

Digital Twin

Focus on Ford Otosan use-case

Michael Glensvig, AVL
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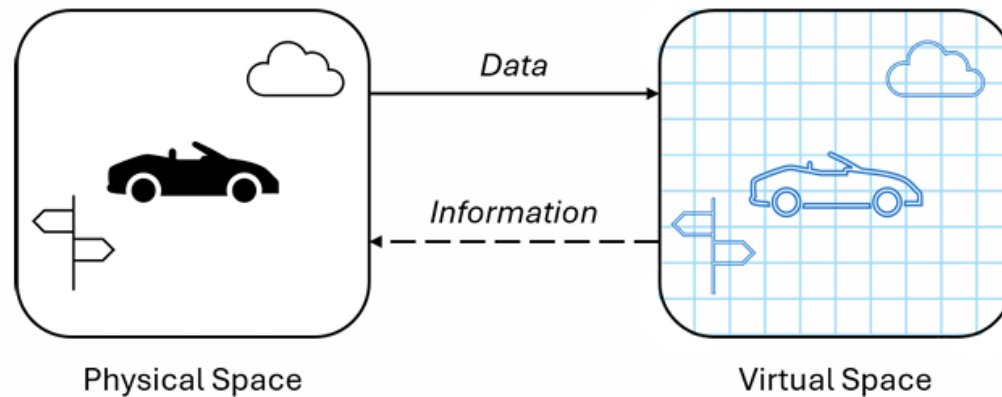
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Digital Twin Definition in NextETruck Project

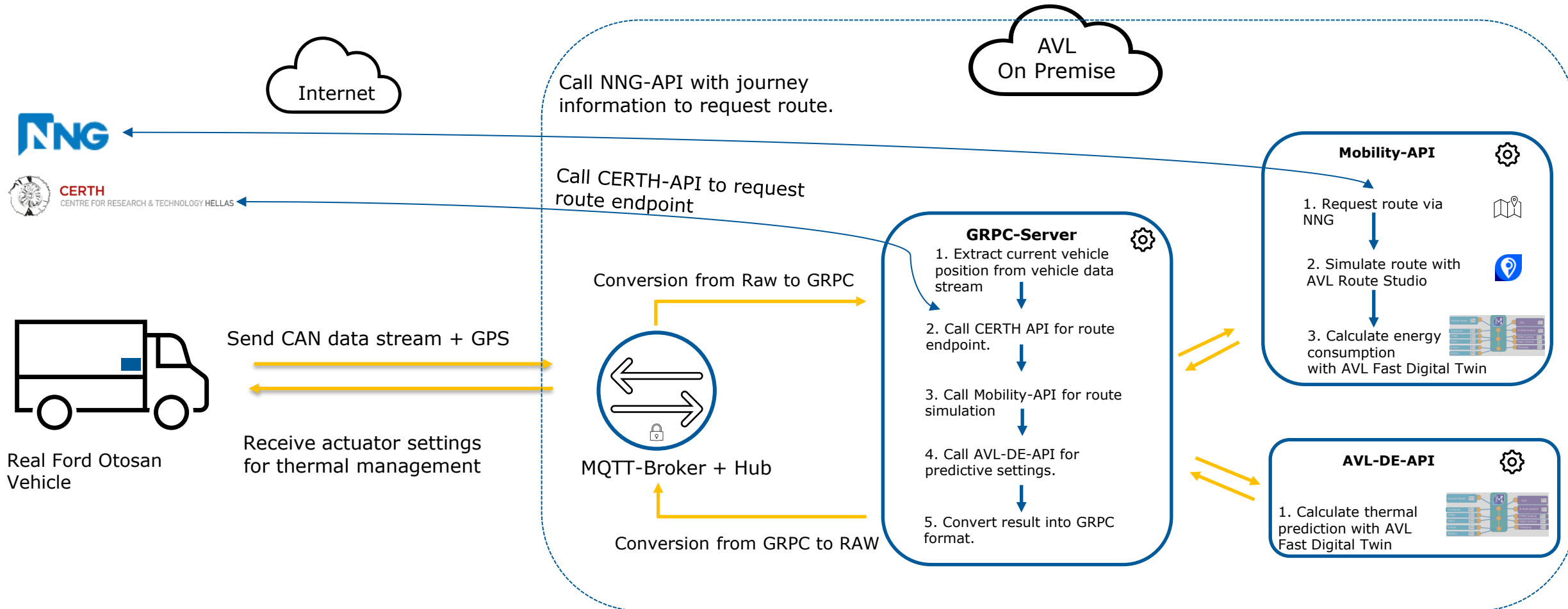
A digital twin consists of:

- 1) The real truck in its environment
- 2) The virtual twin of the truck in its environment
- 3) The data and information flows that connect the two in **real-time** **(both ways)** and **throughout its lifecycle**

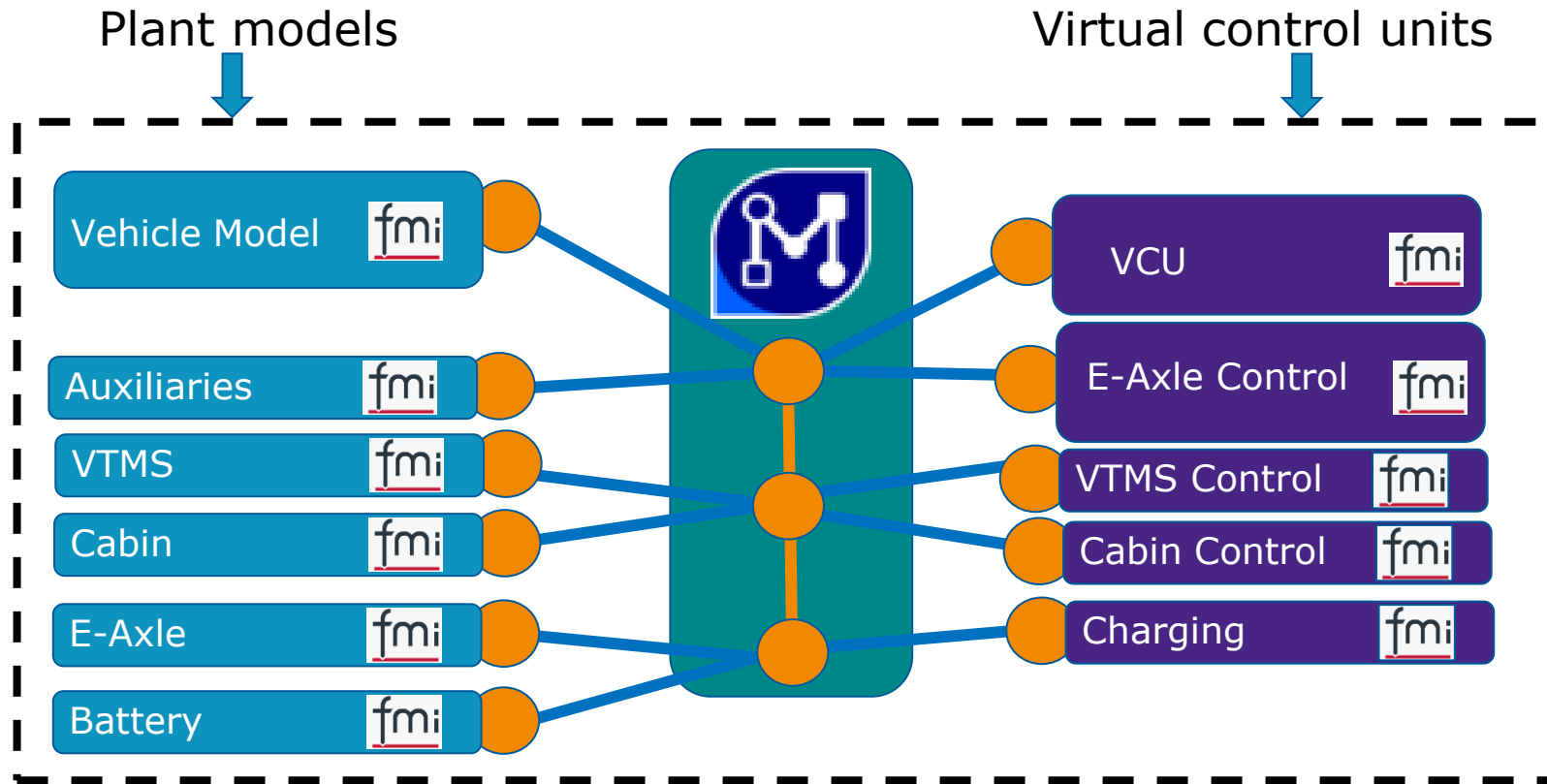


Digital Twin (cf. Grieves, 2014)

NextETruck Digital Twin Use Case: Ford-Otosan



NextETruck: Software in the Loop (SiL)



SiL containing:

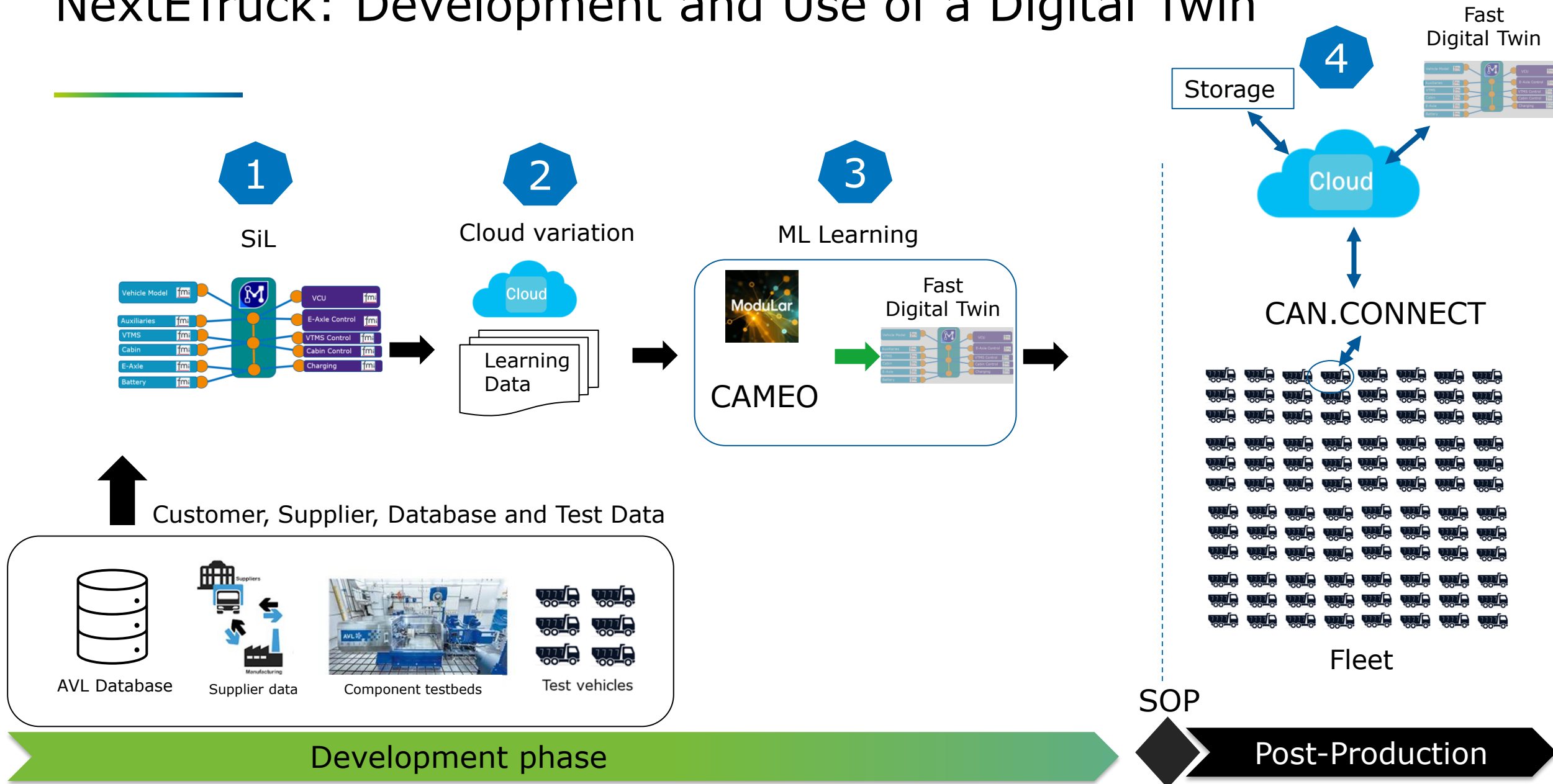
- Physical plant models
- Control unit software
- Supplier data and AVL database/Engineering knowledge used
- Component testbed and vehicle test data used for model parametrization and validation

→ **Leading to high accuracy**

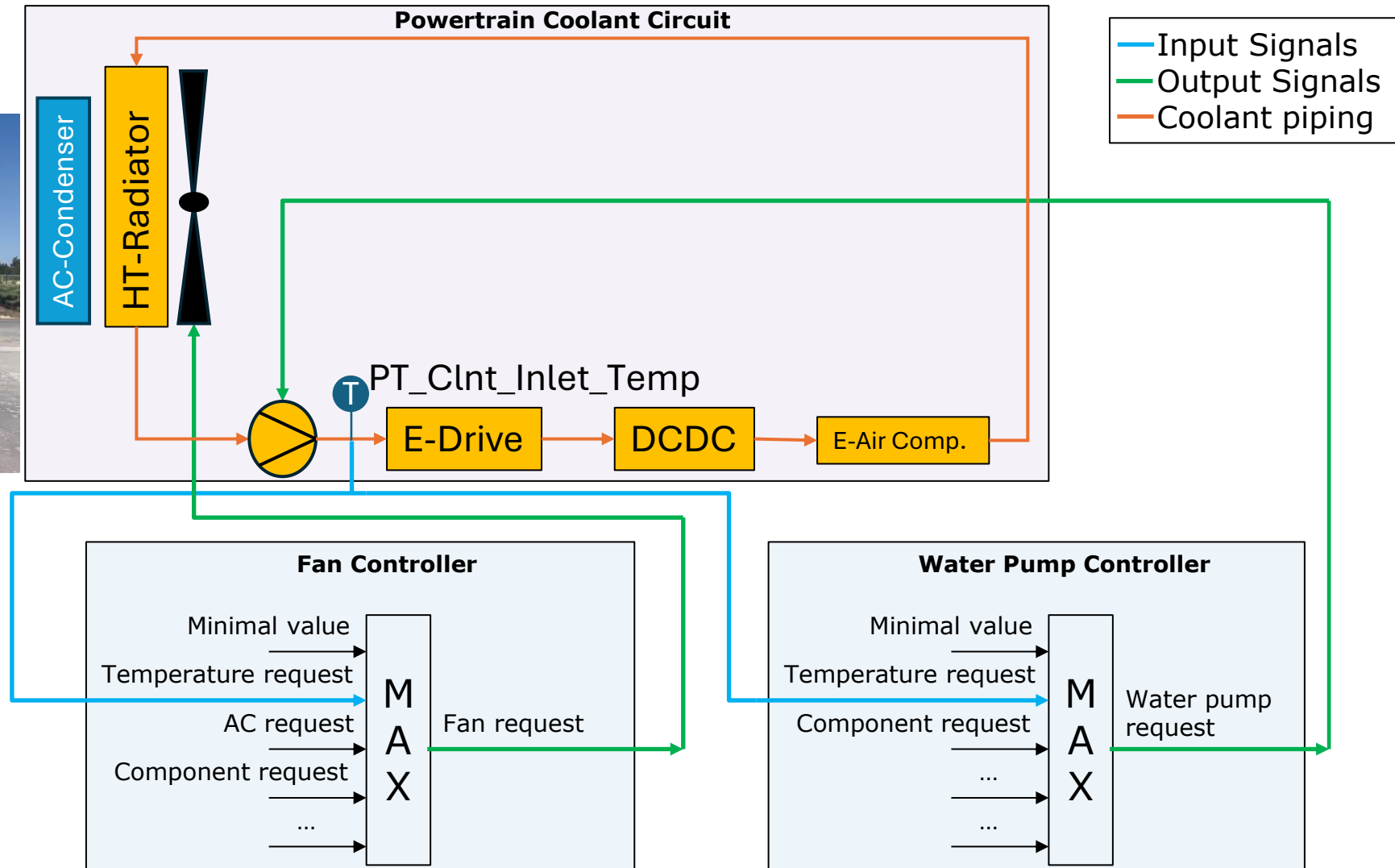


AVL Model.CONNECT™ Co-simulation coupling tool

NextETruck: Development and Use of a Digital Twin



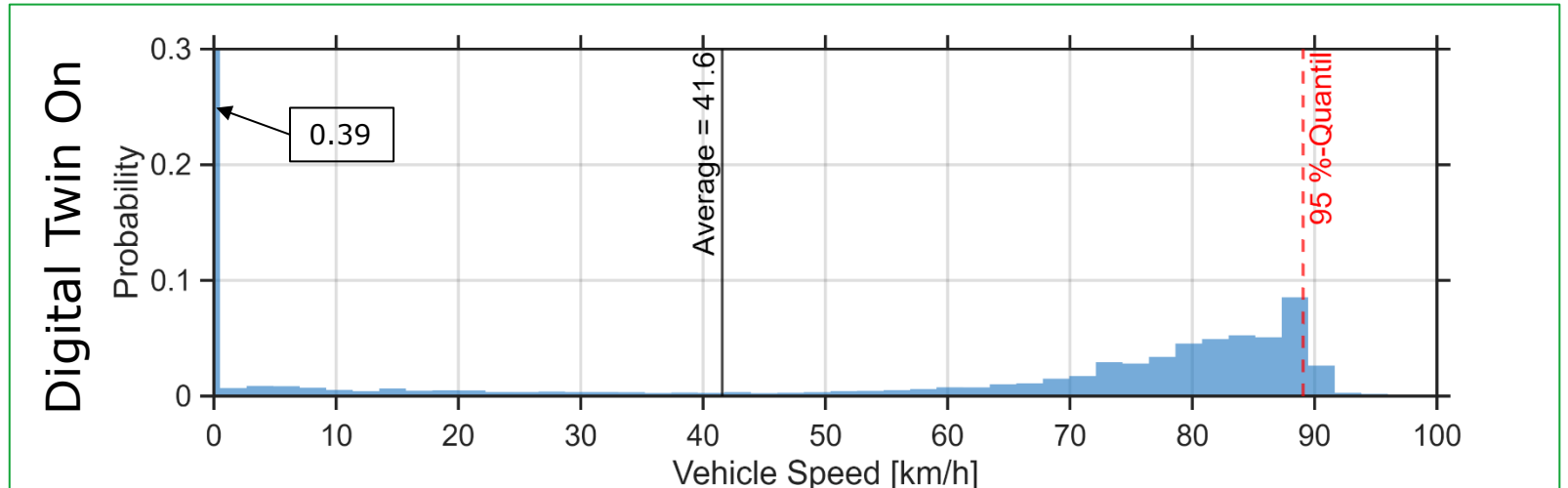
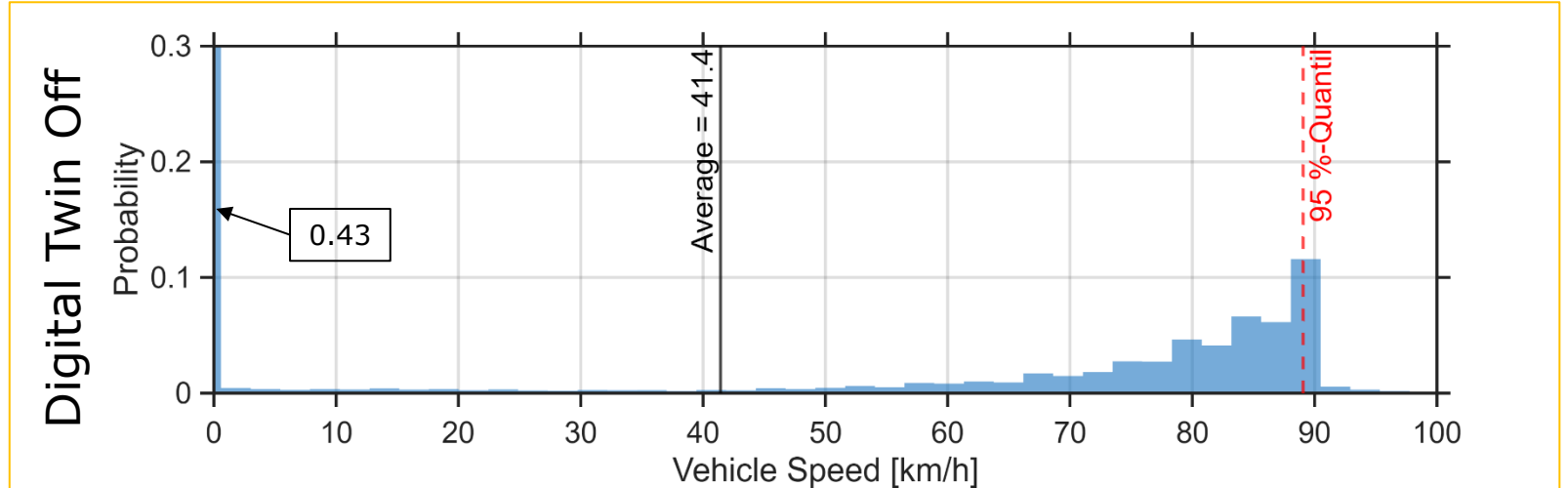
Overview Schematic on Test Vehicle



Results: Vehicle Speed Comparison

Test Track: Golcuk-Inonu-Golcuk (Public road)

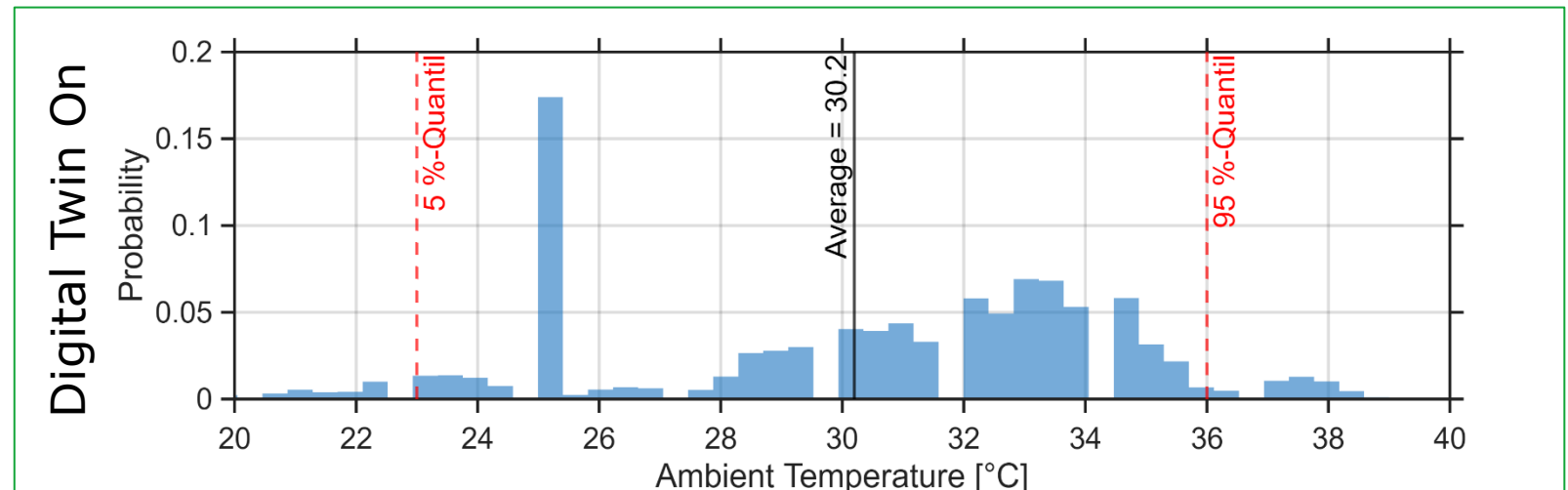
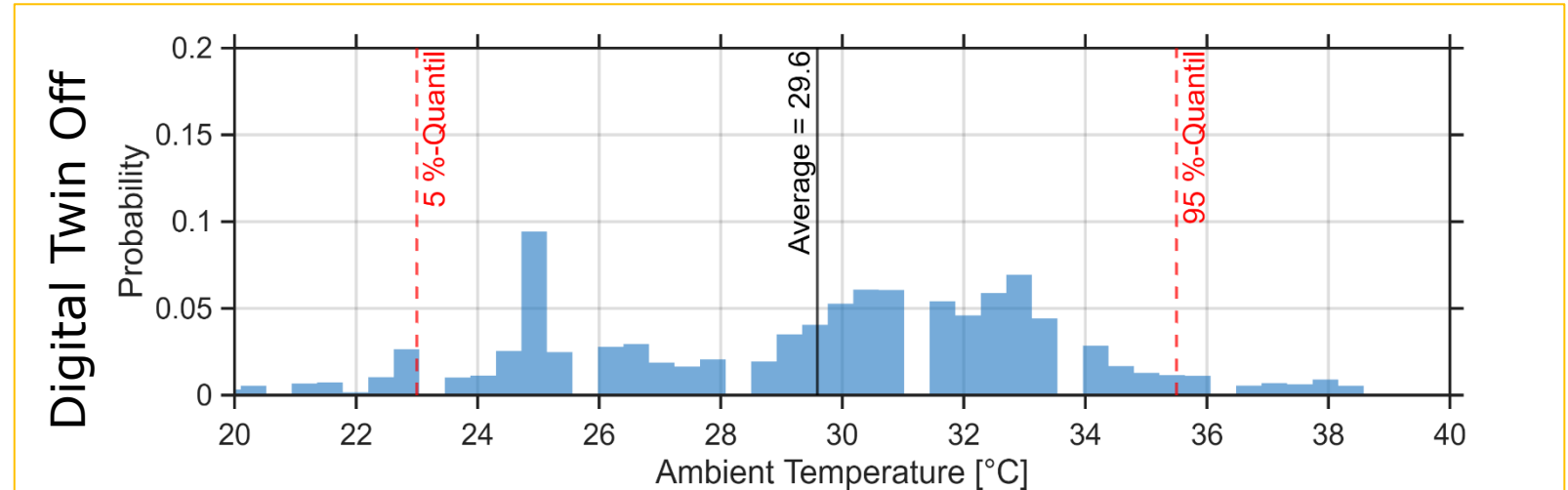
- Speed distribution is similar.



Results: Ambient Temperature Comparison

Test Track: Golcuk-Inonu-Golcuk (Public road)

- Ambient temperature distribution is similar.



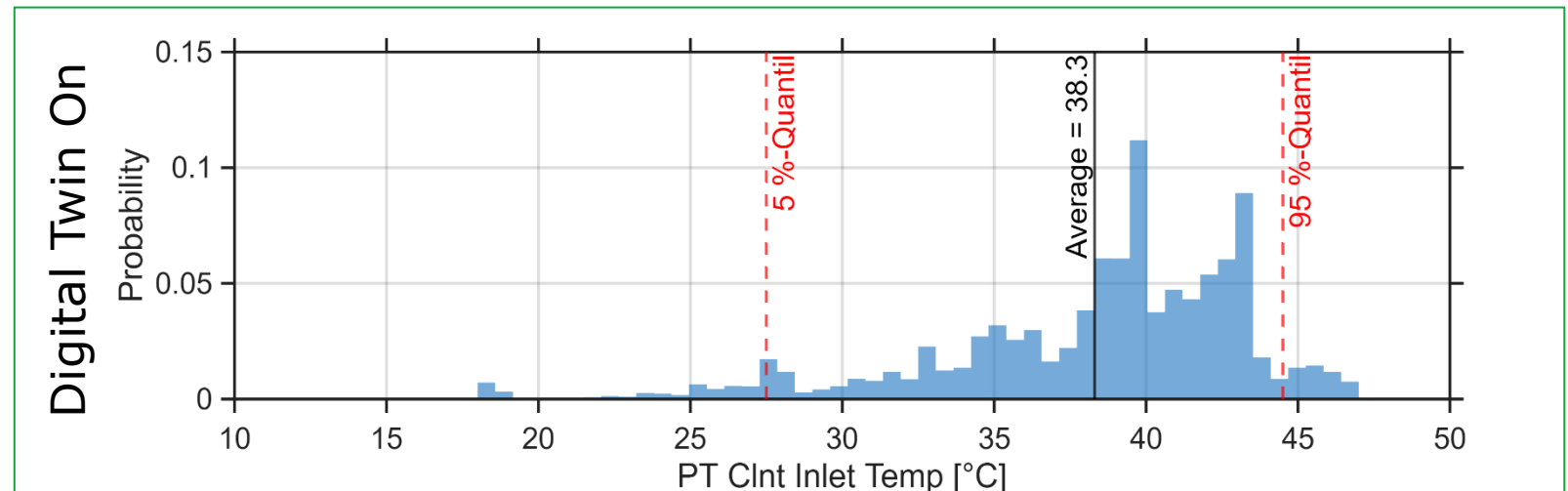
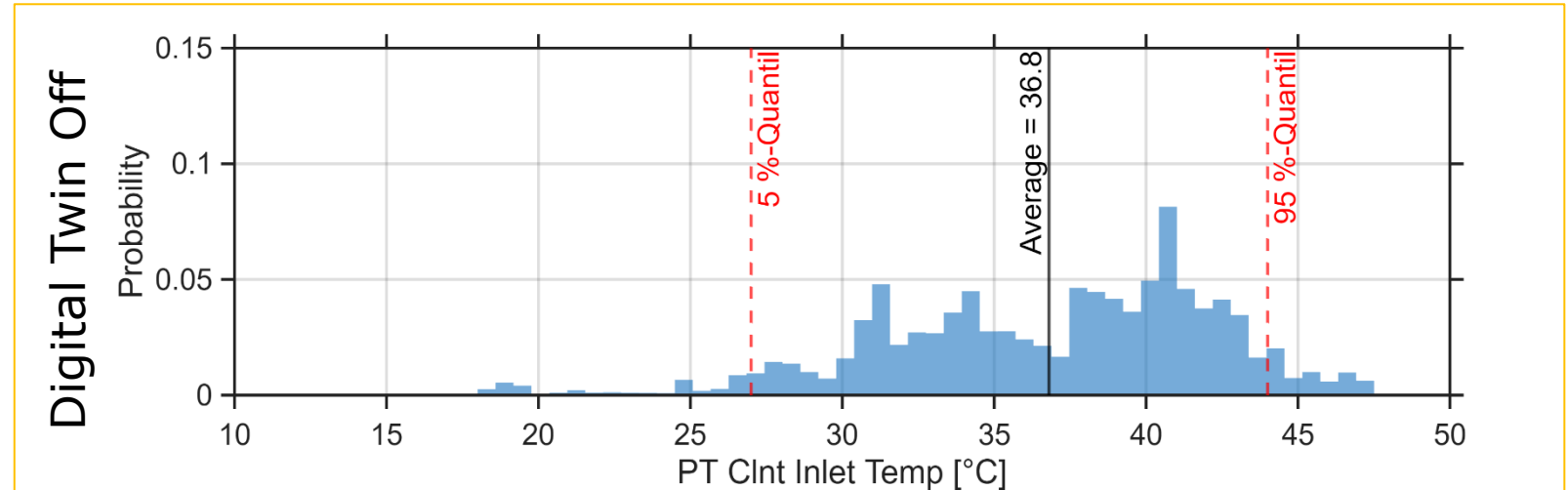
Results: Powertrain Inlet Temperature Comparison

Test Track: Golcuk-Inonu-Golcuk (Public road)

Result of digital twin:

The digital twin controls the system temperature to higher temperatures

→ enables the system to dissipate heat with less effort



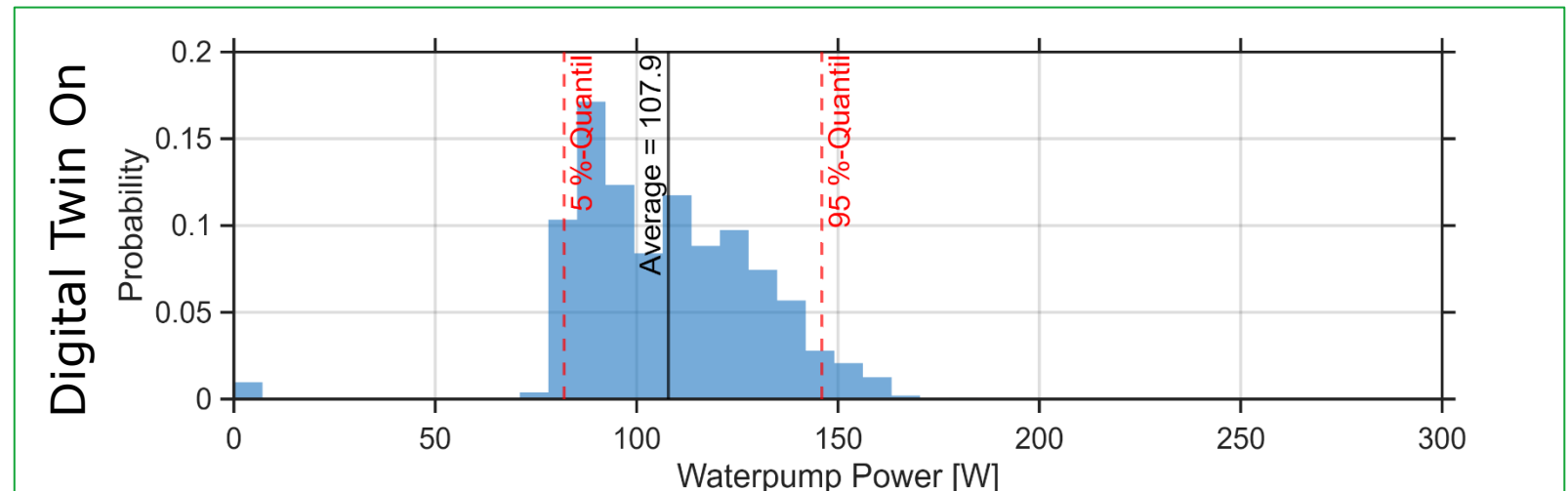
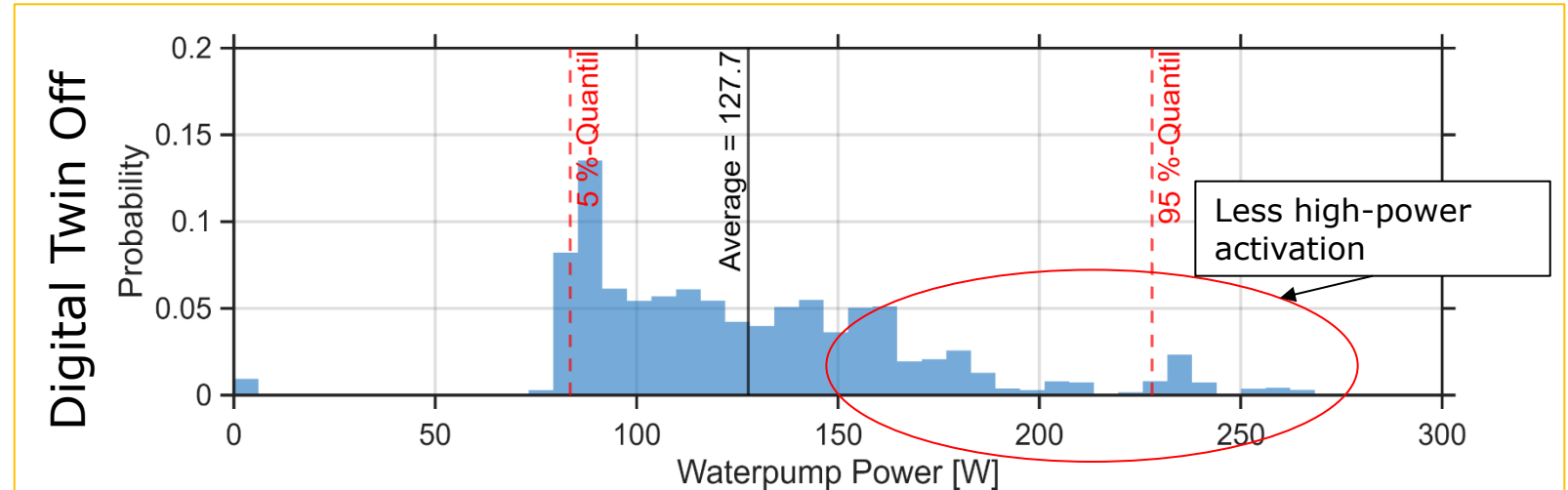
Results: Water Pump Power Comparison

Test Track: Golcuk-Inonu-Golcuk (Public road)

The digital twin enables:

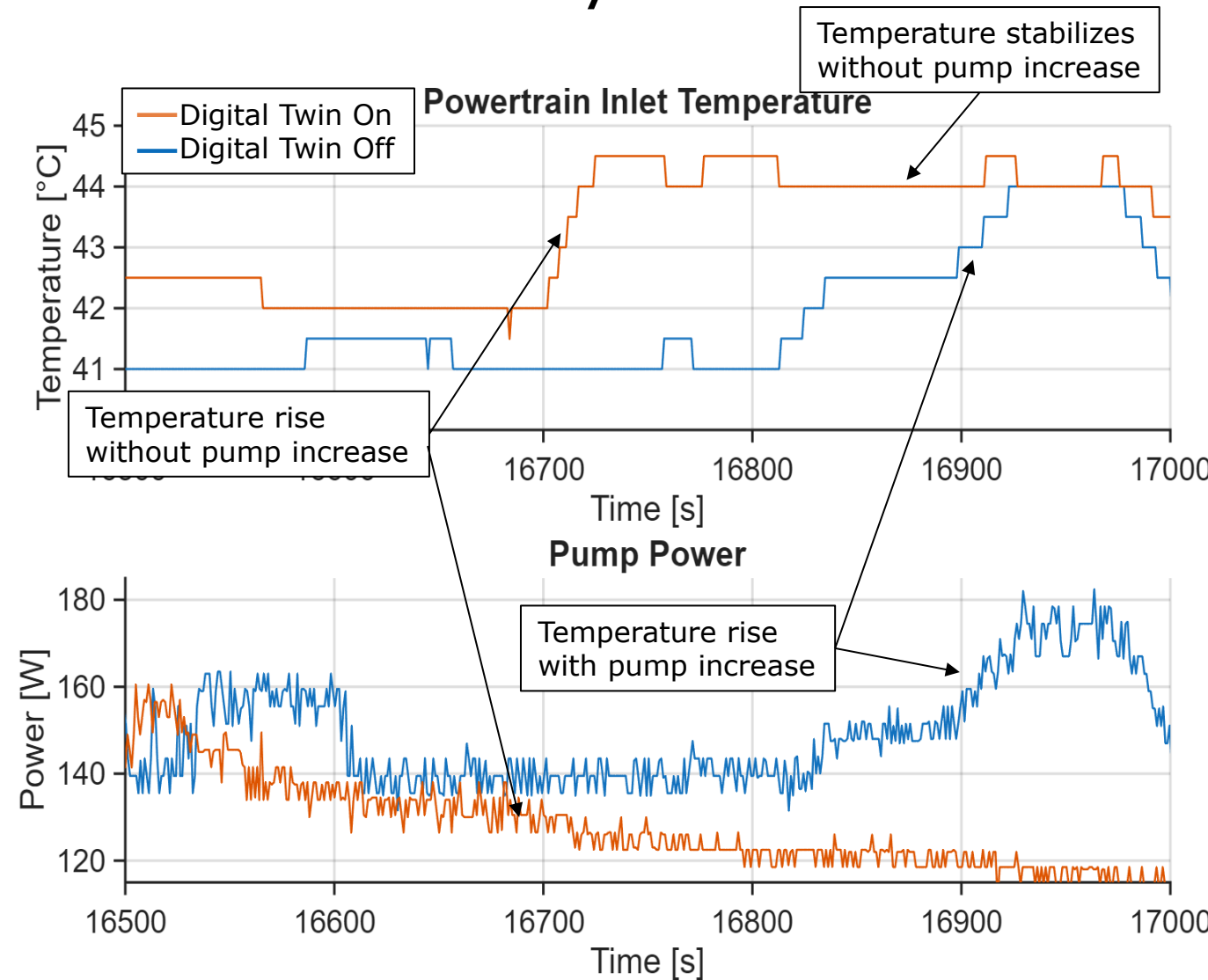
- A reduction in high power consumptions of the water pump can be observed
- The average power consumption of the water pump is reduced from 128W to 108 W

→ 15% reduction in power

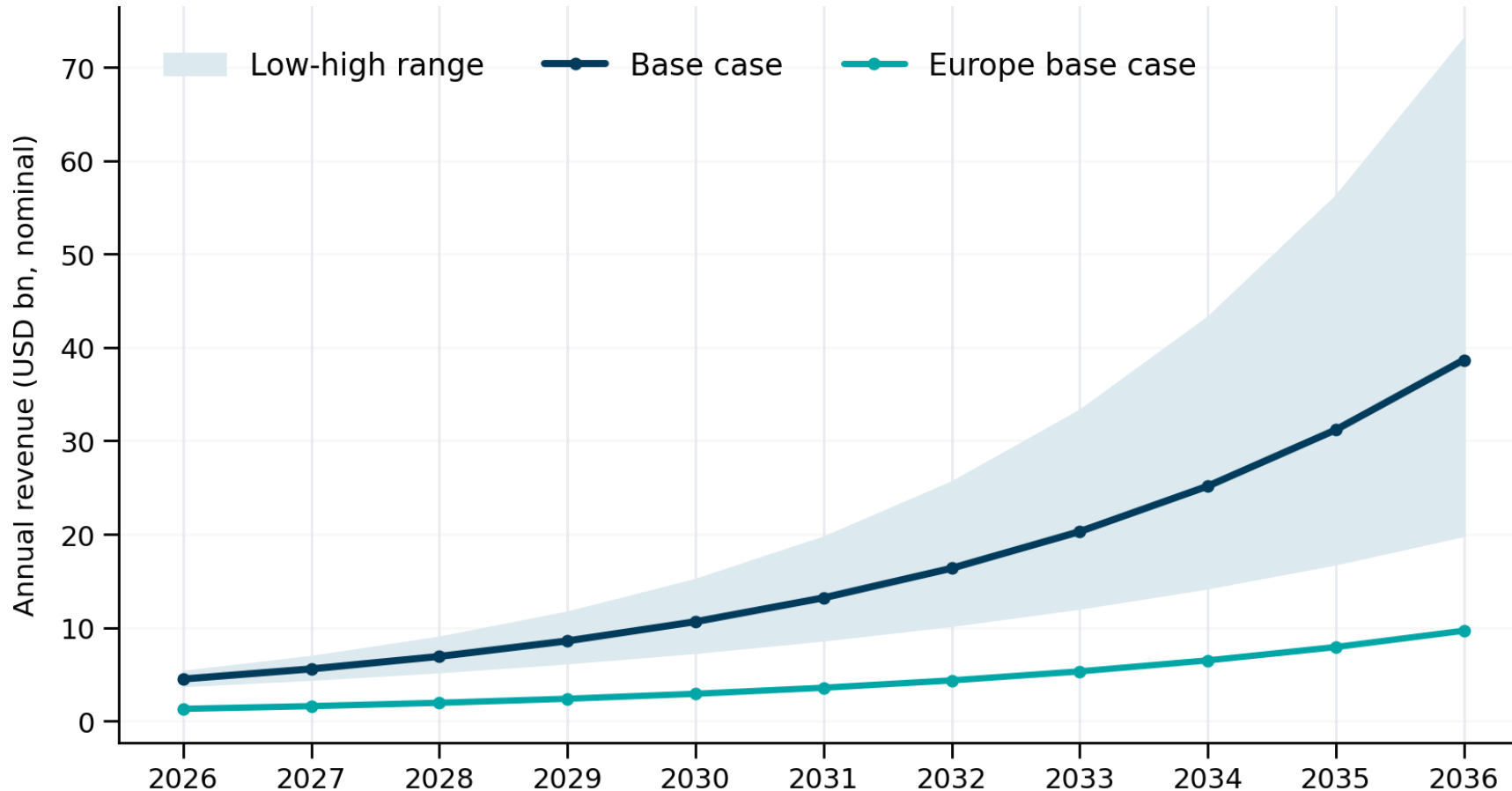


Time Plot Example for Digital Twin functionality

- The digital twin suppresses an increase in pump speed despite rising powertrain inlet temperatures because its prediction indicates that the temperature will not reach the critical threshold of 50 °C.
- In contrast, the baseline strategy responds to the temperature increase by raising the pump speed as a precaution, since it lacks information about future temperature development.
- If a critical temperature were predicted by the digital twin, the system would be able to react proactively and therefore require less cooling capacity.



Digital Twin: Economy of Scale in Automotive Industry



References:

Global Market Insights (GMI),
"Automotive Digital Twin Market
Size", 2025

TechSci Research, "Automotive
Digital Twin Market – Global
Industry Size, Share, Trends...",
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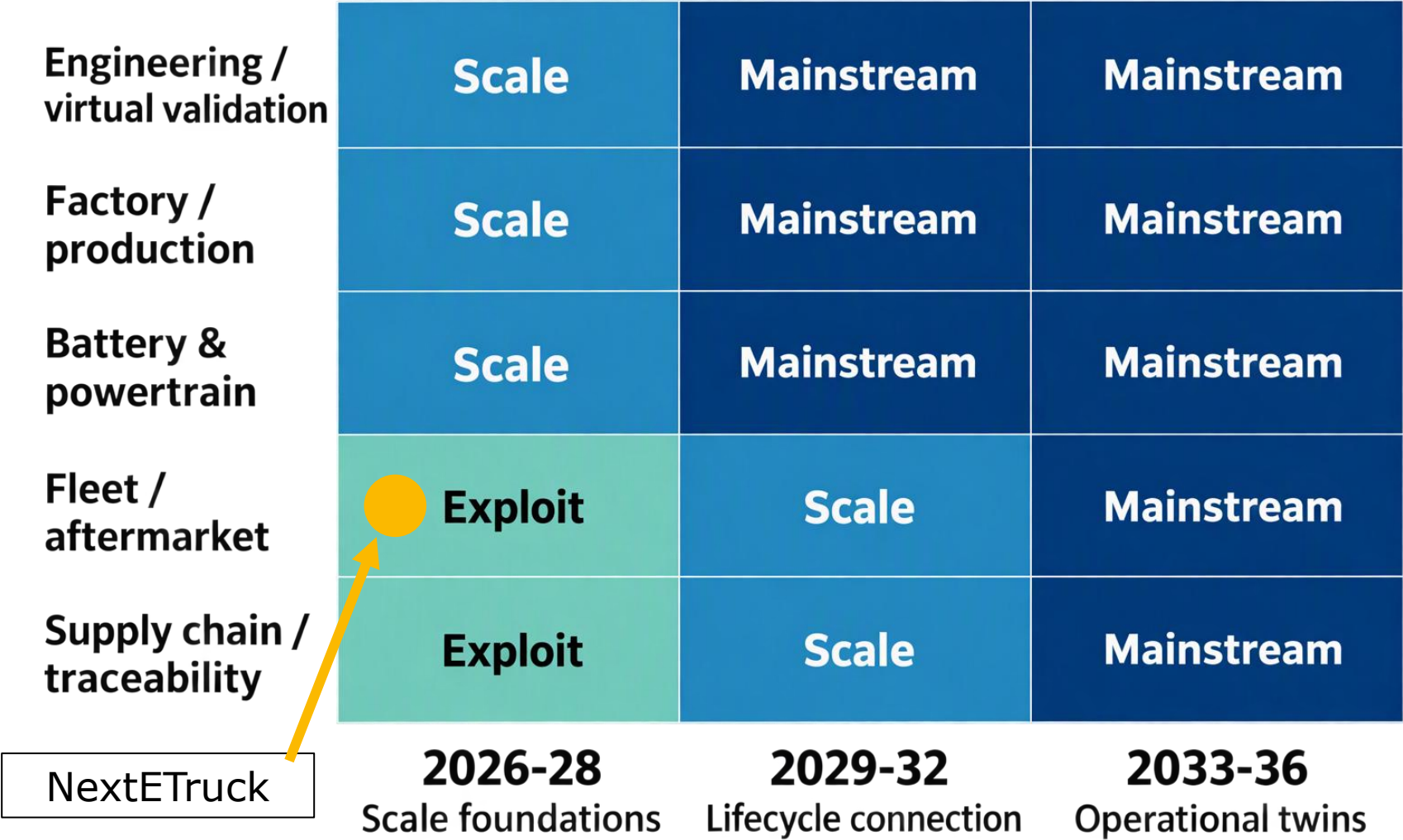
Visiongain, "Automotive Digital
Twin Market Report 2025–
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Allied Market Research,
"Automotive Digital Twins
Market", 2022

IG Transformation Partners,
Automotive Digital Twin Market,
Jun. 2026

Conclusion: Steep increase in the use of Digital twins in the Automotive Industry

Digital Twin: Economy of Scale in Automotive Industry



References:

Peer-reviewed automotive Digital Twin review (2025)

European Union – TWIN-LOOP project

Summary and conclusion

Digital Twin in NextETruck:

- The **Digital Twin** of the **cooling system, real-time communication** between Truck in Turkey and Cloud in Graz, **Cloud deployment/security**, involvement of **3-party suppliers** were successfully **demonstrated on public road**
- The digital twin demonstrated **15% reduction of cooling** power and the potential of **reducing the cooling system size and costs**
- The proven digital twin demonstration can be **expanded to other systems**

Digital Twin in a larger Scale:

- **Digital twin** revenue in the automotive sector are expected to have a **fast expansion** the next 10 years especially within **fleet optimization, predictive maintenance and production**



Thank you for your attention!