HIC
HYDROGEN
INNOVATION CENTER

Virtual Development Platform and Fuel Cell Component Testing at Germany's new Hydrogen Innovation Center

March 18, 2026, 3rd Czech-German Business-Meeting

Gregory Hart

Project Engineer/Stack and System Development

Gefördert durch:

Bundesministerium für Verkehr

Finanziert von der Europäischen Union NextGenerationEU

Freistaat SACHSEN

aufgrund eines Beschlusses des Deutschen Bundestages

HIC gGmbH
a subsidiary of the
HZwo e.V.

www.hzwo.eu

Who we are

European network of hydrogen experts

National Hydrogen Innovation Center

National Transformation Hub

Saxon Competence Center for Hydrogen Technologies

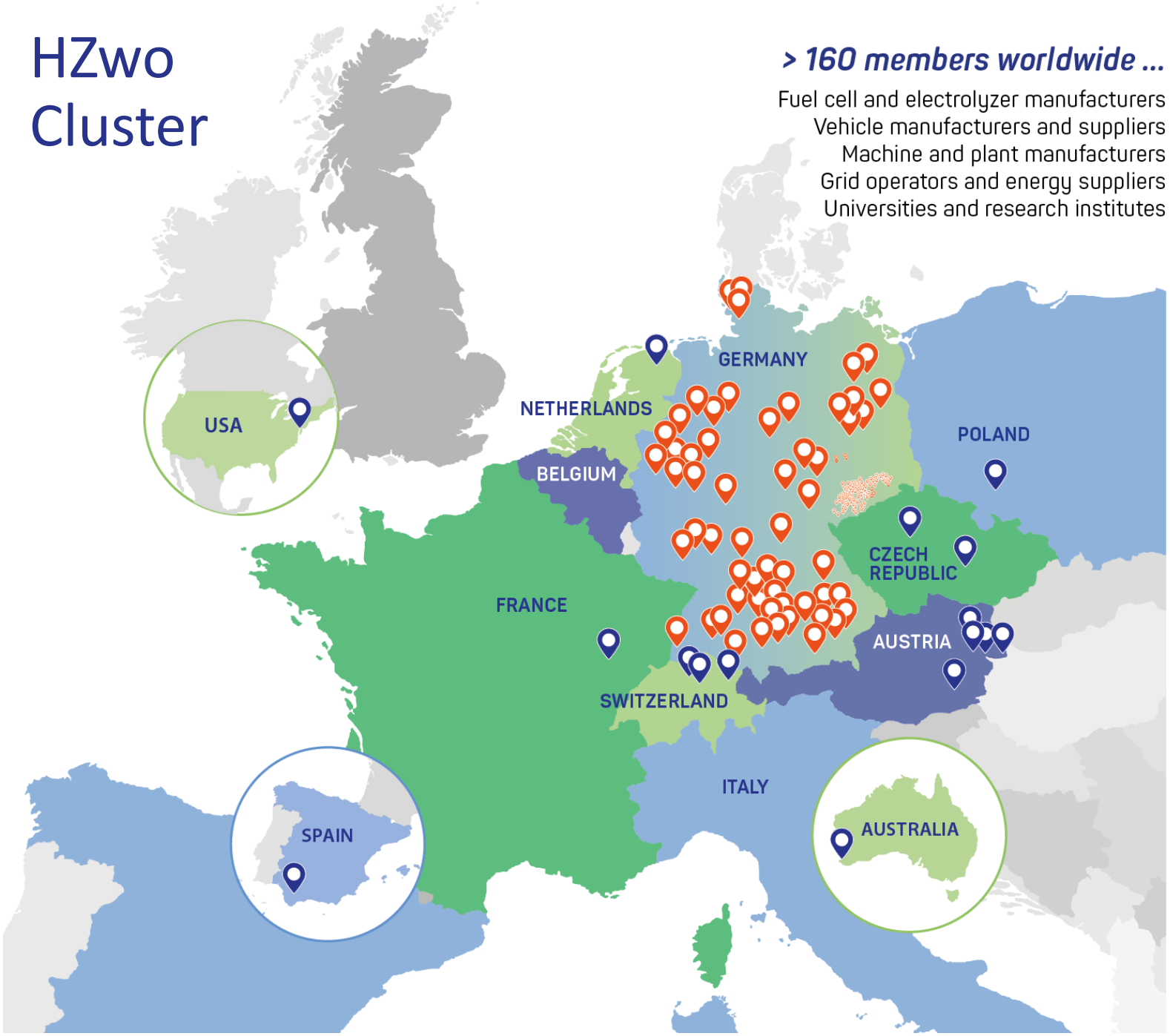
Our memberships:

Zertifizierung:

HZwo Cluster

> 160 members worldwide ...

Fuel cell and electrolyzer manufacturers
Vehicle manufacturers and suppliers
Machine and plant manufacturers
Grid operators and energy suppliers
Universities and research institutes



Organization Structure

HZwo e.V.
Association of > 160 companies
and research institutions

Subsidiary of HZwo

One of four Innovation and Technology Centers (ITZ) across Germany

HIC gGmbH
Hydrogen Innovation Center
ITZ in Chemnitz

- ITZ in Duisburg / NRW
- ITZ in Pfeffenhausen / Bayern
- ITZ Nord in Hamburg, Stade and Bremerhaven

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Hydrogen Innovation Center

Key data of the overall construction project:

Total usable area NUF1-7: 4.872 m²

Total gross floor area: 8.924 m²

HIC Office | HIC Lab | HIC Proving Ground

HIC Structure and Services

Engineering Center
from July 2025

Proving Ground,
Lab and Office
2027-2029

Economic Engineering Services

Testing and renting local Infrastructures (Part of ITZ-Funding)

Research & Development + Transfer (FTZ) (Part of ITZ-Funding)

Development of FC & electrolyzer systems, subsystems and components

Feasibility and market studies + Patent searches, knowledge transfer

Proving Ground - Test field for H2-systems

R&D on testing methods and as a service

Specification development for components and assemblies

Simulation of components and assemblies, development of testing procedures and methods

Rentable proving ground, H2 labs and workshops

Academy for industry and crafts

HIC R&D+T Development path

Open Source R&D Platforms

HZwo e.V. & Partners

Over 50 projects conducted

Open Source Stack (OSS)

TECHNISCHE UNIVERSITÄT CHEMNITZ

HIC Lab + Office

full Service providing

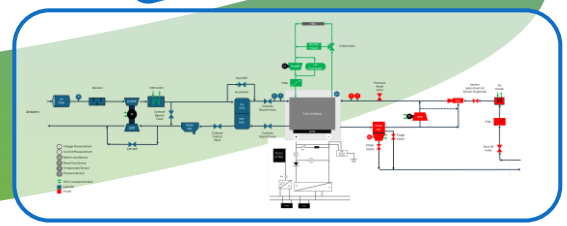
HIC-Stack

FC and EL

HIC-Virtual Testing

System and Facility Simulations

HIC-System



up to heavy duty applications

www.hzwo.eu

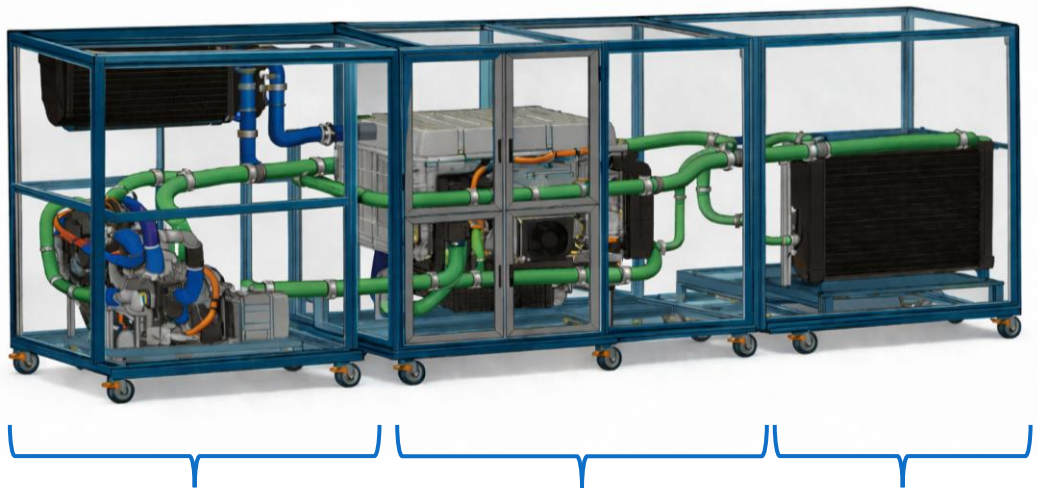
HIC Fuel Cell System

Designed as a stationary, modular tool for assisting LT PEM fuel cell product development at component and system levels.

Industry Features:	Testbench Features:
- Heavy-duty output up to 400kW - High-temp/pressure operation - Single BoP component strategy	- Modular/easy BoP Exchange - Extensive monitoring / safety - Flexible transport - Isolation of subsystems

HIC-System

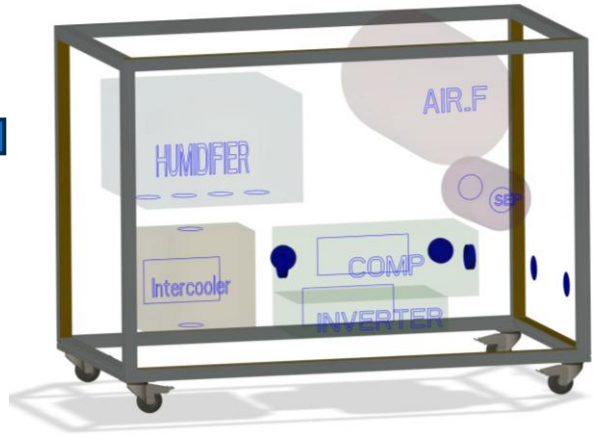
System Example (AI Generated)



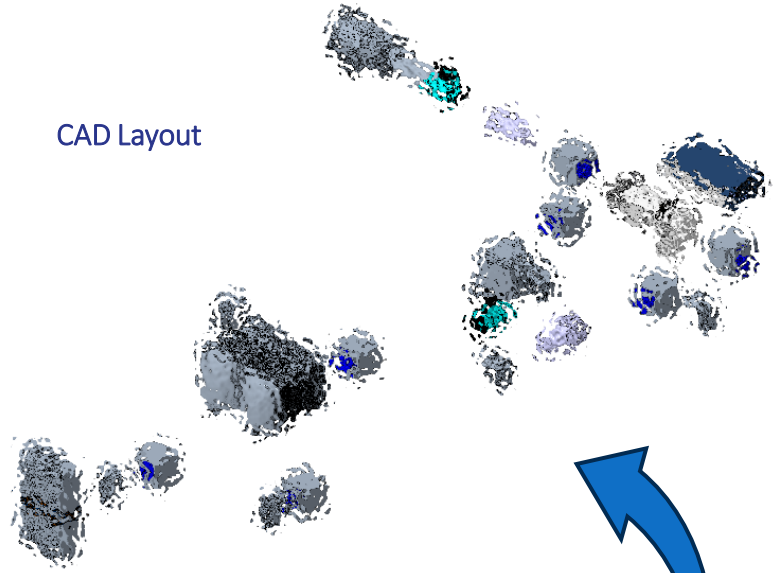
System Buildup: Physical

Final System

Final size requirements based on market components



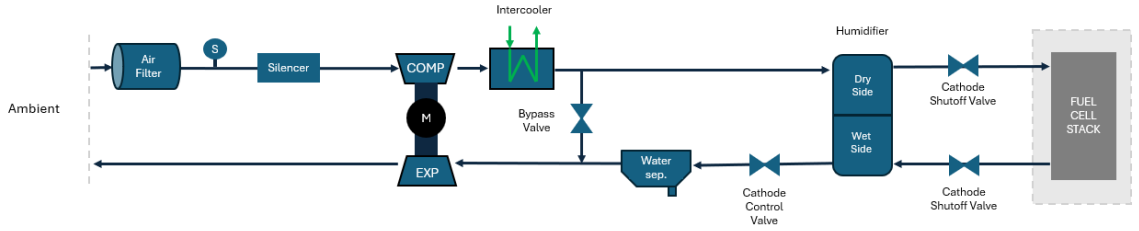
CAD Layout



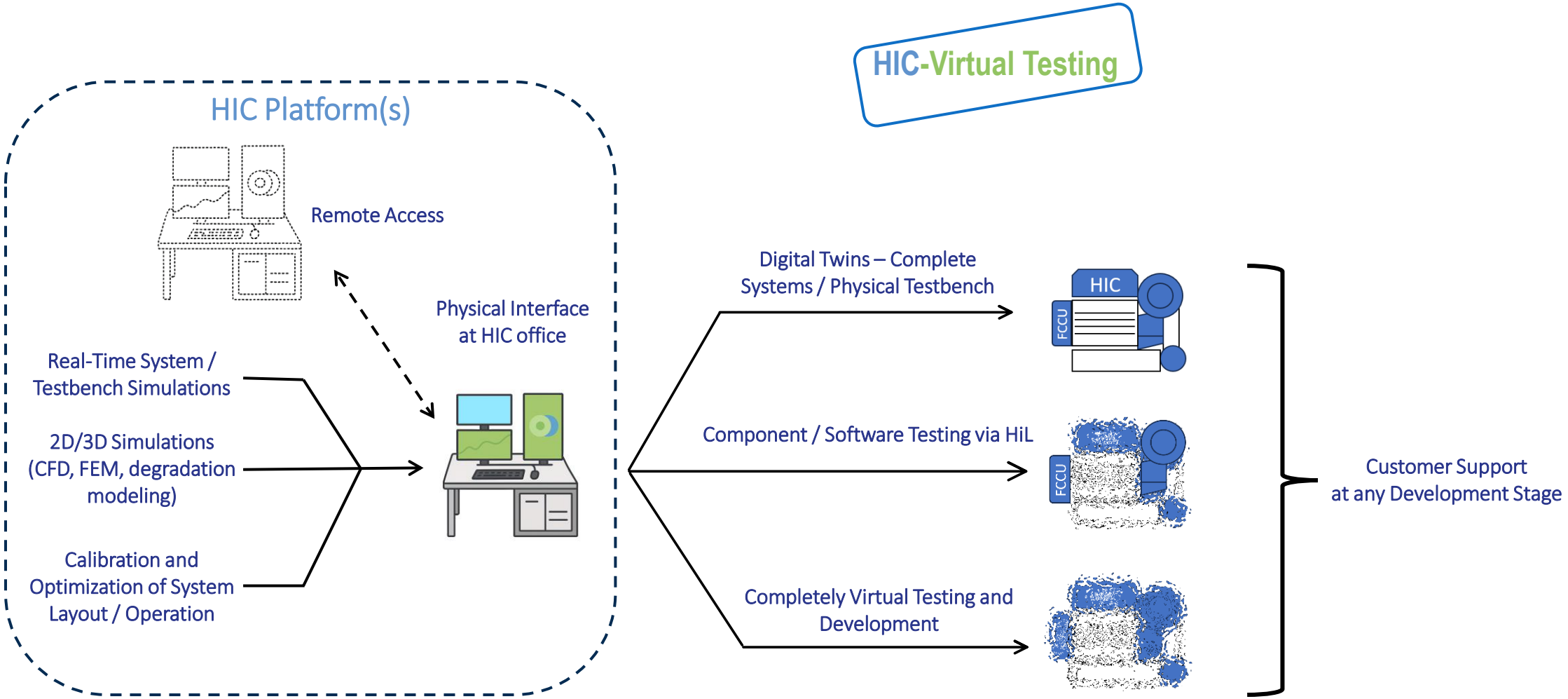
Collaboration for Component Development

COMPANY XY

Fuel Cell Air Side Design



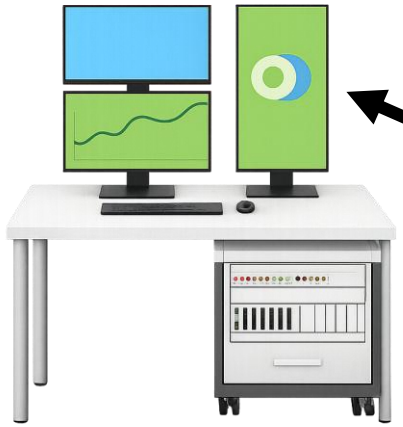
System Buildup: Virtual Testing Platform



Virtual test stand (VTS) overview

Workstation #1
- Test stand operating software (real or virtual)
- HMI + monitoring module of test bench
- Execution 0D to 3D simulation models

Workstation #2
- Test Automation
- Design of Experiments (DoE)



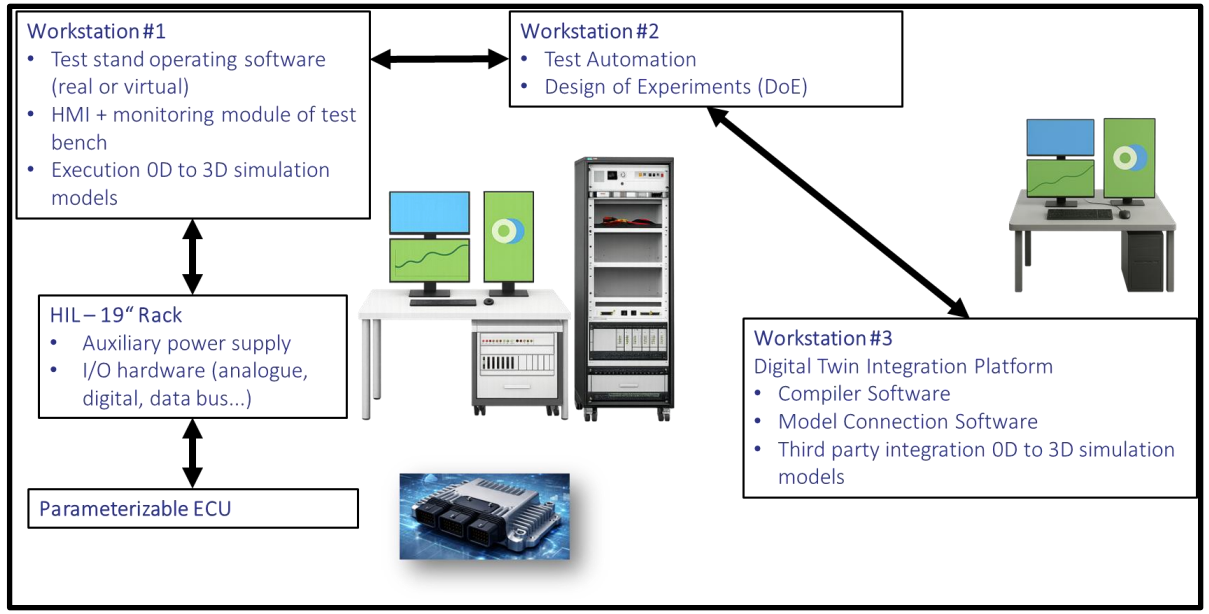
HIL – 19“ Rack
- Auxiliary power supply
- I/O hardware (analog, digital, data bus...)

Workstation #3
Digital Twin Integration Platform
- Compiler Software
- Model Connection Software
- Third party integration 0D to 3D simulation models

Parameterizable ECU

VTS simulation integration

Simulation Environment
- 2D/3D CFD
- Powertrain
- 0D/1D Fuel Cells/Electrolyzer
- System/BoP Simulation



Experience provided by the HIC team

Simulation of longitudinal dynamics

- Passenger car
- Heavy-duty
- Train
- Ship


[1]


[2]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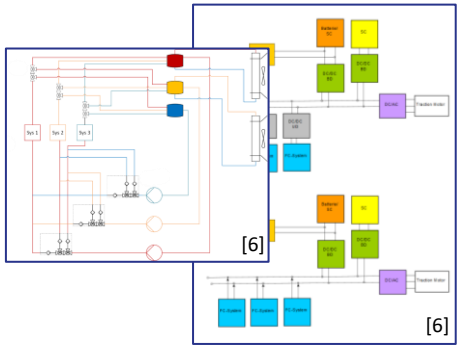
[3]

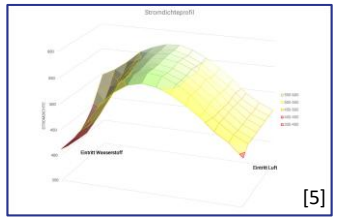
Simulation of energy systems (mobile, portable, stationary)

- interaction of
  - Fuel cell
  - Battery, supercap
- Hybrid strategies
- Thermal management


[6]

Processes in fuel cells

- V-I-characteristics and influencing drivers
- Reactant and media distribution
- Current density and temperature distribution
- Flow field design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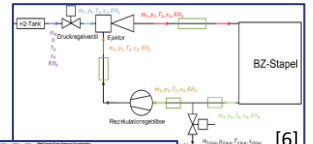
Subsystems and components

- Heat exchangers
- Compressors
- Coolant pumps
- Recirculation pumps
- Water separators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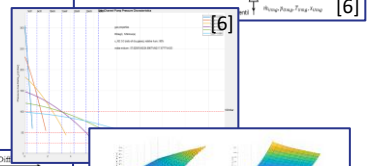
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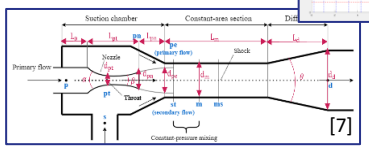
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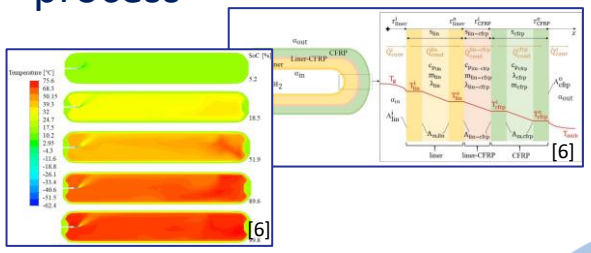
Tank systems

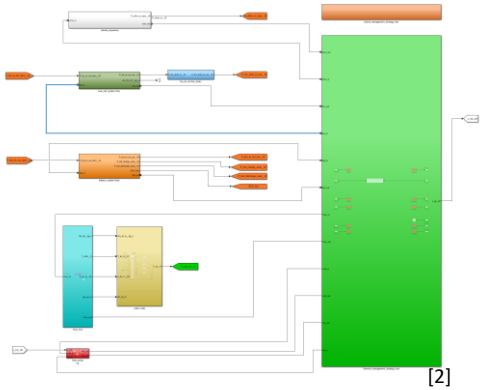
- Real gas behavior
- Pressures and temperatures
- Filling and emptying process


[6]

Source:
[1] https://www.toyota.de/entdecke-toyota/news/der-neue-toyota-mirai
[2] https://www.volvotrucks.com/en-en/news-stories/press-releases/2024/may/Volvo-to-launch-hydrogen-powered-trucks.html
[3] https://www.now-gmbh.de/projektfinder/wasserstoffstrassenbahn-der-neusten-generation/
[4] Lürssen Werft GmbH & Co. KG
[5] https://www.dilico.de/produkte/dilico-curr-temp/kundenspezifisch
[6] TU Chemnitz, Department of Advanced Powertrains
[7] based on https://ww2.mathworks.cn/help/hydro/ref/ejectorg.html

Future ambitions:
Electrolyzer and electrolyzer system simulation

Future capabilities using a virtual test stand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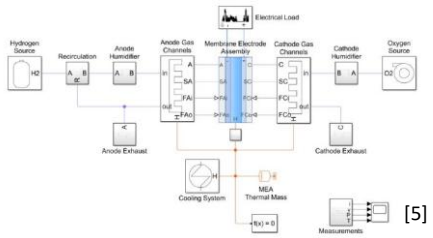
Vehicle/system/component modeling and simulation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Non-real-time simulation

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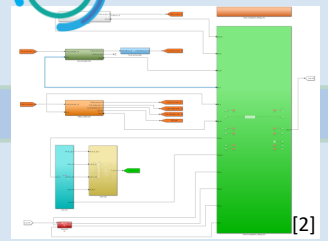
Execute in real-time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couple real-time models with real hardware


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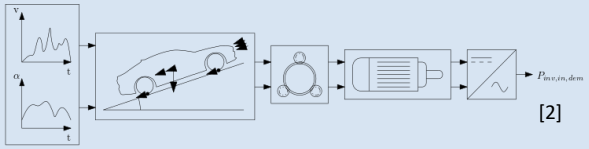
Hardware-in-the-Loop (HiL)


[1]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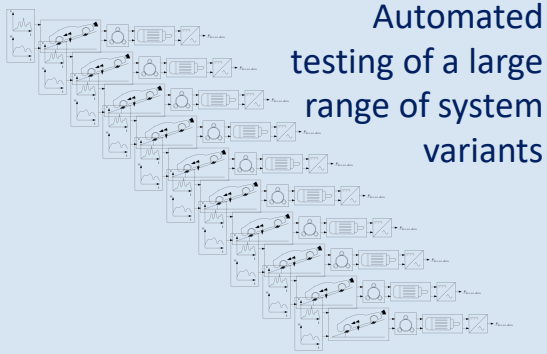
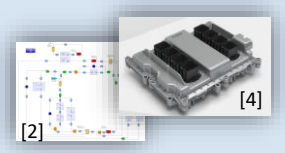
Automated testing of a large range of system variants

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Testing of non-standard parameters without risking a real prototype


[6]

Development and planning of testing programs/DOE for later available real components

Virtual Testing


[3]

Real Testing

Current capabilities

Capabilities with virtual test stand

HIC-Lab

Sources:
[1] HIC, AI generated
[2] TU Chemnitz, Department of Advanced Powertrains
[3] HIC
[4] https://www.bosch-mobility.com/de/loesungen/steuergeraete/brennstoffzellen-steuergeraet/
[5] https://de.mathworks.com/discovery/fuel-cell-model.html
[6] https://www.fischer-fuelcell-compressor.com/en/products
[7] https://www.pngegg.com/en/png-mwarw

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Thank you!

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