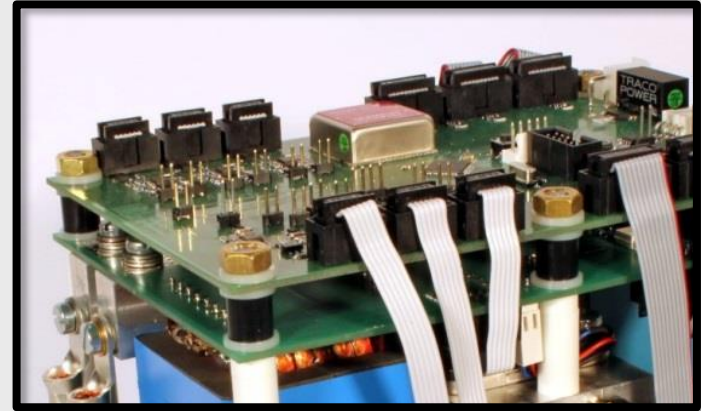
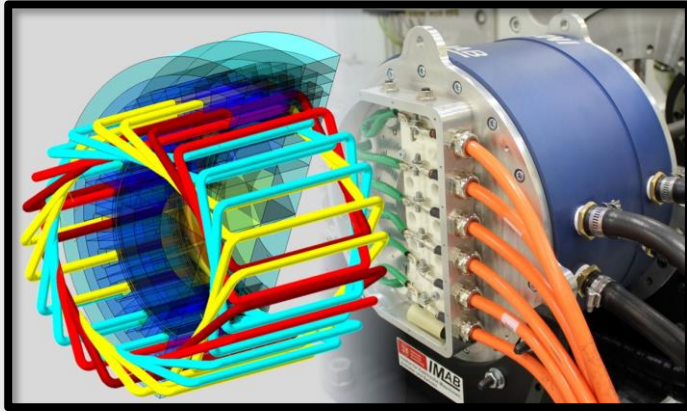




Technische
Universität
Braunschweig

IMAB Institute for Electrical Machines,
Traction and Drives
TU Braunschweig



TU Braunschweig

Institute for Electrical Machines, Traction and Drives

Prof. Dr.-Ing. Markus Henke (Electrical Drives)

Prof. Dr.-Ing. Regine Mallwitz (Power Electronics)

www.imab.de

Institute for Electrical Machines, Traction and Drives



Location:

Hans-Sommer-Str. 66
38106 Braunschweig

Office building

lab for electrical machines

lab for power electronics

workshop

IMAB – Research

Power Electronics

Converter Topologies

Cooling Systems

IGBT Driver Design

Integration

Application of Converters for EM

Inductive Power Transfer

Control of el. Drives

Electrical Machines

Polyphase Machines

Rotational, high power (HTSL)

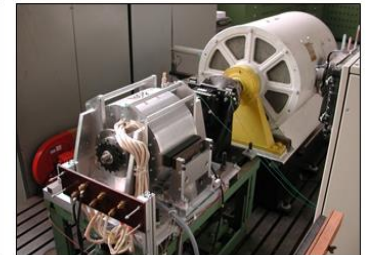
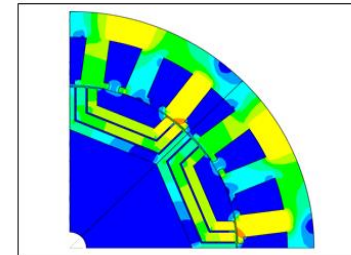
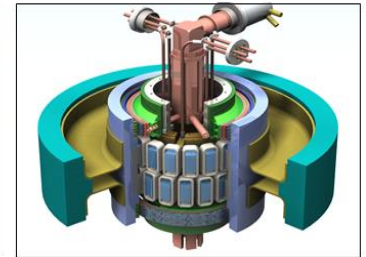
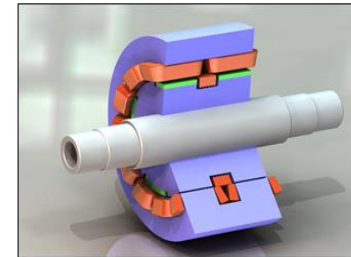
New Materials (Magn., SMC)

Linear Actuators

High Power Test beds

System design, Simulation

Measuring, Validation



Special Fields

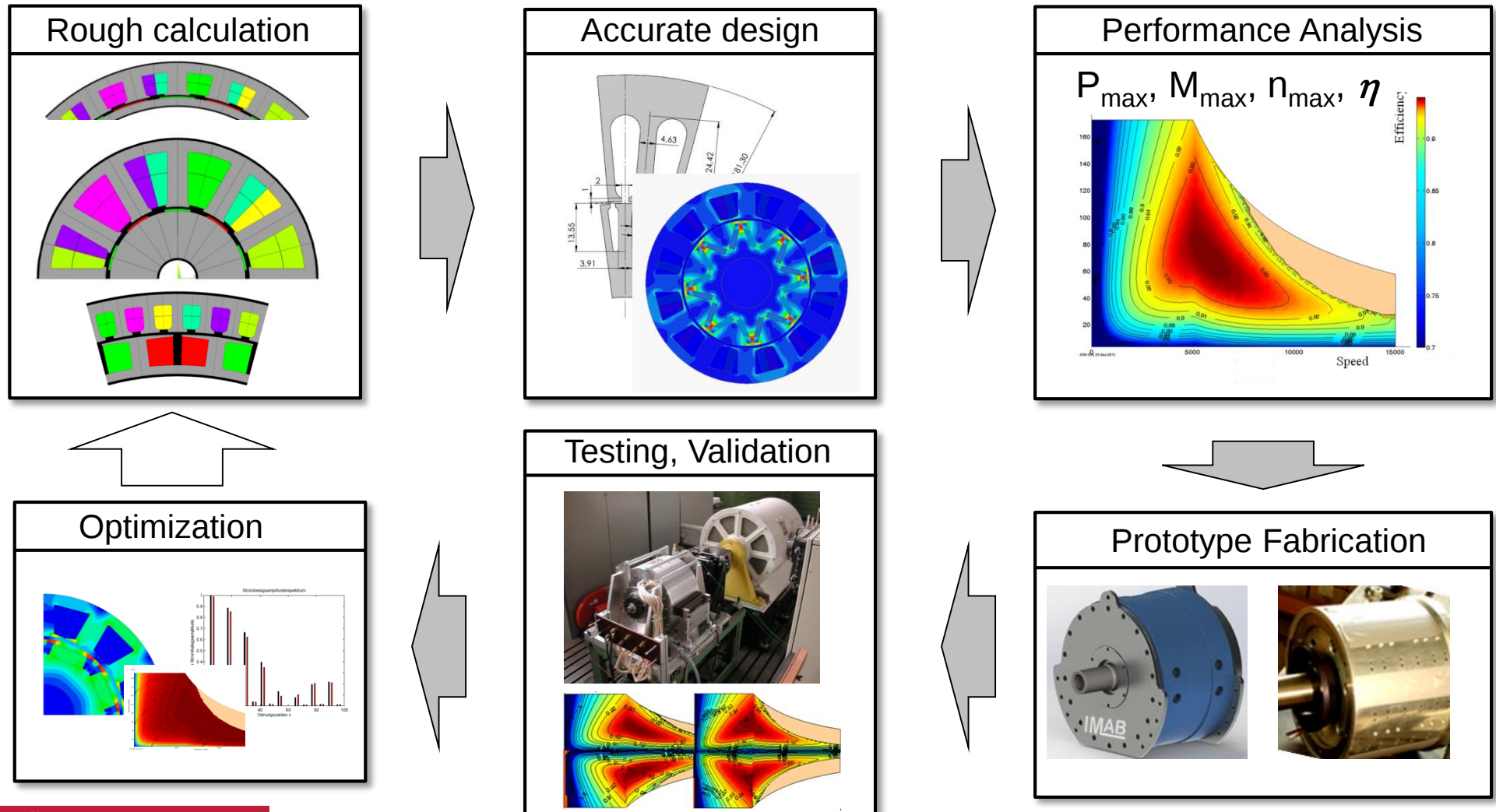
Superconducting Bearings

Flywheel Storages

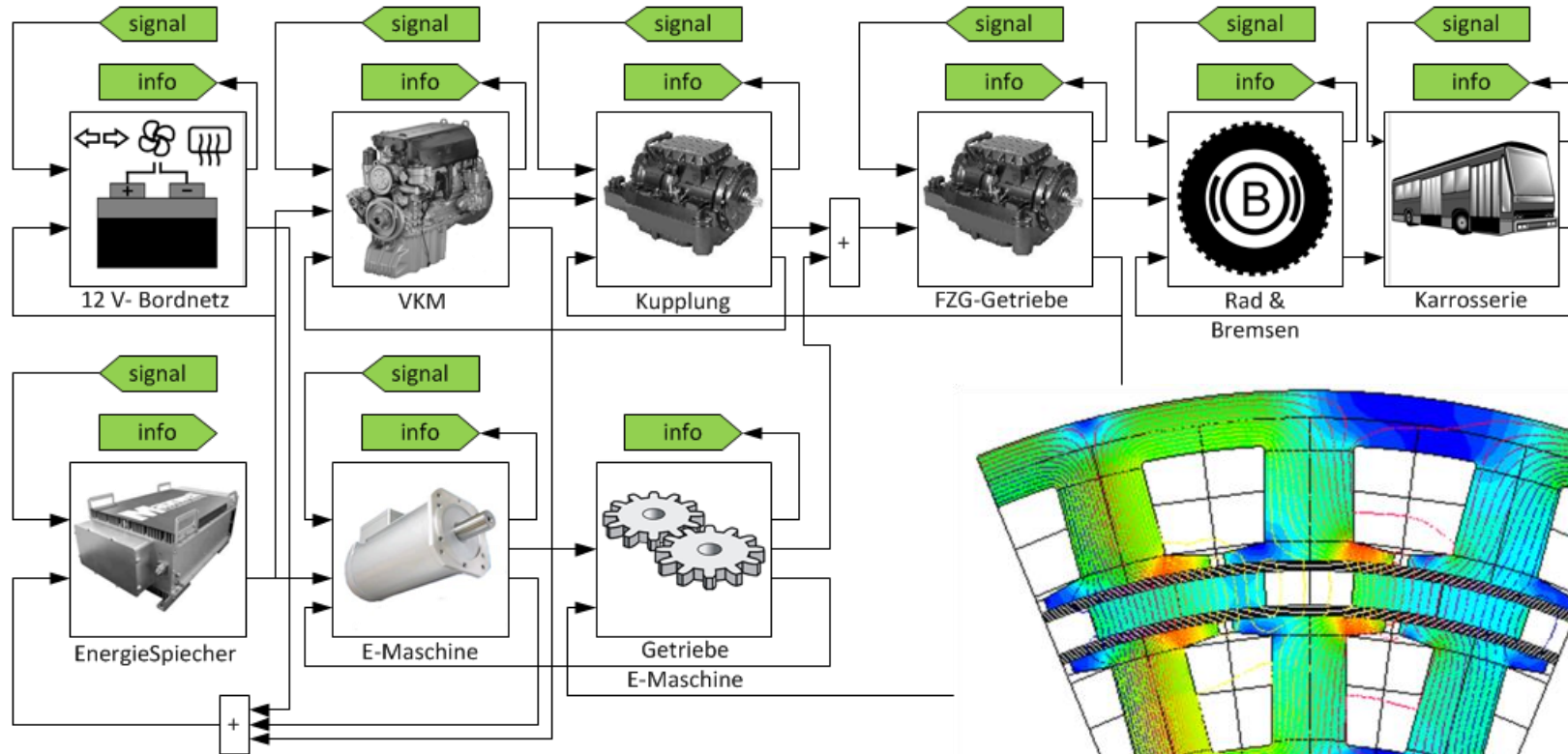
Energy Storage Systems

Intell. Batterymanagement

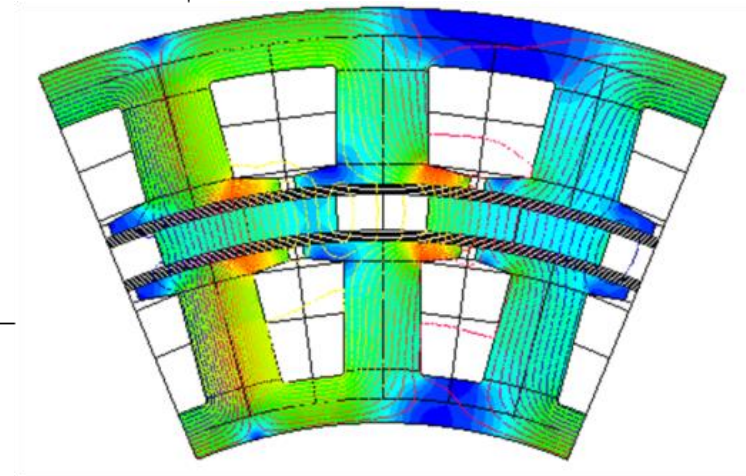
IMAB Core Competence: Prototyping of Electrical Drives



Powertrain Simulation of Hybrid and Full Electric Vehicles



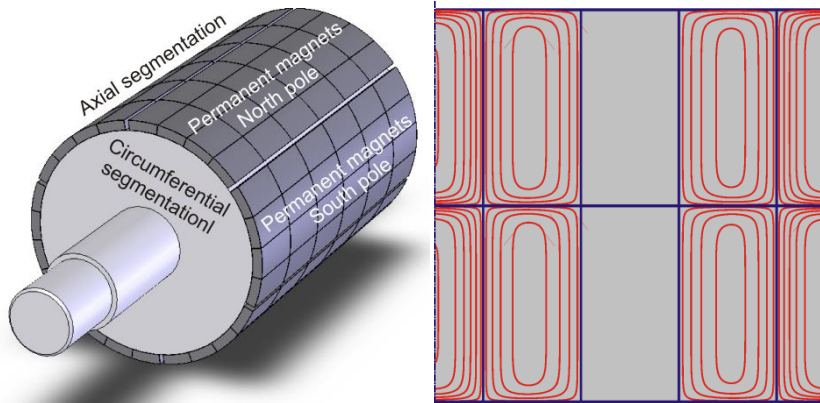
Simulation Environment by IMAB



Tools:

Matlab / Simulink
FLUX, ANSYS

Investigation of Special Effects in Electrical Machines



Segmented rotor of PMSM with eddy currents in magnet material

Results:

- Analytic models were verified via FEM-calculation
- Verification of numerical calculations via measurements

Eddy current losses in permanent magnets

- Development of analytic calculation tools
- Models which consider end effects
- Special analytic tools to represent the whole frequency spectrum

Eddy current losses in high permeable materials

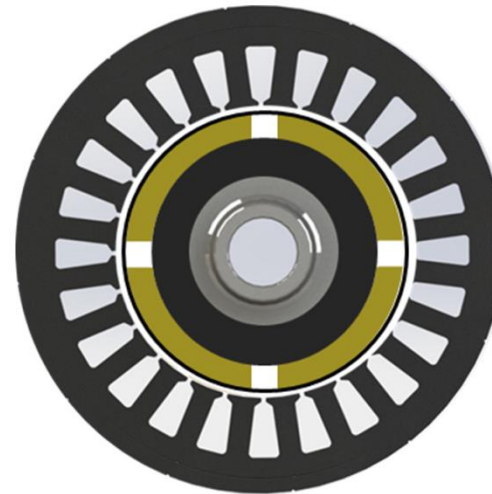
- Design of numerical models for efficient loss calculation on low depth of penetration
- Implementation in ANSYS models

IMAB Fundamental Research : High Speed Drives, > 20.000 rpm

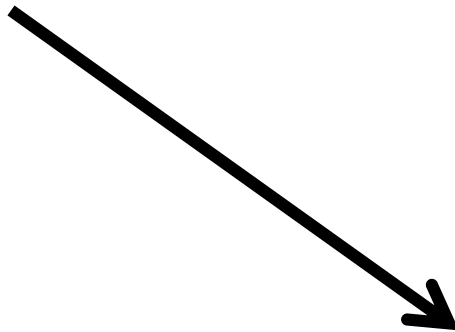


100 kW, **6000 rpm**

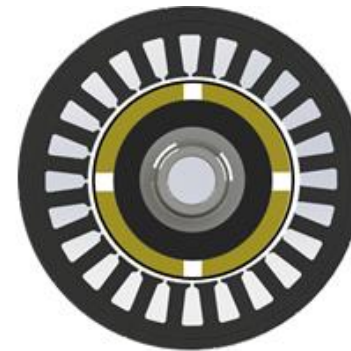
Power Increase



200 kW, **16000 rpm**



Reduction of
volume, weight



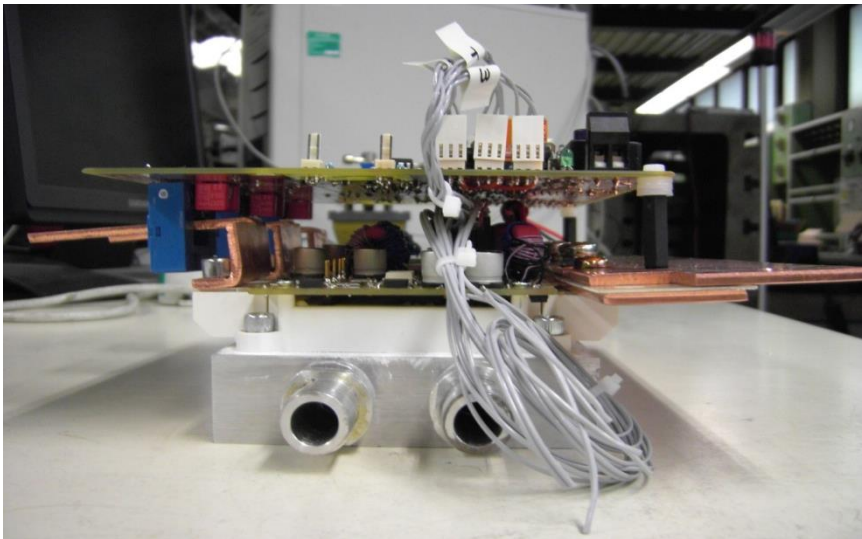
100 kW, **16000 rpm**



Power Electronics, Converter Design

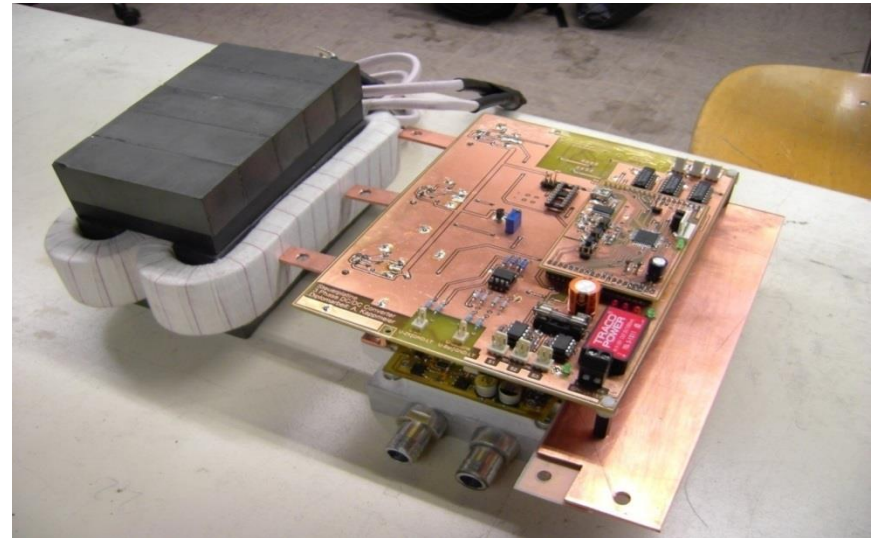
Specifications:

- Bidirektional multiphase DC/DC-converter for supply of DC voltage link ($V_2 = 400 \text{ V}$) out of HV-battery ($V_1 = 180..270 \text{ V}$)
- Nominal power: max. 100 kW
- Very low current ripple

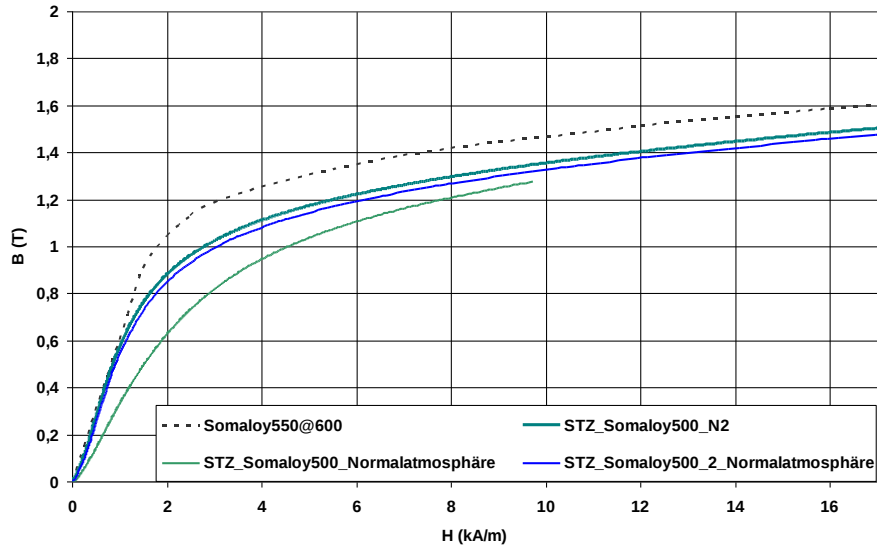


Advantages:

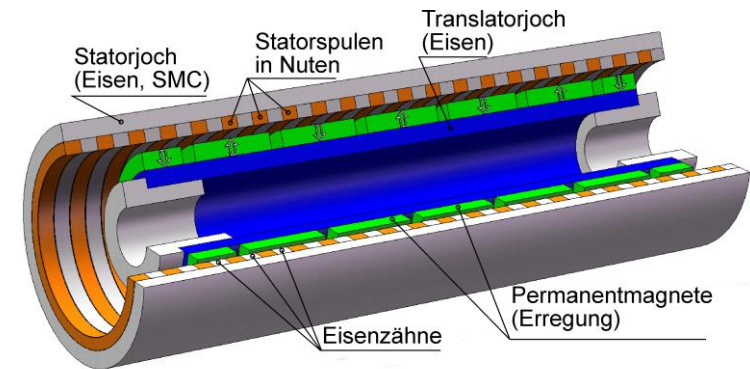
- Low current load of IGBTs
- Low input current ripple
- Scalability



B-H Curves



Linear Actuators



Partners (InDrive):

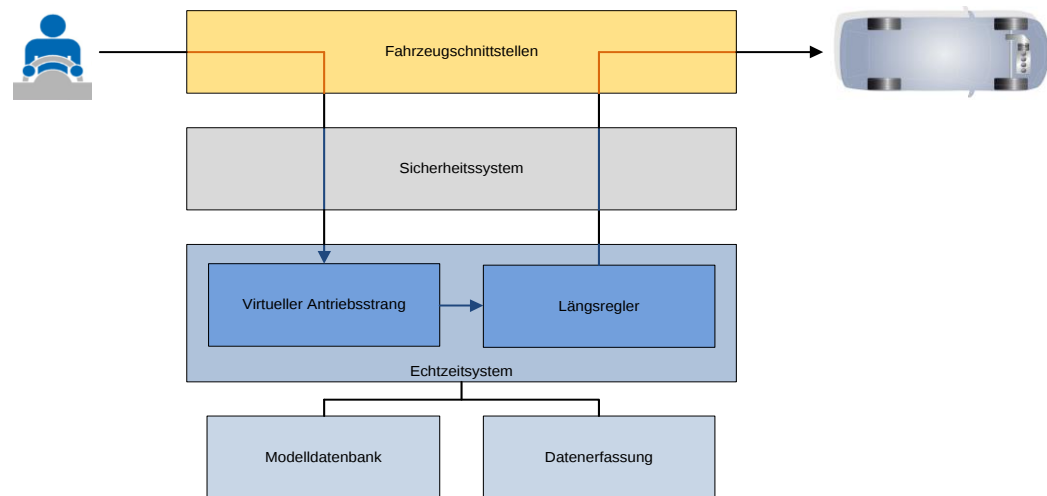
IAV Berlin
TU BS IMAB
TU BS IFR
TU Berlin IKMM

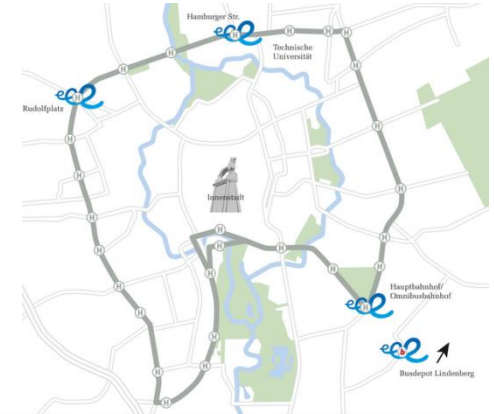
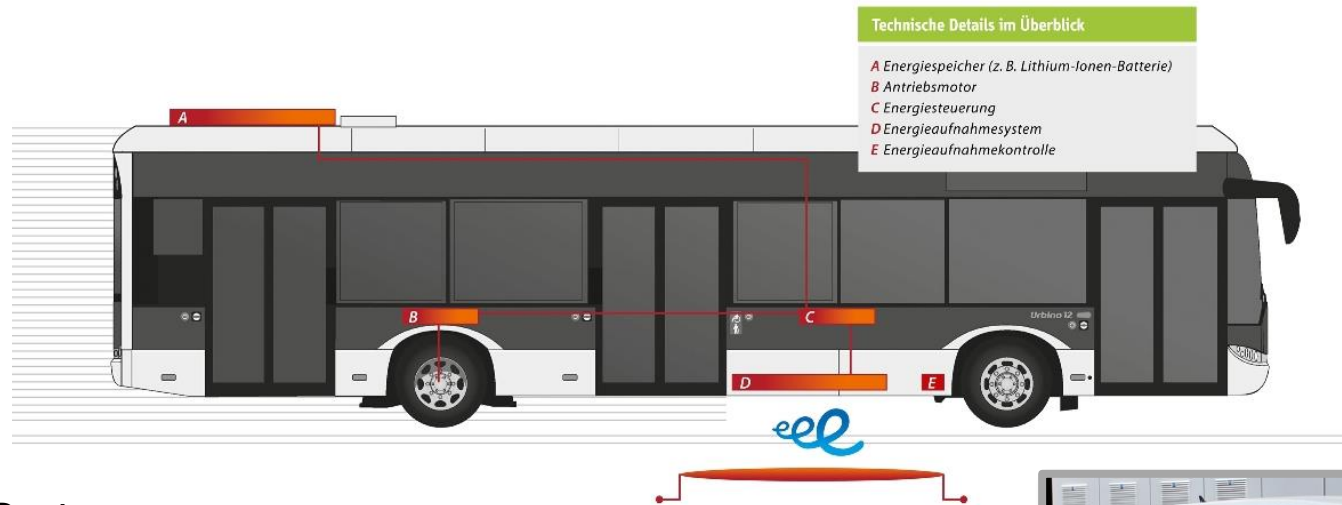
Research Target:

Development of a new innovative tool for simulation and design of complex powertrains in real vehicle operation

Data:

Basis: VW T5 Allrad
E-Drive: 3 x ASM 150 kW / 370 Nm
HV-Battery: LiFePo, $V_{\text{nom}} = 520 \text{ V}$
Weight: 3.5 t





Partners:

Braunschweiger Verkehrs-AG,
BS|ENERGY, Bombardier,
TU Braunschweig (IMAB, Prof. Meins)
TU Braunschweig, elenia, IVA

Funded:

Bundesministerium für Verkehr,
Bau und Städteplanung
Time: 6/2012 – 12/2013

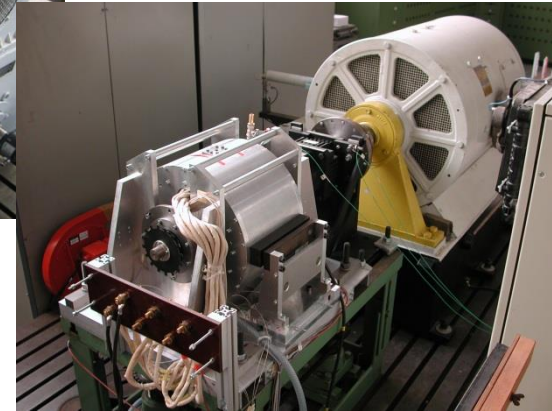
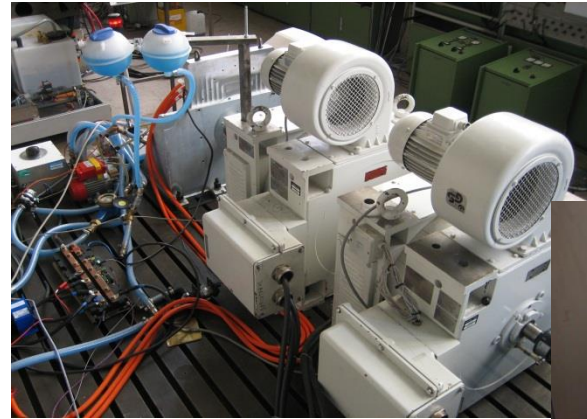


22 kW Induktive Power Transfer

IMAB Testbeds for Electrical Drives

Test bay –Test beds:

- typical **100 ... 250 kW** load
- up to 600 kW possible
- max. torque up to 850 Nm directly
- up to **10 kNm** via gear
- max. speed 10.000 1/min directly
- up to **30.000 1/min** via gear
- machine cooling/ conditioning up to 250 kW cooling power



Measuring Equipment:

- Power analyzer (Currents 3x1000 A)
- torque measuring up to 3 kNm
- vibration measurement
- thermographie camera

HV-Battery Emulation:

up to **1000 V, 1000 A, 350 kW**

Div. DC Power supply

- up to 1000 V
- power up to 500 kW