DEMOCRATIZATION OF CAE-WORKFLOWS WITH OPTISLANG AT BOSCH

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WOST 2019



Democratization?

- ► Democratization in CAE-based product development means to empower non-experts to take advantage from simulation technology
- ► CAE experts could put the power of simulation <u>safely</u> into non-experts hands to overcome the general lack of CAE engineers
- ► Democratization of simulation means mindset change



Democratization?

- ► Democratization in CAE-based product development means to empower non-simulation experts but experts to take advantage from simulation technology
- ► CAE experts could put the power of simulation <u>safely</u> into empower non-simulation experts but experts hands to overcome the general lack of CAE engineers
- ▶ We have to keep in mind: A design decision (in most cases) is not triggered by simulation result only.
- ▶ "Democratization" means as well:
 - ► Efficiency: Lever the expertise of CAE experts by consequent reuse of verified and validated workflows
 - Quality: Standardization of repetitive CAE workflows independent from user and region
 - ► Effectivity: Expert focus on product and design expertise not simulation skills



Outline

- ► Introduction
- ► Our journey to Simulation Process Management
 - ► Drive ANSYS via Microsoft Excel / GUI
 - ▶ Process Automation & ANSYS WB Scripting by ACT
- ► Requirements on Simulation Process Management Tools mirrored on development scenario
 - ► Required Setup of SPM Framework
- ► Introduction to Dynardo Concert Hall
 - ► Practical Examples
- ▶ Outlook and Summary



Our journey to Simulation Process Management



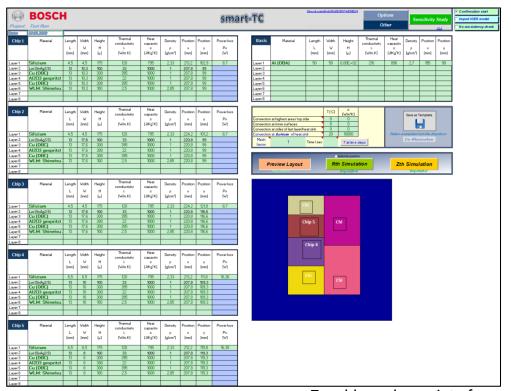


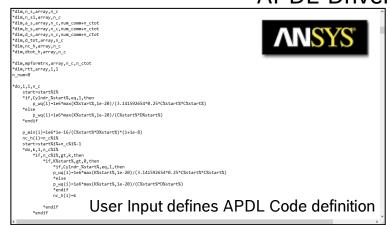
Drive ANSYS via Microsoft Excel: smart-TC

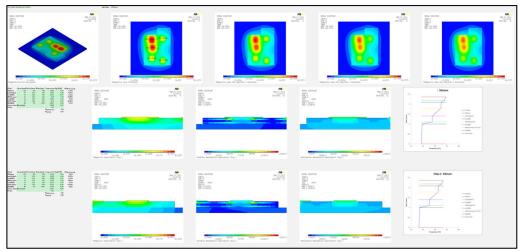
APDL-Driven ANSYS Backend



VBA-Driven MS Excel-Frontend



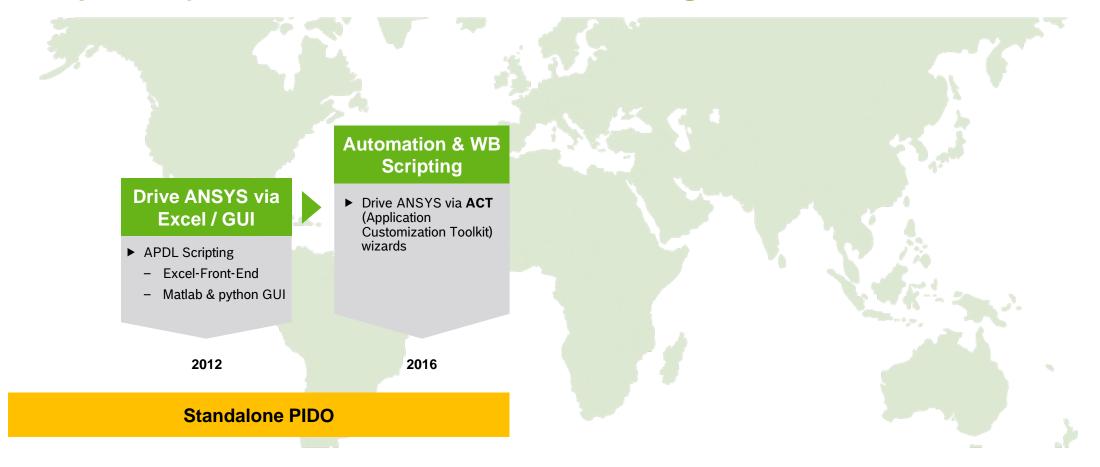




Post processed Results visualized in Excel



Our journey to Simulation Process Management





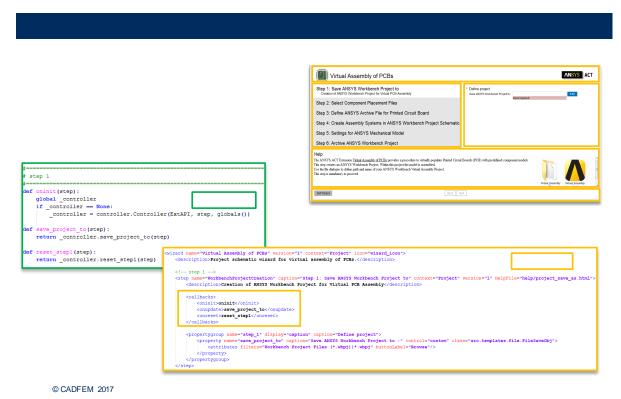
Reliability Assessment of Electronics

Virtual Assembly of PCBs / ECUs-ACT

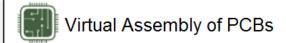
CADFEM®











Step 1: Save ANSYS Workbench Project to

Step 2: Select Component Placement Files

Step 3: Define ANSYS Archive File for Printed Circuit Board Select the archive file for Printed Circuit Board (PCB)

Step 4: Create Assembly Systems in ANSYS Workbench Project Schematic

Step 5: Settings for ANSYS Mechanical Model

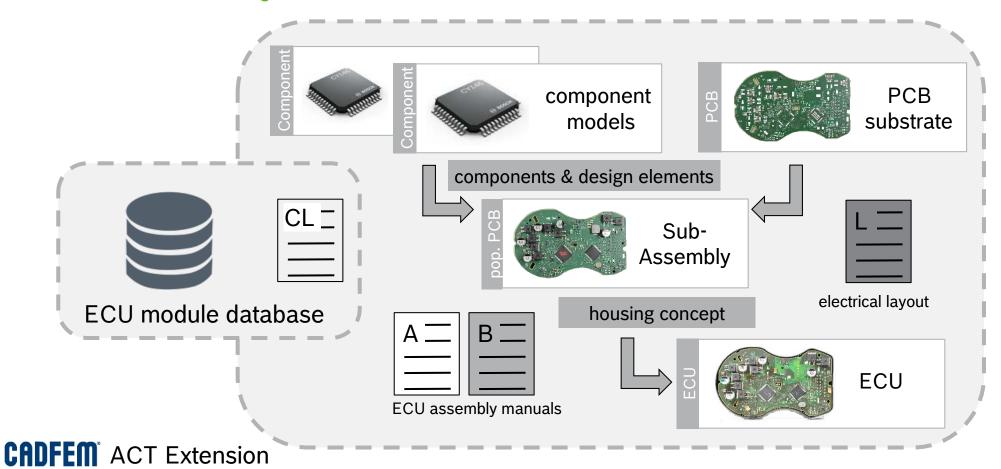
Step 6: Archive ANSYS Workbench Project

Krätschmer, D., Zhang, Y.: "Automatisierter Workflow zur modellbasierten Bauelementbestückung von Leiterplatten elektronischer Steuergeräte",

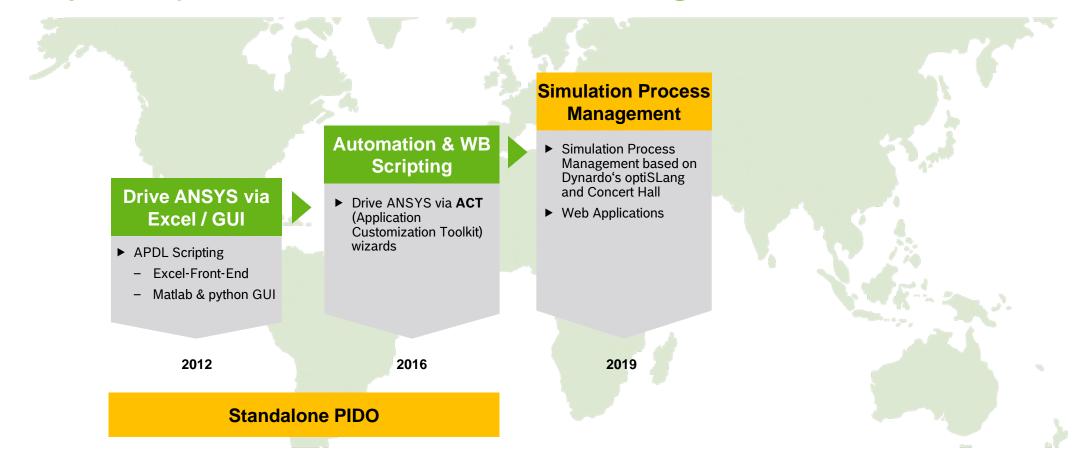
CADFEM ANSYS Simulation Conference 2017

Reliability Assessment of Electronics

Virtual Assembly of PCBs / ECUs-ACT

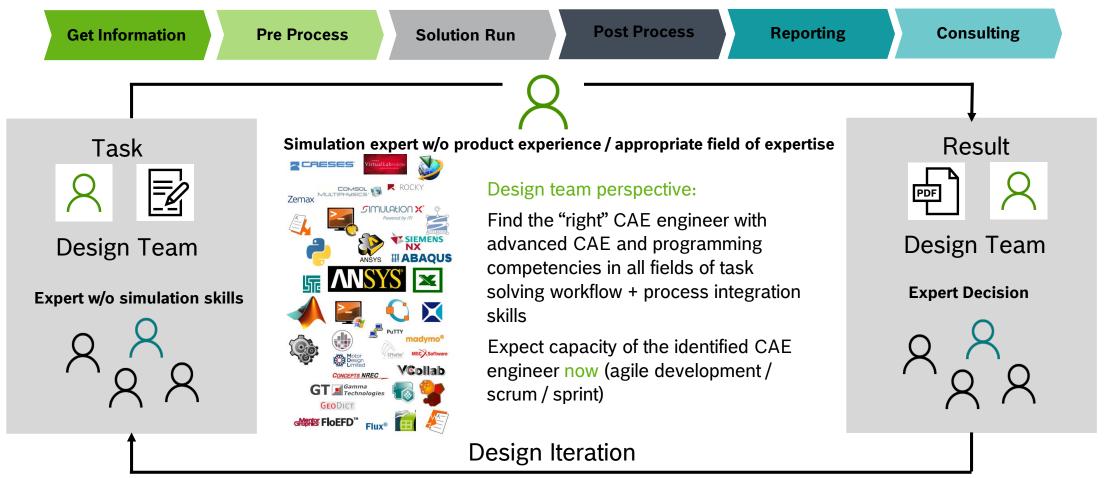


Our journey to Simulation Process Management



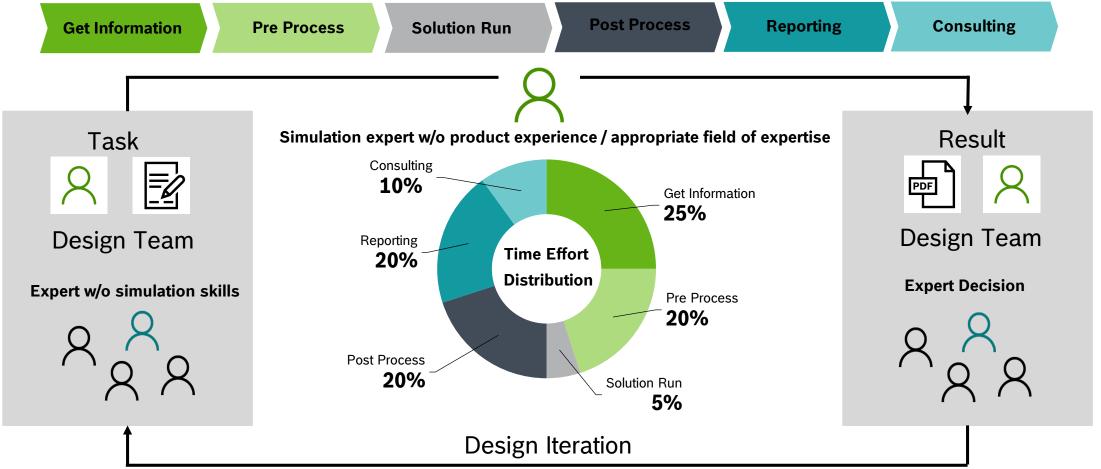


Simulation Process Management (SPM)





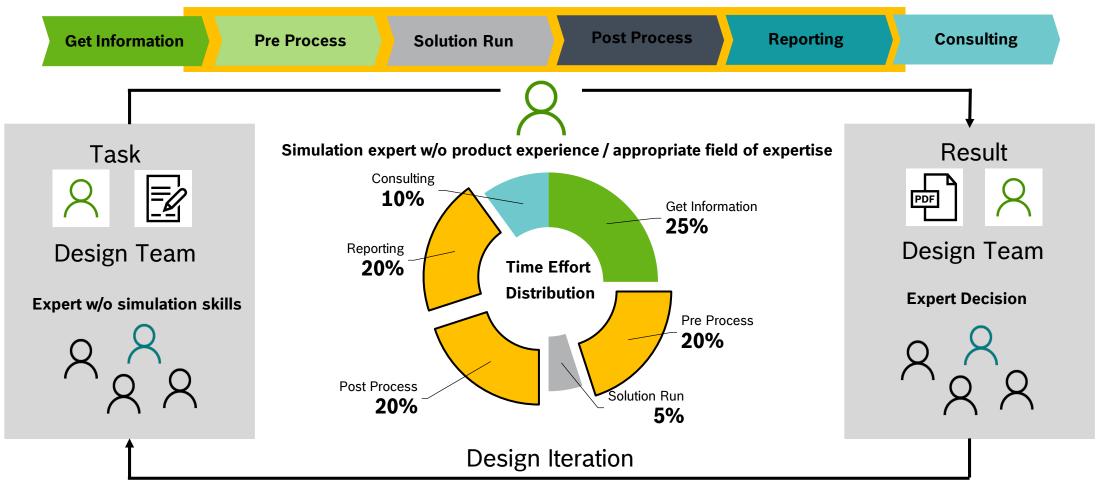
Simulation Process Management (SPM)





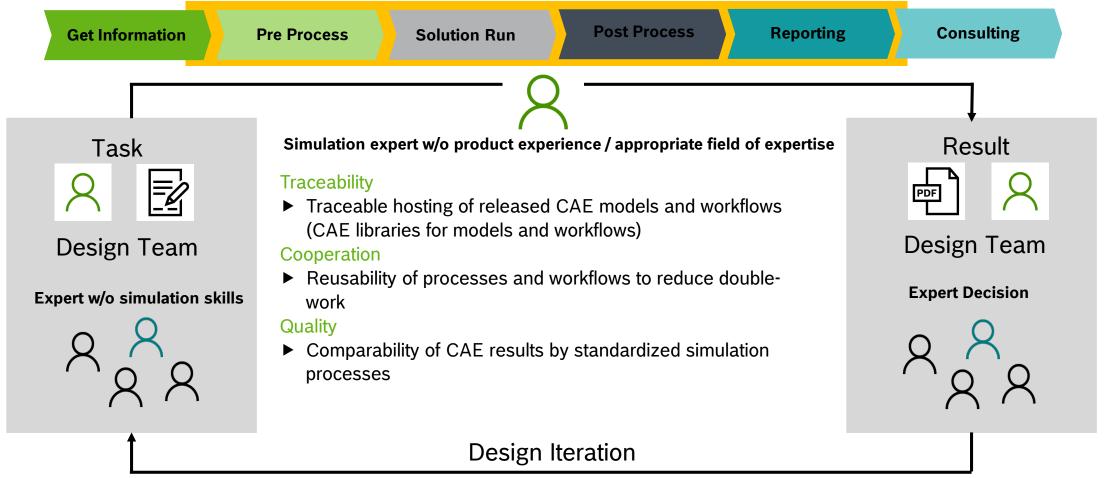
Simulation Process Management (SPM)





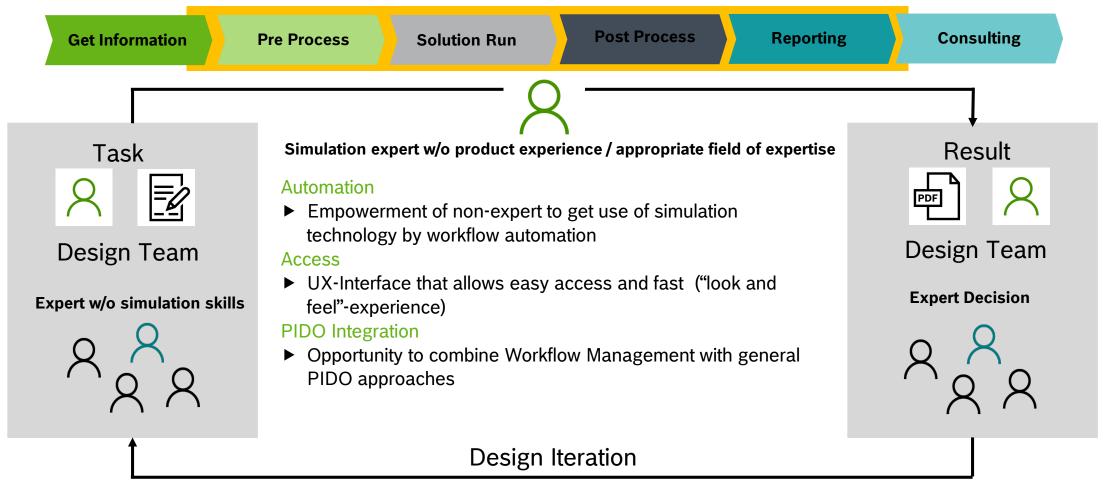


SPM Requirements





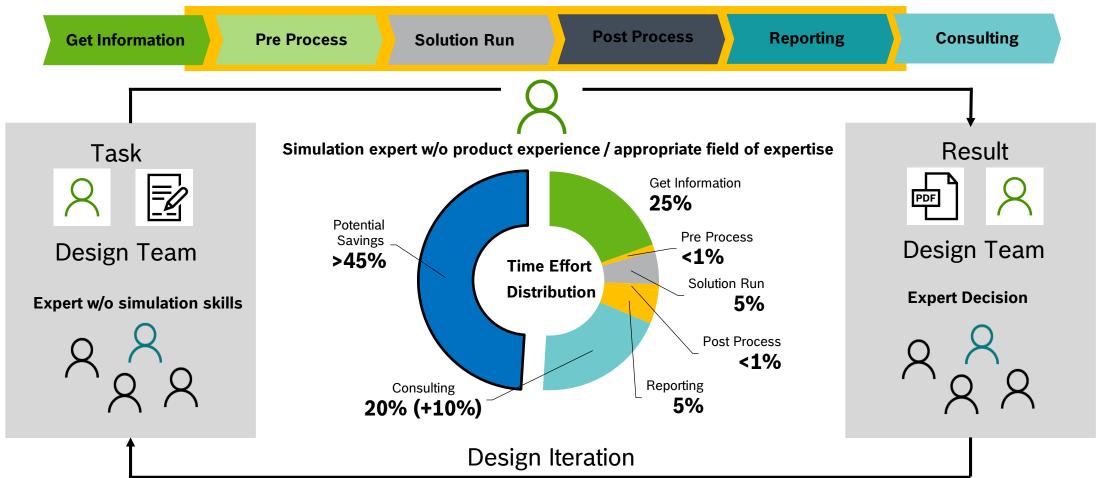
SPM Requirements





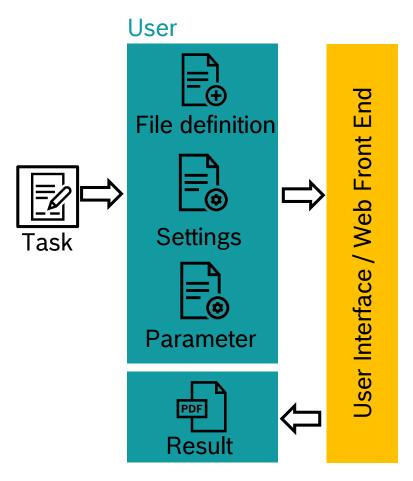
Target State: Expected Savings







Simulation Process Management Setup Draft



IT Infrastructure & License Management

Simulation Data Management

Simulation Process

Management

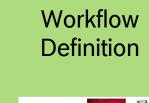
&
Publication of

Workflows

Process Integration & Design Optimization

Report Generation

CAE Expert









Dynardo Concert Hall



Concert Hall menu Bar:

Web-based front-end



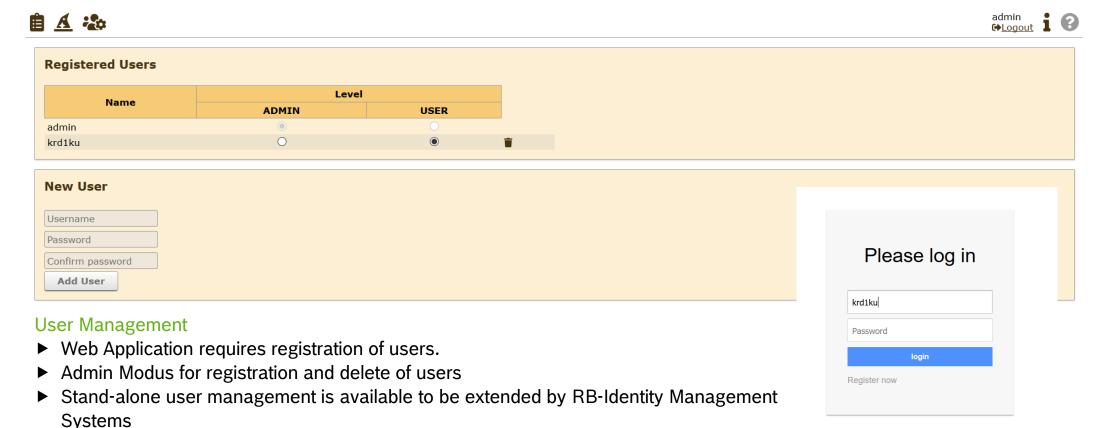
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<u>26</u>	EBS_Thermal_Assessment_python	admin	~	*FINISHED*	Project Status 9, 11:36:59	
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<u>32</u>	EBS_Thermal_Assessment_python	admin	~	*FINISHED*	16.5.2019, 08:41:28	
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<u>45</u>	Component_Model_Updating	admin	~	*FINISHED*	17.5.2019, 11:33:46	
<u>46</u>	Component_Model_Updating	admin	~	*FINISHED*	17.5.2019, 15:58:19	
<u>47</u>	Component_Model_Updating	admin		*PROCESSING*	20.5.2019, 09:10:38	

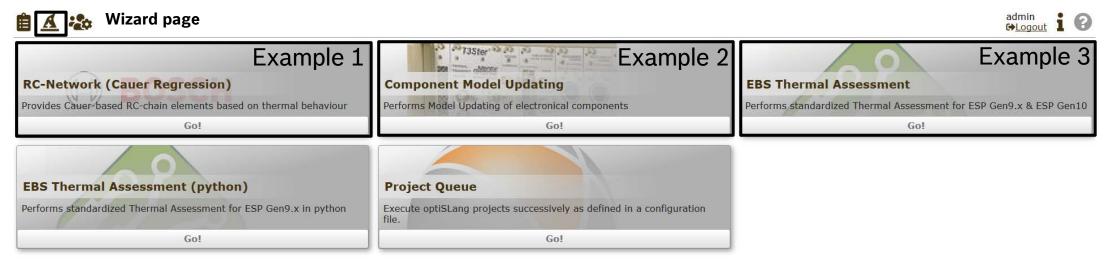


User Management





Wizard Choice (Excerpt)



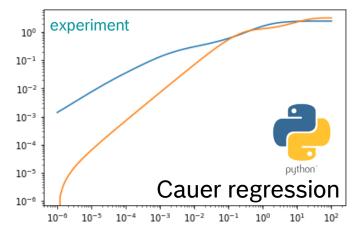
Wizard Choice

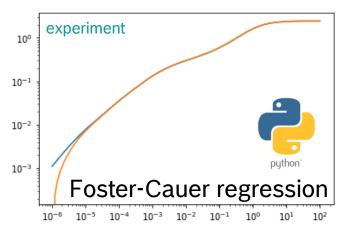
- ▶ Dynardo Concert Hall offers a both graphical and list-based menu for user-friendly tile-based choice of appropriate self-defined wizards
- ► All wizards are based on optiSLang projects with placeholder and registered files for web-based user interaction



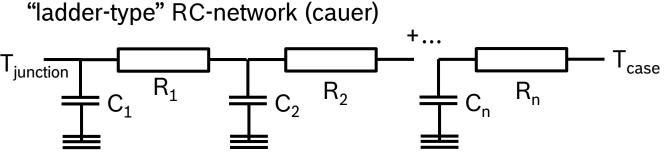
Example: RC-network











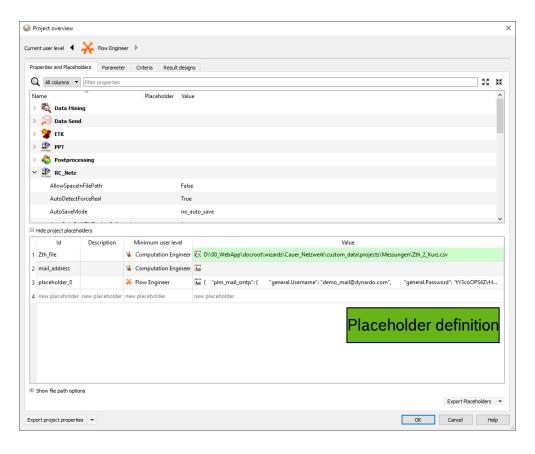
Purpose

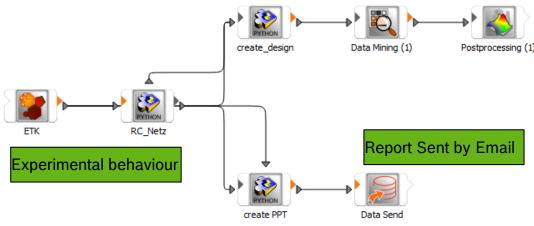
- ▶ Derivation of RC-network parameters for transient thermal behaviour T_{iunction-case} to be used in standard network simulator for circuit simulation
- ▶ Regression analysis with variable number of RC-chain elements based on Foster-regression and Foster-Cauer transformation



Example: RC-network (Cauer-type)







Setup of optiSLang project

- optiSLang setup for the python-based regression analysis to obtain cauer-type RC-chain elements
- ▶ Python-node to auto-generate Microsoft PowerPoint report
- Data Send node to send PowerPoint results via Email

Placeholders and Registered files

Definition of placeholders to be provided by user interface



Interface





Wizard-related user interface

► Relevant user interface needed to feed the workflow with relevant data / information is offered by Concert Hall Web Application Front-End

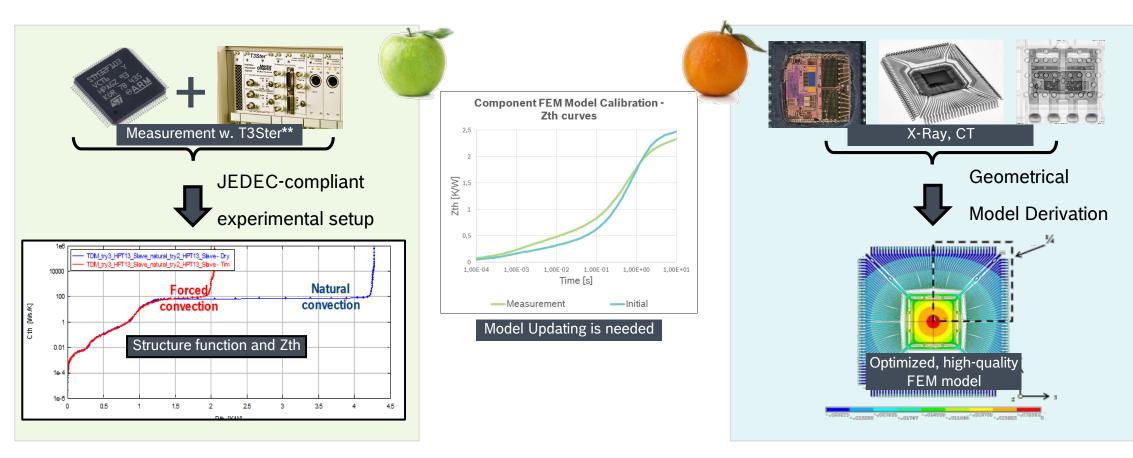
Results

► Thermal Impedance Z_{th} + mail address to send Microsoft PowerPoint report



Example: Component Model Updating





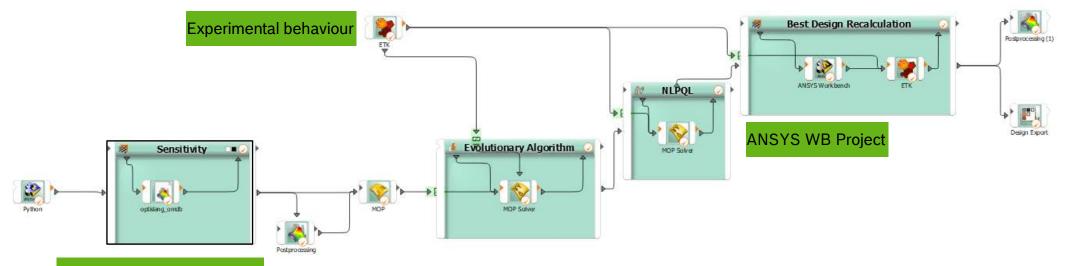
** Transient Thermal Tester



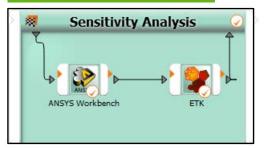


Example: Component Model Updating





Result of Sensitivity Analysis



Setup of optiSLang project

optiSLang setup for the optimization of material (and geometry)
 parameters based on existing Sensitivity Analysis (to reduce test times)

Placeholders and Registered files

 Definition of registered files + placeholders to be provided by user interface



Video Presentation



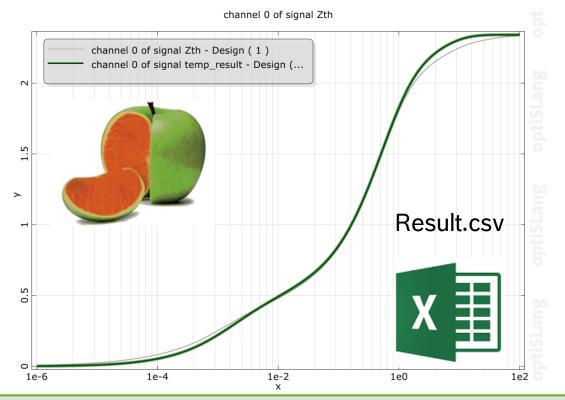
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41	EBS_Thermal_Assessment_python	admin	✓ *FINISHED*	16.5.2019, 16:55:56	
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45	Component_Model_Updating	admin	✓ *FINISHED*	17.5.2019, 11:33:46	
46	Component_Model_Updating	admin	✓ *FINISHED*	17.5.2019, 15:58:19	
<u>47</u>	Component_Model_Updating	admin	✓ *FINISHED*	20.5.2019, 09:10:38	
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49	Component_Model_Updating	admin	✓ *FINISHED*	20.5.2019, 18:08:32	
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Results





Setup of optiSLang project

 optiSLang setup for the optimization of material (and geometry) parameters based on existing Sensitivity Analysis (to reduce test times)

Placeholders and Registered files

 Definition of registered files + placeholders to be provided by user interface

Result

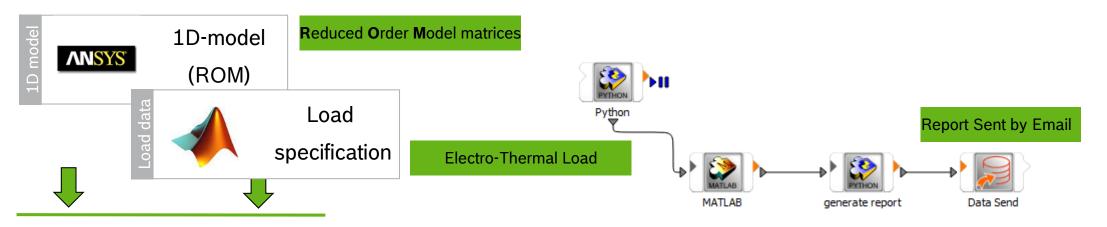
- ▶ Design Parameters of updated model
- ► Resulting Thermal Impedance behaviour
- ▶ (not available now): Auto-Report
- ► (not available now): Sent Results by Email

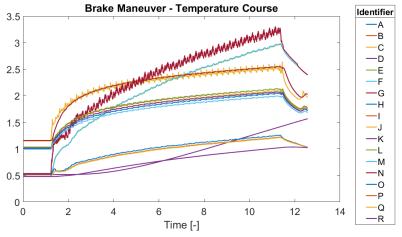
Encapsulated Workflow - Standardized Results independent from user



Example: Thermal Assessment





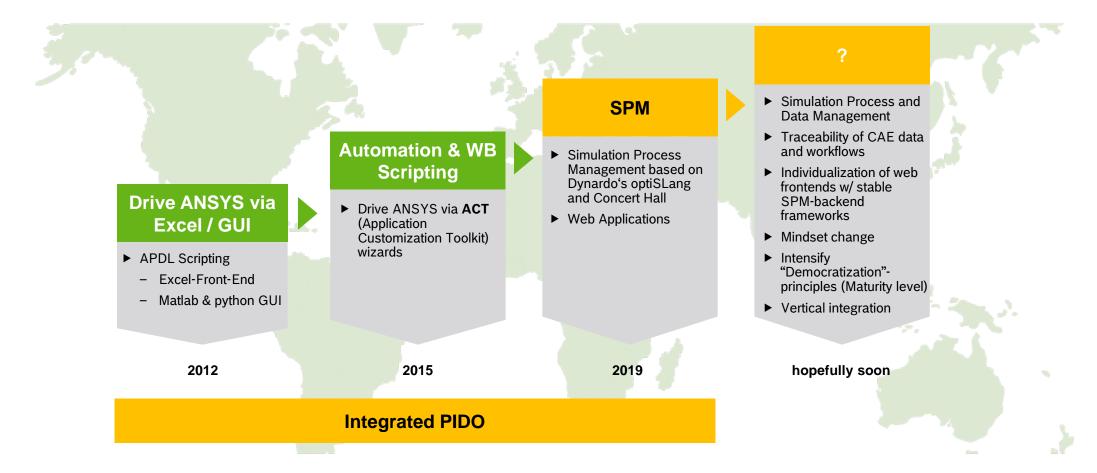


Setup of optiSLang project

- ➤ Simple optiSLang setup for the MATLAB-based calculation of temperature courses (and assessments) based on ANSYS-provided Reduced Order Model (ROM) matrices (MORinsideANSYS)
- ▶ Python-node to auto-generate Microsoft PowerPoint report
- ► Data Send node to send PowerPoint results + result zip-files by Email Placeholders and Registered files
- Definition of placeholders to be provided by user interface



What's next?





Summary

- ► Dynardo's Simulation Process & Workflow Management Framework based on standard optiSLang projects empowers users to publish repetitive workflows
- ► Web Application serves as a central collaboration platform encourages experts to get use of advanced CAE workflows provided by CAE-experts
 - ▶ It's just optiSLang, placeholders and registered files → "Democratization of Wizard Setup"
- ► Presented SPM-System allows an individual tailoring of existing web front end either by templates (shown here) or fully individualized.
- ► SPM Framework potentials needs to be embedded in engineering workflows
- ► Challenging: IT infrastructure, license management
- ► Framework is more than an initial step into democratization of CAE workflow

Democratization of CAE-Workflows empowers "experts" to apply established simulation workflows to improve their design decisions even in agile development scenarios



Democratization of CAE-Workflows Summary

Any Questions?

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TEL.: 07121 35 39127

