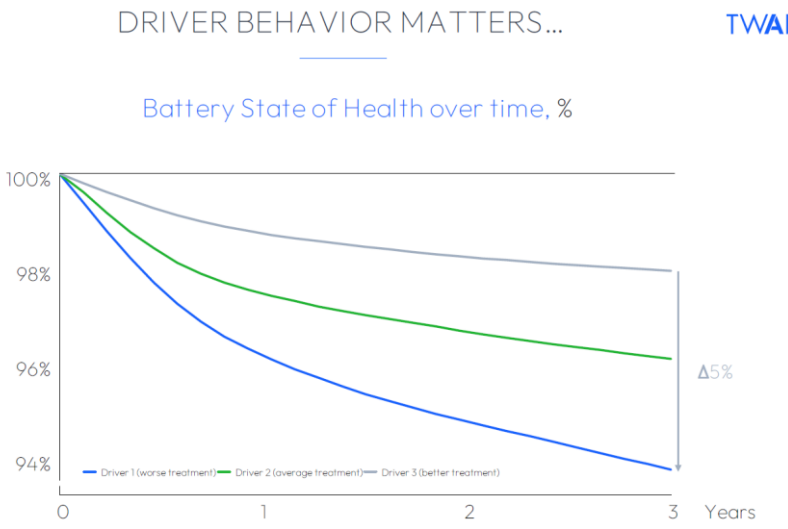
HBK Technology Days – Virtual Seminar Series

Tuesday, November 8, 2022



TWAICE

Closing the loop with hybrid simulation models for battery electric vehicles

Presented by Dr. Matthias Simolka,
Technical Solution Engineering, TWAICE

Closing the loop with hybrid simulation models for battery electric vehicles

Abstract

The change to electromobility continues to pick up speed, ensuring that one component is at the center of attention: the battery. It is both the enabler and Achilles heel of the transition from ICE to EV. Batteries are used in various applications with significantly different requirements and many diverse environmental conditions. Predicting the behavior of batteries with different cell chemistries and formats when impacted by these parameters is challenging. Hence, different individual approaches for battery simulations exist. Combining some of these individual approaches can have a strong impact on the overall model performance.

TWAICE enables the automotive industry to step up its battery game – generate more value with batteries by simulating before start of production and by enhancing after-sales services with our predictive battery analytics. We will shed some light on the benefits of semi-empirical and machine learning models as well as their combination – we call this a hybrid model.

About the presenter, Matthias Simolka, Technical Solution Engineering, TWAICE

Dr. Matthias Simolka is Technical Solution Engineering at TWAICE. In this capacity, Matthias bridges the gap between Sales, Product and Tech, working with all teams to ensure maximum value and the optimal solution is delivered to battery customers. TWAICE supports enterprises across industries with predictive battery analytics software based on digital twins.

Prior to joining TWAICE, Matthias was working several years in academic research focusing on the aging mechanisms of modern Li-ion batteries. His research combined material analysis down to the nanometer scale with system level observations to link the battery behavior to actual degradation mechanisms. After the academic research, Matthias worked for a few years as a Consultant focusing on the German energy market with special attention to renewable energies and energy storage technologies and their applications.

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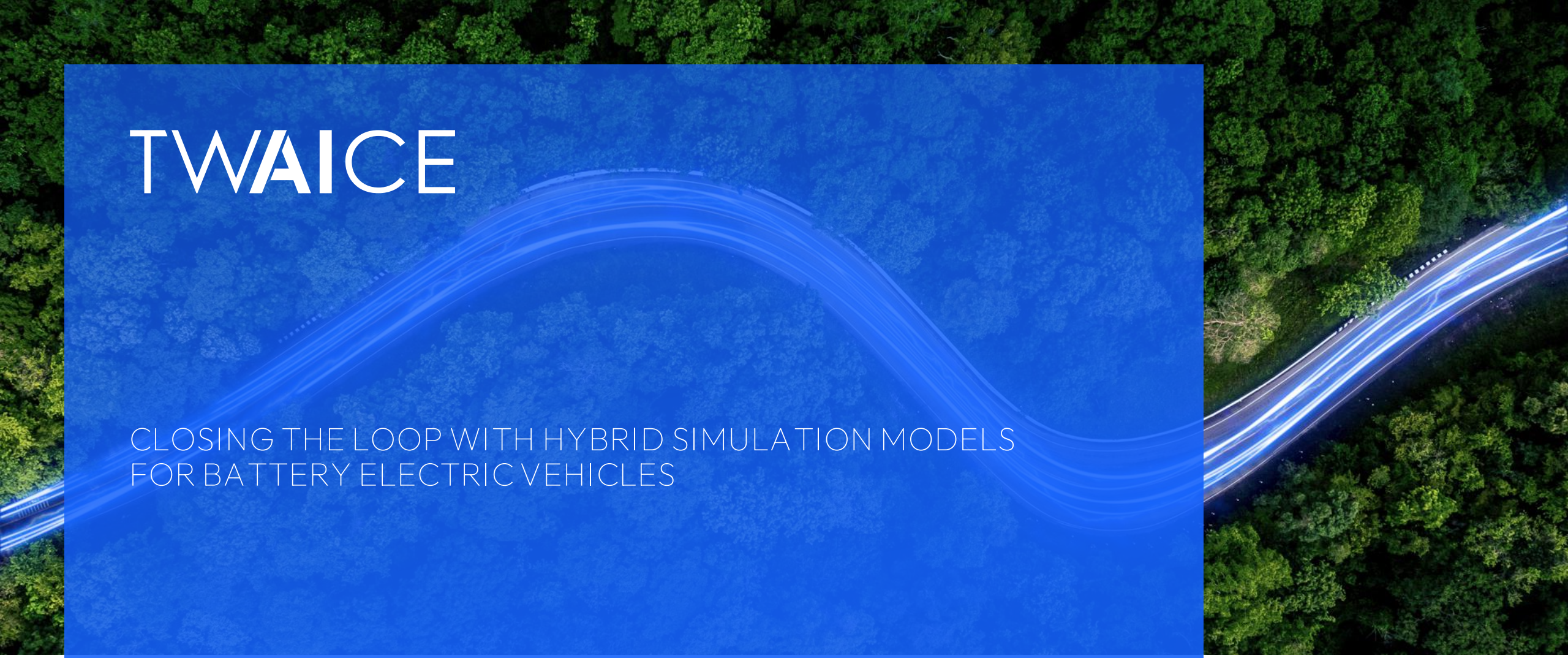
HOTTINGER BRÜEL & KJÆR



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CLOSING THE LOOP WITH HYBRID SIMULATION MODELS FOR BATTERY ELECTRIC VEHICLES

Dr. Matthias Simolka, Lead Technical Solution Engineer
Simolka@twaice.com

2022 HBK Technology Days

HBK HOTTINGER BRÜEL & KJÆR

THE CHALLENGE

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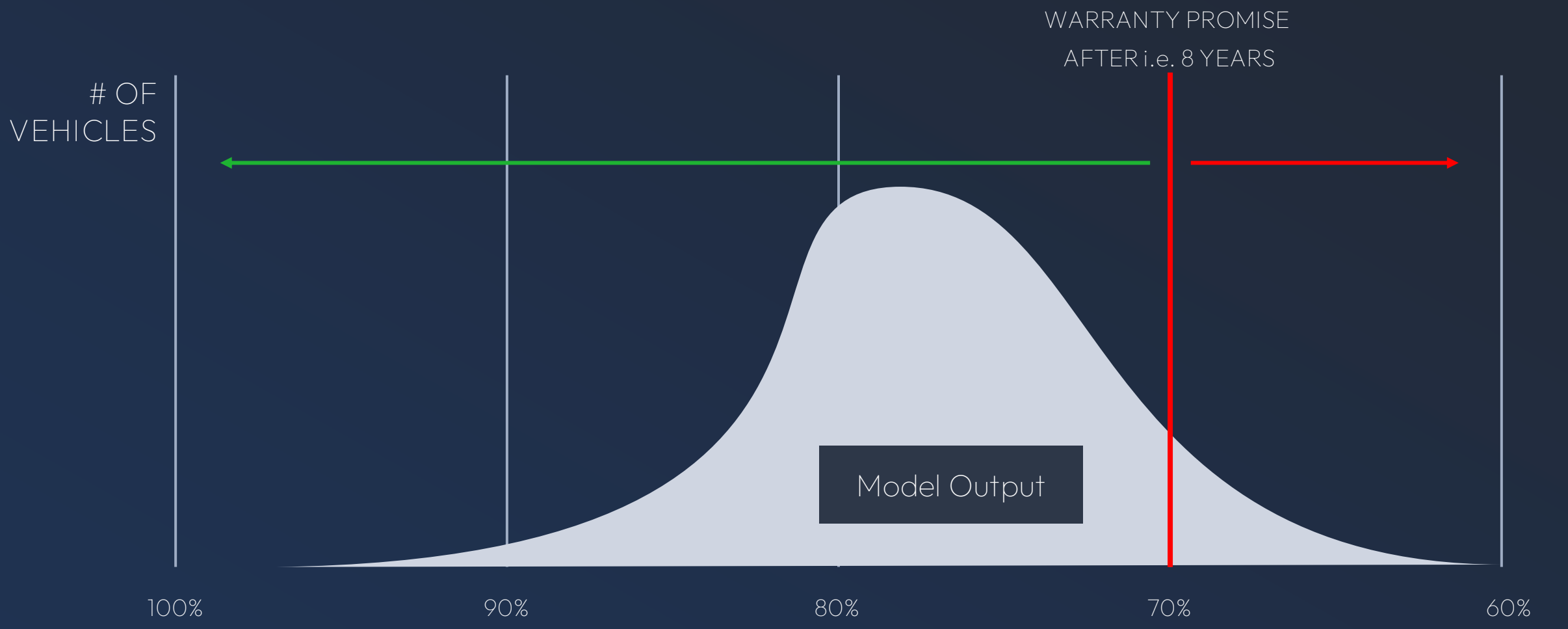

THE BATTERY LIFECYCLE

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WHY MODELS?

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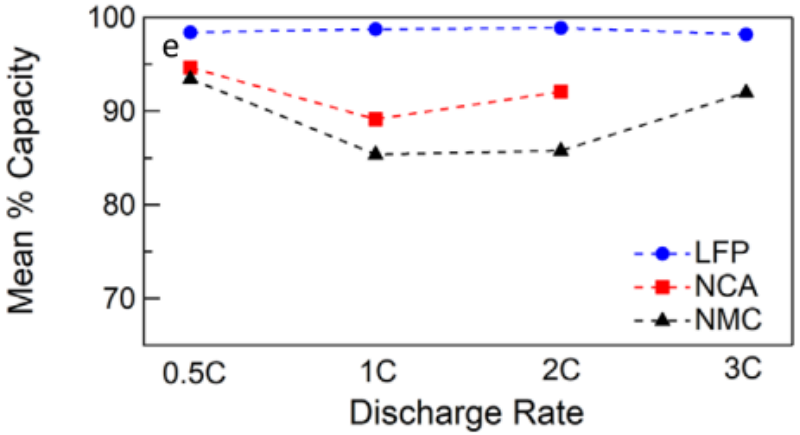
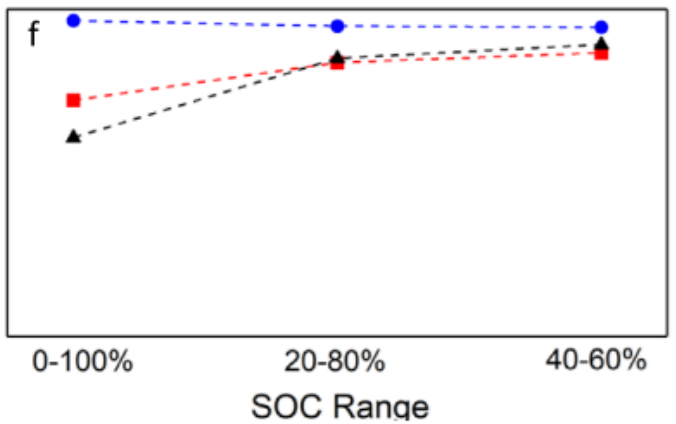
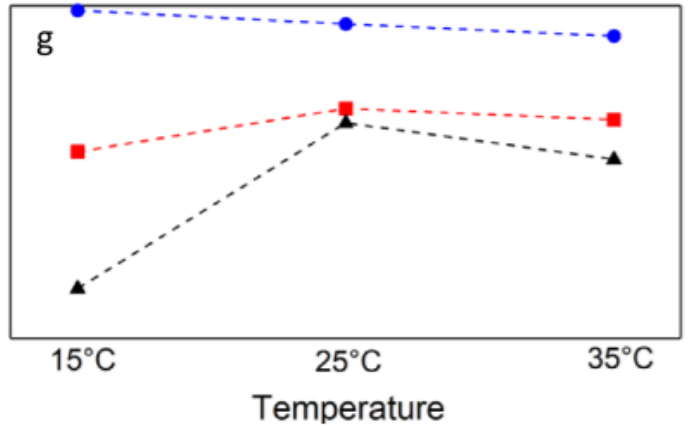
GENERAL TRENDS OBSERVABLE…



- LFP insensitive to C-rate

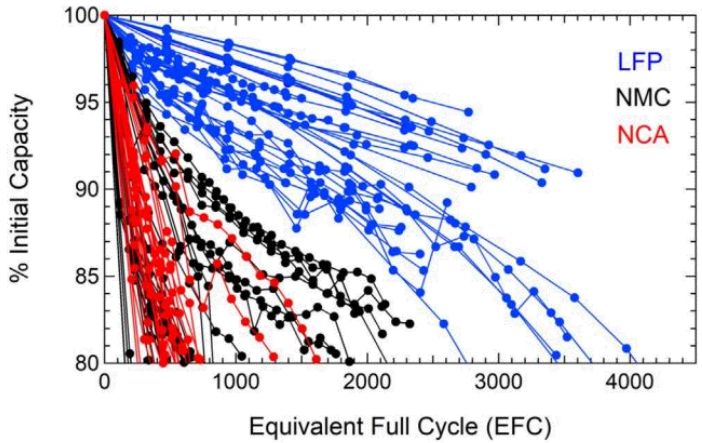


- Inverse behavior for LFP & NMC + NCA



- Inverse behavior regarding LFP & NMC + NCA

BUT IT IS MORE COMPLICATED…



CHECK ALSO..

- Energy vs Charge Throughput
- Exact cell chemistry (i.e. Si+Gr, LFP vs LMFP)
- System design (i.e. cell balancing, cooling)
- …

Mean Capacity after 200 EFC

Preger et al., Journal of The Electrochemical Society, 2020 167 120532

MODELING APPROACHES

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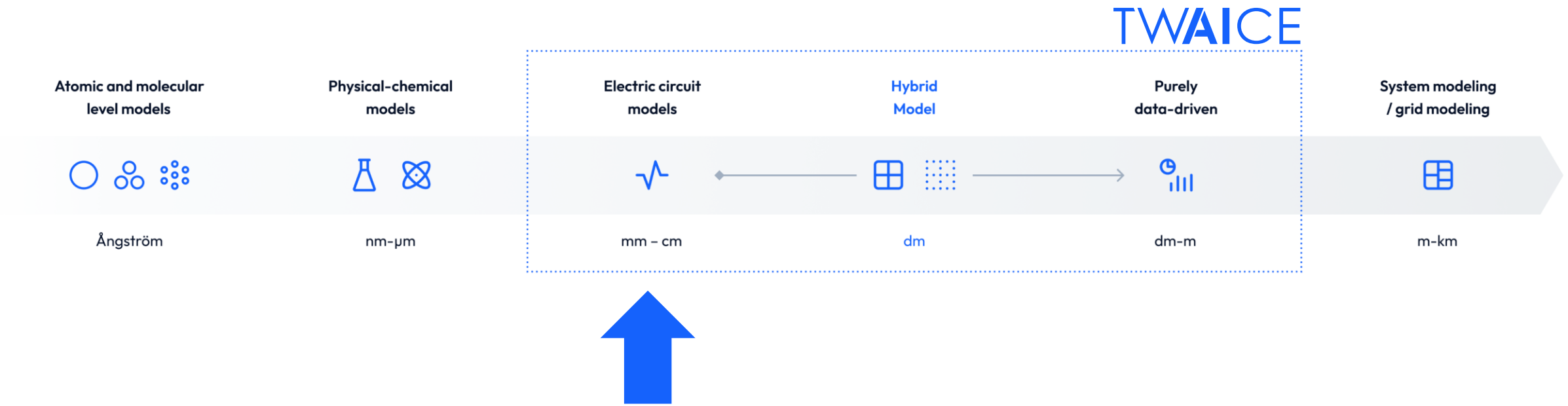
Battery Model on a length scale



DRIVER BEHAVIOR MATTERS…

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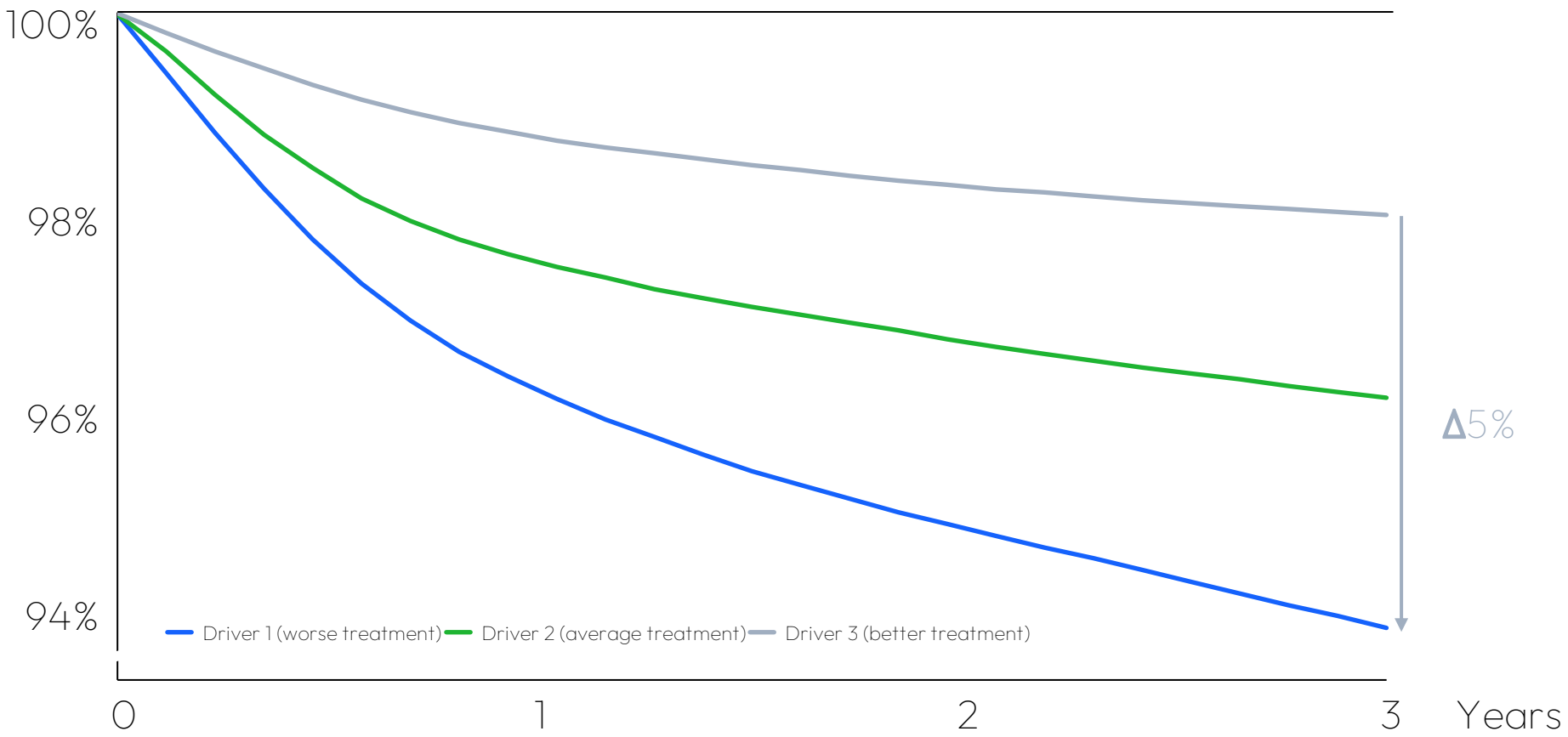
Battery State of Health over time, %



Source: TWAICE Battery Health Report White Paper
1) State of Health

BATTERY BEHAVIOR...

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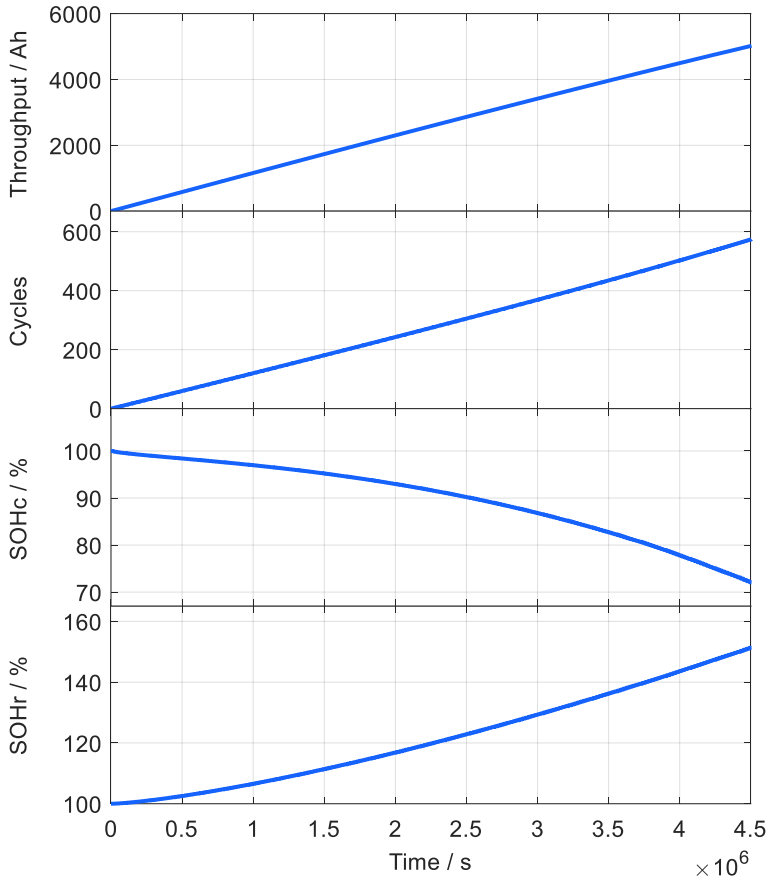

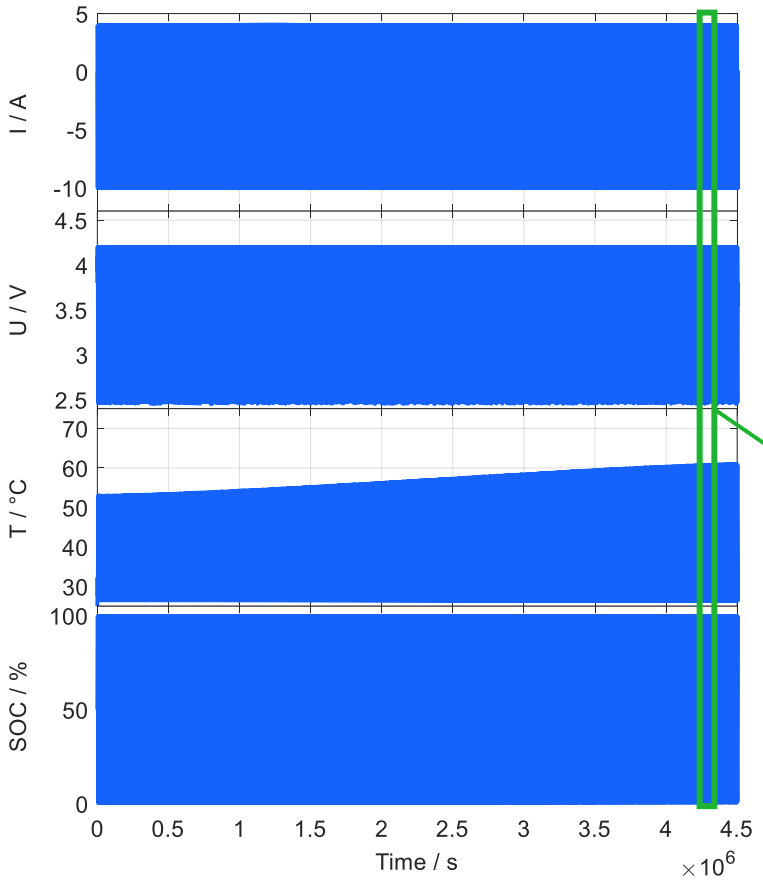

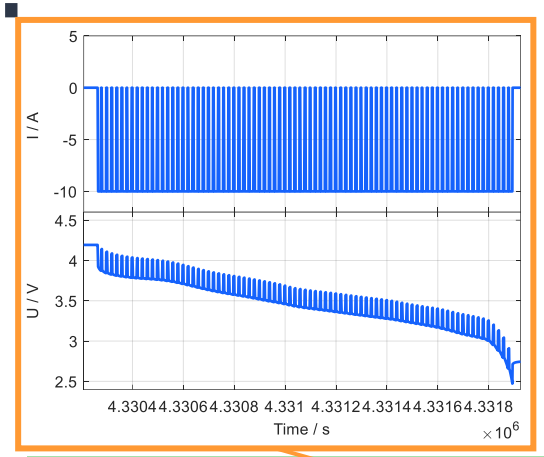

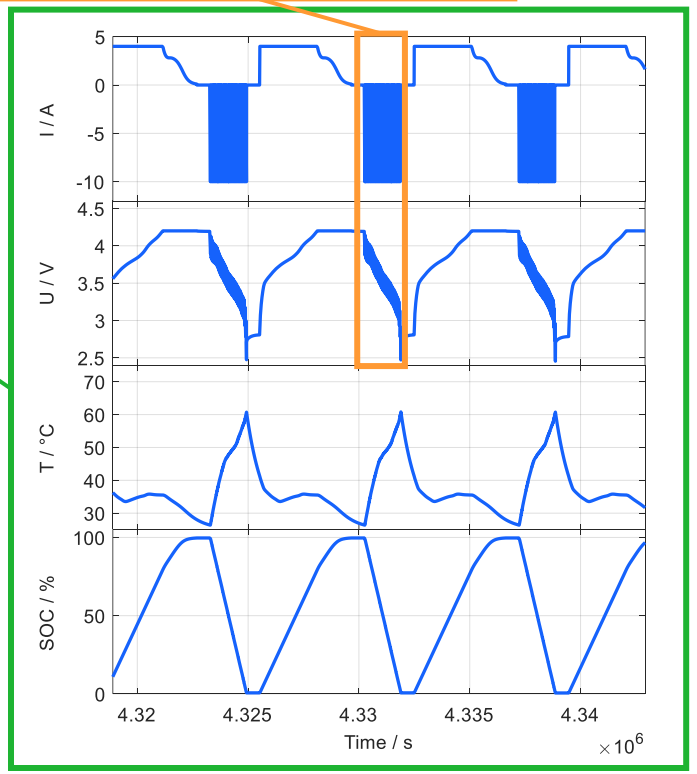

MODELING APPROACHES

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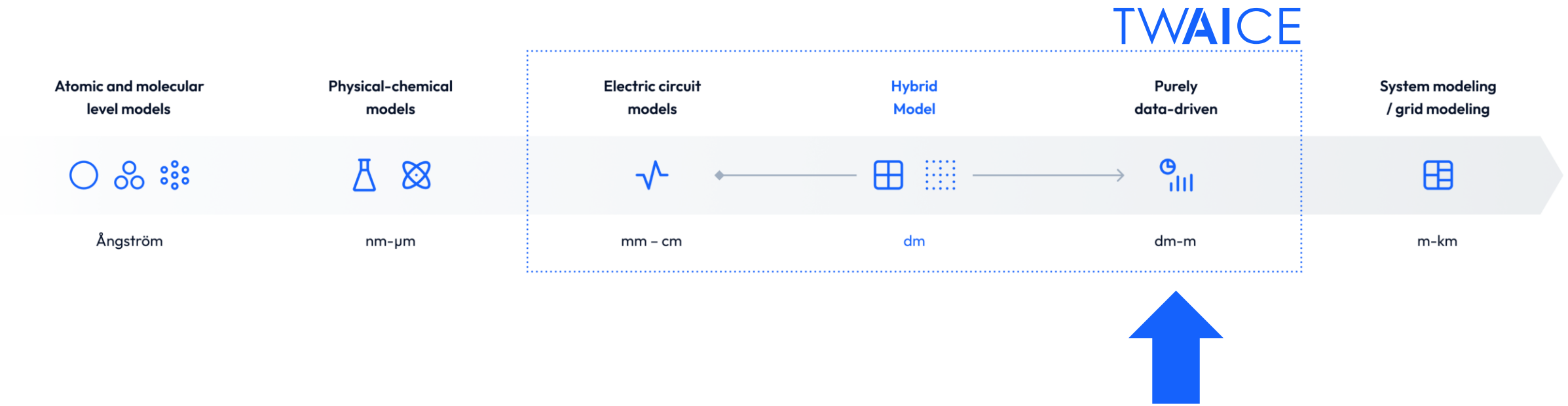
Battery Model on a length scale



SAME BUS, DIFFERENT STORY…

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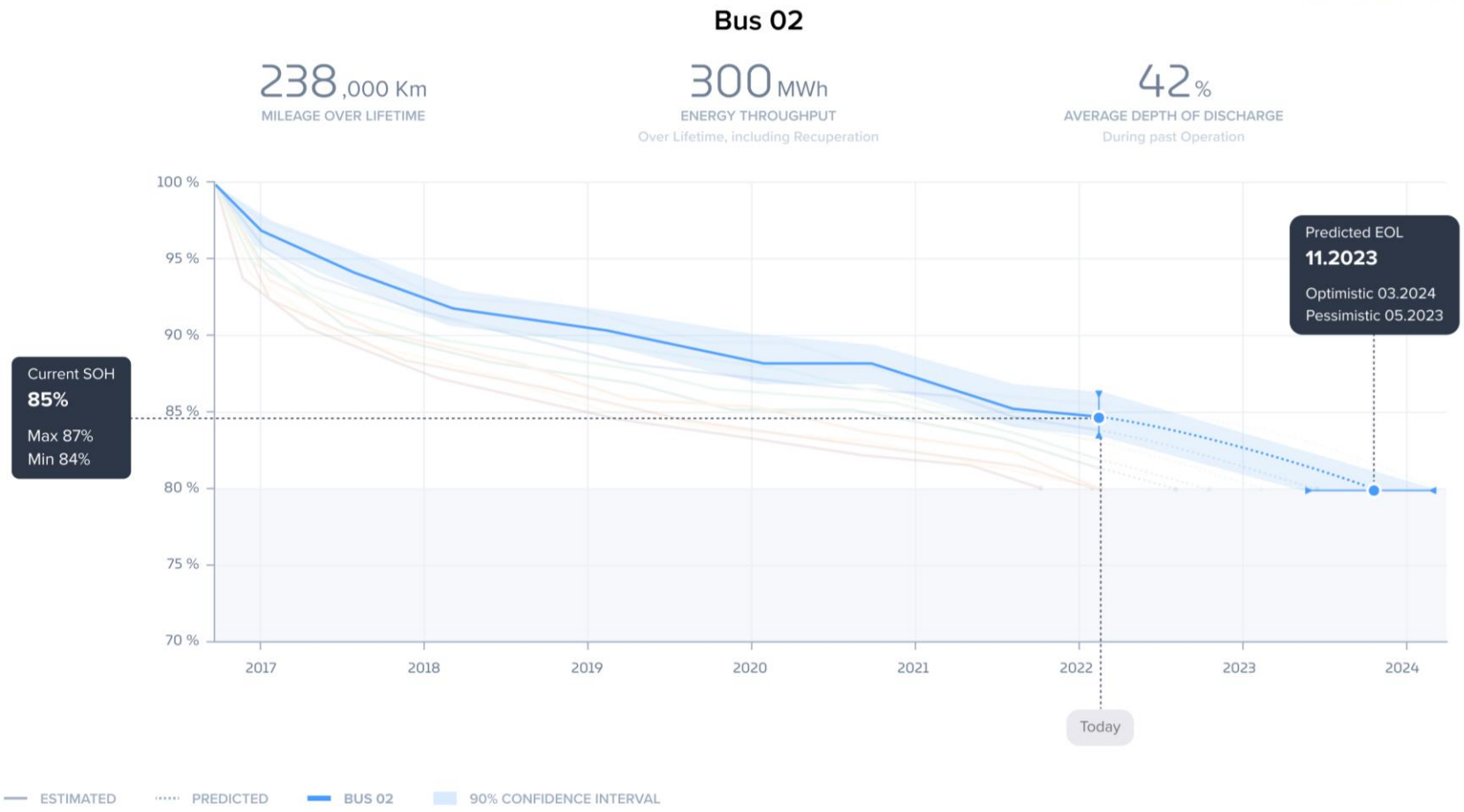

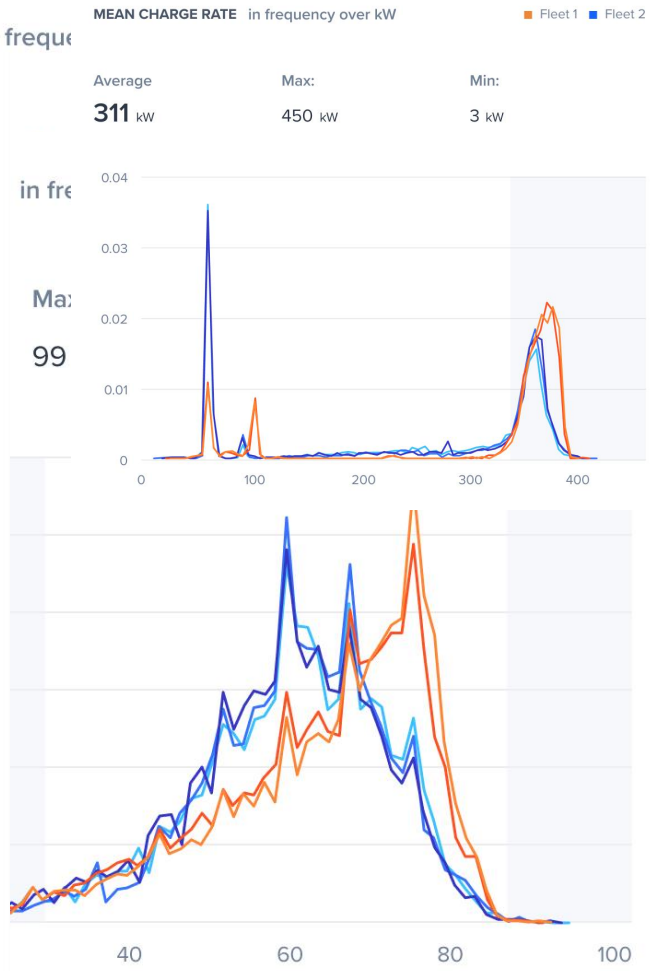

MODELING APPROACHES

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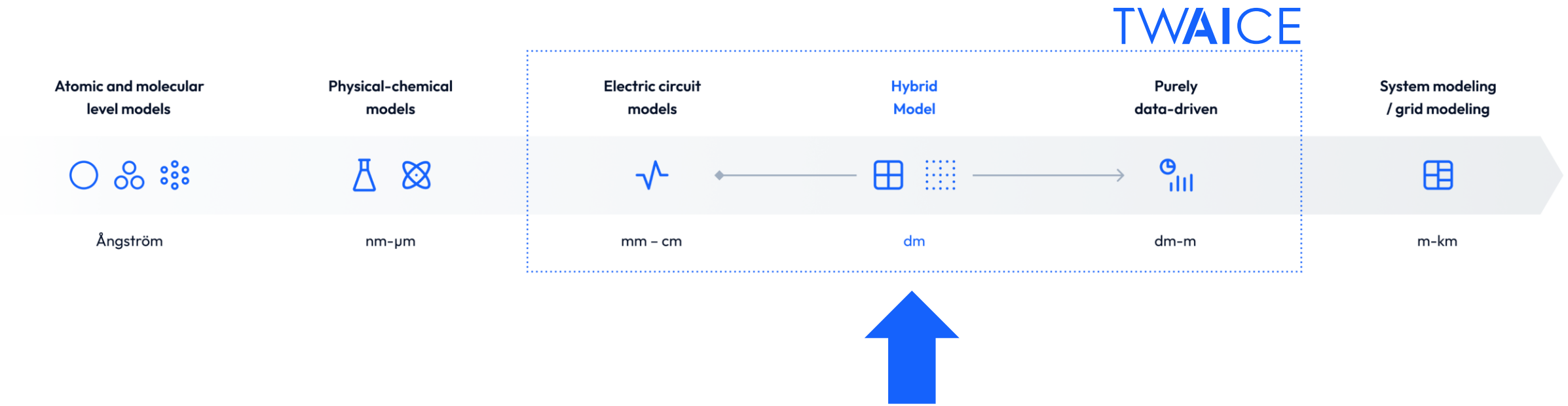
Battery Model on a length scale



TWAICE HYBRID MODEL

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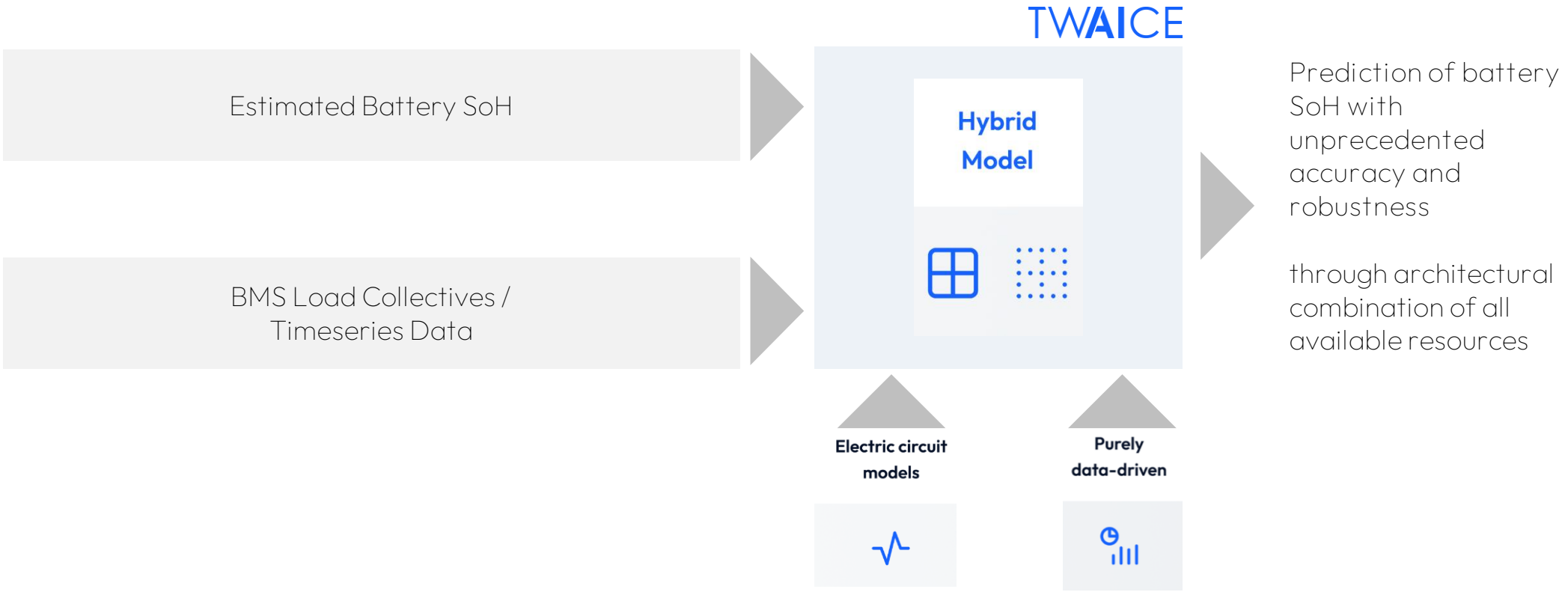

Robust from Day 1

High Accuracy

Automatic Weighting

FROM CHALLENGE TO SOLUTION

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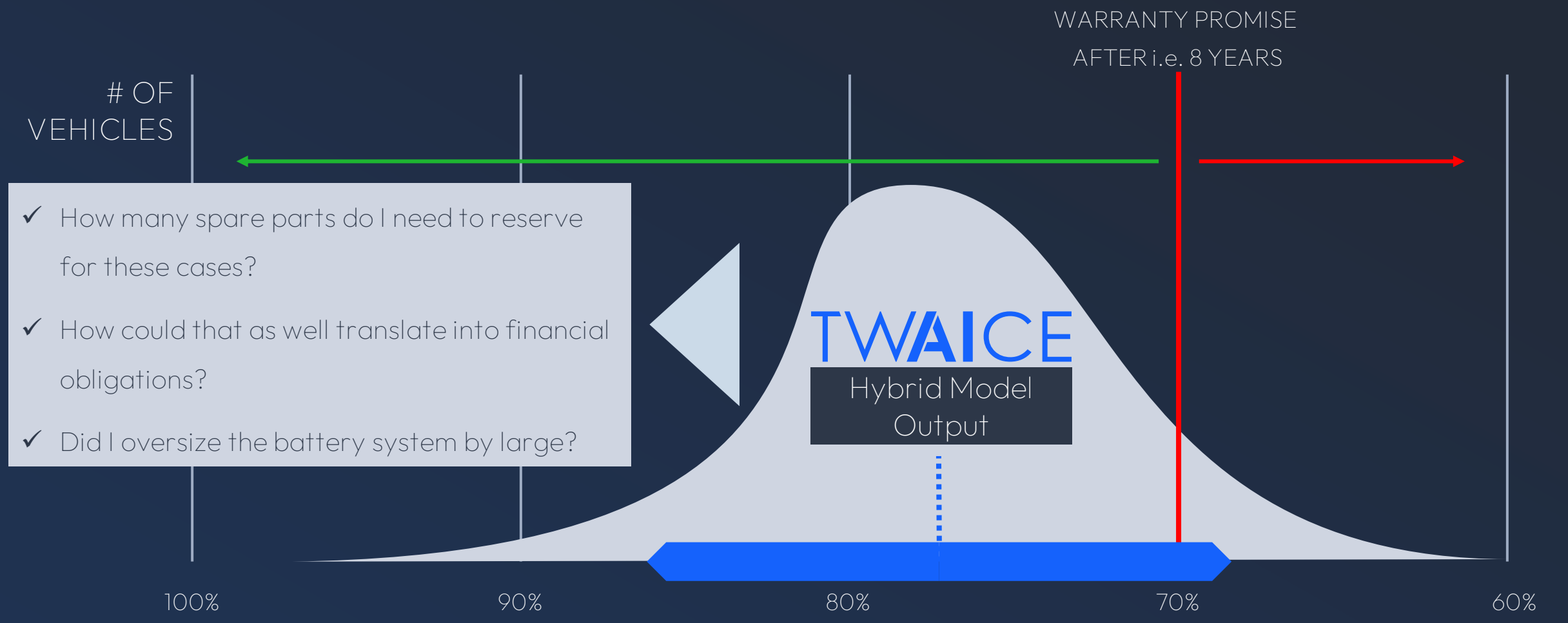

WHICH MODEL TO CHOSE?

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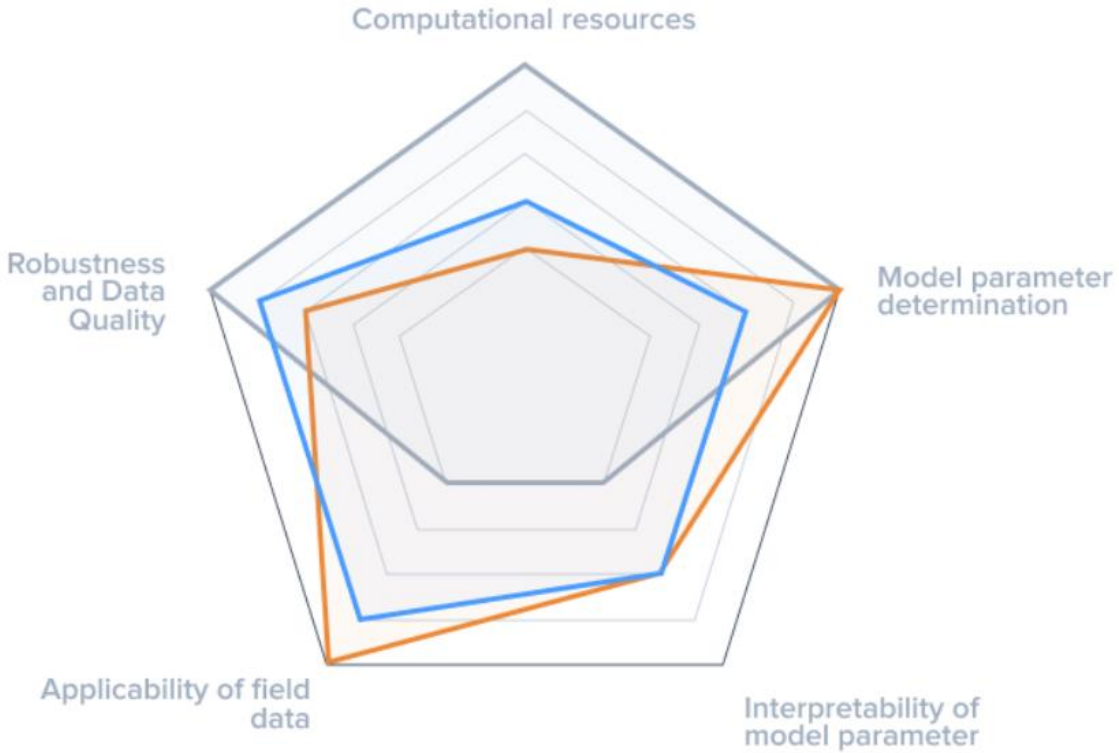
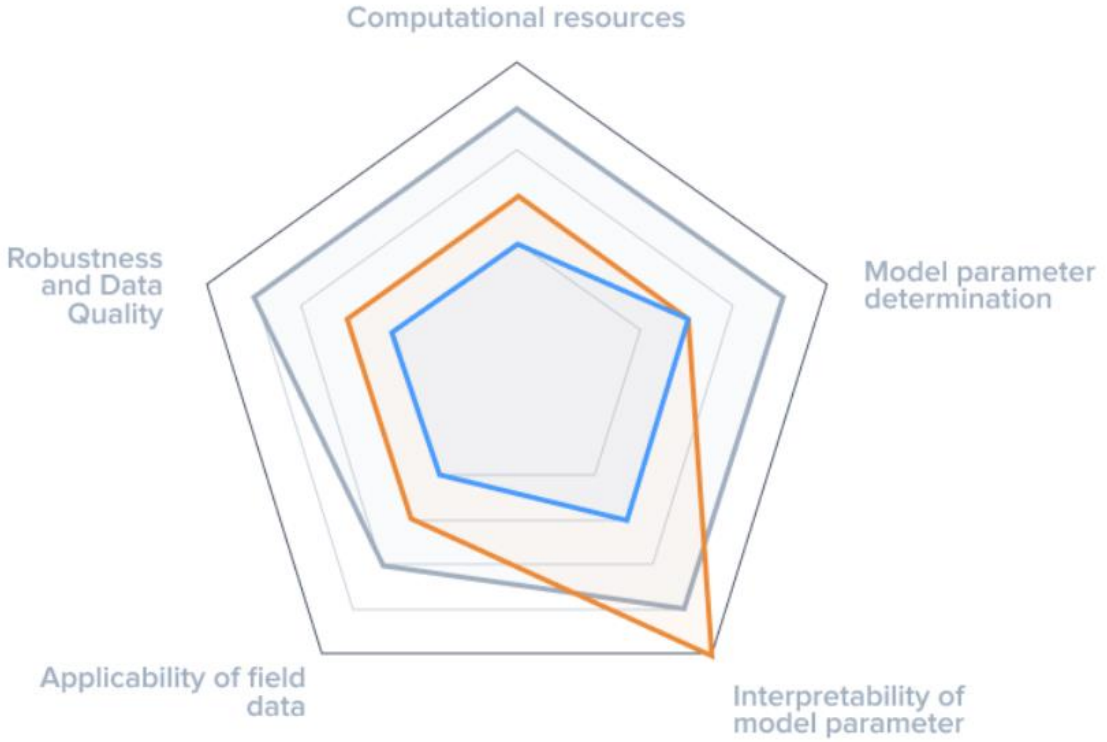
In-Life



Pre-Life



TWAICE PLATFORM

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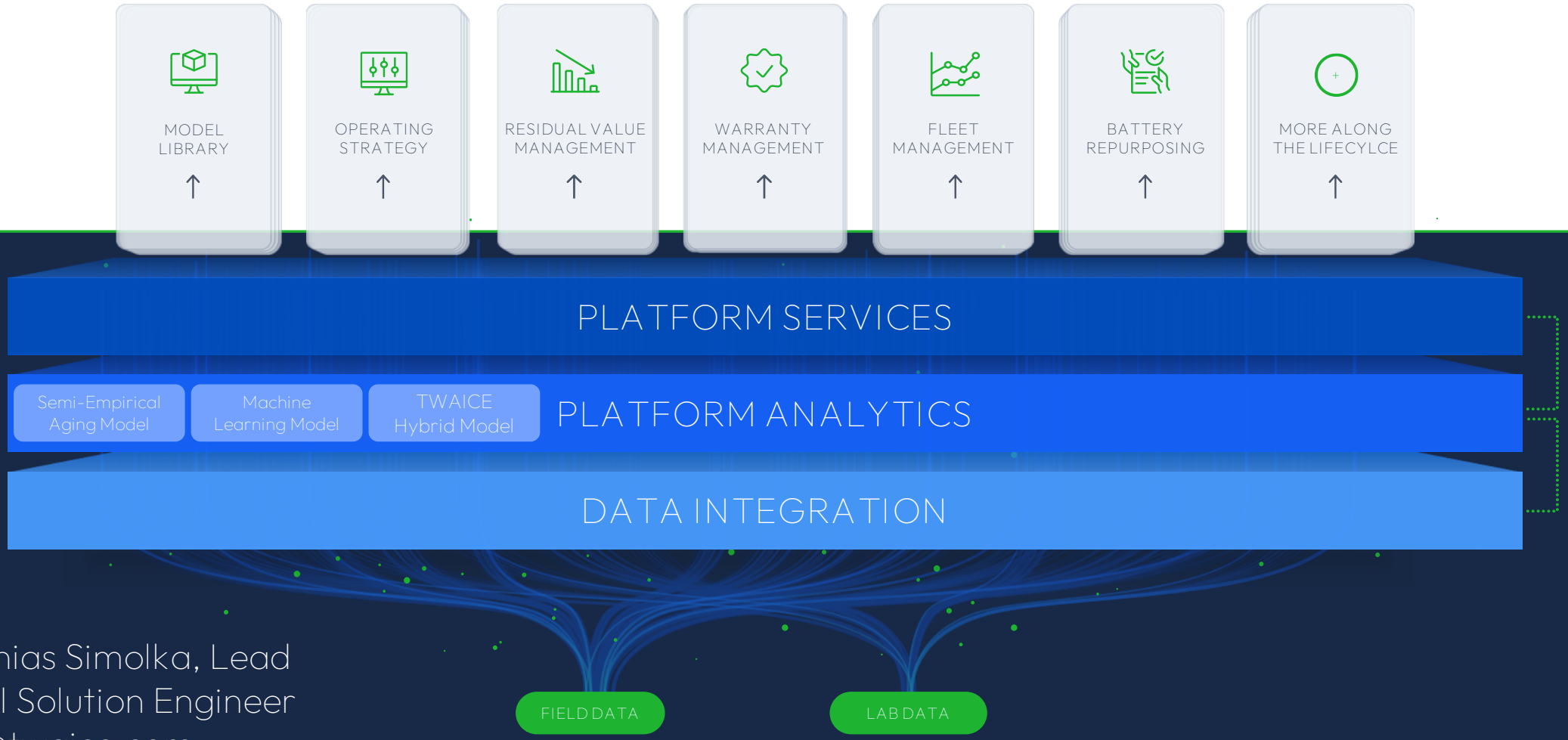
HELPING YOU GENERATE THE VALUE OF A LIFETIME



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BATTERY EXPERTISE + DATA SCIENCE + SCALABLE SOFTWARE

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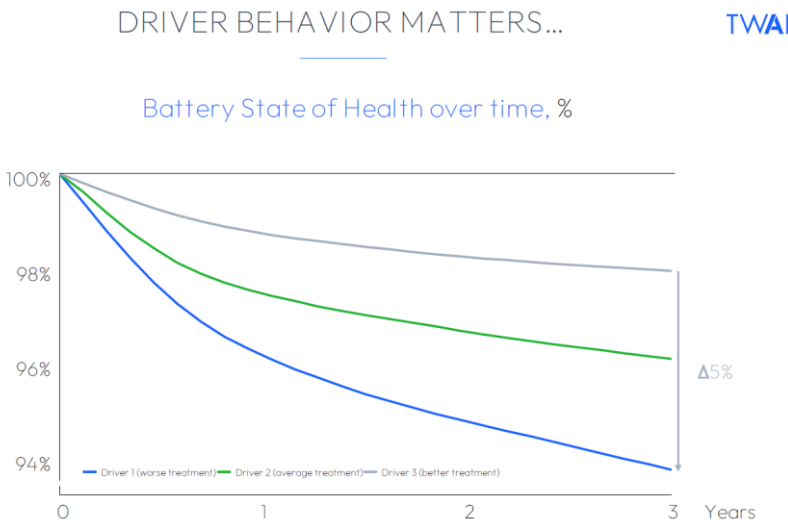

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