

# Was braucht es, um Simulationsabläufe mittels Web-Apps für jeden bereitzustellen

/ Michael Schimmelpfennig, Ph.D.

/ Senior Product Sales Manager / Overlay Sales for Ansys optiSLang

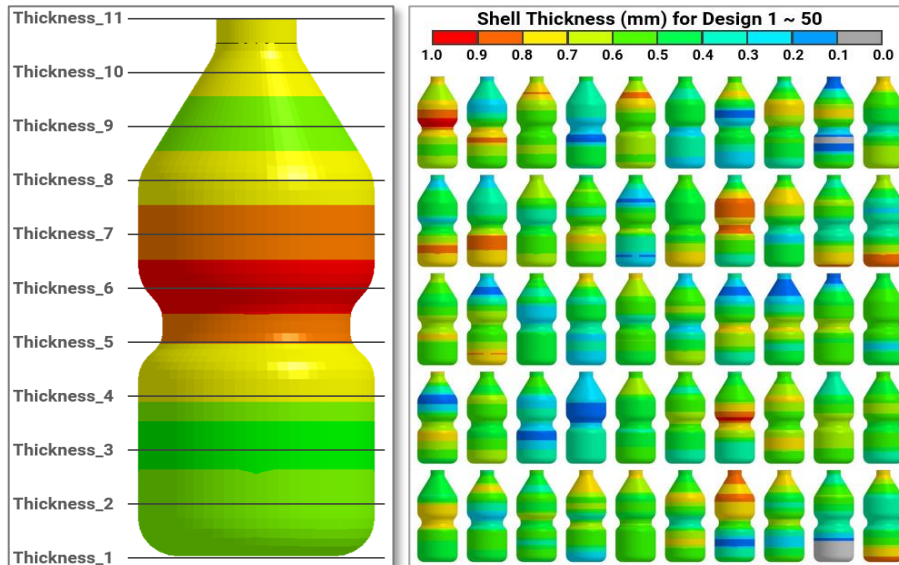
/ CADFEM Ansys Simulation Conference

Rapperswil 2023



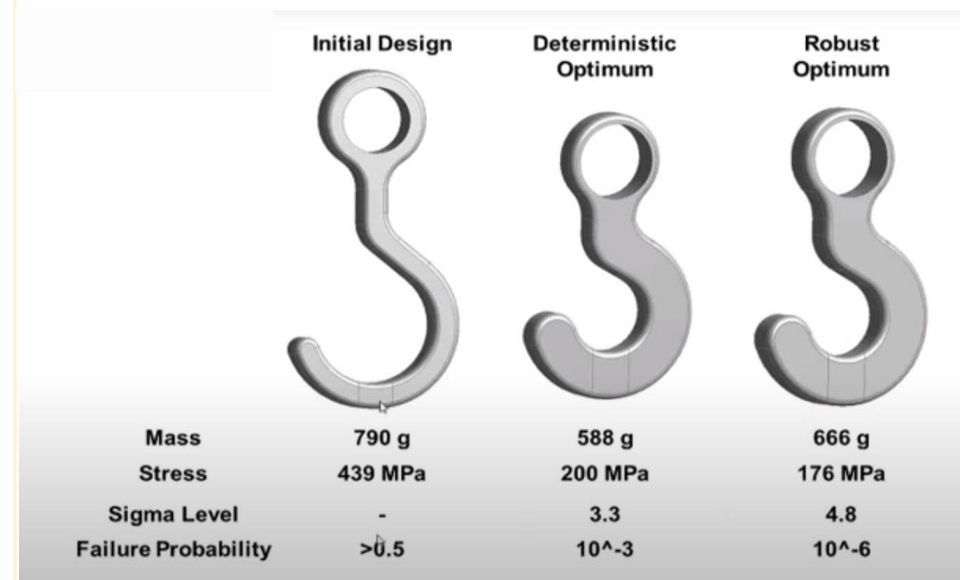
# / What is my optimal design? examples

## Which thicknesses are important?



11 thickness inputs, 50 combinations

## How to reduce the weight ?



Minimizing Stress Level  
Decreasing Failure Probability

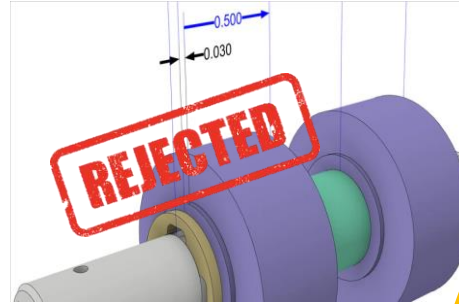
# Significant Challenges Exist To Optimize Multi-Physics Design with Simulation



**Manual,  
Discontinuous  
Process**



**Conflicting Design  
Requirements**



**Poor Quality,  
Narrow Tolerances**

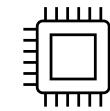
## Typical Applications



Optimization of a Toyota Prius Hybrid-Electric Motor



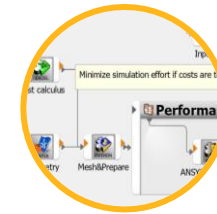
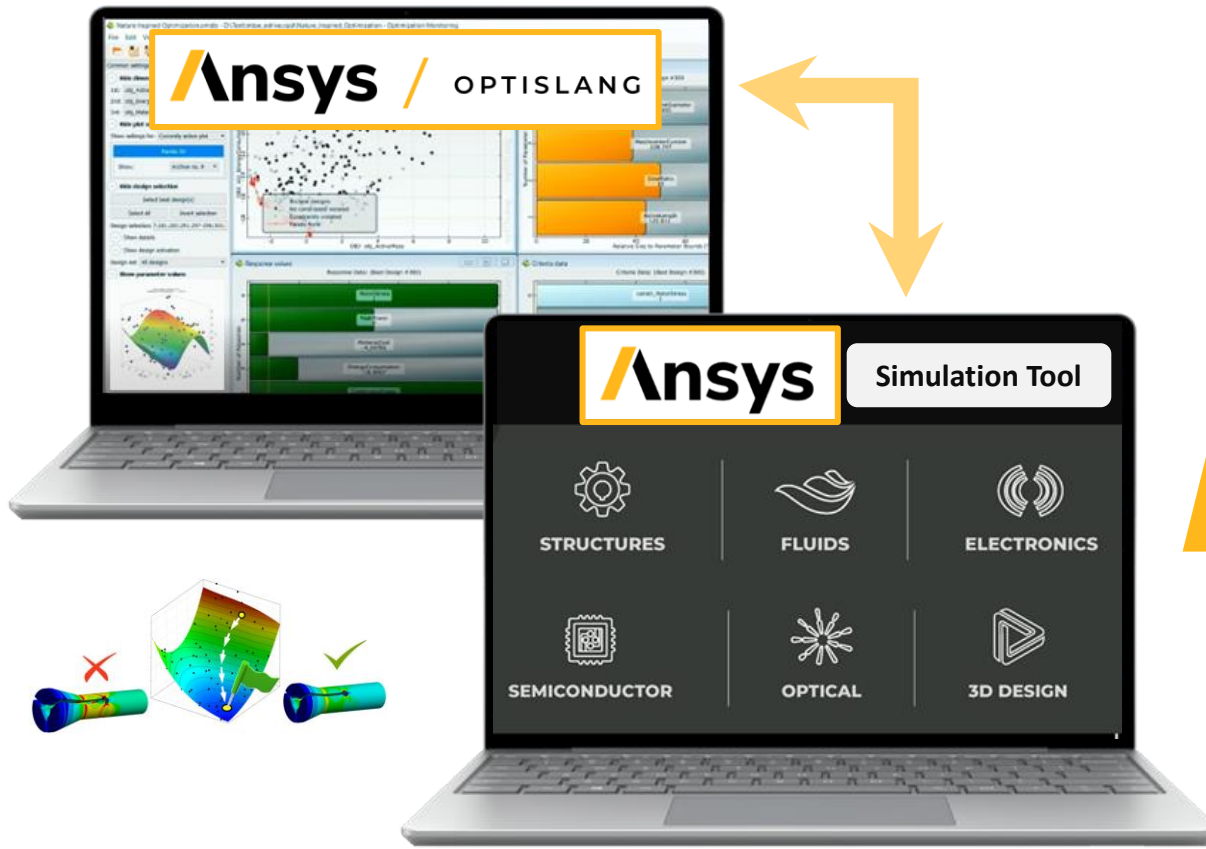
Lightweighting Ariane6 Space Launcher Engine Panel



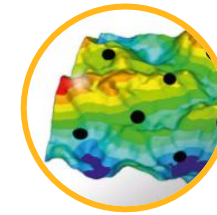
Calibration of IGBT Spice Model

# What is Ansys optiSLang ?

**Ansys optiSLang** is a framework used for **Robust Design Optimization** used in combination with physics-based simulations to optimize product designs



**Process Integration**  
Build and Automate  
Simulation Workflows

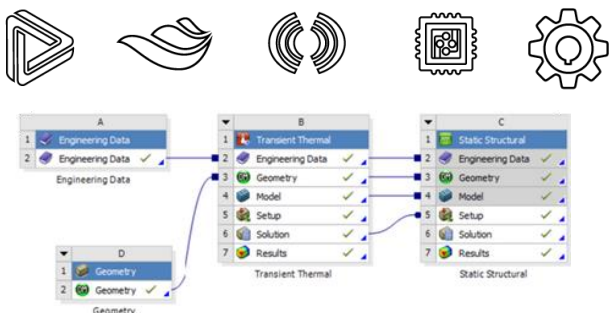


**Design Optimization**  
Use Algorithms for  
Parametric Variation Analysis

# optiSLang: single physics to enterprise simulation democratization

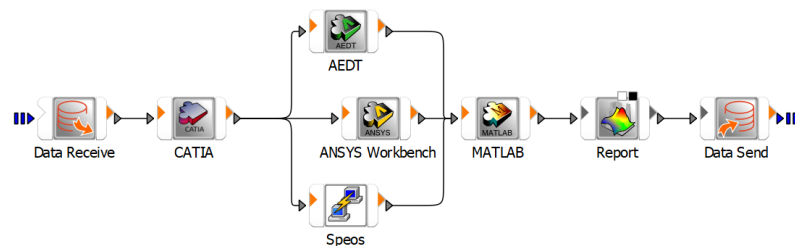
## Capture Multiphysics and Systems

- Industry leading multi-physics & systems offerings
- Vendor neutral, all solvers
- Simulation and Measurement

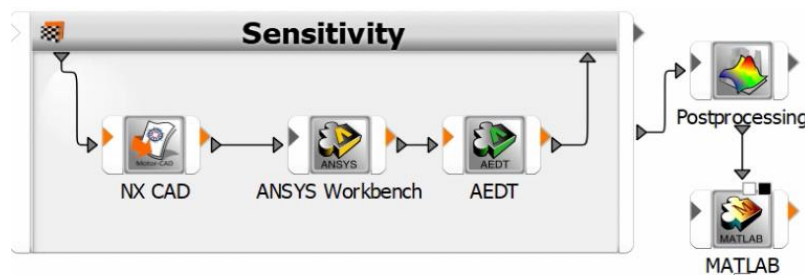


## Connect and automate workflows with Ansys and other vendors

- Simulation automation
- Design Exploration & Optimization incl. AI/ML algorithms and models
- Robustness / Tolerances Analysis

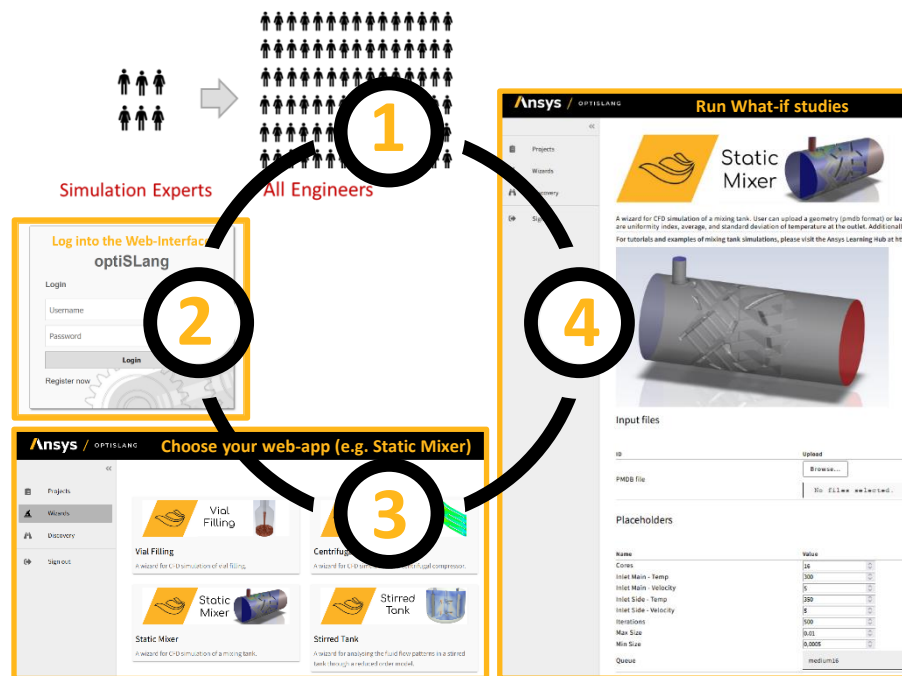


## Workflows & Variation Analysis



## Deploy simulations across the enterprise

- Publish workflows with web-apps
- Don't think about licenses, installation, resources → easy to use with custom GUIs
- Incl. Non-Simulation Experts into projects





# Process Integration and Design Optimization

Automation

Parametric Variation Analysis

Democratization

**Automated  
Workflows**

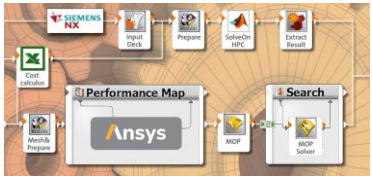
**Model  
Calibration**

**Sensitivity**  
Design Understanding

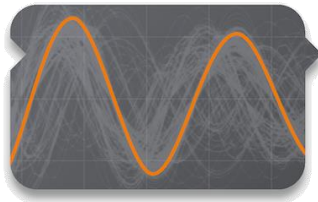
**Optimization**  
Design Improvement

**Robustness**  
Design Quality

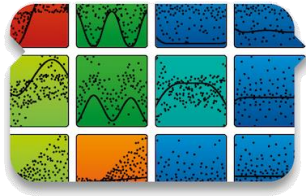
**Publish as  
web apps**



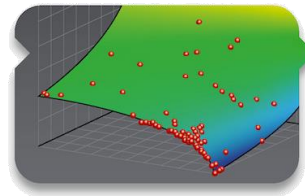
Easy to build and  
publish repetitive  
workflows



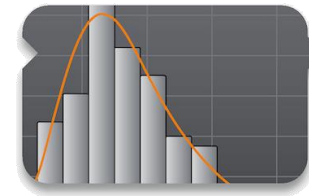
Identify important  
model parameter for  
the best fit between  
simulation and  
measurement



Investigate parameter  
sensitivities, reduce  
complexity and  
generate best possible  
metamodels



Optimize design  
performance



Ensure design  
robustness and  
reliability



Entire organization  
benefits from workflows  
provided by CAE-experts



# Examples of Browser-Based Apps for Simulation Workflows

# Multi-Physics-Workflow with optiSLang and Mixing applications

## Engineering Goals

- Enable more engineers to run standard CFD analysis
- Make it more stable, less manual and even flexible
- Overcome the problem of complex IT configuration for each user

## Ansys Solution

- Parametrized geometry & mesh creation in SpaceClaim & Fluent meshing
- Parameter & Journal driven Fluent runs
- Automated simulation workflow is driven by optiSLang
- Easy to use web frontend customized by python
- Auto-generated HTML report with all needed pictures, graphs, videos, and values

## Benefits

- No local installation needed
- Use multiply queues to submit to cloud or company cluster
- User-friendly web frontend
- Faster product development
- Easy to switch from hardware tests to digital/virtual tests

Web frontend for democratization of CFD mixing applications in stirring tanks

The screenshot shows a web-based configuration interface for a CFD simulation of a stirring tank. It is divided into two main panels: 'Geometry Settings' and 'Fluent Settings', both featuring the Ansys logo and title bar.

**Geometry Settings Panel:**

- Tank Parameters Table:**

Name	Value	Units
Shape	Cylindrical	
Bottom Type	ASME6	
Height	1600	[mm]
Liquid Level	1500	[mm]
Diameter	1100	[mm]
Length	1100	[mm]
Width	1100	[mm]
Disk Height	200	[mm]
Cone Height	200	[mm]
Bottom Diameter	800	[mm]
- Diagram:** A 3D schematic of a cylindrical tank with an internal stirrer. Labels include: Wall Clearance, Tank Diameter, Tank Shape, Tank Height, Liquid Level, Z Offset, Bottom Diameter (Conical Bottom), Bottom Type, Impellers (Type, Diameter, Height, Z Offset, Angular Offset, Blade Number, Blade Angle), Cone Height (Conical Bottom), and Disk Height (Flat Bottom).

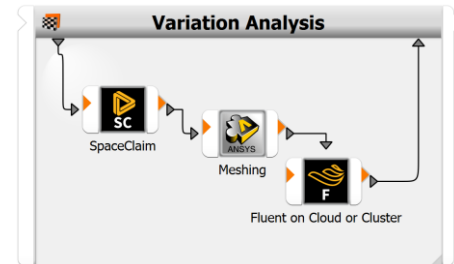
**Fluent Settings Panel:**

- Fluid Flow Inputs Table:**

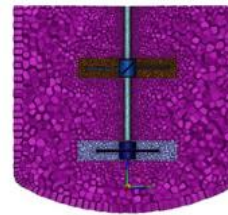
Name	Value	Units
Agitation Speed	100	[RPM]
Fluid Density	998.2	[kg m <sup>-3</sup> ]
Fluid Viscosity Model	Constant	
Fluid Viscosity	0.001	[Pa sec]
Meso Mixing Length Scale	0.05	[m]
- Text:** The Agitation Direction follows the "right-hand rule": direction pointing towards the tank bottom → clockwise rotation.
- Diagram:** A 3D visualization of the flow field around the stirrer, showing velocity vectors.
- CSFR Settings Table:**

Name	Value	Units
Inlet Massflows	1	[kg m <sup>-3</sup> ]
- Fluid Flow Run Settings Table:**

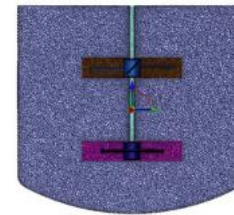
Name	Value	Units
Mesh Refinement Factor	1	
Flow Iterations	10000	



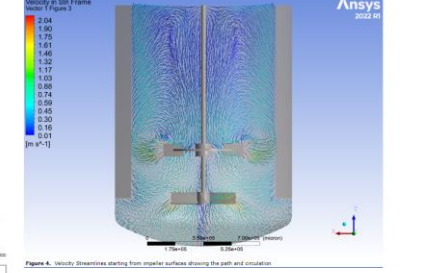
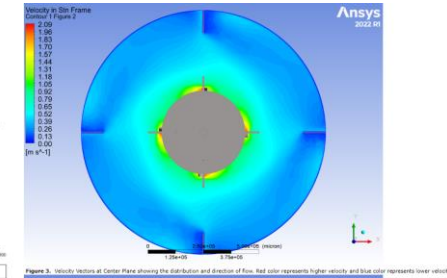
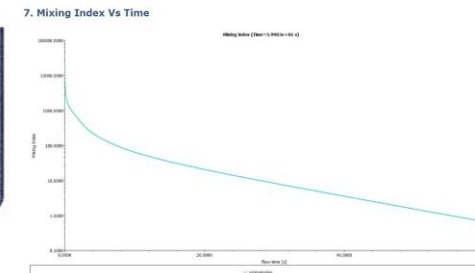
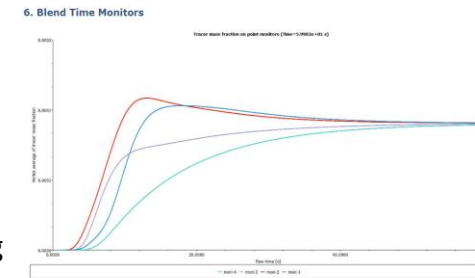
Automated CFD workflow in optiSLang



Mesh Refinement Factor = 1



Mesh Refinement Factor = 0.25



Auto-generated HTML Report





# Multi-Physics-Workflow with optiSLang and Mixing applications

Ansys / OPTISLANG

Projects

Wizards

Mixing Wizard application

built with pyowa 22R2

Geometry Settings

Fluent Settings

Documentation

Tank Parameters

Name	Value	Units
Shape	Cylindrical	
Bottom Type	ASME6	
Height	1600	(mm)
Liquid Level	1500	(mm)
Diameter	1100	(mm)
Length	1100	(mm)
Width	1100	(mm)
Disk Height	200	(mm)
Cone Height	200	(mm)
Bottom Diameter	800	(mm)

Shaft Parameters

Name	Value	Units
Type	Top Mounted	
Direction	Clockwise	
Diameter	30	(mm)
X Offset	0	(mm)
Y Offset	0	(mm)
Z Offset	300	(mm)
Alpha Angle	0	[°]
Beta Angle	0	[°]

Baffle Parameters

Name	Value	Units
Type	Flat	
Number	3	-
Wall Clearance	0	(mm)
Height	1400	(mm)
Width	100	(mm)
Thickness	10	(mm)
Z Offset	300	(mm)
Angular Offset	0	[°]

Impeller Settings

Add impeller

Create	Mount	Type	Height (mm)	Diameter (mm)	Z Offset (mm)	Angular Offset [°]	Blade Number [-]	Blade Angle [°]	Blade Height (mm)	Blade Width (mm)	Blade Thickness (mm)
<input type="checkbox"/>	Shaft	PBT	80	400	300	0	6	30	0	0	0

Fluid Flow Settings

Ansys / GEOMETRY SETTINGS

A high-level overview of geometry parameters can be seen above while general impeller parameters are shown below. For more detailed documentation and parameter definition, please go to the Documentation tab.

PBT

RDT

RCI

9

©2023 ANSYS, Inc. / Confidential

# Simulation-based Design for increased reliability requirements



## Customer Goals

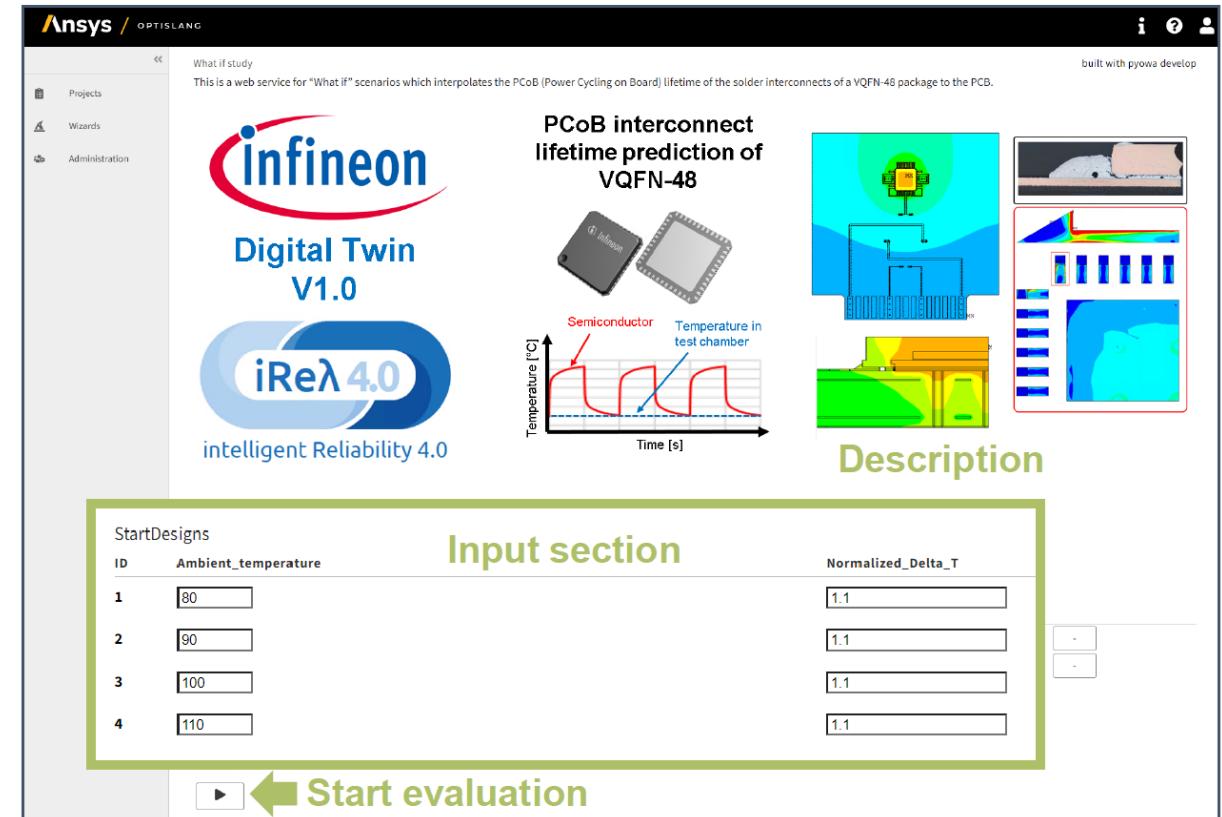
- AEC-Q100 Grade 0 will not cover the today extended requirements for solder joint reliability
- Simulation-based Design for Reliability is needed
- Fast assessments of components are needed for reliability experts

## Solution

- Simulation based digital prototype is an alternative to analytical models
- Created digital prototype published via web service for global usage

## Benefit

- Prediction on digital prototype takes only few seconds
- Additional visualization of local prediction quality increases acceptance
- Web service does allow non-simulation-experts to consume simulations immediately



Martin Niessner, Provision of MOPs via web-apps for the rapid assessment of solder joint reliability, WOST Workshop 2022



# “What if” studies for end-customer usage

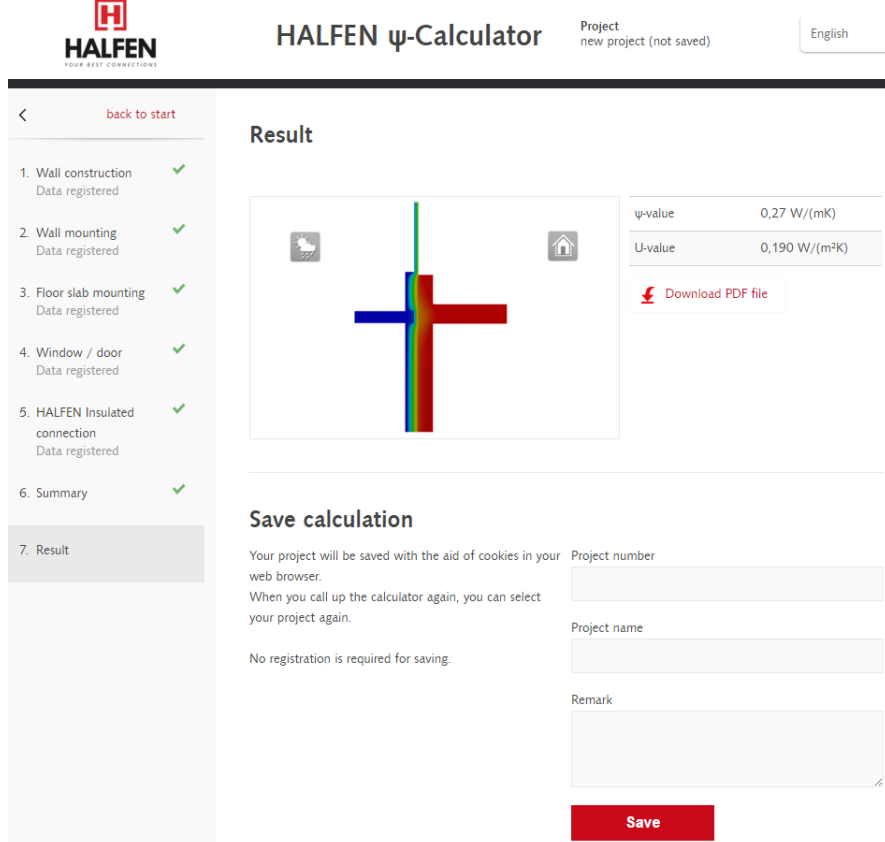
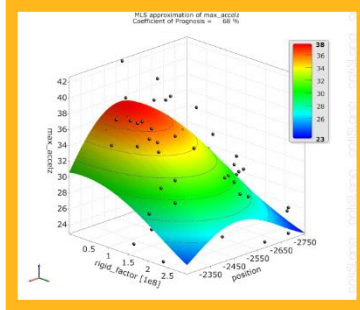
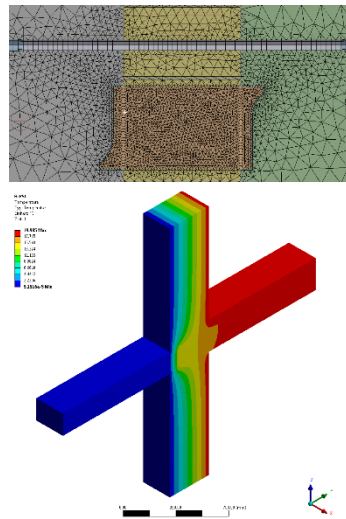

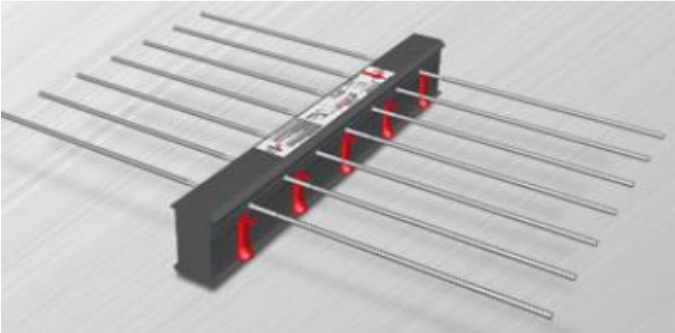
- Combining static product catalog with the simulation knowledge base and creating a Product Twin
- Answer on demand → increase market share → better brand

Floor slab mounting change

Floor slab mounting	Material	d [mm]	$\lambda$ [W/(mK)]
Screed	Anhydrite screed	50	1,200
Insulation	Rigid foam, PS 035 (EPS)	40	0,035
Edge insulation	PE edge insulation 045	10	0,045
Bearing layer	Concrete (1% reinforced)	200	2,300

Window / door change

Window / door	Value
Parapet height [mm]	4
Cover of insulation on window frame [mm]	3



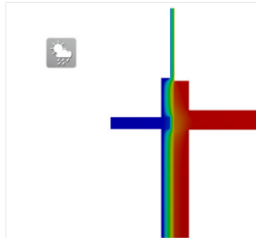
**Start calculation**

**HALFEN  $\psi$ -Calculator** Project new project (not saved) English

[back to start](#)

1. Wall construction Data registered ✓
2. Wall mounting Data registered ✓
3. Floor slab mounting Data registered ✓
4. Window / door Data registered ✓
5. HALFEN Insulated connection Data registered ✓
6. Summary ✓
7. Result

**Result**



$\psi$ -value 0,27 W/(mK)  
U-value 0,190 W/(m²K)

[Download PDF file](#)

**Save calculation**

Your project will be saved with the aid of cookies in your web browser.  
When you call up the calculator again, you can select your project again.

No registration is required for saving.

Project number  
Project name  
Remark

**Save**

Thorsten Heidolf, [Use of metamodels for web-based calculation of thermal bridge parameters](#), WOST Workshop 2022

<https://psi.halfen.com/de-de/start>

# Modular Simulation Workflow for E-Motor Development



## Customer Goals

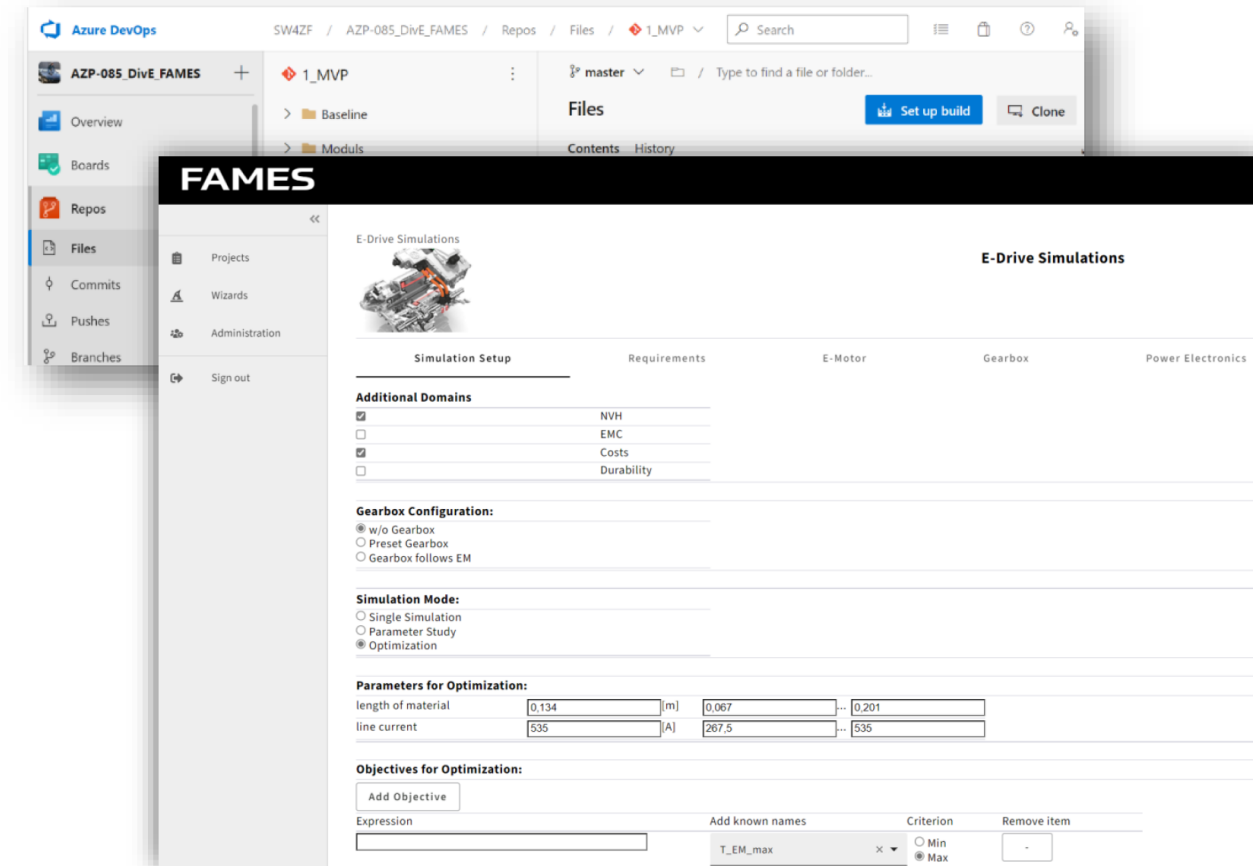
- Modular way to connect any solvers to workflows
- Non-simulation experts should be able to create workflows

## Solution

- Vendor-neutral simulation platform to connect any Ansys and inhouse-tools
- Web service with guided frontend for help to create workflows

## Benefits

- Reducing costs because also non-expert can build advanced workflows
- Increase efficiency because everybody, every time, everywhere workflows can build
- Speed-up development time



Helmut Schmid, [Webservice based Framework for Automated Modular Electric Drivetrain Simulation](#), WOST Workshop 2022



# Web App for AI/ML-driven Intelligent Product Design

## Engineering Goals

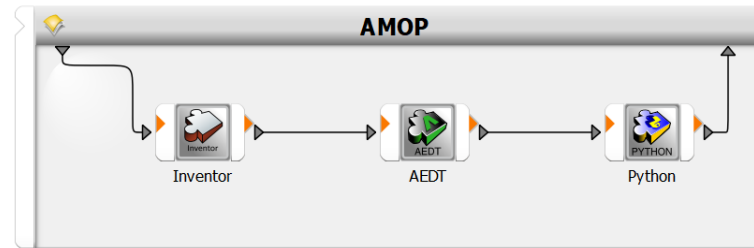
- Develop a platform for **fast** (close to real-time) and easy **design generation & optimization** of product lines
- **Enable non-CAE expert** users with high-fidelity analysis and simulation-driven design optimization.
- **Reduce** overall development time and cost

## Ansys Solution

- **Automated surrogate model extraction:** orchestrating different tools for analysis & design space exploration; real-time approximation and design visualization (*HFSS, optiSLang, Minerva*)
- **Large-scale optimization:** DoE (Design of Experience) study through all possible parameter combinations of the simulation (*optiSLang*)
- **Governance:** maintaining the digital thread throughout the development process (*optiSLang, Minerva*)
- **Customization:** platform customization through Ansys Prof. Service

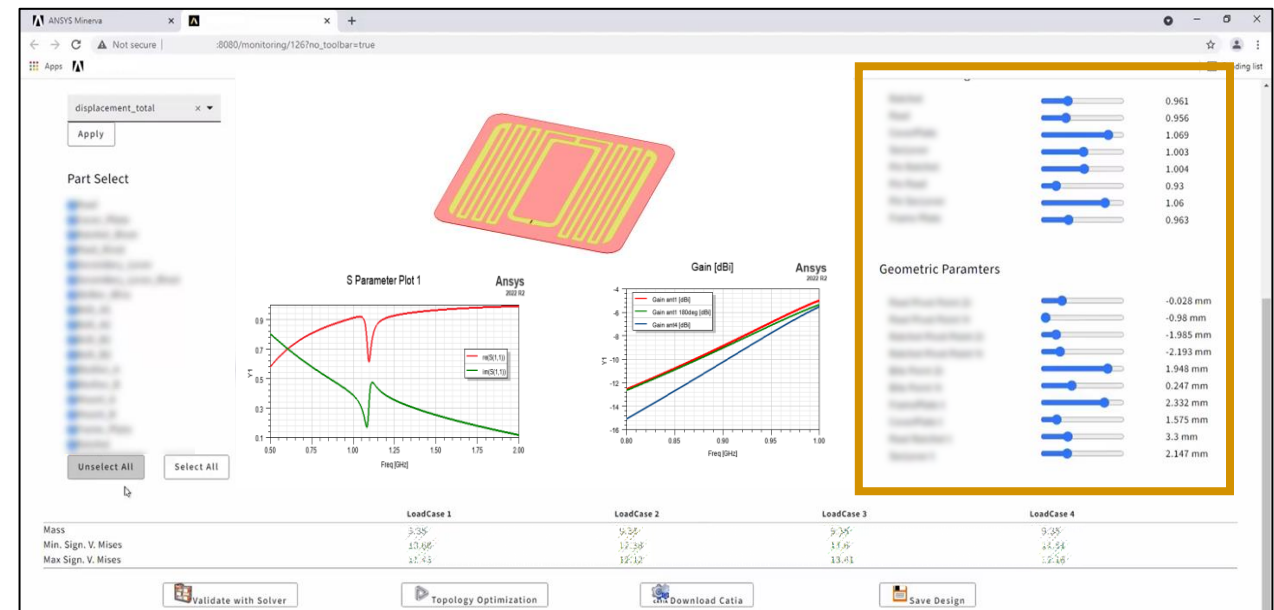
## Benefits

- **Improve cross-BU collaborations & reduced requests for proposals (RFP) turnaround** thanks to real-time design space exploration
- Enable **digital continuity** of CAE models throughout the product development process, significantly lowered the risk of lost Request for Quote (RFQs) & wasted engineering time/labor



Automated Workflow inside Ansys optiSLang to run several 100s of designs to train ROMs

**75% reduction  
development time**



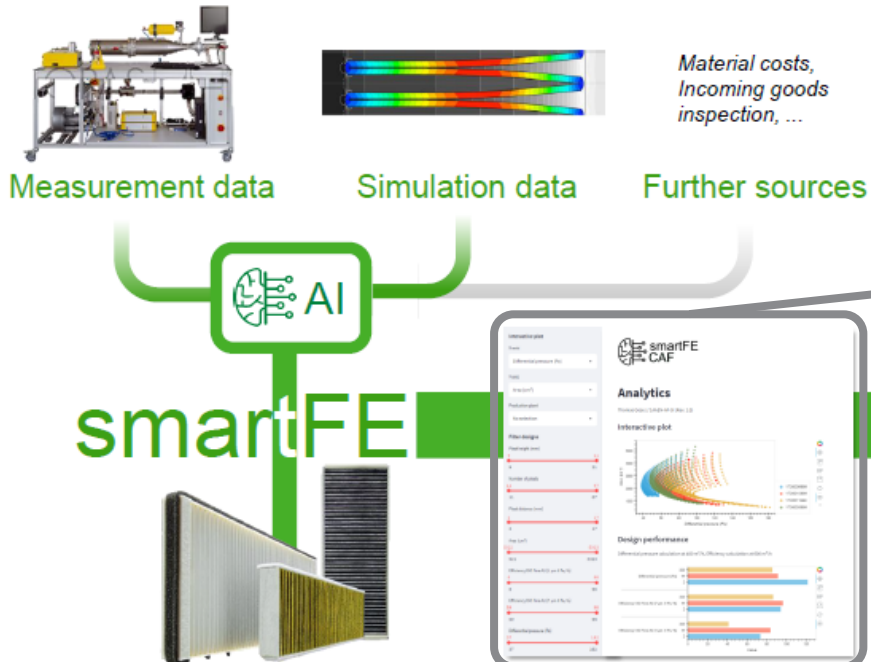
Online Platform for real-time design variation of RFID Tags



# Democratize with Web Apps as Smart Filter Design Toolbox

- / Democratization helps to parametrize, analyze and decide during development
- / Connecting measurements and Simulation data, Browser-Based visualization for non-CAE-user

## Democratization smartFE Vision



13

June 24th  
Smart Filter Element Development Creating ML & optimization based tools provided as webservices

*“What is the optimal filter media and the optimal filter element design to achieve a given specification in my design space?”*

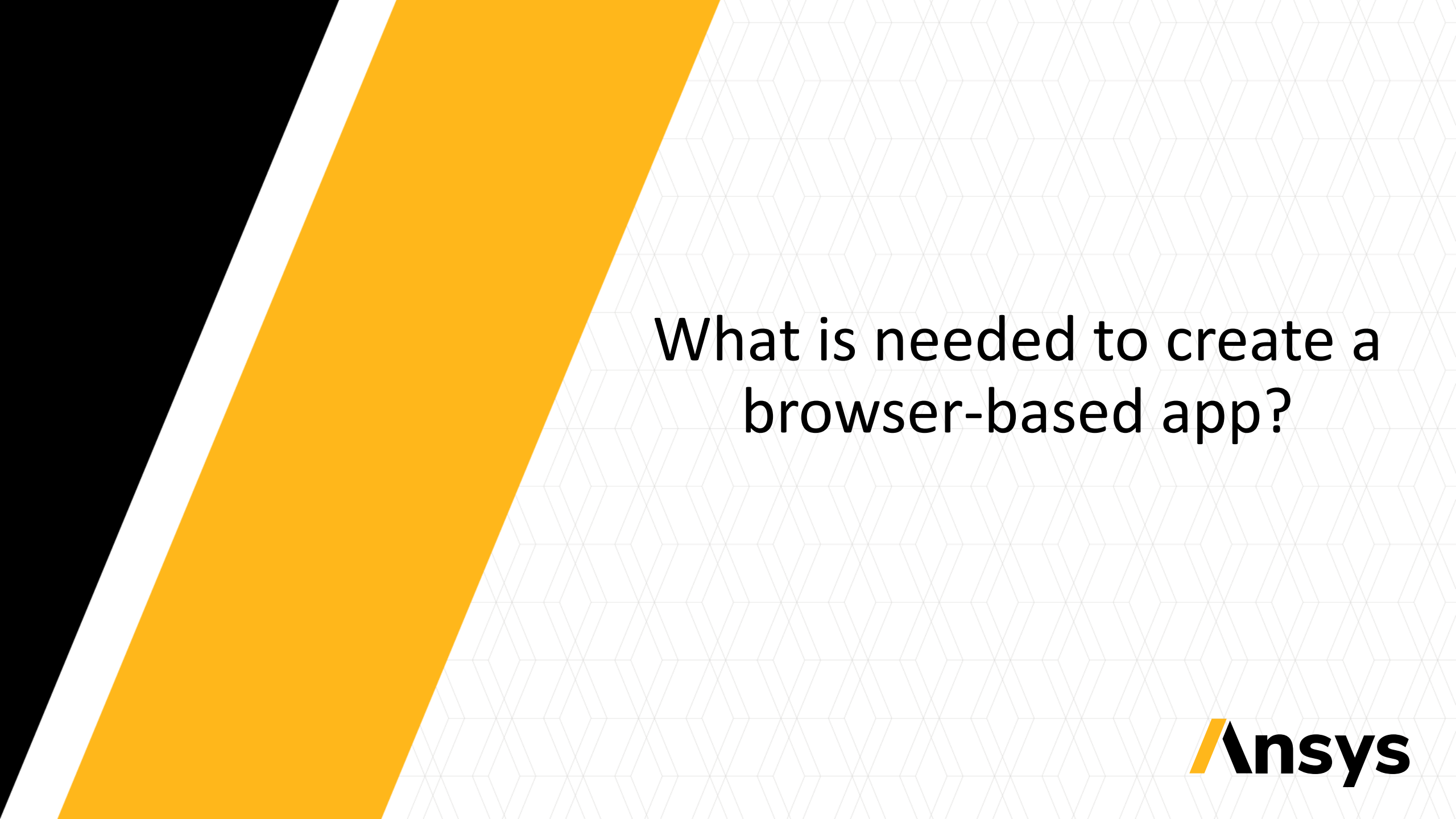
### Features

- Web-based application for global use
- Fast + intuitive element design workflow
- Interactive “what if” analysis + multi-objective optimization
- Reliable element performance prediction



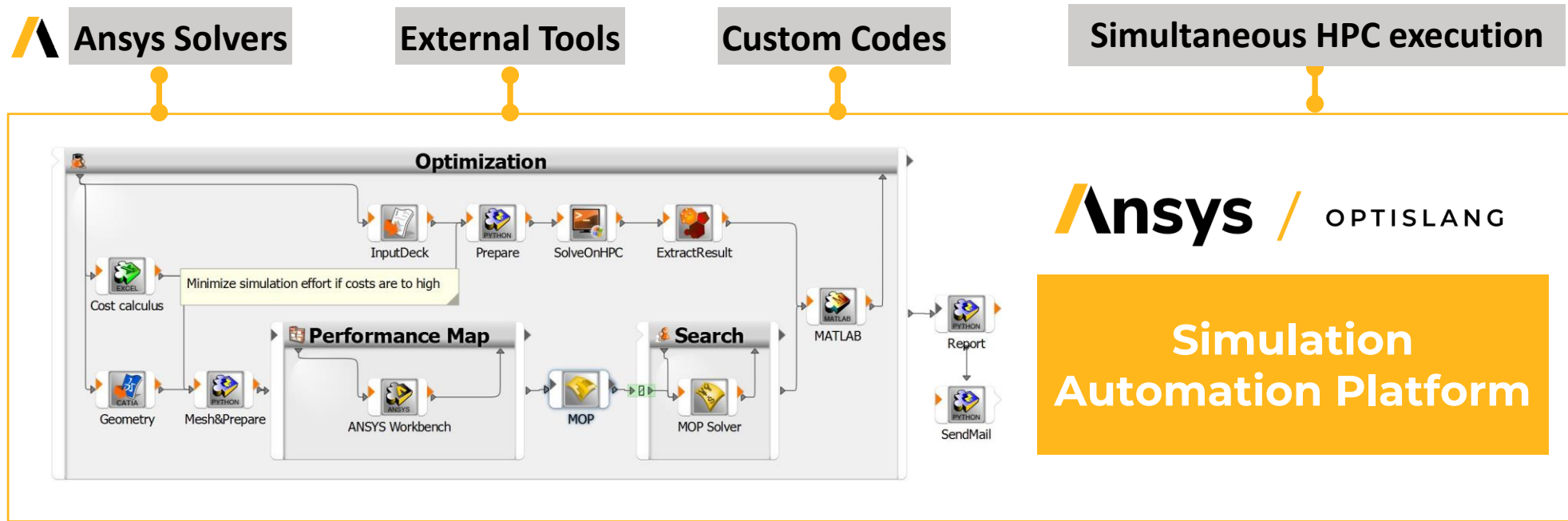
Thomas Gose, Christoph Schulz, Smart Filter Element Development – Creating ML & optimization based tools provided as webservices, WOST Workshop 2022





What is needed to create a  
browser-based app?

# Process Integration is Used to Automate Simulation Workflows



## Connect

Ansys tools, Inhouse Codes, 150+ commercial solutions



## Orchestrate

Set sequences, branches, conditions, loops, combination of algorithms



## Publish

Packaged Apps for Non Simulation experts

# Steps to democratize your simulation workflow

- Build the optiSLang workflow you want to publish (with CAD + Solver or ROM usage), define in the workflow where each part should be executed (Local/Cluster/Cloud)
- Define “placeholders” for parameter access via the app
- Define “registered files” for postprocessing of results in the app or new input files
- Create the GUI of the app with py-based modules (templates)
- Define a workstation in your company as a basis for the web-server
- Give all users of the app access to the IP address of that web-server

The sequence of screenshots illustrates the optiSLang workflow:

- optiSLang Login:** A web form with fields for Username and Password, a Login button, and a Register now link.
- optiSLang Main Interface:** A dashboard with a sidebar for Projects and Wizards. The main area shows tabs for Default, Electronics, and Optics. Under Electronics, there are three cards: EM Web App, What if study (MotorCAD), and Optimization (MotorCAD).
- Optimization (MotorCAD) Workflow:** A detailed view of the optimization process, showing a 3D model of a motor and a table of parameters and results.
- Optimization Results:** A table showing the results of the optimization process, including parameters like Airgap, Armature Length, Magnet Thickness, etc., and their corresponding values.

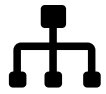
Parameters	Reference value	Lower Bound	Upper Bound
Airgap	1.0	0.5	1.5
Armature Length	88.0	45.0	135.0
Magnet Thickness	4.0	2.0	6.0
Stator Depth Ratio	0.7	0.5	0.9
Stator Opening Ratio	0.4	0.2	0.6
Turns_Tot_Angle	36.0	10.0	45.0
Turns_Whole_Ratio	0.2	0.1	0.3
Turns_Tot_Depth	1.0	0.5	1.5

Designs	Airgap	Armature Length	Magnet Thickness	Stator Depth Ratio	Stator Opening Ratio	Turns_Tot_Angle	Turns_Whole_Ratio	Turns_Tot_Depth
1	1.0	88.0	4.0	0.7	0.4	36.0	0.2	1.0
2	1.0	88.0	4.0	0.7	0.4	36.0	0.2	1.0

# / Ansys optiSLang capabilities - Summary

## Process Integration

Build, Orchestrate and Publish



### Tools Connection & Solver-neutral

Support Ansys & 3rd Party Tools



### Simulate More Automatically

Build Automated Workflows



### Simulation for Non-Sim Experts

Publish Workflows as web apps



### Digital Transformation

ROMs for Digital Twin



## Design Optimization

Use Algorithms for Parametric Variation Analysis



### Reduce Complexity

Sensitivity Analysis



### Find Reliable Optimum

Design Optimization



### Verify Design Quality

Robustness Evaluation



### Fit Simulation & Measurement

Model Calibration





For more information or a demo please contact:

CADFEM – The Ansys Elite Channel Partner

or

[michael.schimmelpfennig@ansys.com](mailto:michael.schimmelpfennig@ansys.com)