



# AI for Efficient Traction Battery Lifecycle Development and Diagnostics

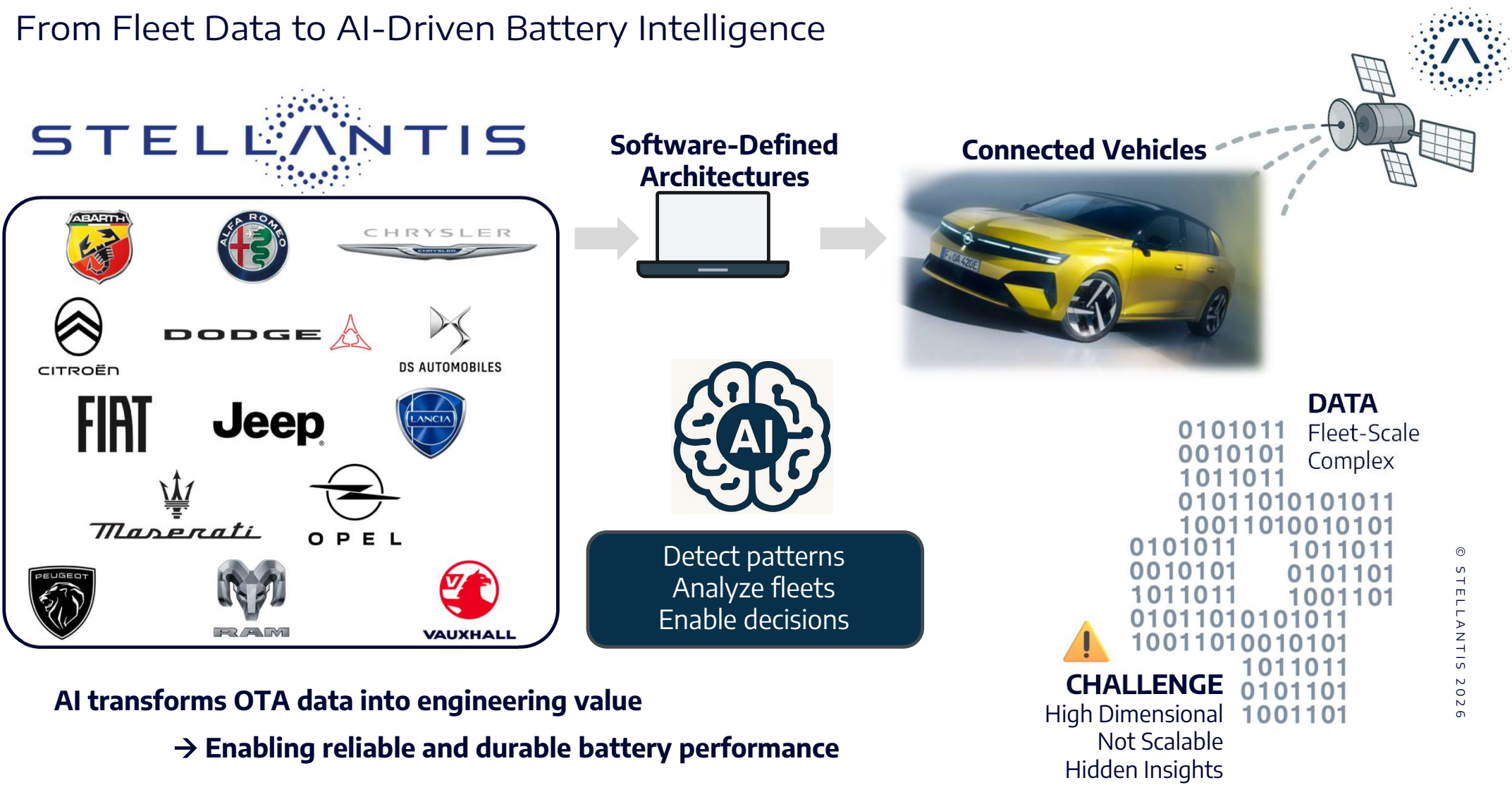
Aachen Automotive Colloquium  
October 5 – 7, 2026

Oliver Breuer, Battery Data Analytics

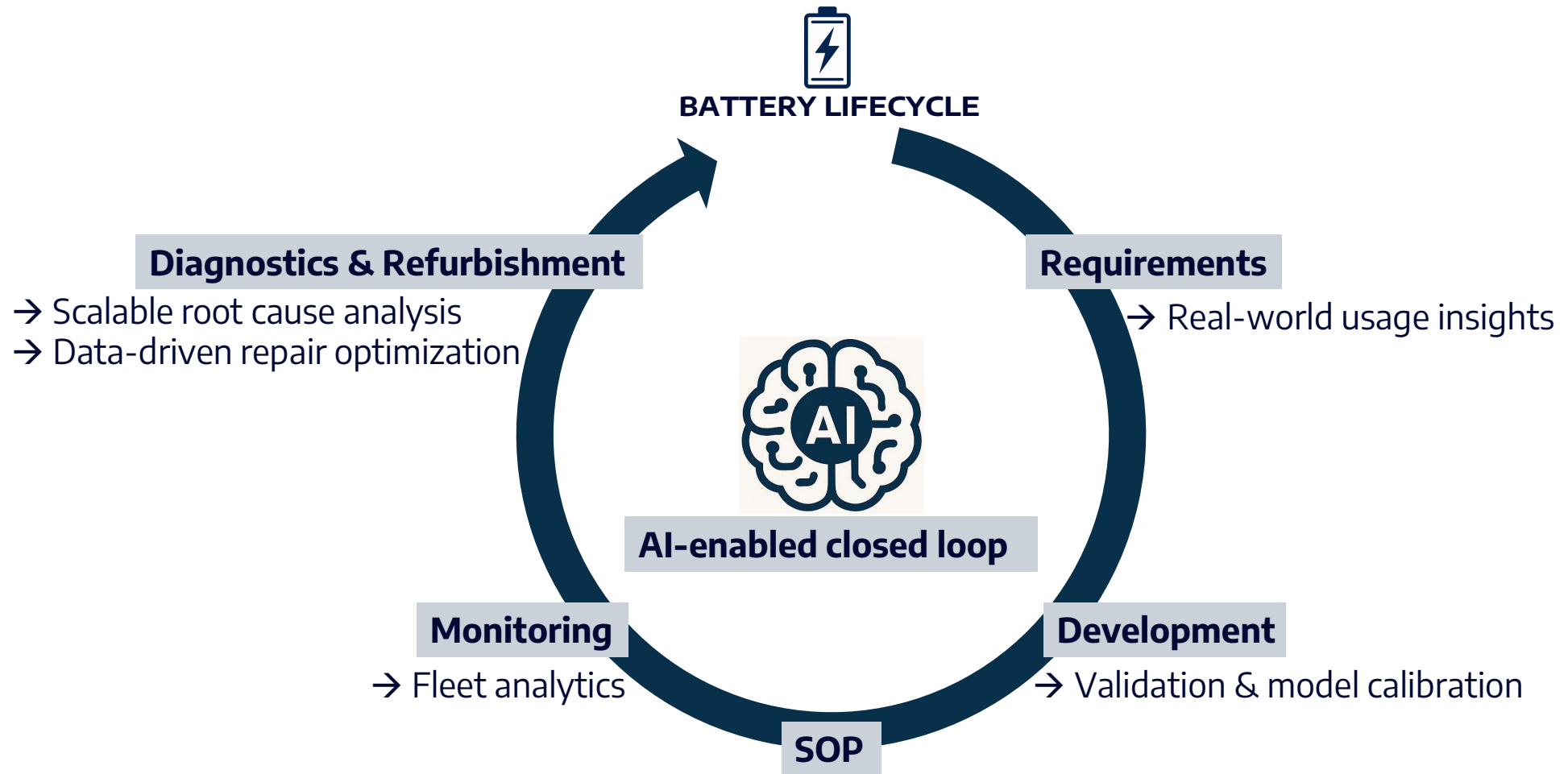


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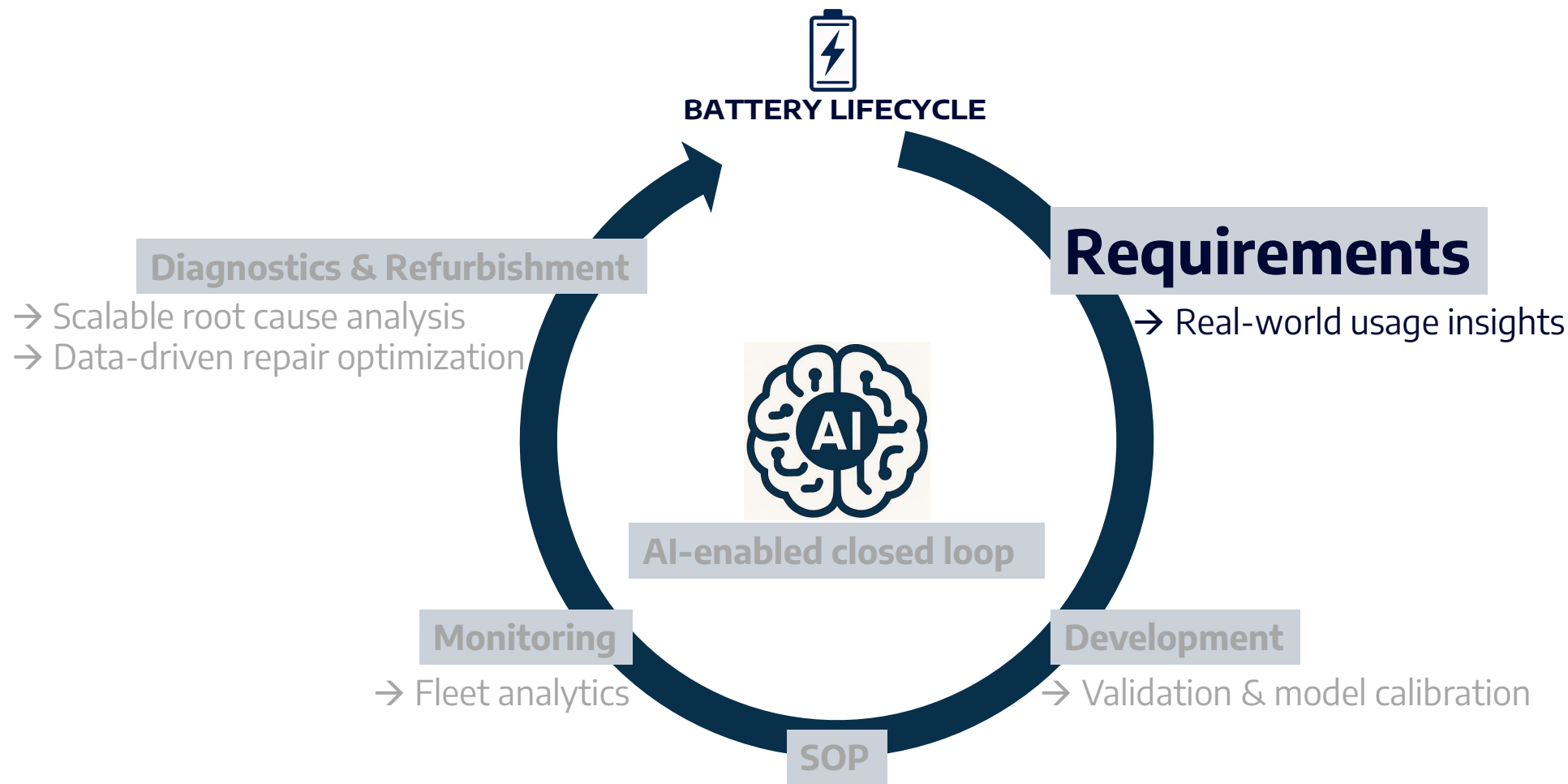
# From Fleet Data to AI-Driven Battery Intelligence



# AI Applications Across the Battery Lifecycle



# AI-supported Requirements



# AI-supported Requirements



Requirement engineering becomes a data-driven statistical discipline

Assumptions



AI-supported Fleet KPIs & Distributions



Design Targets

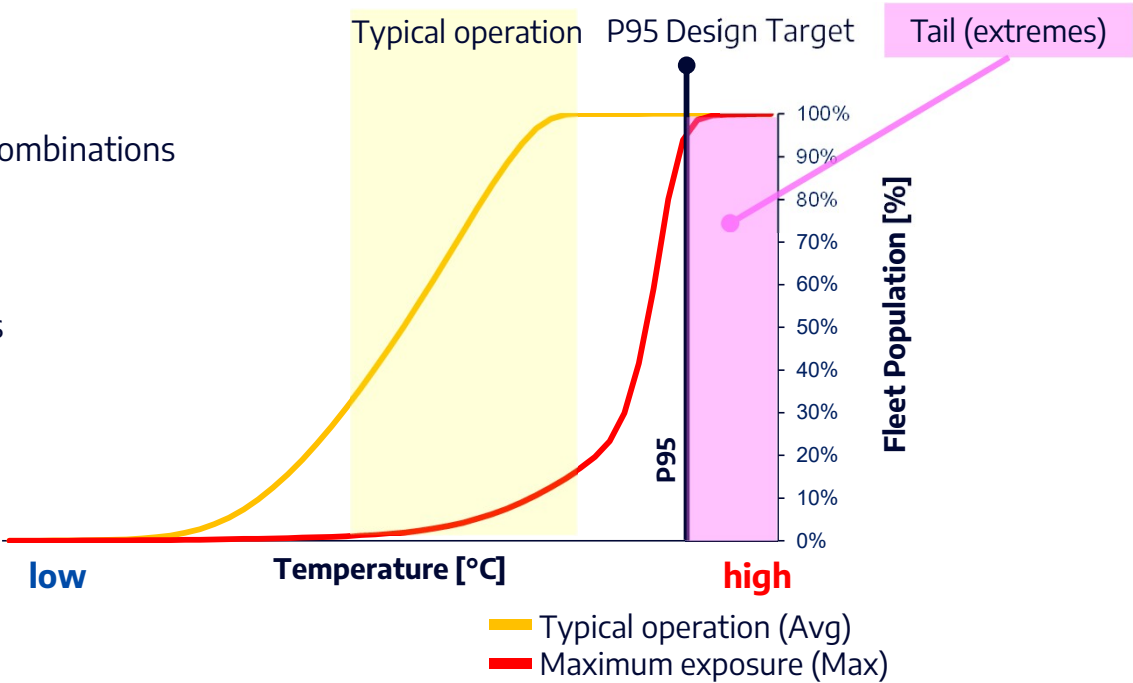
## Classical Approach

- Fixed single values
- Unrealistic worst-case combinations



Risk:

- Over-engineering
- missed edge cases

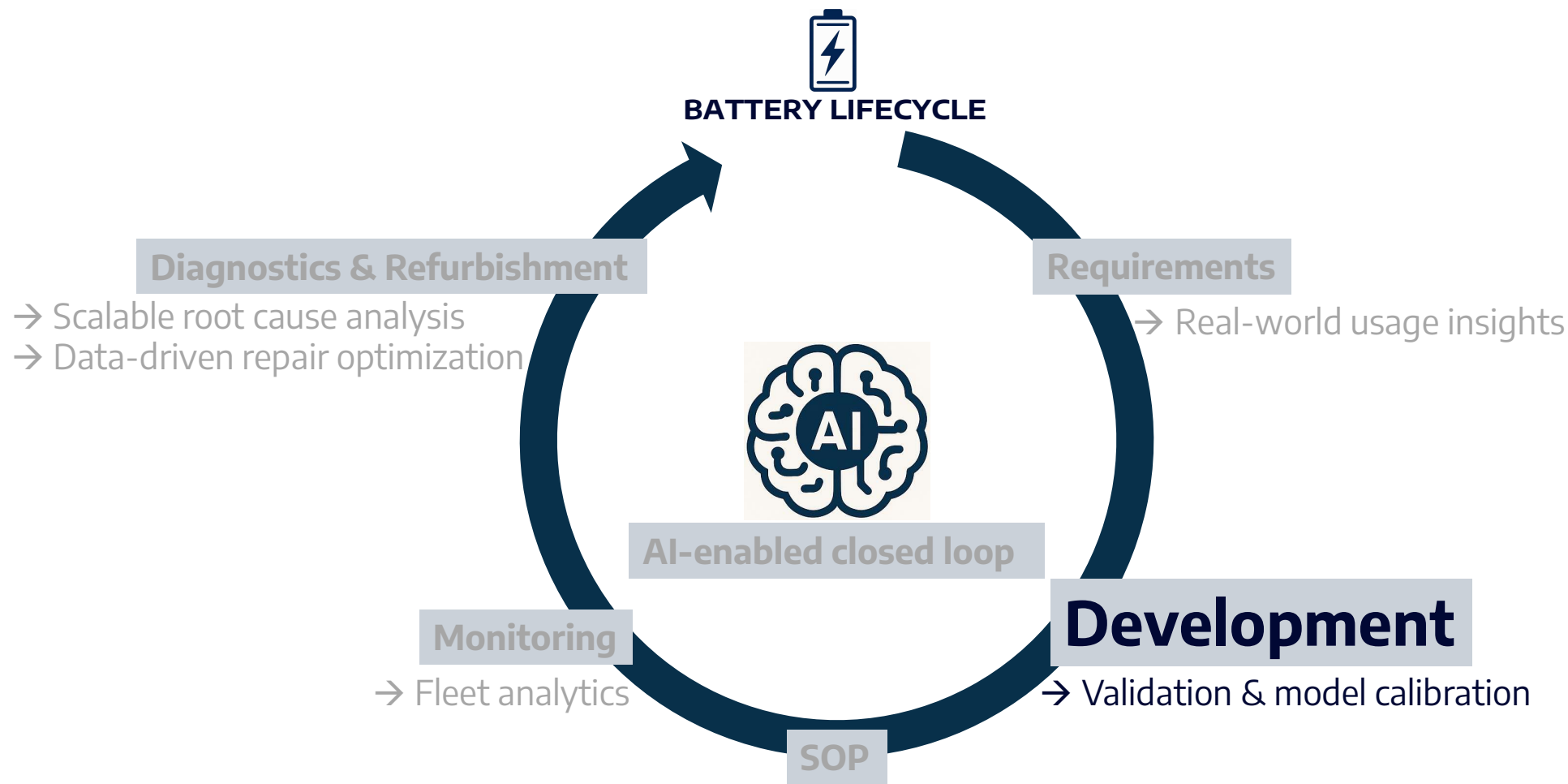


## Data-Driven Approach

- Statistical Fleet distributions
- Design for extreme conditions

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# AI-supported Development



# AI-supported Development



## AI enables early anomaly detection and fleet-ready models

### Battery Development Testing

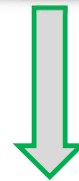
- Extensive pack- and module-level tests (e.g. durability, performance, accelerated ageing)
- Time- and cost-intensive test campaigns
- Early detection of cell and module anomalies is critical
- Test data enables pre-calibration of in-vehicle OTA / AI models



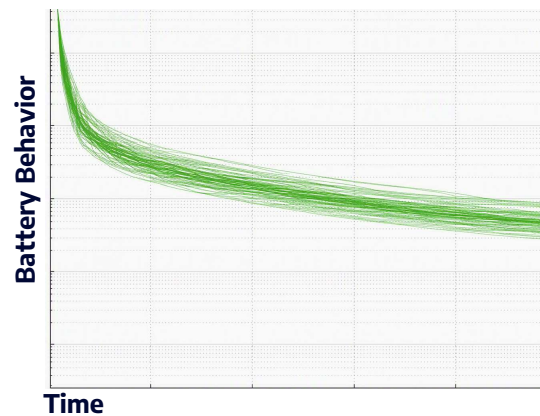
Cell / Module  
anomaly detection



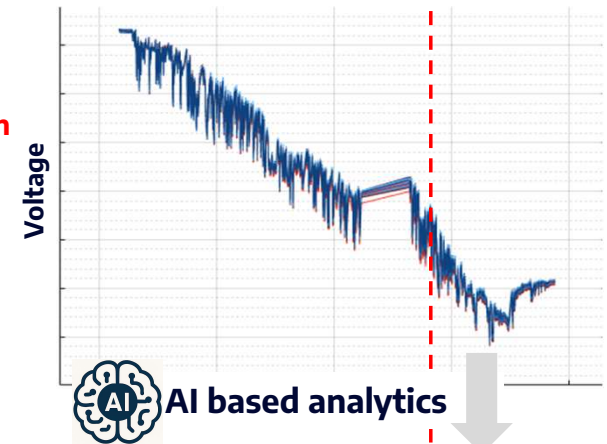
Healthy  
development data



Healthy Data for Model training

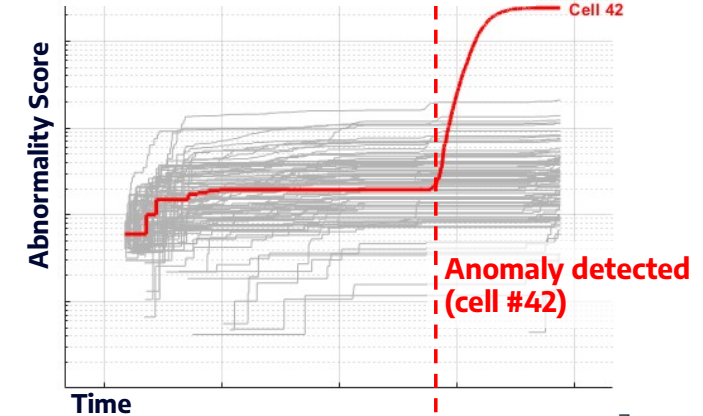


Voltage Signals (with artificial error in Cell #42)



AI based analytics

Cell-based Abnormality Monitoring



Anomaly detected  
(cell #42)



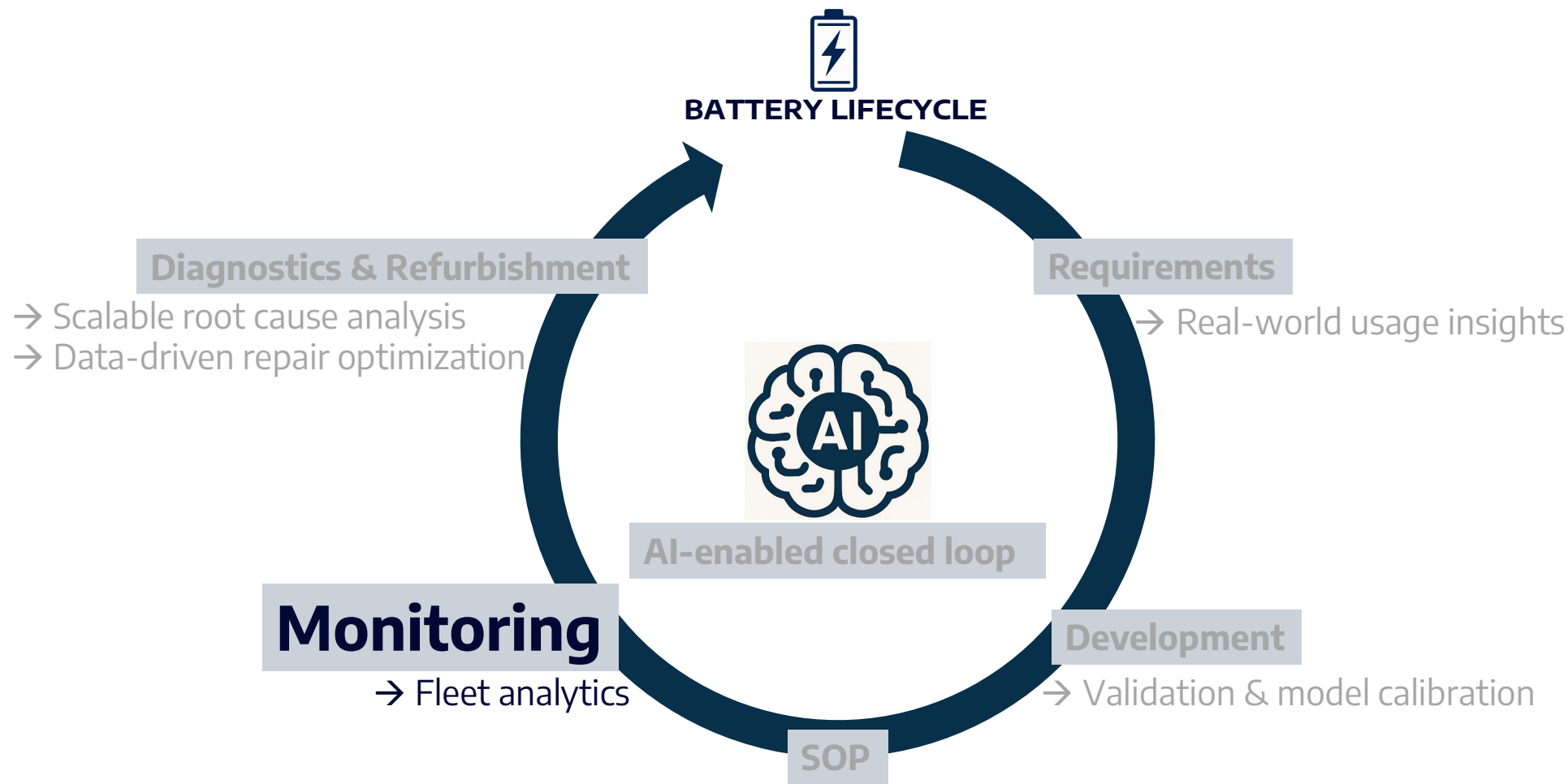
Fleet Monitoring



Model Calibration



# AI-supported Monitoring



# AI-supported Monitoring



## AI enables predictive fleet monitoring and targeted actions

### Fleet Monitoring

- Cell voltage & SOC behavior
- Module-level deviations
- Fleet-scale data (millions of vehicles)



### AI-based predictive analytics

- Detects abnormal degradation
- Predicts failure risk & time horizon
- Identification of high-risk vehicles



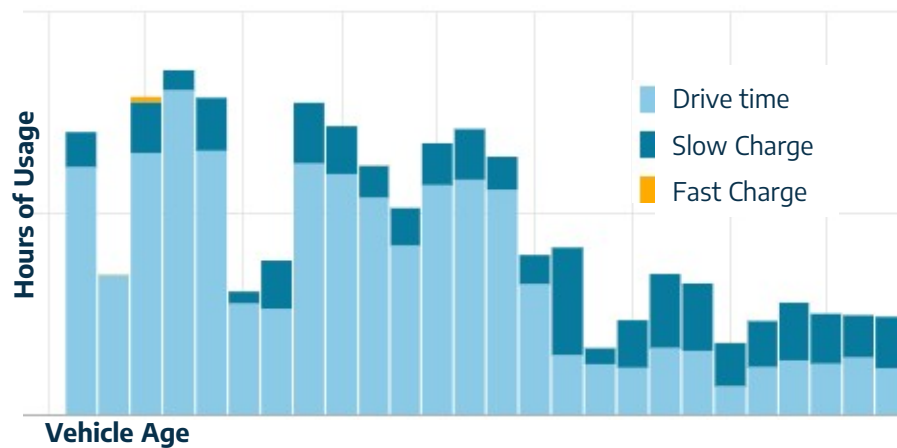
### Data-driven actions

- Targeted inspection (instead of full recall)
- OTA optimization
- Early customer warning

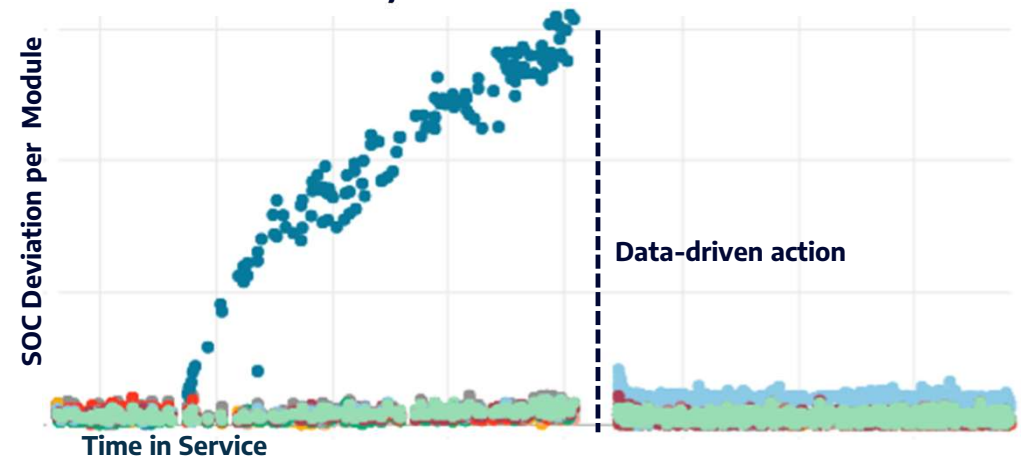
→ Prevents failures before customer impact

→ Reduce cost & improve quality

### Typical Vehicle Usage Profile



### Module-Level Anomaly Detection



## AI-supported Diagnostics & Refurbishment



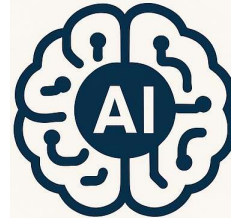
  
**BATTERY LIFECYCLE**

### Diagnostics & Refurbishment

- Scalable root cause analysis
- Data-driven repair optimization

**Requirements**

- Real-world usage insights



**AI-enabled closed loop**

**Monitoring**

- Fleet analytics

**Development**

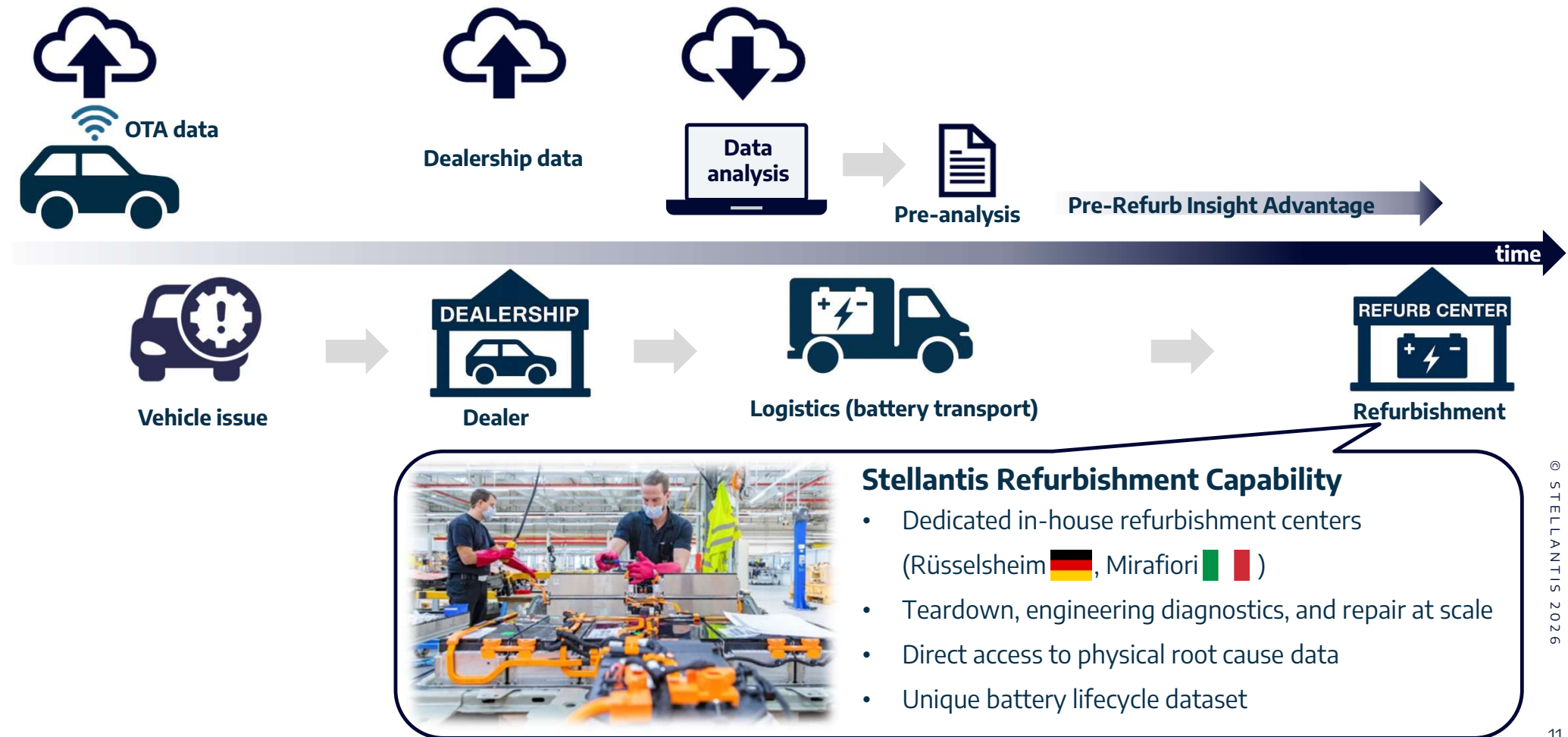
- Validation & model calibration

**SOP**

# AI-supported Diagnostics & Refurbishment



## From Field Issue to Refurbishment Intelligence



# AI-supported Diagnostics & Refurbishment



## From manual root cause analysis (RCA) to AI-driven, scalable diagnostics

### Manual RCA

- Expert-driven analysis
- Limited data integration
- Slow and case-by-case



### AI-supported RCA

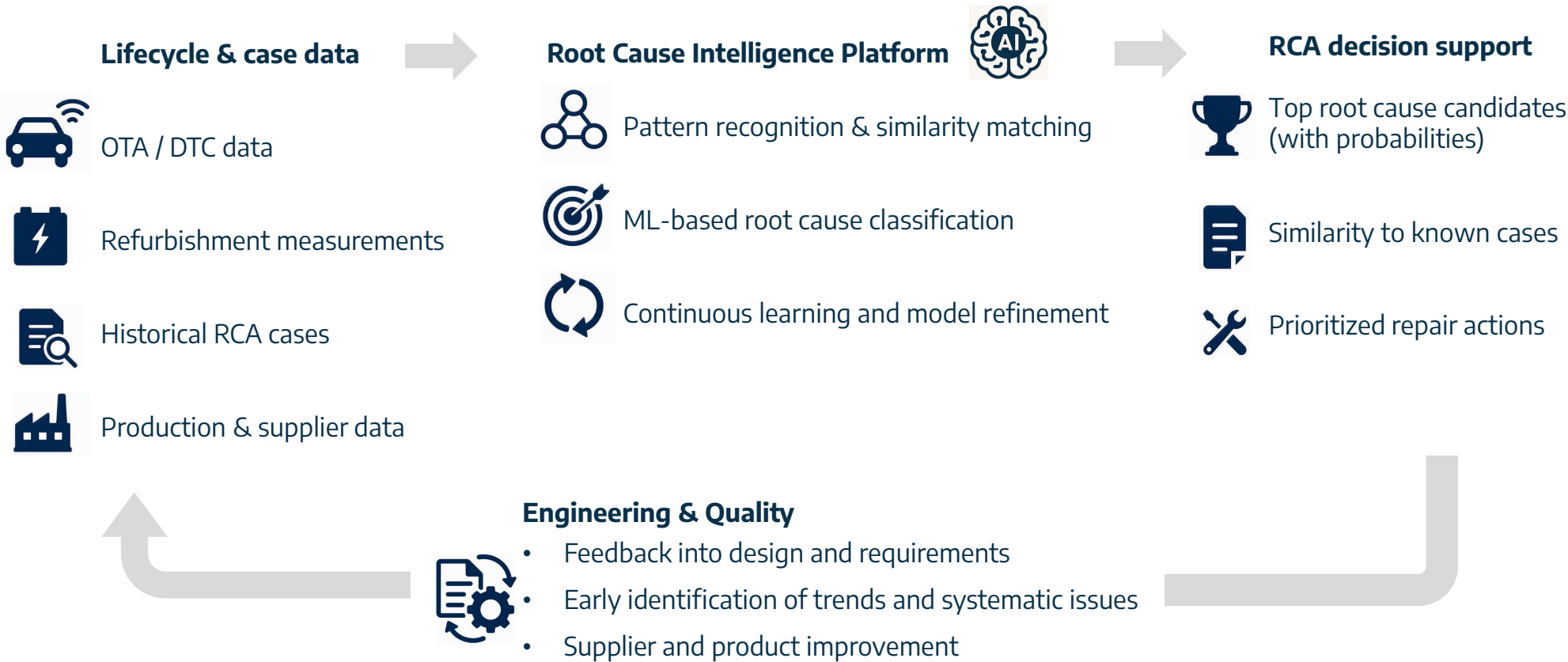
- Multi-source data integration
- Pattern recognition
- Fast and scalable analysis



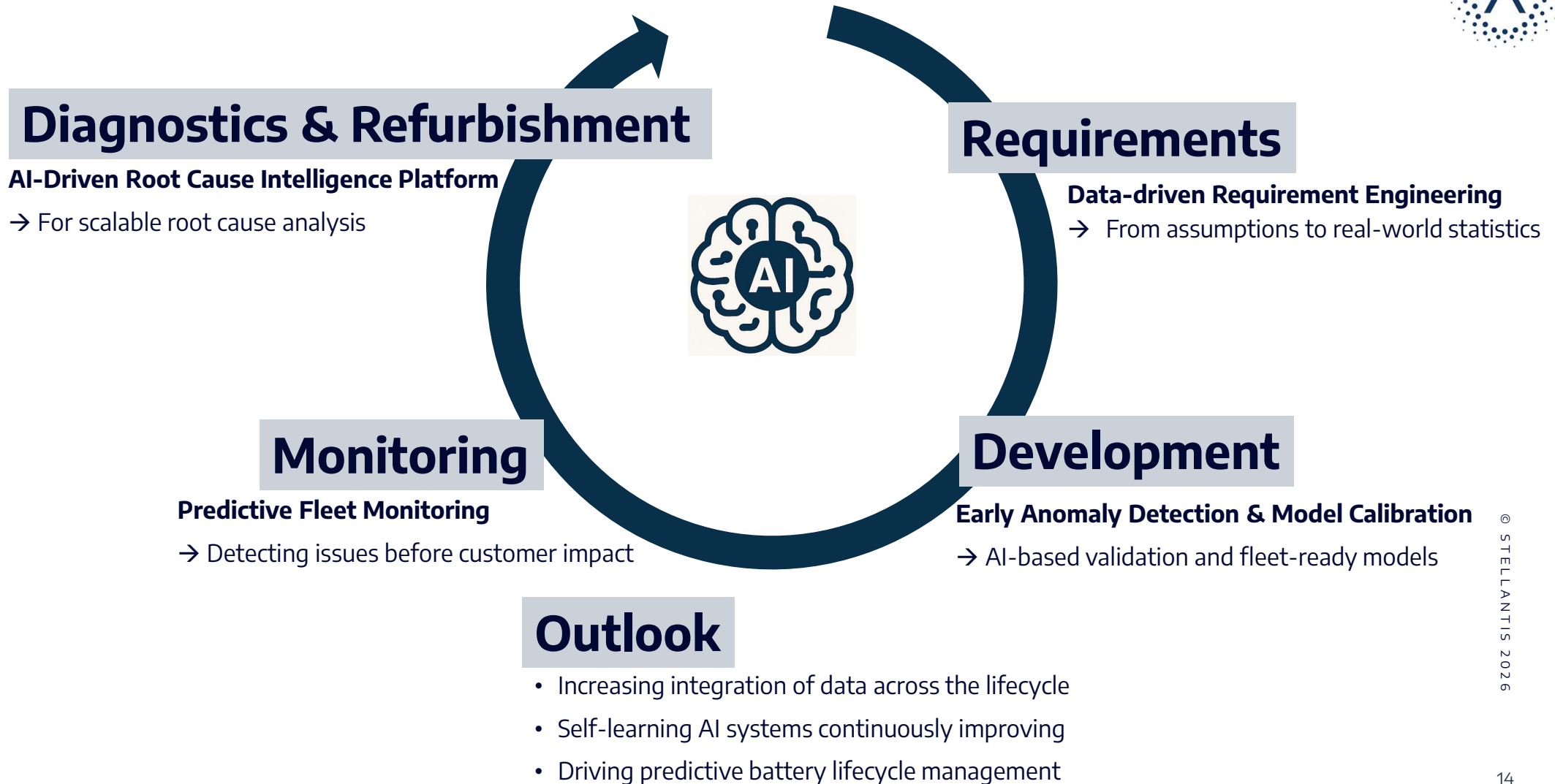
# AI-supported Diagnostics & Refurbishment



## AI transforms battery lifecycle data into root cause intelligence



# AI-Driven Battery Lifecycle: Key Takeaways & Outlook



The Stellantis logo, consisting of a circular arrangement of white dots, is positioned behind the word "STELLANTIS".

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