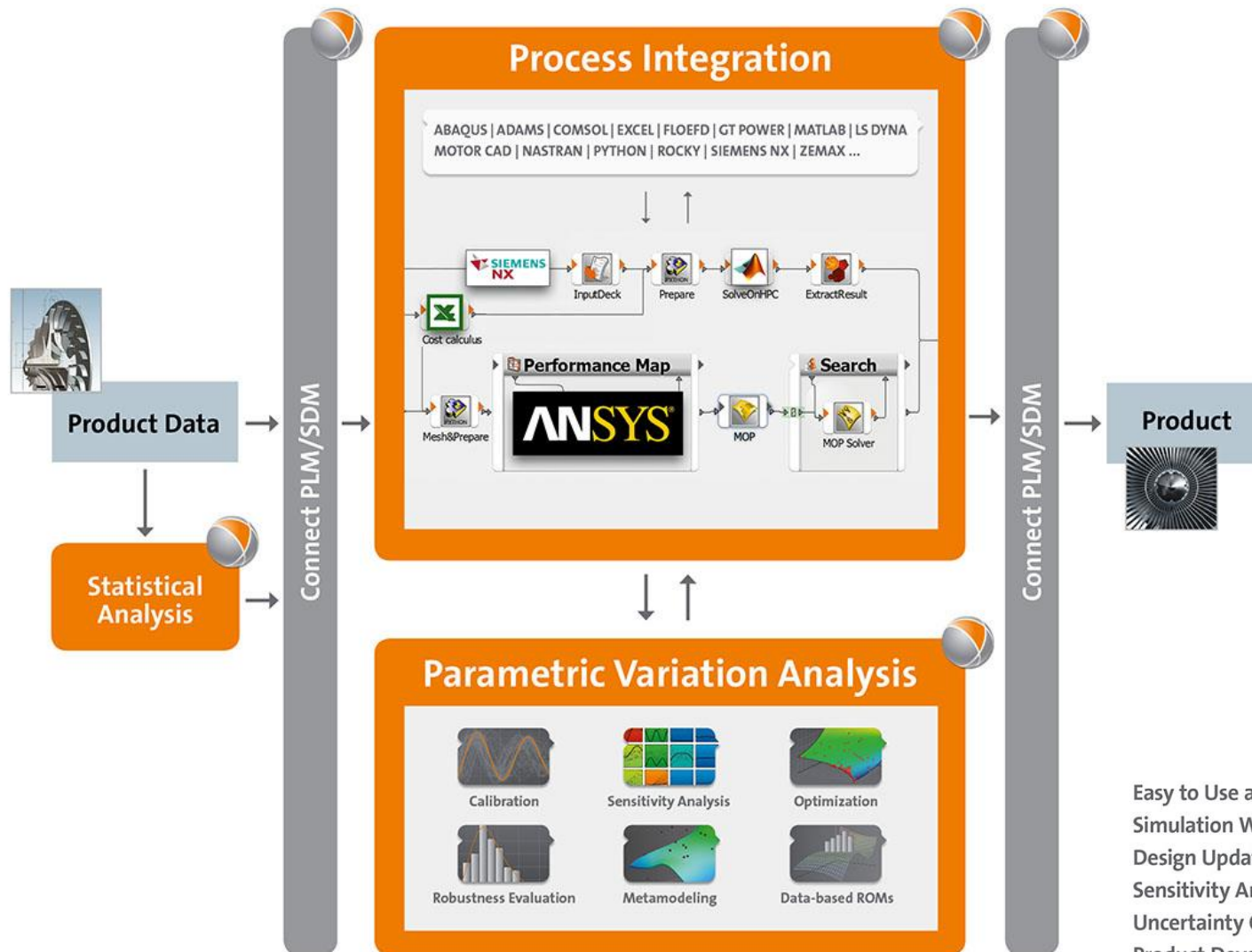


# **WOSD 2019: optiSLang**

## **recent developments**

**David Schneider**  
optiSLang product manager



Easy to Use and Easy to Set Up  
Simulation Workflows for Single  
Design Updates as well as for  
Sensitivity Analysis, Optimization,  
Uncertainty Quantification in Virtual  
Product Development

# Algorithms



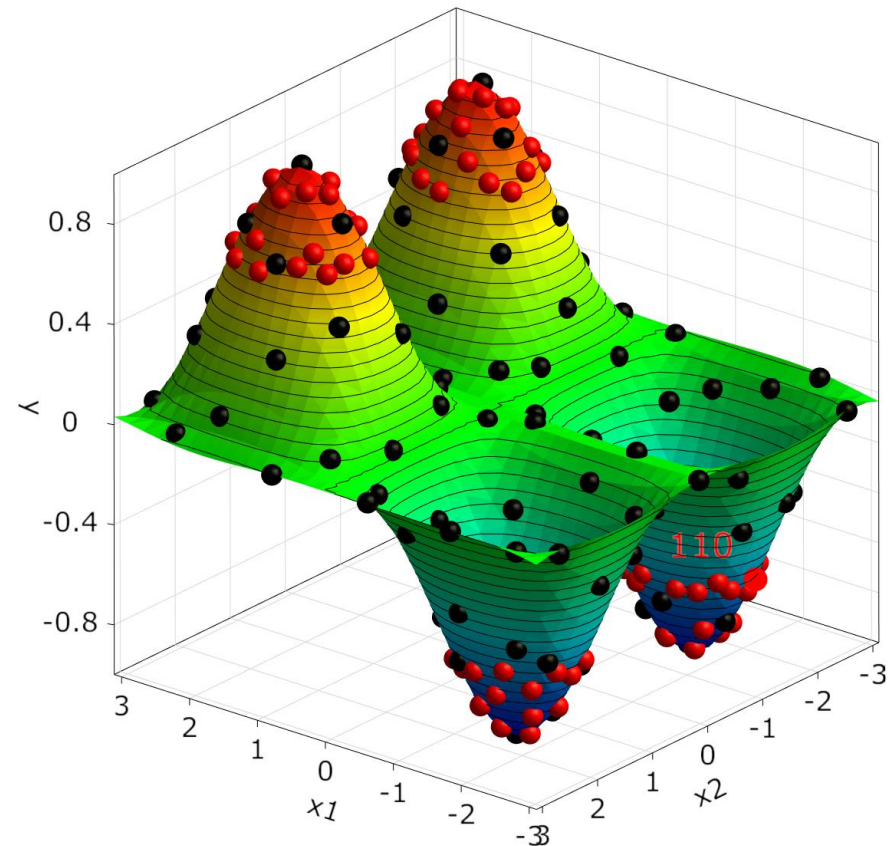
# Adaptive Metamodel of Optimal Prognosis



AMOP

- Automatic adaptation of an initial sampling set
- **Global refinement** with advanced and space-filling Latin Hypercube Sampling
- **Local refinement** considering
  - Sample density
  - Local approximation errors
  - Optimization criteria

AMOP constraint refinement for  $\text{abs}(y) > 0.6$

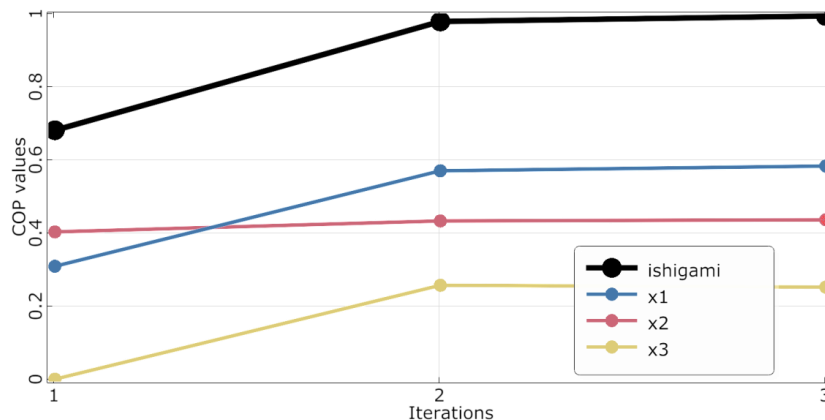
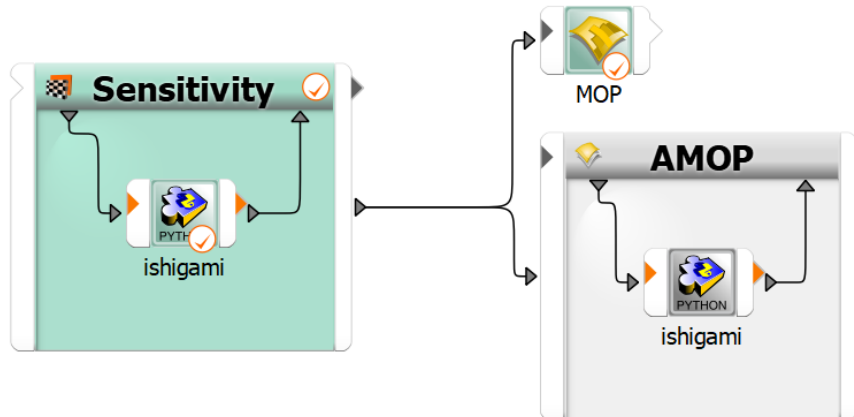


# Sensitivity Wizard

- AMOP with global refinement is default



AMOP



- All previous designs can be considered
- ➔ All simulation runs can be used

Adaptive sampling

☒ Adaptive Metamodel of Optimal Prognosis (AMOP)

Sampling method

☒ Full factorial

☒ Advanced Latin Hypercube Sampling

☒ Space filling Latin Hypercube Sampling

☒ Other (see next page)

Plugins

☐ Replace\_constant\_parameter

☐ my\_algorithm

Start designs

☐ No start designs

☐ Define start designs manually

☒ Receive all designs from system "Sensitivity"

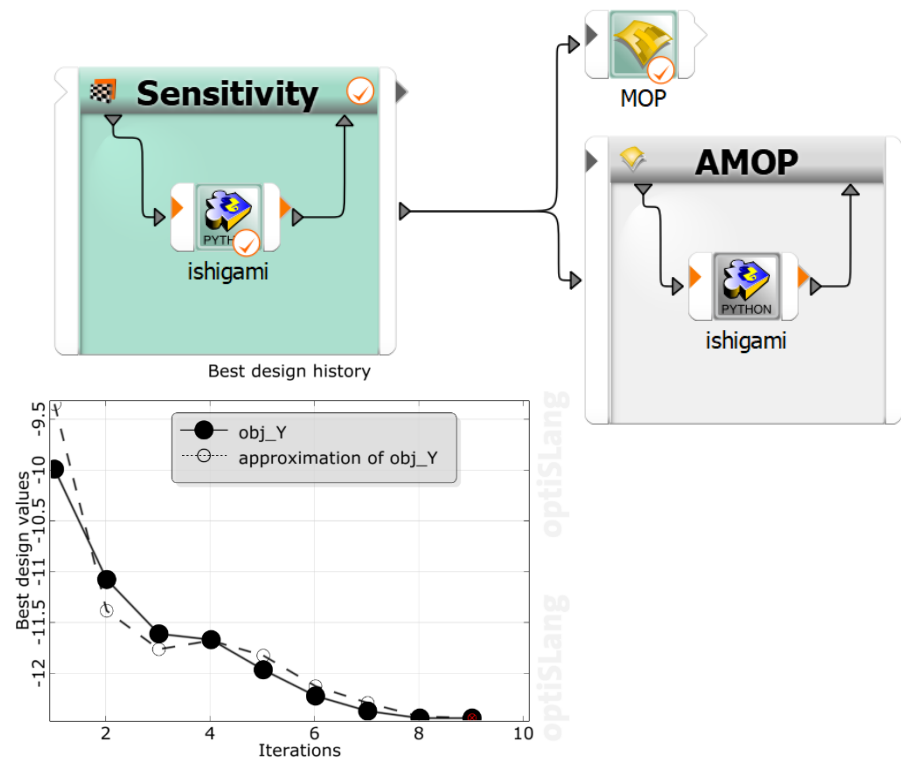
*The AMOP algorithm will use the start designs as start iteration!*

# Optimization Wizard



AMOP

- AMOP with criteria refinement is proposed as optimizer
- Adds promising new designs in every iteration



- All previous designs can be considered
- ➔ All simulation runs can be used

Optimization method

Gradient based

☐ Non-Linear Programming by Quadratic Lagrangian (NLPQL)

Direct

☐ Adaptive Response Surface Method (ARSM)

☒ Adaptive Metamodel of Optimal Prognosis (AMOP)

☐ Downhill Simplex Method

Nature inspired

☐ Evolutionary Algorithm (EA)

☐ Particle Swarm Optimization (PSO)

Plugins

☐ Replace\_constant\_parameter

☐ my\_algorithm

Start designs

☐ Use reference design

☐ Define start designs manually

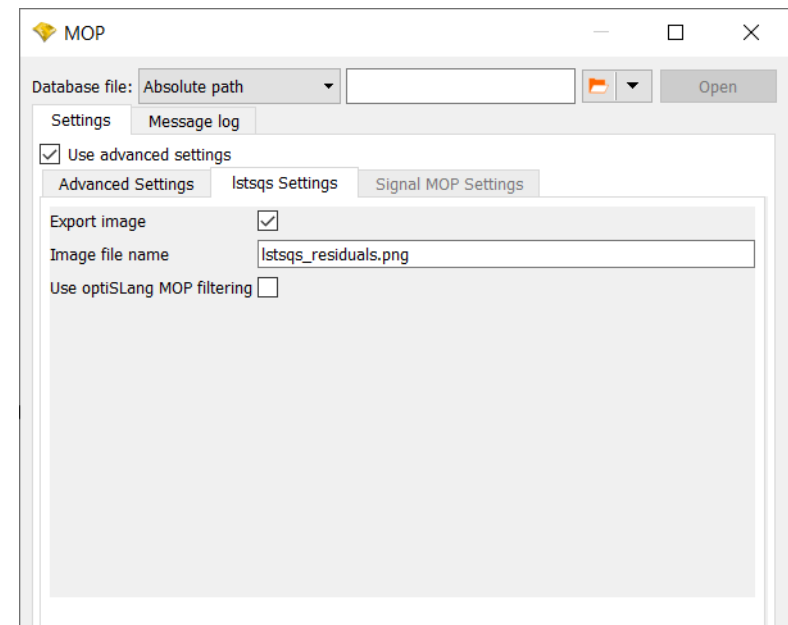
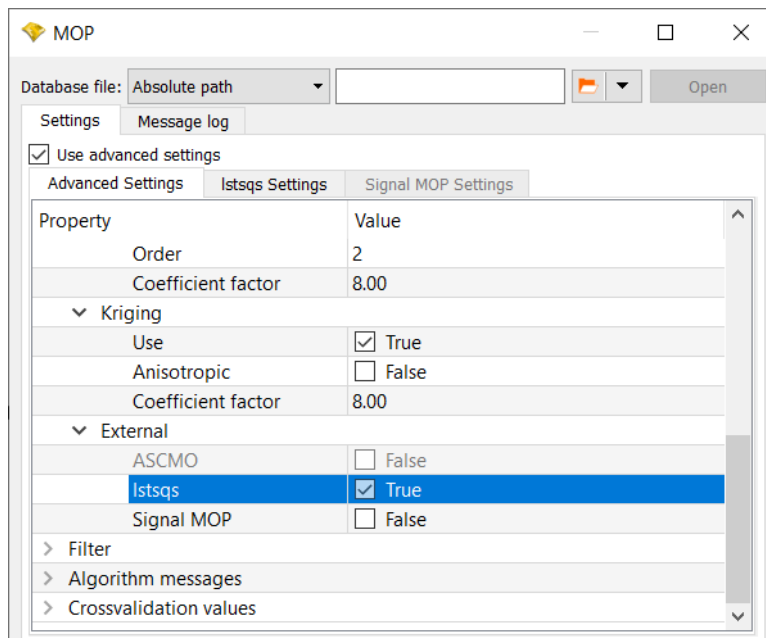
☒ Receive all designs from system "Sensitivity"

☐ Local search

*The AMOP algorithm will use the start designs as start iteration!*

# Bring your own meta model

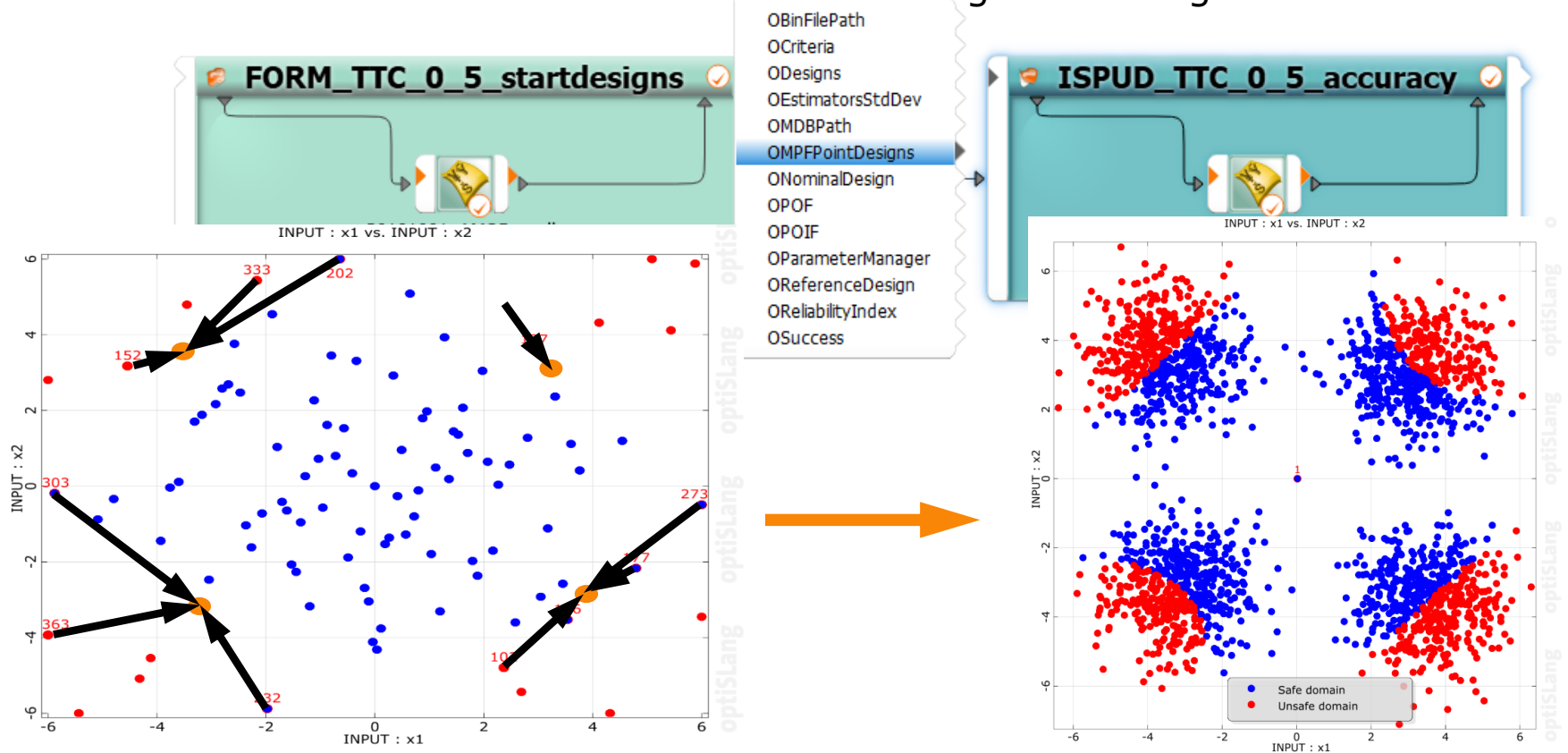
- Surrogate plugins for MOP algorithm
- Considered in MOPs tournament of meta models



- Scalar AI/ML-models presented in Session 1 are available as plugin
- ➔ Please contact us

# Multiple Failure Points

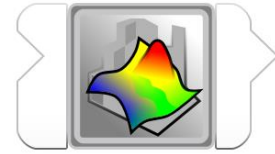
- Identification of several MPFP in FORM
- ISPUD considers multiple sampling densities
- Mean values can be forwarded as start designs from e.g. FORM





# Postprocessing

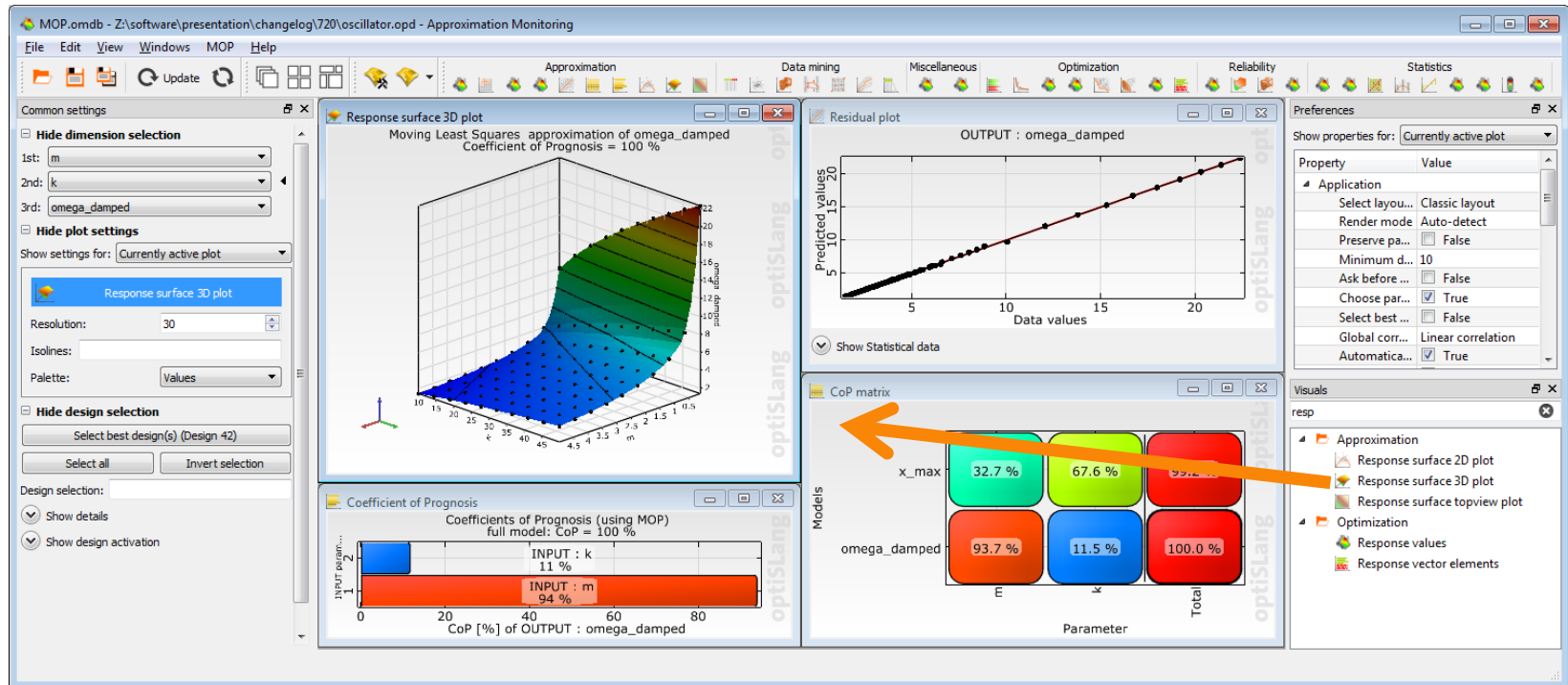




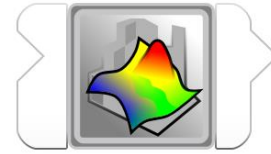
Postprocessing

# Add new plots

- Like in optiSLang workflow-scenery
- Drag&Drop needed plots into postprocessing-scenery
- Use search for quick filtering



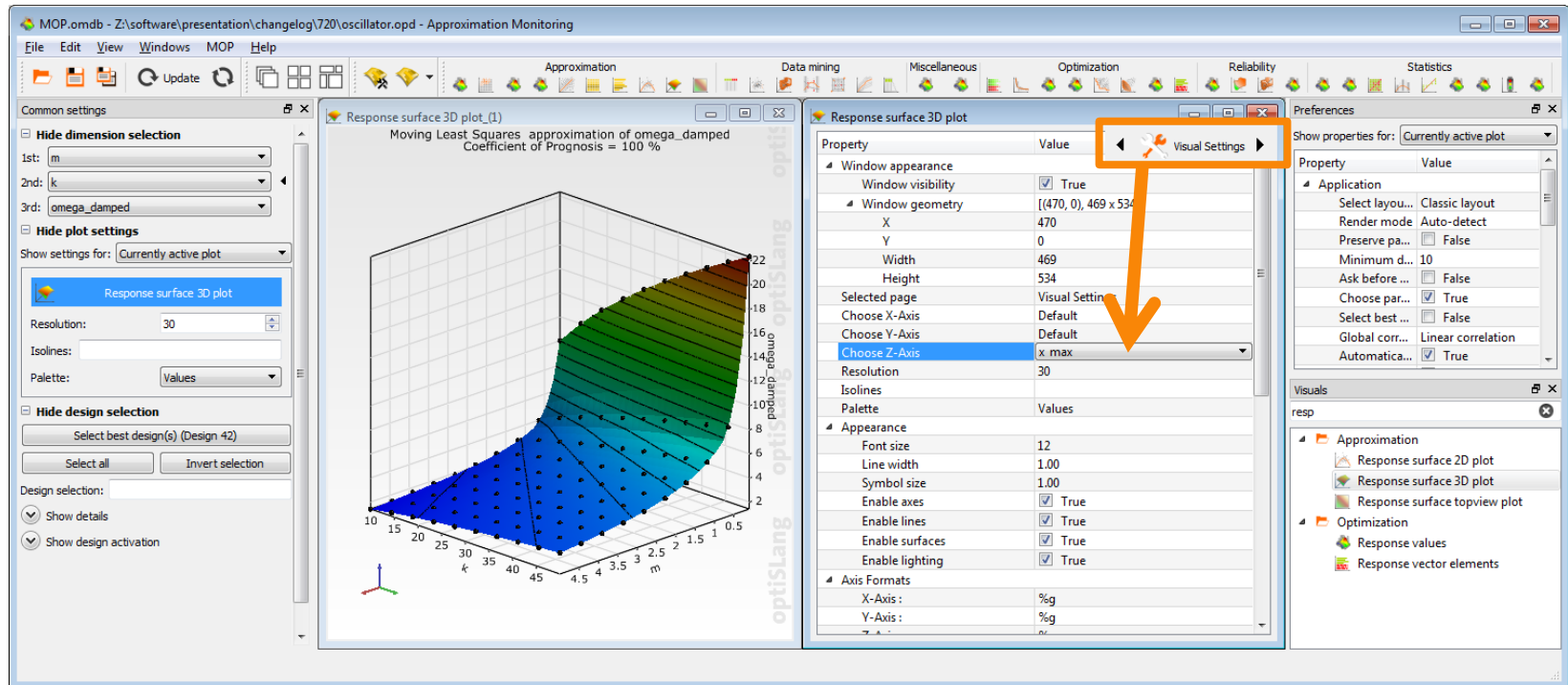
- Replaces a lot of python scripting
- ➔ Easy, Safe and Efficient datamining



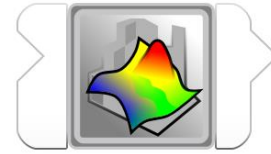
Postprocessing

# Set properties

- Define directly in a plot e.g. *(switch with mouse click in top right corner of plot)*
  - Use axis dimension or interactive mode
  - Labels, font size, ...



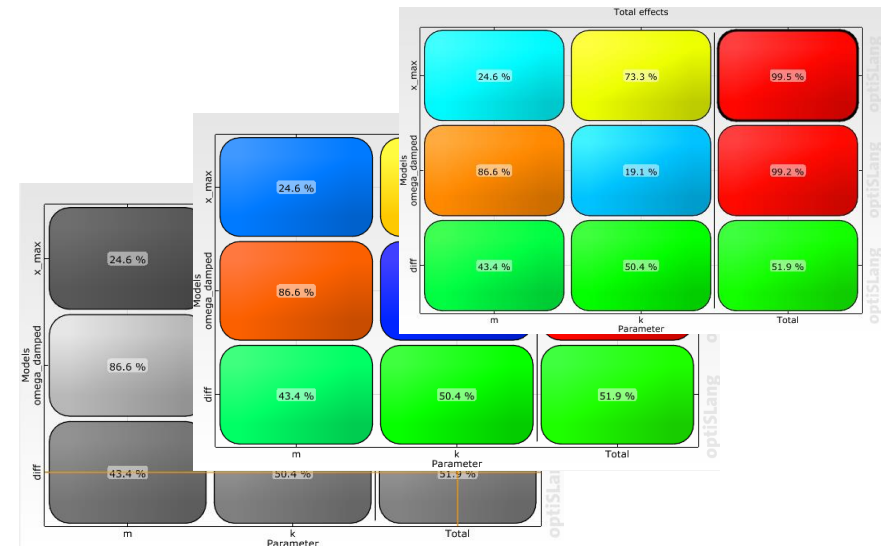
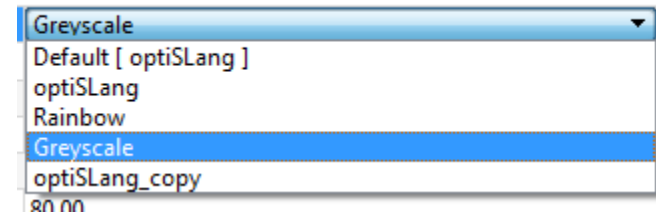
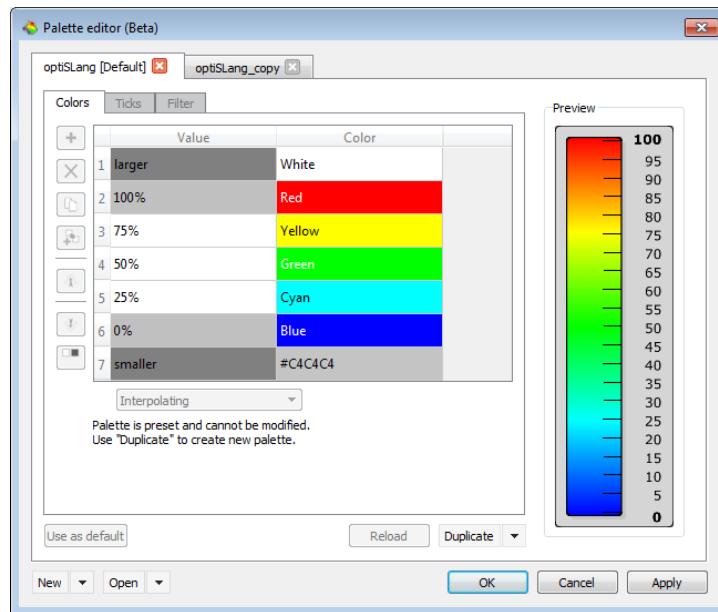
- Allows easy definition of comparison plots
- ➔ Easy, Safe and Efficient datamining



Postprocessing

## Palette editor

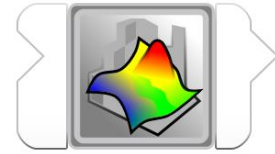
- Use relative (%) or absolute values
- Constant or “interpolated” colors between 2 values
- Store in omdb
- Or Import/Export (JSON)



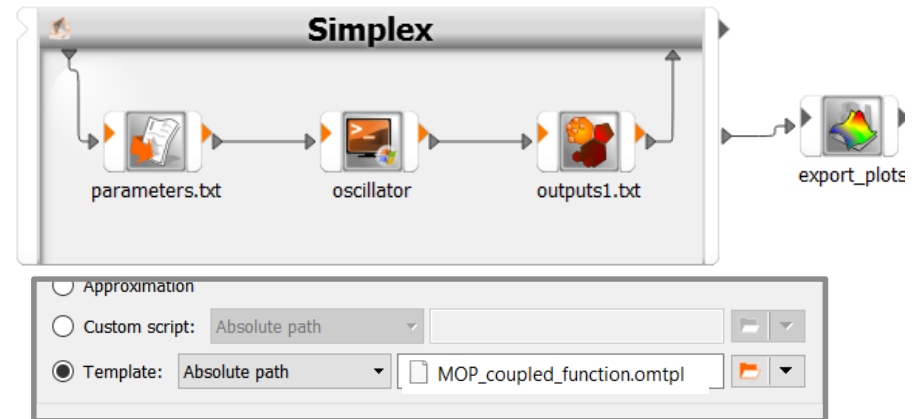
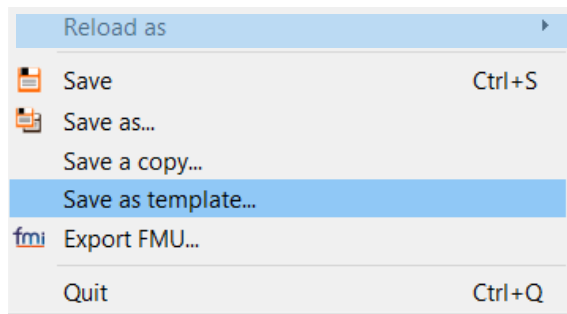
- ➔ Create your own palettes
- ➔ Use your colors in your reports

# Postprocessing template

- Save and re-use post processing template
- In post processing and automatic workflow



Postprocessing



- ➔ More efficient work
- ➔ Easy & Safe set up of standard post processing

# Integrations



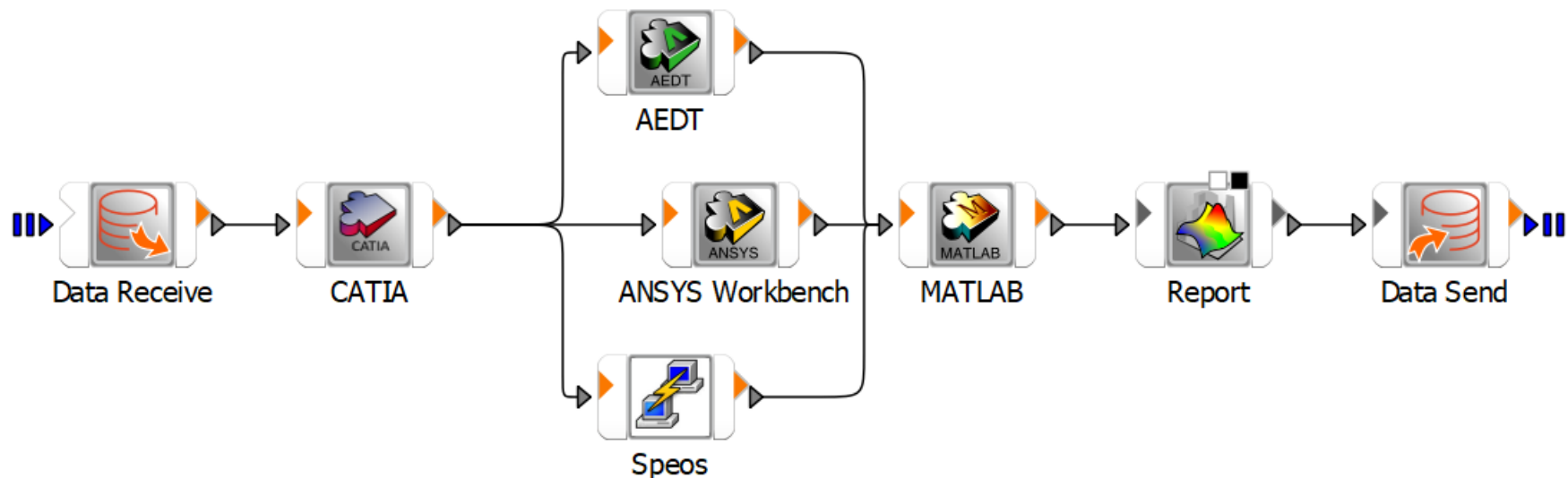
**ANSYS Electronics Desktop**

# ANSYS EDT integration node



AEDT

- Easily add ANSYS EDT applications to optiSLang workflows
- For any Electronics Desktop component, HFSS, Maxwell, Circuit, RMxpert, ...
- Rapid workflow construction with optiSLang solver wizard
- Convenient parameter and response selection via drag and drop
- Native support of signal data
- Coupling of multiple disciplines



# ANSYS EDT supported solvers & run modes



AEDT

In optiSLang installer: AEDT node

- Easy & safe to use
- Run modes for single simulation
- Common optiSLang parallelization

For advanced usage we maintain a 2<sup>nd</sup> node – if needed please contact service team

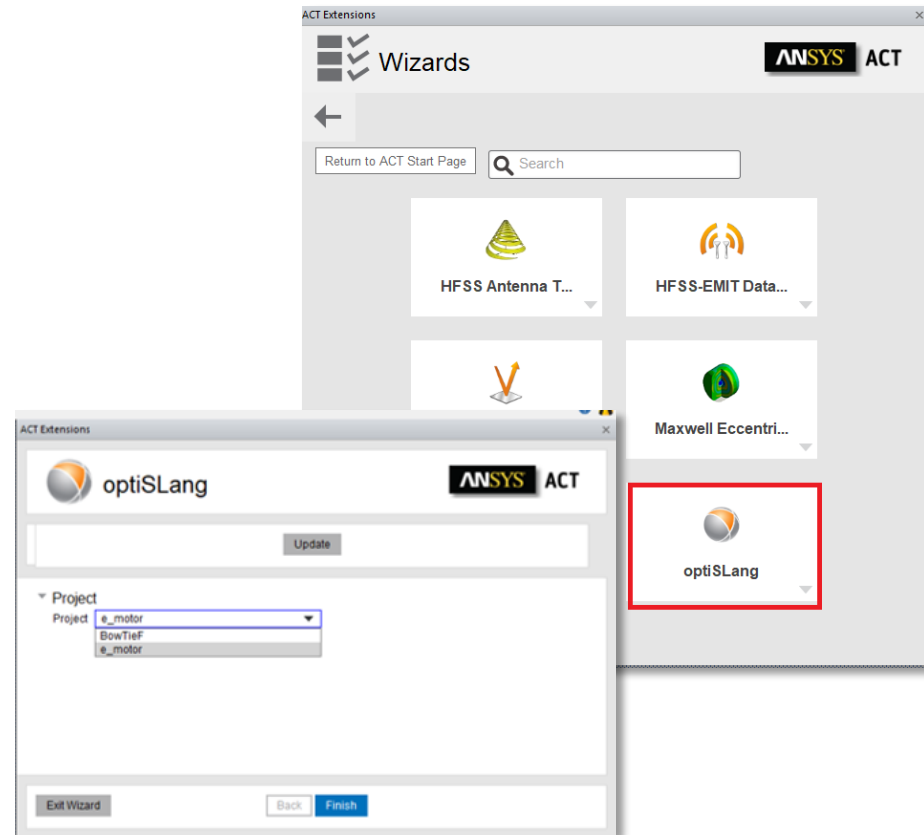
Solver	Single solve	Batch solve	Conditional execution	Common oSL parallelization	regular DSO	large-scale DSO
HFSS Design HFSS 3D Layout Design HFSS-IE Design Q3D Extractor Design 2D Extractor Design Circuit Design Circuit Netlist Maxwell 3D Design Maxwell 2D Design RMxprt Design Maxwell Circuit Design Simplorer Design Icepak Design ...	<p>AEDT</p>				<p>AEDT_advanced (Beta)</p>	

Supporting any ANSYS EDT component



# Outlook: optiSLang inside ANSYS EDT

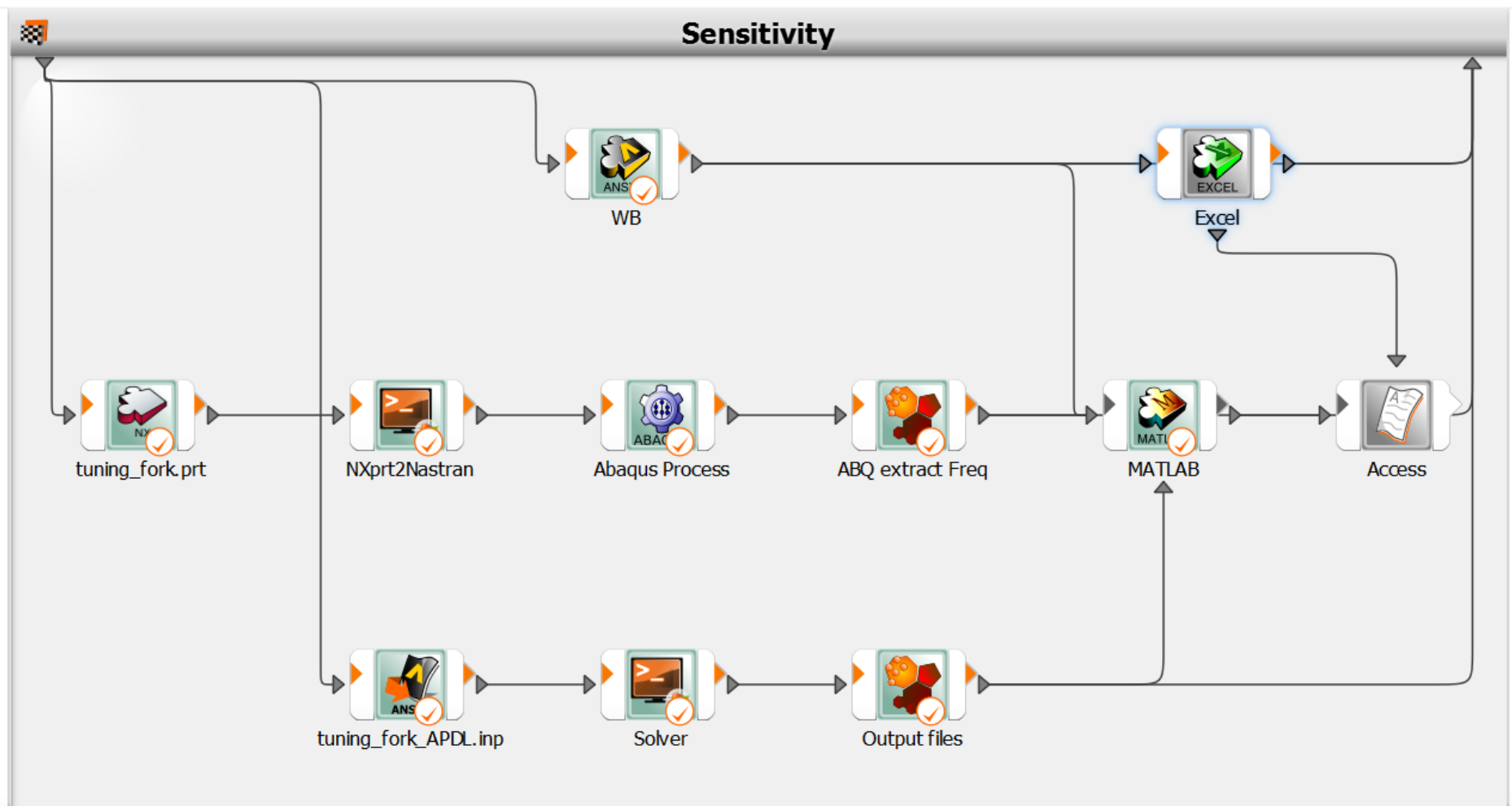
- Create optiSLang workflows directly from inside ANSYS EDT via ACT
- Convenient wizard setup and parameter & response selection
- Create optiSLang workflow for individual ANSYS EDT projects
- For preview installer please contact us



# Collaboration



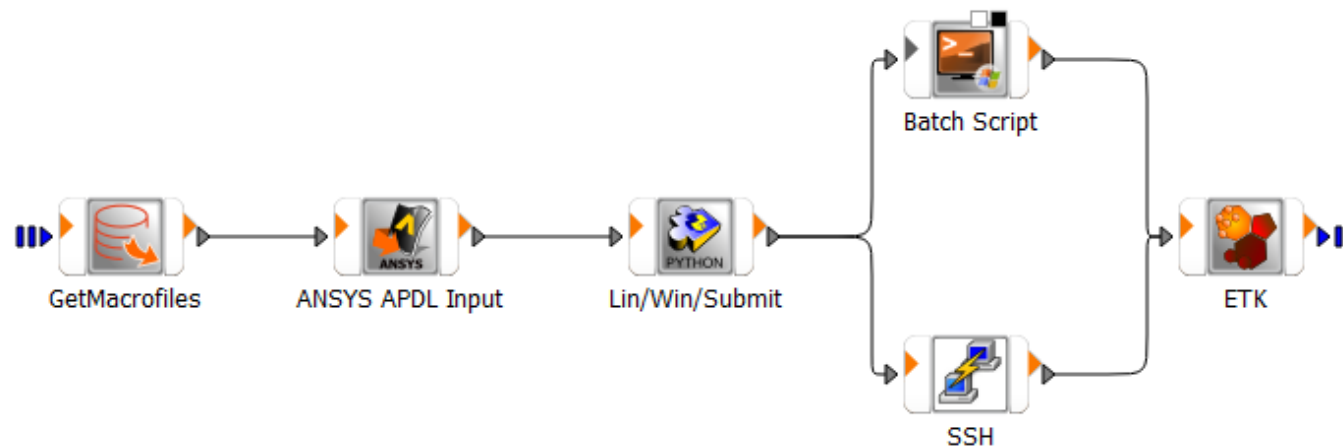
## Multi solver, physics, ... workflow



➔ Hard to find an expert who can do everything (and who has time...)

## "APDL expert"

- Build APDL workflow




- APDL Module → defined responsibility, easier to maintain, ...
- Expert can concentrate on workflow and CAE


## "APDL expert"

- Define parameters, responses, files, password, placeholders etc.

Project overview

Current user level ◀  Computation Engineer ▶

Properties and Placeholders   Parameter   Criteria   Result designs

	Id	Description	Range	Value
1	SolvingSystem	Where should the simulation run?	LIN;WIN;CLUSTER	 LIN

Properties and Placeholders   Parameter   Criteria   Result designs

	Name	Parameter type	Reference value	Constant	Value type	Resolution	
1	Density	Optimization	7.85e-09	<input type="checkbox"/>	REAL	Continuous	7.065e-09
2	Depth	Optimization	5	<input type="checkbox"/>	REAL	Continuous	4.5
3	Emod	Optimization	200000	<input type="checkbox"/>	REAL	Continuous	180000
4	Grip_length	Optimization	30	<input type="checkbox"/>	REAL	Continuous	27
5	Grip_width	Optimization	5	<input type="checkbox"/>	REAL	Continuous	4.5

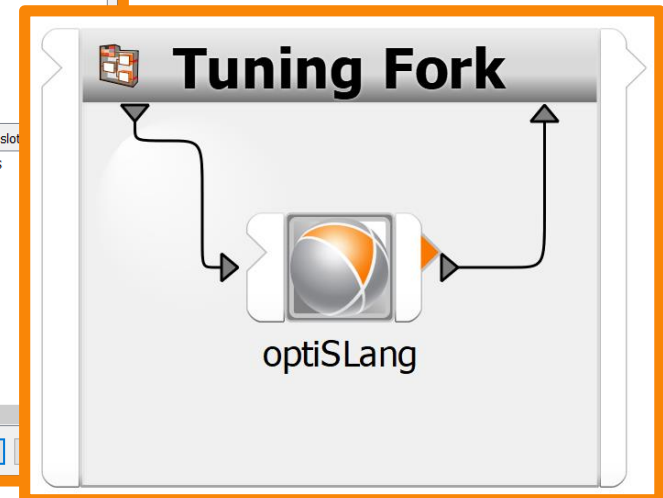
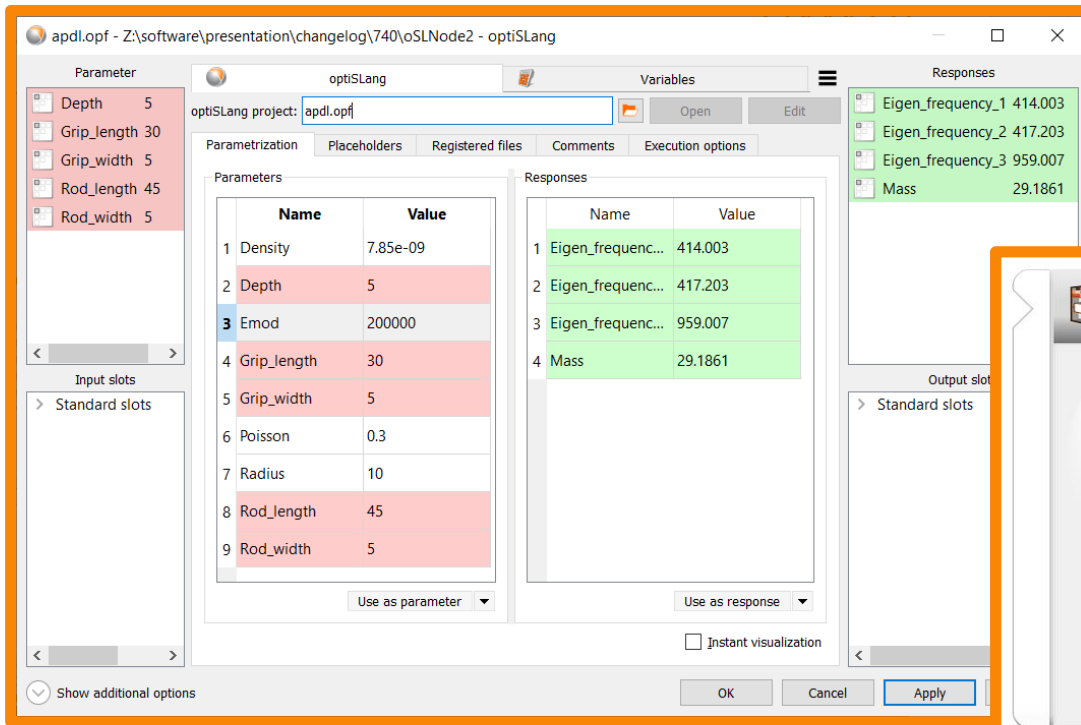
Responses

Name	Value
Eigen_frequency_1	414.003
Eigen_frequency_2	417.203
Eigen_frequency_3	959.007
Mass	29.1861

- Store optiSLang project
- Forward to colleague (via PLM/SPDM/revisioning system)

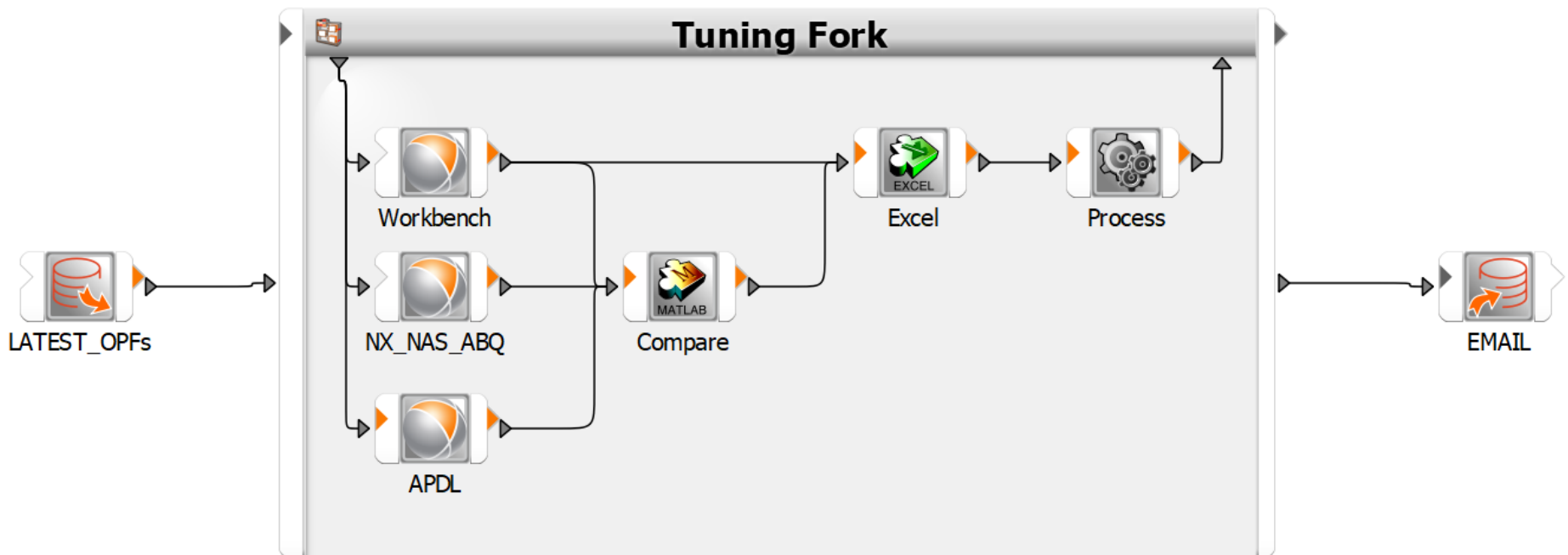
# optiSLang node

- Use optiSLang inside optiSLang like any other integration
- Parametrize (*placeholders available, too...*)
- Connect input/output files
- etc.



## Multi solver, physics, ... workflow

- Combine multiple optiSLang projects



➔ optiSLang project: single design or variation analysis workflows (performance map, optimization, ...)

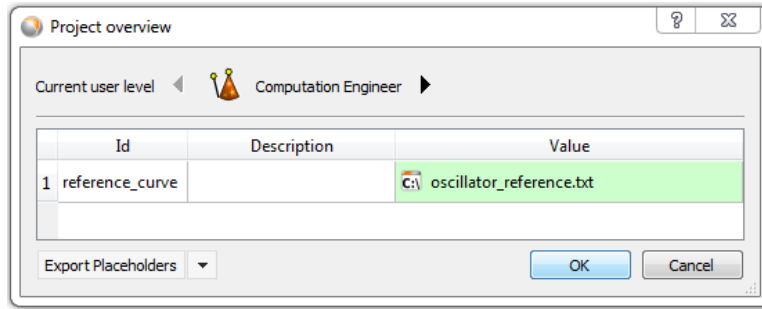
# CAE Concert Hall



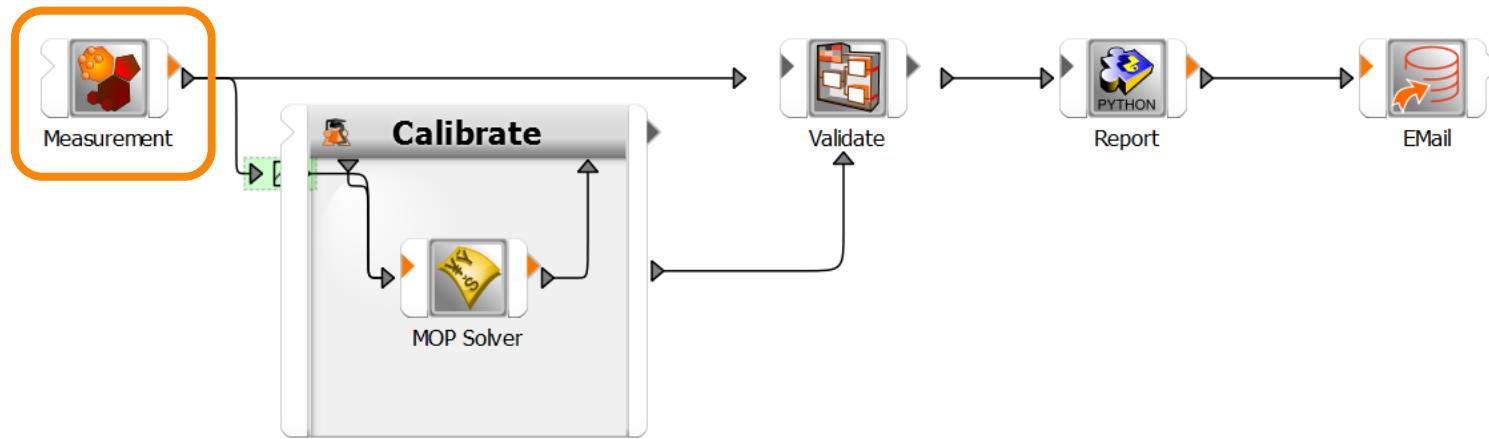
Learned from and with our customers and created  
**A Platform to democratize CAE-workflows**



# Publish a calibration workflow



Measurement



publish workflow

Process Execution  
User & Project Management



# Democratize CAE

Anke Jäger (Daimler AG) <b>CAE_AutoWorkflow: a framework based on optiSLang for the automated build-up of simulation workflows using the example of passenger car aerodynamics</b> <u>&gt;&gt;&gt;</u>	1:55 - 2:20 pm
Daniel Krätschmer (Robert Bosch GmbH) <b>Democratization of CAE-Workflows with optiSLang at Bosch</b> <u>&gt;&gt;&gt;</u>	2:20 - 2:45 pm
Friederike Loerke (Robert Bosch GmbH) <b>Virtual Assembly Line inside an optiSLang SPM system at Bosch</b> <u>&gt;&gt;&gt;</u>	2:45 - 3:10 pm

# Welcome to the CAE Concert Hall

