

Ansys

WOST

WORKSHOP 2022

Automated Workflow for Development of Power Tools

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24th of June 2022

Ansys

StanleyBlack&Decker Power Tools

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StanleyBlack&Decker
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65000 employees
Headquarter New Britain USA

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- Requirements for Layout of Powertools
- Previous vs. current Process
- Overview Workflow
- Workflow
 - AMOP
 - Evolutionary Algorithm
 - Robustness Checks
 - Automated Report Generation
- Conclusion
- Outlook

Requirements for Layout of Powertools

Performance

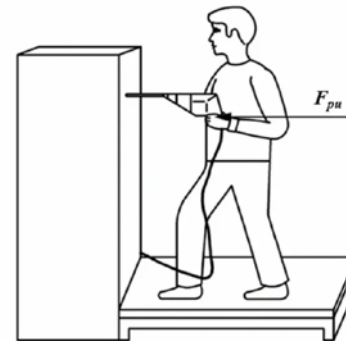


Catalog Data /
Compactness



Robustes

constant performance under all conditions
Application angle, material, bias force, tolerances ...

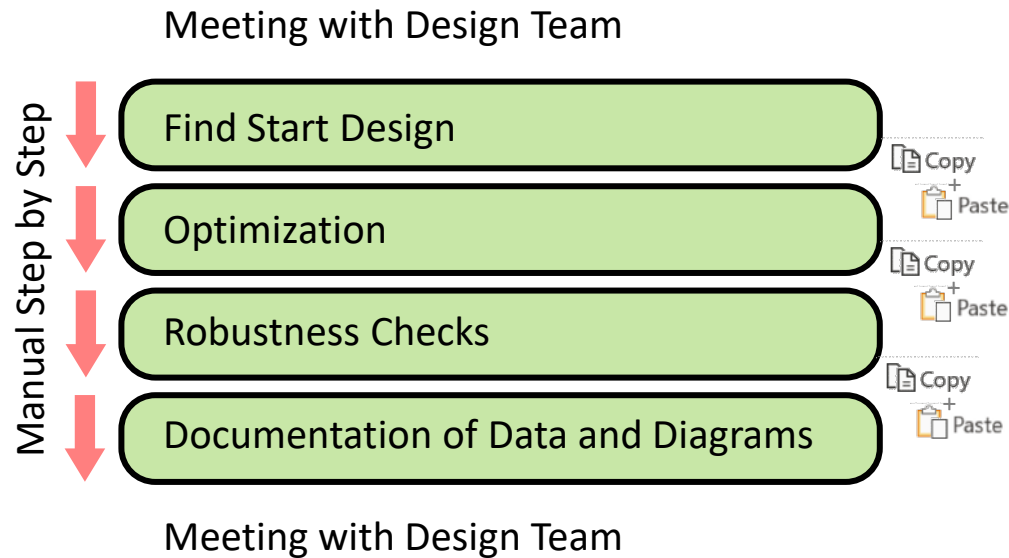


Previous vs. current Process

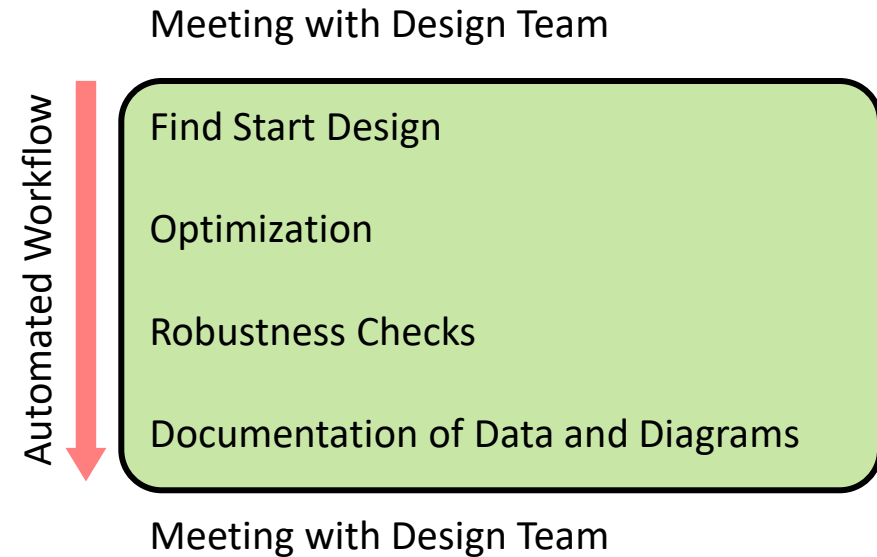
Previous process



Commercial optimization software



Current process



~ 90% time reduction

Overview Workflow

AMOP

Understanding design space
find start designs

EA Optimization

User AMOP start designs
Target function & constraints
Evolutionary Algorithm

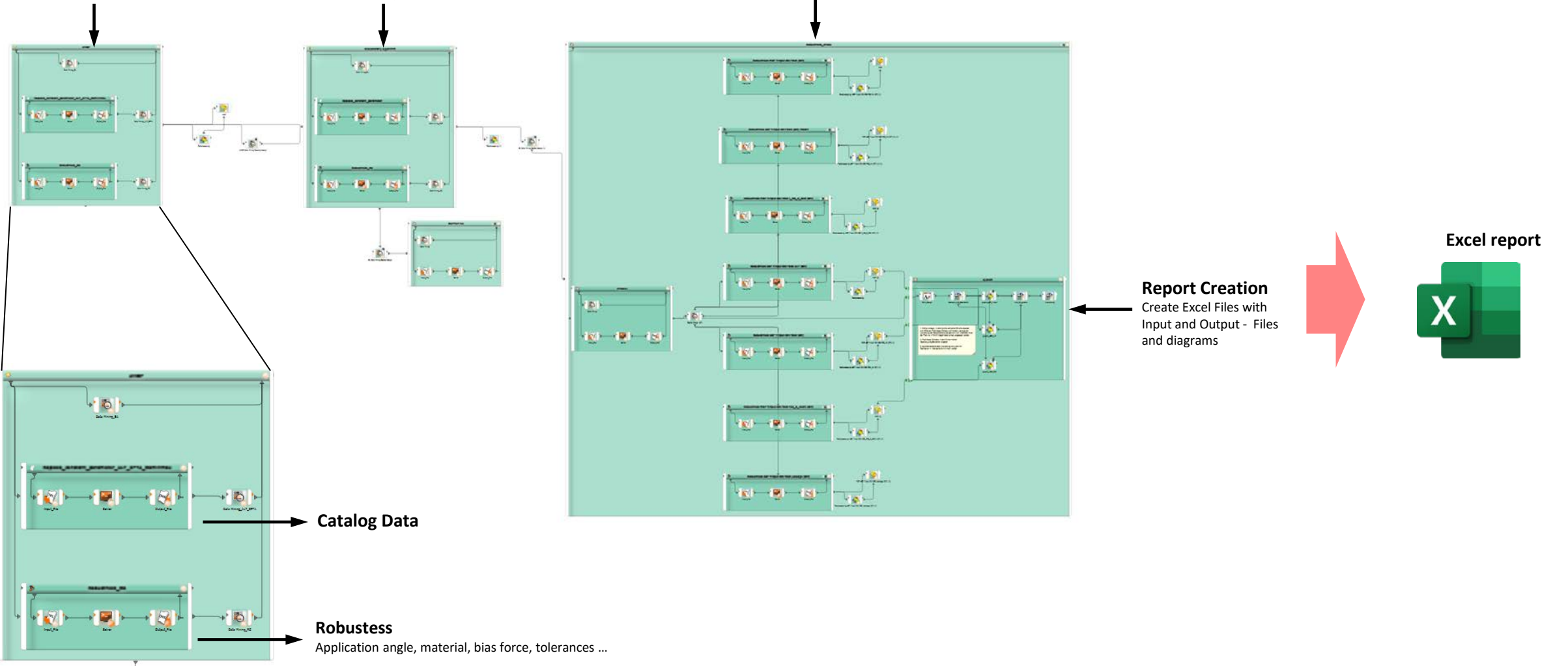
Robustness Checks

Check Best Designs under all possible conditions

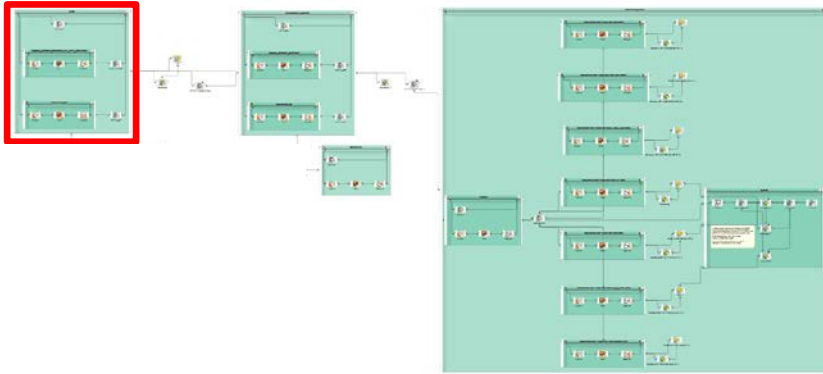
Report Creation

Create Excel Files with
Input and Output - Files
and diagrams

Excel report



Workflow: AMOP



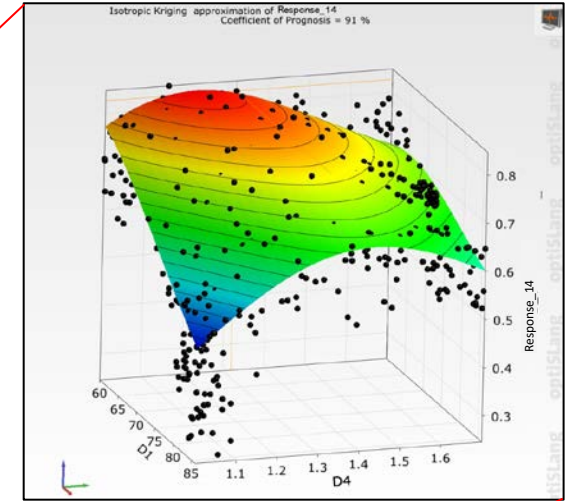
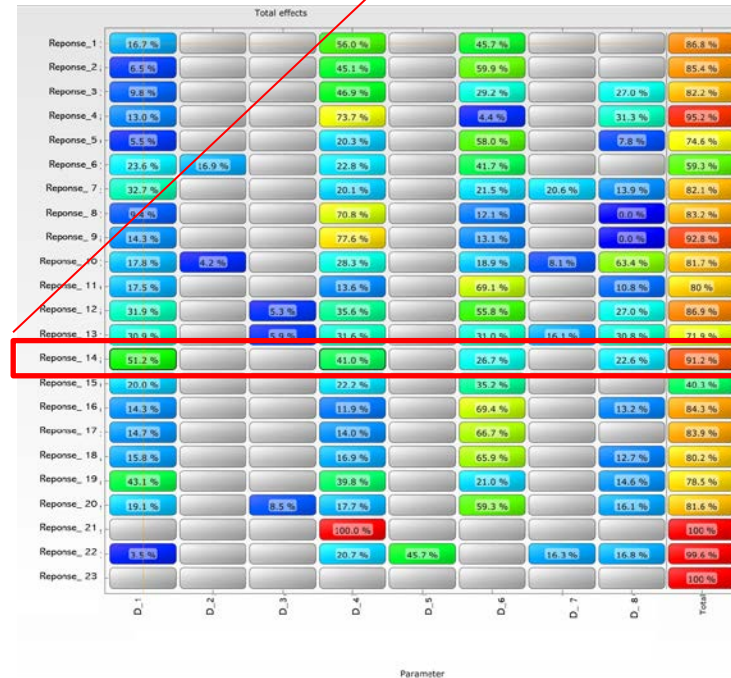
Scope of AMOP system:

- scan of design space
- find best design according optimization criteria
- design understanding

Target function with standardized and weighted targets
600 samples

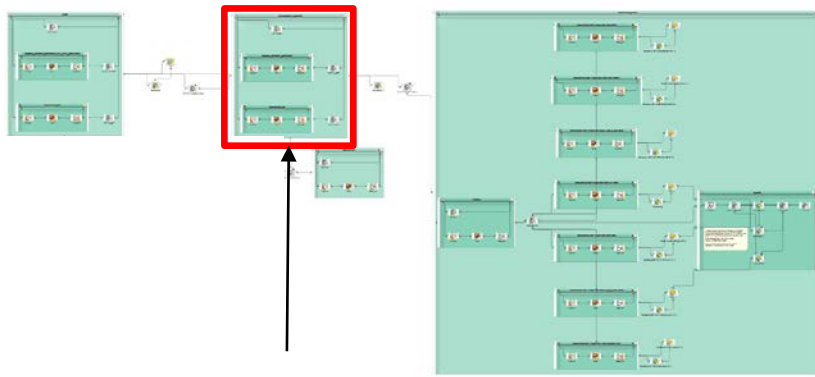


Postprocessing Influence and CoP value of parameters



Response_14
CoP 91%
Main Influence D_1 and D_4

Workflow: Evolutionary Algorithm



EA Optimization receives from AMOP

- feasible designs
- Parameters & Limits
- target function
- constrains



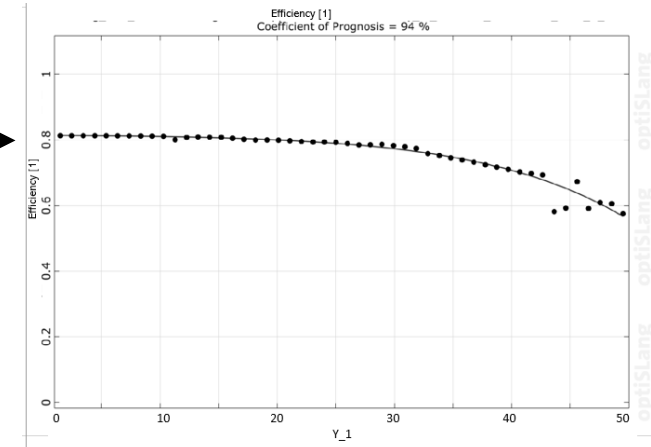
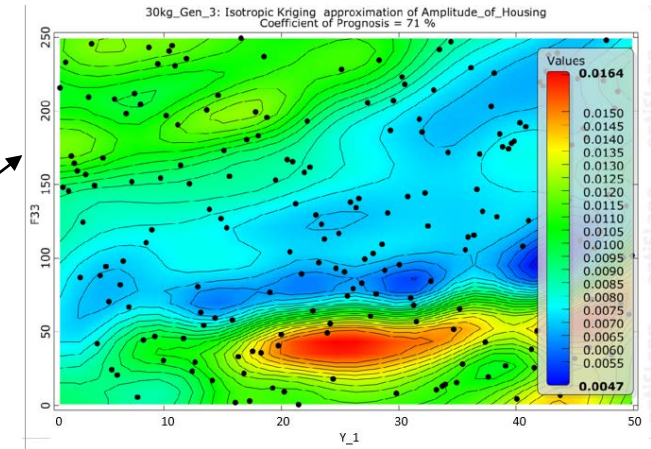
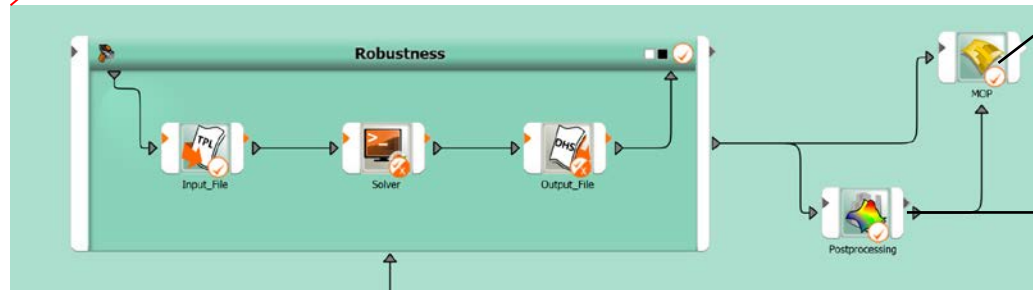
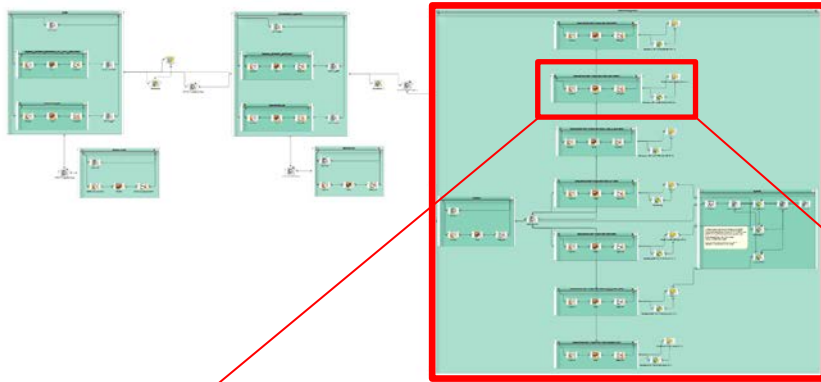
Skript feasible designs (OptiSlang Template)

Id	Feasible	Duplicates	Status	A00	Ab_bias_insd_1	Ab_time_1	Ab_tim
1	0.597	true	Succeeded	2	-100	0.1	0.2
2	0.582	true	Succeeded	2	-100	0.1	0.2
3	0.578	true	Succeeded	2	-100	0.1	0.2

C:/Users/Public/Documents/Dynardo/ANSYS
optiSlang/8.1.0/examples/O2_python_examples/O2_datamining/data_mining_base_functions.py



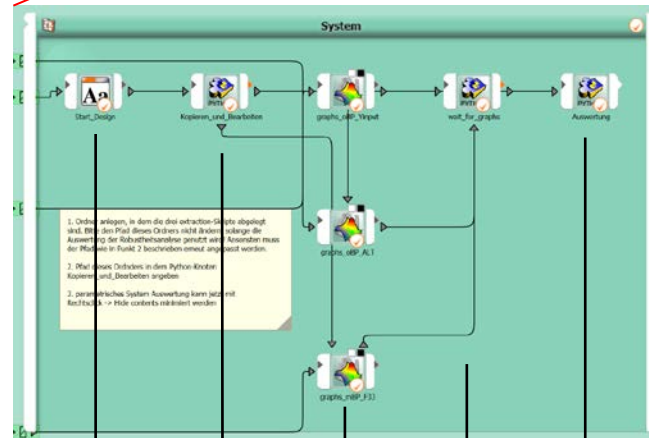
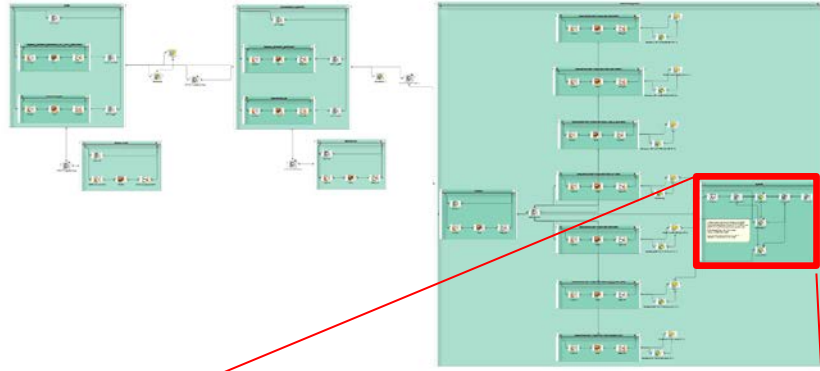
Workflow: Robustness Checks



Calculation of optimal design under various conditions

- Bias Force
- Tolerances
- Application angle

Workflow: Automated Report Generation



Read result data from input file

Create graphs

Create Excel file

Read result data from input file

Wait for graphs



Excel - report

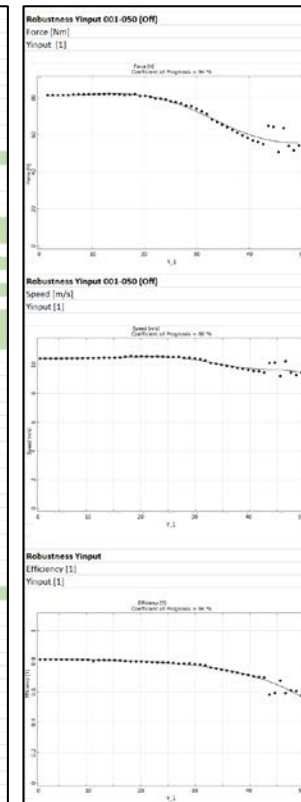
Result Data

Simulation Type (ENTER SIMULATION TYPE)			
Simulation Results			
Result_1	[W]	:	0,983
Result_2	[W]	:	9,886
Result_3	[Hz]	:	6,132
Result_4	[Nm]	:	6,918
Result_5	[Nm]	:	7,266
Result_6	[Nm]	:	1,563
Result_7	[Nm]	:	1,697
Result_8	[Nm]	:	3,656
Result_9	[I]	:	2,054
Result_10	[I]	:	8,072
Result_11	[m/s]	:	6,071
Result_12	[m/s]	:	2,109
Result_13	[mm]	:	7,302
Result_14	[I]	:	1,542
Result_15	[mm]	:	1,542
Result_16	[N]	:	5,352
Result_17	[Nm]	:	0,903
Result_18	[deg K]	:	9,470
Result_19	[I]	:	5,018
Result_20	[I]	:	5,018

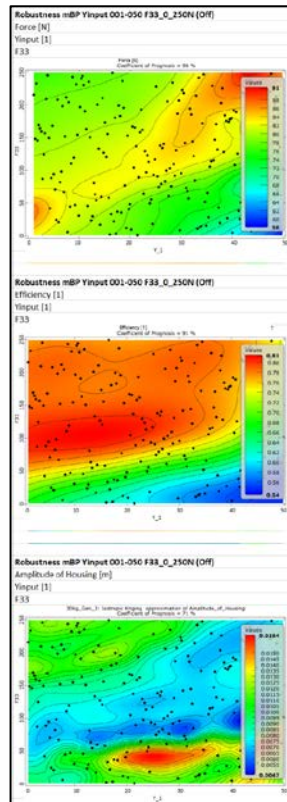
Input Data

Eingabedaten zur Simulation			
Design-Eingabedaten:			
Part Number			Design0001
Name			
Input_1	[I]	:	2
Input_2	[I]	:	1
Input_3	[deg]	:	0
Input_4	[el]	:	300
Input_5	[el]	:	5,566
Input_6	[el]	:	9,690
Input_7	[kcal]	:	25,000
Input_8		:	FALSE
Input_9		:	FALSE
Input_10	[mm]	:	8,006
Input_11	[mm]	:	4,591
Input_12	[mm]	:	45,000
Input_13	[mm]	:	3,654
Input_14	[I]	:	0,650
Input_15	[mm]	:	6,318
Input_16		:	FALSE
Input_17	[mm]	:	6,374
Input_18	[mm]	:	3,506
Input_19	[mm]	:	5,381
Input_20	[mm]	:	1,900
Input_21	[mm]	:	0
Motor-Eingabedaten:			
Input_56	[rpm]	:	20000
Input_57	[rpm]	:	15000
Input_58	[Nm]	:	6,16
Input_59	[Nm]	:	0,44
Physikalische Eingabedaten:			
Input_66	[I]	:	1
Input_67	[mm^2]	:	2
Input_68	[I]	:	293
Input_69	[I]	:	60
Input_70	[I]	:	100
Input_71	[I]	:	10
Input_72	[I]	:	0,6
Input_73	[I]	:	0,3
Input_74	[I]	:	0,4
Input_75	[Pa.s]	:	7
Input_76	[I]	:	0,95
Last-Eingabedaten:			
Input_91	[I]	:	0,2
Input_92	[I]	:	0
Input_93	[I]	:	2
Input_94	[I]	:	0,41
Input_95	[I]	:	0,5
Input_96	[mm]	:	0
Input_97	[N]	:	50
Input_98	[m]	:	1,2

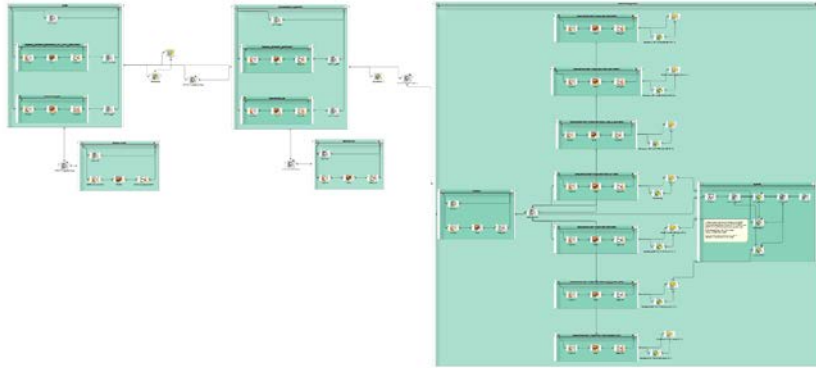
Diagrams #1



Diagrams #2



Conclusion



Benefits

- Less iterations
- Reduced time from idea to layout data
- No copy / paste operations
- Less errors
- better utilization of the workstation

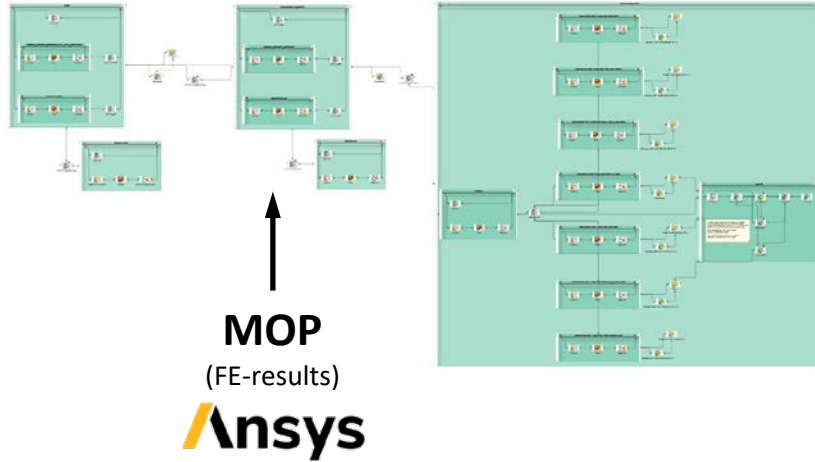
Time to develop the process further



Better products



Outlook



Next Steps



- Integration of FE results by MOP
- Access for Designers by Web App