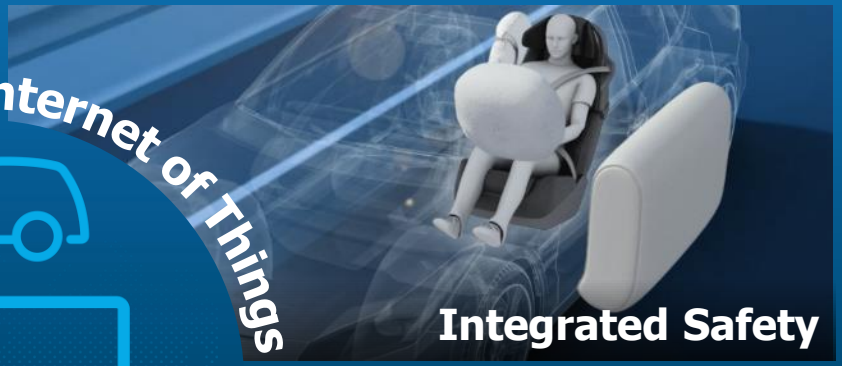
FMU integration in ANSYS-CFD WOST 25.6.-26.6.2020

Philipp Neidhardt

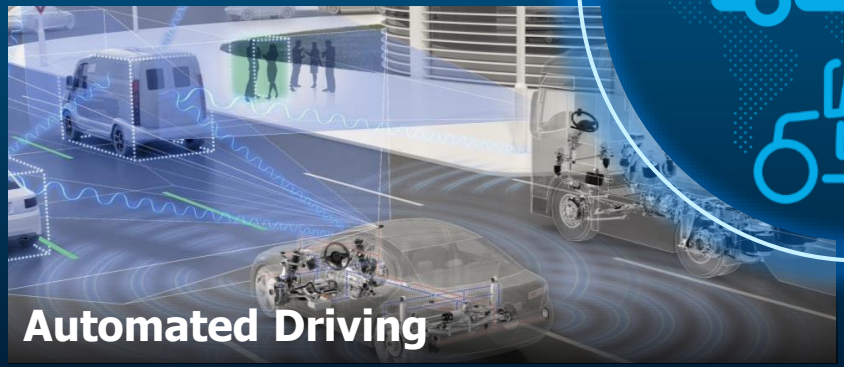
01

Introduction and Company Profile

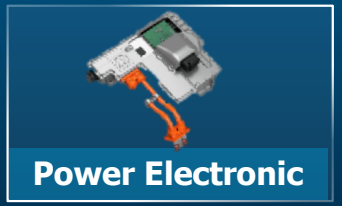
Fields of Technology

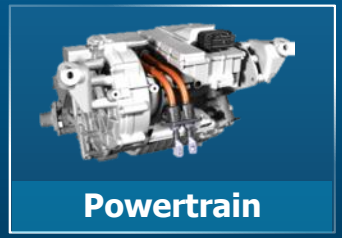


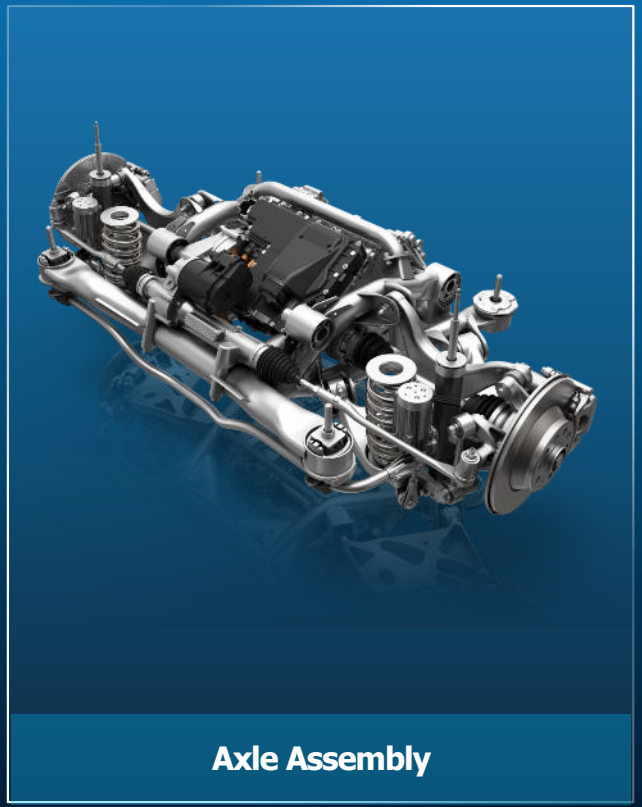
Digitalization / Internet of Things



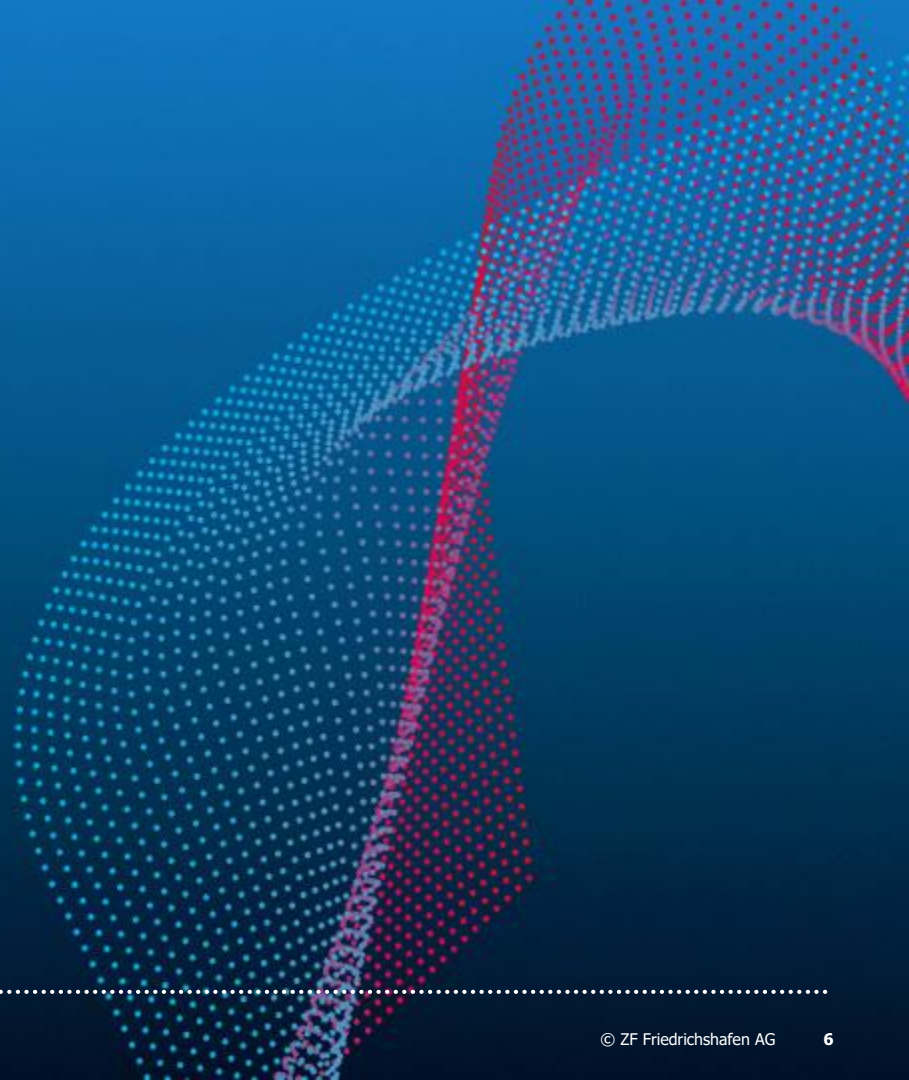
Components and Functional Integration: Axle Assembly





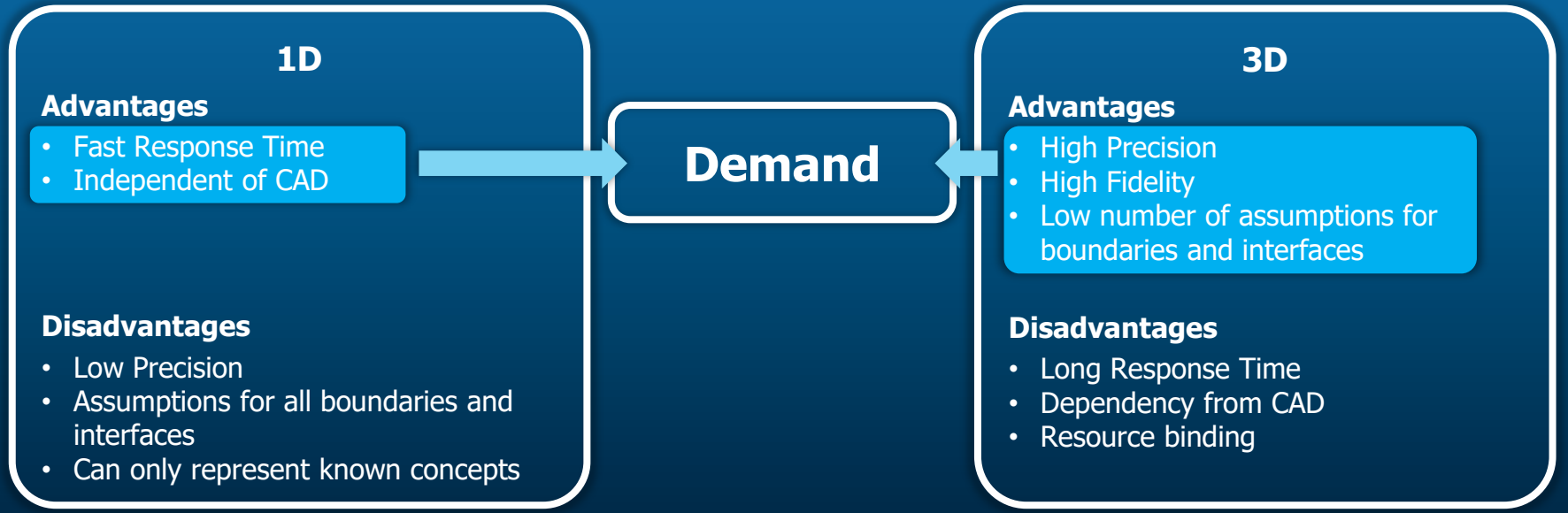


02
Motivation



Motivation

Thermal Simulation of electric drive systems



Motivation

Thermal Simulation of electric drive systems

Demand

- Fast Response Time
- Independent of CAD

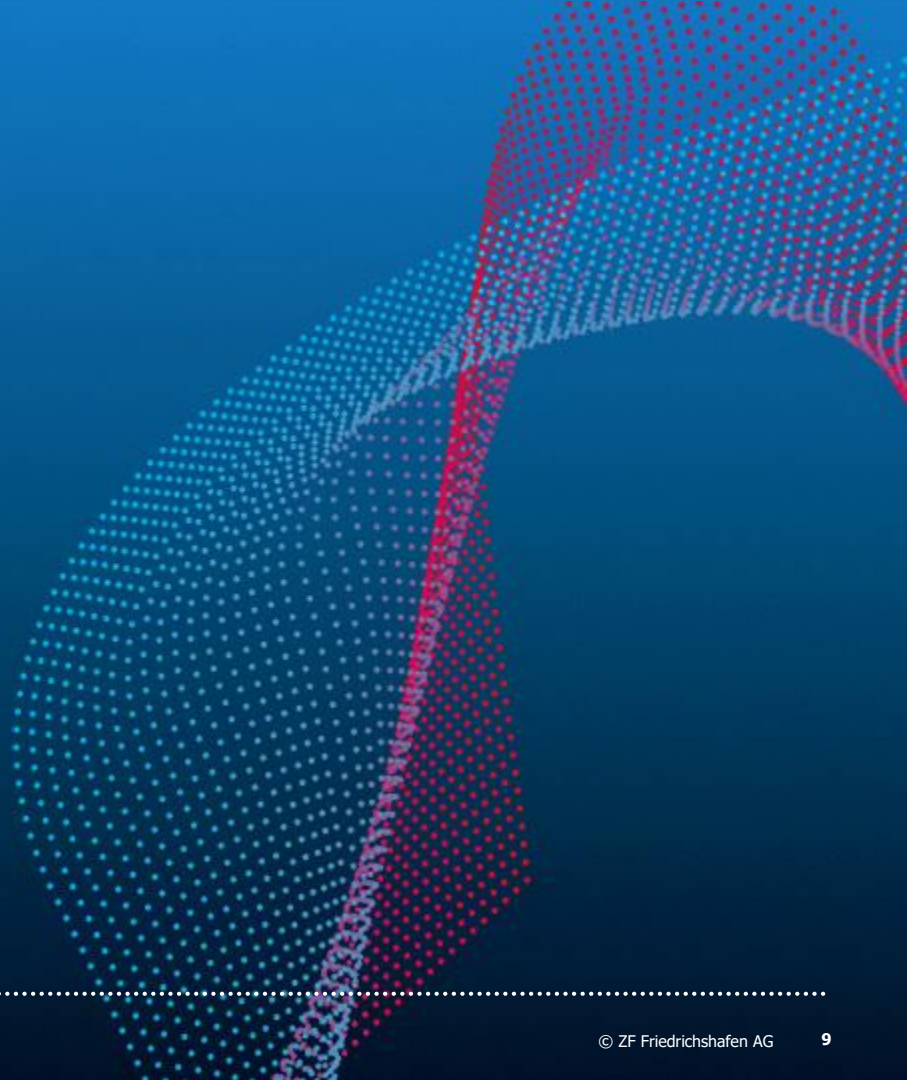
- High Precision
- High Fidelity
- Low number of assumptions for boundaries and interfaces

Model generation

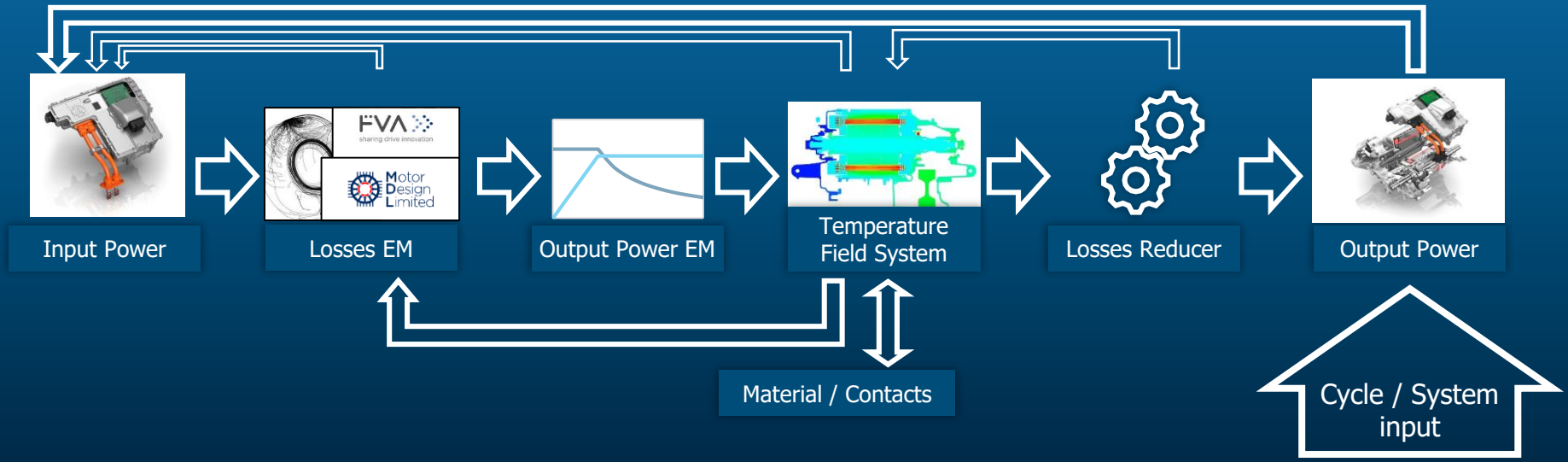
- Evaluation of important parameters for high precision models with reduced computing and preparation effort
- Sensitivity of input- and boundary conditions
  - Externally calculated values
  - Advantages of co-simulation
- Focus on modeling approach and physical behavior
  - Simplification and synthetization of geometry
  - More detailed view on dependencies within the system

03

Simulation Process



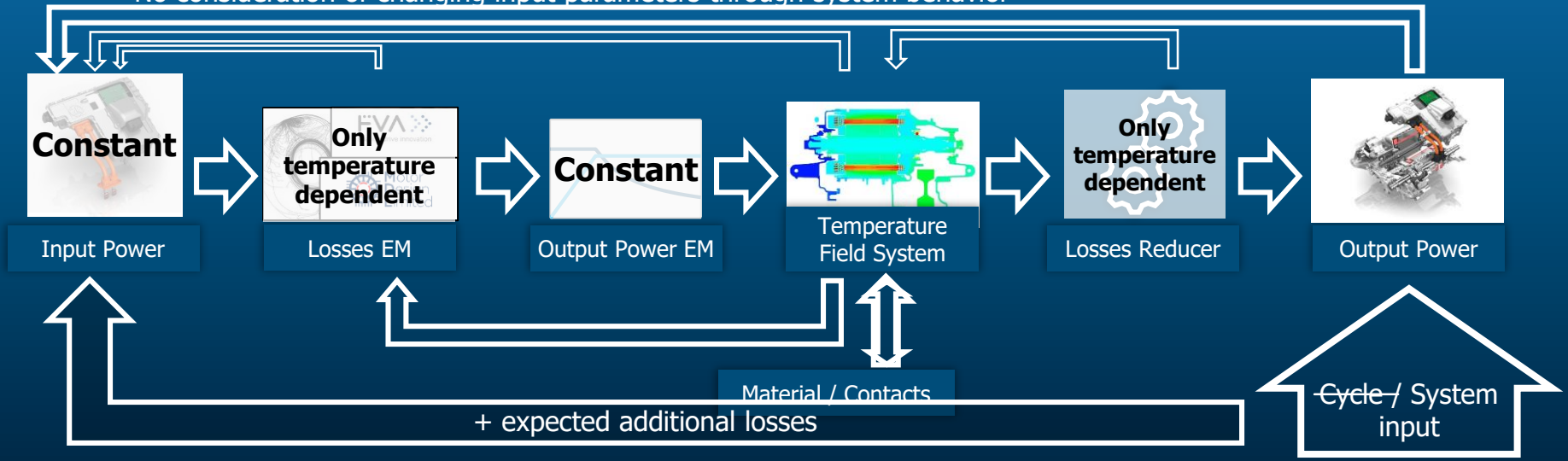
Simulation Process



Simulation Process

Classical approach

- Simulation input data usually a fixed scalar value or analytical function
  - No consideration of changing input parameters through system behavior



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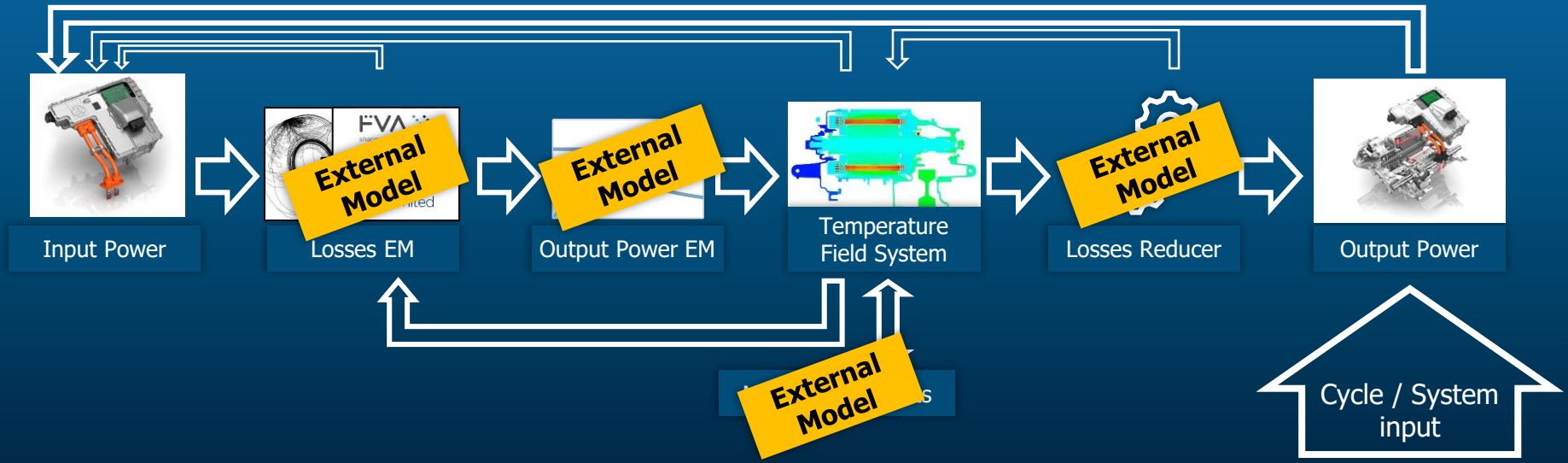

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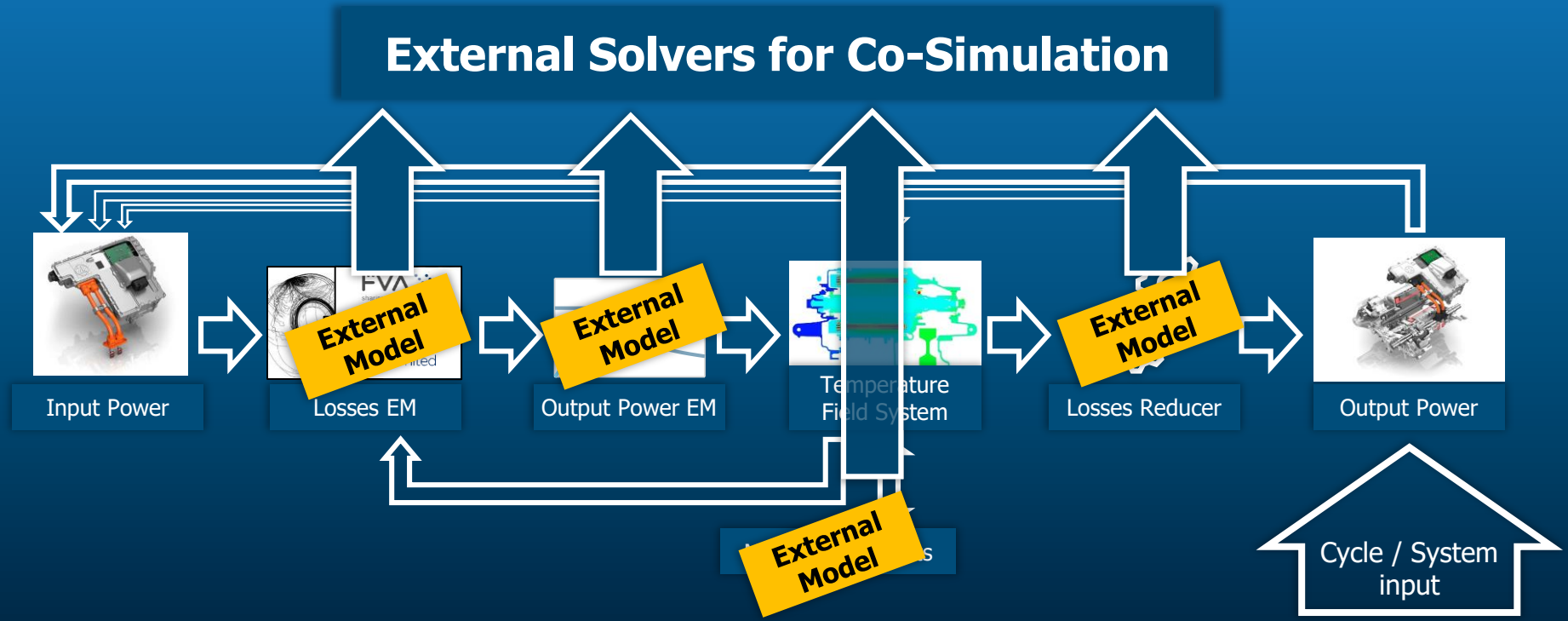
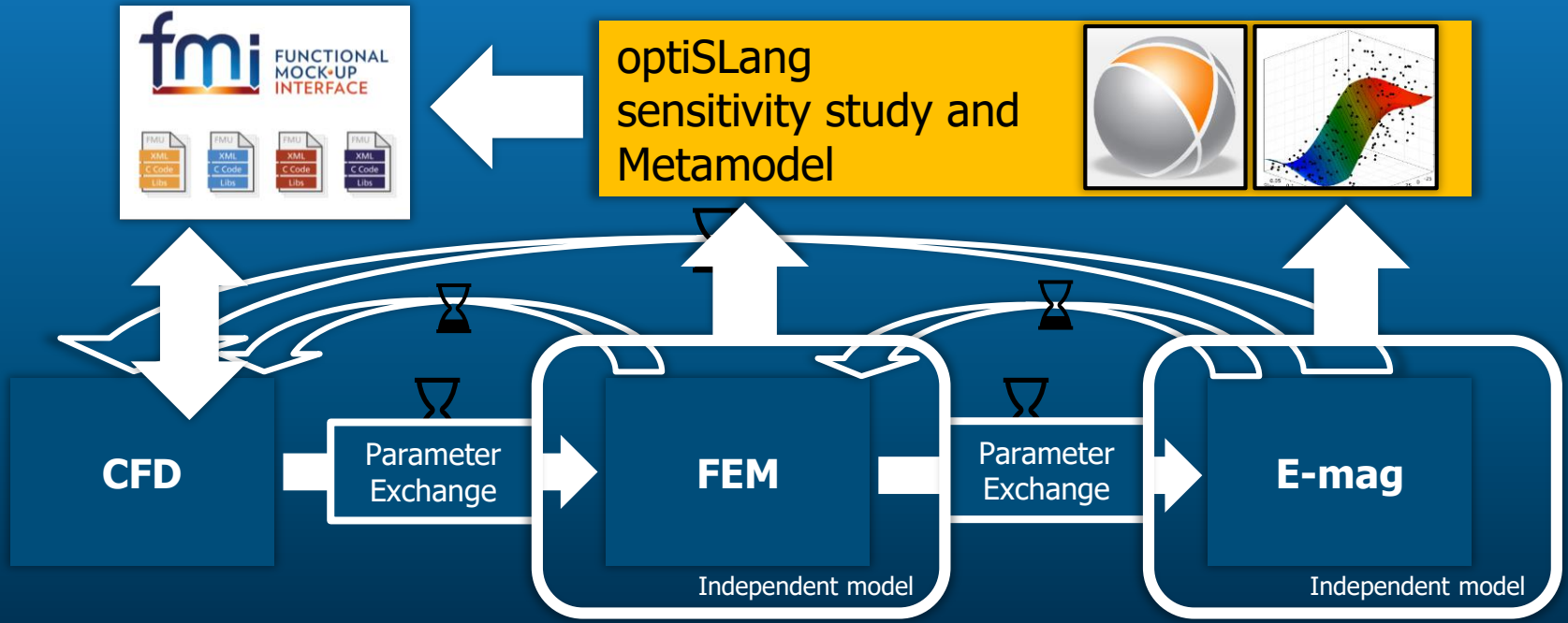


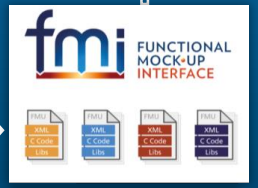
Co-simulation



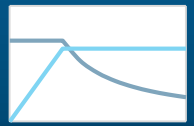
Co-Simulation

CFD-Solver

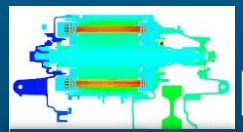
Input Power



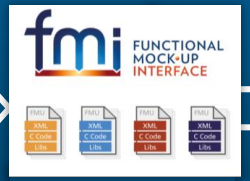
Losses EM



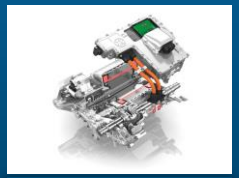
Output Power EM



Temperature
Field System



Losses Reducer



Output Power

Cycle / System
input

Material / Contacts

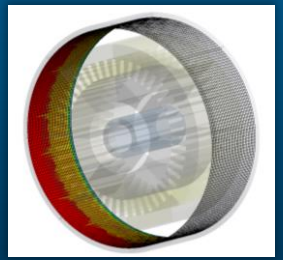
One Simulation
Adaptive Input Data
Co-Simulation
Consideration of all physical effects with high sensitivity

04
Summary

Summary

Restraints

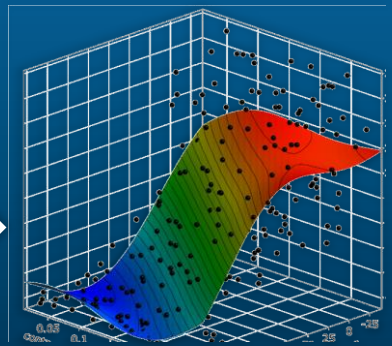
- Transient Simulation
- No field data exchange: Data loss through metamodels
  - Data collection only at specific points or averaged values in model (temperatures, heat transfer coefficients, contact pressures, …)



Field output simulation sub model

$\vec{p} \rightarrow \overline{p}$

Parameter evaluation

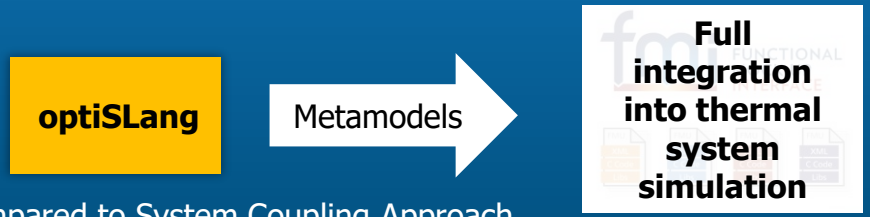


Parameter based metamodel

Summary

Advantages

- Multiphysics consideration
  - Full electromagnetic models
  - Mechanical models
  - Influence of auxiliary components
- Great reduction of simulation time compared to System Coupling Approach



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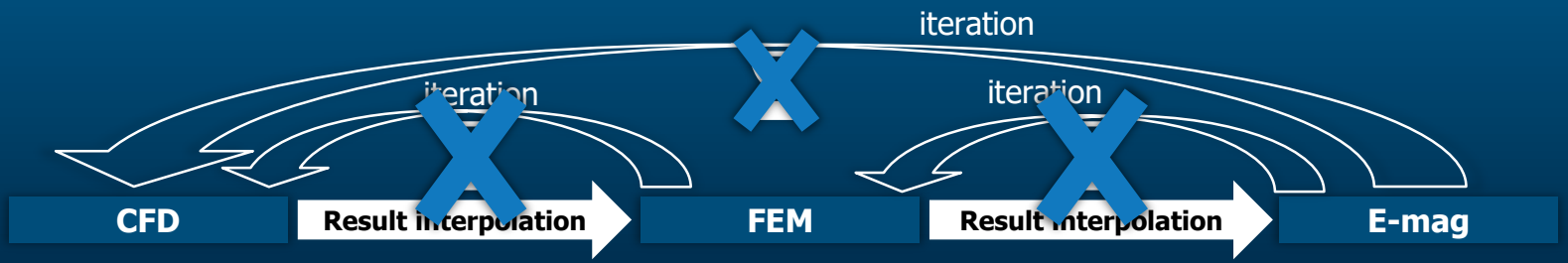
optiSLang → Metamodels → **Full integration into thermal system simulation**



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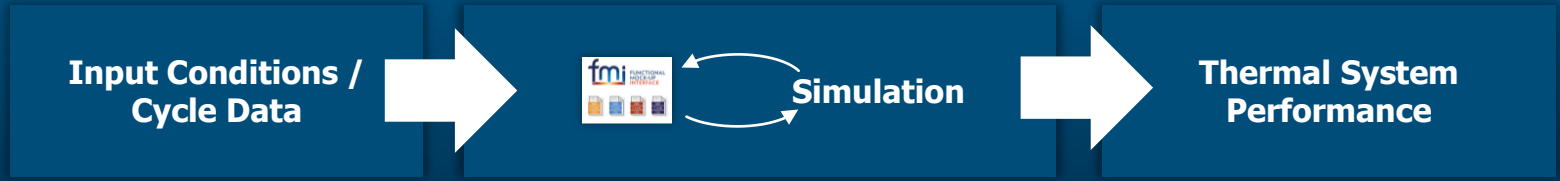

- Exchangeability of sub models
  - Implementation of sub models in various solver architectures

MODELICA, ANSYS, ...

see. think. act.