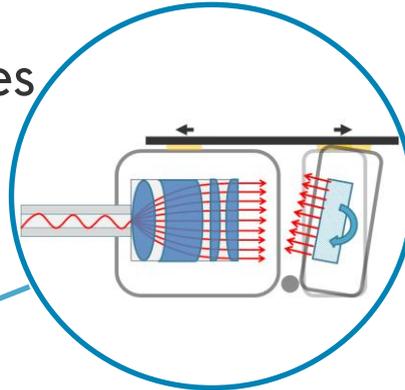
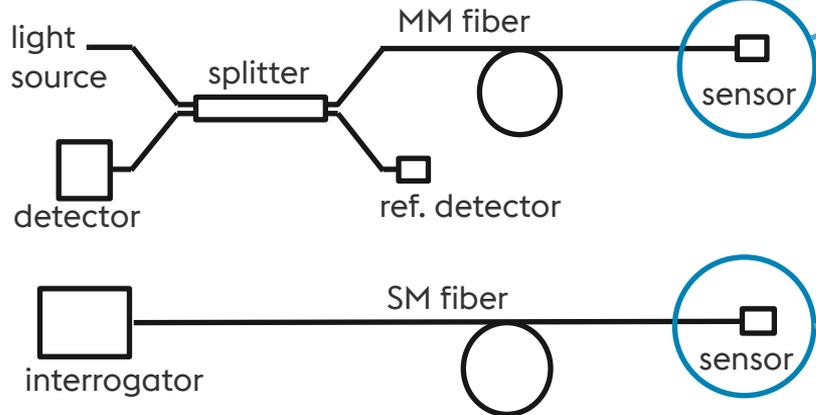


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Wheel Impact Load Detector

- » Wheel force measurement based on fiber-optic sensing technologies
 - » Intensity-modulated sensor
 - » Wavelength-modulated sensor (Fiber Bragg Grating)



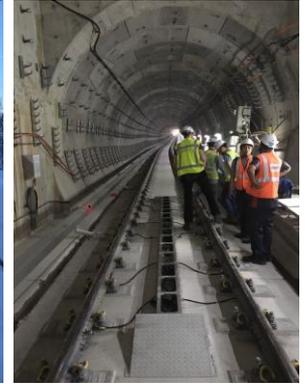
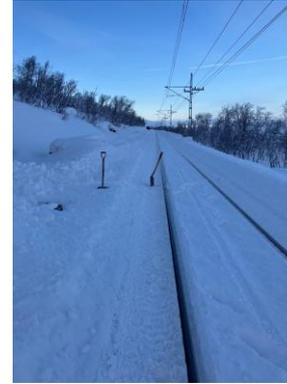
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Resilient Sensing: challenges and solutions

» Harsh measurement conditions in railways

- » Temperature extremes
- » Humidity, moisture, snow and ice
- » Shocks, vibration and mechanical loads
- » Remote locations



» Continuously develop and improve every aspect of the measurement chain



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Real world examples



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Summary and Outlook

- » Fiber-optic sensing is ideally suited for applications in railway systems
- » Committed to innovation and support of the photonics community
- » Visit the Raildagen 2025
 - » Friday 19 and Saturday 20 September
 - » www.raildagen.nl
 - » Meet fiber-optic sensing applications in Utrecht and Hilversum



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Thank you

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